INTERNSHIP REPORT SUBMITTED ON

"AQUA CLINICS AND AQUAPRENEURSHIP"

TO

D.K. GOVT COLLEGE FOR WOMEN(A), NELLORE

In partial fulfillment for the award of the degree of

Bachelor of Science in Aquaculture (Embedded)

Submitted by

ANUHYA MUCHELI

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Department of Zoology

D.K.GOVT COLLEGE FOR WOMEN(A)

NELLORE

524003(A.P.)

2021-2022

COASTAL AQUA INDUSTRIES

Pidhathapolur Village,Muthukur mandal,Nellore-524346

(Registered Under (Govt. of India) – 37AIGPD3156JIZA)

This is to certify that **Ms. Anuhya Muchelj** completed one-month internship program on **"AQUA CLINICS AND AQUAPRENEURSHIP"** in the field of **Hatchery, Aqua labs, Value added products, Probiotic Feed Manufacturing** from Dec 01, 2021 to Dec 31, 2021 via Coastal Aqua Industries, Nellore, Andhra Pradesh, India. During the internship program tenure, she had been exposed at different experimental skills in **isolation of bacteria, purification of bacterial culture, bacterial staining, protein estimation, SDS-PAGE, Preparation of fish & prawn value added products, Pond & Hatchery management and Probiotic feed manufacturing** and was found diligent, hardworking and inquisitive.

We wish Her every success in Her life and career.

Dated: Dec, 2021

Signature of the Co-ordinator

Name & Designation
G.Sarath Kumar Reddy
Research Coordinator & Scientist

MD
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Signature of the Head of Department

Department of Zoology
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Dept of Zoology
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31/12

Signature of the Head of Institution
(DR.D.GIRI)
Principal
D.K.Govt College for Women(A),Nellore
Seal of the Institution

Principal
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NELLORE.

PREFACE

Fisheries and Aquaculture is a major domain in the country as well as world. It is reported that in developing countries more than 500 million people rely on fisheries and aquaculture for their livelihood.

India is the largest fish producer and ranking second to China in inland fish production. India bags large quantum of foreign exchange through aquaculture.Further, fisheries and aquaculture offer numerous job opportunities directly or indirectly to huge number of people. India has avast coastline with rich biodiversity in existing wide EEZ. Fisheries sector is one of the potential sectors of the nation since it generates livelihood for many poor people.

India proposes various plans to develop the fishery industry through various paradigms like increasing production in inland and marine sectors, technology developments providing infrastructure and imparting technical skills,etc. Indian fisheries sector has attained more than double time growth in the last five years from 2015 to 2020 from 4.9% t0 11.9% while from agriculture sector it is considerably less.Considering the potential and growth of the fishery industry, the Government has started spearing its development in multiple approach in enhancing the fish production and self-employment. Career and employment in fisheries and aquaculture sectors are plenty in government and private sectors.Nonetheless.the fishery enterprises stagger in recruiting the personnel in entry level since they prefer the personals who possess either diploma or degree in fisheries.

Even though they acquired professional knowledge in such education, they are unable to perform well in the industry due to short of practical skill. Considering the lacuna of professional skill among the potential candidates in performing their jobs, theGovernment has decided to develop the skill among the fisheries and aquaculture graduates through various short- and long-termprogrammes. As a part of B.Sc. Embedded Aquaculture Comminnisionerte of Collegiate Education, Andhra Pradesh has identified and implemented internship in 5^{th} semester for imparting professional skills in aqua clinics and aquapreneurship among the degree graduates.

One-month skill development internship from 01/12/2021 to 31/12/2021 was organized by Dept of Zoology in collaboration with Coastal Aqua industries. MOU was taken initially betweenDept of Zoology and Coastal Aqua industries in the month of may 2019.As part of MOU internship was organized to 5^{th}Sem Aquaculture and professional knowledge was imparted to aquaculture students in different aspects of aquaculture like Polyculture pond

maintenance, valued added products preparation, aqua lab techniques, hatchery maintenance and probiotic feed preparationetc., The curriculum covered in this programme imparts ample knowledge in promoting aquapreneurship to fulfill the farmer's requirements as well as self-employment opportunities. Students have successfully organized "EARN WHILE U LEARN "programme through FISH & PRAWN FEST on December 30th in our D.K.Govt College for Women(A),Nellore and showcased their gained knowledge through internship by preparing and selling aqua valued added products.

Zoology dept HOD and dept staff are obliged to Dr.G.Giri, Principal,D.K.Govt college for Women(A),Nellore and Sri.K.Sharath Kumar Reddy,Shasireddy sir C/O of Coastal Aqua Industries, Dr.P.Gopi Krishna, Assist Prof, Dept of Zoology,V.S.University and all people who contributed for successful completion of internship.

Place: Nellore

Date: 31/12/2021

Dr. Sri RanjaniTallam

HOD,Dept of Zoology

D.K.Govt College for Women(A)

Nellore District, A.P.

ACKNOLEDGEMENT

I would like to express my sincere gratitude to several individuals and organizations for supporting me throughout this internship study. First of all, my immense respect and gratitude to the Principal sir **Dr. D.Giri,D.K. GOVERNMENT DEGREE COLLEGE FOR WOMEN**, Nellore; for granting the permission for our internship program as a part of our embedded graduation course.

I will always be grateful to Dr. **Sri RanjaniTallam mam** , HOD, Department of Zoology of D.K. Govt Degree College for Women(A), Nellore for her encouragement at all times and guiding me in a right path and made me get used to rational thinking. Also I would like to express my sincere thanks to the Professor **Dr .P .Gopi Krishna sir,** HOD Department of zoology, VikramaSimhapuri University, Nellore for his enthusiasm, patience, insightful comments, helpful information, practical advice and unceasing ideas that have helped me tremendously during my internship program. My sincere thanks to G.Sarath Kumar Reddy sir, Managing Director,Coastal Aqua Industries for permitting us and imparting us knowledge in various aspects of aquaculture.I will always be grateful to them for not only teaching me the techniques with patience but also making me know the reason behind selecting that particular technique in my task.

I'm grateful to **Dr.Ch.Ramadevi mam, Dr. N. Anitha mam , H. Swathi mam, K. Naga raju sir, Dr. CH. Lalithakumari mam**; Faculty of Zoology Department without their constant support; this would not have been completed. Their endless support, guidance encouragement and kindness made us to complete this internship program successfully. Their immense knowledge, profound experience and professional expertise in Microbiology, Animal Biotechnology, Cell biology, Zoology has enabled me to complete this internship successfully. Without their support and guidance, this program would not have been possible.

Finally, I owe my deepest gratitude to my parents and my sibling indeed my strengths for their countless love.

Most of all, I would like to thank God Almighty for giving me the strength, knowledge, ability and opportunity to undertake this study and to persevere and complete it satisfactorily.

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INTRODUCTION:

Aquaculture is the production of aquatic organisms, including fish, mollusks, crustaceans, and aquatic plants, and the cultivation of freshwater and marine plants and animals under controlled conditions for all or parts of their life cycles. Aquaculture is the farming and husbandry of the aquatic organism under controlled or semi-controlled conditions. This includes breeding, rearing, and harvesting of plants and animals take place in all types of water environments including ponds, rivers, lakes, and oceans. Aquaculture is the fastest growing segment of agriculture. It is a kind of agriculture and requires inputs such as clean water and nutrients and depends on species that are farmed.Species lower on the aquatic food chain usually require less input as they feed on the microorganism and are fine in just clean water. Today, more than 250 million people directly or indirectly rely on fisheries and aquaculture for their livelihoods and nutritional requirements. Because of restrictions on the wild harvest of many fish species, demand for "farm-raised" options is very strong. It triggers in increasing the productivity of marine and inland fisheries to meet the minimum required protein to alleviate the poverty and augment the social status of the people. It is reported that in developing countries millions of people rely on fisheries and aquaculture for their livelihood. Fish can consume more protein than other animals and can efficiently convert nitrogen in feed into structural proteins in the body. The higher efficiency of nitrogen excretion in fish is another reason for fish to benefit from a bioenergetic point of view.

India is the largest fish producer and rankings second to China in inland fish production. India proposes various plans to develop the fishery industry through various paradigms like increasing production in inland and marine sectors, technology developments, providing infrastructure and imparting technical skills, etc. India proposes various plans to develop the fishery industry through various paradigms like increasing production of inland and marine sectors, technologydevelopments, providing infrastructure and imparting technical skills.etc. Indian all of these, the later one is considered as most important since the developed technologies are not yet being transferred to the lower level for commissioning the aqua enterprises.

Fisheries sector is one of the promising sectors in uplifting the socio-economic status of downtrodden people as well as national economy. Further, the fishery sector is considered as strong income and employment generator since it triggers the development of various subsidiary industries.

National policy on fisheries development comprises an integrated approach for the betterment of socially backward communities by providing employment opportunities through short- and long-term skill development programmes and internships which evolve necessary infrastructures and manpower at different levels which enhance the fish production.

Even though they acquired professional knowledge in such education, they are unable to perform well in the industry due to short of practical skill. Considering the lacuna of professional skill among the potential candidates in performing their jobs, the Government has decided to develop the skill among the fisheries and aquaculture graduates through various short- and long-term programmes. As a part of B.Sc. Embedded Aquaculture Comminnisionerte of Collegiate Education, Andhra Pradesh has identified and implemented internship in 5^{th} semester for imparting professional skills in aqua clinics and aquapreneurship among the degree graduates.One-month skill development internship from 03/12/2021 to 03/01/2022 was organized by Dept of Zoology in collaboration with Coastal Aqua industries. MOU was taken initially between Dept of Zoology and Coastal Aqua industries in the month of May 2019.As part of MOU internship was organized to 5^{th}Sem Aquaculture and professional knowledge was imparted to aquaculture students in different aspects of aquaculture like Polyculture pond maintenance, valued added products preparation, aqua lab techniques, hatchery maintenance and probiotic feed preparation etc.

POLYCULTUREFISHPOND MANAGEMENT

As apart of Internship in 5thsemester,B.Sc, Aquaculture students of D.K. Govt Degree College for Women (A) , Nellore , went to Polyculture (AQUA) farms at Indukurpetaas a part of our Internship and we learnt about the following things taught by K.Sudheer sir .The first day of our Internship was guided by Dr. T. Sri Ranjani mam and H. Swathi mam.

Outcomes: *On the first day of our Internship we've learnt the following about Fish culture :*

- Types of Culture systems
- Types of Aquaculture
  - Based on **habitat, expenses,**
  - **varieties of fishes cultured &**
  - Based on **site**
- Types of fish ponds
- Preparation of fish pond
- Types of bundhs
- Management of Fish Farms
- Benefits of 6 feet water depth
- Species cultured
- Measures taken by fish farmers
- Problems faced by fish farmers
- Diseases attacked to cultures
- Methods of feeding
- Types of feeds : Live feed , Artificial feed, Fermentation feed
- Nutritional requirements of fish feed
- Composition of an ideal fish feed

TYPES OF CULTURE SYSTEMS

Aquaculture is the **culture of aquatic organisms**. It is the **farming in water**. It is an **industry** or **occupation**. It is also called **culture fisheries.**

There are different types of culture practices. They are classified on various criteria. Based on the **habitat**, Aquaculture is classified into four types:

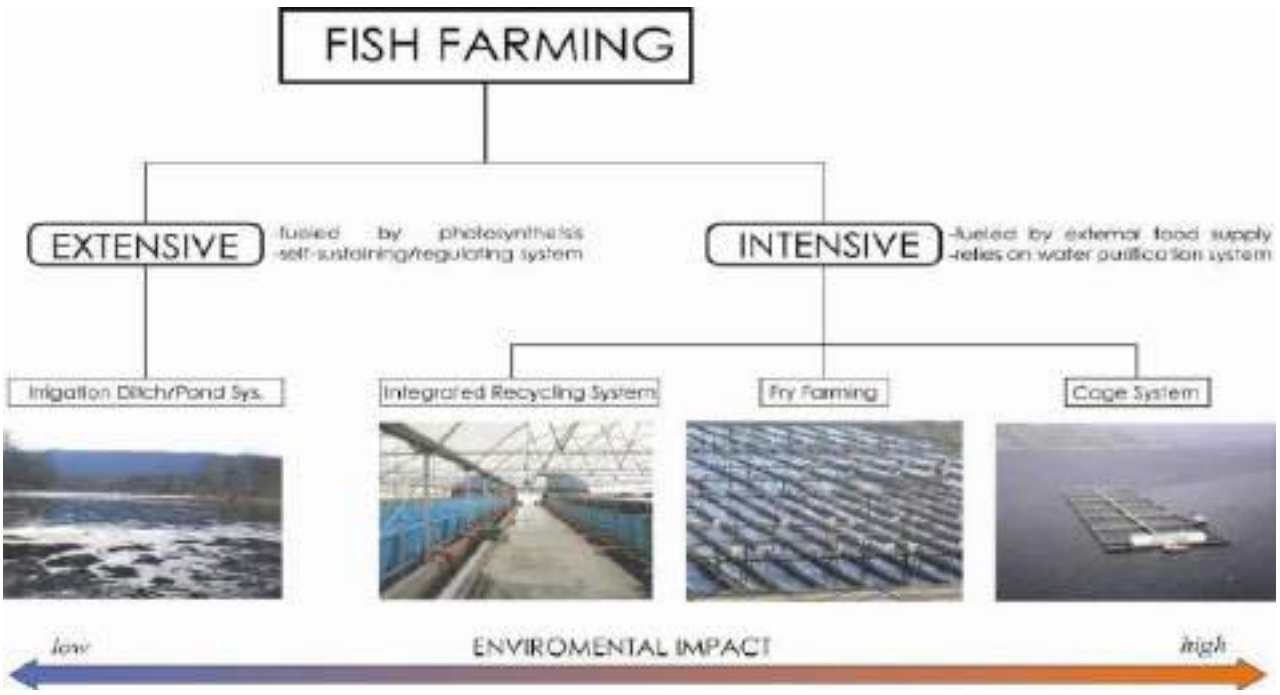
1. Inland aqua culture (Freshwater Aquaculture)

2. Brackish water aquaculture (Estuarine Aquaculture)

Students learning about different parameters in pond culture

3. Mari culture(Marine Aquaculture)

4. Metahalineaquaculture



Based on the **expenses** involved, Aquaculture is classified into three types:

1. Extensive culture
2. Intensive culture
3. Semi-intensive culture

Based on the **site** , Aquaculture is classified into the following types:

1.Pond culture
2.Reservoir culture (Dam culture)
3.Riverine culture
4.pokkali culture
5.Bheri culture
6. Salt Pan culture
7.Tank culture
8.Raceway culture
9. Cage culture
10.Penculture

Based on the **variety of fishes stocked**, Aquaculture is classified into the following types:

1.Monoculture

2.Polyculture

3.Monosexculture

Based on the culture with other organisms (**integrated aquaculture**), Based on the **climatic conditions**, Aquaculture is classified into two types:

1. Water culture
2. Cold water culture

Fish culture with sewage water is called **sewage fed fish** culture.

1. FRESH WATER AQUACULTURE

The rearing of aquatic organisms in freshwater is called **freshwater aquaculture.** It is also called **inland aquaculture** as the fresh water bodies remain within the land .

In freshwater, Indian major carps, exotic carps, tilapia, cat fishes, air breathing fishes, freshwater prawns, etc. are reared .

The freshwater aquaculture is classified into the following types:

1. Pond culture
2. Riverine fish culture
3. Dam culture
4. Lake culture
5. Coldwater fish culture

a. Pond culture

Rearing of aquatic organisms in pond water is called **pond** culture. India has **2.21mh** of freshwater ponds.In ponds, Indian major carps, exotic carps, tilapia, cat fishes, air breathing fishes, freshwater prawns, etc. are cultured.

The ponds may be i. Nursery ponds, ii. Culture ponds, iii. Stocking ponds

In nursery ponds, the **hatchlings** (newly hatched fish larvae) are reared. The hatchlings grow into fingerlings in the nursery ponds. In culture ponds, the **fingerlings** are reared.

In stocking ponds, the young fishes are reared till their harvest. In ponds, a number of culture practices such as **monoculture, mono sex culture, polyculture, integrated fish culture,** are practiced.

b.Riverine Fish Culture

Rearing of fishes in running water is called **riverine fish culture**. The following are the important rivers used for aquaculture in India. Ganga, Yamuna, Godavari, Krishna,Bhramaputra,Sindhu, Cauvery and Mahanadi. The rivers of India have an area of 3.12 million sq.km. In rivers, Indian major carps such as catla,rohu,mrigal, etc. are cultured.

c .Dam Culture

Dams are artificial man-made constructed reservoirs. There are about 6 million hectare area of reservoir in India. The important dams in India are the following:

1.**Hirakud** dam in Orissa at Mahanadhi

2.**Mettur** dam in Tamilnadu at Cauvery

3.**Bhavanisagar** in Tamilnadu at Bhavani

4.Tungabhatra dam in Karnataka at Krishna

5.**Neyyar** dam in Kerala at Neyyar river

The important fishes reared in dams are lndian major carps, channa, wallago, mystus,etc

d. Lake culture

Rearing of aquatic organisms in lakes is called **lake culture.**

Lakes are large standing water formations lager than ponds. Eg.Chilka lake in Orissa. They are natural water formations. Indian has an area of about 0.75 million hectare lakes.

In lakes, Indian major carps and cat fishes are reared.

e. Coldwater fish culture

Rearing of aquatic organisms in chillwater is called **coldwater fish culture.** The lakes and streams located at high altitudes (above 1000m) are called **coldwaters.**

The important coldwater formations are the following:

1. Ooty lake 2. Munnar in Kerala 3. Nainital lake in U.P.

4. Kodaikanal lake 5.Renuka in Himachal Pradesh

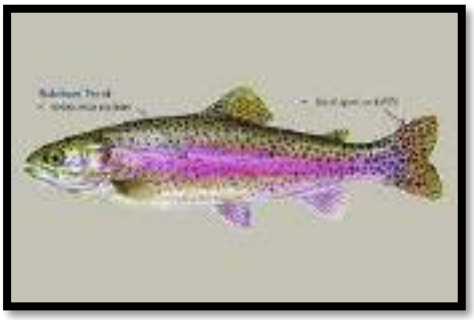
The important fishes reared in cold water are the following:

1.Brown trout -Salmoeruttafairo

2.Rainbow trout - salmogairdneri

3.Mahseer - Tor putitora

4.Indian major carps - Catla, rohu, mrigal



2. Brackishwater Aquaculture

Rearing of aquatic organisms in brackishwater is called **brackishwater.** In brackishwater aquaculture, the organisms are cultured in water where the salinity is more than 1 and less than 32. The brackish water formation includes estuaries, backwaters, lagoons, etc. It is practiced along sea coast. Important organisms:

1.Tilapia 5.Penaeus monodon

2. Etroplus. 6. Penaeusindicus

3. Chanos. 7. Spiny lobsters- palinurus

4. Mugil. 8. Crabs

3. Mariculture

Mariculturerefers to the cultivation of aquatic organisms in sea water where the salinity range is 30 to 32%. It is the **sea farming.** It is also called **marine aquaculture** or **marine culture fisheries.**

Marine is of two types, namely

1. **Coastal aquaculture**

Culture of aquatic organisms along the sea coast is called **coastal aquaculture.**

2. **Offshore aquaculture**

Culture of aquatic organisms in the deep sea is called **offshore aquaculture.**A number of marine organisms are cultured in the sea.They are

1.shrimp. 2. Edible oysters

3. Pearl oysters. 4. Mussels

5. Sea weeds

6. Fin fishes:

Salmon, Pangasous, Trouts, Gouramis, Yellow tail , Rabbit fishes , Sea Boss, Sea breams, Etc

After visiting the polyculture ponds of indukurpeta, sudheer sir explained about the construction and the management of fish farms and the types of bunds of a fish pond as follows:

PREPARATION OF FISH POND

Fish farming needs good planning and wise ideology. A fish farm consists of four different types of ponds, namely

1. Breedingponds.
2. Nursery ponds.
3. Rearing ponds
4. Culture ponds

I. Selection of site

Sustainable fish farming depends on the selection of a suitable site. The fish farm is selected based on technical and socio-economic criteria, considering the following factors.

1. **Road** connection.
2. **Electric** connection.
3. **Telephone** facility.
4. **Gently sloping** terrain to drain out water easily.
5. Suitably**shaped** plot of sufficient size.
6. A**valley basin** with three sides with high lands and with a narrow outlet on the fourth side.
7. Availability of **sufficient wate**r.
8. Suitability of **soil** and **water** for fish culture.
9. The site should be free from **flooding**.
10. Reasonable proximity to the **area** of **fingerlings**.
11. The soil should be **free from seepage**. Clay, silt clay, clay loam, etc. are suitable. Rocky, sandy, gravelled and lime stone are unsuitable.

II. Construction of fish farm

In constructing a fish farm, a **layout** plan should be prepared first. The farm should have

1. An office room.
2. A residential building.
3. A breeding pond.
4. A nursery pond
5. A rearing pond
6. A culture pond,etc.

Of the total area of fish farm, 30% is made for **land area** i.e. for office and residential building. The remaining 70% is made for **water area.**

Bunds

The fish ponds are protected by bunds called **embankments.** The embankment should be strong to withstand the**water pressure** and high enough to **avoid floods.**

Bund is constructed in between the two ponds and also at the margins of the pond. The height of the bund is maintained at 10-12 feet. To avoid water over flow and also to allow extra flooded water to outside. The water is flown through water canals or irrigation canals. The height of bundh has always maintained by dumping the mud fronm the bottom of ponds, whenever bundh width reduced.

These bunds were held strongly by using roots of trees like coconut, plantations like banana,etc., strength of the bunds were given by those roots of trees along with soil.
An Engineered concrete outlet is also placed at one of the margin of pond ; the depth of the outlet is 9-11 feets. The outlet structures are built for two main reasons : To keep the water surface in the pond at its optimum level , which usually coincides with the maximum water level designed for the pond ; to allow for the complete draining of the pond and harvesting of fish. The outlet canals were maintained with two level canals ,they are ; high level water canal used for inflow (Bottom orifice) and Low level

water canal used for outflow (Excess water).

TYPES OF BUNDS

Dry Bundh

- A dry Bundh is a Sensational pond which remains dry on most of the Seasons and becomes filled with water during rainy season. It is used for Controlled breeding of craps. It occurs in West Bengal and MP.
- It has banks on three sides and is open on one side.
- The banks are excavated with Hatching pits or Hatchinghapas are fixed In the bundh water for hatching the eggs.
- During rainy season,Water rushes into the dry Bundh through the open side from the catchment area.
- Carps are introduced into the bundh at the ratio of 2 females and one male.
- The Water flow Stimulates the craps.
- It has an Outlet to drain out water during heavy rain.
- They exhibit Sexual display and release eggs and milt.
- The eggs are fertilised by the milt.
- The fertilized eggs are collected by mosquito nets and are Transferred to hatching pits or hatching hapa.
- The eggs are hatched in the hatching pits or hatching hapa.
- It is a traditional method of seed production.

The dry bundh has the following advantages:

*Economical, *Easy management, *Seeds are pure, *Desired seedcan be obtained, *Egg collection easy.

Wet Bundh:

- Wet bundh is a perennial pond Which contains water throughout the year and is used for breeding of craps. It s simple and small irrigation pond. It occurs in West Bengal and MP.
- It has banks on three sides and the fourth side is connected to the catchment area.
- There are Inlet and Outlet. they are protected by Bamboo screens.
- The wet bundh has a shallow area in the margin and a deeper area in the centre.
- The shallow area is excavated with hatching pits Or hatching hapas are fixed in the bundh water for hatching the eggs.
- During rainy season water rushes into the dry Bundh through
- The open side from the catchment area
- Carps move to the shallow region of the bundh it acts as breeding ground
- They exhibit sexual display and release eggs and Milt
- After spawning, the carps move to the deeper part of the bundh
- The eggs are fertilized by the Milt
- The fertilized eggs are collected by mosquito nets and are transferred to hatching pits or hapa.
- The eggs are hatched in the hatching pits or hatching hapa.

The wet Bundh has the following disadvantages

*Less economical, *Difficult management, *Seeds are mixed with weed seeds, *Desired seed cannot be obtained easily, *Egg collection difficult, *Only one breeding can be achived in a year.

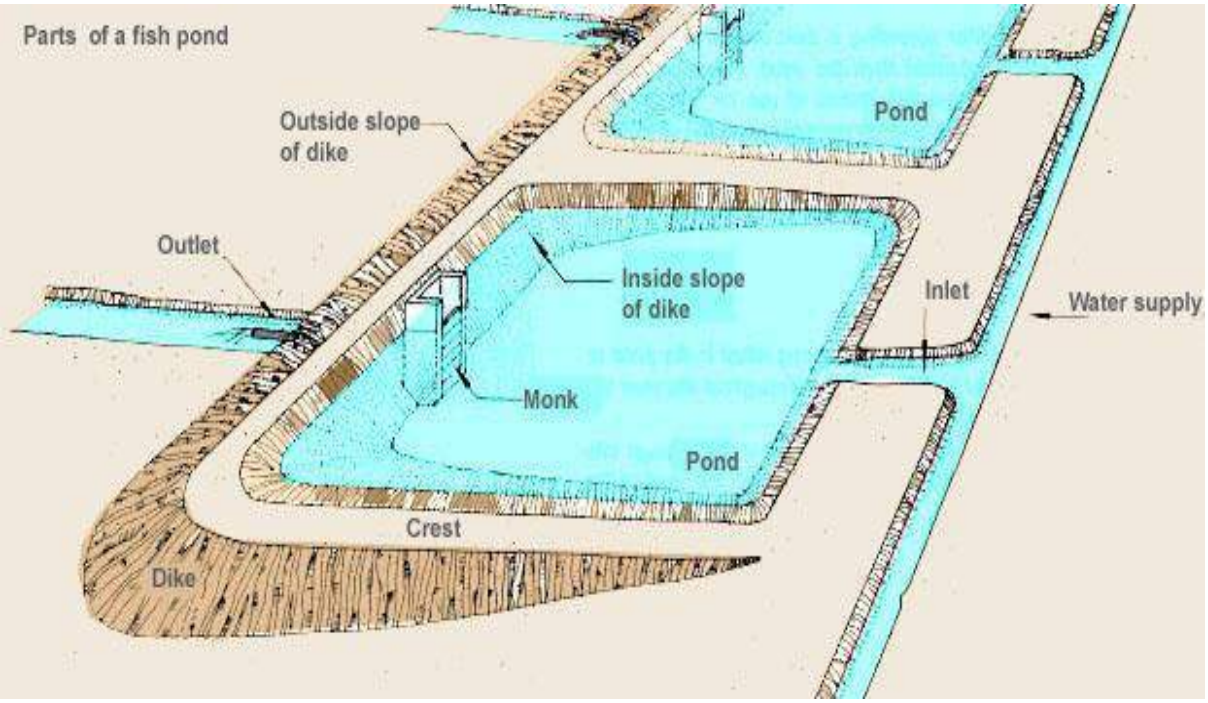
Slope: The embankment is constructed out of clay. The embankment has a **crown** (free board) and a **slope.**

The **crown** is the extra height of the embankment above water level. It will prevent the waves and flood washing out.

The life span and strength of the embankment depend on the slope and the width of the crest.

The slope means the distance in horizontal axis for each foot of height. If the height of the bund is 1 cm and the basal width of its one side is 2m, then the slope is called **dry slope.**

In cross section, the slope is **trapezoid** in shape.

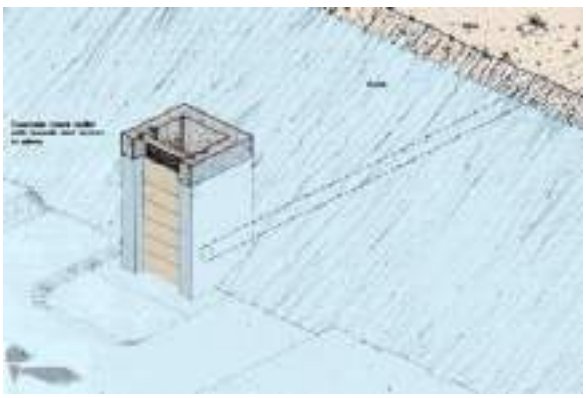


In a fish pond of 0.5ha, the west slope may be 1:15 and the dry slope may be 1:1.

Berm

A platform-like space between the west slope and water area is known as a **berm.** It serves as a walkable space for the fish farmers. It also protects the bund from direct contact with water.

Inlets and outlets



The inlets allow water into the pond and the outlets drain the water out of the pond. The inlet must be constructed on elevated part of the pond. The outlet is constructed at the lowest level of the pond. The inlets and outlets are provided with **screens** to prevent the escape of fish as well as entry of predators.

Nursery Pond: Nursery pond is used to rear hatchlings into fry for a periodofonemonth till the fry attains the size of 2 to 2.5 cm. It is a small pond. The size should be 4 x 1.25 × 0.5 m. 3% of the water area is allotted for this pond. The depth of thewater column should be 1 to 1.5 m.

Rearing pond: Rearing pond is used to rear fry into fingerlings for a periodof 2 months until the fry attain the size of 4 to 10 cm. The size of the rearing pond should be 25x12x1 m. The depth of the water column should be 1.5 to 2m.

Culture Pond: In the culture pond, the fingerlings are reared up to the marketable size. The size of the pond varies from 1 to 2 ha.The depth of the water column may be from 2 to 3 m.

Cemented cisterns for Breeding: About 4x2x 1m dimension are constructed for breeding purposes.

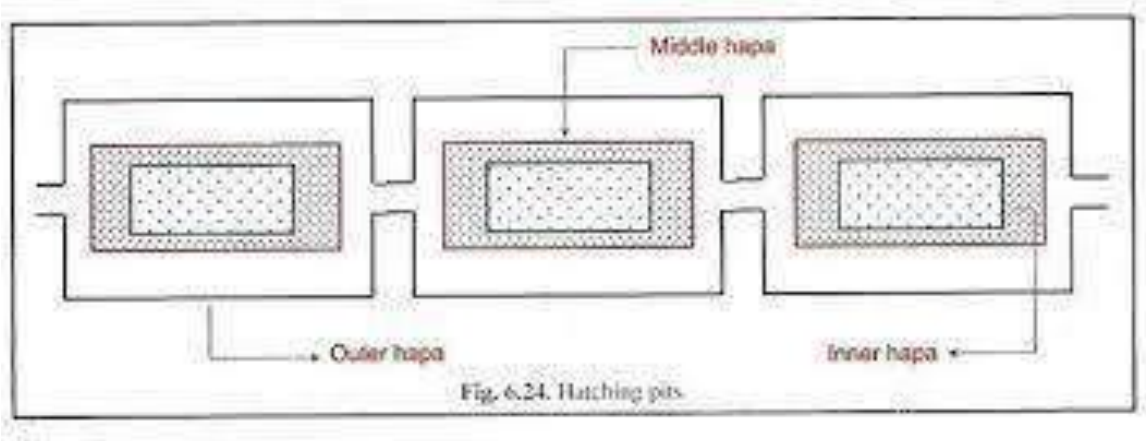


Fig. 6.24. Hatching pits

Hatching Pits: Hatching pits are used to hatch eggs collected from bundhs. The size of a pit may be 2.25 x 1.25 x 1 m. The hatching pits may be arranged in series near the nursery pond. There should be facility for proper irrigation and drainage. Water circulation ensures proper aeration, which is necessary for the development of eggs.


Figure 13. 10 A fish pond-showing fish breeding hapas

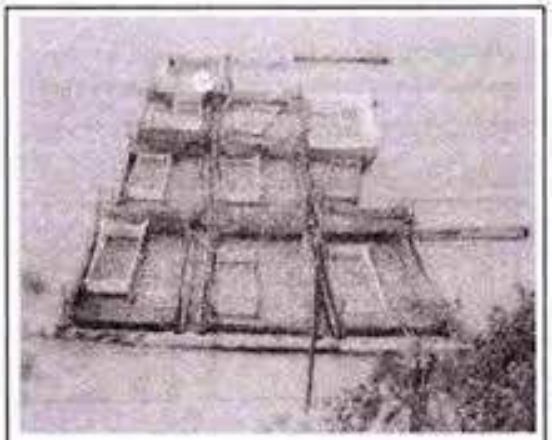


Fig. 6.23. A cluster of hatching hapas being used in India for hatching carp eggs

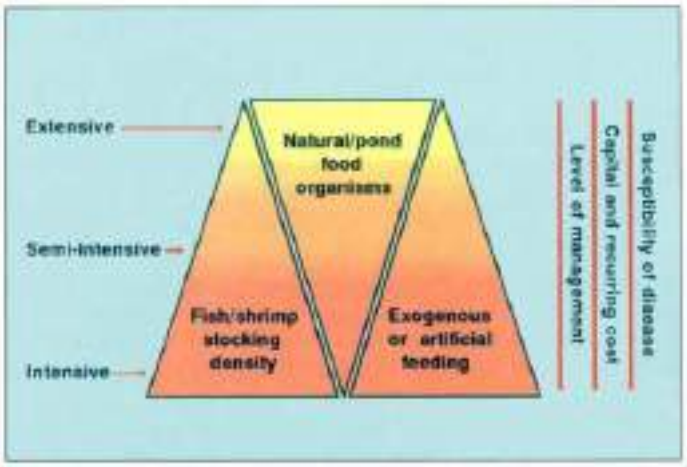
Feeding pits:Feeding pits are used to culture plankton. Plankton form livefeedfor hatchlings. The size of a feeding pit should be 1× 1× 0.6 m. A number of feeding pits are constructed near the nursery pond. In these pits, plankton are cultured using cow dung, stable refuse, oil cakes, decaying vegetation, etc. The pits are bloomed with plankton growth within 10 to 15 days. Thesurfacescumbfrom the pits can be transferred tonursery ponds to feed the hatchlings. Continuous manuring will be provide regular supply of live feed.

Hospital pond: Hospital pond is a small pond to keep the diseased fish in isolation and for treatment. It is constructed in a remote corner.

Marketable Tank : Marketable sized fishes are transferred from culture ponds to small ponds to rear for 20 to 30 days before marketing. It is a cement tank. Major carps grown in muddy and weedy ponds have unpleasant smell in their flesh. This muddy taste is not acceptable to some people. The flavour of major carp can be improved by keeping them in marketable ponds where they may be fed with suitable artificial feed. To stimulate fast growth, fattening food may also be given.

The marketable fish can also be stored for sometime in the marketable pond until the availability of fish is low in the market. This will fetch high price for the fish.

Also we have learnt about the types of culture methods of aquatic organisms based on expenses as:



*1.*Extensive culture

- Culturing of fishers in large areas with low stocking density and natural feeding is called **extensive culture.**
- Stocking density is low but the area is more.
- The fish feeds on natural food available in the pond.
- Supplementary food is not given.

- Water quality is not given.
- There is no artificial feeding.
- The labour is minimum.
- The yield is low.
- Growth rate is low.
- Capital investment is also low.
- Culture of prawns and fishes in **pokkali fields** of Kerala is an extensive fish culture.
- Culture in **Bheries**in west Bengal is another extensive culture.

2.Intensive culture

- Production of large quantities of fishes in small areas by stocking high density, concentrating labour, recirculation of water and providing prepared food is called **intensive culture.**
- The fishes are cultured on constructed ponds.
- Fishers are stocked in highly density in small areas.
- Water is periodically replaced.
- Water is well aerated.
- The pond is fertilized.
- Fishes are fed with prepared food.
- Water quality is regularly checked and corrected.
- Modern techniques are implemented.
- Polyculture, cage culture, pen culture, etc. are intensive cultures.
- The production is very high: 6000/kg/ha/year.

Advantages 1.yield is high

2. Growth rate is maximum.

Disadvantages 1.cost are high.

2. Morelabour is needed.

3. Skillful management is required.
4. Heavy loss is incurred if the management is poor.

3. Semi-intensive culture

- Culture of fishes in large areas with natural feeding and supplementary feed is called **semi-intensive culture**.

- It is intermediate between intensive and extensive cultures.
- It is based on the principle of **'feed the pond, not the fish**.That is, the pond is inoculated with live feed organisms; the pond is fertilized with manures which enhance the of feed organisms. The fish feed on these feed organisms.
- The fishes are stocked at a moderate level.
- The fishes are allowed to feed on natural food such as phytoplankton and zooplankton.
- The pond is **fertilized** to improve the growth of natural food.
- Prepared food is not given.However, supplementary feed is given in the form **of rice bran, oilcakes, plant wastes, animal wastes, slaughter house wastes,** etc.

Based on the varieties of species cultured the fish culture systems are classified as follows:

1. **Monoculture**

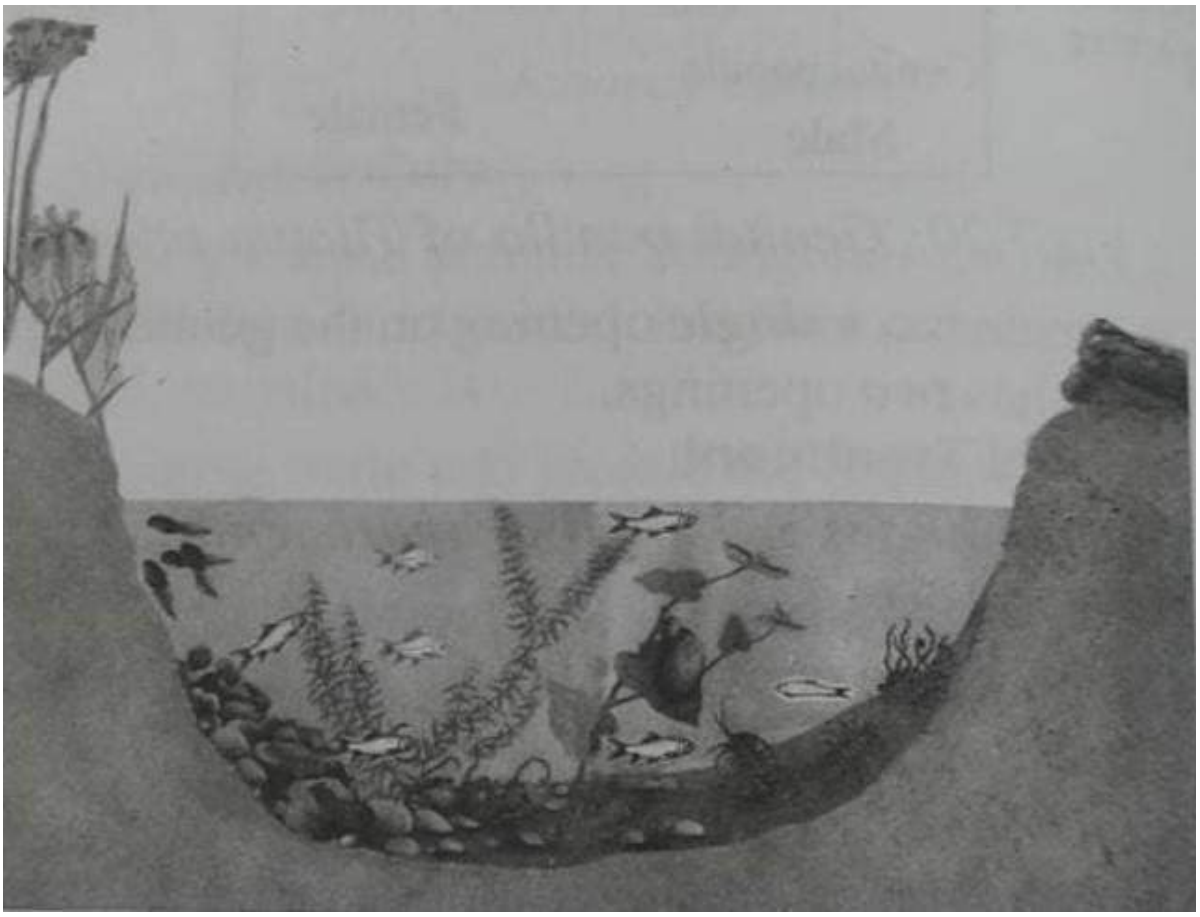
- Culturing of a single species in a pond is called monoculture. It is also called monospecies culture.
- Carps, tilapia, mullet, milk fish, air breathing fishes, prawns, etc.are cultured by monoculture method.
- In monoculture, the pond is stocked with only one age group or with different age groups.
- Stocking fishes with only one age group is called monosize stocking.
- Stocking fishes with different age groups in one pond is called multisize stocking.

Eg. Freshwater prawn.

2. **Polyculture**

- Culture of many species of carps in a pond is called polyculture.

- All the three Indian major carps can be reared in a single pond.Thecatla is a surface feeder and feeds on plankton It lives mostly on the surface of water .
- Rohu is a column feeder, and it feeds on filamentous algae. It lives in the middle zone of the pond.
- Mrigal is a bottom feeder, feeding on detritus and worms.It lives in the bottom of the pond.



- The stocking density of catla, Rohu and Mrigal is 3:6:1. It is a three spices combination of ploy culture.
- In polyculture, five spices combination and six spices combination are followed.
- In five spices combination polyculture, Indian major car[s are combined with commom carp and Cauvery carp with following ratio:

Catla	-6	Commom Carp	-4
Rohu	-3	Cauvery carp	-2
Mrigal	-5		

TYPES OF PONDS:

The polyculture ponds of Indukurupeta Aqua farms include NURSERY PONDS : 2, GROW OUT PONDS :2 , SPAWN PONDS : 1, FEED STORAGE ROOM : 1 and a STORE ROOM.

At indukurpeta, polyculture ponds the ponds are specified as follows:

- **Seed pond also known Spawn pond**: The seeds of fishes, prawns when newly brought from the hatcheries or seed plants were cultured here upto a certain time then they were transferred to nursery pond.

- **Nursery pond** : The seeds are transferred from the seed ponds to nursery ponds upto the size of fingerlings i.e., 5- 8/10cms.
- **Grow out ponds** : The fingerlings were transferred to these ponds for the complete growth upto harvesting and marketing. Very essential care is taken to the fishes at this pond , probiotics were also used regularly to maintain good water parameters. The fishes were fully grown upto 1kg in 6-7 months. Whereas in case of prawn they attain 1kg per 15-18 pieces in 4 months.
- The total area of pond is 5 hectres (1 hec= 2½ acres)and water height is approximately 6 feet in the middle of pond, 2-3 feet near the margins of pond.

Fish ponds

The fish farm contains four types of ponds. They are

1. Breeding ponds
2. Nursery ponds
3. Rearing ponds
4. Culture ponds

1. Breeding ponds

- The pond where major carps are allowed to breed is called breeding pond. Major carps are allowed to breed in bundhs or cement tanks.
- Bundhs are shallow water bodies constructed near the river. They have inlets to receive water from the river and outlets.
- The bundhs are of two tyoes, namely wet bundhs and dry bundhs. In wet bundhs, water will be available perennially.The dry bundh is seasonal and water is available only during rainy season.
- Mature female and male carps are introduced into the bundh at the ratio of 1:2.
- The move to the shallow area and exhibit mating behaviour. The female releases the egg and the male relseases the sperms. After spawing, the parents move to the deeper waters.
- The eggs are fertilized by the sperm and the fertilized eggs float on the water as a frothy mass. The fertilized eggs are transferres to a hatching hapa.

2. Nursery Ponds(spawn pond)

- Nursery ponds are used for culturing hatchlings of carps. The hatchinglings are transferred from hatching hapa to nursery ponds after 2 to 7 days. In the nursery pond, the hatchlings grow into fry. The fry are able to feed their feed on theri own accord. The hatchlings can be cultured in the nursery ponds for about 2 months when the fry will reach 2 to 2.5 cm in length. So in the nursery pond, the hatchlings grow into fry.
- Nursery pond is a seasonal pond which remains dry for most part of the year.
- In the summer season, When the nursery pond is dry, it should be ploughed . The nursery pond is manured by adding organic manur cow dung at the rate of 10000 kg/ha. The fertilizer improves the growth of phytoplankton and zooplankton which the hatchlings feed.
- The pH and acidity should be corrected.
- The nursery pond should be near the breeding place so that long transport of hatchlings can be avoided.
- Large ponds are not suitable for nursing . A very convenient size for nursery pond is 4 x 1.25 x 0.5 m. It can be easily managed . A pond of 10 x 4 x 1.25 size can also be easily controlled.
- The nursery pond should have shallow water.
- It should have warm water .
- It should have full of plankton as food.

- A fine meshed wire netting of about 30 cm high should be fixed around the nursery pond to prevent frogs, tortoise, snakes and other predatory animals.
- The top of the nursery pond can be covered by a wire netting to prevent entry of ducks and other fish eating birds.
- When water is allowed into the nursery pond, a fine meshed wire netting should be placed at the inlet to prevent predatory animals to come in with the inflowing water.
- The nursery is stocked at the rate of 1 million hatchlings/ha.
- The nursery pond is provided with supplementary feed of a mixture of powerdered groundnut cake and rice bran at the ratio of 1:1.
- Harvesting of fry should be done during early hours of either morning or evening.

3. Rearing pond

- Rearing pond used to culture fry of carps . The fry are transferred from nursery ponds to rearing ponds after two months. The fry are reared in the rearing ponds from the 2nd month to the 4th month when the fry will reach 10 to 15 cm in length .
- At this stage ,the Fry are called fingerlings. So in the rearing ponds the fry grow into finger lings. The rearing ponds is also a seasonal pond but with long duration. The rearing ponds are larger than nursery ponds.
- Rearing ponds of 20× 10×1.75 m size is convenient for managing.

1.The depth should not exceed 1.75m.

2.The nursery pond should be near the breeding place So that long transport of hatchings can be avoided.

3. Large ponds are not suitable for nursing.

4. The nursery pond should have shallow water.

5. It should have warm water.

6. It should have full of plankton as food.

7. A fine meshed wire netting of about 30 cm high should be fixed around the nursery pond to prevent frogs,tortoise, snakes and other predatory animals.

- The top of nursery pond can be covered by a wire netting to prevent entry of ducks and other fish eating birds. When water is allowed into the nursery pond, a fine meshed wire netting should be placed at the inlet to prevent predatory animals to come in with the inflowing water.

- The rearing pond is manured with cow dung at the rate of 10000kg/ha. The rearing pond should be added with chemical fertilizers Such as urea and superphosphat at the rate of 40 to 80kg/ha.
- At 15 days interval. The fertilizers promote the growth of phytoplankton and Zooplankton which the fry feed.
- The stocking density of fry is about onelakh/ ha.The fry should be given supplementary feed in the form of Powdered groundnut cake and rice bran mixed in the 1.1 ratio.
- The feed may be kept in bamboo baskets in shal low areas in Different places. In addition, powdered silkworm pupae, prawn waste, etc.
- May be given. Growth promoting nutrients such as B-Complex vitamin,yeast , Cobalt chloride, etc.
- May also be added in the feed. To safeguard, the fry from the attack of parasites, anti-biotics Such as terramycin may be sprayed on the feed at the rate of 100 mg per kg of feed.
- Harvesting of fingerlings should be done during early hours of either morning or evening.

4. Culture ponds (stocking ponds)

- Culture ponds are used to rear fingeerlingsupto the Marketable size. Here the fingerlings are reared for One year until they attain the size of about 1 kg. The culture pond is also called a **stocking pond** or Production pond.
- The culture pond is a perennial pond. It can be of Any size, shape and depth. The village ponds, irrigational ponds and temple ponds can be used as culture ponds. These ponds are auctioned by the panchayats to the fish Farmers.
- The fish farmers stock the ponds with fingerlings. In culture ponds, the following types of culture can be practiced.

  1.Monoculture 2.Polyculture
  3.Monosex culture. 4.Integrated fish culture

- The culture pond should have a well drainage system.
- The ***inlets and outlets*** of the culture ponds should have screen gates to prevent the entry of predators and the escape of fishes. Before releasing the fingerlings, the pond is allowed to dry and is ploughed. It is treated with lime.

  * After ploughing and liming , the pond

  Is filled with water. Optimal temperature for carp culture is 20 to 25°c. The optimal oxygen cotent is 5 mg/l. The optimal pH is arund 7.The pH can be corrected by adding lime or alum. To increase pH, lime is added, to decrease pH, alum is added.

  * After 15 days of ploughing and liming,

Role of fertilizers in pond : The pond is fertilized by organic manure. Cow dung is the suitable organic manure. It is applied at the rate of 20 to 30 tonnes/ha. The pond is fertilized with chemical fertilizers.

The culture pond needs NPK at the ratio of 18:10:14 The chemical fertilizers are applied as per the following rates.

Urea	200 kg/h/yr.
Superphosphate	250 kg/h/yr.
Ammonium sulphate	450 kg/h/yr.
Potassium chloride	40 kg/ h/yr.

- The fertilizers improve the growth of Phytoplankton and zoolplankton on which the fish feed. The culture ponds are stocked with fingerling of 4 to 7cm size. Stocking Should be done 10 to 15 days after fertilization. The stocking density may vary from 2000 to 10000 per ha.
- The fish must be fed with artificial feed. The feed may be placed in bamboo baskets in shallow waters. During harvesting, the water is drained out. Harvesting is done in the early morning or evening hours.

Then they explained us how they maintain their fish ponds and the problems faced by fish farmers. Also about the measures taken by them as follows:

Management of Fish Farms

The large scale rearing of fish in ponds is called fish farming. The success of fish farming depends on skillful management and maintenance of fish farm. The management of fish farm involves the following steps:

1. Selection of site
10. Stocking

2. Construction
3. Ploughing
4. Liming
5. Irrigation
6. Fertilization
7. Water quality management
8. Weed control
9. Predator control
11. Supplementary feeding
12. Disease control
13. Caring fishes
14. Fish pond implements
15. Fish pond record
16. Harvesting
17. Marketing
18. Preservation

1. Selection of Site

The suitable site for fish farm is selected based on technical and economic criteria. There should be sufficient water and facility for transport, electricity and telephone.

2. Construction

A detailed layout plan should be prepared be for the construction of fish farm. The plan should include the following.

1. Residential building.
2. Office room
3. Breeding pond
4. Nursery pond
5. Rearing pond
6. Culture pond
7. Hatching pits
8. Cemented cisterns for breeding
9. Feeding pits
10. Hospital pond
11. Marketable tank

3. Ploughing

The pond is sun dried and ploughed to make the surface soil soft and fragile.

4. Liming

Addition of quicklime to fish pond is called liming. Fish need an optimum pH range from 6.5 to 9. If the soil is acidic, the pH is corrected by adding lime. Addition of lime is called liming. If the soil is alkaline in nature, the pH is reduced by adding gypsum.

Lime is added after ploughing. After 15 days of liming, water is filled in the pond.Lime can be added at the rate of 200 kg/ha. If the soil is acidic, the amount of lime may be increased. The lime does the following functions.

- It increases pH which enhances the growth of phytoplankton and fish.
- It neutralizes the toxic effect of old organic deposits of the bottom.
- It increases the calcium content of the water.
- It increases the bicarbonate content of the water.
- It counteracts the poisonous effects of ions like magnesium and sodium.

Sludge in pond bottom (Indicated by an arrow)

Thick layer of black soil

Ploughing on dry soil using tractor

Ploughing in wet soil using tiller

Liming pond bottom

Liming over water surface

Pumping water into the grow out pond

Optimum algal bloom for stocking post larvae

Healthy hatchery reared PL for stocking

5. Irrigation

After liming, some amount of water is allowed into the pond. The lime dissolves in water and the water is then refilled with abundant water of good quality.

6. Fertilization

Fertilization is the addition of fertilizer (manure). The manure enhances the growth of phytoplankton and zooplankton which form the feed for the fish.

The fertilizers may be organic or inorganic (chemical fertilizer).

The **organic fertilizer** includes cow dung, pigdung, poultry manure, green manure, compost, mahua oil cake, sewage, etc.

The **inorganic fertilizers** include urea, ammonium phosphate and super phosphate.

Fertilizers are applied 15 days after liming.

7. Water Quality Management

Pond water is the medium for the fish. It is the home for the fish.

- The carps require an optimum temperature range from 200 to 25°c
- The dissolved O, should be above 5mg/l.
- The CO, should be 3mg/l of water
- The visibility of the pond should be more than 30cm.
- The pH should be on the alkaline side from 6.5 to 9.

8. Weed Control


Weeds are unwanted aquatic plants growing in the fish pond.

The aquatic plants must be present in the fish pond but in small quantity. When their number increases, they become detrimental to the life of fish.

The aquatic weeds may be microphytes or macrophytes. The microphytes are microscopic algae. Eg. Volvox, Chlamydomonas, Euglena, Peridinium, Microcystis, etc.

The luxuriant growth of algae causes algal blooms.

The **macrophytes** are large aquatic plants. Eg. The weeds can be controlled by thefollowingmethods:

The weeds can be controlled by the following methods:

*Manual removal

*Netting

*Netting

*Application of herbicides

Some fishes eat the weeds. Such fishes are reared in the ponds to control weeds.

9. Predator Control

The fish eaters of ponds are the predators. Eg. Insects, crabs, large fishes, snakes, birds, etc. Predatory insects are controlled by netting and spraying vegetable oils

Vertebrates are controlled by nets which prevent the entry into ponds.

Morethan 50% of insect present in the pond are removed by chemical or biological method.

10. Stocking

Stocking is the release of hatchlings, fry and fingerlings into the nursery, rearing and culture ponds respectively. The stocking density is as follows:

Nursery pond	1 million hatchlings/ha
Rearing pond	1 lakh fry/ha
Culture pond	10000 fingerlings/ha

The stocking density may be increased or decreased depending on the fertility and the availability of feed.

11.Supplementary Feeding

Fish can feed and grow on the natural feed available in the pond. This feed is not sufficient for high stocking density and fast growth. Hence prepared food (artificial feed) should be given for the fish.

The feed should contain carbohydrate, protein, fat, minerals and vitamins. It should be a balanced diet. It should produce healthy growth and fattening.

The hatchlings are given powdered feed only. They are given groundnut cake and rice bran in the ratio of 1:1. The feed is given 2 to 3 times a day. The feed is placed in bamboo baskets in shallow areas.

In the beginning, the baby fish are fed at the rate of twice the weight of hatchlings. After a week, it is increased to three times the weight of baby fish. After two weeks, it is increased to four times the weight of the fish.

The fry are fed with artificial feed. It is a balanced food. It contains carbohydrate, protein, fat, minerals, vitamins, antibiotics, yeast, cobalt chloride, etc.

The feed is given three times in a day. The feed is made into small balls and are placed in bamboo baskets. The bamboo baskets containing the feed are placed in shallow waters in three or four places.

In the beginning, artificial feed is given at the rate of 1% of the body weight of the fry fish. It is gradually increased to 2 to 3%. The fingerlings are fed like that of fry.

12. Disease Control

Diseases cause great loss to fish farmers. Hygienic conditions, prevention of diseases, precautions, identification of diseases, correct treatment, etc. save fish from diseases.

Red disease

Epizootic ulcerative syndrome (EUS), also known as **red spot disease (RSD)** and **mycoticgranulomatoses (MG),** is a seasonal epizootic condition of great importance in wild and farmed freshwater and estuarine fish.
It was first reported in farmed ayu (Plecoglossusaltivelis) in Japan in 1971.
Causative agent: Aphanomyces*invadans*, A.*piscicida*, A.*invaderis* and ERA (EUS-related Aphanomyces).
Diagnosis:EUS can be readily detected in diseased fish specimens collected from EUS-infected areas using histological techniques. Fish may exhibit red spots or small ulcers.

Control / Treatment: Control of EUS in natural waters is probably impossible. In outbreaks occurring in small, closed water-bodies, liming water and improving water quality, together with removal of infected fish, is often effective in reducing mortalities.
But the farmers using some medicines such as ***Multilite*** for the control of the disease. That was mixed with sand at the ratio of 1:4. The multilite was mixed with 20 kgs of sand and was spread all over the pond. For the equal distribution of that it was mixed with sand.

Argulus

Argulus species (Family: Argulidae), more commonly known as fish lice, are members of a large group of branchiuran parasites that infest and cause disease in fish. The argulids are crustaceans and are related to crabs, lobsters, and shrimp.

Argulus infestations tend to peak in the summer and fall. The lice can be found attached to the skin, gill chamber, and mouth. Localized inflammation occurs at the contact site because of mechanical damage from hooks and spines on the stylet and appendages, and irritation from digestive enzymes. In heavy infestations, the fish lice may be seen all over the skin and fins of the fish and in the water column

Fish may “flash” or rub against surfaces in an attempt to relieve irritation or to remove the parasites.

Argulus is also capable of acting as a mechanical vector or intermediate host for several fish diseases. The parasite can carry and transmit spring viremia of carp.

Several medications have historically been used for bath treatment of Argulus, but potential resistance to treatment, current availability, legality of use (especially in food fish species), dosage rates and associated costs, and fish species’ sensitivities may reduce options. It is best to work with a fish health specialist. There are currently no FDA-approved drugs for the treatment and control of Argulus.

Prolongedimmersion of an organophosphate pesticide, such as trichlorfon (Dylox® 80, Bayer), which acts by disrupting the nervous system, has been an effective treatment when dosed at 0.25–0.50 mg/L active ingredient, once a week for 4 treatments.

Argulus infestations are not uncommon in wild or pond-raised freshwater and marine fish. Because infections can rapidly escalate, causing disease and mortalities, management and treatment are recommended as soon as Argulus is identified. While several effective treatments are possible, availability, legalities, logistics and fish species' sensitivities should be considered. The best way to avoid an Argulus infestation is through good biosecurity, including screening and quarantine of incoming fish, and continuous observation of all fish.

The following managerial activities should be followed for disease control:

• The pond should be dried and ploughed now and then.

• Liming should be carried out.

• The pond should be filled with good quality water.

• Silt and weeds may be contcontrolled.

• Fish may be given a salt bath in 1001 of water having1.5kg of salt for 1 to 2 hours before stocking.

• When there is disease outbreak, the fish are treated with potassium permanganate solution (1g per 2001).

• Bacterial diseases are treated by injecting chloramPhenicol 1 to 1.5mg for every 100gms of body weight.

• Fungal diseases are treated with bath treatment in Common salt 25gm in 11 for 10 minutes or

• Potassium permanganate1gm in100/for1to11, hours orCoppersulphate 5gms in 10/ until fatigue

• The protozoan disease costiasis is treated with bath in formalin - 40ml in 1001 of water for 10 minutes.

• Leech parasite is treated with lysol bath. Cresol and soap 1:1; 1ml of this solution in 51 of water for 15 seconds.

• The platyhelminth parasite Dactylogyrus (gill fluke) is treated with

• Formalin bath 1ml in 11 of water for 15 minutes or Salt bath 25g in 11 of water for 10 minutes.

• Argulus is treated with

• Lysol bath : Cresol and soap 1:1 ratio; 1m/ in 5 / of water for 15 seconds or

• Potassium permanganate bath : 1g in 17 of water for 40 seconds.

• Bacterial diseases like vibriosis and ulcer are treated by adding 71/2 gm oxytetracycline for 100 kg of fish per day for one to two weeks in the feed.

• Gut parasites of protozoans can be treatedbyadding magnesium sulphate (Epsom salt) in the feed.

• Gut parasites other than protozoanscanbetreatedby adding thefeed.di-n-butyl tin oxide 25g/100kgfish/dayfor3daysin

• Bacterial infection can betreatedbyaddingFurazolidone 11g/100kg fish/day for about a week.

13. CARING FISHES & MEASURES TAKEN BY FISH FARMERS

1. Following good management practices such as maintaining adequate water parameters (O2 , DO, pH, etc). Aqua technicians visits the pond for every 15 days.
2. Checking water parameters, in this pond the water parameters can be tested using test kits by any one of these two methods: Scaling method, Drop method.
3. Oxygen levels decreases every night so the farmers need to check the o2 levels regularly and carefully. If decreased the aerators are used for aeration and proper supply of oxygen.
4. To avoid water seepage in sandy soils, farmers use Thick polythene covers to cover the surface of the pond so that the water doesn't seep into the ground.
5. Baby fishes are innocent and helpless. They need parental care from the farmers. Baby fishes are carefully watched for their behaviour. They come to the surface in the morninghourstowarm themselves, to play above and to hunt their breakfast. By about 8 am as the water gets warm on the surface they will go down. This is their normal behaviour, when they are comfortable.

When the baby fish are uncomfortable, they will be restless and remain on the surface. Then there is something wrong. This may be due to

- Some enemies in the bottom
- Over crowding
- Excess of putrification at the bottom Foul water

- Shortage of food.

The remedy is A net is dragged to search for the enemy

Some of the baby fishes may be transferred to other ponds to reduce overcrowding.

If the water is not suitable, the impure water is drained and good quality water is refilled.

6. Disease and sick fishes must be transferred to hospital pond and treated.

7. Some poles are fixed in the middle of the ponds. They will help the fish to remove external parasites by rubbing its body against the poles.

8. A few stones may be placed at the bottom. This will provide shelter for the fish in the pond.

9. Plantation may be raised on the northern and western end of the ponds. They provide shade in summer and keep the water cool. Mulberry tree is ideal.

10. The fish must be given enough exercises. This is given by the following methods:

- Occasionally disturbing the water.
- Washerman may be encouraged to wash their cloths in the pond. This not only gives exercise but also helps to maintain alkalinity..
- Buffaloes may be allowed in the pond. This not only encourages exercise but also gives feed.
- . A few larger fish left in rearing ponds will give exercise to baby fish.

11. small snails such as Limnaea, Vivipara, Malonia, etc. are released into the pond. They act as scavengers and they also form live feed for fishes.

- Presence of snails at the bottom of the pond. Along with fishes they also intake oxygen which may results in the oxygen depletion. To avoid snails copper string method is used.
- The aerators (2 hp) should be turned on from 9 pm to 7 am based on the O2 levels. Diesel motors are used more.
- Water levels raises due to floods and pathogens enters into the pond such as snails crabs snakes etc

12, Red disease and argulus Were the most contagious diseases attacked to their cultures.

13. When there is mass mortality of fish, it may be due to scarcity of food, disease outbreak, overcrowding or abnormal Physio -chemical parametres of the pond. One of the main reasons may be low oxygen content of the water.

The depletion of oxygen may be due to:

*Putrification of bottom organic debris

*Slow rate of photosynthesis on cloudy days releases less oxygen.

*This oxygen is exhausted in respiration during night hours.

* Low oxygen content causes asphyxiation.

*When there is low dissolved oxygen, the fishes exhibit the following abnormal behaviour.

*Fishes move restlessly round and round.

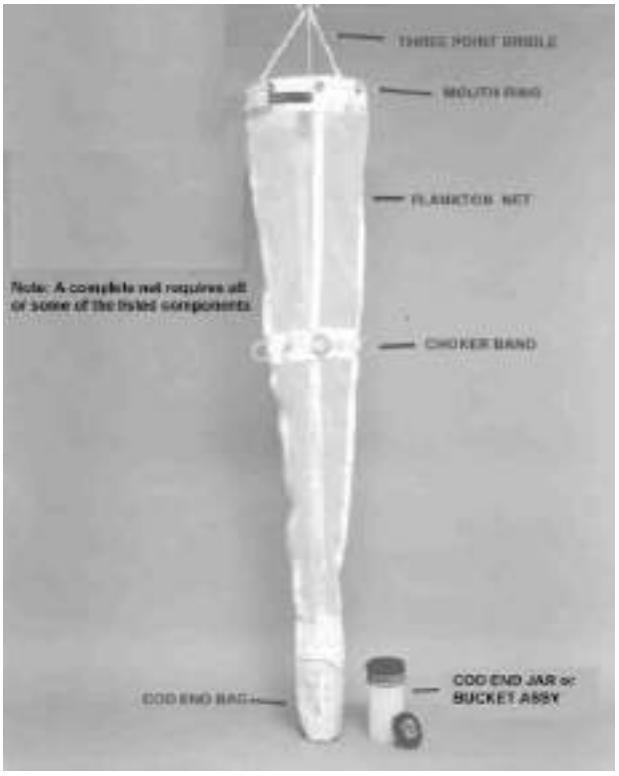
*Fishes move to the surface.

*Molluscs move to the edge of the pond.

The following measures are immediately taken:

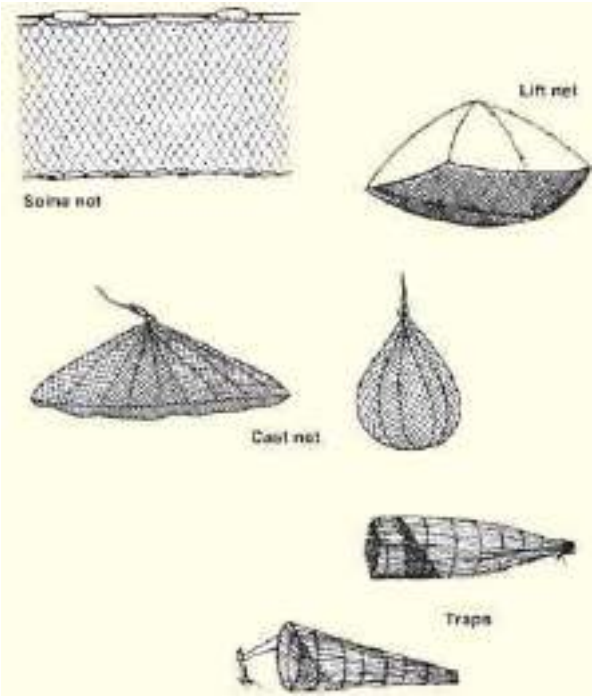
1. The pond water is moved by drag netting. It will oxygenate the water.
2. The water is splashed with hand.
3. The water is beaten with bamboo poles.
4. Freshwater may be added.
5. The putrifying organic debris of the bottom is removed by siphoning.

14. Fish Pond Implements



The fish farmer should maintain the following implements in the fish farm:

1. Raker
2. Nets
3. Hapas
4. pH meter
5. Thermometer
7. Plankton net
8.Water sampler
9. Soil sampler
10. Analysis kit
11. Small boat or a float.
6. Secchidisc.



15. Fish Pond Record

Maintaining record of fish farm helps to improve the farming in the succeeding year.

Ponds should be numbered

Dates of manuring, stocking, feeding, netting, marketing, size and weight are to be entered in a register regularly.

Expenditure on various items and income should be registered. The profit is calculated.

16. Harvesting


The harvesting of fish should be done at the right time. It should not be postponed. Before harvesting, the fish are given fattening feed. This will change the flavour and colour of the fish.

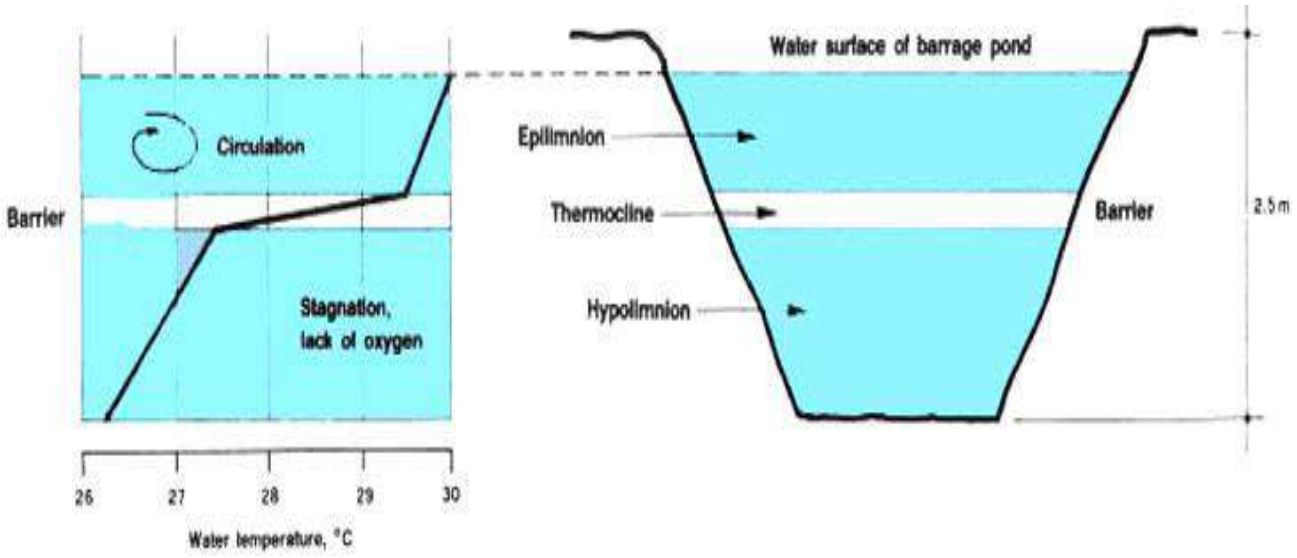
17. Marketing

The marketable fish can also be stored for some time in the marketable pond until the availability of fish is low in the market. This will fetch high price for the fish.

18. Preservation

The unsold carps can be preserved in ice or salt drying.


Benefits of maintaining 6 feet water depth in ponds :



- Useful for the stratification – the layering of pond water ;

The upper ayers of pond water absorb light, so most aquaculture ponds will develop stratification during the summer. This condition is characterized by extreme differences in water quality— especially temperature and dissolved oxygen concentration— between surface and bottom waters. These differences in water quality can affect fish culture.

- Improves distribution of dissolved oxygen through the water column.
- Minimizes organic matter accumulation and improves algae too.
- The climatic temperature effects only the upper layer of the pond; i.e., upto 2 feets and the remaining 4 feet will have the same temperature and doesn't effect the fish cultures.

SPECIES CULTURED

They explained us about the types of species and varieties of fishes cultured in the ponds as follows:

1. TILAPIA

Scientific classification of tilapia :

Kingdom :	*Animalia*
Phylum:	*Chordata*
Class:	*Actinopterygii*
Order:	*Cichliformes*
Family:	*Cichlidae*
Genus:	*Tilapia*

AQUACULTURE OF TILAPIA:

Tilapia has become the third most important fresh water fish in aquaculture after carp and salmon; worldwide production exceeded 1.5million metric tonnes and increases annually. Because of their high protein content, large size, rapid growth, and palatability.

Tilapia fisheries originated in AFRICA and LEVANT .Tilapia farm projecting in this country have the highest potential to be green or environmentally friendly in temperate zone localities, tilapia farmers typically need a costly energy source to maintain a tropical temperature range in their tanks.

Tilapiines are among the easiest and most profitable fish to farm due to their Omnivorous diet, tolerance to high stocking density, and rapid growth. A fully grown adult sizes about 12-15 cms, 5-6 inches.

Characteristics of Tilapia :

- They are laterally compressed,
- They are efficient feeders that can capture a wide variety of food items
- Their mouths are protractible, usually bordered with wide and often swollen lips.
- Tilapia have a long dorsal fin , lateral line which often brakes towards the end of the dorsal fin, and starts again 2 or 3 rows of scales below
- They are best examples for parental care (mouth brooding species). These are fast growing fresh water fishes with a primarily vegetarian diet.
- Tilapias are low in saturated fat, calories, carbohydrates, and sodium, and are a good protein source.
- They consume plant and nutrients unused by other fishes and substantially reduce O2 detritus.

2. LABEO ROHITA (ROHU)

Scientific classification of Labeorohita :

Kingdom: *Animalia*
Phylum: *Chordata*
Class : *Actinopterygii*
Order : *Cypriniformes*
Family : *Cyprinidae*
Genus : *Labeo*
Species : *rohita*

Characteristics of Rohu fish :Its a fresh water fish,

- LABEO is a genus of carps in the family cyprinidae. They are found in fresh water habitats of the tropical and sub tropical regions of AFRICA and ASIA.
- Labeos are larger and have a more spindle shaped body as they are mostly freeswimming.

- The lips are expanded into thick sausage shaped pads which have keratinised edges. Thus, their mouth parts are moderately apomorphic; not as little developed as in barbs
- Labeos have the two barbels on the rostrum which are common among the cyprinidae
- Generally ROHU is cultured with Catla in two species or mrigala and Catla in three species
- Rohu can also be reared with silver carp and grass carp
- It is an omnivores also used in extensive aquacultures
- It is a fresh water bony fish famous in India and South Asia
- It has became popular because of its taste and demand in the market. It cannot survive at below 14^0 C .
- They can live upto 10 years and attains maturity in 2-5 yrs.
- It is a planktivorous fish which feeds mainly on zooplanktons and phytoplanktons.

3. ROOPCHAND

Scientific classification of Roopchand :

Kingdom :	*Animalia*
Phylum:	*Chordata*
Class:	*Actinopterygii*
Order:	*Characiformes*
Family:	*Serrasalmidae*
Genus:	*piractus*
Species:	*mesopotamicus*

Characteristics of Roopchand: Roopchand is a fresh water fish

- It is also known as pach ,Red bellied pach
- It is a single bone fish
- The fat content is very low in this species
- The growth of the fish is more during summer season.
- It cannot tolerate and live in polluted waters
- The growth of the fish is less in winter season as it intakes less feed.
- It can tolerate to many viral and bacterial diseases
- Red disease is the only disease which the health of pacu
- This disease can only known by the identification of red spots, markings on its fins and overall body.
- There is a stable market for this species at any season.
- An average pacu weighs about 1.5 kgs , measuring about 75-80 cms The average time taken for its harvest is 6 months.
- The water management is very important for this species for its growth.
- Pacu , unlike pirana, mainly feed on plant material and not scales , or flesh . The scientific name of this Red bellied pacu was Piaractusmesopotamicus.

4. NONA TANGRA

Scientific classification of Nona tangra (Mystus)
Kingdom : Animalia
Phylum Chordata
Class : Actinopterygii
Order Siluriformes
Family Bagridae
Genus : Mystus
Species: Bagruspelusius

Characteristics of Nona tangra (Mystus):

- Median longitudinal groove on head reaching base of occipital process. Occipital processthreetimes as long as broad at base and reaching basal bone of dorsal fin.
- Teeth villiform, numerous in a continuous band on palate and upper jaw; in a mesially interrupted deeply curved band on lower jaw.
- Four pairs of barbels; maxillary pair extending to base of anal fin, nasal anterior end of operele, outer mandibular base of pectoral fin and inner pair short.
- Rayed smooth, dorsal inner fin surface inserted with above 8-10 half retrorse of pectoral teeth. Pelvic fin, spine fin not strong, reaching outer anal surfacefin.
- Anal fin not reaching caudal fin base. Least depth of caudal peduncle 1.5 to 1.8 in its length. Caudal fin forked, upper lobe longer than lower.

Breeding: Oviparous, distinct pairing possibly like other members of the same family. This genus is known to be egg scatterers and may eat the eggs if they are not separated.

- Cold water changes may start a pair off if they are kept in a species tank on theirown.
- There have been a couple of instances of successfull breeding attempts with Mystus species, notably M. armatus and M.vittatus.

Feeding: Flake food which will give them all the vitamins they desire. They should of course be fed a varied diet consisting of the former, tablet, pellet foods and frozen foods such as bloodworm.

5. COMMON CARP

Scientific classification of tilapia :

Kingdom : *Animalia*
Phylum: *Chordata*
Class: *Actinopterygii*
Order: *Cypriniformes*
Genus: *Cyprinus*
Species: *C.rubrofuscus*

Characteristics of Common carp

The colour of the body varies from gray through silver to bronze with a yellowish or reddish belly
* Common carp has one long dorsal fin which possesses 2-3 hard and 17-22 soft rays The first (largest) hard ray is sharp and is serrated on its posterior margin. Additional morphological vertebrae (Froese characteristics and Pauly, 2011).include 2-3 anal spines, 5-6 anal rays and 36-37
The mouth is large and opens in an accordion-like fashion. There are two pairs of barbels, one pair on the upper lip and the other pair at the corners of the mouth. There are 5-5 molar-like pharyngeal teeth serving to grind the food.
Common carp occur within the temperature range of 3-35 oC (Froese and Pauly, 2011). The optimum water temperature for growth and propagation is 20-25 oC. In nature, common carp live in the middle and lower sections of rivers andinareas where the water is shallow (only a few meters deep) and the bottom is muddy.

* Common carp has been introduced into practically all countries where there is a chance for successful reproduction. In many of the natural waters where it has been introduced, the common carp is considered as an invasive species whose populations should be reduced or even eliminated. Still, common carp is one of the most widely cultured freshwater fish species in the world (Welcomme. 1988; Hasan at al ., 2007; FIGIS, 2011).

Discounting the production of advanced fry, this species is typically reared in ponds in polyculture with other fish species. Polyculture in ponds can be extensive (300-800 kg/ha/season), semi-intensive (1 000-2 000 kg/ha/season) or intensive (2 000-3 000 kg/ha/season or greater). Advanced fry are also reared in ponds but are typically raised in monoculture.
" The mass production of advanced fry in tanks using collected zooplankton and balanced feed is the intensive technique whichis likely to becomefinanciallyviable in the near future

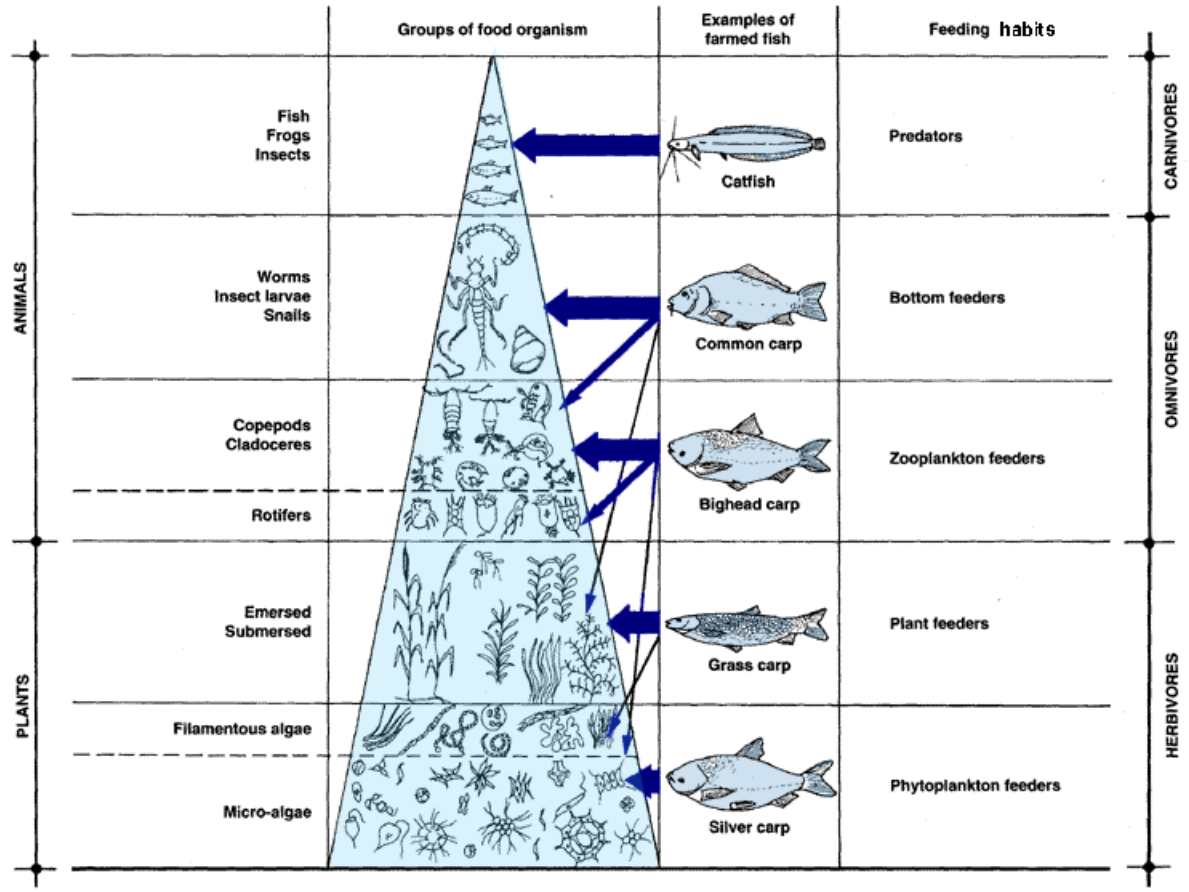
FEEDING (FISH FEED)

Fish feed

Feed plays a vital role in Aquaculture. Growth and all acquired activities of fish mainly depend on the food they consume. In nature, different feeding habits can be observed in finfish, shellfish species. They feed on zooplankton, phytoplankton, filamentous algae, macrophytes, detritus matters, molluscs, small crustaceans and other small fish species. Many of them feed on more than one type of food.

Though all the culturable species of fish mainly depend onavariety of natural feed and supplementary feeds are required for intensive and semi-intensive culture systems. The supplementary feed is a combination of different ingredients both from plant and animal origin.

Classification of Feed



Feeds are classified into live feed and artificial feed.

Live Feed

Live feed also known as natural feed are those food organisms which are available in the natural habitat. Eg. Algae, Diatoms, Rotifer, Artemia, Daphnia, Moina, etc.

Artificial Feed

The prepared feed is called artificial feed or supplementary feed. Artificial feeds are also called compound feed or formulated feed or complete feed.

Feeding fishes artificially with preparedfeediscalled artificial feeding or supplementary feeding. Artificial feed is prepared by using feed ingredients of both plant and animal origin. The commonly used plant feed ingrediants are:

Algal powder, groundnut oil cake, wheat flour, tapioca powder, and seaweed powder.

The animal feed ingredients used in artificial feed are:

Fish meal, chicken intestine, prawn head meal, cuttle fish, and squid meals.

When fishes are reared in large numbers in intensive culture and semi-intensive culture, natural food is not sufficient. In intensive and semi-intensive culture, the fishes are fed with prepared feed.

Artificial feed is a combination of different ingredients both from plant and animal origin. Based on the number of feed ingredients used, artificial feed are classified into 2 groups.

1. Simple feed

2. Compound feed

3. Fermentation feed

Simple feed

Simple feed are made up of a single feed ingredient. They do not supply all the essential nutrients required by the fish. Therefore they are also called unbalanced feed. They are used as supplementary feed along with natural food materials. They include rice bran, groundnut oil cake, silk worm pupae, etc.

Compound feed

Compound feed are made up of more than four feed ingredients. They will supply all the essential nutrients required by the fishes. They are also called balanced feed or complete feed. They include a mixture of different ingredients like trash fish, slaughter house waste or mixtures of

powdered ingredients. The ingredients used for the formulating fish feed should be based on their qualities such as protein content, energy level, type of amino acid etc.

Major ingredients commonly used are

=>corn meal	=>slaughter house waste
=>ground nut oil cake	=>silk worm-pupae
=>soy bean powder	=>cow dung rice bran
=>tapioca flour wheat bran	=>wheat flour fish meal
=>dried algae	=>shrimp meal

Selection of ingredients for the preparation of feed is based more on the availability than on the nutritional value. The finished form of the artificial feed are of different forms. They may be

*Dry, moist or wet,

*Floating or non-floating type,

*Granules, crumbles, balls, cakes, flakes, pellets or paste.

Fermented feed

Ingrediants (main components) of fermented feed:

*Jaggery *Ground nut cake, * mustard cake.

*Rice bran *wheat husk,

Jaggery is the main source of carbon in feed. It is also used as a fermentation supporter and useful for bacterial growth.

Methods of feeding

(feeding methods)

Following the fish methods :are fed with artificial feed by any one of the

1.Manual feeding 2.Automatic Manual 3.Automatic feeding 4. Demand Computer feeding

Manual feeding

Manual feeding is the hand feeding. The feed are collected manually from the store room and placed in the feeding sites

Automatic Feeding

In automatic feeding, the required amount of feed drop into the water automatically, at the required intervals. It is operated by electric and electronic timing devices.

Demand Feeding

In demand feeding, the fish gets the feed, when it operates a device connected to the feeder.The feed is stored in the feeder suspended above the water. A rod or plate hangs from the feeder into the water. When the moving fish touches the rod a small amount of feed is released.

Computer Feeding

Feeding the fish with the aid of computer programming is called computer feeding. The amount of feed and the time interval are automatically programmed by the computer based on the density of fish, growth rate, age of the fish, temperature, etc.

Bag feeding

The feed given to the cultures in INDUKURPETA polyculture farms is **fermented feed** which is made from fermenting the products. The main ingredients of the feed given were: rice bran, jaggery, groundnut oil cake, mustard cake, etc., The fishes were fed through various methods, one of them are bag feeding methods.

Whenever the level of algal blooms raises then farmers reduce feed, so that the fishes intake the excess algae.

Types of Artificial Feed

1. Based on the number of feed ingredients used for the formulation, the feed are grouped into

i. Simple feed ii. Compound feed

Simple feed is prepared by using a single feed ingredient. This feed will not supply all the essential nutrients to fish. Hence, it is also called *unbalanced feed*. Eg. Groundnut oil cake.

Compound feed is prepared by using several feed ingredients. This feed is a balanced feed. It will supply all the essential nutrients to the fish. Eg. Artificial feed prepared by using fish meal, groundnut oil cake, algal powder, wheat flour, tapioca powder. squid meal, etc.

2. Based on the nutrient level and size, the artificial feed is grouped into

i. Starter feed ii. Grower feed

iii. Finisher feed iv. Broodstock feed

Feed type	*Level of protein (%)*
Starter	40 to 45
Grower	35-40
Finisher	30-35
Broodstock	40-45

3. Based on the physical condition of feed, they are classified into two major types. They are :

i. Dry feed ii. Non-dry feed

Dry feed: Dry feed will have the moisture content of 8 to 12%.

They are grouped into: i. Mash or meal ii. Pellet feeds

The dry and powdered form of feed is called mash or meal. It is mostly used in hatchery and nursery ponds. In pellet feeds, the formulated feed ingredients are mixed,cookedand extruded in the form of noodles.

The pellet feed are further grouped into i. Floating feed ii. Non-floating feed

Floating feed will float on the surface of the water. This feed will be consumed by surface feeding fishes.

Non-floating feed will sink to the bottom of the pond. This feed will be consumed by bottom feeding fishes. If the non-floating pellet feeds are crumbled into uniform particles, they are called crumbles or granules. The size of this feed may vary. It is used in nursery and ornamental fish culture.

Non-dry feed: Non-dry feed has high content of moisture.

Non-dry feed are classified into: i. Wet feed ii. Moist feed

Wet feed will have the moisture content of 18 to 45%. *Moist feed* will have the moisture content of 45 - 70%. Both wet and moist feeds are prepared by using moist feed ingredients. The wet and moist feed are again grouped into extruded and *non-extruded forms*.

Non-extruded forms include: i. Balls ii. Cakes iii. Pastes

Extruded forms include pellets and flakes:

1. ***Pellets***: Pellets are in the form of noodles.
2. ***Flakes:*** Flakes are non-dry feeds in the form of corn flakes. Flakes are prepared by using large number of feed ingredients. It is a balanced feed. It is used in nursery and ornamental fish culture.

Feeding Rates

The amount of feed required by the fish is decided by the weight of the fish. Generally, feed requirement decreases with the increase in the weight of the fish. The young fish require more feed but the adults require less feed. For example a fry of 0.25g requires 10% of their weight daily; but a fish of 4g may require only 5% of the body weight daily.

Feeding Schedule

The fish are fed two times in a day. Morning and evening hours are suitable. The fish are fed in specified timings and in fixed places. The fish feed are kept in shallow waters. The feed vessels may or be bamboo sprayed baskets. on surface waters or kept in **earthern vessels** and **bamboo baskets** .

Preparation of Artificial Feed

Artificial feed is prepared by mixing a variety of ingredients. The preparation of artificial feed involves the following steps :

1. Selection of ingredients
2. Grinding
3. Sieving
4. Ratio
5. Mixing
6. Steaming
7. Pelleting
8. Drying
9. Packing
10. Stocking

1. Selection of Ingredients:

The ingredients of fish are selected to fulfill the following requirements

1. Energy
2. Protein
3. Fats
4. Vitamins
5. Minerals

The feed ingredients also should include additives, preservatives and chemo attractants. Locally available ingredients should be selected. They should be at low cost but in good quality.

Fig :Pellet feed grade sieving

2. Grinding:

The various ingredients of the fish feed are collected and dried. They are ground into powder in a hammer mill. Grinding reduces particle size, facilitates easy digestion and hence increases the nutritive value of ingredients.

3. Sieving:

The ground ingredients are sieved through a mesh of 177um. The dust may be controlled by spraying oil.

4. Ratio:

The ingredients are weighed individually according to the feed formula and kept as heaps.

5 .Mixing:

The weighed ingredients are placed as a heap. They are mixed thoroughly. In feed factories, different types of mixing mills are used They may be vertical mixers, continuous mixers, ribbon mixers, liquid mixers, etc.

6. Steaming:

The feed ingredients are passed throughaconditioning chamber where 5% water or steam is added. Water provides lubrication for pellet making. Steaming helps in the killing of bacteria and other pathogens and improves digestibility. The steam also helpsto change the starch into gelatin which helps in more adhesion of particles.

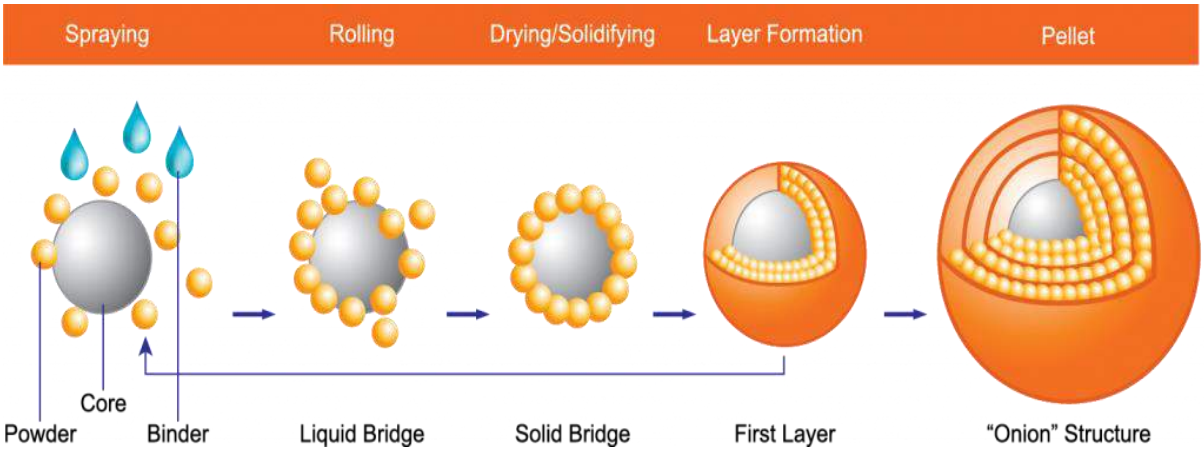
7. Pelleting:

Pelleting is the conversion of conditioned feed into pellets. Pelleting is done on a machine called pelletizer. In the pelletizer different dyes are used to produce different types of pellets.

Inside the pelletizer, the feed is first air dried and then given 15 to 16% moisture at 80 to 90?C. Then the mixture is compressed and extruded through the dye. The pellets are discharged from the pelletizer to a screen belt of horizontal tunnel drier or vertical screened hopper. The pellets are air cooled for 10 minutes.

8. Drying:

The pellets are dried in the oven at 120 degrees Celcius. The dried pellet should not contain more than 10% moisture. The pellets must be hard, stable in water and floating.



9. Packing

Pellets are packed in polyethylene lined sacks.

10. Stocking

The prepared food is stocked safely for future use. It is kept in cool and dry places. Fungi and mycotoxins are prevented by adding sodium benzoate or sodium sarbate.

UV light irradiation prevents fungi.

Lipid oxidation is prevented etc. by anti-oxidants, such as citric acid, ascorbic acid.

Fig. Steps in the preparation of ingredients.

Nutritional Requirements of Fish

The aim of aquaculture is to produce more flesh from fish. The flesh is got by growth. Growth is determined by the feed. Food with the greatest calorific value, gives most rapid growth. At the same time, vitamins and minerals regulate growth.The various components of the feed constitute fish nutrition. The fish feed should contain the following nutrients:

1. Carbohydrate- 4kcal/g

2. Proteins- 4.5kcal/g

3 . Lipids -9 kcal/g

4. Vitamins 5. Minerals

Vitamins and minerals regulate the metabolism. Calcium and phosphorus are essential for the growth of bones.

Composition of an ideal Fish Feed

Ingredients	Quantity in Kg
Tapioca flour	9
Rice bran	27
Fish meal	23
Groundnut oil cake	14
Silk worm pupae	26
Vitamins and Minerals	1
Feed additive, Preservative, Chemo attractants	Trace amount
Total	100 Kg

Qualities of good Artificial feed

A good quality feed must have the following characters:

1. It should contain balanced nutrients

2.Itshould be readily acceptable.

3. It must be adequately stable in the medium.

4. It should have required attractants, stimulants, etc.

5. It must not have anti-nutritional effects.

6. The granules and pellets should be in an acceptable size and shape.

7. The ingredients used should not produce any adverse environmental factors.

8. The ingredients should be available at minimal cost.

9. The time taken for manufacturing the feed should be low.

Food Conversion Ratio (FCR)

The FCR denotes the amount of dry feed necessary to produce 1kg of fish.

$$FCR = \frac{\text{Total dry } - \text{ weight of feed}}{\text{Total wet } - \text{ weight gain (growth of fish)}}$$

Principles of Feed Formulation

The feed must be a balanced diet. The feed should produce optimum growth rate.

The feed should contain all the essential amino acids and essential fatty acids. Fish meal is a good source of essential amino acids and essential fatty acids. Hence fish meal should be compulsorily included in the feed. Ingredients of plant origin and animal origin should be included.

The feed must be in low cost but in good quality. In semi-intensive system, certain vitamins and minerals may be excluded as the fish may get them from natural feed sources. But for intensive culture all the ingredients must be included. The feed must be acceptable by the fish. The typical adult feed should contain more protein but less carbohydrate. In the case of fingerlings, the fats should be less. It should contain all the nutrients essential for life activities.

The following nutrients should be included in the artificial feed:

- Carbohydrates
- Proteins
- Fats
- Vitamins
- Minerals
- Additives – binders
- Preservatives
- Chemo attractants

The feed should contain **Carbohydrate**. It is the source of energy. The energy value of carbohydrate is 4kcal/gram. *The following are the sources for carbohydrate (energy source):*

1. Rice bran
2. Tapioca flour
3. Wheat bran
4. Corn bran
5. Sorghum, etc.

Proteins are the body builders. An ideal feed should contain40% protein. The energy value of protein is 4.5kcal/g. *The ingredients containing protein are the following:*

Fish meal	Cotton seed cake
Silk worm pupae	Linseed cake
Blood meal	Prawn waste
Clam meat	Slaughter house waste
Ground nut oil cake	Gingelly oil cake
Coconut oil cake	Sunflower cake

Fats: The fish feed must contain fats. The fats are the energy producers. They contain more energy than that of carbohydrate and protein. The energy value of fats is 9kcal/g.

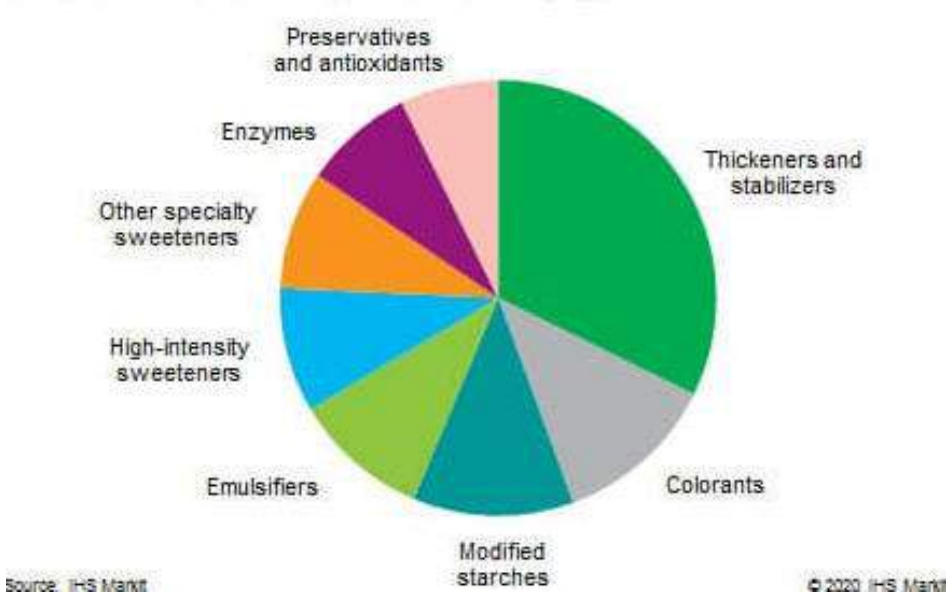
The following are the fat source of fish feed: Vegetable oils, Fish oils

Vitamins: The feed must contain Vitamins.

The following vitamins are essential for fish.

Vitamin A Vitamin B Vitamin C Vitamin D Vitamin E Vitamin K

Preservatives are added to prevent the decay of the feed.



The **minerals** are essential for vital activities of fish.

The fish feed should contain the following minerals in **trace amount**.

Calcium Copper

Sodium Potassium

Iron Zinc

Phosphorus Cobalt Magnesium

The vitamins and minerals are purchased from the medical store and added to the feed.

The **additives** are added to make the feed stable. When additives are added the feed will not dissolve and disappear in the water. They bind the feed ingredients. So they are also called binders. Eg. Tapioca flour, Rice flour, agar, etc.

Chemo attractants are added to add flavour and taste to the fish feed. The ingredients are selected according to their availability and cost. The ingredients are ground well and mixed thoroughly. They are made into pellets, dried and stocked. *The following is a typical artificial feed formula.*

Tapioca flour	9 kg
Rice bran	27 kg
Fish meal	23 kg

Ground oil cake	14 kg
Silk worm pupae	26 kg
Vitamins	1 kg
Minerals	
Feed additive	Trace amount
Preservative	
Chemo attractants	
Total	100 kg

Problems in Artificial Feed

The following problems are faced during the formulation and preparation of artificial feed.

a. Non-availability of needed feed ingredients

b. Low stability of the feed

c. Less feed conversion ratio (FCR) values 300

d. Non-availability of balanced nutrients

e. Low-digestibility

f. Leaching of vital nutrients

g. Presence of anti-nutritional factors

h. Presence of pesticide/heavy metals

i. Presence of microbial pathogens

j. High cost.

HITECH LIFE SCIENCES PVT. LTD

INTRODUCTION : HI-TECH LIFE SCIENCES PRIVATE LIMITED is located in Pothireddypalem of kovur, Nellore, Andhra Pradesh, India and is part of the Pharmaceutical and Medicine Manufacturing Industry. Hi-Tech Life Sciences Private Limited has two directors – VenkataRamana Reddy Nalubolu and SailajaNalubolu. On Jan 3,2022 ,Dept of Zoology, D.K.Govt. Degree College for women (A), Nellore organized field trip to Hitechfarma located at Pidatapoluru,kovur, of Nellore District.We the students of 5th sem aquaculture along with our staff members Dr. T. Sri Ranjani mam (HOD), Smt. H. Swathi(Lect in Zoology), Dr. N. Anithamam(Lect in Zoology),Lalitha mam(Lect in Zoology), and K. Nagaraju sir(Lect in Zoology) accompanied us to field trip.

OUTCOME: We learnt about the probiotics and the manufacturing of them through fermentation. Also we've learnt about the role of probiotics in Aquaculture. The process of fermentation, and it's types, and their production, marketing, sterilisation techniques of

equipments to prevent contamination, producing primary cultures and culture techniques in tha laboratory, we've also took part in culturing techniques and colony counting methods to demonstrate the colonies through microscope.

OBJECTIVES: The Objectives of this trip is to learn about probiotics and culture techniques in laboratories, through which the fermentation processes are taken place , to be an active part of their labs and to observe their work. Also to learn the process of fermentation through which the resultant products can be achived and marketed successfully.

PROBIOTICS

Probiotics are living microbial cells (although heat-inactivated versions have been shown to retain benefits for the host). Although probiotics were initially used for disease control, their use in aquaculture has now extended to improving fish growth and reproduction through addition to the body of water or feed.

Probiotics function by acting as nutrient sources, providing enzymes for better digestion, modulating the immune system and increasing the immune response against pathogenic bacteria. The most common probiotics used in aquaculture include lactic acid bacteria such as Lactobacillus-sp., Bacillus-sp., Enterococcus-sp., and yeast, Saccharomyces cerviciae

The concept is simple; feed adequate amounts of microbes to the organism to modify the gut microflora and replace harmful microbes with beneficial ones. The effect is multipronged. By populating the gut, these exogenous bacteria compete with pathogens, preventing their adhesion to the intestinal wall, limited access to nutrients and secreting antibacterial substances such as bacteriocinis and organic acids. In terms of promoting growth, the proliferation of friendly microorganisms increases digestive enzymes, such as proteases, amylases and lipases, in the gut leading to improved digestive processes and nutrient utilisation

List of probiotic strains used by Hi-tech farmalife sciences pvt. Ltd are

FERMENTATION

FERMENTATION is defined as the process of biological conversion of complex substrates into simple compounds by various microorganisms such as bacteria and fungi. In the course of this metabolic breakdown, they also release several additional compounds apart from the usual products of

fermentation, such as carbon dioxide and alcohol.

- These additional compounds are called secondary metabolites. Secondary metabolites range from several antibiotics to peptides, enzymes and growth factors.

Mainly, there are two methods of fermentation.

- SOLID-STATE FERMENTATION

- SUBMERGED FERMENTATION

SOLID-STATE FERMENTATION

- Solid state (substrate) fermentation (SSF) has been defined as the fermentation process occurring in the absence or near-absence of free water.

- Solid state fermentation (SSF) is method used for the production of enzymes, which involves the cultivation of microorganisms on a solid substrate, such as grains, rice and wheat.
- SSF employs natural raw materials as carbon source such as cassava, barley, wheat bran, Itbagasse.
- Solid-state fermentation (SSF) is a very old traditional technique carried out in many countries. It has been very popular for the production of fermented foods (idli, dosa, dhokla, bread, beverages, fermented fish, meat, yogurt, cheese, pickles).
- SSF is defined as any fermentation process in which a solid non soluble material is used which acts as a physical support as well as a nutrient source for the growth of microorganisms. The technique involves growth of microorganisms on porous particulate media with low moisture content in absence of free-flowing liquid.
- The most commonly used solid substrates for SSF are cereal grains, wheat bran, sawdust, wood shavings and several other plant and animal materials. Solid substrate fermentation is normally carried out as a non-aseptic process. This saves sterilization costs. Bioreactors designed for solid state fermentation are much simpler compared to liquid-state fermentation.

- SSF is normally multistep processes involving the following steps:
- 1. Pre-treatment of substrate raw materials either by mechanical, chemical or biochemical processing to enhance the availability of the bound nutrients and also to reduce the size of the components, e.g., pulverizing straw and shredding vegetable materials to optimize the physical aspects of the process. However, the cost of pre-treatment must be balanced with the eventual product value.
- 2. Hydrolysis of primarily polymeric substrates, e.g., polysaccharides and proteins.
- 3. Utilization (fermentation) of hydrolysis products.
- 4. Separation and purification of end products.

Applications of solid state fermentation:

1.Solid-state fermentation has emerged as a potential technology for the production of microbial products such as feed, fuel, food, industrial chemicals, and pharmaceutical products.

2. It is widely applied to producing several enzymes, organic acids, flavoring compounds etc., which must be extracted and purified and then used in different products.

3. Its application in bioprocesses such as bioleaching, bioremediation, bio-pulping, etc. has offered several advantages.

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Advantages of SSF:

1. Higher productivity will be achieved,

2. Simple Low-cost natural solids are employed as the media.

3. It requires low energy expenditure, minimum technology and less capital investment.

4. No need for sterilization, less chance of contamination.

5. Absence of foam formation so no requirement of antifoaming agent less microbial contamination and easy downstream processing.

6. Better oxygen circulation

7. Bioreactor design, aeration process, and effluent treatment are quite simple.

8. Many domestic, industrial and agricultural wastes can be fruitfully used as substrates in SSF.

Disadvantages of SSF:

1. The microorganisms that tolerate only low moisture content can be used.

2. Precise monitoring of SSF (e.g., O2 and CO2 levels, moisture content) is not possible.

3. The organisms grow slowly and consequently there is a limitation in product formation.

4. Heat production creates problems, and it is very difficult to regulate the growth environment.

5. Mixing of nutrients not uniform.

6. Due to higher impurity product, recovery cost becomes high.

SUBMERGED FERMENTATION

1.Submerged fermentation is a method of fermentation in which enzymes and other reactive compounds are submerged in a liquid such as alcohol, oil or a nutrient broth.

2. fermentation (SmF)/liquid fermentation (LF) Smf utilizes free-flowing liquid substrates, such as molasses and broths.

3. process is used for a variety of purposes, mostly in industrial manufacturing.

4. fermentation is a process involving the development of microorganisms in a liquid broth. This liquid broth contains nutrients and it results in the production of industrial enzymes, antibiotics or other products.

5.A high volume of oxygen is required for the process. The production of enzymes then occurs when the microorganisms interact with the nutrients on the broth resulting in them being broken down. The bioactive compounds are secreted into the fermentation broth.

ypes of ermented Foods	Names of Fermented Foods	Substrates for Fermentation	Key Microorganisms
lilk Products	Curd/Dadhi	Milk	*L. actobacillus bulgaricus, L. cremoris, L. actococcus lact*
	Butter Milk	Milk	*L. acidophilus, L. cremoris*
	Yoghurt	Milk	*L. thermophilus, L. bulgaricus*
	Camembert and Roquefort Cheese	Milk Casein	*Penicillium camemberti, P. roqueforti*
	Yukult	Milk	*L. actobacillus casei*
	Kefir	Milk	*L. caucasicus*
egetable Products	Sauerkraut	Cabbage	*Leuconostoc mesenteroides*
	Tempeh	Soybean	*Aspergillus* sp.
everages	Sake	Rice	*Aspergillus oryzae*
	Wine	Grapes	*S. cerevisiae*
ood Additives	Vinegar	Alcohol	*Acetobacter* sp. and *Gluconobacter* sp.

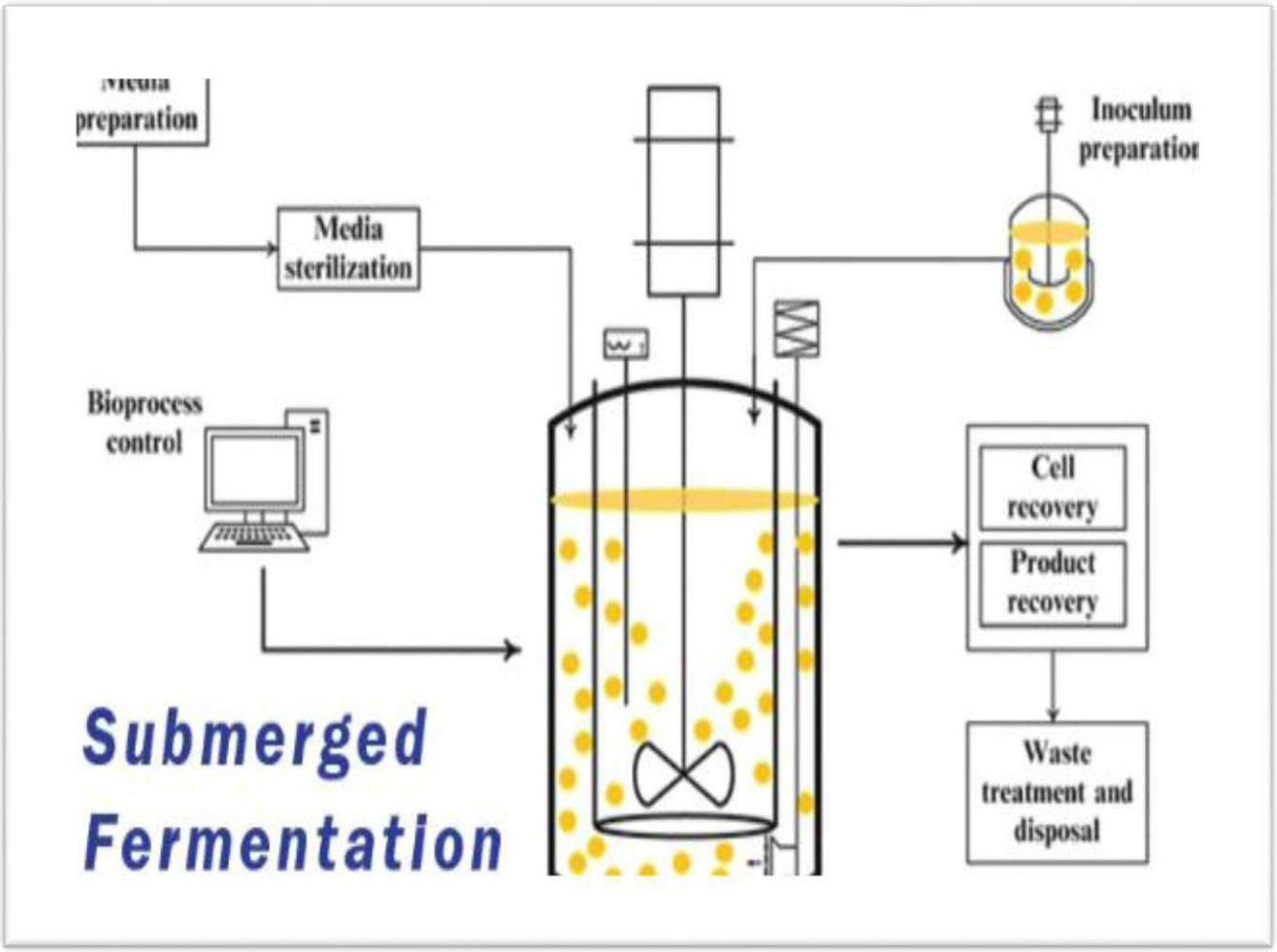
6.Substrates for submerged fermentation Some common substrates used in submerged fermentation are soluble sugars, molasses, liquid media, fruit and vegetable juices, and sewage/wastewater.

7.There are two common methods by which submerged fermentation takes place; they are batch-fed fermentation and continuous fermentation.

8.In batch-fed fermentation sterilized growth nutrients are added to the culture in batches. It is most common in bio-industries as it occurs during the growth of biomass in the fermenter. It helps raise the

cell density in the bioreactor and it is typically highly concentrated to stop dilution. The rate of growth in the culture is maintained by adding nutrients, this also reduces the risk of overflow metabolism.

9.An open system is constructed for continuous fermentation. Then sterilized liquid nutrients are slowly and continuously added to the bioreactor at the same rate at which the converted nutrient solution is being recovered from the system. This results in a steady-rate production of the fermentation broth.



Applications of submerged Fermentation:

- SmF is primarily used in the extraction of secondary metabolites that need to be used in liquid form.
- Submerged liquid fermentations are traditionally used for the production of microbially derived enzymes.

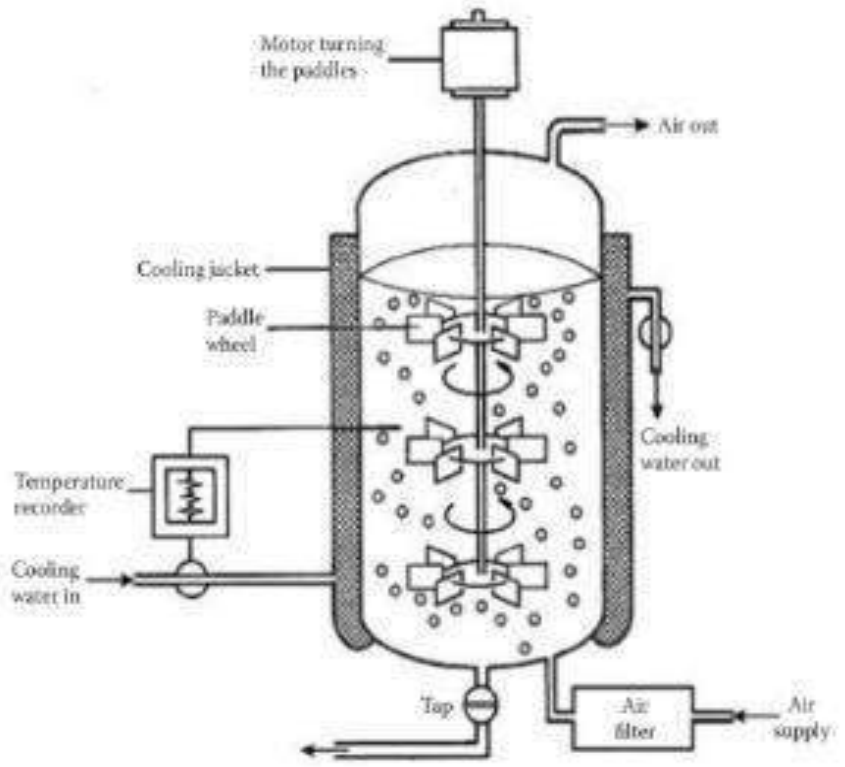
Advantages of submerged Fermentation:

- Submerged fermentation technology has the advantages of short period, low cost and high yield.

- Purification of products is easier.
- In liquid culture the control of the fermentation is simpler and consequently significant reductions in fermentation times can be achieved.
- In the same way, the use of submerged culture can benefit the production of many secondary metabolites and decrease production costs by reducing the labour involved in solid-state methods.

Limitations of submerged Fermentation:

- In recent years, many researchers have demonstrated that SSF has a large impact on productivity, leading to higher yields and improved product characteristics compared to SmF.
- Low volumetric productivity.
- Relatively lower concentration of the products.
- More effluent generation.
- Complex fermentation equipments.



PRODUCT PORTFOLIO FOR FISH CULTURE

Product	Composition	Indications / Benefits	Usage	Packing
TOXIN BINDERS & WATER AND SOIL CONDITIONER				
RESTOX - S	Adsorbent of natural and synthetic toxic residues, toxin binder, Ammonia Controller, D.O. Enhancer and Soil & Water Conditioner	• Adsorbs ammonia, hydrogen sulphide and other toxic gases and suspended organic solids in the pond water	20 - 25 kg per acre	10 kg & 25 kg
ZEOTECH GRANULES	Natural Aqua Zeolite with Activated Charcoal, Calcium Peroxide and Gentian Violet	• Helps in better growth and reproduction of plankton and improves over all water quality	10 - 15 kg per acre	25 kg
SANITIZERS & DISINFECTANTS				
DMD	An Equilibrium Mixture of Disinfectants, Moult Inducers and D.O. Enhancers	• DMD is active at low concentration against a wide spectrum of micro-organisms like bacteria, fungi and protozoa • DMD stimulates moulting in shrimps and improves their regular moulting cycles.	During culture : 3-5 liters/acre	5 lt
SAFEX-80	Alkyl Dimethyl Benzyl Ammonium Chloride - 80% with stabilizers.	• Prevents fungal, viral and protozoan diseases. • Stimulates moulting in prawns and shrimps and improves their regular moulting cycle. • Improves the quality of pond water and prevents water pollution.	Fish : 500 ml per acre	1 lt & 5 lt
SAN PLUS	3-Methyl, 4-Alkyl Two Chain Brominated Halogen Compound : 6% W/W Potentiser, Buffers, Stabilizers, Emulsifiers	• Prevents bacterial infections like gill rot, tail rot, antenna rot, broken appendages etc. • Prevents the growth of viral, fungal, Protozoal and filamentous algae. • Improves water quality.	1 lt per acre	5 lt & 20 lt
SANIDIN-20& 2%	Nonyl Alkyl Phenoxy Poly Ethylene Oxide Iodine Complex Providing Available Iodine-2%	• Controls Tail Rot, Gill Rot, Black Gill, Red Spot in Shrimps. • Prevents secondary infection of Viral, Bacterial, Fungal and Protozoal diseases of Shrimp, Prawn & Fish.	20% : 500 ml to 1 lt per acre. 2% : 1 lt per acre.	1 lt & 5 lt
SANEX	Benzalkonium Chloride Solution I.P. : 15%, Glutaraldehyde 25% with stabilizers	• Controls Tail Rot, Gill Rot, Black Gill, Red Spot. • Prevents secondary infection of Bacterial, Fungal and Protozoal deseases of shrimp, prawn & Fish. • Prevents and control the occurrence of Vibriosis.	Shrimp, Prawn and Fish Pond : 150 ml per acre	1 lt, 5 lt
BLOOM BOOSTER				
BLOOMIN FORTE	Organic and Inorganic Micro & Macro Minerals, Amino Acids supplemented with high performance plankton promoters	• Minerals and Amino acids available in Bloomin forte stimulate the synthesis of diatoms and green algae and inhibit the growth of blue green algae, filamentous algae, lablab and red algae.	Fish : 3 - 5 kg / Acre	5 kg
MINERALS & PLANKTON PROMOTERS				
HI-MIN PLUS	High Quality Micro and Macro Minerals, Amino Acids and Multi Vitamins fortified with Enzymes	• Excellent Shell producer and Plankton Promoter • Prevents loose shell and soft shell formation in shrimps • Improves growth of Plankton.	Every 20 days 5kg per acre	5 kg & 10 kg
ANTI PARASITES				
ECTO-RID PLUS	Biologically derived macrocyclic lactones fortified with herbal extract and Micro-organisms.	• Is very effective for the control of Fish Lice (Argulus) and Anchor Worm (Lernaea) in culture fishes. • Effectively controls Fish Lice and Anchor Worm by interrupting the parasite's life cycle & reproductive processes.	Grow out Ponds: 200 ml / acre	1 lt
GILL-STIM	Biologically derived macrocyclic lactones with herbal extract, inert carrier and adjuvant.	• Is very effective for the control of fish gill flukes. • Controls helminths parasites like Dactylogyrus and Gyrodactylus in fish. • Controls parasites like Ichthyophthirius and Trichodina.	200 gm per ton of fish biomass in 4-5 days. (Repeat the dose every 40 to 50 days)	1 kg & 5 kg
		Trichodina.	days)	

PRODUCT PORTFOLIO FOR FISH CULTURE

Product	Composition	Indications / Benefits	Usage	Packing
GROWTH PROMOTERS, IMMUNO-STIMULANTS, FEED ATTRACTANTS & BINDERS AND GUT PROBIOTICS, HERBAL EXTRACTS				
NUTRIFISH	Multi-Vitamins, Minerals, Essential Amino Acids, Fatty Acids, Growth Promoters, Immunostimulants, Ayurvedic Medicinal Herbs, Digestive Enzymes, Liver Stimulants, Mannan Oligo Saccharides (MOS), Beta Glucan, Carotenoid sources and Choline Chloride	• Aids digestion, improves growth and FCR. • Prevents bacterial and parasitic diseases. • Enhances natural colour of the fishes and strengthens the immune system. • Reduces stress due to diseases and water quality deterioration.	5 kg per ton of Feed	5 kg
HI-LIV Gel	Ayurvedic Herbal Hepatopancreatic Stimulants, Feed Attractant (Betaine) and Choline Chloride.	• Ayurvedic Herbal Liver Tonic. • Hepatopancreatic Stimulant • Growth Promoter & Binding Gel	20-25 ml per kg of feed	5 lt & 20 lt
HI-LIV Powder	Extract of Bhumyamalaki, Sharpunkha, Bhringraj, [illegible], Kalmegh, [illegible], Haritaki, Alfalfa, Ajwain With Betaine and Choline Chloride	• Protects liver from toxins and liver disorders and stimulates the liver and increases appetite in fish. • Increases the liver's ability in detoxifying the toxic substances. • Prevents bacterial, viral and fungal infections in fish.	1 kg per tonne of feed	5 kg
HI-YEAST	SACCHAROMYCES CEREVISIAE (Yeast)	• Improves the efficacy of the immune system. • Improves the intestinal health. • Promotes feed digestion and absorption of nutrients.	3 kg per Ton of feed	1 kg & 3 kg
SOIL AND WATER PROBIOTICS				
SOILMAX	Multi-Strain Soil Probiotics and other Microbial Probiotics, Multi Enzymes and Micro-Nutrients	• Excellent Bottom Conditioner and Water Purifier + Includes Anti-Vibriosis Microbes.	1 - 2 kg per acre.	1kg & 5 kg
PROXY PS	*Rhodobacter spp., Rhodococcus spp., Nitrobacter spp. Nitrosomonas spp. Bacillus Subtilis*	• A Unique Combination of Live Multistrain Soil and Water probiotics. • Efficiently Digests Organic Substances in pond Bottom	2 lt per acre per metre depth	5 lt & 20 lt
PRO-ORG	• Pro-Org pellets contain select strains of Nitrosomonas spp, Nitrobacter spp, Thiobacillus spp and Pseudomonas denitrificans. • Organic Macro Minerals - Nitrogen (N), Phosphorus (P), and Potassium (K). • Organic Micro Minerals – Mg, Co, Zn, Mn & Fe.	• It effectively degrades organic sludge in pond bottom and releases the minerals to pond system. • Absorbs toxic gases like Ammonia, Nitrite and Hydrogen sulphide in Soil and Water. • Supplies organic matter, carbon and nutrients for developing the growth of beneficial microorganisms.	Fish ponds : 5-10 kg / acre.	10 kg
PHOTO-PRO	Consortia of Beneficial Photosynthetic Probiotic Strains Rhodospirillum rubrum, Rhodopseudomonas palustris	• Inhibits the growth of harmful pathogenic microorganisms (Vibrio etc.,). • Promotes the growth of Phyto & Zooplankton and improves the desired water colouration.	Prawn / Shrimp : 3-5 Lts/Acre once every Ten days Fish: 2 - 3 Lts/Acre once every Ten days	5 lt
AMMONIA & TOXIN BINDERS				
ODOSOL Powder & Liquid	Extract of Pure Yucca schidigera and beneficial bacterial culture	• Removes noxious odours and ammonia toxicity in the pond bottom and in the water. • Improves oxygen carrying capacity and overall water quality. • Improves the pond water quality and maintains a pollution free ecosystem.	Powder : 350 gm / acre Liquid : 350 ml / acre	500 gm & 1 kg 500 ml & 1 lt
OXYGEN BOOSTERS & WATER PURIFIERS				
OXYPLUS-Powder	Sodium Perborate Monohydrate, Sodium Percarbonate (Coated), Adsorbents and Deodorisers	• Quickly releases dissolved oxygen (D.O.) to the pond • Reduces the subaqueous content of ammonium and nitrogen. • Eliminates carbon dioxide and hydrogen Sulphide (H_2S)	1kg per acre	1kg
O_2-GEN	Calcium Peroxide with Stabiliser	Increases and maintains Dissolved Oxygen (DO) in the water. Reduces the frequency of water exchange.	2-3 kg per acre	1 kg
OXYTECH	Sodium Perborate Monohydrate, Sodium Percarbonate (Coated), Adsorbents and Deodorisers.	• Quickly releases dissolved oxygen (D.O.) to the pond • Reduces the subaqueous content of ammonium and nitrogen. • Eliminates carbon dioxide and hydrogen Sulphide (H[illegible]	1 kg per acre (Depending on the water condition)	5 kg

PRODUCT PORTFOLIO FOR SHRIMP CULTURE

Product	Composition	Indications / Benefits	Usage	Packing
GROWTH PROMOTERS, AMAINO STIMULANTS, FEED ATTRACTANTS & BINDERS AND GUT PROBIOTICS, HERBAL EXTRACTS				
AMINO PLUS Gel	Amino Acids, B-Complex, Inositol with Folic Acid and Vitamin A, D3 & C	• Excellent Growth Promoter. • Improves better growth and weight gain.	25 - 30 ml per kg of feed	5 lt & 20 lt
B-PRO Gel	Betaine & Protein Aqua Feed Binding Gel	• Excellent Feed Binding Agent & Feed Attractant • Easy to Blend & Tasty to Feed	25 - 30 ml per kg of feed	5 lt & 20 lt
C-TECH	Sodium Calcium L-Ascorbyl Polyphosphate	• Improves disease resistance and immunity. • Increases appetite and feed intake, absorption and better utilisation of feed and gains fast growth. • Plays major role in the collective tissue (collagen) formation.	Regular use : 2-3g per kg of feed. Under stress : 3-5g per kg of feed.	500 gm
C-PLUS	Vitamin C as L-Ascorbyl 2-Poly Phosphate, Vitamin E, Organic Selenium and select Probiotic Strains	• Improves disease resistance and immunity. • Keeps the gut microflora healthy and eliminates the competitive pathogens from the gut. • Plays major role in the collective tissue (collagen) formation. • Improves survival rate. • Improves good quality of flesh.	Shrimps / Prawns : Regular Use : 3 to 5 gm/kg of feed. Stress Condition : 5 to 8 gm/kg of feed. Fish : 1 gm/kg of feed.	1 kg
GUT-ORG	Proprietary blend of organic acids of high biological value	• Improves feed hygiene, through the reduction of pH and buffer capacity in the gut, and control of gram negative bacteria such as Salmonella sp. and E. coli.	3 - 5 ml / kg of feed for 3 days.	1 lt, 5 lt
GUT-STIM	Specifically selected herbal extracts with Vitamins, Enzymes, Probiotics and Organic Minerals.	• Prevents the colonization of pathogenic Vibrio sp. in the gut and hepatopancreas of shrimp. • Stimulates hepatopancreas and improves appetite, feed intake, feed absorption and better utilization of vital nutrients by normalizing the gut permeability in shrimps.	Prawn/Shrimp : Regular : 10 gm Stress Condition : 15 gm Morning & Evening 2 active meals	500 gm
STIMGROW	Multi Vitamins and Organic Minerals.	• Maintains high and uniform growth. • Prevents nutritional disorders and stress. • Enhances animals immune system to overcome the stress and disease.	10 gm/kg feed One meal a day Schedule : Feed for 3-4 days and break for 10days.	500 gm
WHITE CURE	Probiotics, Vitamins, Organic Acids, Amino Acids and Organic Minerals.	• Stimulates hepatopancreas and improves appetite, thus, better feed intake, better utilization of vital nutrients by normalizing the gut permeability in shrimps.	Regular :10 gm per kg of feed for 5 to 7 days Stress Condition :15 gm per kg of feed for 5 to 7 days Morning & Evening 2 active meals	500 gm
HI-LIV Gel	Ayurvedic Herbal Hepatopancreatic Stimulants, Feed Attractant (Betaine) and Choline Chloride.	• Ayurvedic Herbal Liver Tonic • Hepatopancreatic Stimulant • Growth Promoter & Binding Gel	20-25 ml per kg of feed	5 lt & 20 lt
HI-YEAST	SACCHAROMYCES CEREVISIAE (Yeast)	• Improves the efficacy of the immune system. • Improves the intestinal health. • Promotes feed digestion and absorption of nutrients.	Prawn : 3 kg per Ton of feed.	1 kg & 3 kg
SOIL AND WATER PROBIOTICS				
SOILMAX	Multi Strain Soil Probiotics and other Microbial Probiotics, Multi Enzymes and Micro Nutrients	• Excellent Bottom Conditioner and Water Purifier • Includes Anti-Vibriosis Microbes.	2 - 3 kg per acre.	1kg & 5 kg
BIO PLUS	A Synergetic Bio-technological combination of native live non-pathogenic beneficial micro-organisms incorporated microbiomal growth substance	• Soil conditioner, Water Purifier, Ammonia Reducer & Plankton Stabilizer • Provides the natural environment for vannamei and monodon	Shrimp/Prawn : 5 kg/acre	10 kg
WATER TONE	Multi-Strain Water Probiotics strengthened with Anti- Vibriosis and Micro nutrients.	• Specially formulated for high density culture of Penaeus monodon & Penaeus vannamei • Proven Efficacy Against Vibriosis.	250-300 gm per acre	1 kg
PROXY PS	*Rhodobacter spc., Rhodococcus spc., Nitrobacter spc., Nitrosomonas spc., Bacillus Subtilis*	• A Unique Combination of Live Multistrain Soil and Water probiotics. • Efficiently Digests Organic Substances in pond Bottom.	Early Stage: 2 l/ per acre Middle Stage: 4 l/ per acre Final Stage: 4 - 8 l/ per acre	5 lt & 20 lt

RELISH FISH FOODS

INTRODUCTION: UnderSarathkumar sir, from December 4 , 2021 to December 24, 2021. Dept of Zoology, D.K.Govt. Degree College for women (A), Nellore organized field trip to Relish food Processing plant located in Pidatapoluru, Nellore District.We the students of 5th sem aquaculture along with our Aquaculture staff member Dr. T. SriRanjani mam , Smt. H. Swathi mam,Dr. N. Anithamam,Lalitha mam and K.Nagaraju sir accompanied us to field trip. We were ta ken to pre-processing unit, Grading, Individual quick freezing (IQF), Packing, and storage of processed shrimp and fish.

Technical personnel of processing plant explained the processing procedure in detailed manner. We enjoyed each and every step of processing the shrimp. We practically had seen the processing of an aquatic organism and gained knowledge about the process and the care that should be taken to maintain the plant and to handle and maintain the quality of fish and shrimp.

OUTCOME : The outcomes of this internship is to learn, study and to be trained about pre processing of Fish, Shrimp and prawns after harvesting and marketing.

Also to learn the steps of processing fish, Shrimp and their marketing after their respective processes.

OBJECTIVES: The main objectives of this course is to take part in local small scale industries and private companies ,learn about different types of fish recipes that are made and can be marketed. This small scale working industries provides women employment too.

Sanitation and hygiene is the main aspect of pre processing foods. This process includes

Collection of harvested material →cleaning (removing tail, fins and scales) and deheading(shrimp) → grading → freezing → glazing→freezing→ mixing with their respective recipes→marinating (chilling) → packing →marketing. Or storing in -18ºC.

Through these steps the collected fish and prawns were marketed as pre processed foods or ready to cook items, some of them are **Fish fillets, Crunchy fish, Spicy fish, periperi fish, Tornado (shrimp), Butterfly shrimp, fish chicken,fish coconut masala, coconut shrimp and many more recipes were made from Relish fish foods and were marketed all our ANDHRA PRADESH.**

FISH FOOD PROCESSING:

Battered and breaded products:

- Fish fingers →
- Fishportions→*STAPLE BATTERED AND BREADED PRODUCTS*
- Fish cake →

Ready-to-cook convenience of high consumer value also called as “Convenience foods”

Coated Products:

Also called as enrobed product

If a food material is coated with another foodstuff.

A coating will be referred to as the batter and/or breading

Batter- D'ned as liquid mixture composed of water, flour, starch and seasonings into which food products are dipped prior to cooking.

Breading: normally bread-based crumb, small potato chips, puffed grain such as rice.

Functions Of Coating

- Enhance the appearance of food products
- Enhance the taste characteristics by providing food products with more crispy texture
- Improve the nutritional value of the product
- P the more desirable colour acts as a moisture barrier and minimise moisture loss during frozen storag and microwave reheating
- Acts as food sealant by preventing natural juices from flowing out and seal in the flavour.

Coating Ingredients:

1. **Polysaccharides-**

wheat,cornflour,starch ,farinaceousmaterial, modified derivatives of cellulose andgum.

2.Proteins – milk powder, milk protein fractions, egg albumin, cereal flours &seedproteins

3.Fats and hydrogenatedoil

4 Seasonings – sugar, salt, pepper, other spiceextractives

5. Water.

1.Non-wheat Starch

- Rice, corn, soy andbarely
- Corn starch- is a source of natural yellow carotene pigment and hence it can supplement browning agents like reducing sugars and milk powder to impart a golden brown colour to thecoatings
- Cornstarch is also used as a carrier ofspices
- Helps to improve the crispiness of thecoatings
- Helps to reduce the brittleness of the glutenprotein.
- Helps to form wide range ofviscosities.

2. Modified Starches

- The simplest & common modification 2—pre-gelatinsation
- Starch +water -heated gelitnize ---dried to apowder

- Extensive modificationchangesinthedegreeofbranching(variationin amylase &amylopectincontent)change in average chain lengththe extent of cross-linking
- Extensively modified starch known to increase the adhesion of breading with the product.

3. Leaving Agents

- Sodium carbonte□used to produce CO2, the leavening gas, in puff or tempura batter
- Mixture of acid/ salt—controls the release of CO2
- Some produce gas at an ambient temperature and other at high temperature
- Neutralising value: D'n□as the parts of leavening acid required to react completely with 100 parts of sod. Carbonate
- Eg: Tartaric acid, potassium hydrogen tartrate, monocalcium phosphate monohydrate, monocalcium phosphate anhydrous, sodium acid phosphate, dicalciumphospahtedihydrate and sodium aluminiumsulpahte

i. EGG

- Egg contains albumin heat coagulable protein that is useful in binding both breading and batter to the product and to itself.
- Yolk protein contains lecithinan emulsifier ---batter stability
- Addiction of egg to batter will tend to darken the product
- Also add characteristic eggy falvour

ii. MILKAND WHEY

- Added as liquid or dry powders
- Milk and whey protein provides lactose-reducing sugar==involved in browning reactions
- Structural ability

iii. SPICES

- Many species –particularly pepper (3-5%)
- Paprika – added colourflavoring

- Spices are not known to interfere with the functionality of the batter / breading ingredients.

iv. SALTS AND SUGAR:

- Salt
- 1º asflavoring agents
- Salt compete with flour proteins—slow the rate of protein hydration
- Sugar compete for water flavouring agent

v. GUMS

- Many of the hydrocolloidal substances known as gums
- Gum controls viscosity
- Water holding capacity (WHC)
- Participate in a gel or film formation (strengthens coating)
- <2% (0.5% -often)
  Eg: Xanthan

vi. SHORTENINGS AND OIL

- Contributes to the overall flavour& mouth feel
- Tenderizes the coating
- Moisture barriers
- Emulsifiers
- Anti-staling agent
- Breading is often encapsulated with fat to produce a "fried-like" flavour to oven or microwave reconstituted coatings.

vii. PREPARED BREADINGS:

- Prepared beadings are material applied to battered food products
- Enhances the appearance
- Improves organoleptic qualities
- Maintain the integrity of batter
- Size, colour, flavour& compatibility with the existing processing system
- Eg: Bread crumbs & corn flakes

viii. BATTER

- Adhesive batter
- Always associated with a supplemental breading or bread crumb
- 1º Purpose: to increase the adhesion
- By acting as an interface b/n the food & the subsequent coating
- Uniformity & thickness acceptability of the finished product
- The formulation & viscosity of the batter determine the amount of coating pickup
- Consistent batter→ produce uniformly coated products
- Batter viscosity→depends on the ratio of the flour to water→the temperature of mixing
- Typical ratio of batter mix to water is 1:2
- Quick set
- Batter→stored at cool temperature –microorganism viscosity (fall)Tempura batter
- Purpose: to provide aerated crisp coating with or without the application of any other coating , a combination of wheat & corn flour are used along with a chemical raising agent

Tempura batters→used at very high viscosity levels and containing raising agents

- Batter mix- powder-reconstituted with water—desired viscosity

- Final texture –frying the coated product in oil at 180º-220ºC
- Mixing – agitation
- Disadvantage: flesh will flash off as steam & blow off the batter surrounding the void.
- Submersion is used rather than overflow batter applications.

Breadings:

- The secondary coating is referredto as ‘breadings’ (not be derived from bread always)
- Original crumbs –ground dry bread— major secondary coating
- Variety of breading materials----in different sizes &colours
- Used –alone or combined with various crumbs, fours, starches &flavouring Materials (herbs, spices and seeds)
- Breadings are: thermally processed cereal based product though non-cereal products like potato are also used to provide different textures and appearance to the end produced

- Particle size important : in terms of appearance, texture and pickup.

ADHESIVE	TEMPERO
1. Always used with a supplemental breading or bread crumb 2. Purpose: to increase the adhesion 3. A typical adhesive batter mix to water is 1:2 4. Viscosity level is comparatively low 5. Disadvantage: storage of batter at low temperature and the fish to coated frozen, the batter may freeze on the conveyor belt	1. Always used with or without application of any other coating, a chemical wheat & corn four are used along with a chemical raising agent 2. Purpose: to provide aerated crisp coating A tempura batter mix to water is more than1:2 viscosity level is very high Disadvantage: if too much air happens to be incorporate in the batter, the small air bubbles will agglomerate and coalesce into a large bubble on the surface of the fish leading to blown off upon frying.

BREADINGS CHARACTERISTICS

The functional characteristics of breadings depends upon :

**the specific physical

**the chemical attributes built into the particular breading

Important considerations:

- Particle size
- Area to volume relationship
- Browning rate Moisture absorption Colour
- Texture & oil absorption

Mesh size:

- Beadings are made into different particle sizes –finer to coarser
- T proportion of various fractions governs the final appearance of the product
- The proportion of finer to coarser also affect the rate of absorption of moisture from the batter or from the fish itself on the processing line.
- The finer particles rapidly absorb moisture in few seconds from any batter.
- The larger particles provides visual appeal & textural impact

Area to volume relationship : Natural food– particular area to volume relationship

Some are sliced or formed into various shapes and the ratio of their area to volume can be adjusted. A high area to volume relationship permits a good coverage to be applied

Cuboid: area to volume relationship unfavourable

- difficult to apply coatings
- difficult to ensure pickup at economical levels

BROWNING RATE

- Amount of browning is identified with the product quality in coated products
- Browning rate : reducing sugars used in their manufacture corny syrup solids, whey powder, milk powder, lactose.
- Browning takes place during frying the coated products in oil.
- Fast browning rates will permit high processing speeds as also the choice of low frying temperature

Moistureabsorption

- The rate of absorption of moisture by breading is a function of its particle size , Porosity and gelation.

- Smaller granules will move rapidly to point where it can be handled

Conveniently

- Larger granules – improve appearance an texture of the product will protrude from the surface of the coating protruding provide colour highlights as well
- Prosperity& mesh size determines the moisture absorption.

OIL ABSORPTION:

Absorption of oil

Absorption of oil - Higher in porous

Effective rate of heat transfer than in dense granules.

All the major characteristics of breadings interact to produce a wide ranging textural and colour preferences of the consumers of the breaded products.

BREADING TYPES: All the major characteristics of breadings interact to produce a wide ranging textural and colour preferences of the consumers of the breaded products.

Used –alone or combination with other types crumbs, flavours, starches &flavouring materials

Breading types:

1.Reclaimed bread crumbs

2.Industrial crumbs

3.Japanese style crumbs

4.Extruded crumbs

5. Cracker meal

RECLAIMED BREAD CRUMBS:

These are prepared from ordinary

The drying process ---carried out deliberately at a high temperature to give an

Effect of toasting and to reduce the bacterial load.

INDUSTRIAL CRUMPS:

This are factory- baked in large volumes used as crumb coatings in fish fingers/sticks and other products

As a raising agent

Uses lower qt of water

natural colouring agents likepaprika or turmeric ---to impart an appetising appearance

Industrial crumbs have harder texture & higher density than the 1st during bakinga crust develops on the surface of the loaf This is darker & harder than the rest of the crumps.

3.JAPANESE CRUMPS:

Also called as ‘oriental or panko crumb’
Has characteristic flake-like elongates structure -> Excellent visual & provides unique surface structure when fried
It has an open & porous textureimparts a light tender crispiness
Baked--- Electrical induction heating process
One halfthe time taken for conventional baking
Results in a loaf –crust-free & of low density
loaves are cooled, shredded through specially designed mills
And dried to low final moisture level

EXTRUTED CRUMPS:

Extruded crumbs are produced by a continuous process where high starch ingredients are cooked under high pressure.
When the pressure is suddenly released, the moisture expands rapidly as steam and the extradate expands in the extrusion cooking process the heated dough exists from the extruder die as a fully cooked glassy material is quickly flashes off and, in effect, there is no drying system required
Because of its lighter density the extruded crumbs have a tendency to float in oil, potentially leading to contaminating black spots in the fryer and rapid deterioration of oil quality.
--- shrimps----scallops---fillets

Battered and Breaded

STEPS INVOLVED IN PRODUCTION OF COATED FISH PRODUCTS:

Pre-dusting

---To create a surface more conducive to the physical adhesion of a wet batter

---also provide a rough surface which helps the batter to coat the product evenly and obtain the desired pickup

--- usually composed of a cereal flour or flour mixture, spices &seasoningsfor both functional and

flavouring purposes

Application of the batter:

-- Total submersion or overflow batter application

-- Low viscosity batters applied in an overflow batter application

-- Medium viscosity batters total submersion system

The pre-dusted product is conveyed to the batter applicator and transferred to the next conveyor

The fish portion is totally submitted in the batter as it is drawn through it other applicators may use a pour –on application in addition to the submission method. Irregular shaped products should be placed on the line with any concave surface offered to prevent air pockets from inhibiting batter pickup

Line speed is a very critical factor affecting better pickup

An exclusively fast line speed will reduce the batter pickup. The battering may become incomplete. There may not be enough time for the excess batter to drip off, and this excess batter will be blown off during pre-frying. The blown off batter will get deposited in the fryer.

Too low a line speed also can result in excessive better adherence the better weight in the pre-fried product is adjusted to be equivalent to fish flesh weight in most seafood products.

Excess batter is carried over the breading section will cause formation of lumps and can cause blockages in the breading machine. This will also cause formation of shoulders and tails on the edges of the product and contaminate subsequent breading application therefore to overcome these problems the excess batter is removed after coating by blowing air over the product. The position of the air blower should be as close to the product as possible to control the air flow across the product. Carry over from the pre-dusting operation also is critical where pre-dust is carried over the viscosity of subsequent batter will increase leading to an increase in pickup.

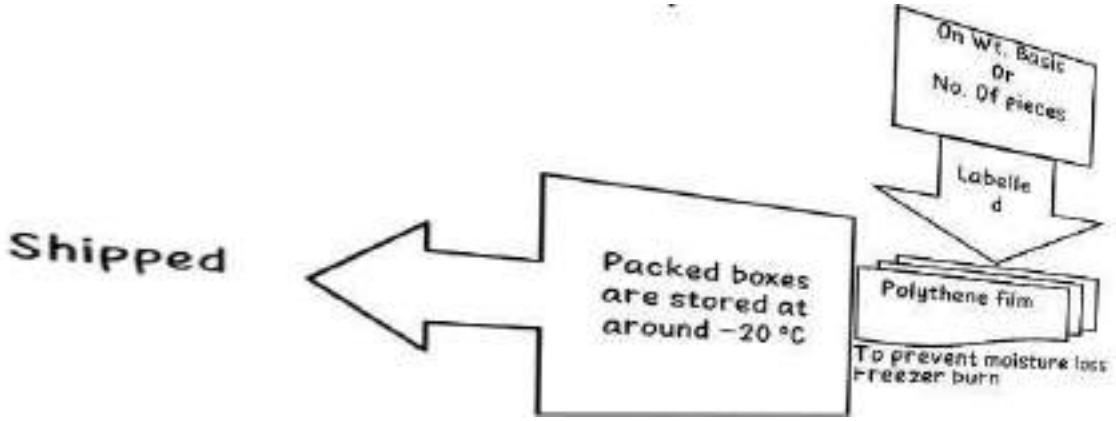
APPLICATION OF BREADINGS : There are many types of breading applicators available and the appropriate machine depends on the ingredients used thee speed of the breading machine is so adjusted to closely match the belt speed off the batter applicator

For soft products the crumb depth should be maintained as thin as possible to avoid product damage when leaving the breading machine however frozen or hard products should have a deep bed of crumb

Pressure rollers are used to apply sufficient force to press crumbs onto the battered products. But the pressure should not be high to distort the product shape or push the product through the crumb bed causing marks in marks on the underside when the product may contact the breading conveyor.

Floor buildings have a tendency to compact and build up on the conveyors. They also tend to bridge and cake causing uneven flow through the breading machine which can result in inconsistent product quality. Due to their fine particle size floor breadings tend to contaminate the frying oil with a residue so fine that it cannot be removed by normal filter system

Japanese style comes with their low bulk density and large granule size make
The crumb pickup difficult by the normal batter systems
Special batter formulations, sometimes containing raising agents, may have to
Be used at medium viscosities for a desired level of pickup of crumbs.
Prefrying
Purpose:
*Sets the batter coating on the fish portions so that it can be further processed by freezing
*Develops the product colour
*Forms a characteristics crust typical of fried foods
*provide the product a fried (oily appearance) inhibits freeze dehydration and contribute to taste
Frying : 180-190ºC for 30 sec
Excess batter called “tags”, “crumbs” or “crunchi”.
Freezing:
--stabilizes coating
--resistant to physical abus
--Prefried fish portions are generally frozen ---two steps
Initial quick freezing- using liquid nitrogen or carbon dioxide
Freezing-using mechanical freezer
Freezing is continued until the internal temperature attained is around -12
Packaging and storage
Fish fingers
Fish portions
Fish cutlet
Individually packed into small boxes.
waxed papers are used to prevent damage.



SHEEDAL

Salt-free fermented fish products

Technology believed to be originated before 1824

It was exclusively made from *Puntius* spp.

Presently *Setipinna phasa* is also used

Sheedal is solid, bilaterally compressed and pasty with strong odour – a characteristic smell of sheedal

Quality deteriorates very fast once exposed to air outside the fermenting container

Punti-sheedal of different NE states

Phasa-sheedal of different NE states

RAW MATERIAL FISHES

Right time of Sheedal production

Actually dry Puntius and phasa fish are available in the market from December. Therefore, December to February is the right time for production of Sheedal. This may be extended upto April, before onset of rainy season.

SOURCE OF RAW MATERIALS

Raw materials of Sheedal, i.e., dry Puntius and phasa fish are available in the local market. But for large scale producers, it is profitable to buy from Jagiroad Dry fish Market of Assam or from the source of production. Usually, dry Puntius fish are imported from UP, MP, Gujarat, Maharashtra etc. and dry phasa fish from West Bengal.

Containers Used For Fermentation

Matka or hundi are local names of earthen made pear shaped container used for fermentation
Neck dia. 8 inch, middle 24 inch, ht. 36 inch, cap. 40kg.
The best quality matkas are made from very fine black soil, due to the fact that these matkas absorb very less amount of oil during oil processing and they also provide very less air permeability.

PROCESSING OF MATKA

Before use, matkas are smeared with oil in order to close the micropores present in its wall to make it almost non-permeable to air and vapour.
Oil extracted from Puntius fish is generally preferred by fishers and commercial producers if it is available in plenty.
In case of large scale production of shidal, vegetable oil especially mustard oil is preferably used.
Oil is smeared in both inner and outer walls of the matka followed by drying in the sun.
The oil smearing and subsequent drying process is continued for 7 to 10 days in case of new matka, until they become fully saturated with oil and unable to absorb any more oil even after a fresh drying.
Matka is now ready for filling of fish. In case of re-use of matka, 2 to 5 days of oil smearing and subsequent drying is required.

PREPARATION OF FISH FOR SHEEDAL

After procurement, dry fish need further drying under sun for 3-5 days.

This is done to remove moisture from the fish to maximum possible extent and also to drive away the maggots, if any.

The dry fish are then cleaned by sorting broken pieces and adhering dusts etc. Fish with already sign of infestation is not taken for Sheedal production.

Water washing-cum-soaking

Dried and cleaned fish are taken in porous bamboo baskets

Traditionally dried fish are water soaked while washing in running water, i.e., in river at shallow depth. But due to poor quality of water in the shallow zone of river, there remains chances of contamination of dry fish with pathogens and other dirt present in the river water.

For hygienic production it is advisable to construct cement cisterns with inletoutlet provision and use of drinking water for water washing-cum-soaking.

This step is very crucial for Sheedal production and also to some extent depends on the total period of fermentation as desired by the producer.

Usually, for fermenting fish for 3-4 months, the duration of washing is approx. 3-5 minutes.
And for fermenting fish for less than 3 months, washing is done for approx. 57 minutes.
However, the duration of water washing-cum-soaking depends on the producers experience and is determined by previous experience depending on the quality of dried fish, period of fermentation desired and shelf-life of the end product.
In case of washing in cistern, it is advisable to change water frequently (after washing of 1-2 lots) to prevent adding of dirt removed from one lot of fish to other lots.
Absorption of water becomes higher and quicker due to previous drying of fish.

POST-WASHING DRYING OF FISH:

After water washing-cum-soaking, wet fish are spread over cleaned bamboo mattress (preferably) or in cemented floor under shade overnight for drying. Evening hours is the best time for water washing-cum soaking, because the subsequent drying of water soaked fish for 10 to 12 hours passes without any nuisance activities from flies and birds.

FILLING OF MATKA

Before filling, the oil processed matka is placed by digging a hole in the ground in such a way that one third of the belly portion of matka remains buried in the ground. This is done to ensure fixing of matka in vertical position and also to allow the matka to withstand the pressure during filling of fish with compaction. Clean gunny bags are spread surrounding the matka to avoid any spilled raw material getting contaminated with the soil underneath while filling.

After fixing matka in the ground, the partially dried fish are spread in a layer of about 4-5 inches in height and uniform pressure is applied with bare hand or feet (in case of large mouth matka).

Once the layer is tightly packed, subsequent layers are put in a similar manner till the layer reach near to neck.

Sometimes wooden stick is also used along with hand or feet for almost air tight packing.

About 35 to 37 kg of Initial sealing with c/paste dried fish is required to fill one 40 kg capacity matka.

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Cover paste : A cover paste with semi-solid consistency is made by grinding left over materials after sorting and cleaning of dried fish, with addition of little water.

INITIAL SEALING OF MATKA

Once the matka is filled upto the neck portion, it is primarily sealed with a cover paste.

After proper sealing with cover paste, seal is covered with broad leaves.

FINAL SEALING OF MATKA

The matka is finally sealed by a layer of wet mud made from clay soil. This soil is usually collected from the pond bottom. Care is taken that sealing is perfect.

This mud layer is checked on and often for about a week for any crack and is repaired immediately by wet mud again. The final mud seal is then covered by a polythene sheet and tied, to prevent damage of the seal by rodents etc.

FERMENTATION SHED

The filled matkas are lifted to the surface and left undisturbed under a shed for maturation/fermentation. The fermentation shed should be such that the matkas will get minimum sunrays and rain. In traditional practice, the ground of the fermentation shed is muddy and both roof and sides are made with bamboo fenches. Entry of dogs, rodents etc. in the fermentation shed should be prohibited. The usual period of maturation is 3-5 months. From third month onward 23 matkas of each lot is tested for checking the maturity or quality of Sheedal. About 40-42 kg Sheedal is obtained from each matka. The filled matkas can be sold during fermentation also after packing in gunny bags in erected position.

SELLING OF SHEEDAL

Usually, the quality of Sheedal, both smell and texture, are lost rapidly after taking out from the matka. Therefore, while retailing Sheedal is instantly taken out and sold.

MACHINERIES FOR FISH PROCESSNIG

Gutting Machine

Wash Master

Master

Vaccum packaging machine

SHRIMP CULTURING

- Shrimp culturing
- Harvesting
- Marketing
- Processing
- Selling

The shrimps of the family penaeidae are known around the world as valuable resources for aquaculture, but the majority of research and development efforts have been directed to few species (e.g., Litopenaeusvannamei and Penaeusmonodon) that dominate world production . In the last decade, farming of the pacific white shrimp Litopenaeusvannamei, of which fast growing and disease resistant strains have been developed by selective breeding programs, has been expanding throughout the world, especially in the far-eastern countries such as Thailand, Vietnam, Indonesia, China and India. This species can be readily reproduced in captivity has wide tolerance to environmental para metres, better utilizes low-protein containing diets and grows fast compared to other penaid shrimp species. Worldwide commercial maturation of female penaeids relies almost exclusively on the technique of unilateral eye stalk ablation the technique give predictable peaks of maturation and spawning, but many associated problems have been reported like deterioration in spawn quality and quantity over time and conflicting results on spawn size, hatch success and other variables.

The control of ovarian maturation and spawning is a major problem in the development of commercial aquaculture of penaeid shrimp. Eye stalk ablation has been used to mature female shrimp in captivity . Eyestalks are the endocrine center for regulating many physiological mechanisms such as molting, metabolism, sugar balance, heart rate, pigments and gonad maturation. Therefore, unilateral eyestalk ablation

affects all aspects of shrimp physiology. Predictable induced reproduction in captive penaeids without the use of eyestalk ablation was considered a long term goal for shrimp aquaculture.

In this study,

We compared spawning success and nauplii production of broodstocks source in imported SPF broodstocks with historical reproductive performance data from broodstocks are reared in the maturation tanks in order to determine if reproductive performance is compromised under bio secure conditions.

Broodstock

The broodstocks were imported from SIS (Shrimp improvement system) Florida, USA and quarantined by the Aquatic Quarantine Facility (AQF) to ensure the SPF status of the imported broodstock, as a consequence avoiding the permission of any infested broodstock into the region.

The matured male and female were packed at 2 no's of the individual bag with proper oxygenated by the insulated vehicle before carried to the hatchery. The broodstocks transport during the night time is avoided for the stress. Keep rubber tubes cover the rostrum of the shrimp to evade puncturing the plastic bags.

Figure 2: Matured Female in *L. vannamei*

Figure 3: Matured male in *L. vannamei*

• Material and Methods

This study was carried out on December 13,2021.

In Aquaprime hatchery, Andhrapradesh, India. Where suitable research facilities for the study of hatchery operation and management were ready available.

Experimental design

Each maturation tank was painted in black and had a central outlet. The drained sea water was recirculating through bio filters, cartridge filter, activated carbon filter and protein skimmers. Recirculation rate was adjusted to 1200% of each tank volume per day. In addition, 5-10% fresh seawater was supplied to recirculation system to avoid high nitrate concentrations. Fluorescent bulbs 80 W were hung 0.5 m above each tank to obtain the desired photoperiod 14 h light and10 h dark. Molting, maturation and spawning of each individual female were monitored and recorded daily. For this purpose, females were marked by number tagging around the eye stalk.

EVALUATED PARAMETRES

Water quality:

Temperature, total ammonia, pH and dissolved oxygen were measured daily using test kits Salinity and nitrite measured weakly.

Eye stalk ablation:

Prepare the ablation equipment, 3-4 pcs ablation forceps, gas burner (LPG), gloves, antiseptic (acriflavin solution), broodstock cage, etc. Exchange 100% of the water in the Female tank one day before ablation and check to make sure that the females are all intermoult and have hard shells (Molting or soft females will die if ablated). Reduce the tank water level down to 30 cm. Collect all the females in a collection cage. Heat the tip of the forceps with the burner until red-hot. Then carefully hold the female and squeeze the eyestalk of one side with the heated forceps tip. Smear the injured eyestalk with acriflavin solution and release the animal in to the tank. Repeat for every female in the cage. Count and record the number of females in the tank.

Fig: Eye stalk ablation of female shrmp

Fig:disinfectant

Spawnwers source and source:

About one week after ablation, some females were become stage 4 and be ready for mating and spawning. In the Male tank which is used for mating is conductedat 90-100% water exchange before adding the ripe females because this tank needs to be clean with clear water for mating. Start to select only those females with stage 4 ovaries at 3.00 pm and place them into the male tank. Normally we can get stage 4 female at about 10% of the total females in the tank daily. Record the number of stage4 females which are transferred to the mating tank (male tank). During the mating period (3-10 pm), turn on the lights over the mating tanks

- Spawning and hatching of the broodstocks: Collect the matedGravid females (those that have 2 sperm sacs contacting the thelycumOf the females) from the mating tank (male tank). The gravid spawners were dipped for about minutes in 100 ppm formalin. After formalin bath the female was rinsed with sea water and placed into the spawning tanks. In each spawning tank 500 L water treated with 10 ppm EDTA to bind
- possible heavy metals and 0.1 ppm treflan for fungicides and placed a gravid female for spawning.

After spawning the spent females were removed from the tanks by a scoopnet. The tank water was drained and the eggs were passed through a 350 micron hand net which retains faeces and they were collected on a 100 micron net in a harvest bucket. Before transferring he eggs to the hatching tanks, they were washed thoroughly with running sea water at least for 5 minutes and then they were treated with 100 ppm formalin for 30 seconds and 50 ppm iodine for 60 seconds and again washed thoroughly with running sea water for 5 minutes before being placed into hatching tanks 500 L. For further 36 h to determine hatching rate. The number of eggs and the percentage of the fertilized eggs were estimated by using the formula of. The hatching rate was determined by using the formula

Result and Discussion

Eye stalk ablation is still the most effective and common method used for the induction of ovarian maturation in penaeid shrimps. As with other species the eyestalk ablation was found to be theBest technique in the maturation and spawning of the pacific whiteShrimp L. vannamei. In agreement with the eyestalk ablation generated more spawning and egg-production, but higher fertilization or hatching rates were increase in our present studySize of maturation tanks and brood stock stocking density are known to influence mating's and ovarian development in shrimps.

A study carried out with L.vannameihad good Results 1.2 m diameter tanks at 1:2 male/female ratio and 10 shrimps per m2.

In this study, we found similar reproductive performance (spawning rate, fecundity, fertilization and hatching rates) In our present study, each tank is 6 × 7 metres in size and 1.2 metres deep. One tank can hold up to 200 pieces of brood stock at a stocking density of 5/m2

Produced significantly more eggs per femaleAnd hatching rate 90% were found. Based on our results and those at the literature , it can be concluded that brood stock tanks of not smaller than 3 m in diameter have to be preferred for the successful reproductive performance of L. vannamei. Suggested the use of at least 6 m2 of the tank bottom for L. vannamei brood stocks.

In general, fertility rates were high but hatching rates were unexpectedly low. Many factors such as low water quality, inappropriate photoperiod, insufficient quantity or quality of the feeds or even genotype of the broodstocks might account for low hatching rates . It is well known that nutrition is one of the main factors influencing gonad development in shrimps (Table 2). In commercial hatcheries, broodstocks are generally fed on fresh seafood (mussel, oyster, squid, Crab or sea worms) and sometimes artificial feeds until satiation for Successful maturation and spawnings . Similarly, in our study we also fed the broodstocks on fresh and occasionally on frozen Polychaetes, squid, oyster, green mussel and commercially INVE

No. of spawning	Gms	No. of Eggs (× 1000)	Nauplii (× 1000)
1	30	1.5	0.18
2	31-32	1.62	0.26
3	32-33	1.68	0.50
4	33-34	1.73	0.74
5	34-35	2.18	1.03
6	35-36	2.42	1.26
7	36-37	2.84	1.65
8	37-38	3.12	1.96
9	38-40	3.51	2.56
10	40-42	3.74	3.30
11	42-44	3.82	2.53
12	44-46	3.93	1.63
13	46-48	4.11	1.33
14	48-50	4.23	0.83
15	50-52	4.42	0.61

Table 1: Relationship between body weight, eggs and nauplii in *L. Vannamei* spawning.

Feed Time	% of Feed	Combination
07.00 am	15	Feed with Polychaetes.
11.00 am	10	Feed with Squids.
16.00 am	10	Feed with Oyster.
22.00 am	60	Feed with **Polychaetes.**
02.00 am	5	Feed with INVE Semi-moisture pellet feed.

Table 2: Feeding program for broodstock.

Parameters	Range
Temperature	27.5-28.5°C
Salinity	33ppt
Total ammonia	0-0.5
Nitrate	0-0.3
pH	7.8-8.2

Table 3: Levels water quality parameters in *L.Vannamaei* Maturation.

Conclusion

Our present findings gave adequate outcomes on ovarian maturation and spawning in imported L. vannamei of Specific Pathogen Free (SPF) shrimp broodstocks in captive eyestalk ablated spaweners, among connection between body weight, eggs and Nauplii. The results of this study has demonstrated that under Mediterranean climatic conditions, the broodstock of this non-indigenous shrimp species can be readily matured and spawned out of season in recirculating matured and spawned out of season in recirculating systems. However, further research is required to increase the spawning activity and evaluate the duration of the reproductive performance in L. vananamei and also has to be carried out to improve hatching rate and nauplii production. To create additional better mixtures of feeds which will supportive for the production of high yield nauplii by way of hatchery post larval production is concerned. This way is useful absolutely achieve the gaps in shrimp industry.

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AQUA PRIME HATCHERY & ALFA BIOLOGICALS

We the students of B.SC [AQUACULTURE TECHNOLOGY] final year, along with our lecturers in zoology department from D.K.Govt College for Women (A) in Nellore visited AQUA PRIME hatchery and ALFA BIOLOGICALS laboratories located at Nellore.

In Aqua prime hatchery we have seen the culture of L.vennamai in which farmers purchase them from Florida and grow in these climatic conditions. They culture the brooder shrimps with different stages like Growth, Maturation, Fertilization, Spawning of eggs. These eggs are maintained/ cultured up to the Nauplius stage. Then Distributed / handovered to the farmers to culture the shrimps.

INTRODUCTION

Shrimps farming in India, till 2009, were synonymous with the monoculture of tigers shrimp, Peneausmonodon. About 1, 90,000 have brackish water area have been developed for shrimp culture in the country. Since 1995 culture of P.monodon is affected by white spot syndrome virus and the development of shrimp farming has been stagnant most of the south-east Asian countries like Thailand, Vietnam, Indonesia

were also culturing P.monodon and since 2001-2002 onwards most of them have shifted to culture of exotic white leg shrimp, Liptopeneausvennamei because of the availability of specific pathogen free and resistance brood stock. In India, pilot scale introduction of L.vennamai was initiated in 2003 and after a risk analysis study large scale introduction has been permitted.

Classification of shrimp

Phylum:Arthropoda

Subphylum:Crustacea

Order: Decapoda

Family: Penaeidae

Genus: Litopenaeus

Species: Vannamei

L.vennamai is a native of pacific coast of Mexico and central South America as far south as Peru. It is mainly found on mud bottoms, down to a depth of 75cm. commonly known as white legged or Mexican white shrimp. It is grayish-white in color. The Maximum Weight of the females in the wild is about 120g. The males are smaller about 60-80g. It lives in the column and prefers clayey bam soil.

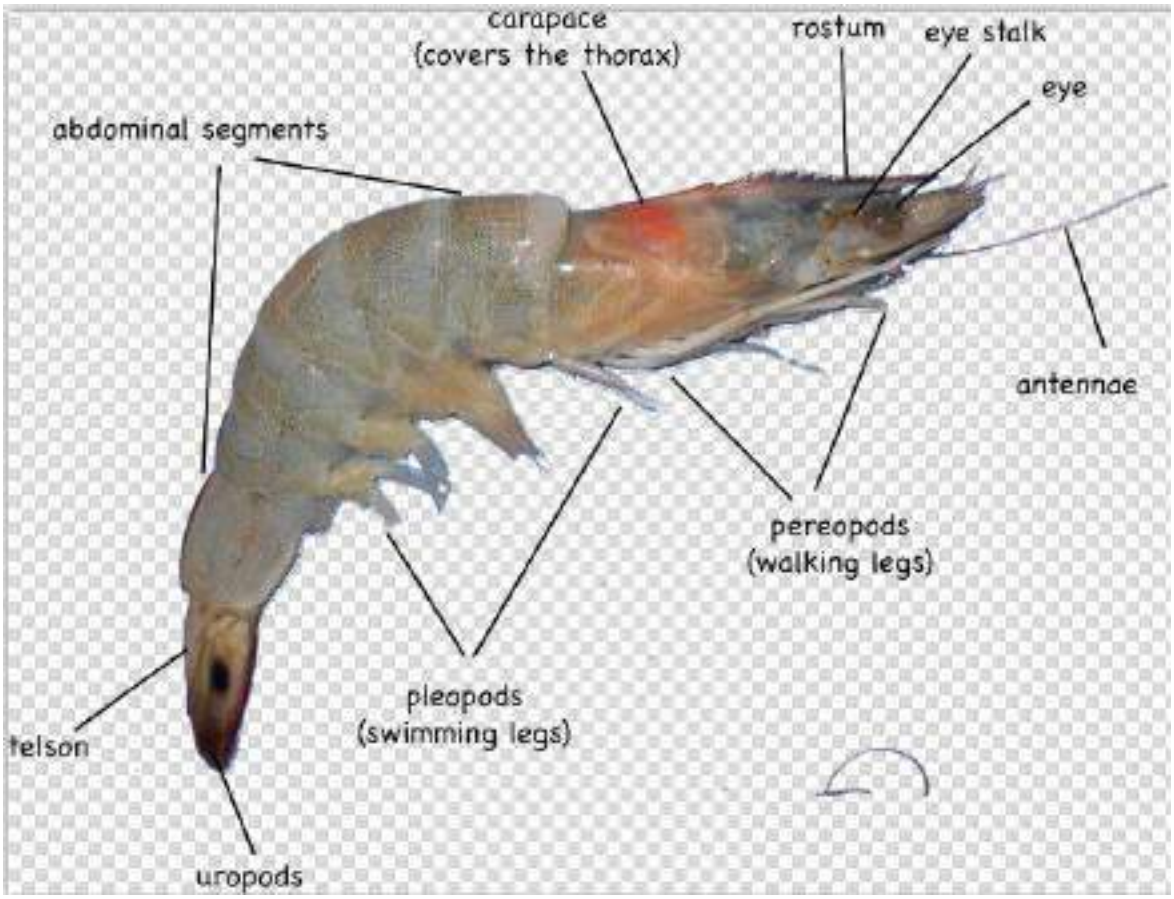
For L.vennamai the growth at 30 c is much higher than at 25c. The optimal range of temperature for the species is between 30-34c.At 20c growth virtually stops. It can tolerate salinity a level of 0 to 50ppt. Growth is uniform within 10-40ppt. They can grow in fresh water also but the growth is slower below 10ppt. p" range of 7-9 is tolerated with optimal growth for optimal growth at p" 8.0. Dissolved oxygen levels above 4.5ppm are required for optimum growth. Turbid water with flocculated particles of more than 0.5 microns resulted in

better growth than clear water mainly because of the presence of algae and bacteria Ammonia-N and Nitrite-N levels should be less than 0.1ppm respectively.

SHRIMP STRUCTURE

Shrimp body is divided into two parts, the head and body sections. The head fused with the chest called the cephalothorax. This section consists of 13 sections. 8 segments the chest and the 5 segments on the head. Body and the abdomen consist of segments. Each segment has a pair of swimming feet are also segmented.

The head protected by a shell called a carapace. The front of the carapace pointed and curved shaped of the letter "S" so called rostrum. At the top of the rostrum there are serrations which totaled 7 to 9, while the



bottom three serrations. Another section contained in the head including a pair of compound eye, mouth with jaws (mandibles) are strong, a pair of large antennae, a pair of fins head, a pair of jaws auxiliaries and 5 pair of feet road.

White shrimp are carnivore's animals that feed on small crustacean's amphipod and polychaeta. White shrimp are naturally nocturnal animals are active at night to find food, whereas during the hiding in the substrate or mud. But in pond aqua culture feeding can be done more frequently to spur growth.

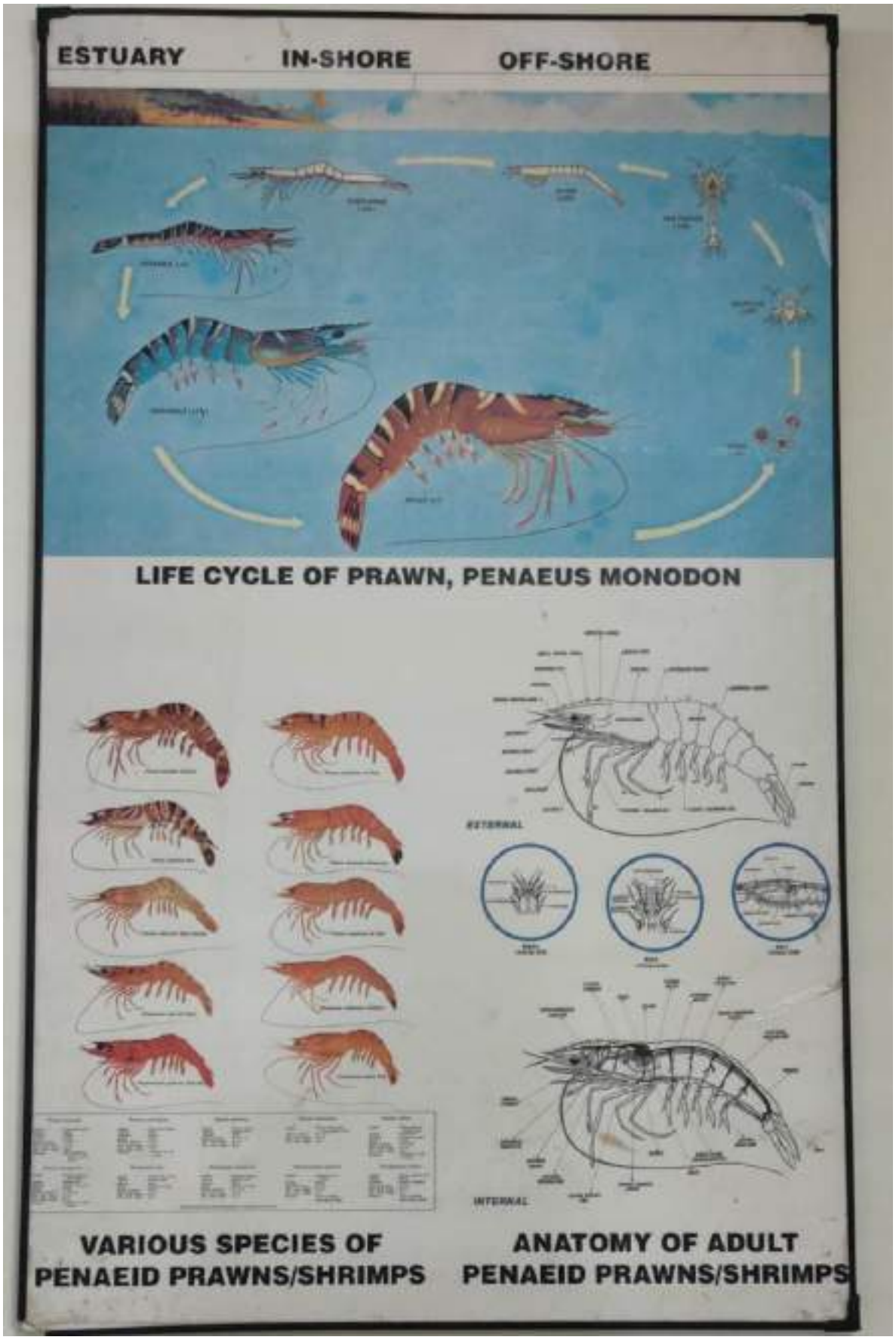
Shrimp growth is influenced by two main factors that are molting frequency and growth rate increases. Environmental conditions and food are the main factors that affect molting.

The newly formed carapace after molting is very soft and getting more and more hardened to adjust the size of shrimp body.

Penaeids are dioecious and the external structure of genital system is the major dimorphic features. The male has two pairs of modified abdominal appendages on the first and second abdominal segments that deliver sperm to the female external receptacle located between the bases of the fifth walking legs. The petasma, appendix masculine and the theylcum are located on the ventral surface.

The petasma is formed by the endopodites of the 1st pair of pleopods which are modified as interlocking structures for spermatophore transfer. The appendix masculine are on the endopodites of the second pair pleopods and serve to separate the petasma into two component halves, The thelycum may be 'open or closed' depending on the species. Closed thelyca are those where the spermatophore is placed by a male in the groove below the plates where as the female soft exoskeleton stage following moulting. The spawning open thelyca are not enclosed by plates and the spermatophore must be placed on it by a male. The female's exoskeleton is hard usually within hrs of spawning. The presence of spermatophore on the female is evidence that she had successfully mated.

AQUA CULTURE OF VANNAMEI:



Andhra Pradesh is known as hub of fisheries. Prawn is the most cultivable shell fish. This species was taken to India from florida. Previously Penaeusmonodon is the most cultivable fish, during 2004-2007 monodon was unable to tolerate to viral and bacterial diseases hence their production decreased and stopped the culture of monodon. In 2009 vannamei culture is started and vannamei replaced the position of monodon .In shrimp culture vannamei occupied the first position in aquaculture.

Vennamei to their less can aggressive be culture nature inextensive ,when compare semi-intensive, to monodon. Hyper The intensive depth of and the intensive pond should pond be due feet, thephysical and chemical requirements are, pH required for vannamei is 7.8-8.3, salinity should be 10-25%, alkalinity should be 150, the ammonia content should be less than 0.02 for seedand the Nitrate content should be less than 0.01. We should check DO 2 times per day, Temperature should be 15-20 degrees celcius.

Vannamei gains more weight during moulting stages . The growth rate of vannamei is fast in summer it takes more feed during this season. The harvest period of vannamei is 3-4 months. The feed given for the first ten days is starter .11-30 days crumble feed,30-45big crumble feed, 46-70days pre grower and from 70 days to harvest they are given the grower feed. Vannamei is a bottom feeder it takes more feed during night. We can check the feed management through check trays.We can control diseases by using probiotics like bacillus Oxygen is supplied through aerators.A rain gun is a high performance micro irrigation device and it is designed for a variety of uses and applications where relatively high flows and extended radius of the water throw are desired. Rain gun sprinkler is available with an operating pressure of 2.0 to 7.5 kg/cms- and flow of 3 to 30 Ipsupto 20 mtrs.

It is used to reduce the Nitrogen and Ammonium contents in a fish pond or shrimp culturing ponds.

It reduces the toxicity of the culturing ponds

ALSO, There we have seen the four types of larval stages of vannamei culturing practises. Significant measures they have taken to culture these larval stages. They implemented this hatchery at a low cost with high benefits. At a low cost maintenance they are getting high productivity with disease control management.

The sea water is used to culture the seeds of vannamei; this water is bleached before its use. They use diesel to run the specific motors by avoiding electricity. The feed which was prepared for the larval stages was prepared under controlled temperatures.

The feed used for these larval stages includes ‘ARTEMIA’ which was known to be a live and algae and certain phytoplanktons.

LARVAL STAGES OF VANNAMEI

Vannamei undergo four larval stages to develop into the adult .The larval stages are

- Nauplius
- Zoea
- Mysis
- Post lavalstage

NAUPLIUS

It is discovered by Muller as the first larval form in the life cycle of all crustaceans. It has unsegmented body which is oval in shape with a large cephalothorax and rudimentary abdomen.

There are three pairs of appendages namely antennules, antenna and the mandibles. The larva has a primitive digestive system for feeding on planktons.

ZOEA

It is common larvae at decapods and hence it has variations in its features in different species.

The carapace is protruded into rostrum at the anterior end.

There is a pair of sessile compound eyes.

Antennules and antenna are short and sensory in function.

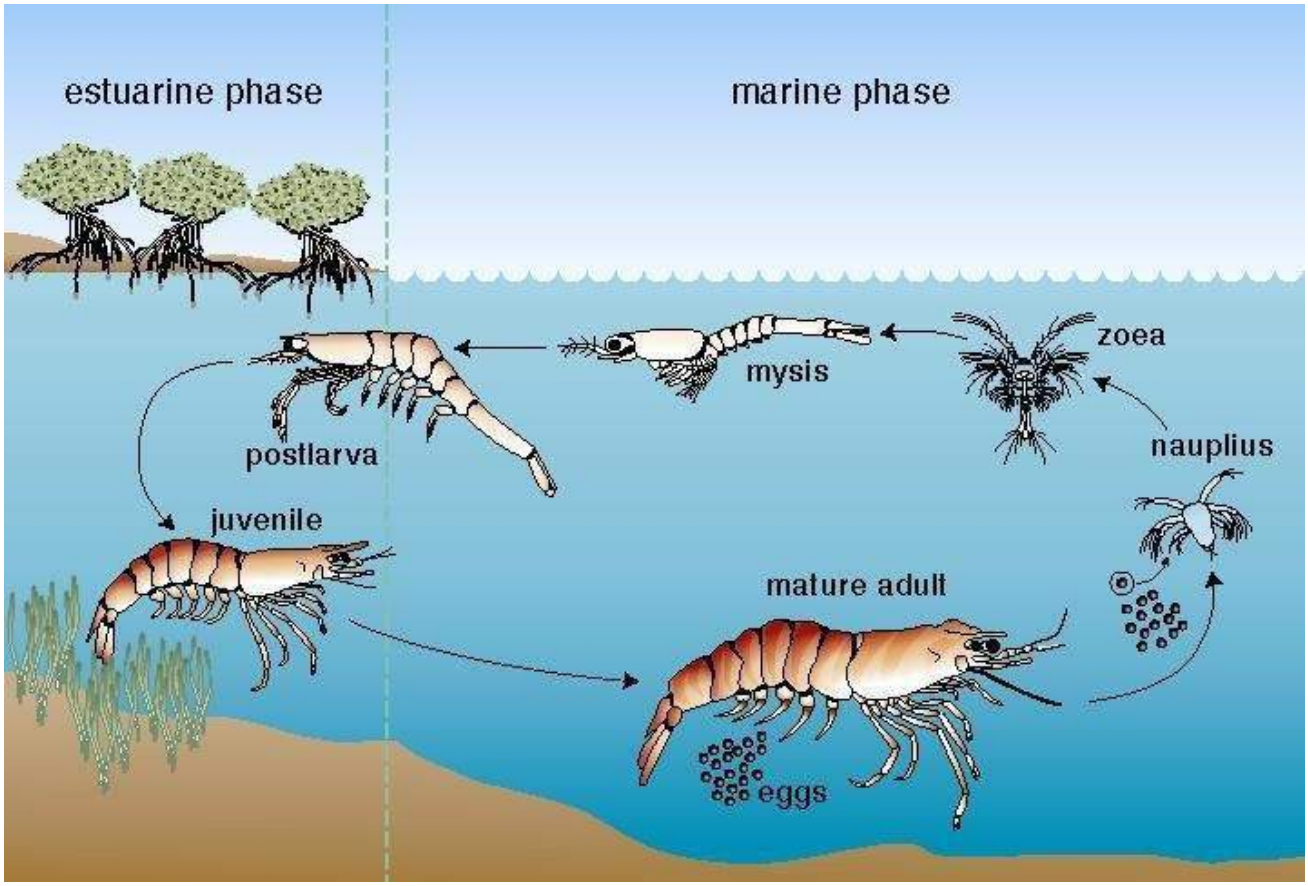
Zoea changes into mysis in melacostracans having abdominal appendages foe swimming.

MYSIS

This is the **third** larval stage in the life history of the crustaceans.

It has cylindrical and elongated body bearing cephalo thorax and 6 abdominalappendages for swimming.

There are 6 pairs of biramous thoracic appendages used foe locomotion.



DESIGN OF SHRIMP HATCHERY AND MANAGEMENT

The chief technician in the hatchery explained about various management methods involved in hatchery management. The basic requirement for the effective shrimp culture hatchery production are discussed below:

BROOD STOCK MATURATION TECHNIQUES:-

The matured male and female brood stocks are reared separately. Each maturation tank was 6x7m in size 1.2m in depth. Each tank can hold up +0 200 pieces of brood stock. The maximum water level should not higher than 70cm, to keep 50cm from the water surface to the top of the tank avert the brood stock from jumping out

prepare the water for stocking the new brood stock by pumping water from the 1st stocking tank through 1 micron filter bags to brood stock maturation tank uuntiyou get 30-40cm water depth. Adjust the temp to 20c by a chiller. The brood stock should be 7 months of age. The males are 35g average weight while females are 40g average body weight the males into the male tanks and the females into the female tanks with 200-300pcs/tank.

Only fresh brood food stock for feed MATURATION:- As used as polychaetes, squids, oyster, pellets feed and supplemented with feed additives to improve their stage of maturity.

EXPERIMENTAL DESIGN:-

Each maturation tank was painted with black for males and white for females .The drained sea water was re-circulating through the biofilters, catridge filters, activated carbon filter and skimmers. Re-circulation rate was adjusted to 200% of each tank volume per day. In addition 5-10% Fresh seawater was supplied to re-circulation system to avoid high nitrate concentrations. Fluorescent bulbs 80W were hung 0.5cm above each tank to obtain the desired photo period 14b light and 10h dark .Molting, maturation and spawning of each individual female were monitored and recorded daily. For this purpose females were marked by number of tagged around the eye stalk.

SPAWNINGANDHATCHINGOFTHEBROOD STOCK: collectthematedgravidcontacting the theylcum of the females from the mating tank. The gravidspawners dipped for about minutes in100ppmformalin.Andrinsedwith sea-water and placed into spawning Monks. In each spawning tank 500L water treated with 10ppm EDTA to windand0.1ppm Teflonforfungicides and placed female for spawning. Afterspawning the spent females were removed by scoop net. And waterdrainedandeggs passed through a 350 micron hand net. These eggstransferredtohatchingtankstheywere washed thoroughly withrunning sea water at least for 5 min. Then treated with 100ppm

SELECTION OF NAUPILI:-

At 5:00am in the morning of the following day, halves the naupili from the hatching tank and put into naupili's collection tank. Harvest the naupili by net. Then these are transport for the culturing and rearing ponds.

BROOD STOCK NUTRITION:-

A good diet feeding the protocol for groups or stock key factors in production of good quality brooder prawns. The quantity of the feed must be determined in relation to the biomass on the tank. The feeding should continue until a small amount of uneaten food remains in the tank. A couple of hours after each feeding. When using fresh feeds such as algae, polychaetes, artemia, mussels etc ,. Efforts must be made to ensure that the material as fresh as possible fresh feeds needs to be chopped to a size suitable for ingestion. Several commercial companies produced artificial feeds to supplements the fresh feed. The some other feed which are given to the female prawns are listed below malesmalealsothesamefeedwillbegivenwithdifferentproportionsThefeedgiventomalesarebloodworms,pellets,cumps, artemiaetc.Meaning willbedoneineveryevening4to6 then the feed will be supplied to the prawns in the tanks.

BIO-SECURITY REQUIREMENTS OF SHRIMPS FARMS:-

Crockingofpathogenfreepostlarvaealonewillnotguaranteedieadefreeculturesincethepathogensstill enter the culture environment horizontally and infect shrimps during the culture, Viral paths enter the pondculture through the:-

- By persisting in the soil.
- Intake water.

Aquatic vectors introduced through intake water by crabs and other animals.

- Contaminated land animals and birds.
- Contaminated farm inputs and farm implements.

The basic elements of a bio-security programme included the physical, chemical and the biological methods necessary to protect the hatchery from all the diseases that represents a high risk. Effective bio-security requires attention to a range of factors some disease specific security ranging from purely technical factors to aspects of management and economics.

WATER QUALITY MANAGEMENT IN HATCHERY:-

Water for the hatchery should be filtered and treated to prevent entry of vectors and pathogens. This may be achieved by initial filtering through sand filters or mesh back filters into settling tank following

Primary disinfectant by chlorination. 3kgs of chlorine is added to800 lit tank.Within 12hrs the water will be filtered. Then these water treatedwithdifferent filters i.e. RS filters to centrifuge and purify

water,thecandelastopreventtheentryoftheorganisms.Then UV Altersto kill thebacteria,microbes present in the water and therecirculationsystem are used to enhance the bio-security.

Regularmonitoring of water quality is very essential. Water quality parameterslike temp, salinity,ph, and alkalinity are monitored on daily basis.

DO levels are recorded at least 2 times a day. Other parameters like ammonia, nitrate, calcium, magnesium are monitored on weekly basis. DO levelsshould be maintained above 4ppm. And also the aeration should beprovided throughout theday to maintain the temp at 26º C thentransferred into transferrable tanks.

Measuring water parameters

HARDNESS

principle : Calcium and magnesitlill ions arc titrated with the complexing agent ethylene diamine tetra acetic acid disodium salt (EDTA) to form the stable complexes. The end point of the titration is signaled with an indicator called Erichrom black-T.

Reagents :

(a) **Buffer solution** : Disolve 67.5 g of ammonium chloride in 570 ml of conc. ammonium hydroxide. Dilute to 1000 ml with distilled water.

(b) **Erichromc black-T** : Dissolve 4.5 g of hydroxyl amine hydrochloride and 0.5 g of Erichromc black-T in 100 ml of 70 % ethanol.

(c) **Standard calcium solution** : Transfer 1.0 g of anhydrous calcium carbonate to a 1 liter beaker. Add 1:1 HCI slowly to dissolve the calcium carbonate and dilute to about 200 ml with distilled water. Boil for 5 to 10 minutes to expel carbon dioxide, cool and adjust to pH 7.0 as determined with a pH meter, with 3N NH40H. Transfer to a 1000 ml volumetric flask and dilute to volume with distilled water.

(d) **Standard EDTA solution** : Dissolve 4.0 g EDTA disodium salt and 100 mg of MgC12.6H20 in distilled water and dilute to I liter. The solution must be standardized against the standard calcium solution. Pipette 10 ml of the standard calcium solution into a 250 ml beaker and add 90 ml of distilled water. Titrate the calcium solution with EDTA solution according to the procedure given below, Compare the molarity Of the EDTA solution the equation : **NV = N' V'**

Procedure:

Nleasure a 100 ml of water sample into a 250 ml Erlenmeyer flask. Add 2 ml of the buffer solution and mix. Add 8 drops of Erichrome black-T indicator and titrate with the EDTA solution. At the end point, the solution will change from wine red to pure blue.

Calculation:

Total hardness (mg/l as caco3)= $\frac{T \times M \times 100000}{S}$

Where, T = Volume in ml of EDTA solution.
M = Molarity of EDTA solution.
S= Volume in ml of sample.

ALKALINITY

Principle: It can be measured by titrating' the water sample with a standard acid using methyl orange.

Reagents:

(a) 0.02 N Sulphuric Acid : Dilute 30 ml of concentrated H2S04 to I liter with distilled water to get approximately IN stock solution. To make 0.02N H2S04, take 20 ml of this stock solution and dilute to 1 liter with distilled water. Standardise this solution against 0.02N sodium carbonate using methyl orange as in indicator.

(b) 0.02 N Sodium carbonate : Dissolve 5.3 g anhydrous sodium carbonate in I liter distilled water. Dilute 50 ml of this solution to 250 ml to get 0.02 N sodium carbonate.

(c) Methyl orange indicator : Dissolve 0.05 g reagent in 100 ml of distilled water.

Procedure : Add 2 drops of methyl orange indicator to 50 ml of water sample. If the sample remains colourless, no alkalinity is there. If it is yellow, titrate with 0.02N H2S04 till the colour turns taint orange.

Calculation: alkalinity (ppm of CaCC3) = volume of 0.02 N H2S04 required for titration x 20

PH

Principle: PH can be measured more accurately and conveniently with a PH meter and combination glass electrode.

Procedure(potentiometer): Take the water sample of the PH meter into it. The indicator of the PH meter shows the PH readings directly. The meter should be calibrated routinely at PH 7.0 using appropriate buffer solution and then accuracy verified by testing at PH 9.2 buffer.

HARVEST

Monitoring of vennamei cultures in nauplius stage, in the 4th stage they are harvest by cast nets and draining out water then put in on bags with aeration fixed. Then it harvested then transported..

FISH & PRAWN FEST (Dec 29-2021)

On December 29, 2021; with the help of lessons we learnt during our internship at RELISH FOODS,Pvtlmtd, we the students of III bsc AZC, along with the help of DEPARTMENT OF ZOOLOGY conducted FISH &PRAWN FEST .

- It's a self earning program using our skills while we learned during our internship.
- Our hon. Principal sir Dr. GIRI (Msc, Phd) inaugurated the program heartfully along with the staff of department of zoology.

FISH & PRAWN FEST

MENU

Crunchy Fish chops

Served with Aioli sauce,tangy sauce, sliced onions, along with lime slice.

50rs-plate, ½kg-350rs

Fish masala coconut

Made with baked and powdered coconut flakes dipped in spicy masala and fried

P1-50rs, ½kg-350rs

Spicy fish

Marinated in spicy masala made from Fresh Indian spices, Black salt and fried.

P1-50rs, ½Kg-350rs

Fish peri peri

Served with spicy tomato puree and creme fraiche,sliced onions

P1- 50rs, ½kg-350rs

Crunchy Butterfly Prawns

Crunchy prawns made from Fresh Indian spices dipped in crunchy corn flakes, served with a zest of lime slice, creme fraiche and spicy tomato puree

P1-60rs, ½kg-450rs


DK. Govt college for women (A)
Nellore
Department of Zoology
"EARN WHILE YOU LEARN"
You're cordially invited to
Fish & Prawn Fest
Venue: Thursday, December 30th
At 03:30 pm in the evening
Room no: 41.
Msc Zoology Ide
By
III Bsc Aquaculture students (andu)

AQUA LAB TECHNIQUES

The students of Bsc III Aquaculture students had a Guest lecture on Oct 25th, 2021 that was given by Dr. Gopi Krishna sir , HOD Department of zoology, from VikramaSimhapuri university , Nellore. He teached us about the various aspects in the field of MICROBIOLOGY, ZOOLOGY and BIO TECHNOLOGY such as

- preparation of culture media ,

- Broth culture techniques,
- Antibiotic sensitivity tests(disc method and well method),
- Microbial diagnostic tests such as Staining techniques of microbial cultures,
- Serial dilution method,
- Isolation and culturing of microorganisms from fish gills, mucosal membranes, fish intestinal walls, soil and pond water too.

Microbial diagnosis

Viral and bacterial diseases can be identified by various microbiological methods. The samples taken from moribund or immediate dead fish are first grown in nonselective media then this culture can be used for differentiating the microbes.

Some of the more regular microbial diagnostic methods are

1. **Staining method**
   a. Gram stain method
   b. Acid-fast staining method
2. **Motility test**
   a. Hanging drop method
   b. Agar stabbing method

I.Staining method

It is a universal staining technique, used for It is used for the identification and classification of microbes or microorganisms especially bacteria and bacterial cells.

a. Gram stain method:

It was created by Han's Christian Gram in 1884.

Bacterial cells are 2 types: they are Gram-positive Gram-Negative.

The classification of the bacteria depends upon the property of a cell to retain or to lose the Crystal violet (Primary strain) after the treatment of decolorizer (alcohol).

Apparatus and chemicals: 1.A clean grease-free slide 2.Primary stain -Crystal violet
3.Secondary stain/Counterstain -Safranin/Basic fuchsin 4.Mordant - Gram's Iodine
5.Decolorizer: 95% alcohol (95% ethanol) 6.Nichrome wire loop
7.Bacterial cell suspension

Procedure: Take a clean grease-free slide, wash it, dry it, and pass it through bunsen's Burner's flame. Take a nichrome loop, wash it, dry it, and flame it. Then make a smear by using a nichrome wire loop. Then allow the slide for air dried and fix it with heat. Add a few drops of primary strain (Crystal violet) to smear and allow it for 2 minutes. Then wash the slide with water and add Iodine, allow it for 2 minutes. Then treat the slide with a decolorizing agent. Wash the slide with water. Then add safranin a secondary strain, allow it for 2 minutes. Wash the slide air dry it and observe under the oil immersion lens.

Observation: Cells appeared with Crystal violet color are called Gram+ cells Cells appeared with pink color are Gram- cells

b. Acid-fast staining method or Ziel-Neelsen staining method:

It was developed by Paul Enrich in 1883. There are a variety of microorganisms in the world and each has its own special characters. Some microorganisms are not easily stained by the simple staining procedure because they have a waxy coat on its surface, such organisms require a special staining technique called acid-fast staining technique.

The acid-fast staining technique helps us to differentiate the organism as as Acid- fast and Non-acid fast organisms.

Acid-fast organism: The organism that gets stained by acid-fast staining mechanism but doesn't get decolorized even by strong acid alcohol is called an acid-fast organism.

Non-acid fast organism: The organism that easily gets stained by acid-fast staining mechanism as well as easily decolorized by strong acid alcohol is called a non-acid fast organism.

Apparatus and chemicals:1.A clean grease-free slide
2.Primary stain: Ziehl Nielsen Carbolfuchsin (Pink color)

3.A bacterial cell suspension 4.Decolorizer: Acid alcohol
5.Counterstain: 1% Malachite green or 0.3% Methylene blue 6.Boiling water bath

Procedure: Prepare a smear on a clean grease free slide by using a nichrome wire loop. Then air dry it and heat fix the slide. Then add ZNCF stain and place the slide on a boiling water bath for steaming about 3-5 minutes while steaming ZNFC is repeatedly added to avoid drying of the smear. Then treat the slide with acid alcohol until the stain disappears. After that wash the slide thoroughly for a number of times. Then add counterstain (1% Malachite green or 3% Methylene blue) for about 2 minutes. Then wash the slide with water and air dried. Then observe it under the oil immersion lens.

ZNCF stain destabilizes the waxy covering of bacteria so that the cell gets stained with pink color. Cells stained with Malachite green or Methylene blue appear in blue/green color.

Observation : Acid-fast bacteria appear in pink color. Non-acid fast bacteria appear in green/blue color.

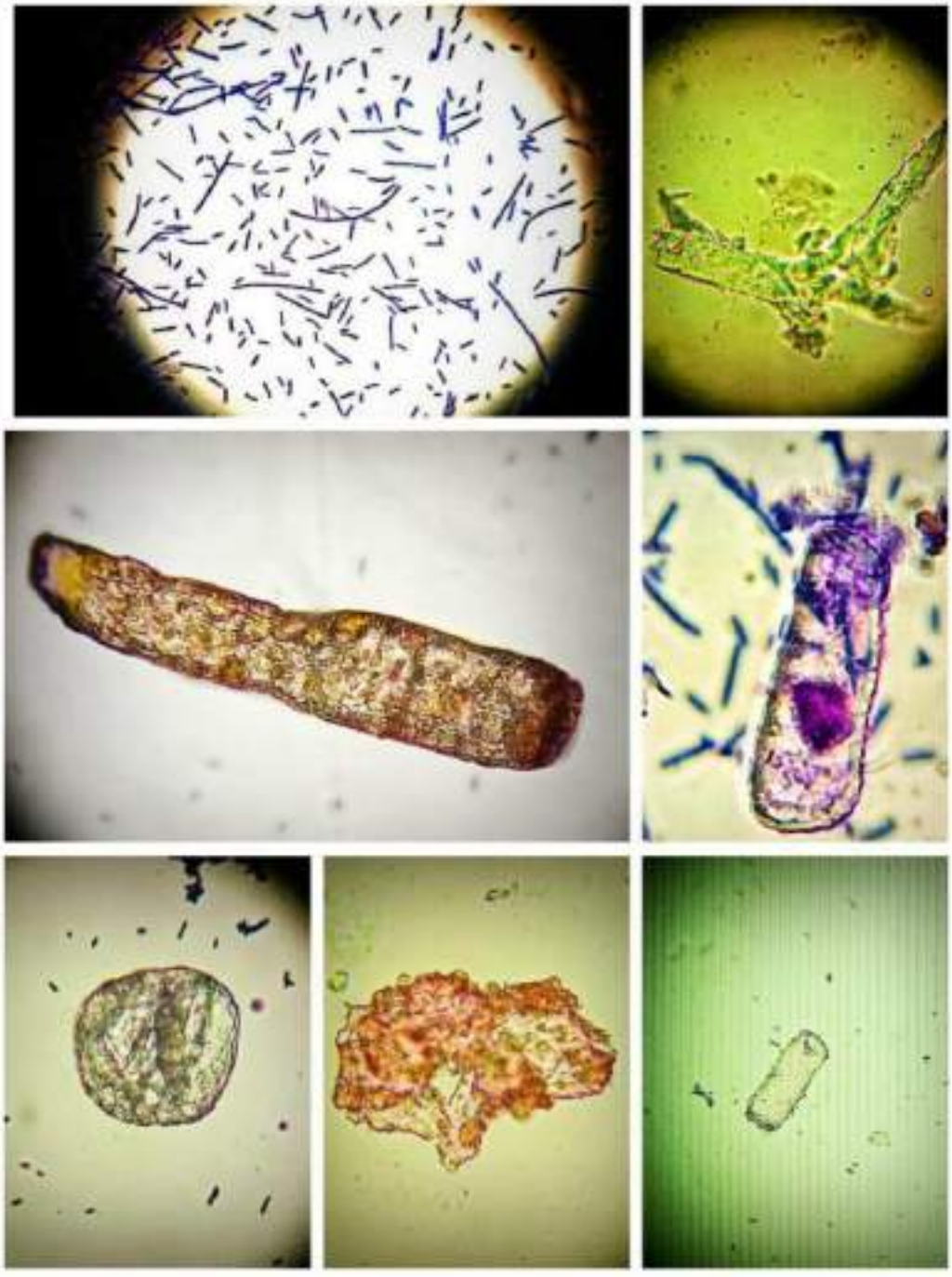


FIG: Gram staining of various microbes taken from water samples, soil sample and fish mucosa.

II. Motility test

It is used to find out the microorganism, a motile one or nonmotile. 2 methods are prominent in the aquaculture system.

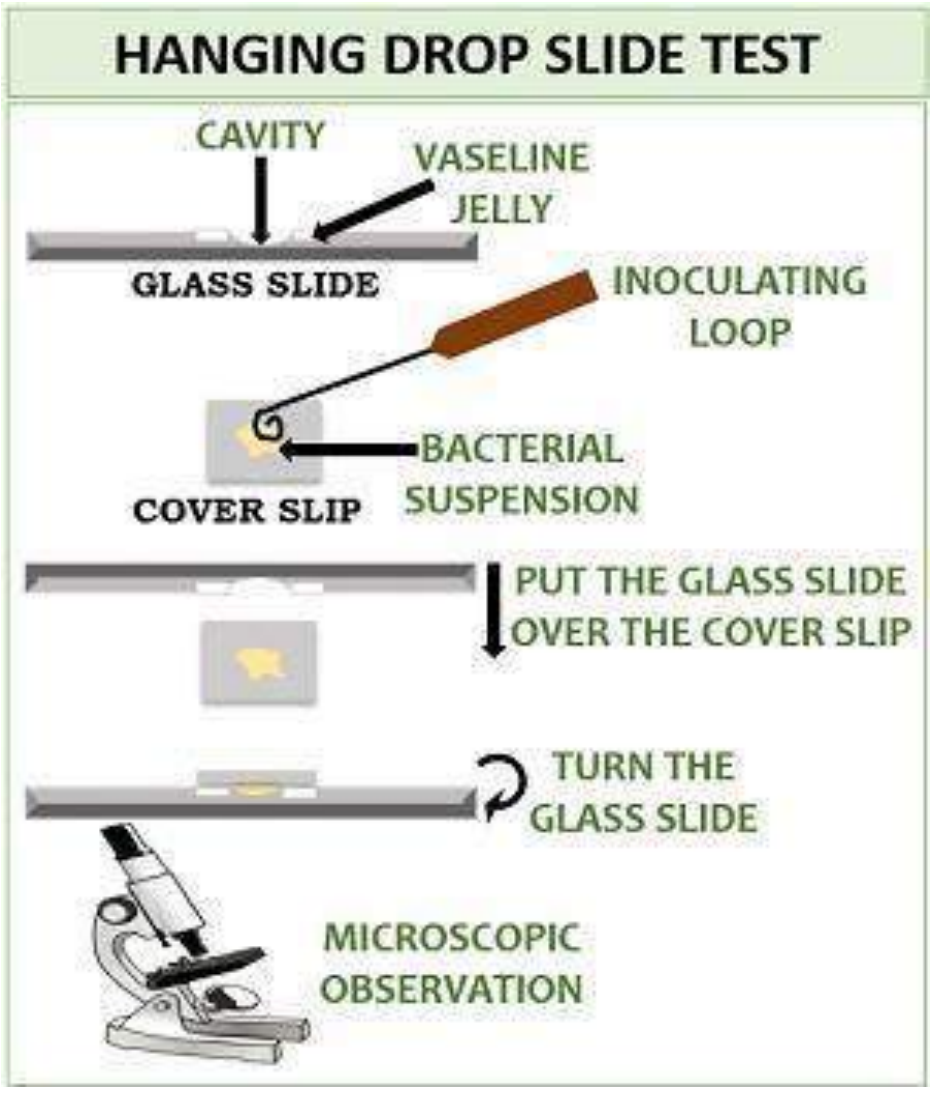
A. Hanging drop method:

It is a regular method in aquaculture practices.

Apparatus and Chemicals: 1.Depression slide 2.Cover slip 3.Petroleum jelly 4.Bacterial culture 5.Inoculation loop 6.Bunsen's burner 7.Laminar Air Flow

Procedure: All the requirements should be in the Laminar Air Flow (LAF).

Take a coverslip, apply the jelly on the four corners of the coverslip with the help of a sterile needle. Then sterilize the inoculation loop by heat and cool process, then take a mouthful of bacterial culture with the help of loop, dropping it at the center of the coverslip. Now take thEdepression slide and place it on the coverslip with the concavity down. Press it and inverse the slide. Now use the slide under microscopic examination.



B. Agar stabbing method:

It is also a regular practicing method in aquaculture to find the motility of the microorganism.

Apparatus and Chemicals:1. Sulphide indole motility medium(SIM) 2.Bacterial culture 3.Inoculation needle 4.Bunsen's Burner 5.Laminar Air Flow 6.Cotton.

Procedure: Take the inoculation needle flame until red hot and allow it cool. Take a bacterial culture test tube, remove its mouth cotton flak, and pass the mouth of the test tube through a flame. Take some bacterial culture with the help inoculation needle. Now take the test tube of SIM to remove its mouth cotton flak, pass the mouth of the SIM test tube through a flame. Now keep the inoculation needle of bacterial culture in the SIM test tube and take it out. Flame again the mouth of the SIM tube and inoculation needle, rack it. Now keep the test tube of SIM in Incubator at 370c for 24hrs.

Observartion : Black precipitation-motile positive, Non-black precipitate -Non motile .

Fig: Culture media preparation, observation of gram staining, inoculation, and measuring salinity of water sample.

PREPARATION OF CULTURE MEDIA

The growth of an organism on a medium is called culture. The food base that support the growth of an organism is called culture medium. The culture media are devised in such a way that the organism should get all the nutritional requirements. However, the culture media are prepared in laboratory by weighing and dispensing the individual ingredients or procured ready-made media from the market. Generally, the common media contain both organic and inorganic nutrients but for the cultivation of many microorganisms specialized media are prepared. If solidification of media are required, agar-agar is mixed with the other ingredients.

Basically, the culture media are of three types: natural, semi-synthetic and synthetic media as given below, any of them are used for microbiological work.

(i)Natural Medium.

The natural medium is that which contains the natural products as such, for example diluted blood, urine, milk, vegetable juices, peptone, or animal cells/tissues/organs. In such medium the exact chemical composition is not known.

(ii) Semi-synthetic Medium

The semi-synthetic medium is that in which the chemical constituents are partially known, for example,potatodextrose agar (where the chemical constituents present in potato are not known), Czapek-Dox agar, nutrient agar, beef extract agar media, etc. In the other words media containing agar are called semi-synthetic media.

(iii) Synthetic medium

The medium in which chemical substances of known concentration are present for the isolation of a large number of microorganisms is called synthetic medium. The synthetic medium will be of different types such as (a) general purpose medium (for routine microbiological work), (b) differential medium (to differentiate the groups of microorganisms by opting such media that contain dyes and colour indicators to give biochemical response e.g. MacConkey and Eosine methylene blue agar), (c) selective medium (contains compounds found in differential media and certain agents that further inhibit growth of most of the microorganisms and promote growth of the required ones), (d) onepurpose medium (highly selective medium used to isolate specific microorganisms, for example, brilliant green agar for isolation of Salmonella from faeces) or (e) assay medium (to assay antibiotics, amino acid, vitamins, etc.)

Preparation of Liquid Medium (broth) for Routine Microbiological Work

Unlike fungi, bacteria are generally cultivated in broth, i.e. the medium devoid of agar. In fact requirement of nutrients is met by supplementing beef extract (which is a source of mineral salts, organic carbon and nitrogen, vitamins, etc.) and peptone (which is semi-digested protein).

Method of preparation of nutrient broth is given below:

(a) Requirements:

- Nutrient broth medium (HCI IN, NaOH IN),
- pH meter,
- Distilled water ,
- Autoclave,
- Heater,
- Culture tubes,
- Glass rod,
- Beaker (1 1 capacity),
- Measuring cylinder

Nutrient broth medium:

Peptone-	5.0 g
Beef extract-	3.0 g
Distilled water	1 litre
PH	7.0

(b)Procedure:

(i) weigh the chemical ingredients of the nutrient broth and transfer them into a beaker containing 500 ml distilled water.

(ii)Gentlyheat the contents withslight agitation to dissolve the ingredients.

(iii)Add more distilled water to make the volume to 1 litre.

(iv) Measure pH of the broth by using a pH meter andadjust the Phto 7.0 byaddingdrops of either HCI or NaOH solution.

(v) Dispense 10 ml broth to each culture tubes.Prepare cotton plugsand apply them TO mouth ofbroth tubes.

(vi) Tightly cover the mouth of cotton plugs with aluminium foil or a paper and tie with a rubber band or thread.

Transfer all the broth tubes into a test stand or iron basket.

(vii) Place the basket inside the autoclave/pressure cooker and sterilise at 121 degrees Celcius for 30 minutes.

(viii) When temperature cools down take out the broth tubes.

(xi) Use the broth tube when required or store at room temperature for further use.

Some points of consideration while preparing the media : Dehydrated or ready-made media are sold in the market. These are commercial preparations and used after weighing (specific measure) and dissolving in required quantity of distilled water. Instructions for the preparation are generallymentioned on the label of container. It is necessary to weigh them accurately and prepare them according to direction on the label. It is possible to prepare smaller amount of media (less than 1 liter). If 100 ml of medium required, simply divide the medium and water by 10. It is easy to calculate the quantity of powdered media to distilled water and then apply accordingly in the process of preparing the media. The agar must be dissolved in hot water before mixing with other chemicals. In case different chemicals are being used for media composition and its preparation, use of magnetic stirrer with Teflon coat magnet helps in dissolution of the chemicals.

DEMONSTRATION OF TECHNIQUE FOR PURE CULTURE OF MICROORGANISMS

Generally, bacteria exist in mixed population. It is very rare to get a single and pure form. For studying the cultural, morphological, and physiological characters of an individual species, it is essential to separate them from the others to get in the form called pure culture. There are many importantmethodsforisolating pure culture frommixed culture.

Streak Plate Method from microbial culture

The colonies on a mixed plate are separated by spreading on a plate with good spacing among each other using streak plate method.

(a) Requirements:

- Tripod stand
- wire gauze
- Bunsen burner
- Beaker of water
- Wire loop
- Nutrient agar pour
- Sterile Petri dish
- Mixed culture

(b)Procedure: Liquefy a tube of nutrient agar and pour into the Petri dish, rotate the plate gently for uniform distribution of the medium.

Streak the plate following quadrant or radiant or T-streak or continuous streak as shown

Keep the streaked plates in inverted position at 25 ^{0}C for 24-48 hours.

Place the Petri dishes upside down to solve the problem of water condensation because if it drops down on the colonies, the organisms of one colony can spread on the other colony.

(c)Results :The isolated colony of desired microbes (at the site of last streak) on the plate will be observed.

SERIAL DILUTION

Definition of Serial dilution

- As the term indicates, it is a series of succeeding dilutions that performed to create a less dense or less concentrated solution from a high dense or concentrated solution.
- In a single and very simple word, Serial dilution is a laboratory technique, in which a stepwise dilution process is performed on a solution with an associated dilution factor. In the laboratory, this method is used to decrease the counts of cells within a culture to simplify the operation.
- In serial dilution, the cell count or density gradually decreases as the serial number increases in each step. This makes it easier to calculate the cell numbers in the primary solution by calculating the total dilution over the whole series.

Purpose of Serial dilution Technique

The main purpose of serial dilution technique is to find out the concentration or the cell counts of an anonymous sample by counting the number of colonies that are cultured from the serial dilutions of the sample.

It also used to avoid having to pipette very small volumes (1-10 µl) to make a dilution of a solution. The incubated plates from the serial dilution generate an easily countable number of colonies, hence we can easily enumerate the number of cells present within the sample.

Formula/calculations for serial dilution technique

In serial dilution, the selected sample is diluted through a set of standard volumes of sterile diluents, such as be distilled water or 0.9 % saline. After that, a small amount of sample from each dilution is used to prepare a series of pour or spread plates.

If the dilution factor of the first tube, r = 10-1 (1 ml added to 9 ml) and the dilution factor of the second tube= 10-1 (1ml added to 9 ml), then,

Total dilution factor will be = previous dilution × dilution of next tube = total dilution of 10-1 × 10-1 = 10^{-2}

Serial dilution Procedure

- The following is the procedure for a ten-fold dilution of a sample to a dilution factor of 10-6:
- Take 7 sterile and clean test tubes.
- The selected sample is taken into a test tube and the remaining 6 test tubes are filled with 9 ml of sterile diluents such as distilled water or 0.9% saline.
- Take a sterile pipette. Draw 1ml of sample into the sterile pipette.
- The sample must be properly mixed, if necessary use a vortex meter.
- Then transfer this 1ml sample within the first test tube to make the total volume of 10 ml. It provides an initial dilution of 10-1. Make sure during the transfer, the tip of pipette doesn't touch the wall of test tube or no amount of sample remains at the tube wall.
- Mix the sample properly with the diluent by shaking the tube.
- Now discard the pipette tip and add a new pipette tip to the pipette.
- Transfer 1 ml of mixture sample from the 10-1 dilution to the second tube by using pipette. The 2nd tube now has a total dilution factor of 10-2.
- Repeat step 8 for the remaining tubes, transfer 1 ml from the previous tube to the next 9 ml diluents.
- The dilution for the bacteria/cells in the last test tube will be 10-6 (1 in 1,000,000).

Limitations of serial dilution technique

Serial dilution faces some challenges such as;A mistake might occur throughout the distribution of the sample, and the transfer errors result in a less reliable and less accurate transfer. This leads to the highest dilution having the most errors and the least efficiency.

It is performed in a stepwise manner, therefore it needs a more long period of time which restricts the capability of the method.

This technique only reduces the counts of bacteria/cells but not separate them like in other methods such as flow cytometry.

Required trained experts to perform this technique.

Advantages of Serial Dilution

It can help reduce the size of cells to a lower concentration that is usable.

A certain amount of bacteria are eliminated with each dilution.

The number of colonies cultured from serial dilutions of the specimen is estimated to estimate the concentration of an unidentified sample. Then backtrack the measured enumerations to the unspecified concentration.

Importance/Application of Serial dilution Method

Serial dilution is a widely employed laboratory technique for experimental sciences such as pharmacology, biochemistry, homeopathy, and physics.

In a microbiology laboratory, it is used to determine the density or counts of cells/organisms in an unknown sample to achieve an incubated plate with a countable number of colonies.

It is also used to achieve the desire concentration of the reagents and chemicals from a higher density oi biochemistry lab.

Serial dilution is also used to get the required concentration of chemicals and compounds in pharmaceutical laboratories as this technique is more efficient than individual dilutions.

In homeopathy, homeopathic dilutions are employed where a substance is diluted within distilled water or alcohol. It is assumed that dilution enhances the strength of the diluted substance by stimulating its vital energy.

TEST FOR ANTIBIOTIC SENSITIVITY BY DISC METHOD (KIRBY-BAUER METHOD)

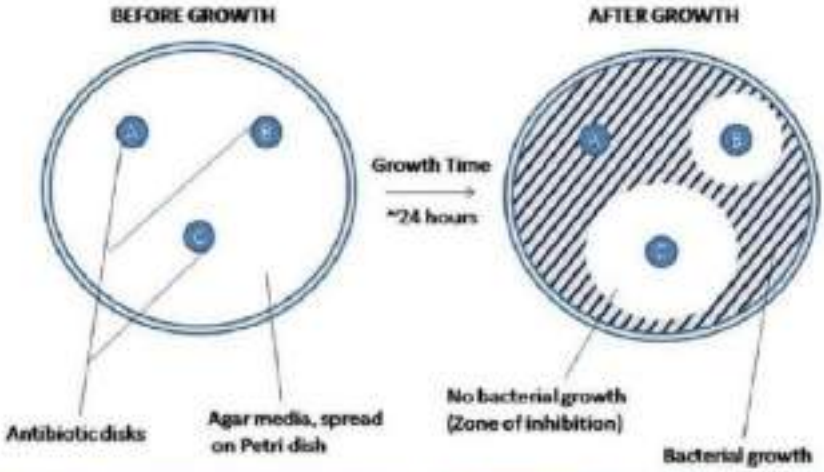
The main drugs used in the medical sciences include antibiotics, sulphonamides and chemotherapeutics. All are called antimicrobics in nature. The antimicrobici.c. antibiotic sensitivity is quite significant due to development of resistance among various microorganisms. The sensitivity of the drug helps in selecting the appropriate line of treatment. The effectiveness is based on size of inhibition zone. However, zone may vary due to diffusibility of drug, size of inoculum, typeofmedium etc.

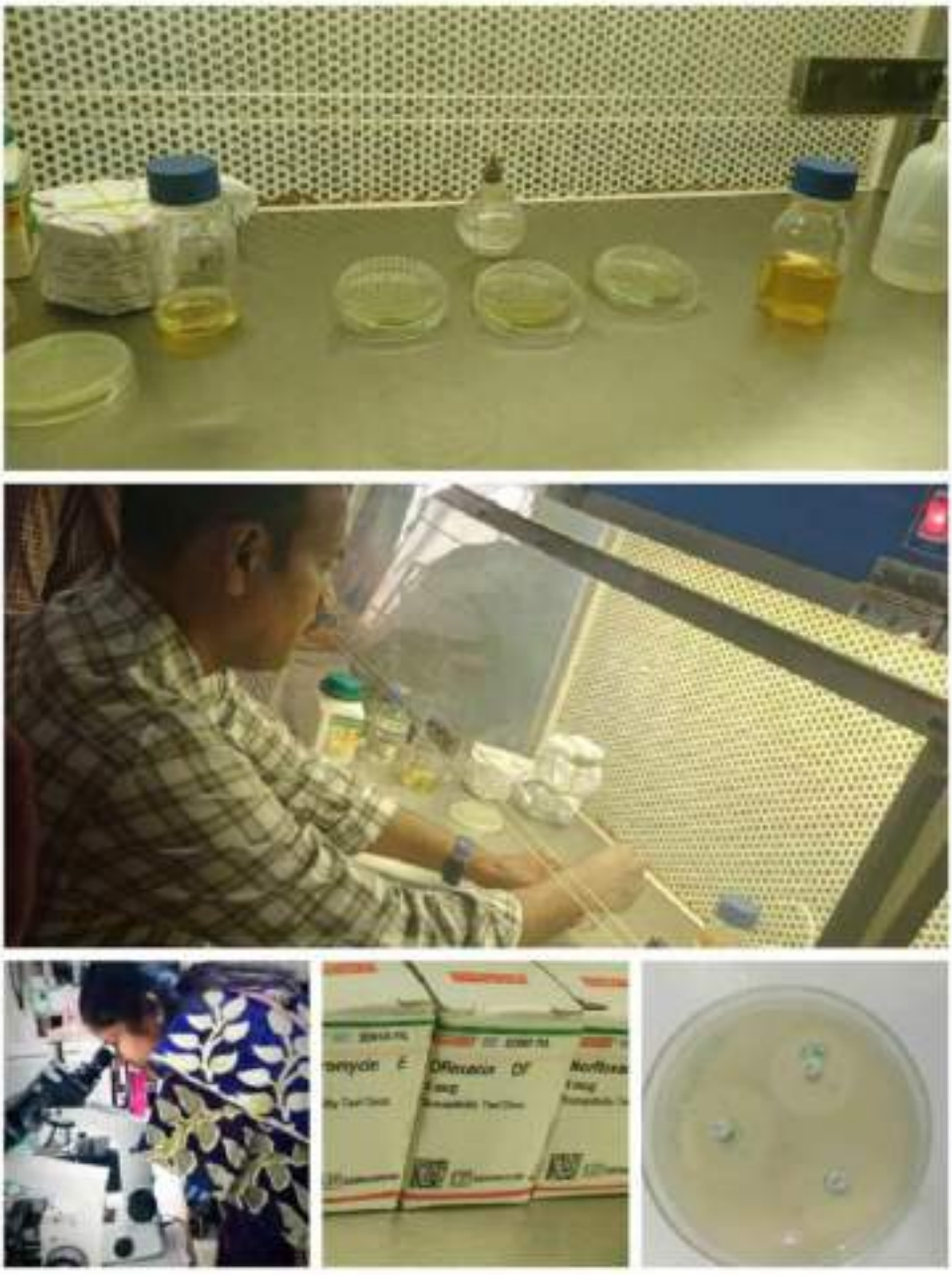
(a) Requirements :

- Agar plate
- Swab
- Bacterial culture
- Antibiotic discs { Erythromycin(5mg), Ofloxacin (5mg), Norfloxacin (5mg) }
- Incubator&Forceps

(b) Procedure:

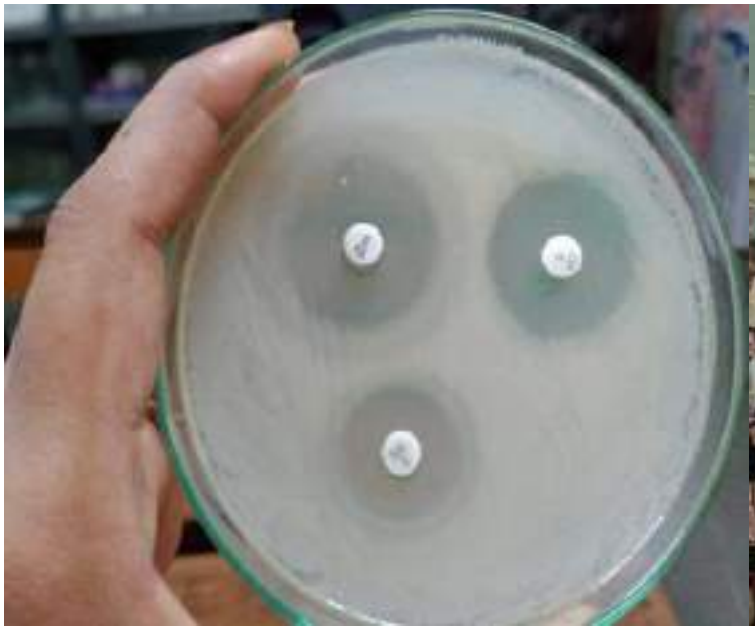
- Plate the culture on the entire surface of the agar plates swabbed with organism to be tested or the bacterial lawn is prepared on the plate as mentioned elsewhere.
- Use the readymade antibiotic discs in cartridges to dispense individuall disc on the plate as shown





- If cartridge of antibiotic is not available, prepare solution of known concentration of an antibiotic in sterile distilled water and dip discs (0.5 mm diam) of Whatmanfiltre paper No.1
- Place only 4-6 discs on one plate and incubate for 12-24 hours at 37^0C.
- Examine the plates and measure the diameter of the clearing zones to the nearest millimetre.
- The faint growth or tiny colonies in the clearing zone may appear due to resistant nature of some bacteria. Avoid such growth.

(**c) Results** : Clear zone around the discs shows inhibitory nature of the drug/antibiotic.



CONCLUSION:

This one month internship in aquaculture gave awareness to us to become aquaculture entrepreneurs, aquaculture farm managers, hatchery managers, fishery officers, research officers, lecturers, quality control specialists, scientists and consultants and this is a field with plenty of opportunities for growth. This course assists in the demand for seafood and enables to maintain the sustainable and consistent of aquaculture. After completion of this internship we got benefitted and enriched in the areas of hatchery pond management where we learned eye stalk ablation in prawn, value added products and also got exposed to the processing of sea products and preparing a variety of ready to use food items followed by packaging and sealing and also learned about the water analysis after visiting to Aqua prime hatchery and Alpha biological labs.

We got hands on experience in the fields of water analysis, eye stalk ablation in prawn, pond management and processing of sea food products. This one month internship paved a way to us to get lucrative job opportunities that are available for fisheries graduates. Finally, it can be concluded that I got enriched with this internship.