DEPT OF ZOOLOGY

V semester

Paper -6A -Sustainable Aquaculture Management

MANUAL

D.N.R. COLLEGE (AUTONOMOUS), BHIMAVARAM

(Affiliated to Adikavi Nannaya University)

III B.Sc- Zoology Practical Syllabus (w.e.f 2020-21) admitted batch

V SEMESTER

PAPER –VI A- SUSTAINABLE AQUACULTURE MANAGEMENT

Total Hours-24 Hours per week-02 Total credits-01

I Identification Of Fresh water Cultivable (Fin & Shell Fish Specimens)

a. Fishes- *Catla Catla, Labeo rohita, Cirrhinus Mrigala, Cyprinus carpio, Hypopthalmichths molitrix, Ctenopharyngodon idella.*

b. Shell fishes- Macrobrachium rosenberggi, macrobrachium malcomsonii,Macrobrachium idella, Macrobrachium rude., Matapenaeus affinis.

II.Identification Of Brackish water Cultivable (Fin & Shell Fish Specimens)

a. *Chanos Chanos, Mughil Cephalus, Lates calcarifer, Etroplus suratensis*

b. Penaeus monodon, Penaeus indicus, Metapenaeus dobsonii, pennaeus vannamei

III. Diseases in Fish and Shell Fish (Bacterial,Viral, Fungal)

a. Bacterial Diseases- Two from fish and two from shrimps
b. Viral Diseases - Two from fish and two from shrimps
c. Fungal Diseases- Two from fish and two from shrimps

IV. Hands on training on the use of kits for determination of water quality in aquaculture (DO, Salinity, pH, Turbidity- Testing kits to be used for the estimation of various parameters/ Standard procedure can be demonstrated for the same)

V.Demonstration of Hypophysation (Procedure of hypophysation to be demonstrated in the practical lab with any edible fish as model)

VI. Visit to fish / prawn hatchery –and submission of field note book.

D.N.R. COLLEGE (AUTONOMOUS), BHIMAVARAM
(Affiliated to Adikavi Nannaya University)
III B.Sc.Zoology practical Examination
Semester-V
Paper VI A - SUSTAINABLE AQUACULTURE MANAGEMENT

Model question paper and scheme of valuation
(w.e.f 2020-21 admited batch)

Duration :3 hrs **Max.Marks-50 M**

1. Identify the Following Spotters (fishes And Prawns) 3x5=15 M

A. B. C.

2. Identify the Following Diseases (fishes And Prawns) 2x5=10M

D. E.

3. One Experiment from the water quality parameters 10 Marks

4. Record 10 Marks

5. Field Note Book 05 Marks

FRESH WATER FISHES

1.Catla catla *Phylum- Chordata*

Class - Osteichthyes

Order- Cypriniformes

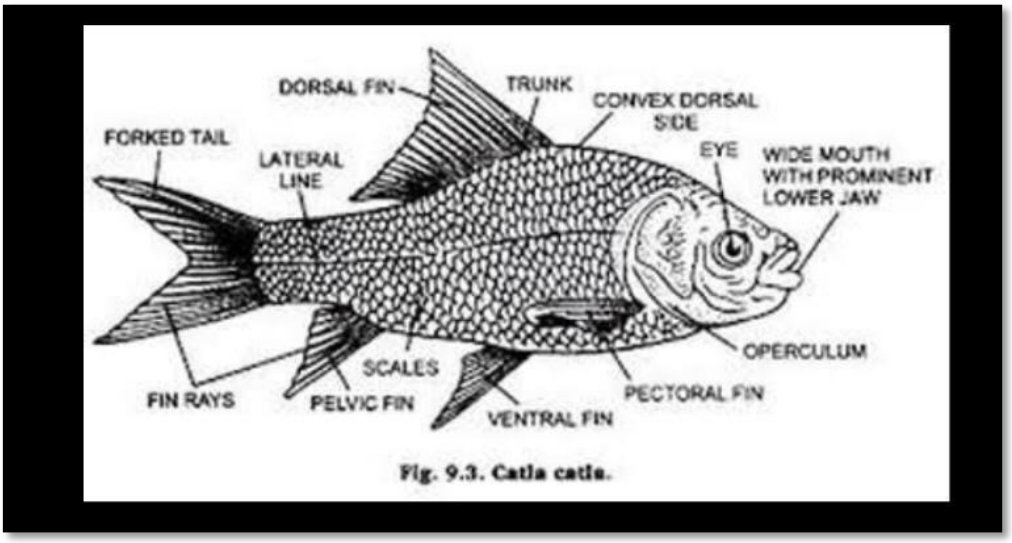


Fig. 9.3. Catla catla.

- It is commonly known as Botcha or Krishna botcha.
- It is the most common Indian carp, widely distributed in tropical and temperate regions.
- Body is broad with a convex dorsal profile. It is stout, laterally compressed, fusiform and covered with cycloid scales.
- Head is large with large eyes but no barbles. Mouth is anterior, wide and upturned.
- It has a thin upper lip and a moderately thick lowerlip with a free posterior margin. Jaws are protrusible and without teeth, barbles are absent.
- Dorsal fin is long and inserted above the tip of the pectoral fin, fin rays are17 to 19 without any spine. Anal fin is short with 6 rays. Caudal fin is forked. Lateral line is complete with 40 to 43 scales.
- It is one of the most valuable food fish. It is greyish coloured on the back and flanks, silvery white on the belly.

2. Labeo rohita

Phylum- Chordata
Class- Osteichthyes
Order- Cypriniformes

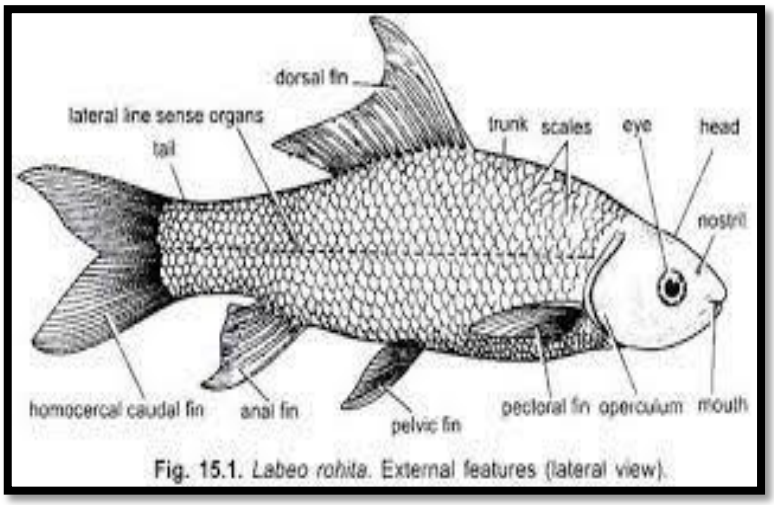


Fig. 15.1. *Labeo rohita*. External features (lateral view).

- It is commonly known as rohu or ragandi or seelavathi.
- Body is compressed, fusiform, about 1 metre in length and weighs about 4 kg. Colour of the body is bluish or brownish on back and silvery white on flanks. Body is covered with large overlapping cycloid scales.
- Head is depressed and is produced into a short obtuse and blunt snout. It bears a subterminal fringe lipped mouth bounded by fleshy upper and lower lips. It also contains paired nostrils and paired eyes.
- A pair of filamentous barbles arises from upper lip; small tubercles cover the snout which is oblong, depressed, swollen and projecting beyond the jaws. Large operculum hangs on both sides on both sides enclosing gills and branchial chamber.
- Lateral line is distinct; scales overlying the lateral line are perforated by tubes of the lateral line system. These overlap to form a complete covering. Dorsal, anal, caudal fins are unpaired. Pectoral and anal fins are with soft fin rays.

3.Cirrhinus mrigala Phylum- Chordata

Class- osteichthyes

Order- Cypriniformis

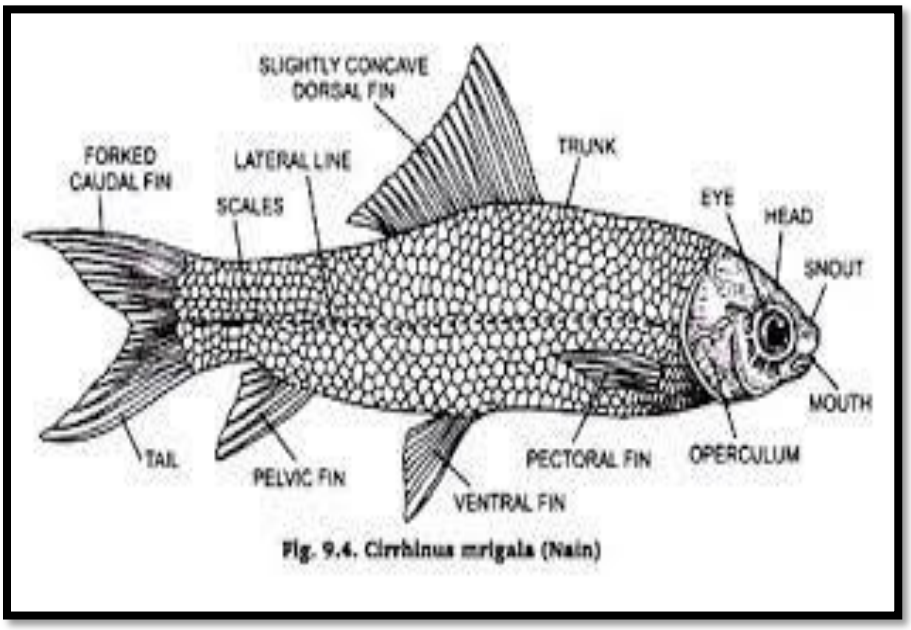


Fig. 9.4. Cirrhinus mrigala (Nain)

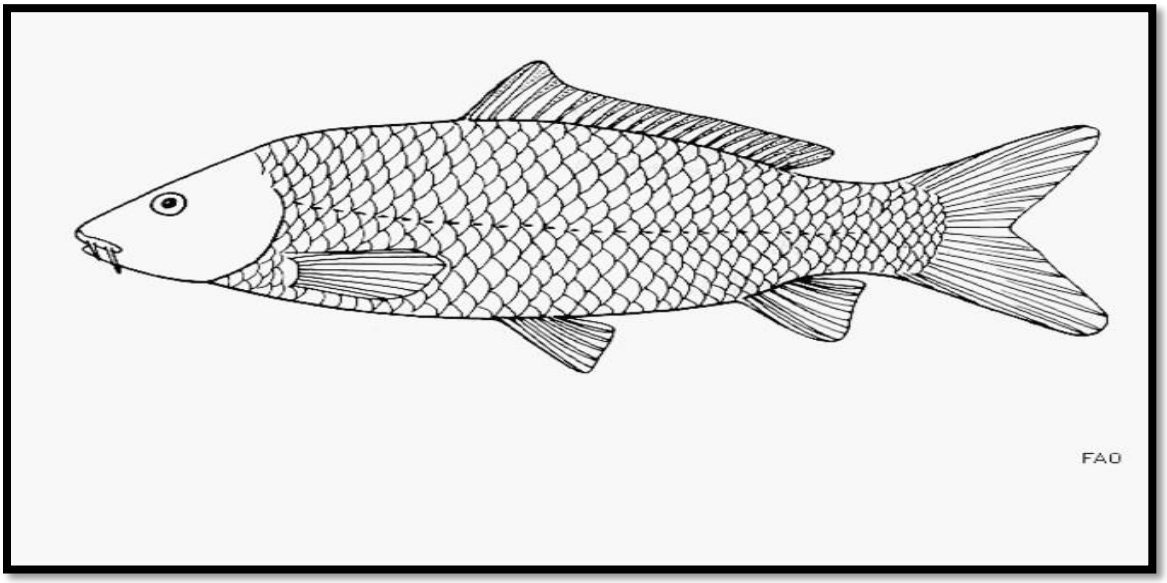
- It is commonly known as mrigal. Body is moderately elongated and compressed. Abdomen is almost round.
- Head is small. Snout is obtusely rounded and covered with thin scales.
- Mouth is broad and transverse. Upper lip entire and transverse. Lower lip may or may not cover the lower jaw. Barbles are small -2, 4 or none.
- Dorsal fin ahead of pelvic fins with 10-19 rays. Caudal fin is forked or lunate.Lateral line is complete.
- Usually fork and back are grey, abdomen is silvery, dorsal fin is greyish, pectoral, pelvic and anal fins are orange tipped.

4.Cyprinus carpio

Phylum- Chordata

Class- osteichthyes

Order- cypriniformis

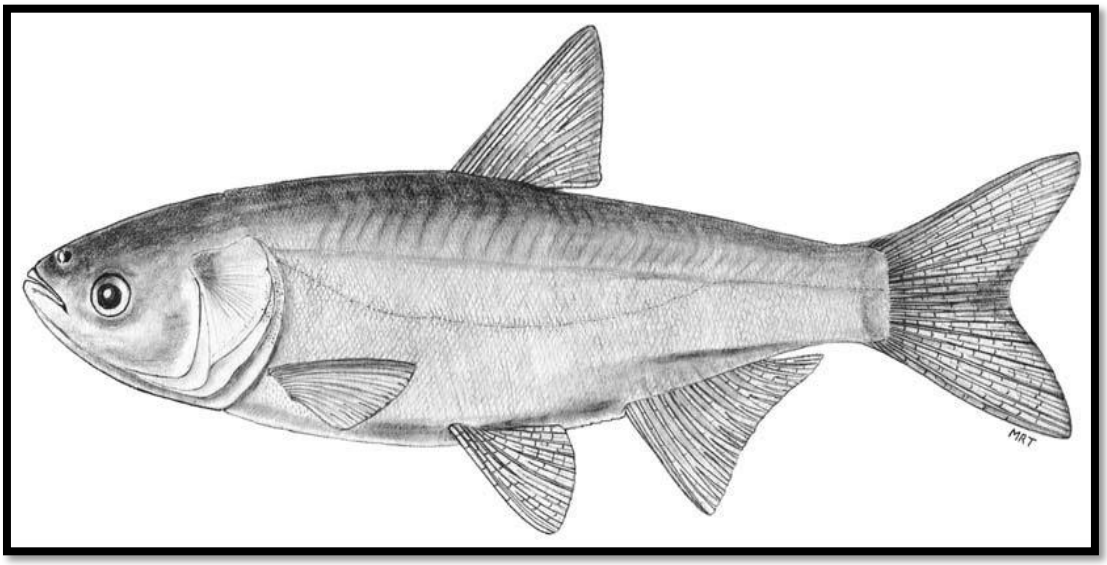


- It is commonly known as common carp, minor carp or scale carp. Body is somewhat compressed, robust anteriorly Abdomen is round in shape.Head is of moderate size.
- Snout is obtusely rounded. Scales are large and pentagonal. Mouth is terminal and oblique.
- Lips are fleshy, upper jaw is projected. Barbles are 2 pairs, one pair is rostral and the o ther pair is maxillary.
- Dorsal fin is very long and inserted above tip of the pectoral fin; third spine is stronglyserrated.
- Caudal fin is deeply emerginate with pointed lobes. Lateral line is straight.
- Colour is variable. Wild carp are brownish green on the upper side, shading to gold yellow¬ventrally.

5.Hypopthalmichtys molitrix Phylum- Chordata

Class- Osteichthyes

Order- Cypriniformis



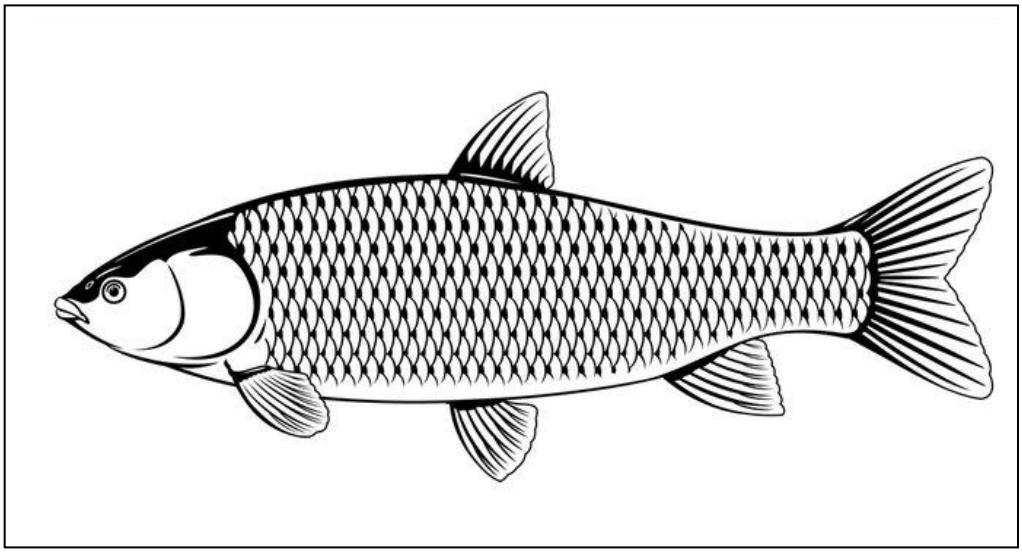
- The silver carp is a deep-bodied fish that is laterally compressed.
- They are a very silvery in color when young and when they get older they fade from a greenish color on the back to silver on the belly.
- They have very tiny scales on their body but the head and the opercles are scaleless.
- They have a large mouth without any teeth in the jaw, but they have pharyngeal teeth. Its eyes are situated far forward on the midline of the body and are slightly turned down.
- The species is known for leaping out of the water when startled (e.g., by noises such as a boat motor).
- They are charcterisised by a ventral keel on the abdomen that run from the anus to the gill membrane.

6.Ctenopharyngodon idella

Phylum-Chordata

Class-Osteichthyes

Order-cypriniformes



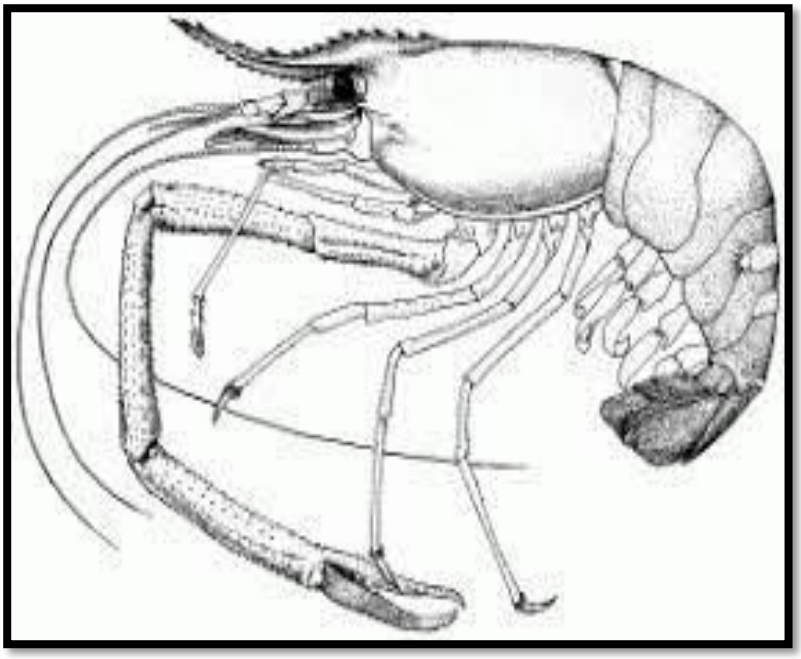
- Body is moderately elongated and compressed posteriorly.
- Head is depressed and flattened.
- Mouth is terminal. Lips are thin. Upper jaw is slightly longer then the lower jaw.
- Eyes are large in position.Barbles are absent.Dorsal fin is inserted ahead of the pelvis. It has 10 rays, out of which 7 are branched and 3 are simple.
- Anal fin is short with 8 and 2 simple rays. Scales are cycloid.
- Lateral line is continuous with 40-42 scales.
- Body colour is dark olive, shading to brownish yellow on the sides.
- Generally used as biological controller to decrease aquatic weeds

Fresh water prawns

1. Macrobrachium rosenbergii

Phylum- Arthropoda
Class- Crustacea

Order- Decapoda



- It is commonly known as giant river prawn This is a freshwater prawn living in rivers, ponds and lakes.
- .Body consists of cephalothorax and abdomen. Cephalothorax is formed by the fusion of head and thorax.
- There are13 segments in the cephalothorax and 6 segments in abdomen. Pleura of 2nd abdominal somite overlap those of 1st and 3rd segments. First two pairs of walking legs are chelate and the remaining three pairs are non-chelate. .
- Rostrum is straight. It consists of a distinct elevated dorsal crest with dorsal teeth, no teeth on the distal part.
- Dorsal teeth are11-14, of which posterior 2-3 are present behind the orbital margin, ventralteeth are 8-14 in number.
- Adult males grow up to 300-340 mm and females grow up to 260 mm in length

2.***Macrobrachium malcomsonii*** *Phylum- Arthropoda*

Class-Crustacea

Order- Decapoda

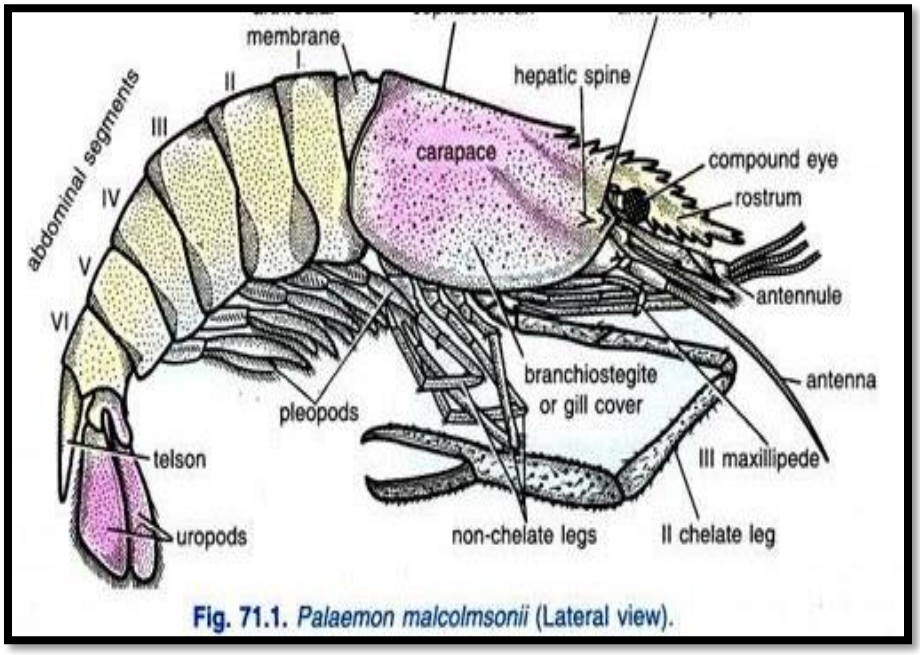


Fig. 71.1. *Palaemon malcolmsonii* (Lateral view).

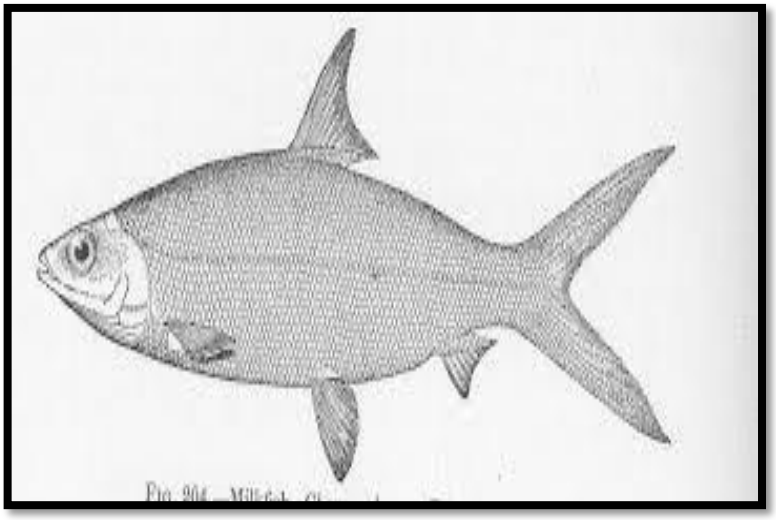
- It is commonly known as monsoon river prawn. This is a freshwater prawn living in rivers, ponds and lakes. Body consists of cephalothorax and abdomen.
- Cephalothorax is formed by the fusion of head and thorax. There are13 segments in the cephalothorax and 6 segments in abdomen. Pleura of 2nd abdominal somite overlap those of 1st and 3rd segments.
- First two pairs of walking legs are chelate and the remaining three pairs are non-chelate. Second pair of chelate legs is robust and carpus is longer than merus. Carpus of adult male is as long as propodus.
- Rostrum is straight. It consists of a distinct elevated dorsal crest with dorsal teeth, no teeth on the distal part.
- Dorsal teeth are 7-11, of which posterior 2-3 are present behind the orbital margin, ventral teeth are 4-7 in number. Gills are phyllobranchiate type.

Marine Water fishes

1. Chanos Chanos

(Milk fish)

Phylum- Chordata
Class: Actinopterygii
Order: Gonorynchiformes



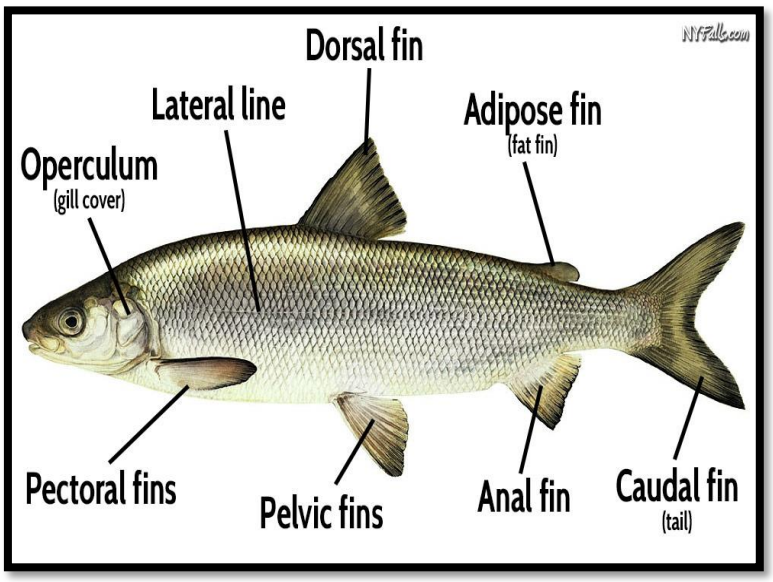
- It is commonly known as milk fish. Body is fusiform, elongated, moderately compressed and streamlined.
- Body is silver coloured on the belly and sides, grading to olive green or blue on the back. Mouth is small and terminal without teeth. Lower jaw is with small tubercle at tip, fitting into a notch in upper jaw.
- Transparent adipose tissue covers the eye. Dorsal, anal and caudal fins are pale yellowish with dark margins. Single dorsal fin with 2spines and 13-17 soft rays. Pectoral fins are low on the body with auxiliary scales.
- Pelvic fins are abdominal with auxiliary scales and 11-12 rays. Short anal fin with 2 spines and 8-10 soft rays, close to caudal fin.
- Caudal fin large and deeply forked with large scale flaps at the base in adults. Scales are cycloid, small and smooth.

2.Mugil cephalus

Phylum- Chordata

Class- Actinopterygii

Order- Mugiliformis



- It is commonly known as grey stripped mullet. Body is cylindrical and robust. Colour of the body is black, blue or green on flanks and pale or silver coloured on the belly. Head is broad, wide more than the width of mouth cleft.
- Adipose tissue is well developed, covers most of the pupil. Mouth cleft ends below the posterior nostril.
- Upper lip is thin, without papillae; labial teeth on the upper jaw are small, straight, and dense, usually in several rows.
- Two dorsal fins, the first fin with 4 spines, the second with 8-9 soft rays. Origin of first dorsal fin is near the snout tip then to caudal fin base; origin of second dorsal fin is at vertical between a quarter and half along anal fin base.
- Pectoral fins with 16-19 fin rays. Anal fin with 8 soft fin rays. Scales on the back and flanks usually streaked to form longitudinal stripe.

3.Lates calcarifer

Phylum- Chordata

Class: Actinopterygii

Order: Perciformes

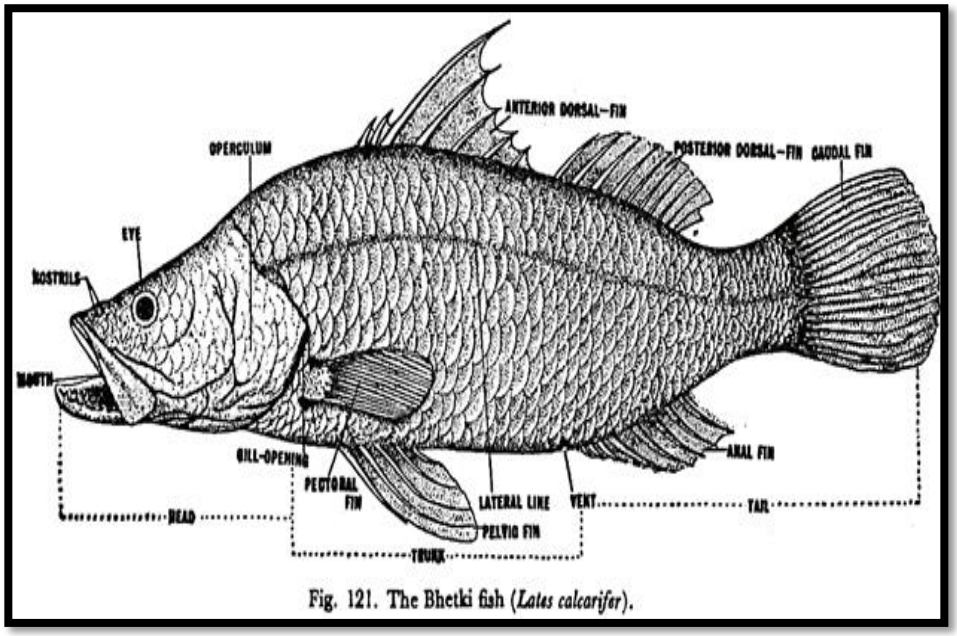


Fig. 121. The Bhetki fish (*Lates calcarifer*).

- It is commonly known as sea bass. Body is elongated, compressed with a deep caudal peduncle. Head is pointed, with concave dorsal profile in front of dorsal fin. Mouth is large, slightly oblique.
- Upper jaw reaches behind the eye. Lower edge of pre-operculum is with a strong spine; operculum is with a small spine and with a serrated flap above origin of the lateral line. Lower, first gill arch is with 16-17 gill rakers.
- Dorsal fin is with 7-9 spines and 10-11 soft rays; a very deep notch almost dividing spinys oft part of the fin. Pectoral fin is short and round, several short, strong serrations above its base.
- Dorsal and anal fins both have scaly sheaths. Anal fin is rounded with 3 spines and 7-8 short rays. Caudal fin is round. Scales are large and cetenoid. Colour in two phases, either olive brown above with silver sides and belly (usually in¬ juveniles) or blue green above and silver on the belly (in adults).

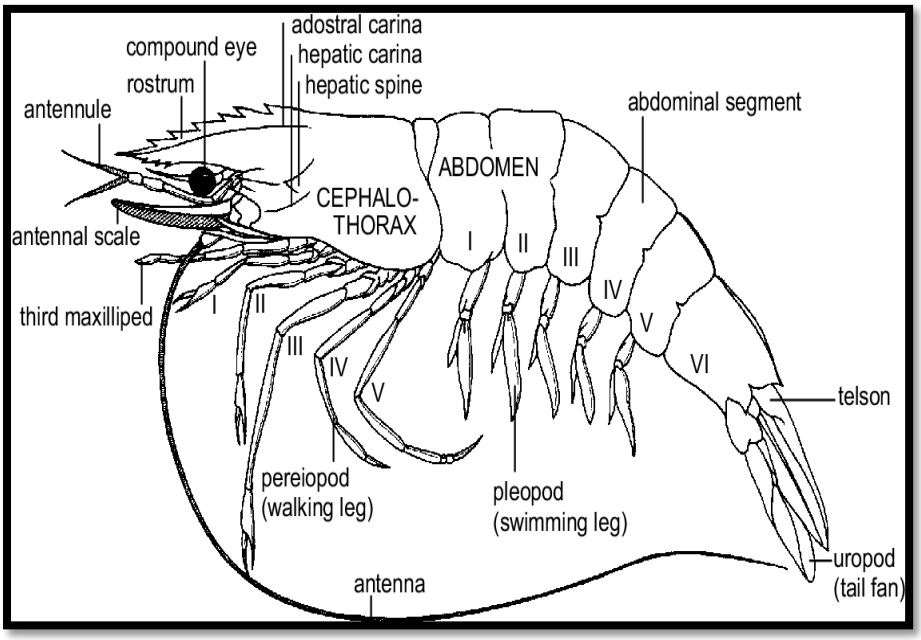
Marine water prawns

1. *Penaeus monodon*

Phylum- Arthropoda

Class- Crustacea

Order- Decapoda



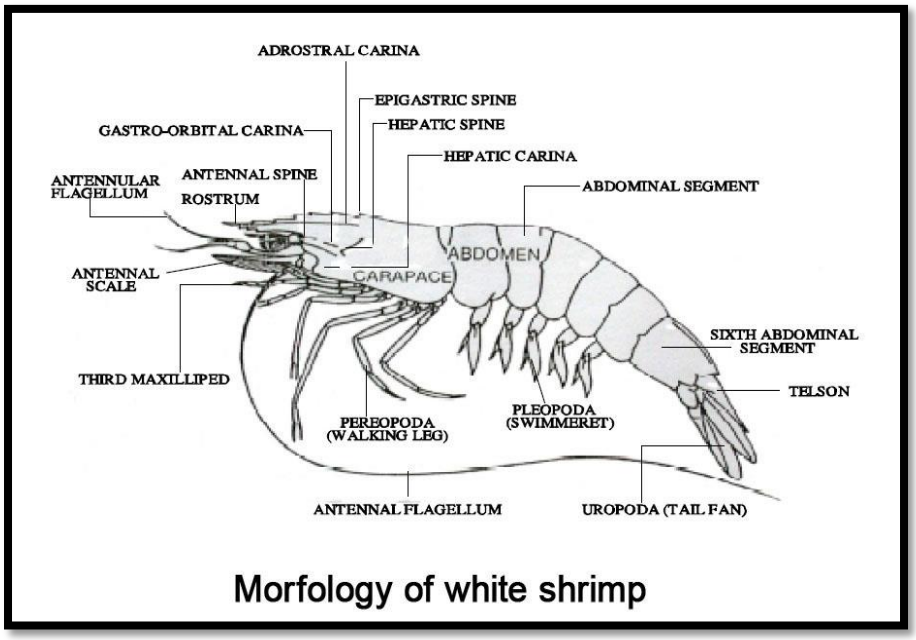
- It is commonly known as tiger prawn or jumbo prawn Though it is a marine water prawn, it can be cultured in brackish water and fresh water.
- Body is divisible into 2 parts, namely cephalothorax and abdomen. Cephalothorax is formed by the fusion of head and thorax. There are13 segments in the cephalothorax and 6 segments in abdomen.
- Body bears dark brown or pale yellow transverse bands. Pleura of 2nd abdominal somite overlap those of 1st and 3rd segments.
- First three pairs of walking legs are chelate and the remaining two pairs are non-chelate. 5 th paraeopod is without exopod. Antennules are with 2 flagellae. Hepatic carina is horizontally straight.
- Rostrum is straight. It consists of a distinct elevated dorsal crest with dorsal teeth, no teeth on the distal part with dorsal teeth are 7-8, ventral teeth are 3-4 in number. Appendix interna is absent.
- Males are with petasma and females with thelycum; posterior process is subtriangular.

2. *Penaeus indicus*

Phylum- Arthropoda

Class- Crustacea

Order- Decapoda



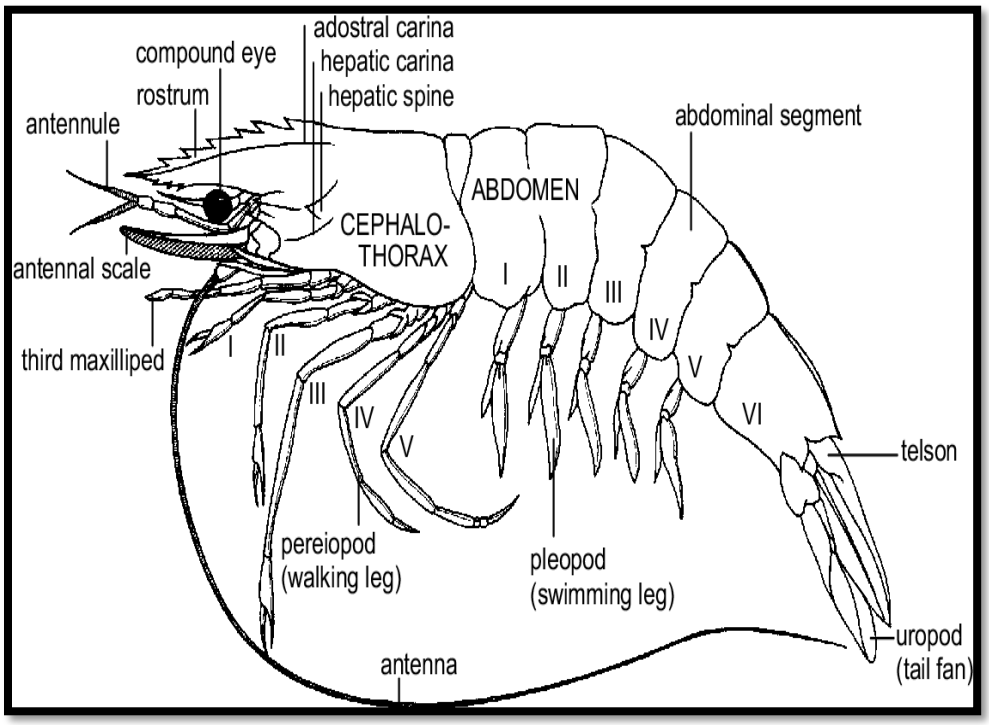
Morfology of white shrimp

- It is commonly known as white prawn. Body is divisible into 2 parts, namely cephalothorax and abdomen.
- Cephalothorax is formed by the fusion of head and thorax. There are13 segments in the cephalothorax and 6 segments in abdomen.
- Body is creamy white with numerous small brownish, greyish or greenish chromatophoresscattered over the carapace and abdomen. Pleura of 2nd abdominal somite overlaps, that of 3rd segments.
- First three pairs of walking legs are chelate and the remaining two pairs are non-chelate. 5 th paraeopod is without exopod. Antennules are with 2 flagellae. Hepatic carina is absent. Rostrum is slender with dorsal crest. Dorsal teeth 7-8, ventral teeth are 3-4 in number.
- Appendix interna is absent. Males are with petasma and females with thelycum; posterior process is calcified.
- Gills are dendrobranchiate type (numerous branched filaments on either side of axis). Total¬ gills or respiratory structures are 24. It grows up to a length of 175 mm and weighs 40 gms.

3.*Penaeus vennamei* Phylum- Arthropoda

Class-Crustacea

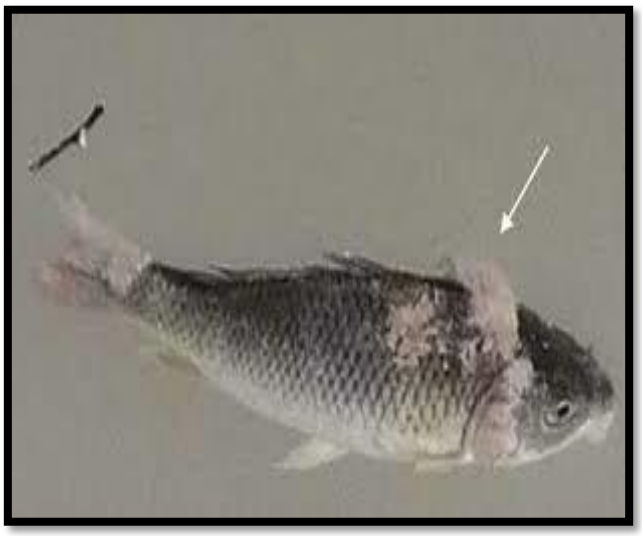
Order- Decapoda



- The vannamei shrimp, *Penaeus vannamei* commonly known as white legged shrimp/ Pacific white shrimp/ Mexican white shrimp is the native of Pacific coast of Mexico and Central and South America.
- It is grevish- white in colour. The maximum weight of female in the wild is 120 g and that of male is 80 g.
- It is an omnivorous scavenger and less aggressive and less carnivorous than the tiger shrimp.
- It prefers clayey loam soil which can also remain in the water column during culture.
- Rostrum moderately long with 7-10 dorsal and 2-4 ventral teeth.
- In mature males petasma symmetrical and semi-open. Spermatophores complex, consisting of sperm mass encapsulated by sheath.
- Mature female has open thelycum. Six nauplii, three protozoeal, and three mysis stages.
- Coloration normally translucent white, but can change depending on substratum, feed and water turbidity.

FUNGAL DISESASES
(FISH &SHRIMP)

1. Saprolegniasis



- Saprolegniasis is a fungal disease of fish and fish eggs most commonly caused by the *Saprolegnia* species called "water molds."
- They are common in fresh or brackish water. *Saprolegnia* can grow at temperatures ranging from 32° to 95°F but seem to prefer temperatures of 59° to 86°F.
- Poor water quality (for example, water with low circulation, low dissolved oxygen, or high ammonia) and high organic loads, including

  the presence of dead eggs, are often associated with *Saprolegnia* infections.

- Saprolegniasis is often first noticed by observing fluffy tufts of cotton-like material--coloured white to shades of grey and brown--on skin, fins, gills, or eyes of fish or on fish eggs.
- With progression of infection fish usually becomes lethargic and less responsive to external stimuli. So fish under such conditions is a target to predators
- Saprolegniasis is best prevented by good management practices--such as good water quality and circulation, avoidance of crowding to minimize injury (especially during spawning), and good nutrition.
- Common treatments include potassium permanganate, formalin, and povidone iodine solutions. Bath treatment in NaOH (10-25g/lit for 10-20min), KmNO4 (1g in 100lit of water for 30-90 min), CuSO 4 (5-10g in 100 lit water for 10- 30min).

2. Branchiyomycosis

- *Branchiomyces demigrans* or "Gill Rot" is caused by the fungi *Branchiomyces sanguinis* (carps) and *Branchiomyces demigrans* (Pike and Tench).
- *Branchiomyces sanguinis* and *B. demigrans* infect the gill tissue of fish. Fish may appear lethargic and may be seen gulping air at the water surface (or piping). Gills appear striated or marbled with the pale areas representing infected and dying tissue.
- Avoidance is the best control for Branchiomycosis. Good management practices will create environmental conditions unacceptable for fungi growth. If the disease is present, do not transport the infected fish.
- Great care must be taken to prevent movement of the disease to noninfected areas. Formalin and copper sulphate have been used to help stop mortalities; however, all tanks, raceways, and aquaria must be disinfected and dried. Ponds should be dried and treated with quicklime (calcium oxide).
- A long term bath in Acriflavine Neutral or Forma-Green for seven days helps this condition.

3. Larval Mycosis (Shrimp)

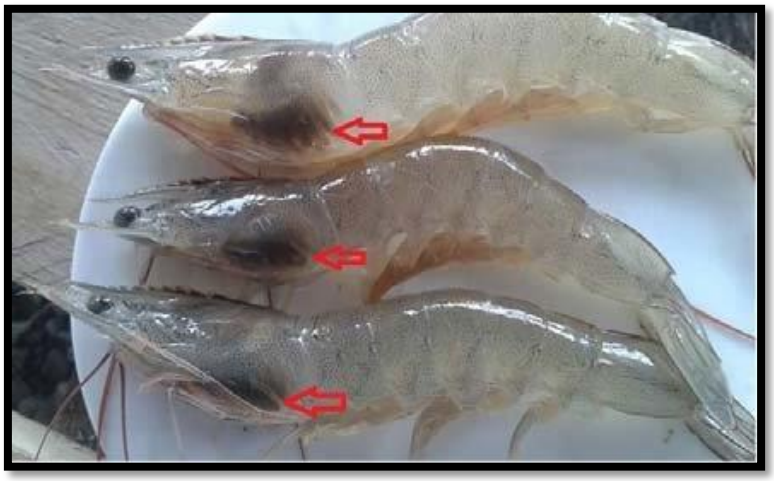
CAUSATIVE AGENTS: Lagenidium spp., Sirolpidium spp., Haliphthoros
GROSS SIGNS: Sudden onset of mortalities in larval stages of shrimps and crabs. Crab eggs are also susceptible for mycotic infection. The commonly affected larval stages among shrimp species are the protozoeal and mysis stages.

EFFECTS OF HOSTS: Progressive systemic mycosis that is accompanied by little or no host inflammatory response can be observed. Infection is apparently lethal, accumulating mortality of 20-100% within 48-72 h after onset of infection

DIAGNOSIS: Microscopic examination of affected larvae will reveal extensive, non-septate, highly branched fungal mycelia throughout the body and appendages Specialized hyphae or discharge tubes, with or without terminal vesicles, may be present, and could be the basis for identification of the causative agent. Motile zoospores may be observed being released from the discharge tubes in the case of some species

PREVENTION AND CONTROL: Disinfection of contaminated larval rearing tanks and chlorination and/or filtration of the incoming water can prevent outbreaks. Different antimycotic compounds have been tested in vitro. Recommended chemicals for therapeutic and prophylactic treatments include the following: 0.2 ppm Treflan 1-10 ppm formalin •egg disinfection with 20 ppm detergent followed by thorough rinsing before hatching

4. Black Gill Diseases/Fusarium (Shrimp)



CAUSATIVE AGENT: Fusarium solani; **SPECIES AFFECTED**: All Penaeus species

GROSS SIGNS: Appearance of "black spots" that preceded mortalities in juvenile shrimps grown in ponds.

EFFECTS ON HOSTS: Infection usually starts on damaged tissues such as wounds, gills damaged from chemical treatments or pollutants, and lesions resulting from other disease processes. Once infection is established, it is usually progressive with 30% remission rate. Lesions may also serve as a route of entry for other opportunistic pathogens.

DIAGNOSIS: Microscopic examination of wet mounts of infected tissues will reveal the presence of canoe-shaped macroconidia (Fig. 4-8). Fusarium spp. are ubiquitous soil fungi. Infection may begin at different loci and spread slowly. Fusarium solani is an opportunistic pathogen of penaeids and are capable of establishing infection in shrimps compromised by other stresses or overcrowding

PREVENTION AND CONTROL: Preventive measures include the elimination of sources of Fusarium conidiophores and destruction of infected individuals.

VIRAL DISEASES IN (FISH & SHRIMP)

1. **Viral Haemorrhagic Septicaemia (VHS) (FISH)**

Causative gent- Viral haemorrhage septicemia virus

Transmisiion- virus is transmitted from fish to fish through water or through contaminated eggs.

Symptoms- Infected fish experience damage of internal organs. Kidney and liver are most affected. Fishes show abnormal position and behaviour in water. Swollen eyes, general anemia condition ,reduced haemoglobin , haemorrhage in the airbladder and muscles ,red intestine ,pale gills etc.,

Diagnosis- Virus can be isolated from cell cultured and confirmed immunologically by virus neutralisation,, ELISA, Immunofloresence ,reverse transcriptase PCR.

Treatment And control-There is no effective treatment. Seed from be bought from uncontaminated farms. High stocking densities should be avoided. Disinfected ponds with clean bottom should be maintained.

2. Infection Pancreatic Necrosis (IPN) (Fish)

Causative agent- It is caused bi Infection pancreatic necrotic virus which belong to Birnaviridae family.

Transmission- A typical transmission of the disease from parent to progeny via the egg is the main reason for fast spread of this disease

Symptoms-Infected fishes revolve on their longitudinal axis. They swim without any sense of direction and finally become unable to move. Become dark in colour, intestine loaded with mucous, gall bladder show sign of necrosis ,both liver and spleen become pale.

Diagnosis- Diagnostic methods for the detection of diseases include –pancreatic histological lesions, indirect flurosecent Ab testing ELISA etc.,

Treatment and Control- there is no perfect medicine, but conomon. Suggested Povidoniodine that can be useful to control the diseases.

3.Monodon Baculo Virus (Shrimp)

Monodon baculovirus (MBV) is the first viral pathogen to be recorded from the cultured prawns of India. MBV infections have been observed in the hepatopancreatic cells of all life stages of the prawn except egg, nauplius and protzoea 1 and 2 stages.

Pathogenisis and diagnosis

MBV is a single-enveloped, rod shaped, occluded double stranded DNA virus belonging tothe group baculovirus. The virus occurs freely or within proteinaceous polyhedral occlusionbodies in the nucleus, with visions measuring 75-300nm. The presence of MBV in the prawncan be detected by direct microscopic examination of impression smears of infectedhepatopancreas (HP) or midgut tissue, stained with 0.05 to 0. % of malachite

Impact on the host

Lethargy, anorexia, dark coloured, and with heavy surface fouling. Acute MBV causes loss of hepatopancreatic tubule and midgut epithelia and consequently, dysfunction of these organs, often followed by secondary bacterial infections. MBV has been linked with high mortalities (over 90%) in late postlarvae and juvenile shrimp in many culture facilities.

Prevention and control

MBV infection may be prevented only through avoidance by quarantine methods,destruction of contaminated stocks, and disinfection of contaminated facilities. There is notreatment for MBV, however good farm management can minimize this disease

4. White Spot Syndrome Disease (WSSD)

- White spot disease White spot syndrome (WSS) is a viral infection of penaeid shrimp.
- The disease ishighly lethal and contagious, killing shrimps quickly. Outbreaks of this disease have wiped out within a few days the entire populations of many shrimp farms throughout the world.
- The virus has a wide host range. While shrimp can survive with the virus for extended periods of time, factors like stress can cause the outbreak of WSS.
- The disease is highly virulent and leads to mortality rates of 100% within days in the case of cultured penaeid shrimps.
- Most of the cultured penaeid shrimps (Penaeus monodon, Marsupenaeus japonicus, Litopenaeus vannamei, and Fenneropenaeus indicus) are natural hosts of the virus.
- The virus infects a wide variety of cells from ectodermal and mesodermal origin. Histological changes are seen in the gill epithelium, antennal gland, haematopoeitic tissue, nervous tissue, connective tissue and intestinal epithelial tissue.
- A large number of disinfectants are widely used in shrimp farms and hatcheries to prevent an outbreak.
- Stocking of uninfected shrimp seeds and rearing them away from environmental stressors with extreme care to prevent contamination are useful management measures.
- Site selection may be one of the most crucial in preventing White Spot Disease.

BACTERIAL DISEASES IN (FISHES & SHRIMPS)

1. Bacterial Gill Diseases in fish

- Myxobacteria are the pathogens causing bacterial gill disease. The disease is observed in salmon fish.
- The first sign of infection is the excessive secretion of mucous.
- Hypermia and haemorrhaging in the gills, swelling of branchial lamellae and dark red colour gills are the symptoms of the disease.
- Many bacteria are found in the swollen gill lamellae, which show proliferation of gill epithelium.
- Prevention of the disease is possible by the complete sterilization of ponds, water ways and pond equipment.
- Sanitation of the culture system is also important.

2. Tail And Fin Rot Disease in fish

- Tail and fin rot is associated with polluted water and poor sanitary conditions in hatcheries. *Pseudomonas fluorescens* is the causative agent.
- This disease was first observed in black mollies. The first symptom of this disease is the appearance of white lines along the margins of the fins.
- The infected fins become opaque and eroded. The fin rays become brittle and break, leading to total destruction. As the disease advances, the size of the fins is reduced.
- The fin tissues undergo death or may be eaten away by pathogenic bacteria. Subsequently, the fin rays may be lost. Infected fins become black in colour.
- Early treatment of fish in 0.5 % copper sulphate solution for 1 to 2 minutes.
- Since the bacterial tail and fin rot disease is caused by unfavourable environmental conditions, the best preventive measures are the maintenance of favourable environment and good sanitation.

3. Filamentous Bacterial Disease in shrimp

- The bacteria involved in this infection are *Leucothrix* species. Growth stages affected by these bacteria are larvae, postlarvae, juveniles and adults.
- Signs are the presence of fine, colourless, thread- like growth on the body surface and gills. It can interfere with locomotary process and moulting.
- It can cause mortalities of PL in heavy infestations. In larger shrimps, it can even result in respiratory distress.
- The infection is treated by $KMnO_4$ at 5-10 pm for 1hr in static treatment for 5-10 days.

4. Luminescent bacterial Diseases in Shrimps

- Luminescent bacteria such as Vibrio haveryi and V. Splendidus are the causative agent of this diseases.
- Eggs, larvae,post larvae,juvenelis and adults can be infected.
- Affected Shrimp larvae become weak and opaque and exhibit greenish bioluminescence under darkness.
- The diseases can be diagnosed with the microscopic examination of shrimp which revels number of bacteria in the haemocoel .
- Daily exchange of water and good water quality will help in minimising the bacterial load in the pond or hatchery.

Determination of pH in the given pond water sample

Aim: To determine the pH of the given pond water sample.

Principle: The principle of calorimetric method of pH measurement is to develop pH dependant colour of the water sample by using indicator of specific range and to compare the developed colour with standard colour discs, coloured buffers or colour charts.

Apparatus: Lovibond comparator

Indicators: The indicators commonly used in such estimation with specific ranges of pH areas follows

Procedure

- Lovibond comparator is used for calorimetric estimation of pH values of water
  .
- Before using the comparator, a primary idea about pH of the sample is usually obtained by dipping a strip of wide range pH paper. The change in colour of which gives approximate idea about the pH of the sample.

- Depending on the observed pH, add a drop of the pH indicator. Then, it indicates corresponding pH range.

- Take 10 ml of clear water sample in two glass cuvettes and keep glass cuvettes in the specific grooves of comparator.

- Put the other cuvettes having water sample only in the other groove just in front of thecoloured discs.

- The disc has different shades of colouration which are comparable to the colour developing within the indicator at various pH levels.

- Match the colours developed by the indicator in the water sample.

- The colour is developed by the indicator in the water sample with the shades of colours of the disc by rotating it slowly.

- When the colour of the test sample and that of the disc matches, it corresponds thereading of the pH of the water sample.

Observation:

S.No	Sample	Temperature

Result: The pH of the given pond water sample is _____.

Determination of salinity in the given pond water sample

Aim: To determine the salinity of the given pond water sample.

Apparatus: Burette, burette stand, pipette, beaker, conical flask, measuring jar, etc.

Principle: Salinity is expressed in which bears a constant relationship to chlorinity which isthe amount of chloride ions present in 1 litre of water. Salinity is the total amount of the saltsin 1 litre of water when all the carbonate being converted to oxidised bromides and iodidesreleased by the oxidised chlorides in space practice the values of salinity is derived from thevalues of chlorinity, chlorine and bromine can be precipitated by AgNO3. The salinity isgiven bears a constant relationship to chlorinity. Salinity is equal to chlorinity.

Reagents: 0.01 N AgNO3 and 5 % K2Cr2O7

1.7 gm AgNO3 is dissolved in 1 litre of distil water

5 gm of K2Cr2O7 is dissolved in 100 ml of distil water

Procedure: A clean burette is rinsed with distil water and then with AgNO3 solution. It is filled with 0.01 N AgNO3 solution. Take 10 ml of given sample in conical flask. Add a fewdrops of 5 % K2Cr2O7 indicator. A lemon yellow colour is produced. This is titrated against0.01 N AgNO3 solution till the appearance of brick red colour. It is necessary to break the clumps. The final reading is noted and the volume of AgNO3 consumed is calculated. This isthe first titration. Repeat the titration until concurrent values are obtained.

S.NO	Volume OF Sample taken (ml)	Burette Reading		Vol Of $Agno_3$ Rundown
		Initial	Final	

Amount of chlorine = volume of $AgNO_3$ rundown X Normality of $AgNO_3$

X 1000

Volume of the sample

Estimation of dissolved oxygen in a water sample

Aim: to estimate the amount of dissolved oxygen in the given sample by using Winkler'stitrimetric method.

Apparatus: Burette, burette stand, conical flask, porcelain tile, measuring jar, sample bottles,etc.

Reagents:

1. Winkler's A: $MnSO_4$

2. Winkler's B: KI + KOH

3. Winkler's C: H_2SO_4

4. 1% starch solution

Sources:

1. From atmosphere, about 5 to 10 ml of oxygen is dissolved in water per litre varyingon the temperature.

2. Phytoplankton and hydrophytes release oxygen in the presence of light during

photosynthesis.

Principle:

Addition of manganese sulphate to the sample leads to the formation of magnanous hydroxide and the addition of alkaline iodide to the above solution leads to the formation of a brown precipitate of manganese hydroxide which traps oxygen present in the sample. When the precipitate is dissolved by the addition of conc.H_2SO_4 or any acid, manganese sulphate is formed which instantaneously reacts with NaI present in the alkaline Iodide solution causing the liberation of I_2. The liberated iodide is estimated by titrating against standard hyposolution.

Procedure:

A sample of water is collected into a glass stoppered bottle with no agitation and care shouldbe taken that no agitation of air bubbles entered. Then, 2ml of Winkler's A and 2 ml of Winkler's B are added and again insert the stopper tightly. The sample bottle is shaken vigorously to facilitate complete mixture of the contents and then the bottle is kept in a dark chamber for 120 minutes. Later, the settled precipitate is dissolved by adding 1 ml ofconc.H_2SO_4 along the sides of the bottle carefully and shaken thoroughly which ensuresuniform distribution of the liberated iodine. 50 ml of the sample is transferred into a conicalflask and titrated against 0.025 N standard hypo solution using colour change as an indicator.

The hypo solution is added until the yellow coloured sample turns to light yellow colour.Then 2 or 3 drops of starch is added. The sample turns to blue colour. This is titrated against hypo until it becomes colourless. The titration is repeated until concurrent values are obtained. The values are tabulated.

$MnSO_4 + 2\ KOH \rightarrow Mn(OH)_2 + K2SO_4$

$Mn(OH)_2 + O_2 \rightarrow MnO\ (OH)_2$

$MnO\ (OH)_2 + 2\ H2SO_4 \rightarrow Mn(SO4)_2 + 3\ H_2O$

$Mn(SO4)_2 + 2\ KI \rightarrow MnSO_4 + K2SO_4 + I_2$

$2\ Na2S2O_3 + I2 \rightarrow 2\ NaI + Na_2S_4O_6$

Observation:

S.NO	Volume OF Sample taken (ml)	Burette Reading		Vol of Hypo Rundown
		Initial	Final	

Amount of Oxygen = volume of Hypo rundown X Normality of Hypo X 1000

Volume of the sample

Result: The amount of dissolved oxygen present in the given water sample is _____ mg/ lit.