D.N.R COLEGE (A) BHIMAVARAM

DEPARTMENT OF AQUACULTURE

UG COURSE

PAPER – FISHERIES HEALTH MANAGEMENT, EXTENSION &MARKETING

AQUACULTURE PAPER 5

FISHERIES HEALTH MANAGEMENT, EXTENSION &MARKETING

ESSAY QUESTIONS

UNIT- I

FUNGAL DISEASES IN FISHES

A)SAPROLEGNIASIS

Introduction: It is a very common water mould diseases or dermatomycosis caused by saprolegnia parasitica. Carps of all ages are easily susceptible to thisfungal infection. It occurs asa a seconbndary infection in fishes which sustain injuries or whose resistance has been weakend by other parasites and bad environmental conditions .

Symptoms: The disease is characterised by the growth of thin threads of dirty white or grey colour on fins, skin and eyes and resembles a tuft of cotton wool in severe cases. Other symptoms are ulceration of skin, haemorrhage , exposureof jaw bones, blindness, erosion of fins , inflammation of liver, intestine etc..

Pathogen: Saprolegniosis is caused by S.parasitica. moulds propagate by means of spores present in aggregation at the hypal ends. Infective spores swim freely with the help of flagella.

Diagnosis: Generally the severe out breaks of saprolegniosis occur in severewinter.
Diseased fish become lethargic and float near the water surface .
Sometimes they stay at the wall of pond without any movement.

Treatment: Pond treatments with common salt at the rate of 75-100 ppm or potassium permanganate at 1 ppm or copper sulphate at 0.5 to 100 ppm in 2 to 3instalments at 3 to 4 days interval are used for controlling this disease.

B) BRANCHIOMYCOSIS

It is caused by branchiomyces sanguinis . this fungus blocks the veins in the gillfilaments . this disease was found in carp, trout, gold fish, sickle backs, pike andtench young fishes are more susceptible to the disease. Infection is epidemic during summer months especially in ponds where putrefying organic matter occurs in abundance.

Symptoms: The hyphae of fungus grow into the respiratory epithelium of the gills causing inflammation and necrosis. This leads to suffocation and ultimatedeath.

Treatment: Prevention of pollution, addition of quick lime (50 -100 kg/ ha), bath in 3-5% sodium chloride and 5 ppm potassium permanganate solution for 5to 10 mins . Pond treatments as given in saprolegniasis are also used for controlling this disease .

Other important fungal diseases are icthyosporidiasis in trout, herrings etc.
Dermocystidium disease in common carp and achlyasis in freshwater and marine fish.

C) GILL ROT

Branchiomyces sanguinis causes gill rot disease in major carps. The infected gills begin to rot the colour the gill changed to pale colour, then red patches areformed . In advanced conditions the gills become yellow and are destroyed.

The fry, fingerlings and adult fish are infected by this disease.

Symptoms: 1. Fish becomes weak.

2. Exposure of the jaw bone.

3. Gills are destroyed.

Treatment:
Infected fishes should be dipped in 3% of common salt solution.
Infected fishes should be dipped 1:2000 CUSO4 or 1:1000 KMNO4 solution.

VIRAL DISEASES IN FISHES

A) Spring viraemia of carp (SVC)

Synonym: Swim bladder infection SBI disease primarily of common carp caused by rahabdo virus haemorrhage and inflammation of the siwm bladder

Etiology: Sub type of Rhabdovirus carpio(RVC) genius vascular virus family Rhabdoviridae

- the virus typical shape bullet shaped .
- it is helical symmetry
- consists of linear negative sense.

Host: Disease occurs primarily in the common carp svc typically occur at watertemperature 18°Cand predominantly in the spring .

Transmission: Virus found in contaminated eggs disease is transmitted throughdirect contact.

Pathogenesis: Virus directly into the anterior gut does not include disease but intra peritoned intra cerebral and intra pneumatic injunction induced the disease.Causes higher mortality capillary endothelium haematopoietic and excretory kidney tissue.

Treatment and control: The sensitivity of SVC to antiviral chemotherapeuticagents has not been tested .

- Prophylactic measures at from level.
- Should include it disinfection ofeggs by iodophore..
- careful handling a fish to minimum stress .
- Avoidance in crowding.
- Water temperature above 20°c till date .
- No effective unsafe vaccine for prevention off svc is available.

B) Swim bladder inflammation of carp (SBI)

Introduction: As the name implies, the swim bladder inflammation of carp found in cultivated carp in Europe. This is an infectious diseases and characterised by intensive inflammation of the tissues of swim bladder wall. Asindicated in the name of the disease fish suffer due to swim bladder inflammation.

Disease symptoms: All age groups of carp will be effected by this virus. Juvenile of two months old may contract the disease. Young carps occasionallyshow 100%mortality.

1. Acute form:-Acute forms appears frequently at higher temperature. Though symptoms appear within one month of contact of virus, 2-3 months are requiredfor disease spreading. The swim bladder becomes inflammed and the wall tissueof the swim bladder undergoes destruction.

2. Chronic form:-This can be observed through out the year and it is exhibitedby many diseased fish. Healing occurs naturally in fish with chronic form.

Disease diagnosis: As the papillomas are outgrowths are hard it , is difficult remove them when they are force forcebley, hemorrhaging occurs at those places. When most of areas of the body is effected by this disease the growth ofthe fish may be stunded and become weak. Fish may not die due to this diseasebut they are prone to die due to secondary infections.

Host range: The pox disease has been found in Cyprinids such as carp, gold fish. In addition to carp, this disease has also been found in trench, pike perch.

Source of infection: The source of infection is probably the papillomas of the diseased fish. Peeled epithelial cells of papillomas which may fallen in water may also be the source of virus.

Carriers of the infection: Water having peeled infected cells of papillomas,fish having papilloma in various sites on the head, trunk and also fins of Cyprinids lodging infection are the potent carriers.

Incubation period: Untill now incubation period of pox virus has not beenreported.

Immunology: No abnormal Serologyical findings has been reported.

Disease Control: There is still a question whether this disease will be inducedby virus. There is some question whether some environmental factors may participate in carrying the disease.

C) Viral Hemorrhage Septicemia(VHS)

Introduction: This viral disease is abbreviated as VHS. It is a dangerous disease observed among cultivated rainbow trout and salmon fish. This diseasealso called as infectious kindly swelling and liver degeneration disease in German.

Disease symptoms: VHS attacks only rainbow trout. Fingerlings (5cm length) and large, harvesting fish (200 to 300 g) are the principal fish infected by VHS pathogen . Virtually no fry and adult contract VHS. Fish older than one year areresistant to VHS.

The symptoms are kindly swelling, obvious distress reduced appetite, erraticspiral swimming , change in body colour reddish fins and hemorrhages in skeletal muscle. VHS disease symptoms can be divided into 3 forms Acute form, Chronic form, Nervous form.

1. Acute form: This is early stage of disease outbreaks. This disease stateadvances very fast and the mortality rate is high.

2. Chronic form: This form is seen after the initial stage of diseaseoutbreaks .The disease course is slow and the mortality is low.

3. Nervous form: This is the last stage outbreaks. The diseased fish suffer dueto nervous disorders like twisting the body.

Pathogen:- The pathogenic virus of this disease is VHS virus. It is a rhabdovirus and resembles IHN(Infectious Haematopoietic Necrosis) virus in morphology and structure.

Disease diagnosis: The disease can be diagnosed Confrimatively by the isolation and identification of virus form the diseased fish . Kidney and Spleenare the best organs for disease diagnosis and virus isolation.

Host range: Rainbow trout , brown trout and Brooks trout are susceptible toVHS. Gold fish are also susceptible to this virus.

Source of infection: Fish which has been infected but survived lodging thevirus in the body are the potent source of infection.

Transmission of VHS virus through water is possible but possibility oral infection has not been demonstrate. Transmission occurs through the water by aflagellate.

Carriers of the infection: A parasite flagellate, *Hexamita* salmonis which infects intestine and pyloric caeca and some arthropods many act as carriers.

Incubation period: Water temperature influences the incubation time of VHS .In general, it is of 1-2 weeks.

Immunology: Protective antibodies where detected in the serum of VHSinfected fish. Trouts showed the synthesis of interferons due to viruses infection.

Disease Control: The only Precautionary measure is prevention of the disease. The most important preventive method is to identify and isolate the fish (carrier)suffer due to viral disease. The contaminated pond bottom and equipment should be Disinfected. Generally ,lime disinfection is recommended to counter the infection.

* BACTERIAL DISEASES IN FISHES*

A)EPIZOOTIC ULCERATIVE SYNDROME:

Introduction: It is the most dreaded disease in carp culture pond . it cause largescale mortality of fish in pond and natural water bodies. It first affects the murrels and other weed fishes in the culture ponds rather than the Indian major carps. The disease is caused by aeromonas hydrophila , A. Punctata , micrococcus or Psuedomonas spp.

Symtoms: The infection starts in the form of red spots. Usually in the scale pockets in carps with rising scales and skin edema. In advanced stages , ulcers are formed with sloughing of scales and later the ulcers deepens and often witha black rim.

Treatment: Bath in copper sulphate solution (1:2000) for 1 min for 3 to 4 days or oxy tetracyclin in feed at the rate of 10 gms per 100 kgs of fish , 7 to 10 days for early stage of infection.

Fish in advanced stage of infection should be removed and destroyed and thepondwater disinfected with 0.5 ppm solution of potassium permanganate.

B) FURUNCULOSIS:

Introduction: Furunculosis is a common disease among salmonids. The apperanace of boils or ulcers in the skin of the deceased fish led to have the disease as furunculosis. This disease appears to infect fish living in dirty waterhaving a large amount of decaying matter.

Symptoms: The typical symptoms of this disease are the formation of boils andulcers . These boils or ulcers may be found in groups on the dorsal region of the fish.

The ulcers may show a tinge of blood and big ones are filled with dark sticky reddish pus. Deceased fish show blood shot fins , blood discharge from the ventand haemorrhages in muscles and other tissues. Heavy infection may result in slow movements inflated intestine , cardio muscular dystrophy , necrosis in spleen and kidneys , bleeding from gums etc.. finally leading to mass mortality.

Pathogen: The disease is caused by a bacterium Aeromonas salmonicida. It is anon motile gram –ve bacterium.

Diagnosis: The development of isolated or aggregate ulcers may result into skinlesions.

Lesions may also be found in musculature .

Control:

- Dead and gravely infected fish should be removed.
- These fish should be either burned.
- Pond equipment should be disinfected.
- Fish should be given vitamin rich food.
- Emptying the tanks, proper care should be taken in handling the fish andin providing sufficient amount of oxygen.
- The empty tank should be disinfected with quick lime.
- Sulfemarazine, Sulfadiazine, Sulphamethazine, can be mixed in food at adose of 10gms per 100 pounds of fish per day for 4 to 7 days.

C) BACTERIAL KIDNEY DISEASE:

Introduction: Bacterial kidney disease is an economically important disease ofsalmonids and trout. It has been termed kidney disease or coryne bacterial disease.

Symptoms: Both young and adult fish may become victims of this disease. Generally the disease appears chronic and the mortality rate is high. Due to thebacterial infection , inflammation of the orbit may result in eye protrusion.
Infected skin shows water filled vesicles and irregularly shaped blisters often filled with clear liquid or creamy or red mucous like fluid. Haemorrhaging spotsappears at the base of ventral fins and the anus , gills become pale and the abdomen swells due to ascetic fluid .

Pathogens: The disease causing bacteria coryne bacterium spp. These arenonmotile, gram negative bacterium.

Diagnosis: The disease can be diagnosed on the pathogenic changes in kidney.

Host Range: Bacterial kidney disease is found in salmonids, brown trout andrain bow trout of young and adult fish through out the year.

Control: It is very difficult to control this disease .it is also difficult to identifyand remove the diseased fish. Prevention of the disease is possible by the complete sterilisation of ponds.

A number of sulphonamides alone used to control kidney disease sulfadiazinefed to infected salmon.

Finger lings @25 g/100kg of fish /day for 7 days and then 13gfor the remainderof the month results in good control of the disease.

Sulfadiazine alone or in combination with sulfamirizine @20g/100kg offish/day is advocated until the mortality is reduced.

1B2. Explain about Epizootic Ulcerative Syndrome.

Introduction: It is the most dreaded disease in carp culture pond . it cause largescale mortality of fish in pond and natural water bodies. It first affects the murrels and other weed fishes in the culture ponds rather than the Indian major carps. The disease is caused by aeromonas hydrophila , A. Punctata , micrococcus or Psuedomonas spp.

Symtoms: The infection starts in the form of red spots. Usually in the scale pockets in carps with rising scales and skin edema. In advanced stages , ulcers are formed with sloughing of scales and later the ulcers deepens and often witha black rim.

Treatment: Bath in copper sulphate solution (1:2000) for 1 min for 3 to 4 days or oxy tetracyclin in feed at the rate of 10 gms per 100 kgs of fish , 7 to 10 days for early stage of infection.

Fish in advanced stage of infection should be removed and destroyed and thepondwater disinfected with 0.5 ppm solution of potassium permanganate.

UNIT- II

*** SHRIMP VIRAL DISEASES***

Introduction:

Viral diseases are the serious and major problem in shrimp farming. About 20 viruses have been recognised as causative agents of diseasesin shrimp. Though there is no remedy to control viral diseases, detection of disease through molecular techniques will help in prophylactic measures.

1)Infectious Hypodermal and Haemopoitic Necrosis Virus

It affects all stages of shrimp. IHHNV was first known to infect

P. Stylirostris and P.vannamei spp. In the year 1981 in America and later transformed to other countries. This disease doesn't cause much effect to P.monodon . In vannamei shrimp it is known to cause runt-deformity syndrome,which is a growth retarded disease.

Symptoms: The infected shrimps show reduced growth, change in colour, deformed cuticle, rostrum, wrinkled antennal flagella, cuticular roughness, deformties in cuticular, thoracic and abdominal areas of the exoskeleton.

Reduction in feed consumption, changes in behaviour and appearance.

Muscles, gut and hepato pancreases are effected and appearance of shrimp changed and distorted.

Often the healthier ones will cannabilise the infected ones and may get thedisease.

Treatment: No treatment for this viral disease.

Preventive Measures: Farmer should stock PCR tested quality seed only.Pond must

be completely dried between two crops.

Strict bio- security measures should be observed. Framers

should follow good management practices.**2)White Spot**

Syndrome Virus (Wssv):

It is known as white spot disease. WSSV is highly virulent with wide host range, high mortality and cause severe economic losses in shrimp farming industry. WSSV infects all stages of animal starting from egg to adult. The effected shrimp dies within 1 to 3 days and it is the most dreadful virus in all viruses. It entered in shrimp industry of India in 1994 and caused havoc and italso affecting the vannamei culture.

Symptoms: There will be abrupt reduction in food intake, lethargy, anorexia.Generalised

reddish to pink discoloration of gills and animal.

Affected shrimp comes to bunds and die in lots.

Treatment: No treatment for WSSV except to take preventive measures, not toenter in culture system.

Preventive Measures: Virus can survive in wet soil up to 3 to 4 weeks. So it isinevitable to dry the pond bottom between two crops.

Virus transmits through carriers.so filter and sanitises the pond water beforestocking.

Stock PCR tested SPF quality seed.

Follow GMP'S and strict Bio-security measures to avoid the entry of disease inculture.

3)Mondon Bacculo Virus (Mbv) Disease:

It affects post larvae, juveniles, adults.

Symptoms: Affected shrimps exhibit pale bluish – grey to dark blue- blackcoloration.

Sluggish and inactive swimming movements.Loss of

appetite.

Retarded growth.

Increased growth of benthic diatoms and filamentous bacteria may causefouling on the exoskeleton.

Yellowish- white hepato pancreas.

Treatment: Use MBV- free stocks

Ensure proper care at hatchery level with respect to brood stock. Reduce stress by

use of good husbandry practices and proper nutrition.Destroy infected shrimp by

burning or burying in pits with lime.

***SHRIMP BACTERIAL DISEASES ***

A) VIBRIOSIS: Two species of vibrio are found to be pathogenic to the shrimps. They are vibrio parahaemolyticus and V. Harveyi. It is easily affectshrimp cultured in saline waters and known as bacterial "septicaemia". The shrimp are affected at any stage . Environmental stress, aggravate the disease,and cause huge losses to vannamei farmers .

Symptoms: The affected shrimps exhibit septicaemia conditions followed byloss of reflex and cuticular fouling.

The gills appear brown in colour and the body becomes red.Antennal

cut is also been observed.

Affected shrimps don not eat and hence their stpmach apeeras emty and at timeswhite watery liquid oozes out sometimes luminescence is also observed in ponds.

In serious conditions mortality could be observed.

Blackening or whitening of the basal part of the antenna, the oviduct and edgesof the abdominal segments.

Shrimps may exhibit either one of the symptoms or all the symptoms based ondisease severity.

Preventive Measures: Drying of the pond after the production cycle. Adopting strict

Biosecurity measures, good water quality managementBacterial free good quality seed

selection.

Uses of sanitizers are some of the precautionary measures we take against thisbacterial attack.

In hatcheries, larval and post larval tanks should be washed thoroughly toremove bio films.

B) BLACK GILL DISEASE

Introduction: Accumulation of organic load feed wastage leads to formation oftoxic gases like ammonia nitrate and hydrogen sulfide are the main cause way to factors for this disease sometimes we bro bacteria may also pose blackening of gills in shrimp .Low D. Olevels in pond water associated with black girl cause deaths in pound .

Symptoms: Gills become black in colour and shrimp swims on the surface ofthe pond.

Deaths maybe notice disease in the low D.O conditions

Preventive measures: Follow good management's practices regular monitoringoff water quality and see that the water parameters and bacterial loads should beunder control use of KMno4 Potassium permanent @500 grams per acre to control the disease.

C)EARLY MORTALITY SYNDROME (EMS):

Early mortality syndrome (EMS) in shrimp also termed "Acute hepatopancreatic necrosis syndrome (AHPNS), is first reported to cause significant losses among shrimp farmers in China 2009 and the remaining southEast Asian countries like Thailand , Vietnam , Malaysia and caused severe damage to the shrimp industry in those countries. This disease affects both P. monodon and P. vannamei and is characterised by mass mortalities. The causative agent is V. Para haemolytic , parahaemolyticus phase bacteria.

Symptoms: Significant atrophy of hepatopancreas is seen and becomes pale towhite due to loss of pigments and black spots or streaks are also may be observed and cannot be squashed easily.

Shrimp become lethargic and don't take feed.

Mortality starts of stocking. (post-stocking in grow-out ponds).

Preventive Measures: This disease is not yet reported in India. All stakeholders need to be vigilant on the impending danger of EMS and shouldtherefore take cautious approach in vannamei farming by adopting best management practices and report to the technical persons and disease surveillance team if mortalities of EMS symptoms noticed.

UNIT- III

GOOD FEED MANAGEMENT PRACTICES FOLLOWED FOR THE FISHCULTURE

INTRODUCTION: Fish feed is a major expenditure for fish farmers. Good fish feed management can reduce overall culture cost, improve fish farm environment and ensure healthy growth of fish stock. Fish feed management includes choosing the right feed, using a correct feeding method, calculating thefeeding cost and ensuring the cost effectiveness of fish farm.

Nutrient requirements of fish Protein, fat, carbohydrates, vitamins and mineralsare the essential nutrients for fish. Protein provides energy and builds muscles. Protein deficiency means slower growth whereas excessive protein will put up the feeding cost. Fat provides fish with energy. A right amount of fat can improve taste and texture but excessive fat may pose a health hazard to fish.

Carbohydrates provide energy but most of them are not easily digested by ordinary carnivorous manne speCkles (e.g. roupeı apper and mangrove snapper). Vitamins and minerals are the essential trace elements that can enhance natural resistance and feed conversion rate (for details of feed It is noteworthy that nutritional requirements of fish vary with different species, sizes, growth stages and feeding habits. For example carnivorous fish require ahigher intake of protein and fat than the omnivorous and herbivorous species, while marine fish require more protein and fat than freshwater fish do. For thisreason, fish feed should be specifically chosen to suit different species.

Common fish feeds: Fish feeds widely used in Hong Kong include traditionalvegetarian feed and trash fish. In recent years pellet feed is also becoming popular. Vegetarian feed Wheat bran, rice bran, weed, soy dregs, flour and peanut cakes are suitable for freshwater fish.

Trash fish: Fishing by- catch or small fish is suitable for marine fish.

Pellet Feed: There are dry and moist pellets. The former is more popular and themajor ingredients are fishmeal made from grinding baked trash fish oil, vitamins and binder. They are extruded and 'ed up to produce dry pellets. Moist pellet feed is made up of vitamins and binder. The pellets are extruded by a pellet machine. Pellet feed is suitable for both freshwater and marine species.

Production of dry pellet feed : Trash fish is first baked and ground intofishmeal. Vitamins, binder and fish oil are then added. The mixture is extruded and puffedup to produce dry pellets.

Production of moist pellet feed : Mix 10 catties (6.05kg) of fishmeal with 8taels (302g) to 1 ca (605g) of binder and 6.5 taels (246g) of vitamin powder, then add shredded or blended trash fish of the same weight and blend into

dough. Put the dough in a pellet machine to produce pellets. Deep freeze to -20or below
Nutrition: Vegetarian feed and trash fish may not have sufficient nutrients to satisfy the needs of all cultured fish. It may lead to malnutrition
which will impair the natural resistance of the cultured fish and heighten the risks of diseases. Pellet feed can be added with animal or plant protein, fish oil or other fats, vitamin complex and minerals as required by specific fish species.They are highly nutritious and can effectively improve the health of your fish stock. Fish feed specially formulated for particular species (e.g. grouper, sea perch and grey mullet) are also available on the market Availability Apart fromtrash fish, the supply of all other fish feeds is generally stable.

Prices: Vegetarian fish feed and trash fish are cheaper than pellet feed.

Hygiene: High moisture fish feed becomes moldy easily. It is vulnerable to bacteria and parasites also and must be stored properly. Vegetarian fish feed hasa low moisture content and preservation treatment is usually not necessary. As long as it is stored properly there should not be any bacteria or mold problem.
Trash fish is high in moisture (about 70%). If not stored properly at a low temperature, it can get heavily infested with bacteria or parasites. The fat of trash fish oxidises and rots easily. Rotten trash fish may cause disease or evendeath.

Storage methods: Low moisture vegetarian feed and dry pellet feed can be keptfor two to three months when stored in a covered cool dry place. High moisture trash fish and moist pellet feed can be kept for about one week when stored at a low temperature of -200(. Otherwise they must be used immediately after purchase.

* ZERO WATER EXCHANGE IN SHRIMP FARMING.*

INTRODUCTION: Water exchange is routinely used in mitigating ammonia, nitrite and organic matters concentrations and preventing algal blooms in conventional intensive shrimp culture. This water exchange management practice works only when the quality of inlet water into ponds is high. However,this is not the case for most shrimp ponds in Asian-Pacific region because the water quality of the water entering into pond is the effluent from outlet of the

other farms (Landesman, l994; Kautsky et al., 2000) which already has low quality (Csavas, l994) and contain parasites and pathogenic microorganisms (Csavas, l994; Landesman, l994). Also, problem in water exchange for improvement of water quality is frequently due to poor engineering design and management of ponds (Rivera-Monroy et al., l999) and the absence of drainagenetworks (Csavas, l994). The practice of flushing water from shrimp farms into water body is also detrimental to environment because this water is nutrient richand cause eutrophication algae blooms (Landesman, l994; Hopkins et al., l995; Smith l996).

MATERIALS AND METHODS

The experimental shrimp cultures Experiment was conducted in 160 litre experimental tanks with no water exchange during culture period (from 28 August 2001 until 23 October 2001) located at the aquaculture outdoor laboratory of Charles Darwin University, Australia. The water was aerated withair-stones and fertilized two weeks before stocking shrimps to stimulate phytoplankton growth. The fertilizers consisted of sodium nitrate ($NaNO_3$) at the rate of 1.67 mg L-1, phosphoric acid (85 % H_3PO_4) at rate of 6 x 10-4 ml L-1and 110 mg L-1of soda ash ($NaCO_3$).

The protocol used in the experiment were :

(1) without molasses with C:N ratio = 6.5 (ZWEM6.5),
(2) using molasses with C:N ratio = 15.0 (ZWEM15.0),
(3) using molasses with C:N ratio = 17.5 (ZWEM17.5),
(4) using molasses with C:N ratio = 20.0 (ZWEM20.0)
(5) using molasses with C:N ratio = 22.5 (ZWEM22.5).

Each treatment had three eplications and tank allocation for every treatment wascompletely randomized. Tanks had three pieces of air stone suspended in bottom of water column. The tank volume of 160 litres was maintained constantby adding 2 litres of freshwater (tap water) weekly to replace loss water due to evaporation. Each tank was stocked with 4 shrimp or equivalent to shrimp density of 30 shrimp m^{-2}(Allan and Manguire, 1992).

The mean individual weight at the stocking time was 5.014 ± 0.336 gram and shrim Levels of viable heterotrophic bacteria were determined by counting the

colonies which grew on plates of Tryptone Soya Agar (TSA) with 10 % of NaCl(Johnsen et al., 1993).

Before plating each sample onto agar medium, serial dilutions were made inphysiological saline solution composed of 9 % NaCl (Sohier and Bianchi, 1985). Levels of bacteria are quoted in colony forming units per ml of water(CFU ml-1)(Smith, 1998).

The amount of water used (litre) to produced one gram shrimp (water consumption rate) was determined by dividing the total water amount used inevery shrimp culture during growing period (litre) with the shrimp production(gram) at the end of study.

Additionally, total concentrations of ammonia, nitrite and nitrate discarded at the harvest time from experiment tanks as primary importance variable in discharge regulation (Hopkins et al.,1993) were determined by multiplying theconcentration of those variables recorded at the end of study with total volumeof experiment tanks.

Shrimp survival rate, growth, percentage weight gain and feed conversion ratioExperiment of shrimp cultures in laboratory was conducted for eight-week duration. Every two weeks, the total body weight of shrimp (W) was measuredfor each experimental container.

Similarly, the number of live shrimp (N) in each tank was counted. Further theamount of feed used in each tank (Wf) was recorded. The average body weight(Wa) were calculated by dividing W by N. The overall average values of survival rate (%), growth rate of shrimp (gram/day), percentage weight gains (%), and feed conversion ratios (FCR) were determined by the following equations below as used in common aquaculture studies (Balazs, 1973; Bages and Sloane, 1981; Tseng et al., 1998).

1.(No – Nt) 1.Survival Rate (%) = ———— x 100 %No(Wat - Wao)

2. Growth Rate (gram/day) = ————t (Wat - Wao)

3. Percentage Weight Gain (%) = ——- x 100%

Wao

4. Feed Conversion Ratio (FCR) = (∑Wf)/ΔW

Result: Where No and Nt are the number of shrimps cultured in eachtank at initial time (to) and time t ; Wat and Wao are the average body weight of shrimps at initial time (to) and time t, t is period timeof raising shrimps, ∑Wf is the total amount of feed used in each tank, and ΔW is the increment of the total weight of shrimps in eachtank for t time culture.

The water minimum, maximum and mean temperature of shrimp culture throughout the study were 25.9 , 28.9 and 27.4 0 C, respectively while water minimum, maximum and mean salinity of shrimp culture were 25.01‰, 27.90 ‰ and 27.20 ‰, respectively.

UNIT- IV

* METHODS OF ECONOMIC ANALYSIS OF BUSINESSORGANISATION*

INTRODUCTION: Fish is a major component of the human diet. Fish account for up to 20% of the average per-capita intake of animal protein . The usage of fish has increased dramatically due to improved technology, which showcases powerful engines and sonar equipment and led to over fishing, causing a worldwide decrease in wild stock accounting for the decline in the fish population dynamics. There is therefore an argent need to increase fish production by fish farming.

Aquaculture can be seen as an aspect of agricultural practices, mainly to increase the production of food above the level that was produced naturally. Today, aquaculture is responsible for an ever-increasing share of global aquatic food production, and accountedfor 65% of the increase in fish production in the period 2005–2014.

The fisheries resources of Ghana supply 45% of natural animal protein to the people. Most fish farmers in Ghana use earthen ponds and rely on natural productivity to feed fish, while others supplement feed with agricultural by-products. The most cultivated species in the country is Oreochromis niloticus (Nile tilapia).

Generally, due to health complications associated with consumption of meat, the consumption of aquaculture products is on the increase . Moreover, Aquaculture is one of the fastest growing animal foods producing sectors offering employment and food security tothe ever-increasing human populace in Ghana. Furthermore, fish have been found to have self-life which is readily enhanced through lowcost sustainable technologies such as smoking, drying and salting . On the other hand, fish is good in terms of gross body weight gain and protein gain per unit of feed intake.

Fish farming in Ghana is a profitable venture and it is rapidly expanding and it will continue to be profitable if the planning and management are well taken care of. Fish farming is geared towards the improvement of nutritional standards of the people and to create self-employment opportunities for Ghanaian communities.

Secondly, fish farming has become more appropriate to developing countries because ofthe opportunities for waste recycling and integration with crops and animal farming .
Before starting any activity all likely costs involved in that activity should be taken into consideration. With aquaculture it is important that important technical factors such as water availability throughout the year, quality of water, availability of raw material (fingerlings, feed,etc.) and size of likely market must be taken into consideration as well as the cost and supply of labor and the selling price of the final product.

The purpose of every business venture is to generate profits. An enterprise budget is used to examine whether any business is profitable or not. If the total farm revenues from sales generated for the period are greater than the costs, it means profits are generated for that given period.

Further studies on aquaculture viability in Sunyani municipality are needed in order to improve the standard of living for people in the area and to help farmers in executing a successful trade. It is an expectation that development of a knowledge base to help the small-scale fish farmers to better understand their business in order to make a significant profit will take place in a short while. This research will contribute to literature and serve asa platform to build upon for future studies. It will also aid small scale fish farmers to know more about aquaculture to improve their economic standards.

MATERIALS AND METHOD

Study Site

Sunyani is a city in the West African republic of Ghana, and is the capital of the Brong-Ahafo Region. The Municipality covers a total area of 29.3 square kilometers. One third of the total land area is not inhabited or cultivated which provides arable lands for future investment.
The Municipality as selected because it has majority of fish farms in the region. Nearly one-half of the region's annual aquaculture production in 2010 **was from the Sunyani Municipality.**

Sampling
Random sampling was adopted in this study. Simple random sampling technique was employed to select farmers for administering questionnaire. Farm list of the study site was obtained from the Fisheries Commission, and farms assigned with numbers from 1-40. Twenty farmers were interviewed. For profitability analysis 600 m2 pond was used a s the basis for analysis because this is the average size used by most fish farmers in the municipality.

Data Analysis

Data collected was entered into Microsoft Excel (version 2016) and analyzed using the

descriptive statistic feature to generate tables.

Economic analysis was done by u sing calculating Net Present Value, Internal Rate of Return, Present Value, Net Profit, and production cost, value of harvested stock and m market price per unit weight in kilogram using Ms. Excel formulas. Results are presented in tables and bar charts. Gender distribution data was coded and entered, and the percentageof occurrence calculated and chatted with pie chat.

*** ROLE OF NABARD IN FISHERIES DEVELOPMENT***

Cooperative Development Corporation: only during 1974, RBT authorized gives well It is NCDC to finance fisheries Sector, NCDC Subsidy of 25% through the Stale government, 50% Loans & the rest 25% is available from the State government in form of NCDC also gives government share, 50% Loan &50% Subsidy to the Cooperative Societies for ice plants & processing plan Is NCDC started financing fishery projects First in following Maharastra features:

, during 1979-80 with following features.

1. Mortgage for vessels

2 charge ofother properties.

3.obtaining Sureties

4. Lic policies at the of signing the Contact

5. Periodical inspections.

6.mode of repayment by the applicant

7. Specified loan& interest rate

8. Maintenance & Submission of financial & operational records in prescribedforms .

Role of NABARD in the development of fisheries/fish farming units Co-operatives

Because of the importance of the fisheries sector in the national economy, NABARD is playing a pivotal role in the development of the sector through;

1. Financial assistance for fisheries and related activities,

2. Support for infrastructure development,

• Funding for technology promotion activities, Implementation of externallyaided fisheries projects.

Consultancy Services of NABCONS (NABARD Consultancy Services) areavailable for preparation, appraisal, monitoring, evaluation of schemes and projects, etc. for various activities/investments in fisheries as shown below;

1) Fisheries Co-operatives

A) Marine

• Mechanized Vessels Trawlers, Gill Netters, Purse Seniors, Long Liners, anddouble Rig Trawlers.

• Others Catamarans, Canoes, and plank built boats with Nets.

• Motorization - Replacement of Engines or New Engines.

B) Inland • Traditional Boat and Nets, Caro Hatchery

• Air-breathing Fish Farming • Fish Seed Rearing

• Integrated Fish Farming - Paddy cum fish, Poultry cum fish, Piggery cum fish,Dairy cum fish, Duck cum fish, Plantation/ Horticulture cum fish earning.

Running Water Fish Culture

• Semi, Intensive Fish Culture

•Fresh Water prawn learning

• Fresh Water Prawn Hatchery

• Ornamental Fish Breeding

C) Aquaculture • Brackish Water Fish Farming

D) Fish Processing Feed Mills Processing Plants • Sea Weed Culture

E) Infrastructure Projects in the Fisheries Sector

• Fishing jetty

• Reverie Fisheries

•Inland fisheries infrastructure

• Infrastructure for reservoir fisheries

•Cold chain and processing

• Marketing

F) Other Services: • Monitoring and evaluation of the projects

• Implementation/ monitoring/evaluation of externally aided projects • Fish Market Management Fisheries Co-operative Management

Eligibility criteria for NABARD schemes for fish farming

The criteria involved in the selection procedure of the beneficiaries are as follows. The individual must own or lease any of the fisheries-related activitiessuch as;• Pond, lake or tank • Open water bodies Raceway and hatchery Rearing farms

Licensed fishing properties

The beneficiaries must be in any of the following professionals or Associationsthat are involved in the Inland Fisheries and Aquaculture.

SHORT QUESTION

UNIT-I

Diagnosis Of Fish Disease

As fish are cold blooded animals, the environmental impact is more in fish thanin warm-blooded animals. The diseased fish can be identified by the following aspects:

a) It is important to use freshly killed/dead fish or live fish to diagnose thedisease. If disease diagnosis is delayed after death, it would be difficult to diagnose due to the chemical changes in the body of the fish.

b) Diseased fish settle to the bottom and die; the dead fish come/ float on the water surface due to the gases produced by the chemical changes. c) Abnormalswimming behaviour

d) Change of body color.

e) Excessive production of mucus on body surface/gills/fins.

f) Mucus samples should be taken from the body surface and gills to examineunder the microscope

g) Protrusion of eyes

h) Hemorrhages on the body surface or at the base of fins.

i) After examining the fish externally, proceed for the internal examination.

j) Open the gill opercula and examine the color and shape of the gills. Also,examine whether slime production is normal or excessive.

k) At autopsy, examine the size, color and shape of digestive tract, swimbladder, liver, pancreas, kidney and spleen.

Examine the abdominal/body cavity for fluid accumulation, hemorrhages andinflammation.

Examine for the presence of helminthes. Examine

for tumors in the internal organs.

l) Samples should be collected from internal organs for virology, bacteriology,mycology and histopathological studies.

m) Blood samples should be collected for hematological studies.

*** Legenidium* (larval mycosis)**

Host: P. Aztecus, p. Setiferus, (others may be infected experimentally)

Stages of growth affected:-eggs larvae, earlypost larvae

Pathogen: Legenidium SPP

Disease signs: Inactivity of infected individuals, hyphae visible in appendagesand lates throughout the body.

Effect on host: It is apparently the most important hatchery fungus it is important is related to the method of transmission and the fact that larval shrimpdo not exhibit host defence and once inside the body fungus proliferates rapidlythroughout their entire body. Motile spores when released with came in contact with another shrimp and undergo encystment the thin exoskeletons of larval Forms allows the developing fungus to send tube into the body. The fungus is then free to develop throughout the body.

Causes: Causes total mortality of larva within 2-3 days treatment malachitegreen 0.006 mg for larval rearing water.

Swim bladder inflammation of carp

Introduction: As the name implies, the swim bladder inflammation of carp found in cultivated carp in Europe. This is an infectious diseases and characterised by intensive inflammation of the tissues of swim bladder wall. Asindicated in the name of the disease fish suffer due to swim bladder inflammation.

Disease symptoms: All age groups of carp will be effected by this virus. Juvenile of two months old may contract the disease. Young carps occasionallyshow 100%mortality.

Acute form: Acute forms appears frequently at higher temperature. Though symptoms appear within one month of contact of virus, 2-3 months are requiredfor disease spreading. The swim bladder becomes inflammed and the wall tissueof the swim bladder undergoes destruction.

Chronic form: This can be observed through out the year and it is exhibited bymany diseased fish. Healing occurs naturally in fish with chronic form.

Disease diagnosis: As the papillomas are outgrowths are hard it , is difficult remove them when they are force forcebley, hemorrhaging occurs at those places. When most of areas of the body is effected by this disease the growth ofthe fish may be stunded and become weak. Fish may not die due to this diseasebut they are prone to die due to secondary infections.

Host range: The pox disease has been found in Cyprinids such as carp, gold fish. In addition to carp, this disease has also been found in trench, pike perch.

Source of infection: The source of infection is probably the papillomas of the diseased fish. Peeled epithelial cells of papillomas which may fallen in water may also be the source of virus.

Carriers of the infection: Water having peeled infected cells of papillomas,fish having papilloma in various sites on the head, trunk and also fins of Cyprinids lodging infection are the potent carriers.

Incubation period: Untill now incubation period of pox virus has not beenreported.

Immunology: No abnormal Serologyical findings has been reported.j

Disease Control: There is still a question whether this disease will be inducedby virus. There is some question whether some environmental factors may participate in carrying the disease.

Infectious Abdominal dropsy

Ans: It is a serious bacterial disease of major carps. It is caused by Aeromonaspunctata (Bacterium). This disease is common during spring season.

SYMPTOMS: 1.Accumulation of fluid inside body cavity.

2. Scale protrusion.

3. Exopthalmic condition.

4. Intestine , liver and kidneys are affected.

TREATMENT: 1.The pond is disinfected with 1ppm KMNO4.

2. Dip treatment in 5ppm of KMNO4 for 2 mins.

* ENTRIC RED MOUTH DISEASE*

Enteric Redmouth Disease, or simply redmouth disease is a bacterial infectionof freshwater and marine fish caused by the pathogen Yersinia ruckeri. It is primarily found in rainbow trout (Oncorhynchus mykiss) and other cultured salmonids.

The disease is characterized by subcutaneous hemorrhaging of the mouth, fins,and eyes. It is most commonly seen in fish farms with poor water quality.
Redmouth disease was first discovered in Idaho rainbow trout in the 1950s. Thedisease does not infect humans.

Distribution of disease: Some fish species serve as vectors for the disease andhave subsequently spread the pathogen to other parts of the world.

An example is the fathead minnow (Pimephales promelas) which is responsiblefor the spread of redmouth disease to trout in Europe. Other vectors include the

goldfish (Carassius auratus), Atlantic and Pacific salmon (Salmo salar), the emerald shiner (Notropis atherinoides), and farmed whitefish (Coregonus spp.).

Infections have also occurred in farmed turbot (Scophthalmus maximus),seabass (Dicentrarchus labrax), and seabream (Sparus auratus)

It can now be found in North and South America, Africa, Asia, and Australia, aswell as Europe.

Clinical signs and diagnosis: Infection can cause subcutaneous haemorrhage that presents as reddening of the throat, mouth, gill tips, and fins, and eventual erosion of the jaw and palate. Hemorrhaging also occurs on internal organs, andin the later stages of the disease, the abdomen becomes filled with a yellow fluid - giving the fish a "pot-bellied" appearance.

The fish often demonstrate abnormal behavior and anorexia. Mortality rates canbe high.

A presumptive diagnosis can be made based in the history and clinical signs, butdefinitive diagnosis requires bacterial culture and serological testing such as ELISA and latex agglutination.

Treatment and control: Several antibiotics are available for the treatment ofredmouth disease in fish.

Vaccines can also be used in the treatment and prevention of disease.

Management factors such as maintaining water quality and a low stockingdensity are essential for disease prevention.

Costiasis

- **Caused by:** Costia necatrix

- **Symptom:** It causes the skin of the infected fish to become cloudy and milky.

- **Treatment:** Due to its inability to live in water above 28°C (82.4°F) , treat asif it was Ich by using commercial Ich treatment or technique.

- Other recommended treatments include MalachiteGreen, Potassium Permanganate, Acriflavine and strong salt baths of 3% Prophylaxis

- Newly bought fish are quarantined for 30 days. Before introducing new fishinto the aquarium, give them three short-tem therapeutic baths.

• It is not advisable to introduce pond plants without first disinfecting them.Nets,scrapers,feed boxes,thermometers, pulverizers and other equipmentshould not be shared between several aquaria.

UNIT-II

*** Mondon Bacculo Virus (Mbv) Disease***

It affects post larvae, juveniles, adults.

Symptoms: Affected shrimps exhibit pale bluish – grey to dark blue- black coloration.Sluggish and inactive swimming movements.

Loss of appetite.

Retarded growth.

Increased growth of benthic diatoms and filamentous bacteria may causefouling on the exoskeleton.

Yellowish- white hepato pancreas.

Treatment: Use MBV- free stocks

Ensure proper care at hatchery level with respect to brood stock. Reduce stress by

use of good husbandry practices and proper nutrition.Destroy infected shrimp by

burning or burying in pits with lime

*** Yellow Head Bacculo Virus***

Disease Agent: Yellow-head shrimp disease, Yellow-head virus (YHV), Yellow-head baculovirus (YBV), Yellow-head disease baculovirus (YHDBV)

Host Species: Penaeus monodon, the giant black tiger shrimp, is the speciesprimarily affected. Penaeus merguiensis, Palaemon styliferus,

Impact on the host: P. monodon suffers acute epizootics with high cumulative mortalities which may reach 100% within 3-5 days after appearance of clinical signs. Infection is horizontally transmitted.

Diagnostic techniques:

Gross Observations: Initially, feeding increases, followed by reduced feeding in later stages of the disease. Pale body, yellowish swollen cephalothorax and

hepatopancreas, whitish-yellowish-brownish gills. Presumptive diagnosis ismade on the basis of pond history, clinical signs, gross changes and histopathology. Bioassay reinfection studies and transmission electron microscopy are used for definitive diagnosis.

*** Filamentous Bacterial Disease***

Disease agent: Filamentous bacterial (Leucothrix) disease.

Scientific name or taxonomic affiliation: Leucothrix mucor, Thiothrix sp.,Flexibacter sp., Cytophaga sp., Flavobacterium

Host species: All penaeids. Similar bacteria have been observed on Pandalusplatyceros held in captivity.

Impact on the host: Discolouration of gills due to associated secondaryinfections. Larvae and postlarvae fouled. Reduced mobility, feeding and growth. Increased mortality.

Diagnostic techniques

Gross Observations: Direct microscopic examination of body surface at 100 ×or higher reveals filaments of bacteria 3-5 µm wide and of variable length but often 100 to 500 µm long.

Methods of control: Possibly associated with poor water (high nutrient loading) or other poor husbandry which should be rectified.

*** Black gill disease***

Introduction: Accumulation of organic load feed wastage leads to formationof toxic gases like ammonia nitrate and hydrogen sulfide are the main cause way to factors for this disease sometimes we bro bacteria may also pose blackening of gills in shrimp .Low D. Olevels in pond water associated with black girl cause deaths in pound .

Symptoms: Gills become black in colour and shrimp swims on the surface ofthe pond.

Deaths maybe notice disease in the low D.O conditions

Preventive measures: Follow good management's practices regular monitoringoff water quality and see that the water parameters and bacterial loads should be

under control use of KMno4 Potassium permanent @500 grams per acre tocontrol the disease.

Vibrio infections

Two species of vibrio are found to be pathogenic to the shrimps. They are vibrio parahaemolyticus and V. Harveyi. It is easily affect shrimp cultured in saline waters and known as bacterial "septicaemia". The shrimp are affected at any stage . Environmental stress, aggravate the disease, and cause huge losses tovannamei farmers .

Symptoms: The affected shrimps exhibit septicaemia conditions followed byloss of reflex and cuticular fouling.

The gills appear brown in colour and the body becomes red.Antennal

cut is also been observed.

Affected shrimps don not eat and hence their stpmach apeeras emty and at times white watery liquid oozes out sometimes luminescence is also observed inponds.

In serious conditions mortality could be observed.

Blackening or whitening of the basal part of the antenna, the oviduct and edgesof the abdominal segments.

Shrimp may exhibit either one of the symptoms or all the symptoms based ondisease severity.

Preventive Measures: Drying of the pond after the production cycle. Adopting

strict Biosecurity measures, good water quality managementBacterial free good

quality seed selection.

Uses of sanitizers are some of the precautionary measures we take againstthis bacterial attack.

In hatcheries, larval and post larval tanks should be washed thoroughly toremove bio films.

*** Aflatoxicosis***

Aflatoxicosis is a fungal toxicosis that may affect all species of animals. Thefungus grows on carbohydrate-rich feeds such as peanuts, cottonseed, corn, sorghum and cereal grains when they are stored in hot conditions without adequate drying and aeration.

The cause of this disease in poultry and other food-producing animals has been attributed to the ingestion of various feeds
contaminated with A. flavus. This toxigenic fungus is known to produce a groupof extremely toxic metabolites, of which aflatoxin B1 (AFB1) is most potent.

Most common signs and symptoms are: Nausea, Yellowing of skin and sclera(icterus), Itching, Vomiting, Bleeding, Abdominal pain, Lethargy, Edema.

Diagnosis: Serum chemistry is useful in the diagnosis of aflatoxicosis. Prothrombin time is generally increased and frank hemorrhage can occur. Serum bilirubin levels are also increased and photosensitization can occur. Thechanges in hematologic parameters generally are due to hemoconcentration andblood loss

UNIT-III

* PCR TECHNIQUE*

Definition: PCR or Polymerase Chain Reaction is a technique used in molecular biology to create several copies of a certain DNA segment. This technique was developed in 1983 by Kary Mullis, an American biochemist. PCR has made it possible to generate millions of copies of a small segment of DNA. This tool is commonly used in the molecular biology and biotechnology labs.

Components Of PCR: Components Of PCR constitutes the

following:DNA Template– The DNA of interest from the sample.

DNA Polymerase– Taq Polymerase is used. It is thermostable and does not denature at very high temperatures.

Oligonucleotide Primers- These are the short stretches of single-stranded DNA complementary to the 3' ends of sense and anti-sense strands.

Deoxyribonucleotide triphosphate– These provide energy for polymerization and are the building blocks for the synthesis of DNA. These are single units of bases.

Buffer System– Magnesium and Potassium provide optimum conditions for DNA denaturation and renaturation. It is also important for fidelity, polymerase activity, andstability.

PCR Steps: The PCR involves three major cyclic reactions:

Denaturation

- Denaturation occurs when the reaction mixture is heated to 94℃ for about 0.5 to 2 minutes. This breaks the hydrogen bonds between the two strands of DNA and converts it into a single-stranded DNA.
- The single strands now act as a template for the production of new strands of DNA
- The temperature should be provided for a longer time to ensure the separation of the two strands.

Annealing

- The reaction temperature is lowered to 54-60℃ for around 20-40 seconds. Here, the primers bind to their complementary sequences on the template DNA.
- Primers are single-strand sequences of DNA or RNA around 20 to 30 bases in length.
- They serve as the starting point for the synthesis of DNA.
- The two separated strands run in the opposite direction and consequently there are two primers- a forward primer and a reverse primer.

Elongation

- At this step, the temperature is raised to 72-80℃. The bases are added to the 3' end of the primer by the Taq polymerase enzyme.
- This elongates the DNA in the 5' to 3' direction. The DNA polymerase adds about1000bp/minute under optimum conditions.
- Taq Polymerase can tolerate very high temperatures. It attaches to the primer and adds DNA bases to the single strand. As a result, a double-stranded DNA molecule is obtained.
- These three steps are repeated 20-40 times in order to obtain a number of sequences of DNA of interest in a very short time period.

Applications of PCR

Medicine: Testing of genetic disease mutations.
Monitoring the gene in gene therapy.
Detecting disease-causing genes in the parents.

Forensic Science: Used as a tool in genetic fingerprinting.
Identifying the criminal from millions of people.
Paternity tests

Research and Genetics: Analysis of gene expression.
Gene Mapping.

* Quarantine Ponds*

Quarantine is one of the most important animal management and biosecurity measures. Quarantine is the procedure by which an individual or population is isolated, acclimated, observed and, if necessary, treated for specific diseases before its release onto the farm orfor live market sale (e.g., to grow out or for aquarium fish stores).

The principles of quarantine apply for new fish coming into a facility, fish moving from one area or system to another within the facility, and resident fish that become diseased.

Well-designed quarantine systems physically separate incoming fish from the rest of the farm. Water in quarantine systems also should be separate from that on the main farm, and discharges should be handled appropriately.
Proper quarantine not only protects established populations from potential exposure to pathogens but also gives the new animals time to acclimate to water, feeds and management and to recover from handling and transport. Handling and transport have beenshown to reduce disease resistance and recovery may take weeks.

Fish in the general population that become sick may have to be isolatedintanks in the same system or room as their healthy counterparts; signs or other methods should be used to alert employees that the population is diseased.

Major components of quarantine include all-in-allout stocking, isolation or separation,observation and diet adjustment, and sampling and treatment. All-in-all-out stocking.

This involves bringing animals in as a group fromonly one original source population and maintaining them as a group throughout the quarantine period.

It prevents exposure to other pathogens not currently in that population. Ideally, no new animals should be added to a group currently in quarantine. All-in-all-out quarantine may involve an entire facility, roomor system.

Zero Water Exchange

The extensive zero-water exchange shrimp farming system in the periphery of Chilka lagoon (Orissa, India) was studied.

- The study aimed to describe this unique farming system with special reference to dynamics of macrozoobenthos, production characteristics and economics.
- The study conducted was based on a general survey as well as monitoring of five individual farms over a complete production cycle.
- The farming practice in this area is characterized by complete absence of water exchange during rearing.
- Ponds in this area are generally shallow (mean 72cm). Most of the water and soil quality characteristics of these farms are within acceptable levels.
- Macrozoobenthos belonging to 12 taxa were collected, amphipods (81%) and polychaetes (13%) being most numerous. Overall macrobenthic density of farms studied varied from 968 to 11,470 individuals/m2 with a gross mean of 5644 individuals/m2.
- There was no general pattern to the variation in abundance of various taxa in different phases of the rearing cycle, suggesting a low predatory pressure by shrimp in the farms studied.
- Shrimp production was highly variable (91–250kg/ha), but generally low with a meanof 145kg/ha.
- The net income of these farms was estimated to be Rs. 63,250per crop per ha. Compared with the shrimp farming system with regular water exchange in the same

area, Chilka farms generated a high benefit-cost ratio indicating high profitability andsustainability.

11a. Probiotics In Health Management

Introduction: Aquaculture is emerging as one of the fastest growing and most promising industries for providing animal protein and food security to the growing population. Due to itslucrativeness it is surpassing the agriculture sector also.
The expansion of culture area and intensification of culture practices are leading to high stocking densities.

The diseases and deterioration of environmental conditions often occur and result in serious situations.

Types of probiotics They are three types of probiotics, as mentioned below:

Water probiotics: these are marked in 2 forms i) dry forms ii) liquid forms. Liquid forms givepositive results in lesser time, when compared to the dry and spore form bacteria, though they are lower in density (Nageswara and Babu 2006). These play a major role in improving the water quality of culture ponds.

Soil probiotics: Bacteria like Nitrobacter, Nitrosomonas and sulphur reducing bacteria clean the bottom of aqua ponds.

Feed / gut probiotics: Lactic acid bacteria. Probiotics act as a microbial dietary medicine that benefits the host health condition by reducing mucosal and systemic immunity and improving the physiological and nutritional actions.
These enhance the fish and shrimp feed efficiency by stimulating digestive enzymes and maintain the balance of intestinal microbes, resulting in improved nutrient absorption, utilization and ultimately the survival, growth of fishand shrimp.

Role of probiotics: The three types of probiotic bacteria can be directly applied to soil, water of the farming pond and also as an additive to feed.
Various commercial probiotics areavailable in the market in different combinations and bacterial counts. Reports inform that use of probiotic bacteria reduces mortality rate. However, the quantity of cells present in the probiotic preparation which are non digestible ingredients help in stimulating the growth of probiotic bacteria especially in the colon region of fish.
Probiotic bacteria are isolated from the pond, sediment, soil, water and animals. The potential effect of probiotic relies on the source from which the bacteria are isolated and the way of application.

*** Pond Bio Security***

Good husbandry practices, including optimal waterquality, nutrition, and stocking density, are importantnot only for promoting good growth rates and body condition but also to strengthen an animal's immunesystem and minimize risk of infection. In addition to the general aquaculture biosecurity considerations described in SRAC

Biosecurity in Aquaculture

An Overview, the following recommendations for pond producers will help reduce their biosecurity risks. Because aquaculture species and pond production systems differ from one farm to another, producers should contact an aquaculture health specialist and production specialist for more facility-specific biosecurity recommendations. Reasonable safety precautions should always be followed, including use ofpersonal protective equipment when handling disinfectants, drugs, pesticides, and other chemicals.

Water source, quality, and daily observations

Water quality parameters should be tested regularly for optimal health. Dissolved oxygen should be checked daily when at its lowest point (early, pre-dawn). Other parameters, including total ammonia, temperature, nitrite, and pH may require daily testing, initially, until values stabilize. Alkalinity and hardness may not fluctuate as widely and so may require less frequent testing. Stocked ponds should be observed at least once or twice a day during feeding for changes in appetite, behavior, and appearance. Feeding may be the only time that fish are at the surface and visible. Periodic sampling of fish from each pond by the facility health manager or consultant will help identify disease issues before a major outbreakoccurs.

* TYPES VACCINES*

Subunit Vaccines

Subunit vaccines take advantage of using only antigenic components for vaccination and since subunit vaccines cannot replicate in the host, there is no risk of pathogenicity to the host or non-target species . Subunit vaccines can be produced in a highly characterized state, and they target immune responses towardspecific microbial determinants, enable the incorporation of unnatural components, and can be freeze- dried, allowing for non-refrigerated transport and storage .

Nucleic Acid Vaccines

Several nucleic acid vaccines have been developed for use in aquaculture over the past 20 years [113]. It has been suggested that these vaccines have the combined positive attributes of both live attenuated and subunit vaccines [113,114]. Nucleic acid vaccines consist of DNA or RNA encoding the antigen(s) of interest and are considered relatively simple to generate and safe to administer since they cannot revert to apathogenic state.

DNA Vaccines

DNA vaccines consist of an expression plasmid that carries a specific gene that personcodes for a selectedantigenic protein, which when expressed in the host is expected to elicit a strong immune response.
Plasmid production is scaled-up within bacterial cells, and the gene of interest is flanked by promoter andtermination elements that facilitate expression within eukaryotic cells. DNA vaccines are able to stronglyactivate cellular and humoral immunity. The development of DNA vaccines can be rapid and relatively straightforward if a protective antigen is known.

RNA-Based Vaccines

At present, there are two major RNA-based vaccines, which are distinguished by the translational capacityof the RNA: conventional, non-amplifying mRNA and self-amplifying mRNA (i.e., replicons) [110]. The RNA-based vaccines are developing rapidly and several have demonstrated encouraging results in both human and animals