FISH FARMING ENGINEERING (3 UNITS)

FIS 509

LECTURE GUIDE

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RECIRCULATORY AQUACULTURE SYSTEM (RAS)

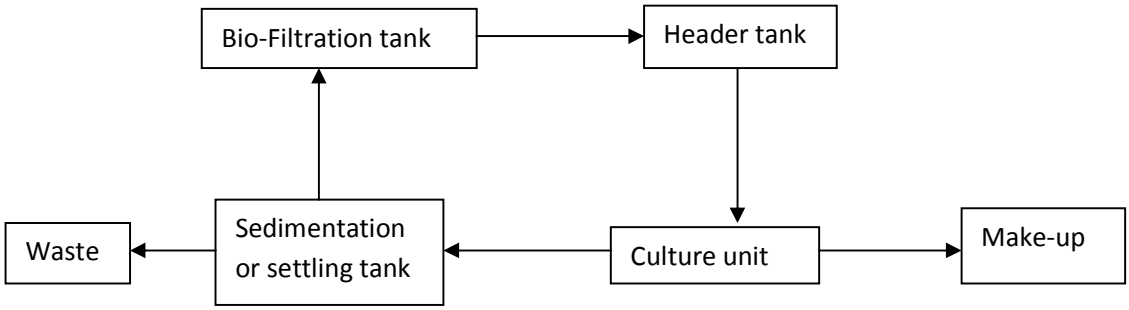
Re-circulatory Aquaculture System (RAS) is described as the techniques of reusing the volume of water that has been utilized to produce fish in a closed or semi-closed system. It is mechanically sophisticated and biologically complex. It is biologically intense meaning fish are usually reared intensively to make the system cost-effective. Thus RAS involves the process of recycling the water used in the rearing of fish through series of filtration processes, and disinfection using chlorination, ultra-violet irradiation, ozonation or combination of these to control or remove unwanted organisms and metabolites that enter into the system.

Water from the fish rearing tanks flows by gravity into the sedimentation tank which has filtration materials to filter the solids and suspended materials contained in the used water. The filtered water is then disinfected and pumped into the bio-filtration tank which contains the bio-filter media that harbor nitrifying bacteria. The nitrifying bacteria convert ammonia in the water first to nitrate and then to nitrate. Thus, the ammonia free water flows into reception tank where it is aerated, and flows back into the tank and the process continues.

Many commercial RAS, to date have filed because of poor design, inferior management or flawed economies component failures, poor water quality, stress, diseases and off flavor are common problems in poorly managed systems.

Re circulatory System must maintain uniform flow rates (water and air/oxygen), fixed water levels and uninterrupted operation in order to provide a suitable environment for intensive fish production. Management of RAS takes education, expertise and dedication.

Flow Chart for Re-Circulatory Aquaculture System



DESIGN AND CONSTRUCTION OF CAGES

The basic approach to fish cage system design involves the principle of GETTING-WHAT-YOU-WITH-WHAT-YOU-HAVE i.e. to adjust structures and materials to local supply and conditions such that the desired effects or results are achieved.

MATERIALS

There are two types of cage systems in use viz. Floating cages and fixed cages. Both types of cages are made up of the cages and a framework (raft in the floating type) except that there are anchors and floating devices in the floating cages system. The following are used for the different parts;

(i) Cages: galvanized wire mesh, plastic nets, Styrofoam and other nettings, wood and bamboo lattices e.t.c.

(ii) Framework (raft): Bamboo, galvanized iron, weed and plastic.

(iii) Floats: Bamboo, PVC pipes, logs, spherical buoys, metal drum, plastic keg/drum, aluminum cylinders, used rubber tyres.

(iv) Mooring devices: Concrete stones, wooden pegs, large metal anchors.

DESIGN

There are various design of fish cages depending on the purpose, the species for culture, the location e.t.c. the detail as follows:

Rafts

(i) 9m * 6m with six, 3m* 3m apartments

(ii) 9m * 9m with nine, 3m * 3m apartments

(iii) 9m * 9m with sixteen, 2m* 2m apartments

(iv) 7m * 7m with four, 3.5m * 3.5m apartments

(v) 6m * 6m with sixteen, 1.5m * 1.5 apartments

(vi) 6m * 6m with four, 3m * 3m apartments

(vii) 5m * 5m with sixteen, 1.25m * 1.25m apartments

Net-Hapas

Only three net-hapa sizes have been experimented upon: 2*2*1m, 1*2*1m and 1*1*1m

Net Cages

Four different sizes of net-cages have been tried:

(i) 1*1*1.5m

(ii) 2*2*2m

(iii) 3*3*2.75m

(iv) 3*3*3.5m

The mesh sizes of these capes vary from 10mm to 25mm. There is a cage system operation termed TVIS- Tilapia Vertically Integrated System- every stage in the life history of the fish (from hatchlings to adult or table size). The present most portable and practical Tilapia hatchery/nursery is that, it include consisting of 6*6m raft with sixteen, 1.5*1.5m apartments fittable with sixteen, 1*1*1m net-hapas. The net-hapas have top covers which prevent the caged fish, especially the breeders from jumping out. The covers also protect the fry/fingerlings from being preyed upon by aerial predators such as birds. On the other hand, the most ideal design for growing table-size fish and brooders is the module of 7m*7m raft with far 3.5*3.5m apartments to which can be tied four 3*3*2.75m. The mesh size of the net-cages (210/9, 400md) may vary from 3/8" (10mm) to 1" (25.4mm) depending on the size/shape of the fish. The smaller the size of the fish to be stoked, the smaller the mesh size of the net cage.

Several modules of these hatchery/nursery and grow-out facilities can be linked together for commercial cage fish culture enterprise.

CONSTRUCTION

Net-Hapa

- The net-hapa is sown into the required shape and size with nylon thread (210/2) using a sewing mmachine.
- Kuralon rope (NO.15) is passed through nylon cloth tape on the vertical corners of the hapa to fortify the hapa.
- The kuralon rope is made such that it extends out of the four bottom rope is made such that it extend, out of the four corners of the hapa in form of loops to which riggers (small sinkers) are tied when the hapa is floated in the water for fish culture/breeding.

Net Cage

The net cage is mounted into the designed shape/size using kuralon rope (NO.15) as reinforcement and nylon rope (210/21) passed into a mounting needle following the procedure for gillnet. The kuralon rope is mounted to extend out at all the corners (top and bottom corners, square or rectangular cage) in form of loops for rigging at the bottom corners and attachment of the cage to the bottom raft at the top four corners.

Floating Raft

The bamboo (floating) raft acts as framework for the net-hapas or net-cages is constructed by first trimming the both bamboo poles to the appropriate or required length. For sixteen apartment's hatchery/nursery-raft, ten units of bamboo poles i.e. four, 2-piece units and six, 3piece units are nailed together at the 25 intersections with 6" nails.

Well sealed plastic kegs (100 liters capacity) are then fastened to the raft using 1/3" (3mm) diameter iron rods or kuralon (NO.15) rope. The raft is then launched by manual carrying into the water and paddled like a boat to the require site. The raft is anchored to the site with concrete sinkers (30-50kg each) to which are tied nylon or polypropylene anchor rope and then do the raft. The net-hapas or net cages can then be tied to the raft apartments in preparation for stocking.