FISH BREEDING

Fish breeding is synonymous to fish propagation which simply means multiplication. Breeding entails all the various techniques or methods which can be used or at least maintain a fish stock (i.e. methods of fish seed production).

This concept in fish production is important when an increase demand for fish and for culture is considered. Also, in tropical world, many fish species breed only once a year. Therefore, a continuous demand for fish seed makes fish propagation sine-qua-non. There are various techniques which differ from different parts of the world depending on local conditions and available local facilities. For instance, in developing world where facilities are not available, fish seeds are obtained from the wild while in advanced countries where there are facilities, propagation is completely artificial.

Basically there are 3 types of fish breeding/propagation

- Natural propagation/breeding techniques
- Naturally induced breeding/pond or enclosure propagation
- Artificial propagation through hypophysation.

Natural breeding technique: is a technique whereby fish are allowed to breed in their natural environment and their eggs, larvae, fry and fingerling are collected for pond stocking. The fry and fingerling (fish seeds) of Cichlids, *Clarias, Chrysicthys* as well as mullets (*Mugil sp*) are available in Nigerians waters fairly in large quantities all the year round. *Heterotis niloticus* is seasonal in abundance and can be obtained within a short period in a year usually at about the beginning of the rainy season. Many other species are known to be available during the rains (April to September) in the flood plains-inundated river banks and the estuaries. However, much

is still desired to be studied in Nigeria concerning the season and nursery grounds of other species. Accurate statistics of fish seeds obtained from the wild is not available in Nigeria.

The collection of fish seed is carried out with no physical damage to the seeds which entails the elimination of gill-nets and hooks as used gears. Gears for collection include the hand net; lift net, drag/seine nets, cash nets. Light is used to attract them at night, pieces of feeds, GNC can also be used to attract them to avoid mudding during seining. Special traps especially in streams and river could be used. Before transportation, the collected fry are fingerling are kept in Happa, net or pots and starve overnight in clean water to avoid defaecation which can utilize O_2 during transit. The collected fry and transported in well aerated, cool water to the pond for stocking.

Problems associated with natural breeding technique include:

- For many species, the seed may not be available as and when needed or required. Hence, there is shortage of fingerling for stocking leading to low fish production.
- Weed fishes and fish enemies e.g. Dragonfly larvae, water bugs which may feed on eggs or attack the fry or compete for the fish food may also be collected with the fish seed. Fish parasites e.g. leeches are collected with fish seed from the wild and introduced in-advertently into the rearing ponds.
- Difficulty of accurate identification of the fry/fingerling stages of certain species which results in the desired species being stocked with undesirable stunted species. e.g. observed in catfish with *Barbus*.
- There is high mortality during catch/collection and at transportation.
- May be uneconomical e.g. cost of going to the wild, pay workers to gain access to the spawning sites through trial and error methods.

However, natural breeding technique needs little or no skill which is an advantage.

Ponds or enclosure propagation

Essentially it is a naturally induced breeding technique that involves introduction of broodfishes or brooders into specially constructed ponds or tanks and allow them to breed. It is a common practice to leave the brooders breeding repeatedly. This is not ideal in terms of quality and is anti-selective since the age and parentage of the fish cannot be determined after some time. Therefore, a proper and systematic pond propagation technique that would ensure production of fry of known age is recommended. Usually, ponds used for propagation are small, about 0.1ha or $100m^2$ and shallow usually less than 1m. Cement/concrete tanks with measurements of 5x3x1m have been successfully used for pond propagation of Tilapias in Nigeria. Some fishes which reproduce easily in ponds are Tilapia, *Oreochromis, Sarotherodon, Lates, Heterotis, Clarias*, Carps and *Gymnarchus* breed in special ponds. Intensive efforts are going on to propagate *Chrysichthys* in ponds. For example, the propagation of tilapias in ponds does best in shallow waters and the pond must have sandy bottom. If tank is used, the floor of tank is usually covered with a layer of sand for making their nests (spawning area). The eggs hatch within 1-2days after external fertilization. These hatchlings/larvae are usually carried by one of the two parents until they are free to go or fend on their own. The fry move in shoals (school) along the edges of the water from where they can be collected. Discuss the newly designed special receptacle for propagating tilapias.

Also, discuss pond breeding of *Heterotis, Gymnarchus* which require some stimuli to effect breeding in enclosures. These species would not breed in ponds without submerged higher plants e.g. grasses. In case of *Clarias*, it requires moving water and hence an artificial water current of the water must be created. Carp requires a special pond called Hoffer or Dubisch pond and it must have a large bottom with grasses and it is shallow. Temperature and dissolved Oxygen are

crucially and optimally required in the ponds. In addition, the water must be free of other fishes especially the carnivorous ones e.g. *Hemichromis*. Also, mention the success story so far about *Chrysichthys* breeding in an enclosure.

The above techniques are simple and inexpensive in addition to achieving the best possible survival rate, good growth and health for the fish. The techniques require no sophisticated installations or tools and without difficulties and risks involved in artificial fertilization.

Artificial Propagation through Hypophysation

The hypophysation technique which uses the pituitary gland (the hypophysis) to induce spawning in fish can be carried out at any time of the year and under any environmental conditions. The technique ensures fish seed availability at all times of the year. For instance, using this technique a single common carp (*Cyprinus carpio*) has been induced to spawn five times within a year at intervals of 60,62,41 and 186 days between successive spawning, even though carp breeds naturally only once a year.

Artificial propagation was first described in 1765, but was neglected until 1842 when it was described again. A number of experiments were carried out and by 1937 artificial propagation at commercial level was attained. By 1964, it has spread to many parts of Europe, America, Japan, China, Israel but to date there are increased trials in Nigeria with varying degrees of success. It was first reported in Panyan fish farm and Agodi fish farm where carp propagation was successful. Other privately owned fish farms have tried hypophysation using catfishes e.g. *Clarias gariepinus, Heterobranchus bidaorsalis*.

For the purpose of easy description and discussion, artificial propagation can be divided into 6 stages as:

- Selection of brooders
- Maturation of the brooders
- Stripping i.e. obtaining eggs and sperms (milt) from the brooders
- Fertilization
- Incubation of fertilized eggs to ensure that they hatch
- Rearing of the larvae/fry up to fingerling stage.

Discuss each stage with good illustrations and examples with the students.

On the whole, more fry can be obtained from an individual fish through artificial propagation involving stripping after hypophysation when compared to what is obtained through other propagation techniques.

ADVANTAGES

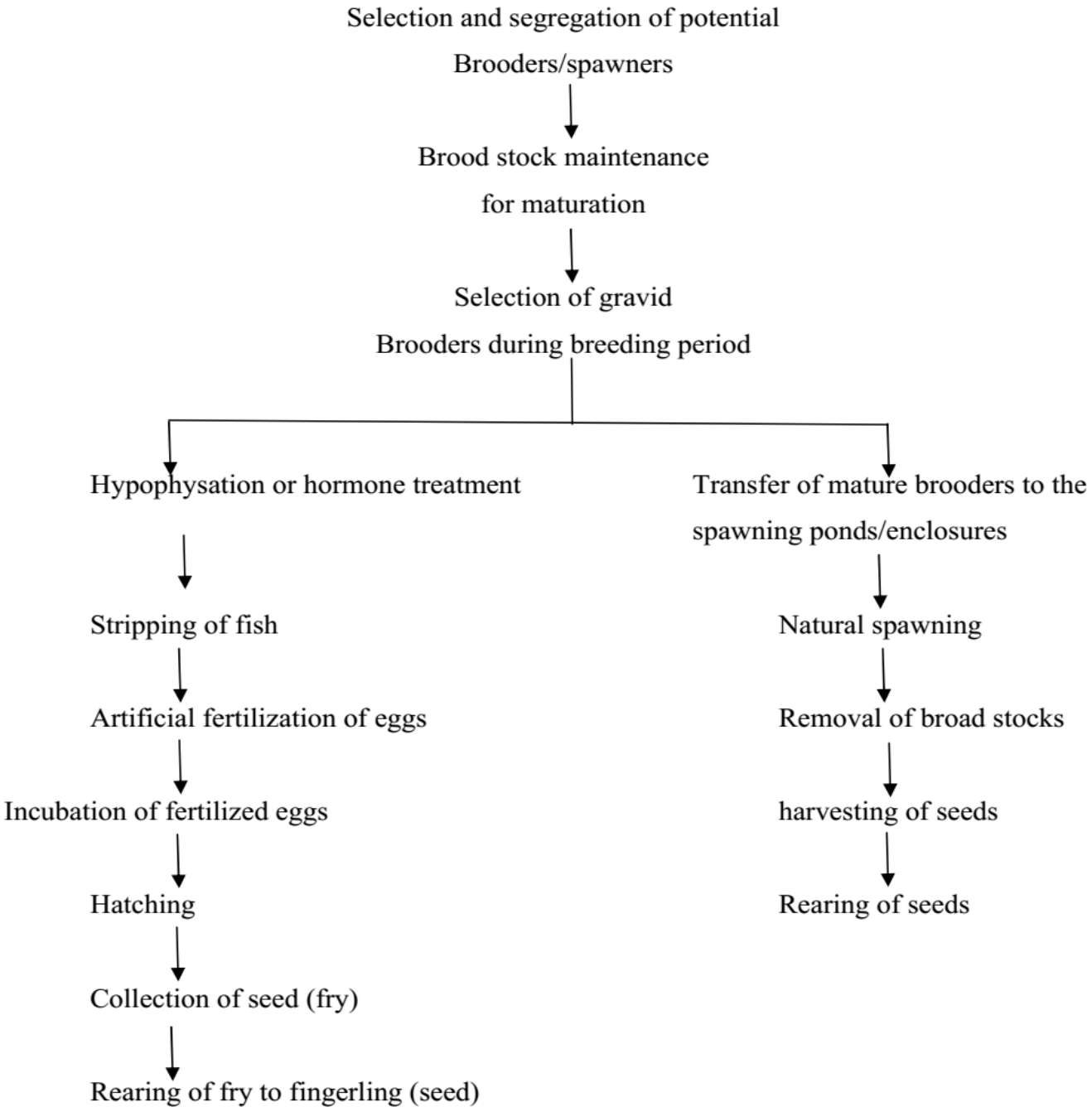
- Fish seed is guaranteed all the year round
- Fish seed is obtained outside the natural environment of fish.
- It increases the survival rate of the fry
- It improves quality by crossing two different species (i.e. hybridization) can be obtained.

DISADVANTAGES

- The donor fish has to be sacrificed in most cases and hence of loss of fish.
- The whole process is laborious and highly technical.
- Very expensive in that it requires proper housing, constructions of tanks, installation of jars in a close circulatory system.

It should be noted that artificial (i.e naturally induced or through hypophysation) production of fish seed are carried out in enclosures known as Hatcheries which may be an indoor or outdoor facilities and they require inputs such as brood stock, adequate water supply and suitable feed.

The sequence of steps involved in artificial production of seed can be schemed as:



Management/Maintenance of Broodstocks

Maintenance or management of broodstocks on a breeding farm is very necessary because it permits the build-up and selection of healthy, high quality brooders for stock improvement. In ponds for keeping broodstocks, they need to be simulated to that of the fish's preferred habitats in terms of O_2 content, temp, pH, tranquility, size and depth of the water, stocking density and quality and enough food.

Sharp fluctuations in the physico-chemical parameters of the water in the enclosures or ponds must be prevented especially temperature and O_2 as these are known to inhibit gonadal development. Overcrowding in the pond conditions must be avoided because it constitutes negative stress on the stock, though many cultured species are able to tolerate some degrees of crowded pond situations. For example, brooders of catfish (*Clarias*) are held at a stocking density of one fish in 2.-5.0m^2 of pond area with the depth of 1.0-1.5m.

Frequent disturbances also interfere with normal gonadal development and therefore care must be taken to restrict seeing or netting of the fish to the minimum. For example *Clarias* being hardy can withstand being netted out of water two or thrice a week, other fish species should not be seined more than once a week.

Provision of suitable and adequate quantity of food is equally of great importance. It has been known that brooders reared or maintained on adequate natural food and/or protein-rich artificial feed have a higher fecundity of larger eggs and thus yield best results.

To prevent outbreak of diseases in the stock used for breeding or subsequent transmission of any diseases to the offspring, brooders should be routinely treated and bathed in a 25% NaCl or 150ppm formalin solution for 10-30minutes. Malachite green can also be used.

Maintenance or management of brood stocks kept depends on the species, their size and the no of eggs per Kg per female, the survival from fertilized egg stage to the fry stocking phase and the demands for the fish from the grow-out units.

On principles of brood stock management solve the following problem with the students. Problem as:

As a fishery consultant, you have to supply one million Clarias gariepinus fry for restocking a Government farm.

i. How many eggs of this species will you require to produce the fry assuming that the average female brooder produces 5600eggs per kilogram body weight and that only 90% of eggs spawned are viable and of these, 86% will be successfully fertilized and out of these, only 78% would hatch?

ii. The average weight of each female *Clarias* as at the time of this contract was 3kg. Calculate the number of female brood stock to be maintained that would produce the above eggs to supply the required numbers of fry.

iii. If the sex ratio of male to female to effect the breeding was 2:3, how many male would be required, assuming each weighed 2.4kg to effect the above fry production?

iv. For proper management, at least thrice the required brood stocks must be maintained in a brood stock pond at a density of 600kg per hectare. Calculate the surface area of the pond required to maintain the brooders that would ensure the above fry supply.