

# FEED AND FEEDING MANAGEMENT

## CHAPTER 1: CULTURE OF LIVE FOOD ORGANISMS

### 7.1.1 Introduction

Proper feeding of aquarium fish requires patience. It is important to understand the different species, and their life cycles. The amount of food required depends upon the type of food, culture conditions, and individual fish. Newly hatched larvae may feed almost continuously. Fish generally will not overeat, unless they are fed too infrequently. One to two feedings a day are best for most fish. More for newly hatched fish and less often for larger fish.

Most problems with overfeeding result when wasted food spoils the quality of water in fish tank. Ammonia and other products of decay will degrade water quality and stimulate disease organisms. In the aquarium with under gravel filters, it is common for the under gravel to clog from accumulated uneaten food and debris. This problem can be eliminated with frequent aquarium care, including water changes, redistributing the aquarium decorations, and cleaning external filters. Common bottom-feeding fish such as loaches, plecostomus, and catfish can also help to keep the aquarium clean.

### 7.1.2 Live food organisms

A number of live foods can be used to add colour and to condition the fish for breeding. Feeding a restricted range of live foods, and exclusion of all other kinds of foods, is unlikely to provide a balanced diet, and may even lead to nutritional or other internal disorders for the fish. As many live foods originate from ponds, streams or rivers, they may bring with them aquarium pests, such as hydra, snails, or disease causing organisms. The risk of introducing disease organisms can be reduced by collecting live foods from fish free water, but the possibility of introducing aquarium pests still remains. It may be safer to use live foods disinfected before use.

Earthworms are an excellent, live food for all kinds of fish, including goldfish. Anyone, who has access to a garden or patch of waste ground should be able to collect enough for their fish. After collection, the earthworms must be kept for a few days in a sealed container. This should have small air holes. During this time the worms will clean themselves of solid and wastes and will then be more palatable for the fish. The worms can be given as whole or chopped, depending on their size and the size of the fish.

Sludge worms, such as [Tubifex](#) and other tubificid worms, are a live food familiar to most tropical fish *hobbyists*. These slim, centimeter-long, maroon worms are often used to tempt fish such as Discus to feed, and are given as a live food to adult breeding fish. [Tubifex](#) worms are not easy to culture successfully and so are most often obtained from an aquatic shop. Unfortunately, in nature these worms live in polluted stretches of rivers and streams, and it is from these unsavoury sources that most [Tubifex](#) are collected for aquarium use. Therefore, tubifex should be used sparingly in the aquarium only as an occasional food rather than as a staple diet. Before use, the worms should be rinsed gently in cold running tap water for several hours. Once cleaned, [Tubifex](#) worms live for some time in a shallow dish of cold water.

Water fleas are tiny planktonic crustaceans, such as [Daphnia](#) and [Cyclops](#). Like tubifex, they are a popular live food among tropical aquarists. This is suitable for larger fish fry or to condition adult fish for spawning. However, like [Tubifex](#), using water fleas as a live food may result in the introduction of unwanted pests or disease causing organisms. Unfortunately, [Daphnia](#) and related forms are less easily disinfected than [Tubifex](#), ideally therefore they should be obtained from a safe fish-free pond. Bloodworms are the aquatic larval stage of a two-winged fly. Difficult to culture, they are best obtained from aquatic shops and are particularly useful in the winter months, when other live foods may be scarce.

In egg laying fish species, nutrients trapped in the egg sac would be normally sufficient to the hatchlings. Afterwards, the tender hatchlings are fed with green water consisting of microscopic algal species of *Protococcus*, *Tetrasphaerium*, *Chalmydomonas*, [Chlorella](#), *Volvox*, *Eudorina*, *Pandorina*, etc. Certain filamentous algal species of *Spirogyra* are known to serve as an ideal food

source for the fry and juvenile fishes. The above green water is a viable food source especially during the first two weeks of growth.

[Aquarium](#) fish, depending on their feeding habits and preference may be fed with live foods. Such as mosquito larvae, fruit flies, bloodworms, tubificids, [Cyclops](#), daphnids, rotifers, brine shrimps earthworms white worm and microworm or with moist pellets, dry pellets, flakes and chopped bits of fish, shrimp, beef, oyster, crab and liver, spleen, lung, heart and brain of cattle.

#### 7.1.3 Feeding of young ones (fry)

Fish fry require smallest size of food. Generally fry of live bearers are bigger than that of egg layers. Live bearers fry eat food items immediately after release from the parents. In the case of egg layer, after hatching the fry takes yolk as food from its throat region. They search food only after 3 to 5 days when they become free swimming.

#### 7.1.4 Oxbow theory Feeds of fry

The fry immediately after they become free swimming can be fed with either of the following items or all the items alternatively.

1. [Green water](#) – [Green water](#) is collected from pools or ponds or tanks. Small containers are used to produce green water. Scrapings of green algae are inoculated and urea and super phosphate are added as fertilizer. After 5 days, the green water is ready to feed the fry.
  2. [Infusoria](#) – [Infusoria](#) can be either cultured or collected and fed to fry.
  3. Baker's yeast suspension – Yeast is dissolved in water and this milky liquid is used as food.
  4. Egg yolk suspension – Yolk of boiled egg is dissolved in the fry tank through bolting silk cloth.
- In case of feeding with egg yolk, water exchange should be done every day to remove excess food to avoid bad smell and mortality of young one.

#### 7.1.5 Feeding frequency- 5 or 6 times daily

The above feeds are continued for 7 to 10 days. In case of cichlid fry and live bearers fry, the above food items can be skipped and directly the following food items can be given as their size are comparatively bigger. Early hatched (immediately after hatching) daphnia and artemia nauplii can be given. Finely ground formulated feeds can be given to live bearers fry immediately after their birth for 10 – 15 days. The following food items can be given after 25 to 30 days of birth -[Daphnia](#), blood worms, earth worms, tubifex, mosquito larvae, artemia and formulated feeds.

#### 7.1.6 Collection and culture of Infusoria

##### **Collection :**

[Infusoria](#) belong to the class Ciliata under the phylum Protozoa. They serve ideally as starter feed for early stages of ornamental fishes. The tiny microscopic one celled animalcules like *Paramecium* are collectively called [Infusoria](#). They are found in ponds, tanks and ditches. They can be easily collected with 0.13 mm mesh cloth.

##### **Culture of [Infusoria](#) :**

By using Banana peelings, cabbage, potato, hay, lettuce leaves :

Any one of the above material is kept in a container filled with water. The container is covered to prevent the entry of mosquitoes but air should be allowed. The container is kept in a cool place. In two days the water will turn milky and have foul smell. This is due to the multiplication of bacteria which decay the material. A film of slime will be formed on the water surface. In about 4 or 5 days the water will turn clear, with light yellow colour. This is because of the floating spores of [Infusoria](#) in the air which have settled in the water and are feeding upon the bacteria and multiply. Subsequently the film of slime on the water surface will break up and disintegrate. The culture is now ready for feeding the early stage of fish larve. The culture will continue to flourish for 2 to 3 weeks if a few drops of milk are added.

#### 7.1.7 Culture of daphnia

[Daphnia](#) are commonly called as water fleas. They are cladocerons. [Daphnia](#) inhabits in freshwater ponds and tanks. It feeds on algae, bacteria etc.

##### **Natural collection :**

[Daphnia](#) can be collected from pools, ditches and any stagnant water bodies. They swims on the water

surface before sun rise and after sun rise they go to bottom. Hence [Daphnia](#) should be collected during early morning hours. [Daphnia](#) can be collected with the help of a scoop net having 100-200 micron mesh.

#### a) Stock and pure culture

[Daphnia](#) can be cultured in mass scale level. To prepare stock and pure culture daphnia should be collected and the sample has to be diluted and taken in a glass beaker. Individual [Daphnia](#) is picked with the help of a dropper and placed one in each tube containing 10 ml of filtered freshwater.

[Daphnia](#) is fed with yeast or groundnut oil cake at 200 ppm daily. These tube cultures are transferred to 1 litre jar and feeding is continued. After 5-6 days, the jar culture is inoculated in mass culture tanks.

#### b) Mass culture

Depending on the requirements, [Daphnia](#) is cultured in 500 to 20,000 litre capacity cement or plastic tanks. The culture tanks is thoroughly cleaned and filled with filtered freshwater. Before starting a mass culture, medium is prepared as follows :

##### Medium preparation :

Slurry is prepared by adding 10 kg of chicken droppings, 5 kg of groundnut oil cake and 2.5 kg of single super phosphate in 250 litre freshwater. Continuous aeration is given for 3 days for the escape of obnoxious gases, fermentation and release of nutrients. After 3 days the slurry is used as fertilization solution in the mass culture tanks. In the mass culture tanks, the medium is added at 3 to 4 ml per litre of water regularly for 3 to 4 days. On 4th day, [Daphnia](#) is inoculated at 50 individuals per litre. In about 7 days, [Daphnia](#) multiplies and density reaches from 10,000 to 25,000 individuals per litre. The [Daphnia](#) is harvested using 100-200 micron mesh scoop net in the early morning or late evening when they are on water surface. The [Daphnia](#) is washed thoroughly and fed to fish fry.

##### *Moina* culture and *Brachionus* culture :

Culture of monia and brachionus are similar as that of [Daphnia](#) culture. Inoculation is done with respective live foods.

### 7.1.8 Culture of tubifex

[Tubifex](#) comes under the phylum Annelida. [Tubifex](#) are small, reddish worms up to 2 cm long which occur in the mud of ditches and streams. Their front portion is inside the mud for taking food and posterior end is above the mud for respiration. [Tubifex](#) worms form an ideal food for faster growth and reproduction of ornamental fishes.

Natural collection :

They can be collected from ditches and canals. The mud along with tubifex is collected and kept in a large bucket for drying of water. During drying, the worms will congregate to the surface due to lack of oxygen. Then, they are collected and washed to remove the residual mud attached to the body. But their guts still may contain mud which they have eaten and should be kept under the stream of water for the mud to be evacuated from the intestine. After proper cleaning, they are fed to fishes.

##### Method – 1 :

Cement tank can be used. Mud from ponds or canals is kept upto 5 cm. Water is filled to 5 cm depth. Rice bran is spread over the surface and left to ferment for 3 days. After 3 days the [Tubifex](#) worms are inoculated. Care must be taken not to let the pond mud dry completely. After one month the pond can be refilled with water up to 4 to 6 inches above the mud. After the filling the worms will congregate on the mud surface where they can be easily harvested. The cycle can be repeated after three days.

##### Method – 2 :

It can be cultured in any container with 5 cm thick pond mud on the bottom mixed with decaying vegetable matter and rice bran and bread. Continuous mild water flow is to be maintained in the container with a suitable drainage system. Then [Tubifex](#) worms are inoculated. Within 15 days, clusters of [Tubifex](#) worms develop.

### 7.1.9 Culture of blood worms

Blood worms are otherwise called as Chironomus larvae. The intermediate larval stage of the midge fly is commonly called blood worms. They belong to the family Chironomidae of the phylum Arthropoda. They are usually red in colour. It is one of the best live food items for ornamental fishes.

Culture :

Flat trays are used as container. Water is filled and then soil and compost cattle manure is added to

attract the chironomous flies to deposit eggs. Each female lay about 20000 eggs which hatch out about 3 days. The larvae are harvested and washed thoroughly and kept for conditioning to evacuate the gut contents before feeding to the fish.

#### 7.1.10 Mosquito larvae

It comes under the phylum Arthropoda. They breed in stagnate water bodies. Cow dung is the medium for culture of mosquito larvae. They can be harvested using scoop net.

#### 7.1.11 Live food feeders

##### Worm feeder

When feeding with live food like [Tubifex](#) care should be taken. By dropping tubifex, the worms go to the bottom and burrow in to the substratum before the surface and mid water fish get at them. In order to facilitate the feeding for the surface and mid water fishes, worm feeder is used. Worm feeder is a plastic conical device perforated with minute holes. This device is attached on the sides of the glass tank. The worms are introduced into the feeder and worms wriggle free of the holes. Thus allowing fish plenty of time to eat.

## CHAPTER 2: PREPARATION OF ARTIFICIAL FEED

### 7.2.1 Formulated feeds

Ornamental fishes are classified into three feeders according to the feeding level.

- i) Surface feeders
- ii) Column feeders
- iii) Bottom feeders

Like other fishes their feeding habits resembles, omnivore, carnivore, herbivore and piscivore.

Nutritional requirement :

	Protein	Fat	CHO
Small fishes	40 – 45%	4 – 6%	40%
Adult	30 – 35%	6 – 8%	50%

### 7.2.2 Types of feeds

- i. Dry feed – 8 – 10 % moisture – Further classified into five categories :
  - a). Pellets – Sinking or floating
  - b). Flakes – Flat in shape. It floats at first and then sinks slowly. It is available in different colours.
  - c). Freeze dried feed – kept for longer time without degradation of nutritional value. These are available in cubes which adhere to glass tank. Fishes nibble at it as it dissolves.
  - d). Tablet form – It can be stuck at different water levels.
  - e). Granular or crumble feed – small particles suitable for larvae.
- ii. Moist feed : It can be prepared daily and fed to fishes. The moisture content of the feed is 35%. It can not be kept longer periods due to their high moisture content.
- iii. Semi-moist / paste feed : For baby fishes, this can be given by squeezing through mesh.

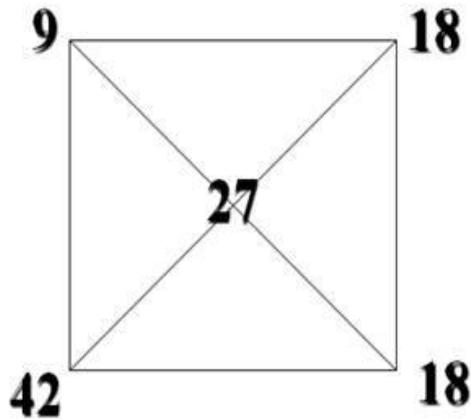
### Preparation of dry feed using two ingredients

Using rice bran (protein 9%) and ground nut oil cake (protein 45%) a fish diet with 27% protein can be prepared as follows.

A square is constructed and the two ingredients are put on the two left corners along with the protein content of each. The desired protein level of the feed is placed in the middle of the square. Next, the protein level of the feed is subtracted from that of the ingredients and the answer is placed in the opposite corner.

### Square method

Rice bran



Groundnut oil cake

Now the figures on the right side corner of the square are added i.e.  $18+18=36$

Then the % of rice bran to be added in the feed =  $\frac{18}{36} \times 100 = 50\%$

% of Groundnut Oil cake =  $\frac{18}{36} \times 100 = 50\%$

To make 1 kg feed 500g rice bran and 500g-groundnut oil cake should be added.

### Flow chart - Preparation of dry feed

