Feed Of fish

Introduction

Food is very essential as it is the main source of energy for the living organisms. Regarding food and feeding habits in fish, there are four basic eating groups among fish: carnivores, herbivores, omnivores and limnivores. Each group of fish needs to be fed in a particular way.

1. **Carnivores** fish – These are meat-eating fish. Carnivores need at least 45% of protein in their food. Earthworms, Red worms, Tubifex worms and Daphnia. - Larvae of mosquitoes or fruit flies. - Oysters, shrimps, clams and other fish.
2. **Herbivorous fish** – These are fish that will eat only plants. Algae, leafy vegetables, diatoms etc.
3. **Omnivore fish**- These fish prefers both plants and animals as their food.
4. **Limnivores** fish - These are also known as mud-eaters. Limnivores fish feed mainly on algae and on the microorganisms.

The food feeding mechanism in fish depends up on type of food, the culture conditions and individual fish. The younger fish need more frequent feedings than the older ones. The fishes have their own feeding needs. Fishes can feed in calm and quiet environment. Disturbances in environment, overcrowding, deterioration of water quality, rearrangement of aquatic plants, can affect the feeding behavior of the fishes. This leads to nutritional deficiencies causing stunted growth, loss of appetite, cloudy eyes, weakness or tumors in fish. For this reason it is advisable to give your fish vitamin supplements from time to time.

Fish Feeds :

Feeds play an important role in aquaculture. The food is very important for the growth and other activities in the fish. Various types of feeds can be observed in different types of fishes. The fishes can feed on zooplankton phytoplankton algae, macrophytes, molluscs, crustaceans and small fishes also. The fish feeds are classified into live feeds and artificial feeds.

A) Live Fish Feeds :

The live fish feeds comprise of living organisms that are available in the nature for example algae, diatoms, Rotifer are fish feed organisms for live feeds or natural feeds. The live feeds are naturally occurring in the ponds plankton's forms main form of live feed. Planktons are of two types. Phytoplanktons and zooplanktons. Some of the phytoplanktons are *Chlamydomonas, Volvox, Euglena, Hydrodictyon, Selenastrum, Pinnularia Cymbella, Anabaena, Nostoc, Chlorella, Sphirulina* etc. Similarly zooplanktons consist of Amoeba, *Arcella, Difflugia, Vorticella, Cyclops, Monia, Artemia, Actinospharium, Daphnia* etc.

The zooplankton or phytoplankton can be culture in the laboratory and can use as live fish feeds.

Culturing of some live fish feeds :

i. **Culture of Daphnia:** Daphnia is live feed. It is use to feed Indian major carps and prawns. It is freshwater crustacean. It reproduces by parthenogenesis. It is cultured in cement tanks filled with pond water. The water is mixed with chicken droppings, oil cake, and superphosphate. After few days thick bloom of phytoplankton is observed in the tank. On the third day, seed Daphnia are introduced into the tank. The seed Daphnia can be grown in the tank by feeding on the bloom which contains phytoplanktons. After 6-7 days 10000 to 20000 individuals are produced.

ii. **Culture of Cyclops:** Cyclops is copepod Crustacean. It is live feed for fish and is cultured on intensive method. It is cultured in cement tanks. The culture medium is prepared by mixing chicken droppings, oil cake and superphosphate. The mixture of manure promotes the growth of Chlorella and other algal forms which is food for Cyclops. Cyclops collected from the pond is inoculated on the 3rd day. Manure mixture is added on every alternate day. After 7th day harvesting is done.

iii. **Culture of Chlorella:** Chlorella is live feed for aquaculture. It is spherical non-motile unicellular green algae. It is very common in freshwater habitats. It is rich source of proteins, vitamins and minerals. Chlorella is mass culture in large open circulating tanks using Sorokin- Krauss culture medium or liquid effluent from digested human excreta. The medium is formulated and filled in concrete tank. A small volume of Chlorella culture is inoculated into the tank. As Chlorella grows, the cells get settled at the bottom of the tank. The culture is filtered through a fine cloth to get Chlorella biomass. The biomass is sub- dried and packed in aluminium foiled bags.

B) Artificial or formulated fish feed

The fish feed which is prepared artificially is called artificial feed. It is also called complete or formulated feed. Artificial fish feed is prepared by using feed ingredients which are both plants as well as animal origin. Plant ingredients are algal powder, groundnut oilcake, wheat flour, tapioca powder sea weed powder etc. animals ingredients are fish meal, earthworms, chicken intestine, prawn head meal, Cuttle fish and squid meals etc. Artificial feeding is essential when the fishes are reared in intensive or on large numbers. The artificial feed is classified onto two classes on the basis of ingredients used i.e. Simple feeds and compound feeds.

Simple feed: This type of feeds is made from single gradient. They include rice bran, ground nut oil cake, silkworm pupae. Simple feeds do not provide all essential food elements. Therefore, they are also called as unbalanced feeds.

Compound feed: They are also called as balanced feeds because they provide all essential food elements. Compound feeds are made up of more than four feed ingredients' comprising animal and plant sources. The main ingredients' of compound feed are corn meal, ground nut oil cake, rice bran, soya bean powder, fish meal, silk worm pupae, cow dung, tapioca flour, dried algae, wheat flour etc. The formulated feeds are available in three forms;

i) Dry/moist or wet.
ii) Floating or non-floating type
iii) Granules, crumbles, balls, cakes, flakes, pellets or paste.

Composition of an ideal fish feed

Ideal fish feed contains all requirements of balanced diet. It is rich in Carbohydrates, Proteins, fats, Vitamins, minerals etc.

Ingredients	**Amount (Kg)**
Tapioca flour	09
Rice bran	27
Fish meal	23
Ground nut oil cake	14
Silk worm pupae	26
Vitamins and minerals	01
Additive, preservative chemical attractant	Trace amount
Total	**100**

Methods of preparation of formulates or artificial feeds :

Artificial feed is prepared by mixing of various ingredients. The preparation of artificial feed involves following steps;

a) **Selection** : good quality ingredients are selected which are rich sources of energy, proteins, fats, vitamins and minerals. The ingredients should be locally available at low cost.

b) **Grinding** : Selected ingredients of fish feed are dried ground in to powder. Grinding reduces particle size, facilitates digestion and also increases nutritive value of ingredients.

c) **Sieving** : the powdered ingredients are sieved through a mesh of 177 µm.

d) **Weighing** : the ingredients are weighed individually and kept as mass.

e) **Mixing :** the individual masses of weighed ingredients are mixed thoroughly. For mixing various type of mixing mills are used.

f) **Steaming** : the feed ingredients are passed through conditioning chamber in which 5% water or steam is added. It provides lubrication for pellets making. Steaming also help to kill bacteria and other pathogens and improves digestibility. The starch of ingredients is converted to gelatine which helps to adherence of particles.

g) **Pelleting** : The process of conversion of conditioned feed in to pellets is called as Pelleting. It is done by the machine called pelletizer. Different dyes are used to produce different types of pellets. During Pelleting the feed is first air dried. Then it is given 15% moisture at 80 ^{0} C. then the mixture is compressed and extruded through the dye. The pellets are discharged and air cooled for 10 minutes.

h) **Drying** : the pellets are dried at 120 ^{0} C in oven. The pellets become hard, stable and floating in water.

i) **Packing** : The pellets are packed in polythene sacks.

j) **Stocking** : the prepared artificial feed is stocked safely for future use. It is kept cool and dry place. The feed is protected from fungi and mycotoxins by adding sodium benzoate or sodium ascorbate.

DIET FORMULATION

- Diet formulation is a process in which the appropriate feed ingredients are selected and blended to produce a diet with the required quantities of essential nutrients .
- No single ingredient can be expected to meet all the nutrient requirement of a cultured organism.
- Various ingredients which is nutritionally balanced , pellatable, palatable and easy to store are used to formulating feeds.
- The basic information required for feed formulation are:

1. Nutrient requirement of the species cultivated
2. The feeding habit of the species
3. Local availability, cost and nutrient composition of ingredients.
4. Ability of the cultured organism to utilise nutrients from various ingredients as well as the prepared diet.
5. Expected feed consumption
6. Feed additives needed
7. Type of feed processing desired

- Man factors to be considered when formulating feeds for use in aquaculture .
- Feed cost is considered to be the highest operational cost in both intensive and semi intensive aquaculture systems.
- Supplying adequate nutrition for various aquaculture species involves the formulation of diets containing about 40 essential nutrients and proper management of multitude of factors relating to diet quality and intake.
- So it is ensure that feed formulae developed are nutritionally and economically sound.
- An economic diet is expected to produce a kilogram of healthy fish at the least cost under normal growing conditions.
- To formulating economically sound and nutritionally balanced diets we can use two mathematical calculations.
- The are Pearson squares and linear programming.
- On the basis these formulae man computer programmes are developed for feed formulation.

Pearson squares

- Formulation of diets with a few ingredients ,and in which amino and fatty acid balances are not taken into consideration.
- It is one of the best and simply achieved method
- The complicated least cost formulae used in Pearson squares are based on series of simultaneous equations.
- It can be balanced only one nutrient (make your choice for crude protein or crude fat)

Sample Calculation

1. Please calculate to prepare a fish feed that includes 45% crude protein, using fish meal and corn gluten meal…

2. Always keep in mind the nutrient value of

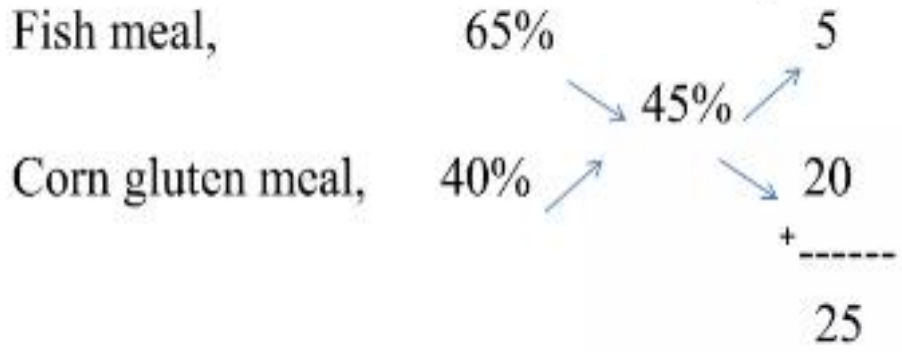
the ingredients…

3. Fish meal includes 65% crude protein,

4. Corn gluten meal includes 40% crude protein…

5. What will be the solution to reach 45% crude protein using fish meal and corn gluten meal?

6. The solution is to create a mixture rip…



% of Fish meal is calculated as: (5 x 100) / 25 = 20

% of Corn gluten meal is calculated as: (20 x 100) /25 = 80

7. The contribution from fish meal is: 20% x 65 = 13

The contribution from corn gluten meal is: 80% x 40 = 32

The total is: 13 + 32 = 45

If we have more than two ingredients take them as groups and calculate the average value of each group.

Linear programming

- Another mathematical technique available to nutritionists for selecting the best combination of feed ingredients to formulate diets at the least possible cost is linear programming.
- The information necessary for using the technique includes

1. Protein and fat content in the diet
2. Nutrient content and DE(digested energy) or ME (metabolisable energy) of ingredients
3. Unit price of feedstuffs including vitamin and mineral mixture.
4. Any other additives to be considered to be used in the feed
5. Minimum and maximum restriction on the amount of each ingredient in the feed.

Least cost linear programming software's for feed formulation are readily available, the price varies with sophistication required.

A commonly used spreadsheet such as Lotus 1-2-3 can also be used for feed formulation.

It is a high coast methode so not useful for local farmers.

Aquarium Fish-food may include

1. live foods and
2. processed foods.

1. Live food consists of plants, animals and microorganisms that do not cause harm to the fish. Live foods are always better than dried processed foods as they contain better quality of protein than dried foods.

2. Processed foods include fresh, frozen, freeze-dried, and canned foods.

a) Fresh foods can be small bits of meats, vegetables and fruits like beef, chicken, pea, beans, peeled apple etc.

b) Canned foods provide a balanced diet and comes in a variety of forms such as flakes, pellets, granules etc. Among canned foods flaked food is the most common food used and is best for small fish. Pellets such as the floating ones and sinking ones are suited for big fishes. Pelleted forms, some of which sink rapidly, are often used for larger fish or bottom feeding species such as loaches or catfish.

c) Frozen diet such as shrimp or bloodworms provide a good source of digestible

Live foods

Live fish food include earthworms, sludge worms, water fleas, bloodworms, and feeder fish. Food for larvae and young fish include infusoria (Protozoa and other microorganisms), newly hatched brine shrimp and microworms.
These are the most preferred type of food for fishes, but are difficult to get. However, freeze dried forms of earthworms, tubifex etc. are available now.

Feeder fish is the generic name for certain types of inexpensive fish commonly fed as live prey to captive animals such as sharks and turtles.
The species of fish usually sold as feeder fish are invariably some of the easiest fish for fishkeepers to rear and breed, such as goldfish and guppies. Typically, these species are tolerant of overcrowding and have a high fecundity and rapid growth rate. In some cases, species of predatory animals, typically large fish such as catfish and cichlids but sometimes also animals such as freshwater turtles, are provided with feeder fish because they accept them more readily than alternatives.

Species used as feeder fish

Several fast-growing and hardy species are commonly sold and used as feeder fish. Depending on the locality, feeder fish may include:

- Low-quality, common livebearers, usually guppies, mosquito fish and platies
- Small cyprinids, particularly rosy red minnows and goldfish
- Unwanted livebearer and cichlid fry
- Female Siamese fighting fish
- Young tilapia
- Defective and weak fry

Additional Types

Prepared foods

Prepared foods are those foods that are non-living and are made by the aquarist or bought already prepared for consumption for fish.

Dry foods

Flake food is a type of proprietary or artificially manufactured fish food consumed by a wide variety of tropical and saltwater fish and invertebrates. It is ideally suited to top dwellers and mid-water fish though numerous bottom dwelling species consume flake food once it has settled on the bottom. Flake food is baked to remove moisture and create the flaking, thus allowing for a longer shelf life. Generally the more moisture a particular example of fish food contains, the more readily it will deteriorate in quality. Dry foods is also available as pellets, sticks, tablets, granules, and wafers, manufactured to float or sink, depending on the species they are designed to feed.

Vacation food

Vacation foods — also known as "food blocks" — are designed to be placed inside the aquarium to forgo feeding while the owner is absent. These blocks release small amounts of food as they dissolve. Food blocks can be a good choice for smaller tropical fish, but can pollute the water.

Medicated fish food

Medicated fishfood is a safe and effective methods to deliver medication to fish. One advantage is that medicated food does not contaminate the aquatic environment and also, unlike bath treatments, does not negatively affect fish, filtration and algae growth in the aquarium. The parasites will get treated spot on by medicated food, because the fish is ingesting it.

Freeze-dried and frozen fish diets

Freeze-dried and frozen fish foods were primarily developed for tropical and marine fish and are useful in providing variety to the diet or specialist feeding needs of some species. These include tubifex worms, mosquito larvae, bloodworms, water fleas (*Daphnia* and *Cyclops* spp.) along with brine shrimp (*Artemia salina*).