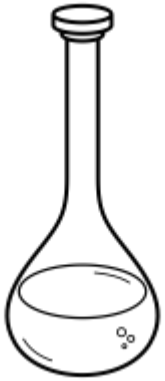
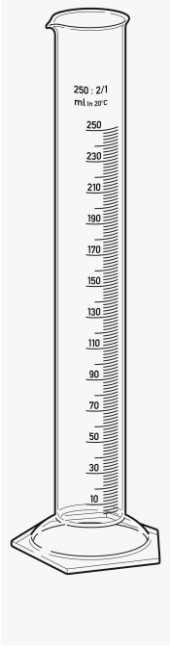
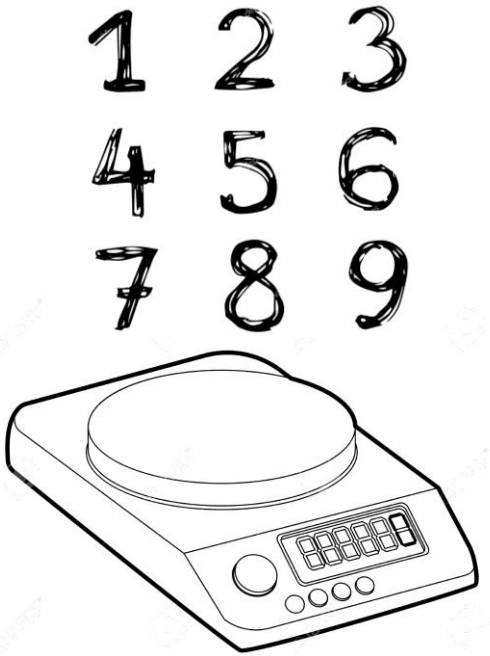
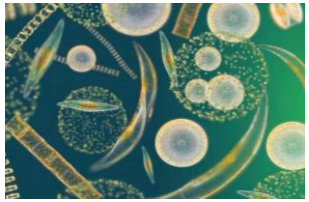
Food or Gut Content Analysis









Method of Gut Content or Food Analysis

- Fish diets can be measured in a variety of ways. Methods of gut contents analysis are broadly divisible into two, *viz., qualitative and quantitative.*

- ***The qualitative analysis*** *consists of a complete identification of the organisms in the gut contents. Only with extensive experience and with the aid of good references it is possible to identify them from digested, broken and finely comminuted materials.*

- ***Quantitative methods*** *of analysis are three types, viz., numerical, gravimetric and volumetric.*

Quantitative Method for Food Analysis

- Numerical Method
- Volumetric Method
- Gravimetric Method

Numerical methods

- The numerical methods are based on the counts of constituent items in the gut contents. The numerical methods can be classified under four distinct heads

- a) Occurrence method
- b) Dominance method
- c) Number method
- d) Point (Numerical) method

- **A) Frequency of Occurrence:** ***Stomach contents are examined and the individual food organisms sorted and identified.*** The number of stomachs (fishes) in which each item occurs is recorded and expressed as a percentage of the total number of stomachs (fishes) examined.

$$\text{Frequency of Occurrence, } O_i = \frac{J_i}{P}$$

- Where, J_i is number of fish containing prey **i and P is the number of fish with food in their stomach.**

- ***b) Dominance method:***

Essentially the dominance method is a partial improvement of the occurrence method, viz., the lack of consideration of the quantities of the food items present in the stomach, sought to be remedied.

The stomach contents comprising the main bulk of the food materials present, is determined and the number of fish in which each such dominant food material is present is expressed as a percentage of the total number of fishes examined.

- **c) Number method:** ***The number of individual of each food type in stomach is counted and expressed as a percentage of the total number of food items in the sample studied, or as a percentage of the gut contents of each specimen examined, from which the total percentage composition is estimated.***

- **It is suitable method for plankton feeder only.**

- ***D) Points (Numerical) Method:*** ***The points method is an improvement on the numerical method where consideration is given to the bulk of the food items.***

- ***The food items are seprated and counted and presence or absence of each food item in a stomach is recorded. Food items may be classified as very common, common, frequent, and rare based on rough count and judgment by eye.***

Volumetric Method

- The chief methods that are employed in assessing the volume of food items in the gut contents of fishes are:

  a) Eye estimation method

  b) Points (Volumetric) method

  c) Displacement method

a) Eye estimation method

This is probably the simples and easiest means of determining the volume of food constituents. In this method the contents of each sample is considered as unity, the various items being expressed in terms of percentage by volume as estimated by inspection.

- ***Points (Volumetric) method:***

This method is a variation of the eye estimation method. Here instead of directly assessing the volume by sight as in the previous method, each food item in the stomach is allotted a certain number of points based on its volume.

The diet component with highest volume was given 16 points. Every other component was awarded 16, 8, 4, 2, 1 and 0 points depending on the volume relative to the component with the highest volume.

- In point (volumetric) method, percentage volumes within each subsample were calculated as:

$$\alpha = \frac{\text{Number of points allocated to component } \alpha}{\text{Total points allocated to sub sample}} \text{X}100$$

- Where α is the percentage volume of the prey (food item) component α

- **Displacement method:**

  The displacement method is probably the most accurate one for assessing the volume. The volume of each food item is measured by displacement in a graduated container such as a cylinder with the smallest possible diameter for accuracy. This method is eminently suited in the estimation of the food of carnivorous fishes.

Gravimetric Method

- The gravimetric method consists of the estimation of the weight of each of the food items, which is usually expressed as percentages of the weight of the total gut contents as in other quantitative methods.

- Generally the wet weigh of the food after removing superfluous water buy pressing it dry between filter papers is taken for this purpose.

Food analysis indices

- **Simple indices**

1) Index of fullness: This is measured as the ratio of food weight to body weight as an index of fullness, which is very widely employed. (The ratio of corresponding volume can also be used.) This index can be applied to the food in the stomach, or to that in the whole digestive tract. It is usually expressed as parts per 10,000 (%00, or parts per decimile); that is:

$$\text{Fullness index} = \frac{\text{weight of the stomch contents x 10,000}}{\text{weight of fish}}$$

2) Index of selection or forage ratio:

Most fishes have a scale of preference for the organisms in their environment, so that some are consumed in large numbers, others moderately, some not at all. A quantitative index of such differences called as the forage ratio. A study of the quantities of different organisms available to the fish is made, and also of the various items in their stomachs; then;

$$\text{Selection index} = \text{forage ratio} = \frac{s}{b}$$

Where, s = percentage representation by weight, of a food organism in the stomach and b = percentage representation of the same organism in the environment. The lower limit for this index is 0; its upper limit is indefinitely large.

- **Index of electivity:**

  Somewhat different quantitative measure of selection which has been widely used as mean of comparing the feeding habits of fishes and other aquatic organisms with the availability of potential food resources in natural habitats. The relationship is defined as

$$\text{Electivity index} = E = \frac{s - b}{s + b}$$

The index has a possible range of -1 to +1, with negative values indicating avoidance or inaccessibility of the prey item, zero indicating random selection form the environment, and positive values indicating active selection.

Compound indices

- **1) Index of Preponderance:** This index gives a summary picture of frequency of occurrence as well as bulk of various food items. It provides a definite and measurable basis of grading the various food elements. The bulk of food items can be evaluated by volumetric or Gravimetric methods. If V_i and O_i are the volume and occurrence index of food

$$\text{Index of preponderance } I_i = \frac{V_i O_i}{\sum V_i O_i} X100$$

- **Index of Relative Importance:** This index is an integration of measurement of number, volume and frequency of occurrence to assist in evaluating the relationship of the various food items found in the stomach. It is calculated by summing the numerical and volumetric percentages values and multiplying with frequency of occurrence percentage value.

Index of relative importance, $IRI_i = (\% N_i + \% V_i)\ \% O_i$,

Where, N_i, V_i and O_i represent percentages of number, volume and frequency of occurrence prey **i** respectively.