

Classification of benthic regions, beach zones, periphyton, distribution

Benthos

The term **benthos** includes all bottom dwelling organisms, comprising the great assemblages of plants and animals. Benthos includes the organisms of the bottom from uppermost water bearing portion of a body of water right up to the greatest depths.

Classification of benthic regions

The benthic habitat is not uniform and it can be classified into different zones, they are.

1. Lake zone:

There are usually 3 zones and in exceptionally in deep lakes there are 4 zones, they are Littoral, Sublittoral, Profundal and Abyssal zones.

- i) Littoral Zone : Extends from water's edge to the lakeward limit of rooted vegetation.
- ii) Sublittoral Zone : From lakeward limit of vegetation down to about the level of the upper limit of the hypolimnion.
- iii) Profundal zone : The entire lake floor that bounds the hypolimnion
- iv) Abyssal : Present only in lakes of depths greater than 600 m.

1. Beach zones

Benthic region was formerly regarded as water's edge extending to the deepest region. The biota is truly aquatic, living in water at beach and has direct continuity with the main body of the lake or stream and the organisms involved are benthos and the environment are considered as benthic region. The exposed sandy beaches maintain 3 parallel environments, they are :

- a. The inner beach
- b. The middle beach
- c. The outer beach

The inner beach extends from water's edge, during periods of calm water up to the slope to the place where the surface of sand ceases to be with water and shows the first signs of drying. This zone is narrow and exposed to the slight wash of gentle wave of calm weather.

The middle beach occupies the space just beyond the inner beach to the waves during the rough weather. The outer beach extends from middle beach to the outer limits of beach proper. It is washed by waves during storms or during times of highest water levels.

2. Sandy Beach (Psammolittoral)

This is divided into three categories, they are as follows :

- i. Hydrosammon : Submerged sandy bottom
- ii. Hygrosammon : Zone immediately landward from water, edge – always saturated with water roughly corresponds to the inner beach.
- iii. Eupsammon : Zone above hygrosammon – corresponds to middle beach.

Benthic Communities of Inland waters

The benthos of inland waters are vast assemblage of flora and fauna. However, it must be remarked that, "no vertebrates are represented as true Benthos". The benthic organisms may be classified as follows :

i) Based on size

- a) Macrobenthos (more than 0.5 mm) eg. Crab, insects and their larvae, other crustaceans, molluscs such as gastropods, polychaete worms.
- b) Meiobenthos (Size 0.1 – 0.5 mm) eg. Ciliates, annelids, copepods
- c) Microbenthos (size smaller than 0.1 mm) eg. Bacteria, flagellates, ciliates.

ii) Based on mode of nutrients

- a) Phytobenthos : Autotrophic life, include varieties of algae, flowering plants and other angiosperms, sea grasses etc.
- b) Zoobenthos : Heterotrophic life, range from microscopic to macroscopic organisms.

iii) Based on mode of life and area of dwelling

a) Epibenthos : Live on top of the substratum regardless of whether the bottom sediment is soft or hard rock. eg. benthic molluscs, crabs, prawn, macrophytes, worms, micro algae.

b) Endobenthos : Live within the substratum regardless of its type. Interstitial fauna may be included under endobenthos, mainly borers and burrowers.

iv) Based on Mobility

a) Sessile : They do not possess any form of mobility but remain attached to the substrate.
eg. Fresh water sponges, macrophytic and microvegetation

b) Vagrant : They possess locomotive powers and can move either rapidly or slowly eg. shelled macro – invertebrates, worms etc.

v) Based on ooze film

a) Ooze film assemblage : Ooze forming / secreting organisms.

b) Associated ooze film assemblage : organisms associated with ooze film.

Periphyton

Periphyton are a miscellaneous assemblage of organisms growing upon free surfaces of objects submerged in water frequently appearing as a brownish green slimy, slippery layer. It commonly found on plants, wood, stones and various other objects. It seems to develop in littoral and sub-littoral regions. Periphyton may not always be regarded as true benthos as they tend to grow on any solid support and likely to contain plankton and benthic organisms

Distribution of benthos

Qualitative distribution

At different bottom conditions and exposure to wave action diversify the littoral zone and makes differences in fauna and supports different kinds of animals.

- Depth and quality related distribution
- Decreasing diversity and numbers with increase in depth
- Mostly of uniform distribution

The following animation shows the qualitative depth relations of two American lakes

The littoral and sub-littoral populations, insects and molluscs comprise as much as 70% of total number of different components. Increasing depths beyond the littoral zone, the number of benthic organisms may diminish namely Bryozoans, Platyhelminthes, Snails, Bivalves, Nematodes, Annelids, insects etc. especially at first 18 m depth. There is no constancy of composition of different types of lakes because lakes do not have profundal benthic animal population. Even within a single lake different composition of population occur at different places.

The nature of the bottom has selective influence upon the quality of the fauna. Baker (1981) classified bottom materials in the littoral zone of lake Oneida into 6 different types namely mud, sand, clay, gravel, boulders and sandy clay. Microfauna exists in the bottom deposits is also established and hence microorganisms are considered as bottom dwellers and appear as :

- 1) free swimming or
- 2) free swimming only in some stage of life cycle or
- 3) always spend most of time on the bottom materials

Bigelow (1928) divided littoral benthic microorganisms of lake Nipigon, Canada into two ecological groups :

- i) the ooze-film assemblage and
- ii) the associated ooze-film assemblage

The former group comprises those microorganisms living in and on that film of ooze at upper surface of the lake bottom contain certain algae, including diatoms, protozoa, rotifers and

cladocerans, while the latter directly dependent upon the ooze film and swim very close to it eg, Cladocerans and rotifers .

Quantitative and Qualitative movements, seasonal changes and migrations of benthos

Quantitative distribution

In shallow lakes, the entire bottom is uniformly productive. The growth of bottom dwellers, whose quantity of produce at different depths especially in shallow lake, is not same.

The deeper inland lakes can be divided in to 2 groups 1) Those which do not develop chemical stratification during summer and 2) Those which become chemically stratified and remain so throughout the summer period.

In non-stratified deeper lakes, the benthic forms extend much deeper into the basin resulting in greater mass production. However, in stratified deeper lakes during summer, the bottom region exposed to hypolimnic conditions lead to less production quantitatively than the regions above them.

Movements and migration of benthos

Under certain circumstances, the benthos exhibits movements within or on the bottom. Certain other organisms move up and down in streams. Moffett (1943) observed movements of bottom organisms on large wave swept shoal and found some changes in space due to bottom shifting.

Moon (1935) found that :

- (a) the littoral fauna in lake Windermere is in a continual state of movements
- (b) this fauna is sensitive to changes in surface level of the lake
- (c) more active elements of the fauna move quickly into the inundate portions of the beach and
- (d) a rise in surface level only 2.5cm is sufficient to produce a movement of the fauna.

Seasonal changes in benthos

Little is known about the seasonal changes in benthic organisms. In very shallow lakes, the seasonal changes in the whole benthic region are essentially the same as those which prevail in the littoral zone of deeper lakes. In the abyssal regions of deeper lakes which never overturn and hence the benthic conditions remain same throughout the year. Benthos are known to show different morphological changes with respect to different seasons (spring, summer, autumn and winter) at different zones (littoral, sub-littoral and profundal). In some lakes, the organisms may compose the overwhelming bulk of entire population and significant fact that each profundal species manifests similar and corresponding seasonal increase and decrease magnitudes, which are characteristics of the species.

Origin and permanence of profundal bottom fauna

The preformed bottom fauna occurs in inland lakes is composed of forms which occur in neither peculiar nor restricted to the profundal region, they seem to occupy also the sub-littoral and some extent the littoral zones. The bottom fauna is not qualitatively unique but is composed of representative of a few species belonging to larger littoral and sub-littoral population. During spring and fall overturns, these population spread down the lake bottom into the profundal region bringing into not only the greater numbers of individuals but certain additional species characteristics.

However, the gradual development of stagnation at the bottom bring about a condition which some of the species cannot under go. Occasionally in unusually deep lakes, certain animals occur which never come to shallow depth (above 50m). Hence, it appears that profundal bottom forms are not truly a permanent profundal fauna but may themselves be eliminated completely or partly by exposing to stagnation.

Vertical distribution of profundal bottom fauna

Evidently it has been assumed that the profundal bottom fauna largely confined to the uppermost layer of the bottom deposits. Information secured by Lenz (1931) who by using constructed bottom

sampler was able to bring virtually undisturbed, vertical samples of bottom deposits to the surface and then isolating and examining horizontal strata in their unaltered relations. Various horizontal levels have been studied down to a depth of 24cm. The largest part of the fauna occurred in the upper half of the sampler. Some difference appeared in the vertical distribution of various organisms for eg, Tubificidae concentrated in the upper position, while Chironomus were distributed from the surface of the mud to a depth of 20cm or more. Moore (1939) indicated and noted that there was an obvious similarity in the vertical distribution of micro and macro benthos.