LECTURE NOTE ON FIS 305
FIS 305 – LIMNOLOGY (2 UNITS)

What is Limnology?

It is simply defined as the science or study of freshwater bodies. The study involves the physical and chemical features of the freshwater (FW) and the life forms that exist in such bodies mainly the streams, rivers, lakes and reservoirs. It is a branch of Hydrobiology

Hydrobiology

Give further illustrations in the class. The Course is introductory.

Limnology (freshwaters)

Oceanography (Brackish water and Marine water)

Classification of Aquatic environment

Based on salinity or chlorinity is equivalent to the salt content in the water (i.e. Cl^- present in one litre of water) aquatic environments are described as thus:

(a) Oligohaline – water contains very low salinity usually less than 1‰

(b) Mixohaline – volume of water with highly variable salinity, it can be from 1-30‰

(c) Mesohaline – water with medium salinity ranging from 10-20‰

(d) Metahaline – water contains very high salinity usually above 30‰

Note that it is assumed that life started from aquatic environment and this view is further supported by the marine plankton (especially phytoplankton) supplying O_2 for the earth. Hence, study of aquatic environment is vital to life on earth. Aquatic environment serves not only as habitat for its inhabiting organisms but it is a source of gaseous exchange, source of nutrients and medium for disposal of waste products of metabolism.

Also, based on the nature of habitat, aquatic environment can be divided into 3 groups for easy description:

(i) Marine water/habitat – is metahaline, very high salinity ranging from 30-40‰ (av. 35‰). Exception is found e.g. Baltic sea in Europe has salinity ranging from 7-35‰. Above this range are the Red sea and Mediterranean sea having salinity range of 40-43‰ - thus referred to as hypersaline. This is due to high evaporation in their locations. One feature of the marine water is that the relative concentrations of different salts do not vary markedly. Salinity along the coast is usually lower than the normal range due to rivers and flood water with virtual zero salt flowing into it thereby lowers the salinity. Other examples of marine water are the oceans e.g. Atlantic, Indian, Pacific oceans etc.

(ii) Brackish water – is mixohaline ranging from 1-33‰ depending on the season e.g. Lagos lagoon in rainy season is as low as 0.9‰ and at the peak of dry season – 31.8‰. other examples are the estuaries, creeks and bays.

(iii) Freshwater – is oligohaline i.e. low salinity. In most cases, the salinity is less than 0.5‰. Examples are the rivers, streams, ponds, lakes and reservoirs which are inland waters. Note that some inland waters may not be fresh water by having more than 1‰ e.g. the Great salt lakes in North America have higher salinity, Lake Elmentia (East Africa) has about43‰. Hence, not all inland waters are necessarily fresh water.

Classification of Freshwater (FW). FW is the core of this course.

FW may be considered into 2 groups based on the presence or absence of unidirectional current.

(A) 1st Series – Lotic water is otherwisely called 'runnng water' i.e. lotic water shows unidirectional movement. It includes spring, streams, rivulets, rivers. Rivers column of water moving from inland areas towards the sea. They usually have slow motion during dry season.

Note that motion is expressed as rate of flow or stream velocity. Also, note that rate of flow is equivalent to discharge rate defined as the volume of water passing an observation point in a specific unit of time. Expressed as cubic metreSec^{-1} or cu.ftSec^{-1}. The discharge rate increases towards the sea as the main river is joined by many tributaries. Motion may be even i.e. water particles move parallel to one another.
In such column, water is said to exhibit laminar flow. Motion may be quite irregular hence showing turbulence. High turbulent water has higher erosive power and high concentration of dissolved O_2 than rivers with Laminar flow.
Lotic water is sub-divided into 3 types:
(i) Ephemeral lotic water – short living, water appears for a short time e.g. few hours or days especially during the rainy periods e.g. run offs.
(ii) Intermittent lotic water – Are streams or even rivers which flows seasonally i.e. seasonal rivers. Live longer than ephemeral. Give your local example e.g. Alaata river
(iii) Perennial lotic water – permanently flowing rivers e.g. R.Ogun, Niger river etc.
Each of these lotic water can be divided into zones as Rapid zone – shallow, fast current and firm bottom and the Pool zone which is deeper, slower current and soft substratum. Illustrate all these with further examples.
(b) 2nd Series – Lentic waters – Have multidirectional currents. Can move in any direction and hence referred to as 'standing' waters. Examples are swamps, ponds, lakes, man-made lakes/reservoirs. A lentic water has basically three zones:
Littoral zone – shallow parts of the water with light penetrating to the bottom
Limnetic zone – Ends where the light penetration is effective. It is the open part of the water.
Profundal zone – This is the bottom and deep part of the water which is beyond the part of effective light penetration. It is called the dark region of the water and usually no green plants survive in the zone. Give the diagram during lecture hours.
It has to be noted that the boundaries between these zones are not rigidly defined. For example, seasonal rivers may be lotic in the rainy season and turns lentic in dry season. Rivers can be turned into artificial lakes e.g. through human factor or geographical/geological factors. For example Oxbow lake, volcanoes forming crater lakes, tectonic lakes or Graben lakes formed by movement of the deeper portion of the earth (i.e. upward e.g. Caspian sea; downwarp e.g. L. Tangayika, L. Baikal (deepest). Thus, the classification of the freshwater bodies is not rigid and can be changed by any of these factors.
Importance of FW: FW habitat is very small and confined. Usually surrounded by land and thus the organisms are localized. FW provides the cheapest and most convenient source of water for domestic and industrial uses to man, useful for waste disposal system especially in advanced countries. FW is also important for agriculture e.g. irrigation and raising fish for human consumption.
Important features of comparison between lotic and lentic waters will be fully discussed in class. For instance, in lotic water, the flow is often turbulent but in standing water the flow if any is rather gentle: stratification is rare and unimportant in lotic water in view of the turbulent flow but this is important in lentic water even though convection currents sometimes mix up the layers/strata. In running water, plankton are poorly developed because most of them are eliminated by floods and turbidity e.g. rotifers and diatoms. The benthic flora and fauna are richer in species and adapted to movement of the water. Whereas in standing water, the fauna and flora are well developed. Etc