# Fresh water Ecology

The nature of all aquatic environments depends upon the following factors which exert their effects in varying degree:

**i) The depth of water**

Has an important secondary effect by reducing the penetration of light and hence the degree of colonisation by plants.

**ii) Light**

Water absorbs light of long wavelengths, particularly the blue part of the visible spectrum. Since this would not normally be sufficient for photosynthesis, many freshwater plants possess adaptations so that light does not become a limiting factor in their growth.

**iii) Substrate**

Streams that carry a large amount of sediment in suspension (e.g. due to a muddy stream bed) may have a decreased amount of light available to submerged aquatics. A muddy stream bed may also pose problems to the attachment or respiration of animals, and can lead to a build up of semi decomposed organic matter. This can lead to a high biological oxygen demand (BOD) and the water becoming anoxic, killing off most life.

**iv) Temperature**

Water possesses certain thermal properties which make it a unique environment. In particular, it has a high specific heat, high latent heat of fusion and the highest known latent heat of evaporation. The combination of these properties explains why temperature variations occurring in water are less than those on land. Moreover, when they occur, they take place far more slowly. Most aquatic organisms are well able to tolerate the normal range of temperature variations that occur throughout the year and are known as eurythermous. Species with a narrow temperature tolerance (stenothermous) tend to be restricted in their distribution to particular habitats such as the sources of mountain streams, where the temperature of the water changes little throughout the year.

Another important physical feature of water is that it achieves its maxiumum density at 4°C. Above and below this temperature it expands and therefore becomes lighter. This accounts for the fact that deeper waters never freeze solid in cold weather - an important consideration for the animals that live there.

**v) Availability of Oxygen**

Freshwater contains significantly less oxygen than air, causing aquatic animals to need to move much more of the surrounding medium than land organisms, to extract the equivalent oxygen. The availability of oxygen relates closely to the development of gills and other respiratory organs. Some burrowers in mud, such as the lavae of some Diptera make use of respiratory pigments like haemoglobin which aid oxygen uptake, indicating the degree of adaptation to anaerobic conditions.

Fast flowing water, because of its turbulence, will tend to be saturated with air, or nearly so, in contrast to static water where the oxygen supply may become depleted, particularly during winter.

**vi) The buoyancy of the water**

Since water is a denser medium than air, it is more buoyant, and the upthrust exerted on plants and animals enables them to survive without having to support their own weight. They do not have skeletal support or the need for the accompanying musculature which means that their structure can be of a more diverse and delicate kind than that necessary for life on land.

**vii) Surface Tension**

Aquatic insects may use surface tension to run over the surface of the water (pond skaters), to adhere breathing tube to the water surface (e.g. water scorpions), or to enclose bubbles of air around their bodies (e.g. water boat men).

**viii) The chemical composition**

Changes in nitrate levels resulting from organic pollution may affect the ecology of a river or stream directly. The use of nitrate fertilisers, or the break down of sewage, silage can lead to an algal bloom which may cause changes to the effective substrate by trapping and creating organic matter altering the ecology and oxygen levels.

Inorganic pollution such as dissolved heavy metals (e.g. copper) can have disastrous effects on fresh water ecology.

In streams and rivers water flowing over calcareous rock such as chalk or limestone will tend to be 'hard' with a high pH value. Such conditions favour calcicole plants and animals with calcareous shells such as gastropod molluscs and crayfish.

**ix) The existence of a current**

The existence of a current gives rise to the following features:

§ The eroding impact of a current tends to wash away the smaller and lighter soil particles such as clay, also the finely divided organic matter (detritus). These materials tend to accumulate on obstructions such as stones and the roots of plants. When the flow of water is slow, mud tends to accumulate at the sides of a stream and supports a characteristic flora and burrowing community of animals.

§ The churning action of the water maintains it in a state of almost permanent saturation with air. Moreover, it tends to bring about local uniformity of pH and temperature, and the distribution of dissolved substances.

§ The force of the current also tends to wash away all living organisms other than those which are either rooted, capable of finding shelter, or powerful swimmers. Plankton is therefore largely absent from streams and rivers, which accounts for the limited range of species found in them compared with that of still water.

In spite of the eroding effects of flowing water, streams frequently support an abundance of plant and animal life which displays a variety of adaptations:

i) Attachment mechanisms - many plants have well developed rooting systems anchored firmly in the substratum of silt or gravel. The colonists of the surfaces of stones tend to be filamentous algae which have an adhesive outer surface, or mosses such as the willow moss, which have well developed rhizoids that are able to penetrate small cracks in the rock surface. Many animals also have adhesive structures, ranging from the sponges and small protozoans, to large insects such as the encased lavae and pupae of many caddis fly species.

ii) Suckers and hooks - Suckers are characteristic of many small insects such as the lavae of the midge. They are also a feature of the leeches and the brook lamprey, with its circular mouth. Some caddis larvae are web spinners and these have hooks at the rear of the body which serve as anchors.

iii) Body surface - Many stream plants have mucilage on the surface of their leaves and are slimy to touch. No doubt this plays some part in reducing friction against the substratum. Among animals, planarians have a slimy adhesive surface, while gastropod molluscs like the wandering snail have a muscular foot which is well supplied with mucous glands.

iv) Stream lining - The stems and leaves of many aquatic plants are streamlined to some extent whilst others produce floating and submerged leaves enabling the plant to flourish in both flowing and static water. The shape of most of the animals found in streams tends to be bluntly rounded in front tapering to a narrow point behind. This is the shape that reduced the 'drag' of the water to a minimum, thus lessening the effect of the current and facilitating more rapid movement. Many animals living in mid-stream have achieved some degree of flattening as well such as the large mayfly nymphs.

v) Behavioural responses - In general, stream animals face and move upstream. This facilitates the use of gills in gas exchange and also the capture of food floating towards them. Another response is a tendency to cling to any surface with which the body comes into contact. This is particularly important for small molluscs whose powers of locomotion and avoidance of an excessive current are limited.