

## **POLLUTION TOLERANCE OF FRESHWATER INVERTEBRATES**

**STONEFLIES** - These insects are the most sensitive group to organic pollution such as sewage and farm slurry and are then the first to disappear. They are therefore clean water indicators but are however fairly tolerant of acidified waters and streams suffering mild metal pollution.

**MAYFLY (Ephemeridae)** - These large nymphs burrow into the silt in slower flowing reaches of rivers. Water flows through the burrows and needs to contain plenty of oxygen if the nymphs are to survive. They are therefore very sensitive to sewage and slurry which quickly removes oxygen from solution. They are not found in acidified streams.

**BLUE-WINGED OLIVE (Ephemerellidae)** - These nymphs are common in water weed and river moss and are pretty sensitive to sewage and slurry pollution and quickly disappear when oxygen levels fall.

**FLAT-BODIED MAYFLY NYMPHS (Heptageniidae)** - These are adapted to living on stones in fast water with plenty of oxygen and again are very sensitive to organic pollutants.

**OLIVE NYMPHS (Baetidae)** - These are fast swimming streamlined nymphs living in fast well aerated streams. They need plenty of oxygen and therefore dislike organic pollution. One species, the Large Dark Olive, can however tolerate some mild sewage/slurry pollution.

**CASED AND CASELESS CADDIS** - These groups are also indicators of clean water but can nevertheless tolerate a little mild organic pollution.

**FRESHWATER SHRIMP (Gammarus)** - These prefer clean water but can tolerate some mild sewage/slurry pollution.

**HOG LOUSE (Asellus)** - These feed on detritus and decaying organic material and can tolerate lowered oxygen levels. When present in good numbers they often indicate mild organic pollution or recovery from more serious pollution.

**SNAILS** - These are mainly herbivores feeding on green algae. Many are air breathing and can come to the surface to breathe if oxygen levels are low. Thus although preferring well-oxygenated waters they can still thrive in moderate organic pollution.

**LEECHES** - These are found in all streams but are tolerant of low oxygen levels and if present in large numbers they often indicate organically polluted waters where they feed on the larger numbers of bloodworms and sludge worms that are then usually present.

**BLOODWORMS (Midge larvae)** and **SLUDGE WORMS (Nais and Tubifex worms)** are pollution indicator organisms. These are not recorded in the Riverfly Partnership sampling. The absence of stoneflies etc is sufficient indication of the presence of organic pollution. Although present in small numbers in all streams they are tolerant of very low oxygen levels and are often present in very large numbers feeding on decaying organic material in streams badly polluted with sewage or slurry. Members of these groups often contain blood pigments with a high affinity for oxygen and can survive in waters where this gas is present in only low concentrations. They can then thrive on the rich supply of nutrients found in the sewage and slurry and will be present in large numbers because the lack of oxygen has killed off the clean water organisms with whom they would otherwise have to compete. **Note** that if streams are polluted by insecticides such as sheep dip all the insect groups may be severely reduced or wiped out over several miles of stream leaving perhaps only non-insect groups such as the snails, leeches and various aquatic worms etc. Fish species will then die from lack of food. An unpolluted river or stream will contain a wide range of invertebrate groups and the clean water indicator species will be present in good numbers. In a river polluted with organic material bacteria break down the sewage/slurry to release nutrients but remove vital oxygen in the process. Pollution sensitive species will disappear, species diversity will be much reduced and the pollution tolerant species remaining may be present in very large numbers. As the river recovers further downstream of the entry of the pollutant the clean water organisms will gradually reappear with improving oxygen levels and the numbers of pollution indicator organisms will decrease as a result of increasing competition. The most pollution sensitive groups such as the stoneflies will be the last to reappear.

**Note also** - we should remember that salmonid fish are the most pollution sensitive of all the organisms living in our rivers and streams and are the ultimate clean water indicator organisms.