How are aquatic invertebrates adapted for gas exchange?

Some of the invertebrates that were observed had a large surface area to volume ratio like the flatworm, which was found close to rocks in shallow areas. The flatworms are able to flatten themselves, which increases the surface area meaning there is less distance internally in the flatworm meaning the amount of diffusion is reduced.
In deeper areas of the river oxygen is in short supply so when the organisms go the surface maximum oxygen needs to be collected. This can be done by the use of hairs called plastrons on the under side of the abdomen to collect an air bubble from the surface so the organisms can return to the depths of the water and use the oxygen it has collected until it runs out. This sort of adaptation can be found on water beetles such as platambus maculates.
There were some aquatic invertebrates that have tracheal gills that are seen by the small plates on the side off the organism with are linked to the tracheal system. An example of an aquatic invertebrate with this adaptation is the stonefly nymph, which was located in deep areas of slow moving water as it can get the oxygen it needs through this form of gas exchange.
There were also organisms that had a circulatory system meaning that the oxygen they need is quickly transported via the blood that has obtained the oxygen by diffusion. The surface area to volume ratio also contributes to the high oxygen levels taken in. This adaptation was in the leeches that were observed where there is a steep diffusion gradient to supply the organism with oxygen to diffuse to the capillaries to the rest of the body; the oxygen is obtained from the oxygen rich water around the leech that is diffusion through the permeable and very thin skin.
Some of the aquatic invertebrates that we observed contained a respiratory pigment called hemoglobin, which is found in the blood which increases the amount of oxygen that the invertebrate can carry meaning the organism will not need to rise to the surface as often to get oxygen, and this also reduces the organisms movement, using less A.T.P. in the process. This is useful for invertebrates such as leeches that live in deep water where not much oxygen is found.
One of the other forms of respiratory structures that were observed in the river were aquatic invertebrates with breathing tubes or siphons that need to rise to the surface for the oxygen. These invertebrates live in the slow moving part of the river where they are not going to be washed away in the current while they are collecting the oxygen they need. When the organism needs oxygen it makes it's way to the waters surface with its breathing siphon just exposed at water level. The organisms breathing siphon can be 6cm or more in length meaning it doesn't raise any higher to the surface

then it has to. In some cases the end of the siphon exposed to the atmosphere is covered with dense, tiny hairs, which stop water from getting into the siphon. An aquatic invertebrate with a siphon that was found during the observations of the river was a drone fly larvae or known as a rat-tailed maggot this was found in the shallow slowing moving part of the river.

In gastropods such as fresh water snails they have been adapted by having a lung in the mantle cavity, which they use for gas exchange. They need to rise to the surface for the oxygen they need, this organism can cope with different amounts of oxygen concentration in the water it just rises to the surface more often to obtain oxygen. Occasionally these organisms may contain a respiratory pigment with means the concentration of oxygen it there blood is even greater.

In the deep parts of the river organisms with swimming limbs can be found were they can travel from the deep, slow moving parts of the river to the fast flowing surface of the river, when they reach the surface they can take in the oxygen they need. There bodies are flattened each side so they travel though the water in a streamline way to reach the top as quick as possible. An aquatic invertebrate with these adaptations that was found in the river was a freshwater shrimp or gammarus,

Freshwater limpets were found in the fastest moving water in the river as these organisms can cling to the rocks and never have to move meaning they need very little oxygen at all.

The adaptations that are found on these aquatic invertebrates are all different to each other as it depends on where the organism is located in the river, the shallow areas, deep areas, or the riverbed.

Invertebrates that live in shallow water areas are adapted to intake the oxygen they need for a short period of time and organism that live in deeper water need as much oxygen as they can obtain.

The aquatic invertebrates that live in the deepest areas of the river are the most adapted out of all the organisms observed as these need to diffuse the oxygen from the water itself.