

ACTIVITY TWO: INVESTIGATING THE HEALTH OF OUR RIVERS

This LIFE SCIENCES lesson looks at visible animal life to determine the health of our rivers and streams.

MiniSASS is a simplified form of the South African Scoring System. It is a technique that can be used to measure the health of a river and the general quality of the water in that river. Developed by Umgeni Water and Ezemvelo KZN Wildlife, it uses the composition of invertebrates living in rivers and is based on the sensitivity of the various animals to water quality. It does not, however, measure contamination of the water by bacteria and viruses and thus does not determine if the water is fit to drink without treatment.

The MiniSASS is a miniature version of the more sophisticated SASS method that is used as part of the National River Health Programme. The results produced using MiniSASS have been tested against the more rigorous SASS method and have been found to be sufficiently close to be of real value.

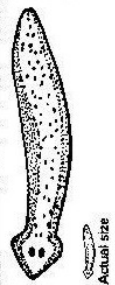
Are you ready for some environmental action?

Method:

1. The best sites to find insects in a nearby river are where the current is fairly fast moving and where there is some vegetation growing in the water, along the sides of the river.
2. Look for invertebrates in as many of the different habitats (biotopes) you can find at a river site. Insects are collected holding a small net (a kitchen sieve will do) in the current, and then disturbing the stones, vegetation and sand using your feet (with boots on!) or hands just upstream of the net. Be bold in turning the stones over. The insects will be dislodged and will flow into the net. Do this for about 5 minutes while ranging across the river to a number of different habitats. You can also lift stones and pick off the insects with your fingers or you can brush off the underside of the stones with a clean paintbrush.
3. Rinse any mud out of the net then turn the contents into a plastic tray (a 2 litre ice-cream container is ideal). Identify each group using the sheet given on page 6 (keep a tally of the number of each group). If the river is in reasonable condition, you should have several hundred individual insects in the sample.




Flat worms
SCORE 3



Actual size

Soft bodied worm-like form but flattened shape. Dark grey colour; head arrow shaped with a pair of dorsal eye spots. Move with a gliding movement over the substrate and are generally scavengers or carnivorous.

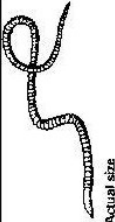
Leeches
SCORE 2



Actual size

Variable colour from grey to red, brown and black. Body very flexible, extending long and thin while moving but contracting into a short stubby shape when disturbed. Often uses suckers at front and rear to aid movement and will stick tightly onto the surface. Also swim with a fast snake-like movement. Often found under stones, vegetation or debris and are common in polluted water. Mostly carnivorous on other invertebrates, with a few blood suckers occurring mainly in the more tropical regions.

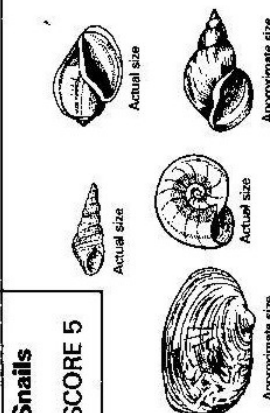
Worms
SCORE 2



Actual size

Elongate cylindrical shape much like small earth worms. Colour usually pink to brown. Seen writhing around in debris where they feed on deposits. Tolerant of very polluted water.

Snails
SCORE 5

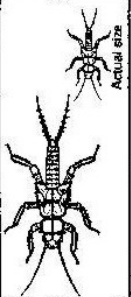


Actual size

Approximate size

There are a range of snails in rivers, including small black limpets which cling to rocks, clams or muscles found in sand, and the more common snails which move over stones and vegetation. Some of the latter are host to bilharzia, a most serious health hazard for humans.

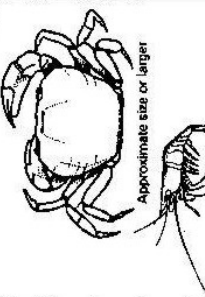
Stoneflies
SCORE 14
(26)



Actual size

The nymphs of an adult terrestrial fly, stoneflies usually have two long tails, robust bodies and legs each having two claws at the tip. Wing pads on the thorax are often dark and obvious. Some species (usually brown and yellow) run across the substrate very efficiently and are potent predators on other invertebrates. Other species are smaller and feed on plant material. Most live in well oxygenated clean water. When confined in a bottle or sample container, they soon start to bob up and down as if doing 'piss ups' as they try to get oxygen.

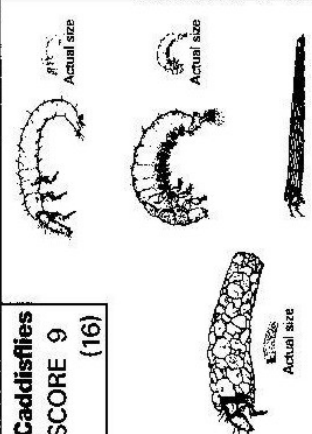
Crabs and shrimps
SCORE 6



Approximate size of larger Actual size

A large diverse group including crabs, shrimps, water fleas, sand fleas and pill bugs. Crabs and shrimps are the largest and most commonly seen in rivers. Crabs are scavengers feeding mainly on leaf litter but will feed on animals when given the chance. Shrimps are mostly scavengers or deposit feeders.

Caddisflies
SCORE 9
(16)



Actual size

These are the aquatic larvae of adult caddisflies. Most caddisflies have a hard head with three pairs of legs. The abdomen is long and smooth except for some which have gills along the under surface. Some caddisflies swim freely in rivers, other take up a 'house' made up of a reed or piece of grass, or construct a case of grains of sand or other matter. Still others construct nets under stones which they use for protection and also to catch food. Some feed on algae and detritus while others are predators.

Mayflies
These are the nymphs of small delicate mayflies that fly close to rivers and lakes, usually swarming in the early evenings. Most only live for a day or two, never feed, and live to mate and lay eggs in the water. The nymphs hatch from the eggs and take months to develop. Most mayflies have three tails although occasionally some have two which can lead to confusion with stoneflies. Mayflies have only a single claw at the tip of each leg and have visible gills on the side or back of the abdomen.

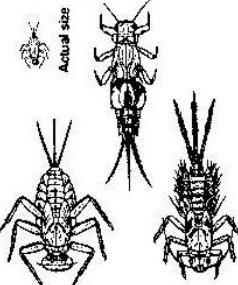
Minnow mayflies
SCORE 5



Side view Actual size

Minnow mayflies all belong to the family Baetidae. These mayflies are most easily recognised by their strong, fish-like way of swimming, darting rapidly about in the container. They have a narrow head and a humped back which gives them an arched appearance when viewed from the side. Their bodies are slender but not flattened. Minnow mayflies are very common in rivers and feed in a variety of habitats. A few species are tolerant of some pollution but others are sensitive.


Other mayflies
SCORE 13



Actual size

Besides the minnow mayflies above, there are a number of other mayfly families present in rivers, many of which are less tolerant of pollution than the minnow mayflies. They occupy a variety of habitats, from burrowing in mud to crawling amongst decaying leaves, to scurrying over stones in the fastest of currents. They have a variety of different shapes as illustrated and also feed on a range of foods.

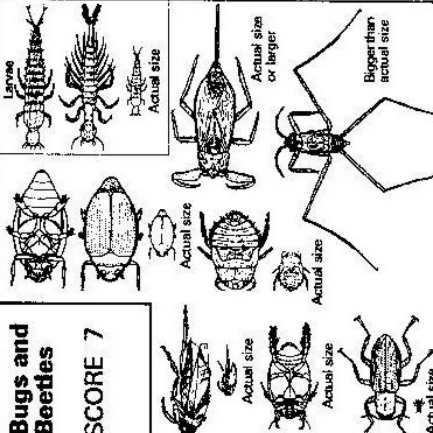
Damselflies
SCORE 4



Actual size

The nymphs of damselflies are all carnivorous feeding on other invertebrates. They have a 'mask' over the lower part of the 'face', which hinges out to reveal a pair of pincers with which they catch their prey. Damselflies have elongated bodies with three broad tails on the tip of the abdomen. They walk slowly over the substrate, or swim slowly with a sideways flexing movement.

Bugs and Beetles
SCORE 7

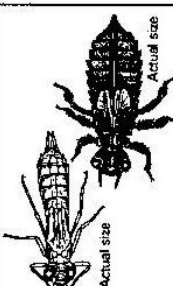


Actual size

Bigger than actual size

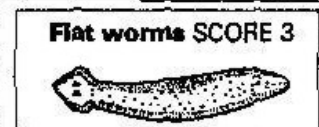
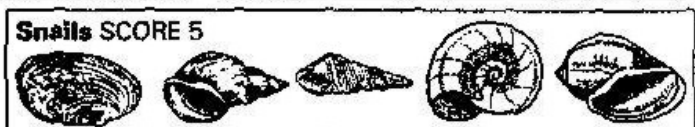
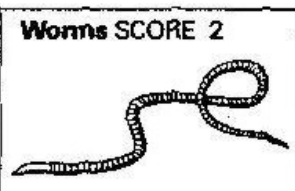
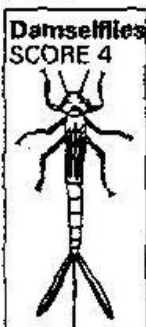
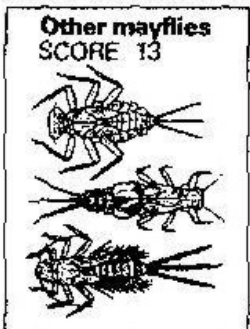
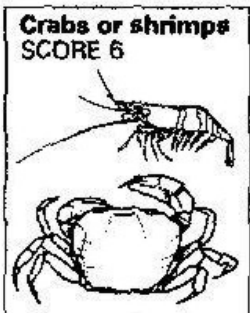
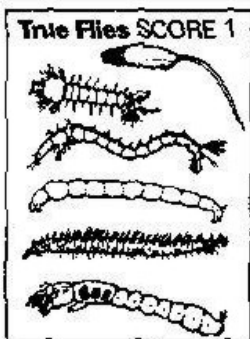
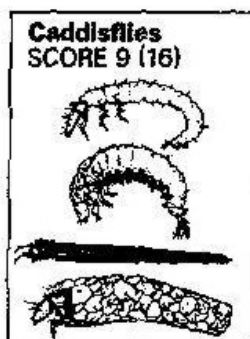
These are two very distinct groups of insects, bugs having a piercing and sucking beak with two pairs of membranous wings, while beetles have 'jaws' and the outer pair of wings are hardened. In most of these insects, both the adult forms with wings, and the larvae, occur in water. There is a range of bugs including water boatmen, backswimmers, water scorpions, water bugs, pond skaters and water striders. Most are carnivorous but some like the backswimmers feed on algae. Others like the water scorpion and water bugs, catch prey with their front legs and pierce the body with the beak, sucking out the insides. The beetles have proper mandibles or 'jaws' and feed on a range of foods including vegetation and other animals. Included here are whirligig beetles, predaceous diving beetles and riffle beetles. They are often seen in the larval form which differs from the adult form. Some of these are illustrated.

Dragonflies
SCORE 6



Actual size

Dragonfly nymphs are more robust than damselflies having stouter bodies with a larger head and 'mask'. Some have short while others have very long legs. They are generally large and will usually be the largest organism found in a sample with the exception of crabs. The do not have any tails and when disturbed, will swim using 'jet propulsion' by forcefully ejecting water from the abdomen. Some species live under rocks while one common species crawls over sandy river beds making snake-like tracks in the sand. Dragonfly nymphs are probably the most powerful invertebrate predators in rivers, and will even take small fish and tadpoles.



mini SASS **UMGENI**
WATER · AMANZI
A community river health monitoring tool for South Africa.

March 2000

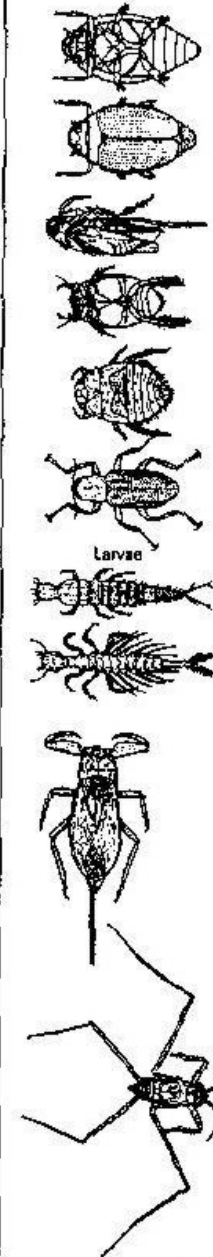
SCORE SHEET

Circle the score of each group found

(Scores in brackets- to be used in Western Cape)

GROUPS	SENSITIVITY SCORE	
FLAT WORMS	3	
WORMS	2	
LEECHES	2	
CRABS OR SHRIMPS	6	
STONEFLIES	14	(26)
MINNOW MAYFLIES	5	
OTHER MAYFLIES	13	
DAMSELFLIES	4	
DRAGONFLIES	6	
BUGS OR BEETLES	7	
CADDISFLIES	9	(16)
TRUE FLIES	1	
SNAILS	5	
TOTAL SCORE		
Number of groups		
AVERAGE SCORE (divide total by number of groups)		

Bugs or Beetles
SCORE 7



Calculating your river's MiniSASS score

1. For each of the groups found in your sample, circle the score on the table on page 8.
2. Total the scores and divide by the number of groups found. This will give you an average score. MiniSASS produces a single score which is similar and comparable to the average score which is produced by the more complex version of SASS.

Interpretation

0 - 2	Highly impacted stream (poor condition)
2 - 4	Impacted stream (fair condition)
4 - 6	Slightly impacted stream (good condition)
> 6	Good quality stream (probably approaching natural condition)

On rare occasions, an incorrect result will be obtained when the average score is high but the sample only contained a few (1 to 3) insect groups. When this happens this means that the river is impacted or disturbed but in a way that favours some organisms.

Now that you have calculated and interpreted your river's MiniSASS score, display a summary of your results in the form of a poster – be creative and add as much details as possible, without making the poster too text heavy.

Remember to return all the insects back to the river.

Criteria to assess learners during this life sciences lesson

Criteria	Outstanding	Meritorious	Satisfactory	Adequate	Partial	Inadequate
The learner followed the instructions given by the teacher						
The learner collected insects and added the data to a table						
The learner designed a poster to display a summary of their MiniSASS results						