ORASECOM

THE ORANGE-SENQU RIVER COMMISSION

Joint Basin Survey-1

ORANGE - SENQU RIVER COMMISSION
BOTSWANA LESOTHO
ORASECOM
NAMIBIA SOUTH AFRICA
Established 2000

2010

Setting the baseline water resources quality in 2010

"One river, four nations"

Water, especially in southern Africa, is one of our most precious natural resources. Water is not only becoming severely limited as demands grow, but rainfall is highly variable and unevenly spread across the region. Frequent droughts, often broken by severe flooding, have had an impact on all our lives, affected our economic growth and have posed real challenges for our water managers. Climate change promises to further exacerbate these challenges.

These water management challenges are even more significant when water crosses borders. In these cases, water managers in different countries need to work together to share the resources and maximise the benefits for all. We will need closer cooperation if we are to continue to grow our economies, address poverty and protect the shared environment.

The Southern African Development Community (SADC) has led the way by providing a framework for countries sharing river systems to come together to address these challenges from a common platform established by all the countries sharing water resources.

The Orange-Senqu River Commission (ORASECOM) was established to do just this. The organisation was established through an agreement between Botswana, Lesotho, Namibia and South Africa – the four countries that share the water resources of the basin. ORASECOM is founded on the provisions of the Revised SADC Protocol on Shared Watercourses and is one of the first Shared Watercourse Institutions to be established under this Protocol. This year, ORASECOM celebrates a decade of collaboration and cooperation.

The ORASECOM Agreement signed on 3 November 2000 tasks us with advising the Governments' of the four Contracting Parties on the development, use and conservation of the water resources of the Orange-Senqu River System. ORASECOM has, over the last 10 years, focussed its attention on building a common understanding of the state of the River System, understanding the key factors impacting on the system and on developing the tools that will help us develop a joint Basin Wide Plan for the system by 2012. Already some of the studies have led to interventions that will improve water flows from, and protect critical wetlands, in the Lesotho highlands.

This Joint Basin Survey continues this spirit of cooperation and is the first such joint survey of the state of the system. This represents an important milestone in ORASECOM's development, underlining that we are "one river – four nations". We wish it every success.

Mr V. Bagopi **Head of Delegation** **Botswana**	**Mr K. Tau** **Head of Delegation** **Lesotho**	**Ms A. Shiweda** **Head of Delegation** **Namibia**	**Ms D. Twayi** **Head of Delegation** **South Africa**

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Foreword

One of the most important lessons coming out of the last two decades of global debate has been the recognition of the unity of the environment captured so poignantly and simply by the 1992 World Children's Conference as:

"We all live downstream!"

This concept is close to the heart of the Orange-Senqu River Commission (ORASECOM). Several clauses of the ORASECOM Agreement, as well as the Revised SADC Protocol on Shared Watercourses, require the Contracting Parties to jointly protect and conserve the environment of the shared watercourse.

We know that the cornerstone of this task must be a sound and common understanding of the state of the river system. ORASECOM has already made considerable progress towards establishing common methods for assessing Aquatic Ecosystem Health, water quality and water availability, as well as to share and build trust in the data from each country. We are now ready to test these procedures.

It was with this in mind that ORASECOM launched this first Joint Basin Survey (JBS-1) of the state of the system. JBS -1 aims to set the baseline conditions in the Orange-Senqu River System in 2010. This will serve as a basis against which the organisation can measure progress towards our common goals. It is the first joint survey of the whole river system, and we hope to be able to repeat this every five years.

Importantly, this survey is "Joint". It is not only being actively supported by all the ORASECOM Contracting Parties, but also by all the major support programmes. The European Union, Germany's gtz (Gesellschaft für Technische Zusammenarbeitung) BMZ (the German Federal Ministry for Economic Cooperation and Development), DFID (The British Department for International Development), and the UNDP – Global Environment Facility are all gratefully acknowledged for their valuable contributions. Similarly, the Lesotho Highlands Development Authority is gratefully thanked for their contributions.

However, the success of this survey will only be guaranteed through the contributions of the specialist staff from all four countries that contributed to its planning and who will contribute to the sampling effort and scientific discussions. To all these people, a hearty

Thank you

Lenka Thamae

Executive Secretary
ORASECOM: Secretariat

Contents

The Lower Orange River

Introduction

“You can’t manage what you can’t measure”

To effectively manage our water resources, we need to understand that the state or health of the system and the factors that impact on the system. A Preliminary Transboundary Diagnostic Analysis (www.orasecom.org/publications/undp.aspx) provided significant progress by identifying key problems and their causes.

Work on understanding the system and the impacts on the system is continuing. However, monitoring is complicated in river systems that cross borders between countries. In these cases, we not only have to share data and information, but may have to develop common methodologies for measuring so that data from one country can be directly compared to that from another country.

Importantly, therefore, the ORASECOM Agreement requires the development of standard methods of collecting and presenting data on the state of the shared watercourse. ORASECOM has already made considerable progress towards this goal, by agreeing on a common method of assessing Aquatic Ecosystem Health, and on critical transboundary sites for assessing water quality. This progress can now be put to the test in this first Joint Basin Survey (JBS-1).

The intention of JBS-1 is to provide a snapshot of the quality of the water resources of the basin in 2010. This may serve as a baseline against which future improvements can be measured. The survey will be the first joint monitoring of the Orange-Senqu basin supported by all the Contracting Parties working together, and will provide assessments for a wide range of water quality, aquatic ecosystem health and ecosystem habitat (hydro-geomorphology) parameters. It is hoped that the survey can be repeated on a regular basis.

This booklet provides a brief overview of JBS-1 and is aimed at involving people living throughout the basin in the survey.

A brief overview

The Joint Basin Survey (JBS-1) will include samples from 50-60 sites scattered throughout the whole Orange-Senqu River System. It will be undertaken in October and November 2010, and will have four main components:

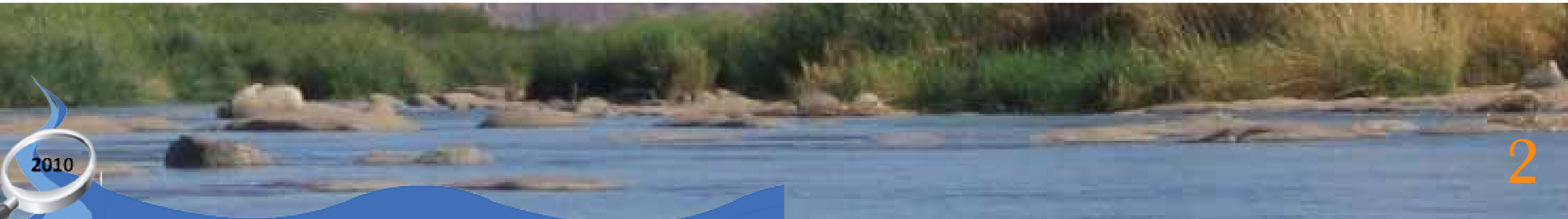
- **Aquatic Ecosystem Health**
  To assess the state of aquatic ecosystems based on the species found;

- **Persistent Organic Pollutants (POPs) and Metals Survey**
  To assess the presence of pollutants which may affect human health even when in low concentrations;

- **Water chemical and biological quality**
  To assess the impacts of major pollution sources on the system; and

- **Inter-laboratory benchmarking process**
  To help laboratories in all the countries establish quality control procedures.

The main focus of this effort will be to understand the current state of the system in terms of all these aspects, as well as the main factors causing degradation of the system. The Survey will not, however, identify individual sources of pollution.



Ms Colleen Todd sampling macro-invertebrates in the marginal vegetation.

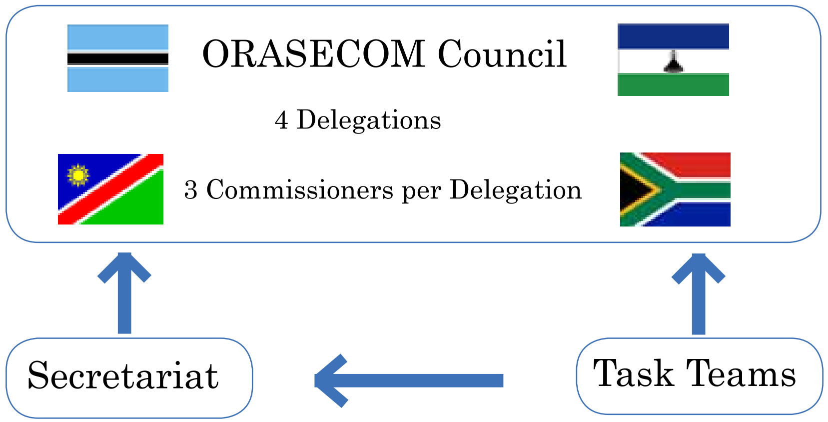
The Orange-Senqu River Commission (ORASECOM) was established on 3 November 2000 when the Ministers of Water in Botswana, Lesotho, Namibia and South Africa signed the ORASECOM Agreement.

The Commission has its origins in the Revised SADC Protocol on Shared Watercourses and is one of the first Shared Watercourse Institutions to be established under this Protocol. The highest body of ORASECOM is the Council, which is made up of four Delegations with three Commissioners each.

The Council is supported by several Task Teams which provide the scientific basis on which the Council can make decisions. A Secretariat was established in 2007 to support the organisation. The Secretariat is based in Pretoria, South Africa, where it enjoys diplomatic status.

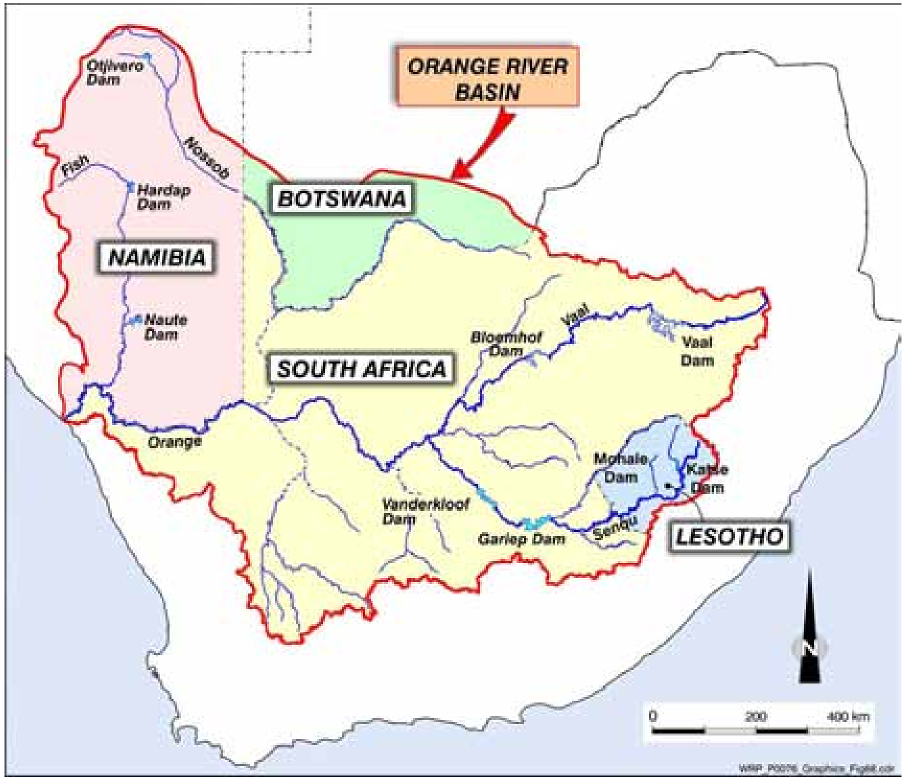
The ORASECOM Council advises the Governments of the Member States (the Contracting Parties) on matters related to development, utilisation and conservation of the water resources in the River System. This may include recommendations on, inter alia, water availability, equitable and reasonable utilisation of water resources, development of the river system, stakeholder participation, harmonisation of policies, and a standardised form of collection, processing and dissemination of data and information.

In addition, ORASECOM may advise Member States on the prevention of pollution and control of aquatic weeds, contingency plans for responding to emergencies, and a variety of procedural matters on water related development between the Member States. Secretariat operations are financed through equal contributions from all four countries, while South Africa supports the hosting of the Secretariat. At this stage several International Cooperating Partners (donors) are providing support to programmes run through the Secretariat.



The Orange-Senqu River system

The Orange-Senqu River originates in the Lesotho Highlands, from where it flows westwards to its mouth at Alexander Bay/ Oranjemund on the Atlantic West Coast of Africa.



The river basin is the third largest in southern Africa, after the Zambezi and the Congo, covering a total area of 1,000,000 km^2, most of which lies inside the Republic of South Africa. The basin is home to just over 14 million people.

Lesotho, the most upstream country, falls entirely within the basin and contributes over 40% of the stream flow from only 5% of the total basin area. Lesotho is one of the smallest users of water from the basin. South Africa is by far the biggest user of water from the Orange-Senqu River system and this use drives the economic heartland of southern Africa. In South Africa, the basin receives additional water from interbasin transfers from basins shared with Mozambique and Swaziland, and from the Tugela system. Water is also transferred out of the basin to the Limpopo system, shared with Botswana, Zimbabwe and Mozambique and into the Eastern Cape Province of South Africa.

The part of the Basin in Botswana is entirely covered by the Kalahari Desert with very little surface runoff, but groundwater contributes to the water demands in this portion of the basin. The water requirements in the lower reaches of the river are driven primarily by irrigation demands from both Namibia and South Africa, as well as the need to maintain environmental flows to the estuary.

The middle and lower reaches of the river are subject to periodic and often devastating floods. The Orange River estuary is ranked as one of the most important wetland systems in southern Africa. Developments in and around this wetland system as well as altered freshwater inflows have resulted in environmental degradation.

Some key facts on water in the Orange-Senqu River System

	Botswana	Lesotho	Namibia	South Africa
% of the population of the basin	0.3	15.4	2.6	81.7
% of the land area of the basin	7.9	3.4	24.5	64.5
Average rainfall	295	755	185	365
% of the natural runoff	0.3	41.5	5.2	53
% of the total water use.	Negligible	< 0.37	1.4	98

Tricorythidae

Tabanidae

Humans depend on healthy aquatic ecosystems for drinking water, food security and a wide range of environmental goods and services.

Ultimately, our use of the River System depends on maintaining a healthy ecosystem. Possibly the least appreciated, but in the long term perhaps the most important of these ecosystem services, is “resilience to a changing world”.

Ecosystems have the capacity to absorb change and to recover from damage. When an ecological system loses this resilience, it becomes vulnerable. For example, if climate change raises the average temperature, several species may die out, but in a healthy resilient system, there will be new ones which will take over. ‘Unhealthy’ ecosystems lose this resilience - making us all more vulnerable to change.

Aquatic organisms live permanently in the river system, and respond to even short term changes that can be missed by sampling that occurs irregularly. So, by measuring the amount and type (species) of aquatic organisms in the river and comparing that to what we might expect to find at that point, we can get an idea of the ‘health’ of the system and how this may have changed due to human impacts.

However, aquatic organisms also respond to the habitat available. If, for example, certain species require rapids to survive, then they will not be present where there are no rapids. Any assessment of aquatic ecosystem health must therefore also include assessments of the habitat that is available, Then, if you compare the numbers and types of species you would expect to find at any point with what you actually do find - and if you take into account the habitat - you can get a good idea of the ‘health’ of the system. This is done using indexes developed especially for our river systems.

JBS-1 will therefore include assessments of:

- Macro-invertebrates using the South African Scoring System (SASS5): To measure the number and types of organisms (mostly insects) found on the bottom of the river. This will be compared to unimpacted sites with the same habitat characteristics.

- Fish biodiversity: This will assessing the types of fish found to those that you would expect to find.

- Diatoms: Diatoms have proven sensitivity to pollution, and the numbers and types of diatoms present on rocks and plants helps assess the health of the system.

- Vegetation in and on the banks of the rivers.

- Habitat health based on flows in the rivers, as well as developments upstream of the sampling point.

All these factors will be used together to provide a broad assessment of the Aquatic Ecosystem Health at points throughout the Orange-Senqu River System.

Assessing water quality

Intensive use of the water in urban centres, industry, mining, as well as irrigation, and the need to treat waste water and return it to the river systems for use further downstream, inevitably impacts on the quality of the water in the system. This is further complicated by the way the system must be operated to maximise the use of the limited water resources.

The Orange-Senqu River System is one of the most complex basins in the world. Water is transferred from the Lesotho Highlands to meet demands for water in the industrial heartland of South Africa in Gauteng. Some of the effluent from these areas drains back to the Vaal River, while some is transferred into the Limpopo Basin to the north. Water is transferred into the basin from neighbouring basins in South Africa, and out of the basin to meet demands in South Africa's Eastern Cape Province.

A basin wide assessment of the quality of the water therefore forms a critical component of the Joint Basin Survey. This will entail taking samples from about 40 sites scattered throughout the basin. These include surface and groundwater samples. These samples will be analysed by an independent and accredited laboratory for a range of salts and plant nutrients.

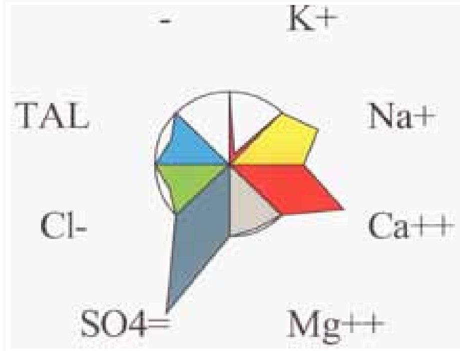
High concentrations of certain salts dissolved in the water are indicative of certain pollution problems, for example high concentrations of Sulphate suggest pollution from mining, whereas high concentrations of Sodium and Chloride suggest return flows from irrigation areas are impacting on water quality.

The natural background water of the basin is dominated by Calcium and Carbonates - usually at quite low concentrations. However, evaporation along the length of the river increases the concentrations of these salts. By examining the concentrations of these various salts in the water, scientists can get a good idea of the chemical state of the system, what the sources of these salts might be, and the impact that these can have on the use of the water in the system.

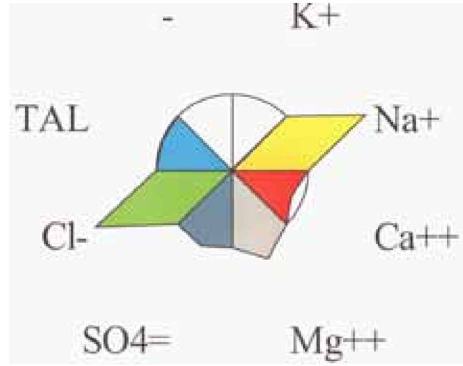
High concentrations of plant nutrients in the water stimulate the growth of algae in the water which makes the water expensive to treat and impacts on aquatic ecosystems. Plant nutrients stimulate the growth of aquatic weeds like water hyacinth, water lettuce and the water fern, which can clog waterways and rob the water of oxygen and, in so doing, kill aquatic life. High concentrations of nutrients are typical of poorly treated effluents and runoff from urban areas.

The water quality part of the survey will also be using data from water treatment facilities throughout the basin. This will provide information on algal concentrations and the microbiological quality of the water.

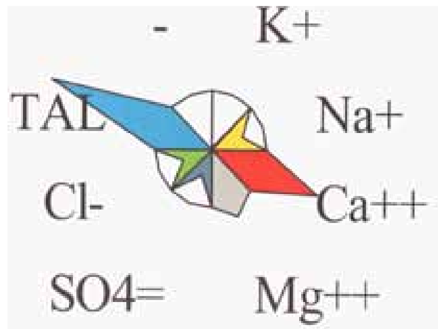
Samples taken for these substances must be analysed within a short time of the sample being taken and it is therefore difficult to send these to a central laboratory. These samples will also help identify the impacts of pollution from human settlements on the river system.



600 mg/L Total Dissolved Salts
Water affected by pollution from mines



1000 mg/L Total Dissolved Salts
Water affected by irrigation pollution



100 mg/L Total Dissolved Salts
Natural background water, Senqu River

Dr Rialet Pieters (NWU) carefully entering water to sample sediment.

Monitoring persistent organic pollutants and heavy metals

For some time it has been known that certain chemical compounds, such as the pesticide DDT, persist for long periods in soil, sediment, plants and animals. These substances are known as Persistent Organic Pollutants or POPs.

These POPs can be transported via air, rivers and oceans, over long distances. Residues of some of the POPs have now been found in penguins and snow in the Antarctic, as well as in the sands of the Kalahari - far from their production sites or regions of use. These substances affect human health and impact on the functioning of ecosystems even when they are present in very low concentrations.

Due to their persistence, and the fact that these substances are transported over long distances and across international borders, the control of POPs became a global concern. The alarming findings on the presence of POPs around the world prompted a multi-government response managed by UNEP Chemicals which, on 17 May 2004, became an international convention called the Stockholm Convention on Persistent Organic Pollutants. This convention, from time to time, publishes lists of chemicals that fall under the control of the Convention.

The aim of the Convention is to protect human and environmental health from the effects of exposure to specific POPs. Restricting the use and production, or banning of these chemicals in all countries will, when implemented, reduce the risks posed by these POPs. South Africa, Botswana, and Lesotho joined the convention in 2004 (thereby becoming parties to the Convention), and Namibia joined in 2005. Currently, 172 states are party to the convention.

However, almost all developing states had to negotiate and participate in the deliberations which led to the Stockholm Convention with limited knowledge or information about sources and levels of POPs in their own territories. While South Africa had adequate data on some of the POPs pesticides (including usage, stocks, environmental levels and impacts), very little was known about POPs in the other ORASECOM Contracting Parties. This exercise will therefore survey all of the POPs in sediment, fish, and bird eggs from the whole of the Orange-Senqu System. This is the first time an entire catchment has been surveyed in this way in the whole of Africa.

Other critical pollutants, often found in intensively utilised river systems like the Orange-Senqu System are heavy metals. These substances are often found associated in intensive mining and industrial areas and can have severe impacts on aquatic ecosystems and human health. This ORASECOM JBS-1 will therefore also investigate the levels of heavy metals in rivers throughout the basin.

Analysing and interpreting this vast amount of data will be a challenge. However, the data generated will not only contribute towards ORASECOM's objectives but will further empower member States in their priority setting for interventions that will lead to a better, cleaner, and healthier catchment.

Inter-laboratory benchmarking

One of the most important components of managing rivers that are shared between countries is to share data and information. This is only possible where laboratories in each of the countries analyse samples to common standards.

One of the greatest challenges for ORASECOM is that the Contracting Parties often have limited resources for laboratory analyses.

The JBS-1 will therefore also include an inter-laboratory benchmarking exercise. The idea of this process is to send the same samples to laboratories in each of the ORASECOM Member States. Laboratories will also receive standard samples of known concentrations. By comparing the results from these laboratories, we can help the Member States identify what additional support the laboratories need, or to help them identify laboratories that can provide reliable data. In this way ORASECOM can be sure that all the laboratories providing data to better understand the system, or better manage the system are producing quality data to a common standard.

In a separate process, ORASECOM has identified 12 sites scattered across the basin which are transboundary sites of significance. These sites will help identify where activities in one of the countries may affect another. Of these sites, 10 have been selected to form the basis of the inter-laboratory benchmarking exercise. These sites will be sampled by staff from all four Member States and the sample will be homogenised, so that the same sample can be sent to each laboratory. In addition, samples of known concentration will be sent to each laboratory.

The following laboratories will be participating in the exercise:

Botswana:	Department of Water Affairs and Geological Surveys
Lesotho:	Department of Water Affairs, Water and Sewage Authority and National University of Lesotho
Namibia:	NAMWATER
South Africa:	Department of Water Affairs.

These laboratories will analyse the samples for a range of pollutants and naturally occurring substances. The laboratories will test the samples for these substances using their normal procedures. The results of this benchmarking exercise will be used to identify inconsistencies between the laboratories.

The issues could be related to the analytical methods, sample handling procedures, sample storage, equipment calibration, sample transport and detection limits. The reasons for the differences will be determined and the required adjustments and recommendations made to improve the transboundary sampling program. In this way trust and co-operation in the collection, testing, results and management of the data will be developed over time.

Christa Thirion assessing macro-invertebrates

Public participation in the survey

Involvement of the people of the river is essential for its effective management. The livelihoods of people living in the basin, particularly in an arid basin like the Orange-Senqu, are often directly linked to the way the system is managed to ensure the supply of sufficient water of a good quality.

People of the River

In many cases people also depend directly on healthy river ecosystems. It is therefore important that the people of the Orange-Senqu Basin are also involved in the Joint Basin Survey.

Five public participation events have been planned as part of the Joint Basin survey, during which stakeholders and local officials can interact with the specialists in the sample teams, to find out more about the river system and about ORASECOM. The survey teams will explain how and why they will sample surface and ground water, sediment, bird eggs and fish, as well as organisms found along the bottom of rivers. They will also describe how these samples will be used to assess a wide range of water quality, aquatic ecosystem health and habitat parameters, and how this information will form the baseline for the current condition of the Orange-Senqu River Basin.

The purpose of these public events is also to create awareness about the importance of water for life and to encourage the perception of 'our shared river' among stakeholders and the broader public.

The public events are aimed at local officials, key stakeholders groups or organisations, target school groups, and the media. Evening seminars are also to be arranged at some of the locations, to offer an opportunity for the local scientific community to engage in discussions with the specialists in the sampling teams.

Posters and banners will be displayed at the public events and information brochures and educational material will be available for distribution and dissemination. MiniSASS water quality sampling demonstrations and practice will also be undertaken, specifically for the target schools and learner groups invited to attend the events.

The planned locations for the five public events are:

- Maseru — Lesotho
- Parys — South Africa (Free State Province)
- Upington — South Africa (Northern Cape Province)
- Tsabong — Botswana
- Rosh Pinah — Namibia

What happens after the survey?

The success of this first Joint Basin Survey (JBS-1) depends not only on the dedication and hard work of all the samplers and scientists but also on the people of the river.

Those whose livelihoods directly depend on the river must be seen as an integral part of the River System. Their support to the process, participation in the public events, and ongoing interaction with ORASECOM is essential to the effective functioning of the organisation.

This might be, for most of you, your first interaction with ORASECOM. It will not be the last. As the organisation moves ahead with the development of the Basin Wide Plan due at the end of 2012 and as a number of demonstration projects start up in the basin, so the need for your participation will grow..

We would like to use this opportunity to start getting to know you better. Please visit us at our website www.orasecom.org.

Find out more about the River System, its history and key challenges at www.orangesenqurak.com.

This Joint Basin Survey will continue to build on our common understanding of the Orange-Senqu River System, and the challenges we all face in developing, managing and conserving its waters. Once the survey is completed, ORASECOM will use the information generated to contribute to a Basin Wide Plan. This Plan, due in late 2012, will outline what needs to be done so that all the ORASECOM Contracting Parties can continue to benefit from and protect the waters of the system far into the future.

The JBS will also help harmonise our monitoring efforts and identify where we need to work together to maximise the benefits of our sampling. Repeating this exercise at regular intervals will help track progress in improving the state of the system, and will help us assess the impacts of our joint efforts to better manage the system.

Most importantly, keep on the lookout for the results of the JBS-1 which will be posted on these websites, and made available in hard copy in the first half of 2011. We will be completing the survey by mid-November, after that we will be writing up the results of the survey in a series of scientific reports, which will be presented to the ORASECOM Council in April 2011.

However, we will also prepare a simpler public document highlighting the main findings of the survey, and presenting the results in less scientific terms. This will be made available by June 2011, and will be uploaded to the ORASECOM websites.

Mr Ian Smith (NWU) preparing sediment samples for POPs and heavy metal analysis.

Contacts

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Appendix

Version 2.0 **January 2009**

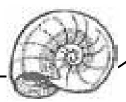
miniSASS can be used to monitor the health of a river and measure the general quality of the water in that river. It uses the composition of macroinvertebrates (tiny insects) living in rivers and is based on the sensitivity of the various animals to water quality. (note: miniSASS does <u>NOT</u> measure the contamination of the water by bacteria and viruses and thus does not determine if the river water is fit to drink).

Equipment list

- net
- white container / tray / ice-cream box
- pencil
- magnifying glass (optional)
- shoes/gumboots
- Hand wash / soap

How to make your own net

Take any piece of wire, for example an old clothes hanger, and bend it into the shape of a net. Then tie the netting (which can be any porous material) to the wire with a piece of string. And you have a net!



Method

The best sites are those with rocks in moving water. Not all sites have rocks (**<u>rocky type</u>** rivers), but may be largely sandy (**<u>sandy type</u>** rivers).

1. Whilst holding a small net in the current, **disturb** the stones, vegetation, sand etc. with your feet or hands.
2. You can also lift stones out of the current and **pick** insects off gently with your fingers or forceps.
3. Do this for about **5 minutes** whilst ranging across the river to **different habitats** (biotopes).
4. Rinse the net and turn the contents into a plastic tray and **identify** each group using the identification guide (see insert: you could start with the dichotomous key and then use the identification guide for more information).
5. **Mark** the identified insects off on the identification guide.
6. Fill in the site information and **Add up** the sensitivity scores to determine the average score (see scoring sheet on back page).
7. Remember to **WASH** your hands when done!

SITE INFORMATION TABLE		
Date (dd/mm/yr):		
Collectors name:		
River name:		
GPS co-ordinate:	S	E
Comments / Observations		

Co-ordinates as lat/long (e.g. 29°30'25" S / 30°45'10" E) **<u>OR</u>** as decimal degrees (e.g. 29.50694°S/30.75277°E)

Scoring

1. On the table below, circle the sensitivity scores of the identified insects.
2. Add up all of the sensitivity scores.
3. Divide the total of the sensitivity score by the number of groups identified.
4. The result is the average **<u>score</u>**, which can be interpreted below.

GROUPS	SENSITIVITY SCORE
Flat worms	3
Worms	2
Leeches	2
Crabs or shrimps	6
Stoneflies	17
Minnow mayflies	5
Other mayflies	11
Damselflies	4
Dragonflies	6
Bugs or beetles	5
Caddisflies (cased & uncased)	9
True flies	2
Snails	4
TOTAL SCORE	
NUMBER OF GROUPS	
AVERAGE SCORE	
Average Score = Total Score ÷ Number of groups	

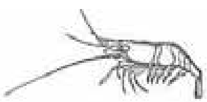
Interpretation of the miniSASS score: Although an ideal sample site has rocky, sandy, and vegetation habitats, not all habitats are always present at a site. If your river does not have rocky habitats use the **<u>sandy type</u>** category above to interpret your scores.

Ecological category (Condition)	River category	
	Sandy Type	Rocky Type
Unmodified (NATURAL condition)	> 6.9	> 7.9
Largely natural/few modifications (GOOD condition)	5.8 to 6.9	6.8 to 7.9
Moderately modified (FAIR condition)	4.9 to 5.8	6.1 to 6.8
Largely modified (POOR condition)	4.3 to 4.9	5.1 to 6.1
Seriously/critically modified (VERY POOR condition)	< 4.3	< 5.1

History of the miniSASS tool

South Africa has been a world leader in biomonitoring techniques using macroinvertebrates. The most successful of these is the South African Scoring System version5 (SASS5). miniSASS is based on SASS and also uses the presence of macroinvertebrates to indicate the "health of a river". Where SASS5 contains over 90 different macroinvertebrate classes, miniSASS only has 13 different classes, allowing for simpler identification and understanding. miniSASS has been found to provide similar indications of "river health" status as the more comprehensive SASS5 assessment, thereby providing a good means of generating useful biomonitoring data. The original miniSASS (version 1) was developed/based on approximately 2000 SASS4 data records, whilst this updated miniSASS (version 2) is based on over 6000 SASS5 records. This makes miniSASS ver2 more robust as a useful water quality monitoring tool & more widely applicable in Southern Africa.

Macroinvertebrates



What are they?

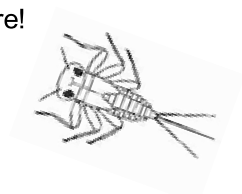
Macroinvertebrates are animals that have no backbone and can be seen with the naked eye.

Why they're used for biomonitoring?

- Different macroinvertebrates have different sensitivities to pollution. The higher their score, the more sensitive they are.
- They are generally easy to collect and identify.
- They are relatively sedentary which allows the source of pollution to be detected.
- They integrate the water quality conditions at a site, providing an overall measure of the "health" of a river.
- They can provide a picture of the historical water quality at a site.

What is the importance of water quality monitoring and management in South Africa?

Fresh water is essential for most life on earth. It is also used in all spheres of human life, namely agriculture, industry, biodiversity conservation, sanitation and hydration. However due to the amount of rainfall that South Africa receives, it is classified as a water stressed country. This means that if we do not monitor, manage and conserve our current water resources, we will be placing them and the population under tremendous stress in future!



As the general public, we can play a part in making a difference to managing freshwater resources in a community. miniSASS has the potential to be a powerful '<u>red flag</u>' indicator for the identification of aquatic pollution sources. By using miniSASS we can actively take an interest and management in the health of freshwater bodies in our community.

Your interest and knowledge can be enhanced by adopting a local river in your community and monitoring it over time, identifying sources of pollution and taking <u>local action</u> to make a difference. You could also encourage more members of the community to take positive action towards monitoring and conserving water.

Additional resources

www.wrc.org.za
www.groundtruth.co.za
www.wessa.org.za
www.dwaf.gov.za

Download copies of miniSASS
www.groundtruth.co.za

Send your results to minisass@groundtruth.co.za
to contribute to a developing picture of river quality in South Africa.
miniSASS is available from Share-Net, PO Box 394, Howick, 3290. Tel (033) 3303931

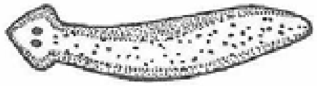
River safety: take special care in polluted waters. Beware of dangerous animals (crocs/hippos!) and fast flowing waters. Wear protective gear when necessary and wash your hands regularly with soap and clean water wherever possible!!

Key words for for further readin g/resources:
macroinvertebrates, benthic, water quality, conservation, biodiversity, water quality, river health, aquatic pollution.

Glossary

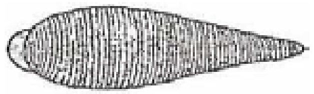
Biomonitoring: the monitoring of biodiversity using biological organisms
Biodiversity: diversity within species, between species and of ecosystems
Ecosystem: a complete community of living organisms and the nonliving materials of their surroundings.
Sedentary: inactive, motionless, not moving
Conservation: the maintenance of environmental quality and functioning

Flat worms



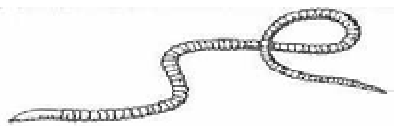
Flat worms are characterised by their flattened shape and soft bodied, worm-like form. They have an arrow-shaped head with two dorsal eyespots and are generally mottled or dark grey in colour. Flatworms move with a gliding action and are generally scavengers or carnivores.

Leeches



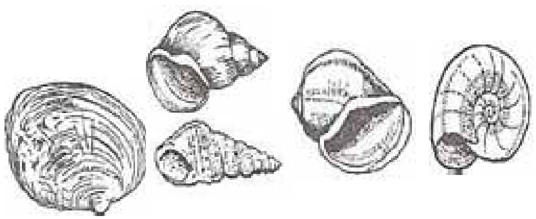
Leeches are segmented organisms that have very flexible bodies. When moving they expand to become long and thin, and then contract to become short and stubby. They have suckers on both ends of the body that are used for feeding and locomotion. Leeches are variable in colour, from grey, to red-brown and black. They swim with a fast, snaking movement and are found under stones, vegetation and debris.

Worms



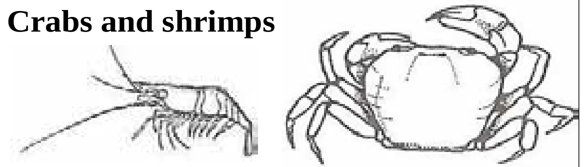
Worms are long and segmented and have a cylindrical shape much like small earth worms. Their colouring is usually pink to brown. They are usually seen writhing around in debris digesting the substrate they fed on.

Snails



Snails are molluscs with hard shells that vary in size, shape and colour. Habitats vary, with some snails such as limpets clinging to rocks, whereas clams and muscles are found in sand. The more common snails move over stones and vegetation. Some snails are host to bilharzia, a serious health hazard for humans.

Crabs and shrimps

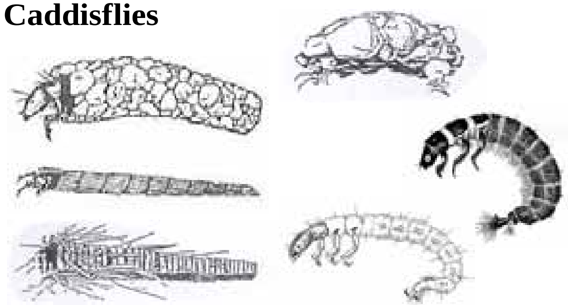


Crabs and shrimp form part of the order Decopoda (ten legs) and have bodies and legs hardened to form a tough shell. They have four or five pairs of legs, and eyes that are carried on stalks and are movable. Crabs are scavengers that feed mainly on leaf litter but will feed on animals when given the chance. Shrimps are mostly scavengers or deposit feeders.

Stoneflies

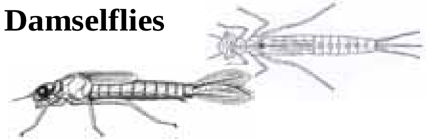
The nymphs of adult stone flies usually have two long tails and three pairs of legs each having two claws at the tip. A characteristic feature of stonefly nymphs are the tufts of gills on the side of the body as well as gills between the two tails. Wing pads on the thorax are often dark and obvious. Some species 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.

Caddisflies



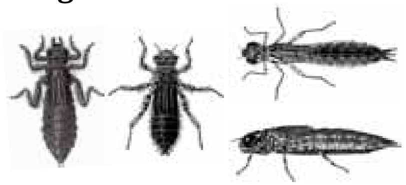
The aquatic larvae of adult caddisflies have a hard head with three pairs of legs which are attached to an elongated, soft body. Finger-like gills on the abdomen and anal appendages can be seen with the naked eye. Some caddisflies construct portable shelters/cases from sand grains, bits of vegetation and/or silk that are glued together to form a characteristic case shape. Most of the case-building types cannot swim whereas the case-less type swim freely across the substrate. Some feed on algae and detritus whereas others are predators.

Damselflies



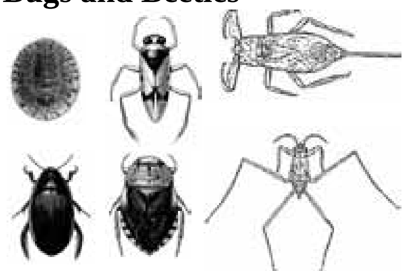
Damselflies have elongated bodies with generally three broad tails/gills on the tip of the abdomen. Damselflies are carnivorous and have a 'mask' over the lower part of the face which hinges out to reveal a pair of pincers with which they catch their prey. They are often to be found in vegetation growing on the edge of rivers.

Dragonflies



Dragonfly nymphs are robust creatures that are stout and have a large head and protruding eyes. Some have short legs whilst others have long legs. They do not have tails, but swim using 'jet propulsion' by forcefully ejecting water from the abdomen. Dragonfly nymphs are usually the largest organisms found in a sample and are the most powerful invertebrate predators in the water.

Bugs and Beetles



Bugs can be defined as having a piercing and sucking beak for mouthparts, and two pairs of membranous wings. Beetles on the other hand have 'jaws' and outer wings that are hardened to protect the inner wings. Some bugs and beetles are well adapted to swimming, such as water boatmen, backswimmers, pond skaters and water striders. Most bugs and beetles are carnivorous, but some feed on algae.

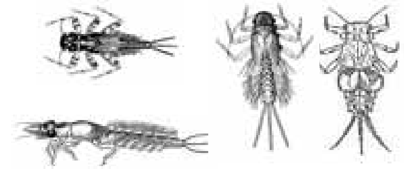
Mayflies

Mayfly nymphs vary greatly in shape and size and live only for a day or two. In this time they will never feed and live to mate and lay eggs in the water. Mayflies fly close to rivers and lakes, usually swarming in the early evenings.

Minnow mayflies

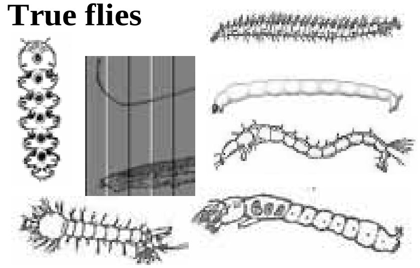
These mayflies have a narrow head and a small, slender, but not flattened body. They have leaf shaped gills on both sides of the abdomen and two but more commonly three tails, depending on the species.

Other mayflies

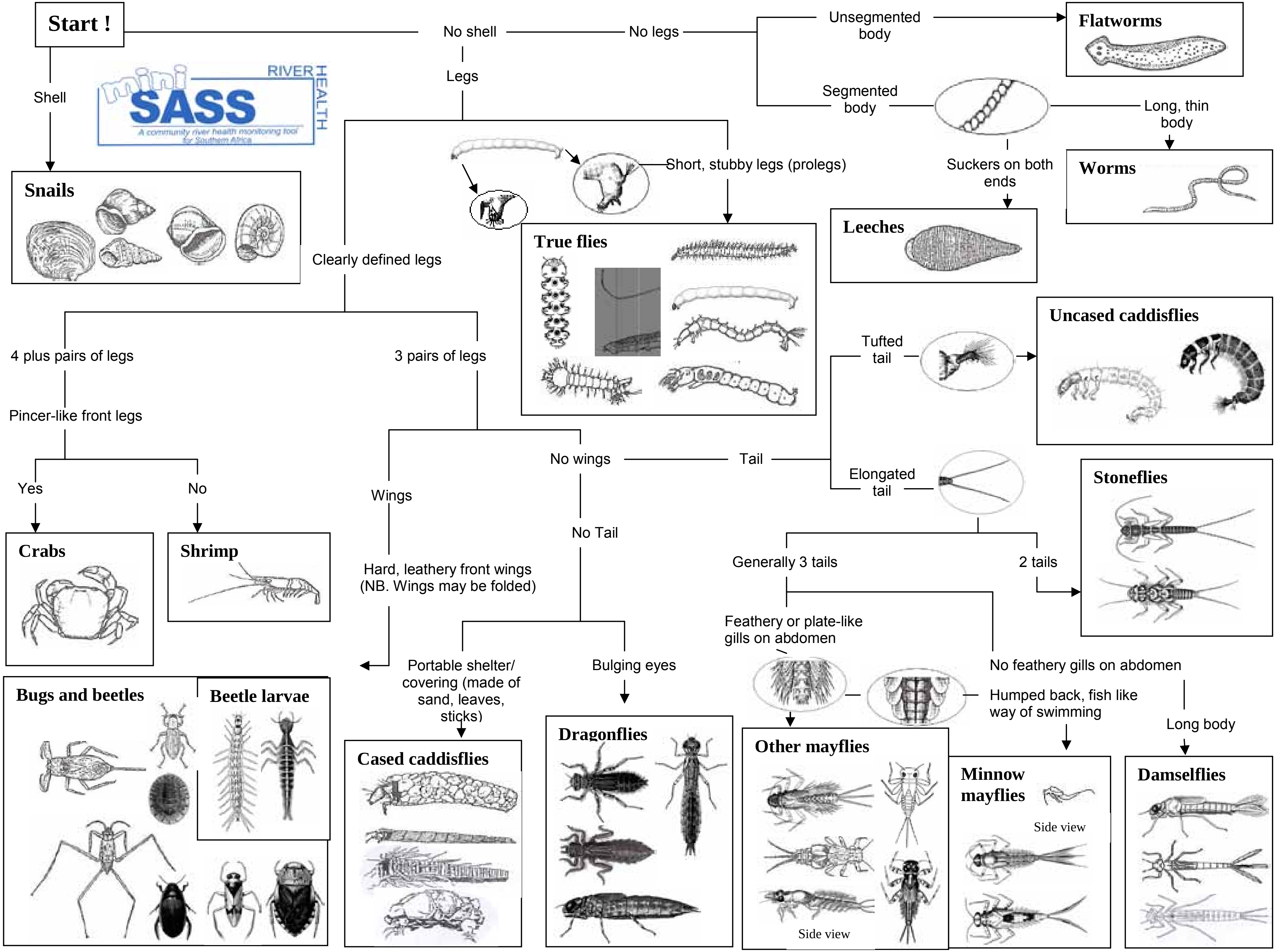


Other mayflies are characterised by an elongated body, large head, well-developed mouthparts and stout legs. They live in a variety of habitats including burrowing in mud, crawling amongst decaying leaves, and scurrying over stones in fast flowing currents.

True flies



Most fly larvae have a fairly indistinct head but elaborate tail ends. They often have small, soft legs (prolegs), segmented bodies and have the appearance of maggots. Some have bristles/ spines and antennae. True flies live in a variety of habitats including sand, mud and stones in fast flowing water. They can either be carnivorous or filter feeders.



Start !
No shell
No legs
Unsegmented body
Flatworms
Shell
mini SASS
RIVER HEALTH
A community river health monitoring tool for Southern Africa
Legs
Segmented body
Long, thin body
Short, stubby legs (prolegs)
Suckers on both ends
Worms
Snails
Leeches
Clearly defined legs
True flies
Uncased caddisflies
4 plus pairs of legs
3 pairs of legs
Tufted tail
Pincer-like front legs
No wings
Tail
Elongated tail
Stoneflies
Yes
No
Wings
Crabs
Shrimp
No Tail
Generally 3 tails
2 tails
Hard, leathery front wings (NB. Wings may be folded)
Feathery or plate-like gills on abdomen
Portable shelter/ covering (made of sand, leaves, sticks)
Bulging eyes
No feathery gills on abdomen
Bugs and beetles
Beetle larvae
Humped back, fish like way of swimming
Long body
Dragonflies
Other mayflies
Cased caddisflies
Minnow mayflies
Damselflies
Side view
Side view


Orange River Rapids

ORASECOM

THE ORANGE-SENQU RIVER COMMISSION

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