Frogs in the Classroom

Anatomy and Physiology *Lesson 1*

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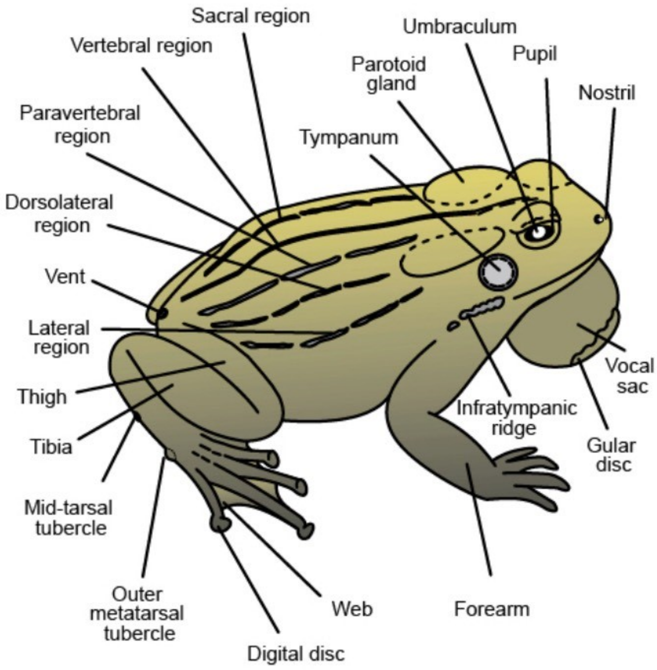
1 What are frogs?

Frogs are vertebrate animals (with a backbone), that belong to the Class 'Amphibians'. The word amphibian comes from the Greek words 'amphi' meaning 'both', and 'bios' meaning 'life'. This is because most amphibians live part of their lifecycle in or near water and the other part of their life on land. There are three orders of amphibians: Anura (frogs and toads), Caudata (salamanders), and Gymnophiona (caecilians). Frogs are the only type of amphibian in South Africa.

2 Frog external morphology



The body of a frog can be divided into the head, a short neck, and the trunk. The head consists of the brain, mouth, eyes, ears and nose. The external anatomy of a frog consists of the following:

1. Permeable skin to absorb water;
2. Chromatophores, cells that contain or produce pigments to display certain colours for protection;
3. External nares for breathing;
4. Eyes and nictating membranes for protection;
5. Tympanic membrane, the eardrum which receives sound waves;
6. Fore and hind limbs attached to the shoulders and hips respectively. Frogs have long hind limbs which assists them with jumping together with urostyle which results in a strong shock absorbing pelvic structure. Toads have shorter limbs which are better suited to walking and short hops; and
7. Webbing varies from absent to full and toes may have terminal bulb or disks.

Frogs in the Classroom

Anatomy and Physiology

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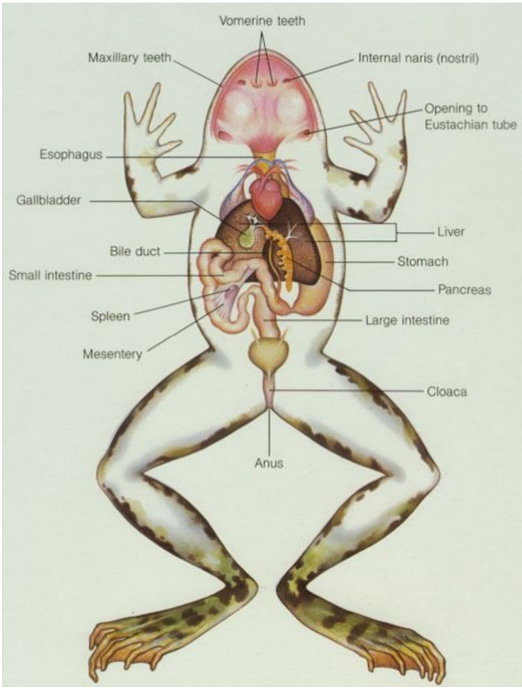
3 Frog internal morphology

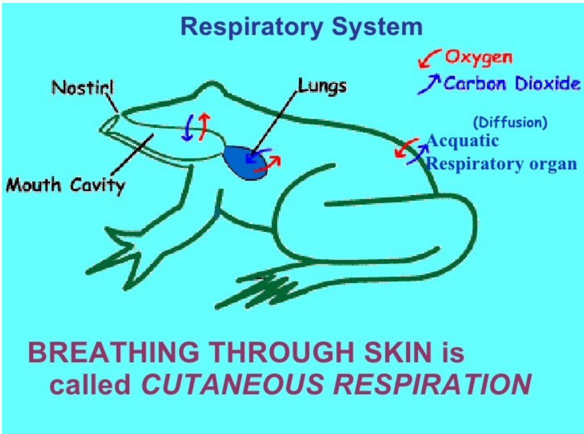
The trunk of a frog forms walls for a single body cavity known as the coelom. The coelom holds all of the frog's internal organs. The internal structures of a frog includes: the heart, the lungs, the kidneys, the stomach, the liver, the small intestine, the large intestine, the spleen, the pancreas, the gall bladder, the urinary bladder, the cloaca, the ureter, the oviducts, the testes, the ovaries and fat bodies. The organs perform the following functions:



- Stomach - breaks down food
- Liver – makes bile which helps with digestion
- Small intestine – absorbs nutrients from the food
- Gall bladder – bile is stored in the gall bladder between meals
- Large intestine – absorbs water and collects waste
- Cloaca (opening) - where sperm, eggs, urine, and feces exit the frog's body.
- Spleen - stores blood
- Kidneys - filter the blood.
- Pancreas – produce endocrine hormones and digestive enzymes
- Lung – used for breathing, vocalizing and hearing

3 Respiration

Frogs do not have a diaphragm. Air is pumped into the lungs by lowering the floor of the mouth to draw air in through the nostrils into the buccal cavity and expelled through raising the floor of the mouth.



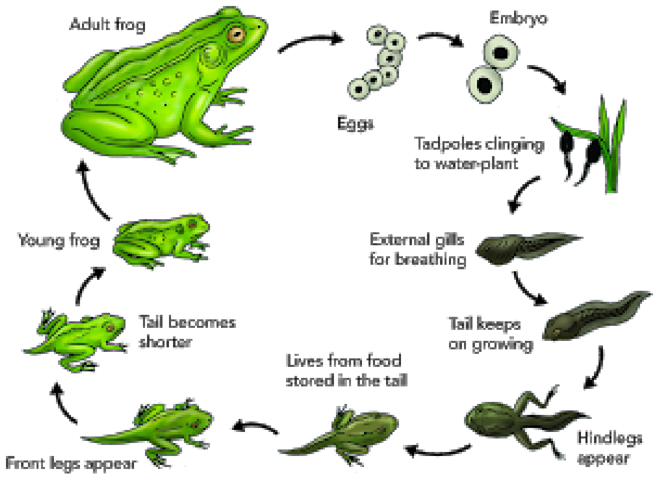
Respiration also takes place through the skin which is exclusively used when under water. Blood capillary networks close to the surface of the skin allow carbon dioxide to be released and, to a lesser extent, oxygen to be absorbed.

Frogs in the Classroom

Anatomy and Physiology

5 Life cycle of a frog

The transition from tadpole to frog is called metamorphosis. It is a complete change from one form to another – one of the most remarkable biological events in zoology. Depending on the species and the location, this can take from a few weeks up to two years to be completed.



6 Bioindicators

Frog skin is permeable ,which means it is are able to absorb water, as well as gases—Frog actually breathe through their skin!. As such, frogs are very sensitive to pollution and climatic changes. Dwindling frog populations are a sign of potential health threats to surrounding communities, including people!

7 Frogs in the curriculum

Subject: Natural Sciences

Specific Aims

1. Doing science
2. Knowing the subject content and making connections'

Process Skills

Accessing and recalling information; observing, raising questions, doing investigations, recording and interpreting investigations.

Integration

Language and Life Skills

Lesson Format

Work though the information in the factsheet with learners and complete worksheets 1 & 2 as well as the practical assessment.

Assessment

1. Worksheet 1: External morphology
2. Worksheet 2: Life cycle of a frog
3. Practical: Investigating permeability

Next Lesson

Frogs and Wetlands

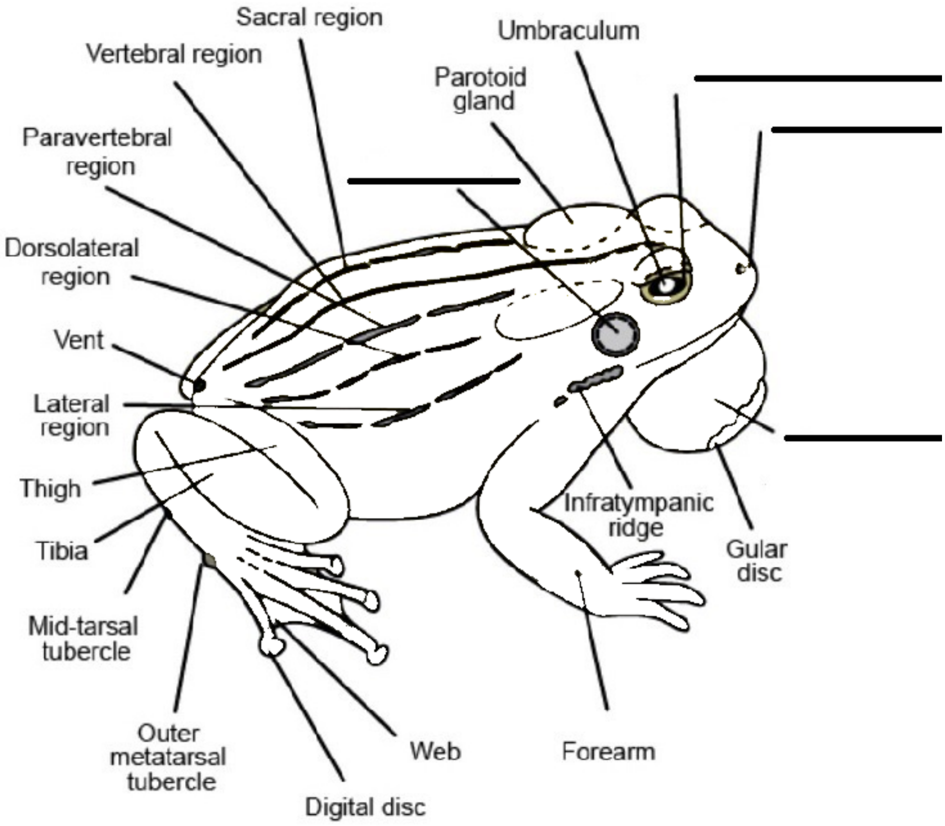
Worksheet 1

Frogs: External Morphology

Name: _________________________________ **Surname:** ______________________________

Grade: ______________________________ **Date:** _____________________________________

Task: Colour in an label the diagram below and define the terms below.



Explain what functions the following parts perform for a frog:

1. External Nares –

2. Tympanic membrane –

3. Nictitating membrane –

4. Cloacal opening –

5. Chromatophore –

(10)

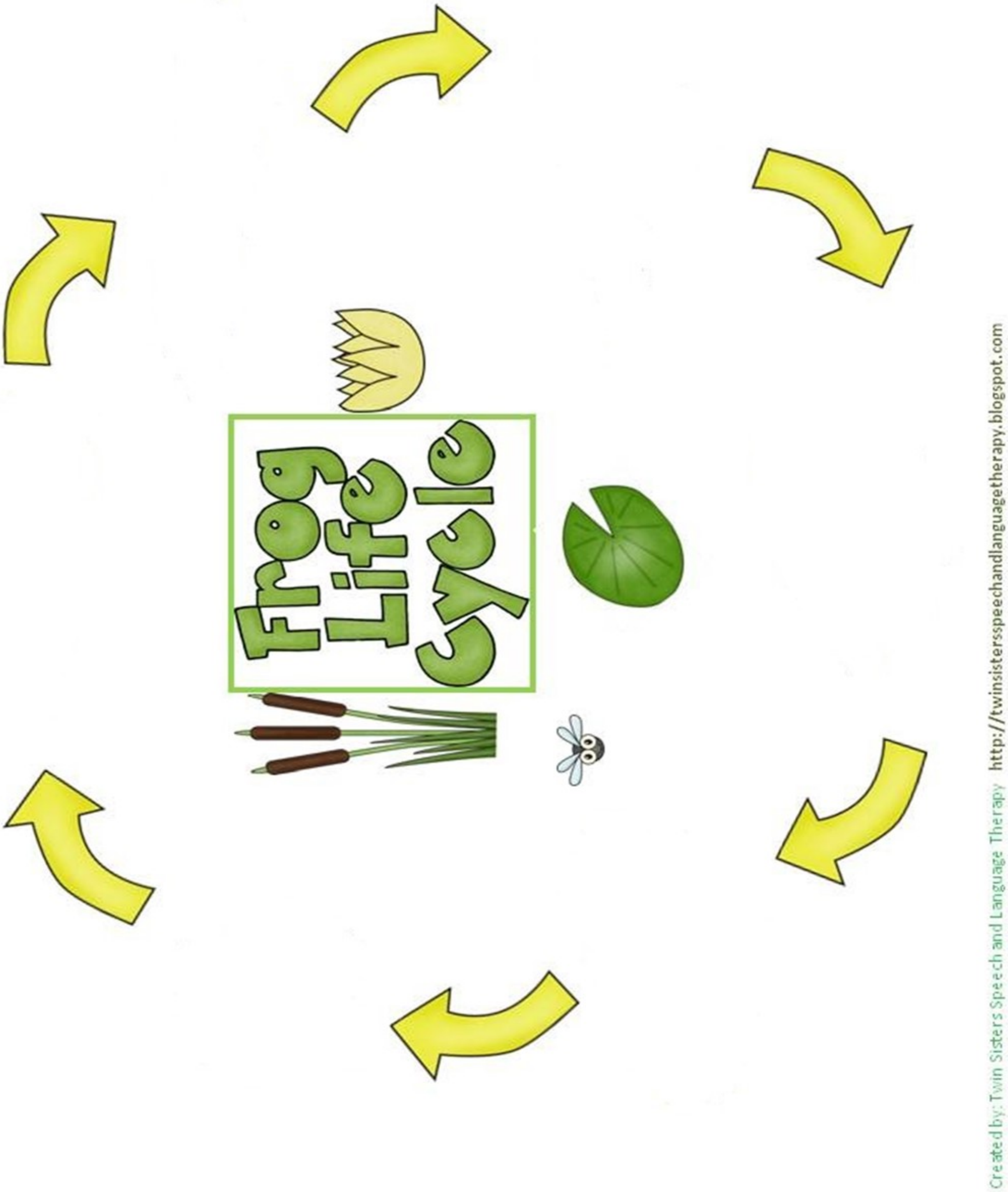
Worksheet 2

Frogs: Life cycle of a frog

Name: ________________________________ **Surname:** _____________________________

Grade: _____________________________ **Date:** ____________________________________

Directions: Complete the life cycle of a frog in the diagram below.



Practical assessment

Frogs: Investigating Permeability

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Name: ________________________________ **Surname:** _____________________________

Grade: _____________________________ **Date:** ___________________________________

Aim of Activity

- To understand the concept of permeability and how it effects how fast a chemical moves into an animal's body.
- Amphibians are more readily affected by pollution because of their permeable skin

Materials you will need

- 2 x Hard boiled eggs,
- Food coloring (dark colors work best),
- Ruler,
- 2 x Clear cups,
- Water, and
- A knife

Directions

- Label one cup 'Peeled Egg' and the other cup 'Unpeeled Egg'.
- Peel one of the eggs and place it in the 'Peeled Cup'.
- Placed the unpeeled egg in the cup labeled 'Unpeeled Egg'.
- Peel one of the hardboiled egg.
- Add at least 20 drops of dye to each cup and stir gently (again, dark colors work best).
- Let the eggs rest in the water for AT LEAST 24 hours.
- What do you think is going to happen?
- After 24 hours, remove both eggs from the cups.
- Gently peel the egg that still has a shell.
- Gently cut each egg in half (from top to bottom, through the yolk).
- Using rulers or measuring tape, measure how far into the egg the food coloring has moved.
- What do they see? How does this demonstration relate to a frogs skin?

Results

Explain what you observed. Use a diagram to illustrate your answer.

Follow directions ____/ 5

Understanding ____/5

Assessment Sheet 1

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Learner Name and Surname	Worksheet 1	Worksheet 2	Practical Assessment	Total	Average

Frogs in the Classroom

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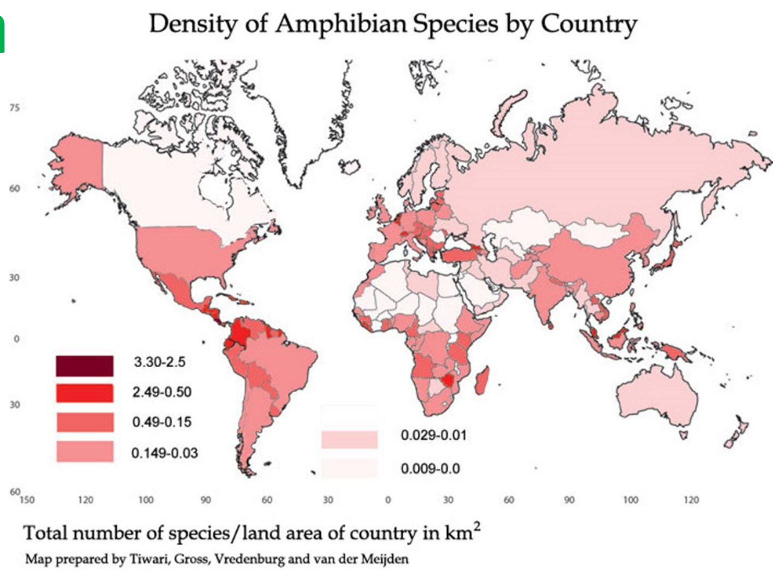
Frogs in the Classroom

Frog habitats *Lesson 2*

1 Global frog distribution

Frogs are found throughout the world, inhabiting a vast range of habitats. Globally, there are over 7,000 species of frogs (which includes the toads). They are found on every continent, except Antarctica, which is too cold for them, and in almost every habitat type. Typically, frogs are associated with warmer, moist environments and species density is concentrated in the equatorial regions.

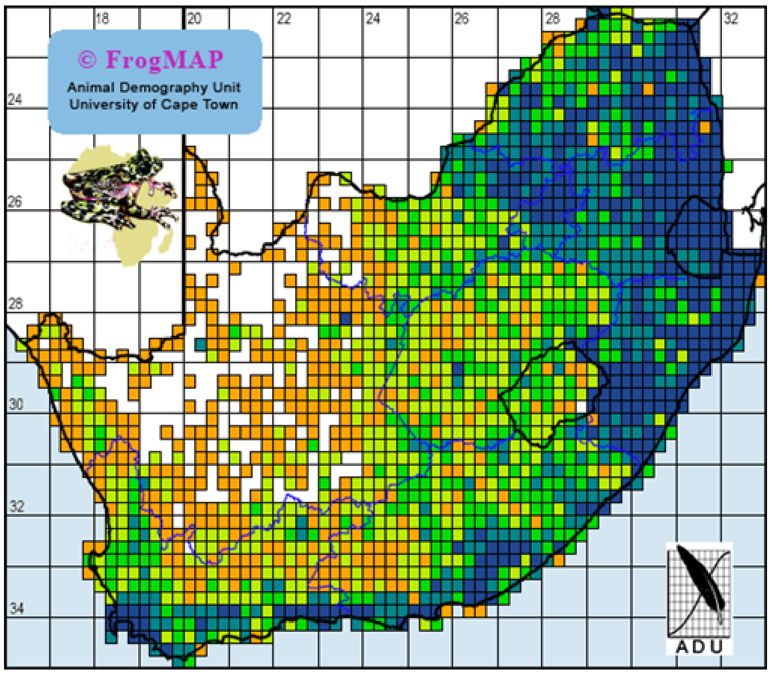


2 Frog distribution in South Africa

There are 135 species of frogs in South Africa (as of 2018), which are unevenly distributed across the country, both in terms of species and density. The three main determinants of distribution patterns are climate, centre of origin and range restriction.

Fun Froggy Fact

New frog species are discovered every year. On average, 147 new species have been described every year for the past 10 years. Fourteen of these are from South Africa



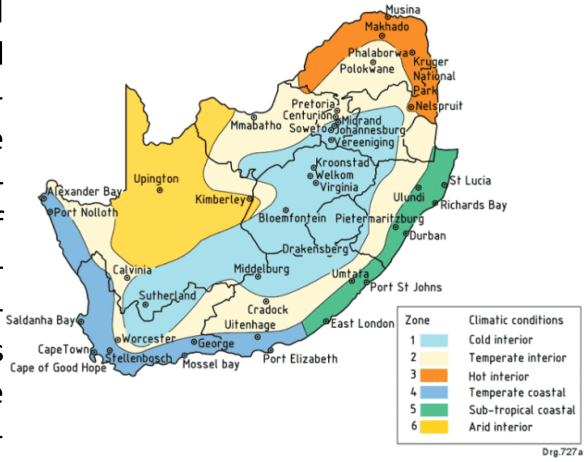
Number of records:		47656	
Number of grid cells:		1760 (86.91%)	
Number of species*	Symbol	No. QDSs	% QDSs
1 - 3	■	411	20.3
4 - 6	■	407	20.1
7 - 9	■	318	15.7
10 - 13	■	274	13.53
14 - 52	■	350	17.28

* ranges selected according to the closest percentiles for 5 categories.

Frogs in the Classroom

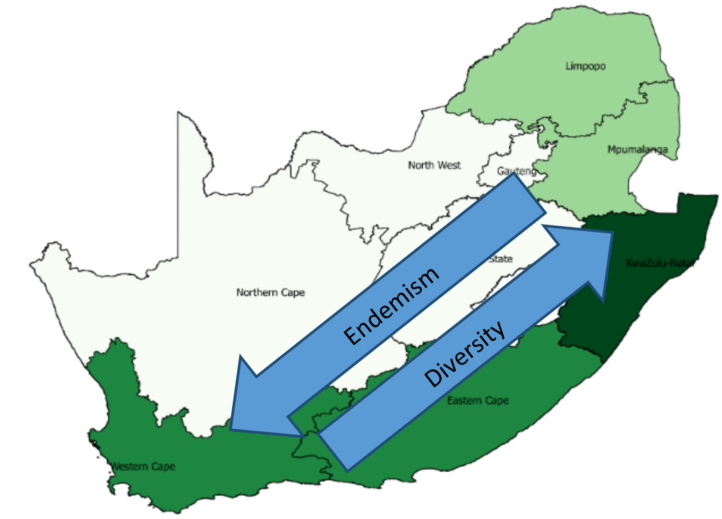
Frog habitats *Lesson 2*

3 Frogs and climate



The rich amphibian fauna of southern Africa is attributed to the diversity of the region's topography, climate and habitats. Frogs have adapted to almost every type of environment on the subcontinent and many species are highly specialised to suit conditions in a particular locality, including even in desert environments. In spite of some remarkable adaptations to cope with changing environmental conditions, all amphibians remain physiologically dependent on moisture and temperature. Thus a larger number of species are found in areas that are warm and wet. The number of species found at any locality increases from the arid west to the water east of the subcontinent.

4 Centres of origin



Most southern African frog species fall into two broad categories. The first comprises species with evolutionary origins centred in the southern provinces or high altitude areas of the interior. The second comprises species with tropical origins distributed in the north-east. During past periods of climatic warming the distribution of tropical species expanded southwards, while those already inhabiting the south retreated. During periods of climate cooling this process was reversed. At the interface between theses two faunal groups, some populations became isolated and evolved into independent allopatric species. There is an increase diversity northwards along the coast from the Western Cape towards northern Kwa-Zulu Natal, and an increase in endemicity southwards. In general, the interior of the region has a lower level of species diversity and endemicity.

Frogs in the Classroom

Frog habitats *Lesson 2*

5 Range restriction

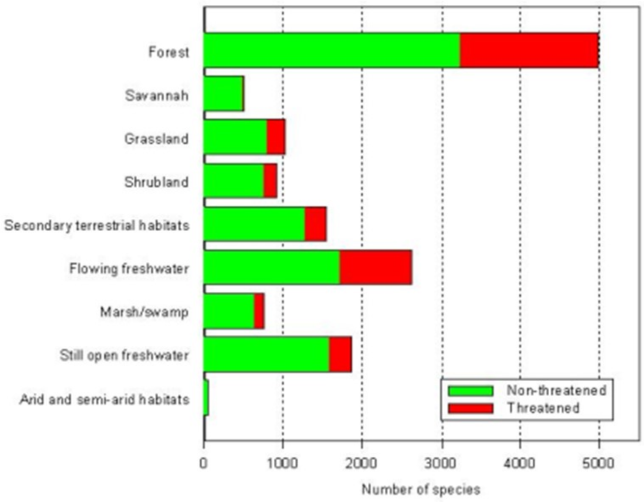
Several southern African species have restricted ranges of less than 20 000km², confined to 13 isolated topographical areas. This means that, for example, mountains and deeply incised river valleys, are barriers which have limited the movement of these species.

6 Frog habitats

The environmental conditions need to be suitable for frogs and most species are located only in very specific habitats.

In South Africa, there are nine biomes and within each biome frogs can be found: Coastal bush, forest, desert, grassland, karoo, fynbos, mangroves, moist and arid savanna.

In general, forests and flowing freshwater biomes are where the most diversity of frogs are found. While arid and semi-arid habitats are where frog species are less diverse.

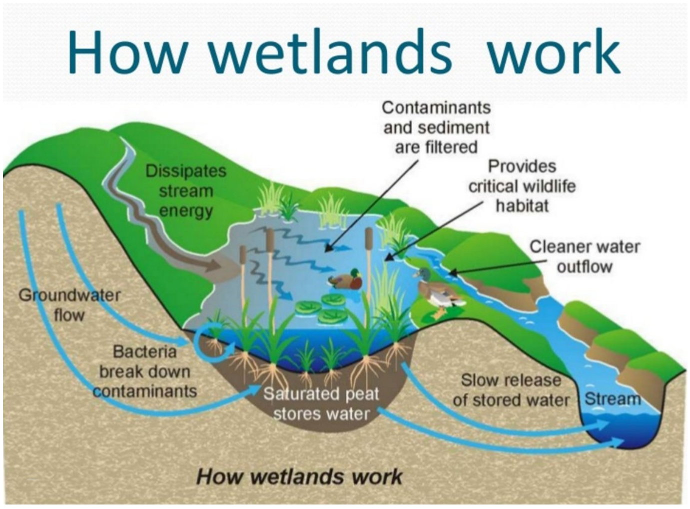


7 Wetlands

Areas covered by water are known as wetlands. Marshes, ponds, pans, vleis and estuaries are all types of wetlands. Globally, wetlands provide ideal habitats for frogs.

Wetlands provide:

- A home for plants and animals;
- Water storage and filtration;
- Protection against floods;
- Food and resources; and
- Areas of recreation and An income for surrounding communities.



Many people rely on wetlands for food and resources. Our wetlands are being drained for mining, agriculture, and development. Losing wetlands threatens biodiversity and livelihoods and means we lose a clean water supply and a natural water storage system.

8 Forests

A forest is characterized by dense woodland of large trees which form a closed canopy. Forests occur in patches in high rainfall areas along the south and eastern escarpments at various altitudes in South Africa. These environmental conditions make it a suitable habitat for frogs to live.

An example of a frog that lives in a forest the Bush Squeaker, *Arthroleptis wahlbergi*

Forests provide:

- Climate control;
- Air purification;
- Soil stabilization;
- Food and natural resources; and
- Support a high biodiversity.

People depend on forests not only for the services they provide but also generate an income through forests. However, forests are under threat from deforestation which threatens the not only frog survival but biological diversity and human wellbeing.

Fun Froggy Fact

The Bush Squeaker lays its eggs in the leaf litter on the forest floor. There is no free-swimming tadpole phase, rather, the entire development is completed within an egg capsule and tiny, fully metamorphosed frogs emerge after about four weeks.

9 Frogs in the curriculum

Subject: Natural Sciences

Specific Aims

1. Doing science
2. Knowing the subject content and making connections'

Process Skills

Accessing and recalling information; observing, raising questions, doing investigations, recording and interpreting investigations.

Integration

Language and Life Skills

Lesson Format

Work though the information in the factsheet with learners and complete worksheet 2.1., practical 2.1. and visit a wetland using field visit sheet 2.4.

Assessment

1. Worksheet 2.1. Frogs in South Africa
2. Practical 2.1. Wetland in a bottle
3. Field visit 2.3. Wetland visit

Next Lesson

Frog Identification

Worksheet 2.1.

Frogs in South Africa

Name: ________________________________ **Surname:** _____________________________

Grade: _____________________________ __ **Date:** _________________________________

Task: Complete the following questions using the species richness map

1. How many species of frogs are there globally (1)?

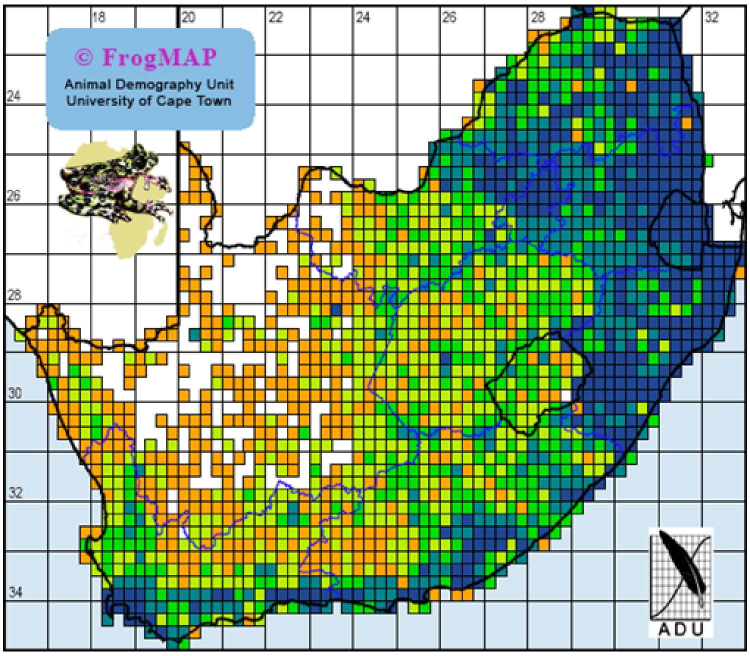
2. How many species of frogs are found in South Africa (1)?

3. Whereabouts is the highest number of frogs in South Africa found? (3)

4. Why do you think there is such a high number of frog species found in these areas? (3)

5. What is the average number of species frog found in Kwa-Zulu Natal? Is it high or low? And why is this? (3)

6. What is the average number of frog species found in the Northern Cape? Is it high or low, why? (3)



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* ranges selected according to the closest percentiles for 5 categories.

____/15

Worksheet 2.1.

How forests help to clean air

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Name: ________________________________ **Surname:** _____________________________

Grade: ________________________________ **Date:** _________________________________

Task: Conduct the photosynthetic efficiency test to observe how trees absorb carbon dioxide and release oxygen

<u>You will need:</u>

- Container;
- Water;
- Dishwashing liquid;
- Bicarbonate of soda;
- Syringe
- Light;
- A punch; and
- Leaves.

<u>Directions</u>

- Obtain 300 mL of bicarbonate solution. (It contains 1/8 tsp of sodium bicarbonate)
- Add 1 drop of soap to the bicarbonate solution. If your solution generates excessive suds, add more water and bicarbonate.
- Hole punch 10 uniform leaf disks in texture and thickness avoiding major leaf veins .
- Remove the plunger of the syringe and place 10 leaf disks in the syringe barrel .
- Replace the plunger being careful not to crush the leaf disks.
- Push on the plunger until only a small volume of air and leaf disk remain in the barrel
- Draw a small volume of the sodium bicarbonate solution into the syringe.
- Invert the syringe and tap the syringe to suspend the leaf disks in the solution.
- Push the plunger removing as much air a possible from the syringe.
- Hold a finger over the syringe opening and draw back on the plunger to create a vacuum. Hold this for 10 seconds while swirling the syringe to further suspend the leaf disks in solution.
- Let off the vacuum and repeat step 8 if needed 2-3 more times until all leaf disks sink. If leaf disks do not sink, add more soap to the bicarbonate solution.
- Pour the disks and solution into the cup with bicarbonate solution
- Place the cup under a light source;
- Observe what happens. The leaf discs will begin to rise. This shows that the leaves are photosynthe-sizing taking in the carbon (bicarbonate of soda) and releasing oxygen which makes the leaf discs rise to the top.
- Why is this important to the survival of frogs?

Practical 2.1.

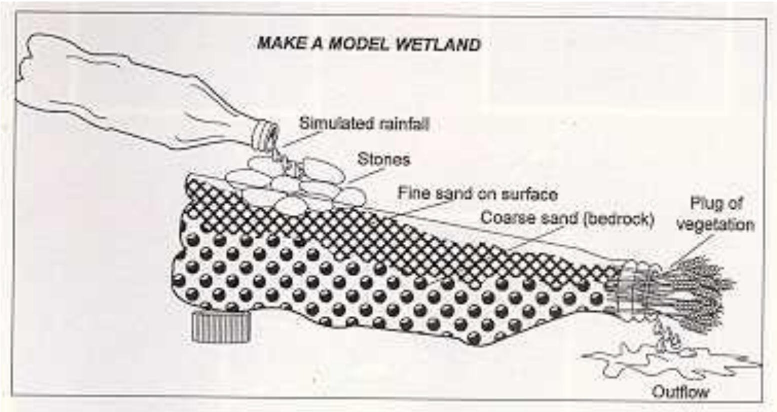
Make a wetland in a bottle

Name: _______________________________ **Surname:** ____________________________

Grade: _______________________________ **Date:** ________________________________

Task: Follow the directions below to make your own wetland in a bottle.

You will need:



- An empty 2 litre bottle cut in half along the length;
- Coarse sand,
- Fine sand,
- A few small rocks,
- A few grass clippings; and
- The lid of the bottle.

Directions

Step 1

1. Cut the 2 litre bottle in half along the length without damaging the neck of the bottle.
2. Plug the neck of the bottle with grass clippings.
3. Fill bottom of the bottle with the coarse sand.
4. Put a layer of fine sand on top of the coarse sand.
5. Pack the stones in a little heap near to the fat end of the bottle.
6. Now put the fat end of the bottle on top of the lid of the bottle and rest the neck of the bottle in a little bowl in such a way that the bottle is at an angle going down towards the neck. The bottle has to be at an angle so that the water will run down from the fat end towards the neck of the bottle and into the bowl.

Step 2

Slowly pour water over the rocks. Watch through the sides of the bottle to see what happens. See how the water level in the sand rises. This can be compared to groundwater in a real wetland.

Step 3

Now mix water in a see-through container with dirt until the water is murky and muddy. Slowly pour the murky water over the stones in the "wetland". Keep a little bit behind in the container. Wait until the water has moved through the soil and flowed into the little bowl underneath the neck of the bottle. What is the colour of the water? Compare it to the colour of the murky, muddy water left behind in the see-through container.

Field Trip 2.1.

Visit a frog habitat

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Name: ________________________________ **Surname:** _____________________________

Grade: _____________________________ __ **Date:** ________________________________

Task: Visit a habitat in your area and conduct a habitat study:

Describe the habitat and draw a diagram of the wetland. (10)

List 5 plants that you observed at the habitat. (5)

List 5 animals you observed at the habitat. (5)

Did you find any frogs? (1)

What kind of frog was it? (1)

How big was the frog? (1)

Where did you find the frog? (1)

What was it doing? (1)

Describe any threats to frogs that you can observe in and around the habitat. (4)

_______/29

Assessment Sheet 2

Learner Name and Surname	Worksheet 1	Practical 2	Field visit	Total	Average

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1 An amphibian perspective

Amphibians are currently the most threatened vertebrates on earth, with almost half of all known species (nearly 8,000) experiencing population declines. Frogs make up the largest number of amphibians (over 7,000 different types around the world), and are the only type of amphibian that occur in South Africa. These animals, use both water and land during their lifecycle, as such, are good indicators of the health of the environment – and ultimately human health too. The disappearance of frogs around the world is a direct indication of the loss of freshwater habitats. In the past century, the world has lost up to 71% of its wetlands and many of our rivers are seriously deteriorated - alarming indications of the global threat to water security.

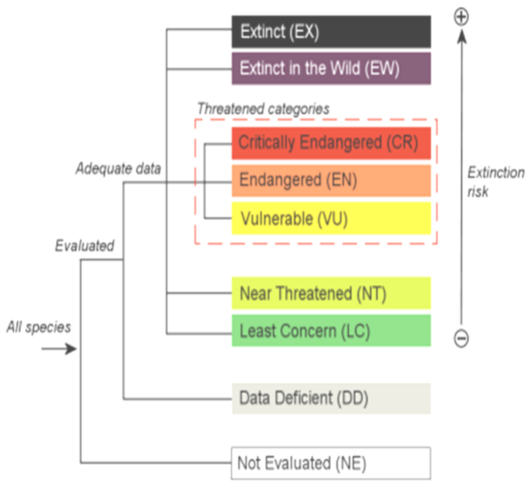
2 Amphibians under threat

Changes to the environment made by humans are the major threat to amphibians. Globally, loss of habitat is by far the biggest factor causing species declines, followed by pollution. In South Africa, habitat loss and modification from agriculture, urban development and natural system modifications are among the main causes for declines in frog populations.

FACTOR	PROCESS(ES)
Habitat destruction, alteration and Fragmentation	Roads, introduced species, or other factors separate remaining populations of amphibians from each other.
Introduced Species	Non-native species prey on or compete with native amphibians.
Over-Exploitation	Amphibians are removed from the wild and sold internationally as food, as pets, or for medicinal and biological supply markets
Climate Change	Amphibians are extremely sensitive to small changes in temperature and moisture. Changes in global weather patterns (e.g. global warming) can alter breeding behaviour, affect reproductive success, decrease immune functions and increase amphibian sensitivity to chemical contaminants.
UV-B Radiation	Levels of UV-B radiation in the atmosphere have risen significantly over the past few decades. Researchers have found that UV-B radiation can kill amphibians directly, cause sub-lethal effects such as slowed growth rates and immune dysfunction, and work synergistically with contaminants, pathogens and climate change.
Chemical Contaminants	Chemical stressors (e.g., pesticides, heavy metals, acidification and nitrogen based fertilizers) can have lethal, sub-lethal, direct or indirect effects on amphibians. These effects may include death, decreased growth rates, developmental and behavioural abnormalities, decreased reproductive success, weakened immune systems and/or hermaphroditism.
Disease	Diseases (such as chytridiomycosis) or increased susceptibility to existing diseases leads to deaths of adults and larvae.
Deformities	There has been a recent and widespread increase of deformities (or malformations) in natural populations of amphibians; this is now perceived as a major environmental problem.
Synergisms	Multiple factors can act together to cause mortality or sub-lethal effects.

3 A system for monitoring amphibian declines

The IUCN (International Union for the Conservation of Nature) Red List assesses the conservation status of species on a global scale in order to catalogue and highlight those plants, fungi and animals that are facing a higher risk of global extinction i.e. those listed as Critically Endangered, Endangered and Vulnerable. It also assesses species that are categorised as Extinct, Extinct in the Wild, Near threatened and Least Concern. Least Concern does not mean however that we do not have to worry about these species.



4 The status of frogs in South Africa

A major global assessment on the status of amphibians was done in 2004, which included 117 frogs species in South Africa. Of these, 17% of species were considered to be in a threatened category: four Critically Endangered, eight Endangered and eight Vulnerable; five were considered Near Threatened (NT), 84 Least Concern (LC) and eight as Data Deficient (DD). This process was repeated in 2010 and 2016, with the most recent figures showing that the proportion of globally threatened species is now at 30%, and the proportion of Data Deficient species has increased globally to 25%, largely due to new species descriptions. If we compare the South African data with global data for frogs only, we still get similar proportions as we do for the entire amphibian dataset, with 29% of all frogs assessed in a threat category (CR – 7%, EN – 12% and VU – 10%), whereas 6% are assessed as NT, 39% as LC, and 26% as DD (Measey, 2011).

Red List Category	Number of species (Global) 2004	% of species (Global) 2004	Number of species (Global) 2010	% of species (Global) 2010	Number of species (South Africa) 2004	% of species (South Africa) 2004	Number of species (South Africa) 2010	% of species (South Africa) 2010
Extinct (EX)	34	0.6	37	0.6	0	0	0	0
Extinct in the Wild (EW)	1	0.02	2	0.03	0	0	0	0
Critically Endangered (CR)	427	7.4	484	7.7	4	3.4	5	4.2
Endangered (EN)	761	13.3	754	12	8	6.8	7	5.9
Vulnerable (VU)	668	11.6	657	10.5	8	6.8	5	4.2
Near Threatened (NT)	359	6.3	382	6.1	5	4.3	5	4.2
Least Concern (LC)	2199	38.3	2371	37.7	84	71.8	96	81.5
Data Deficient (DD)	1294	22.5	1597	25.4	8	6.8	0	0
Total Number of Species	5743		6284		117		118	

5 Red List of frogs in South Africa

The IUCN Red List is used to guide conservation of frogs to prioritise species that are Critically Endangered, Endangered or Vulnerable. There are at present a variety of projects aimed at conserving and protecting priority frog species in South Africa, including the Endangered Wildlife Trust's Threatened Amphibian Programme.

The Red List species of South African frogs in order of status between 2004 and 2016. Threatened categories: CR = Critically Endangered, EN = Endangered, VU = Vulnerable NT = Near Threatened (Note these are subject to change, please check https://www.iucnredlist.org/ for updates.

Frog species	Province	Red List Category 2010	Red List Category 2019
Anhydrophryne ngongoniensis	KwaZulu-Natal	EN	EN
Heleophryne hewitti	Eastern Cape	EN	EN
Heleophryne rosei	Western Cape	CR	CR
Microbatrachella capensis	Western Cape	CR	CR
Hyperolius pickersgilli	KwaZulu-Natal	CR	EN
Vandijkophrynus amatolicus	Eastern Cape	CR	CR
Leptopelis xenodactylus	KwaZulu-Natal	EN	EN
Natalobatrachus bonebergi	KwaZulu-Natal	EN	EN
Sclerophrys pantherina	Western Cape	EN	EN
Afrixalus knysnae	Western Cape	EN	EN
Anhydrophryne rattrayi	Eastern Cape	EN	VU
Xenopus gilli	Western Cape	VU	EN
Breviceps sylvestris	Limpopo	EN	VU
Breviceps macrops	Northern Cape	VU	NT
Capensibufo rosei	Western Cape	VU	CR
Hemisus guttatus	KwaZulu-Natal	VU	NT
Afrixalus spinifrons	KwaZulu-Natal	NT	LC
Breviceps gibbosus	Western Cape	NT	NT
Cacosternum capense	Western Cape	NT	NT
Hyperolius horstockii	Western Cape	VU	LC
Strongylopus springbokensis	Northern Cape	VU	LC
Arthroleptella rugosa	Western Cape	N/A	CR
Arthroleptella subvoce	Western Cape	DD	EN
Breviceps bagginsi	KwaZulu-Natal	DD	VU

8 What can we do?

Take action! When a problem has been identified that threatens our environment and our community use the diagram below to determine the action that you can take to address the problem.

Some project ideas include:

1. Reduction and prevention of pollution;
2. build environmental citizenship in your community;
3. Monitor water quality in your community;
4. Adopt a wetland ;
5. Celebrate Leap Day for Frogs and World Wetlands Day;
6. Let authorities know if there is a problem;
7. And many, many more.

A project all depends on the situation of the environment and community.

9 Frogs in the curriculum

Subject: Natural Sciences

Specific Aims

1. Doing science
2. Knowing the subject content and making connections'

Process Skills

Accessing and recalling information; observing, raising questions, doing investigations, recording and interpreting investigations.

Integration

Language, Mathematics and Life Skills

Lesson Format

Work though the information in the factsheet with learners and complete worksheet 3.1. Worksheet 3.2.—3.9. will assist with the planning and implementation of an action project to address the threats to frogs in your area.

Assessment

1. Worksheet 3.1. : Threats to frogs
2. Worksheet 3.2.—3.9.: Action project guide

Worksheet 3.1.

Threats to frogs

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Name: ________________________________ **Surname:** _____________________________

Grade: _____________________________ __ **Date:** _________________________________

Task: Use the table on major threats to frogs and answer the questions below.

1. What are the major threat to South African frogs (1)?

Major threats	All species Global	% of all species Global	All species South Africa	% of all species South Africa
Residential and commercial development	2063	32.8	38	32.8
Agriculture and aquaculture	3125	49.7	58	50.0
Energy production and mining	229	3.6	3	2.6
Transportation and service corridors	256	4.1	3	2.6
Biological resource use	2908	46.3	6	5.2
Human intrusions and disturbance	276	4.4	1	0.9
Natural systems modifications	913	14.5	30	25.9
Invasive and other problematic species and genes	987	15.7	43	37.1
Pollution	1111	17.7	17	14.7
Geological events	63	1.0	0	0.0
Climate change and severe weather	397	6.3	3	2.6

2. Draw a graph showing the % of all South African frogs and their major threats as outlined in the table above (11).

Worksheet 3.2.

Project identification guide

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Name: ______________________________ **Surname:** ___________________________

Grade: ______________________________ **Date:** _______________________________

Directions: Use the table to below as a key to determine what project is relevant to you. Projects are colour coded to action themes, namely: Frog Diversity (green), Habitat (orange), Water (blue) and Waste (red). Once you have identified your project, use the worksheets specified to complete your project. *For example, if you have illegal dumping around in a river near your school, go to waste management (red) then use worksheet 3.3, 3.7, 3.8 and 3.9 to complete your project.*

Problem	Colour Guide	Worksheet Reference
Frog Diversity		
Critically Endangered frogs present		Worksheet 3.3., 3.4., 3.8 and 3.9.
Endangered frogs present		
Vulnerable frogs present		
Habitat disturbance		
Wetland disturbance		Worksheet 3.3., 3.5, 3.8. and 3.9.
Forest disturbance		
River disturbance		
Grassland disturbance		
Water management		
Industrial pollution		Worksheet 3.3., 3.6, 3.8 and 3.9.
Agricultural pollution		
Domestic pollution		
Waste management		
Illegal dumping		Worksheet 3.3., 3.7., 3.8 and 3.9.
Waste management		
Knowledge		
Document existing knowledge		Worksheet 3.3.
Source existing knowledge		
Enquiry		
Conduct frog surveys		Worksheet 3.4.
Conduct habitat condition assessments		Worksheet 3.5.
Conduct water quality tests		Worksheet 3.6.
Conduct waste audits		Worksheet 3.7.
Action		
Habitat management		Worksheet 3.8.
Pollution reduction from source		
Develop and implement a waste management plan		
Community action campaigns towards environmental citizenship		
Monitor		
Conduct community attitude surveys		
Conduct frog surveys		Worksheet 3.4.
Conduct habitat condition assessments		Worksheet 3.5.
Conduct water quality tests		Worksheet 3.6.
Conduct waste audits		Worksheet 3.7.
Evaluate		
Compare pre and post audits		Worksheet 3.9.
Measure change		
Calculate inputs and outputs		
Document and report with recommendations		

Worksheet 3.3.

Knowledge audit

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Name: ________________________________ **Surname:** _____________________________

Grade: ________________________________ **Date:** _________________________________

Task: Write down what you know about the problem that you have identified for your project.

Name of site	
What is the main problem at this site?	
What do you think is the cause of the problem?	
Who is responsible for the problem?	
Who is the management authority for the site?	
Do you have contact names and numbers?	
What information do you need to collect to address the problem?	
Draw a map in the space below to show the location of the problem.	

________/8

Worksheet 3.4.

Frog Survey

Name: ________________________________ **Surname:** _____________________________

Grade: ________________________________ **Date:** _________________________________

Task: Draw up a list of frogs in your area and list the scientific and common names as well as their Red List status

Number	Scientific Name	Common Name	IUCN Red List status
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			

_____________/63

Worksheet 3.5.

Habitat condition assessment

Name: ________________________________ **Surname:** _____________________________

Grade: _____________________________ __ **Date:** ________________________________

Task: Habitat condition assessment

A habitat condition assessment is conducted to determine the condition of that habitat. There are a variety of different methods to achieve this. The method outlined below serves to provide an overview of the condition by measuring the following indicators:

Name of site:		Land Area: How big is the habitat in hectares or square meters?		
Condition assessment				
Indicator	Description	Low—1 (0-33% land area)	Medium—2 (34—67% land area)	High—3 (68—100% land area)
Soil erosion	How much land is exposed as bare soil?	Low—1 (0-33% land area)	Medium—2 (34—67% land area)	High—3 (68—100% land area)
Alien invasive plants	How much of the land area is covered by alien invasive plants?	Low—1 (0-33% land area)	Medium—2 (34—67% land area)	High—3 (68—100% land area)
Land pollution	How much of the land area is covered by pollution?	Low—1 (0-33% land area)	Medium—2 (34—67% land area)	High—3 (68—100% land area)
Water clarity	How clear is the water? Circle the relevant condition.	Poor—1 (water is not clear and you cannot see to the bottom)	Average—2 (water is a little murky and you can just see the bottom)	Good—3 (water is very turbid and the bottom cannot be seen)
Total score	Add up the scores and circle the condition category below.			
Condition category		Low quality (0—5)	Medium (6—10)	Good (11—15)
List the top three indicators of concern		1.	2.	3.

_______/12

Worksheet 3.6.

Water quality assessment

Name: ________________________________ **Surname:** _____________________________

Grade: _____________________________ __ **Date:** _________________________________

Task: Conduct a water quality assessment to test bacteria presence, pH, ammonia and nitrates.

You will need:

- Petri dishes
- Gelatin
- Water samples
- Water tests for pH, Ammonia and Nitrates

Directions

Step 1: Bacteria tests

1. Clean and sterilise petri dishes
2. Mix gelatin with water and place a small amount that shallowly covers the bottom of the petri dish.
3. Let the gelatin set over night
4. Label petri dishes and water samples either a, b, c depending on how many water samples have been collected.
5. Using a pipet place a drop of a water sample into the correspondence petri dish.
6. Seal the petri dishes and place in a dark, warm cupboard for 7 days;
7. After 7 days observe the growth of bacteria on the gelatin.;
8. Record bacteria growth as low, medium and high.

Step 2: pH, ammonia and nitrate tests

1. Using relevant test kits, conduct pH, ammonia and nitrate tests according to the instructions.

Step 3: Record results

1. In the table below, record the results of the test.

Test	Control	Sample A	Sample B	Sample C	Sample D	Sample E	Sample F	Sample G
Bacteria								
pH								
Ammonia								
Nitrates								

Discussion

1. Which sample had the lowest quality?
2. Why do you think this was?
3. What action can be taken to address the quality of water? _____/20 (10 results and 10 following directions)

Worksheet 3.7.

Waste audit

Name: ________________________________ **Surname:** _____________________________

Grade: _____________________________ __ **Date:** ________________________________

Task: Conduct a waste audit using the data sheet below.

Site Name:			Date:		Land area:		
Item	Paper	Plastic	Metal	Glass	Organic Material	Non-Recyclable	Other e.g. nappies
Tally the number of items found in the area.							
Total							

What waste item did you find the most of in the area?

Why do you think this is so high?

What do you think can be done to reduce this category of waste?

Draw a graph to illustrate your results.

Worksheet 3.8.

Action planning

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Name: ________________________________ **Surname:** _____________________________

Grade: _____________________________ __ **Date:** ________________________________

Task: Using the template below develop a plan to take action to address the problem you have chosen to address.

Action Project					
What do you want to achieve?					
Action Steps	Who is responsible?	When will this take place?	What resources are needed?	What are the potential challenges?	Who should be involved?
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					

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Worksheet 3.9.

Evaluation

Name: ________________________________ **Surname:** _____________________________

Grade: _____________________________ __ **Date:** ________________________________

Task: Evaluate the action take using the table below.

Measure of change—is there a difference between the pre and post audit/surveys?	
Was there a small of big change? Explain.	
Did you achieve your objectives?	
What were some of the main successes?	
What were some of the main challenges?	
How much time did it take to complete the project?	
How much did the project cost?	
Who did you report to on the outcomes of the project?	
Did you enjoy the project?	
What did you learn?	

___________/10

Assessment Sheet

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Learner Name and Surname	Worksheet 3.1.	Worksheet 3.2.	Worksheet 3.3.	Worksheet 3.4.	Worksheet 3.5.	Worksheet 3.6.	Worksheet 3.8.	Worksheet 3.9.	Total	Average

References

du Preez, L., & Carruthers, V. (2009). *A Complete Guide to the Frogs of Southern Africa.* Cape Town: Random House Struik (PTY) Ltd.

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Measey, G. (2011). *Ensuring a future for South Africa's Frogs: A strategy for conservation research.* Pretoria: South African National Biodiversity Institute.