

Wonderful Water

An Environmental Education Programme

A Watery World

Mangrove Ecosystems in TCI

7. Classification of Organisms in a Mangrove Ecosystem

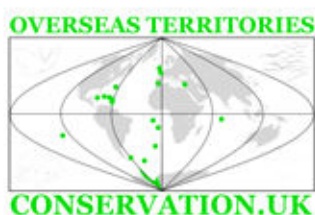
Teachers' Guide



Plant Kingdom



Animal Kingdom



TCI
Education Department



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Teachers' Guide

Target Age Group - 9 - 11 years

This environmental education programme has been produced by the UK Overseas Territories Conservation Forum (UKOTCF) and the Turks and Caicos Department of Education.

It was part-funded by the Overseas Territories Environment Programme (OTEP) of the UK Department for International Development and the Foreign and Commonwealth Office.

The project was developed from an original idea by Mr Edgar Howell, Director of Education, Turks and Caicos Islands, and these materials developed by a team co-ordinated by Ann Pienkowski, Environmental Education Co-ordinator, UKOTCF. It is hoped that through the teaching materials developed for this project, students in TCI will gain a greater understanding of the importance of the water ecosystems in TCI, and the need to conserve these.

As a possible model to assist environmental education in other areas of the Caribbean (especially UK Overseas Territories) these materials will be made available to a wider audience.

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Introduction

In devising these teaching materials, reference was made to the TCI Science Curriculum for Grade 5 and 6, and the science teaching materials currently being used in primary schools in TCI.

A curriculum framework has been developed, which links the Wonderful Water themes to curriculum requirements. As part of the curriculum framework, expected levels of achievement for a particular stage in a students' education have been developed into statements of competency which can be used to assess the levels students have reached. The purpose of these statements of competency is to support teachers in their review of students' progress. The objectives given in the pupils' materials relate to these statements of competency.

Assessment criteria / Statements of competency

These level statements relate to levels of attainment given in the Science National Curriculum for England, but are compatible with such statements about expected attainment in many other curricula.

This table gives the level (L) a child is expected to achieve at a particular stage in their schooling:

End of grade:	Expected attainment related to curriculum levels (from National Curriculum for England)		
	Slower progress	Most pupils	Faster progress
4	L2	L3	L3/4
5	L2/3	L3/4	L4/5
6	L3	L4	L5

7 - Classification of Organisms in a Mangrove Ecosystem: statements of competency

The assessment criteria / statements of competency, which relate to the unit on Classification of Organisms in a Mangrove Ecosystem are given below

Variation and Classification

L2: Sort living things into groups using simple features

L3: Sort organisms into broad groups using easily observable features

L4: Group animals and plants scientifically by specific features. Know that the major groups of animals are vertebrates and invertebrates and that the major groups of vertebrates are mammals, fish, birds, reptiles and amphibians

L5: Understand the importance of classification and classify living things into the major taxonomic groups

The pupils' text provides key information for pupils.

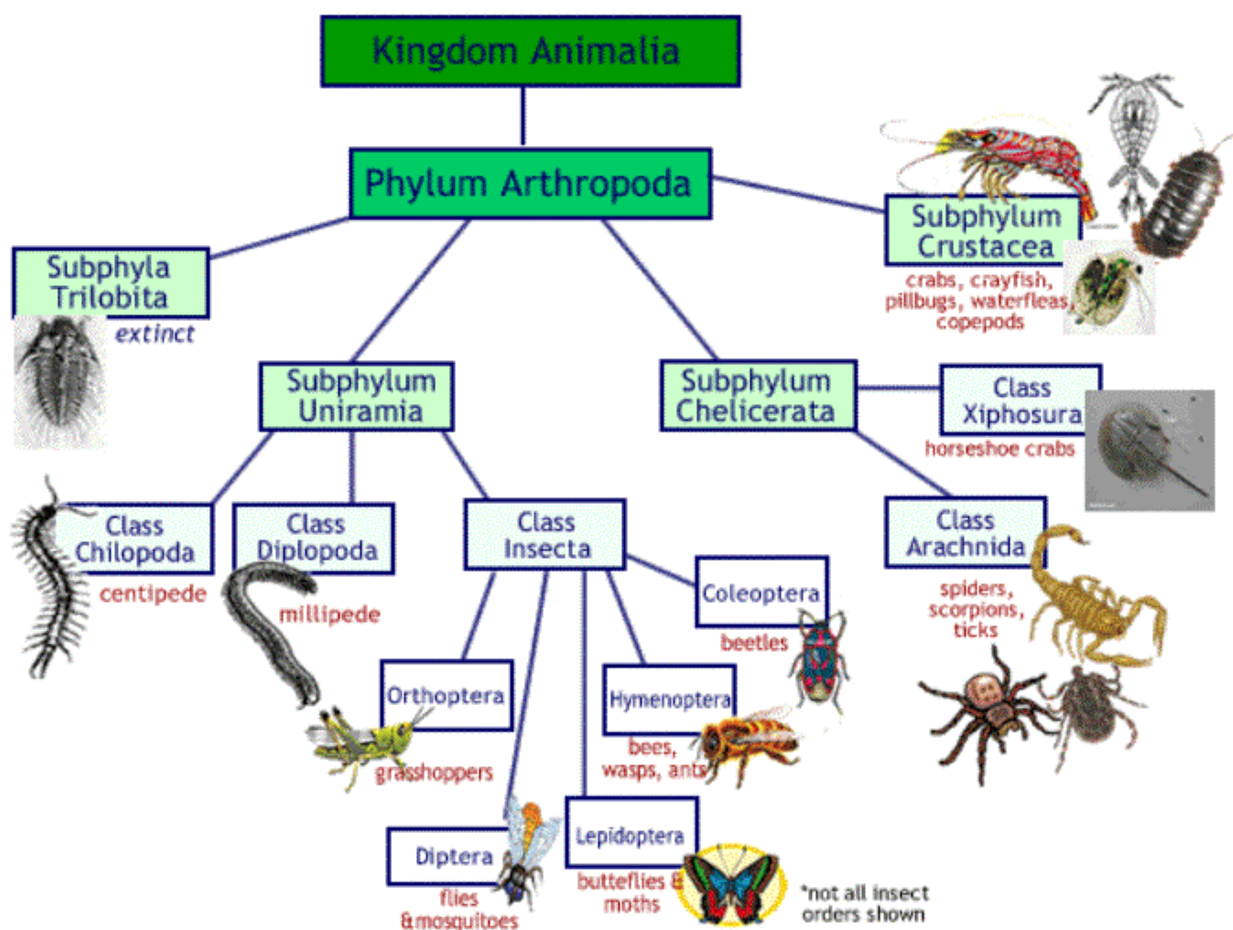
The teachers' guide contains further information and resources for teachers, suggested activities for pupils, and example pupil worksheets.

The illustrations in this guide, and those in the pupil text, will be provided as powerpoint pdfs.

The suggested pupil activities and worksheets can be carried out by individuals, pairs or small groups.

These materials are a working draft, and any suggestions for further activities, amendments and improvements are welcome.

Any comments / suggestions should be sent to the UKOTCF Environmental Education Co-ordinator, Ann Pienkowski. Email apienkowski@ukotcf.org



Example classification chart for the arthropods

Classifying Organisms - overview

There are billions of different kinds of living things (or organisms) on earth. To help study them, biologists have devised ways of naming and classifying them according to their similarities and differences. The science of classifying living organisms is called taxonomy

The system most scientists use puts each living thing into seven groups (or taxons), organized from most general to most specific. Therefore, each species belongs to a genus, each genus belongs to a family, each family belongs to an order, and so on.

From largest to smallest, these groups are:

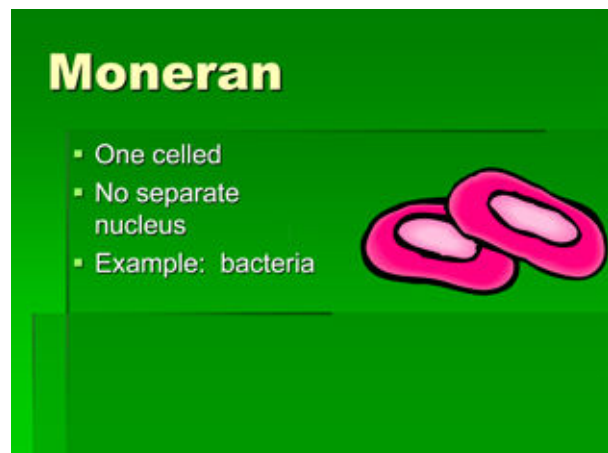
- Kingdom
- Phylum
- [Sub Phylum]
- Class
- Order
- Family
- Genus
- Species

The inventor of modern scientific classification was Carolus Linnaeus (1707-1778) a Swedish botanist who classified and described more than 4,400 species of animals and 7,700 species of plants.

Biologists today have classified and divided all living things into five groups they call Kingdoms. These kingdoms are based on how living things are the same and how they are different.

At present there are five kingdoms: the Monera Kingdom, the Protist Kingdom, the Fungi Kingdom, the Plant Kingdom, and the Animal Kingdom.

The following slides can be used to illustrate the five kingdoms. (These are provided full-size in the illustrations from the Teachers' Guide document).



Protist

- Most one celled
- Have nucleus and other cell structures
- Examples: algae, amoeba



Fungus

- Many celled
- Cannot move
- Absorb nutrients from other organisms
- Examples: mushrooms, yeast, molds



Plant

- Many-celled
- Cannot move
- Use energy from the sun to make sugars
- Examples: trees, flowers, ferns



Animal

- Many-celled
- Most can move
- Get energy by consuming other organisms
- Examples: invertebrates, fish, birds, mammals

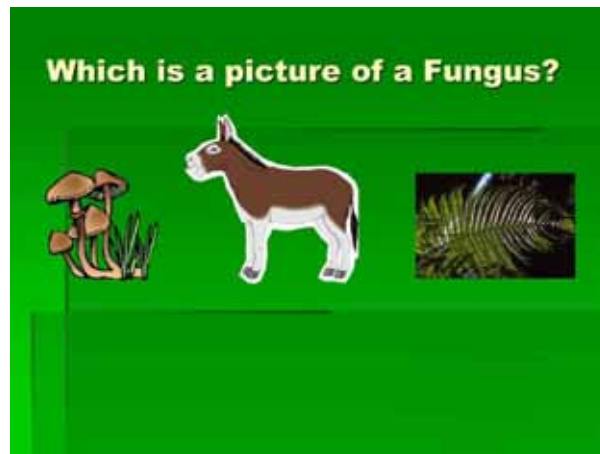
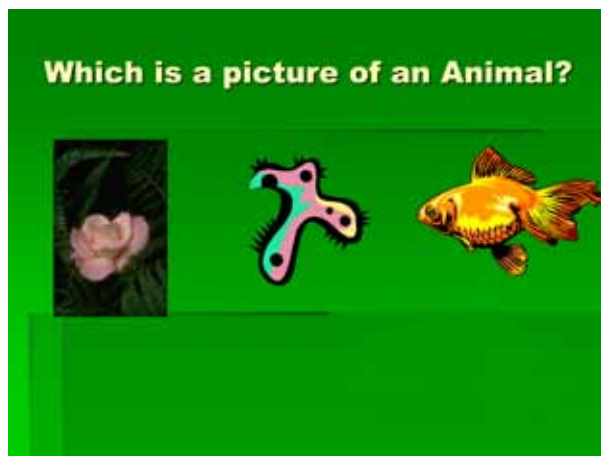


Which is a picture of a Plant?



Which is a picture of a Protist?





For the purposes of the work pupils are expected to cover in Phase 1, the focus is on certain aspects of the Plant and Animal Kingdom and organisms which pupils might be more familiar with. Brief mention is made of the Fungi Kingdom, and two other Kingdoms for different kinds of micro-organisms.

Species are the smallest groups. A species consists of all the animals of the same type, who are able to breed and produce young of the same kind. For example, while any two great white sharks are in the same species, as are nurse sharks, great whites and nurse sharks are in different species (since they cannot interbreed). Here is an example of the full classification for a nurse shark.

Nurse Shark Classification		
Kingdom	Animalia	(animals)
Phylum	Chordata	
SubPhylum	Vertebrata	(vertebrates)
Class	Chondrichthyes	(cartilaginous fish)
Subclass	Elasmobranchii	(sharks and rays)
Order	Orectolobiformes	
Genus	<i>Ginglymostoma</i>	
Species	<i>cirratum</i>	

Classification of Vertebrates - common characteristics

VERTEBRATES Animals that have a backbone		
Group	Main features	Examples
Mammals	Babies are born alive Have hair or fur on their body Breath with lungs Warm Blooded	bat, whale, dog, horse, human
Birds	Lay eggs with hard shells Have feathers Breath with lungs Warm Blooded	tern, egret, osprey, owl
Reptiles	Lay soft-shelled eggs on land Skin covered in scales Breath with lungs Cold blooded	snake, lizard, turtle,
Amphibians	Born with gills that turn into lungs Lay eggs in water but live on land Cold blooded	frog, toad,
Fish	Breath with gills Lay eggs in water Have fins and scales Cold blooded	grouper, snapper, shark,

Warm blooded animals have a steady body temperature (human body temperature is 37 °C)

Cold blooded animals have a body temperature that changes according to the ambient temperature.

Classification of Invertebrates - common characteristics

INVERTEBRATES Animals that have no backbone		
Animal group	Main features	Examples
Insects	3 pairs of legs, 3 parts to their body, hard outside skin	ant, butterfly, fly
Arachnids	4 pairs of legs and 2 parts to their body	spider, scorpion
Crustaceans	More than 8 legs but less than 20. Often have a very hard, jointed skin.	lobster, shrimp, crab
Molluscs	Have a soft body and a muscular foot.	snail, octopus, sea lettuce
Annelids	Have a long, thin body which is divided into little segments.	worms

Explanation of some animal groups - writing frame

1. **A shark** is a
 because
2. **A butterfly** is an
 because
3. **A spider** is an
 because
4. **An ant** is an
 because
5. **A bat** is a
 because
6. **A human** is a
 because.....
7. **A lizard** is a
 because
8. **A frog** is an
 because
9. **A snail** is a
 because
10. **A heron** is a
 because

Writing Frame to identify vertebrates and invertebrates

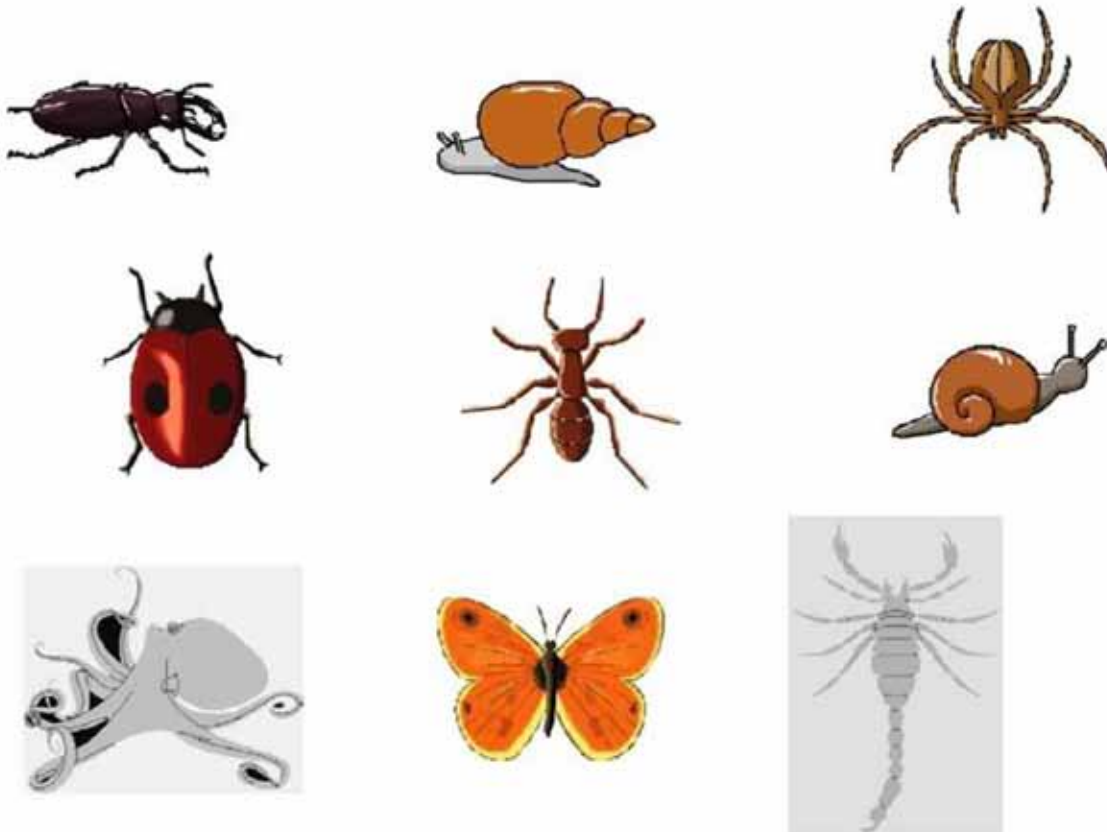
Vertebrate or Invertebrate?

Vertebrates	Invertebrates

List animals in the correct column - here are some to get you started:
bat, ant, spider, snake, frog, butterfly, crow, snapper, snail, worm,
jellyfish

Think of some other animals you find in TCI, and write them in the correct column of the table.

Picture resource to accompany invertebrate classification writing frame



Sorting using observable features

Sorting plants and animals into groups by looking for similarities and differences is a good starting point for work on classification, and can be done at different levels depending on the age and ability of the students. The pictures of living things found in the mangroves (such as those on this page) can be used to discuss how the animals can be sorted into two groups. These are some of the suggestions for sorting into two groups which pupils might make:

vertebrate – invertebrate; lives in water – lives out of water; legs – no legs; flies – does not fly; swims – does not swim; feathers – no feathers; shell – no shell.

(Note: in order to provide pupils with examples of animals from all the major groups, some animals have been included which are not found in the mangroves. Pupils can be asked to think about which ones might be found in mangroves, and which ones not.

Identification photo resources - Set 1 (available as powerpoint pdf)



Queen conch



Green turtle



Upside-down jellyfish



Crab



Yellow-crowned
night heron



Haitian tree frog (NB - not found
in a salt-water environment)



Roseate skimmer



Mosquito



Isopod



Nurse shark



Lettuce leaf sea slug



Humpback whale

Online activities for grouping and sorting

If you have internet access, there are a number of online activities which help students think about similarities and differences. Of course, the animals and plants in these online activities are general rather than specific to TCI. Screenshots of these programmes are shown.

Grouping Animals and Plants, available from:

<http://www.kineticcity.com/mindgames/grinder/>



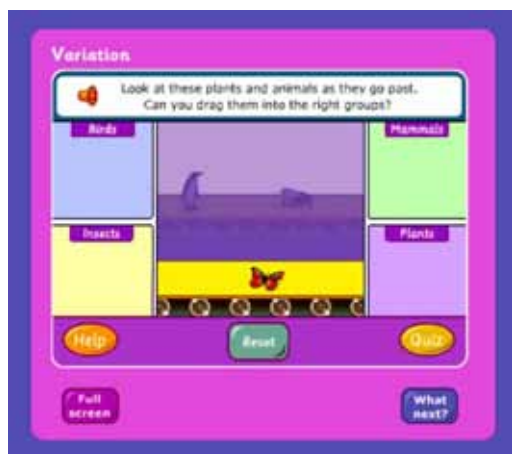
There are two online grouping activities available on the BBC education site:

http://www.bbc.co.uk/bitesize/ks2/science/living_things/variation/play/



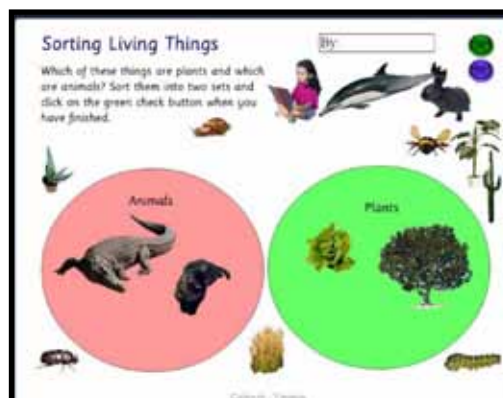
This game asks students to sort 60 deadly animals into different groups, based on their characteristics.

http://www.bbc.co.uk/schools/scienceclips/ages/6_7/variation.shtml



Pupils are asked to look at pictures of plants and animals as they go past, and drag them to the right groups.

Another website with links to suitable activities to support learning about grouping and variation is <http://www.crickweb.co.uk/ks2science.html>



This activity includes 3 options: 1. Sorting plants and animals into distinct sets; 2. Sorting animals using own criteria; 3. Explaining similarities and differences in animals.

Sorting organisms lesson plan

A lesson plan accompanies this online activity, and is reproduced below. This plan can also be used, of course, independently of the online version, using other picture resources.

Learning objectives

- to observe and recognise some simple characteristics of animals and plants
- know that the group of living things called animals includes humans
- know that humans are more like each other than they are like other animals

Introduction:

Sort pictures of animals and plants asking for pupils to suggest how they know whether it is an animal or a plant. Ask pupils to identify criteria for sorting, and suggest similarities and differences between animals.

Independent Activity: If resources allow, ask pupils to work through the activities in the online programme. If computer and internet resources are not available, ask pupils to undertake sorting and grouping activities using pictures (like those available in this guide and the accompanying illustrations pdf.

Plenary: Ask pupils to:

- identify ways in which the animals are like each other (for example they all have heads, they all have eyes, they all move,);
- identify ways in which humans are like each other (two eyes, two legs,)
- and are different from many other animals (humans do not lay eggs, do not have fur,).

Ask questions to check understanding eg What have all living things in common?

Here is another version of the lesson plan:

Objective: to investigate how animals and plants are grouped.

Introduction:

Make sure that pupils understand that everything alive is called an organism. Ask: "How do we group these organisms?" Note pupils' ideas on flip chart, chalk board or computer with projector.

Show children some animal and plant pictures (cards, print-outs, on-screen with computer projection). Ask questions: eg Can you identify any similarities between these plants and animals?

Using identified similar characteristics (eg with / without legs; with / without shell) demonstrate how Venn diagrams can be used to group these.

Activity

Ask pupils (in pairs, groups as appropriate) to explore different ways of grouping species cards by looking at their similar features, using Venn diagrams. Make sure the pupils understand that they need to be able to explain why they have grouped organisms in a particular way.

Plenary

Pupils explain how they have grouped their species.

Identification photo resources - Set 2 (available as powerpoint pdf)

Note that, in order to give pupils opportunities to group a wide range of species, not all species represented here are found in the mangrove ecosystem, although they are all found in TCI. So an interesting question for students could be “Which of these species are found in the mangroves in TCI?”



Spider



Snail



Curly-tailed lizard



Caicos pine



Red mangrove



Coral



Long strap fern - view of spores inset



Turks head cactus



Centipede



Arenicola worm



Orchid



Donkey



Algae



Buffy flower bat



Drury's hairstreak butterfly



Erebus moth

NOTE: The most obvious difference between butterflies and moths is in the antennae. Most butterflies have thin slender filamentous antennae which are club-shaped at the end. Moths often have comb-like or feathery antennae, or filamentous and unclubbed. This distinction is the basis for the earliest taxonomic divisions in the lepidoptera: the *Rhopalocera* meaning clubbed horn (butterflies) and the *Heterocera* meaning varied horn (moths).



Typical butterfly antennae



Feathery moth antennae

Carroll Diagram for sorting

Another method of sorting and grouping living organisms is to use a Carroll Diagram. Below is an example Carroll Diagram for sorting animals.

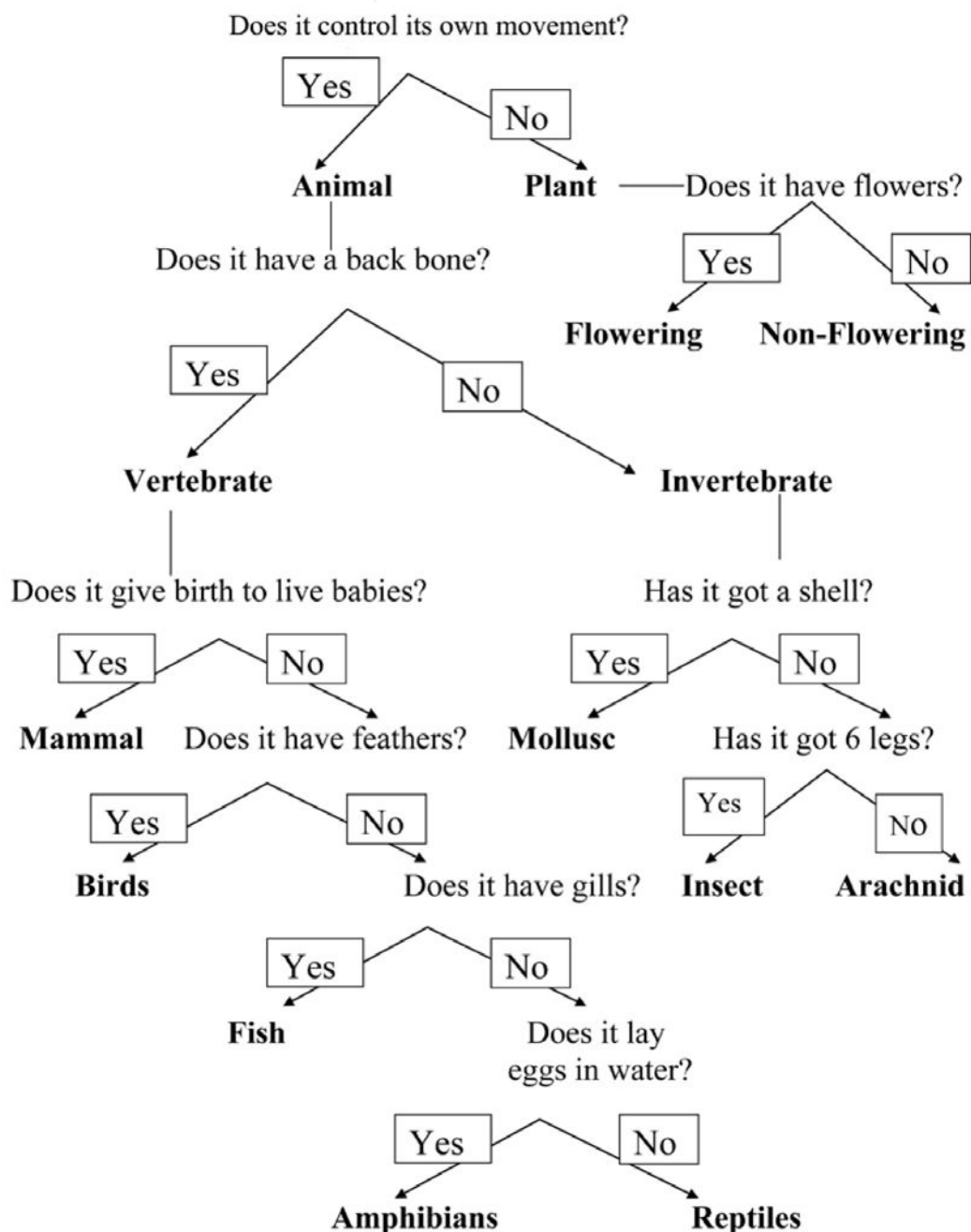
	<i>Lives in water</i>	<i>Lives on land</i>
<i>Has legs</i>		
<i>Has no legs</i>		

Using and Creating Dichotomous Keys

To devise a simple key:

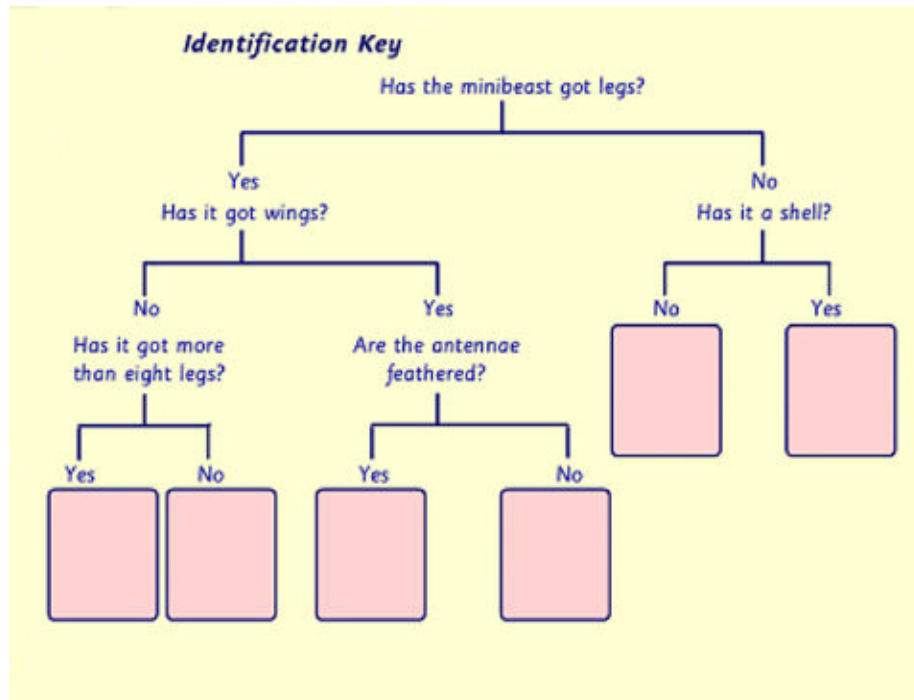
- Make up questions that divide the group of living things into two groups.
- Construct questions that have a clear yes or no answer.
- Keep going until there is only one living thing in each group

Here is one example of a dichotomous key which separates plants and animals into major groups, according to their characteristics



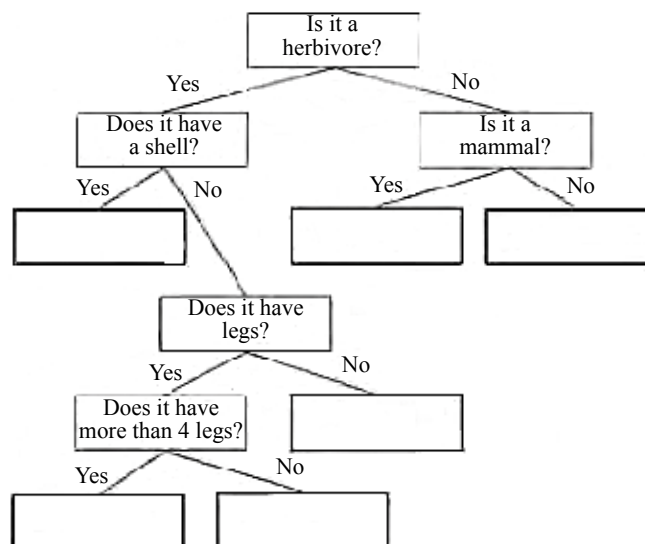
If you have internet access, a simple online application demonstrating the use of dichotomous keys can be found at : http://www.crickweb.co.uk/ks2science.html#Minibeast_classification

The online version asks students to place the pictures of 6 animals in the correct place (the term minibeast is often used for invertebrates). However, this model can readily be adapted for other living organisms, and also used as a starting point for students to create their own identification keys for another set of organisms.

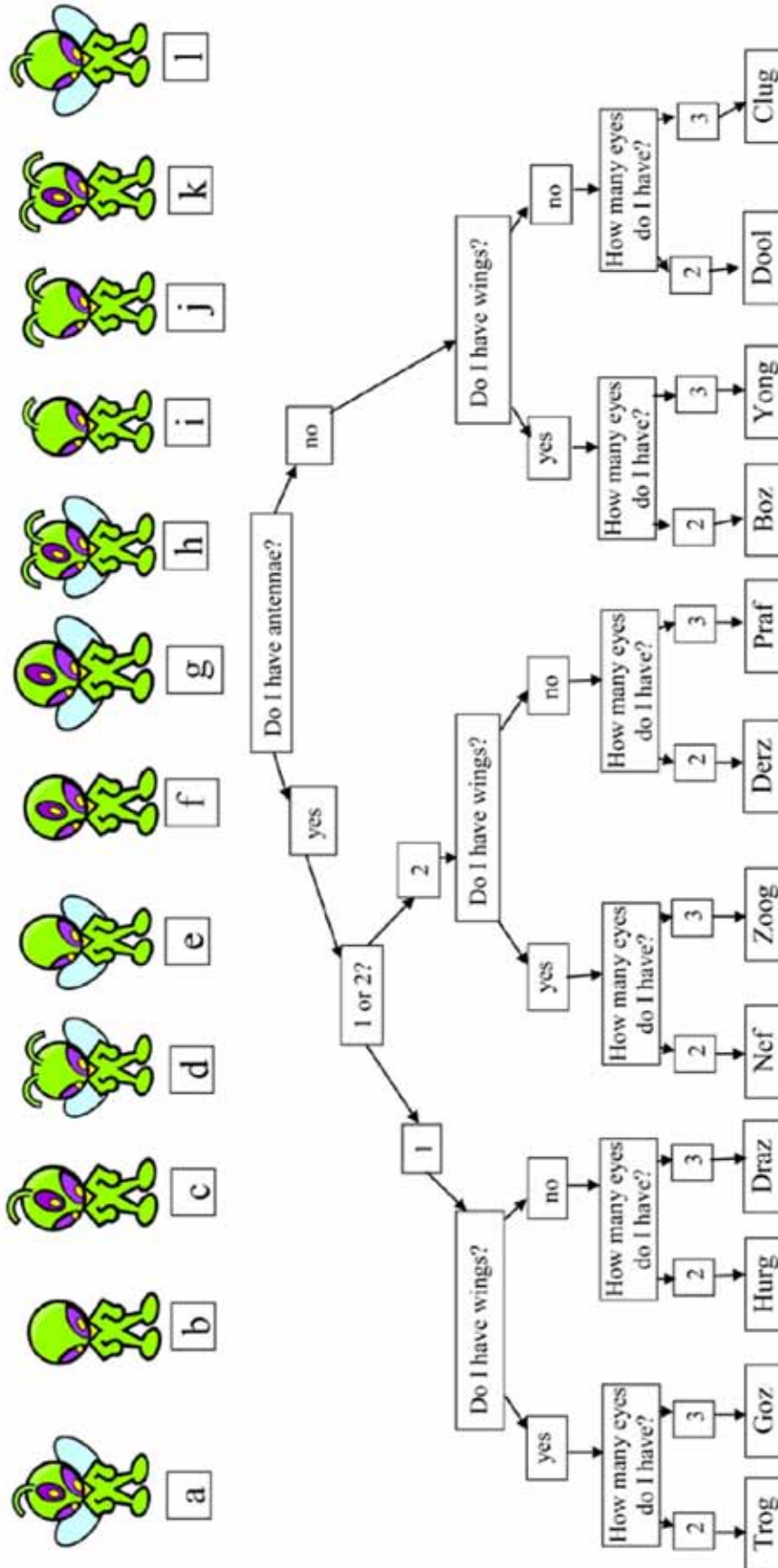


Introducing students to making their own identification key

Give students a set of cards of different living organisms. Ask them to sort the organisms in the whole set into two groups. Then ask the students to divide each of these into two further groups, until they end up with only one organism in each group. The results of these yes / no groups can be shown like this:



Identify the Aliens - a fun dichotomous key



Letter	Alien's Name	Letter	Alien's Name	Letter	Alien's Name
a		e		i	
b		f		j	
c		g		k	
d		h		l	

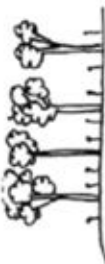
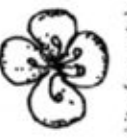
Answers to Aliens Dichotomas Key activity

Letter	Alien's Name	Letter	Alien's Name	Letter	Alien's Name
a	Goz	e	Boz	i	Hurg
b	Dool	f	Clug	j	Derz
c	Draz	g	Yong	k	Praf
d	Nef	h	Zoog	l	Trog

Students could be challenged to make up their own fun dichotomous keys, to identify imaginary organisms.

Identification guide to the four most common species of mangroves

(from Wondrous West Indian Wetlands Teachers' Resource Book. If you or your school do not have a copy of this resource, copies should be available from DECR or the Education Department. If you are unable to find a copy, please contact apienkowski@ukotcf.org)

Characteristic	Habitat	Roots	Leaves Appearance Position	Flowers	Fruit
	 near the sea on rocks, beaches and salinas (not usually in water)	 no prop or breathing roots	 long and thin, 2 small bumps (salt glands) at base of leaf stem Alternate	 very small, in clusters	 in clusters in rounded heads
	 usually to landward of black mangroves in brackish water	 thick knobby breathing roots, no prop roots	 rounded, sometimes with pinkish stems, 2 small bumps (salt glands) at base of leaf Opposite	 very small, white	 green and ribbed, in clusters
	 usually to landward of red mangroves in shallower, salty water	 no prop roots, surrounded by thin snorkel roots which stick out above the water	 long and thin, salt crystals on back Opposite	 white, four petals	 about 1 inch long, flattened
	 along the shoreline, and in lagoons, in salty water	 thick stilt or prop roots and long, slender aerial roots	 large, rounded and leathery Opposite	 yellow-cream with 4 pointed petals	 form torpedo-like plantlets on the tree

Identifying the four species of Mangroves found in TCI - Activity

The identification guide is based on the Wondrous West Indian Wetlands Teachers' Resource Book chapter 1, and lesson ideas (differentiate between mangrove species by comparing their roots, leaves, flowers and fruit) produced by the Bahamas Reef Environment Educational Foundation (BREEF).

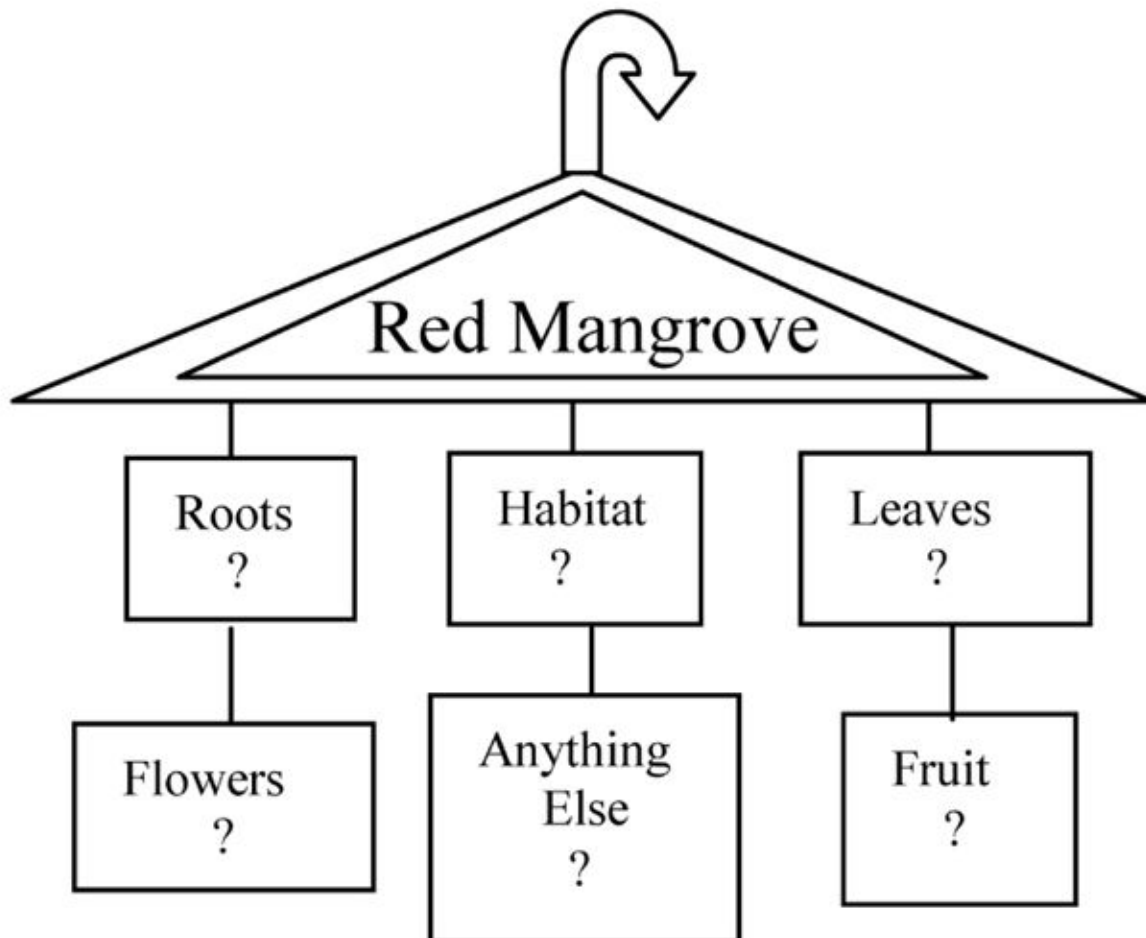
Give students a copy of the mangrove identification guide, and discuss similarities and differences between their roots, leaves (appearance and position), flowers and fruits.

Ask different groups of students to compare two species of mangroves, for example:- group 1 compare red mangrove and buttonwood; group 2 black and white mangrove; group 3 red and white mangrove; group 4 black mangrove and buttonwood; group 5 red and black mangrove; group 6 white mangrove with buttonwood.

Students can record their observations on a large sheet of paper.

Ask students to share their comparisons with the class.

As a follow-up, students can make an "identification mobile" to show the characteristics of different species of mangroves.



Animal Description Creative Writing Frame

Choose an animal – either one observed in TCI, or a picture of one.

For each part of the animal ask students to describe it, then say what it is like using suggestions given in the writing frame below. Not all the suggestions will be useful for all animals, and students will be able to think of additional features to describe.

Example:

Name of Animal: Donkey

Different body part shapes: legs: – bony with knobbly knees – simile: like jointed matchsticks

Feature	Description	Simile
different body-part shapes		
size		
colour		
external covering (skin, feathers, exoskeleton, ...)		
legs / fins		
tail / wings		
eyes		
claws		
movement		
sound		
own ideas:		

Challenge students to write a riddle poem about their animal, using a mixture of descriptions and similes as clues:

What am I?

Classification vocabulary wordwarch

Classification



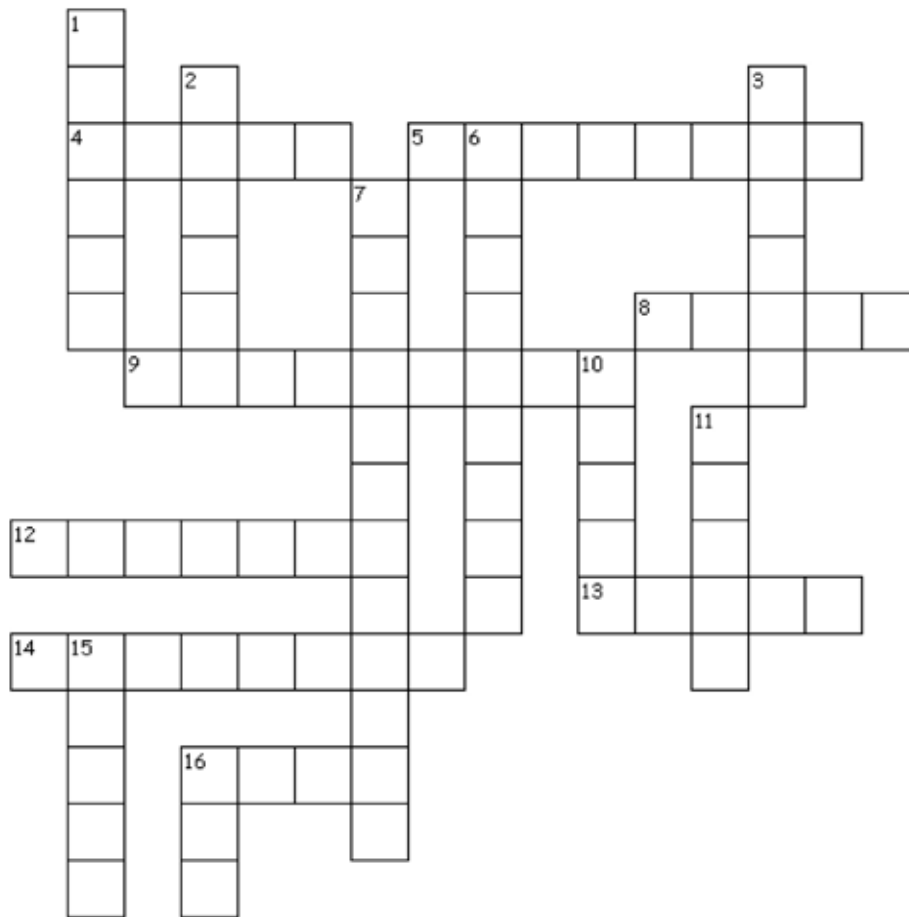
Words to find:

amphibian, annelid, arachnid, bird, crustacean, fish, fungus, insect, invertebrate, mammal, mollusc, plant, reptile, vertebrate.

Puzzle created by:

<http://www.teachers-direct.co.uk/resources/wordsearches/>

Classification vocabulary crossword



Across

4. Reptiles have a _____ skin.
5. Vertebrates have a _____.
8. Algae belong to the _____ kingdom.
9. An orchid is a _____ plant.
12. Turtles belong to the _____ group.
13. A conch is a mollusc with a _____.
14. Birds have _____.
16. Molluscs have a _____ body.

Down

1. A butterfly is an _____.
2. A whale is a _____ because its babies are born alive.
3. Coral belongs to the _____ kingdom.
6. A frog is an _____.
7. Animals that have no backbone belong to the _____ group.
10. A shark is a fish because it breathes with _____.
11. The Caicos pine produces seeds in its _____.
15. Spiders have _____ legs.
16. Insects have _____ legs.

Puzzle created by:

<http://puzzlemaker.discoveryeducation.com/CrissCrossSetupForm.asp>