KS4 Science Resource Pack - Notes for Teachers

Lesson 1
Biodiversity & Endangered Species

Aims
- To understand what biodiversity is and why it is important
- To understand what an endangered species is

Spec

Data, evidence, theories and explanations
- SC1.a
- SC1.b
- SC1.d

Practical & enquiry skills
- SC2.b

Communication skills
- SC3.c

Applications & implications of science
- SC4.b

Breadth of study
- SC5.a
- SC5.b
- SC8.a

Suggested Programme

Introduction (5-10 minutes)
- Write "BIODIVERSITY" on the whiteboard.
- Ask the class what they think the definition of biodiversity is.
- Write any correct suggestions on the board - brainstorming.

Main

Biodiversity discussion (10 minutes)
- Ask the class what they would find in areas of low biodiversity and high biodiversity. Write these on the board in two columns. Encourage pupils to think about geographic range and genetic diversity in addition to the overall number of species.
- Introduce biodiversity hotspots.
- Highlight biodiversity as the "variety of life" and inform the class that not all species that contribute to biodiversity are abundant in numbers and/or habitats

Endangered Species discussion (10 minutes)
- Class discussion regarding what pupils think makes species endangered
- Use information sheet as prompt - population size & stability, mature individuals, habitat range.
- Ask the class to think of some endangered species and highlight that not all endangered species are big and charismatic.
- Introduce the IUCN Red List and hand out Biodiversity & Endangered Species information sheets.

Activity (20 minutes)
- Split the class into groups of 4-5. Give each group an A1 piece of paper and write "BIODIVERSITY" in the middle of it. Then ask them to discuss and write or draw what they feel threatens biodiversity.
- Give them 20 minutes to complete the task.
- Ask each group to briefly show their poster and write correct points from each group on the board.

Resources

- EDGE Fact Sheet 1 - "Biodiversity"
- EDGE Fact Sheet 2 - "Endangered Species"

Materials

- A1 paper (5-6 sheets)
- Coloured marker pens

Notes

Classroom suggestions
- Do not hand out the information sheets until just before the activity
- Use the sheet as a prompt

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Lesson 2
EDGE Species & Calculating EDGE

Aims
- To understand what EDGE species are & how they are classified.
- To understand why it is important to conserve species and maintain the variety of life
- To understand that scientists use more than one way to classify endangered species & can't save them all

Spec

Data, evidence, theories and explanations
- SC1.a
- SC1.b
- SC1.d

Practical & enquiry skills
- SC2.a
- SC2.b

Communication skills
- SC3.a
- SC3.c

Applications & implications of science
- SC4.a
- SC4.b
- SC4.c

Breadth of study
- SC5.a
- SC5.b
- SC8.a

Suggested Programme

Introduction (5 minutes)
- Write "EDGE" on the board and ask the pupil what they think it stands for.
- Define EDGE highlighting the use of the Red List status in "GE". (Students will already be aware of the Red List from the "Endangered Species" lesson).

Main/Activities
- Draw a simple evolutionary tree on the board to highlight historic divergence vs. recent divergence.
- Hand out information sheet & Activity Two sheet.
- THERE'S ISN'T ENOUGH MONEY TO SAVE ALL THE ENDANGERED SPECIES ON EARTH (the "Agony of Choice")
- Emphasise that the species they have been given are all REAL and not theoretical. Conservationists have had to decide on conservation priorities based on EDGE scores.
- A lot of EDGE species are endemic or have unusual adaptations that enable to live in environments where others cannot.

10 minute activity
- Following the instructions on the Activity One sheet, each student should plot a graph of the 25 listed species.

15 minute discussion
- On the activity sheet provided with the graph, there is a column for students to rank the species in terms of EDGE ranking. The species in the top right hand corner of the graph should receive immediate conservation attention, and the species in the bottom left hand side of the graph are the least in need of immediate conservation attention, yet all are still EDGE species.
- This further highlights the "agony of choice" - not all species can be saved as there is limited funding in conservation.
- EDGE classification is not necessarily the "best" way of choosing conservation priorities but it one method of many that scientists can use.

Resources

- EDGE Fact Sheet 3 - "Edge Species
- EDGE Fact Sheet 4 - "Calculating EDGE"

For Activity 1
- EDGE Work Sheet 1 - "Prioritising EDGE species"
- EDGE Species - Class Rank.ppt

Materials
- Pencil for graph plotting

For Activity 2
- Teachers notes page 4 - Species names for presentation
- EDGE Species Blank Presentation.ppt

Materials
- Computer with internet access

Notes

Classroom suggestions
- This worksheet should follow on from the Endangered Species worksheet.

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Activity 1
Prioritising EDGE species

Aims
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Data, evidence, theories and explanations
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Practical & enquiry skills
- SC2.a
- SC2.d

Communication skills
- SC3.a
- SC3.c

Applications & implications of science
- SC4.a
- SC4.b
- SC4.c

Breadth of study
- SC5.a
- SC5.b
- SC8.a

Activity Information

- Page 4 of the Teacher's notes contains instructions for this activity, with a table of all the species the students are given on work sheet 1.
- Students may ask why the GE scale on the y axis goes up to 6. There are two additional conservation categories– extinct in the wild "EW" and extinct "EX". There can be no in-situ conservation programmes for species that are already extinct in the wild, which is why only the other categories are used.
- Students may also ask about some of the unusual species names. The PowerPoint presentation "EDGE Species Rank Photos" can be shown when going through the official EDGE rank at the end of the activity. On page 4 of this publication, some species' letters are highlighted in **BOLD**. These species have photos on the presentation. Read the EDGE rank from lowest to highest (the Echinda should be read out last). This way the photos will be in the correct slide order as you go through them.
- Highlight again that this is not the only method to classify species for extinction.
- Encourage pupils to think about Biodiversity and the variety of life - all the EDGE species are at risk from extinction, and the species in the activity pack have been selected to highlight the fact that endangered species are not always big and charismatic - importance is also based on how evolutionarily distinct each species is.

Resources

- EDGE Species Rank Photos.ppt

Materials

- Pencils

Notes

Classroom suggestions
- This worksheet should follow on from the Endangered Species worksheet.

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Activity 1 - Prioritising EDGE Species

Materials required for activity

- Pencils & rulers for plotting graphs

Instructions

- This activity can take between 15 and 30 minutes depending on the length of the discussion
- Ask students to plot each species on a graph.
- Ask students to write in the "Conservation rank" column which species they would focus conservation efforts on first, then second etc (highlight again that there is not enough funding in science to focus conservation on ALL endangered species, and that they scientists need to priorities based on current conservation efforts, knowledge on the habitat and species, and what funding and community assistance they have).

Discussion

- Read out the class rank column below and compare similarities and differences with the class "conservation rank" answers.
- Their rank may differ to the one below - why? - Maybe the species that they think should be second already has active conservation attention, whereas species 3 has none so it is a higher priority etc.
- Read out the official EDGE rank for each species so that the pupils can complete the "EDGE rank" column on their worksheet.

Species	Common Name	Scientific Name	ED	GE	EDGE Score	Class rank	Official EDGE Rank
K	Eastern Long-beaked Echidna	*Zaglossus bartoni*	55.84799	4	6.812969633	1	1
D	Bactrian Camel	*Camelus ferus*	26.04535	4	6.070103812	2	13
O	Kha-nyou	*Laonastes aenigmamus*	44	3	5.886	3	16
R	Pygmy Hippopotamus	*Choeropsis liberiensis*	32.92161	3	5.603493957	4	29
W	Smokey Bat	*Amorphochilus schnablii*	30.50515	3	5.52959265	5	38
J	Dugong, Sea Cow	*Dugong dugon*	58.46921	2	5.471753105	6	44
E	Black-spotted Cuscus	*Spilocuscus rufoniger*	12.92719	4	5.406431894	7	55
T	Red Slender Loris	*Loris tardigradus*	24.21705	3	5.306962065	8	63
B	Amazonian Manatee	*Trichechus inunguis*	47.70343	2	5.272043719	9	68
F	Blue Whale,	*Balaenoptera musculus*	22.63298	3	5.242084831	10	71
S	Red Panda	*Ailurus fulgens*	39.19581	2	5.080057094	11	91
V	Sangihe Tarsier	*Tarsius sangirensis*	18.89284	3	5.069801341	12	100
M	Giant Armadillo	*Priodontes maximus*	26.44123	2	4.698341062	13	207
C	Aye-aye	*Daubentonia madagascariensis*	41.58964	1	4.444758125	14	292
X	Tiger	*Panthera tigris*	7.99331	3	4.275922517	15	381
Q	Philippine Flying Lemur	*Cynocephalus volans*	51.34123	0	3.957784458	16	564
N	Koala	*Phascolarctos cinereus*	41.28775	0	3.744497406	17	725
P	Lion	*Panthera leo*	7.761625	2	3.556675698	18	870
Y	Wolverine	*Gulo gulo*	16.4007	1	3.549657659	19	880
A	African Buffalo	*Syncerus caffer*	13.95992	0	2.70537459	20	1697
G	Capped Langur	*Trachypithecus pileatus*	1.97648	2	2.477035916	21	2074
U	Samoan Flying Fox	*Pteropus samoensis*	2.844537	1	2.039800476	22	3097
L	European Brown Hare	*Lepus europaeus*	6.501926	0	2.015159786	23	3161
I	Decken's Horseshoe Bat	*Rhinolophus deckenii*	1.919392	1	1.764522608	24	3263
H	Chaco Grass Mouse	*Akodon toba*	1.264429	0	0.817322554	25	4432

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Activity 2
PowerPoint presentation on an EDGE Species

Aims
- To understand what EDGE species are & how they are classified.
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- SC4.b
- SC4.c

Breadth of study
- SC5.a
- SC5.b
- SC8.a

Activity Information

- Download the Powerpoint presentation "KS4 Science - EDGE species presentation" from the EDGE website.
- Save the presentation on the school network so that the class are able to access it.
- Print off page two of this document, cut to size and fold each piece of paper in half. Let each student pick a name "from the hat". This will be the species they will do their presentation on.
- The presentation has already been laid out with text boxes ready for each student to complete.
- One suggestion would be to set this activity as a homework assignment, and choose the best 5 for class presentations.
- From the presentations done to the class, a vote can be taken on which species the pupils feel should be given the highest conservation priority, and this file can be uploaded onto the EDGE website (under the schools resources section).

Resources

- Blank slides for Activity 2.ppt

Materials

- Computer with internet access

Notes

Classroom suggestions
- This worksheet should follow on from the Endangered Species worksheet.

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Your EDGE species is the... **Long Beaked Echidna** *Zaglossus bruijni* www.edgeofexistence.org/mammals/mammal_search.php	Your EDGE species is the... **Hispaniolan Solenodon** *Solenodon paradoxus* www.edgeofexistence.org/mammals/mammal_search.php	Your EDGE species is the... **Riverine Rabbit** *Bunolagus monticularis* www.edgeofexistence.org/mammals/mammal_search.php	Your EDGE species is the... **Sumatran Rhinoceros** *Dicerorhinus sumatrensis* www.edgeofexistence.org/mammals/mammal_search.php
Your EDGE species is the... **Bactrian Camel** *Camelus ferus* www.edgeofexistence.org/mammals/mammal_search.php	Your EDGE species is the... **Asian Elephant** *Elephas maximus* www.edgeofexistence.org/mammals/mammal_search.php	Your EDGE species is the... **Pygmy Hippopotamus** *Choeropsis liberiensis* www.edgeofexistence.org/mammals/mammal_search.php	Your EDGE species is the... **Giant Panda** *Ailuropoda melanoleuca* www.edgeofexistence.org/mammals/mammal_search.php
Your EDGE species is the... **Hawaiian Monk Seal** *Monachus schauinslandi* www.edgeofexistence.org/mammals/mammal_search.php	Your EDGE species is... **Bulmer's Fruit Bat** *Aproteles bulmerae* www.edgeofexistence.org/mammals/mammal_search.php	Your EDGE species is... **Gilbert's Potoroo** *Potorous gilbertii* www.edgeofexistence.org/mammals/mammal_search.php	Your EDGE species is the... **Ruffed Lemur** *Varecia variegata* www.edgeofexistence.org/mammals/mammal_search.php
Your EDGE species is the... **Sea Cow** *Dugong dugon* www.edgeofexistence.org/mammals/mammal_search.php	Your EDGE species is the... **Sumatran Orangutan** *Pongo abelii* www.edgeofexistence.org/mammals/mammal_search.php	Your EDGE species is the... **Slender Loris** *Loris tardigradus* www.edgeofexistence.org/mammals/mammal_search.php	Your EDGE species is the... **Ganges River Dolphin** *Platanista gangetica* www.edgeofexistence.org/mammals/mammal_search.php
Your EDGE species is... **Archey's Frog** *Leiopelma archeyi* www.edgeofexistence.org/amphibians/amphibian_search.php	Your EDGE species is the... **Chinese Giant Salamander** *Andrias davidianus* www.edgeofexistence.org/amphibians/amphibian_search.php	Your EDGE species is the... **Sagalla Caecilian** *Boulengerula niedeni* www.edgeofexistence.org/amphibians/amphibian_search.php	Your EDGE species is the... **Purple Frog** *Nasikabatrachus sahyadrensis* www.edgeofexistence.org/amphibians/amphibian_search.php
Your EDGE species is... **Anderson's Salamander** *Ambystoma andersoni* www.edgeofexistence.org/amphibians/amphibian_search.php	Your EDGE species is... **Luschan's Salamander** *Lyciasalamandra billae* www.edgeofexistence.org/amphibians/amphibian_search.php	Your EDGE species is the... **Olm** *Proteus anguinus* www.edgeofexistence.org/amphibians/amphibian_search.php	Your EDGE species is... **Myers' Surinam Toad** *Pipa myersi* www.edgeofexistence.org/amphibians/amphibian_search.php
Your EDGE species is the... **Alabama Waterdog** *Necturus alabamensis* www.edgeofexistence.org/amphibians/amphibian_search.php	Your EDGE species is the... **Chinhai Spiny Newt** *Echinotriton chinhaiensis* www.edgeofexistence.org/amphibians/amphibian_search.php	Your EDGE species is... **Gardiner's Seychelles Frog** *Sooglossus gardineri* www.edgeofexistence.org/amphibians/amphibian_search.php	Your EDGE species is the... **Black Jumping Salamander** *Pseudoeurycea nigra* www.edgeofexistence.org/amphibians/amphibian_search.php
Your EDGE species is the... **Luristan Newt** *Neurergus kaiseri* www.edgeofexistence.org/amphibians/amphibian_search.php	Your EDGE species is the... **Redbelly Egg Frog** *Leptodactylodon erythrogaster* www.edgeofexistence.org/amphibians/amphibian_search.php	Your EDGE species is the... **Malagasy Rainbow Frog** *Scaphiophryne gottlebei* www.edgeofexistence.org/amphibians/amphibian_search.php	Your EDGE species is the... **Lake Oku Clawed Frog** *Xenopus longipes* www.edgeofexistence.org/amphibians/amphibian_search.php

Biological diversity (biodiversity)
The variety of life on Earth, reflected in the multitude of ecosystems and species, their processes and the way they interact, and the genetic variation within and among species.

Conservation
Planned management of a natural resource to prevent exploitation, destruction, or neglect.

Deforestation
Removal of trees from a forested area without adequate replanting.

Ecology
The study of the relationships between organisms and their environments, including: the interactions of living organisms with one another and with their non-living surroundings, the flow of matter and energy in an environment, and the structure and functions of nature.

Ecosystem
An ecological community of various plants, animals, and other organisms, interacting with each other and with the nonliving resources in their environment, all functioning as a unit.

EDGE
Evolutionarily Distinct and Globally Endangered

Endangered Species
Wild species with so few individual survivors that the species could soon become extinct in all or most of its natural range.

Endemic
Only found in to a particular locality, area or region.

Environment
external conditions and factors, living and nonliving (chemicals and energy), that affect an organism or other specified system during its lifetime; the earth's life-support systems for us and for all other forms of life

Evolution
(Biological) evolution refers to the changes over time that occur in living organisms

Extinct
A species that is no longer living on earth. All representatives of the species are dead

Extinction
Complete disappearance of a species from the earth. This happens when a species cannot adapt and successfully reproduce under new environmental conditions, when it evolves (through a process called *radiation*) into one or more new species, or when every member of the species is killed by overpredation, pollution, or other man-made causes.

Fragmentation
The breaking up of an organism's habitat into discontinuous chunks, particularly for organisms that have difficulty moving from one of those chunks to another.

Habitat
Place or type of place where an organism, population, or community lives.

Invasive Species
These species can be plants or animals, that are non-native to the ecosystem in question, and may out-compete native species.

Mature Individual
An individual organism who is capable of reproduction.

Phylogenetic
Based on the evolutionary history of a group or lineage of organisms to form the underlying framework for their classification. It is NOT based on the observation of physical similarities.

Population
A group within a single species, the individuals of which can and do freely interbreed. Breeding between populations of the same species is less common because of differences in location etc.

Species
A group of organisms having common characteristics, formally recognised as distinct from other groups: the basic unit of biological classification.

Tropical Rainforest
a rainforest found near the equator, typically characterised by high rainfall, poor soil, and a high diversity of plant and animal species.

http://www.edgeofexistence.org
ZSL's official EDGE of Existence website

http://www.zsl.org
ZSL's official website, with links to the London Zoo and Whipsnade pages

http://www.iucn.org
IUCN's official website

http://www.iucnredlist.org
IUCN's official Red List website

http://www.biodiversityhotspots.org/Pages/default.aspx

Other useful links that can be used to support this pack:

http://www.guardian.co.uk/environment/biodiversity

http://www.conservation.org/Pages/default.aspx

http://www.cbd.int/2010/welcome/

http://www.ukbap.org.uk/

http://www.bbc.co.uk/nature/species
Useful information on species—some may be relevant to Activity 1 as a secondary information resource.