Biological Diversity

Aquarium Toolkit

Stage 6 resource

OUTCOMES CONTRIBUTED TO:

BIO11/12-1

BIO11/12-2

BIO11/12-7

BIO11-10

Welcome to the teacher toolkit

We hope we can help you and your students find inspiration in wildlife through this enrichment project.

'Bringing Nature into a classroom can kindle a fascination and passion for the diversity of life on earth and can motivate a sense of responsibility to safeguard it'.

Sir David Attenborough

What is in this package:

- Syllabus-linked activities to complete **prior to your excursion**
- Supporting resources for students to conduct a real-world science investigation
- Suggested template for students to assess their success

Resources required to best use this toolkit:

- Computer and screen or smartboard
- Internet access
- Upcycled resources to create enrichment items

We acknowledge the First Nations People, their past, present and their future generations.

Content Overview

Module 3 Biological Diversity – Depth Study

Outcomes

A student:

- develops and evaluates questions and hypotheses for scientific investigation BIO11/12-1
- designs and evaluates investigations in order to obtain primary and secondary data and information BIO11/12-2
- communicates scientific understanding using suitable language and terminology for a specific audience or purpose BIO11/12-7
- describes biological diversity by explaining the relationships between a range of organisms in terms of specialisation for selected habitats and evolution of species BIO11-10

Content

Adaptations

Inquiry question: How do adaptations increase the organism's ability to survive?

Students:

- conduct practical investigations, individually or in teams, or use secondary sources to examine the adaptations of organisms that increase their ability to survive in their environment, including:

– structural adaptations

– physiological adaptations

– behavioural adaptations

Enrichment project outline

Design a scientific investigation to test one adaptation of otters that increase their ability to survive in their environment.

To complete your task you will need to:

Part 1 – at school prior to your excursion

- research species' environment in the wild to understand where they have evolved to live
- research the structural, physiological and behavioural adaptations they have to aid their survival
- research different types of enrichment
- at school, in a team or class, **design and build a suitable enrichment item** following the below guidelines

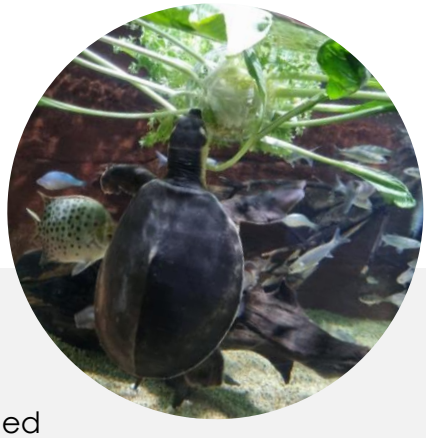
Part 2 – at Sydney Zoo

- **bring your item to Sydney Zoo on your set excursion date** for keepers to install in the habitat
- gather data to investigate how well your enrichment item was used/received by the species and how well it encouraged their use of your chosen adaptation

Part 3 – assess your success

- potentially complete scientific report (your teacher will tell you how they will assess this task).

The Aquarium at Sydney Zoo



The Aquarium residents at Sydney Zoo are cared for by a skilled team of **aquarists (aquarium zookeepers)**. Zookeepers are always on the lookout for new and innovative ways to keep the animals in their care active, healthy and engaged in the world around them.

There are 10 tanks in the Sydney Zoo aquarium, most of them are freshwater tanks which house freshwater fish, reptiles and invertebrates or even penguins and sharks!

Your mission is to help the aquarist team keep a variety of species mentally and physically active by designing and building some new **enrichment** items.

Each Tank can have 1 enrichment item added to it on the day of your visit, (except Tank 3 if there are 2 items targeting the different species). The target species will be pre-approved upon booking the program dates and may or may not include all of the following:

Tank 1: Pig-nosed turtle (named Basil) OR Scats and Pighead Gudgeons

Tank 2: Tandans, Murray Cod (named Hammer) OR Long finned Eel

Tank 3: Water dragons/monitors = 1 item (must be land based for insect dispersal) AND

Tank 3: Archer fish = 1 item (must be hanging over water for insect dispersal) see a video of a basic example here.

Tank 8: South American Cichlids and a Spotted Garfish (named Noodle)

Tank 9: Little penguins = (can be land or water based)

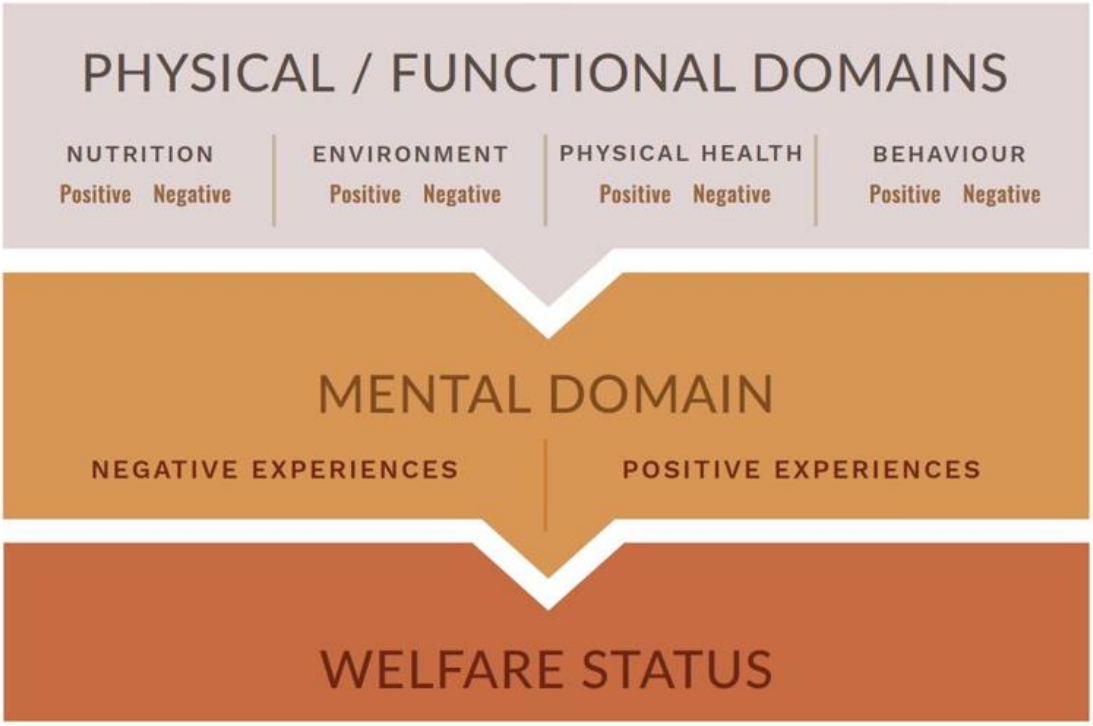
See a tour of some exhibits **here**.

Animal care in a zoo

Zookeepers are tasked with creating a positive welfare state for the animals in their care. What does this mean?

An animal's nutritional needs must be met as well as their physical health needs, environmental needs and behavioural needs. If we do well in providing for the animals in our care then we are also looking after their mental needs and creating a positive welfare state for our animals. The model currently used in our zoo is the 5 domains of animal welfare.

Some people may have heard of the 5 freedoms (freedom from thirst, hunger, discomfort, pain/injury/disease and freedom to express natural behaviours). The 5 domains of animal welfare go beyond these freedoms.



5 domains of animal welfare. *Image from zooaquarium.org.au*

Enrichment

Enrichment is a very important part of creating a positive welfare state for our animals. Different kinds of enrichment will allow the animals to exhibit natural behaviours, have choice in their daily routines and provide for physical and mental stimulation.

Enrichment comes in many forms and there are lots of considerations including, is it:

- safe for the animals (this requires planning and research for your design)
- appropriate for the animal (this requires background research)
- easily used by keepers
- easy to add food to if that is the intention
- easy to clean
- will actually stimulate your animal – see the different types of enrichment below

Types of enrichment

Sensory/ Olfactory	Environmental	Cognitive/ Manipulative/ Toys	Food based	Behavioural/ social
Using sounds, smells, textures for the animals to investigate with their different senses (sight, hearing, smell, touch, taste)	Recreating their habitat in new ways for them to explore, adding new items e.g. rocks and logs, live plants, bubble baths, digging new holes	Chew toys, boxes, training sessions, whole foods they need to take apart or other items they need to manipulate and interact with mouths or claws	Food items that are new, or fed in different ways e.g. freeze into ice blocks, food scattered instead of in bowls	Play recordings of animal calls, using animal scents from other parts of the zoo, allowing interaction (even if only visual) with other animals

Guidelines for enrichment item

Safety – any item placed in an exhibit needs to:

- be made of sturdy enough material they cannot bite pieces off
- be mobile and easy to install and remove from exhibits
- be large enough it cannot be swallowed
- not contain any toxic or allergen materials
- be clean and free of potential disease
- be easy to clean if the intent is to use it again
- be able to be firmly secure – if separate parts they should not be able to detach easily, or if it needs to be attached somewhere in the exhibit, the fixings need to be secure

Look – At Sydney Zoo we try to use natural looking items and colours to blend into the exhibit design, the design should:

- align with the exhibit theme
- promote natural behaviour of the animal
- ensure respect of the animal – e.g. not trying to create an unnatural behaviour or look
- use natural items where possible e.g. logs and bark

Food – if your design needs to have food included then it should:

- be easy to clean
- have a way to easily put food in and remove uneaten food after use
- food used will be crickets or mealworms for water dragons and archer fish, or leafy greens for pig nosed turtle

Guidelines for enrichment item

Approved construction materials:

- Wood/logs
    - If purchasing wood – aim for raw timber and avoid anything with varnish/lacquer/paint
    - If using tree logs, just ensure there are no traces of unidentified foliage/flowers
- Hard plastic (with smooth edges)
    - This can be painted with water based (non-toxic) acrylic paints
- Screws can be used to hold items together, as long as no sharp edges protruding
- Shiny surfaces, but if using a mirror opt for plastic not glass to avoid potential glass shards in the exhibit if it breaks

Some ideas and notes from the keepers

- Tank 1 – Basil the pig nosed turtle – feeding options – multiple items to place his leafy greens into so they sink or float and he can access
- Tank 1 – Scats and Snakehead Gudgeon
- Tank 2 – Murray Cod, Long-finned Eels and smaller fish – feeding ball or puzzle (for small chunks of fish/mince), could use pumps and create flows. Hides for the smaller fish that can move around.
- Tank 3 – Archer fish cricket dispenser – needs to have crickets able to fall out/jump out the bottom in some way so they fall to the water
- Tank 3 – water dragon/Mertens Water Monitor on ground bug dispenser (woodies/mealworms)
- Tank 3 – Eastern Longneck Turtles – feeding ball/puzzle
- Tank 8 – Cichlids feeding ball or puzzle (for small chunks of fish/mince), could use pumps and create flows. A hide that looks natural that will float near the top of the tank.
- Tank 9 – Penguins – they love shiny items, but what faces the viewing area of the tank should look as natural as possible. They love bubbles, shiny items in the water (can't be made of glass)
    - Keepers would like anything that encourages penguins to investigate in the water – this can be something that floats or sinks in the water

Approved enrichment items

Below is the current list of approved and not approved items for enrichment at Sydney Zoo. If an item you want to use is not on the approved list, this does not mean you cannot use it. Ask your teacher to email us to discuss this as an option.

Sensory/olfactory

Sounds (music, animal calls – anything is fine, even predatory sounds)

Environmental

Bubbles (penguins)

Change terrain

Food based/feeding

Feed scatter (taken from their daily diet)

Hanging (archer fish) invertebrate feeding tubes with holes for insects to climb out

Land based invertebrate feeding tube (water dragons)

*note any food required for your project will be live mealworms, crickets or greens– no other food items should be used with your items – the zoo will provide on the day

Cognitive/manipulative/toys

Fire hose toys

Plastic tubs/milk crates

Coconuts or boomer balls

PVC pipes and tunnels

Mirrors (plastic not glass) in water or on land

Behaviour/social

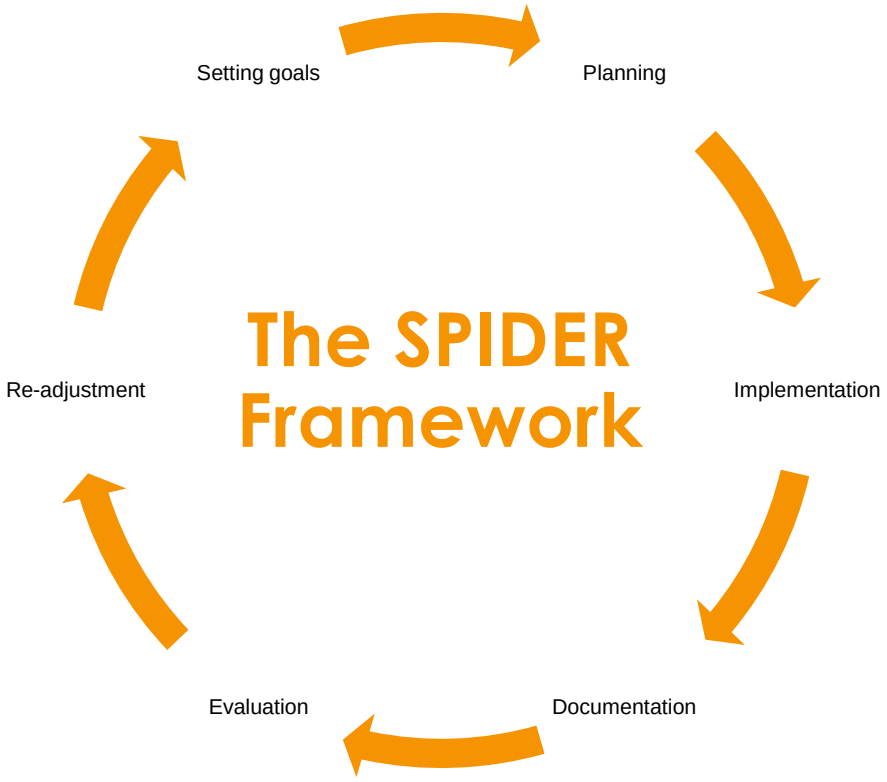
Mimicking prey items to engage penguins in the water

Not approved

Food based items that are not part of normal diet without curator permission

Essential oils (these can be toxic)

Planning for success



Zookeepers use the SPIDER framework to create their enrichment. They are constantly setting new goals, evaluating success (and failure) and using what they have learned to readjust for success next time. It is a cycle.

S- Setting Goals

Understanding natural history and behaviours – what is the target behaviour

P – Planning

Enrichment plans and their goals

I- Implementation

Deploying items, adding to calendars and planning tools

D – Documentation

Were the specific goals achieved?

E – Evaluation

Was the enrichment deemed successful?

R – Re-adjustment

Can happen throughout the process and adjust as needed

How do you know you're successful?

Ethograms

Ethograms are one way you can assess the success of your enrichment item. Watch a video about ethograms here.

Scientists and zookeepers alike use them to study behaviour – they can assess how animals use their environment, interact with one another and what they get up to each day. There are multiple ways of doing an ethogram. We need to set up some rules for this first:

- Sampling rule
- Which subjects will you observe (individual or group)
- Where you will observe
- When to observe

Types of behaviour sampling

- Ad libitum sampling (at random when you're there)
- Focal sampling (one animal for a specific of amount of time and recording all instances of their behaviour)
- Scan sampling (one or more individuals are scanned and their behaviour noted at set intervals for a set amount of time – this is what we use in our example)
- Only sampling rare or special events e.g. fighting

Recording rules

Define how you will record your behaviour

- Continuous (record exact time and duration of a behaviour of a set period of time)
- Time sampling (records animal behaviour periodically over a set period of time – this is what we have used in our example)

To know if you're successful you need a baseline – what do these animals do when your enrichment is not in their environment? Then comparing it to when they do have this new enrichment item. Does it change their behaviour? Initiate any natural behaviours they were not doing before?

There are other ways of assessing your success. This is just one example.

Ethograms are used to study behaviour

Ethogram

Use this ethogram to gather data on an animals behaviour. You'll need to define behaviours on the left hand side and have a timer ready. Set it for 5 minutes, every 30 seconds record what the animal is doing by placing an X in the appropriate box.

Date: _____ Time of day: _____

Weather (circle all that apply): Sunny Cloudy Raining Cold Hot Storm Windy

Species: _____ Individual description: _____

Behaviour	0 sec	30 sec	1 min	1 min 30 sec	2 min	2 min 30sec	3 min	3 min 30 sec	4 min	4 min 30 sec	5 min

INFO@SYDNEYZOO.COM : 02 7202 2560

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