

Water... WOW!

STAGE 3 EDUCATION

Module 6: Living Things in Water

All plants and animals are adapted to survive in specific environments, which excludes them from living in other environments in which they are not adapted to live.

In this module, students will:

- identify animals that live in waterways
- consider the meaning of 'adaptation'
- explore examples of animal and plant adaptations
- classify aquatic animals according to their physical traits



Module 6: Living Things in Water



Teacher Background

Adaptations of Plants and Animals Living in Water (ST3-4LW-S: Examines how the environment affects the growth, survival and adaptation of living things)

In *Module 4: Catching Water* and *Module 5: Water for Living Cities*, students learned about the natural water cycle and how it is altered by humans changing their environments from forested to hardened urban landscapes. This has implications for all plants and animals. All plants and animals are adapted to survive in specific environments, which excludes them from living in other environments in which they are not adapted to live. Plants and animals need to be adapted to the conditions and resources in their environment. Conditions are things that affect survival, but are not consumed, like temperature and the salinity of water. An adaptive trait to enable an animal to cope with low temperature could include a thick layer of fat or fur. Resources are things that affect survival and are 'consumed' (that is, there is a limit to how much resource is available, so if you are not as good as others in the environment at accessing the resource, you will miss out!). Resources include nutrients for plants, food for animals and space for both plants and animals. An adaptive trait enabling predators to capture limited prey resources could include being faster than the prey and others trying to capture the prey.

An example showing how adaptations are suited for a particular environment is the adaptation of camels to survive in the dry conditions and with the limited resources (particularly, low water availability) prevailing in deserts. The traits of camels include the ability to forego drinking water for a couple of weeks (recall the 'Playground fact' from *Module 1: Water for Life*) whilst travelling through the desert, nostrils that can close and long eyelashes to keep desert sands out of the nose and ears during a sandstorm, etc. But, those traits are not useful for surviving in a rainforest, on a coral reef or in a city.

There are a few key differences in the conditions affecting survival on land and in water, with corresponding differences in traits, e.g.

- Water is denser and therefore harder to move through than air. Many animals that live in water have streamlined bodies to minimise the resistance pushing against them as they are moving through water.
- All animals need to maintain internal body warmth to function, but heat is taken away from the body more by water than air. Many of the animals that live in water near the cold poles have a thick layer of fat to insulate their bodies.
- Not much food travels through the air, but lots of food is suspended in water and travels around on water currents. There are few animals that create traps or have feeding structures designed to filter food flowing through air (spiders building webs is the exception), but lots of animals filter food from water, including sponges, barnacles, corals, oysters, some ducks, many fish, jelly blubbers, krill, baleen whales and flamingos.
- All plants and animals require oxygen for metabolism, but there is less oxygen in water than in air. Some animals overcome this by coming to the surface and breathing air, whereas fish have gills (see below).

Animals Adaptation: Fish Gills

Breathing requires extracting oxygen from the surrounding environment and disposing of carbon dioxide from the body. We do this by drawing air into our lungs, but most fish breathe underwater using gills. The challenge when breathing underwater is that it contains only about one twentieth the amount of oxygen that occurs in air. Fish pull water through their mouths and are constantly actively pumping it over their gills, which have lots of exposed surface area to facilitate the extraction of the relatively small amount of oxygen in water. The high surface area of gills is a crucial adaptation allowing fish to breathe in water.



Plant Adaptation: Mangrove Pneumatophores (ST3-4LW-S: Examines how the environment affects the growth, survival and adaptation of living things)

Branching is used as a linkage concept that will reappear throughout *Georges Riverkeeper Stage 3 Education Modules*, here in the context of the root networks of plants such as mangroves. Each time that branching is mentioned through the modules, ask students to reflect on how branching networks through which water-based substances flow contribute to carrying materials from one place to another. Repetition of this concept should reinforce the importance of the ability of water to carry substances through networks, which is one of the main reasons that water is so important for people.

Recall the branched networks of blood vessels within our body, streams across catchments and urban distribution infrastructure through which water flows through, which were mentioned in previous modules. Water also flows through branched roots of trees.

By using root 'snorkels', mangroves cope with low oxygen in saturated soils in a different way than fish cope with low oxygen in water. The branching roots (pneumatophores) bring oxygen back to the whole plant so that it can survive in saturated soils. Branching roots also carry water from the ground up through the trunk and to all branches, so that all of the tree has adequate water and nutrients that are carried in water.

Sequence for Module 6: Living Things in Water

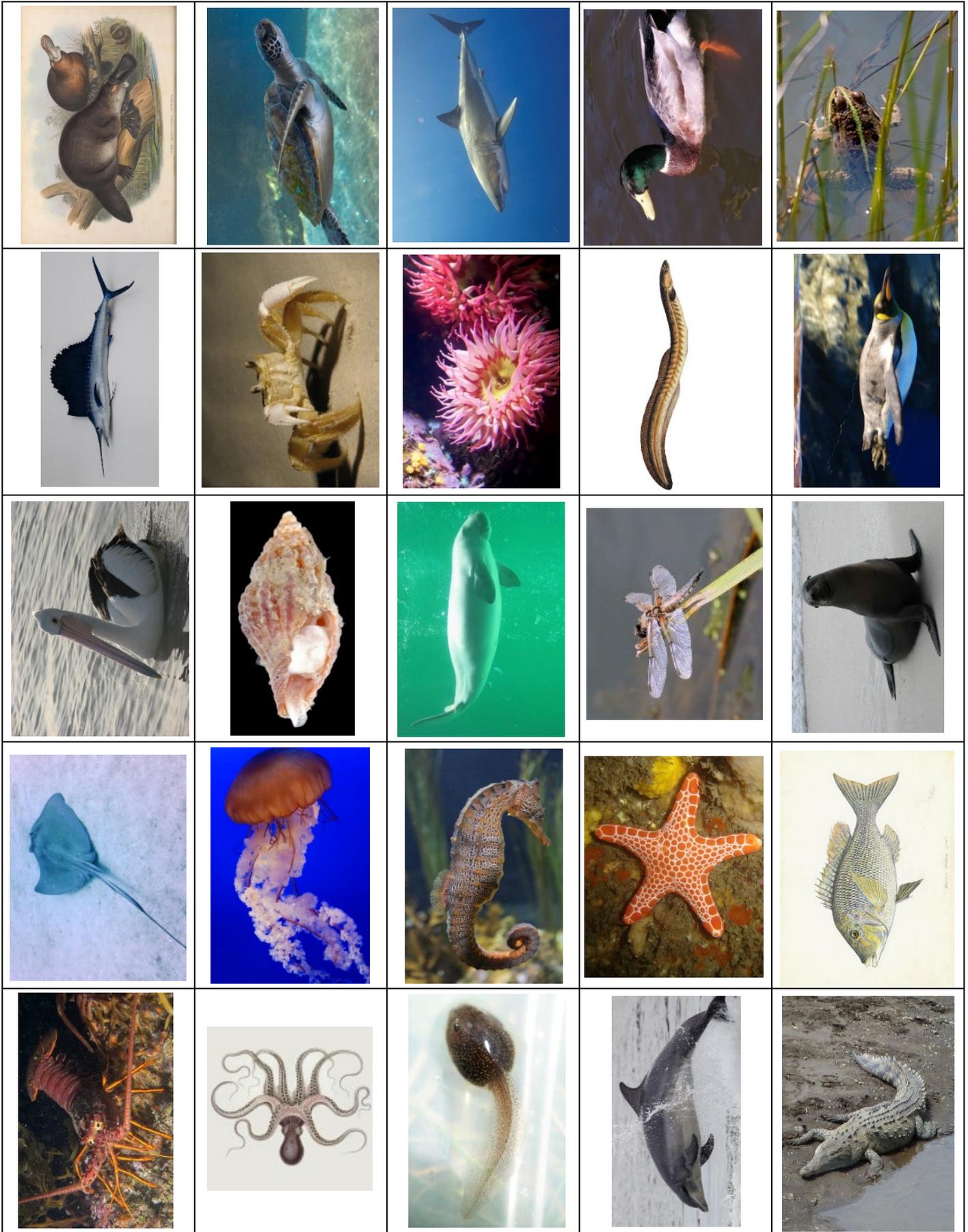
Syllabus Outcomes	<p>ST2-4LW-S Compares features and characteristics of living things and non-living things.</p> <p>ST3-4LW-S Examines how the environment affects the growth, survival and adaptation of living things.</p>
Learning Intentions	<p>For students to:</p> <ul style="list-style-type: none"> ◆ identify animals that live in waterways ◆ explain the meaning of 'adaptation' ◆ give examples of animal adaptations ◆ explain how gills help fish breathe ◆ write an informative text on mangrove adaptations ◆ explain the role of pneumatophores ◆ classify aquatic animals according to their physical traits
Teaching & Learning Activities	<p><u>Inquiry Question:</u> <i>How do the structural features of living things support survival?</i></p> <ul style="list-style-type: none"> ◆ Students brainstorm and list animals that live in a waterway. From this list, print or draw these animals for a classification activity later in the module (alternatively, use the images provided within this module, page 35). ◆ Introduce the term <i>adaptation</i>. What does this mean? Provide students with an example of an animal adaptation. For example: An ibis has long legs for wading and a long, curved beak for probing in mud searching for food. Its head and top of neck are bare of feathers allowing its head to be lightweight after probing for food in the water. Feathers on its head would become heavy when wet. ST2-4LW-S ◆ View: How do fish gills function? Write an explanation to show understanding of how gills help a fish to breathe. ST3-4LW-S ◆ Why are mangrove trees special? Mangroves have unique adaptations that allow them to survive. View this 7 minute video explaining survival and adaptation of mangroves. From the information presented in the video, write an informative text explaining the importance of mangrove adaptations. Mangrove don't have gills, so how do they breathe when their roots are in water? Explain the role of pneumatophores. ST3-4LW-S <p><u>Inquiry Question:</u> <i>How can we group living things?</i></p> <ul style="list-style-type: none"> ◆ Use the 'Playground fact' to encourage students to think about the advantages of particular traits for animals living in water: consider why do some very different animals living in the same

	<p>environment have similar traits?</p> <ul style="list-style-type: none"> ◆ All animals have adapted features that help them survive in their environment. Using the images of (25) aquatic animals, ask students to classify these animals according to their physical traits. ST2-4LW-S - Using the (25) animals provided, cut the sheet up into individual animals - Distribute the animals across the class, so that each student has one animal - Divide the class into two groups. Ask each group to think about the physical traits of their animals (the second table provided within this module has some suggestions of obvious traits for each animal) and how their animals could be divided into different groups based on similarities/differences in traits. - Students could divide their animals into two groups, based on traits (e.g. one group of animals may have webbed feet or fins, the other without webbed feet or fins), then the other group of students could look at the animals within the two groups and be asked whether they know the trait that was used for classification into each group OR students could be challenged to keep dividing their animals into groups until they can't go any further, writing the traits used for each division on the back of their animal cards as they move through the exercise. - Think of why the traits that you have identified are useful for animals living in water. Ask each student to describe one trait of their animal that is adapted for life in water.
Resources	<ul style="list-style-type: none"> > How do fish breath? https://www.youtube.com/watch?v=zj5v3n6Nlm8 > How do mangrove trees live in mud and sea water? http://education.abc.net.au/home#!/media/85976/how-do-mangrove-trees-survive- > 25 aquatic animals for classification (page 35) + accompanying table with traits (page 36)
Feedback	<p>Your feedback is important to us. Please complete this quick online survey: http://bit.ly/ModulesFeedback</p>

Playground fact:

Animals with very different ancestors and evolutionary histories have ended up with similar physical traits that work well in particular environments. For example, in open water streamlined bodies with large, flat appendages for propulsion work well and animals with this body shape include fish, reptiles (e.g. turtles), mammals (e.g. seals, dolphins and whales) and birds (e.g. penguins). The evolution of similar traits in different animals is called convergent evolution.





Biographies of authors

Dr David Reid

David is a scientist who studies waterways for his work at Georges Riverkeeper in southern Sydney. He grew up near Lake Macquarie and the beaches south of Newcastle, where he spent much time swimming, surfing, exploring the life in water and generally enjoying being close to water. After finishing school, he went to university and his studies eventually led to completion of a PhD on waterbugs and food webs in farmland streams. Gaining those qualifications has allowed him to do research and monitoring work in waterways around the world, including those in New South Wales, Victoria, South Australia, New Zealand and New York City (see https://www.researchgate.net/profile/David_Reid15). He still enjoys having fun in water too!

Antonina Fieni

Antonina loves rivers. She is often seen paddling up rivers and creeks looking for Eastern water dragons or sacred kingfishers. When not paddling, Antonina is teaching environmental science and geography at the Georges River Environmental Education Centre and at the Field Study Centre at Sydney Olympic Park. Her qualifications include a Bachelor of Education and a Graduate Diploma in Environment.

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with collective responsibility for the Georges
River and its catchment.

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