

Survival and Adaptations

Teachers

This unit of work has been designed to support your class visit for the ‘Survival and Adaptations’ programme at the National Aquarium of New Zealand. Students will participate in a range of interactive activities.

The primary focus of this programme is the Living World Strand of the Science Curriculum, however when planning your unit of work links can be made to other essential learning areas. Similarly, different essential skills can be emphasised depending on the needs of your students.

It is recommended that these materials be reproduced in their entirety for each of your students. It is hoped that students will be able to use this resource for preparatory work prior to their visit to the National Aquarium, as a workbook during their visit and as reference material after their visit.

Programme Overview

Why should you learn about survival and adaptations at the aquarium?

Diversity of aquatic life is enormous. The survival of an organism is dependent on how it is adapted to the challenges of its particular habitat and environment. At the aquarium, students are able to see first hand how a diverse range of aquatic animals adapt to survive. They will observe examples of structural, functional and behavioural adaptations to gain a greater understanding of these concepts.

Essential Learning Area: Science

Strand: Living World

Achievement Aim 2: investigate and understand relationships between structure and function in living organisms.

Level	Essential Learning Area	Strand	Achievement Aim	Achievement Objective
4	Science	Living World	Structure and Function	Investigate and describe special features of animals which help survival into the next generation.
5	Science	Living World	Structure and Function	Investigate and describe structural, physiological, and behavioural adaptations which ensure the survival of animals in

Scientific Skills and Attitudes

- Focusing and Planning
- Information Gathering
- Processing and Interpreting
- Reporting

The 'Survival and Adaptations' programme at the National Aquarium of New Zealand lays the foundations for developing the above investigative skills and attitudes.

Specific Learning Outcomes

- To understand why a particular type of animal lives in certain habitats.
- To understand, describe and identify examples of structural, functional and behavioural adaptations which help animals survive into the next generation.
- To become aware of the environmental factors affecting aquatic organisms and discuss how certain factors affect their survival.

Survival

There are four important reasons why animals live in a particular place. There needs to be a **good food supply**, **few predators** who feed on the animal, **little competition** from other animals that need the same food and living space, and **suitable climate and weather conditions**.

Any animal or plant in a food web can be food for another animal. To survive in a particular habitat, animals have to find enough food to eat and be clever enough not to be eaten.

To find food an animal should have:

- very keen senses
- fast muscle reactions
- claws to hold prey and suitable mouth parts to eat the prey.

Find an animal in the aquarium that is highly skilled at finding prey and describe the features that make them such a successful predator.

To avoid being eaten an animal might:

- be able to move very quickly
- have excellent camouflage
- be poisonous to other animals or have spines, barbs or prickly skin.

Find an animal in the aquarium that is skilled at avoiding being eaten and describe the features that make them so successful at surviving.

Can you make a generalisation about the types of features of herbivorous animals compared with those of carnivorous animals? Use aquarium animals to support your ideas.

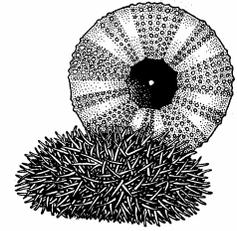
Adaptations

The survival of an organism depends on a number of **physical** (abiotic) and **biological** (biotic) factors.

The physical factors include weather conditions and the availability of water while the biological factors include diseases, competitors, predators and the availability of food. Clearly aquatic animals are not faced with having to find water but there are a number of other physical factors which affect their survival. These are explained later in this unit.

The survival of an organism also depends on the characteristics of the organism itself. Every organism has characteristics which enable it to live in its own particular habitat. These characteristics are called adaptations.

Types of Adaptations



Kina

The kina or sea urchin is an echinoderm, like a starfish. It feeds on seaweeds, particularly kelp and film algae. Fish such as snapper, moki and porae – or humans, feed on kina. A kina has a number of adaptations which ensure its survival. Their body is a spiky greeny-brown ball which helps to camouflage it amongst the rocky shores below low tide where it lives. During the day, kina will often hide under seaweed and other debris to hide from predators. The spikes offer good protection from most predators. Between the spikes there are maroon tube feet like tiny strands of cotton, which help kina move around and move food towards its mouth. These tube feet also prevent the kina from being knocked off the rocks by wave action. Kina reproduce sexually by sending spores into the water.

We can classify adaptations into three groups; structural, functional and behavioural.

Structural adaptations refer to the size and shape of the organism and how the various parts of its body are put together; for example, the kina's spiky, greeny-brown ball shaped body.

Functional adaptations are concerned with the working of an animal's body; for example, the kina's method of reproduction and its ability to digest a range of seaweeds.

Behavioural adaptations refer to the way an animal behaves; for example, the way kina cover themselves in seaweed and feed only at night.

Classify the adaptations of aquarium cards (provided by the Education Officer) according to whether they refer to structural, functional or behavioural characteristics.

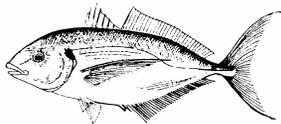
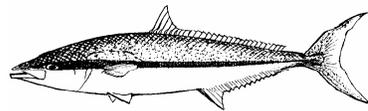
Structural Adaptations in Fish

The structural adaptations of a fish can tell us a lot about how and where the fish lives. Body shape, tail shape, mouth location and size, and colour are good indicators of a fish's lifestyle.

Body Shape

Fusiform

A streamlined fish, capable of swimming very fast.

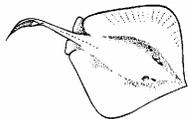
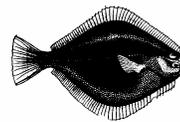


Laterally Compressed 1

Flattened from side to side, swims slowly but is very manoeuvrable, many are found near coral reefs.

Laterally Compressed 2

Flattened from side to side, lies on its side on the bottom.

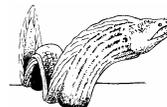


Depressed

Flattened from top to bottom, lives on the bottom.

Eel like

Has a snake like body, lives in holes or among rocks.



Caudal Fin

The caudal fin of a fish is commonly referred to as its tail. The shape of a fish's tail can be an indicator of how fast a fish usually swims. There are three main tail shapes.



Crescent shaped: Fish with crescent shaped tails are very fast swimmers who are constantly on the move.



Forked: Fish with forked tails are also fast swimmers although they may not swim fast all the time. The deeper the fork, the faster a fish can swim.



Rounded: Fish with a rounded or flattened tail are mostly slow moving although they are capable of short, accurate bursts of speed.

Mouths

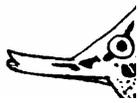
The location and size of a fish's mouth can be a good indicator of the food a fish eats and where it lives. Fish with large mouths generally eat large food items like other fish. Fish with small mouths eat small food items like small crustaceans and molluscs. Fish with tiny mouths eat tiny things like zooplankton.

Fish with a **terminal mouth** located at the end of the head may chase and capture things or pick at things.



Fish with an **up-pointing** mouth with the opening towards the top of the head and a strong lower jaw usually feed near the surface or above themselves.

Fish with a **sub-terminal** mouth with the opening on the underside of the head usually feed on the bottom.



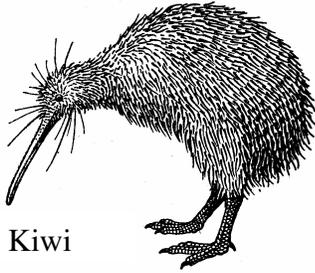
Some fish have **specialised** mouths, like the seahorse, which has a tiny mouth at the end of a straw like snout that is used to 'slurp' zooplankton (e.g. brine shrimp).

Select two fish from the New Zealand Commercial Fish Species poster and infer as much as you can about how the fish lives by looking at its structural adaptations. Justify your reasoning.

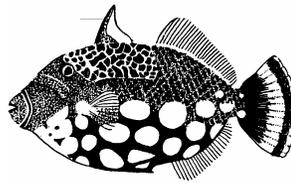
Fish Name: _____
Lifestyle:

Fish Name: _____
Lifestyle:

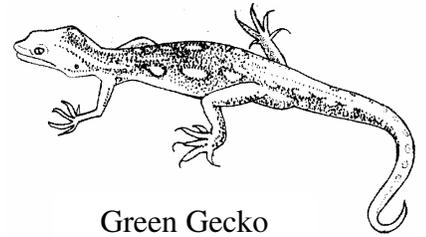
Select three of the following six animals to observe. Use the tables on the following pages to guide and record your observations and inferences.



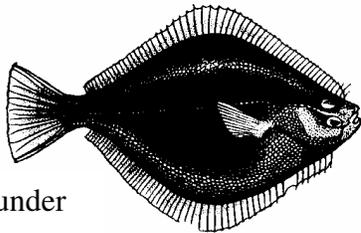
Kiwi



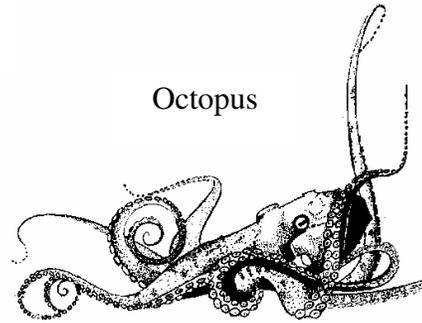
Clown
Triggerfish



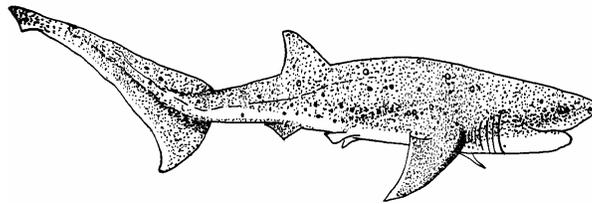
Green Gecko



Flounder



Octopus



Sevengill Shark

<p>Name of Animal:</p> <p>Sketch:</p>	<p style="text-align: center;">Adaptations</p> <p>Structural:</p> <p>Behavioural:</p> <p>Functional:</p>
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Describe the habitat you think the animal lives in:

What food do you think it eats and what methods does it use to obtain this food:

Describe how you think the animal avoids being eaten:

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Natural Selection

In any population of a particular type of organism there are variations amongst the individuals. The organism in a population which has the most favourable characteristics survives, breeds and passes their characteristics on to their offspring. This is called natural selection. Over time, most individuals in the population become adapted to that habitat.

Find the stargazer in the rock pool tank. What favourable characteristics have been naturally selected to enable this animal to survive in the sandy or muddy seafloor habitat?

Physical Challenges of Aquatic Environments

An environment is everything in an organism's habitat, both living and non-living, that affects its survival. The environment supplies the organism's requirements of food, water, air and protection from predators and competitors.

The living (biotic) environment is all the living things that interact with an organism – its food, predators, competitors and disease organisms.

The physical (abiotic), or non-living, factors which affect the survival of aquatic organisms include the **amounts of dissolved gases** in the water, **water temperature**, **light**, **currents or waves**, and the **buoyancy effect of water**.

Give one example of how each of the physical factors in aquatic environments, can affect the survival of a specific aquarium organism.

Dissolved gases and water temperature:

Light:

Currents or waves:

Buoyancy effect of water:

References used:

Hook, P., Stannard, P., and Williamson, K. (1999) Science World for the New Zealand Curriculum 10. MacMillan Publishers New Zealand Ltd., Auckland, N.Z.

National Aquarium in Baltimore web page:

<http://www.aqua.org/education/teachers/activities/fishanatomy.html>