

Activity 4: Investigating marine ecosystems



Let's learn about
feeding behaviours
and relationships in the
marine environment



CURRICULUM LINKS

Learning areas

Science: Levels 1–4:

- Living world: Life processes
- Planet Earth and Beyond: Earth systems
- Nature of Science: Investigating in science, Communicating in science

Science capabilities: Interpret representations, Engage with science

English: Listening, Reading, and Viewing: Ideas

Te Marautanga o Aotearoa:

Pūtaiao: The natural world

Learning intention

Students are learning to:

- Understand how different animals feed and how they interact with each other.

Success criteria

Students can:

- Describe feeding behaviours and relationships through constructing a food web.

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BACKGROUND NOTES

Note: The activity is based around a food web for a nearshore coastal environment, specifically rocky reefs. There are different food webs in different habitats (see Other resources  page 9).

INTRODUCING MARINE ECOSYSTEMS

What is a marine ecosystem?

An ecosystem is a group of living things which interact with each other and the environment.

A marine ecosystem is all of the living and non-living things in an ocean environment interacting with each other and the physical world. The living things in the ecosystem interact through behaviours such as feeding and moving.

The transfer of energy

Energy from the sun is captured by producers such as seaweeds and then passed about in the food chain. Some energy is lost in the process.

What are producers and consumers?

Coastal plants, seaweeds and phytoplankton produce their own food using the sun's energy: they are known as **producers**. Animals need to consume food to survive, therefore they are known as **consumers**. Plants and animals are connected in the ways they gain energy and feed.

Vocabulary	Definition
Producer	A living thing that can make its own food using the sun's energy and a process called photosynthesis, e.g. bull kelp, seagrass.
Consumer	A living thing that eats other living things to survive. Some eat plants (herbivores), some eat other animals (carnivores), and others will eat both (omnivores).

Types of producers

Neptune's necklace

A producer, Neptune's necklace is a seaweed that makes its own food using the sun's energy in a process called photosynthesis.

Photo: Maomao, NatureWatch NZ (CC BY-NC 4.0)



Phytoplankton

The major primary producers in the marine ecosystem, phytoplankton harvest sunlight through photosynthesis and store it as chemical energy.

Photo: NOAA MESA Project (Wikimedia Commons)



Types of consumers

Filter feeder

A type of consumer that filters water to get tiny living things (such as plankton) to eat, e.g. barnacles.

Photo: Katy Johns, NatureWatch (CC BY-NC 4.0)



Grazer

A type of herbivore that scrapes plant matter and other small living things from the rocks to eat, e.g. kina.

Photo: Lisa Bennett, NatureWatch NZ (CC BY-NC 4.0)



Browser

A type of herbivore that eats some/certain producers, such as seaweeds, e.g. butterfish.

Photo: © Brian Mackie



Predator

A type of carnivore or omnivore that hunts to find food and eats other consumers, e.g. snapper.

Photo: Danica Stent



Scavenger

A type of consumer that feeds on the dead remains of living things, e.g. mud whelk.

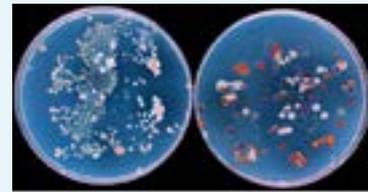
Photo: Lisa Bennett, NatureWatch NZ (CC BY-NC 4.0)



Decomposer

Decomposers, e.g. fungi, bacteria and some invertebrates, feed on waste from living things and also break down their dead remains. This returns nutrients back into the ecosystem.

Photo: NIWA



What is a food chain?

A food chain shows the flow of energy in what living things eat. A food chain always starts with a producer and then shows the consumer, usually a herbivore species, that eats the producer, and then the carnivore species that eats that herbivore species, and so on until you reach the top predator. A top predator is a species that is not eaten by any other species.

Example marine food chain in the subtidal zone:



What is a food web?

A food web is a more complex diagram showing the feeding relationships of living things in a particular habitat. It is made up of many food chains that are interlinked.

What is a feeding behaviour?

A feeding behaviour is how a living thing eats and what it eats.

Is feeding the only way living things interact in an ecosystem?

Living things interact in a variety of ways in ecosystems. For example, they compete for resources like light and space. Some animals may use other animals for habitat, or share their habitat with other living things. Animals may have special relationships, for example some shrimp and pilot fish clean the teeth of larger fish and sharks. Both animals benefit from the relationship: the shark/fish gets clean teeth and the shrimp/pilot fish gets food.



LEARNING EXPERIENCE 4: INVESTIGATING MARINE ECOSYSTEMS

Resources for this activity

- Feeding behaviour integrated literacy sheets:
 - Producer – Neptune’s necklace (seaweed) (🔒) page 10
 - Producer – Phytoplankton (🔒) page 11
 - Consumers – Filter feeders: barnacle and oyster (🔒) page 12
 - Consumers – Grazers: limpets and kina (🔒) page 13
 - Consumer – Browser: butterfish (🔒) page 14
 - Consumers – Predators: Oyster borers, crayfish/lobster, sting rays, snapper, orca (🔒) page 15
 - Consumers – Scavengers and decomposers: cushion star, mud whelk (🔒) page 16
- Young Ocean Explorers: *What is a food chain?* Video clip (01:17 min): ▶ <http://www.youngoceanexplorers.com/youe/video/220259834183#cplayer>.
- Science Learning Hub’s *Marine food webs* resource: 🔒 <https://www.sciencelearn.org.nz/resources/143-marine-food-webs>.
- ‘Who’s eating who?’ by Bronwen Wall, *Connected*, level 4, 2012. Article on Antarctica food webs: 🔒 <http://literacyonline.tki.org.nz/content/download/23432/262796/file/Who%5C%27s+Eating+Who+Connected+4+TSM.pdf>

Vocabulary

Food chain, food web, scavenger, grazer, predator, producer, consumer, herbivore, carnivore, omnivore, filter feeder, fungi, bacteria, decomposers, algae, plankton, phytoplankton, zooplankton, seaweed.

Focus question:
What do animals eat in
a marine rocky shore
environment? How do
they eat?



Inquiry stages 3: Investigate, 4: Extending thinking



INTRODUCING TYPES OF FEEDING BEHAVIOURS

Note: These are suggestions only, teachers are encouraged to adapt and change material to suit their students.

- Introduce the three main types of feeding behaviours: producer, consumer and decomposer (see *Background notes*).
- Then discuss the different types of consumers: e.g. predators, scavengers, grazers and browsers, using the table on 🔒 page 4.



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Activity 4: Investigating marine ecosystems
PROTECTING OUR MARINE WORLD

- Try this Socrative quiz to encourage learning about producers, decomposers and types of consumers: <https://b.socrative.com/teacher/#import-quiz/30468393>. Join Socrative at <https://www.socrative.com> and then add the quiz to your list.

Use the following to investigate and extend thinking in your inquiry.

Feeding behaviour: Integrated literacy sheets

- Students can read through the following integrated reading/literacy sheets individually, in pairs or in groups, to find out more about feeding behaviours of different living things within marine reserves. See the *Feeding behaviour integrated literacy* sheets on [pages 10–16](#).
- After reading the information sheets, students summarise their findings and share their information with the other groups. This could be through a presentation or a jigsaw/4 stray, one stay teaching strategy (see *Teaching strategies* on page 33 in the [Appendices](#)).
- You could also use a digital tool to record and sort information, such as: <https://padlet.com>, www.wordclouds.com, or www.symbaloo.com.

Food chains

- Introduce students to the concept of food chains (see *Background notes*, [pages 3–4](#)).
- Watch the *What is a food chain* video by Young Ocean Explorers to learn about food chains: <https://www.youngoceanexplorers.com/yoe/video/220259834183#cplayer>. This food chain is from a rocky reef. Food chains from different habitats can look very different, according to which species are present.
- Ask students to construct their own marine food chains and food webs using the information in the *Feeding behaviour Integrated literacy* sheets on [pages 10–16](#).



REFLECTING ON LEARNING

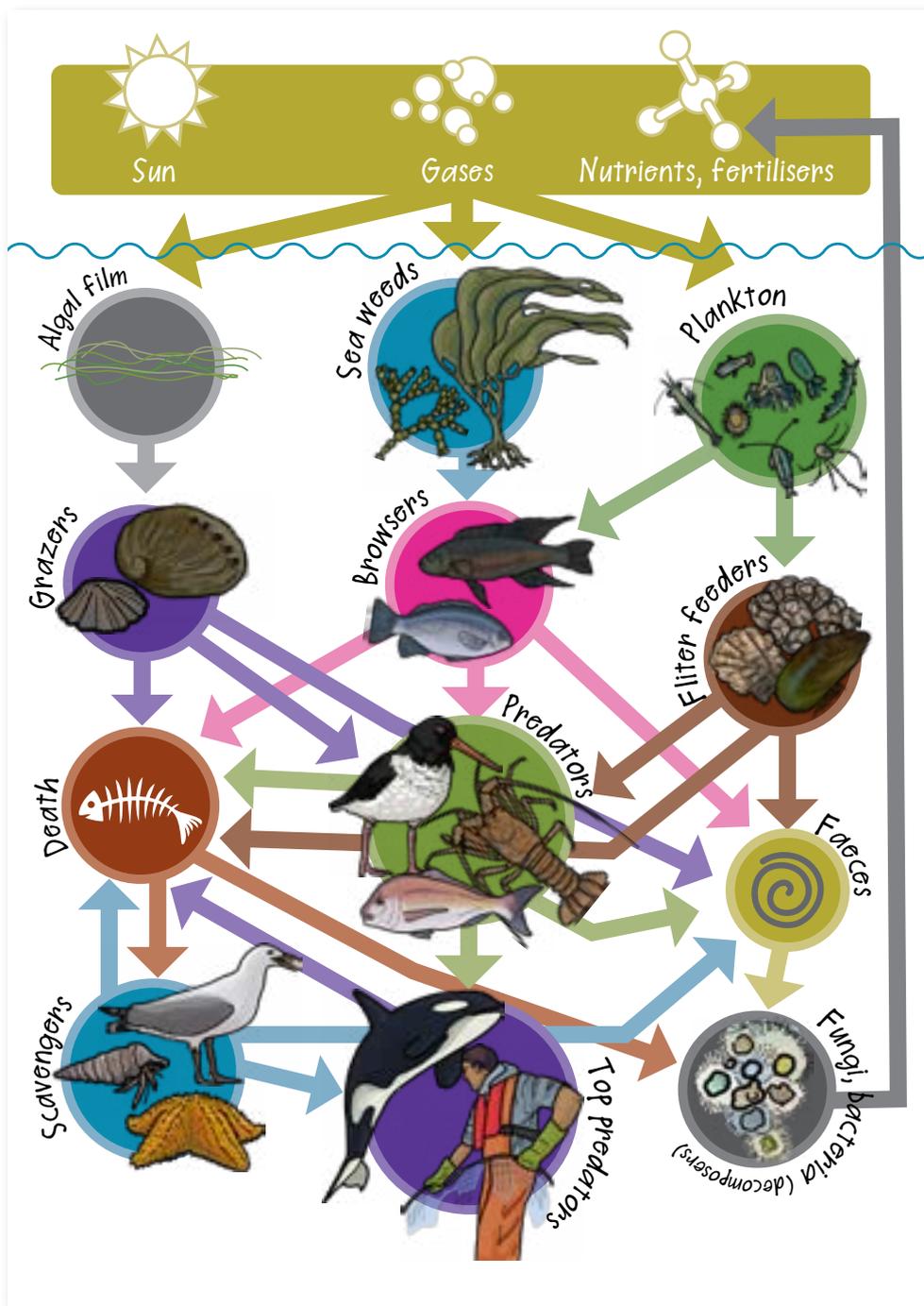


Food webs

- Students could construct a possible marine reserve food web, to show their understandings of feeding relationships. An example is given below.

A blank version of this food web for students to complete, *Student worksheet: Food web diagram*, is available on page 17.

Subtidal food web example



Please note: this food web is specific to the rocky shore/ reef habitat. Different habitats and ecosystems have their own food webs. For example, a deep ocean food web would have very little in common with this food web.



EXTENDING LEARNING



- Construct a food web for ecosystems in the Ross Sea in Antarctica using the Science Learning Hub's resources:  <https://www.sciencelearn.org.nz/resources/1526-making-a-food-web>.
- Learn more about how our understandings of food webs have changed over the years and about trophic levels:  <https://www.sciencelearn.org.nz/resources/143-marine-food-webs>.
- What happens when people take predators out of the food chain? Watch this Young Ocean Explorers video about kina barrens: *Where did all the kelp go?* (02:06 min)
 <http://www.youngoceanexplorers.com/yoe/video/220259837417#cplayer>.

OTHER RESOURCES ABOUT FEEDING BEHAVIOURS AND ECOSYSTEMS

- For more food web information and activities, see *The rocky shore who eats who?* colouring book by New Zealand Marine Studies Centre:  <http://www.otago.ac.nz/marine-studies/resources/download/otago062864.pdf>.
- Learn more about apex/top predators of the food web/food chain in this Young Ocean Explorer quiz *What is an apex predator?* (01:30 min)  <https://www.youngoceanexplorers.com/yoe/video/232307003474#cplayer>.



Producer
Makes its
own food

Neptune's necklace *Hormosira banksii*

All seaweeds, including Neptune's necklace, kelp and flapjack, make their own food. They are called producers.

Algae (another name for seaweed) can make food from the sun's light energy by a process called photosynthesis.

What is Neptune's necklace?

It's actually a seaweed. It is also known as a brown alga, but it can be orange or green coloured.

Habitat

Neptune's necklace grows in clumps on rocky reefs. It often covers large areas.

What eats Neptune's necklace?

Browsers and grazers such as fish, kina, snails and crabs eat Neptune's necklace and other seaweeds.

Photo: Jon Sullivan, NatureWatch NZ (CC BY-NC 4.0)

Photo: Maomao, NatureWatch NZ (CC BY-NC 4.0)



Did you know...
Neptune's necklace is a
seaweed shaped like a
bead necklace!



Producer
Makes it
own food

Phytoplankton

Sea water may look clear and transparent, but it is filled with many different types of plankton! Plankton is lighter than sea water and can stay near the surface. Phytoplankton can make food from the sun's light energy by a process called photosynthesis. When they do this they produce oxygen that we breathe!

What is plankton?

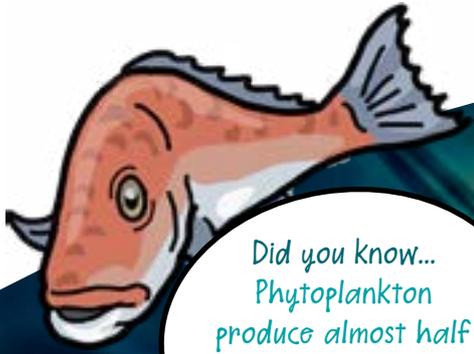
There are three main types of plankton: plant plankton, animal plankton and bacteria. Phytoplankton is plant plankton. Zooplankton is animal plankton and is not a producer.

Habitat

Plankton float freely in the water. They are not attached to any one habitat and can move between habitats and float with the currents.

What eats plankton?

Filter feeders such as barnacles, tubeworms and sponges eat plankton. Zooplankton also eat phytoplankton.

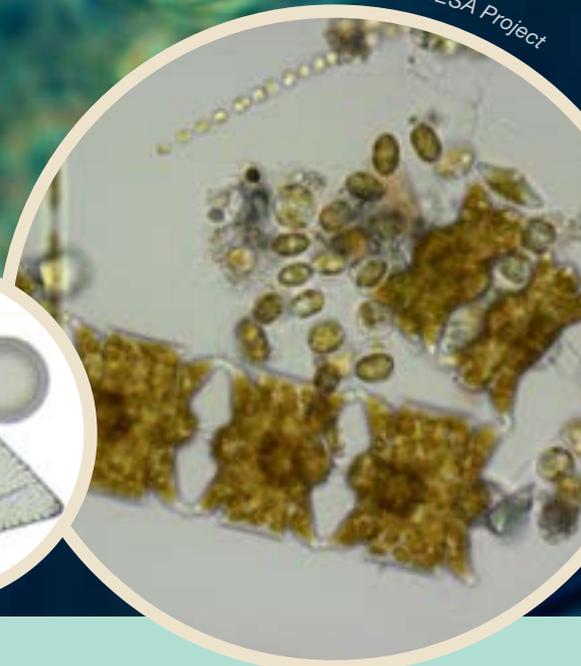


Did you know...
Phytoplankton
produce almost half
of the oxygen in our
atmosphere!

Photo: NOAA MESA Project (Wikimedia Commons)

Photo: NOAA MESA Project

Photo: NIWA, Healey Collection



Consumer:
Filter feeder
Filter their
food from
water

Oysters and barnacles

Sea water is filled with plankton: an excellent food source for filter feeding animals. Filter feeders have adapted to be able to filter out plankton from the water with their body parts. Examples of filter feeders are oysters, other shellfish, tubeworms, sponges and barnacles. Oysters filter the salt water through their gills, inside their two shells. The gills suck the water inside and absorb the food.

What are oysters and barnacles?

An **oyster** is a shellfish. It is called a bivalve because it has two shells.

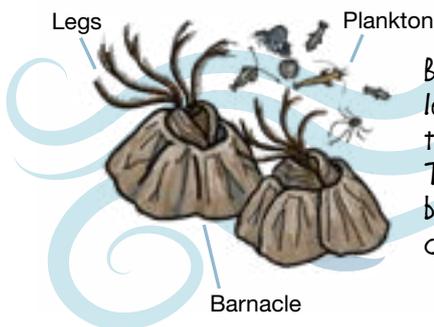
A **barnacle** is an animal that lives on the rocks and has a trap door on top that it shuts and opens.

Habitat

Oysters and barnacles live on the rocky shore, attached to the rocks. They can also live on artificial surfaces like wharves.

What eats oysters/barnacles?

Oyster borers (another type of shellfish) and some shorebirds eat oysters and barnacles.



Barnacles kick their hairy legs out into the water where the hairs catch plankton. The barnacle brings its legs back into the shell to eat the captured plankton.



Pacific oysters



Did you know...
Oysters and barnacles
can't move so they like
to live in faster currents
as then more food
comes their way!

Photo: David Monniaux;
modified by Peter Gugerell
(CC BY-SA 2.0 FR)



Consumers:
Grazers

Scrape their
food off the
rocks

Limpets and kina

Most of the rocky shore is covered in a layer of algae, that is hard to see. Limpets use radulas (a tongue on their foot!) to scrape algae off the rocks. The radula has lots of rows of tiny teeth. Teeth on their tongue!

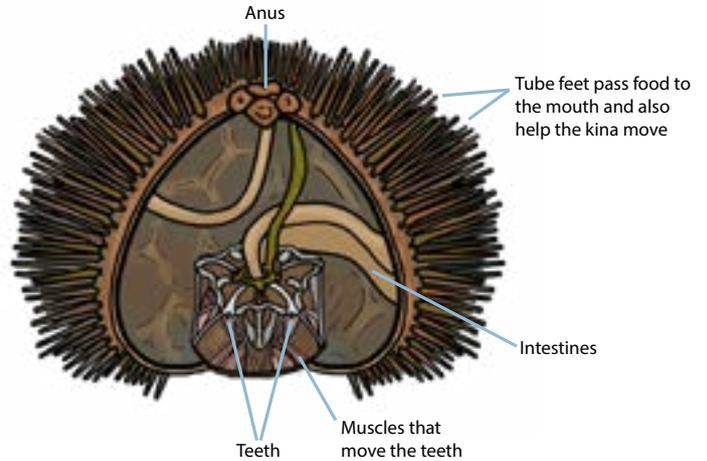
What are limpets and sea urchin/kina?

A **limpet** is a small snail-like animal that lives in a shell.

A **kina** is a type of sea urchin that is green and spiky. It is related to sea stars.

How does a kina feed?

A kina/sea urchin also feeds by grazing. Instead of a radula, a kina has a grinding mill (see diagram on right).



Habitat

Limpets and kina live on the rocky shore. Limpets can survive in the intertidal zone. Kina live in the subtidal zone.

What eats limpets and kina?

Predators such as fish and crayfish eat limpets and kina.



Consumer:
Browser
Eat (browse)
seaweeds

Butterfish

What is a butterfish?

A butterfish is a type of fish that eats mostly brown seaweeds.

Habitat:

Butterfish live in the subtidal zone of the rocky shore.

What eats butterfish?

Butterfish are eaten by larger fish-eating fish, sharks and possibly New Zealand fur seals.



Photo: © Brian Meckie

Photo: © M. P. Francis



Did you know...
Grazers and browsers
are herbivores: they
do not eat other
animals.



Consumers:
Predators

Hunt and eat
other animals

Oyster borers, crayfish/lobster, stingrays, snapper, orca

Small predators

Small predators like **oyster borers** eat barnacles, chitons, limpets and oysters.

Large predators

Large predators, like crayfish/lobster, snapper and stingrays, eat smaller predators/consumers. **Crayfish** eat anything from algae to fish – they are not fussy eaters! **Stingrays** and **snapper** eat kina, shellfish and smaller fish.

Top (apex) predators

Orca are top predators because nothing eats them! They eat a range of foods, including stingrays, New Zealand fur seals, fish and squid.

Other predators

Other predators include octopus, sharks, and shorebirds. Birds like the oystercatcher feed on shellfish like mussels and tuatua.



Oyster borer feeding on chiton.

Photo: Karen Pratt, NatureWatch NZ (CC BY-NC 4.0)



Did you know...
Our stingrays are only eaten by New Zealand orca and they like them a lot!



Consumers:
Scavengers
Feed on dead
remains

Cushion stars and mud whelks

Scavengers feed on the dead remains of animals. They are specialists at finding and eating rotting food.

What is a cushion star?

A cushion star is a type of sea star that has five arms and looks spongy like a cushion.

What is a mud whelk?

A mud whelk is a type of sea snail that has a spiral-shaped shell. Mud whelks have a siphon (tube) at the back of their shell to help them smell and find food.

Habitat

These animals both live in the intertidal zone of the rocky shore.

What eats sea stars and whelks?

Predators, such as fish and shorebirds, eat these animals.

Other scavengers

Hermit crabs, gulls and some worms are also scavengers.

Consumers: decomposers

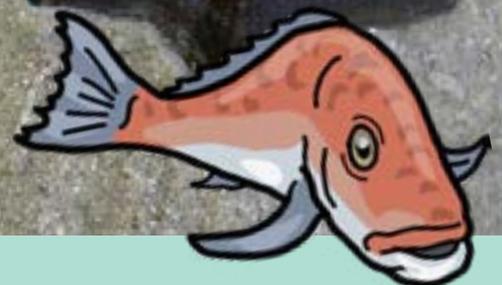
Decomposers, such as fungi, some invertebrates and bacteria, break down waste and remains and recycle these back into the ecosystem.

Mud whelk. Photo: Lisa Bennett, NatureWatch (CC BY-NC 4.0)

New Zealand common cushion star.

Photo: Kaytee, NatureWatch NZ (CC BY-NC 4.0)

Siphon/
tube →
Foot →





Food web diagram

