

Activity 4: Life in an estuary



Let's find out more about estuary plants and animals



CURRICULUM LINKS

Learning areas

Science: Levels 1–4

- Science: Living world: Life processes.
- Nature of Science: Investigating in Science.

Science capabilities

- Gather and interpret data.
- Interpret representations.

Te Marautanga o Aotearoa

- **Pūtaiao:** The natural world

Learning intentions

Students are learning to:

- understand how plants and animals feed, reproduce and live in an estuary
- investigate a species of their choice and describe how it feeds, reproduces and interacts with other living things.

Success criteria

Students can:

- research an estuary animal, plant or other living thing, recording ideas about its feeding, breeding and habitat in estuaries
- continue their learning inquiry to find out more about estuary animals or plants and describe how they interact in the wider ecosystem.

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Eels/tuna

Variable oystercatcher/tōrea pango

My animal is: (blank activity sheet)



3

Activity 4: Life in an estuary
PROTECTING OUR ESTUARIES

BACKGROUND NOTES

WHICH LIVING THINGS DO YOU FIND IN ESTUARIES?

Estuaries are home to a wide variety of animals, plants and other living things. The species that live here must be able to tolerate a saltwater environment that is very changeable.

Fish species such as snapper/tāmure, flounder/pātiki, black bream/parore and eels/tuna are often found in estuaries, while birds such as oystercatchers/tōrea, fernbirds/mātātā, banded rails/moho pererū, kingfishers/kōtare, fantails/pīwakawaka, herons/matuku and shags/kawau are also common.

A number of invertebrates are also often found here, such as crabs/pāpaka, snails/whētiko, cockles/tuangi and worms/toke moana. Seagrass grows in soft sediments in estuaries. They provide important habitat for young fish.

The species that occur in a particular estuary will depend on the location, temperature, exposure to weather, vegetation and human impacts.



Hermit crab at Pohatu Marine Reserve. Photo: Dave Bradshaw



Seagrass/eelgrass. Photo: Peter de Lange



Bar-tailed godwit at Waipu Estuary, Northland. Photo: Rod Hay

WHICH ANIMALS VISIT ESTUARIES?

Birds and fishes often visit estuaries to feed or breed while spending most of their lives elsewhere. For example, bar-tailed godwits/kuaka visit estuaries to feed during their migration and some fishes, such as īnanga, need the estuarine environment for part of their life cycle.

WHAT DO ENDEMIC, NATIVE AND INTRODUCED MEAN?

Term	Definition
Endemic	Endemic animals are only found in New Zealand. Examples include longfin eels/tuna and variable oystercatchers/tōrea.
Native	Native animals live and breed in New Zealand but may also be found in other countries. These animals may have introduced themselves to New Zealand (self-introduced). Examples include īnanga and shortfin eels/tuna.
Introduced	Introduced animals were brought to New Zealand by people and have never been found here naturally. Examples include koi carp and rats/kiore.

HUMAN IMPACTS: SEDIMENTS AND HABITAT DESTRUCTION

Habitats can be affected by human impacts and actions, such as pollution and sedimentation. For more information, see  *Activity 8: Healthy estuaries*.



LEARNING EXPERIENCE 4: LIFE IN AN ESTUARY

Resources for this activity

- Student worksheet  Life in New Zealand's estuaries, page 9.
- Student integrated literacy activity sheets (provided at the end of this activity, pages 10–19):
 - Seagrass/karepō
 - Mangrove/mānawa
 - Snapper/tāmure
 - Īnanga
 - Pied shag/kāruhiruhi
 - Cockles/tuangi
 - Mudflat snails/whētiko/karahū
 - Eels/tuna
 - Variable oystercatcher/tōrea
 - Blank learning sheet



Focus question
What's life like
in an estuary for
animals, plants
and other living
things?

Vocabulary

Life cycle, breeding, breed, reproduce, migration, endemic, native, introduced, erosion, sediment, pollution.

Links

To open the links throughout this resource without losing your place in the document, follow either of these steps:

- Right click on the link and click **Open Hyperlink**. Now the link will be opened in new tab.
- Hit the **Ctrl** key while you left click the link. This will also force the browser to open the page in a new tab.

Either of these methods will open the link in a new tab leaving the teaching resource open.



INTRODUCING STUDENTS TO LIFE IN AN ESTUARY

Note: These learning experiences are suggestions only. Teachers are encouraged to adapt and change the material to suit their students' needs and interests.

Inquiry stage 3: Investigate



What is life like in an estuary?

- Share ideas about what life is like on the mud flats using a talking donut (see  *Teaching strategies* in the Appendix).
- View the New Zealand Marine Studies Centre's *March of the Mudflats* video clip.
 - ▶ **March of the mudflats**
Brainstorm what life might be life for snails on a mud flat.
- Students could act out a day in the life of a bird, fish or snail on the mud flats.



Mangroves in Whangateau Harbour. Photo: Lorna Doogan (courtesy of Experiencing Marine Reserves)

Endemic, native and introduced



- Introduce the terms 'endemic', 'native' and 'introduced'. Share ideas about what the students understand these terms to mean. See background notes on page 5 for definitions.
- Clarify the meanings of these terms by viewing the Science Learning Hub's *Endemic, native or introduced?* PowerPoint presentation.
 - 🔗 Science Learning Hub: New Zealand's native birds – endemic, native or introduced?
- View the literacy activity sheets (pages 10–19) to see which estuary species are endemic, native or introduced.

Thinking about life in an estuary from a Māori perspective



- Learn more about Māori perspectives by finding out about the different names, whakapapa (genealogy) and importance of eels/tuna on the DOC website.
 - 🔗 Tuna – ā tātou taonga
- Which taonga (natural treasures) are significant to your local iwi and why?

Continuing your inquiry and investigating a species

- Reflect on your students' inquiry questions from Activities 1 and 2.
 - What is the next step? Some inquiry questions may relate to the student learning sheets in this activity.
 - Copy the student worksheet *Life in New Zealand's estuaries* (page 9) and cut out the individual animals. Give one bird or fish to each student. These can be used to form groups or partners to work with for inquiry or a reading/literacy activity – students can find someone with the same picture as them to partner with.



- Get students to use the student integrated literacy activity sheets (pages 10–19) to further investigate an estuary species, eg where it lives (its habitat), its diet, its life cycle and how it depends on the estuary.
- Groups could share their findings with the class through a presentation, talk, artwork or drama. Reflect on the group presentations. Why are estuaries important for the life cycles of these animals?

REFLECTING ON LEARNING

Inquiry stages 4: Extending thinking

- After sharing their information, students can explore the similarities, connections and differences between species. How are animals, plants and other living things connected in the ecosystem? How do these connections relate to the freshwater and saltwater environments? Examples of how living things are connected through feeding relationships and food chains include:
 - plant plankton (diatoms) > insects > fish > eel
 - seagrass detritus > lugworm > godwit
 - detritus/bacteria (in the sediment) > algae > cockle > variable oystercatcher.

For more information about food chains and feeding relationships, see

 Activity 4 of DOC's *Protecting our marine world* resource.

Students could learn more about species such as mudflat snails, cockles, whelks and birds through the New Zealand Marine Studies Centre's Mudflat Mysteries educational book and game.

 Mudflat mysteries



EXTENDING LEARNING

- How do different fish species move in rivers and estuaries? To see how different whitebait species cope with climbing and fast water movement, watch this video on the DOC website.

 Freshwater fish videos

- How do cockles help to enhance estuary habitat? Observe cockles up close if possible by collecting them and keeping them in salt water in your classroom for a few hours. What happens to the cockles? (*Shellfish such as cockles and mussels will filter the water to make it clean.*) See the Science Learning Hub's Cockles video for more information.

 Cockles

Note: Wrap the cockles in a towel, mesh or seaweed and keep them in a cool place away from direct sunlight. Do not place them in still salt water for more than a few hours as they cockles will open, feed and use up the oxygen in the water. They can be kept out of water in a cool place for 2 days. Return the cockles to the collection site once you have made your observations.



- At what other times would shellfish close up in an estuary? (*When the tide goes out.*)
What other behaviours would you expect to see from estuary animals when the tide goes out? (*Some animals bury themselves, crabs go into holes, birds come to feed. These are behavioural adaptations that help the animals to survive.*)

OTHER RESOURCES RELATING TO ESTUARIES AS HABITATS

- *Collins field guide to the New Zealand seashore* by Sally Carson and Rod Morris (Harper Collins, 2017):
 - 🔗 Field guide to the New Zealand seashore
- DOC's *Whitebait - migratory galaxiids* webpage:
 - 🔗 Whitebait - migratory galaxiids
- Whitebait Connection's Inanga spawning webpage:
 - 🔗 Whitebait Connection inanga spawning resources
- Seagrass/karepō padlet page:
 - 🔗 Seagrass/karepo
- Eels/tuna padlet page:
 - 🔗 Eels/tuna
- Cockles/tuangi padlet page:
 - 🔗 Cockles/tuangi
- Oystercatcher/tōrea padlet page:
 - 🔗 Oystercatcher/torea
- Longfin eel *Tuna kuwharuwharu* resource by Joseph Potangaroa:
 - 🔗 Tuna Kuwharuwharu The longfin eel
- New Zealand Birds Online White-faced heron webpage:
 - 🔗 White-faced heron
- Revive Our Gulf's video on how mussels filter seawater and how this is helping to restore the Hauraki Gulf:
 - ▶ Revive our Gulf display movie
- Science Learning Hub's Life in the estuary webpage for more information about estuarine connections in an ecosystem:
 - 🔗 Life in the estuary
- Ministry of Education's policy on keeping animals in ECE centres and schools:
 - 🔗 Policy on animals for ECE centres and schools



LIFE IN NEW ZEALAND'S ESTUARIES



Students can research one of these animals to find out more about how they live in estuaries, including their feeding, breeding and life cycles.



Variable oystercatcher/tōrea.
Photo: Bernard Spragg



Seagrass/karepō.
Photo: Peter de Lange



Whangateau mangroves.
Photo: Lorna Doogan, courtesy of Experiencing Marine Reserves



Tanga in eelgrass.
Photo: G.A. Eldon, DOC



Eel/tuna.
Photo: Gusmonkeyboy



Mudflat snail/whētiko/karahū.
Photo: Jane Percival (CC BY-NC-SA)



Pied shag/kāruhiruhi.
Photo: Bernard Spragg



Snapper/tāmure.
Photo: Brian Mackie



Cockle/tuangi. Photo: Helen Kettles, DOChttp://naturewatch.org.nz/photos/4217841



White-faced heron/matuku.
Photo: Bernard Spragg



Godwit/kuaka.
Photo: Rod Hay, DOC



Flounder/pātiki. Photo: Roban Kramer (CC BY-SA 2.0) www.flickr.com/photos/robanhk/



SEAGRASS/KĀREPO

Zostera muelleri subsp. *novazelandica*

Native

It is also found in southern Australia. Seagrass is also known as eelgrass.

The importance of seagrass in estuaries

Carbon storage	Seagrass can take in carbon dioxide from the air and water. This is very important for helping to prevent climate change. Seagrass (and the sediment beneath it) can lock up 10 times more carbon than the same sized forest! Seagrass also helps to reduce acidification of the oceans.
Feeding ground	Large fishes and birds feed in seagrass meadows.
Oxygen pump	Seagrass produces a lot of oxygen for animals and people.
Nutrient and sediment trapping	Seagrass holds and traps sediments and nutrients.
Seabed stabiliser	Seagrass holds the seabed together with its roots.
Habitat for animals	Seagrass provides habitat and hiding places for animals.

Seagrass and animals

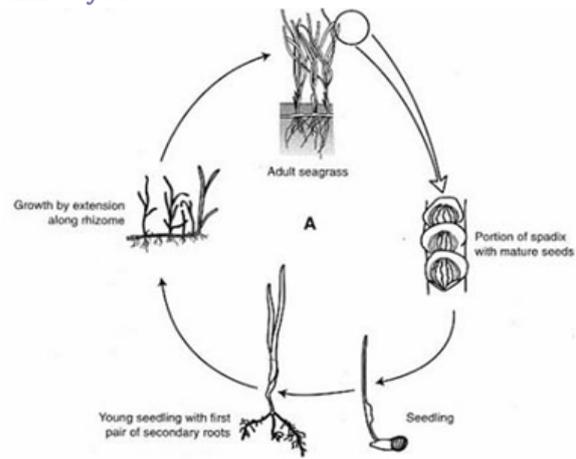
Fishes like to keep their young near seagrass because it protects and hides them from predators. Snapper, leatherjackets and trevally often breed near seagrass, and a rare New Zealand pipefish lives there all the time.

Seagrass is important for people too: it traps sediments, provides us with oxygen and provides food for some of the animals we eat (such as snapper and trevally). It also helps to hold the seabed together.

Habitat

Seagrass can grow in places where it is always under the water (the sub-tidal zone) if it can get enough light. It can also grow on mud flats or sand in estuaries.

Life cycle



Northland Regional Council's Estuaries School Information pack

Seagrass is a plant. It starts life as a seed and then grows into a small seedling and eventually a large grass. The large grass then produces tiny flowers and seeds.

For more information, see:

- NIWA's seagrass guide.
 - 🔗 New Zealand seagrass guide
- DOC's seagrass/karepō padlet page.
 - 🔗 Seagrass/karepo student inquiry/research page
- The interactive SeagrassSpotter site, where you can view and add sightings of seagrass.
 - 🔗 Project Seagrass SeagrassSpotter



Photo: Peter de Lange

MANGROVE/MĀNAWA

Avicennia marina subsp. *australasica*

Native

Mangroves are native trees that can grow in salt water.

Mangroves and animals



Photo: Lorna Doogan, Experiencing Marine Reserves (CC-BY-NC-SA-4.0)

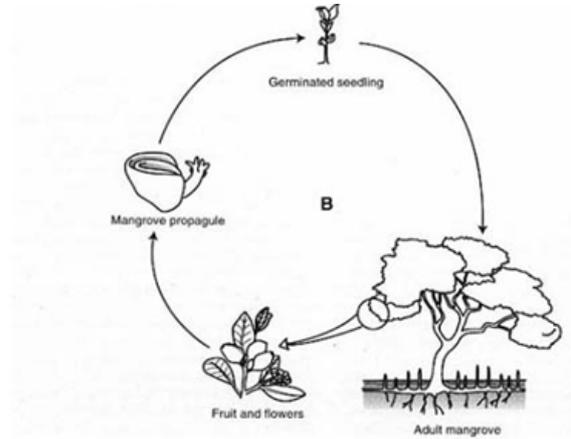
Fishes such as flounder/pātiki and shortfin eels/tuna are common in mangrove habitats, especially at high tide. Birds such as kingfishers/kōtare, herons/matuku and pūkeko find food and nest around mangroves. Crabs, shellfish, snails, worms and other animals also live near mangroves.

Habitat

Mangroves only grow in northern New Zealand – you will not find them south of Kawhia or Ohiwa harbours. Mangrove forests trap sediment and protect the coast from erosion (wearing away).

Seagrass is important for people too: it traps sediments, provides us with oxygen and provides food for some of the animals we eat (such as snapper and trevally). It also helps to hold the seabed together.

Life cycle



Northland Regional Council's Estuaries School Information pack

The mangrove starts life as a seed (propagule) from which it grows into a seedling and tree. Adult trees flower in summer but branches do not usually flower every year.



Mangrove seeds float for a few hours, then shed their coating and sink into the mud to grow

Mangrove breathing

Mangroves breathe through some of their roots: they send up spikes that rise into the air above the level of the mud like **snorkels!**

Mangrove propagules. Photo: Jacqui-iNaturalist (CC-BY-NC) www.inaturalist.org/observation/5215888



Photo: Shan Walker, EfS Initiatives



SNAPPER/TĀMURE

Pagrus auratus

Native

Snapper/tāmure is one of our most popular and well-known fishes.

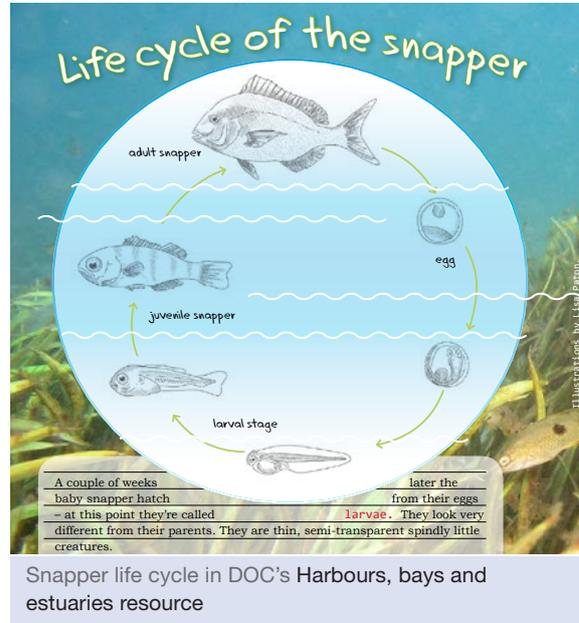
Snapper are more common in the warmer waters of northern New Zealand. They can grow to be very large fish (up to 1 m long and over 15 kg).

Habitat

Young snapper like to live in sheltered areas where they are safe from predators and there is plenty of food. They live close to the shore near seagrass meadows, kelp forests, sponge gardens or horse mussel beds.

Snapper live in harbours, bays and estuaries as young fish. Many then move offshore to live in the open sea as adult fish.

Life cycle



Adult females release thousands of eggs at a time, some of which survive to become larvae. The larvae eventually grow into big adult fish.

Foods

Snapper eat a variety of foods, including small fishes, kina, shellfish, crabs, worms and molluscs. Adult snapper are top predators (meaning very few animals eat them).

For more information, see:

- DOC's snapper education resource.
-  Harbours, bays and estuaries - at the edges of land and sea

All snapper start life as girls. As they grow up, half become boys!



Snapper in Cape Rodney-Okakari Point Marine Reserve. Photo: Brian Mackie

ĪNANGA

Galaxias maculatus

Native

Īnanga are the most common and smallest (about 10 cm long) of the five types of native fishes whose young are called 'whitebait'.



Photo: Lycaon.cl (CC BY-SA 3.0)
<https://creativecommons.org/licenses/by-sa/3.0/deed.en>

Īnanga are also known as common galaxias (named for the starry patterns on their bodies). Unlike other species of freshwater fishes, they are not able to climb barriers.

Habitat

Īnanga are found throughout New Zealand. They move from the sea to estuaries and into rivers at different stages of their life cycle.

Life cycle

Īnanga adults lay eggs in grasses at the edge of the estuary during the 'spring' tide (when the water levels are very high). The eggs hatch

about 3 weeks later when the tide is very high again and the larvae are flushed into the estuary or the sea. Once they have grown bigger, the Īnanga swim back into the rivers.

Numbers of Īnanga are declining due to habitat destruction and over-harvesting.

Foods

Whitebait species, including Īnanga, eat insects and other small fishes.



Īnanga amongst seagrass (*Vallisneria gigantea*).
Photo: G.A. Eldon

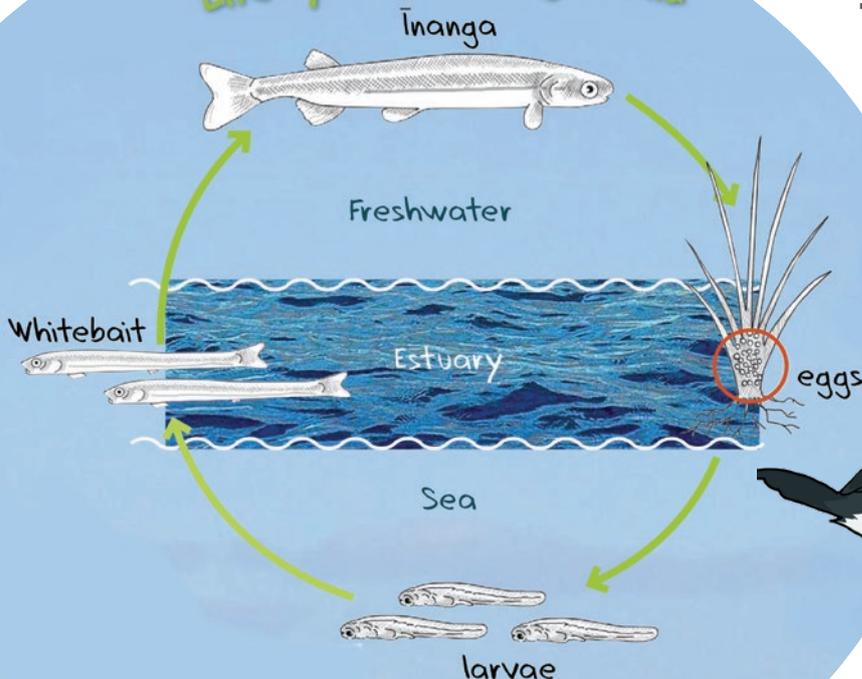
For more information, see:

- DOC's Īnanga webpage.
- Īnanga - the most common whitebait
- Whitebait Connection's *Īnanga spawning* resource.
- Whitebait Connection Īnanga spawning resource

Īnanga do most of their hunting at night (they are nocturnal)

Whitebait life cycle in DOC's Harbours, bays and estuaries resource

Life cycle of the galaxiid



PIED SHAG/KARUHIRUHI

Phalacrocorax varius

Native

Pied shags are large, black and white coastal birds. The breeding adults have pale yellow skin in front of their blue eyes.



Pied shag. Photo: Bernard Spragg

There are 12 shag species in New Zealand. The pied shag is one of the larger species. .



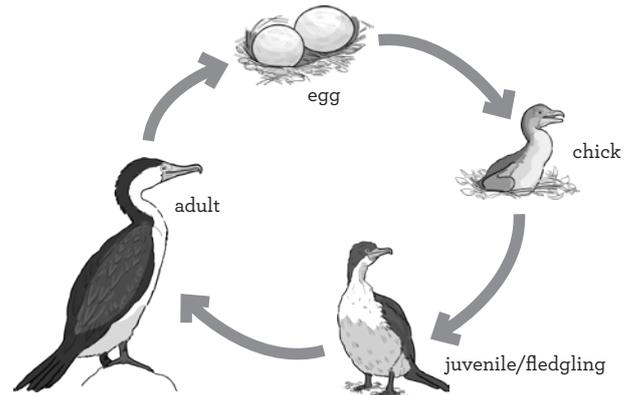
The word 'pied' means having two or more different colours

Habitat

You will find pied shags close to the shore near harbours and estuaries. They are found in a variety of areas around New Zealand, including Northland, Auckland, Wellington, Canterbury, Fiordland and Stewart Island/Rakiura and they are spreading to new areas.

Life cycle

Pied shags almost always build their nests in trees. Adult females lay 2-5 eggs and both parents guard and keep them warm until they hatch.



Foods

Pied shags are expert fishers, diving underwater to catch a variety of fishes. They eat eels, trevally, flounder, perch and kahawai.

They mostly catch fish in salt water, especially in estuaries.

For more information, see:

- New Zealand Birds Online.
🔗 Pied shag
- Te Ara: The Encyclopedia of New Zealand.
🔗 Shags

Juvenile pied shag. Photo: Raewyn Adams © All rights reserved



NEW ZEALAND COCKLE/TUANGI

Austrovenus stutchburyi

Endemic

The New Zealand cockle is a common shellfish in our estuaries that is found only in New Zealand. There can be thousands of cockles in only one square metre of sand!

Cockles are also sometimes called clams. Inside their two shells is a living animal that burrows under the sand.

Habitat

Cockles are usually very common in estuaries, mud flats and intertidal beaches around New Zealand. These shellfish live a few centimetres under the sand or mud and can have anemones, limpets and seaweed living on them.

Life cycle

Life cycle of cockles

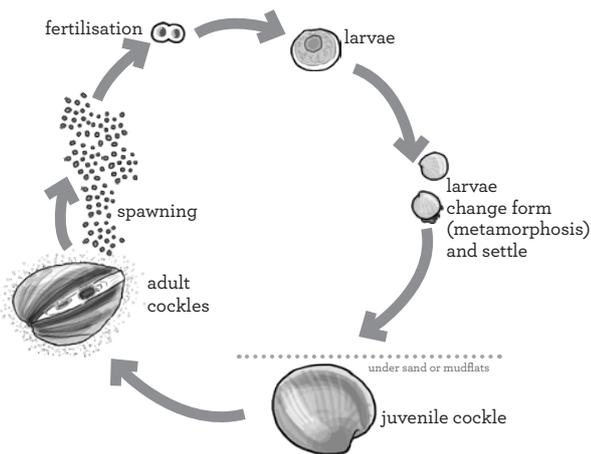


Photo: Lisa Bennett (CC_BY_NC) iNaturalist photo 32960682

Adult cockles live at the low tide mark. They release eggs into the ocean. Fertilised eggs become larvae. These settle and change form (metamorphosis). Juveniles (young cockles) settle into the sand or mud flats and grow to become adult cockles.

Foods

Cockles are filter feeders. To eat, they pump sea water across their gills and filter it to catch phytoplankton (tiny plants). You can tell when cockles are feeding because their shells are open and you can see their siphons.

As they are feeding, cockles also filter the water, removing pollution and sediments. Estuaries with lots of cockles could have all of the water filtered in just 1 day!

Cockles are also very important in the food chain. Many other animals rely on them for food and without cockles and other shellfish, the entire ecosystem can become unbalanced.

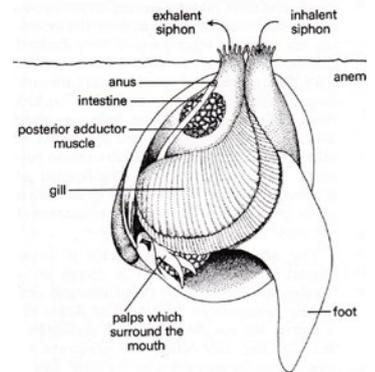


Image taken from Healy, W.B. 1980: Pauatahanui Inlet – an environmental study. Reproduced with permission from NIWA



Photo: © sea-kangaroo (CC-BY-NC-ND) Some rights reserved iNaturalist photo 2688180

For more information, see:

- DOC's cockles education resource.
- Harbours, bays and estuaries
- DOC's cockles/tuangi padlet page.
- Cockles/tuangi student inquiry/research page

They may be small but cockles can live to 25 years!



MUDFLAT SNAILS/WHĒTIKO/KARAHŪ

Amphibola crenata

Endemic

Mudflat snails/whētiko are found in many New Zealand estuaries and mud flats.

These snails live in one shell and are therefore called univalve molluscs. They are special because they breathe with a simple lung, not gills.

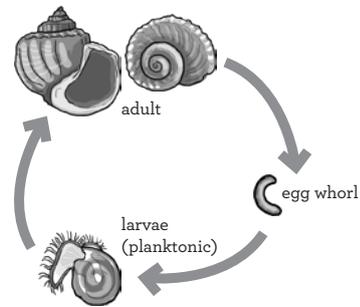


Photo: © Jane Percival (CC BY-NC-SA 4.0)
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Habitat

Mudflat snails live on and in the mud flats. They usually feed at high tide. At low tide, when it is very dry, they will close their trap doors and bury into the mud until the water comes back in.

Life cycle



Mudflat snails make a nest of mud and lay long, rounded egg trails that contain thousands of eggs. The eggs hatch into larvae and then grow into adult snails.

Foods

Mudflat snails are deposit feeders, sifting through the mud to get bacteria and algae to eat. They will also feed on tiny plants.

Mud snails are the gardeners of the estuary. They can plough through their body weight in mud every hour!



For more information, see:

- The Marine Life Database.
 Snail, Mud
- New Zealand Marine Studies Centre's Mudflat Mysteries activity book.
 Mudflat mysteries: an educational activity book

Mudflat snails. Photo: Lisa Bennett (CC-BY-NC)

Amphibola landscape at Little Waihi, Bay of Plenty. Photo: Helen Kettles



EELS/TUNA

Shortfin eel: *Anguilla australis*

Longfin eel: *Anguilla dieffenbachii*

Native

Shortfin eel

Endemic

Longfin eel

Eels/tuna are long, slimy fishes with snake-like bodies.

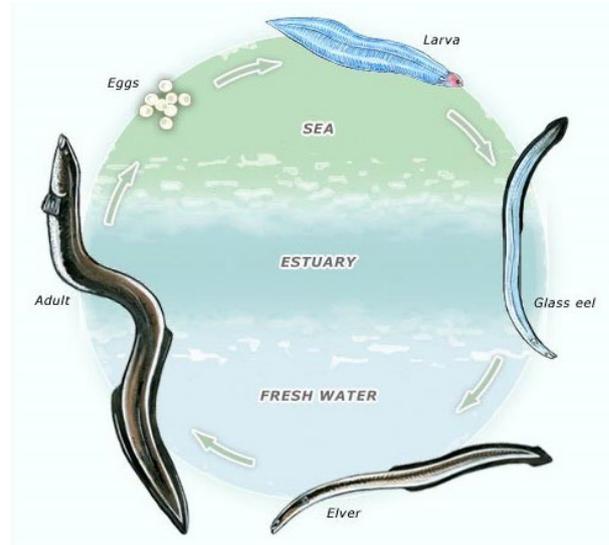
New Zealand estuaries and streams are home to both shortfin eels (native) and longfin eels (endemic).

Shortfin eels are smaller than longfin eels and only live until they are about 22 years old.

Longfin eels can grow very big (up to about 40 kg) and can reach 100 years old. However, it is rare for an eel to grow that big and survive to that age these days because of the many changes that were made to their habitats and overfishing in the past.



Shortfin eels. Photo: Gusmonkeyboy



Eel life cycle. Te Ara - The Encyclopedia of New Zealand. Artwork by Bruce Mahalski

Foods

Eels eat other animals, such as snails, freshwater crayfish/koura and other fishes. Large eels also sometimes eat small birds and ducklings.

Eels usually hunt at night, using their strong sense of smell

Life cycle and habitat

Eels spend some of their time in coastal environments, including estuaries and mangrove forests. They also spend part of their life cycle in rivers and streams.

Large adult eels swim out to sea to breed. The young (larvae) are swept back to shore and into estuaries on the ocean currents.

Adult eels migrate a very long way out into the Pacific Ocean to breed – they breed only once, at the end of their lives



For more information, see:

- DOC's freshwater eels webpage.
 Freshwater eels in New Zealand
- DOC's freshwater eels leaflet.
 Freshwater eels in New Zealand.pdf
- The eels/tuna padlet page.
 Eels/tuna

VARIABLE OYSTERCATCHER/TŌREA PANGO

Haematopus unicolor

Endemic

Oystercatchers/tōrea pango are very noisy birds and are easily seen because of their bright orange beaks and legs.

There are several types of oystercatchers in New Zealand, three of which are endemic (found only in New Zealand). The variable oystercatcher can be black or a combination of black and white.



Variable oystercatcher. Photo: Tony Whitehead (all rights reserved). www.wildlight.co.nz

Habitat

You will find oystercatchers looking for food on mud flats in estuaries, beaches and on the rocky shore. They nest in all sorts of places but especially on sand dunes.

Oystercatchers can be found around most of New Zealand.

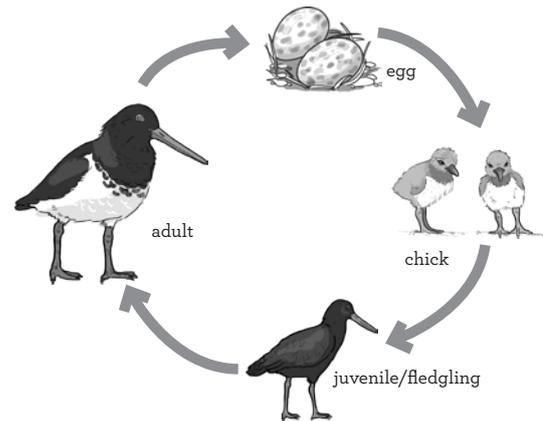
Life cycle

Oystercatchers make simple nests on shell banks or sand. These nests are hard to see as they are like a scrape in the sand.

Sometimes, when they can't find a good spot, oystercatchers will even roost on rugby fields!

Adult females lay 1-3 eggs and both parents sit on the eggs to keep them warm until they hatch.

Life cycle of a variable oystercatcher/tōrea pango



Unlike its cousin the South Island oystercatcher, the variable oystercatcher doesn't migrate when the weather gets cold.

Foods

Oystercatchers like to eat shellfish, such as cockles, pipi, tuatua, limpets and oysters.

They can eat as many as 200 cockles each day! They will also eat small crabs and worms.



For more information, see:

- New Zealand Birds Online.
 - 🔗 Variable oystercatcher
- The oystercatcher/tōrea pango padlet page.
 - 🔗 Oystercatcher/torea

MY ANIMAL IS:

Research an interesting animal that is found in your local estuarine environment, eg flounder/pātiki, white-faced heron/matuku or bar-tailed godwit/kuaka. Create a factsheet, webpage or Padlet (see other resources on page 8) about the animal.

Māori, English and scientific names:

About the animal

Habitat

Life cycle

Foods

Additional resources