

Ahuriri Estuary Te Whanganui-a-Orotu

Education resource kit for primary schools

HAWKE'S BAY 2010

Published by
Department of Conservation
Hawke's Bay Area
P.O. Box 644
Napier 4140, New Zealand

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ISBN ##### (web PDF)

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Ahuriri Estuary Education Resource

This teacher resource package can be used for field activities at Ahuriri Estuary. Most of the activities are recommended for school levels 1 to 6, however, the range of activities in this booklet should suit most school and family groups. You may wish to pick and choose activities and adapt them to suit the individual level of learning. Other resources that may also be useful for ideas or help with identification of estuary plants and animals in the field are noted in the reference section. Where possible, Latin names have been added in italics and Māori names have been added in parentheses.

History

In pre European times, the estuary occupied about 3800 Ha (now about 450 Ha) consisting of tidal shell beds, shingle, sand, mud flats, shallows and channels supporting a variety of plants and animals.

Water extended to the Poraiti hills and the estuary covered the airport areas, the suburbs of Tamatea, Onekawa, Marewa, Maraenui, Pirimai, and Napier South. Park Island was an island picnic spot with a shelly beach, and it was possible to sail across the Inner Harbour to Napier. *It is interesting to dig a hole in these areas, to discover the marine origins of the buried sediments.*

The Esk River flowed into the northern end of the estuary while the Tutaekuri River flowed next to Riverbend Road and along Georges Drive. *The old river bed can be clearly seen on either side of Prebensen Drive at the Austin Street intersection.*

Westshore was simply a single spit, known as Rangitira then West Spit, that extended north beyond Bay View. Low lying damp reedbeds may be seen in the paddocks beside the road. These outlets were often blocked by heavy seas washing shingle into the outlet. Captain Cook (1769) mapped the estuary outlet in the Bay View area. Yet when Dumont d'Urville visited in 1827, the outlet was in its present position. See appendix 2 for a historical map from around 1850. In between these visits the outfall was blocked at least once, and the rising waters of the estuary threatened kumara gardens and shellfish beds. A visiting chief and his warriors dug a channel to the sea where the present outlet is now located, and it has not blocked since. The chief's name was Tu Ahuriri.

European visitors became more frequent from 1830. Reclamation of land by filling in marshy areas was well under way before 1900 and the development of Napier South was largely completed by 1908.

The 1931 earthquake which measured 7.75 on the Richter Scale raised the bed of the estuary an average of 2 metres, with a range of 1.5 to 3.4 metres. This exposed 1200 ha of land and subsequently more was drained especially in the airport and Lagoon Farm area (now the site of Parklands Residential Estate). Since that time a large area was reclaimed near Humber Street in 1951.

Pandora Pond was created by dredging for landfill in 1971. Small scale reclamation and dredging have made significant physical changes east of the embankment bridge. See Appendix 3 for aerial photos of the estuary.

Maori habitation

For hundreds of years the lagoon was a rich place for the gathering and cultivation of food and other natural resources (mahinga kai) by the Māori people. It has been referred to as the 'Māori supermarket' such is the variety and abundance of food available—fish and shellfish as well as birds and eggs.

The population was estimated at up to 10 000 people before settlement by Europeans. Many kainga (village) sites and other historical locations exist. Pouwhenua have been carved and erected at the end of Humber Street and across the estuary on the Northern part of the walkway. The pouwhenua represent ancestors of the people and look outwards from the estuary guarding approaches to Te Whanganui-a-Orotu, a place of great historical and spiritual importance.

Birds

In spite of its reduced size following the 1931 earthquake, Ahuriri estuary is significant as a food source and sheltered roosting area, with 55 species being recorded. Some are migratory from as far away as Siberia, such as the godwit *Limosa lapponica* and other northern hemisphere migrants (curlews and sandpipers). The white heron *Egretta alba modesta* and royal spoonbill *Platalea regia* are winter visitors from their west coast breeding sites. There are five species of duck present as well as Canada geese *Branta canadensis*, black swans *Cygnus atratus* and pūkeko *Porphyrio porphyrio*, which are especially evident on the northern pond by the airport.

The white-faced heron *Ardea novae-hollandiae* is a common resident, as is the pied stilt *Himantopus himantopus*, the black-backed gull *Larus dominicanus*, the red-billed gull *Larus novaehollandiae*, the pied oystercatcher *Haematopus ostralegus* and the pied shag *Phalacrocorax varius*. Occasionally an Australasian gannet *Morus serrator* is seen diving for fish.

Fish

Ahuriri Estuary is the most important Hawke's Bay estuary in terms of fisheries production. It is a nursery, spawning and feeding habitat. Approximately 11 species breed in the estuary, of which 9 are commercial species in Hawke's Bay. So far, 29 species have been recorded—the most abundant being shortfin eel *Anguilla australis*, yellow eyed mullet *Aldrichetta forsteri*, parore *Girella tricuspidata*, sand flounder *Rhombosolea plebeia*, and yellow bellied flounder *Rhombosolea leporina*.

Some species, such as flounders, kahawai *Arripis trutta*, and yellow-eyed mullet, move in and out of estuaries each day. They swim over the tidal flats on the incoming tide searching out shellfish, crabs and worms. Others such as snapper *Chrysophrys auratus* and gurnard *Chelidonichthys kumu* are seasonal visitors. They enter the estuary as immature fish and spend some months feeding in the rich, sheltered waters before heading back out to sea. Healthy estuaries are vitally important for many New Zealand native fish, which migrate out to sea as juveniles as part of their life cycle. Adult eels migrate from rivers where they spend most of their life, out through estuaries to spawn at sea in the tropical Pacific. Their larvae make their way back to New Zealand estuaries in the spring, and the juvenile glass eels migrate back upstream with the whitebait.

Very small finger nail size flounder can be spotted by following the 30–40 cm trails of mud they raise when disturbed in the shallow runnels of low tide on the southern side of the lower estuary.

Shellfish and other bottom dwellers

The estuary is an extremely productive environment with amazingly high numbers of shellfish present.

- N.Z. Cockle (*Austrovenus stutchburyi*)—up to 7000/m²
- Tunnelling mud crab (*Helice crassa*) in the upper tidal zone—up to 420/m²
- Horn shell (*Zeacumantus lutulentus*)—up to 740/m²
- Thin wedge shell (*Macomona liliana*)—up to 730/m²
- Mud worms—up to 5000/ m²

The cockle is one of the most important creatures of the estuary. It provides food for oystercatchers, flounder and people. The cockle modifies the estuary habitat, playing a critical role in filtering water. Mud worms, like earthworms, leave casts of undigested

sediment at their burrow entrance or along the trails they make. Mud worms are a significant food source for wading birds and fish.

Another tunnelling crab, the stalk-eyed crab *Macrothalamus hirtipes*, is larger and greener than *Helice crassa* and is more common in the mid-tide zone at night.

Also common are the mudflat (or harbour) topshell *Diloma subrostrata*. This snail is a grazer that feeds by scraping off algae that grows on the backs of other shellfish with its sandpaper-like feeding tongue (radula). The mud snail *Amphibola crenata* may be seen at low tide when it unburies itself and comes out to feed on small animals and organic material in the mud. The mud whelk, *Cominella glandiformis* is a scavenging carnivore which quickly tracks down its prey by following its scent. Up to 50 or even more mud whelks may be seen tightly clustered around a dead animal.

When sieving samples from the bottom, you will also find animals such as chitons, small limpets and small cushion starfish clinging on to stones and shells.

It is interesting to wash and sieve samples from different substrates such as muddy, sandy and shingle areas as well as at different tidal levels to compare the animals found.

Plants

The estuary is a harsh habitat for most plants because of the salt-laden environment. A few grow further back on the shore, where they live in a fluctuating environment of sea water and fresh water. These plants must cope with varying salinity levels, strong currents and storm waves and low oxygen levels in muddy soils.

The edible green sea lettuce (*Ulva* sp.) is present all year and abundant in the water in summer. It may be seen bleached white by the sun on the strand line. Small red seaweeds (algae) are also present, as is the occasional brown seaweed.

Close to the waters edge is the pink fleshy glasswort *Sarcocornia*, a native succulent. It is covered by very high tides, and traps debris and sediment thus slowly building up the level of the shore. In less saline areas of the glasswort zone, an occasional plant of the problem weed buck's horn plantain *Plantago coronopus*, is found.

Some native plants present at Ahuriri estuary are:

- Flax (*Phormium tenax*). 'Phormium' after the Greek for basket, and 'tenax' Latin for strong. The Maori name for

flax is harakeke: 'hara' is derived from Polynesian names for the tropical Pandanus tree, and 'keke' meaning strong or stubborn.

- Toetoe (*Cortaderia toetoe*). The flower head forms white, feathery, arching plumes. Native toetoe is often confused with introduced pampas grass. You can tell pampas grass by its erect flower spikes in autumn and tightly curled dead leaves at the base. Toetoe flowers are droopier than pampas.
- Taupata (*Coprosma repens*). The oblong leaves are dark green and very glossy and often rolled under at the edges. Orange berries in summer and autumn provide food for native birds.
- Ngaio (*Myoporum laetum*). Name rhymes with "bio". A shrub or small tree reaching 10 m. Leaves are bright green with a flattened petiole and small spotted glands. White flowers from mid-spring to mid-summer. Purple berries ripen through summer and autumn, providing food for bellbirds and tui.
- Karo (*Pittosporum crassifolium*). A small coastal tree with leathery leaves with woolly undersides, similar to PŌhutu. It flowers prolifically in spring to early summer, producing clusters of small, dark red to purple flowers. Seeds form in a lumpy three or four sectioned capsule containing sticky black seeds. Widely used as a hedge plant.
- Some weed (exotic, or non-native) plants at Ahuriri estuary are:
 - Spur valerian or false valerian (*Centranthus ruber*). On dry sites, Purple/red showy flowers in summer, with a strong and somewhat rank scent
 - Fennel (*Foeniculum vulgare*). An aromatic perennial herb — crush the leaves to get an aniseed smell. (Exotic)
 - Paterson's Curse or Purple Viper's Bugloss (*Echium plantagineum*). Rough, hairy, lanceolate leaves up to 14 cm long. The flowers are purple and borne on a branched spike, usually in spring.
 - Bone seed (*Chrysanthemoides monilifera*). Boneseed is an aggressive shrub, up to 3 metres tall. It has daisy-like bright yellow flowers from late winter to early summer. The seed is very hard and bone coloured when ripe. (Exotic)
 - Boxtorn (*Lycium ferocissimum*). A densely branched, woody shrub up to 6 m tall with strong spines at the tips of the branches. Flowers white or pale mauve from July to March, followed by poisonous orange-red berries. (Exotic)
- Broom or Scottish broom (*Cytisus scoparius*). An erect, much branched, almost leafless shrub up to 2.5 m tall. Golden-yellow, pea-like flowers from September to April followed by oblong green pods that turn black as they mature and eventually disperse seeds explosively, leaving empty coils hanging from the plant. (Exotic)
- Gorse (*Ulex europaeus*). An erect, perennial shrub with strong spikes that will grow to 4m. European settlers introduced it in the early 1800s to create hedges, and now it is widespread throughout most of New Zealand. It spreads from seedpods which explode in summer heat and eject seeds many metres. Forms dense impenetrable patches if left uncontrolled, and will displace pasture and low growing species. (Exotic)
- Cotoneaster or Khasia berry (*Cotoneaster simonsii*). A shrub up to 4m tall, with upright and spreading branches. Leaves shiny pale-green. Clusters of one to four small whitish to pale-pink flowers from November to December followed by shiny orange-red or scarlet berries.
- Silverbeet (*Beta vulgaris*). This garden vegetable is established beyond the glasswort in the lower estuary.

The Department of Conservation and volunteers are working hard to remove problem plants and re-establish native vegetation at the estuary. They meet monthly for a morning's work. For further information, contact the Napier Area Office on 59 Marine Parade, Napier. Phone 06-834 3111.

Making the most of your field trip

It is recommended that basic estuarine ecology is discussed in the classroom and that some pre-visit activities are attempted before going to Ahuriri Estuary, and that on completion of the field trip some post-visit activities are used for revision. Check the weather forecast and tides before going. It would be suitable to work two hours before and after low tide. (Tide information can be found on the LINZ web site, under: mariners/major ports). Lunch tables, a playground and toilet facilities can be found on the east side of the estuary (Pandora's pond), down Humber Street.

Suggested check list of equipment

- Activity sheets
- Writing boards
- Pencils
- A box to put completed work in
- Sellotape
- Sieves and buckets
- Identification books
- Binoculars
- Plastic container for observing animals (make sure animals are returned to their homes!)
- Water/Sunscreen/Hats
- Towels
- Cell phone
- Camera

Field trip activities

1. Preparing for a field trip

Pre-visit activities

- Ask the class to discuss what they need to do or know before going to Ahuriri Estuary. Make a list on a whiteboard, for example, will they go if the weather is bad – should they check the weather forecast for the week they go? What about the tide? Are there toilet facilities at the site? (There are toilets at Pandora's pond, down Humber Street). What type of footwear do they need? Are they going to take their lunch with them? What sampling equipment do they need?
- Ask the children to make their own checklist for when they go to Ahuriri Estuary (refer to the field trip check list in the 'Making the most of your field trip' section). Once the children have made their own lists make a class field trip checklist.
- Ask the class to find out what the tide is likely to be like for their trip to Ahuriri Estuary – should they plan to go at high or low tide? Learn about spring and neap tides. See tide information in appendix 1 at back of the booklet.
- Ask the class to help create a letter to inform parents about the trip to Ahuriri Estuary.
- What tasks are the children going to do at Ahuriri Estuary? Make a tick sheet of tasks for the day.

Field day activities

- Go through the checklist on the day before going to, and before leaving Ahuriri Estuary.
- Tick off the day's tasks as they are completed at Ahuriri Estuary—a good way to make sure everyone has completed the activities.

Post-visit activities

- Re-evaluate the field trip—was there anything that could be improved upon for the next field trip? Can you make a better check list?

2. English: Pre- and post-visit evaluation and word games

Pre-visit activities

- Brainstorm the word 'estuary'. Come up with a class definition and compare it to the dictionary's definition.
- Make word towers using words to describe the estuary.

e.g.,

Eels

Shells

Terns

Under water

Appealing to birds

Roam and explore

Yes to estuaries!

- Ask the children to make a sketch of what they think the estuary looks like, including some of the plants and animals that they may find there.

Field day

- Make sketches of the estuary. Ask the children to write descriptions or words about the sights and sounds of the estuary.

Post-visit activities

- Have a discussion about the estuary. What did the children like the most? What did they see? Compare the pre-visit and field day sketches, how do the sketches differ?
- Make new word towers, using the 'sights and sounds' words written down on the field day.

3. Living World: Mud crabs

Pre-visit activities

- Make a mud crab. Use the 'put the mud crab together' **activity sheet, page 8**.

Field day

- Observe an area of mud on the estuary for 2–3 minutes. Watch what the mud crabs are doing. Write down your observations. Did you see a male and female crab—how are they different? What were the mud crabs doing? Fighting for territory? Feeding?
- Learn the difference between male and female crabs. See information below.

Do you know...

The difference between male and female crabs?

The best way to tell the difference between male and female crabs is to look at the width of their tails. A crab tail is tucked up on the underside of a crab. The tail is wider on a female crab because she carries eggs under her tail during the breeding season.



Female



Male

Post-visit activities

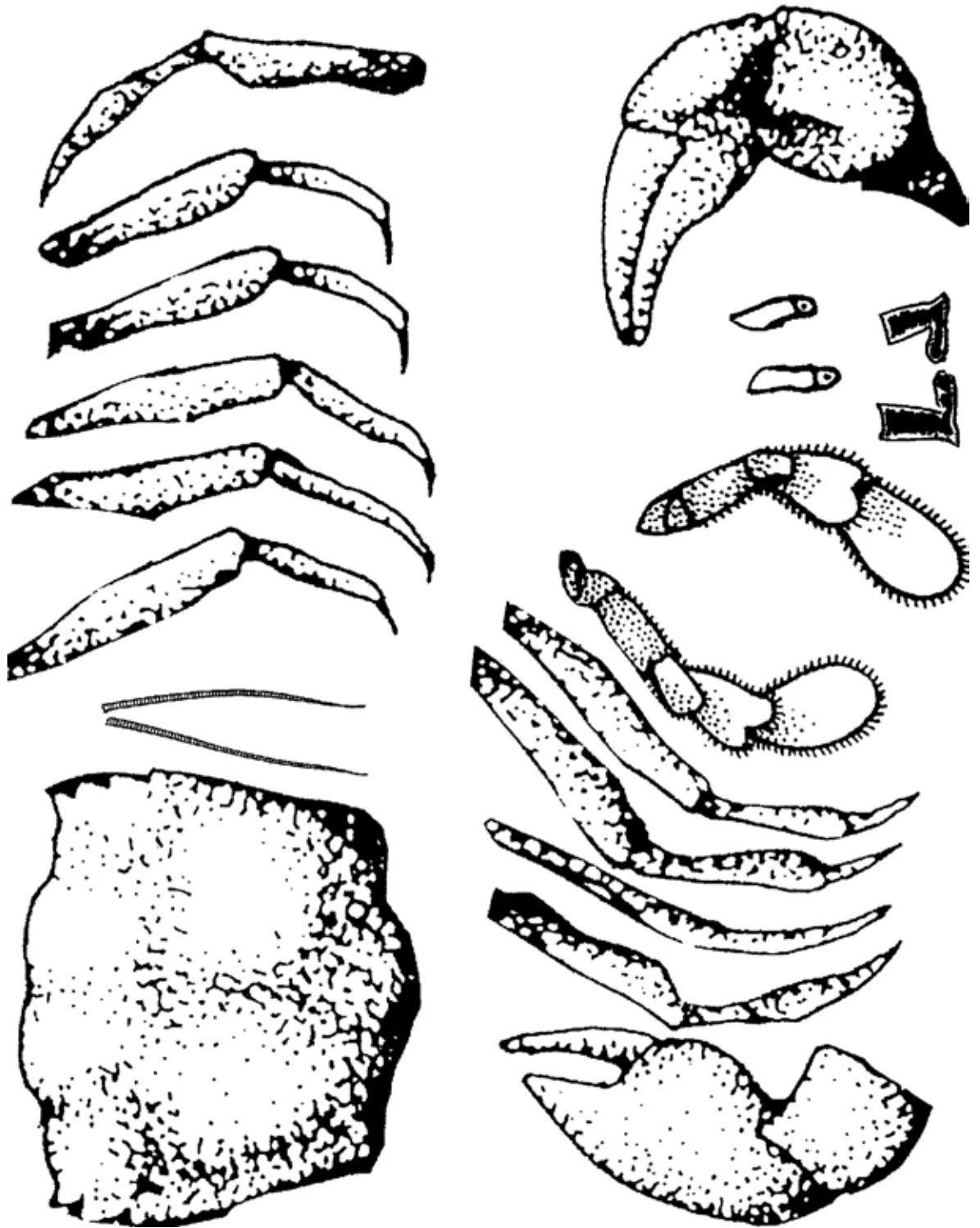
- Make a mud crab poster and include your field day observations. For example, what environment did the mud crabs live in? What predators do the mud crabs have to look out for? How many do you think there were?

Further ideas

- Learn about the different features of a mud crab, e.g. feelers, claws, exoskeleton (hard outer shell), carapace (shell covering the top of the crab), reproductive parts and eyes. Discuss what the functions of the features might be. 'The lifecycle of a shore crab' activity unit by the NZ Marine Studies Centre is a very useful resource.
- Learn about the life-history of crabs. 'The lifecycle of a shore crab' activity unit by the NZ Marine Studies Centre is a very useful resource.
- Learn about other animals the mud crabs are related to (other crustaceans). For example crayfish, barnacles, shrimps and sand hoppers. Good reference books can be found at the back of the booklet.
- Learn about introduced crabs or invasive crabs that might invade New Zealand saltwater and freshwater ecosystems. For example, MAF, Ministry of Fisheries and Biosecurity NZ may have good information on their websites.
- Count how many crab burrows you find in a square metre of mud, then estimate the number of crabs in a square metre. (Ask the children to *observe* how many crabs there are in a burrow—discourage digging burrows up). From the initial calculations, estimate how many mud crabs there are in the whole estuary. The estuary size is 450 ha (4.5 km²).

3. Living World: Mud crabs activity sheet

Put the mud crab together. (You will not need all the pieces.)



3. Living World: Mud crabs activity sheet

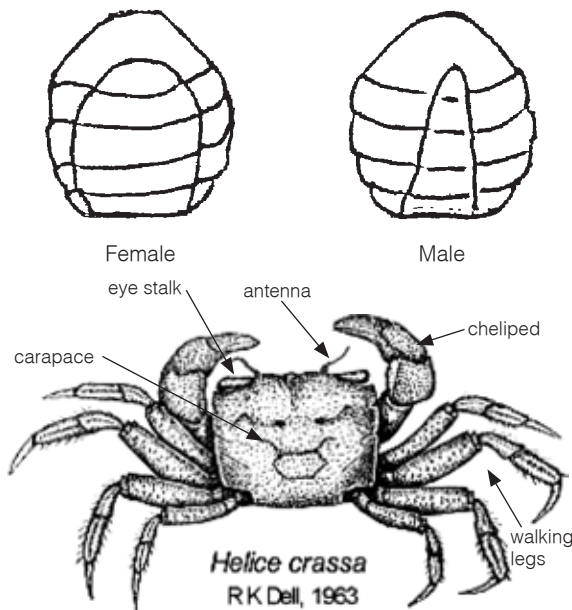
Teacher/parent information

Mud crab, *Helice crassa*. This is the species commonly seen at Ahuriri estuary.



This type of activity raises questions that are recorded at school and answered at the estuary. This gives a point to catching crabs! The children also become interested to realise that the sex of crabs can easily be determined by the shape of the abdominal flap on the underside of the body.

The female has a wide flap because she carries fertilised eggs between the flap and her body during the breeding season. When the female is carrying eggs, it is sometimes called being "in berry". The male has a narrow triangular flap, while the female crab's flap is shaped like a broad oval.



Anatomy of a mud crab.

The teacher may raise questions with children while moving around the classroom, and identify differences between assemblies which will lead children to formulate their own questions. Questions can be collated at the end of the session, and the children can research the correct answers. (Please note: not all the legs on the diagram will be needed. *Helice crassa* does not have flattened swimming legs like some marine crabs.)

Questions that the children may ask are along the lines of:

- How many legs does a crab have?
- Where do they join the body?
- Do they have feelers?
- What do they use their nippers for?

Each child will need:

- A sheet of paper on which to assemble the crab
- A pair of scissors and glue

Some crab information

Crabs are 10-legged animals that walk sideways. They are invertebrates, animals without a backbone. They have an exoskeleton (also called a carapace), an outer shell that both protects them from predators and provides support. These crustaceans have ten jointed legs, two of which have large, grasping claws (called pincers or chelipeds). They have a flattened body, two feelers (antennae), and two eyes located at the ends of stalks. Marine crabs breathe underwater using gills, which are located in two cavities under the carapace.



A pair of mud crabs outside their burrow.



4. Living World: Animals at the estuary

Pre-visit activities

- Brainstorm which animals that the children may find at the estuary. Make a class list.
- Using the class list find out a little more about the different animals. Are they camouflaged? Where do they live? What 'adaptive features' do they have?

Field day

- Using the **Animals at the estuary activity sheet, page 11**) explore and hunt for the animals throughout the estuary. *Make sure the animals and shells are returned to their original positions at the end of the activity!*

Post-visit activities

- Using the field day activity sheet, discuss the functions of the main parts of the animals and the features that help survival into the next generation.

Further ideas

Using the field day activity sheet, find out a little more about the animals seen at the estuary. For example:





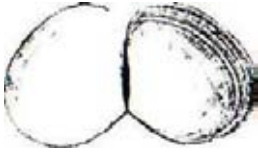











- What do cockles eat?
- How do flounder end up with two eyes on the same side of the head?
- Where do eels migrate to?

Hint: Life in the Estuary, Illustrated guide and ecology by M.B.Jones and I.D. Marsden and 'Forest and Bird Kiwi Conservation club magazine' no.19 (2005) are useful references.

4. Animals at the estuary activity sheet

Name: _____

Tick the box for each animal you see.

 <p><i>Cyclomactra ovata</i> Oval trough shell Ruheruhe</p> <input type="checkbox"/>	 <p><i>Spirobranchus cariniferus</i> Tube worm</p> <input type="checkbox"/>	 <p><i>Anguilla</i> spp. Eel Tuna</p> <input type="checkbox"/>	 <p>Cushion star</p> <input type="checkbox"/>
 <p><i>Macoma liliana</i> Wedge shell Hanikura</p> <input type="checkbox"/>	 <p><i>Amphibola crenata</i> Mud snail</p> <input type="checkbox"/>	 <p><i>Rhombosolea</i> spp. Flounder Patiki</p> <input type="checkbox"/>	 <p>Chiton</p> <input type="checkbox"/>
 <p><i>Paphies australis</i> Pipi</p> <input type="checkbox"/>	 <p><i>Diloma subrostrata</i> Mudflat top shell Whetika</p> <input type="checkbox"/>	 <p><i>Helice crassa</i> Mud crab Kairau</p> <input type="checkbox"/>	 <p><i>Maoricolpus roseus</i> Common turret shell</p> <input type="checkbox"/>
 <p><i>Austrovenus stutchburyi</i> N.Z. cockle Tuangi</p> <input type="checkbox"/>	 <p><i>Cominella glandiformis</i> Mud whelk</p> <input type="checkbox"/>	 <p>Mud worm</p> <input type="checkbox"/>	 <p><i>Zeacumantus lutulentus</i> Horn shell Koeti</p> <input type="checkbox"/>

















(Scientific names are in italics, followed by the English common name, and the Maori name where possible)



4. Animals at the estuary activity sheet

Teacher/parent information

When children ask “What is this?”, encourage them to look at the sheet first. Some of the creatures are abundant, others rare. Tick each time one is found—this will give an idea of relative abundance.

 <p><i>Cyclomactra ovata</i> Oval trough shell Ruheruhe Up to 7000/m².</p>	 <p>Tube worms Blue tentacles retract into tubes when gently touched.</p>	 <p><i>Anguilla spp.</i> Eel Tuna</p>	 <p>Cushion star Usually attached to stones and shells with small white barnacles as well.</p>
 <p><i>Macoma liliana</i> Wedge shell Hanikura Up to 730/m². “Bird feet” patterns on mud made by the feeding siphon.</p>	 <p><i>Amphibola crenata</i> Mud snail Eats twice its own weight every day. Edible—as are many of the shellfish here.</p>	 <p><i>Rhombosolea spp.</i> Flounder; Patiki Very small-fingernail size. Spot them by short lengths of disturbed mud.</p>	 <p>Chiton Usually attached to stones and shells with small white barnacles as well.</p>
 <p><i>Paphies australis</i> Pipi Many old shells still around.</p>	 <p><i>Diloma subrostrata</i> Mudflat top shell Whetika</p>	 <p><i>Helice crassa</i> Mud crab; Kairau Up to 420/m². Size of hole related to size of crab? Male or female?</p>	 <p><i>Maoricolpus roseus</i> Common turret shell</p>
 <p><i>Austrovenus stutchburyi</i> N.Z. cockle Tuangi</p>	 <p><i>Cominella glandiformis</i> Mud flat whelk Carnivorous. Crush a cockle to show how whelks converge on it.</p>	 <p>Mud worms Up to 5000/m².</p>	 <p><i>Zeacumantus lutulentus</i> Horn shell; Koeti Up to 7400/m².</p>

(Scientific names are in italics, followed by the English common name, and the Maori name where possible)



5. Living world: Birds at the estuary

Note: It is difficult to study birds with a large group of children. However, a small group with binoculars an adult helper may want to give it a try. Bird footprints are often inaccessible as they tend to feed and roost on the islands away from humans.

Pre-visit activities

- Learn about the different features of a bird and their functions e.g. wings, bills, feet, eyes.
- Investigate the migration patterns of some birds e.g. godwits and curlews. Display the migration patterns of the birds on a world map. Use different coloured string showing the migration route for the different birds.

Field day

- Note what birds you saw at the estuary. Observe the birds for 2–3 minutes, and note what they were doing. Sketch some bird bills and feet.
- Count the number of different birds you see at the estuary. Use the **Birds at Ahuriri Estuary activity sheet, page 15**. See the identification chart, next page.

Post-visit activities

Make posters of the estuary birds; use your sketches from the field day. Add information about the bills and feet—what adaptive function might they have?

- Make graphs to show the numbers of different birds recorded at Ahuriri Estuary

Further ideas

- Look at birds around the school. Make comparisons between the birds observed at the school and at the estuary. How are they different (compare bills and feet)? Are differences related to what food the birds eat?
- Make food webs for the Ahuriri Estuary birds. “Life in the Estuary, Illustrated guide and ecology” by M.B.Jones and I.D. Marsden may have useful information for food webs.
- Investigate the New Zealand distribution of birds seen at the estuary. For example, are the birds only found in the North Island? Are the birds only found in wetlands, like Ahuriri Estuary? ‘Collins field guide, Birds of New Zealand’ maybe helpful.

Did you know...

More than 55 species of bird have been recorded at Ahuriri Estuary.

Many of the birds are migratory, and visit the estuary seasonally (either summer or winter).

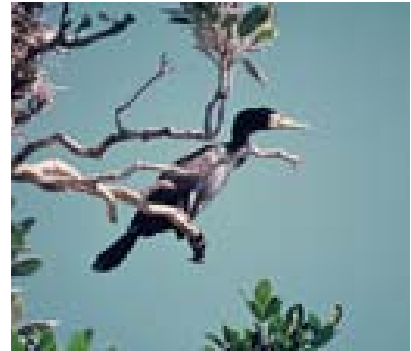
Here are a few pictures of estuary birds to help you with your identifications.



Pied stilt



Kingfisher



Godwit



Pukeko



Royal spoonbill



White-faced heron



Black shag



Variable oystercatcher



Red-billed gull



White-fronted tern










Black-backed gull

5. Birds at the estuary activity sheet

Name: _____

Note: You may be fortunate to see a gannet diving for food. Pied stilts and herons are often visible feeding in shallow water. Shags may be seen drying their wings and occasionally diving for fish in Pandora Pond.

BIRD	NUMBER	WHERE DID YOU SEE IT? WHAT WAS IT DOING?
 <p>Gannet; Takapu</p>		
 <p>White-faced heron; Matuku-moana</p>		
 <p>Black-backed gull; Kāroro</p>		
 <p>Godwit; Kuaka</p>		
 <p>Pied oystercatcher; Torea</p>		
 <p>Pied stilt; Poaka</p>		
 <p>Royal spoonbill; Kotuku-ngutupapa</p>		



6. Living world: Plants at the estuary

Pre-visit activities

- Look at the plants around the school. Describe the shapes and colours of the leaves and flowers. Make posters of leaf rubbings, place word descriptions alongside the leaves.

Field day

- Describe some of the different plants found around the estuary. Use the **Plants at the estuary activity sheets, pages 17–19.**

Post-visit activities

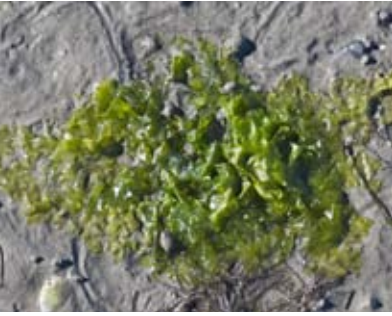







- Make posters or murals of the estuary plants; add words to the posters to describe the plants.
- Discuss the difference between exotic (introduced) plants and native plants and how this ties in with 'how places reflect past interactions of people with the environment'.

Further ideas

- Make a leaf and flower quiz—describe a leaf or flower and ask the children to find it. The teacher could bring a collection of leaves and flowers along to school and play the game in the classroom.
- Make up a class quiz using the descriptions of the estuary plants. See if the children can work out the correct names for the plants.
- Learn more about one or two of the estuary plants. For example, when do they flower? What 'adaptive features' do they have? What animals eat them? Where else are the plants found... other wetlands, people's gardens?

6. Plants at the estuary activity sheet 1 of 2

Name: _____

PLANT	SAY SOMETHING ABOUT THE PLANT (Where found, flowers, smell, introduced from overseas...)	PLANT	SAY SOMETHING ABOUT THE PLANT (Where found, flowers, smell, introduced from overseas...)
	Sea lettuce		Spur valerian
	Glasswort		Fennel
	Buck's horn plantain		Sea rush
	Viper's bugloss		Leafless sedge

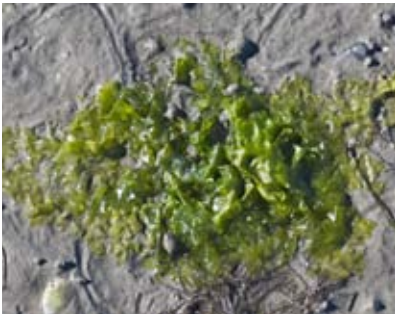









6. Plants at the estuary activity sheet 1 of 2

Teacher/parent information

Note: Year 7 and 8 pupils may have their attention drawn to the variation in leaf size and plant size.








Science: The terrestrial environment here is dry and salty. Many plants in such environments have hairy leaves to reduce evaporation. Thick or fleshy leaves have the same effect to reduce moisture loss and enhance the ability to survive long dry summers.

PLANT	SAY SOMETHING ABOUT THE PLANT (Where found, flowers, smell, introduced from overseas...)	PLANT	SAY SOMETHING ABOUT THE PLANT (Where found, flowers, smell, introduced from overseas...)
	<p>Sea lettuce; <i>Ulva lactuca</i> Native. An edible green seaweed. Turns white when bleached by the sun.</p>		<p>Spur valerian; <i>Centranthus ruber</i> Introduced. Strong rank scent.</p>
	<p>Glasswort; <i>Sarcocornia quinqueflora</i> Native. Succulent.</p>		<p>Fennel; <i>Foeniculum vulgare</i> Introduced. Crush and smell the leaves—cooking herb.</p>
	<p>Buck's horn plantain; <i>Plantago coronopus</i> Introduced. Problem weed.</p>		<p>Sea rush; <i>Juncus maritimus</i> Native. Dark green, fine-leaved rush.</p>
	<p>Viper's bugloss; <i>Helminthotheca echioides</i> Introduced. Rough hairy leaves.</p>		<p>Leafless sedge; <i>Ficinia nodosa</i> Native. Grows in tufts.</p>



6. Plants at the estuary activity sheet 2 of 2

Name: _____

PLANT	SAY SOMETHING ABOUT THE PLANT (Where found, flowers, smell, introduced from overseas...)	PLANT	SAY SOMETHING ABOUT THE PLANT (Where found, flowers, smell, introduced from overseas...)
	Broom	<p>Other plant that you draw</p>	
	Boneseed		Ngaio
	Taupata		Karo
	Blackberry		Boxthorn










6. Plants at the estuary activity sheet 2 of 2

Teacher/parent information

Note: Year 7 and 8 pupils may have their attention drawn to the variation in leaf size and plant size.

Science: The terrestrial environment here is dry and salty. Many plants in such environments have hairy leaves to reduce evaporation. Thick or fleshy leaves have the same effect to reduce moisture loss and enhance the ability to survive long dry summers.

PLANT	SAY SOMETHING ABOUT THE PLANT (Where found, flowers, smell, introduced from overseas...)	PLANT	SAY SOMETHING ABOUT THE PLANT (Where found, flowers, smell, introduced from overseas...)
	<p>Broom <i>Cytisus scoparius</i></p> <p>Introduced. Yellow flowers; explosive pods disperse seeds.</p>		<p>Ngaio <i>Myoporum laetum</i></p> <p>Native. Purple fruit; glands dot the leaves; leaf buds sticky. Many here have been planted.</p>
	<p>Boneseed <i>Chrysanthemoides monilifera</i></p> <p>Introduced. Yellow daisy flowers; very hard seeds.</p>		<p>Karo <i>Pittosporum crassifolium</i></p> <p>Native. Look under the leaf—furry layer reduces water loss. Very sticky seeds.</p>
	<p>Taupata <i>Coprosma repens</i></p> <p>Native. glossy leaves help reduce water loss.</p>		<p>Boxthorn <i>Lycium ferocissimum</i></p> <p>Introduced. Thorns protect against being eaten. Fruit poisonous.</p>
	<p>Blackberry <i>Rubus fruticosus</i></p> <p>Introduced. Prickly; berries spread by birds.</p>	<p>Draw another plant here</p>	



7. Living world: Common plants at the estuary

Pre-visit activities

- Learn what 'common' means. Make a list of common and uncommon (rare?) objects that the children know.
- Find some common plants around the school (e.g., grasses, flax). Make posters of the school's common plants.

Field day

- Find some of the common plants around the estuary. Using **Common plants at the estuary activity sheet, page 22**. Match the description with the plant.

Post-visit activities

- Make new posters of estuary common plants and the features that they have. Use observations from the field day task, **Common plants at the estuary activity sheet, page 22**.

Further ideas

- Brainstorm about why some plants are 'common'. Hint: some plants may be particularly 'common' or abundant for a number of reasons. For example they may produce a lot of seed or have underground runners (i.e. invasive), may not be edible to insects and maybe able to tolerate a range of conditions (i.e. salty and dry soil).
- Make a list of features the common estuary plants have. For example, runners, large seed head, low growing mat-like plants.
- Have a discussion about the common plants found at school and at the estuary. Were there similarities between common plants at the estuary and at school? If not, could this be because the environmental conditions are different?

7. Common plants at the estuary activity sheet

Draw or rule a line between a picture in the left column the description(s) and/or the name in the right column that fit. (Some may have more than one.)

Name: _____



Glasswort

Can be eaten. Grows in the water



Buck's horn plantain

Fluffy seed head

Large areas close to the water's edge



Spur valerian

Very strong scent when crushed



Sea lettuce

Pink and fleshy



Hare's tail



Purple/pink or occasionally white flowers

Yellow/orange flowers



Calendula

Large sharp thorns



Fennel

Thin green or white sheets

Sea rush



7. Common plants at the estuary activity sheet

Teacher/parent information

Draw or rule a line between a picture in the left column the description(s) and/or the name in the right column that fit. (Some may have more than one.)



Glasswort



Buck's horn plantain



Spur valerian



Sea lettuce



Hare's tail



Calendula



Fennel

Can be eaten. Grows in the water

Fluffy seed head

Large areas close to the water's edge

Very strong scent when crushed

Liquorice smell. Fennel is related to dill and aniseed. Herb used in cooking.

Pink and fleshy

Explain that fleshy means soft and juicy.

Purple/pink or occasionally white flowers

Flowers in summer. Plant has a strong, rank smell.

Yellow/orange flowers

Large sharp thorns

Thin green or white sheets

Sea rush



8. Living world: Special features of animals: Animal tracks and signs

Pre-visit activities

- Look for animal tracks around the school, make sketches and identify them (if you can!). Familiarise yourself with dog and cat paw prints at home, so that you can recognise them if seen at the estuary.

Field day

- Look along the footpath or sandy and muddy areas around Ahuriri Estuary. See if you can match the photos of animal tracks and signs with the tracks you see around the estuary. Draw some animal tracks and signs and guess what creature made the tracks. Use the **Animal tracks and signs activity sheet, page 25**

Post-visit activities

- Compare the animal tracks found at the school and at the estuary. Look at another environment (e.g., bush) and compare animal tracks.

Further ideas







- Look at the different patterns the soles of shoes have. Be daring and make a paint poster of shoe and footprint patterns.
- Make up an animal track, use paint and different objects to paint with (e.g. sponge, small sticks, piece of rough paper) to design the tracks. Ask the children to describe the animal from its tracks. Is it a large or small animal? Is it a carnivore or herbivore?
- Back at school, make Plaster of Paris or clay imprints of the tracks the children have seen.

8. Animal tracks and signs activity sheet

Which animals do you think left these tracks or signs? Choose from: bird, mud snail, starfish, wedge shell, mud crab, glasswort, horn shell, mudflat top shell.

Name: _____

Do this activity on the south side of the lower estuary near Pandora Pond.

		
		
<p>Did you find one not on this sheet? Sketch it here</p>	<p>Did you find one not on this sheet? Sketch it here</p>	<p>Did you find one not on this sheet? Sketch it here</p>



8. Animal tracks and signs activity sheet

Teacher/parent information

Name: _____

Do this activity on the south side of the lower estuary near Pandora Pond.



Mud snail egg case



A bird's foot prints



Large wedge shell (The shellfish that makes this pattern is buried several centimetres down in the sand or mud.)



Mud snail trail of droppings



Mud crab burrow



Horn shell



9. Science: Developing investigative skills and attitudes: Sieve-sampling

Pre-visit activities

- Learn to identify some of the creatures that are found in muddy sandy estuaries e.g. cockles, chitons and mud flat whelk. See the reference list for good identification books

Field day

- Try the **'What lives here?' activity sheet 9, page 28**).
- You will need a sieve for every 2–3 children, a container to place animals into to count, backing boards and activity sheet and pencils.
- Children should take a small handful of mud or sand at the low tide area by digging fingers gently down into the mud. At the waters edge wash the mud and sand through the sieve leaving shells and stones.
- Count the living animals into a container (small ones count the same as large ones). Return the animals to the hole they came from. Parents can help with identification and record the numbers counted.
- Repeat the exercise for each tidal zone. Note: It is interesting to try washing and sieving samples from muddy, sandy and shingle areas as well as different tidal levels.

Post-visit activities

- Ask each group of children to graph their results from the field day sieve sampling exercise. For example, bar graphs for each species at each tide level.
- Collate and graph the class data from the field day. Ask the children to explain the results... make 'wise statements'.






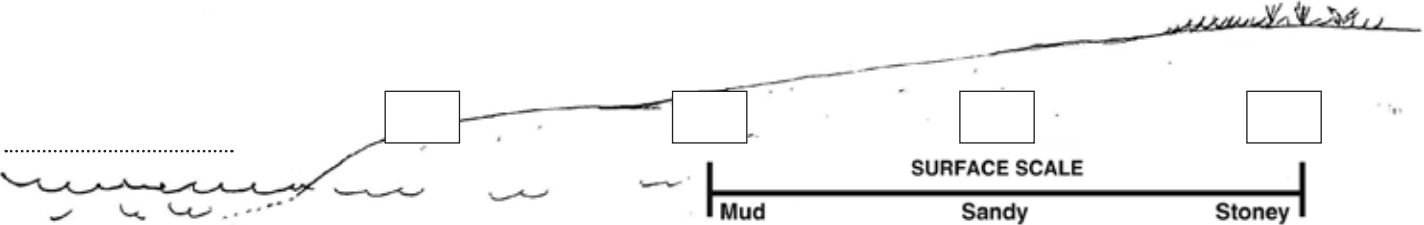
Further ideas

- Practice sampling methods at school. Measure out a 'transect' line and sample the soil every few metres. Put the soil through a coarse sieve and see what you find. Did you find any earthworms or cicadas?
- Find out what cockles, chitons and mud flat whelk eat and what their main predators might be.
- Sieve-sample a different area e.g. river sediments or a pond. Compare the results with the findings from Ahuriri Estuary. (Estuary sediments are usually very abundant with life—look at all the birds that feed in the estuary.)

9. What lives here? Sieve sampling activity sheet

Name: _____

What lives here?

Animals	Low tide	Mid tide	High tide	Total
Number of live animals found in each sieve				
 Cockle	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
 Mud snail	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
 Horn shell	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
 Mud crab	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
 Large wedge shell	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
				






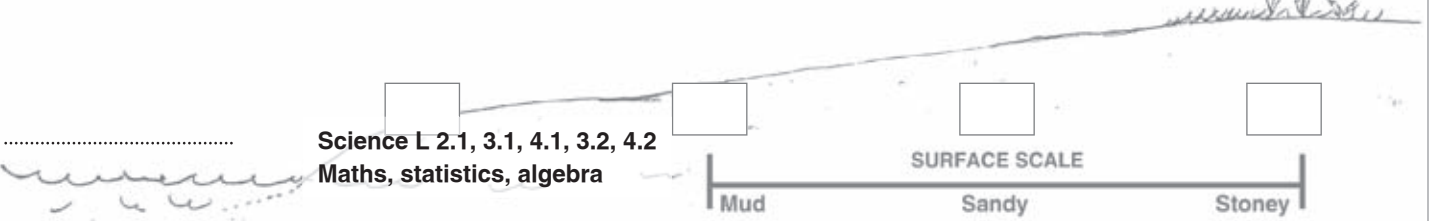


9. What lives here? Sieve sampling activity sheet

Teacher/parent information

Team leader: _____

What lives here?

Animals	Low tide	Mid tide	High tide	Total
Number of live animals found in each sieve				
 Cockle	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	You need <ul style="list-style-type: none"> A sieve for every 2 children A container to count animals into Backing boards Groups of 3–4 children/parent Record sheet for each parent (with a pen or pencil) 			
 Mud snail	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	What to do <ul style="list-style-type: none"> Children take a double handful of mud or sand at the low tide area by digging fingers gently into the mud Place the mud in a sieve At the water's edge, wash the mud and sand through the sieve, leaving the shells and stones Count the living animals into a container (small ones count the same as large ones) Return the animals to the hole they came from Repeat at each tidal zone 			
 Horn shell	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Parents <ul style="list-style-type: none"> Help with identification if needed Write down the numbers counted 			
 Mud crab	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	At school <ul style="list-style-type: none"> All groups graph their results. Bar graphs for each species at each level? Collate and graph class data What do the graphs say?!! Make "wise statements" 			
 Large wedge shell	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Science L 2.1, 3.1, 4.1, 3.2, 4.2 Maths, statistics, algebra			
				



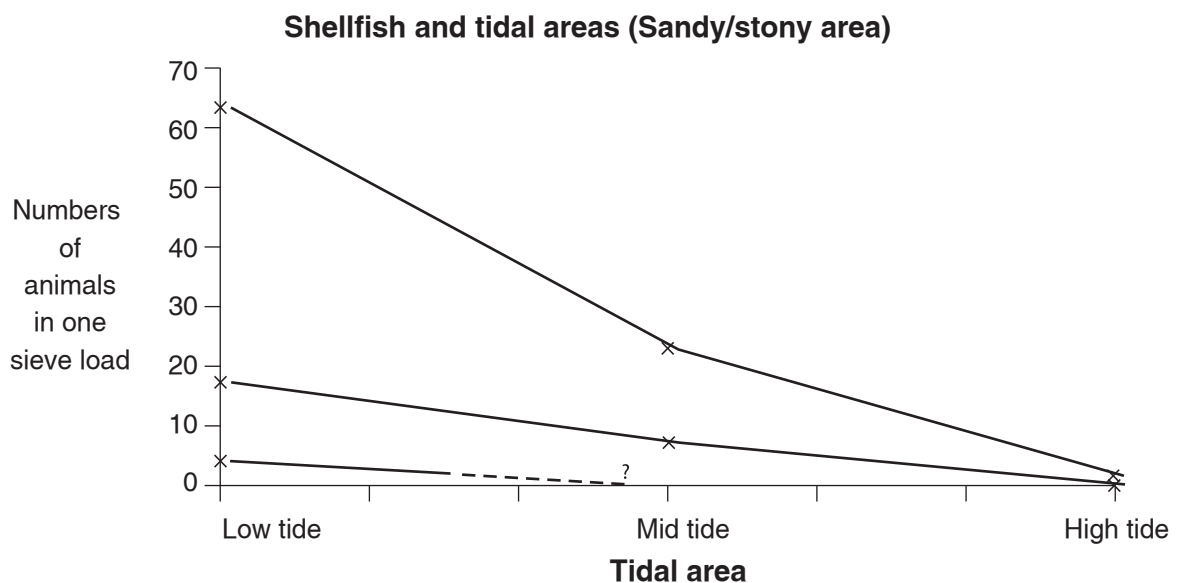
9. What lives here? Sieve sampling activity sheet

Teacher's answer page for classroom use

Suggestions for analysis in the classroom, using science, algebra and statistics

This is a rich meaningful context that enables data to be gathered and later processed through graphs and reasonable "wise statements" derived from the data presented.

Different groups may sample different areas: e.g., muddy and sandy areas. Handfuls should be about the same size.



Wise statements may be as simple as:

"There were no chitons at high tide."

"There are more horn shells than chitons."

"Fewer of these animals live at high tide than low tide."

A question may arise:

"Is that because they are under water longer at low tide?"

They may become more detailed:

"There are ten times as many cockles at low tide as at high tide in the muddy areas."

"Wedgeshells were more common in ??? areas."

It is likely that different groups will have similar graphs, but differences will occur in distribution outlines and clusters. These need to be talked about (p. 178 MiNZC – Statistics).

Field notes may be noted by parents and might comment on:

- How deep below the surface different species live
- Chitons and starfish were on stones and shells
- Mud crabs ... (ran for holes for protection?)



10. Science: Developing investigative skills and attitudes: Survival and adaptation of animals and plants at the estuary

Pre-visit activities

- Learn about features of animals or plants that help them survive at the estuary. For example, mud crabs have hard shells which stop desiccation when the tide goes out. The white-faced heron has a spear-like beak for catching fast moving fish. Flounder have a flat shape adapted to living on the bottom and their colouration helps them blend into the surrounding sand, and therefore they are less likely to be seen and caught by birds. Note: you may want to distinguish between functional and behavioural 'adaptations'.

Field day

- Look around the estuary... sit still for 2–3 minutes and observe the animals at the estuary. Fill in the survival and adaptation sheet (**activity sheet 10, page 33**). Choose some common plants and animals to observe. Write their names in the top row, and tick which adaptive features they may have. The features that get the most ticks are successful strategies for estuarine creatures.

Post-visit activities

- Make posters showing the survival and adaptive features of animals and plants at the estuary. Use the results from the survival and adaptation sheet (**activity sheet 10, pages 41–42**).

Further ideas

- Ask the children to come up with some features the animals and plants have. List some of the features that animals and plants may have to help them survive in very dry, salty or wet environments.
- Find three different animals or plants at the estuary. Make sketches and along side write notes about some of the animal or plant's 'survival' features.
- Play the 'survival' quiz. See information box on the following page. (Answers: Cat's eye—stops me drying out, Crab's claw—make burrows and fight, Oyster catcher's bill—catch marine worms, Royal spoonbill's beak—sieve through water column, Whitebait—transparent colour)
- Make up your own quiz using the results collected on the field day.

Survival quiz.....

How quickly can you match the animal feature with the 'survival' description? Draw a line between the animal feature and the survival description.

Cat's eye's shell



My transparent colour makes me difficult to see in the water.

Crab's claw



This helps me sieve through the water column and mud for little animals to eat.

Oystercatcher's bill



This enables me to catch marine worms and other creatures buried in the mud.

Royal spoonbill's beak



This helps me to make burrows and fight off other animals.

Whitebait



This stops me from drying out at low tide and protects my soft body.

10. Survival and adaptation of animals at Ahuriri Estuary activity sheet

PLANTS	Karo	Glasswort	Calendula	Buck's horn plantain	Taupata	Boxthorn	Ngaiio	Flounder	Bristle worm	Mud crab	Mudflat top shell	Whelk	Cockle	Wedge shell	Mud snail	ANIMALS
Have								Have								
Hairy leaves																Shell
Thick leaves																Feelers
Shiny leaves																Mouth
No leaves																Siphon
Thin leaves																Eyes
Hooks																Nippers
Spines																Soft bodies
Juicy leaves																Hard bodies
Trunk																Camouflage
Flowers (not always there)																
Fruit (not always there)																
Live								Live								
In water																In water
Beside water																High tide zone
Above very high tides																Low tide zone
On flat near water																Sand
Up banks																Mud
Under bushes																
Do								Do								
Climb																Swim
Scramble																Fly
Grow upright																Glide
Grow in clumps																Walk
Smother																Nip
																Dig
Science L 3.2, L4.2 Survival								Eat								
<p>The relative number of ticks indicates the adaptive features and behaviours that enable most species to survive. The children decide what species to include and will have to devise more descriptors to go down each side, e.g., "dart" for flounder or "stays still". Birds would need "long legs", "webbed feet" etc.</p> <p>It may be necessary to look up information on what some species eat.</p>																Plankton
																Plants
																Animals
																Debris/ dead things



10. Survival and adaptation of animals at Ahuriri Estuary activity sheet

Post-activity teacher's copy

PLANTS	Karo	Glasswort	Calendula	Buck's horn plantain	Taupata	Boxthorn	Ngaiu	Flounder	Bristle worm	Mud crab	Mudflat top shell	Mud whelk	Cockle	Wedge shell	Mud snail	ANIMALS							
Have								Have															
Hairy leaves	✓		✓	✓		✓					✓	✓	✓	✓	✓	Shell							
Thick leaves	✓						✓				✓	✓	✓		✓	Feelers							
Shiny leaves					✓		✓				✓	✓			✓	Mouth							
No leaves											✓	✓			✓	Siphon							
Thin leaves							✓				✓	✓	✓	✓	✓	Eyes							
Hooks							✓		✓							Nippers							
Spines										✓	✓	✓	✓	✓	✓	Soft bodies							
Juicy leaves		✓							✓							Hard bodies							
Trunk					✓	✓	✓			✓	✓				✓	Camouflage							
Flowers (not always there)	✓	✓	✓	✓	✓	✓	✓																
Fruit (not always there)	✓	✓	✓	✓	✓	✓	✓																
Live								Live															
In water								✓								In water							
Beside water		✓														High tide zone							
Above very high tides			✓	✓					✓	✓	✓	✓	✓	✓	✓	Low tide zone							
On flat near water			✓	✓												Sand							
Up banks	✓				✓	✓	✓			✓	✓	✓	✓	✓	✓	Mud							
Under bushes																							
Do								Do															
Climber/scrambler								✓								Swim							
Tree/shrub																Fly							
Ground cover	✓								✓		✓	✓		✓	✓	Glide							
	✓									✓						Walk							
Grow in clumps																Nip							
Smother													✓		✓	Dig							
Science L 3.2, L4.2 Survival								Eat															
<p>The relative number of ticks indicates the adaptive features and behaviours that enable most species to survive. The children decide what species to include and will have to devise more descriptors to go down each side, e.g., "dart" for flounder or "stays still". Birds would need "long legs", "webbed feet" etc.</p> <p>It may be necessary to look up information on what some species eat.</p>															✓	✓	✓	Plankton					
																						Plants	
																							Animals
																					✓	✓	Debris/ dead things



11. Social studies, Place and Environment: How different groups view and use places and the environment: People at the estuary

Pre-visit activities

- Ask the children why the estuary might be important to them. What do they do at the estuary, make a list. (exercise, walk dogs, collect shell fish, play in the mud, bird watching, picnics)
- Have a debate or role-play using the scenarios below.

Scenario 1

A developer wishes to reclaim and drain most of the estuary between the embankment and Pandora bridges, which is a huge area of land. A central drain will remain.

Or

A developer wishes to place a marina in the estuary.

You and your team are presenting a legal case appealing against the development. Your case must be in writing, but is to be presented orally to a tribunal. Different members of the team may present different aspects of the case.

Scenario 2

Industrial pollution of drains running into the estuary is a recurring problem at Ahuriri. Find out who is responsible for finding the offender and what action is to be taken. Consider what action you would like to see taken and how could such events be prevented. See Hawke's Bay Regional Council website or staff for information.

Field day

- Observe people at the estuary—what are they doing? Note down your observation in **activity sheet 11, page 36**.
- Read the Department of Conservation sign at the start of the estuary track. Discuss why no dogs, horses or bikes are allowed on the estuary.

Post-visit activities

- Discuss what issues currently threaten the estuary and how we might deal with them. For example pollution, invasion by mosquitoes, development of a marina or disturbance to wildlife with new developments occurring around the estuary.
- Make posters informing people about the present problems that the estuary is facing.

Further ideas

- Write a list of activities that people would have done around the estuary at a selected time in the past, and what people do around the estuary now. Write your ideas and observations in a 'before and now' table.
- Make 'before and now' posters or murals of the estuary. What did people use to do at the estuary? What do people do now?

11. People at Ahuriri Estuary activity sheet

Name: _____

Who goes to the estuary and what do they do?

PEOPLE SEEN	WHERE, AND WHAT THEY ARE DOING



11. People at Ahuriri Estuary activity sheet

Teacher/parent copy

Social studies: Levels 2, 3 and 4. Place and Environment. how activities are influenced by location and features of a place.

Who goes to the estuary and what do they do?

PEOPLE SEEN	WHERE, AND WHAT THEY ARE DOING
	Walkway
Runners	• Training on the track around the estuary
Elderly(?) couple	• Walking their dog around the estuary
	• In the water at low tide, collecting cockles
Family	• Picnicking on the reserve
	• On walkway
	Pond
Class of children	• Sailing Optimist yachts
	• In canoes paddling up the estuary – training ?
Two adults	• In the Pandors Pond
	• Paddling around the edges of the pond
	• Chatting and watching children paddling
Swimmers	
Children	
Parents	
Families	



12. Art: Texture and colour of objects at Ahuriri Estuary

Pre-visit activities

- Make a list of words to describe different textures.

Field day

- Find different estuary items using the **'Texture and colour of objects at Ahuriri Estuary' activity sheets 1–3** (3 different activities), **pages 39–43**. Draw some of the objects or stick the object to the activity sheet using sellotape. It is best to encourage students to draw most objects and only paste a few... Empty shells are homes for many estuary creatures.

Post-visit activities

- Make 'texture pictures' of estuary creatures seen on the field trip. Draw an outline of the creature and glue different textured material or fabric onto the outline.

Further ideas

- Ask the children to find an object in the school playground and describe its look and texture.
- Found out about Maori fishing hooks—look at the different designs and create your own.
- Weave your own fish using colour paper or flax. *"Fun with Flax"* By Mick Pendergrast (2004) Reed publishing, Auckland has some good ideas.

12. Texture and colour of objects at Ahuriri Estuary activity sheet

1 of 3

Name: _____

Find something for each space. Draw it. If you are unsure what some of these items are, look at the "Animals at the estuary" or "Plants at the estuary" worksheets

Hairy—puhuruhuru	Soft—ngohengohe	Red—whero
Thin—tuai	Little—iti	Sharp—koi
A seed—he kakano	Univalve shell—anga kotahi	Bivalve shell—anga rua



12. Texture and colour of objects at Ahuriri Estuary activity sheet

1 of 3: Teacher/parent copy

Name: _____

Find something for each space. Stick it on or draw it. If you are unsure what some of these items are, look at the “Animals at the estuary” or “Plants at the estuary” worksheets

<p>Hairy—puhuru <i>Not from someone's head!! Many leaves are hairy.</i></p>	<p>Soft—ngohengohe</p>	<p>Red—whero</p>
<p>Thin—tuai</p>	<p>Little—iti</p>	<p>Sharp—koi <i>Plants such as boxthorn and blackberry have sharp spines or hooks to discourage grazing animals.</i></p>
<p>A seed—he kakano <i>Silver beet and grasses are often seeding</i></p>	<p>Univalve shell—anga kotahi <i>One shell, e.g., mud snail, top shell</i></p>	<p>Bivalve shell—anga rua <i>Two shells, e.g., cockle (tuangi), pipi</i></p>



12. Texture and colour of objects at Ahuriri Estuary activity sheet

2 of 3

Name: _____

Find something for each space. Stick it on or draw it. If you are unsure what some of these items are, look at the “Animals at the estuary” or “Plants at the estuary” worksheets

Mud snail shell	Purple	Glsswort	Sea lettuce
Hairy leaf	Planted by a person	Thick leaf	A flower or seeds
(teacher’s choice)	Buck’s horn plantain	Plant that “escaped” from someone’s garden	Rubbish



12. Texture and colour of objects at Ahuriri Estuary activity sheet

2 of 3: Teacher/parent copy

Name: _____

Find something for each space. Stick it on or draw it. If you are unsure what some of these items are, look at the “Animals at the estuary” or “Plants at the estuary” worksheets

Mud snail shell	Purple	Glsswort	Sea lettuce
Hairy leaf	Planted by a person	Thick leaf	A flower or seeds
(teacher's choice)	Buck's horn plantain	Plant that “escaped” from someone's garden	Rubbish



12. Texture and colour of objects at Ahuriri Estuary activity sheet

3 of 3

Name: _____

Find something for each space. Stick it on or draw it. If you are unsure what some of these items are, look at the "Animals at the estuary" or "Plants at the estuary" worksheets

Shiny	Two shells joined together	Hard	Something you could use
Thrown away	From an animal	Spotty	From a boat
Yellow	Surprising	Eaten	Smelly plant
Interesting	Old	New	
Shell with a hole in it	A small shell	A big shell	



12. Texture and colour of objects at Ahuriri Estuary activity sheet

3 of 3: Teacher/parent information

Name: _____

Find something for each space. Stick it on or draw it. If you are unsure what some of these items are, look at the “Animals at the estuary” or “Plants at the estuary” worksheets

Shiny	Two shells joined together <i>A bivalve, e.g., cockle</i>	Hard	Something you could use <i>The child must be able to say how they would use it.</i>
Thrown away	From an animal <i>e.g., a feather, shell, animal droppings...</i>	Spotty <i>e.g., Ngaio leaves</i>	From a boat
Yellow	Surprising	Eaten <i>Leaves often have holes and other signs of being eaten by insects</i>	Smelly plant <i>May be pleasant or unpleasant. Many plants are aromatic if crushed (fennel, gum leaves)</i>
Interesting	Old	New	<i>Children or teacher can choose something for the empty spaces</i>
Shell with a hole in it <i>Probably caused by a carnivorous whelk that drilled a hole to eat the animal inside.</i>	A small shell	A big shell	<i>Children or teacher can choose something for the empty spaces</i>



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- The New Zealand Sea Shore. John Morton and Micheal Miller, Collins, 1968.
- The story of Napier 1874 –1974. Dr D.N. Campbell, Napier City Council, 1975.
- What's on the beach, a guide to coastal marine life, Glenys Stace, 1997. Penguin Books, Auckland.

Useful websites

- Ministry of Fisheries www.fish.govt.nz for factsheets on fish
- Albany museum www.arc.govt.nz/albany/fms for factsheets on shellfish
- Department of Conservation www.doc.govt.nz

Appendix 1

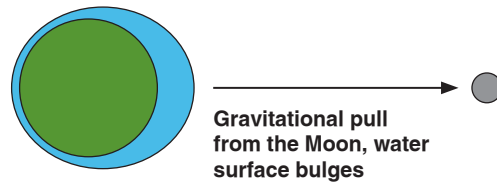
What causes tides?

The rise and fall of tides around the New Zealand coastline occur twice daily (diurnal cycle) and is the result of gravitational and centrifugal forces.

Gravitational forces

The Moon's gravitational attraction pulls the Earth's major water bodies towards it. The gravitational pull of the Moon is greatest on the side of the Earth it faces. That is, the strength of gravitational pull is directly related to the distance between the Earth and the Moon (figure 1).

Figure 1: A diagram of the Earth and the water surface, showing the gravitational effect that the Moon has on the Earth's water.

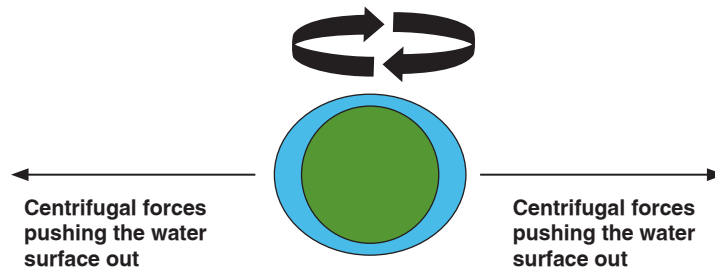


Centrifugal forces

As the Earth spins, it pushes the water out from its axis. This is called centrifugal force and means that the bulge of water on either side of the Earth will become balanced. See figure 2. To give you a visual representation of centrifugal forces try these two mini experiments:

1. Find a globe that spins easily; stick a few coloured tassels around the top and centre of the globe. Spin the globe. Which tassels are pushed out more by centrifugal force, the ones at the top of the globe or those around the middle?
2. Try placing a piece of blue tack onto the side of a spinning top—see how it spins. Then place a piece of blue tack on the exact opposite side to the first piece of blue tack and see how it spins. One spinning top is balanced, but the other isn't.

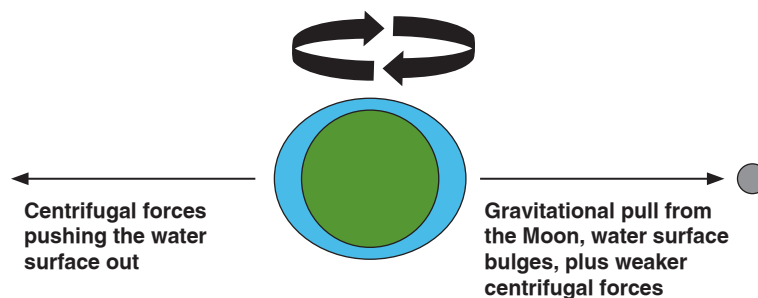
Figure 2: A diagram of the Earth and the water surface, showing the centrifugal forces on the Earth's water.



Combination of gravitational and centrifugal forces

Both combinations of gravitational and centrifugal forces create the high tides on either side of the Earth. As you will recall, the gravitational pull of the Moon is much stronger on the side of the Earth that is facing the Moon, so that tide is mostly influenced by gravity whereas the other tide is influenced mainly by centrifugal forces. See figure 3.

Figure 3: The gravitational and centrifugal forces on the Earth's water surface.



Another gravitational force....

The Sun is another gravitational force that has some effect on the Earth's water surface. The Sun is further away than the Moon, so its gravitational force is weaker, but it still causes the water surface to be pulled towards it, especially when in combination with the Moon.

The Sun works with and against the Moon's gravitational force, causing two types of tides to occur. When the Sun and Moon are aligned (new Moon) or at opposite sides of the Earth (full Moon) the gravitational pull is large, resulting in *Spring tides*. Spring tides are very low low-tides and very high high-tides. See figure 4.

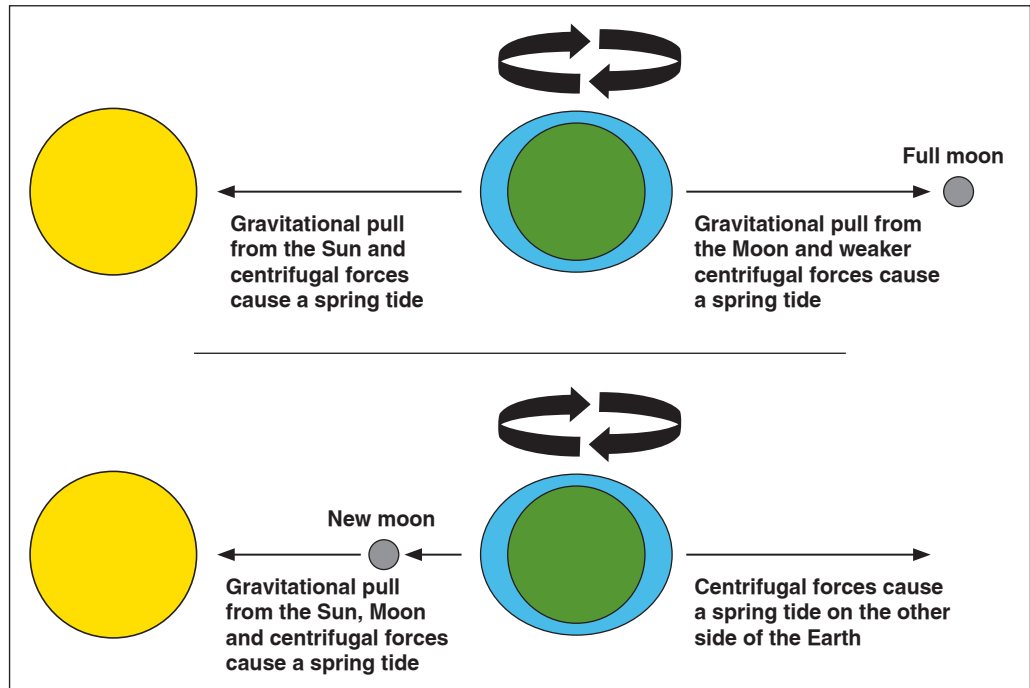


Figure 4: A diagram to show the two ways Spring tides can occur.

When the Moon's rotation puts it at right angles to the Sun (first and last quarter of the Moon), the Sun and Moon's gravitational forces counteract each other forming *Neap tides*. Neap tides are smaller and have less extreme low and high tides. See figure 5.

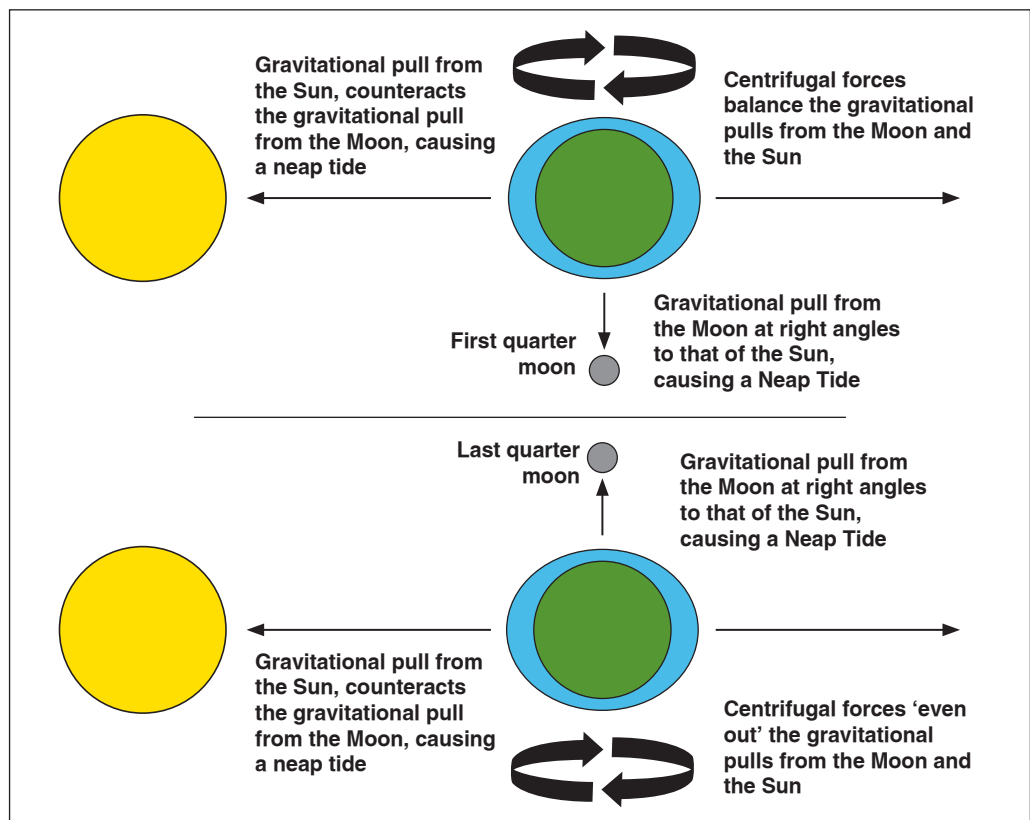


Figure 5: A diagram showing the two ways Neap tides can occur.

Appendix 3

Aerial photos of Ahuriri Estuary around 1999



Appendix 4:

New Zealand Environmental Care Code



10 POINT CHECKLIST

Protect plants and animals

Treat New Zealand's forests and birds with care and respect. They are unique and often rare.

Remove rubbish

Litter is unattractive, harmful to wildlife and can increase vermin and disease. Plan your visits to reduce rubbish, and carry out what you carry in.

Bury toilet waste

In areas without toilet facilities, bury your toilet waste in a shallow hole well away from waterways, tracks, campsites, and huts.

Keep streams and lakes clean

When cleaning and washing, take the water and wash well away from the water source. Because soaps and detergents are harmful to water-life, drain used water into the soil to allow it to be filtered. If you suspect the water may be contaminated, either boil it for at least 3 minutes, or filter it, or chemically treat it.

Take care with fires

Portable fuel stoves are less harmful to the environment and are more efficient than fires. If you do use a fire, keep it small, use only dead wood and make sure it is out by dousing it with water and checking the ashes before leaving.

Camp carefully

When camping, leave no trace of your visit.

Keep to the track

By keeping to the track, where one exists, you lessen the chance of damaging fragile plants.

Consider others

People visit the back country and rural areas for many reasons. Be considerate of other visitors who also have a right to enjoy the natural environment.

Respect our cultural heritage

Many places in New Zealand have a spiritual and historical significance. Treat these places with consideration and respect.

Enjoy your visit

Enjoy your outdoor experience. Take a last look before leaving an area; will the next visitor know that you have been there? Protect the environment for your own sake, for the sake of those who come after you, and for the environment itself.

*Toitu te whenua
(Leave the land undisturbed)*



Department of Conservation
Te Papa Atawhai

newzealand.govt.nz

Appendix 5:

New Zealand Water Care Code



NEW ZEALAND
water
CARE CODE

10 POINT CHECKLIST

Find out first

Find out and follow the regulations governing recreational use of waterways and access. They are designed to minimise conflict between users and protect everyone's health and safety.

Stay on established tracks and use existing facilities

By using existing facilities, where these are provided, you run less chance of disturbing wildlife and damaging riverbanks and foreshores.

Take care of your gear

Careless use of equipment can harm wildlife and other users.

Remove rubbish

Litter is unattractive, harmful to wildlife and pollutes water. Plan your visit to reduce rubbish, and carry out what you carry in.

Dispose of toilet waster properly

Improper disposal of toilet waste can contaminate water, damage the environment, and is culturally offensive. Use disposal facilities where provided or bury waste in a shallow hole at least 50 metres away from waterways.

Be careful with chemicals

Use chemicals sparingly, and refuel with care. Dispose of cooking and washing water well away from the source.

Respect our cultural heritage

Many New Zealand waterways have special cultural, spiritual or historical values. Treat these places with consideration and respect.

Take only the food you need

When taking food from the sea or freshwater don't overdo it. Sustain life in our waterways by taking only what you need and no more than the legal limit.

Consider plants and animals

Remember we are only visitors to water environments. Other animal and plant species live there all the time.

Consider other people

Respect other visitors ... everyone has the right to enjoy the environment in safety.

Toitu te marae a tane
Toitu te marae a tangaroa



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