Biodiversity

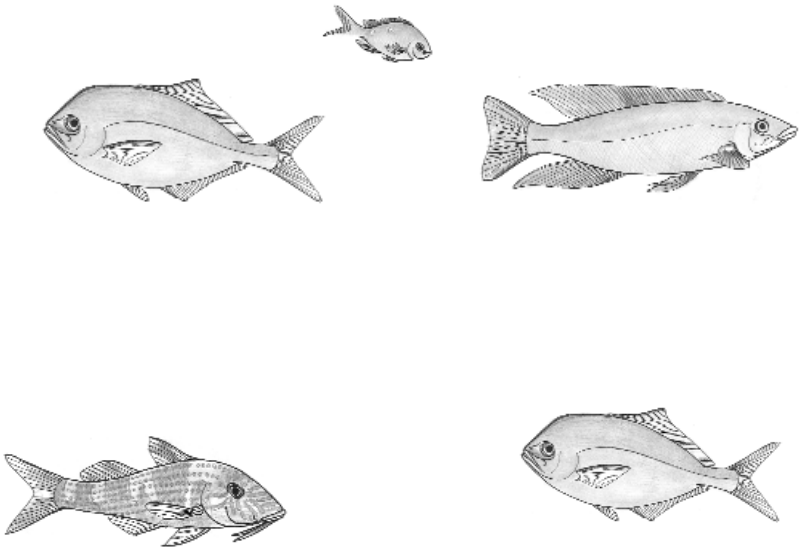
The number of different animals and plants on a seashore can be used as a biological indicator of the richness and health of a shore. In comparative terms marine reserves should eventually be richer and healthier than equivalent shores which do not have reserve protection. Investigating the biodiversity of a particular shore is a good method of introducing students to the great variety of life forms through exercises that require them to seek, check off and make observations about the life styles of particular species.

However, students cannot appreciate shoreline biodiversity without an understanding of the different types of marine life. Most primary and secondary school students have a poor knowledge of the species to be found along rocky and sandy shores or even the characteristics of the common animal and plant groups. It is not possible for students to appreciate the importance of maintaining a rich biodiversity if they do not have at least an elementary understanding of the variety of life that occurs along the coast.

Knowing the names of all the animals and plants they see is not important and rote learning of species names has little merit. Even qualified marine biologists will not know the names of all the creatures and plants on the shore. However familiarity with the different animals groups/types is important and knowing the names of some of the very common species that are characteristic of particular habitats is worthwhile if at the same time they learn about their lifestyles.

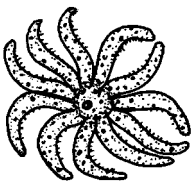
This unit addresses the factors which:

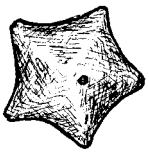
1. result in deterioration of biodiversity in unregulated shores
2. result in biodiversity recovery in a marine reserve



In a pre-visit class exercise lead the students in a discussion session in which they suggest activities (both direct and indirect) that may reduce biodiversity. It may be necessary to provide some clues so that they can produce a full list. Tabulate the activities on the board with extension comments extracted from the students to suggest how each activity may cause problems.

The unit also suggests starter lists of marine animal groups for primary and secondary school students that should be studied in pre-visit lessons and identified on a field trip. The lists include basic characteristics of each group and in many – but not all – cases, give species names of the commonest examples. The lists are illustrated.





The group characteristics given here are not comprehensive but rather at a general introductory level that can be reiterated at the beach when students make new finds on a discovery search. More detailed descriptions can be found by the students during post-visit follow-up sessions in the classroom using the resources listed.

Factors affecting biodiversity

Factors causing biodiversity deterioration on unregulated shores:

Harvesting

Fishing

Reduces fish numbers and, as some methods target particular species, these methods may eliminate them locally.

Shellfish and sea egg gathering

By stripping these species from a shore there may be a related reduction of total loss of some predators (such as octopus and some species of fish and whelks) that rely on them for food.

Disturbing the seabed

Dragging trawl nets (for fish) or dredges (for scallops or flat oysters)

This disturbs burrowing animals and the stable structure of the bottom sediments. It also damages sponges and other immobile marine life, breaks the thin edges of clam and scallop shells and churns up soft mud creating sediment clouds that choke or clog the gills of many marine animals.

Anchoring

Repeated casting of anchors and dragging them so that they dig into soft substrate or snag on subtidal reefs, damages the delicate marine life at those sites.

Disturbing the shore

Over turning boulders

Some subtidal creatures are able to survive in the intertidal zone if they shelter or anchor themselves permanently under intertidal boulders. If boulders are left overturned by fossickers, sea egg hunters or students, most of the marine life living underneath – especially the permanently attached organisms – dry out or are burnt by UV rays.

Vehicles and excessive foot traffic over hard shores

Many creatures (barnacles, snails, tubeworms and some bivalves) can be crushed by excessive pedestrian or vehicular traffic on hard shores. For an extreme comparison, compare the amount of marine life on a concrete boat ramp with that on the rocks beside it.

Vehicles on sand

When vehicle wheels rumble over damp sand the physical nature of the sand can be altered (technically known as a physical phase state change). The agitation or vibrations can temporarily change moist, hard sand into a jelly-like liquid, which has the sand in suspension. In the two states the proportions of the sand and water remain the same. The agitation causes the change of state.

This change can cause the positions of buried animals to be disturbed and some shellfish (eg, juvenile toheroa and tuatua) respond by coming up to the surface where they are then vulnerable to predators such as black-backed gulls.

Vehicles travelling along the top of sandy beaches destroy the eggs and shallow nest scrapes of many shore nesting birds such as fairy tern, white fronted tern, New Zealand dotterel and northern variable oystercatcher. Regular disturbance of birds on these nests by vehicles or people (especially with dogs) passing close by can also result in failed clutches. This frequently occurs because the eggs become overheated and addled on clear sunny days if they are uncovered for too long while the parents spend time drawing attention away from the nest site.

Vehicles travelling along the top of sandy beaches also cause damage to sand binding drift line and dune front vegetation, which is so important in stabilising the foreshore.

Rubbish

Some types of rubbish discarded from boats or dropped along shorelines are specifically harmful. Fishing hooks with line still attached can injure and snag sea birds. Plastic 6 – pack yolks used to hold soft drink or beer cans together become caught around the necks of sea birds. Clear polythene sheet or bags are swallowed by some fish, dolphins and birds (sometimes they confuse sheet polythene for jellyfish) and can clog their guts because it is indigestible.

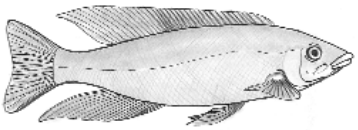
Interfering with water quality

Food rubbish

Throwing food scraps into the sea from boats or to feed fish introduces unnatural foods into the marine environment (see section on feeding fish in the reserve). Some of the food may be eaten but the uneaten food encourages cultures of fungi and bacteria to develop as it rots. These may harm some of the marine life.

The unnatural food can upset the ecological balance by encouraging general scavengers such as seagulls and mallard ducks that may harm the natural marine and shore life. Ducks were seldom seen in the Cape Rodney – Okakari Point Marine Reserve before it became a popular visitor attraction and now there is a sizeable population that is semi-resident around Goat Island Beach where most visitors picnic and swim.

Pollutants



A range of pollutants – most of them produced as a result of human activities – are found in coastal waters and some cause serious problems to marine life and can reduce biodiversity locally.

The Goat Island marine reserve is located just outside the Hauraki Gulf and is usually swept by clean ocean currents that move in from the north. In its isolated position outside the Gulf it is seldom exposed to the common sources of water borne pollution that are common close to city centres.

The Long Bay marine reserve, well inside the Hauraki Gulf, and much closer to Auckland City, is much more vulnerable to pollutants associated with residential living and development, industrial activity, and toxic wastes produced by transport and recreation.

Pollution threats at Goat Island

Residential settlement

There is very little residential settlement over looking the reserve so there is little or no septic tank effluent. (Effluent from the University Marine Laboratory is pumped inland to a high grade filter and treatment system that is well away from the shoreline.)

Farming run off

High levels of stock effluent or fertiliser that run off farmland after heavy rain can cause nutrient and algal bloom problems in quiet coastal waters. The reserve is backed by agricultural land grazed by sheep and dry stock but the farming is of low intensity with little use of fertiliser and low use of pesticides and weedicides

Industrial or commercial activity

There is no industrial or commercial activity alongside the reserve. Elsewhere these businesses can be the source of hazardous chemicals

Residential building

There is little building development in the water catchments that drain into the reserve so silt loads associated with storm water flows after moderate rain are generally fairly low though sediment plumes do occur after heavy rainfall

Roads and traffic

There are few roads close to the marine reserve apart from the road that leads down to Goat Island Beach. Chemicals – including heavy metals – that come from vehicle tyres, engine oils and fuel additives are therefore in low concentrations

Boats and antifouling paints

The marine reserve is a fairly popular destination for pleasure craft but they are mainly trailer boats that do not require anti-fouling paint. Commercial fishing boats that do use anti-fouling paints seldom pass through the reserve. (Anti-fouling paints slowly release heavy metals and other chemicals which are toxic to the larval stages of encrusting organisms and can have a variety of damaging effects on other marine life)

Silt

The importance of silt as a pollutant is generally underrated. Heavy loads of silt in the water can clog the gills of marine animals and the delicate feeding mechanisms of filter feeders along the shoreline and in inshore shallow water. It can also reduce light levels penetrating the water column and thereby limits photosynthesis so there is less algal production to support grazing and browsing animals.

Pollution threats at Long Bay

Residential settlement

This reserve is close to the heavily developed residential suburbs of Torbay, Browns Bay, and Rothesay Bay to the south and Arkles Bay and Manly at the base of the Whangaparaoa Peninsula to the north. Storm water flowing from these settlements typically has high loads of silt associated with section development and exposed road cuttings along with the cocktail of waste chemicals typical of suburban settlements: car washings, paint washings, waste oil, garden fertilisers and pesticides, chlorinated swimming pool flushings. Browns Bay has also been the site of many sewerage line failures over recent years that have resulted in overflows of raw sewerage spilling into the sea adjacent to the reserve.

Farming run off

The countryside around Long Bay has some intensive sheep and dry stock farming and a steady increase in market gardening. Agricultural and horticultural chemicals flow from these ventures into the Okura River and Weiti River catchments that both drain into the sea alongside the marine reserve.

Industrial or commercial activity

The industrial area of Silverdale and commercial activity at Silverdale and around the base of the Whangaparaoa Peninsula are also sources of run off into the Weiti River.

Residential building

Auckland's urban sprawl is putting great pressure on further residential subdivision all around the Long Bay marine reserve both in the East Coast Bays settlements and along the Whangaparaoa Peninsula. The area is already heavily populated and domestic chemical waste associated with modern urban living that runs untreated directly into the sea is certain to increase.

Roads and traffic

Vehicle flows are directly related to settlement intensity and polluting chemical wastes from cars and trucks that wash off the roads directly into the sea are already heavy and certain to increase.

Boats and anti-fouling paints

Recreational boat use and ownership in the inner Gulf (inside Whangaparaoa Peninsula) is very high. Most boats do not have sewerage holding tanks and many release untreated toilet wastes into the waters that bathe the Long Bay marine reserve. With permanent anchorages nearby associated with boating clubs in the Weiti River and at the extensive Gulf Harbour Marina at Hobbs Bay, the potential for local waters to be contaminated by toxic chemicals from antifouling paints is high.

Silt

After heavy rain silt loads in the stormwater run-off are very high. They flow into the Weiti River and Okura River catchments and from along all subdivided parts of the coast. Further proposed development in the district threatens to worsen this problem.

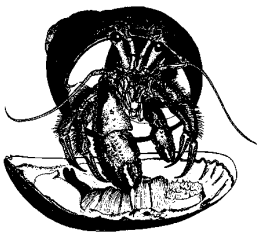
Classroom exercises

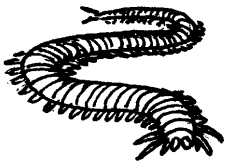
Art and Language

Biodiversity poster

1. Design individual posters highlighting one of the factors that may reduce marine biodiversity. Include a method of reducing the threat or mitigating its effect.

2. Have the whole class contribute to the design and production of a large mural poster for one wall of the classroom to show, at one end, the effects and origins of the whole range of pollutants and hazardous rubbish. It should grade into a rich diverse seascape free of pollutants and rubbish.





Social Science, Science, Language

Table of pollution threats

3. Construct a table to compare the pollution threats to marine life:

   a. at Long Bay Marine Reserve close to Auckland, well inside the Hauraki Gulf

   b. at Cape Rodney – Okakari Point Marine Reserve, just outside the Hauraki Gulf

Biological Science, Ecology

Shore exercise

Biodiversity Treasure Hunt

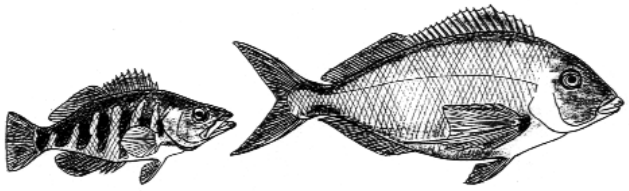
In groups of about five or six with a teacher or parent helper, the students attempt to find examples of all the animal types on the Diversity Sheet – page 78. Staying in close contact, students indicate to the teacher whenever they find an example of a different animal group, which is verified by the teacher. Before moving on to the next animal the teacher reinforces the students' knowledge by pointing out each of the visible characteristics listed on a master sheet – page 83–8.

From a number of categories described on the field sheet students record the micro-habitats on the shore where each of the animal types were found. Some species may be found in more than one micro-habitat and different species of some groups may be restricted to particular habitats.

Example: Column barnacles and surf barnacles are only found on top of exposed rocks between high and low tide but wafer barnacles are only found under boulders in the intertidal zone. Pink striped barnacles live under boulders between the tides but are common on open surfaces below the low tide mark.

Identifying habitat preferences or limitations shows that biodiversity is a more complex issue, with particular species being adapted to cope with the range of environmental conditions found across a seashore and down into the subtidal zones.

This exercise is compatible with marine reserve restrictions for it does not require any collection of creatures and involves minimal or no disturbance of the animals being categorised to their groups.



List of seashore animals

This list introduces only the most obvious/common animal types along with a couple of others to demonstrate that there is much more to learn. Primary classes will easily find most of them on the beach, while secondary students can expand the list by finding more examples of different categories.

Sea anemones

Molluscs

Snails – Grazers (Shell rounded or conical)
– Predators & Scavengers (Shell pointed at both ends)
Chitons – Grazers with eight hinged shell plates
Slugs – Snails with no shell or small shell hidden inside body
Bivalves – Oysters (one shell cemented to the rock)
– Mussels (anchored to rock with many threads)
– Clams (most burrow into sand)

Crustacea

Crabs
Half crabs
Hermit crabs
Shrimps
Sand hoppers
Slaters
Barnacles

Echinoderms

Sea eggs (urchins or kina)
Starfish and cushion stars
Brittle stars

Worms

Chalky tubeworms
Soft (parchment) tubeworms
Free ranging worms (ragworms)

Fish

Blennies and triplefins
Sucker fish
Black rockfish

Birds

Seagulls (Red-billed gull and black-backed gull)
Northern variable oystercatcher
Pied shag
White-faced heron

Common marine animals – biodiversity checksheet

Sea anemones

A simple, soft bodied, tube-shaped animal with a large mouth at the top surrounded by a crown of tentacles. The tentacles catch prey and push it through the mouth to be digested.

Common examples: Red beadlet anemone (in crevices and under large boulders high on shore) and olive beadlet anemone (mid to low tide in pools and moist crevices).

Molluscs

Soft bodied animals usually protected by a shell. Six types: Chitons, snails, slugs, bivalves, octopus / squid and tusk shells.

Chitons (pronounced 'kite-ons'):
Grazing molluscs with eight shell plates surrounded by a scaly girdle. This flexible shell bends to fit the lumps and hollows of rough rock.

Snails

Molluscs protected by a single shell. Clings to rock or crawls on sole of a muscular foot. Head has sensitive tentacles. Withdraws into shell if detached. Most have a lid to close the shell opening.

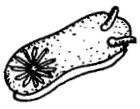
- **Grazers**
  Rounded like helmets (nerita or cats-eye) or
  Shaped like inverted spinning tops (topshells) or
  Pointed like a chinaman's hat (limpets).

- **Predators and scavengers**
  Whelks. Usually pointed at both ends. Have a breathing tube protruding from notch at front end for sensing prey or carrion.

Slugs

Soft bodied molluscs that either have no shell or shell hidden inside body. Most have obvious head tentacles.

- **Sea hares:** Have prominent flaps along back. May grow very large. Seaweed browsers or grazers.



- **Rear gill slugs:** Have flower-like rear gill. Many are brightly coloured. Predators of sponges and other encrusting animals.

Bivalves

Molluscs enclosed inside a pair of shells. Most are filter feeders that strain plankton but some suck up deposits from the surface. Several types:

- **Oysters:** Have one shell cemented firmly to the rock or other shells. Top shell thick and often sharp edged.
- **Mussels:** Thin, smooth, streamlined shells anchored to rocks by tough elastic threads called byssus.

- **Clams**: Thick or thin shells, usually in equal pairs. Most burrow into sand or mud but some bore into rock, hide under boulders or nestle down in crevices.

Crustaceans

Many jointed animals with hard outer skeletons. Most have clearly segmented bodies, obvious antennae (feelers) and stalked eyes.

Crabs
Flat or wedge shaped body with four pairs of walking legs plus one pair of pincer legs. Reduced tail is tucked away under the body. Short antennae. Some are fast runners, others brandish pincers and some are camouflaged.

Half crabs: Like crabs but with weak flat pincers, long antennae, and only three working pairs of walking legs (fourth pair reduced). Feed by filtering plankton. Often found together in large numbers.

Hermit crabs: Live in empty snail shells and have twisted, asymmetrical bodies to fit shell spiral. Have long antennae and stalked eyes. Feed by scavenging, browsing small seaweeds and filter feeding. Never out of water.

Shrimps
Small, long-bodied animals with slender walking legs and swimming legs under a muscular tail. Tail has a large tail fan and can flick forwards or back to power the shrimp through water. Usually scavengers or predators.

Sand hoppers
Bodies laterally flattened and often comma shaped. Some have flattened legs for digging or kicking as they jump. Often found under the driftline debris which they eat.

Slaters (sea lice, isopods)
Have oval segmented bodies flattened from above. They have many small legs below the body for running, burrowing into sand and swimming. Often scavengers. Some live in the drift-line sand.

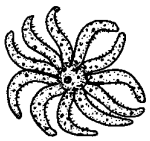
Acorn barnacles
Small to tiny crustacea living inside boxes made from chalky shell plates that are cemented to hard surfaces. Underwater, their lids open so that long, feathery legs can beat through the water to strain out the plankton. Closely related goose barnacles are attached by a flexible stalk.

Echinoderms

The group name means the 'spiny skins'. Their shapes vary from discs to tubes to plates with many having bodies divided into five equal parts. They have many flexible tube feet – usually with suckers on the ends – for walking and holding food.

The group includes: urchins, heart urchins, starfish, cushion stars, brittle stars, sea cucumbers, sand dollars and feather stars.

Sea eggs (urchins or kina)
Rounded spheres with long spines and five double rows of tube feet protruding from surface. The mouth underneath has five chisel-like teeth to grind up encrusting animals and seaweeds.



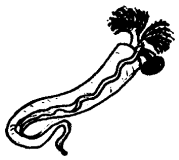
Starfish
Echinoderms with long arms which have hundreds of suckered tube feet on the underside. The 11-armed star is common on rocky shores and in harbours where it eats mussels, urchins and clams.

Cushion stars
Flattened starfish with short arms and webbing between them. Usually five arms but occasionally four, six or seven arms. Feeds by everting its stomach through its mouth to digest whatever it is smothering.

Brittle stars
Starfish with five long slender arms snaking out from a small central 5-sided disc. Often break up if taken out of water. A purple-black species is common clinging to the underside of boulders and a striped species in debris below boulders.

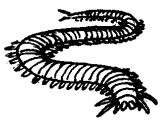
Worms

Long, soft bodied animals. Some have segmented bodies and others have smooth bodies. Some are free roaming and others live inside hard or soft tubes.



Chalky tubeworms
Segmented worms with crowns of head tentacles for filtering plankton. Their chalky tubes are cemented to the rock and give protection from drying out and predation.

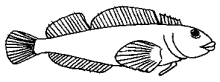
Soft (parchment) tubeworms
Segmented worms in soft papery tubes either buried in sand or attached under boulders. Some have feathery head crowns for filtering plankton. Others have crowns of long thread-like tentacles for gathering up food fragments from the surface.



Ragworms
Free-roaming segmented worms living in sand or under boulders. They have small false legs on each segment. Small jaws inside their mouths are used to grab animal food and rasp off the flesh.

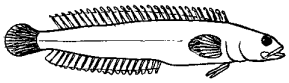
Fish

Some small fish are commonly found in rocky shore pools. Like all fish they are streamlined animals which have fins above and below the body and around the tail tip. Rock pool fish are mostly small and stocky with fairly large eyes. They are very wary and usually seen only by people prepared to sit motionless for several minutes.



Triplefins (or cockabullies)
Small blunt-headed fish with three distinct dorsal fins. They have a large ventral fin and broad leaf-shaped pectoral fins. Pelvic fins are reduced to slender sensory fingers. About 20 species: many are less than five cm long.

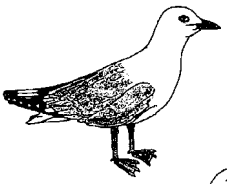
Clingfish or sucker fish (including lumpfish)
Small fish with broad flat heads. Pelvic fins modified to form sucker on the belly for clinging to rocks or seaweed. No scales and body slippery smooth with mucus. Of 12 species, seven are common in pools.



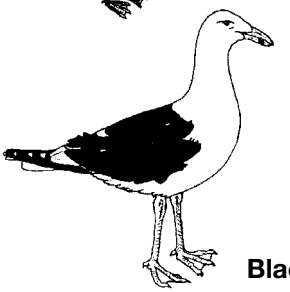
Rockfish
Long dark fish with scaly bodies and blunt spined dorsal and ventral fins. Pectoral fins are large and pelvic fins narrow with several feeler fingers. A thick skin of mucus helps them survive under stones when the tide is out.

Shore birds

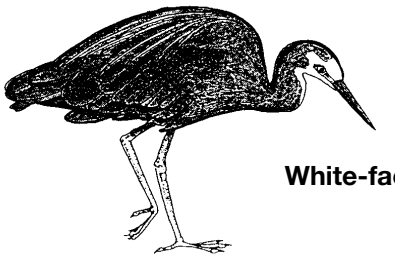
Crowds of people scare most sea birds away but two confident scavengers, the red-billed and black-backed gulls, often remain. Pied shags are also common, roosting in pohutukawa trees over-arching the beach on Goat Island's cliffs. White-faced herons and variable oystercatchers are regularly seen on the rock flats at low tide but keep their distance from people. Rare NZ dotterel may also be spotted at Long Bay.



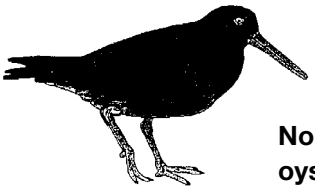
Red-billed gull



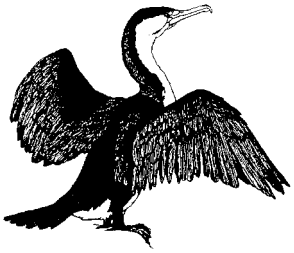
Black-backed gull



White-faced heron



Northern variable oystercatcher



Pied shag

NZ Dotterel

Sea anemones

A simple, soft bodied, tube-shaped animal with a large mouth at the top surrounded by a crown of tentacles. The tentacles catch prey and push it through the mouth to be digested.

☐ 

Common examples: Red beadlet anemone (in crevices and under large boulders high on shore) and olive beadlet anemone (mid to low tide in pools and moist crevices).

Molluscs

Soft bodied animals usually protected by a shell. Six types: Chitons, snails, slugs, bivalves, octopus / squid and tusk shells.

☐ 

Chitons (pronounced 'kite-ons'):
Grazing molluscs with eight shell plates surrounded by a scaly girdle. This flexible shell bends to fit the lumps and hollows of rough rock.

Snails

Molluscs protected by a single shell. Clings to rock or crawls on sole of a muscular foot. Head has sensitive tentacles. Withdraws into shell if detached. Most have a lid to close the shell opening.

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Grazers

- Rounded like helmets (nerita or cats-eye) or
- Shaped like inverted spinning tops (topshells) or
- Pointed like a chinaman's hat (limpets).

☐ 

Predators and scavengers

Whelks. Usually pointed at both ends. Have a breathing tube protruding from notch at front end for sensing prey or carrion.

Slugs

Soft bodied molluscs that either have no shell or shell hidden inside body. Most have obvious head tentacles.

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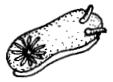
- **Sea hares:** Have prominent flaps along back. May grow very large. Seaweed browsers or grazers.

☐ 

- **Rear gill slugs:** Have flower-like rear gill. Many are brightly coloured. Predators of sponges and other encrusting animals.

Bivalves

Molluscs enclosed inside a pair of shells. Most are filter feeders that strain plankton but some suck up deposits from the surface. Several types:

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- **Oysters:** Have one shell cemented firmly to the rock or other shells. Top shell thick and often sharp edged.

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- **Mussels:** Thin, smooth, streamlined shells anchored to rocks by tough elastic threads called byssus.
- **Clams**: Thick or thin shells, usually in equal pairs. Most burrow into sand or mud but some bore into rock, hide under boulders or nestle down in crevices.

Crustaceans

Many jointed animals with hard outer skeletons. Most have clearly segmented bodies, obvious antennae (feelers) and stalked eyes.

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Crabs

Flat or wedge shaped body with four pairs of walking legs plus one pair of pincer legs. Reduced tail is tucked away under the body. Short antennae. Some are fast runners, others brandish pincers and some are camouflaged.

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- **Half crabs:** Like crabs but with weak flat pincers, long antennae, and only three working pairs of walking legs (fourth pair reduced). Feed by filtering plankton. Often found together in large numbers.

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- **Hermit crabs:** Live in empty snail shells and have twisted, asymmetrical bodies to fit shell spiral. Have long antennae and stalked eyes. Feed by scavenging, browsing small seaweeds and filter feeding. Never out of water.

Shrimps

Small, long-bodied animals with slender walking legs and swimming legs under a muscular tail. Tail has a large tail fan and can flick forwards or back to power the shrimp through water. Usually scavengers or predators.

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Sand hoppers

Bodies laterally flattened and often comma shaped. Some have flattened legs for digging or kicking as they jump. Often found under the driftline debris which they eat.

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Slaters (sea lice, isopods)

Have oval segmented bodies flattened from above. They have many small legs below the body for running, burrowing into sand and swimming. Often scavengers. Some live in the drift-line sand.

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Acorn barnacles

Small to tiny crustacea living inside boxes made from chalky shell plates that are cemented to hard surfaces. Underwater, their lids open so that long, feathery legs can beat through the water to strain out the plankton. Closely related goose barnacles are attached by a flexible stalk.

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Department of Conservation Marine Reserves Education Kit

Echinoderms

The group name means the ‘spiny skins’. Their shapes vary from discs to tubes to plates with many having bodies divided into five equal parts. They have many flexible tube feet – usually with suckers on the ends – for walking and holding food.

The group includes: urchins, heart urchins, starfish, cushion stars, brittle stars, sea cucumbers, sand dollars and feather stars.

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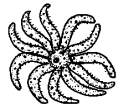
Sea eggs (urchins or kina)
Rounded spheres with long spines and five double rows of tube feet protruding from surface. The mouth underneath has five chisel-like teeth to grind up encrusting animals and seaweeds.

☐ 

Starfish
Echinoderms with long arms which have hundreds of suckered tube feet on the underside. The 11-armed star is common on rocky shores and in harbours where it eats mussels, urchins and clams.

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Cushion stars
Flattened starfish with short arms and webbing between them. Usually five arms but occasionally four, six or seven arms. Feeds by everting its stomach through its mouth to digest whatever it is smothering.

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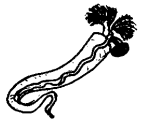
Brittle stars
Starfish with five long slender arms snaking out from a small central 5-sided disc. Often break up if taken out of water. A purple-black species is common clinging to the underside of boulders and a striped species in debris below boulders.

Worms

Long, soft bodied animals. Some have segmented bodies and others have smooth bodies. Some are free roaming and others live inside hard or soft tubes.

☐ 

Chalky tubeworms
Segmented worms with crowns of head tentacles for filtering plankton. Their chalky tubes are cemented to the rock and give protection from drying out and predation.

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Soft (parchment) tubeworms
Segmented worms in soft papery tubes either buried in sand or attached under boulders. Some have feathery head crowns for filtering plankton. Others have crowns of long thread-like tentacles for gathering up food fragments from the surface.

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Ragworms
Free-roaming segmented worms living in sand or under boulders. They have small false legs on each segment. Small jaws inside their mouths are used to grab animal food and rasp off the flesh.

Fish

Some small fish are commonly found in rocky shore pools. Like all fish they are streamlined animals which have fins above and below the body and around the tail tip. Rock pool fish are mostly small and stocky with fairly large eyes. They are very wary and usually seen only by people prepared to sit motionless for several minutes.

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Triplefins (or cockabullies)
Small blunt-headed fish with three distinct dorsal fins. They have a large ventral fin and broad leaf-shaped pectoral fins. Pelvic fins are reduced to slender sensory fingers. About 20 species: many are less than five cm long.

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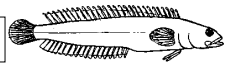
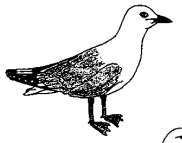
Clingfish or sucker fish (including lumpfish)
Small fish with broad flat heads. Pelvic fins modified to form sucker on the belly for clinging to rocks or seaweed. No scales and body slippery smooth with mucus. Of 12 species, seven are common in pools.

☐ 

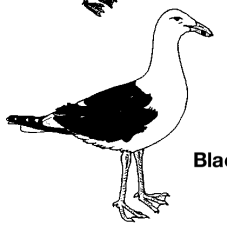
Rockfish
Long dark fish with scaly bodies and blunt spined dorsal and ventral fins. Pectoral fins are large and pelvic fins narrow with several feeler fingers. A thick skin of mucus helps them survive under stones when the tide is out.

Shore birds

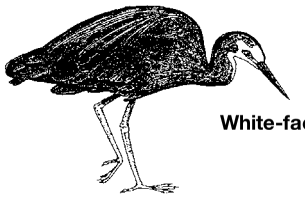
Crowds of people scare most sea birds away but two confident scavengers, the red-billed and black-backed gulls, often remain. Pied shags are also common, roosting in pohutukawa trees over-arching the beach on Goat Island’s cliffs. White-faced herons and variable oystercatchers are regularly seen on the rock flats at low tide but keep their distance from people. Rare NZ dotterel may also be spotted at Long Bay.

☐ 

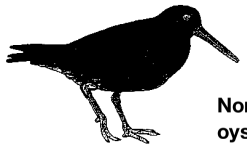
Red-billed gull

☐ 

Black-backed gull

☐ 

White-faced heron

☐ 

Northern variable oystercatcher

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Pied shag

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NZ Dotterel