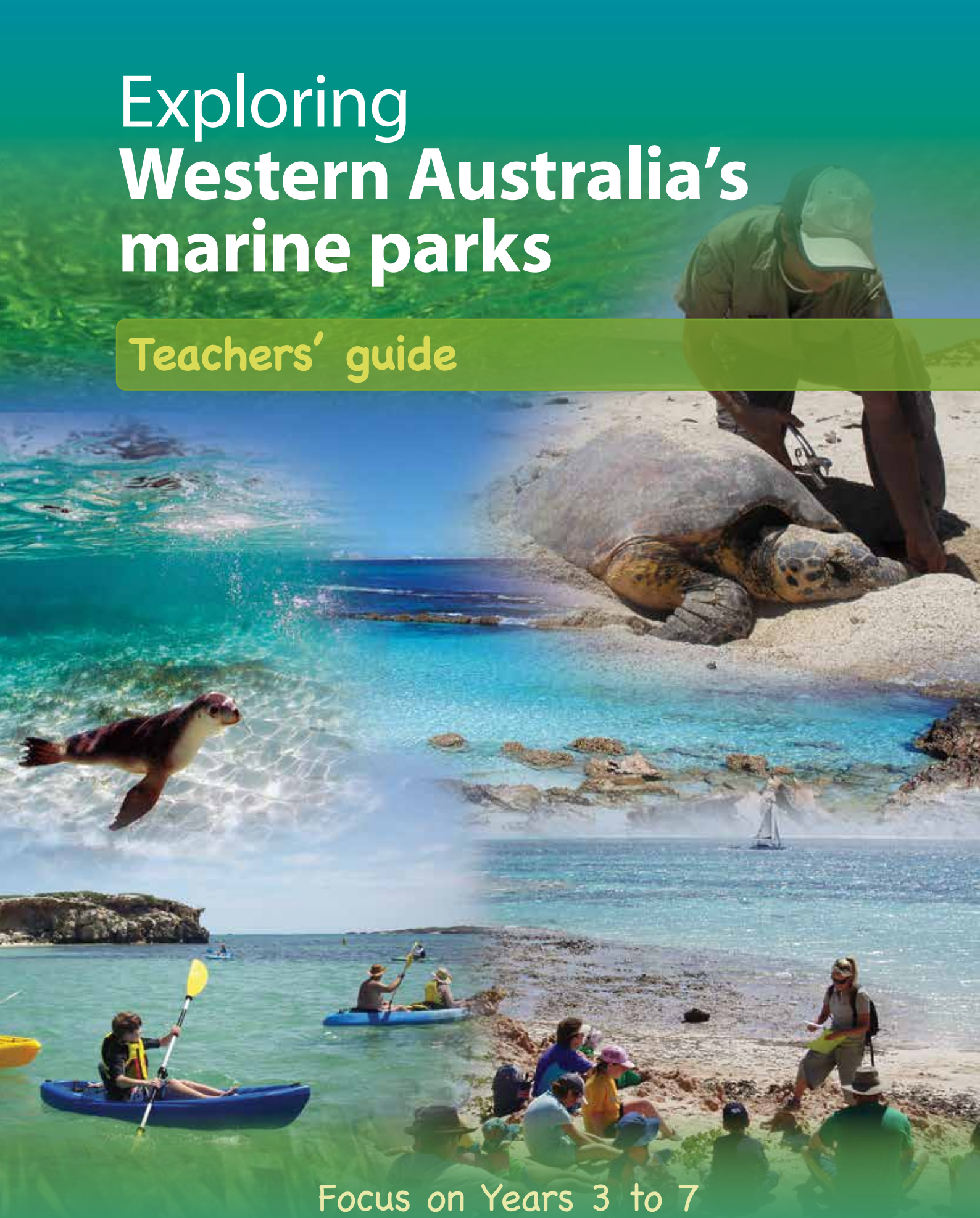
Exploring
Western Australia's marine parks

Teachers' guide



Focus on Years 3 to 7

Department of
Parks and Wildlife

Exploring **Western Australia's marine parks**

Our marine areas are unique and many of them rival their terrestrial counterparts in scenic grandeur. Western Australia's coastline spans more than 13,500 kilometres and is home to some of the world's most remarkable ecosystems and marine wildlife, including massive whale sharks, humpback whales and several threatened species of sea turtles. Many of the state's marine plants and animals are found nowhere else in the world.

The west coast of Western Australia is ranked second highest out of 18 of the world's marine biodiversity hotspots (based on species richness and the number of species found nowhere else) and fourth lowest in terms of threatening processes.

Marine parks and reserves have been progressively established in Western Australia since 1987 to conserve marine biodiversity and provide special places for people to enjoy, appreciate and learn about the state's spectacular marine life.

There are 16 marine parks and other marine reserves in Western Australia, including the Ngari Capes and Camden marine parks created in June 2012 and the Eighty Mile Beach Marine Park created in January 2013. Plans to create another three marine parks in the Kimberley region are well underway.

This upper primary teachers' guide designed to raise awareness of Western Australia's marine parks has been prepared by the Department of Parks and Wildlife (DPaW) with financial support from ExxonMobil Australia.

DPaW has the lead responsibility for protecting and conserving the nature of Western Australia on behalf of the community. This includes managing the state's marine parks and other marine reserves, as well as national parks and other conservation reserves. DPaW currently manages lands and waters with a total area of more than 28 million hectares, an area equivalent to the state of Victoria.

ExxonMobil

THE GOVERNMENT OF WESTERN AUSTRALIA

Department of **Parks and Wildlife**

Contents

Conservation code

When you visit marine parks and other marine areas including the beach please take care—both of yourself and of the environment.

Be cool: Remember to 'slip, slop, slap, wrap' and make sure you're well prepared. Always bring sunscreen, a hat and a T-shirt. Take extra drinking water and wear protective footwear when reef walking.

Be careful: Explore with a friend.

Always display a dive flag when snorkelling or diving.

Never go underneath limestone overhangs and ledges. They may collapse without warning.

Don't run on rocks.

Wear gloves when doing litter surveys—inform a ranger or teacher if you see a needle and do not touch it.

Use a stick when looking through seaweed.

Be courteous: Make sure your activities don't spoil someone else's enjoyment.

Be conservative: Keep to paths and beaches. Help conserve wildlife and take care not to disturb nesting seabirds and vegetated dunes. Always put things back where you found them. Look rather than take.

Be clean: Please do not feed wildlife. Take your rubbish with you when you leave.

Remember, take only photographs and leave only footprints.

Introduction – why do we need marine parks?

Photo: Lisa Bland/DPaW

Our coastline spans more than 13,500 kilometres and is home to some of the world's most remarkable ecosystems and marine wildlife, including massive whale sharks, humpback whales, several threatened species of marine turtles, playful sea lions, leafy seadragons and little penguins. Many of Western Australia's marine plants and animals, particularly those in southern temperate waters, are found nowhere else in the world.

Western Australia's marine areas are unique and rival their terrestrial counterparts in scenic grandeur. Think of Australia's largest fringing reef at Ningaloo Marine Park (in the Ningaloo Coast World Heritage Area), the vast seagrass meadows and their grazing dugongs at Shark Bay Marine Park (also in an amazing World Heritage Area) and the spectacular coral atolls of the Rowley Shoals Marine Park, which rise almost vertically from the seafloor hundreds of metres below. These areas are special and, like national parks on land, warrant protection.

Our coastal waters are valued by Western Australians. The wide range of environmental, cultural, commercial and recreational values they offer generate employment and revenue and provide people with a source of pleasure. Marine recreation and tourism are very important in this state and the capacity of our marine areas to continue to provide these benefits depends on them remaining healthy.

Multiple-use marine parks and reserves balance use of marine resources and environmental protection.

Marine parks:

- create recreational opportunities for people and a chance to enjoy these beautiful natural areas
- play an important role in scientific research and educating visitors about marine conservation, marine ecology and marine park management
- protect culturally significant sites and maritime heritage such as historic shipwrecks
- help protect areas known to be important for some large marine mammals whose numbers were depleted by hunting, such as the blue whale breeding area at Ngari Capes Marine Park and the incredible humpback whale breeding area in Camden Sound Marine Park
- support a growing marine ecotourism market which includes whale watching, sea lion and dolphin and dugong viewing, scuba diving, snorkelling, kayaking and glass-bottomed boat tours
- help protect assets important to commercial and recreational fishers, such as schooling sites, nursery areas, spawning and breeding grounds.

About this teaching resource

This teachers' guide for school students from Year 3 to Year 7 has been produced by the Department of Parks and Wildlife (DPaW), with financial support from ExxonMobil Australia, to help educate people about Western Australia's unique marine parks.

A free full colour educational activity book titled *Discover Western Australia's marine parks* (also produced by DPaW with financial support from ExxonMobil Australia) is available from DPaW on request.

1. Marine parks and reserves in Western Australia

Concepts

- Marine parks protect important underwater habitats that are unique, not just to Western Australia but the only habitats of their type in the world.
- Western Australian marine parks are zoned for different types of use.
- Recreational use is welcome in marine parks, as long as people do not remove plants or animals from sanctuary zones.
- Sanctuary zones within marine parks are 'no take' areas where visitors cannot fish or remove plants and animals.

Objectives

- Students will be able to explain which kinds of activities are allowed in the four different types of zoning in marine parks.
- Students will be able to understand how zones are used to protect particular marine values. They will do this by designing their own marine park and thinking about which zones to place in certain marine areas.

Values

It is important to protect our most biologically important and beautiful marine areas in marine parks so they remain in a healthy state for future generations to enjoy, so they can support the same diversity of marine plants and animals and for their intrinsic value.

Australian curriculum links

Science (Understanding):

- Year 7 Interactions between organisms can be described in terms of food chains and food webs; human activity can affect these interactions (ACSSU112) e.g. Marine park zoning allows different activities; Design a marine park.

Science (Human endeavour):

- Year 5/6 Scientific understandings, discoveries and inventions are used to solve problems that directly affect peoples' lives (ACSHE083) e.g. Design a marine park.
- Year 5/6 Scientific knowledge is used to inform personal and community decisions (ACSHE217) e.g. Design a marine park; Ecology of rockpools, intertidal zones and marine parks can be altered by human activity.
- Year 7 Science and technology contribute to finding solutions to a range of contemporary issues; these solutions may impact on other areas of society and involve ethical considerations (ACSHE120) e.g. Design a marine park.

Photo: Lisa Bland/DPaW

- Year 7 Science understanding influences the development of practices in areas of human activity such as industry, agriculture and marine and terrestrial resource management (ACSHE121) e.g. Marine park zoning allows different activities; Design a marine park.

Geography:

- Year 4 The importance of environments to animals and people, and different views on how they can be protected (ACHGK022) e.g. Design a marine park
- Year 5 The location of the major countries of Europe and North America in relation to Australia and the influence of people on the environmental characteristics of places (ACHGK026) e.g. Design a marine park
- Year 5 The influence of people, including Aboriginal and Torres Strait Islander Peoples, on the environmental characteristics of Australian places (ACHGK027) e.g. Marine parks are zoned for different uses and activities to maximise conservation AND allow for human enjoyment, commercial activities and recreation.
- Year 7 *Unit 1* The classification of environmental resources and the forms that water takes as a resource (ACHGK037)
  - The ways that flows of water connect places as it moves through the environment and the way this affects places (ACHGK038)
  - The causes, impacts and responses to an atmospheric or hydrological hazard (ACHGK042)
  - e.g. The ocean is the largest water environment on Earth, supports life and carries organisms and debris large distances. Marine parks are zoned for different uses and activities of this large environmental resource in order to maximise conservation AND allow for human enjoyment, commercial activities and recreation.
- Year 7 *Unit 2* The factors that influence the decisions people make about where to live and their perceptions of the liveability of places (ACHGK043)
  - The influence of accessibility to services and facilities on the liveability of places (ACHGK044)
  - The influence of environmental quality on the liveability of places (ACHGK045)
  - The strategies used to enhance the liveability of places, especially for young people, including examples from Australia and Europe (ACHGK047)
  - e.g. The ocean is the largest water environment on Earth, supports life and a large proportion of the world's population choose to live near oceans. Marine parks zoning provides maximum conservation values AND allows for human enjoyment, commercial activities and recreation.

Sustainability Priority: Sustainability is about maintaining the capacity of the environment to support life

English:

- Year 6 Participate in and contribute to discussions, clarifying and interrogating ideas, developing and supporting arguments, sharing and evaluating information, experiences and opinions (ACELY1709) e.g. Design a marine park. Discussion of design and improvement.

Background information

Western Australia's marine park and reserve system has been progressively established according to the advice of scientists and the principles of a COMPREHENSIVE, ADEQUATE and REPRESENTATIVE (CAR) reserve system. A COMPREHENSIVE marine conservation reserve system is one in which all major bioregions have marine reserves within them. In WA, 18 major bioregions have been identified. ADEQUATE refers to the number, size, configuration and level of protection of the reserves within a bioregion—a few very small reserves are not truly sustainable in the long term, especially in the ocean where currents and other conditions create a high degree of connectivity between different areas. The reserves also need to be REPRESENTATIVE of the ecosystems within the bioregions. This means that all species of plants and animals found in Western Australian waters will be represented somewhere in our marine reserve system.

There are three types of marine parks and reserves in WA: marine parks, marine nature reserves and marine management areas.

Zoning within marine parks and reserves provides for conservation while allowing sustainable recreational and commercial activities. While a range of activities is permitted in multiple-use marine reserves, the zoning system minimises conflict by establishing some zones for extractive or intrusive activities and other zones for undisturbed nature study and passive enjoyment of the natural environment.

Marine nature reserves and sanctuary zones in marine parks provide the highest level of protection.

Marine parks protect natural features and aesthetic values while enabling recreational and commercial uses that do not compromise conservation values. Western Australia's 13th marine park, the Eighty Mile Beach Marine Park, was declared in north Kimberley waters in January 2013. Within marine parks there may be four types of management zones:

- **Recreation zones** provide for conservation and recreation, including recreational fishing, but exclude commercial activities.
- **General use zones** are managed to conserve natural resources while allowing sustainable commercial fishing and petroleum exploration and production where they will not affect sensitive marine habitats. There are very few restrictions on recreational activities in such zones, which form the bulk of most marine parks.
- **Sanctuary zones** are 'look but don't take' areas that provide the strongest form of protection for the marine environment. Scientific evidence shows that sanctuary zones usually boost the abundance, diversity and size of marine species living within their borders. The public is encouraged to visit and enjoy sanctuary zones, whether by snorkelling, diving or boating.
- **Special purpose zones** are managed for a particular use or issue, such as protection of habitat or nursery grounds, seasonal events such as whale watching or a particular type of commercial fishing. Commercial and recreational activities may be allowed if they are compatible with the primary purpose of a special purpose zone.

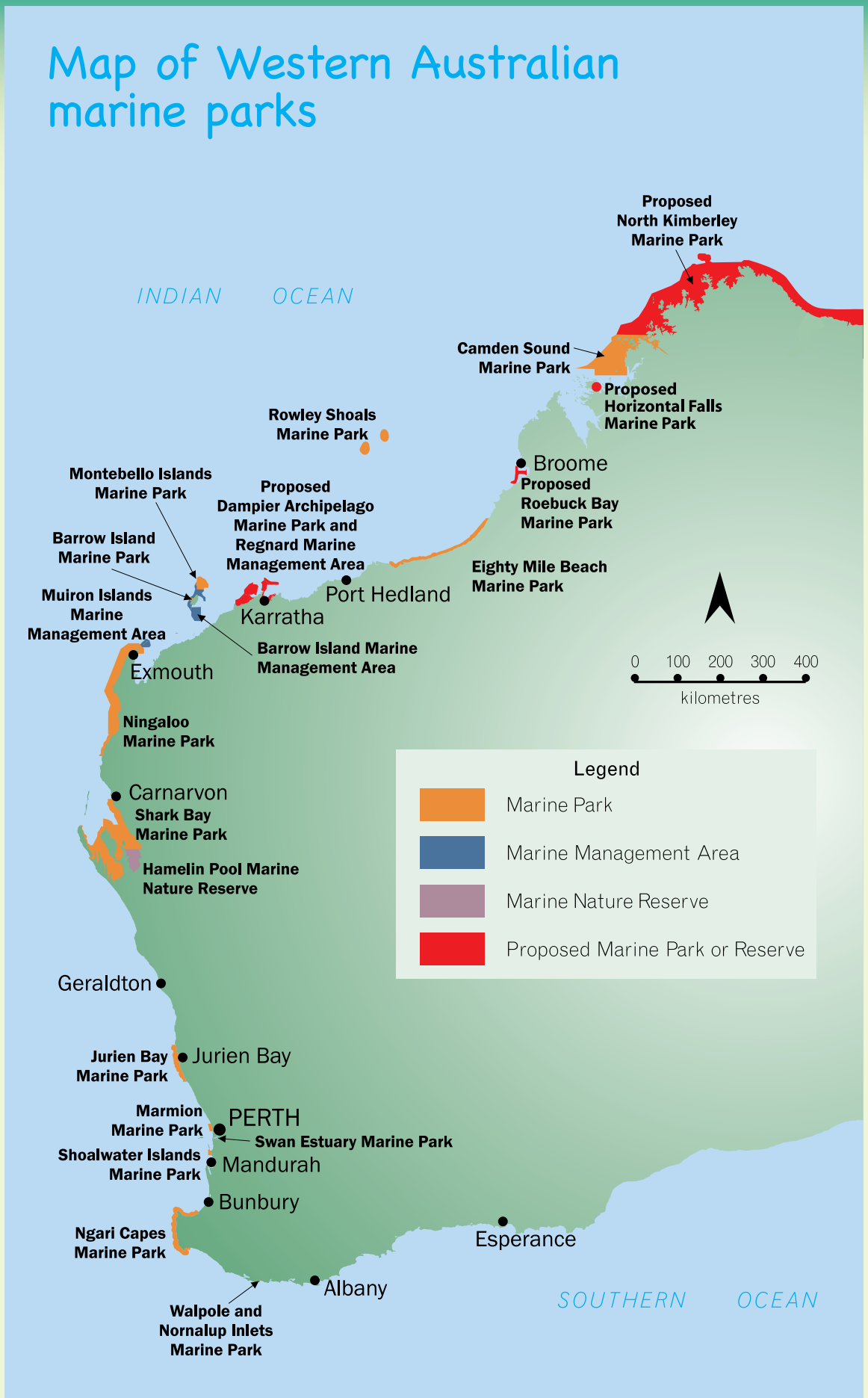
Marine nature reserves are created for conservation and scientific research. Although low-impact tourism may be permitted, they are 'look but don't take' areas given the highest level of environmental protection. Hamelin Pool Marine Nature Reserve at Shark Bay is the only marine nature reserve in WA.

Marine management areas provide an integrated management structure over areas that have both high conservation value and intensive multiple use. There are currently two marine management areas in Western Australia (at the Muiron Islands and Barrow Island).

Visitors are very welcome to swim, dive, snorkel and enjoy other low-impact activities throughout all areas in Western Australia marine parks and reserves. However, in sanctuary zones and other 'no take' areas, visitors may not fish or collect marine plants and animals. Including no take areas in marine parks and reserves helps to ensure that future generations can see the same range of marine plants and animals and undertake similar activities in these areas that we do today.

Photo: Tourism WA

Map of Western Australian marine parks

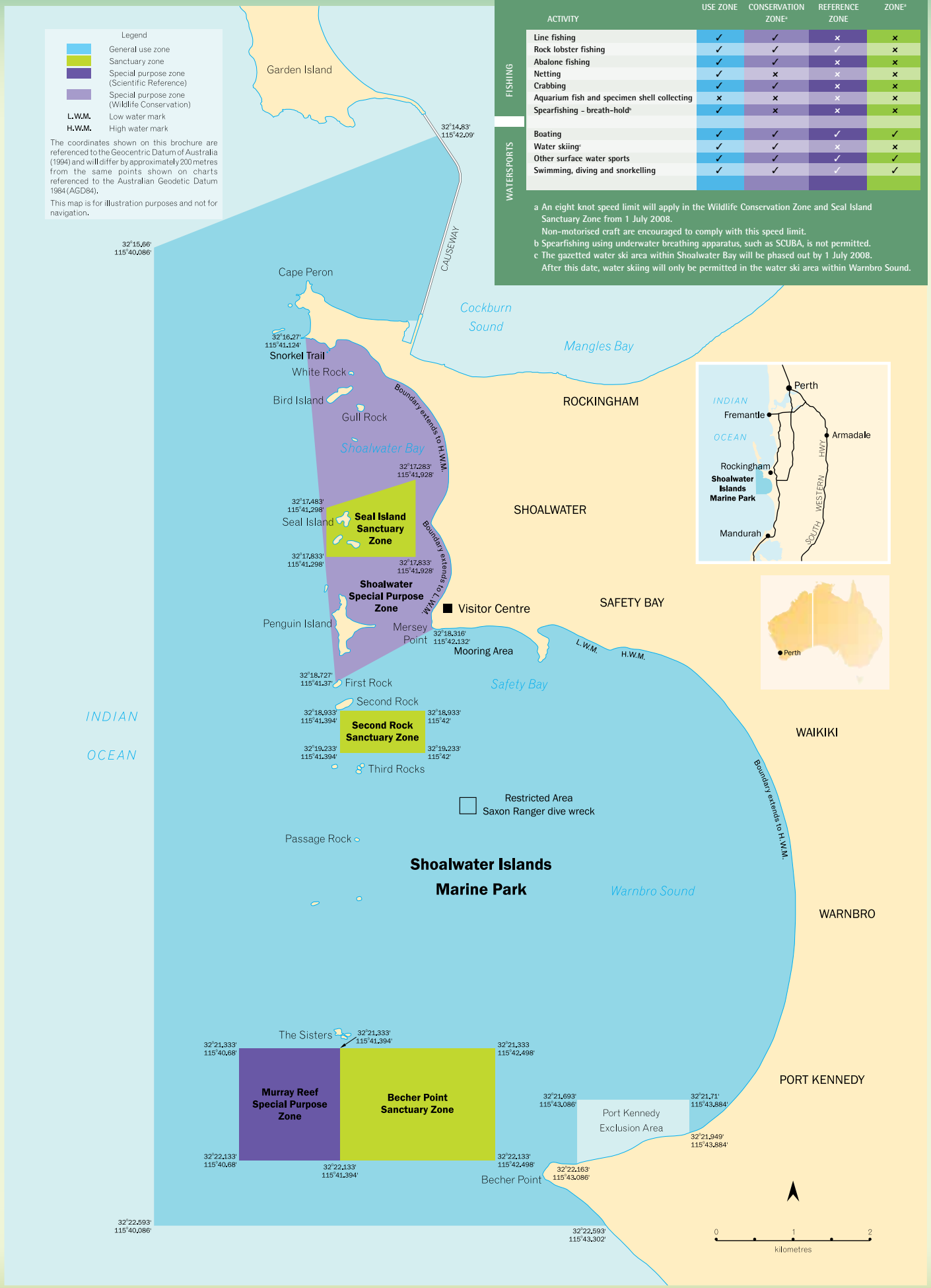


WA marine parks and reserves.

Resource sheet 1

	ACTIVITY	GENERAL USE ZONE	WILDLIFE CONSERVATION ZONE[a]	SCIENTIFIC REFERENCE ZONE	SANCTUARY ZONE[a]
FISHING	Line fishing	✓	✓	×	×
	Rock lobster fishing	✓	✓	✓	×
	Abalone fishing	✓	✓	×	×
	Netting	✓	×	×	×
	Crabbing	✓	✓	×	×
	Aquarium fish and specimen shell collecting	×	×	×	×
	Spearfishing – breath-hold[b]	✓	×	×	×
WATERSPORTS	Boating	✓	✓	✓	✓
	Water skiing[c]	✓	✓	×	×
	Other surface water sports	✓	✓	✓	✓
	Swimming, diving and snorkelling	✓	✓	✓	✓

a An eight knot speed limit will apply in the Wildlife Conservation Zone and Seal Island Sanctuary Zone from 1 July 2008.
Non-motorised craft are encouraged to comply with this speed limit.
b Spearfishing using underwater breathing apparatus, such as SCUBA, is not permitted.
c The gazetted water ski area within Shoalwater Bay will be phased out by 1 July 2008.
After this date, water skiing will only be permitted in the water ski area within Warnbro Sound.



Work sheet 1

Name _____

Date _____

Marine park zoning

You have been appointed as a ranger for the Shoalwater Islands Marine Park. The marine park surrounds Seal Island and Penguin Island and is home to many wildlife species including an Australian sea lion colony, a large colony of little penguins, dolphins, seabirds and many other species.

Before you can start work, you need to 'know your zones' so you can educate park users about which activities they can undertake in various zones. Use Resource Sheet 1 and look at the map and the matrix at the top right which shows which activities are allowed in each zone. Then answer the following questions:

1. In which zones are you allowed to fish?

_____

_____

2. List the activities that are allowed in all zones of the marine park:

_____

_____

3. One activity isn't allowed anywhere in the marine park. What is it?

_____

4. Why do you think it isn't allowed?

_____

_____

5. A sanctuary zone is an area from which no animal or plant can be removed at all. Which activities are not permitted in marine park sanctuary zones?

_____

6. Which activities are welcome in sanctuary zones of marine parks?

_____

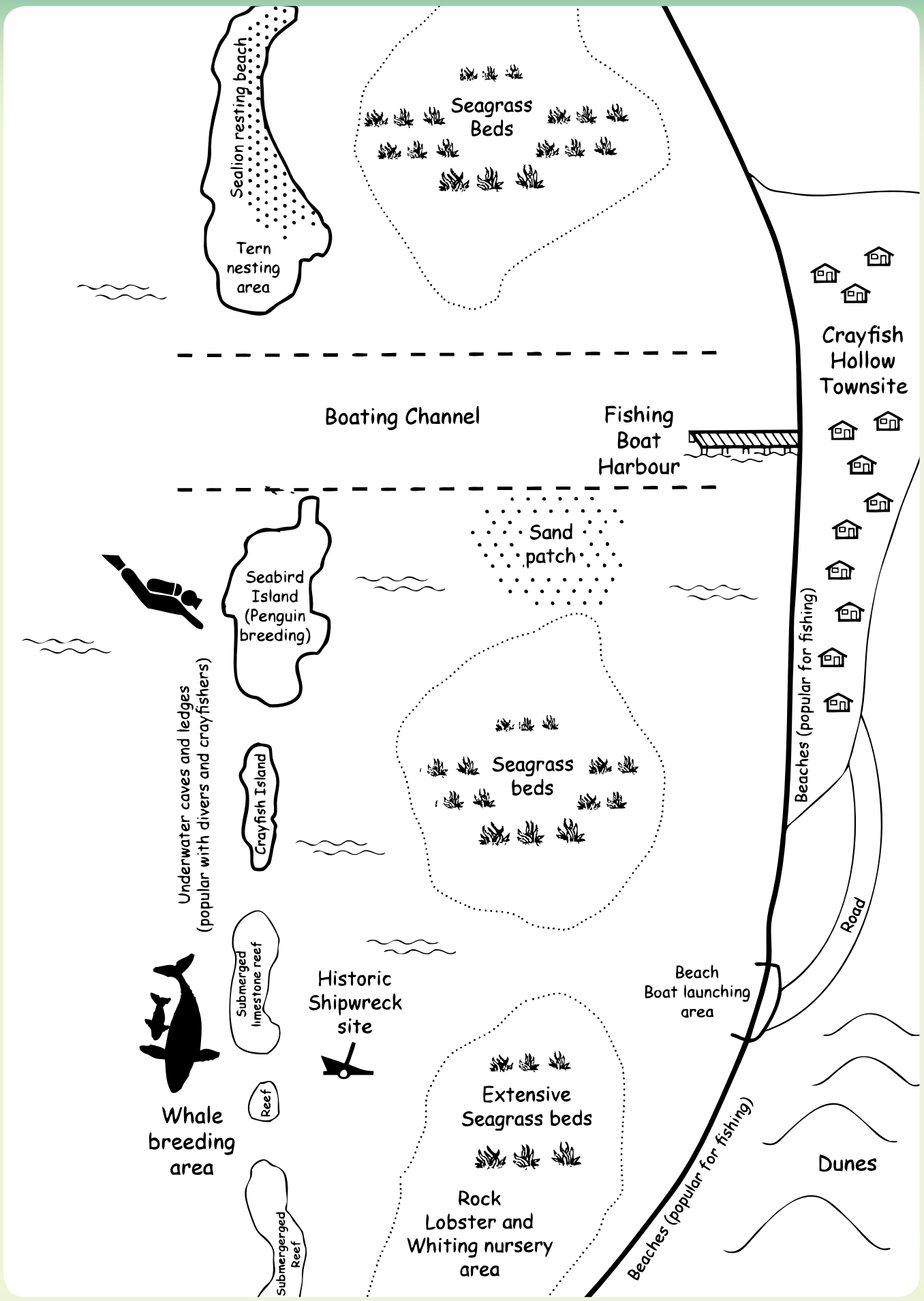
_____

7. Why do you think sanctuary zones have been declared around Seal Island and Second Rock?

_____

_____

Resource sheet 2



Work sheet 2

Name _____

Date _____

Design your own marine park

Look at the map provided in Resource sheet 2. Scientists have suggested a marine park should be created in this area to protect an important whale breeding area, reefs, sea lion resting areas, seagrass beds and other natural values. The area is also important to the local economy for fishing and tourism and many of the locals like to fish from the beach.

The government has assessed the area and agrees that it needs protection but they still want to allow sustainable use by tourists and fishers where this doesn't conflict with conservation.

You are a marine park planner. Think about the special marine features that need protection and the areas where people would like to fish. Some of these in are the same places. Remember that you can still fish inside marine parks but not inside marine park sanctuary zones.

When you are designing your marine park think about what kinds of recreation activities might not fit in well with conserving certain types of marine animals.

Draw the boundaries of your new marine park on the map. Include some sanctuary zones within these boundaries (areas where you can't fish at all).

1. Which features did you include inside the park boundaries?

_____

_____

2. Which areas did you put inside sanctuary zones?

_____

_____

3. Why did you include these locations in sanctuary zones?

_____

_____

_____

4. Which features did you leave out of the park?

_____

_____

5. Why?

_____

_____

6. Would the whale breeding area be a good place to allow water skiing?

_____

_____

7. Why or why not?

_____

8. Would the sea lion nesting beach be a good place for fishing nets?

_____

_____

9. Why or why not?

_____

_____

10. Would you allow fishing in the whiting nursery area (this is where the smaller fish shelter from predators)?

_____

_____

11. Why or why not?

_____

_____

12. Suggest a name for your new marine park.

_____

13. Prioritise your zones in order of most protection for biodiversity to least protection for biodiversity.

_____

_____

Post your design on the wall and discuss and compare it with other students' designs.

Photo: John Huisman/DPaw

2. Rocky reef safari

Students complete a transect type study of a coastal limestone reef shelf for marine animals. Students identify what adaptations each animal has developed that enable it to survive in the areas where it is found.

Concepts

- Plants and animals develop the right adaptations to meet the prevailing conditions of their environment.
- Plants and animals are found in places where they are best adapted to survive.

Objectives

- To complete a transect type study.
- To identify adaptations an organism has developed to meet its prevailing environmental conditions.
- To understand that for living things to survive they must adapt to their environment.

Values

Students will understand the need to put marine organisms back in exactly the same places they were found.

Australian curriculum links

Science (Understanding):

- Year 4 Living things, including plants and animals, depend on each other and the environment to survive (ACSSU073) e.g. Survival in extreme environments – transect of rocky shores.
- Year 5 Living things have structural features and adaptations that help them to survive in their environment (ACSSU043) e.g. Survival in extreme environments – transect of rocky shores.
- Year 6 The growth and survival of living things are affected by the physical conditions of their environment (ACSSU094) e.g. Survival in extreme environments – transect of rocky shores.
- Year 4 Earth's surface changes over time as a result of natural processes and human activity (ACSSU075) e.g. Survival in extreme environments – transect of rocky shores.

Science (Human endeavour):

- Year 3/4 Science involves making predictions and describing patterns and relationships (ACSHE050) e.g. Survival in extreme environments – transect of rocky shores.
- Year 5/6 Science involves testing predictions by gathering data and using evidence to develop explanations of events and phenomena (ACSHE081) e.g. Survival in extreme environments – transect of rocky shores.

Science (Inquiry skills):

- Year 4 Safely use appropriate materials, tools or equipment to make and record observations, using formal measurements and digital technologies as appropriate (ACSIS066) e.g. Survival in extreme environments – transect of rocky shores.

- Year 6 With guidance, plan appropriate investigation methods to answer questions or solve problems (ACSIS103) e.g. Survival in extreme environments – transect of rocky shores.
- Year 5/6 Use equipment and materials safely, identifying potential risks (ACSIS105) e.g. Survival in extreme environments – transect of rocky shores.
- Year 5/6 Communicate ideas, explanations and processes in a variety of ways, including multi-modal texts (ACSIS110) e.g. Report on findings from transect of rocky shore.

Geography

- Year 7 *Unit 1* The classification of environmental resources and the forms that water takes as a resource (ACHGK037); the ways that flows of water connect places as it moves through the environment and the way this affects places (ACHGK038); the causes, impacts and responses to an atmospheric or hydrological hazard (ACHGK042) e.g. In the transition between the ocean and rocky shores, there are challenges to the living and non-living resources in this area. Survival in extreme environments – transect of rocky shores.
- *Unit 2* The factors that influence the decisions people make about where to live and their perceptions of the liveability of places (ACHGK043); the influence of environmental quality on the liveability of places (ACHGK045) e.g. In the transition between the ocean and rocky shores, there are challenges within that environment. Survival in extreme environments – transect of rocky shores.

Interpreting, analysing and concluding

- Year 5/6 Interpret geographical data and other information, using digital and spatial technologies as appropriate, and identify spatial distributions, patterns and trends, and infer relationships to draw conclusions (ACHGS037) e.g. Survival in extreme environments – transect of rocky shores.
- Year 7 Analyse geographical data and other information using qualitative and quantitative methods, and digital and spatial technologies as appropriate, to identify and propose explanations for spatial distributions, patterns and trends and infer relationships (ACHGS051) e.g. Survival in extreme environments – transect of rocky shores.
- Year 7 Apply geographical concepts to draw conclusions based on the analysis of the data and information collected (ACHGS052) e.g. Survival in extreme environments – transect of rocky shores.

Communicating

- Years 5-7 Present findings, arguments and ideas in a range of communication forms selected to suit a particular audience and purpose; using geographical terminology and digital technologies as appropriate (ACHGS053) e.g. Survival in extreme environments – transect of rocky shores.

Reflecting and responding

- Years 4-6 Reflect on their learning to propose individual and collective action in response to a contemporary geographical challenge and describe the expected effects of their proposal on different groups of people (ACHGS039) e.g. Survival in extreme environments – transect of rocky shores.

Mathematics

- Year 5 Pose questions and collect categorical or numerical data by observation or survey (ACMSP118) e.g. Survival in extreme environments – transect of rocky shores.

English

- Year 6 Identify and explain how analytical images like figures, tables, diagrams, maps and graphs contribute to our understanding of verbal information in factual and persuasive texts (ACELA1524) e.g. Report on Rocky Reef Safari, incorporating the use of or reference to tables, maps and graphs in the final report.
- Year 6 Use interaction skills, varying conventions of spoken interactions such as voice volume, tone, pitch and pace, according to group size, formality of interaction and needs and expertise of the audience (ACELY1816) e.g. Report on findings from transect of rocky shore.

- Year 7 Use a range of software, including word processing programs, to confidently create, edit and publish written and multimodal texts (ACELY1728) e.g. Construction of a reef transect safety plan.

Background information

The intertidal zone can be a difficult place for marine plants and animals to live. To survive they must be well adapted to resist the pounding of waves and exposure to the drying rays of the sun, and withstand considerable periods out of the water.

Some of the animals have adapted a strong muscular foot to hold them fast to the rocks when they are stationary or on the move (e.g. periwinkles, chitons, limpets). Some animals also have a hard shell for the dual purpose of protection against the forces of waves and also to resist moisture loss when exposed to the sun. Still other animals form a hard outer body to provide the same protection as shells.

On the intertidal rocky shore zone, marine life can be found in distinct areas on the rock. The species present are directly related to their level of adaptation to the slope of the rock and the exposure to waves and the sun.

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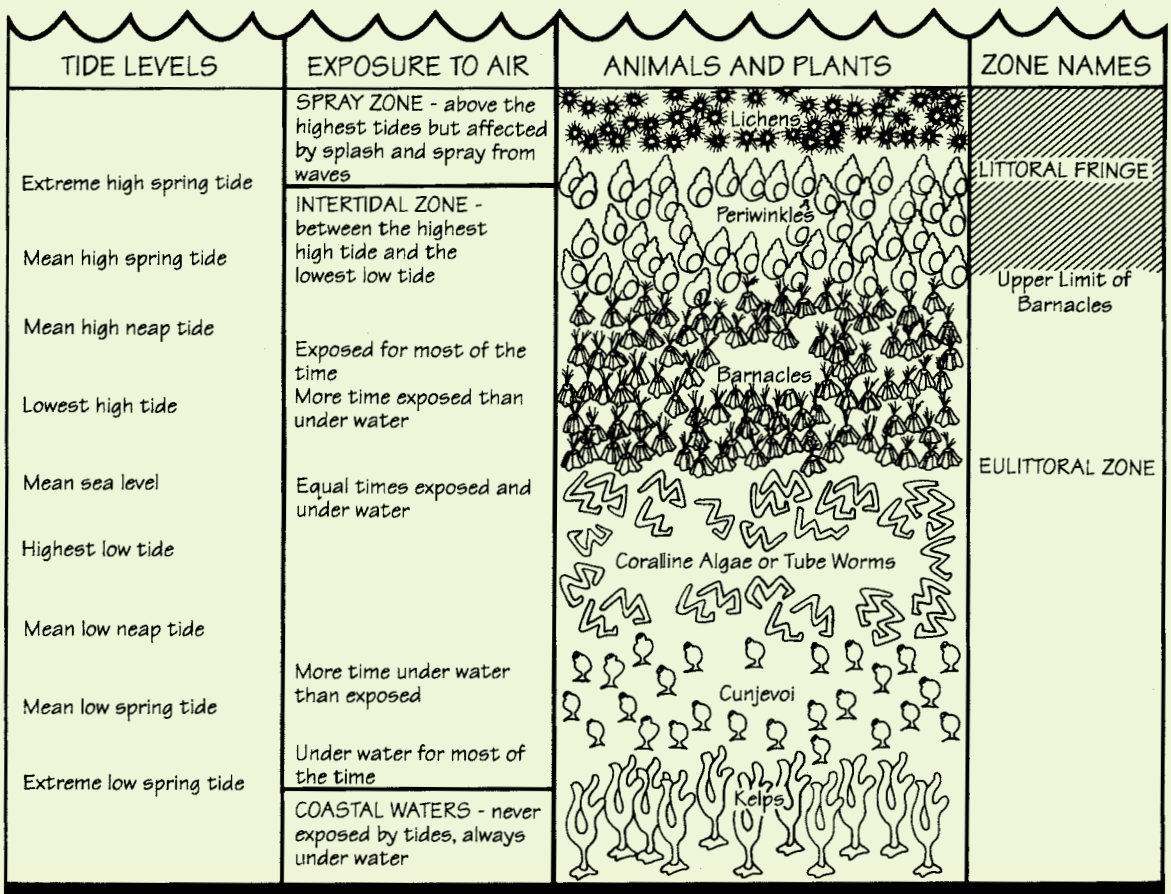


A general diagram of zonation on a typical rocky shore (not to scale)

Teacher directions

Materials

- ☐ **Clipboards**
- ☐ **Witch's hats (one per group)**
- ☐ **2 coat hangers (stretch the coat hangers out to a diamond shape)**

Lesson outline

Pre-excursion activity (Resource sheets 3 and 4)

Introduce to the students the creatures they are likely to see in the Rocky reef safari survey using Resource sheet 2. Describe the physical features of the reef platforms using Resource sheet 4. Have the students predict where certain marine creatures are likely to be found on the reef.

Excursion activity (Work sheet 3)

A suitable excursion site needs to have a wide rocky reef platform of about 20 metres or more in width and have a frontage of about 30 to 50 metres. It is best if the reef structure has small cliff faces or outcrops which would be covered at high tide or against which waves crash. The students to work in groups with each person being assigned a specific task (i.e. recorder, pacer, counter). At the excursion site place witch's hats about five metres apart along the high tide water mark. Start at the marker and work along a straight line for about ten metres towards the sea. At each witch's hat, put the two stretched coat hangers side by side. Count the number of different marine animals within the area framed by the coat hangers and record on Work sheet 3.

Student safety plan

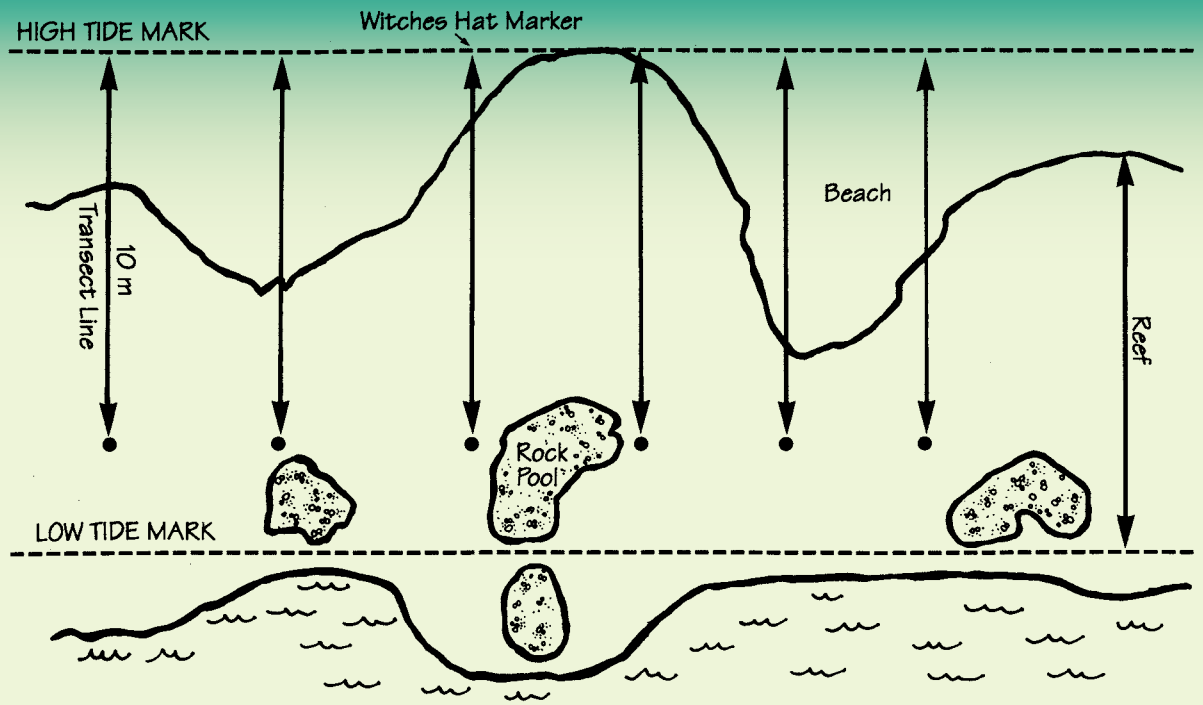
Brainstorm safety issues and draw up a safety plan. Ensure students include the need to check the Bureau of Meteorology website for weather conditions, including high winds, and mention the need to consider cancelling proposed field work in unsuitable weather and tide conditions.

Transect diagram

Progress towards the sea, stopping to carry out the survey at each paced interval. The figure of ten metres is only a suggestion. If shorter, allow for more surveys by shortening the pace interval (e.g. each half). Complete the transect and answer the focus questions on Work sheet 3.

Evaluation

- Were the students able to complete a transect study?
- Were the students able to recognise how each animal had adapted to suit its environment?
- Did the students understand that an animal evolves adaptations to suit its environment?



TRANSECT DIAGRAM

Complementary activities

Students could make models of a reef platform, showing the reef's physical features and the distribution of marine life.

TAKE CARE:
Have at least one member of the group watching the sea and waves at all times.

Photo: Cathy Zwick

Animals on the limestone reef

Photo: Carolyn Thomson-Dans

Limpets: Limpets are cone-shaped snails which anchor themselves to the reef by a large yellow muscular foot. Under the shell, they have antennae and a mouth that contains thousands of abrasive teeth. At high tide, limpets move slowly over the reef, grazing on tiny algae. At low tide, they tend to return to exactly the same spot that they left, each fitting its shell back into the tiny groove it made in the rock.

Photo: Gilbert Stokman

Mussels: Mussels attach themselves to the rocks by a net of anchor threads called a 'byssus'. They feed at high tide by opening up and filtering the water for microscopic plants and animals. At low tide, they protect themselves by closing their two shells.

Photo: John Huisman

Sea anemones: Most sea anemones are fixed to the reef by the base of the column of their bodies. They look like flowers, but are really animals. A sea anemone's mouth is surrounded by a ring of stinging tentacles which are used to catch and paralyse small sea creatures. Jellyfish are relations of anemones.

Photo: John Huisman

Dog whelks: Dog whelks are carnivorous molluscs that feed on mussels, barnacles and limpets. They have thick heavy shells to protect them from damage when tossed about by the waves. Their shells change colour depending on what they eat. They have a file-like tongue that can drill holes through shells with the aid of a special chemical, which helps to soften the shell as they drill. The drilling process can take up to three days.

Photo: Carolyn Thomson-Dans

Nerites: Nerites are molluscs that look similar to snails. They live on breakwaters and wet rocks.

Photo: John Huisman

Chitons: Chitons cling to rocks tightly by means of a single muscular foot, similar to that of a limpet. Unlike limpets, chitons have divided shells that fit together like armour. They move over rocks with a tiny wave-like movement of their muscular feet, feeding on algae as they go.

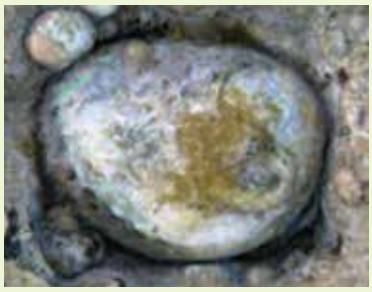


Photo: John Huisman

Abalone: The large muscular foot with which abalone move and cling to the rocks, is also highly prized as food. These molluscs feed on drifting algae and seagrass.

Photo: Mark Westera

Barnacles: Barnacles are often found in large colonies on the rocks. When the tide is in, their feathery tentacles filter out plankton from the water.

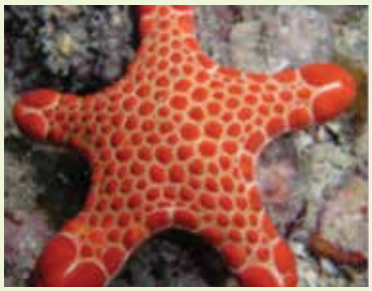


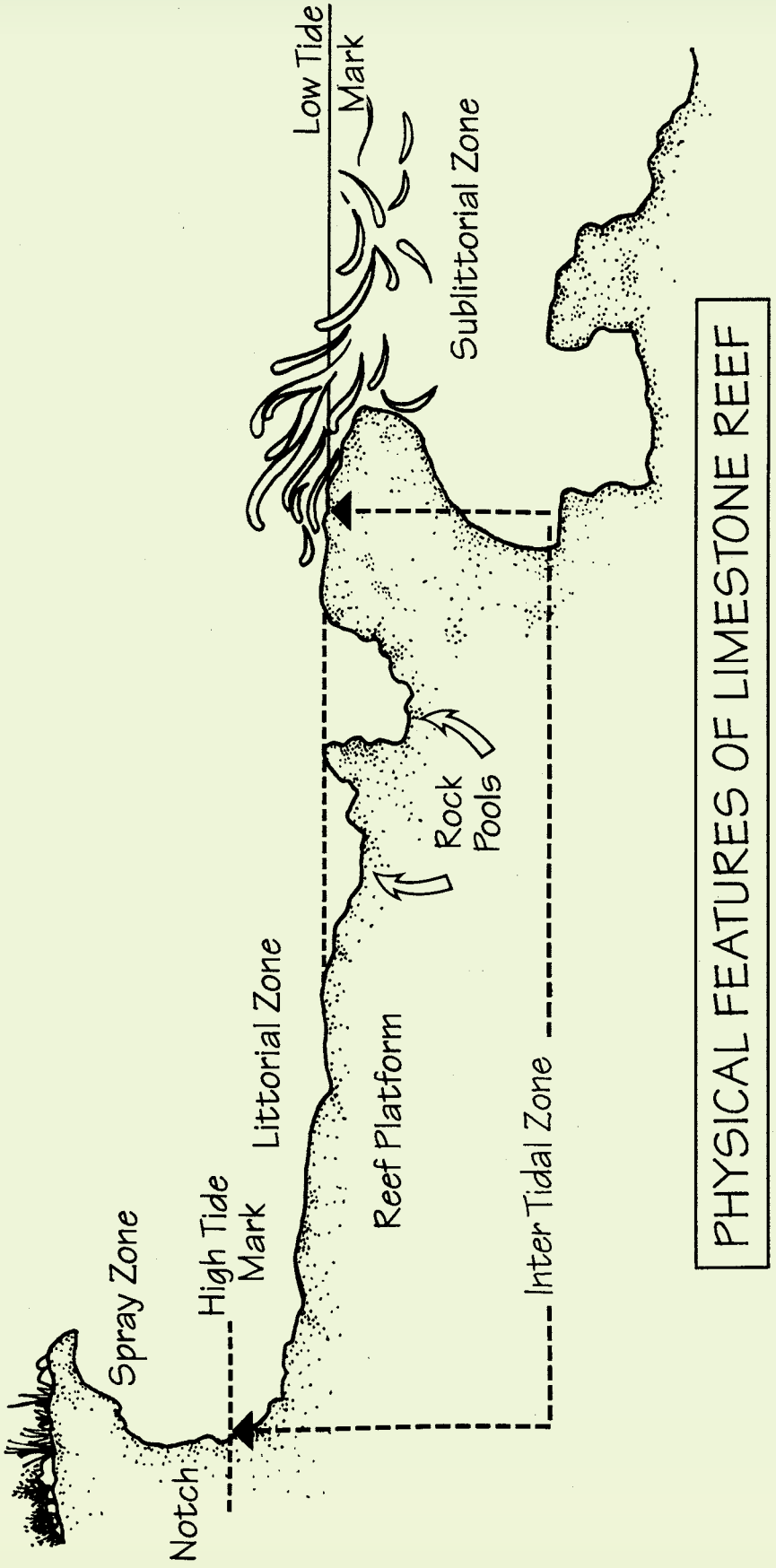
Photo: Kevin Crane

Sea stars: When the tide is out, sea stars hide under rocks. When the tide is in, they leave the shelter of the rocks and search for food. They have hundreds of tiny tube feet on the underside of each arm that enable them to move. If an arm is broken off, a whole new animal can grow from the severed arm. Most sea stars are predators, prising open the shells of different creatures with their arms. They then expel their stomachs onto the shellfish, digest the flesh, then return their stomachs through their mouths.

Photo: John Huisman

Sea urchins: have an external shell, known as a test, that is often found washed up on the beach after the animal has died and the spines have been broken off. Sea urchins are most common in intertidal habitats and on shallow reefs. These animals are closely related to sea stars, sharing the same five-fold symmetry, and they too move about on hundreds of tube feet. Sea stars and sea urchins are from a group known as echinoderms, a word meaning 'spiny skins'. Sea urchins use their teeth to scrape up kelp and other forms of seaweeds that form the bulk of their diet.

Physical features of the limestone reef



Work sheet 3

Name _____

Date _____

Rocky reef safari

Location _____

Survey time Start _____ Finish _____

REEF SECTION	HABITAT	PERIWINKLES	LIMPETS	CHITONS	DOG WHELKS	BARNACLES	ABALONE	MUSSELS	CRABS	SEA ANEMONES	SEA URCHINS
Spray zone (above the high tide mark)	Notch										
Intertidal zone (between the high tide mark and low tide mark)	Reef platform										
	Rock pools										
Sub littoral zone	Shallow submerged reef										

Use these questions to help you analyse your survey:

1. Which marine creature was found the most?

_____

2. On which part of the reef was it most commonly found?

_____

3. Which animal was found the least?

_____

4. Where was it seen the most?

_____

5. Which habitat contained more different creatures than any others?

_____

6. Why do you think this was so?

_____

_____

7. Which marine creature was most abundant in the intertidal zone?

_____

_____

8. What adaptations did this creature need to have to survive so well in the intertidal zone?

_____

_____

9. Which marine animals were found in nearly every habitat of the survey?

_____

10. List the special features these creatures have in common with each other.

_____

_____

11. What special features do marine creatures need to have to survive on the rocky reef platform environment?

_____

_____

Write a conclusion or give a summary of your findings.

_____

_____

Write a brief report including your results and conclusion. Write some recommendations for 1. a marine scientist, 2. a fisherman specialising in shellfish. Ensure that a conservation recommendation is included in both of these.

3. What's that shell?

Students fossick on the beach looking for as many different shells as they can find, then classify them in as many ways as possible. This is an enjoyable way to become familiar with the shells on the beach and their many characteristics.

Concepts

- A large diversity of shell types is found on the coastline.
- The numbers and kinds of shells found on the beach habitat being explored will be affected by the adjacent marine habitats.

Objectives

Students will be able to:

- collect and record the types of shells found on a sandy beach
- classify the shells according to the selected criteria
- name the shells collected and identify them as either gastropods or bivalves.

Values

Shells can be homes for many sea animals and must not be removed from the beach.

Australian curriculum links

Science (Understanding):

- Year 3 Living things can be grouped on the basis of observable features and can be distinguished from non-living things (ACSSU044) e.g. Different types of shells can used to classify different types of shellfish (molluscs).
- Year 4 Living things, including plants and animals, depend on each other and the environment to survive (ACSSU073) e.g. Numbers of shells/molluscs will be affected by the marine habitat.
- Year 5 Living things have structural features and adaptations that help them to survive in their environment (ACSSU043) e.g. Numbers of shells/molluscs will be affected by the marine habitat.
- Year 6 The growth and survival of living things are affected by the physical conditions of their environment (ACSSU094) e.g. Numbers of shells/molluscs will be affected by interactions with the marine habitat.
- Year 7 There are differences within and between groups of organisms; classification helps organise this diversity (ACSSU111) e.g. Different types of shells can used to classify different types of molluscs.

Science (Human Endeavour)

- Year 5/6 Scientific knowledge is used to inform personal and community decisions (ACSHE217) e.g. Ecology of rock pools, intertidal zones and marine parks can be altered by human activity.

Geography

- Year 5 The influence of people, including Aboriginal and Torres Strait Islander peoples, on the environmental characteristics of Australian places (ACHGK027) e.g. Human activity affects oceans. We can make a pledge to protect oceans and shores.

- Year 7 *Unit 1* The classification of environmental resources and the forms that water takes as a resource (ACHGK037); the ways that flows of water connect places as it moves through the environment and the way this affects places (ACHGK038); the causes, impacts and responses to an atmospheric or hydrological hazard (ACHGK042)
  - e.g. Human activity affects oceans. We can make a pledge to protect oceans and shores and develop a code of conduct.
- *Unit 2* The factors that influence the decisions people make about where to live and their perceptions of the liveability of places (ACHGK043); the influence of environmental quality on the liveability of places (ACHGK045) e.g. Human activity affects oceans. We can make a pledge to protect oceans and shores and develop a code of conduct.

Mathematics

- Year 4 Select and trial methods for data collection, including survey questions and recording sheets (ACMSP095) e.g. Collect and record types of shells.
- Year 4 Construct suitable data displays, with and without the use of digital technologies, from given or collected data. Include tables, column graphs and picture graphs where one picture can represent many data values (ACMSP096) e.g. Collect and record types of shells.

Background information

Shells belong to a group of animals called molluscs. Mollusca, meaning 'soft body', is one of the largest groups of the animal world and can be found in marine and freshwater environments. The shells that we commonly find on the beach are from one of two groups, gastropods or bivalves.

Bivalves are made up of two parts, joined by a hinge of interlocking teeth, with a tough ligament holding the two parts together. Some of the common bivalves are clams, scallops, oysters, cockles and mussels. You may see two siphon tubes of a bivalve protruding just above the sand. These tubes are used for breathing and feeding.

Gastropoda, meaning 'stomach foot,' include abalone, tritons, periwinkles, limpets, cowries, whelks, turbans, the common garden snail, and a range of animals without shells, including the common garden slug and a range of sea slugs. Most gastropods have a single spiral shell, which is why they are sometimes referred to as univalves. They have a head which includes a pair of tentacles and a pair of eyes on or at the base of the tentacles.

Shell shapes are adapted to help the animals live in specific environments. The wedge-shape of some shells allows the animal to burrow in the sand easily. Some shells, which are streamlined and quite flat in shape, help the animal to stay attached to rocks that are subject to turbulent conditions. Many shells are spiral-shaped, which allows for the growth of the animal without it needing to a find a new home. These are just a few of the variations in shells.

References

www.marineparks.dpaw.wa.gov.au/fun-facts

Beachcombers guide to south-west beaches, Department of Parks and Wildlife

Photo: John Huisman/DPaW

Teacher directions

Materials

- ☐ **Shell identifier (Resource sheet 5, Work sheet 4)**
- ☐ **Bags or buckets for collecting shells**

Lesson outline

Pre-excursion activities

Using the shell identification key (Resource sheet 5) students become familiar with the various types of shells common to the coast.

Excursion activity

Students divide into small groups and collect 100 shells per group. Whole, undamaged specimens are best as they are easier to classify and study.

Remember

Shell collecting is a fascinating activity but always follow these simple steps:

- Only collect shells that do not have an animal living in them.
- Limit the number of shells you take as a variety of marine creatures use empty shells as their homes.
- Return shells to the beach when you have finished with them.

Students use Work sheet 4 to sort the shells and put five in each category according to:

- size (smallest to largest)
- colour (lightest to darkest)
- shape (circular, spiral, elongated, symmetrical)
- texture (rough, smooth)
- patterning
- type (gastropod, bivalve)
- student's own choice.

1. Discuss which form of classification would be the most useful for the average shell collector to use. Give reasons for the choice.
2. Students use Resource sheet 5 to identify their shells and classify them as either bivalves or gastropods.
3. Look at the variety of shell shapes. Suggest reasons why the shapes are different and what advantages the shapes have for the molluscs such as protection from predators or camouflage.
4. Discuss ways the various molluscs may obtain their food. Would they move around or are they stationary? Do they bury themselves in sand or are they found on the reef? How could these factors affect the shell shapes?
5. Create a beach display of the shells collected complete with identification and classification.

Evaluation

- Did the students classify shells into two groups using a variety of criteria?
- Did the students identify their shells by name?
- Did the students classify the shells as either bivalves or gastropods?

Complementary activities

This activity can also be done in conjunction with the Rocky reef safari activity in this package (Work sheet 3).

After completing this activity, students can use what they have learnt to include various shell shapes into the diorama created in the Creature feature activity in this package (Work sheet 7).

Students look for growth lines on a variety of shells. Separate the shells according to those which you think are very old and those that are very young.

Design a shell. Imagine you are a creature living in the sea. Design an original shell which will give you protection, ease of movement and room in which to grow.

Make a shell fossil. You will need modelling clay or plasticine, paper cups and plaster of paris. Half fill the cup with the modelling clay and press a selected shell into the clay to make an impression. Remove the shell and add the plaster of paris. When dry, remove the paper and separate the clay from the plaster.

Using the shell shapes found on the beach, create a design that can be made into a lino print, string print or silk screen print, and which can then be put onto either paper or material in art class. This can be extended to printing T-shirts or other articles of clothing.

Photo: Gilbert Stokman

Gastropods

Photo: Gilbert Stokman

Abalone: Flattish ear-shaped shell with a low, off-centre spire and large body whorl. A row of respiratory holes is found on the side of the shell. The shell often has a rough, pinkish exterior, but the inside layer is very beautiful, with a pearly texture and lustrous silvery appearance.

Photo: Carolyn Thomson-Dans

Limpet: Cone-shaped snails, which anchor themselves to the reef by a muscular foot. At high tide, limpets move slowly over the reef, grazing on tiny algae. At low tide, they tend to return to exactly the same spot that they left, each fitting its shell back into the tiny groove it made in the rock.

Photo: Dave and Fiona Harvey

Top shells: Small, conical shell that is circular on the bottom. Mostly found in shallow water.

Photo: Gilbert Stokman

Turban shells: Medium to large in size and generally heavy. Found in shallow water. The shell is rough, heavy greyish-white or greenish-brown. The spire of the shell is quite low and flattened, and there are raised, angular ridges around the whorl. It can reach a length of nine centimetres across.

Photo: Gilbert Stokman

Pheasant shells: Rounded with few whorls, a moderate spire and a smooth outer surface, and attractively patterned.

Photo: Carolyn Thomson-Dans

Nerites: Black nerites have a thick shell, which is black, matt and rounded with a white, flattened spire. The opening is semi-circular and has a white rim. The operculum is also a semi-circle. The shells measure less than three centimetres long. They live mainly on rocky shores.

Photo: Dave and Fiona Harvey

Coneshells: The huge number of species of coneshell are found in a great variety of decorative patterns and vary greatly in size. Some species of coneshell are venomous and can shoot out a venomous barb that can paralyse their prey (or people trying to collect them).

Photo: Gilbert Stokman

Cowries: Known for their highly polished shells, which usually have delightful colours and patterns. The upper side is beautiful rounded oval shape. On the bottom is an opening slit that extends for the length of the shell.

Photo: Pam Sutton

Screw shells: Long, tapering shell with up to 25 whorls and a small rounded opening.

Photo: Gilbert Stokman

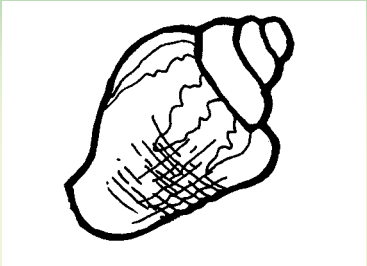
Creepers: Shell size can vary. A large spire and a long, often curved, anterior siphon and small opening.

Photo: Pam Sutton

Wentletraps: Small, generally white and high spired, with numerous whorls and strong ribs. Found in shallow, sandy areas along with sea anemones, on which they feed.

Photo: Dave and Fiona Harvey

Triton shells: Range from small to large in size with solid shells and pronounced varices, which are never spiny. The operculum is brown and horny with the opening either rounded or oval.

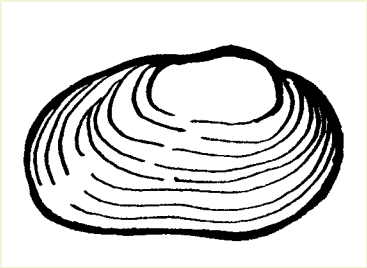


Dove shells: Small, heavy shells that are smooth or with a spiral rib, and a very narrow opening (aperture). They live among seaweeds and seagrasses.

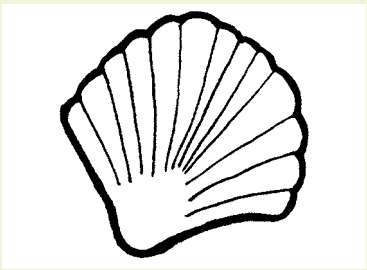
Photo: Gilbert Stokman

Dog whelks: Small with a medium to high spire, often with a pronounced sculpture. They are common on intertidal and subtidal sand and mud.

Bivalves



Ark shells: Small to large in size and elongated. Valves are equal and often almost rectangular in shape. They are common in intertidal and subtidal rocks and sand.



Dog cockles: Usually medium to large in size. Valves are equal and almost circular, fitting tightly together. Usually found in fairly shallow, sandy areas.

Mussels: A typical mussel shell is inequilateral with the anterior side short. Generally found in shallow water, forming dense beds on rocky shores, jetty piles and boat hulls.

Photo: Dave and Fiona Harvey

Scallops: Scallops typically have rounded or fan-shaped shells. Depending on the species, they tend to be purple, pink, orange or white in colour. They often have strong ribs that radiate from the centre of the straight hinge, which forms wings on either side of the 'fan'. They are usually found lying on the sandy bottom in shallow water.

Photo: Pam Sutton

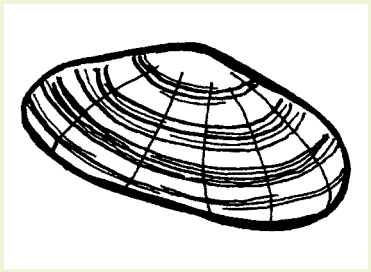
Oysters: Medium to large in size with a heavy shell, which can vary its shape to fit the area in which they live. They are commonly found in large numbers on intertidal rocks.

Photo: Dave and Fiona Harvey

Cockles: Sizes range from small to large. Valves are almost circular and equal. Found burrowed in shallow sand and mud.

Photo: Pam Sutton

Trough clams: Medium to large in size, almost triangular or oval in shape, with equal valves and a smooth or ribbed outer surface.



Tellins: Size ranges from small to large. Egg shaped or oblong, with thin flattened, brightly coloured valves. They live in shallow, sandy areas, lying just below the sand surface with only their siphons showing.

Photo: Pam Sutton

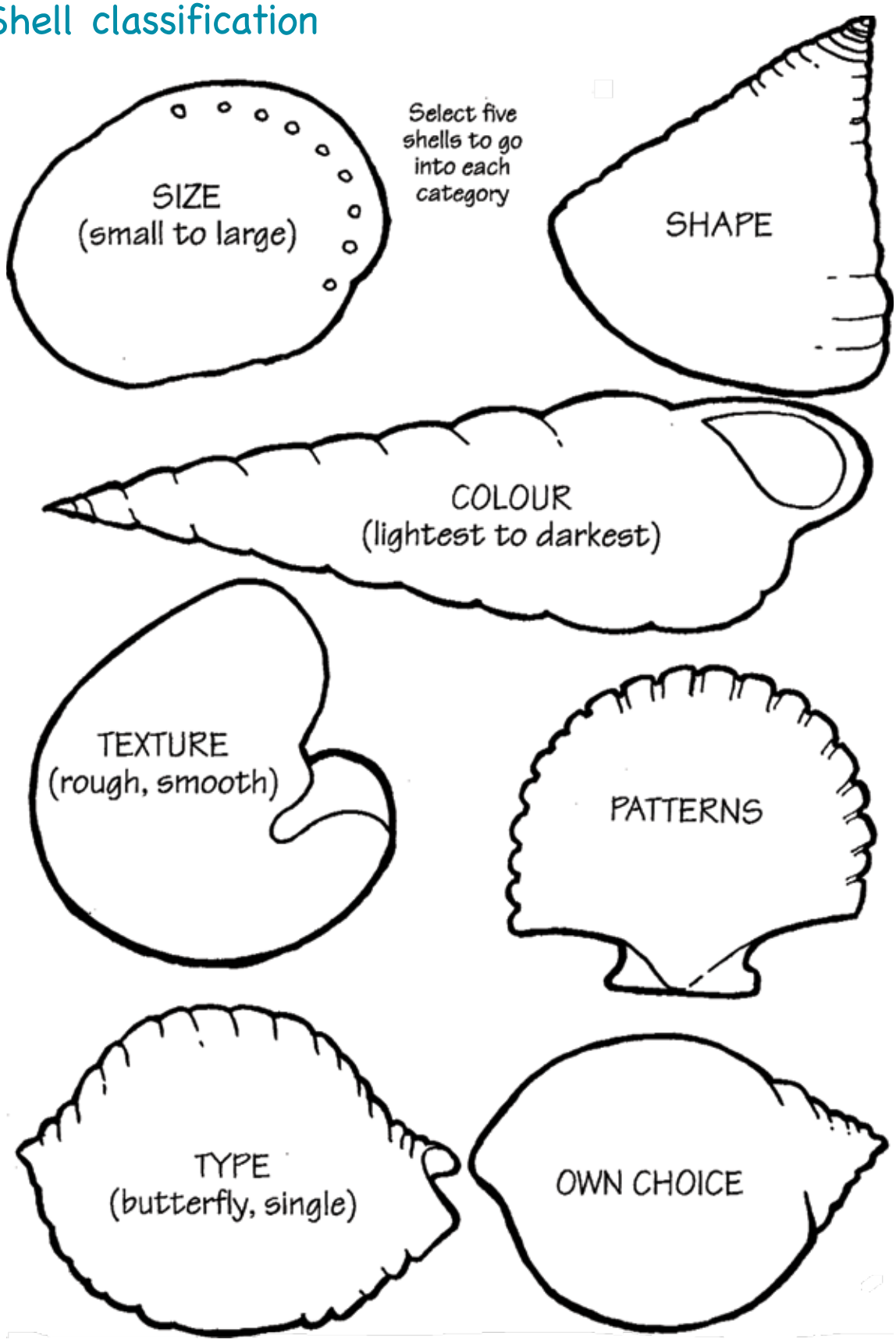
Pipis: Small to medium in size, wedge-shaped, flattened, with equal valves. They are abundant in the surf zone of sandy beaches, lying just below the sand surface.

Work sheet 4

Name _____

Date _____

Shell classification



4. Hopping rock pools

This is an excursion-based activity, studying the marine plants and animals of the rock pool ecosystem, and focusing on constructing food chains and food webs.

Concepts

- Ecology is the study of organisms in relation to the living and non-living parts of their environment.
- Food chains and food webs are diagrammatical representations of the feeding relationships between living organisms within an ecosystem.
- Conserving the marine ecosystem involves preserving the relationships between the organisms that nature has established.

Objectives

- To construct food chains of organisms found in a rock pool ecosystem.
- To construct a food web of organisms found in rock pool ecosystem.
- To recognise that changes will occur within an ecosystem if the food web relationship between organisms is altered.

Values

Students will recognise the importance of preserving feeding relationships between marine animals.

Australian Curriculum Links

Science (Understanding):

- Year 4 Living things, including plants and animals, depend on each other and the environment to survive (ACSSU073) e.g. Relationships in a rock pool – simple feeding relationships/foodchain.
- Year 6 The growth and survival of living things are affected by the physical conditions of their environment (ACSSU094) e.g. Food and other relationships can be altered with changes in the environment of a rockpool.
- Year 7 There are differences within and between groups of organisms; classification helps organise this diversity (ACSSU111) e.g. A variety of named organisms are identified in rock pools.
- Year 7 Interactions between organisms can be described in terms of food chains and food webs; human activity can affect these interactions (ACSSU112) e.g. Food chains and food webs of a rock pool and seashore; Producers (autotrophs), herbivores, carnivores, detritivores (heterotrophs) can be identified in rock pools.

Science (Human Endeavour)

- Year 5/6 Scientific knowledge is used to inform personal and community decisions (ACSHE217) e.g. Ecology of rock pools, intertidal zones and marine parks can be altered by human activity.

Science (Inquiry skills)

- Year 4 Safely use appropriate materials, tools or equipment to make and record observations, using formal measurements and digital technologies as appropriate (ACSIS066) e.g. Measurement of different aspects of rock pools.

- Year 5/6 Use equipment and materials safely, identifying potential risks (ACSIS105) e.g. Measurement of different aspects of rock pools.
- Year 5/6 Communicate ideas, explanations and processes in a variety of ways, including multi-modal texts (ACSIS110) e.g. Verbal report with description of process and evidence, describing the organisms and food chains of a rock pool.

Geography

Communicating

- Year 5-6 Present findings and ideas in a range of communication forms, including written, oral, graphic, tabular, visual and maps; using geographical terminology and digital technologies as appropriate (ACHGS038) e.g. Share findings of the rockpool survey.
- Year 7 Present findings, arguments and ideas in a range of communication forms selected to suit a particular audience and purpose; using geographical terminology and digital technologies as appropriate (ACHGS053) e.g. Share findings of the rockpool survey.

English

- Year 6 Use interaction skills, varying conventions of spoken interactions such as voice volume, tone, pitch and pace, according to group size, formality of interaction and needs and expertise of the audience (ACELY1816) e.g. Verbal report with description of process and evidence, describing the organisms and food chains of a rock pool.

Background information

An ecosystem can be defined as a community of living organisms (different species of living plants and animals) interacting with each other and with their non-living surroundings (air, water, soil, waves, currents, sunlight) in a defined space (e.g. rock pool, rainforest, wetland).

Permanent rock pools are essentially self-contained ecosystems. They provide excellent opportunities to discover, appreciate and understand the ecology of marine life.

The interaction that exists between different organisms within a community of different plants and animals is quite varied. One of the most obvious examples of this interaction is the feeding relationship.

In the rock pool there are the plant organisms that produce their own food through photosynthesis. These organisms are called 'producers' or 'autotrophs'. Other living organisms feed on plants and are called 'herbivores', while those that feed on other animals are called 'carnivores'. There are also animals that feed on both plants and animals. They are called 'omnivores'. Finally, there are a whole range of other organisms, both plant and animal, which break down dead organic matter. These are known as 'detritivores'. Herbivores, carnivores, omnivores and detritivores are collectively known as 'consumer organisms' or 'hetrotrophs'.

A single array of organisms feeding on each other is called a 'food chain'. In many cases, consumer organisms feed on several different food sources. A network diagram showing the complex feeding relationships within an ecosystem is called a food web.

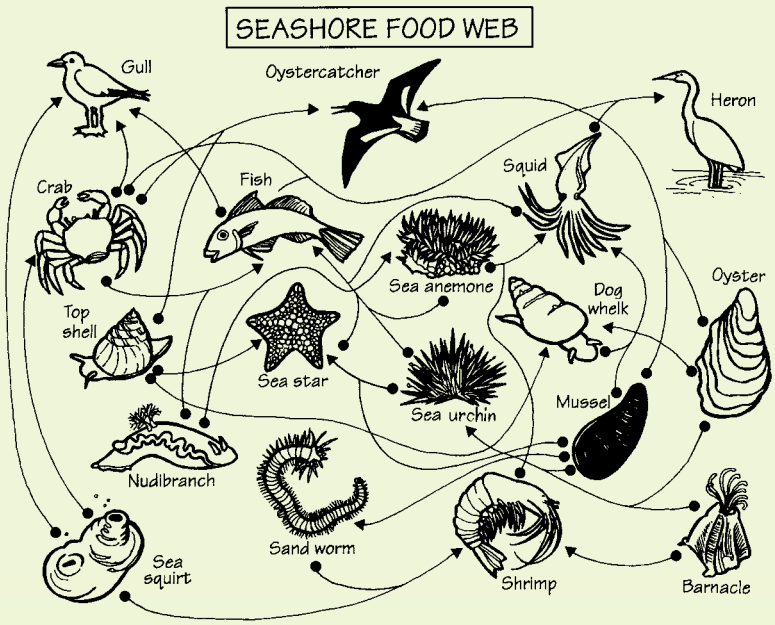


Diagram of a marine food chain

→ Algae → mussel → sand worm → shrimp → squid → fish → gull

The relationships between organisms extend beyond important feeding relationships. For example: marine plants (producers) provide food for herbivores and contribute significantly to the oxygen content of the water. They also help maintain temperature levels and provide places of refuge.

The removal of a plant or an animal due to pollution or overfishing, for example, can have a wider destabilising effect that extends right through the food web of an ecosystem.

References

Teacher directions

Materials

- ☐ **Scoop net**
- ☐ **Clipboard**
- ☐ **Resource sheets (seaweeds, sea animals)**
- ☐ **Thermometer attached to a string and weight**
- ☐ **Ice-cream containers**
- ☐ **Plastic cling wrap**
- ☐ **Cutting knives**
- ☐ **Box of good quality elastic bands**

Lesson outline

Pre-excursion activity

Viewing containers will be used on this excursion. They can be made by cutting out the bottom of an ice-cream container, and covering the opening and the sides of the ice-cream container with plastic wrap and securing it with elastic bands.

Develop a food chain and food web for an animal with which the students are familiar (e.g. mouse, skink, frog, magpie). What will happen when one or more members are removed from the food chain and food web? Explain the term 'ecosystem' using a rock pool as an example.

Excursion activity (Work sheets 5 and 6)

Divide students into small groups and assign each a rock pool.

Measure the depth of the rock pool using the weighted string and rule.

Attach a thermometer to the string and measure the surface (top 15 centimetres) and bottom temperatures of the rock pool. The students estimate the dimensions of the rock pool. Record the measurements on Work sheet 5.

Complete a survey of all the plants and animals in the rock pool using Work sheet 5.

Move back to shore and, using Work sheet 6, construct a food chain diagram of one of the consumer organisms. Decide, based on its features, whether it is an omnivore, herbivore, detritivore, or carnivore.

Construct a food web of the rock pool, including as many of the organisms that were recorded as possible.

Study and/or discuss the food chain and food web diagrams in light of the focus questions on Work sheet 6.

Evaluation

- Were the students able to complete the survey accurately?
- Are the students able to construct accurate and clear food chain and food web diagrams?
- Do the students understand the significance of preserving established feeding relationships in marine ecosystems?

Complementary activities

Construct food web models.

Photo: DpaW

Work sheet 5

Name _____

Date _____

Rock hopping

ROCK POOL

Dimensions (estimate) _____

Maximum depth _____

Temperature – bottom _____ **surface** _____

Plant name	Colour

Animal name	H	C	O	D

H – Herbivore C – Carnivore O – Omnivore D – Detritivore

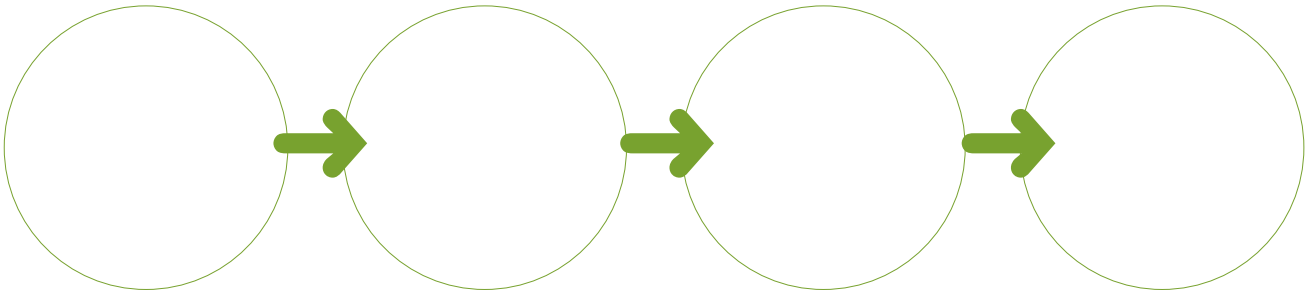
Work sheet 6

Name _____

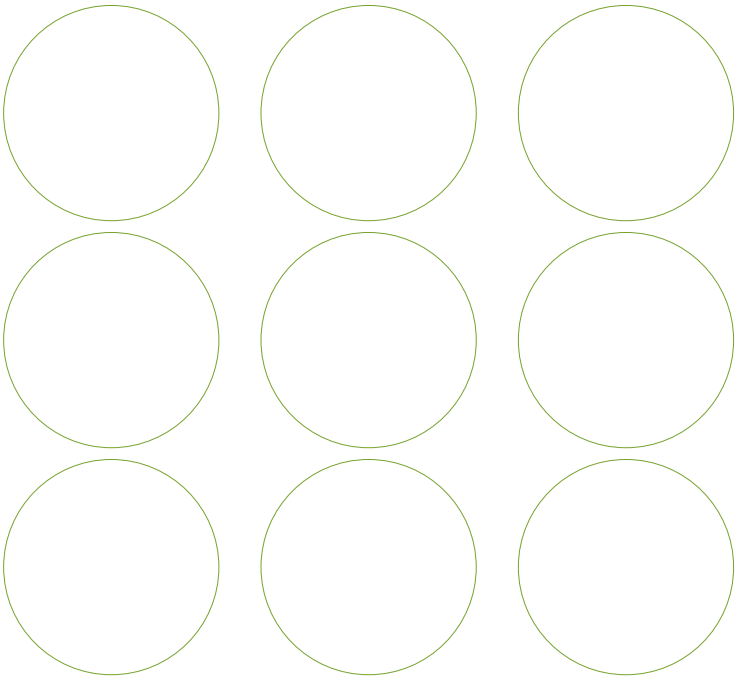
Date _____

Rock pool food chains

Construct a food chain for one of the marine animals.



Construct a food web diagram of the rock pool. (Mark in the arrows.)



What animals would be likely to die in the rock pool if all the seaweeds (algae) in the rock pool were destroyed by pollution?

_____

_____

What would be the effect on the other animals in the food web of the rock pool if all the meat eating animals were destroyed by chemical pollution?

_____

_____

5. Creature feature

Students construct a 3D model or diorama of a rock pool environment and create and describe their own rock pool marine creature.

Concepts

Marine plants and animals have evolved and adapted to suit the conditions of their environment.

Objectives

- To construct a 3D diorama of a rock pool environment.
- To create a marine animal creature that inhabits the rock pool.
- To understand how marine creatures adapt to a rock pool environment.

Values

The diversity of marine life needs to be preserved.

Australian Curriculum Links

Science (Understanding):

- Year 3 Living things can be grouped on the basis of observable features and can be distinguished from non-living things (ACSSU044) e.g. Make your own creature.
- Year 4 Living things, including plants and animals, depend on each other and the environment to survive (ACSSU073) e.g. Create a rock pool environment diorama and make up a creature able to live there.
- Year 5 Living things have structural features and adaptations that help them to survive in their environment (ACSSU043) e.g. Make up a creature that can live in a rock pool.
- Year 6 The growth and survival of living things are affected by the physical conditions of their environment (ACSSU094) e.g. Construct a creature that can live in the extreme environment of a rock pool.
- Year 7 Interactions between organisms can be described in terms of food chains and food webs; human activity can affect these interactions (ACSSU112) e.g. Create a creature that can live in a rock pool, and food chains that it may be part of.

Background information

Rock pools are essentially self-contained ecosystems that are isolated on the limestone reef platform for periods of time between tidal shifts. Rock pools can range in size and depth from minor puddles to large, deep pools.

On average, rock pools are recharged with sea water, nutrients and sea life twice a day with tidal movements.

The marine life that inhabit these rock pools have evolved characteristics that help them to survive and reproduce in their rock pool environment.

References

Gunzi, C. (1992) *Rock Pool.* Angus and Robertson, NSW.

Teacher directions

Materials

- ☐ **Cardboard boxes of various sizes**
- ☐ **Art and craft material (such as paint, paper, egg cartons, string and sponges)**

Lesson outline (Work sheet 7)

Discuss the rock pool ecosystems of coastal reefs. Include the range of creatures that live there, the conditions which make life difficult, and the characteristics or adaptations made by various organisms to survive and thrive in such an environment.

In small groups, students construct 3D diorama models of a rock pool ecosystem, using various art and craft material resources. Encourage creativity by folding and shaping paper and using a range of materials to create marine life and 3D effect.

Each group should create a rock pool marine animal and place a model of it in the diorama. The creature may be based on a known marine animal and modified to make it unique, but still suitable for the rock pool ecosystem.

Complete Work sheet 7, describing how the creature is well adapted to surviving in the rock pool environment. The description should extend to what it eats and what eats it. Include a diagram of the creature's food chain and where it fits into the rock pool's food web.

The students present their creatures and dioramas to the class.

Evaluation

- Were the students able to construct a quality 3D diorama of the rock pool ecosystem?
- Were the students able to create an imaginative rock pool marine creature?
- Were the students able to describe their creature, detailing clearly how the creature had adapted to living in the rock pool environment?

Complementary activities

Present diorama as a mini marine park by producing an accompanying information pamphlet.

Make large model marine creature mobiles.

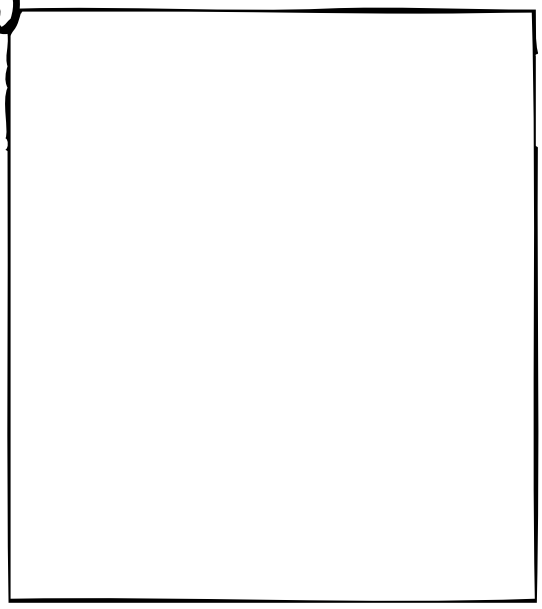
Photo: John Huisman/DPaW

Work sheet 7

Name _____

Date _____

Creature Feature



Name of creature

Identification profile

Size: _____

Colour patterns: _____

_____

_____

How does it move? _____

_____

_____

What does it eat? _____

_____

Who are its predators? _____

_____

Active at night or day? _____

_____

What are its special features?
(e.g. sting, poisons, sonar, suckers, claws, tentacles, shell,...)

_____

_____

_____

6. Conservation code

Students write their own pledge to conserve the marine environment.

Concepts

- Conservation of the natural environment is everyone's responsibility.
- Limestone reefs have unique conservation values.
- Conservation codes are necessary to define the behaviour required to protect and preserve the marine environment.

Objectives

- Students will produce a pledge and conservation code for the coast.
- Students will list human activities that are having a harmful effect on the limestone coastal reef environment.
- Students will put their conservation code into practice whenever they visit the coast.

Values

The community needs to be active in helping to conserve marine environment.

Australian Curriculum Links

Science (Understanding):

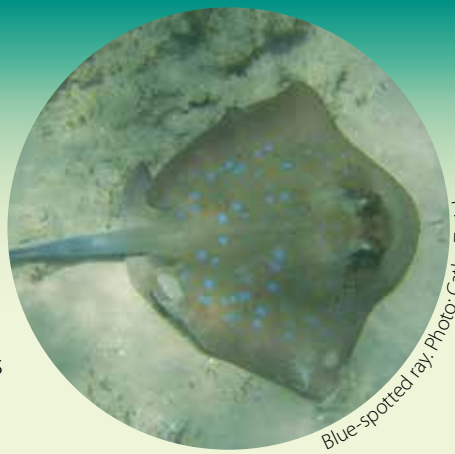
- Year 4 Living things, including plants and animals, depend on each other and the environment to survive (ACSSU073) e.g. The seas and oceans are so important that we can make a pledge to protect them.
- Year 6 The growth and survival of living things are affected by the physical conditions of their environment (ACSSU094) e.g. There are multiple human impacts on marine environments. Personal commitment and protection can be in the form of a pledge.
- Year 4 Earth's surface changes over time as a result of natural processes and human activity (ACSSU075) Human activity affects oceans. We can make a pledge to protect oceans and shores.

Science (Human endeavour):

- Year 3/4 Science knowledge helps people to understand the effect of their actions (ACSHE062) e.g. Human activity affects oceans. We can make a pledge to protect oceans and shores.
- Year 5/6 Scientific knowledge is used to inform personal and community decisions (ACSHE217) e.g. Human activity affects oceans. We can make a pledge to protect oceans and shores.
- Year 7 Science and technology contribute to finding solutions to a range of contemporary issues; these solutions may impact on other areas of society and involve ethical considerations (ACSHE120) e.g. Human activity affects oceans. We can make a pledge to protect oceans and shores and develop a code of conduct.

Geography

- Year 5 The influence of people, including Aboriginal and Torres Strait Islander people, on the environmental characteristics of Australian places (ACHGK027) e.g. Human activity affects oceans. We can make a pledge to protect oceans and shores.


Blue-spotted ray. Photo: Cathy Zwick

Reflecting and Responding

- Years 4-6 Reflect on their learning to propose individual and collective action in response to a contemporary geographical challenge and describe the expected effects of their proposal on different groups of people (ACHGS039) e.g. Human activity affects oceans. We can make a pledge to protect oceans and shores.

English

- Year 6 Plan, draft and publish imaginative, informative and persuasive print and multimodal texts, choosing text structures, language features, images and sound appropriate to purpose and audience (ACELY1704) e.g. Make a written pledge to protect oceans and shores.

Background information

More than 80 per cent of Western Australia's population is concentrated along our coast. The advent of four-wheel-drive vehicles and small pleasure craft has opened up our massive coastline to recreational pursuits as never before. This has placed enormous pressure on our coastal environment and on conservation management practices.

The level of human impact on the coastal marine environment can be so severe that government management bodies have found the need to implement special laws and regulations to ensure the preservation of our marine environment. For instance, in Western Australia there are specific catching limits, or bag limits, for recreational species of fish, molluscs such as abalone, and crustaceans such as rock lobster.

The community can help by adopting appropriate codes of behaviour that aim to conserve our marine environment in practical and important ways.

The special value of conservation codes is that they are motivated and imposed by the community itself wanting to protect and preserve the coastal marine environment.

Teacher directions

Materials

☐ **Work sheet 8**

Lesson outline

Discuss conservation of the marine environment, and ask students to discuss examples of conservation in action.

List the human activities that are having destructive impacts on our marine environment. Identify which human activities have a harmful effect on coastal limestone reef systems. Refer to newspaper articles and magazines to highlight current issues.

Discuss the conservation code on page 3. What is the value of this type of action in promoting conservation?

List the issues a pledge and conservation code would need to address to promote behaviour that aims to protect coastal limestone reef systems.

Develop a pledge and conservation code that would help protect your local marine environment (Work sheet 8).

Use the pledge as the basis for the code of behaviour of the class on all excursions.

Evaluation

- Do the students understand the meaning of the term conservation?
- Were the students able to produce an effective pledge and conservation code for limestone reef environment?
- Were the students able to identify and list human activities that threaten the quality of limestone reefs?

Complementary activities

The conservation code could complement the Creature feature activity (Work sheet 7).

Visit a marine park or marine nature reserve – see map on page 7 (remember to watch for changing weather, look out for waves and abide by the conservation code on page 2).

Invite a Department of Parks and Wildlife officer to speak to the class about marine parks and marine conservation.

Make badges with the conservation pledge printed on it.

Find out the bag limits for particular species of commercial fish, molluscs and crustaceans.

Work sheet 8

Name _____

Date _____

I pledge that I will do the following to protect the marine environment...

7. Beach litter survey

An activity where students examine beach litter and discuss the problems arising from littering.

Concepts

- Rubbish can have serious physical impacts on coastal and marine environments.

Objectives

Students will be able to:

- collect, tabulate, graph and analyse rubbish collected at the beach
- describe the possible sources of the rubbish collected on the beach
- describe the effects that rubbish has on the marine environment, in terms of injury and destruction of marine life.

Values

- People, individually and as a society, need to take responsibility for the care and protection of the marine and coastal environments.
- We all need to minimise the impact we make on these environments (reduce, reuse, and recycle).

Australian Curriculum Links

Science (Understanding):

- Year 4 Living things, including plants and animals, depend on each other and the environment to survive (ACSSU073) e.g. Litter in the environment can harm wildlife.
- Year 7 Interactions between organisms can be described in terms of food chains and food webs; human activity can affect these interactions (ACSSU112) e.g. Litter can enter a food chain and cause harm to organisms and food webs.
- Year 4 Earth's surface changes over time as a result of natural processes and human activity (ACSSU075) e.g. Persistent and increasing litter affects marine and shore environments.

Science (Human endeavour):

- Year 5/6 Science involves testing predictions by gathering data and using evidence to develop explanations of events and phenomena (ACSHE081) e.g. Beach litter survey and litter sort and origin.
- Year 3/4 Science knowledge helps people to understand the effect of their actions (ACSHE062) e.g. Beach litter survey and litter sort and origin.

Science (Inquiry skills):

- Year 4 Safely use appropriate materials, tools or equipment to make and record observations, using formal measurements and digital technologies as appropriate (ACSIS066) e.g. Beach litter survey and litter sort and origin.
- Year 6 With guidance, plan appropriate investigation methods to answer questions or solve problems (ACSIS103) e.g. Beach litter survey and litter sort and origin.
- Year 5/6 Use equipment and materials safely, identifying potential risks (ACSIS105) e.g. Safety aspects of a beach litter survey and litter sort and origin.
- Year 5/6 Communicate ideas, explanations and processes in a variety of ways, including multi-modal texts (ACSIS110) e.g. Beach litter survey and litter sort and origin – tables, construct graph and discussion.

Geography

- Year 4 The natural resources provided by the environment, and different views on how they could be used sustainably (ACHGK024) e.g. Beach litter survey and litter sort and origin – look at effects of local and global pollution.
- Year 5 The sustainable management of waste from production and consumption (ACHGK025) e.g. Beach litter survey and litter sort and origin – look at effects of local and global pollution.
- Year 7 *Unit 1* The classification of environmental resources and the forms that water takes as a resource (ACHGK037); the ways that flows of water connect places as it moves through the environment and the way this affects places (ACHGK038); the causes, impacts and responses to an atmospheric or hydrological hazard (ACHGK042) e.g. Beach litter survey and litter sort and origin.
- *Unit 2* The factors that influence the decisions people make about where to live and their perceptions of the liveability of places (ACHGK043); the influence of environmental quality on the liveability of places (ACHGK045); the strategies used to enhance the liveability of places, especially for young people, including examples from Australia and Europe (ACHGK047) e.g. Beach litter survey and litter sort and origin.

Collecting, recording, evaluating and representing

- Year 5/6 Collect and record relevant geographical data and information, using ethical protocols, from primary and secondary sources, such as people, maps, plans, photographs, satellite images, statistical sources and reports (ACHGS034) e.g. Beach litter survey and litter sort and origin.
- Year 5/6 Evaluate sources for their usefulness and represent data in different forms, such as maps, plans, graphs, tables, sketches and diagrams (ACHGS035) e.g. Beach litter survey and litter sort and origin.

Interpreting, analysing and concluding

- Year 4 Collect and record relevant geographical data and information, e.g. by observing, by interviewing, conducting surveys and measuring, or from sources such as maps, photographs, satellite images, the media and the internet (ACHGS027) e.g. Beach litter survey and litter sort and origin.
- Year 4 Represent data by constructing tables and graphs (ACHGS028); interpret geographical data to identify distributions and patterns and draw conclusions (ACHGS030) e.g. Beach litter survey and litter sort and origin.
- Years 5-6 Interpret geographical data and other information, using digital and spatial technologies as appropriate, and identify spatial distributions, patterns and trends, and infer relationships to draw conclusions (ACHGS037) e.g. Beach litter survey and litter sort and origin.
- Year 7 Analyse geographical data and other information using qualitative and quantitative methods, and digital and spatial technologies as appropriate, to identify and propose explanations for spatial distributions, patterns and trends and infer relationships (ACHGS051); apply geographical concepts to draw conclusions based on the analysis of the data and information collected (ACHGS052) e.g. Beach litter survey and litter sort and origin.

Communicating

- Years 5-6 Present findings and ideas in a range of communication forms, including written, oral, graphic, tabular, visual and maps; using geographical terminology and digital technologies as appropriate (ACHGS038) e.g. Share conclusions of beach litter survey.
- Year 7 Present findings, arguments and ideas in a range of communication forms selected to suit a particular audience and purpose; using geographical terminology and digital technologies as appropriate (ACHGS053) e.g. Share conclusions of beach litter survey.


Photo: Kevin Crane

Reflecting and responding

- Years 4-6 Reflect on their learning to propose individual action in response to a contemporary geographical challenge and identify the expected effects of the proposal (ACHGS032) e.g. Beach litter survey and litter sort and origin. Ways to reduce debris and pollution and other actions.
- Years 4-6 Reflect on their learning to propose individual and collective action in response to a contemporary geographical challenge and describe the expected effects of their proposal on different groups of people (ACHGS039) e.g. Beach litter survey and litter sort and origin. Ways to reduce debris and pollution and other actions.
- Year 7 Reflect on their learning to propose individual and collective action in response to a contemporary geographical challenge, taking account of environmental, economic and social considerations, and predict the expected outcomes of their proposal (ACHGS054) e.g. Beach litter survey and litter sort and origin. Plan appropriate personal and school actions.

Mathematics

- Year 4 Construct suitable data displays, with and without the use of digital technologies, from given or collected data. Include tables, column graphs and picture graphs where one picture can represent many data values (ACMSP096) e.g. Beach litter survey and litter sort and origin.
- Year 5 Pose questions and collect categorical or numerical data by observation or survey (ACMSP118) e.g. Beach litter survey and litter sort and origin.

English

- Year 6 Participate in and contribute to discussions, clarifying and interrogating ideas, developing and supporting arguments, sharing and evaluating information, experiences and opinions (ACELY1709) e.g. Recount experiences or observations of litter harming animals.
- Year 6 Use interaction skills, varying conventions of spoken interactions such as voice volume, tone, pitch and pace, according to group size, formality of interaction and needs and expertise of the audience (ACELY1816) e.g. Report on findings from beach litter survey and litter sort and origin.

Background information

People have impacted on the coastal environment in many ways. One of the most noticeable of these is the presence of rubbish. As well as being an eyesore, rubbish has serious effects on the plant and animal life on the coastline.

Rubbish can be found in three forms: biodegradable, photodegradable and persistent. Materials such as wood, paper, cloth and food are all forms of biodegradable rubbish. This means they will break down in a relatively short period of time. Material that can be broken down into small pieces when exposed to light over a period of time are said to be photodegradable.

Rubber and most plastics are neither biodegradable nor photodegradable and are therefore classified as persistent. This means that it takes years, maybe hundreds of years, for them to break down or disintegrate. Plastics, fast food containers, wrappers and similar items can cover vegetation, blocking off water and sunlight, and cause the plants to die. The plants are a necessary link in the coastal chain of survival. Without them to bind the sand dunes, rapid wind and water erosion will occur and will ultimately lead to the degradation of the coast.

Most of the rubbish that washes up onto beaches is plastic. Waste such as plastic bags, six-pack ring holders, bait straps and fishing nets or lines are responsible for the death of many marine animals. Sea lions, fish, dolphins and birds often become entangled in plastic waste and die of strangulation, drowning or exhaustion. Turtles and birds often feed on plastic bags, thinking they are jellyfish, then starve to death as the plastic clogs their digestive systems.

However, people are working towards solving these problems. Recycling is becoming increasingly common and will make a growing impact on these environmental issues as the trend increases. Scientists are also contributing by developing biodegradable and photodegradable plastics, as well as working in other areas of research.

References/resources

www.marineparks.dpaw.wa.gov.au/marine-park-protectors

Teacher directions

Materials

- ☐ **Gloves to protect hands**
- ☐ **A collecting bag per group (plastic or mesh bags)**
- ☐ **Beach litter survey form (Work sheet 9)**
- ☐ **Pencils and clipboards**

Lesson outlines

Pre-excursion activities

Brainstorm the many ways that rubbish can affect the marine and coastal environment. Students recount occasions when they have observed marine creatures that have been affected by rubbish, either on beaches or in the water (seagulls with hooks in their beaks, fishing line wrapped around them or caught up in plastic are common sights).

Discover what it would be like to be caught up in a plastic six-pack holder. Students place their hands through the rings of a six-pack holder and try to break the plastic. Imagine they are an animal, such as a young sea lion, with plastic caught around them. Describe what it would be like to live like that. What would be the eventual outcome?

Discuss the special safety requirements for collecting rubbish on the beach:

- **always wear protective gloves**
- **handle glass, jagged metal and sharp objects with extreme care**
- **never pick up a syringe found on the beach; inform the teacher who will dispose of it**
- **remember to always wear sunscreen, a shirt and a hat**
- **take a first aid kit on the excursion.**

While still at school, the students are organised into small groups. Establish the rules under which they will be operating at the beach. Reinforce the safety precautions that are to be observed during the activity.

Excursion activity

1. Each group collects 100 (or as many as possible) pieces of rubbish in their collection bags.
2. When the task is completed, return to the gathering point.
3. Students sort the rubbish into separate piles, as Work sheet 9 indicates.
4. Count all the items in each pile and record the results on the work sheet.
5. When recording has been completed, sort according to non-recyclable or recyclable. Dispose of all rubbish in a suitable fashion.

Post-excursion activity

Graph the results of the survey. Select five of the most common rubbish items and record where each comes from.

Discuss ways to reduce the rubbish on our beaches.

Evaluation

- Did the student fill in the Beach litter survey form correctly?
- Did the student graph the class results accurately?
- Did the student make reasonable suggestions as to possible sources of the rubbish?
- Did the class suggest possible consequences of rubbish remaining in the marine environment?
- Did the class suggest ways to improve the rubbish problem on our beaches?

Complementary activities

Design a poster with the theme 'Clean Marine', 'Killer Plastics', or your own slogan. Contact local community centres about the possibility of displaying the work.

Write a letter to the local council or other manager of a coastal area to ask for information on steps being taken to care for the coastal area and the marine inhabitants.

Hold a Recycling Week at school. Students collect articles such as paper, aluminium and steel cans, food scraps, and soft and hard plastics. Find out which organisations are available to recycle these items.

Students complete a litter survey of their home, recording what is thrown out or discarded that could have been recycled (e.g. food scraps, plastics, paper, aluminium and steel cans, chemicals/detergents and other items washed down the sink).

Contact and arrange a visit from a ranger from your local marine park or a member of a community group involved in marine conservation.

Photo: Carolyn Thomson-Dans/DPaW

Work sheet 9

Name _____

Date _____

Beach litter survey form

Types of rubbish	Number of items	Total
From boat and beach users		
Glass bottles		
Plastic bottles		
Cans		
Plastic bags/containers		
Food wrappers		
Wood		
Paper/cardboard		
Rubber		
Cloth		
Bottle tops		
Polystyrene		
Other glass		
Other metal		
Other		
From fishing sources		
Rope		
Plastic bait wrapping		
Plastic bait straps		
Bait buckets		
Floats (or parts of floats)		
Fishing line		
Other		
From ships at sea		

8. Seabirds in Western Australian marine parks

The students will complete a survey of the local birds found on the beach, observing and recording their varied behaviour.

Concepts

- A variety of birds are commonly found in a coastal environment.
- Birds display specific behaviours when in a flock.

Objectives

- Students will be able to observe and record the types and number of birds found at the beach.
- Students will be able to observe and record the behaviour of silver gulls in a flock.

Values

- Wild animals, such as silver gulls, are in balance in nature. Human interference may upset this delicate balance.

Australian Curriculum Links

Science (Understanding):

- Year 3 Living things can be grouped on the basis of observable features and can be distinguished from non-living things (ACSSU044) e.g. Observe and comment on the features of gulls and their behaviours.
- Year 5 Living things have structural features and adaptations that help them to survive in their environment (ACSSU043) e.g. Identify the features/adaptations of seabirds that help them thrive in marine environments.
- Year 7 There are differences within and between groups of organisms; classification helps organise this diversity (ACSSU111) e.g. Identify different seabirds using their features and their common and scientific names.
- Year 7 Interactions between organisms can be described in terms of food chains and food webs; human activity can affect these interactions (ACSSU112) e.g. Describe different seabirds positions in foodwebs depending on their diet.

Photo: Carolyn Thomson-Dans/DPaW

Background information

Almost three-quarters of the Earth is covered by the oceans, which provide habitat for more than 260 species of bird.

Adaptations

When bird watching, look at the size and colouring of the birds and also at their beak and feet formations.

The shape of a bird's beak will indicate what it eats. There are five main sources of food for birds: seeds, fruit, nectar, insects and meat (including fish).

Seed-eaters have short beaks which end in a point and are strong enough to crack the husks and shells of seeds. Fruit eaters are referred to as soft-billed birds, as their beaks are reasonably long, but not very strong. Nectar feeding birds fit into this category, as they need the long bills to get into flowers. Insect eaters, which feed from the ground, usually have long, fairly thin beaks. Meat eaters, which catch their prey live, have short, hooked beaks. Those birds that eat the flesh of dead animals have longer hooked beaks. In both cases, the beak is used to tear up the flesh. Fish-eaters have similar beaks to meat-eaters, being slightly hooked at the end to hold the fish.

The feet of a bird will tell you something of the habitat in which it lives. If it has webbed feet, it will feed in a watery habitat, as it needs the webbing to swim or wade in the water. Land-dwelling birds have four distinct toes. These are used to scratch around on the ground when looking for food or to grip onto a perch in the branches of trees.

Osprey

Common shorebirds and seabirds

Photo: Duncan Dodd

The silver gull (*Larus novaehollandiae*) is found around the entire coast of Australia, and along major rivers. It feeds on fish, crustaceans, plankton, insects, carrion, and almost all types of food scraps. Adults have white eyes with a red eye ring, red bill and feet. Young birds have dark eyes, bill and feet and light brownish feathers among the grey and white give them a mottled look. Silver gulls generally nest in large colonies on islands off the coast. They establish a hierarchy of dominance. It is common to see birds run forward aggressively or adopt a more submissive, begging posture.

Photo: Ian Herford

Australian pelicans (*Pelecanus conspicillatus*) have bold, black and white markings, blue legs, an enormous bill with pink pouch and yellow eye-rings. During courtship the pouch becomes bright red, blue and orange. It is used to scoop up small fish and shrimps and to catch rain, with a total capacity of seven litres! Pelicans nest in colonies on islands. Nests are little more than shallow scrapes on the ground with two eggs. Australian pelicans are common in fresh and saltwater lakes and estuaries, rivers, swamps and sea shores through most of Australia, with small numbers in the Indo-Pacific.

The **crested tern** (*Sterna bergii*) is found around the entire Australian coast, and around the fringes of the Indian and part of the Pacific oceans. Its colouring is similar to that of the gull, but distinctive black feathers on the top of the head are tufted at the back. They have long, pointed, tapering wings, a forked tail and a long, pointed, yellow bill. Terns feed mostly on small surface fish, and do not swim under water. Fish are only taken within plunging depth of the surface. Crested terns also eat squid, crustaceans, and sometimes eggs and baby turtles.

The **pied oystercatcher** (*Haematopus longirostris*) is mainly found on beaches and estuaries around the coast of Australia. It is a chicken-sized bird with black plumage on its head, back and wings, and white underparts. The pink legs, long scarlet bill and eyes stand out in contrast. Pied oystercatchers are wading birds that feed mainly on molluscs. Their chisel-shaped bill, which is flattened side on, makes feeding easier. They move along wet sandy flats and bars at low tide, probing beneath the sand for molluscs. Pairs mate for life.

Photo: Babs and Bert Wells/DPaW

The **pied cormorant** (*Phalacrocorax varius*) is found mainly in coastal and salt water areas. Coastal pied cormorants breed in colonies all year. The pied cormorant has a distinct plumage with black above, white below and an orange-yellow face patch in front of its eye. Its bill is grey and feet black. Pied cormorants feed mainly on fish and on some crustaceans and molluscs. They dive headlong into the water to grasp their prey in their hooked beak before rising to the surface. Cormorants often perch on rocks, poles and boats, holding their wings outstretched to dry.

Photo: Samille Mitchell

The **little penguin** (*Eudyptula minor*) is the smallest of the world's 17 penguin species and is the only one that nests along Australia's mainland coast. These flightless seabirds are superbly adapted to the marine environment. Their wings have evolved into flippers with which they propel themselves, 'flying' underwater. On land they stand upright, walking or waddling awkwardly on their hind legs. Little penguins have a life expectancy of six or seven years, although some survive for 20 years. A great place to see little penguins and learn about them is the Penguin Island Discovery Centre, which is just a short ferry ride across the Shoalwater Islands Marine Park in Rockingham. Little penguins are bluish-grey in colour, with a white underside and throat. They have a black bill, pale pink feet and silvery-grey eyes. The males are slightly bigger than the females, and have a deeper bill and a larger head. Adults stand about 40 centimetres tall and weigh about a kilogram.

Resources

www.marineparks.dpaw.wa.gov.au/fun-facts

Discovering Penguin Island and the Shoalwater Islands Marine Park, Department of Parks and Wildlife

Teacher directions

Materials

- ☐ **Clipboard file**
- ☐ **Work sheets 10 and 11**

Lesson outlines

Pre-excursion activities

Discuss Work sheets 10 and 11 with the students.

The students need to become familiar with the features of the selected birds to be identified on the Birds on the beach survey sheet, along with any other common seabirds found on the coast. This will help with identification on the day.

Excursion activities

At the beach, discuss the following code of behaviour:

Move about as little as possible.

Sit still and quietly when observing the birds.

Don't look into the sun, have it behind you.

The feet and beaks of the birds will tell you a lot about them.

Observe the colour of their feathers, eyes, legs and facial skin, and any colour patterns, as those are usually more important for identification than colour alone.

Remember to always wear sunscreen, a hat and shirt when at the beach.

Students should spread out along the beach and find a place to sit to observe the birds in the area. Complete Work sheet 10.

Spend about 20 minutes on the survey, observing important features of the birds. Use these observations to try to determine what they may feed on, whether they perch on branches or swim, and other behavioural characteristics. Much of this information can be gained by observing the birds' feet, beaks and necks and their general activity.

Discuss Work sheet 11. Each student should then resume their old position or find new one and complete Work sheet 11 over a 20-minute period.

Post-excursion activities

Graph the class results of Work sheet 10.

Discuss the results of Work sheet 10 and the various adaptations the students have observed. Different shaped beaks and feet determine their uses. Compare the shape of the feet in waterbirds, tree-perching birds and ground-dwelling birds. Compare the shapes of beaks for meat-eating, seed-eating, nectar-feeding, and waterbirds.

Behaviours of the silver gull (Work sheet 11) can also be graphed to see what, if any, behavioural trends occur in a community of silver gulls. Discuss the roles that were observed in the bird community (such as dominance or territory claims, for example), and how this would impact on weak, injured or sick birds. Can the students suggest reasons why the birds act in this way?

Evaluation

- Did the students fill in the survey forms correctly?
- Did the students graph the class results accurately?
- Did the students understand the reasons for the increase in numbers of birds such as silver gulls?

Complementary activities

This activity can be linked with the 'Rocky reef safari' activity on page 13. It looks at the special adaptations birds have developed to allow them to survive in their specific environments just like the creatures of the rocky shore. Both activities can be completed while on the same outing.

Students research bird colonies which have pecking orders and specific behaviours. Compare and contrast to the silver gulls.

Invite a guest speaker to the class from an ornithological society, or the Gould League.

Work sheet 10

Name _____

Date _____

Birds on the beach

Identify and count any birds you see on the beach.

Bird type		Tally
Silver gull (adult) – white eyes with red ring, scarlet to red feet and bill, clean white to grey feathers with black outer primaries on wing.		
Silver gull (young) – dark eyes, brown feet and bill, grey and white feathers interspersed with brown tail feathers.		
Pacific gull – bigger than the silver gull, has a much thicker bill, and a black back and wing feathers.		
Australian pelican – bold black and white markings, blue legs, enormous bill with pink pouch and yellow eye rings.		
Crested tern – similar colour to seagull with black feathers tufted at the back of head, long pointed wings, forked tail.		
Bridled tern – long fine white eyebrow, black crown, black bill and black legs, back tail and wings are a sooty dark brown, dull white beneath.		

Caspian tern – red bill, black crown that becomes streaked and mottled with white when not breeding, pale grey upper body, black legs, white beneath.		
Pied oystercatcher – black head, breast and back except for white rump patch and upper tail coverts, belly and underwings white, bill bright orange, red legs.		
Sooty oystercatcher – Black all over, with a long bright orange bill and red legs.		
Others (describe):		

Photo: Leanne Thompson

Work sheet 11

Name _____

Date _____

Behaviours of the silver gull

At rest

TOTAL

Forward posture

Head is dropped until it is lower than the tail with bill pointed upward - a sign of submission.

TOTAL

Oblique threat

Neck is stretched up and head tilted down, wings may be lifted a little.

TOTAL

Hunched threat

Threatening behaviour, body is hunched, feathers ruffled. Bird makes quick walking movements at other birds.

TOTAL

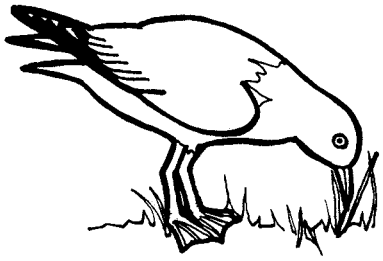
Upright alarm posture

Eyes wide open, neck stretched, feathers pressed tightly against the body, wings held slightly out.

TOTAL

Grass stabbing/grass pulling

Possibly signalling territory.



TOTAL

9. The ocean's garden

Classify seaweeds and seagrasses, and construct a herbarium.

Concepts

- Seagrass and seaweed (algae) are different types of plants.
- Living seagrasses are more commonly found subtidally.

Objectives

- To classify seaweed and seagrass, and recognise the characteristics of each.
- To establish a herbarium using the seaweed and seagrass collected.

Values

To treat seaweed and seagrass with care so as not to damage the delicate balance of the marine environment in which they both play an important part.

Australian Curriculum Links

Science (Understanding):

- Year 3 Living things can be grouped on the basis of observable features and can be distinguished from non-living things (ACSSU044) e.g. Seaweeds and seagrasses are examples of marine plants.
- Year 4 Living things have life cycles (ACSSU072) e.g. Seaweeds reproduce by spores, seagrasses reproduce by seeds.
- Year 4 Living things, including plants and animals, depend on each other and the environment to survive (ACSSU073) e.g. Underwater seagrass meadows provide important habitat and nurseries for marine animals.
- Year 7 There are differences within and between groups of organisms; classification helps organise this diversity (ACSSU111) e.g. Identify the difference between seagrasses (flowering plants) and seaweed (algae) and different types of each. Construct a plant press and herbarium.
- Year 7 Interactions between organisms can be described in terms of food chains and food webs; human activity can affect these interactions (ACSSU112) e.g. Seagrass and seaweed are important producers.

Science (Human endeavour):

- Year 5/6 Scientific understandings, discoveries and inventions are used to solve problems that directly affect peoples' lives (ACSHE083) e.g. Seagrass meadows provide important habitat and nurseries for animals. This knowledge influences conservation and other actions.
- Year 7 Science understanding influences the development of practices in areas of human activity such as industry, agriculture and marine and terrestrial resource management (ACSHE121) e.g. Seagrass meadows provide important habitat and nurseries for marine animals. This knowledge influences conservation and other actions.

Science (Inquiry skills):

- Year 5/6 Use equipment and materials safely, identifying potential risks (ACSIS105) e.g. Safety and care when handling seaweed or seagrass accumulations.
- Year 5/6 Communicate ideas, explanations and processes in a variety of ways, including multi-modal texts (ACSIS110) e.g. Design a noticeboard on seagrasses and seaweeds to provide conservation messages.

Geography

- Year 5 The influence of people, including Aboriginal and Torres Strait Islander people, on the environmental characteristics of Australian places (ACHGK027) e.g. Seagrasses provide important marine habitat and nurseries. Appropriate actions for protection.
- Year 7 *Unit 1* The classification of environmental resources and the forms that water takes as a resource (ACHGK037); the ways that flows of water connect places as it moves through the environment and the way this affects places (ACHGK038); the causes, impacts and responses to an atmospheric or hydrological hazard (ACHGK042) e.g. Seagrasses provide important marine habitat and nurseries.
- *Unit 2* The factors that influence the decisions people make about where to live and their perceptions of the liveability of places (ACHGK043); the influence of environmental quality on the liveability of places (ACHGK045); the strategies used to enhance the liveability of places, especially for young people, including examples from Australia and Europe (ACHGK047) e.g. Seagrasses provide important marine habitat and nurseries.

English

- Year 7 Use a range of software, including word processing programs, to confidently create, edit and publish written and multimodal texts (ACELY1728) e.g. Design a public noticeboard to inform about the importance and conservation of seagrasses and seaweed.

Background information

Seaweeds (marine algae)

Seaweeds may be brown, green or red. They are simple plants that do not have roots, stems, leaves, flowers or fruit. Roots are unnecessary because they are anchored to rocks by holdfasts (which look like fingers) and their minerals and nutrients are provided by the constant movement of sea water over them. Seaweeds reproduce by spores which are released directly into the water.

Seaweeds provide food and shelter for a range of marine animals.

Seagrasses

Seagrasses are not related to the seaweeds. They are flowering plants with actual roots, stems, leaves and inconspicuous flowers. They produce fruits and set seeds like grasses on land. Some seagrasses form large underwater meadows. They grow in sheltered parts of the sea, bays and estuaries.

Seagrass meadows form important breeding grounds and nurseries for fish and invertebrates.

Teacher directions

Materials

- ☐ **Paper or plastic bags**
- ☐ **Scissors**
- ☐ **Trays**
- ☐ **Stiff paper (white and coloured)**
- ☐ **Salt water**
- ☐ **Newspaper**
- ☐ **Nylon stocking**
- ☐ **Telephone books or similar weighty objects**

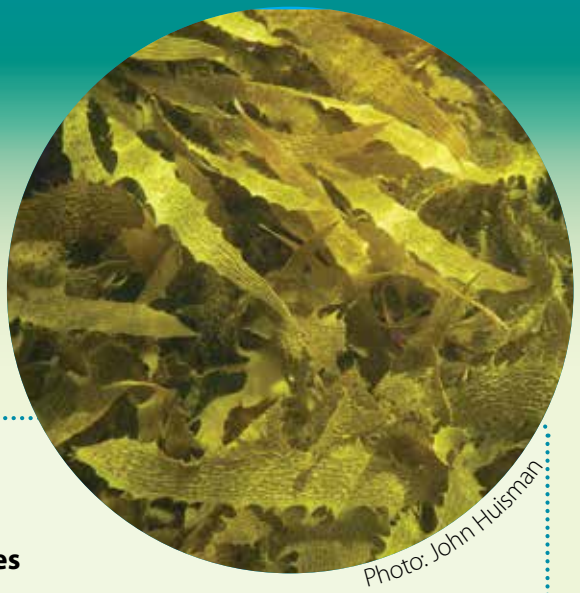


Photo: John Huisman

Lesson outline

Pre-excursion activity

Explain to students the differences between seaweeds and seagrasses.

Note

Before commencing any sea plant exploration activities, be sure to stress the need for care at all times when picking up or going through the plants. There could be dangerous items of rubbish hidden amongst them. A gardening fork makes the job much safer.

Excursion activities

1. Collect a variety of fresh sea plants from the beach, not from the water.
2. Separate them into two groups—seagrass and seaweed—using Resource sheet 7 to help with classification.
3. Label the bags.
4. Take a cutting from each plant (to fit A4 page) and place it into the correct bag.

Post-excursion activity

Complete the following as soon as possible, as seaweed smells after a while.

1. Follow the directions for presenting the plants on Resource sheet 8.
2. Place seagrasses on different coloured cards.
3. Using Resource sheet 7 as a reference guide, identify the plant you have pressed. Use reference books to find out more information about the plant. Complete a plant identity sheet (Work sheet 12) for each plant and attach it to the page.
4. To protect and preserve, laminate the worksheet with clear adhesive plastic. Collate all the sheets into a book and keep in the library as a resource titled Marine Herbarium.

If a beach visit is not possible for this activity, collect the plants yourself from the beach and complete the activity at school.

Evaluation

- Were students able to classify the plants into the correct categories using the information provided?
- Were students able to identify the seagrass and seaweeds from the diagrams?

Complementary activities

Paint a mural of all the seagrass and seaweeds that were studied.

Design a public noticeboard that could be erected at the beach to inform people about seagrasses and seaweeds. Include a safety and conservation message.

Seagrass or seaweed?

SEAGRASS	SEAWEED (marine algae)
	
Stems	No stems
Leaves	No leaves
Flowers (though difficult to see)	No flowers
Fruit	No fruit
Sets seeds	No seed
Roots	No roots
Forms large underwater meadows	Cling to rocks, other underwater surfaces or other plants by a holdfast

Plant press

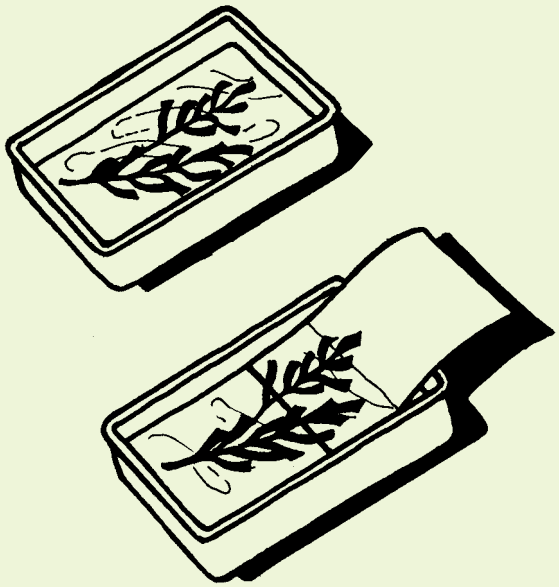
1. In a dish of salty water, spread out a piece of seagrass or seaweed.

2. Slide a piece of stiff paper under it and arrange it so that it looks well laid out.

3. Lift the paper and plant out of the tray and place both of them on a thick layer of newspaper. Place a nappy liner over the plant and place more newspapers on top.

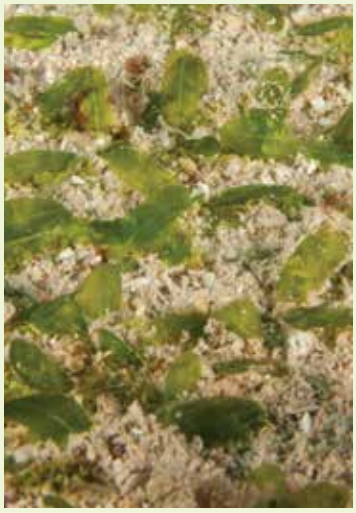
4. Place a heavy weight on top and press everything flat. The seaweed or seagrass will then stick to the paper.

5. Leave to dry for a week before removing. You may need to change the newspaper after the first few days.



The seaweed or seagrass will then stick to the paper without glue.

Plant identification chart



Seagrasses

Paddleweed (*Halophila* species)

Plants are usually less than five centimetres high. They have upright leaves, which have a short stem and oval blade with obvious veins. They arise in pairs from the runner (rhizome), which grows under the sand. Like most seagrasses, paddleweed colonises shallow sandy areas. It does not form large beds like strapweed or wireweed, but instead tends to grow in the gaps between them. When detached and drifting by, paddleweed leaves look remarkably like fallen leaves from a terrestrial plant that might have blown into the ocean.

Southern wireweed (*Amphibolis antarctica*)

Wireweed grows from a dense base of creeping rhizomes that produce wiry upright stems. These are segmented and very tough. At the tips, the stems produce several paired leaves that are strap-like. Two species are found in the Perth region. Southern wireweed (*Amphibolis antarctica*) has relatively short leaves (2–5 centimetres long) that are generally slightly twisted, whereas Griffith's wireweed (*A. griffithii*) has longer (3–8 centimetres) straight leaves.

Strapweed or fibreball weed (*Posidonia* species)

Plants grow from a tough rhizome that can spread just below the surface of the sand for some distance. The grass-like uprights develop from this creeping base, forming dense beds. Each cluster of leaves has a fibrous sheath at its base, and these fibres often wash up as tangled balls on beaches.

Three common species of strapweed occur in the Perth region. Southern strapweed (*P. australis*) has broad flat leaves up to two centimetres across. Sinuous strapweed (*P. sinuosa*) has narrower leaves (to one centimetre) that are slightly curved at the margins. A third species, tough strapweed (*P. coriacea*), has thicker leaves that are almost oval in section.

Photos: John Huisman

Seaweeds

Green algae

Sea lettuce (*Ulva lactuca*)

Almost transparent, bright green in colour and attached by a small holdfast, sea lettuce is common in many parts of the world, and can often be seen in large quantities on intertidal reef platforms, where its bright green colour makes it particularly conspicuous. Over summer, these intertidal plants will often die off in the warmer temperatures, leaving only the bleached white remains. Sea lettuce is edible and makes an interesting addition to salads and soups, or can be toasted in sesame oil and added to rice.

Dead man's fingers (*Codium galeatum* and others)

Dead man's fingers is a large, dark green plant that regularly branches into two. It can grow to a metre tall, with cylindrical branches about 10 millimetres in diameter with a firm but spongy texture. Dead man's fingers grows on hard underwater surfaces, such as reef or rubble, from low tide level to depths of around 35 metres. It prefers rough-water coasts. Dead man's fingers can tolerate a range of light conditions and, as such, can be found in shady positions right through to well-lit areas.

Photos: John Huisman

Sea grapes and sea berries (*Caulerpa racemosa* and *Caulerpa sedoides*)

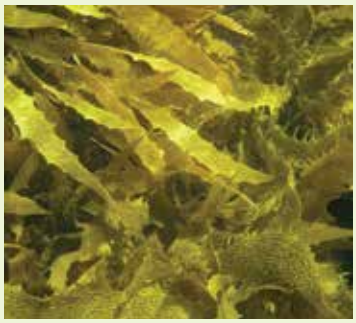
Sea grapes and sea berries, like all species of *Caulerpa*, have creeping stems from which upright branches arise. The upright branches are surrounded by small club-shaped or spherical vesicles, which give the plants their common name. In sea grapes, the vesicles taper smoothly into the upright branch, whereas a distinct constriction forms just below the vesicles in the similar-looking sea berries.

Brown algae

Funnel weed (*Padina* species)

Plants are fan-shaped and grow to about 15 centimetres high. The fronds often become divided, so mature plants are generally composed of a cluster of fan-shaped branches. The edges of funnel weed plants are rolled inwards, generally towards the surface that has the chalky coating.

They grow as clusters of funnel-shaped fronds, hence the common name, on rocks and rubble and are often most abundant on unshaded reef surfaces, as they do not tolerate being shaded by larger seaweeds.



Common kelp (*Ecklonia radiata*)

Brown to olive-brown, and grows up to two metres high. Attached to the bottom, usually to rock, by a strong holdfast with finger-like branches. Arising from the holdfast is a cylindrical stem, which broadens gradually into a flattened blade with numerous side branches. The blades are extremely tough and can have a smooth surface or be covered with corrugations and small spines.

Sargassum (*Sargassum linearifolium* and *S. spinuligerum*)

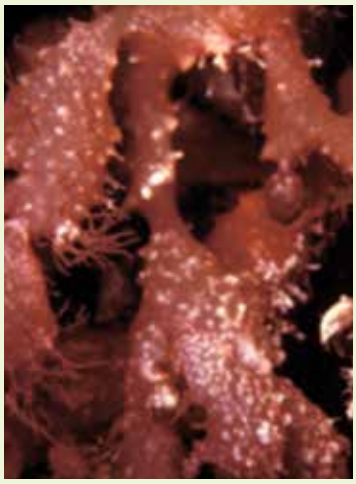
Recognised by the little round floats about the size of a sultana. These keep the plants upright in the water. All species of sargassum weeds have distinct stems and leaf-like lateral branches, which may have smooth or spiny edges. The side branches are leaf-like, and lower branches are often larger than upper ones.

Photos: John Huisman

Red algae

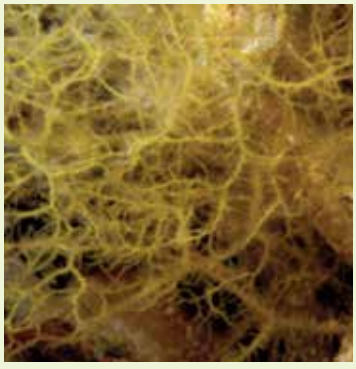
Articulated corallines (*Metagoniolithon stelliferum* and *Haliptilon roseum*)

Very neatly branched. Plants can grow up to 20 centimetres high and are generally a light pink or whitish colour. Articulated corallines are extremely common, and many different species occur in the Perth region. They all have calcium carbonate incorporated into their tissues, which makes them firm to touch, but have uncalcified joints that allow them to flex with the water motion.



Jelly weed (*Betaphycus speciosum*)

Large deep red seaweed common on rocky reefs exposed to waves. Can be bleached greenish-yellow or white when washed up on beaches after storms. Plants can grow to 30 centimetres high, often with many branches growing from a consolidated base. The branches are very thick, sometimes with constrictions and often with numerous short spiny branches covering the surface. Jelly weed is one of few Australian seaweeds with a history of human use. In the early days of the Swan River Colony, women would collect jelly weed plants that had been cast up along the shoreline. These would then be boiled and the liquid used to make jellies and blancmanges.



Spiny red weed (*Hypnea charoides*)

Spiny red weed commonly grows on the stems and leaves of several seagrasses (usually wireweeds), where it can form tangled masses without a regular growth pattern. There are numerous species within the genus *Hypnea*. Many of these are widespread, and the appearance of plants can vary markedly. All, however, have main branches that produce relatively short spiny lateral branches. Despite the name, red spiny weed can often be other colours, and is commonly yellow or brown.

Red blades (*Schizymenia dubyi*)

Soft fleshy, irregular brownish-red fronds, 50 centimetres long, 25 centimetres across. When dried onto paper the fertile fronds feel like fine sandpaper.

Photos: John Huisman

Work sheet 12

Name ____________________

Date ____________________

Herbarium

Number:	Date:
Collected by:	
Common name:	
Scientific name:	
Place found:	
Colour:	
Plant form:	
Other notes:	

Number:	Date:
Collected by:	
Common name:	
Scientific name:	
Place found:	
Colour:	
Plant form:	
Other notes:	

Number:	Date:
Collected by:	
Common name:	
Scientific name:	
Place found:	
Colour:	
Plant form:	
Other notes:	

Number:	Date:
Collected by:	
Common name:	
Scientific name:	
Place found:	
Colour:	
Plant form:	
Other notes:	

Number:	Date:
Collected by:	
Common name:	
Scientific name:	
Place found:	
Colour:	
Plant form:	
Other notes:	

Number:	Date:
Collected by:	
Common name:	
Scientific name:	
Place found:	
Colour:	
Plant form:	
Other notes:	

10. What am I?

Using 'What am I?' hints, students identify the correct sea plant or animal, and later explore the beach to discover if they were correct.

Concepts

Different plants and animals can be found on the coastline.

Objectives

To identify marine plants and sea creatures found on the beach, using hints and picture clues.

Values

To treat plants and sea creatures on the beach with the same care and respect that all living creatures should be shown.

Australian Curriculum links

Science (Understanding):

- Year 3 Living things can be grouped on the basis of observable features and can be distinguished from non-living things (ACSSU044) e.g. Play 'What am I?' to identify many living things that may be found on a beach.
- Year 5 Living things have structural features and adaptations that help them to survive in their environment (ACSSU043) e.g. Identify features of marine organisms within descriptions, photos and real life in order to recognise each one.
- Year 7 There are differences within and between groups of organisms; classification helps organise this diversity (ACSSU111) e.g. Use a 'What am I?' strategy to examine differences and name organisms.
- Year 7 Interactions between organisms can be described in terms of food chains and food webs; human activity can affect these interactions (ACSSU112) e.g. Identify producers, herbivores, carnivores and detritivores based on the descriptions in 'What am I?'

Photo: John Huisman

Background information (answers to Work sheet 13)

Photo: Carolyn Thomson-Dans

Crab: Active at high tide or at night. Shelters in crevices, under rocks and seaweed in the day time. Crabs have five pairs of legs, with pincers at the end of one pair. They eat the remains of dead creatures. Every few weeks they moult their old shell.

Photo: John Huisman

Seagrass: Has stems, leaves, barely noticeable flowers, forms fruits and sets seeds like grasses on land. Grows in sheltered parts of the sea. Forms large underwater meadows which are breeding grounds for fish and other sea creatures.

Photo: John Huisman

Seaweed (macro algae): Simple plants that lack roots, stems, leaves, flowers and fruit. They cling to rocks by 'holdfasts', which look like fingers. Sea water provides them with the necessary minerals, so they do not need stems or leaves. They provide food and shelter for marine animals. There are green, brown and red varieties.

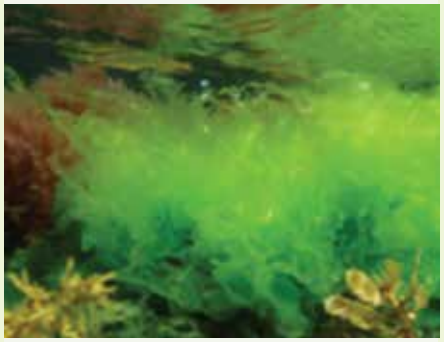


Photo: John Huisman

Sea lettuce (Ulva lactuca): Bright green, flat-leaved algae. Bright green fronds found on exposed rock platforms and shallow pools that are only covered at high tide. Called sea lettuce because of its shape and colour. Traditionally prepared and eaten by Aboriginal people.

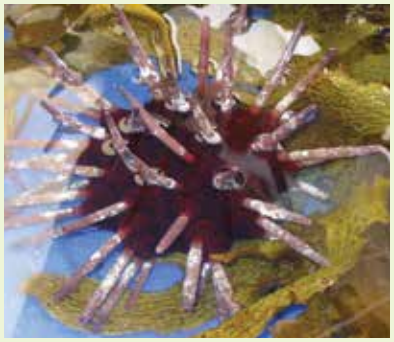


Photo: Kevin Crane

Sea urchins: Round, slightly flattened body covered with spines made of a chalky substance. Related to sea stars. Move around using special tube feet. They can feed as they move along as their mouths are at the base of their bodies.

Sea anemone: Soft bodied relatives of coral and jellyfish. Can be found under rocks and in cracks or pools where they are protected from the sun. They attach themselves to the reef or sea floor by the base of their body. They look like flowers, but are really animals.

Photo: John Huisman

Dog whelk: Active, carnivorous animal that bores through the shells of other molluscs to feed on the soft flesh inside. This process can take up to five days. They have thick, heavy shells so they are not harmed if they are tossed about by the waves. Their shell colour changes depending on what they eat.

Photo: Ian Herford

Sea star: Has five or more arms. Along each arm are two rows of little legs with terminal discs called tube feet. These enable the animal to move slowly over the reef. If an arm is broken off, a whole new animal can grow from the missing arm.

Photo: Graham Edgar

Sea slugs, nudibranchs: Snails without shells. Sea slugs disguise themselves by blending with their surroundings as they do not have outer shells. The gills form a frilly ring on their backs but these are withdrawn inside the body when in danger. It is both male and female in the same animal (hermaphrodite). They move with the use of soft muscular feet under their bodies.

Photo: Carolyn Thomson-Dans

Cuttlefish: Creatures with eight arms and two suckered tentacles with which to capture food (usually retracted when not in use). The common cuttlefish is about a foot long. It can quickly change colour to camouflage into its surroundings.

Cuttlebones found on the beach are the skeletons of this animal. The cuttlebone enables the cuttlefish to remain on the bottom or swim freely at any depth. The density of the cuttlebone can be changed by pumping liquid in and out of chambers within it, thereby altering the volume of the gas-filled space.

Photo: John Huisman

Sea cucumber: Belong to a group of marine animals called echinoderms, meaning 'spiny skin'. Their body is soft and sausage-like. Instead of teeth, they have a group of branched tentacles which help them feed. They can part with a considerable portion of their body and grow a new portion to replace it. Other members of this group are sea stars and sea urchins.

Photo: John Huisman

Sponge: Colourful, porous organism that is a very simple animal. Obtains food by filtering plankton from water passing through the holes in its body. It grows on or under rocks or reefs.

References

Beachcombers Guide to South-West Beaches, Department of Parks and Wildlife (Bush Book series)

Discovering Penguin Island and the Shoalwater Islands Marine Park, Department of Parks and Wildlife (Discovering Book series)

Marine plants of Western Australia, Department of Parks and Wildlife

Wonders of Western Waters, Department of Parks and Wildlife

Teacher directions

Materials

- ☐ **Work sheet 13**

Lesson outline

Pre-excursion activity

Using the background information and the photos on Work sheet 13, discuss the types of marine plants and creatures found on the beach. Read through the descriptions.

Go through the activity sheet, then let the students try to work out the answers.

Excursion activity

The students should explore the beach in groups using Work sheet 13 as a basis for a 'treasure hunt'-type activity. As each item on the list is found, it should be examined in more detail, then ticked off the list.

Don't forget to return all items to the beach when you have finished looking at them. Answers to the clues are in found in 'Background information'.

Evaluation

- Were the students able to complete the activity successfully?
- Were the students able to find the correct items?

Complementary activities

Students make up their own 'What am I?' questions on items, plants or animals found at the beach.

Students design 'Wanted' posters, which give a written description and a picture of the plant or animal in question.

Work sheet 13

Name _____

Date _____

What am I?

1. I have several pairs of legs. I moult my hard outer shell every few weeks and replace it with a new one. I like hiding under stones, in crevices or burrow in sand. My colours usually blend with my surroundings. I scavenge the remains of dead creatures.

I am a _____

2. I live in large meadows and often wash up on the beach. I need light to keep me alive. I am similar to plants that live on land. Human activities have reduced my habitat.

I am a _____

3. I can be brown, green or red or many other colours. I cling to rocks with my 'holdfast'. I am also known as algae. You see me everywhere when you walk along the beach in a variety of forms. Some people like eating me!

I am a _____

4. I am green and look somewhat transparent. I am edible but I taste quite salty! I am quite easy to find on the reef.

I am a _____

5. I have a hard spiny body and can be quite painful to touch. I often can be found in pretty colours such as purple or red. My mouth is underneath my body, and I feed as I move.

I am a _____

6. I am carnivorous (a meat-eater). I am related to jellyfish. I attach myself to rocks or bury myself in sand. My soft arms wave around in the water. I look like a flower, but I am really an animal.

I am an _____

7. I creep slowly over rocks. I am a marine snail (gastropod). My body is soft. I bore through the shells of other molluscs to feed on the soft flesh inside. I don't look anything like my name suggests.

I am a _____

8. If part of me is broken off, a new animal can grow from the lost part. I have hundreds of tiny suckers under five or more arms. I turn my stomach inside out on top of my victim, then I eat them.

I am a _____

9. I am related to snails but have no outer shell. I scrape food off rocks with my file-like tongue. I am neither male nor female, I am both at the same time. I often have beautiful patterns and colours on my soft body.

I am a _____

10. I am the source of cuttlebones washed onto the beach. I can camouflage into my surroundings by changing colour.

I am a _____

11. I have a soft body with a sausage shape. To defend myself, I squirt out most of my internal organs, which I can later regrow. I live in sand and gravel under rocks.

I am a _____

12. I am an animal but look like a plant. My body has many holes or 'pores' which are used to pass water in and out of my body. Sea slugs and fish love eating me. In some countries, I'm collected so people can use me to clean themselves.

I am a _____

11. Seagrass forests

A story about the life support system that seagrass meadows provide, and how they can be adversely affected by human activities.

Concepts

- There is a correlation between seagrass loss and the discharge of effluent that is rich in plant nutrients.
- The earth is an organism with seagrass being one of its lungs.
- Healthy seagrass means a healthy ocean.

Objectives

- To create an understanding of the importance of seagrasses and the causes of their decline.
- To ensure responsible behaviour from people using boats (to avoid damage by anchors and propellers, for example).

Values

Preventing pollution and reducing human impacts will keep our seagrass meadows healthy.

Australian Curriculum links

Science (Understanding):

- Year 7 Interactions between organisms can be described in terms of food chains and food webs; human activity can affect these interactions (ACSSU112) e.g. Identify food webs of a seagrass community. Evidence showing human activity and consequences.

Science (Human endeavour):

- Year 5/6 Science involves testing predictions by gathering data and using evidence to develop explanations of events and phenomena (ACSHE081) e.g. Predict and state evidence of what would happen in marine environments with loss of seagrass meadows.
- Year 5/6 Scientific understandings, discoveries and inventions are used to solve problems that directly affect peoples' lives (ACSHE083) e.g. Underwater seagrass meadows provide important habitat and nurseries for marine animals. This has important consequences on our use of marine environments.
- Year 7 Science understanding influences the development of practices in areas of human activity such as industry, agriculture and marine and terrestrial resource management (ACSHE121) e.g. Seagrass habitat destruction or conservation have important consequences for our use of marine environments.

Geography:

- Year 7 *Unit 1* The classification of environmental resources and the forms that water takes as a resource (ACHGK037); the ways that flows of water connect places as it moves through the environment and the way this affects places (ACHGK038); the causes, impacts and responses to an atmospheric or hydrological hazard (ACHGK042) e.g. Human impacts or alternatively good management of marine plants and animals such as seagrasses and whales, have important consequences on our use of marine environments.

- *Unit 2* The factors that influence the decisions people make about where to live and their perceptions of the liveability of places (ACHGK043); the influence of accessibility to services and facilities on the liveability of places (ACHGK044); the influence of environmental quality on the liveability of places (ACHGK045); the strategies used to enhance the liveability of places, especially for young people, including examples from Australia and Europe (ACHGK047) e.g. Human impacts or alternatively good management of marine plants and animals such as seagrasses and whales, have important consequences on our use of marine environments.

Reflecting and responding

- Year 7 Reflect on their learning to propose individual and collective action in response to a contemporary geographical challenge, taking account of environmental, economic and social considerations, and predict the expected outcomes of their proposal (ACHGS054) e.g. Underwater seagrass meadows provide important habitat and have important consequences on our use of marine environments. Plan appropriate actions.

English:

- Year 4–6 Use comprehension strategies to build literal and inferred meaning to expand content knowledge, integrating and linking ideas and analysing and evaluating texts (ACELY1692) e.g. Comprehension exercise and graphic outline on underwater seagrass meadows and their important consequences for our use of marine environments.

Background information

Australia has the largest seagrass meadows in the world and the largest number of seagrass species.

Ngari Capes Marine Park and Jurien Bay Marine Park in Western Australia provide settlement and nursery areas for the largest single species fishery in Australia—the western rock lobster. Its value is around $275 million per year. Integral to this industry's survival are the seagrass meadows in which the lobsters forage.

Seagrass meadows are the basis of complex ecosystems, providing homes and feeding areas for a variety of marine creatures, including the dugong in the extensive seagrass meadows within Shark Bay Marine Park. There are about 40 times more animals in seagrass than in the adjacent bare sand areas.

The living leaves of seagrass plants provide areas for minute plants and animals (epiphytes) to live. Many species of fish, crabs, shrimp, and snails feed on the tiny organisms on both the living and decomposing seagrass leaves. The complex canopy formed by the leaves provides valuable shelter from predators for a variety of animals, and therefore are vital nursery areas for recreational fish species.

Improper industrial and sewage disposal can cause nutrient enrichment. This can stimulate excessive algal growth, which can smother and kill seagrass. Seagrass is a fragile ecosystem that, once affected, does not recover easily or quickly. For example, large circular clearings created in the Posidonia meadows in Jervis Bay during the 1950s and 1960s are still evident today. It has been suggested that recolonisation of some areas may take 80 to 200 years.

In Australia more than 45,000 hectares of seagrass have been lost, mostly because of reduced light intensity due to human activities. In Princess Royal Harbour in Albany, 80 per cent of seagrasses have been lost since 1960, and 97 per cent lost in Cockburn Sound since 1969. Boat users should try to minimise damage by anchoring in bare sand and avoid using outboard motors in very shallow water over seagrasses.

References

Kirkman, H. (1985) *Seagrasses*. Australian Science Magazine. Offprint of Seagrasses, Issue 3, CSIRO. Western Australia.

CSIRO *Seagrasses, Salt Marshes and Mangroves of Jervis Bay*. CSIRO Division of Fisheries. Western Australia. (pamphlet).

Walker, D.I. *Rottnest Island Seagrasses*. Rottnest Island Authority, WA (pamphlet).

Walker, D.I. and McComb A.J. (1992) *Seagrass Degradation in Australian Coastal Waters*. Marine Pollution Bulletin. Vol:25 6–8, pp 191–195 Great Britain.

Ocean Rescue 2000 (1994) Seagrass. *A Lawn too Important to Mow* Sea Notes, Department of Environment, Sport and Territories, Brisbane.

Teacher Directions

Materials

- ☐ **Work sheet 14**

Lesson outline

Have the students complete Work sheet 14, 'Grasses of the sea'. Distribute Resource sheet 10 for supplementary information and give students access to www.marineparks.dpaw.wa.gov.au/fun-facts.

Evaluation

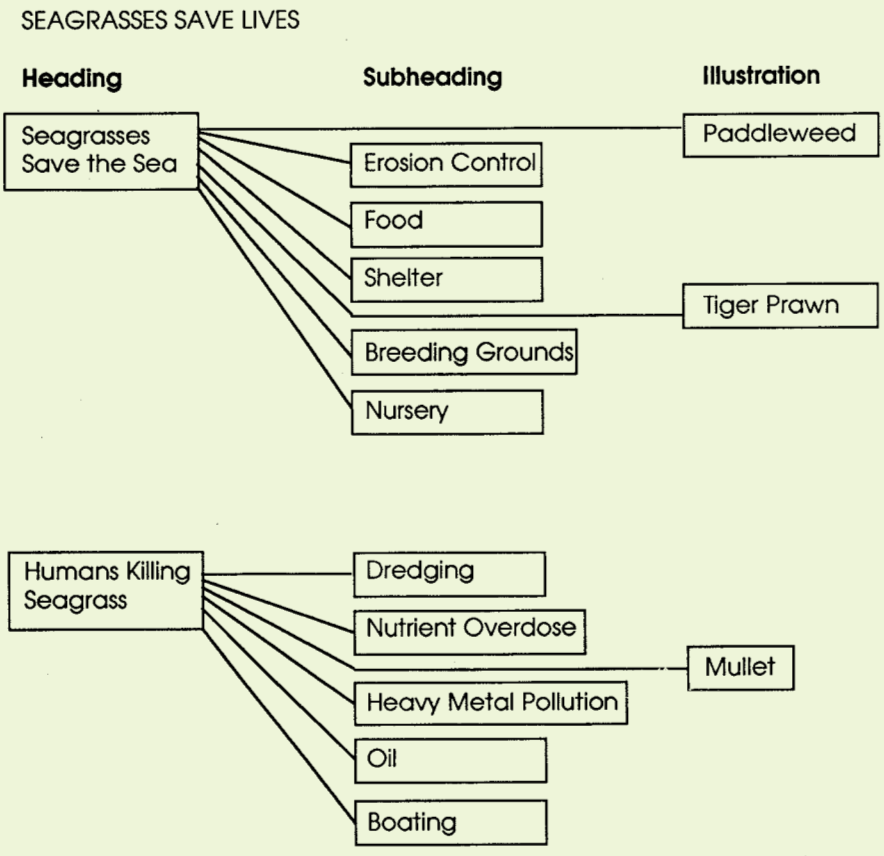
- Did students complete the work sheet accurately?

Complementary activities

Make a class mural, showing industry, pipes into the water and seagrasses covered with algae.

Teacher's copy

This graphic outline will provide a purpose for reading and help students to recognise the scaffolding of text as an aid to confirming the content.



Student copy

This diagram will help you to understand the text you are about to read in Resource sheet 10. Fill in the missing sections.

Work sheet

Name _____

Date _____

Seagrasses save lives

Fill in the missing sections.

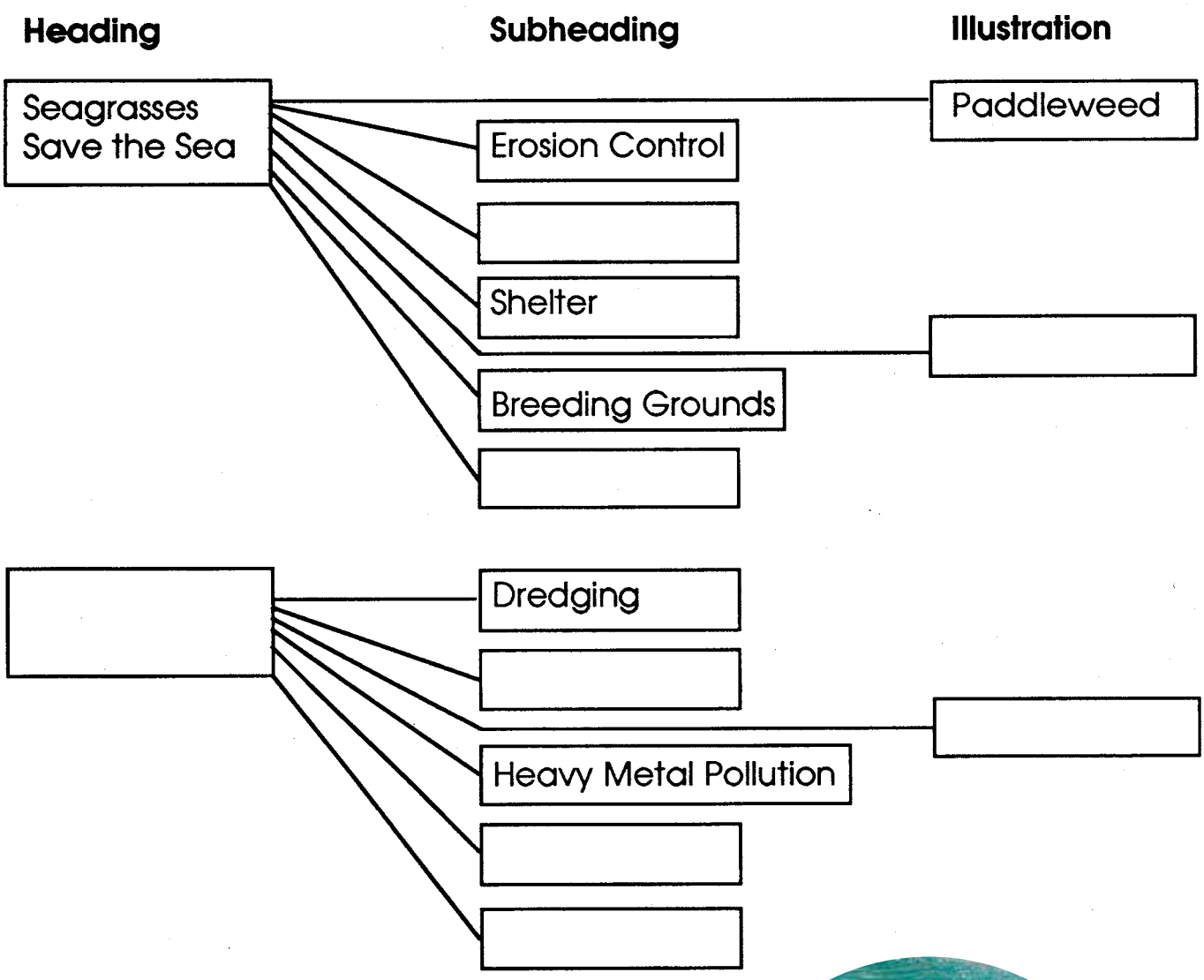


Photo: Suzanne Long/DPaW

Seagrasses save the sea

Seagrasses are vital for the ongoing health of our coastal waters and fisheries. They stabilise the sand and mud in which they grow, and provide food, shelter, breeding grounds and nursery areas for many marine organisms, such as fish and prawns.

Erosion control

Seagrasses stabilise the sea bed with their roots. This prevents fragile coastal sea bottoms eroding and therefore helps to create permanent communities for algae and marine animals.

Food

Green turtles, swans, many invertebrates (animals without backbones) and some vegetarian fish feed directly on seagrass. It is also the main food of dugongs.

Decaying seagrass leaves also provide a bountiful supply for small animals, such as bacteria, worms and crabs; which in turn are eaten by juvenile fish, prawns and seabirds. In Port Hacking, New South Wales, 65 per cent of the food eaten by leatherjackets are the tiny animals and plants living on the seagrass.

Seagrasses actively produce small amounts of nutrients required by other coastal plants and animals.

Shelter

Small animals and plants shelter in the seagrass leaves, receiving protection from predators, too much sunlight, or temporary changes in salinity and temperature. Fast water movement is also reduced considerably inside seagrass beds, creating a protected home for its inhabitants.

Breeding grounds

Seagrass beds provide breeding areas for many fish, including commercially important species such as King George whiting.

Nursery

As a nursery for juvenile fish, crabs and prawns, seagrass meadows are worth hundreds of millions of dollars every year to our commercial fisheries. The value of the northern Australian prawn trawl fishery, for example, is $100 million per year, and important commercial prawn species are dependent on seagrasses for the early part of their life.

Young prawns hatch in the open ocean and rapidly make their way to coastal waters where they settle in seagrass beds. Here, they receive food, and protection from tidal currents and larger predatory fish. When they become large juveniles, they move back out to sea.

Juvenile fish that depend on seagrass include mullet, tailor, bream and flathead.

Humans killing seagrasses

Natural processes, such as storms, can damage seagrass beds. However, because seagrass beds are usually found in shallow coastal waters close to human habitation, they are particularly vulnerable to impacts from human activities.

Nutrient overdose

MYTH: Seagrasses are plants and therefore need lots of nutrients, so sewage outfalls in coastal waters should help seagrasses grow.

Wrong!

FACT: The nutrients in sewage help algae to grow, and too much algae can kill seagrass. Sewage often contains an overabundance of nutrients such as nitrogen and phosphorus. These nutrients encourage the excessive growth of microscopic algae suspended in the water above the plants, or the overgrowth of algal plants on the seagrass leaves. If enough algae grows, the sunlight needed for photosynthesis cannot penetrate to the seagrass, and it cannot grow, eventually dying.

Excess nutrients also come from fertilisers in the water run-off from cleared coastal land, cities, towns and farms.

Heavy metal pollution

Seagrass roots can concentrate heavy metals then pass them up the food chain, poisoning many animals. Seagrasses in an area of 1.5 square kilometres in Spencer Gulf, South Australia were found to contain 73 tonnes of cadmium, 51 tonnes of lead and 571 tonnes of zinc, probably from the nearby lead smelter. The variety of animals, including commercially fished species, was drastically reduced in this poisoned seagrass bed.

Boating

Damage to seagrass meadows by boat propellers, anchors and anchor chains is also common. Boat users should try to minimise damage by anchoring in bare sand and avoid using outboard motors in very shallow water over seagrass areas.

Work sheet 14

Name _____

Date _____

Grasses of the sea

Read Resource sheet 10 and look at the WA Marine Parks website (www.marineparks.dpaw.wa.gov.au/fun-facts) then answer the following questions.

List at least 10 marine animals including fish species that shelter in seagrass meadows:

_____

_____

_____

Which large marine mammal feeds almost exclusively on seagrass?

_____

List at least four Western Australian marine parks that contain important seagrass areas.

_____

_____

_____

What kinds of pollution can impact on seagrass habitats?

_____

_____

Why do excessive nutrients impact on seagrass?

_____

_____

_____

How many years does it take seagrass to recover after it has died in a certain area?

_____

What can boat users do to avoid damaging sensitive seagrass areas?

_____

_____

_____

Construct a food web of organisms relying on seagrass as the producer in the web. (Mark in the arrows).

Write down some of the impacts of destroying seagrass.

_____

_____

_____

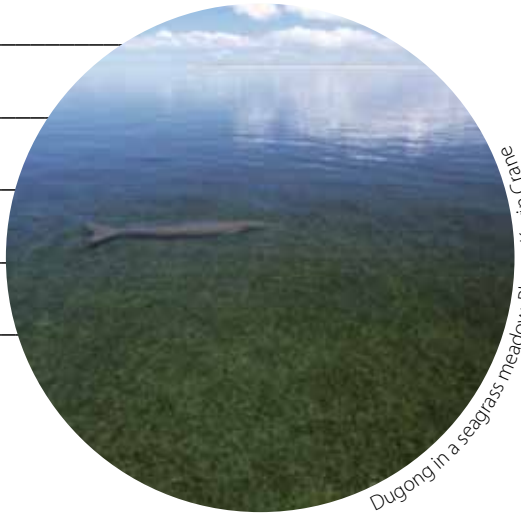
_____

_____

_____

_____

_____



Dugong in a seagrass meadow. Photo: Kevin Crane

12. A whale of a time

Students will study a whale of their choice and then produce life-size shapes to compare the whales with their own body size. They will also become aware of whales' dependence on the vastness of healthy ocean and the importance of marine parks in helping to protect their habitat.

Concepts

- Whales include the largest known animals on Earth.
- Marine life, unlike terrestrial life, depends on huge expanses of ocean for their survival.
- Whales and all marine life need to be conserved.

Objectives

Students will be able to:

- recognise the characteristics specific to each whale group
- reproduce a life-size outline of a whale
- understand the importance of setting aside healthy, well-managed areas of the ocean for protecting marine animals and their habitat.

Values

To recognise the importance of whales in the marine ecology, and thus the need for their protection on a worldwide basis.

Australian Curriculum links

Science (Understanding):

- Year 3 Living things can be grouped on the basis of observable features and can be distinguished from non-living things (ACSSU044) e.g. Use whale shapes and sizes to compare features of whales.
- Year 4 Living things, including plants and animals, depend on each other and the environment to survive (ACSSU073) e.g. Whales depend on vast, healthy oceans in their migrations, including habitats to eat, breed and produce young.
- Year 5 Living things have structural features and adaptations that help them to survive in their environment (ACSSU043) e.g. Features of a whale to help them survive in warm and cold waters, move for long distances and eat.
- Year 6 The growth and survival of living things are affected by the physical conditions of their environment (ACSSU094) e.g. The physical conditions of the environment that assist a whale to survive.
- Year 7 There are differences within and between groups of organisms; classification helps organise this diversity (ACSSU111) e.g. Recognise characteristics specific to each whale group. Named species that occupy WA marine waters.

Science (Human endeavour):

- Year 7 Science understanding influences the development of practices in areas of human activity such as industry, agriculture and marine and terrestrial resource management (ACSHE121) e.g. Understanding whale ecology and habitat needs should influence our protection and practices of marine environments.

Geography:

- Year 7 *Unit 1* The classification of environmental resources and the forms that water takes as a resource (ACHGK037); the ways that flows of water connect places as it moves through the environment and the way this affects places (ACHGK038); the causes, impacts and responses to an atmospheric or hydrological hazard (ACHGK042) e.g. Human impacts or alternatively good management of marine plants and animals such as seagrasses and whales, have important consequences on our use of marine environments.
- *Unit 2* The factors that influence the decisions people make about where to live and their perceptions of the liveability of places (ACHGK043); the influence of accessibility to services and facilities on the liveability of places (ACHGK044); the influence of environmental quality on the liveability of places (ACHGK045); the strategies used to enhance the liveability of places, especially for young people, including examples from Australia and Europe (ACHGK047) e.g. Human impacts or alternatively good management of marine plants and animals such as seagrasses and whales, have important consequences on our use and perceptions of marine environments.

Reflecting and responding

- Year 7 Reflect on their learning to propose individual and collective action in response to a contemporary geographical challenge, taking account of environmental, economic and social considerations, and predict the expected outcomes of their proposal (ACHGS054) e.g. After research or an inquiry on whales and knowing that whales are the largest single organism on earth and are being impacted by human activities, plan for their conservation and protection and appropriate decision-making.

English:

- Year 6 Participate in and contribute to discussions, clarifying and interrogating ideas, developing and supporting arguments, sharing and evaluating information, experiences and opinions (ACELY1709) e.g. Discuss, share and review information on whales.
- Year 4-6 Use comprehension strategies to build literal and inferred meaning to expand content knowledge, integrating and linking ideas and analysing and evaluating texts (ACELY1692) e.g. Review information on whales to compile ideas on a whale project.
- Year 7 Use a range of software, including word processing programs, to confidently create, edit and publish written and multimodal texts (ACELY1728) e.g. Construct a letter to a politician about whale protection.

Background information

Whales, dolphins and porpoises belong to the order known as Cetaceans. They are classed as the most advanced marine mammals. They live entirely in the sea and breathe air. They communicate by sounds, which are also used as a form of echo-location navigation (that is, a sound is emitted and an echo received). There are 75 to 80 different species of whale, dolphin and porpoise known, with these being classed into two groups:

1. Toothed whales, which also includes the dolphins.

2. Baleen whales (baleen is a series of horny plates arising from the mucous membrane of the palate, which sifts out the plankton from the water).

Whales are found in various types of waters around the world. Larger whales such as humpbacks and southern right whales undertake extensive annual migrations from cold waters to tropical areas and back. Such journeys are often as long as 20,000 kilometres.

The southern humpback whale is the most common migratory whale seen along our coastline. The abundance of food and their breeding cycle is related to their annual migration. The most productive feeding areas are in the rich upwellings found in the Antarctic and here they spend summer and early autumn consuming vast amounts of food and laying down thick layers of blubber. From May to July, humpbacks move north to tropical waters to mate and give birth, then in August through to November they return south toward the poles. The females are often accompanied by newborn calves and return more slowly and closer to the coast so the young can fatten up before they reach cold Antarctic waters.

Whales are not the only marine animals to migrate. Many animals, some no bigger than a pinhead, make journeys of hundreds of kilometres. The sea is full of marine life migrating. Some are returning to nesting colonies (turtles to lay eggs), others are heading for feeding areas (whales) and others are on their way to inland rivers (lampreys in the south west). Some, such as salmon, travel in big schools but others, like the turtle, travel alone.

Most of the larger migrating marine animals are threatened. Whales have been hunted since 1,500 BC for food, clothing, weapons and oil for lighting. Several hundred thousand blue, humpback and southern right whales were killed throughout the world before they became protected in 1966. However, they still face many threats such as entanglement in fishing equipment, pollution and accidentally ingesting marine rubbish.

Whales are the largest animals known, and the heaviest, so without the buoyancy of the ocean waters, their internal organs would be crushed from their weight.

References

www.marineparks.dpaw.wa.gov.au/fun-facts

Whales and Dolphins of Western Australia, Department of Parks and Wildlife

Marine wildlife of southern WA Identification guide, Department of Parks and Wildlife (phone your nearest DPaW office to obtain a copy for each student or download from www.marineparks.dpaw.wa.gov.au/downloads)

Marine wildlife of north-west WA Identification guide, Department of Parks and Wildlife (phone your nearest DPaW office to obtain a copy for each student or download from www.marineparks.dpwa.wa.gov.au/downloads)

Whale Patrol DVD, Sea Dog TV International

Deepsea Whale Rescue, Department of Parks and Wildlife

Teacher directions

Materials

- ☐ ***Whale Patrol* DVD**
- ☐ ***Marine wildlife of southern WA Identification guide* (contact DPaW to obtain a free class set)**
- ☐ **Art paper**
- ☐ **Graph paper**
- ☐ **Library resources**
- ☐ **Tape measure**
- ☐ **Chalk**
- ☐ **Pictures of whales**
- ☐ **Map of the world**
- ☐ **Large bitumen area**

Photo: Doug Coughran

Lesson outline

Preliminary activity

Scale will need to be taught so the students can transfer their whale to a life-size model. Explain scale and

its use in maps to demonstrate distance on a smaller level, such as 1 centimetre = 100 kilometres.

1. Using normal graph paper, have the students trace around their hand. Then using larger grid paper have the children transfer their hand onto the larger grid. The squares on the grid paper can be numbered to make it easier for students experiencing difficulty.
2. Distribute Marine wildlife of southern WA Identification guide to the class, look at the website www.marineparks.dpaw.wa.gov.au and discuss:
    - types of whales found in WA marine parks
    - their size
    - threats to whales such as whaling and entanglement in marine rubbish
    - migration
    - feeding
    - breeding
    - which WA marine parks protect important humpback and blue whale breeding and migration areas
    - the importance of marine parks in protecting whales and why there is a need for DPaW's whale disentanglement team.
3. In groups of two, select a whale species from Resource sheet 11. Complete Work sheet 15.
4. From their review, and using the information provided, each pair writes a letter to the leaders of countries that still allow whaling (such as Japan, Norway and Iceland), asking them to stop.
5. Each group will produce, to scale (e.g. 1 centimetre = 2 metres), a paper cut-out of their whale and place it on the map of the world. Discuss the whale's habitat, habits and migratory patterns.
6. After comparing sizes of paper cut-outs of whales in class, move outside so the students can measure and draw the real life replicas of their whales on the oval or school court. A grid of one metre squares can be established, by using markers and string, with each square being numbered. The groups then transfer their smaller models to the larger grid, using chalk.
7. On completion, the class can compare sizes of whales and see how many students can fit inside each outline.

Evaluation

- Were the groups able to successfully produce a scale model of their whale?
- Were the students able to transfer their research into letter form?
- Were the students able to explain migratory patterns and their importance to the species' survival?

Complementary activities

Design posters stating the need for protection and the 'Rights of the whales' to survive.

Using www.marineparks.dpaw.wa.gov.au, find out which species of whales and dolphins are listed as threatened in WA and why.

Undertake a class debate on how marine parks help to protect whales and dolphins.

Visit the marine room at the WA Museum and examine the full size whale skeleton.

Facts about whales

The oceans house about 80 different species of whale. There are two groups of whales:

- **Baleen** – which feed by allowing water to pass through their mouths as they move through the ocean. Food is strained from the water by thin plates made of a horny substance called baleen.
- **Toothed** – these whales have teeth to help them chew larger pieces of food such as squid and fish.

Photo: Doug Coughran

BLUE WHALE *(Balaenoptera musculus)*

The blue whale is a mottled bluish-grey colour and has a stubby dorsal fin well back on its body. The largest living animal on Earth, its average length is 25 to 26 metres, but females can reach more than 30 metres and weigh more than 160 tonnes. The blow, up to nine metres high, is vertical.

Photo: Dave and Fiona Harvey

SOUTHERN RIGHT WHALE *(Eubalaena australis)*

Weigh up to 80 tonnes and may reach 18 metres long. They have horny growths called callosities on the top of the head, behind the blowholes, on the chin, above the eyes and on the lower lip. Patterns formed by the callosities are different for each individual. The head is up to a quarter of the total body length, and the lower jawline is distinctively bowed. There is no dorsal fin. The flippers are broad, triangular and flat and body colour ranges from blue-black to light brown. The twin blowholes produce a high, V-shaped blow.

Photo: Barbara Parker

PYGMY RIGHT WHALE *(Caperea marginata)*

Baleen whales with a strongly bowed lower jaw. The pygmy right whale is the smallest baleen whale at about six metres long. They have a more streamlined shape than southern right whales, a small dorsal fin and narrow flippers. There are no callosities. The narrow, arched head is smaller in proportion to the body than in other baleen whales. The upper body and flippers are grey or black, with lighter colouring beneath, and the tail flukes are broad and notched.

Photo: Holly Raudino

HUMPBACK WHALE *(Megaptera novaeangliae)*

Humpback whales have distinctive throat grooves and knobs on their heads (tubercles), very long pectoral flippers with knobs on the front edge, and a humped dorsal fin that shows as the whale arches its back when it dives. They are blackish, with white undersides and sides. The underside of the tail fluke is usually white with black patterning. Adults are approximately 15 metres long. The maximum length is 18 metres and a mature adult may weigh up to 45 tonnes.

Photo: Doug Coughran

FIN WHALE *(Balaenoptera physalus)*

Fin whales reach 25 to 27 metres in length and weigh up to 90 tonnes. This species has a taller dorsal fin than other baleen whales. The head is bi-coloured, with a white lower jaw and white baleen plates.

Photo: Doug Coughran

SEI WHALE *(Balaenoptera borealis)*

These threatened whales are rarely seen. They are long and streamlined, between 17 and 21 metres long and have a single central ridge on the top of the body and a bi-coloured head.

Photo: Holly Raudino

MINKE WHALE *(Balaenoptera acutorostratus)*

The smallest of the seven great whales at about eight metres long, minke whales are occasionally seen off WA's coast. Their most distinctive feature is the narrow, sharply triangular head on which there is a single raised ridge. Minke whales arch their backs while diving but do not raise their tail flukes. Their blows are about two to three metres high.

Photo: Stephen Wong/marinethemes.com

SPERM WHALE *(Physeter macrocephalus)*

The largest of the toothed whales, sperm whales can weigh up to 60 tonnes with average lengths of 15 metres in males and 11 metres in females. They are easily recognised by the huge rectangular head, which is a quarter of the body length in calves and, with age, may form more than a third of the length of the body. The cylindrical lower jaws contain rows of huge teeth. The body is dark grey or brown with short, stubby flippers. The tail is large and powerful and the triangular tail flukes are often raised before diving.

Photo: Holly Raudino

KILLER WHALE *(Orcinus orca)*

These stocky, black and white whales have broad flippers and rounded heads. The dorsal fins are extremely high and the straight fins of males may reach 1.8 metres. Females have shorter, more dolphin-like fins. Males may reach more than nine metres in length, though females are smaller, and weigh about 14 tonnes. They are toothed. They live in pods of up to 40. Killer whales occasionally visit WA waters and often follow migrating humpback whales to feed on the calves and old, sick or injured animals.

Work sheet 15

Name _____

Date _____

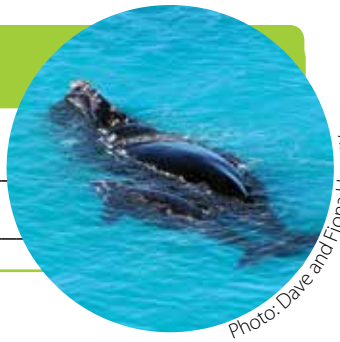


Photo: Dave and Fiona Harvey

Whales

You have been chosen as a promising marine biologist to complete an information search on a whale of your choice. This information is valuable in the conservation of whales.

Name of whale: _____

Type: ☐ **baleen** ☐ **toothed** **Length:** _____

Weight: _____ **Colour:** _____

Where is it found?_____

_____

What does it eat? _____

Where and why does it migrate?

_____

_____

List any unusual features:_____

_____

Draw your whale

13. Find my home

Students will complete a 'beach walk' to collect, examine and classify pieces of evidence that demonstrate that the sea is in constant motion and that motion delivers objects from the ocean depths to the shore.

Concepts

- The ocean depths differ from coastal regions in the diversity of animals and plants.
- Humans have a major impact on oceans and beaches and need to be aware of this.
- The ocean is in constant motion and objects from thousands of kilometres away can be dumped on the shore.

Objectives

Students will be able to:

- identify as many different items as possible from their beach walk and observations
- classify the items found into groups according to their original habitat
- define and understand how humans impact on the ocean.

Values

To understand the care needed and conservation methods required by the community to help protect the ocean environment.

Australian Curriculum links

Science (Understanding):

- Year 3 Living things can be grouped on the basis of observable features and can be distinguished from non-living things (ACSSU044) e.g. On a beach walk, identify what is living and what is non-living, what is rubbish and what are animal homes, what belongs there, where the other objects come from, how it gets there.
- Year 4 Living things, including plants and animals, depend on each other and the environment to survive (ACSSU073) e.g. The ocean is the largest water environment on Earth, supports life and carries organisms and debris large distances.
- Year 6 The growth and survival of living things are affected by the physical conditions of their environment (ACSSU094) e.g. The ocean is the largest water environment on Earth, supports life and carries organisms and debris large distances.
- Year 7 There are differences within and between groups of organisms; classification helps organise this diversity (ACSSU111) e.g. On a beach collection walk, classify the organisms and the debris or pollutants found, and hypothesise their origin.
- Year 7 Water is an important resource that cycles through the environment (ACSSU222) e.g. The ocean contains 97 per cent of the Earth's water and covers 70 per cent of the Earth's surface.

Science (Human endeavour):

- Year 5/6 Scientific knowledge is used to inform personal and community decisions (ACSHE217) e.g. The ocean is the largest water environment on Earth, supports life and carries organisms and debris large distances. Humans have significant impacts on the oceans and we can make decisions that conserve oceans.

Geography:

- Year 5 The influence of people, including Aboriginal and Torres Strait Islander people, on the environmental characteristics of Australian places (ACHGK027) e.g. The ocean is the largest water environment on Earth, supports life and carries organisms and debris large distances. Past human decisions have had significant impacts on oceans. People can decide to conserve ocean environments.
- Year 7 *Unit 1* The classification of environmental resources and the forms that water takes as a resource (ACHGK037); the ways that flows of water connect places as it moves through the environment and the way this affects places (ACHGK038); the causes, impacts and responses to an atmospheric or hydrological hazard (ACHGK042) e.g. The significance of the ocean as an important environmental resource.
- *Unit 2* The factors that influence the decisions people make about where to live and their perceptions of the liveability of places (ACHGK043); the influence of accessibility to services and facilities on the liveability of places (ACHGK044); the influence of environmental quality on the liveability of places (ACHGK045); the strategies used to enhance the liveability of places, especially for young people, including examples from Australia and Europe (ACHGK047) e.g. The significance of the ocean as an important environmental resource. Locations near the ocean and the quality of these are chosen by large proportions of people.

Interpreting, analysing and concluding

- Year 4 Collect and record relevant geographical data and information, for example, by observing, by interviewing, conducting surveys and measuring, or from sources such as maps, photographs, satellite images, the media and the internet (ACHGS027) e.g. Beach objects survey, sort and determine origin.
- Year 4 Represent data by constructing tables and graphs (ACHGS028). Interpret geographical data to identify distributions and patterns and draw conclusions (ACHGS030) e.g. Beach objects survey, sort and determine origin.

Reflecting and responding

- Years 4-6 Reflect on their learning to propose individual action in response to a contemporary geographical challenge and identify the expected effects of the proposal (ACHGS032) e.g. Beach objects survey, sort and determine origin. Ways to reduce debris and pollution and other actions.
- Years 4-6 Reflect on their learning to propose individual and collective action in response to a contemporary geographical challenge and describe the expected effects of their proposal on different groups of people (ACHGS039) e.g. Beach objects survey, sort and determine origin. Ways to reduce debris and pollution and other actions.

English:

- Year 7 Use a range of software, including word processing programs, to confidently create, edit and publish written and multimodal texts (ACELY1728) e.g. Design communication products to provide a message to community on a range of environmental issues, including conservation of oceans and other marine conservation issues.

Background information

"The living things of the seashore are truly marine (that is, they have come from the sea). In fact the very nature of the seashore is made by the sea. Without the sea, there would not be a seashore."

I Bennett

Even the sand has been produced from decaying matter and eroded shells and bones. Wind, waves, tides and currents all play a part in transporting marine animal parts, plastics and decaying matter to the shore.

The ocean is the large mass of water covering about 70 per cent of the Earth's surface. It contains approximately 97 per cent of the Earth's water. The ocean provides us with food and energy, regulates air temperature, supplies moisture for rainfall and provides a means for transport. It is also used for many types of recreation.

The deep ocean and ocean floor have long fascinated people. Little was known about them until the 1940s, when seismic methods were first used. The ocean floor has similar topography to the land, with hills, mountains, valleys, ridges and trenches.

Because of the depths and strong currents of the ocean, few items from the deep are found on the beach. The amount of damage and erosion of washed-up material may indicate that the items have come from a long distance away.

The beach and ocean floor are made from plant and animal materials that have come from the ocean, so remember to return all items to where they were found.

The pollutants found on the beach usually come from rubbish dumped from boats, or washed along the shore by the waves. The general source of the pollutants is usually easy to determine.

References/resources

Beachcombers guide to south-west beaches, Department of Parks and Wildlife

Dakin, W.J. and Bennett I, (1992) *Australian Seashores*. Collins, Angus & Robertson Pty Ltd, NSW.

Moffat B, (1992) *Marine Studies – A Course for Senior Students*. Wet Paper Publications, Brisbane.

Pick, C. (1977) *The Young Scientist Book of Undersea*. Usborne Publishing Ltd.

Teacher directions

Materials

- ☐ **Plastic bags or buckets to carry rubbish**
- ☐ **Overhead of continental shelf profile (Resource Sheet 12)**
- ☐ **Large hoops (5)**
- ☐ **Student notebook**
- ☐ **Camera**
- ☐ **Hand lens**
- ☐ **Beachcombing chart, available from the Gould League**
- ☐ **The video Sea Creatures, available from Parks and Wildlife district offices**

Lesson outline

Pre-excursion activities

1. Examine Resource sheet 12 and discuss.
2. View the video Sea Creatures and discuss the animals most likely to come from the deep sea. Discuss animal movement, camouflage, defence and any unusual features.
3. In groups, students list items they expect to find on the beach and note where each item might come from.
4. Collate the group predictions onto the board. Students copy data onto Worksheet 16.

Excursion activity

Stress the need for students to:

- **return items to the place they were found**
- **use established paths over dunes**
- **take care when picking up rubbish**
- **leave syringes alone; ask the teacher to dispose of them.**

The students search the beach for marine plants and animals and any rubbish. Tick off items from Work sheet 16 and place all rubbish into plastic bags.

On completion, discuss a set of criteria for classifying the items found into groups (e.g. ocean, sandy shallows, reef, and cultural). The hoops provided will represent each of the groupings. The teacher selects a few items from each hoop and asks the students the reasons for classifying them into the respective grouping.

Examine the rubbish found and decide where each piece may have originated (e.g. ships, people on the beach, drains, or blown from elsewhere). Discuss the environmental damage that may be caused by these objects to both the living and non-living components of the environment.

Take the bags of rubbish back to school and return all other items to the places where they were found.

Post-excursion activities

Discuss the results of Work sheet 16. Use the beachcombing chart to identify the various objects.

Research the items not identified at the beach and investigate some books to help identify the origin (e.g. cuttlefish).

Evaluation

- Were students able to classify the objects?
- Were they able to find or predict the homes of various animals and plants?
- Were cultural objects evaluated as a major problem on the shore?

Complementary activities

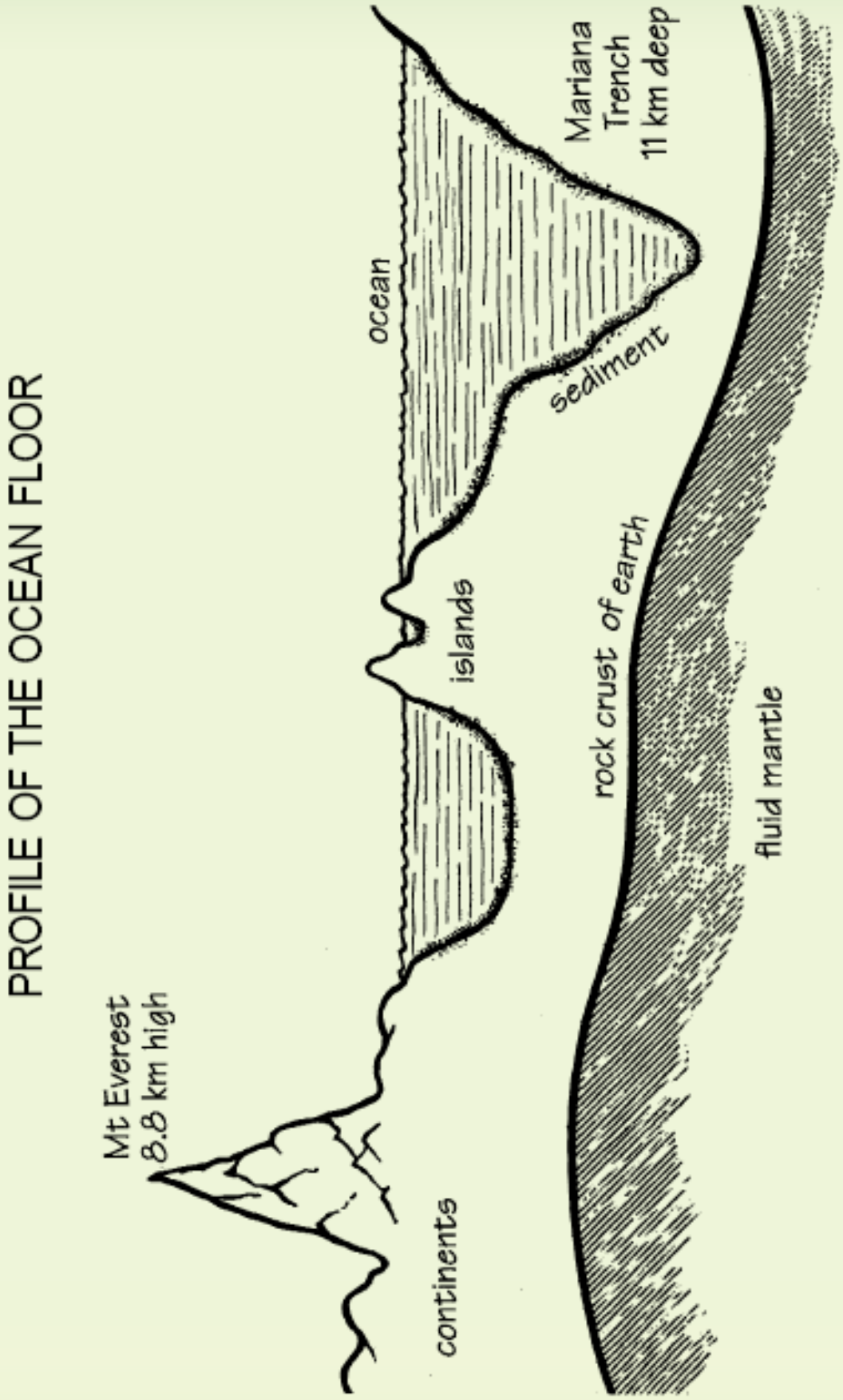
Write a letter or report from an animal's (seal, dolphin, fish) point of view, stating its concern for its habitat because of the increasing rubbish being dumped in the ocean.

Design posters advertising the need to conserve animals, collect rubbish from the beach, or bring rubbish home after fishing trips.

Design bumper stickers that stress the need for conservation in our oceans. Reproduce the designs on white contact so students can have their own stickers.

Produce 10 rules for people to abide by to conserve the marine environment.

Profile of the ocean floor



Work sheet 16

Name _____

Date _____

Item - Home address

Item - Home address

Item - Home address

Item - Home address

14. Zones of the ocean

To examine the depths of the ocean and the diverse animal and plant groupings that live there.

Concepts

- There are three different layers within the ocean depths and a variety of changes in temperature, light and marine animals between these layers.
- Plants need light to survive, thus they are unable to survive on the bottom of the ocean depths.
- Animals have made a number of adaptations to survive in the dark depths of the ocean.

Objectives

Students will be able to:

- demonstrate their understanding of the ocean structure by creating a diorama
- become aware of the diversity of plants and animals in the layers and their adaptations to their environment
- gain an understanding of the relationship between water pressure and depth.

Values

To understand that the deep sea is a fragile environment that can be affected by human impact so needs to be cared for.

Australian Curriculum links

Science (Understanding):

- Year 4 Living things, including plants and animals, depend on each other and the environment to survive (ACSSU073) e.g. Oceans have different depth zones in which different organisms live.
- Year 5 Living things have structural features and adaptations that help them to survive in their environment (ACSSU043) e.g. Within the different depth zones in oceans, organisms have different features or adaptations for survival.
- Year 6 The growth and survival of living things are affected by the physical conditions of their environment (ACSSU094) e.g. Organisms growth and survival are affected by the ocean depth in which they live.
- Year 7 Interactions between organisms can be described in terms of food chains and food webs; human activity can affect these interactions (ACSSU112) e.g. Food webs at different ocean depths.

Background information

The waters of the oceans fill the enormous hollows in the hard outer rock surface of the planet. The 'continental shelf' is the great rock platform that surrounds each continent.

The waves, currents, and rivers have dumped heaps of sand, mud and loose debris from the land over the shelf. The continental shelf is inhabited by many seaweeds and a variety of animals such as sea anemones, smaller molluscs, sponges and sea urchins. The shelf dips to the 'continental slope' and then into the 'continental rise' where there are less plants and animals, although larger molluscs, squid, octopuses and cuttlefish are present. The 'rise' leads to the 'abyssal plains', which supports unusual fish and free swimming molluscs but very little plant life.


Photo: Cathy Zwick

Mountain ranges rise from the abyssal plains followed by trenches. The greatest depths known in the ocean are in the Mariana Trench (south of Mariana Island in the South Pacific) and are up to 11,038 metres deep. The ocean is divided into three levels depending on the amount of sunlight.

Near the surface, from 0 to 200 metres, is the sunlit zone, where most creatures such as jellyfish, dolphins, fish and plankton live because it is warm and sunny.

The second level is the twilight zone, from 200 to 1,000 metres, where only blue light remains. Here, the water pressure increases and the temperature drops. Plants cannot grow in these waters. The animals use bioluminescence to attract mates, but often it is on the lower parts of their body to camouflage themselves against the prey in the sunlit zone. Animals living here include lantern fish, viperfish and hatchetfish.

The third level is the deep sea zone, below 1,000 metres. Often known as the 'Midnight Zone', the water pressure increases strongly, temperatures are near freezing and it is completely dark. The animals in this level have adapted to their environment by using special organs or lights (bioluminescence) which shine to lure their prey. Most deep sea fish are black, due to the lack of light. They usually have big jaws for swallowing their prey (e.g. gulper eels and angler fish). Few fish live here because food is scarce.

The very bottom dwellers (benthic creatures) are blind or have no eyes. They are usually white and do not use bioluminescence. These creatures include tripod fish, annelids and shrimp.

Although the ocean floor is solid rock, most of it is covered with a soft ooze which has been produced from billions of shells of tiny plants and animals that lived in the surface waters, but died and sank.

Teacher directions

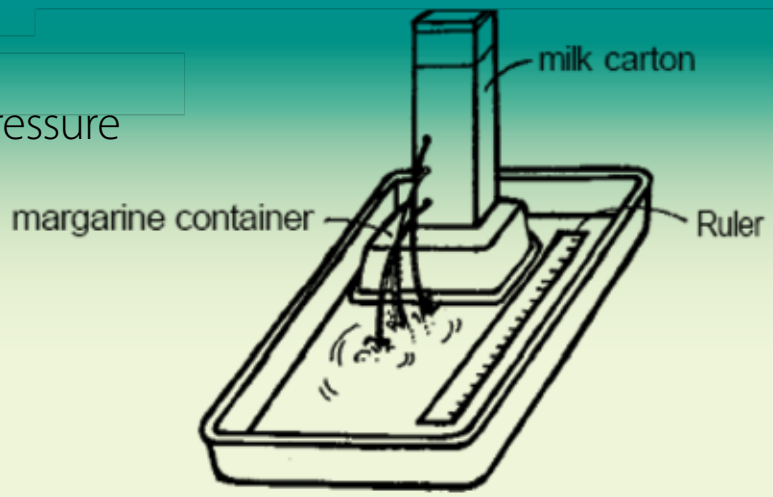
Materials

- ☐ **Library resources**
- ☐ **Cellophane**
- ☐ **Glue**
- ☐ **Plastic tubing**
- ☐ **Nails (3)**
- ☐ **Empty margarine container**
- ☐ **Water**
- ☐ **Paints and brushes**
- ☐ **Art paper**
- ☐ **Balloons**
- ☐ **One empty one-litre milk carton**
- ☐ **Ruler**
- ☐ **Large tray**

Lesson outline

Using Resource sheet 12 discuss the three layers of the ocean depths; their features and the adaptations of the animals to the lack of light and the water pressure.

Water pressure



1. Open the top of the milk carton. Then push the three nails through one side of the carton about 2.5 centimetres apart, making sure the lowest is seven centimetres above the bottom of the carton.
2. Place the ruler along the bottom of the tray so the 30-centimetre end is touching one end of the tray.
3. Place the margarine container upside down at the one-centimetre end. Place the milk carton on top of the tub with the nails pointing towards the 30-centimetre end.
4. Fill the carton with water, pull out the nails and keep pouring water into the carton so it is always full.
5. Take note of how far each jet squirts. Why is this? What does this tell you about the pressure as you go deeper under the ocean?

The bottom jet should travel further because it is under the greatest pressure from the water above. Life in the ocean depths is adapted to this.

Have each student blow up a balloon. Fill a deep dish or bucket full of water and have the students attempt to blow up the balloons while holding them under water. Plastic tubing may need to be connected to the neck of the balloon. Discuss the difficulties of blowing up the balloon under water and how the water pressure causes this.

Evaluation

- Were they able to correctly demonstrate the diversity and adaptations of the animals and plants in their group's level of the ocean correctly?

Complementary activities

Produce a class mural to display the different levels of the ocean and its inhabitants.

Invite a diver to come to talk about the undersea world and the effects of pressure on divers while diving. Ask them to explain what 'the bends' are.

Each group can create a diorama of their level, including samples of the inhabitants of that layer. The dioramas could fit on top of each other to show the depths of the ocean and the changes that occur.


Photo: Ann Storrie/DPaW

Ocean dwellers

Photo: John Huisman

PLANKTON:

Plants (phytoplankton) or animals (zooplankton) that drift in the sunlit layer at the mercy of the water currents. The phytoplankton need the light for photosynthesis. These microscopic organisms provide most of the food for the larger organisms. Examples of larger zooplankton are larvae, krill or sea jellies. 'Upwellings' from the ocean floor refertilise the plankton with nutrients released by bacterial decomposition of organisms on the floor.

Photo: Tourism WA

Photo: Tourism WA

Photo: John Huisman

NEKTON:

The larger and stronger swimming animals of the ocean such as fish and squid. The surface dwellers tend to be stronger swimmers and more streamlined whereas the bottom dwellers tend to be slower and flatter.

Photo: John Huisman

Photo: John Huisman

Photo: Marine Futures

BENTHOS:

Consists mostly of invertebrates that burrow into the sand or shelter in crevices or attach themselves to rocks. They feed on scraps that float down from the top layers or decaying matter.

Zones of the deep

15. Why is the sea salty?

The students will examine reasons why the sea is salty and experiment with the properties of salt.

Concepts

- Salt water is denser than fresh water, thus allowing plants and animals greater buoyancy in the ocean.
- Sea water is composed of a variety of salts and minerals which are used by marine organisms in a variety of ways including building stronger shells.
- Salinity varies from ocean to ocean around the world.

Objectives

Students will be able to:

- understand where the salt in the ocean comes from
- determine some of the properties of salt water.

Values

To understand the importance of human care in rubbish disposal, and the environmental risks of pouring substances down the sink and using fertilisers – as they eventually end up in the ocean and cause an imbalance in the ecology.

Australian Curriculum links

Science (Understanding):

- Year 4 Earth's surface changes over time as a result of natural processes and human activity (ACSSU075) e.g. Ocean environments change as a result of saline environments creating currents.
- Year 7 Water is an important resource that cycles through the environment (ACSSU222) e.g. Relate how sea water fits into the water cycle.

Science (Human endeavour):

- Year 5/6 Science involves testing predictions by gathering data and using evidence to develop explanations of events and phenomena (ACSHE081) e.g. Conduct a series of investigations on salt in water and predict, draw conclusions and research effects on oceans.

Science (Inquiry skills):

- Year 4 Safely use appropriate materials, tools or equipment to make and record observations, using formal measurements and digital technologies as appropriate (ACSIS066) e.g. Conduct investigations to find the effects of salt in water.
- Year 6 With guidance, plan appropriate investigation methods to answer questions or solve problems (ACSIS103) e.g. Investigate the effects of salt in water and apply findings to oceans.

Background information

The chemical composition of sea water is important to scientists to help determine why some areas of the oceans are more productive than others (e.g. in producing more fish and prawns). Seawater provides food for microscopic animals and for seaweeds which only have holdfasts and do not absorb nutrients from the soil. Sea water provides oxygen for marine life.

Sea water contains about three per cent sodium chloride (common salt). The body fluids of marine invertebrates are about the same whereas land animals have about half that amount. Sea water contains a number of other chemicals, such as magnesium, calcium sulphur and potassium.

The amount of salt in the ocean (salinity) varies from place to place. Many of the salts in the ocean come from the land. As rocks break down they release chemicals which are washed into the oceans via rivers and streams.

Water running off the land brings with it dissolved salts and chemicals, as well as effluent. Chemicals are also released by undersea volcanoes and springs.

Evaporation, precipitation (rainfall) and temperature affect the salinity of the world's oceans, making them differ in their levels of salinity. In hotter regions, evaporation removes the fresh water, leaving a higher concentration of salt in the oceans. Areas of high precipitation return fresh water to the ocean, which dilutes the salt concentration. Fresh water from rivers also lowers the level of salinity in oceans.

Salt that comes from evaporated sea water is called sea salt and is produced commercially from a series of evaporation ponds.

Marine life uses calcium, silicon and phosphates from the sea water to produce their shells and skeletons, and to build cellular tissue.

Salt makes water heavier than fresh water. This makes it easier for marine plants and animals, such as jellyfish, whales and microorganisms, to float.

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Teacher direction

Materials

See individual experiments


Photo: Kevin Crane

Lesson outline

Discuss sea water properties, such as the salt in water which allows for greater buoyancy which helps whales and jellyfish float; how the salt comes from the land; and how marine organisms use these properties for their survival.

NB. The following experiments can be done as a rotational activity or all together.

Experiment 1:

Salt solution – a seven-hour evaporation process demonstrates how rock pools that dry out show salt remains, and how salt is collected commercially.

Materials

- ☐ **Salt**
- ☐ **Water**
- ☐ **Jar or beaker**
- ☐ **Saucer**

1. Fill a jar or beaker with water. Dissolve as much salt in the water as possible.
2. Pour the saturated solution into a saucer and place in a warm, dry place in the water for a few days.
3. Observe and record results each day. Discuss what is happening and why. (Each day the water evaporates until only salt crystals are left.)

Experiment 2:

Buoyancy – this experiment demonstrates how the marine plants and animals are aided in their movements by the salt water.

Materials

- ☐ **Salt**
- ☐ **Water**
- ☐ **Jars or beakers (4)**
- ☐ **Petri dish or saucer**
- ☐ **Eggs (2) or plasticine**
- ☐ **Eye dropper**

1. Fill two glass jars with water. Place three tablespoons of salt in one of the jars and stir until all the salt has dissolved.
2. Place an egg into the unsalted jar of water and observe what happens (it will sink).
3. Place an egg into the salted jar and observe what happens (it will float). (Salt water is denser than fresh water, thus allowing marine plants and animals to be more buoyant.)

Experiment 3:

The Salty Sea – this experiment demonstrates how saltier water is denser than fresher water and will sink more, thus showing that fresher river water flowing into the ocean will remain near the surface.

Materials

- ☐ **Jars (5)**
- ☐ **Food colouring**
- ☐ **Eye droppers**
- ☐ **Salt**
- ☐ **Scale**

1. Dissolve 35 grams of salt in 1 litre of water (sea solution).
2. Pour a cup of salt water solution into two of the jars and label them A and B.
3. Add an extra teaspoon of salt to solution A and stir.
4. Pour ¼ cup of solution A into another jar and label the new jar C. Add 4 to 5 drops of food colouring to jar C.
5. Pour 4 centimetres of solution B into another jar and label it D, then add 20 drops of solution C into the jar. Observe what happens as the coloured extra salty solution drips into less salty water.
6. Now pour ¼ cup of solution B into another jar and add 4 to 5 drops of food colouring and stir. Label this jar E.
7. Pour 4 centimetres of solution A into a jar, drop 20 drops of solution D into the jar.
8. Observe what happens as less salty water drips into extra salty water.

Experiment 4:

The Ocean Currents – this experiment demonstrates how denser colder, saltier water will flow underneath water of normal salinity. Similarly, the colder waters of the polar regions sink and flow towards the warmer Equator. These cold currents are important to the oceans' circulation.

Materials

- ☐ **Water**
- ☐ **One clear, flat dish**
- ☐ **Salt water solution**
- ☐ **Ice cube tray**
- ☐ **Freezer**
- ☐ **Food colouring**
- ☐ **Lukewarm tap water**
- ☐ **One jar**

1. Add 5 drops of food colouring into a jar of salt water solution and stir well.
2. Fill 4 compartments in an ice cube tray with the coloured solution and freeze.
3. Fill the clear tray with lukewarm tap water. Line the 4 ice cubes along one end of the tray. You may need to hold them to stop them floating away.
4. Observe what happens as the ice melts. Look from all angles. Explain why you think this happens. Predict what might happen in colder areas of the ocean.

Evaluation

- Were the students able to conduct the experiments successfully, and observe and record their findings?
- Were the students able to extrapolate from the experiments to the real world?

Complementary activities

Design your own experiment to demonstrate other properties of salt water.

Produce a cartoon demonstrating the properties of salt in the ocean.

Investigate the causes of the saltiness of Hamelin Pool Marine Nature Reserve in Shark Bay, and how this affects the marine life, including stromatolites (with few predators).

Produce a chart of the water cycle and how this relates to the sea water.

Grow your own salt crystals and examine them under a microscope.

Photo: Kevin Crane

Glossary

adaptations: any characteristics that an organism has evolved to make it particularly suitable to survive and thrive in its environment.

algae: aquatic photosynthetic plants (seaweeds) which reproduce by spores.

anterior: the front of an animal or shell.

aperture: the opening of a gastropod shell through which the animal emerges.

autotrophs: an organism which can manufacture its organic constituents from inorganic materials (for example, most chlorophyll-containing plants manufacture organic materials from water, CO_2, nitrates, etc).

biodegradable: capable of decomposing by the action of living organisms especially bacteria.

bioluminescence: production of light by living organisms.

bivalve: animal with a shell in two parts hinged together.

buoyancy: keeps organism afloat.

calcium carbonate: a chemical compound that is a major component of limestone.

camouflage: the means by which any creature renders itself indistinguishable from its background assuming the colour, shape or texture of objects in that background.

carnivorous: flesh eating.

cetacean: an order of placental mammals which includes whales, dolphins and porpoises.

chlorophyll: a green pigment found in most algae and higher plants that is responsible for capturing light via photosynthesis.

conservation: the act of keeping unimpaired especially with regard to natural resources.

consumers: users.

continental shelf: that part of a continent submerged under relatively shallow sea.

continental slope: a relatively steep section of the ocean floor that separates the continental shelf from the deep ocean basins.

current: a portion of a large body of water moving in a certain direction.

deposit feeders: generally burrowing animals, like small crabs, that feed on detritus.

detritivore: organism which consumes detritus.

detritus: any disintegrated material.

diorama: a miniature scene produced in three dimensions.

dugong: an aquatic herbivorous mammal found in tropical coastal areas. Has front limbs adapted as flippers, no hind limbs and a horizontal lobed tail.

ecology: study of the relations of animals and plants communities to their surroundings.

ecosystem: a community of organisms interacting with one another plus the environment in which they live and with which they also interact.

effluent: liquid industrial waste.

environment: biological conditions in which an organism lives.

epiphyte: a plant that grows on another but which does not obtain food, water or minerals from it.

equivalve: bivalves where the two shell valves are of equal size

erosion: the process by which the surface of the Earth is worn away by the action of water, glaciers, winds and waves.

evaporation: the giving off of vapour.

food chain: a chain of organisms existing in any natural community through which energy is transferred.

food web: all the food chains in a community make up the food web.

gastropod: class of Mollusca, including snails, slugs, sea hares. Often a single shell (univalve).

habitat: the native environment where a given animal or plant naturally lives or grows.

herbivore: plant-eating animal.

hermaphrodite: an animal or plant having normally both the male and female organs.

hinge: the movable joint on which a door or lid turns or moves

holdfast: an anchoring device that strongly holds seaweeds to rocks.

intertidal: the region of the shoreline between high and low water marks.

invertebrates: animals without a backbone.

larval stages: the immature form.

life cycle: progressive series of changes undergone by an organism.

limestone: a rock consisting wholly or chiefly of calcium carbonate originating principally from the calcareous remains of organisms of or pertaining to the sea.

marine: of or pertaining to the sea.

microbe: a microscopic organism.

migration: the act of passing periodically from one region to another.

mollusc: any invertebrate of the phylum Mollusca, characterised by a calcareous shell (sometimes lacking) of one, two or more pieces that wholly or partially enclose the soft, unsegmented body, includes chitons, squid and octopuses.

muscular foot: part of the body of a mollusc (snail) that holds it securely onto rocks.

nitrogen: colourless, odourless gas that makes up about four-fifths of the volume of the atmosphere and is present in animal and vegetable tissues (chiefly in proteins).

omnivore: organism that eats all kinds of foods indiscriminately.

operculum: the trapdoor of a gastropod shell that seals the aperture when the animal withdraws. It may be either calcified or horny.

organism: any form of animal or plant life.

photodegradable: substance that breaks down in light.

photosynthesis: the synthesis of complex organic materials by plants from carbon dioxide, water, and inorganic salts using sunlight as the source of energy and with the aid with a catalyst such as chlorophyll.

phytoplankton: plants of plankton.

pollution: the introduction of harmful substances or products into the environment.

precipitation: the falling of products of condensation from a state of vapour in the atmosphere (such as rain, hail or snow).

predator: organism which preys on another animal.

producers: organisms which can convert the energy of the sun to readily usable forms.

productivity: fertility.

profile: a vertical section (e.g. of a soil or rock face).

recolonisation: the replanting or re-establishment of a colony.

salinity: the salt content of.

seagrass: any of various marine flowering plants of temperate seas.

seaweed: any plant or plants growing in the ocean especially marine algae.

sediment: matter which settles to the bottom of a liquid.

sedimentary: set down in layers (as in sedimentary rock).

solution: dissolved state.

species: the basic category of biological classification, intended to designate a single kind of animal or plant.

spire: in gastropods, all of the shell above the body whorl.

sponge: any of a group of aquatic (usually marine) animals with a porous structure and usually a calcareous framework and which except in the larval state are fixed.

subtidal: the region of a shoreline below the lowest level reached at low tide.

transect: line or belt of vegetation etc selected for charting plants and animals.

valve: a part of the shell. There is one valve in gastropods and two in bivalves.

If you find a sick or injured native animal, contact the Department of Parks and Wildlife's 24-hour emergency number:
WILDCARE (08) 9474 9055

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