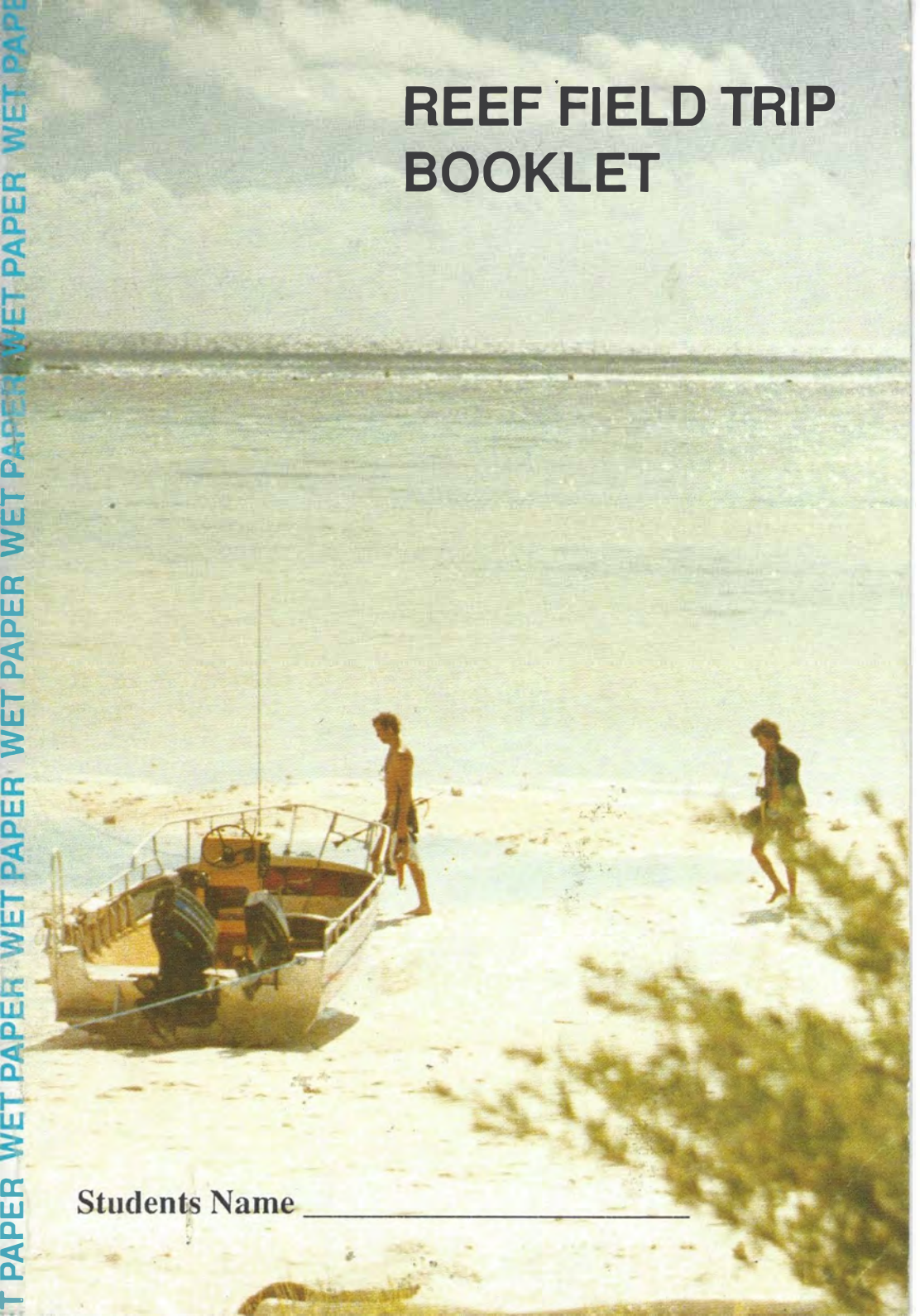
REEF FIELD TRIP BOOKLET



Students Name _____

REEF FIELD TRIP BOOKLET

by

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Acknowledgements

The author would like to thank the following individuals for their criticism, inspiration and advice in both editions:- David Kopelke, Greg Martin, Graham Mitchell, Steve Hall, Sue Oats, Meran Kilgour, Tony Failes, Ken Gilbert, Kelvin Rodgers, Jim Baker, Vera Weitsz, Sue Cerato, Stanna Hodge, John Howard, Dianne Hempenstall, Ann Kenny, Dennis Bridger, Bob McAllistar, Mel Phillips, Bill Baumann, John McGregor, Ann Summers, John Howard, Ian Hodge, Sue Oats, Gill Green, Kel Rodgers, Carol Clavery, Jill Green, Tony Failes, Steve Savvakis, Rob Heaney, Dave Read, Meran Kilgour, and especially the troups at home, Thelma Moffatt, Greg Moffatt, Paula Moffatt, Mark Moffatt and Trent Moffatt.

Thanks also to the Great Barrier Reef Marine Park Authority for permission to reproduce sections of Project Reef Ed.

Published by

WET PAPER PUBLICATIONS
14 Milbong Terrace
Ashmore Queensland
Australia 4214
Telephone: 075 39 4187

ComputerGraphics and Typesetting by Apple Macintosh Systems.

Original Illustrations by Rose Bedford, Sue Oats, Steven Byers, Mark Moffatt, Reef ed.

Computer Scanning by Word Works

First Printed August 1989
Second Printing August 1990
ISBN 1 86823 008 8

Proudly Printed in Queensland

This edition dedicated to **Mark Warne** whose enthusiasm and hard work has carried on the tradition.

STRIVING
BENOWA HIGH
CARING

REEF EXCURSION CERTIFICATE

This certificate may be traded for Semester four marks in either Biology, Multistrand Science, Marine Studies, Art or Music.

This is to certify that .....
has attained the following level of achievement in Barrier Reef Excursion Studies.

.....

Criteria for Sound Achievement (complete all of the following projects successfully) **Page**

Criteria for High Achievement (complete all of the following projects successfully)

Very High Achievement (complete any four of the following projects successfully)

.....
Supervising Teacher

.....
Date

Activity 1

My Conservation Code:

You will need a map of the marine park. You can get one from your supervising teachers.

Detail eight codes of behaviour that you intend doing that are consistent with the practical conservation of the reef giving your reasons.

Code of behaviour	Reason
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	

In the space below draw a map of the island you are on and mark on the Green, Light Blue, Dark Blue and Yellow Zones. State clearly what activities can be done in each of these zones.

What is a reef appreciation area and why is it there? _____

_____

Activity 2

Demonstrate a knowledge of the zoning of the reef park by correctly obeying park rules

Behaving in such as way as to demonstrate the knowledge.

☐ Place a tick here if you can appreciate the need not to drop minty papers on the ground because they get in the ghost crab burrows and kill the ghost crab

3. Safety on the reef

FROM PROJECT REEF ED

Concepts
Safety

Skills
Decision making
Cooperating
Communicating

Attitudes
Appreciation of importance of health and safety procedures

Aim

- To become aware of the need for safety on the reef.

You will need

- To work in a group
- Paper and pencil
- Blackboard

RULES FOR BRAINSTORMING

- *No criticism of other people's ideas.*
- *All ideas are written down, irrespective of whether you agree or not.*
- ***After** brainstorming, criticism begins.*

What to do

1. Brainstorm in your group (maximum of six people) a list of unsafe situations for your forthcoming trip. Appoint a leader and scribe. (5 minutes)
2. Reduce your list to the six most dangerous situations or places. Remember the rules for brainstorming. (5 minutes)
3. Each group leader reports back to the class on the six most dangerous situations or places. (5 minutes)
4. The class then decides what the six most dangerous situations or places are and why they are dangerous. (Class discussion)
5. Prepare an individual report on the need for safety on the reef.

Answers

First aid at the reef

Concepts
First aid
Safety

Skills
Using reference materials

Attitudes
Self-reliance
Responsibility

Aim

- To become more acquainted with some first aid procedures on the reef.
- To become familiar with the contents of the first aid kit being taken to the reef.

When

After your group leader has talked with your class about first aid and dangerous marine creatures on the reef.

You will need

- A first aid book or booklet
- Some reference books (see below)

What to do

1. Complete the first aid table using the information available in the reference books.
2. Make sure you have your table checked by your group leader for accuracy.
3. Check the first aid kit list and decide whether the proposed kit would be sufficiently stocked and complete to handle the injuries and complaints listed in the table. What changes if any do you suggest?

First aid table

Injury or complaint	*Marine creature involved (if any)*	*First aid*
Severe sunburn		
Coral cut to the ankle		
Jellyfish sting to arm		
Puncture wound from stonefish		
Boiling water burn		
Bite from a centipede		
Bite from a wobbygong shark		
Sea-sickness		
Stepping on glass		
Cramp while snorkelling		
Asthma		
Sore ears		
Ulcers in the mouth		
Diarrhoea		
Broken ankle		
Severe headache		
Cone shell sting		
Cut from a rusty peg in the ground		

References

Thomas, R., and McKenzie, B. *The divers' medical companion.* Diving Medical Centre Monograph, repr. 1986.

Dunleavy, M. 1981. *Stay alive.* Canberra: AGPS.

Edmonds, C. 1975. *Dangerous marine animals of the Indo-Pacific region.* Melbourne: Wedneil Publications.

Edmonds, C. 1984. *Marine animal injuries to man.* Sydney: Wedneil Publications.

Saenger, P. 1977. *The divers guide.* Brisbane: AUF.

St John's Ambulance Brigade *First aid manual.*

4. Dangerous reef creatures

1 hr •

FROM PROJECT REEF ED

Concepts
Toxin
Venom
Polyp
Stinging cell
Hydroid
Safety

Skills
Observing
Using literature

Aim

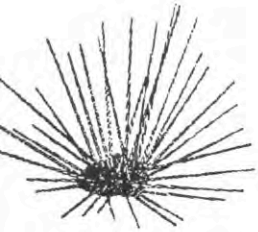
- To become more aware of some dangerous animals which can be met during reef walks and snorkelling activities.

You will need

- Coloured pencils
- Reference books or slides on dangerous marine animals

What to do

1. For each dangerous creature shown on worksheet A, select a name from the list given and write the names in the spaces underneath the pictures. Use reference material to help you make your choices, and/or discuss with your teacher.
2. Using reference books or slides on marine organisms, colour the main areas of each picture lightly so that its distinctive colour features are shown.
3. Answer each of the questions shown on worksheet B, using information given.
4. Why do some reef animals produce toxic material and develop the ability to inject it?



Box Jellyfish

5. How can visitors avoid injury from these creatures?

6. What are the dangerous effects of these creatures? What are the main first-aid treatments for these?

Butterfly Scorpian Fish

Readings

Covacevich, J., Davie, P., and Pearn, J., eds. 1987. *Toxic plants and animals: a guide for Australia.* Brisbane: Qld Museum.
Edmonds, C. 1975. *Dangerous marine animals of the Indo-Pacific region.* Melbourne: Wedneil Publications.
Edmonds, C. 1984. *Marine animal injuries to man.* Sydney: Wedneil Publications.
Marsh, L., and Slack-Smith, S. 1986. *Sea stingers.* Perth: W. A. Museum.
Saenger, P. 1977. *The diver's guide.* Brisbane: AUF.

Dangerous reef creatures

Crown-of-thorns starfish *(Acanthaster planci)*
Colour: Blue-grey arms often with reddish-orange tips
Location:
Description: Up to 60 cm in diameter and up to 16 arms covered with short, sharp spines. Spines can penetrate human skin. Venom may be injected. Slime on the starfish can irritate human skin.

Sea-urchins with long spines (e.g. *Diadema setosum*, described below)
Colour: Black
Location: On sandy bottoms or under rocks in reef-top pools or on reef slope.
Description: Have very slender needle-like spines about 25 cm long. The spines are very brittle and sharp. They can easily penetrate and break off in human skin.

Sea-cucumber (e.g. *Holothuria leucospilota*)
Colour: Various colours, according to species
Location: Sandy bottoms.
Description: Sausage-shaped bodies. When disturbed, many species produce sticky white threads from arms. Material from these may cause inflammation of human eyes or skin.

Stonefish (e.g. *Synanceia horrida*, described below)
Colour: Brownish; mottled
Location: Buried in mud, coral or rocks in shallow water.
Description: About 30 cm long. Lies quietly concealed on bottom. Strong spines along the back pierce human body if trodden on or touched. Venom is discharged into wound.

Bristle worm (e.g. *Eurythoe complanata*, described below)
Colour: Salmon pink
Location: Under boulders or in weed mats on reefs.
Description: Body up to 14 cm long with a pair of short hollow bristles on each segment. The bristles contain venom which causes painful injury if touched.

Butterfly cod *(Pterois volitans)*
Colour: Red and white striped
Location: In reef-top lagoons and reef slope habitats, often under ledges or in caves.
Description: Up to 35 cm long. Brightly coloured. Have long spines along the back and in the anal and pelvic areas. The spines can pierce human flesh and venom passes along the spine into the wound.

Dangerous reef creatures

Fire coral *(Millepora)* (sometimes called **stinging hydroids**)
Colour: Light brown with smooth, yellowish branch tips
Location: On outer reef flat and upper parts of reef slope.
Description: Has a hard limey skeleton with smooth stumpy branches. Looks like a true coral but is a member of a related group, the hydrozoans. Has minute stinging polyps in its branches.

Cone shells (e.g. textile cone, *Conus textile*)
Colour: Often have striking patterns of various kinds. The textile cone pattern is one example.
Location: On bottom of reef flat and elsewhere. Often buried or hidden.
Description: Usually, but not always, cone shaped. Inject venom using a harpool in their mobile proboscis. Easily confused with harmless types of shells, such as the red-lipped stromb. Beware!

Stingrays (e.g. blue-spotted ray, *Taeniura lymma*, described below)
Colour: Bright blue spots
Location: In shallow waters of reef-top. May shelter under ledges during day. May be partly buried on bottom.
Description: Flat disc-like body about 37 cm in diameter. Long whip-like tail may inflict wound and discharge venom.

Box jellyfish *(Chironex fleckeri)* (sometimes called **sea wasp**)
Colour: Translucent; almost colourless
Location: Often in shallow water in muddy inshore areas but can also be found in many other kinds of locations.
Description: Consists of round-topped, box-like bell (often 10-17 cm) attached to many tentacles up to 2 metres long. Stinging cells occur on tentacles.

Stinging hydroid — "white" *(Lytocarpus phillipinus)*
Colour: White
Location: In deeper water than fireweed. Look out for this when snorkelling over the outerslope of a reef.
Description: This is a more delicate hydroid than fireweed. It has a feathery appearance; stems are brown; polyps are white.

Fireweed *(Aglaeophenia cupressina)*
Colour: Khaki
Location: Reef flat, among coral in pools.
Description: This looks like a clump of small brown fern but is actually a colony of small animals — hydroids. In each "frond" there is a central stalk and side branches along which small stinging polyps occur.

WORKSHEET A

Dangerous reef creatures

- Write the names of the pictured animals in the spaces provided.

Fig. 112.1

(a) _____

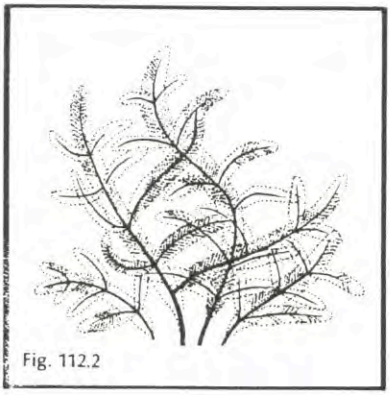


Fig. 112.2

(b) _____/_____

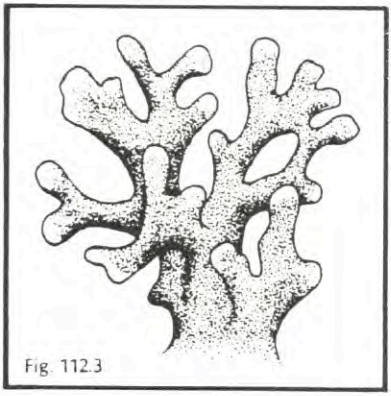


Fig. 112.3

(c) ____/_____

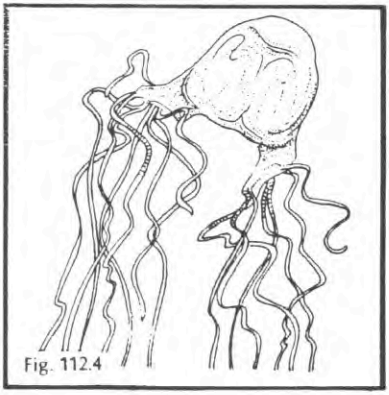


Fig. 112.4

(d) ___/_____

WORKSHEET A (cont.)

Dangerous reef creatures

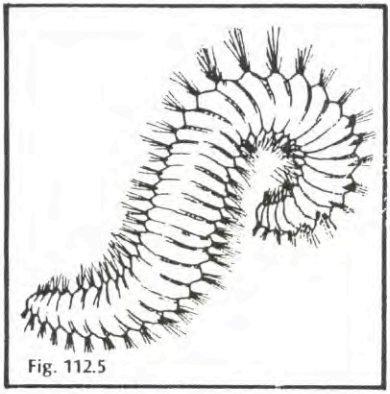


Fig. 112.5

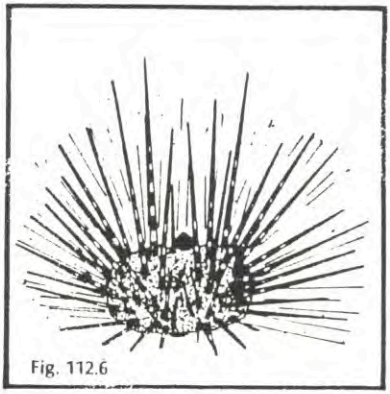


Fig. 112.6

(e) _____/____

(f) __/_____

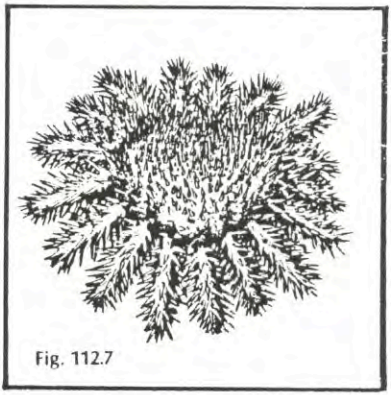


Fig. 112.7

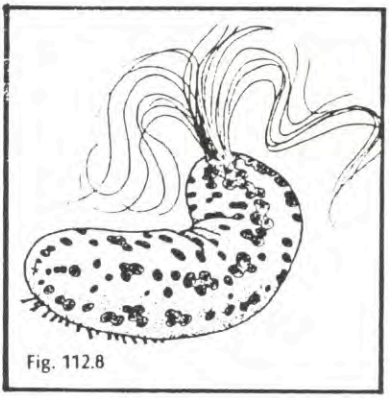


Fig. 112.8

(g) ____/_/_____/_____

(h) __/_____

WORKSHEET A (cont.)

Dangerous reef creatures

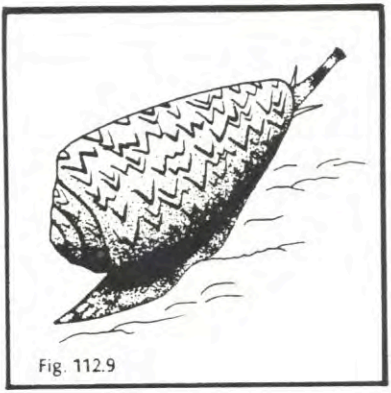


Fig. 112.9

(i) ____/_____

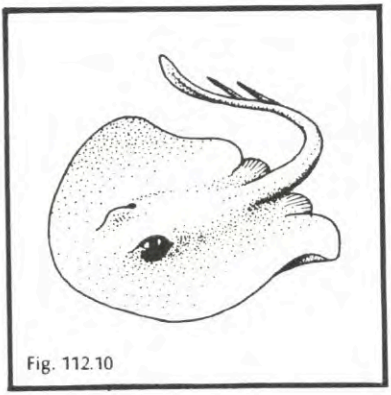


Fig. 112.10

(j) ________

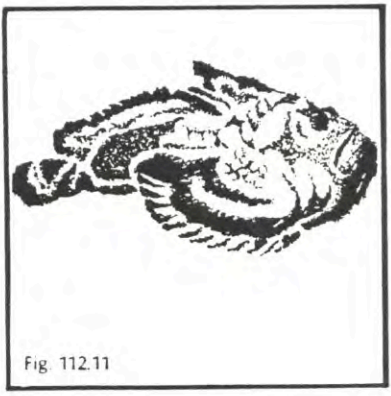


Fig. 112.11

(k) _________

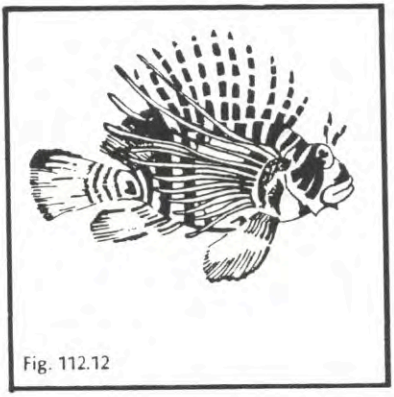


Fig. 112.12

(l) _________/___

FROM PROJECT REEF ED

WORKSHEET B

Dangerous reef creatures

- In each of the spaces below write an appropriate name from the range of animals illustrated on worksheet A.

(a) Molluscs which inject venom using a harpoon _ _ _ _/_ _ _ _ _ _

(b) Red-and-white fish which sting using venomous spines _ _ _ _ _ _ _ _/_ _ _

(c) Feathery white animals whose polyps contain stinging cells _ _ _ _ _ _ _ _/_ _ _ _ _ _ _ _

(d) Hard brown-coloured colonies with yellow, smooth tips _ _ _ _/_ _ _ _ _

(e) Bottom-dwelling fish with venomous barbs on whip-like tail _ _ _ _ _ _ _ _

*(f) Plagues of these echinoderms have occurred at some reefs _ _ _ _ _/_ _/_ _ _ _ _/_ _ _ _ _ _ _

(g) Animals which dwell on the surface of the sea and which are hazardous in northern parts of the Great Barrier Reef area in summer months _ _ _/_ _ _ _ _ _ _

(h) Material from the slimy outside of these animals must not be allowed to get into your eyes _ _ _/_ _ _ _ _ _ _

(i) These dull-coloured fish are well camouflaged. Wear stout shoes when reef-walking. _ _ _ _ _ _ _ _

(j) Khaki animal colonies which look like brown clumps of fern _ _ _ _ _ _ _ _

Answers to worksheet A
(a) Fireweed, (b) Stinging hydroid, (c) Fire coral, (d) Box jellyfish, (e) Bristle worm, (f) Sea-urchin, (g) Crown-of-thorns starfish, (h) Sea-cucumber, (i) Cone shell, (j) Stingray, (k) Stonefish, (l) Butterfly cod

Answers to worksheet B
(a) Cone shells, (b) Butterfly cod, (c) Stinging hydroids, (d) Fire coral, (e) Stingrays, (f) Crown-of-thorns starfish, (g) Box jellyfish, (h) Sea-cucumbers, (i) Stonefish, (j) Fireweed

5. Your first reef walk

2 hr •

FROM PROJECT REEF ED

Concepts
Reef flat
Reef crest
Sediment
Corals
Algae

Skills
Observing
Using all senses
Handling living things

Attitudes
Appreciation of natural environment
Enjoyment of outdoor experience

Aim

- To see the reef for the first time and to experience the changes as you walk from the beach across the reef flat to the edge of the reef.
- To develop skills and confidence in observing, and handling living things on the reef.

When

Start when the tide is going out.

You will need

- Suitable reef-walking footwear and clothing, gloves, hat and sunscreen
- Underwater viewers and/or face mask

SAFETY
Avoid touching your eyes during a reef walk. Some marine creatures, e.g. sea-cucumbers, produce substances which can irritate our eyes. Before the reef walk discuss dangerous living things of the reef with your leader.

Complete a low tide reef walk and answer a series of questions about reef animals

Complete the Questions Activity 2, *Your first reef walk* in the space below

What to do

1. Each person should pick up a handful of sand from the beach.
2. Look carefully through the sand and try to decide what it is made of. Discuss and share information. Where do you think all the "bits" came from? How did they get here?
3. Walk out from the beach across the reef flat towards the reef edge where you should see water breaking and some large coral boulders.
4. Look for changes as you walk out:
   - Notice changes in water depth.
   - Notice changes in material you tread on as you walk out: is it sandier close to the island or close to the reef edge? Walk carefully in the coral zone to avoid hurting the coral or yourself.
5. Look for colour variations; listen for sounds.
6. Pick up and feel the textures of animals such as a sea-cucumber, a blue sea star, a sea hare.
7. Stand still for a few minutes, then use a coral viewer or face mask to look into a pool. Is anything moving about?
8. Try to distinguish between hard coral, soft coral and algae. Feel each one with your gloved hands.
9. Can you find four types of corals which look different?

Caution

Octopus
Wobbygong

10. When you reach the outer edge of the reef, carefully lift a few boulders and observe the variety of life and colour beneath these drab-looking boulders. Always return the boulders to their original positions. Organisms on boulders left upside down will quickly die.
11. Look down over the reef crest at the sea. What do you see? How does it make you feel? Look back at the cay.
12. Observe the tide situation. It may be beginning to come in again.
13. Walk back to the beach in your own time but be aware that the tide may be coming in.
14. When you get back either write down or discuss with your group:
    - your two outstanding impressions from the reef walk
    - whether the reef was as you expected
    - where the easiest and most difficult places to walk were
    - your favourite animal.

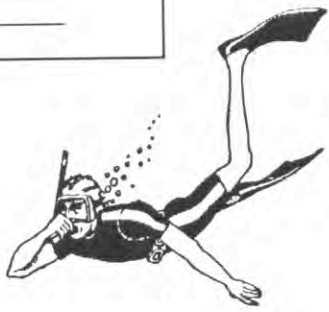
ACTIVITY 6. YOUR SNORKELLING CERTIFICATE

Complete this activity to the satisfaction of your supervising teacher before you go snorkelling anywhere.

SNORKELLING CERTIFICATE

This is to certify that the following level of achievement has been gained

_____



CRITERIA

Sound Achievement

[ ] Swims 100 metres continuously any stroke
[ ] Selects and fits gear correctly
[ ] Enters and exits water correctly
[ ] Snorkels length of pool
[ ] Duck dives and swims for 5 metres underwater

High Achievement

[ ] All of the above plus
[ ] Fit fins in the water and treds water for 2 minutes
[ ] Fits mask from an underwater recovery situation
[ ] Surfaces and clears a snorkel from an underwater mask and snorkel recovery situation
[ ] Recovers an object from a deep water situation

Very High Achievement

[ ] All of the above plus
[ ] Clears a mask completly from an underwater mask recovery situation

Supervising Teacher: .....

7. Snorkelling over the edge 2 hr

Concepts
Reef edge
Current
Equalising
Snorkel-clearing

Skills
Snorkelling
Cooperation

Attitudes
Appreciation of natural environment
Self-confidence
Responsibility
Enjoyment

Aim
- To become more confident in using snorkelling equipment
- To gain confidence in snorkelling over the reef edge.

You will need
- Face mask, snorkel, sandshoes, gloves
- Fins
- Wetsuit (optional)
- Safety boat, motor
- Safety line (20 m float rope)
- Vinegar and Stingose in boat

To be done during a low-tide period.

Before this activity, revise your snorkelling skills in the lagoon on the reef-top close to the beach. Show your buddy that you can fin correctly, keep your hands at your sides, clear your mask, and duck dive.
The next stage is to snorkel over the edge of the coral crest in an organised group.

Safety Precautions
- *Stay with your buddy in a group.*
- *Do not go snorkelling in strong currents.*
- *An adult observer must remain on the reef crest.*
- *Sandshoes and first aid equipment can be stored in a small boat; plastic tidy bins or buckets can be tied to dead coral on the crest.*
- *Less-confident swimmers should snorkel in reef crest pools.*
- *A safety boat with driver and observer should anchor about 10 metres off the reef crest. One or two float ropes should be run out from the boat.*

What to do
1. Walk across the reef-top to the reef edge with the rest of your party. Put on snorkelling gear and carefully enter the water outside the reef crest. Take care not to get cut by corals. Avoid breaking corals.
2. In groups of eight, snorkel around the float ropes — keep with your buddy. Gain confidence with your gear and try diving to see the reef below. Be careful of dangerous animals you have learned about. Swim and snorkel up-current.

ACTIVITY 8. Feeding fish

Feed some fish with bread describing some fish behaviour

Describe your success with fish feeding and name and draw any three fish you fed.

Beaked coral fish

Blue Green Chromas

Clown Anemone Fish

Bicolour Angel Fish

Blue Spot Butterfly Fish

Trigger

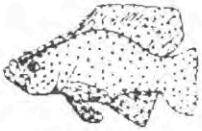
Clown Trigger Fish

Birdwrasse

Broard Barred Putter fish

Clown Unicorn Fish

Black Anneimone Fish



Barramundi Cod

Coral trout

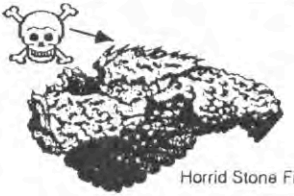
Dusky Butterfly Fish

Grouper

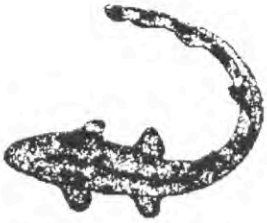
Emperor Angel Fish

Harlequin Tuskfish

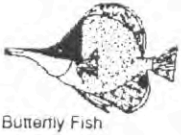
Horned Squirrel Fish



Horrid Stone Fish



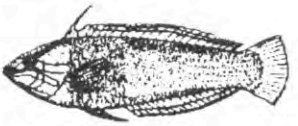
Epaulette Shark



Longnosed Butterfly Fish

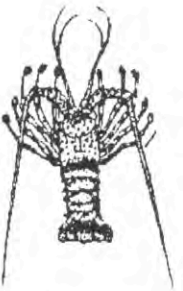
Footballer Trout

Masked Banner Fish



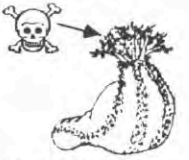
Gramards Wrasse

Moon Wrasse

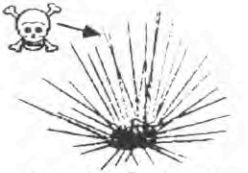


Crayfish or Lobster

Pincushion Starfish



Sea Cucumber



Longspined Sea Urchin

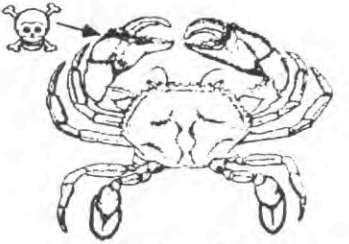
Sea Egg

Bottle Nosed Dolphin

Sea Anemone

Cone Shell

Blue Ringed Octopus



Swift Footed Crab

Copepod

Crab Larvae

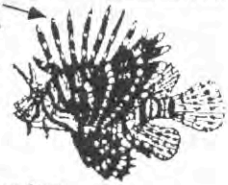
Lobster Larvae

Orange Fairy Basselet

Porcupine Fish

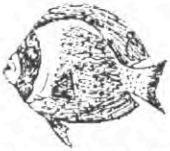
Racoon Butterfly Fish

Butterfly Scorpian Fish



Saddled Butterfly Fish

Sailfin Tang



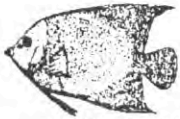
Scribbled Angel Fish

Blue Stripe

Cleaner Wrasse

Snarpnosed puffer fish

Spotted hawkfish



Blue Angel Fish

Stripey

Sydney Codfish

Tarwine

Blue Tang

Vagabond Butterfly Fish

Wobbegong Shark

Banded humbug

Moray Eel

Longfinned
Banner Fish

Barramundi

Snorkel successfully and confidently in a reef pool

Ask your teacher to observe you snorkelling successfully in a reef pool.

Place a tick in this box
if you completed this task

9. Your first cay walk

½ hr +

FROM PROJECT REEF ED

Concepts/topics
Area
Perimeter
Vegetation
Direction
Distribution
Windward
Leeward

Skills
Observing
Using equipment

Attitudes
Confidence
Appreciation of natural environment
Enjoyment of outdoor experience

Aim

- To develop skills and confidence in knowing your way around the cay
- To become aware of some features of the cay environment.

You will need

- Hat, sunscreen
- Suitable footwear and clothing for walking on the beach
- Camera (optional)
- Binoculars (optional)
- Magnetic compass (optional)
- Outline map of reef and island (optional)

What to do

1. Walk around the edge of the cay, noting the time you leave and return.
2. As you walk around the cay, think about the following questions and make observations.
   (a) Where are the directions north, south, east and west?
   (b) How far out is the edge of the reef from here? (Look for waves breaking.)
   (c) How far up the beach do you think the water comes at high tide? Can you see tide lines?
   (d) Where did the sand on this beach come from?
   (e) Is there any rock on the beach? Where?
   (f) Where is the wind coming from? Can you notice different wind effects on different sides of the island?
   (g) Which is the leeward and which is the windward side of the island?
   (h) What kinds of living or dead animals or plants can you spot on the beach as you go along?
   (i) Does vegetation on the windward side of the island seem different from that on the leeward side? How?
   (j) How many different kinds of birds can you see? What are they doing?
   (k) What signs are there on the cay of human activities, past or present?
   (l) Can you see any tracks leading into the cay from the beach?
3. When you get back, have a group discussion about what you've seen.
   (a) Decide which looked like interesting spots to go back to next time.
   (b) On a piece of paper on the wall at base camp, start a list of birds which your group has seen. Don't worry about names, brief descriptions will do! You could add to the list throughout the trip.
   (c) Decide: Is the cay as you expected?

CONSERVATION NOTES
- *Be careful not to disturb birds while walking on a cay.*

10. Introductory nocturnal studies 1 hr+

FROM PROJECT REEF ED

Concepts/topics
Nocturnal behaviour
Change in diversity

Skills
Observing
Recording
Questioning

Attitudes
Self-reliance
Curiosity
Appreciation of need for safety
Interest in natural environments

Aim

- To find out what a cay is like at night.

You will need

- Sandshoes
- Torch
- Hand lens (optional)

Do this activity after you have walked around the cay in daylight.

WARNING

- *On many islands, the Queensland Department of Geographic Information has left star pegs. These are small, often inconspicuous, sharp pieces of metal which stick out of the sand and can severely damage your feet. Wear shoes.*
- *In summer, turtles come up on to the beach to lay eggs. Don't shine your torches into their eyes as they will return to the sea and may not lay for another year — consult information on turtle watching.*

What to do

1. Walk around the cay at about 7.30 p.m. noting crabs, turtles, mutton-birds, stingrays, sharks, spiders, luminous life, shells.
2. If it is the appropriate season, get up early, about 5.00 a.m., and find a mutton-bird runway. Observe the mutton-bird take-off patterns.

Walk around the cay at night describing differences from the day.

Note these in the space below. Also make a sketch of what you think the cay looks like and where you are camped.

3. Depending on what you see, try to answer some of these questions:
   (a) **Ghost crabs.** Where are they going? What are they doing? What is their reaction to light? How do they behave when frightened? Are there different populations from one side of the island to the other? What was the biggest one you saw?

   (b) **Fish.** Can you spot any small sharks or fish in the shallows? What do they appear to be doing? Do they seem to be affected by your torch light?

   (c) **Spiders.** Spider spotting can be fun! Do their eyes glow? Are the eyes different colours? Can you identify species by eye-glow colour? How many different species can you spot?

   (d) **Luminous life.** Look back at your footprints in the sand. Can you see glowing dots in the sand? Can you still see them when you shine the torch on them? Pick them up, observe with a hand lens. Who can find the largest and the brightest? Put them on your face, hands, arms. Make yourself a glowing skeleton. How long does each animal glow? Do different areas have greater abundance (wet sand, dry sand, north, south, east or west aspect)?

   (e) **Molluscs.** Look on the beach rock. Can you find any giant chitons? How many? What are they doing? Who can find the largest one? What other molluscs are active at night?

   (f) **Turtles.** If you are visiting in the laying season, how many turtles were seen during your walk round the island? What species? Did there seem to be different numbers at different places on the island? Can you track a turtle? Can you tell the difference between tracks of animals heading for the land or the sea?

11. Associations between species

FROM PROJECT REEF ED

Concepts
Association
Mutualism
Symbiosis
Commensalism
Adaptation

Skills
Observing
Snorkelling

Attitudes
Perseverence
Appreciation of natural environments

Aim

- To observe some distinctive associations between some unlike organisms which "live together".

You will need

- Usual reef-walking and/or snorkelling gear
- Underwater slate.

This activity requires several hours at various times during the fieldtrip.

What to do

1. On the reef, try to find examples of some of the interesting distinctive associations between unlike organisms. Good ones to look out for are: Goby and shrimp, needle coral and gall crab, turtleweed and crab, anemone and clownfish, cleaner wrasse and large fish.
2. Go on a shallow snorkel over the sandy flat at high tide. Look for holes in the sand with a sand-coloured goby standing guard. Hover nearby until the goby no longer notices you and you may find there is also a shrimp living in the hole and working industriously to clean it out. Observe them carefully and try to work out what sort of relationship is involved — who is helping whom?
3. On a reef walk, look for needle coral *(Seriatopora)* or the more club-like branching coral *Pocillopora*. In each clump look for a slightly expanded fan-shaped branch.

   A tiny female gall crab lives inside coral gall. What sort of relationship do you think this is?
4. Find some bright-green turtle weed. Gently run your fingers through the tuft. If you find a small lump in there, very gently tease it out. You will probably find it is a tiny, delicate, pale-green crab. What sort of relationship is this? (Make sure the crab gets back safely into its own tuft of turtle weed).
5. On the reef walk near the reef crest or when snorkelling, look for the large anemone with its attendant clownfish. How many clownfish are there? What sizes are they? Which is the dominant one? Look for other anemones and compare them.
6. When snorkelling, look for the small, slim, blue wrasse and see if you can find its cleaning station. You may find large fish of several different species lined up for cleaning just like cars at a car wash. What sort of relationship is this?
7. When snorkelling, if you are ever lucky enough to see a large manta ray look for the remora or sucker fish attached to it. (You may even find remoras following you around.) What sort of relationship is the one between a remora and a manta ray?
8. Make a table of all the relationships you find on the reef, heading your table as shown below.

Animal 1	Animal 2	Which animal benefits and how

Activity 12 Three Fish, Three Plants and Five Invertebrates

Aim:

To locate a variety of reef organisms

Emperor angle fish

You will need:

Reference books, pencil and colouring in pencils

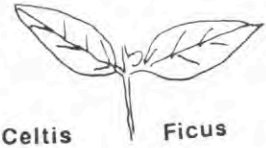
What to do:

1. Locate any three plants on the coral island. Make a sketch of the main shape and a sketch of the leaf.
2. Locate any five animals without backbones. Again make a sketch, but this time show the characteristic external features and not e the overall colour.
3. While snorkelling, find any three fish. See if you can name them. Now make a sketch noting their colours. Use your colouring in pencils top colour in the main features.

Long nosed butterfly fish

Raccoon butterfly fish

Pisonia

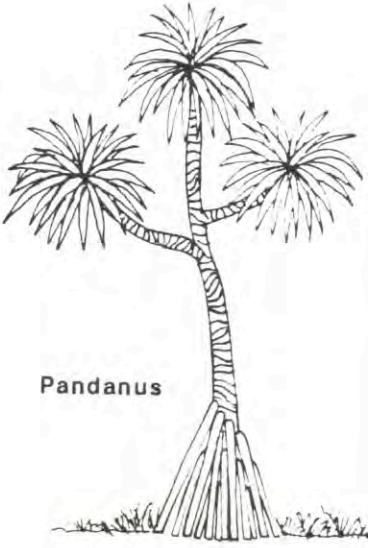


Celtis

Ficus

Scaevola

She oak



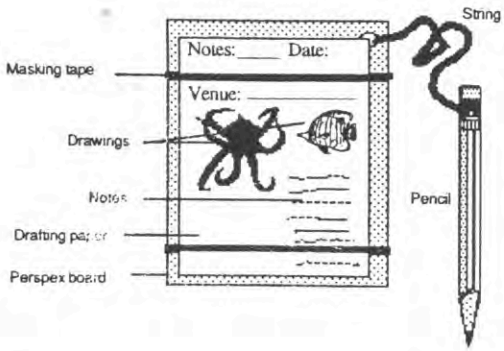
Pandanus

Argusia

In the following activities you will need an underwater slate, some drafting paper cut to fit, masking tape, a pencil and good reference books for the area in which you are snorkelling.

At home you should start an underwater life scrapbook in which you can record the lifeforms seen on each snorkelling trip.

This way you will learn more about the sea and if you decide to take photographs later, you will know what you are taking.



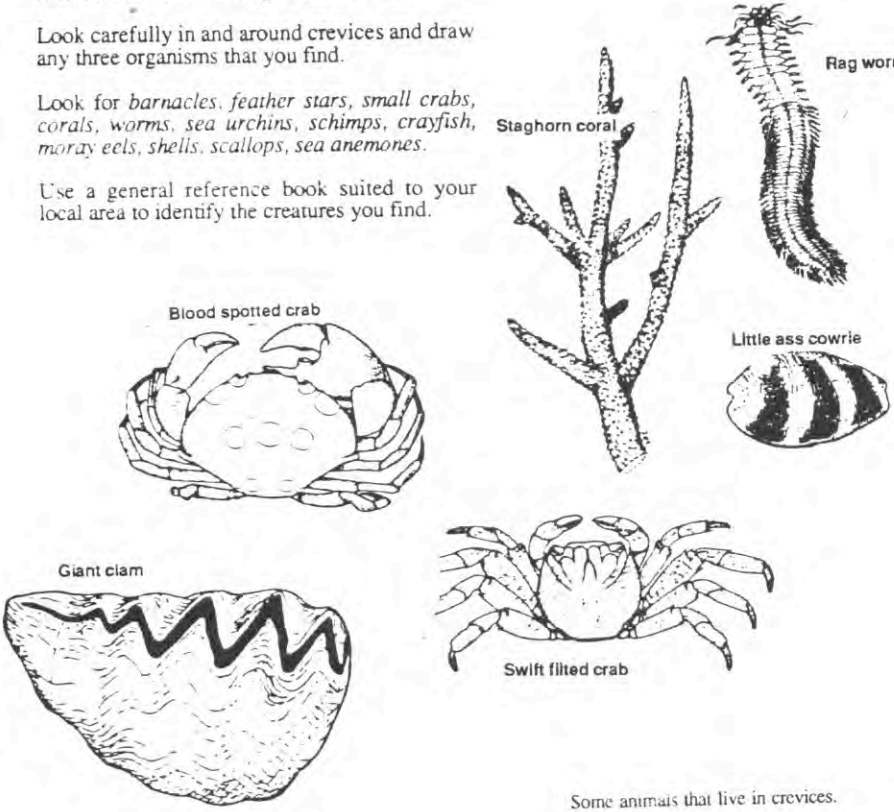
Activity Animals that live in crevices

There is an enormous diversity of lifeforms near the rock or coral ledges in our seas.

Look carefully in and around crevices and draw any three organisms that you find.

Look for *barnacles, feather stars, small crabs, corals, worms, sea urchins, schimps, crayfish, moray eels, shells, scallops, sea anemones.*

Use a general reference book suited to your local area to identify the creatures you find.



Some animals that live in crevices.

Activity **Plants that live in the sea**

Equally important to the sea's ecology are the plants. They supply the oxygen that the animals live on.

Some plants, called algae, live on rocks or coral. Don't confuse the sea anemones or corals with plants, because they have a system that requires feeding on living materials.

Look on the rocks or corals for different coloured algaes or seaweeds. Look at the ways these plants attach themselves to the rocks and once again learn three. Draw them on your underwater paper and find out their names when you get home.

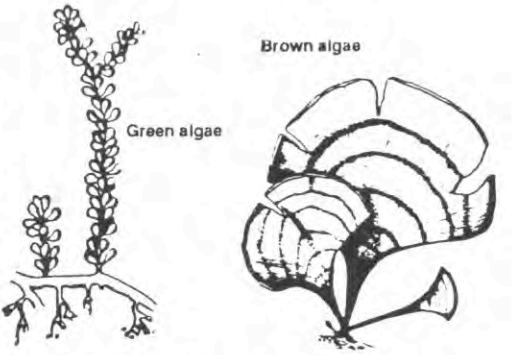


Fig Some plants that you can see while snorkelling.

13. Keep cooking 2+ hr ••

Concepts
Hygiene
Planning
Nutrition

Skills
Organising

Attitudes
Willingness to cooperate
Tolerance and respect for others

Aim
- To cooperate as a group in organising the meals for your trip.

You will need
- Writing materials
- Information from the field-trip organiser about facilities which will be available for cooking at the island and about arrangements already made (if any) for food supplies.

What to do
1. Discuss the roles each of you wishes to play in cooking, depending upon what facilities you will have. This will depend on which island you are visiting.
2. Make a list of jobs.
3. Plan what food and equipment to take. How is the food going to be purchased? You may need to get a list of food prices before you can make your plan.
4. Decide how you are going to transport food and equipment.
5. Decide how you are going to store food and equipment.
6. Submit a complete organisation plan for your group based on the following:
   - Cooking roster (includes days, and names of those doing the preparing and washing up, as well as those who will be cooking)

Get your group leader to tick the following saying when it ocurred

[] Prepare and cook a camp meal Day.....Meal..... Verification.....

[] Wash and tidy up Day.....Meal..... Verification.....

14. [] Maintain a clean and hygenic campsite Verification.....

Comments:

Record here your feelings about those who do not help wash up, are always slack around the campsite, sleep in while others have to do the work, always scunge off others, are too lazy to move their backsides and are generally bad group members and need a good kick in the tail.

15. Following a friendly fish — 1 hr •

Concepts
Fish structure
Fish behaviour
Interrelationships
Adaptations

Skills
Observing
Recording underwater

Attitudes
Appreciation of natural environments
Confidence in making and recording observations

Aim

- To investigate the lifestyle of a single fish.

This activity consists of two parts — an introductory exercise and an in-depth exercise for those who wish to investigate their fish further.

You will need

- Snorkelling gear and appropriate protection from sun
- Underwater slate and pencil

What to do

Introductory activity

1. In a reef pool or harbour follow a particular fish quietly. (A sweetlip or bream is suggested.)
2. Observe its feeding behaviour. How much searching and "working" for food is performed?
3. What structural adaptations possessed by the fish help it to find and take its food?

In-depth activity — a single fish

4. Select one fish which you can observe carefully. (A parrotfish, butterfly fish or puffer fish is suggested.)
   (a) Observe and record its general structure. Note its size; sketch it, noting scale; record exact colour patterns, relative size and position of fins, size, shape and position of mouth.
   (b) Observe and record its
   - method of locomotion (note use of all fins, tail, etc.)
   - method of catching/obtaining food and ingesting — snorkel around with the fish to observe
   - method of perceiving and reacting to the environment
   - sense organs
   - response to changes (waves/depths/other fish/other groups/you)
   - special behaviour, e.g. territoriality, special relationships (symbiotic, commensal, parasitic).

Note: To get definitive data you will need to devise a record sheet which
- is easy to use and record on in the field,
- allows you to record factual data such as measurements, numbers.
- allows you to obtain statistically valid data, i.e., number of observations, to enable you to put forward an hypothesis on behaviour.

5. After your snorkel, identify your fish by reading.

Ideas for further things to do

6. Refer to the books listed below and compare the authors' notes with your own observations.
7. Check previous research findings on the species you've observed.

16. Manta towing

One of the most enjoyable experiences for the snorkeller is manta towing. This technique was developed by the first marine park officers of the Great Barrier Reef Marine Park Authority so that they could study a large area of reef while collecting data.

The officers made a manta board from marine ply and used to place their study sheets on it like the one shown

A 3.5m boat with a 55hp centre console boat is about the minimum for extended work with two people being towed at any one time.

The idea of manta towing is to use the manta board to dive down underwater and observe different seascapes. Don't forget to equalise and arrange a set of handsignals with the boat operator as to fast and slow.

NB.

Another way with smaller boats is to use a rope and oar. To tow about four snorkellers a short distance requires a 3m boat with a 15hp motor.

A good rule for manta towing is to tow the number of people the boat is rated to carry minus one. Don't forget to have an observer in the boat .

Manta Towing

Snorkel at high tide

Record your observations of snorkelling at high tide.

21. BEACH PROFILES STUDY

Most people come to a beach to relax but few actually think about how a beach forms. Do you know where sand comes from or better still how a beach changes in slope.

Purpose:

The purpose ofthis project is to investigate the slope of the beach.

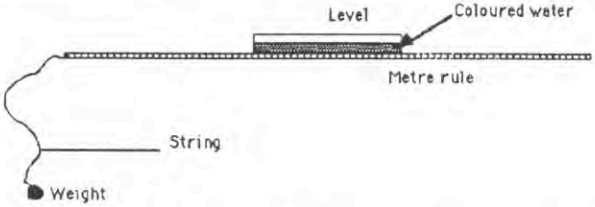
The aims of this project are to:

(a) have you collect data so that you can draw a beach profile
(b) suggest some hypothesis about the ways beaches form and change

Research Methods:

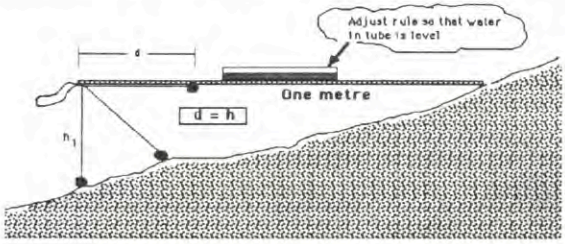
The range pole:-

This is a device that determines the slope of the beach. A weight is tied to the end of a metre stick by a piece of string a metre long. A level is constructed with a glass tube, some tape and coloured water so that when the rule is level, the coloured water will be level at each end.



The string is then used with the level to measure the drop in height from one point to another exactly at one metre intervals. Place your ruler so that the water is level.

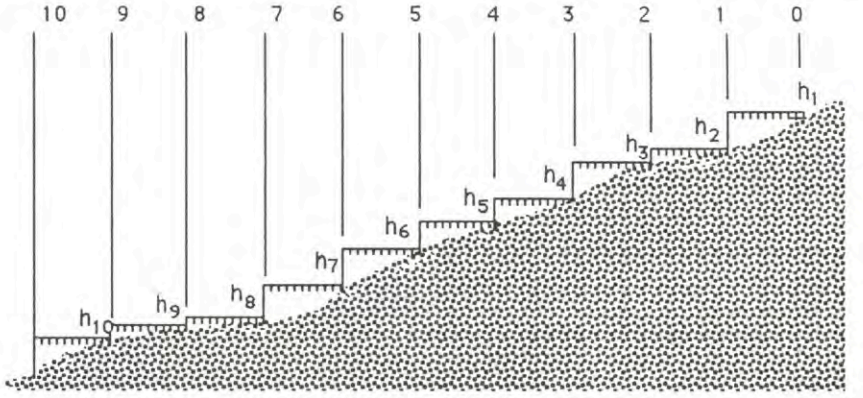
Mark one end with the stick with a stick and let the weight drop down to touch the sand. Lets call this height (h) Now measure the length of the string against the ruler. Lets call this length (d).



Now **d** will equal **h**, so we have a measure of the drop in height over a metre. We can use this principle to draw a beach profile.

On the beach

Start at the top of the beach. Lets call this point h_1. Measure out 1 metre and call this point h_2. Now use the ruler, string and level to determine the drop in height from h_1 to h_2.

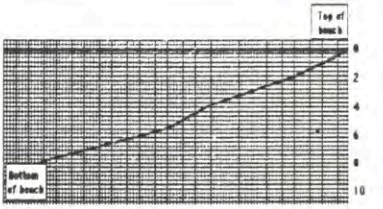


Collect data from a number of points down the beach and enter this in a data table like the one below.

Position on beach	Height difference	Height below datum (h_1+...)
1 (1metre out)	h_1	0
2 (2 metres out)	h_2	0+h_2
3 (3 metres out)	h_3	0+ h_2+h_3
4 and so on		

Data Table

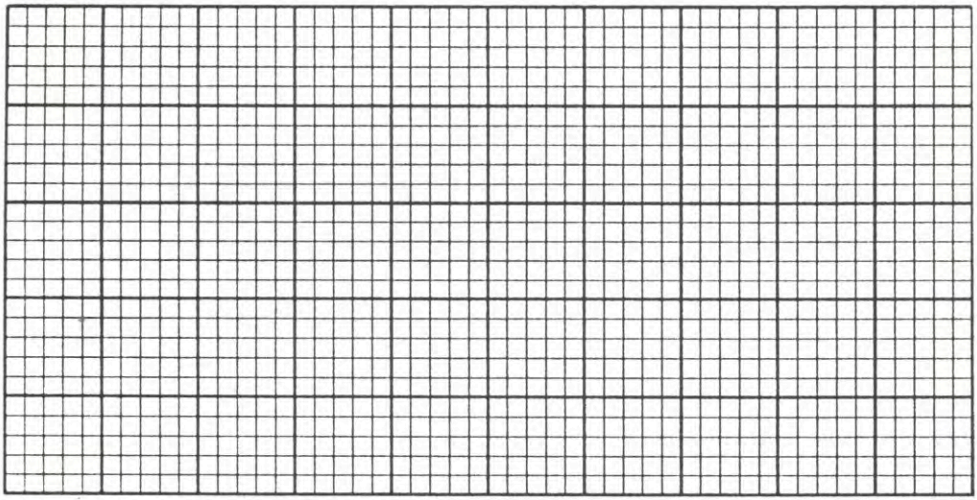
Fall in cm for each metre	Cm below datum
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	



Now plot this data on the graph paper overpage like the graph above.

Name of beach..... State of tide: High/mid range/low

Title of graph .....



Questions

1. Draw an angle of line of best fit to represent the beach slope.
2. Would this angle always be the same? _____
3. If it changed, why would it change and what factors would cause it to change?

_____

4. What role would longshore drift play in the changing beach angles?

_____

5. How would turtles affect the angle? Would it be as bad as people and why?

_____

18.
SAND GRAIN STUDY


Purpose

We have all built sand castles at some stage in our lifetime and have noticed that sand grains are of differnt sizes. Do you know where the biggest grains are and why they are found their? The purpose of this project is to investigate these questions.

The aims of this project are to:-

(a) have you collect and sieve sand samples from various parts of the beach.
(b) calculate and plot percentages of big and small grain sizes
(c) suggest some reasons for differnt grain sizes

Research methods

You will need:

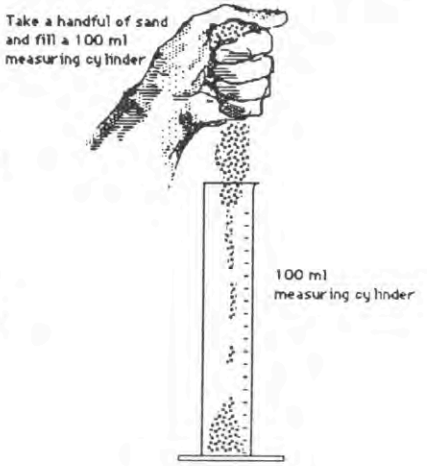
Sample bottle to collect sand sample
Seive for different sand sizes
Collection dish (empty margarine container)
100 ml measuring cylinder

What to do

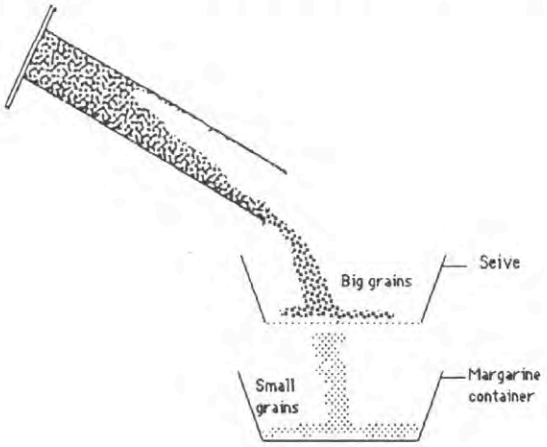
***Note** that on Australian beaches, different sand types are found. On coral barrier reef islands, the sand is much courser and will require a different seive size than say a beach in New South Waleswith fine sand. A number of seives should be taken so that the equipment will match the sandsizes for the particular beach under investigation.*

1. Start at the bottom of beach and collect a handful of wet sand from the waters edge. Now collect another a metre up the beach and take these to the top of the beach and lay them out on the piece of plastic to dry in the sun. They will be the last samples to seive and must dry.

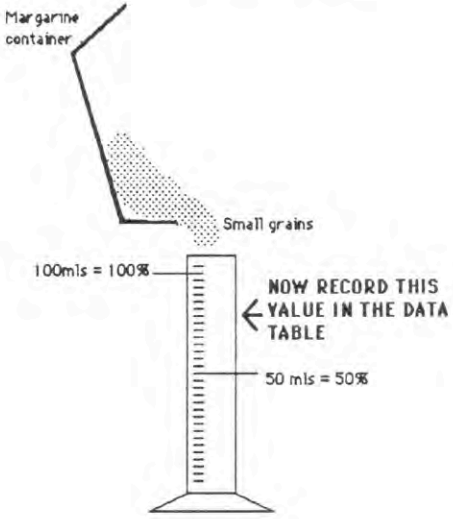
2. Now start at the top of the beach. Take a sand sample in you hand and fill the 100ml measuring cylinder. This sample is the first and so is called **the datum point** sample.

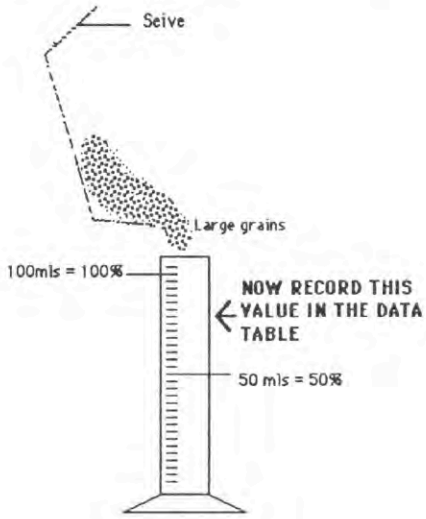


3. Now seive this 100 mls of dry sand through the sand seive into the margarine container. A little shaking may help.



4. Now take what remains in the seive (the big sand grains) and pour them back into the measuring cylinder and record the number of mls in the data table below. This can now be regarded as a percent.





REEF EXCURSION Teachers Guide

These are suggested prompt questions to help you check these criteria

You will need:

- A deck chair and hat
- A cool drink, magazine and pen

What to do:

Take up a vantage point overlooking the reef. Read your magazine until the first student comes up, then ask for this excursion booklet. In many cases, students copy off each other. This technique is designed to force the student who has copied to go back and learn thework.

Its impossible to be perfect here, but the stduent who has done the work should know the answers straight off. If the student seems to know what the activity was about, check the written work. If it becomes obvious that the work was copied, send the student back to learn the answers. If the student is having difficulty give assistance. You don't have to ask all the questions. They are there so you can learn also and you can play a part. I've seen teachers treat thecamp like a holiday. If you treat it like a holiday, so will the students and the word will get back that it was a holiday and that will spell the end of reef trips in school time. That's putting it a bit blunt, but that's what will happen. You should split up the tasks taking responsibility for a particular group.

Note:

SA = Possible student answer TQ = Teacher question to check ifthe student did the activity
( ) = Reason for answer and its importance expressed in very blunt language. Remember you will have to deal with 50 students and a possible 30 criteria so you you will have to be quick.

Questions and possible answers for Sound Achievers **Page**

S.A Lollie paers in bag and taken home, All rubbish in bag and taken back to mainland, crap in the can and not in the bush, use common walking tracks to beach, don't take shells home, dont fish in the green zones.

T. Q. Why do lollie papers kill Ghost Crab? (Trap burrows and suffocate) Why does rubbish kill baby turtles? (Increases seagull population who are not natural island predators) Why should you stick to a common walking track when going to the beach? (Protect natural dune vegetation, holds pioneer vegetation in tact and so stabilizes vegetation behind. Prevents possible blow out) Why crap in the can and not in the bush? (Keep vegetation in tact. Places for noddy terns to nest). Why not take shells home? (Dead shells make home for hermit crabs or breakdown to form sand which makes coral island)

T. Q. Where is the green zone on this island? (Between the yellow markers on the beach). Why have a green zone (So people can see the reef in a reef apreciation area) What can't you do there (Spearfish, Fish, Moor a boat or generally, rape pillage or plunder) What can you do there? (Snorkel, reef walk and admire the beauty)

T.Q. Whats the first aid for .... (You should know the answer)..... What would you do if you ...stood on a .....

4. [] Complete a worksheet on dangerous reef creatures and reef first aid 5

Answers are given to this one and are upside down on page 11

5. [] Complete a low tide reef walk and answer a series of questions about reef animals ... 12

T.Q. What makes the sand for this island? (The parrot fish, waves, animals and plants dying) Describe the shapes of any threee types of corals

6. [] Snorkel confidently at high tide close to the campsite to the satisfaction of your teacher ... 14

Just sight the signature on the bottom of the page and tick the box.

7. [] Snorkel at low tide in a reef pool 15

T.Q. What was it like? (Great) How long did you stay in the water? (About 20 minutes ..Average) Why so short a time (Bloody cold) ...it varies.

8. [] Feed some fish with bread describing some fish behaviour 14

TQ. What did you use to feel the fish? (Bread. How was it?....

9. [] Walk around the cay describing differences from one side to the other in the daytime ... 19

TQ. On what side are the trees the shortest? (The windward..other side..) What did the beach at the end of the cay look like. (It got all rubbly.. was pointy...was diferent). What did you notice about the sand at the tip of the cay?(It gets more gritty because the wave action is greater here and only large sand grains arfe heavy enough to stay. The smaller ones get carried away.) Did the tree types change at the end of the cay? Yes only casurinas are found at the western end. By the way where is N<S<E<W>?

10. [] Walk around the cay at night describing differences from the day 20

(There are Ghost crabs in their squillions. Some turtles ??, Birds roosting, manta rays, stingrays in close to shore eating the pippies..

11. [] Find, observe and describe one association between animals or animals and plants ... 22

TQ. Which one did you find? Play it by ear.

12. [] Identify, recall and describe at least three plants , three fish and five invertebrates ... 23

TQ. Which ones did you find? Play it by ear.

13. [] Prepare and cook a camp meal washing and tidying up afterwards 25

Check the box for their peers signature. They have to have it signed by one, two ?? of their peers. Over to you....

14. [] Maintain a clean and hygenic campsite 25

Over to you.

The importance of these 14 makes or breaks the standards set by you. IWhen we first started these trips some got away with doing precious little because we were learning. We now have a good standard but it can get even better if you tell me the things that you liked and didnt like about this book. Please give me some feedback.

Thanks Bob Moffatt, Telephone: (075) 39 4187. Tell me the good bits first.

Criteria for High Achievement (complete all of the following projects successfully)

15. [ ] Follow a friendly fish recording data about its movements underwater 26

Basically look for descriptions of movement. Ask for the underwater recording sheet as evidence.

16. [ ] Participitate in a group manta tow and snorkel at high tide 27

Ask them to describe what it looked like underwater as they went out and over the crest. Ask them where the crest is.

17. [ ] Make a successful study of a beach and plot its profile accurately 28

Where is the beach slope the greatest? (End) and least on the cayt (Middle) Why. All the energy is at the end of the cay.

18. [ ] Measure and plot a graph of beach sand grains comparing middle & tip of cay beaches ... 31

Where are the big sand grains? (Grain sizes are larger as you go down the beach.)

19. [ ] Determine the direction of longshore current off the crest at low tide 35

Where is the current the strongest? (Depends on the cay .. should be deepest part. Coral absorbs wave energy)
Where is N>S>E>W> on this cay. Which way did the current go? (Should be west if camped on the lee side)

20. [ ] Maintain a reef diary 38

Read some parts of it... should be interresting..students sometimes tell all). Maintain privacy however.

21. [ ] Gather data on beach and island temperatures ploting results on a graph 42

Where was the hottest place...(Should be middle beach midday. The coolest place. Under trees.
What was the water temperature in degrees C. (This one always gets the cheats)

Very High Achievement (complete any four of the following projects successfully)

22. [ ] Sediment rain 44
23. [ ] Sand patterns and sediment structures 46
24. [ ] Getting food 48
25. [ ] Pursuing a parrot fish 50
26. [ ] Cucumber count 52
27. [ ] Sea cucumber habitats 55
28. [ ] Goby and schrimp 57
29. [ ] Clownfish and anemone... 58
30. [ ] Cleaner wrasse 59
31. [ ] Map a bommie scuba project 60
32. [ ] Recreational fishing and filleting... 62
33. [ ] Reef art 64

....
Supervising Teacher Date

A few quick suggestions:

Don't swim at night. (That's when sharks feed the most.) All rubbish, including cigarette butts go back to the mainland. At the end of the camp, sprinkle leaves etc so tha camp looks like the way you came in. North West may have changed. (The next people would like to feel thay discovered it too). Keep to campsites at night and operate a buddy system. (Helicopters can't find these islands at night as they have no radar). Take a VHF radio to Masthead.

Your notes for next year and some feedback for me...

What we forgot

What activities could go...which could go in. any new ones you did..thought up

What went well

What didn't go so well

Anything else

5. Record your results as a percentage in the data table. Also use the sticky tape provided to collect a sand sample from each station. Continue now to take samples at one metre intervals until you reach the point where you took the wet sand samples. Return to the drying plastic and continue to collect data for the now dry samples. Record all your data in the table below.

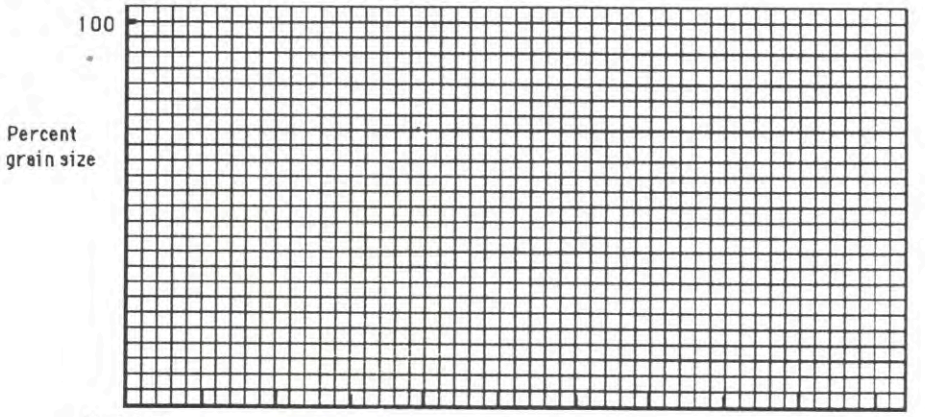
DATA TABLE

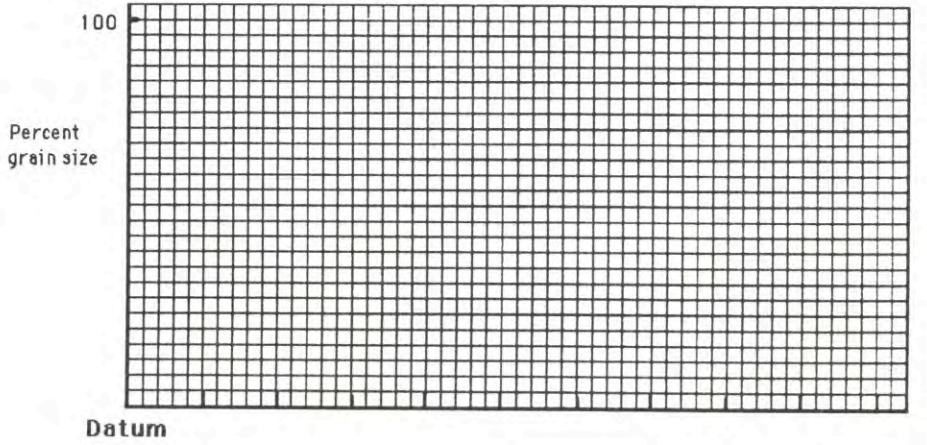
Grain size	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
% Big															
% Small															

DATA TABLE

Grain size															
% Big															
% Small															

6. Use the data collected to plot 2 graphs, in different colours, of grain size verses position on beach.





Questions to answer

1. Where is the largest grain size found and why?

2. Where is the smallest grain size found and what effects do you think it has on the beach environment?

3. Any other conclusions or hypothesis you might suggest from this study?

6. Make drawings in the spaces below of the different types of sand grains. Are they really sand or the decomposed remains of animals and plants. Give reasons.

19.

REEF CREST LONGSHORE DRIFT STUDY

(Based on an original project by Mary Lou Carle)

Purpose

The aims of this project are to:-

(a) discover if longshore drift is consistent in direction and speed along a straight stretch of reef crest when measured at 15m intervals at the same time.
(b) find out if longshore drift is consistent at differ ent distances from the crest
(c) manipulate data in graphical form
(d) estimate the positions of rip currents and describe some of their effects
(f) Optional if activity can be completed over tide:- to estimate if the longshore drift changes before and after high and low tides.

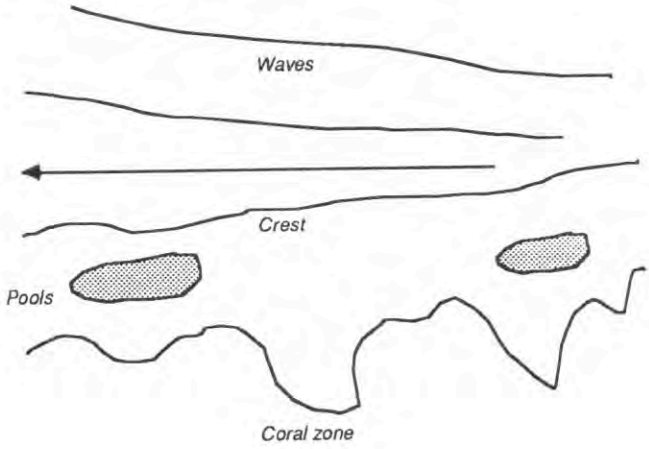
Defintions

Longshore drift is the movement of water parallel to the shore caused by waves striking the beach at an angle, forcing water to move parallel to the shore. On the reef crest it is the current set up beside the coral as the tide changes. This could be compared with grabbing a piece of wet soap and propelling it foreward. The thumb (representing the beach's inertia and the fingers, (representing the oblique wave pressure)

Importance

Longshore drift moves sand along the coastline, making problems for mariners wishing to enter and exit from rivers and bays.

A rip is an underwater channel that returns incoming water out to sea resulting in a current moving away from shore which dissipates as the channel widens.



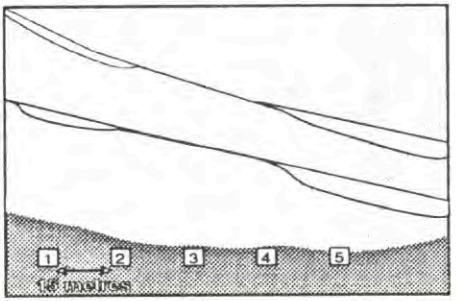
As the tide goes out, currents are set up along the crest. These currents can be quite strong and pose a danger to snorkelers or divers who are unaware of their strenghts. They are at their extremes at half tides when the rule of twelfths is at its maximum fall.

You will need:

A straight streatch of reef crest
two sticks same size and weight (oranges or coconuts can also be used)
data sheet, pencil, hard surface to write on
watch with second hand

What to do

Mark out 5 stations, 15 metres apart on the beach with your foot.



1. You are going to study longshore drift in close and out far. Decide which partner is going to throw the orange far and which close.

2. At a pre-arranged signal, such as a whistle, look to your teacher. At the second signal, and it must be emphasised **pre-arranged,** you caste your oranges into the sea and the timekeeper starts the watch.

3. You then follow your oranges and any variations. If the orange comes in, you should throw it out again.

4. After one minute the timekeeper signals and you are to mark the position of your orange in the sand opposite where the orange is. After two, three, four and five minutes, recording data accurately in the tables provided.

Longshore Drift Data Sheet

Name _____ Teacher _____

Team Station _____ Ornage throw (circle one) Short Long

Date _____

Rip Yes ☐ No ☐

Wind speed _____

Direction _____

Surf height _____

Ocean substrate offshore _____

Short throw

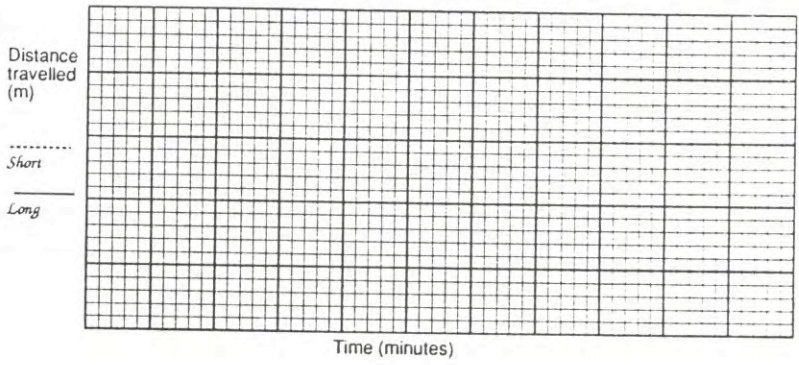
Minutes	Drift direction	Distance

Long throw

Minutes	Drift direction	Distance

Notes _____

Notes _____



20.

Your Reef Diary _____

Your Reef Diary _____

Your Reef Diary _____

Your Reef Diary _____

BEACH TEMPERATURE PROJECT

Purpose:

To record and graph the temperature changes in the marine environment

You will need

-10°C to 110°C Thermometer

What to do

Select 14 differnt places in the study area and record the temperature above the environment and the temperature in the environment.

Eg: Position 1: (Under trees at top of beach) In (24°C) Above (27°C)

Make sure you record as many varied position s as possible and note them in the table below:

Table: Record of places temperature taken

Place	Place
1 _____	7 _____
2 _____	8 _____
3 _____	9 _____
5 _____	10 _____
5 _____	11 _____
6 _____	12 _____

Now complete the data table over and draw graphs of your results

Position Above	Temp	Position in	Temp	Position Above	Temp	Position in	Temp
1				8			
2				9			
3				10			
4				11			
5				12			
6				13			
7				14			

Questions to answer:

1. Where is the hottest place on the island and when?

2. What problems do high temperatures create for plants?

3. How are animals affected by high temperatures?

4. What is the collest place?

Draw a graph of the temperature as you go from under the trees, down the beach and then into the water for surface temperatures.

Are there any conclusions that can be drawn?

Plot the same graph at night.

How well does the sand hold its temperature?

22. Sediment rain

1-1½ hr x 2 • •

FROM PROJECT REEF ED

Concepts
Sediment
Distribution
Interaction

Skills
Observing
Measuring
Recording
Analysing

Attitudes
Interest in methods of enquiry in science

Aim

- To find out whether the amount of sediment raining down is different on different parts of the reef flat.

Purpose:

To measure the amount of sediment that falls from the sea water on organisms on the reef.

You will need

- Reef-walking gear
- Small plastic specimen tubes (about 2 cm diameter) with holes drilled near upper rim (35 mm film canisters or cut down vinegar bottles can be used. The holes can be drilled with a hot nail.)
- Strong twine or wire
- Air photo of reef-top (optional)
- Knotted 20 m rope (optional)
- A suitable permit
- Small boat for use at night tide (optional)

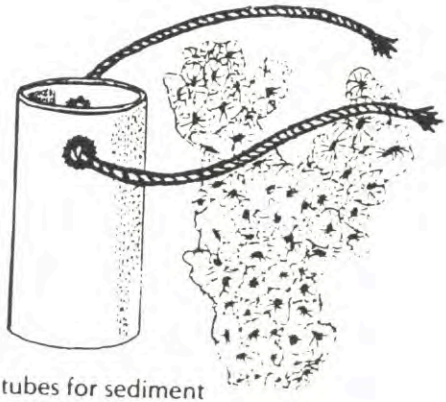
This activity requires two sessions each of about 1-1½ hours on the reef flat at low tide. One session should be at the beginning of your trip, the other at the end.

The amount of sediment raining down from above may affect the distribution of plants and animals on a reef. If different amounts of sediment rain down on different parts of the reef, this could possibly be one factor influencing the relative distribution of corals and fleshy algae on a reef flat.

What to do

1. Across the reef flat, put out a series of open plastic tubes attached to fixed objects (e.g. boulders, iron slabs). The tubes should be held in place using, for example, wire or tape threaded through holes near the top of the tube. The mouths of the tubes should all be at the same tidal level (e.g. slightly below the upper limit of coral growth on the reef flat). It may be useful to set out the sediment traps along a transect line if used for other study.
2. After a number of days, collect the tubes. (Or check the tubes daily at low tide and, if a boat is available, at high tide.)
3. Compare the amount of sediment in the tubes. Is there any systematic variation in amount across the reef flat? Is there any variation in the size of the sediment in the tubes, i.e., do some tubes contain coarser sediment than others?
4. Discuss your findings and their possible significance with others in your group.

We acknowledge the help of A. Cribb, Botany Department, University of Queensland with this activity.



Attach collecting tubes for sediment to dead coral at low tide water level.

23. Sand patterns: sedimentary structures 2 hr • •

Concepts
Inorganic sedimentary structure
Organic sedimentary structure
Bed
Ripple mark
Burrow
Trail
Classification

Skills
Measuring
Recording
Observing

Attitudes
Appreciation of natural environments
Interest in methods of science

Aim

- To gain some understanding of the way structures in reef-top sediment deposits are produced by moving water and air, and by living things.

You will need

- Reef-walking gear
- Snorkelling gear
- Clipboard and paper
- Plastic ruler
- Camera (optional)
- Transparent viewing box

This activity requires approximately 2 hours — part of which should be at time of low tide and part at higher tide level. It could be carried out over a number of days.

In places where deposits of sand or other sediments are forming, air, water and living things act on the sediment to produce distinctive features known as sedimentary structures. These include various kinds of ripple marks, grooves, burrows, tracks and trails.

What to do

1. As the tide goes out, walk along the beach and also through the water on the inner reef flat.
   (a) Look for structures produced on the surface of the sand by moving water. You might find grooves, or ripple marks, or other similar structures. How many different kinds can you find? A transparent viewer will help you look through shallow water to the sandy bottom.
   (b) Try to make a pictorial catalogue of all the different kinds of sedimentary structures produced here by water movement. Make labelled sketches with a scale. Use a camera, too, if you have one.
   In each case, try to work out which way the water currents or waves moved to produce the structure. Show this on your sketches with arrows.
   (c) If you see ripple marks, note their wavelength (i.e., distance between crests) and amplitude (i.e., difference in height between trough and crest). Are the crests, in plan view, straight or curved? Are the marks, in profile view, symmetrical or asymmetrical? Draw sketches. Do you think they were produced by currents (asymmetrical) or waves (symmetrical)?

2. While walking on the beach or reef flat, keep your eyes open for sedimentary structures made by living things. Look for trails, tracks, burrows, holes or mounds. Do you know what animals made these and how they were produced? Make some pictures of the features you've seen.

3. While snorkelling over the reef flat or looking out from a "submarine" or glass-bottomed boat, keep your eyes out for ripple marks on the bottom and especially for ripples of moving sand. Look at the moving sand carefully and notice how the ripples change. Make a sketch to show what you see.

24. Getting food

2 hr +

FROM PROJECT REEF ED

Concepts
Diversity
Herbivore
Carnivore
Predator
Grazer

Skills
Observing
Recording
Analysing
Synthesising

Attitudes
Confidence in own powers of observation
Curiosity

Aim

- To observe a variety of invertebrates feeding on the reef flat so as to analyse the relationship between the environment, the animal's way of life and the food it eats.

You will need

- Reef-walking gear
- Snorkelling gear (optional)
- Transparent viewer for reef walks
- Field sheet and pencil
- Underwater slate (optional)
- Tape-recorder (optional)
- Camera (optional)

What to do

1. Throughout the time you are at the reef, make observations of reef invertebrates feeding (e.g. sea anemone, sea-cucumber, crab, gastropod, chiton, clam). Observe each animal carefully and make notes on the field sheet (or record into the tape-recorder) about:
   - its habitat (a brief description)
   - what it is eating
   - how it obtains the food
   - type of food
   - whether the animal is mobile or sessile (fixed)
   - if mobile, how the animal moves
   - if mobile, an estimate of its speed. (See if you can devise a good way of measuring speed so that comparisons between animals can be made.)
2. When you have built up a number of records, analyse the information. Can you place any of the organisms you've observed into feeding groups such as predator, grazer, filter feeder, scavenger. Can methods of food-getting be related to other aspects of an organism's way of life, especially such things as immobility and locomotion? Can methods of food-getting be related to an organism's habitat?

Ideas for further things to do

3. You might like to get from books some more information about feeding by animals you have seen in the field.

References

Talbot, F., ed. 1984. *Reader's Digest book of the Great Barrier Reef*. Sydney: Reader's Digest.
Bennett, I. 1981. *The Great Barrier Reef*. Sydney: Lansdowne.

Getting food

Animal	*Habitat*	*Food*	*How obtained*	*Mobile or sessile (fixed)*	*Method of locomotion (if any)*	*Speed*

25. Pursuing a parrotfish

2 hr •

FROM PROJECT REEF ED

Concepts
Fish structure
Fish behaviour
Interrelationship
Adaptation

Skills
Observing
Recording underwater

Attitudes
Appreciation
Perseverence
Enjoyment of outdoor experience

Aim

- To investigate the lifestyle of a parrotfish (family Scaridae).

You will need

- Snorkelling gear
- Underwater slate and pencil
- Reef-walking shoes

This activity requires one hour at high tide and one hour at low tide.

What to do

At high tide

1. Before going into the water, put a copy of the outline drawing of a parrotfish on your underwater slate.
2. Snorkel across the reef flat and find a school of parrotfish.
3. Lie very still in the water and listen. What do you hear?
4. Can you observe where these creatures have been feeding? As the school moves on, examine the coral more closely.
5. Follow the school and try to observe how many individuals are present. Are they all the same colour? Are they all the same species? Are they all the same size?
6. As you follow the school, try to observe what types of corals are grazed. Make as many observations as you can on behaviour and factors which you believe are important in the life of a parrotfish.

At low tide

7. Walk across the reef flat at low tide, leave your sandshoes on a conspicuous coral boulder and put on your fins and mask.
8. Find a school of parrotfish close to the reef edge. Repeat the observations you made at high tide. However, make comparisons between the behaviour of the school at low tide and at high tide. Do the fish appear to be as active? Are the schools larger or smaller? Is feeding activity as intense?

9. Consider the following questions in relation to your observations.
   (a) Do you believe parrotfish would have an effect on the growth rate of corals?

   (b) What would limit the distribution of parrotfish?

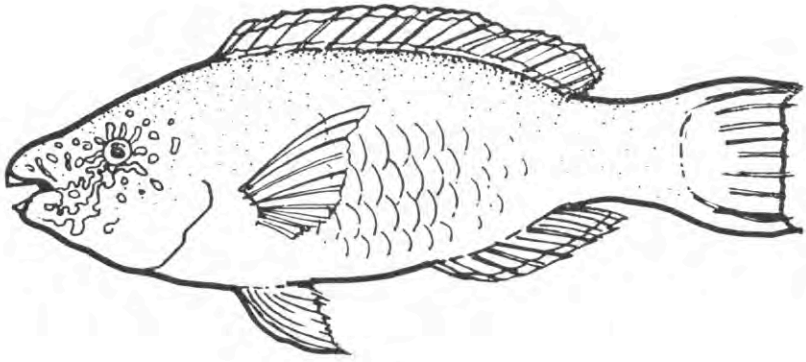
   (c) How would a Crown-of-Thorns starfish plague affect parrotfish populations on a coral reef? How would this affect the predators of parrotfish?

Ideas for further things to do

10. Distinguishing between parrotfish species can be difficult. You may like to consult the list of references given below. With the aid of these texts, carefully mark in your slate diagram distinguishing features of three different species. It will be quite a feat if you can go on to the reef and find these species. You may also like to research sexual dichromatism from the references given.

Readings

Coleman, N. 1981. *Australian sea fishes north of 30°S*. Sydney: Doubleday.
Carcasson, R.H. 1977. *A field guide to the reef fishes of tropical Australia and the Indo-Pacific region*. London: Collins.
Grant, E. 1978. *Guide to fishes*. Brisbane: Dept Primary Industry.



26. Cucumber count

2 hr +1 hr • •

Concepts
Population distribution
Abundance
Habitat
Adaptation
Competition
Niche
Sustainable yield

Skills
Observing
Collecting and recording data
Synthesising data
Hypothesising

Attitudes
Appreciation of natural environments
Confidence in making observations
Interest in methods of science

Aim

- To estimate the size and density of the sea-cucumber (holothurian) population of the reef-top.
- To gain an appreciation of the part sea-cucumbers play in the reef ecosystem.

You will need

- Reef-walking gear and possibly snorkelling gear
- Underwater board, waterproof field sheet and pencil
- Reference material
- Measuring tape or cord (20 m) (optional)
- 1-metre string, or metre stick
- Map or air photo of reef
- Ruler
- Transparent graph paper (optional)

This activity requires about two hours at low tide for fieldwork and about one hour for follow-up work.

PRECAUTIONS

Avoid touching eyes after handling sea-cucumbers. Material from these animals may irritate the eyes.

What to do

Gathering data (field work)

1. Divide into small groups (about four people per group). Each group is to make a transect at low tide across the reef-top from beach to reef crest, counting sea-cucumbers.
   (a) Each group should select a starting point which is recognisable on a map or air photo, take a compass bearing to the reef crest and walk along this bearing.
   (b) Use a knotted cord or measuring tape as the transect line, or measure the transect line using paces.
   (c) At sample points every 20 metres along the transect line, count all the sea cucumbers in a 4-square-metre area (you could conveniently do this by looking at a 2-square-metre area on either side of the transect line at each of your sample points). If you can, decide what species the sea-cucumbers belong to by referring to reference material.
   (d) Record the information on the field sheet.

Analysing data

2. Work out the *average number of sea-cucumbers* (all kinds) *per square metre* on the reef-top.
   One way this can be done is to combine the totals from each station on your transect and divide this by the total number of square metres sampled.
3. Make an estimate of the *total number* of sea-cucumbers on the reef flat and reef rim.
   (a) Use a map or air photo to work out the total area of the reef-top (not including lagoon, if present). (A grid such as transparent graph paper will help you do this.)
   (b) Use the value obtained in (2) for the average number of individuals per square metre. Multiply this by the total area of the reef-top (excluding lagoon).
4. Work out the *relative numbers* of the various species of sea-cucumber. (List the names of the species in order of abundance. Express the relative abundance as a ratio.)

FROM PROJECT REEF ED

Questions to consider

5. Do you think that the method used to calculate the average number of sea-cucumbers per square metre is valid? If not, how could the method have been improved?
6. (a) Look at your transect data. Does the population density of sea-cucumbers seem to be different in different zones of the reef-top (inner reef flat, outer reef flat, reef rim, etc.)? (You could make a graph showing the total numbers of sea-cucumbers obtained at each station along the transect.)
   (b) Look at the transect data obtained by other groups. Is there any difference between sea-cucumber population density on the windward and leeward sides of the reef?
   (c) If sea-cucumber population density is *not* the same on different sides of the reef or in different reef-top zones, what factors might contribute to this?
7. (a) Select two common sea-cucumber species, e.g. the "curry" cucumber *(Stichopus variegatus)* and the "knobbly" cucumber *(Stichopus chloronotus)*.
   (b) Examine the distribution data for each.
   (c) In which zone of the reef-top is the population density of each species least? greatest?
8. According to research studies reported by Bakus (1973), an individual sea-cucumber might take in as much as 100 grams (estimate) of sediment each day. Let's assume an average intake rate per individual of 30 grams per day. How much sediment might be taken in annually by all the sea-cucumbers on this reef-top?
   Try to design an experiment to find out what sedimentary material they are taking in and what they are actually using from it?
9. What factors, natural and human-influenced, might cause a population of a species of sea-cucumber on a reef-top to fluctuate from time to time? How could this fluctuation be identified?

> *Sustainable use*
> *When humans harvest living things, it is important to safeguard future production by ensuring that annual harvest size is not too great. The term "sustainable use" refers to the conservation practice of using a living resource at a level which allows the supply of the resource to be maintained indefinitely into the future.*

10. In the past, fishing of some sea-cucumbers (called beche-de-mer or trepang) took place on many reefs in the Great Barrier Reef area. Suppose someone wanted to carry out beche-de-mer fishing now at a particular reef. Reef management authorities would have to decide whether this would be allowed. How do you think they could determine whether the proposed fishing activity would be detrimental to this reef and whether, and how, it could be carried out on a sustainable use basis? Are there other factors which you think should be taken into consideration in deciding whether the proposed fishing should be allowed to go ahead? What kind of information do you think the reef management authorities would ideally like to have available to them before they have to make a decision like this?

Cucumber count

Station no.	Metres from shore	Zone of reef e.g. reef flat, reef rim	Total sea-cucumbers present	No. of each species, e.g. A = 24, C = 3	Station no.	Metres from shore	Zone of reef e.g. reef flat, reef rim	Total sea-cucumbers present	No. of each species, e.g. A = 24, C = 3
1					21				
2					22				
3					23				
4					24				
5					25				
6					26				
7					27				
8					28				
9					29				
10					30				
11					31				
12					32				
13					33				
14					34				
15					35				
16					36				

ISLAND REEF:

LOCATION OF TRAVERSE:
Starting point:

Bearing:

DATE:

PEOPLE IN GROUP:
(Initials)

CALCULATIONS:
Total no. sea-cucumbers counted
.....

Total area of reef-top (including lagoon)
.....m²

Total area of reef sampled on this traverse
.....m²

No. of sea-cucumbers on this reef-top (excluding lagoon)
.....m²

Average no. of sea-cucumbers per metre² on this traverse
.....

If sediment consumption each day = 30g, total amount of sediment consumed yearly
.....

27. Sea-cucumber habitats

2 hr •

FROM PROJECT REEF ED

Concepts
Habitat
Adaptation
Competition
Niche
Niche diversity

Skills
Observing
Collecting and recording data
Synthesising data
Hypothesising

Attitudes
Appreciation of natural environments
Confidence in making observations

Aim

- To find out where different types of sea-cucumber live on the reef-top.

You will need

- Reef-walking gear and possibly snorkelling gear
- Board, field sheet and pencil
- Reference material

At least two hours are required for fieldwork, mainly or entirely at low tide. The activity could be done piecemeal over several days.

PRECAUTIONS
Avoid touching eyes after handling sea-cucumbers. Materials from these animals may irritate the eyes.

What to do

Gathering data (fieldwork)

1. Walk or snorkel across the reef-top on one or more occasions. Explore living and dead coral clumps and look under boulders. Each time you find a sea-cucumber, note which species it is and the habitat in which it lives. Record on the field sheet provided.
2. During your fieldwork, think about the physical differences between the various habitats. Which seems to provide the most and least protection from light and desiccation? Which is best and least endowed with loose sediment particles? Which seems most exposed to wave action? Make a note of other ways in which the habitats might differ physically from one another.

Analysing data (back at base)

3. How many species did you find?
4. From the data recorded on your field sheet, what appears to be the habitat, or range of habitats, favoured by each species?

5. Is each habitat occupied by more than one species?

Questions to consider

Based on your fieldwork, literature study and discussion, answer the following:

6. Can you recognise any adaptation(s) which especially seem to fit each species for the habitat it occupies?

7. Where one or more species occupy the same habitat, to what extent do you think they might be competing with each other?

(Turn over for Question 8 and Field Sheet)

8. There is a tendency in reef areas for life roles of inhabitants to be very diverse, with available resources being finely divided up (i.e., partitioned) by reef inhabitants. This is called niche diversity. To what extent do studies of sea-cucumbers support the idea of niche diversity?

FIELD SHEET

Sea-cucumber habitats

Reef:	*Date(s):*	*Observers:*

For each species make a tally in the spaces below as you go.

Species	*Reef flat*				*Reef crest*			
	Exposed on sandy areas	Under boulders or coral	Exposed on rubble	Other	Under boulders	Exposed on pavement	Exposed on rubble	Other
A								
B								
C								
D								
E								
F								
G								
H								

Calculations:

Reading

Bakus, Gerald. 1973. The biology and ecology of tropical holothurians. In *Biology and geology of coral reefs*, ed. O. A. Jones and R. Endean. vol. 2. New York: Academic Press.

28. The goby and shrimp

½ hr

FROM PROJECT REEF ED

Concepts
Camouflage
Mutualism
Relationships

Skills
Observing underwater
Recording underwater

Attitudes
Perseverence
Fascination
Wonder

Aim

- To investigate the mutualistic relationship that exists between a goby and a shrimp.

(This project requires patience and careful observation while snorkelling in shallow water.)

You will need

- Snorkelling gear
- Underwater slate and pencil

What to do

1. At high tide, snorkel over the sandy patches in the lagoon (choose an area as close to the cay as possible). Focus your vision about 2-3 metres in front of you and directed down to the sand. Move slowly, making as little noise as possible. Keep your eyes open for a pale slim little fish with large eyes lying on the sand at the entrance to a hole.
2. Once you've found your fish, move in cautiously to about 2 metres distance. If the fish quickly retreats down the hole, move back slightly, remain very still, and wait for its reappearance.
3. Now, observe carefully, taking note of the following:
   (a) How would you describe the reappearance of the goby (bold, watchful)?

   (b) After the goby takes up station at the entrance to the hole, now long does it take for the shrimp to appear?

   (c) When the shrimp does appear, is it involved in any particular activity?

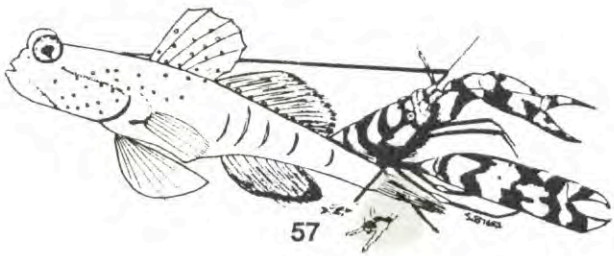
   (d) Does the goby appear to be involved in any activity besides observation?
   (e) Make a sudden movement towards the hole. What happens?
   (It would be a good idea to copy these questions on to your slate before you leave the beach).

Questions to consider

4. What appears to be the relationship between the goby and the shrimp?

5. Would survival be any more difficult for either the goby or shrimp if each lived a solitary life?

6. What particular adaptation does the shrimp have to fulfil its role in the relationship? What adaptations do you think the goby possesses to fulfil its role in the relationship?



29. Clownfish and anemone

½ hr +

FROM PROJECT REEF ED

Concepts
Special association
Adaptation
Commensalism
Symbiosis

Skills
Observing
Recording
Hypothesing

Attitudes
Perseverence
Appreciation of natural environment
Confidence in making observations

Aim

- To investigate the association between anemones and clownfish.

You will need

- Snorkelling gear or reef-walking gear and transportable viewer
- Underwater slate or waterproof sheet; pencil

This activity can take from half an hour to many hours. It can be done in pools on the reef-top at low tide or on the reef front while snorkelling.

What to do

1. Visit a particular anemone while snorkelling on the reef front or while observing a reef-top pool.
   (a) Record the size of the anemone and sketch the species of fish associated with it for later identification.
   (b) Record the numbers of clownfish fish present. Is there a dominant member of the group?
   (c) Do the clownfish touch the anemone? If so, how do they move when doing this?
   (d) Do the clownfish appear to concentrate in any particular region of the anemone?
   (e) Does the anemone react to the movements of the fish?
   (f) What evidence, if any, do you see of either the clownfish or anemone feeding?
   (g) How far do the clownfish move from the anemone?
   (h) What do the clownfish do when away from the anemone?
   (i) What behaviour is displayed by the clownfish to other fish species?
   (j) How have the fish reacted to your presence and movements?
2. If possible, visit and observe other clownfish/anemone associations.
   (a) Are other species of clownfish present?
   (b) Are particular types of clownfish associated with particular types of anemones?
   (c) Can you recognise common patterns in the behaviour of the clownfish at the anemones you observe?

Questions for you to consider

3. Clownfish, unlike other fish, are not stung by nematocysts from the anemones they are associated with. Various reasons have been suggested for this. Try to find out about the research that has been undertaken on this.
4. In this association, who benefits, and how? Read literature discussing symbiosis and commensalism relationships. What kind of association is the clownfish/anemone partnership? How does the special association compare with other special associations you know of on the reef?

30. Cleaner wrasse

1 hr •

FROM PROJECT REEF ED

Concepts
Interrelationships
Symbiosis
Fish behaviour

Skills
Observing
Recording underwater

Attitudes
Confidence in making observations
Interest in natural environment and especially in interrelatedness of living things

Aim

- To investigate a mutualistic relationship on the reef.

You will need

- Snorkelling gear
- Underwater slate and pencil

What to do

1. Snorkel along the reef edge until you find a cleaner station. Coral bommies are likely areas.
2. Observe a fish being cleaned. What parts of the fish are cleaned?
3. Study the behaviour of the wrasse inviting the fish to be cleaned and the behaviour of the fish receiving the cleaning.
   (a) Record the movements of the wrasse *before* cleaning begins.
   (b) Record the behaviour of the fish about to be cleaned.
   (c) Observe the range and territory of the wrasse.

Questions to think about back on the beach

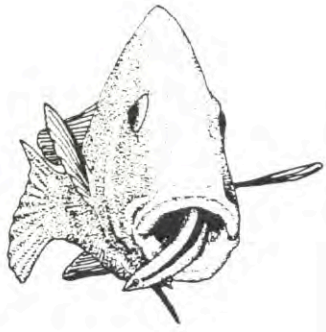
4. Did different species show similar behaviour before cleaning commenced?

5. What factors might influence the size and position of a station?

6. Comment on the role of the wrasse in the coral reef community.

Ideas for further things to do

7. You can learn more about the cleaner wrasse by consulting the following reference:
   Behavioural ecology of cleaning fish.



31. Map-a-bommie scuba project 3 hr +

FROM PROJECT REEF ED

Concepts
Ecology
Distribution
Habitat
Population
Environment

Skills
Organisational skills
Orientation skills
Using compass
Observing and recording underwater
Mapping
Cooperation

Attitudes
Appreciation of natural environment
Perseverence
Enjoyment of outdoor experience

Aim

- To investigate the ecology of a submerged coral mass (bommie). This is a project requiring the use of scuba. It is recommended for a group of three or four divers.

You will need

- Diving gear (scuba)
- Underwater slate and pencil
- Underwater camera and torch (optional)
- Submersible compass

You will need to make three scuba dives at less than 10 metres.

What to do

1. To understand the ecology of a bommie, it is first necessary to analyse the physical features of the bommie and to assess the physical factors to which it is exposed. Choose a bommie which has appealed to you while snorkelling along the reef slope. Try to choose a bommie no larger than 5 m in diameter and no smaller than 2 m in diameter. Your bommie should also be in less than 10 m of water (to reduce your air consumption and avoid decompression problems).

First dive

2. (a) Record the position of your bommie on an outline map of the reef. You will need to take compass bearings from the bommie to prominent features of the island (end of vegetation, towers, etc.).
   (b) Record the size of your bommie.
3. Record the depth of the bommie at low tide. Hover above the bommie and make an outline sketch of the bommie on your slate. Now descend to the base of your bommie and make a sketch of its western side. Move through 90° (naturally, using your compass) and make a sketch of its northern side. Continue this procedure so that you obtain sketches of the eastern and southern aspects also. As you make these sketches, pencil in any prominent features, e.g. masses of brain coral, caves.
4. Make relevant notes on such things as currents in the area, slope of the bottom, proximity of other bommies and any other physical factors which you think may have an influence on your bommie.

Second dive

5. Slowly circle your bommie and, on the sketch you made on the first dive, record the locations of resident fish on your map (e.g., cod in caves, painted sweetlip, flutemouths under coral overhangs). Take particular note of territorial species such as moray eels, clownfish, etc. Try to find any cleaner stations. As you record the different fish species, jot down their approximate numbers as shown in the example in figure 77.1.

Third dive

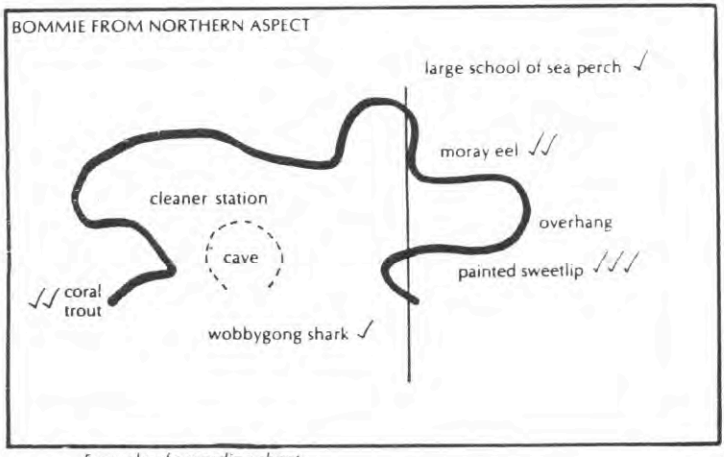
6. Now move in close to your bommie and record the interesting and noticeable invertebrate life. By this time, you may have to use fresh outline drawings of your bommie. Try to find and mark on your map the location of nudibranchs, stinging hydroids, soft corals, etc. Look for sponges and ascidians under overhangs.
   What kind of hard corals are predominant on your bommie? (perhaps you can enlist the aid of students who have done activity 43, "Coral Colonies".) Make sketches of some of the corals so that you can identify them later.

Questions to consider

7. Over your three dives, did you have the feeling that your bommie retained a constancy in terms of the number and types of species present, or did you feel that the bommie was continually changing?

8. Were there any areas on your bommie where life appeared to be more concentrated? If so, why do you think more life was present in these areas?

9. How have your feelings changed towards coral bommies after this project? Is it possible to feel affection for a bommie?



Example of recording sheet.

32. Recreational fishing

FROM PROJECT REEF ED

Concepts
Fisheries
Management
Conservation

Skills
Catching, preparing and cooking fish
Using literature

Attitudes
Fishing ethics
Self-reliance

Aim

- To develop skills in interpreting the Great Barrier Reef Marine Park Authority regulations on recreational fishing.
- To follow the motto "Enough Fish for One Meal" while fishing.

You will need

- Boat and outboard motor complete with safety gear
- Fishing gear (hand lines, sinkers, hooks, bait)
- Bait net (check if permit required)
- Great Barrier Reef Marine Park zoning information
- Fish identikit or field guide
- A licenced boat driver
- Correct anchoring gear, e.g., reef pick

What to do

1. Discuss how many fish you will need for one meal.
2. Find out about recreational fishing regulations at the reef you are visiting and read carefully the zoning information.
3. Check weather, tide, boat, gear and equipment.

SAFETY RULES

- *Do not go offshore further than 50 metres.*
- *Do not go out in one boat alone.*
- *Do not gut fish near snorkelling or swimming areas.*
- *Do not keep fish that are unsafe to eat or that are the wrong size.*
- *Do not stay out too long — 2 hours must be considered a maximum.*

4. In choosing your spot, stay clear of areas prohibited for fishing and stay away from popular snorkelling areas.
5. Tell someone where you are going and when you will be back. Watch the tides. Wear suitable clothing.
6. Go out and catch the number of fish you need. (If you catch a fish which is protected or undersize, return it quickly.)
7. Clean and prepare your fish by gutting and filleting it.
8. Either pan fry or cook in alfoil.

Notes

Readings

Grant, E. M. 1982. *Guide to fishes.* Brisbane: Department of Harbours and Marine (Use waterproof edition)

Russell, B. C. 1983. *Annotated checklist of the coral reef fishes in the Capricorn-Bunker Group, Australia.* Townsville: GBRMPA.

Ideas for further things to do

9. Discuss the zoning strategy for the reef you are visiting. Does it have a reef appreciation area? Does it have a seasonal closure area? If so, why do you think it has these? Why are some parts of the Great Barrier Reef Marine Park set aside as "replenishment areas"?

10. Locate information about coral trout. Draw a diagram of a coral trout and make notes on the habitat of coral trout. Seek information on coral trout surveys carried out under the auspices of GBRMPA. Why are the surveys done and what have been their findings and significance? Try to find out how many coral trout are caught at the reef you are visiting. What about catches during previous trips by members of your group?

11. With other members of your group discuss and make a list of some reasons for and against going fishing at the Reef. How important are each of these reasons in your view?

12. Do you think that the principle of catching only "enough fish for one meal" is a worthwhile one? Why?

13. In some parts of Australia, there are legal limits, called bag limits, on how many fish can be caught by a recreational fisherman in any one day. Do you think that such bag limits should also apply in the Great Barrier Reef area? Why?

33. Art and the reef

Concepts
Environment
Creativity
Perception

Skills
Expressing
Craftwork
Modelling

Attitudes
Appreciating aesthetic qualities
Perseverence

Aim

- To represent your impressions of the Great Barrier Reef in an artistic way.

You will need

- Pencils, charcoal, crayons, paper
- Coloured or black paper
- Cellophane
- Glue
- Origami paper
- Cotton gauze
- Light card in several colours
- 3 kg plaster of Paris
- A basin
- A book on origami
- Roll of self-adhesive Contact
- Fabric paint in red/black
- Stanley knife or razor blade
- Permit (where appropriate)

What to do

Select from these suggestions to express your feelings:

(a) Using paint, charcoal, pencil or other medium, depict the same scene at sunrise, noon and sunset.

(b) Do reverse pictures (black/white) of trees, shells, coral, etc.

(c) Select a small portion of a large object or scene and draw the detail in a "blow-up", using black or colour.

(d) Try drawing an enlargement of a grass seed, the stamen of a flower, the opening of a shell, the junction of a twig with a branch.

(e) Using coloured or black paper, create a mosaic or picture or silhouette on white paper to show some aspect of the reef.

(f) Using scraps of coloured paper and a large sheet of butcher's paper, make a collage inspired by a reef cross-section or a reef food web.

(g) Make origami (paper folding) fish and suspend on a mobile.

(h) Make a fish mobile, using fish shapes cut from paper or card, suspended by cotton or fishing line, to be hung in the classroom. These can also be made from coloured cellophane or coloured tissue paper, with fine wire supports (florist's wire) to permit light to show through shapes.

(i) Make 3D replicas of fish, shells, sea stars or any other suitable living or dead reef organism using plaster of Paris, plasticine or clay (permit needed). If you use plaster of Paris, you need about 1 kg of plaster in a basin with fresh water to mix to a paste. Press the animal briefly into damp sand to form a mould. Return it to its original site. Then pour freshly mixed plaster into the mould, and wait till it is set. Dispose of waste plaster carefully.

(j) Design a logo suitable for using on the proposed field trip to the reef. It should be suitable for black and white reproduction.

(k) Design a poster showing dangerous marine organisms of the Capricornia group area. (This should preferably be in colour and have some type of scale.) This could be prepared beforehand and displayed on the field trip.

(l) Do spray painting of leaf shapes using a piece of gauze wire, toothbrush and water/plastic paint (can be used for species identification).

(m) Make a "bark" painting on a card (postcard size).

(n) Make a design on a T-shirt by making a stencil from a piece of self-adhesive Contact and painting fabric paint over it with a brush. The design could be a reef shape or symbol. Cut the design as an aperture in the plastic with a razor blade or Stanley knife. Place a wad of newspaper inside the T-shirt. Strip the backing paper off the plastic, press the plastic on to the T-shirt and then paint on the colour. Leave the shirt to dry. Iron the shirt before washing to set the paint.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Developed
by Bob Moffatt
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