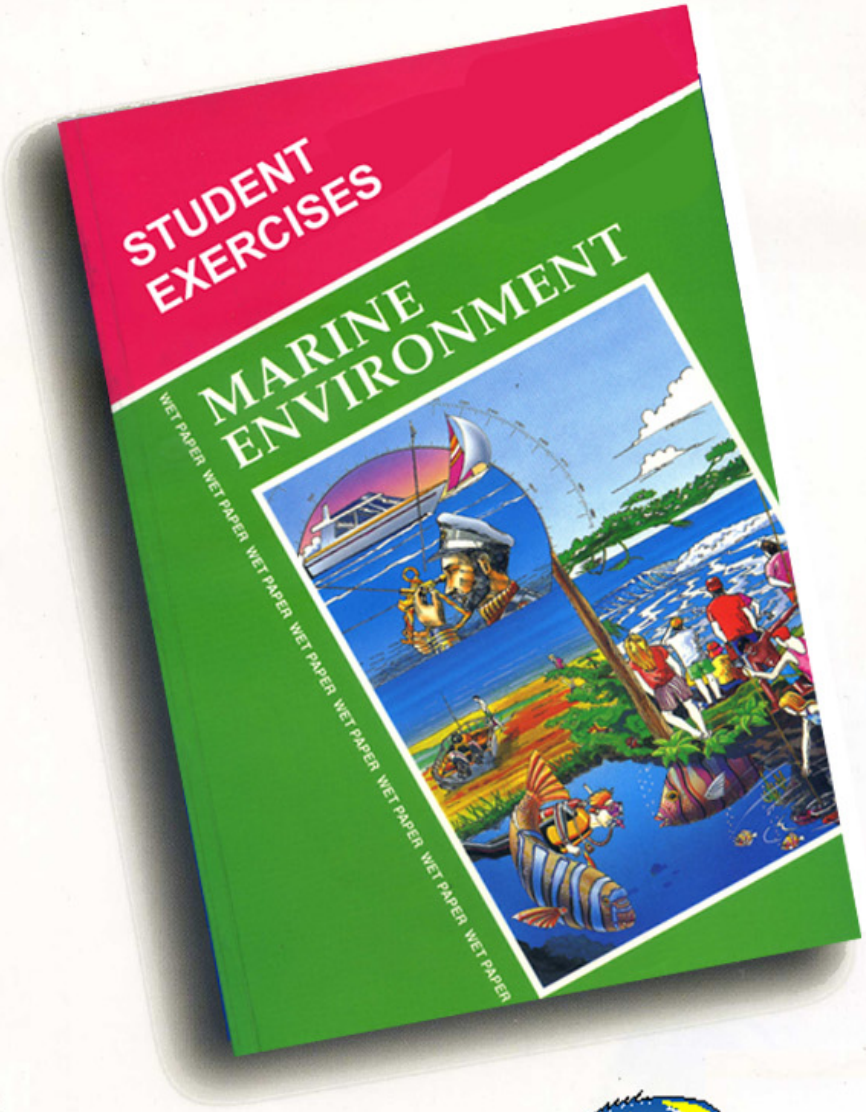
Marine Environment

Suggested answers



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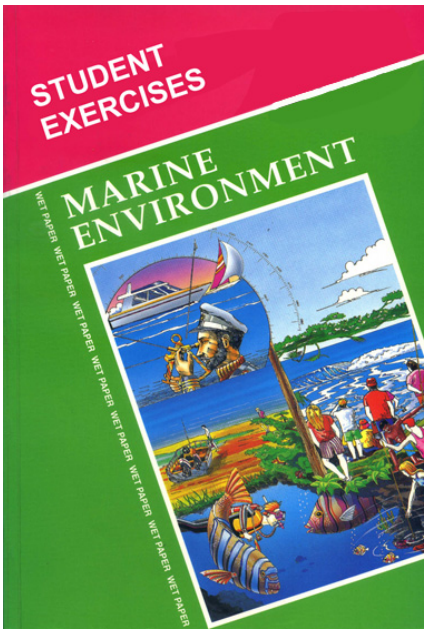
Suggested answers to Marine Environment manual



by

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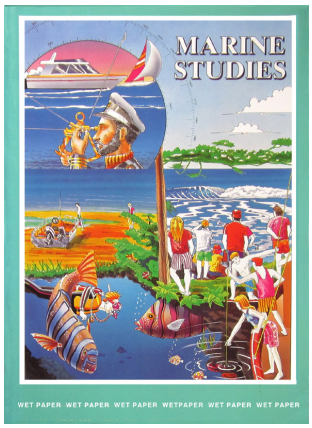
Companion to the textbook

Marine Studies for Senior Students



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Section 1 Non – living aspects of the sea

Exercise 1 Sea water salts

1. The water starts to evaporate from the bottom of the flask and the temperatures rises. You can see steam on top of the water.
2. Pure water comes off the top and salt water is left behind.
3. When you get to the end of the process the salt starts to spit up and crackle.
4. Up to students.
5. Solute –the material that dissolved in the water e.g. the salt
   Solvent –the liquid the solute dissolves in e.g. the water
   Solution –the solute plus the solvent

Exercise 2 Salinity

1. Students should see that the potassium di-chromate turns red as end point approaches.
2. The graph should be like the one shown in Figure 2.3

Notes:

a. You must be consistent in the use of the same size eye-dropper.
b. A good quality salinity meter can be used to check students results and help them draw the graph properly.

Exercise 3 Sea water density

Part A

The pencil in salt water should float higher.

Part B

1. Students plot graph to get results. The graph should change with salinity.
2. Students own results.
3. Salt water is more dense.
4. Fresh water would be found on the top.
5. A line of water where salinity changes quickly.

Exercise 4 Waves

Part A

1. The velocity
2. The wavelength
3. The frequency
4. a. frequency
   b. wavelength
   c. velocity

Part B

5. They slow down.
6. The sand in the bottom of the tray.
7. Refraction is the bending of waves as they pass into shallow water
8. Orbit fields are energy fields under the wave.
9. A perfect break is when the shoulder of the wave breaks evenly as the wave passes into shallow water in the form of a tube or barrel. This allows the surfer to ride the wave endlessly in the barrel.
10. A groyne: Boulders placed by humans that jut out to sea to capture sand and form a beach. Found to be ineffective process as only causes erosion on other side of rock wall.
11. Students copy Figure 4.5

Exercise 5 Longshore drift

1. The longshore drift
2. Yes
3. Students locate Page 331 and draw Figure 40.
4. Swim with the rip to the next sandbank and catch a wave in.
5. Locate Page 332 and draw Figure 43.

Exercise 6 Longshore drift field work

1. The longshore drift should flow in the direction that the waves are breaking (that is if there are waves and if the waves are approaching the beach at an angle – which is how a longshore current begins).
2. Students own calculation. Speed = distance ÷ time.
3. Students own observation. Usually water moves the quickest in the middle of the wave zone.
4. Students use map to work out distance and calculate time from above formula.
5. Dye

Exercise 7 Forces that cause ocean water to move

1. 1 – Wind
   2 – High pressure
   3 – Warm air
   4 – Low pressure
   5 – Orbit fields
   6 – Developing swell
   7 – Hot air rises
   8 – Fully developed swell
   9 – Cool air falls
   10 – Rising sea
   11 – Cold Air
   12 – Ripples
   13 – Crest, ripples, wind makes ripples
   14 – North east trades
   15 – Low pressure system (arrow omitted)
   16 – Fetch
2. A rising sea is where the wind is still blowing.
3. For Sydney - distance form NZ to Sydney (2 000 km) Brisbane - NZ to Brisbane (2 500 km) Perth (1500 km)

Exercise 8 Ocean Currents

1. Students mark in answers on map.
2. Two currents join to flow in the same direction.
3. Wind – causes surface waters to move, upwellings and convergences – where water rises and falls under each other, pressure systems – rising air can cause different sea level heights, tides a – the movement of water in and around large land masses.
4. Drift bottles, drift cards, current markers, biplane drogues. Students use Figures 62 and 63.

Exercise 9 Currents around Australia and NZ

1. Students mark in places on map.
2. 1 – Flinders current
   2 – East Australian
   3 – South equatorial
   4 – South equatorial
   5 – Leeuwin
   6 – Western Australian
3. A – West wind drift
   B – Eddies form
4. Students use web sites - basically the height difference between the Coral sea and the Tasman sea causes the eddies to be pinched off. The cooling of the Tasman sea is influences the direction of the Antarctic current.
   The EAC is the East Australian current.

Exercise 10 Local currents

Students make and test the drogue shown in Figure 10.1.

Exercise 11 Ocean shapes

1. a. is the continental margin, b is the continental shelf, c is the continental slope, and d is the continental rise.
   b. Scales are already in.
2. Students use Figure 10 Page 287 to mark in features.
3. a. Students use colouring in pencils to show the difference.
   b. A –□Abyssal plain
      B –□Queensland Plateau
      C – Scott Plateau
      D –□Exmouth plateau
      E –□Naturaliste plateau
      F – Ceduna Plateau
      G – Continental slope
      H – East Tasman plateau
   c. Northern
   d. Eastern Australia - drops to abyssal plain –□site of last major subduction zone (island arc)
   e. 4 (Qld, NSW, SA, WA)
4. a. A (1 atmos), B (62.5 atmospheres), C (300 Atmospheres), D and E 1070 atmospheres (mistake in text)

b. E is the Trieste a deep sea diving vessel

c. 10 9375 m

d. At point C

5. Students use box to find answers

Exercise 12 Hypothetical bay

Note: The book incorrectly refers to Exercise 26 as part of the Marine Environment Manual. The correct Exercise 26 can be found in the Mariners Skills Manual and since students can make copies for private study, they can make a copy from this book to complete this exercise. Hypothetical Bay can also be found in the Wet Paper Workbook – Classroom Navigation

1. Students use Exercise 26 to match names.
2. a. Maloney Beach (because its protected by a headland and the wind will be offshore)
   b. Jensen or Heyer Rivers
   c. Go to Watson Swamp and then climb Critchley Peak on Wiley Island
   d. Try Perry Shoals, MacLean or Rogers Reef
   e. O'Connor Reef
   f. Cape Jordan National Park, Kaigan Point

Exercise 13 Hypothetical reef

Note: In the first edition the North was pointing incorrectly to the top of the page. In the second Edition the North is pointing to the outside side of the page (to the right).

1. The windward side of the reef is the one facing East – the reef slope is step, there are no bommies, or caverns that protrude form the reef crest.
2. The Leeward side faces north - its on the protected side so the corals can grow into bigger plates and bommies can form because of the more sheltered conditions and reduced wave action.
3. The prevailing winds come from the south east. That means the reef starts to erode at the southern end and sand is transported along either side of the reef crest by wave action in the longshore drift.. If you have a copy of the Wet Paper book the Barrier Reef World, Figure 6.3 on Page 73 tells you how a coral cay forms. (Page 517 of your textbook also tells you). What happens is the sand gets pushed around the reef and when it gets to the end, the waves from both directions meet, stop and droop the sand they have been carrying – the end result is the sand spit.
4. 2 m
5. No you would not get over the reef crest
6. High tides - any time between two hours before and after high tide

Exercise 14 Beach formation and erosion processes

1. A wave bore is the part of the wave that carries sand up the beach. Students draw Figure 45 of their textbook. (See definition also in Box on Page 334 of their textbook)
2. A microridge is the line of sand that forms on the beach when the wave bore stops. (see definition also in Box on Page 334 of their textbook)
3. Swash zone is the maximum distance the wave bore travels up the beach. It can be identified as the wet bit.
4. Students draw figure 48 on Page 335.
5. They catch the sand as it blows in the wind from the beach. Without the trees the sand would blow away.
6. A beach that is in building mode. Strong winds onshore little swell, dry conditions.
7. They erode it.
8. The sand moves offshore to a storm bar and an erosion scarp forms on the beach.
9. Box on Page 337.
10. Students summarise the boxed section on Page 337. Concluding sentence – once the storm passes and small waves return to the beach, the orbit fields can interact with the offshore storm bar to gradually move sand through the gutter and then up ono the beach in the wave bores.

Exercise 15 Orbit fields

1 Yes
2. Increased frequency – decreased wavelength
3. Better to forget celerity and concentrate on basic formula velocity = wavelength x frequency and study the relationship between the two.
4. The sand should move towards the beach if left for a long time. Make sure the depth of water is not too great over the storm bar. Suggest 20 - 30 mm is max water depth.
5. It is difficult from this wave tank because you have to consider amplitude – see your Physics Teacher.
6. Coastal engineers – calculate/simulate movements of sand over time.

Exercise 16 Sand per cent composition

Note: In the First edition - the sieves were the wrong way around. The sieve with the biggest pore size should be on top to allow the smaller sand grains to fall through.

1. The sieve should separate out different sizes of grain – So there should be different grain sizes in each of the sieves.
2. Because they are light and blow up there.
3. Dune vegetation –□coastal spinnifex and sand dune trees (she oaks, banksias, coastal heath).
4. To catch the small sand grains
5. Because they are heavier and don't get carried up in the wave bore.
6. A oven is a good way to dry sand, but don't bake it. Sand grains from different beaches should have different sand percent compositions. There may be a relationship between wave energy and sand gain size.
7. a. Steep beaches usually have a high wave energy and higher grain size than flatter beaches – mangrove swamps.
   b. Mangroves
   c. High wave energy beaches
   d. Maloney Bay, Steggles beach Jensen Beach, Thelmas Point beach, Townsend Bay

Exercise 17 Beach profiles

1. If there is a beach erosion scarp, erosion would have occurred (The beach profile will show this if there is a sudden drop in beach height).
2. As the tide comes in and goes out the swash zone will change – depends on the slope of the beach.
3. Winter storms should erode the beach and summer winds with gentle seas should build up the beach
4. Profile angles can be done with an inclinometer on the beach or by measuring to with a protractor on the graph of your beach profile.

Exercise 18 The active beach system

Note: P –□Paragraph, L – Line

Level 1

1. True P1, L1
2. False P1, L2
3. True P3, L1
4. False P5, L4
5. True P8, L4
6. True P10, L2

Level 2

1. True P3, L 3
2. True P3, L4
3. True P9, L2

Level 3

1. True – Only by public education will people learn to keep off the dunes.
2. False –□If development occurs on the dunes, they will fall into the sea during storms or cost ratepayers heaps of money to put in expensive boulder walls as they had to do on the Gold Coast.

Exercise 19 Beach erosion mind mapping

1. a. Lifestyle
   b. Tourism
   c. Climate
2. Conservation and management
3. Storm bar >>>>> reduces wave energy
4. Sand moves onto the beach, caused by smaller waves
5. • Interfered with longshore drift
   • Trapping 14 million cubic metres of sand behind the Tweed River Walls
   • Starvation of offshore shoals in Southern Beaches
   • Then in 1967 a series of 9 cyclones
   • Caused huge beach erosion
5. The deflt report made three recommendations:
   a. Build groynes to follow contours of coastline
   b. Beach nourishment
   c. Offshore sand replacement

   Funding from 25% GCCC and 75% State Government 0% Federal Gov
6. Another cyclone causes the Kirra Camp ground to be washed into the sea

   Lead to the building of groynes

   1974 cyclone lead to boulder wall at Kirra

   To prevent further erosion of the Gold Coast Highway
7. a. Government gave more money
   b. Management plan
8. a. Dune nourishment and fencing
   b. Training walls to protect South Stradbroke Is
   c. Sand by pass system to keep the northerly sand longshore drift flowing
   d. Dredging to replace the offshore storm bars and restore the beach
   e. Board-walks to be removed if need be but to control traffic along foreshore
   f. Boulder walls to protect property

      Paid for by residents ($20,000 each)
   g. Fill the hole in the sand reserve to stop the hole moving north

Exercise 20 DDT in the food chain

1. This refers to the fact that DDT accumulates in the food chain from one trophic level to the next.
2. It only takes for a very small percent (e.g.. 1 percent) in a population develop resistant genes to the spray. This 1 per cent reproduces to give say a 5 per cent resistance and before you know it, a significant percentage of the population has resistant genes.
3. DDT killed mosquitos which were the carriers of the malaria. Wipe out the mosquitos and you wipe out the malaria. The mosquito has a saliva gland which contains the infectious disease. Its the saliva gland which stops the blood from clotting when the parasite feeds off your skin and this is the place where the transfer takes place.
4. The testing of chemical effects on humans has to be over the long term. Some chemical take a long time to show their effects. Eg. The side effects of the contraceptive pill took a long time to become known.
5. About 20 times
6. We could try biological control where we find a natural predator. Attitudes also play a role - by reducing the sex or food supply or breeding grounds, you can reduce population sizes. Eg. Sterilize males, get rid of places where water accumulates – eg old car types, buckets or pot plants. Pour oil on water (in some places)
7. In water ways and has been blamed for the deaths of fish
8. You need exhaustive scientific testing and computer modelling.
9. It was quick and almost 100% effective. 2–4–D.
10. The developers or it – law suits –□can you sue a Nobel prize winner?
11. 25 x 1 400 000 = 35 000 000 t

Exercise 21 Management of longshore drift

Note: P –□Paragraph, L – Line

Level 1

1. True P1, L3
2. False P2, L2 (had never)
3. False P2, L6 (it was the State Gov)
4. True P2, L9
5. True P3, L4
6. True Its the text in Figure 21.1
7. True P3, L6

Level 2

1. True –□ No loss of life has been recorded since the building of the seaway. There is a deep water channel for boats to go in and out. When cyclones occur, the coastguard blocks the seaway with a ship preventing any vessels going out to sea.
2. False - The whole idea of the system is to trap sand so it can be collected and pumped under the sea way
3. True - People who fish off the jetty cause fouling of pumps from rubbish and fishing lines, more people use the area leading to greater pollution.
4. False - Their is little life in the sand zone.

   True - Certainly some life would be effected - pippies, sandworms - but it is hoped this is minimal

Level 3

1. True - the wishes of the boating public, the need to protect the foreshores inside the Broadwater and the need to protect South Stradbroke Island out weigh the negative effects of an eyesore, interfering with the animals and plants in the surf zone, increasing rubbish on the foreshore. Ecological sustainable development must have management plans for the area and the spit at present does not have one.
2. True - conservation groups are usually the only ones who think about the animals an plants by them selves. They also make people think, make politicians accountable for their actions and avoid the she'll be right approach.

Exercise 22 St. Vincent Gulf

1. Cadmium, copper, lead, zinc, sewage, litter, detergents, oil
2. Diffuse inputs (i.e. non-point source), variable wind and current conditions. However you could speed this up by analysing marine organisms. By using marine organisms.
3. Fish, molluscs and plants
4. Cadmium, copper, lead, zinc
5. National Health and Medical Research Council
6. Gills - this is the place for oxygen-water exchange.
7. a. 7.5 mg/Kg
   b. 5 000 mg/Kg
   c. 350 mg/Kg
8. Yes - E.g. Molluscs cadmium in muscles
9. 1.53 – 3.9
10. 360 – 600
11. More cadmium, more copper, less zinc in fish at Cockburn Sound compared with St Vincent Gulf
    In general, Cockburn Sound is more polluted.
12. Yes due to bioaccumulation effects. No – cadmium decreased, copper decreased, lead decreased, zinc however increased. Possible behaviour of trace elements and requirements for muscle metabolism.

Exercise 23 Practice essay on beach erosion

Students write essay and are marked according to teachers criteria sheets.

Exercise 24 Methods used to combat oil pollution

See answers that accompany video.

Exercise 25 Marine oil pollution

See answers that accompany brochure.

Exercise 26 Effect of oil on feathers

1. It causes the primary feathers to stick to the barbs.
2. Students copy Figure 26.2.
3. It can kill them.
4. So they don't harm the birds.
5. Yes
6. Students have to research this. Many places such as animal welfare leagues (e.g. RSPCA), receive some government funding to help look after animals. In some states National Parks and Wildlife Officers are paid to help clean birds.
7. Varies from AUS and NZ. Australian Marine Safety Authority co-ordinates oil spills. NZ equivalent unknown.

Exercise 27 Oil spill in Hypothetical Bay

1. Rate of oil loss = 1 tonne per minute
   = 60 tonne per hour

   If time = 10 hours
   Oil lost = 600 tonne

   Area of 1 tonne = πr^2 = 3.14×250^2
   = 196 250 m^2
   = 443 m x 443 m

   ### Notes

   Total area covered after 10 hours after 10 hours
   = 117 749 400m^2
   = 10.8 km^2
2. The slick will be 60% of expected size
   = 70 650 000m^2
   = 8.4 km^2
3. No
4. Volatile liquids such as petrol and light oils evaporate very quickly and hydrocarbon is a gas which is very explosive and easy to ignite.
5. The burning of the oil is ineffective since it is not that volatile and does not completely evaporate) and the oil slick is so thin (0.5mm).
6. a. Break up slicks with detergents
   b. Soak up the oil from the surface
   c. Stop the loss of oil from the ship.
7. a. The oil slick will move in a west north westerly direction. A current in the area will move the slick to the north west. The winds will move the slick to the west. Approximate over movement is west north west.
   b. The area expected to be most effected would be the coast north of Lewisville airport, including Pitman Point, Heyer River, Langley Reef and the south eastern port of Wiley Island.

   The booms should be placed North West of the site where the collision occurred.
8. Dispersal of the slick does not solve the problem it is just transferring the problem elsewhere.
   - Some people believe that if we see no evil there is no evil.
   - The problem disappears with spraying.
   - The dispersant may harm the environment even more than the oil itself. Most organisms have natural oils which can be affected by the dispersants.
9. Some marine organisms are bioaccumulators e.g. oysters, mussels.
   - Also organisms high on the food chain may be affected by the accumulation of the toxin.
10. - Some animals migrate and may not be in the area.
    - The effect may be greater if it is in the animals breeding season. Juveniles are more likely to be affected than adults.
11. Large seas make containment harder. Heavy seas increase dispersal.
12. Light oils are more volatile and dispersed readily by winds. It is also less viscous and will spread more easily.
13. • Ocean currents
    • Tidal flows
    • River flows

• Local weather conditions

14. a. Feathers become coated - loss of warm air under the feathers - bird suffers hypothermia
    b. If young are still in nest and relying on adult for food and protection they will die
15. Mud - hard for tractors and vehicles to move in this terrain - get bogged
    Rock - hard to remove oil from rock crevices and scrape off oil. Not a flat surface
    Sand - vegetation that is stabilizing beach is also removed
16. • poor access to the beach
    • isolated area
    • lack of skilled personnel in the area
17. a. No
    b. Mangrove roots will be covered by oil and the roots sill suffocate
    c. There are points for and against spraying
18. Some bacteria can digest and break down oil.
19. The government is responsible for the cleanup. The company should contribute to the funding.

Exercise 28 Point break

1. Water usually travels the fastest around rocks and the exposed part of the headland. Mark this on your mud map.
   Evidence comes from observing the water and the speed it is flowing. You could check this by throwing in a stick.
   Surfers usually paddle around the wave breaking zone and then out the back to the take off zone.
2. The sea bed takes the energy out of the wave.
3. It could –☐as the tide goes out the waves could get hollower and as the tide comes in the waves could get fuller –☐depends on the beach
4. See answer from local life guard.
5. Students make note of places where sandbanks are.
6. Common materials are rocks, water, air, sand, plants, animals, soil. Some have concrete, glass, steel, iron fabrics.
7. Students take times. Common periods of waves are 15 seconds but can vary greatly. Common distances are 20 - 30 metres. Speed = Distance ÷ time
8. Usually one or two, but can vary depending on sea conditions.
9. They are too crowded, too steep to take off on, too big, are about to dump and drill you into the sea bed.
10. Reflection usually occurs where waves strike the rocks at 90 degrees. Refraction occurs where waves strike a point at an angle.
11. Students make records.
12. Colour varies as the clouds pass by and as the sun moves from one point in the sky to another. Also on the amount of sediment in the water as well as after rain.

Exercise 29 Making a beach walkway

Students can apply to Coast Care in Australia to for a grant to build a walkway. Other places you could get grants from are:

- Local councils
- Beach protection authority
- Local industry with sponsorship

Exercise 30 Seawater test

Students complete test –☐see answers in book Page 66

Exercise 31 Beaches test

Students complete test –☐see answers in book Page 68

Section 2 Living components of the sea

Exercise 32 Key Terms

1. Nekton - refers to the body of water from the bottom to the top , includes animals that swim freely in this area, e.g. sharks, bony fish, turtles dolphins whales, squid. These are nektonic animals:

   Benthos - refers to the bottom of the ocean and anything living in or on the bottom is benthic; including scallops, worms, crabs corals.

   Pelagic - refers to those animals of the nekton which live mostly in the middle and upper layers.

   Food chain - a linear representation of who eats who where arrows indicate the direction of biomass flow.

   Feed web (food web - results from putting all the food chains of an area together.

   Photic zone - is the zone where penetration of sunlight is sufficient to allow phytoplankton to carry out photosynthesis i.e. phytoplankton can only live in this zone.

   Bioaccumulation - is when toxins and poisons are passed from one organism to another along the food chain, larger amounts are found to accumulate in the flesh of secondary and tertiary consumers e.g. ciguatera in mackerel, barracuda, groupers.

   Producers - or autotrophs, are organisms that make their own food using sunlight e.g. plants.

   Consumers - or heterotrophs are organisms that feed on producers or other consumers, they cannot make their own food e.g. shark, mackerel.

   Decomposers - are organisms which breakdown dead plants and animals and waste products into chemical compounds that can be used by other living organisms.

2. A plankton net is a net used to catch plankton. It is made of a very fine mesh net which is held open at one end by a metal ring (bridle) and at the other end is a container that collects the plankton. The size of the mesh determines the type of plankton caught. The net is towed behind a boat, the plankton are trapped in the container, this unscrews for easy collection.

3. Ultraplankton - plankton that are smaller than 5 μ

   Nannoplankton - plankton sized between 5 - 60 μ

   Microplankton - plankton sized between 60 - 1000 μ

   Mesoplankton - plankton sized between 1 - 5 mm

   Macroplankton - plankton above 5 mm

   Megaplankton - larger forms of plankton

4. a. 0.5 m = 500 000 m
   b. 0.005 m = 5 000 m
   c. 1.0 m = 1 000 000 m
   d. 0.0002 m = 200 m
   e. 10.0 m = 10 000 000 m

Exercise 33 Plankton of your local area

Students observe local plankton and make notes.

Exercise 34 Plankton three level guide

Note: P –□Paragraph, L– Line, t –□Top

Level 1 literal

1. t page 399 p3 l1,2
2. f page 402 p5 I 1,2
3. t page 401 box l 9
4. f page 401 p1 l1
5. t page 400 p6 l4,5
6. t page 403 p4 l2,3,4
7. t page 403 p2 l5,6
8. See diagrams over

Level 2 interpretive

1. t page 400 p6 l3,4,5
2. t page 402 p6 l4,5
3. f page 401 p2 l2,3
4. f page 403 p3 l2,3

Level 3 applied

1. t page 402 p3,4
   - the zone where all producers live (forms the base of the food chain), energy from this zone passed up to other members of the food chain.
   - diatoms in the zone can trap nitrogen from the air and also recycle it, all organism need nitrogen to develop and maintain themselves.
2. t page 402 p2
   - form diatomaceous earth, used commercially in toothpastes, paint, polish kitchen cleaners, lubricant, in filters; also deposits of oil result from diatoms.
3. f page 403 p4, box; page 404 p1,2
   - although dinoflagellates can cause ciguatera poisoning in humans, it is rarely fatal and can be treated with drugs (mannitol); poisoning can be avoided by not eating known ciguatera carrying fish or certain parts of these fish.

Answers to question 8 page 79

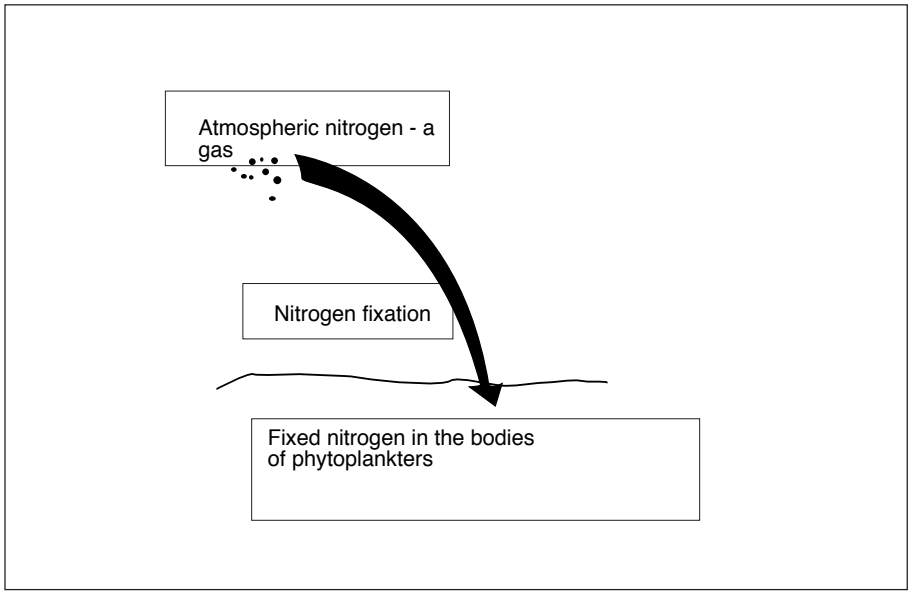


Figure 34.1 **Nitrogen fixation**

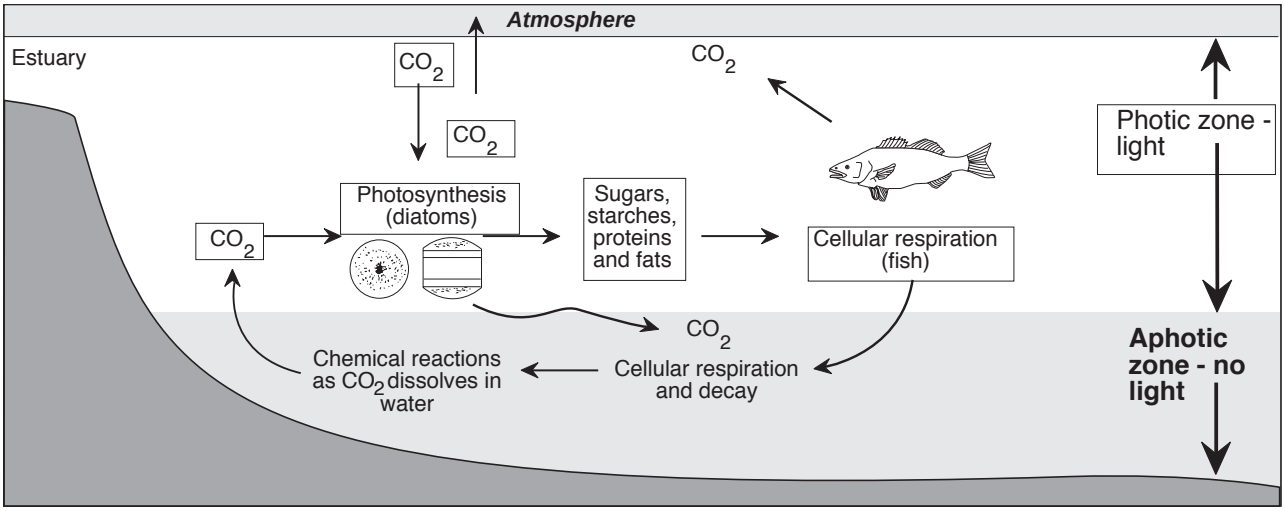


Figure 34.2 **Photosynthesis and the photic zone**

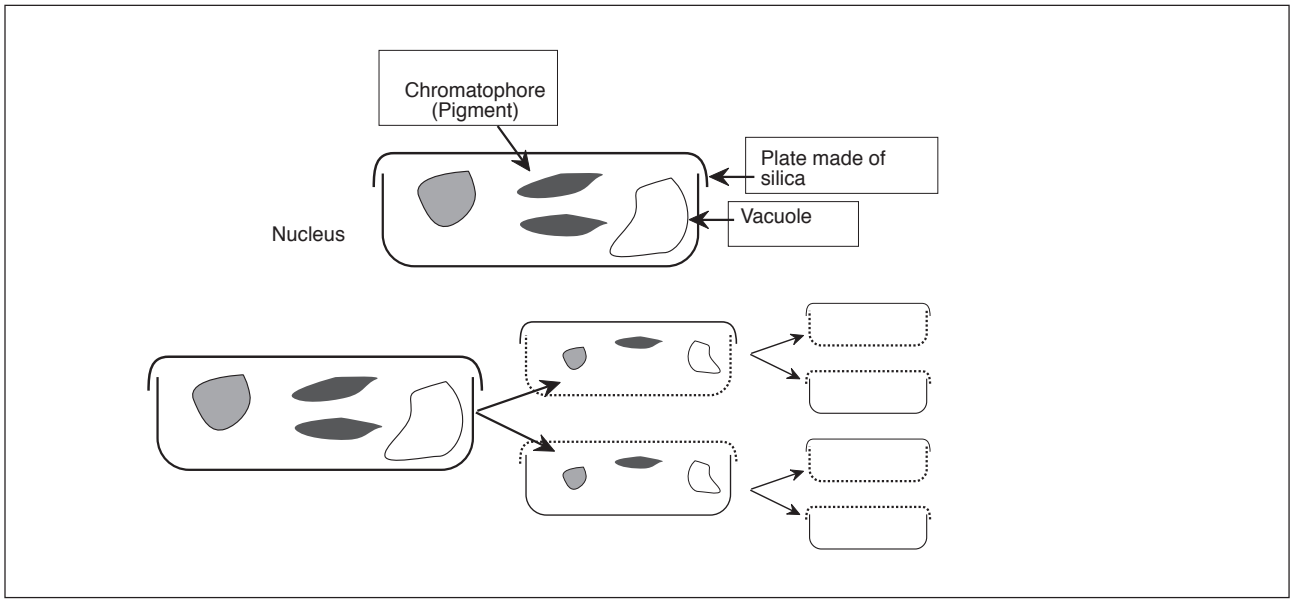


Figure 34.3 **Diatom reproduction**

Exercise 35 Life cycles

1. a. not shown (page 406 of text)
   b. 9
. c. 8
   d. 1
   e. 4
   f. 10
   g. 5
   h. 6
   i. 7
   j. 2
   number 3 not identified is the trochophore larva of an annelid
4. 5 stages (4 larval stages and the adult)

Exercise 36 Associations

1. See figure over
2. Example of (Mutualism) inquilism (incorrect spelling) - clown fish\ sea anemone, the clown is protected by the anemone; a fish living around the tentacles of jelly-fish for protection.
3. Remora and shark; crab and sponge.
4. A goby and shrimp, the goby benefits from living in the burrow built by the shrimp.
5. Parasitism, it is where the flatworm feeds on the fish.
6. The flatworm is a parasite on the fish and feeds directly on it, the cleaner fish feeds on the parasite.

Associations and interactions			
Organisms	**Name given to association**	**Detrimental or beneficial**	**Summary of association**
Tapeworm and barramundi	Parasitism	Detrimental to barramundi host	Tapeworm feeds on contents of the barramundi's gut
Gobi and shrimp	Commensalism	Beneficial for Gobi	The Gobi lives in a burrow dug by the shrimp
Clownfish and Anemone	Mutualism	Beneficial	The anemone provides protection from predators for the Clownfish. The Clownfish acts as a lure to the prey of the Anemone
Remora and Shark	Commensalism	Beneficial for Remora	The Remora gets free transport and small food particles from the shark
Whiting and Bream	Predator Prey	Beneficial for Bream	Bream preys on Whiting
Mackeral and Garfish	Predator Prey	Beneficial for Mackeral	Mackeral feeds on Garfish
Parrot fish and Coral	Predator Prey	Beneficial for Parrot fish	Parrot fish feed on coral
Wrasse and Cod	Mutualism	Beneficial	The Wrasse removes external parasites from the Cod (food) and the Cod benefits from the removal of parasites
Clam and Algae (Zooxanthellae)	Mutualism	Beneficial	Zooxanthellae receive protection and nutrients from the clam. The clam gets food made by Zooxanthellae
Barnacle and Copepod	Predator Prey	Beneficial for Barnacle	The Barnacle feeds on Copepods

Figure 36.4 Associations and interactions

Exercise 37 Sponges

1. Multi- cellular - an organism whose body is made up of more than one cell.
2. Ectoderm, the flattened out cell layer
3. They secrete a sticky substance to anchor the sponge.
4. Water enters the sponge through pores found all over the surface. Figure 37.2 is a pore cell.
5. Water filled chamber
6. Osculum
7. Bacteria, fragments of other animals, dinoflagellates, and plankton.
8. a. Collar cell
   b. These cells draw water into the chamber by the beating of their flagella and filter food particles from the water using their collars.
   c. a = flagella; b = collar; c = nucleus; d = food vacuole.
   d. Water is filtered through the collar where food particles are trapped, these are then transported to food vacuoles for digestion.
9. a. Amoeboid cells within the sponge form silica secreting cells, these cells make the spicules.
   b. They give strength to the structure.
   c. They can be used to distinguish between species.
10. Is a jelly-like substance which holds the different types of cells together.
11. a. a = cell wall; b = cytoplasm; c = nucleus.
    b. By surrounding its food and engulfing it = phagocytosis
    c. Develop cells which secrete the spicules.
12. See figure below.
13. Both on the reef and in deeper waters.
14. Release eggs and sperm into the water where fertilisation would take place.
15. Sponges are common and there are many different species, they are host to a variety of small animals, they compete for space with other sedentary organisms e. g. corals, by producing chemicals to keep larva from settling.

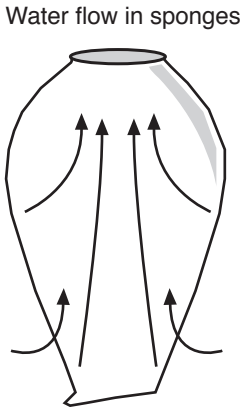


Figure 37.5

Exercise 38 Adaptations of plankton

1. See diagram opposite.
2. A float containing air to keep it afloat; a sail to move with the wind; long tentacles hanging beneath it to capture other planktonic animals.
3. Nematocysts - consist of an inverted barb attached by a thread and a trigger point. When the prey brushes against the tentacles the trigger is released firing the barb into the prey, toxin in the barb is injected into the victim, killing it.
4. The sail lead to its name. The sail and the float are adaptations to planktonic life.

Adaptations of plankton

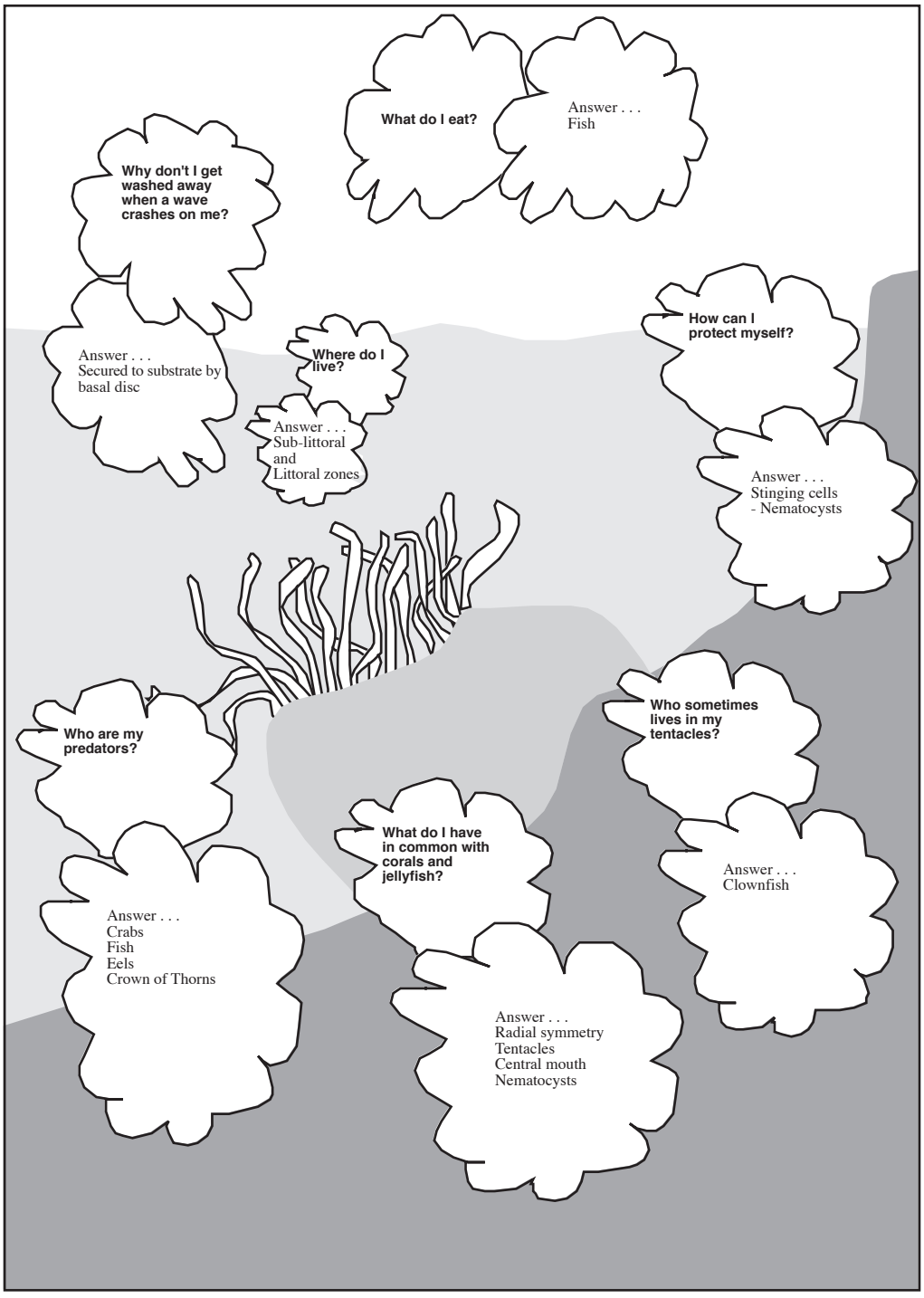
1 Sketch	2 Name	3 Permanent	4 Temporary	5 Phytoplankton	6 Zooplankton	7 Structure	8 Function / survival benefit
Figure 3 P 400	Biddulphia (diatom)	✓		✓		Projections from body	•Increase surface area to stay afloat •Less able to be ingested by predators
Figure 8 P 400	Ceratium (dinoflagellate)	✓		✓		Flagellum	•helps to keep afloat and mobile
Figure 15 P 405 Copepod	Copepod	✓			✓	Eye spot, no digestive system	•for orientation in the water column
Figure 15 P 405 Lucifer	Lucifer	✓			✓	Appendages	•for mobility to stay in place in the water column
Figure 15 P 405 Comb Jellyfish	Comb Jellyfish	✓			✓	Hair and shape	•to keep afloat
P 405	Medusa stage of Jellyfish	✓			✓	Statocysts and bell shape	•Statocysts for orientation in water column •Bell shape to stay afloat
Figure 6 P 401	chaetocerus sp	✓		✓		Air filled sac and chromatophore	•Air filled sac to stay afloat •Chromatophore contains chlorophyll for photosynthesis
P 408	Nauplius larvae		✓		✓	Appendages	•Appendages are external feeding cirri

Figure 38.4 **Adaptations of plankton**

Exercise 39 Anemones and corals

1. See answers below.
2. Radial symmetry. Common to echinoderms and coelenterates.
3. 1 = f; 2 = g; 3 = e; 4 = c; 5 = d; 6 = a; 7 = b; 8 = h.

   Coral reproduction - polyps contain both testes and ovaries (male and female gonads), in these sperm and eggs are produced. In late spring early summer the corals release egg, sperm bundles into the water during the evening high tide. The bundles break up in the water and fertilisation occurs, usually at the surface, forming a zygote. The zygote develops into a planula larva, which remains in the plankton for around 30 days, then the planula settles on the sea floor and grows into a juvenile polyp.



Exercise 40 Fish dissection

Students complete fish dissection as per instructions in manual

Exercise 41 Sharks and rays

1. Rays have their mouth and gills on the ventral surface, sharks have their gills on the side of their heads.
2. See answer below
3. See answer below
4. a = dorsal; b = ventral
5. Rays fed on the bottom; sharks have the nostrils at the fore most point to allow for smelling prey
6. Cartilage
7. Not a good question. Discuss respiration as process by which oxygen enters blood over gills.
8. Air bladders are sacs filled with are to keep fish buoyant. Sharks do not have these, they must swim continually to keep their position in the water column.
9. Sharks mate when the male wraps himself around the female, holding her in position with special claspers on the pelvic fin. Fertilisation is internal.
10. c = embryo; d = yolk sac
11. Sharks teeth are continually replace as they break or wear out. They are modified scales
12. Sharks find food by smell. They're nostrils (olfactory pit) contain many leaf-like folds called lamellae, which are able to detect sent in minute quantities, as the water flows over them. They able to sense body fluids of their prey diluted to one part per half million. As the shark approaches the prey its lateral line system takes over, this is a complex system of pressure sensitive cells which detect vibrations in the water (those made by struggling or injured fish). At around 15 m the shark can see its prey.

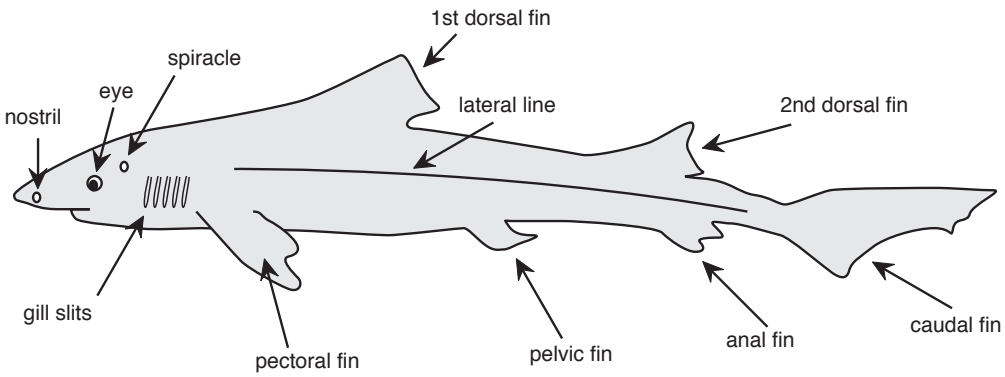


Figure 41.1 **Generalised shark**

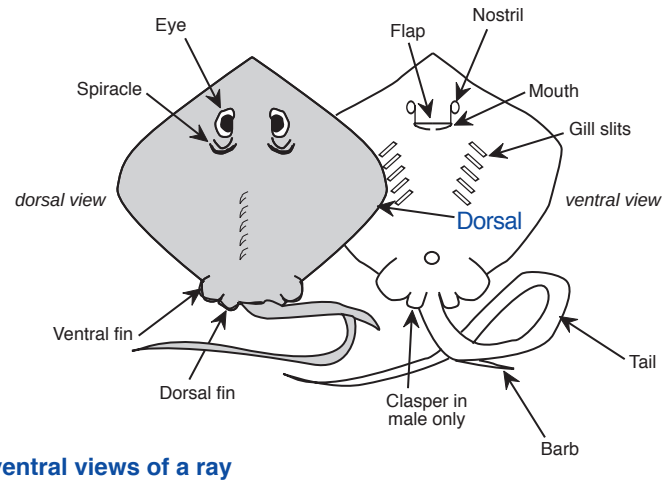


Figure 41.2 **Dorsal and ventral views of a ray**

Exercise 42 The importance of mangroves

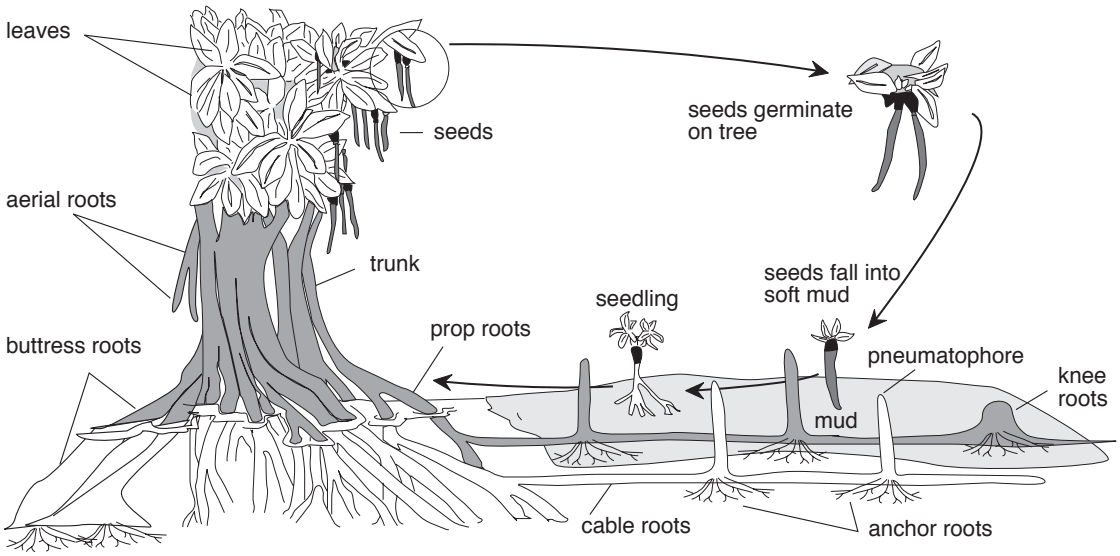
1. **The seed and leaf come from the yellow or spurred mangrove, Ceriops** sp
2. a - *Bruguiera* sp; b - *Avicennia* sp; c - *Avicennia* sp; d - *Rhizophora* sp; e - *Aegiceras* sp.
3. 1 = leaves; 2. = aerial roots; 3 = buttress root; 4. = trunk; 5 = seeds; 6 = pneumatophore.
   a - seeds germinate on tree; b - seeds fall into mud; c - seedling develops
4. See Figure below.

Research project

1. Cutting down the mangroves: primary effect - mangrove destruction; secondary effects - acid sulphate soils, loss of habitat for inhabiting species, fisheries affected; tertiary effects - reduced productivity and income, unemployment, loss of recreational value, pollution, further habitat loss.

   Excavating the land to establish the canals: primary effect - establishment of canals; secondary effect - increased breeding area for midges, disruption of tidal patterns, increased boat usage, siltation requiring further dredging; tertiary effects - human discomfort, increased use of organophosphate larvacides, tidal ranges affected in neighbouring areas, lowering of the water table, reduced water flow, flooding and erosion, pollution erosion of banks; quaternary effects - nearby agriculture affected.

   Dredging: primary effects - dredged waterways; secondary effects - disruption and or destruction of bottom dwellers, surrounding mangroves affected by increased siltation, increased turbidity; tertiary effects - further habitat loss, clogging of animal feeding apparatus, reduced light penetration affects photosynthesis; quaternary effects less food for plant eating fauna.



Exercise 43 Seagrasses

1. Seagrasses are angiosperms or flowing plants. They possess veins, roots stems, leaves seeds and flowers. They spread by producing rhizomes or runners form which new shoots develop.
2. Worms, long bill adapted to piercing the sea bed.
3. The leaves of seagrasses reduce current velocity and so increase the amount of sediment that settles out of the water column.
4. Parrot fish, turtles, sea urchins, dugongs.
5. Nitrates and phosphates in the water would result in algal blooms. The algae would strip the water of carbon dioxide needed for photosynthesis and oxygen needed for respiration. This would result in the seagrasses dying.

Exercise 44 Mangrove transect

1. Well developed roots because:
   a. the substrate is unstable, so the roots are needed for support and
   b. the mud contains little oxygen, so many roots are needed to acquire oxygen.
2. Adaptations to salty habitat:
   a. salt exclusion; mangrove roots can exclude salt ions while taking up other necessary ions.
   b. salt secretion; the leaves of some mangroves contain salt glands that function to secrete excess salt from the plant.
   c. salt accumulation; mangroves can deposit salt in old leaves, when these die the salt is lost.
   d. salt dilution; a few mangroves can store water (succulence). By doing so they dilute the internal concentration of salt.
3. Adaptations to reproduction in intertidal habitat:
   a. viviparity = germination of the seed while attached to the parent plant. This is advantageous as the root can quickly attach to the mud.
   b. buoyancy; all seeds are buoyant, so the seedling is correctly positioned for rooting, this also makes dispersal by water possible.
4. The importance of mangroves: they are the producers for an entire ecosystem. This ecosystem acts as a nursery for many species of fish and crustaceans, including many commercially important species eg. mud crabs, prawns and it is also an area where nutrient recycling occurs for other ecosystems.

Exercise 45 Mangrove life cycles

Students complete field report from suggestions in manual.

Exercise 46 How to build and use a plankton net

Students build net according to instructions in manual.

Exercise 47 Sampling methods

Students make equipment as outlined in manual and test it in the field.

Note that the transect square can be made from electricians condute tubing and that the turbidity tube is available from your state WaterWatch coordinator.

Exercise 48 Osmosis

1. The chemical test for starch is the change in colour of iodine from yellow to blue/black.
2. Black
3. The bag expands in both cases.
4. Water and simple substances such as iodine.
5. A membrane which allows certain substances to pass through it but not others.

Exercise 49 Environmental effects of freshwater

1. Water temperatures too low
2. Barramundi, because its growth rate is 45 cm/yr, which is greater than the other fish listed
3. Barramundi produce the most eggs, saratoga produce the least. The morality rate in most larval fish stages is high, so by producing a large number of eggs ensures the survival of the species.
4. These fish are not considered good eating, so their is no market for them and no money to be made by breeding them.
5. Pollution cause death in most aquatic animals. Pollutants include: decaying food material from over feeding; ammonia a waste produce excreted from the gills of fish; nitrates also waste produce of fish.
6. The resource is in short supply in the wild, the demand for the resource is high, the cost of the resource is high.
7. The nature of the animal and its needs will determine if the animal is suitable for aquaculture, and the type of system required to breed, keep, grow and market the animal. If these parameters are not known and understood the venture will probably result in failure.
8. Susceptibility to disease, tolerance to crowding, temperature and pH changes.
9. Hot water could help in incubation, promote algae growth.
10. a. fish larvae and algae
    b. the algae need light to grow
    c. nutrients for algal growth and oxygen
    d. rearing of larvae

Exercise 50 Rocky shore habitats

1. Sub-littoral zone; littoral zone; supra- littoral zone
2. Four tides are shown in figure 50.2, 2 high tides and 2 low tides.
3. Students redraw figure
4. The tide is higher on the side of the earth where the moon is, because the moon's gravitational force pulls more water toward it, creating a higher high tide than that which occurs on the opposite side of the earth.
5. Water would rise and fall on the diagram
6. Need to show a diagram with sun, earth and moon in line to create an spring tide and then sun, earth and moon at right angles to show a neap tide
7. Exposed beaches can have big waves - up to 4 metres. Sheltered beaches could have 1 - 2 metre seas - see local knowledge
8. Some could be:
   a. under boulders - wave action
   b. rocky pools - temperature - evaporation
   c. exposed rocks - waves, wind, heat, cold.

Exercise 51 Rocky shore life

1. a = mollusc (snail); b = coelenterate (anemone.; c = crustacean (crab).
2. a. Snail - mollusc; anemone - coelenterate
   b. See figure below
   c. The drawings where the animals are "out" are at high tide; where the snail is enclosed in its shell and the anemone has its tentacles withdrawn are at low tide.
   d. Problems the animals face at low tide include: dehydration due to exposure to sun and winds, increased levels of salinity if they are tidal pools, exposure to predators (birds), increased wave action as the tide moves in and out.
   e. The snail has an operculum which closes during low tide, and the anemone can retract its tentacles to minimise dehydration. Both can attach firmly to the substrate to prevent becoming dislodged during high energy waves. The snail is protected by its hard shell against attack by predators, the anemone is protected by its leathery basal disc, any others students may discover.
3. a. Crustaceans
   b. Tough carapace to prevent damage to internal organs by waves
   Dorso-ventrally flattened to squeeze between rocks
   Jointed legs to move rapidly over rocks
   Tough claws to crush prey
   Eyes and mouthparts at anterior to grab and eat whatever passes
   c. In rock crevices, sand, rock pools
   d. Tough carapace, dorso-ventrally flattened, jointed legs, tough claws, eyes and mouthparts at anterior.

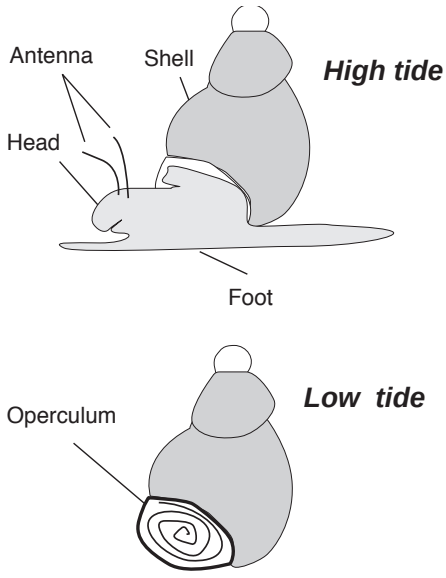


Figure 51.2

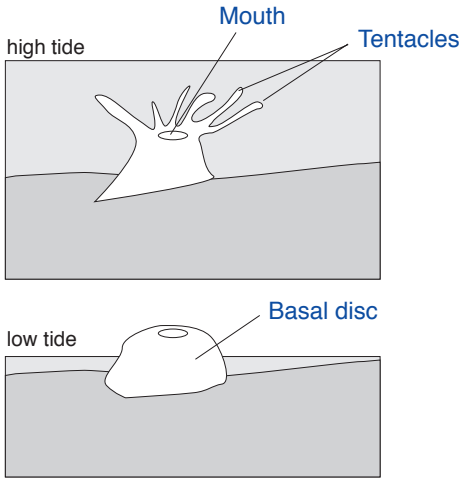


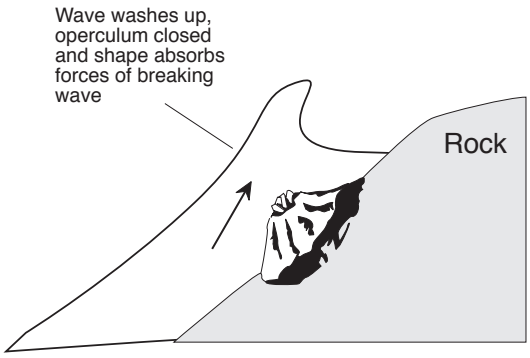
Figure 51.3

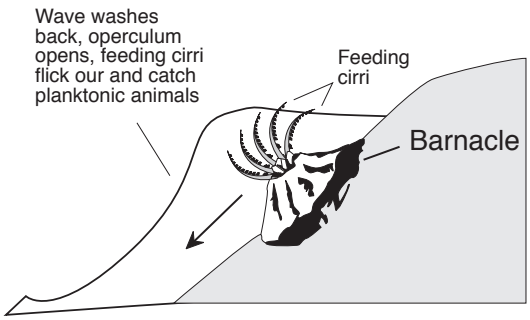
Exercise 52 Looking at marine life

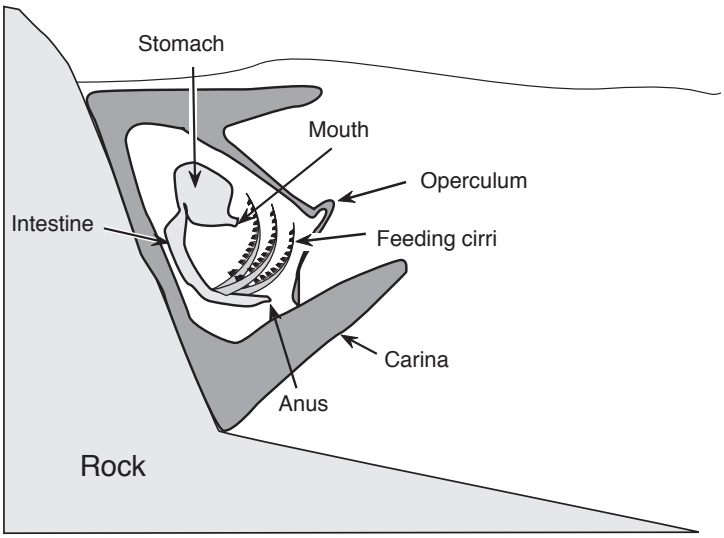
1. Ensuring the water is suitable for the animal and plant life it is to contain.
2. Make sure you don't stress them out.
3. Crabs - they eat everything.
4. Snails eat the algae that grows on rocks and the glass of the aquarium.
5. Undergravel filtration - to remove nitrates and phosphates.

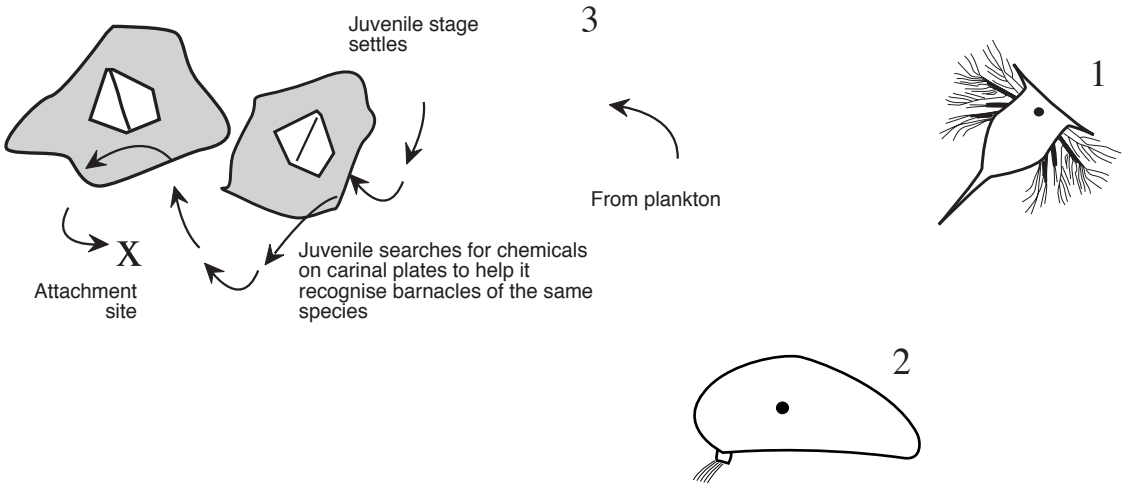
Exercise 53 Barnacles

1. a = stomach; b = mouth; c = operculum; d = carina; e = anus; f = intestine
2. Barnacle feeding: as the wave washes up the beach, the operculum closes, protecting the cirri. As the wave washes back the operculum opens and the cirri extend to catch plankton.
3. See diagrams next page
4. Barnacle life cycle: eggs are released and become planktonic, they develop into a nauplius with external feeding cirri to catch phytoplankton. These then develop into cipris larvae which use chemical sensors to find the shore. Before settling it changes into a juvenile which crawls on the rocks. It can detect the protenaceous material in adult carinas and uses this ability to settle close to other adults to ensure reproductive capability.
5. Adaptations to life in the sub-littoral zone: conical shape - to disperse forces of the waves; cement themselves to the substrate so that they are not washed away; reproduce on high tides to ensure eggs are washed out to sea; are capable of self fertilisation; operculum that closes when waves wash up the beach to prevent damage to the barnacle, the operculum also closes during low tide so that the animal does not dehydrate.
6. The conical shape helps disperse the force of the waves as they crash onto the shore.



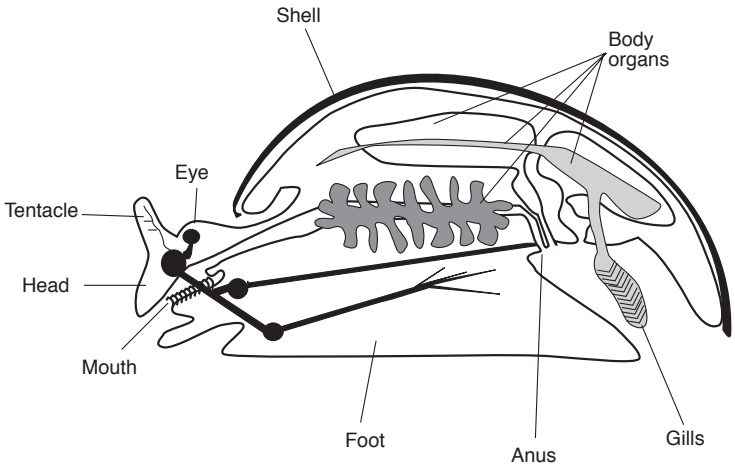






Exercise 54 Gastropods

1. Chitons are molluscs.
2. Feeds by scraping the teeth on its radula across the surface its on.
3. If all the chitons and snails were removed from the shore there would be a massive build up of algae on the rocks.
4. See figures below.
5. See figures below.
6. Chitons are adapted to the rocky shore because they are dorso-ventrally flattened, and have a hard girdle, a series of tough plates and a strong foot, which all enable it to withstand the forces of waves, its mouth is located under the animal so that it can feed while firmly attach to the substrate.
7. Figure 54.1 is a veliger larval stage of a snail, this stage is planktonic.
8. Figure 54.2 is the shell of a mollusc called nauplius.
9. Cone shell, periwinkle, limpet etc.



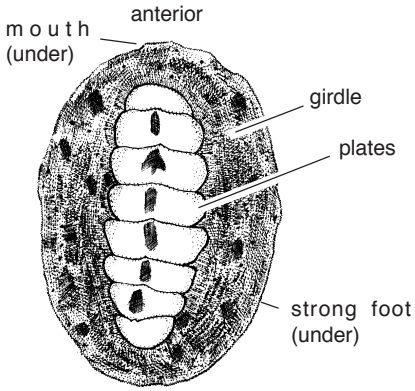
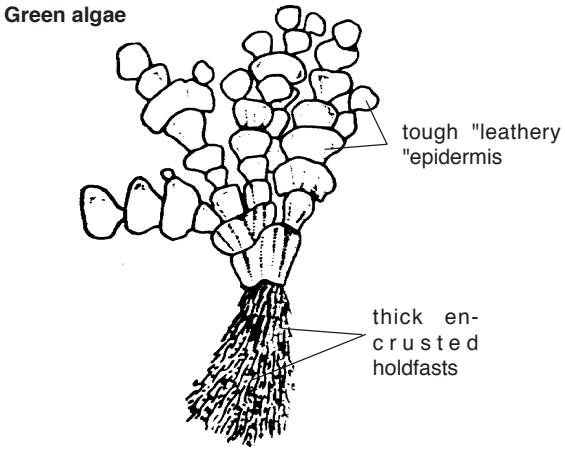
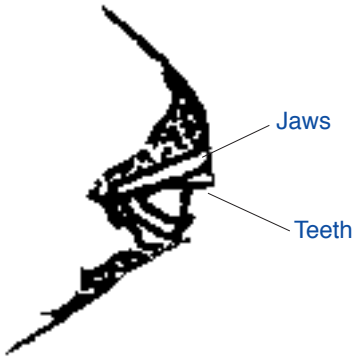


Fig 15 A chiton - dorsal view

Exercise 55 Algae

1. Feeding apparatus to remove algae from rocks: the radula of gastropods or the beak of parrot fish.
2. Algae would grow unchecked and cover other organisms such as barnacles, these could not filter feed because of the algal cover and would die.
3. These are the nutrients required by algae for growth.
4. Zooxanthelle, these algae provide the clam with extra food material and the clam provides the algae with a stable environment, and the nutrients it requires. The association is mutualism. Neither the algae or the clam grow as well without the other.
5. This is a parrot fish, it feeds at high tide. - see figure below
6. This type of algae (halimeda sp) has a tough leathery coating to prevent dehydration during low tide and to protect the algae during wave action.
7. This type of algae (halimeda sp) occur in intertidal areas. They has a thick, strong holdfast, tough leathery coating and contains calcium for strength. These are all adaptations to living in an intertidal zone.





Exercise 56 Corals

1. Soft corals: are sedentary and usually cemented to the substrate, they are made up of a large number of polyps joined by fleshy tissue.
2. Colonies have no hard, stony limestone skeleton, instead they contain fragments of calcareous particles called sclerites.
3. The algae living inside the tissue convert sunlight energy into food, which the corals can access.
4. Soft corals contain terpenes which are either toxic or distasteful to fish.
5. The spicules are present in some soft corals as a defence against predation by fish.
6. The egg cowrie is able to eat soft corals because it can change the toxic terpenes into a non-toxic substance during digestion.
7. The faeces of the egg cowrie were collected and showed to contain the converted non-toxic chemical.
8. a = mushroom coral (family fungiidae.; b = pipe organ coral; c = brain coral (family faviidae.; d = plate coral (family acroporidae.; e = branching coral (family acroporidae.; f = pocillopora (family pocilloporidae.
9. a = tentacle; b = zooxanthellae; c = corallite; d = coelenteron; e = tentacle; f = tentacles capturing prey; g = coral polyp; h = polyp interconnections.
10. Coral polyp - radially symmetrical cylinder of tissue, closed at the bottom, with a mouth surrounded by tentacles. Inside it contains only a stomach cavity.
11. During the day hard corals retract their tentacles to allow zooxanthellae to absorb as much light as possible. They feed at night when greater amounts of zooplankton are present.
12. Corals are related to anemones and jellyfish.
13. Septa - radiating walls or partitions of corals pointing toward the central mouth.
14. Zooxanthellae are algae living in a symbiotic relationship with corals and clams. They provide the corals with nutrients they gain through photosynthesis and the corals provide them with protection and shelter.
15. Corals feed by extending their tentacles armed with nematocysts and catching zooplankton as it passes over the tentacles. The nematocysts paralysis the prey and the tentacles move it toward the mouth. Some corals make mucous net to snare their prey.

Exercise 57 Echinoderms

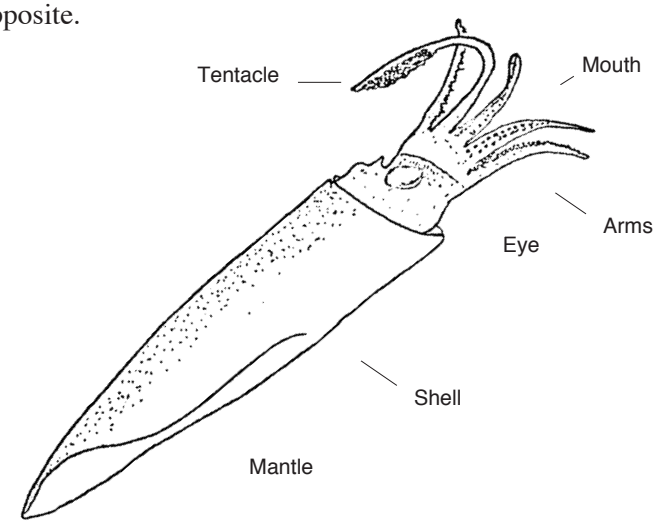
1. b= brittle star; c= feather star or crinoid; d= starfish; e= crown of thorn starfish; f= sea urchin; g= holothurian or sea cucumber.
2. a= a pluteus the larval stage of a sea urchin, it is found in the plankton.
3. The tubed feed extend forward and attach to the substrate, pulling the starfish along. They then release, extend forward again and re-attach, and so on, thus moving the animal.
4. The crown of thorns starfish is famous because it eats corals and its numbers have grown so high at times in the past 30 years that it has devastated many reefs in the Great Barrier Reef and continues to do so; the reasons for these explosions in the number of these starfish are still being debated.
5. The spines of sea urchins are poisonous.

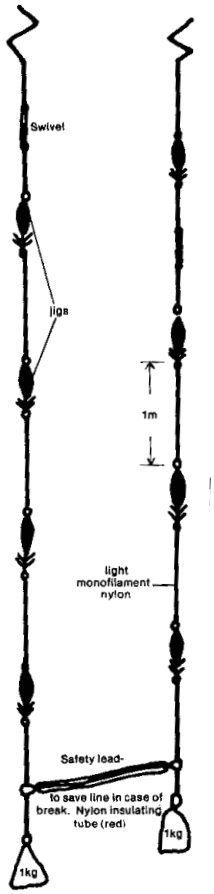
Note: Re-number questions 3 and 4

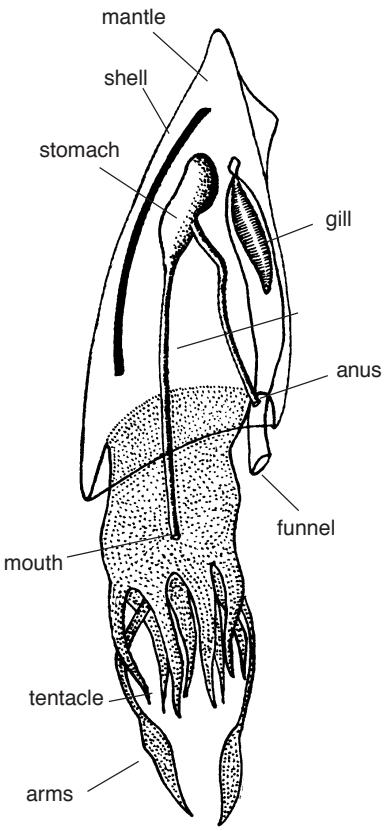
Exercise 58 Cephalopods

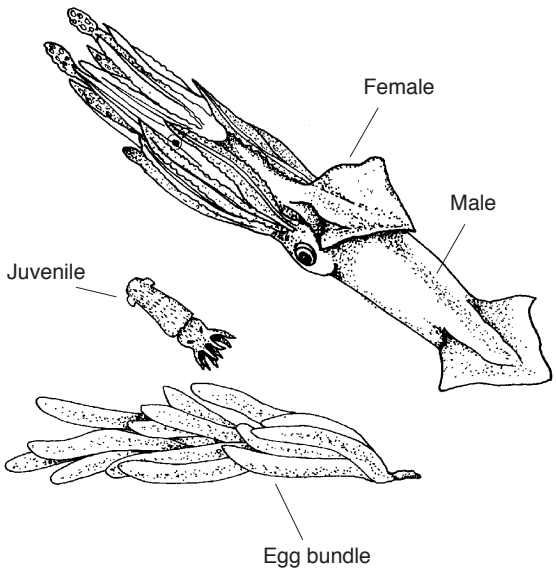
1. See diagram below.
2. See diagram below.
3. See diagram below.
4. See diagram below.

   copulation in squid - squid mate either head or with the male holding the female from the left side. The male collects a spermatophore from his penis and deposits it in the female's mantle cavity. They remain joined until the sperm are released from the spermatophore.
5. No - there is not a relationship between the commercial methods of catching squid and the way they mate. Commercial methods of fishing for squid use lures on jigs, as they are voracious eaters.
6. See students own answer.
7. See diagram opposite.



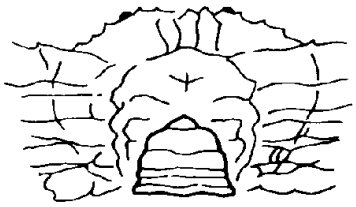




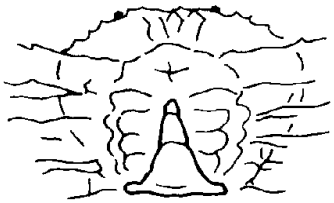


Exercise 59 Crabs

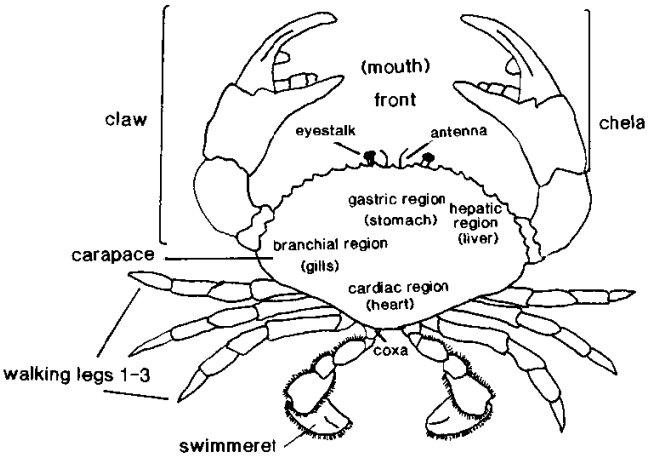
1. See diagram opposite.
2. Dorso-ventrally flatterned means squashed from back to front.
3. See diagrams below.

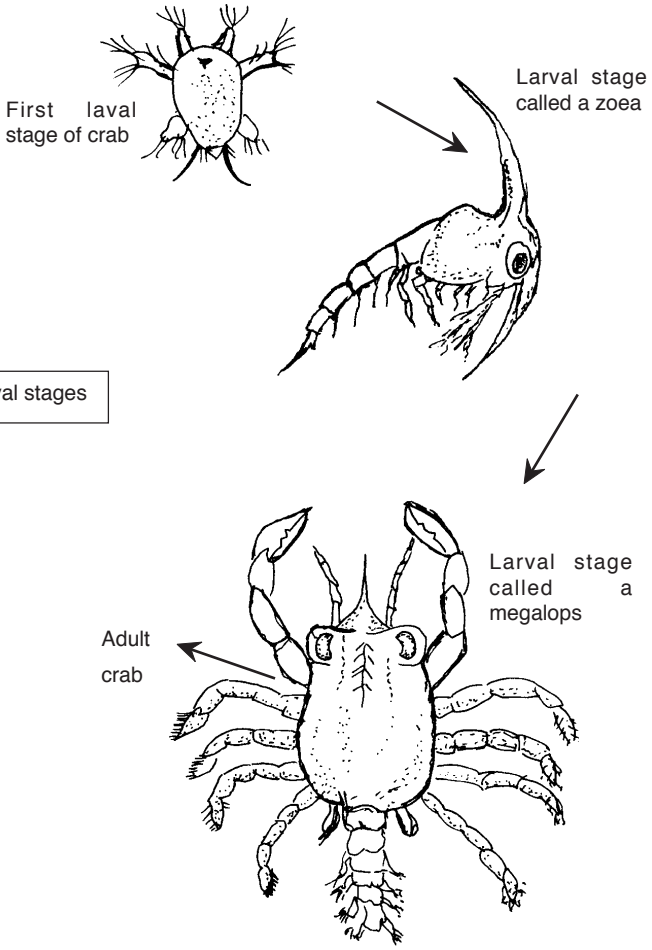


Female



Male





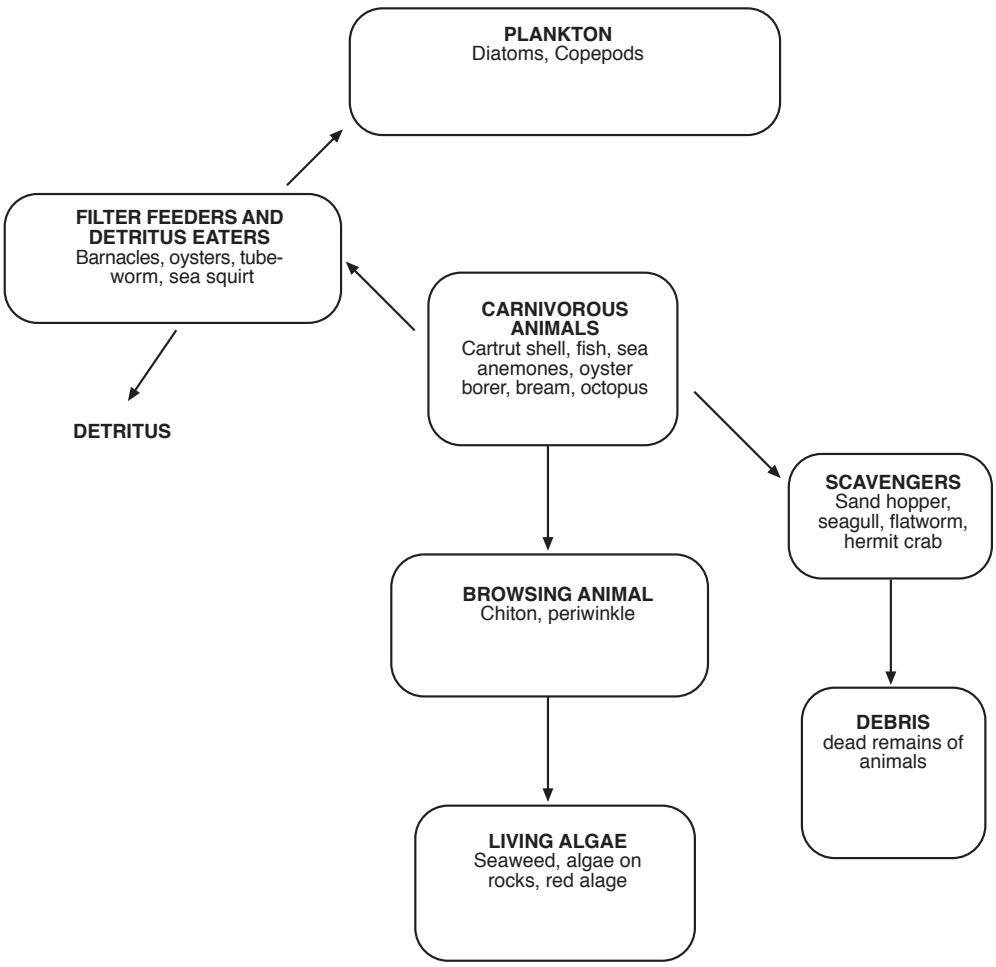
Crab planktonic larval stages

Exercise 60 Rocky shore ecosystem study

Students complete activity and draw kite diagrams as shown on page 136.

Exercise 61 Drawing food chains

1. See figure below.
2. Students complete their own food web.



Exercise 62 Marine ecosystems

1. Ecosystem - a group of organisms interacting with each other plus the environment in which they live. An ecosystem can be as large as the great barrier reef or as small as a fishes gut. An ecosystem is defined depending on the area being studied.

   Habitat - place or environment in which an organism lives.

   Productivity - (of an ecosystem) is the rate at which energy from the sun is absorbed and utilized with carbon dioxide to form organic matter (photosynthesis). It represents food potentially available to the consumers of the ecosystem.

   Biological succession - progressive change in the make up of a community of organisms towards a largely stable climax, from initial colonization.
2. See table over.
3. See table over.
4. See table over.
5. See students answers.

Components of the environment

Biological biotic variables	Physical abiotic variables	Chemical abiotic variables
producers	light availability	oxygen
consumers	turbidity	carbon dioxide
decomposers	waves	nitrates
habitat	currents	phosphates
territory	temperature	silicates
	pressure	salinity
	dessication	pH

Figure 62.1 **Components of the environment**

Ecosystem	Important physical factors	Typical producers	Typical animals
Rocky shore	Wave action	algae	barnacles
	Temperature change Dessication	phytoplankton	anemone
Reef	tidal movement wave action	algae	coral
	temperature salinity	phytoplankton	fish
Mangrove	tidal movement	mangroves	crabs
	temperature salinity	algae	small fish
Mud flat	tidal movement	sea grass	worms
	temperature dessication	algae	crabs
Coastal dune	winds / wave action	spinifex grass	crabs
	temperature	casuarina	seagulls

Figure 62.2 **Some Australian ecosystems**

Exercise 63 Adaptations

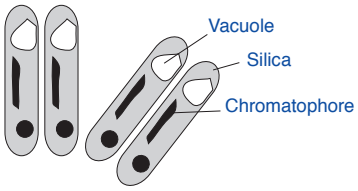
1. See students answers.
2. E.g. different, compares with, than those, unlike.
3. See figure below.

   E.g. the bream and the flounder live in very different habitats, the former is an open water fish, and the latter a bottom dweller. The flounder is asymmetric, with both eyes on the one side of its head to enable it to see when lying on the bottom. The bream is a strong swimmer, unlike the flounder who has poor muscle development. The flounder is capable of changing its skin colour to blend in with its background, whereas the bream's skin tone is constant, but suitable for its habitat. The bream has better eye sight than the flounder, as it catches its food on the move.
4. E.g. - the long nosed butterfly fish has different adaptations from the two fish described above as it lives in a different habitat and relies on a different food source. It has an extended mouth to allow it to feed on worms living between the spines of sea urchins. It is also laterally flattened to access sea urchins between rocks.

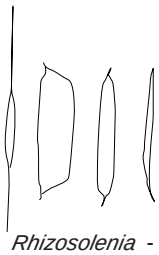
Feature	Flounder	Bream
habitat	River bottom	Open water
Movement	Poor swimmer	strong swimmer
Eye position	both eyes on one side of the head	Eyes on opposite side of the head
body muscles	Pooly developed	Well developed
Eyes	Small eyes	large eyes
Body colour	dull brown body	Silver-white
body pattern	Changing - depends on substrate	Fixed

Exercise 64 Phytoplankton

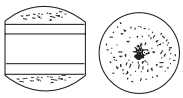
1. Dinoflagellate - has a flagellum.
2. See diagrams below.
3. See diagrams below.
4. Diatoms have silicon shells.
5. Rhizoselenia - causes the red tide.
6. See diagrams below.
7. Phytoplankton
8. See students answers.



Noctilucia - a Dinoflagellate

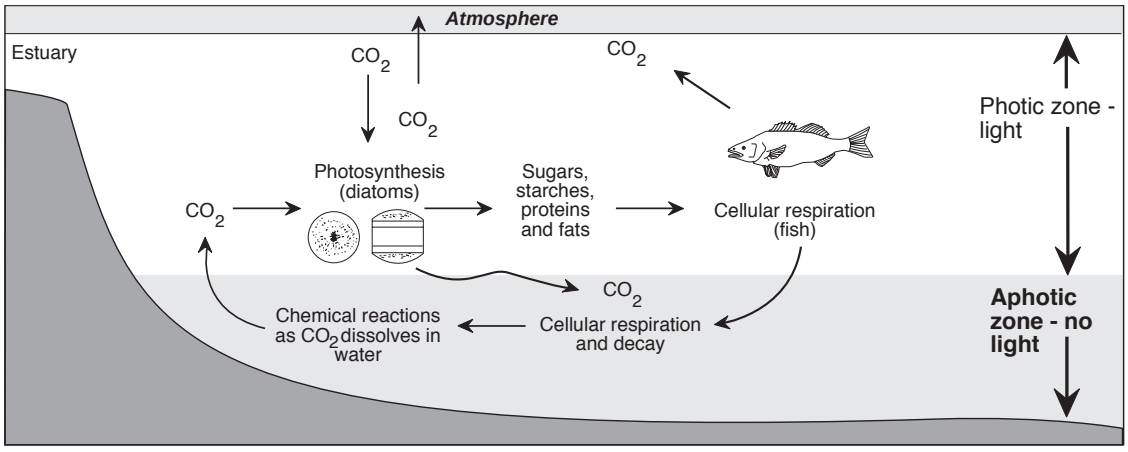


Rhizosolenia - a Diatom (4 species shown)



Coscinodiscus- a Diatom

Biddulphia - a Diatom



Exercise 65 Seaweeds

1. Floating _____seaweed_____ do not have roots, stems and leaves as land plants do.
2. The entire body is called a _____thallus_____.
3. Seaweeds that are attached have a thicker root-like or foot-like portion called a _____holdfast_____.
4. Instead of leaves or stems , some seaweeds have a stem-like area called the _____stipe_____ , and a leaf like area called a _____blade_____ .
5. Most seaweeds have a holdfast, stripe and a blade, although they may be hard to distinguish on many plants. Green plants reproduce by forming flowers, which in turn produce seeds, however seaweeds produce _____spores_____ on the tips of their branches.
6. These spores are very tiny, and when released, float away to become part of the great mass of floating _____phytoplankton_____ .
7. Use Figure 65.2 to write a description of how a seaweed reproduces. Distinguish between the asexual and sexual stages and draw in the place where the juvenile would grow.
8. How do seaweeds help animals such as starfish, clams, crabs and worms?

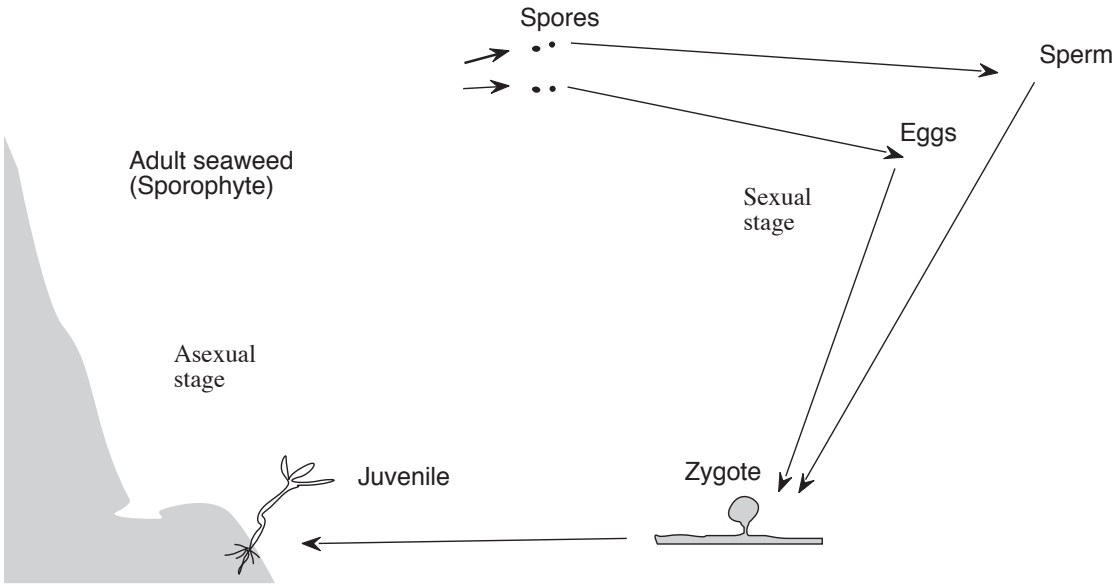
   The holdfasts provide shelter for these animals

9. Name one adaptation of a seaweed giving a reason for your answer.

   Holdfast - adaptation to clinging to rocks
   Planktonic sexual stage - increased change of cells uniting in water, genetic variation

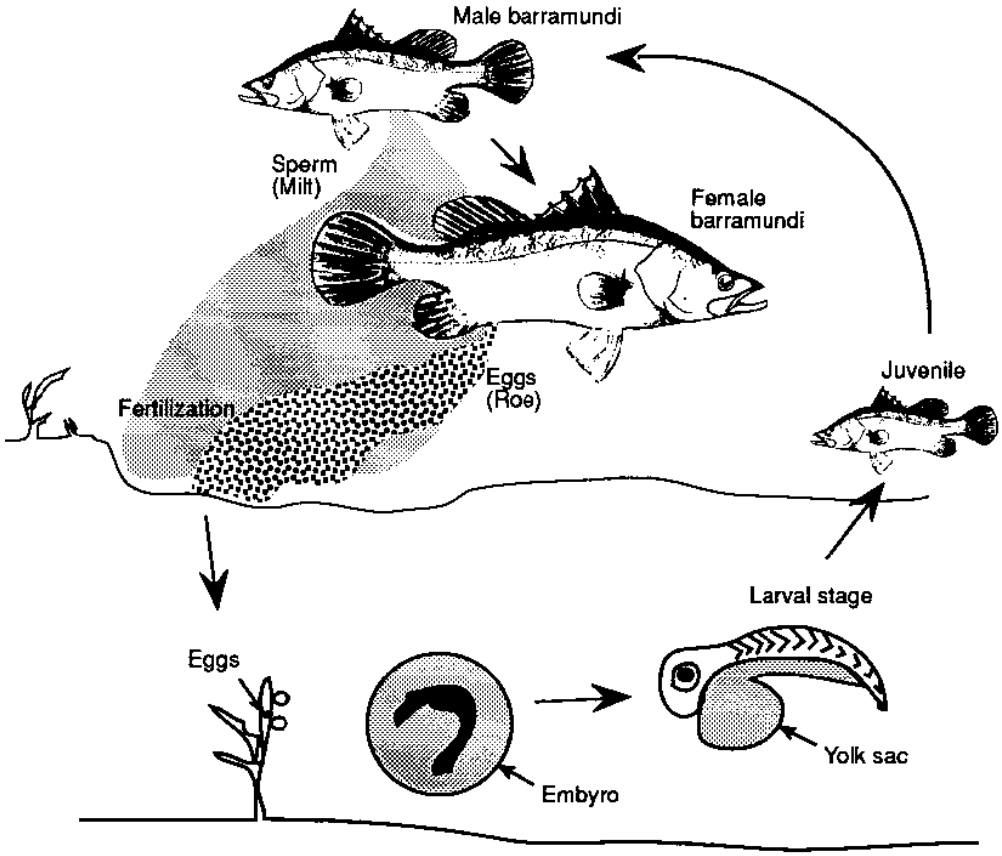
10. Why do some species of seaweeds have air bladders?

    So the plant can remain upright in the water to get the suns rays for photosynthesis



Exercise 66 Adaptations of fish

See figure below.



Exercise 67 Streamlining

1. 3
2. E.g. mackerel tuna, salmon barramundi, etc.
3. The caudal fin gives the fish the power to push through the water, the forked shaped caudal fin provides the fish with the greatest power.
4. a. - damselfish, bottom dweller, moderately fast.
   b. - trout, bottom dweller, fast
   c. - tuna, pelagic, very fast
   d. - cod, bottom dweller, slow
   e. - shark, pelagic fast.

Exercise 68 Viscosity

1. Note there should be an extra tube - sea water. The ball bearing should sink the slowest in the most viscous medium.
2. Time/metres
3. Time/metres = 4188 metres.

Exercise 69 Buoyancy

1. See students answers.
2. See students answers.
3. See students answers.
4. An animal living in air requires more internal structures as water offers more support for the body than air, which accounts for the difference in weight in air and water.
5. Land animals have hollow bones to keep body mass to a minimum, the bones offer support to the body for minimum weight.
6. A land animal would not be able to use gills to breathe . Gills collapse in air as they have no support structures for operating in air, so oxygen could not diffuse across the membrane. The gills would also dry out in air, preventing oxygen diffusion, as oxygen must first dissolve before it can be absorbed.
7. An aquatic plant would not survive on land. Aquatic plants have no support structures to keep them from collapsing in air, they also have no protection against desiccation.

Exercise 70 Density of sea water

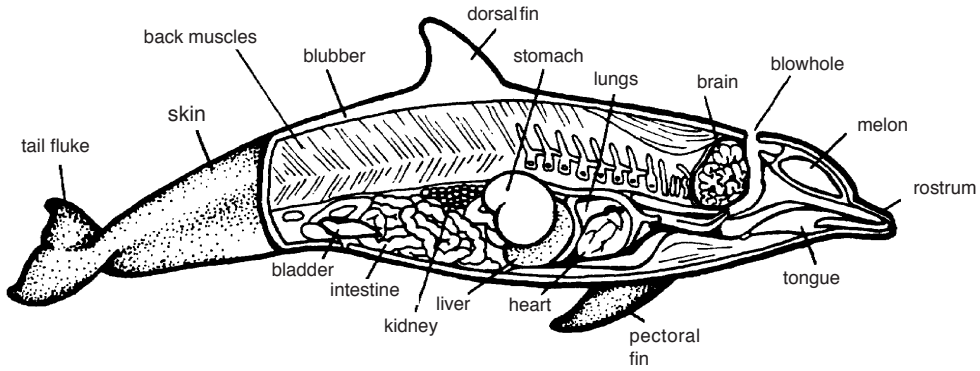
See students answers.

Exercise 71 What makes adaptations necessary

Note:

Q1. e — correction – turtle should be dolphin and there is no question 2.

1. a See diagram below.



b. Adaptations of dolphins to life in the sea:
   - Shape of tail to propel it through the water
   - Large back muscles to provide power for propulsion through the water
   - Streamlined body so that movement through the water is efficient
   - Blow at the top of the head to breathe while body under water
   - Large dorsal fin for stability

c. The blow hole allows the dolphin to breathe, it opens at the surface and expels air very quickly (about 90% in 1 second).

d. Sound travels 4 times faster in water than in air. The melon and lower jaw are adaptations associated with this.

e. Dolphins use echo-location to navigate in the water. High pitched clicking sounds are made in the nasal cavity and these are amplified by the upper jaw and melon. Sound waves are transmitted at different frequencies, these hit objects and bounce back differently depending on the object. The lower jaw absorbs the sounds bounced back and transmits them to the inner ear and then to the brain where distance size and shape of objects is determined.

f. Poorly developed senses are sight and taste.

3. a. Could be better worded.

   Ans. - adaptations to the viscosity of water: fatty deposit; light spongy bones; flattered shape.

c. The hard shell is required for protection

d. Plastic bags are a danger to turtles. They resemble jellyfish, a food source of the turtle. When turtles ingest them their digestive tract becomes blocked.

e. Turtles lay 100s of eggs because there is no parental care involved in raising the hatchlings, so the mortality rate is extremely high. a large number of eggs ensures that at least a few will reach maturity and breed.

f. Dr. Col Limpus: - no one country has total control of turtle populations due to migratory their habits, so this responsibility must be shared
   - street lights must be turned off to minimise disorientation to hatchlings
   - turtles must be carefully removed from fishing nets and released.
   - avoid buying turtle products.

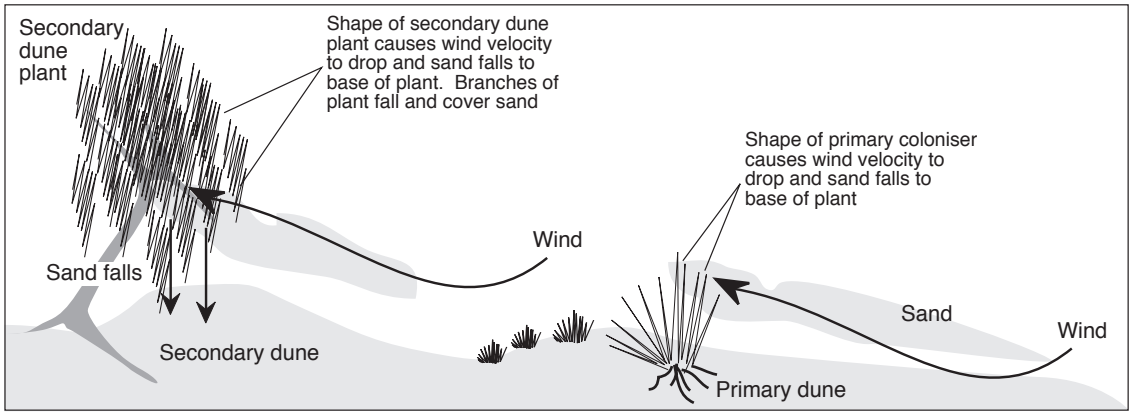
Exercise 72 Comparing and contrasting mangroves and estuaries

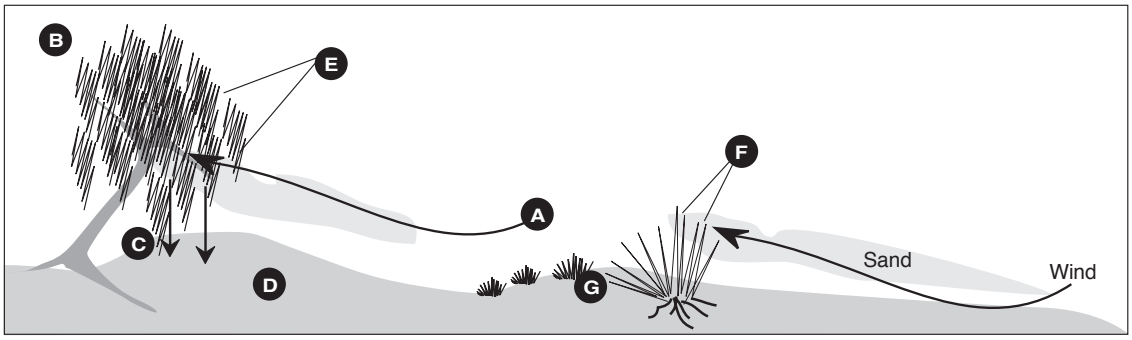
See students answers.

Exercise 73 Sand dune plants

Q 1 - 6 See students answers.

Q7.





Matching letter	Statement
E	Shape of secondary dune plant causes wind velocity to drop and sand falls to base of plant. Branches of plant fall and cover sand
B	Secondary dune plant
G & F	Sand falls
D	Secondary dune
A	Wind
F	Shape of primary coloniser causes wind velocity to drop and sand falls to base of plant
G	Primary dune

Exercise 74 Prawn dissection

See students dissection.

Exercise 75 How to set up a marine aquarium

See students aquarium (See also Chapter 15 of Introduction to Marine Studies 1997 New Textbook).

Exercise 76 Food chains

1. a. Producer: an organism that makes it's own food using sunlight energy.
   a. Consumer: an organism that feeds on other organisms.
   b. Decomposer: an organism that feeds on dead organisms and breaks them into their basic parts, and so releasing nutrients back into the ecosystem.
   c. Nutrient: compounds required by organism to survive and thrive e.g. nitrogen oxygen, phosphates etc.
2. a. Beach worm - consumer
   b. Sea lettuce - producer
   c. Bacteria - decomposer or consumer (depending on the species)
   d. Pippi - consumer
   e. Nitrates - nutrient
   f. Prawn - consumer
   g. Dinoflagellate - producer
   h. Fiddler crab - consumer
   i. Algae - producer.
3. Producers are fed upon by herbivorous consumers, these in turn are food for carnivorous consumers. When the producers, herbivores and carnivores die, their remains are broken down by decomposers, which release the nutrients they contain back into the ecosystem.
4. See students food web.
5. Humans are tertiary consumers.
6. Students listen to talk and complete question.

Exercise 77 Artemia life cycle

See students results.

Exercise 78 Fibreglass fish

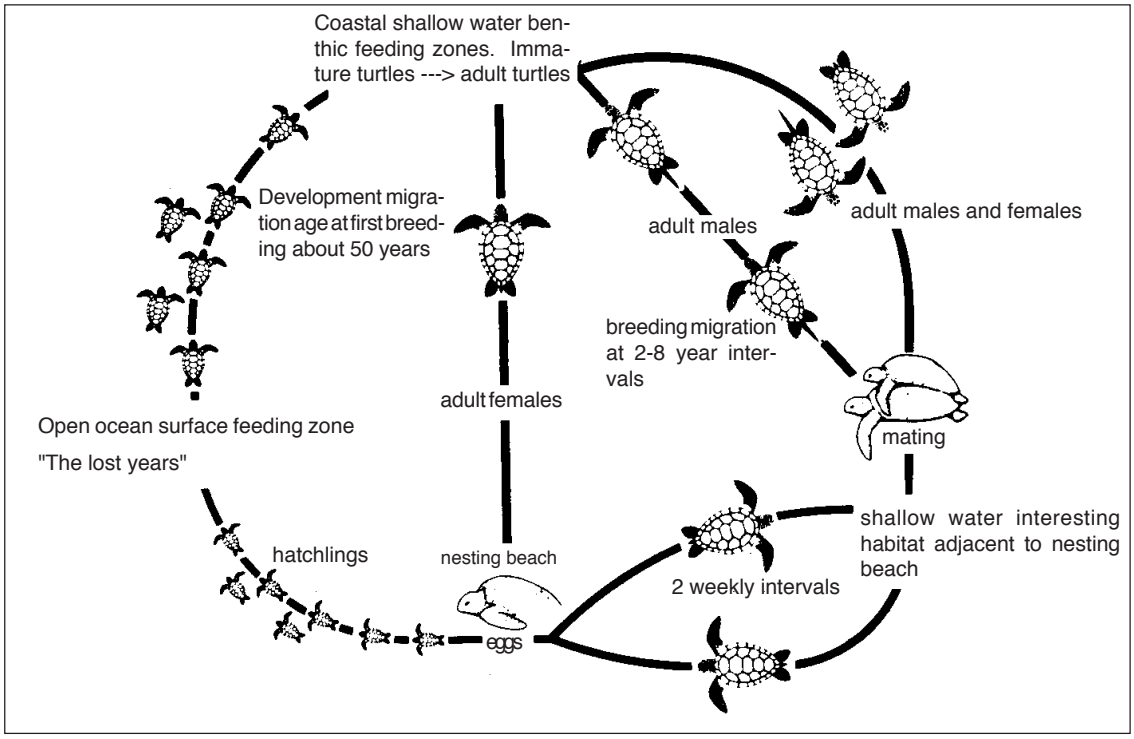
See students results.

Exercise 79 Pressing seaweeds

See students results.

Exercise 80 Turtles

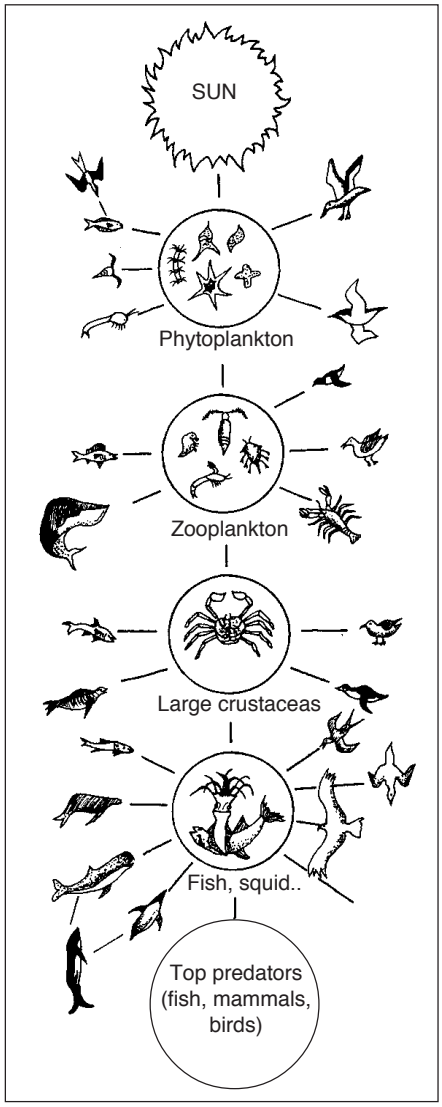
1. See figure below.



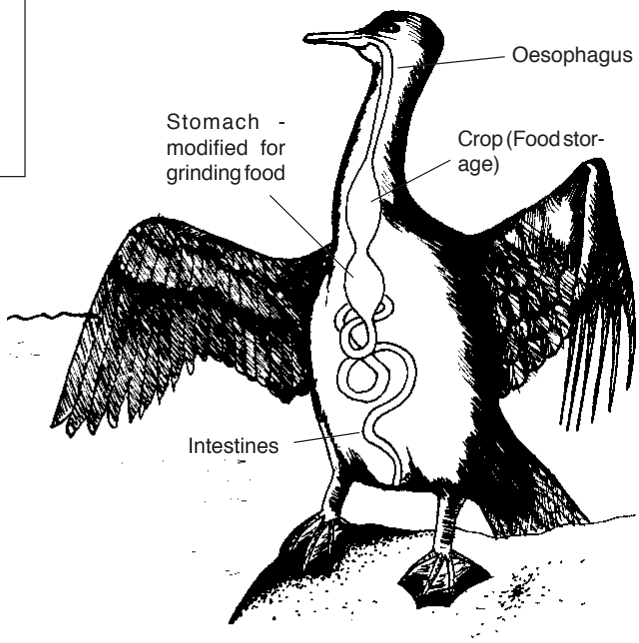
2. a. If you were to find a turtle with a tag, you must record the date, location and other relevant information and sent it to the address shown on the tag.
   b. On seeing a turtle coming up the beach - minimise the use of lights; do not approach closely, or shine lights as the turtle leaves the surf; wait until egg laying is in progress before shining lights; avoid making noise, sudden movements and keep dogs away.
   c. When ready to lay eggs, the female crawls up the beach, digs a pit above the high water mark and lays her eggs. She then covers the eggs with sand and returns to the sea. This occurs at regular intervals over summer. Temperature does affect the sex of the hatchlings.

Exercise 81 Sea birds

1. See diagrams below

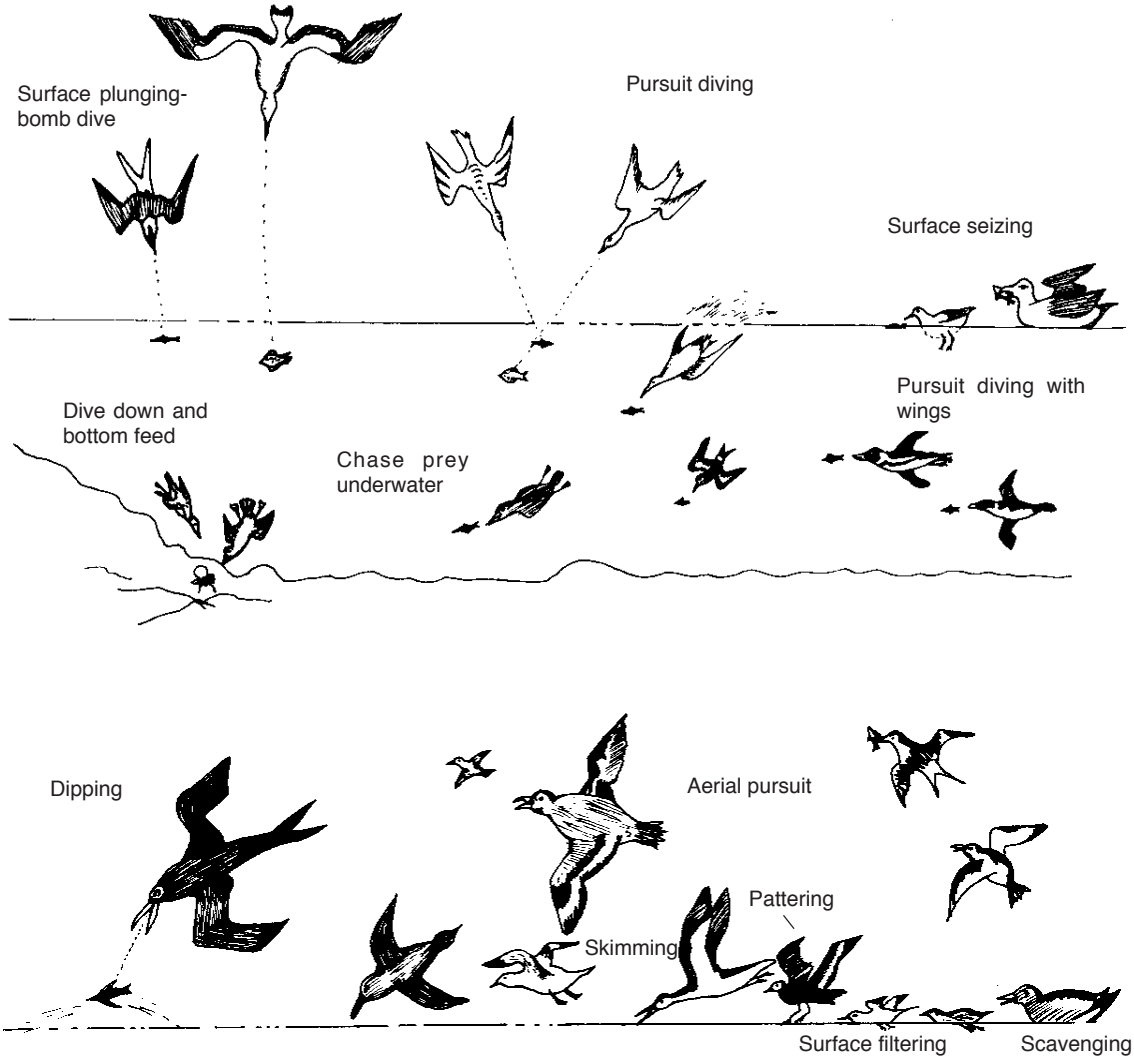


2. See diagram opposite.



Cormorant (After Lerman 1986)

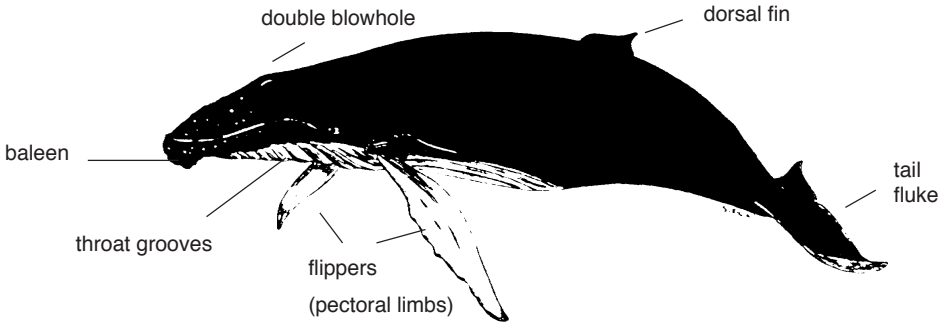
3. See diagrams below.



Exercise 82 Marine mammals

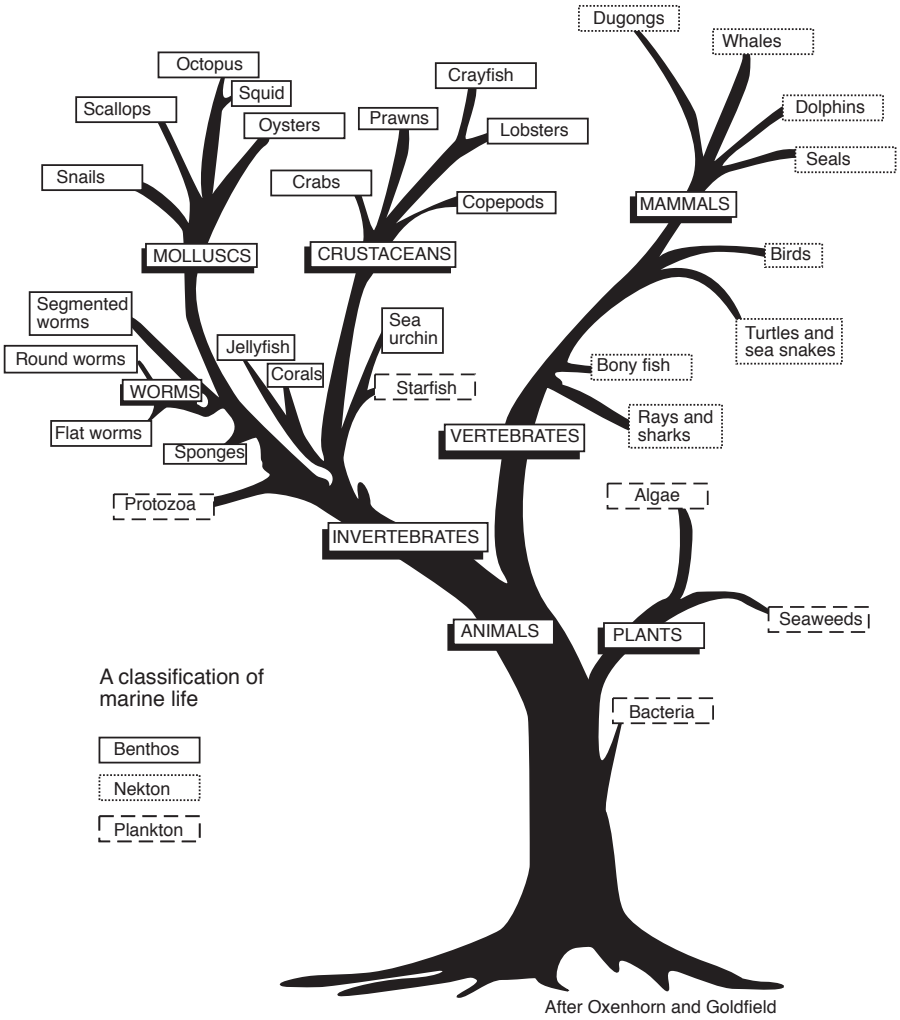
1. a. Sea cow

   b. Dolphin
2. Mammals. Dugong and dolphins have in common the fact that they are air breathing and give birth to live young, which they suckle.
3. See diagram below.
4. Southern right whales are baleen whales and use the baleen plates to sieve food out of the sea water. Humpback whales are toothed whales, they form bubble nets using air from their blowholes to catch small fish.



Exercise 83 Classification

1. Any from the boxes with solid outline - see diagram opposite.
2. Amoebas and starfish could be considered to be distant relatives that would have had a common ancestor at the point on the tree where their branches separate.
3. Scallops and squid belong to the same group known as molluscs.
4. Bird and sharks have a backbone or vertebra in common, they both belong to the grouping vertebrates
5. The early branching of the tree is into plant and animal kingdoms. However before this bacteria branch off.
6. Bacteria and blue-green algae are neither plant nor animal, instead they have characteristics from both these kingdoms and have been placed in a kingdom of their own.
7. Any three flowering plants.
8. There are tree different types of worms there are: flatworms; segmented worms; roundworms
9. Dugongs, whales, dolphins and seals are all in the class mammals.
10. Crabs belong to the class crustaceans.
11. There are more than six major groupings of organisms they are listed here; the phylum porifera (sponges), phylum cnidarian (corals and jelly fish), phylum platyhelminths (flatworms), phylum nematode (roundworms), phylum annelid (segmented worms), phylum mollusca, phylum echinodermata (starfish sea urchins), class crustaceans, class mammalia, class fishes, class protozoans and the kingdom plants.
12. The subdivisions in the invertebrate group are: phylum porifera (sponges), phylum cnidarian (corals and jelly fish), phylum platyhelminths (flatworms), phylum nematode (roundworms), phylum annelid (segmented worms), phylum mollusca, phylum echinodermata (starfish sea urchins), class crustaceans, phylum protozoans.
13. The subdivisions in the vertebrate group are: class mammalia, class fishes.
14. Copepods belong to the Class Crustaceans.



Exercise 84 Fish classification

a = 1a, 2b, 7a - diamond fish

b = 1a, 2a, 3b, 6b, 8a - barramundi

c = 1a, 2b, 7b - bream

d = 1a, 2a, 3b, 6b, 8b, - trevally

e = 1b, 12b - pike eel

f = 1b, 12a, 13b - porcupine fish

Exercise 85 Seaweed classification

Note algae have been labelled a - i from left to right for the purpose of providing answers

1. Brown algae = phaeophyta
   Red algae = rhodophyta
   Green algae = chlorophyta

3a. a. description - see manual page 188
   b. classification - bladder kelp (macrocystis)
   c. where found - in cold water to depths of 30m
   d. illustration - a

3b. a. description - see manual page 188
   b. classification - bull kelp (nerocystis)
   c. where found - in cold water in large beds
   d. illustration - b

3c. a. description - see manual page 188
   b. classification - rockweed (fucus)
   c. where found - exposed areas around high tide mark
   d. illustration - c

3d. a. description - see manual page 188
   b. classification - oar weed (lamanaria.
   c. where found - cool shallow waters
   d. illustration - d

3e. a. description - see manual page 188
   b. classification - intestine shape algae (enteromorpha.
   c. where found - on wharves, buoys, woodwork and boat hulls
   d. illustration - e

3f. a. description - see manual page 188
   b. classification - sea lettuce (ulva.
   c. where found - areas of pollution
   d. illustration - f

3g. a. description - see manual page 188
   b. classification - turkish towel (gigartina.
   c. where found - intertidal zone
   d. illustration - g

3h. a. description - see manual page 188
   b. classification - blade algae (iridaea.
   c. where found - rocky shores
   d. illustration - h

3i. a. description - see manual page 188
   b. classification - coralline algae (corallina.
   c. where found - coral reefs
   d. illustration - i

Exercise 86 Underwater slate

See students slate.

Exercise 87 Nekton test

See answers in manual.

Exercise 88 Benthos test

See answers in manual.

Exercise 89 Research questions

See answers in manual.

Section 3 Commercial uses

Exercise 90 Abalone stock

1. The abalone inhabit rocky reefs around the cool temperate coastal areas. The abalone feed on pieces of seaweed.
2. The black lip abalone *Haliotis reeler* is commercially fished of New South Wales.
3. The abalone spawn during summer.
4. The abalone are collected individually by skindivers who prise them from rocks using chisels.
5. Information on the changes in stock densities can be gained from an analysis of catch per unit of effort (catch per diver per day).
6. Turnover stock is approximately the long term sustainable yield of maximum average yield. The stock that is produced next year after harvesting.
7. The total biomass does not take into account the age, size or sex of the population harvested.
8. Highest catch was 960 tonnes in 1971.
9. Catch of abalone rose from 1965 - 1971 then declined until 1975. The catch remained fairly constant from 1975 - 1979 then increased in 1980 and had again remained constant for 4 years at this level.
10. • Many abalone may be sold on the Black Market.
    • Many could be harvested illegally.
    • Who would believe a fishermens catch details.
11. a. To reduce fishing pressure on the fishery.
    b. To allow the stock to have a chance to breed before being harvested.
12. The stock removed by one unit of fishing effort and it increased from 1977 - 1981.
13. • To reduce fishing pressure.
    • To maximise economic harvest.
14. 17 divers give greatest difference between revenue and cost.
15. No fishery is in good health. Constant review is advised.
16. No. These are models and give an idea of the health of the fishery.

Exercise 91 The Australian herring

1. Herring are found south from Shark Bay in Western Australia, in estuaries and bays right across the Great Australian Bight and all the way to Port Phillip Bay.
2. Western Australian season is May to June.
   South Australian season is March to April.
   Victorian season possibly February to March.
3. They inhabit coastal waters (inshore and do not venture out to sea).
4. Juveniles grow in the protected waters of bays and estuaries and live off sea grass.
5. The juveniles are very susceptible to pollution.
6. About 3 years from egg to adult.
7. The herring migrate back to the coastal reefs off Shark Bay to mate and spawn.
8. The idea is to give fish enough time to migrate and spawn. Only slow ones are caught.
9. It would be easy to overfish the species and wipe out the breeding stock.
10. Sensible fishing measures will provide a valuable food source and have little effect on total population.
11. A herring that Europeans love to eat.
12. Legal size of herring is set at a minimum size of 18cm total length.

Exercise 92 South east fishery

1. a. South East fishery species
   b. Total annual catch
2. a. Flathead - 350,000kg
   b. John Dory - 240,505kg
   c. Silver Trevally - 500,001kg
   d. School Whiting - 2,000,000kg
   Note: There is an error in the table under the column 2 heading: It should read TAC in Kg not % of TAC in Kg
3. a. Blue Eyed Trevally - $5.51
   b. Red fish (Red coral prawn is not a fish)
4. a. 63 870 x $2.09 = $133,488
   b. $361,253
5. John Dory
6. - These fish were mostly caught in waters around Melbourne
   - There is a greater demand for this fish in the Melbourne market.
7. **Can not be calculated using this table**
8. a. Blue Grenadier
   b. Orange Roughy
   c. Flathead
9. Orange Roughy total catch = 8 000 000kg
   Number of household freezers = 100 000
10. - Not found in these waters in commercial numbers
    - No demand at the market for these species.
    - Harder for trawlers to target
11. - Some fish sold on the black market.
    - Fishermen may not give full detail to evade tax.
    - Who believes a fishers catch details.
12. a. - To pressure fish shock of fish such as the Orange Roughy (See exercise 106).
       - To monitor populations.
    b. - To better manage the resource.
    c. - To get an inside range of views.
       - To keep the public informed of review process.

Exercise 93 Ecotourism

1. Heron Is. Biodiversity means lots of animals to see.
2. Bikes create no pollution.
3. Find out when the whales were from the whale information centre
4. People are on the shore.
5. To float down the rivers - minimal pollution
6. In Qld - Famous bommie
7. Tells natural heritage - explains cultural significance - illustrates multiculturalism.

Exercise 94 Mariculture

Students complete project work.

Exercise 95 Aquaculture projects

Students complete project work.

Exercise 96 Shipping

See shipping article answers.

Exercise 97 Ecotourism survey

See survey results.

Exercise 98 Is tourism good for the community?

1. a. Extra food required
   - 6 479.4 tonnes of lamb
   - 1 468.7 tonnes of butter
   - 17 711 tonnes of citrus fruit
   - 3 239 tonnes of seafood
   - 4.82 million dozen eggs

   b. - new sewage treatment plants
   - new dams to supply water
   - more resorts
   - new shopping centres
   - new airports
   - more roads and housing estates
   - theme parks

2. Cost for 1 person;

Accommodation	$40 per night	$560
Food	$25 per day	$350
Travel	$10 per day	$140
Entertainment	4 day trips	$300
	night activities	
Clothing/shopping		$200
Gifts/souvenirs		$60
Photography		$25
	Total:	$1 635

3. Tourism brings large amounts of money into the community and this leads to improved facilities in the area. Some may suggest it will lead to the destruction of the natural environment.

4. - Many tourists may need medical attention while on holidays
   - Engineers will be needed to help build the resorts, houses, roads, bridges etc . . .
   - Business leased in the tourist industry will need to use lawyers, accountants etc . . .

5. 1 lamb = 25kg meat
   x lambs = 6 479 400
   $x = \frac{6\ 479\ 400}{25}$
   = 259 176

6. Present seafood eaten;
   $\frac{3\ 239}{2.3}$
   = 1 408 tonnes
   I believe aquaculture ventures (marine farms) will need to be developed.

7.

Bakery	Cleaning staff
Shop assistants	Waiters
Bus drivers	Bar attendant
Taxi drivers	Cooks
Newsagents	Butchers
Accountants	Council workers
Tourist operators	Engineers
Caravan Park operators	Architects
Commercial fishermen	Fruit pickers

8. Tourists do not like to be restricted by shopping times. A large number of tourists only visit on weekend and public holidays when shops may be shut.
9. Negative effects of tourism;
   - reef destruction
   - removes natural look of area.
   - native animals killed by netting
   - changing sea birds diet
   - effect of building the structure on the environment
   - changes in currents
   - pollution
   - removal of shells, disturbing habitat.
10. Good idea if tourism is not affected (does not cause a loss in number of tourists). Money raised;
    - to improve roads.
    - to improve waste management.
    - to promote tourism.
    - to help conservation.
    - pay for wages of conservation officers.
11. The heading gives idea of mood/theme of article of article 'Statistic make for a good cackle.' It is a cynical review of possible effect tourism could have on a region and the use of University researchers.
12. 1. Tourist operators
    2. Motel operators
    3. Food outlets (McDonalds)
    4. Restaurateurs
    5. Hotel operators
    6. Accountants
    7. Engineers
    8. Builders
    9. Doctors
    10. Police

Exercise 99 Ballast water problems

1. *Asterias amurensis* is the scientific name for the northern hemisphere starfish.
2. It was most likely transported to Tasmania in the ballast water.
3. The species has a gluttonous, insatiable appetite. It is greedy and competes vigorously for food.
4. Could wipe out different mollusc species and aquaculture ventures set up with these species, eg: scallops.
5. The starfish belong to the phylum Echinodermata.
6. Exotic species - foreign species not native.
7. The starfish was first discovered in Hobart in 1986.
8. This species;
   - slightly flatter arms
   - 4 rows of tubed feet
   - spines not pointed
   - different colour
9. This would allow us to have a record of nature as it is today so that future base line surveys will show changes that are taking place.
10. A taxonomist identifies/classifies animal species. More taxonomists are needed to detect introduced or exotic species and to monitor the marine environment.
11. The *Asteris amurensis* is a relatively large starfish with an arm length of up to 200mm. It has 4 rows of tubed feet on the underside of the arms. The spines are chisel shaped. The species can live in a number of habitats. It has a temperature range of (0.1 to 7.5°C).
12. I do not believe that the species will eventually threaten the scallop industry in Queensland as our water temperatures are above the tolerance levels of this species.
13. Complete more studies of the infected areas.
14. Method of control;
    - biological control (use of its natural predators to control its numbers)
    - use divers to physically remove the adults
    - inject the adult with a poison
    - find a commercial use for the species
    - introduce a virus or disease to control its numbers
    - study the species to better understand its life cycle, tolerance limits, breeding season, food source, predators etc . . .
15. Government measures;
    - structure control on release of ships ballast water.
    - lease line surveys of most environments which are regularly repeated.
    - increase numbers of pest control officers.
    - increase number of quarantine officers.
    - improve coordination between federal and state governments.
    - improve community education on problem.
    - inject more money into departments involved in the conservation of resources and wildlife.

Health of Marine environment

Topics to consider;

1. pollution;
   - by human wastes
   - by industry
   - by agriculture (fertilisers, pesticides)

- by mining
- by oil
- by radioactive wastes

2. how to test for pollution
3. effect of pollution
4. how to overcome the problem
5. new competitors
6. exploration - overfishing
7. protected areas - marine parks
8. quarantine
9. factors effecting Barrier Reef
   - crown of thorns
   - turbidity
10. wetland destruction

Exercise 100 Positive and negative effects

1. Allow students to select the topics as much as possible but only 6 students per topic.
2. These 6 students can then be allotted with either the negative or affirmative side.
3. A marking system mat be developed to help the adjudicators. See guide given.

Maryborough State High School
Singles Debating - Senior

AFFIRMATIVE Exit item 7

Name _____ Class _____

Topic _____

_____

Criteria	Opening (2 mins)					Reply (4 mins)				
	A	B	C	D	E	A	B	C	D	E
1. Matter subject matter information preparation										
2. Manner audience contact presentation delivery										
3. Method opening argument conclusion timing										

Comments: _____

_____

Level: VHA HA SA LA VLA Mark: _____

Teachers Signature: _____ Date: _____

Maryborough State High School
Singles Debating - Senior

NEGATIVE Exit item 7

Name _____ Class _____

Topic _____

_____

Criteria	Opening (2 mins)					Reply (4 mins)				
	A	B	C	D	E	A	B	C	D	E
1. Matter subject matter information preparation										
2. Manner audience contact presentation delivery										
3. Method opening argument conclusion timing										

Comments: _____

_____

Level: VHA HA SA LA VLA Mark: _____

Teachers Signature: _____ Date: _____

Some Notes from QDU seminar 19/3/95

The following are the steps needed for a team to produce their argument.

- Read topic carefully
- Define using dictionary and/or common sense
- Brainstorm your ideas
- Separate rubbish from good points
- Priority points (Not too many. Restrict only to important ones. You should need only six - eight for a team)
- Choose a theme (a statement that summarises your team position)
- Decide on a speaker's arguments (1st and 2nd speaker)
- The team split could be, eg: effect on individual/society or local versus national versus international. A bad split would be moral and practical because in all should topics moral and practical must go together. Each speaker should prove the topic i.e. do not have hung cases where the following speaker is needed to prove the point.
- After team split is divided, individual speakers prepare their points, giving an explanation of each point and examples. Give a really good explanation because, unlike you, the adjudicators have not yet heard the argument before. Give a very good example and be sure to tie the point back to the theme.

Rebuttal

Rebuttal is what distinguishes debating from public speaking.

What did they say?

Attack points or themes. It is most important to attack these. Attacking examples is the least important so start with the theme. It may not be relevant i.e. they haven't read the topic properly (rare). It could be a factual problem or they may have used incorrect logic. Where possible logic should always go first.

Method

This is how you put your argument together. The structure of your speech and the structure of the arguments within the team and the role of each speaker. It is important to note that debating is a team activity.

First speaker

The first speaker gives an introduction and overview of the team's case. They introduce the topic and they introduce the team approach. The definition, theme and roles of each speaker.

Second speaker

The second speaker gives the bulk of the information i.e. the consolidation of the argument.

Third speaker

The third speaker gives the conclusion or summary.

First speaker	–	Introduction
Second speaker	–	Consolidation
Third speaker	–	Conclusion

In fact, each speaker also has the same structure - an introduction, a consolidation and a conclusion. First speaker gives the formal introduction. He needs to grab the attention of the audience with an interesting idea or approach. He defines the topic. In definition, he must state the topic, identify the key words, explain key words and justify the teams interpretation. (IMPORTANT: Do not define every word) Once this is done, there needs to be a sentence that sums up the definition, i.e. using the meaning of key words. Next state your theme. Explain what you mean and how it relates to the topic.

Team split

The team split should relate to the theme. In the very, very best debates, it is often not required to describe what the third speaker will do. Everybody knows the third speaker compares and contrasts the themes and

arguments of the two teams and summarises his/her team case. Then the first speaker should consolidate his/her points - two to three only - emphasis on just two. When writing for each point, the following structure should be used;

1. A general statement (what the point is)
2. Explanation
3. Example
4. Link back to theme. How does this point prove your theme?

After these two to three points have been stated, you need your summary.

First negative

Again in some very, very good debating, a formal introduction may not be necessary but you must rebut the definition. You agree or disagree with parts of the definition, key words etc. Do not challenge if they are mostly the same i.e do not be pedantic. You must point out the key words that you disagree with, show why you are right and they are wrong. You could appeal to common sense. Definitions do not necessarily have to come from a dictionary. They could come from common usage, eg TV, radio, press. Your rebuttal should attack the theme first. It is most important that a theme is attacked first, then points with the most important first to the least important. The remainder of the speech for the first negative is the same as first affirmative, i.e. introduction, consolidation and summary. The first negative is really a very complex and most important speaker. Many teams put their strongest speaker first negative.

Second affirmative and second negative

Second affirmative and Second negative are the same. They need to rebut firstly the theme, secondly points from most important to least important. In rebutting specific points, the following structure is advisable:

1. State what they said.
2. Explain what is wrong.
3. Use an example if possible.
4. Link back to your own theme.

After rebuttal, the second speakers have an introduction or an overview of the points they were covering and how they related to the team split. Speakers should have three to four points. Second speakers time should be split between one-third rebuttal, two-thirds prepared speech.

It is important that you use points rather than examples. If you have a really good example, look closely and draw out the general principle. Explain that and then, and only then, give the example.

Lastly, speakers need to summarise their argument.

Voice

Do not shout. Lower pitch and tones are more easily listened to.

Don't be afraid to pause if you lose your place or stumble. Don't lose your cool. Take your time. Compose yourself.

Use persuasive language - emotive language. Use of the personal pronoun often helps e.g. when talking about Australia in world history, make statements like, "We need to . . . " thus evoking nationalism.

It is always best to convey your ideas in short sentences. Always start with short sentences and finish with short ones.

Use language that everybody understands.

Use a conversational tone. Talk to the audience about the topic in a comfortable manner as if you were talking in the playground. Vary your delivery. Only use argumentative tones two to three times during the speech. Don't do it all the time. Vary it with others, e.g. use sincere mode, use excitement, ethos attacks (attack the credibility of opposition) and comedy. WARNING: Do not use comedy if it is not related.

Use of props

In answer to this question, the presenter said it was not illegal to use props but he personally would find it very difficult to find a situation that the use of a prop advantaged the user. In fact, in most situations, it would be to their detriment. Therefore, do not use props.

The final speakers - third affirmative and third negative

Their primary objective is to give a summary.

Their rebuttal should be more general and broad. There should be a case comparison. What was the big issue? What were we really debating about? Why was your team better? Try to pretend to be unbiased when you are comparing the cases. Do not rebut minor or insignificant points e.g. he incorrectly stated the name of the dictionary used or the page number. Your team summary is important. Therefore, the third affirmative and negative speakers need to know the speeches of the other two speakers. They need to understand the team case totally - who, what and when. This is important if they are to properly compare and contrast each team's arguments. The summary needs to state clearly the theme and definition. It needs to follow the team splits- first speaker's points, second speaker's points. The conclusion must reiterate the theme.

Manner

It is bad manners to obscure the Chairperson. Stand to one side. High school speakers should aim to remain on one spot and not walk around. The ultimate goal of all speakers should be to have no palm cards. However, for junior debating, it is advisable that you begin with ten and try to set a goal of three to five cards with main points only.

Eye contact

Pick out people in the audience at random and make eye contact. Practise, Practise, Practise!

Gestures

They aid an understanding. They also need to be practised with various parts of the speech.

Exercise 101 Starfish pest study in Hypothetical Bay

1. The control of the number of pests by using its natural enemies (living organisms).
2. Dr. Morrison bred thousands of baby Crown of Thorns as that they could be released in a study area and their survival rates monitored.
3. Crown of thorns feed on coral polyps.
4. Dr. Morrison can better manipulate and control the experiment. Knows the number of starfish present.
5. The Great Barrier Reef Marine Park Authority.
6. The project will monitor;
   1. the effects of pesticides
   2. the effects of fertilisers
   3. human effect on reef
7. Possible biological control;
   - triton shell
   - other molluscs
   - reef fish
   - many possible species
8. An introduced biological control organism may itself become a problem.
9. 1. control of prickly pear
   2. control of salvina (water weed)
   3. control of rabbit population
10. 1. introduction of cane toad to control cane better
    2. introduction of mosquito fish to control mosquito

Exercise 102 Marpol

See answers in booklet

Exercise 103 Master Mariners story

1. Students use map to locate ports.
2. Not far
3. With plastic bands
4. For sale, breading, slaughter
5. See student answers.
6. Wooded crates, glass, paper, plastic, cans
7. Use the facilities at an ecoport

Exercise 104 At the fish shop

See students project results.

Exercise 105 Prawn fishery economics

1. Preliminary catch is the catch for the first half of the season. This gives a reasonable measure of the total catch of conditions remain constant
2. 1. Mornington
   2. Bold
   3. Melville
   4. Bonaparte
   5. Weipa
   6. Port Essington
   7. Croote
   8. Mitchell
   9. Limmen Bight
   10. Admiralty
   11. Fog Bay
   12. Edward
   13. Arnham
   14. Sweers
   15. Keerwer
   16. York sound
   17. Gove
   18. Collier Bay
3. 1. 263
   2. 1597
   3. 447
   4. 444
   5. 1448
   6. 573
   7. 549
   8 1175
   9. 864
   10. 615
   11. 574
   12. 1388
   13. 305
   14. 438
   15. 943
   16. 880
   17. 242
   18. 692
4. 1. Prawns not distribute evenly through the area
   2. Weather condition may vary
5. 1. Bold
   2. Weipa
   3. Edward
   4. 1175

5. Kearwaer
6. York sound
7. Limmen Bight
8. Collier Bay
9. Admirality
10. Fog Bay
11. Port Essington
12. Groote
13. Melville
14. Melville
15. Bonaparte
16. Sweers
17. Arrheen
18. Morington

6. No val pattern e.g Mornington had the highest effort but the lowest efficiency index and bold was the second best in these areas.
7. Average 6000 tonnes /167 boats 35.9 tonnes/boat
8. 19 +11 + 17 + 6 + 5 + 4/167 = 37%
9. These value change weekly.

Research

You are urged to get up to date information from Australia fish Management Authority P.O Box 7051 Canberra Mail Centre 2610.

Exercise 106 The Orange Roughy

1. Fish that live in tropical waters and in the deep sea do not experience growth seasons. Growth is constant and condition are constant.
2. The method used involved measuring the natural levels of the radioactive element radium = 226. Which decays at a known rate. By using this rate it is possible to calculate how long ago the element was taken up.
3. Radium 226
4. Since 0.l25g is 1/8 original sample

   1g - .5g will take 120 years

   .5g - .25g will take 120 years

   .25 - .125g will taken 120 years

   age of sample is 360 years
5. The growth rate is the highest in the first 10 years
6. See graph.
7. a. The fish have a maximum size of approximately 40cm, and reach this length after approximately 50 years, they remain at this size of up to 130 years. If a human population was sample this way in would get similar results. Growth stops at 15 - 18 years.

   b. These are not irregular results
8. Approx equation mass x activity /2 = age

   400 x 9/2 = 180 years
9. Half life is equal to rate of radium 226 = 47 years.
10. The fishery will have a short life. It is not a sustainable fishery. The stocks being taken has taken 100 years to build up and growth rates are show
11. Reduce fishery pressure

    Continued research on effect of fishing on the species.

Exercise 107 Adopt a ship

See student results.

Exercise 108 Commercial fishing game

See students game board.

Exercise 109 What type of farm for me?

1.

Species	Yield (kg/ha)
Murray cod	1800
Golden Perch	20002
Cat fish	7750
Marron	2625
Barramundi	1125
Mud Crab	783
Prawns	2800
Mussels	3000
Oysters	2250
Seaweed	30 000

2.

Species	Cost to operate
Murray Cod	$8000
Marron	$9000
Oyster	$120 000
Seaweed	$1000

3.

Species	Profit	
Murray Cod	$374 400	$5.20/Kg
Marron	149100	$7.10/kg
Oyster	432 000	$4.80/kg
Seaweed	60 000	$0.10/kg

4. Food bill is 32%.
5. Prawns have the greatest production cost per hectare.
6. Set up cost.
7. Mud crabs have the greatest profit margin.
8. Billboard, pamphlets, brochures radio TV and paper advertisements.
9. In all areas - especially in electricity usage.
10. Seaweed farms - bottom of food chains
11. Farming problem
    - Drought - salination of soil
    - Disease - less hyries
    - Flood - theft of stocks
    - Pests - food shortage

    This could also affect aquaculture.
12. Advantages of an estuary fishes
    - constant water supply
    - not affected by drought
    - has setting up cost

    Disadvantage
    - changing salinity
    - has control environment
    - more government controls
13. - Better water quality
    - Reducing chances of disease
    - Multicroping - produce seaweed, fish, crabs
14. - Poor knowledge of biology of the species, lack of quarantining of incoming stock (disease) No market for product.

Exercise 110 Aquaculture Research

1. Factor to consider when selecting an aquaculture species
    1. Marketability
    2. Production costs
    3. Growth rates
    4. Breeding rates
    5. Resistance to disease
    6. Tolerance levels
2. Increase food demand (increase in population wild stocks will not meet demand)
3. Cleanliness reduces chances of disease and disease transfer.
4. Naturally
    - Jan - march
    - Spawn at sea - young move upstream

    Hatchery
    - Water temp 21^0c, salt water
    - Use of hormones to induce breeding
5. Incorrect
    a. Water temperature
    b. Salinity
    c. Disease
    d. Infertilie eggs
6. Plankton
7. Phylum Rotifera
8. Hatchery house egg stage - fingerling stage

    Grow out area fingerling stage - adult
9. Catadromous
    - Young in fresh water adult in salt
    - Egg to fingerling , move upstream and into salt
10. 5 years
11. 5 year size of 120 cm
12. Control of salt concentrations by the liver
13. 25^OC in brackish
14. Depends on farming conditions
15. Depends on farming conditions
16. Depends on farming conditions
17. Mud crabs are
    1. Territorial
    2. Cannibalistic
    3. Burrow in dam walls
    4. Hand to harvest live under the mud feet at night
    5. Disease problem when the moult.

Exercise 111 Test

See answers in text .

Section 4 Management and conservation

Exercise 112 Key Terms

See terms and definitions in text .

Exercise 113 Attitudes and values

See students results.

Exercise 114 Ecological sustainable development

See students answers.

Exercise 115 Sea rights - three level guide

Note: P = paragraph, L = line

Level 1

1. True, P2, L1
2. True, P7, L9
3. False, P14, L1
4. True, P11,L1
5. False, P6,L5
6. True, P3,L1

Level 2 Drawing conclusions

1. False professor Richard Bartlett stated that coast in Canada, USA, and NZ have recognized the sea rights
2. True, P8 line 1. The hope ownership of marine areas linked with land
3. False, this has not been claimed
4. False, no buffer zone has been suggested
5. Customary marine estates that has ownership
6. Non-aboriginal of aboriginal people can have native title.

Exercise 116 Territorial waters and eez

See students answers.

Exercise 117 Multiple Use

1 a. Boat netting and spear fishing is allowed in all areas except around Halfway Island and Middle Island.
b. A permit is required for camping but it is allowed
c. Collected is limited in most areas but not permitted in Great Kepple, North Kepple, Middle or Halfway Islands
d. Commercial netting is allowed in most areas but not permitted in Marine National Parks 'a' and 'B' zones
e. Diving and research is allowed in all areas
f. Tourism and education facilities are permitted in all areas of this section
g. Traditional hunting is permitted in all areas except for around Middle and Halfway Islands
h. Trawling is not allowed in this area.

2. Oil drilling and mining is not allowed because it may lead to the destruction of the reef by pollution

3. Colour is used because it is easier to understand

4. Activities prohibited in green zone are:
a. Boat netting
b. Collecting
c. Commercial netting
d. Crabbing
e. Line fishing
f. Spear fishing
g. Traditional Hunting
h. Trawling

5. Yes you may trawl for scallop around man and wife rock.

6. You can camp on North Kepple Island if you have a permit

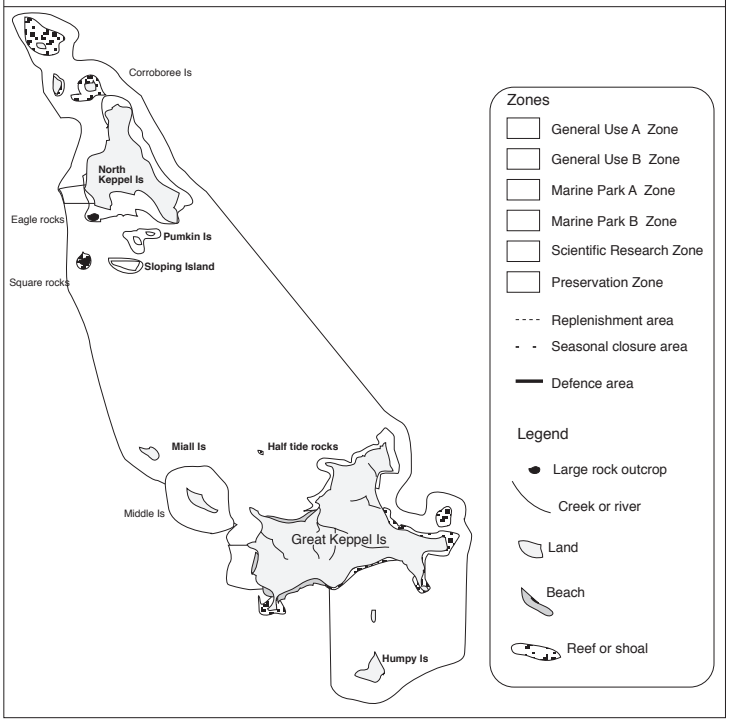
7. Fishing is allowed but normal fishing regulations apply (QFMA rules)

8. To protect the environment

9. I believe these zones should be revived regularly (approx every 5 years)

11. To allow regeneration of the these areas.

Permitted activities guide	Bait netting and gathering	Camping	Collecting (recreational not coral)	Collecting (commercial)	Commercial netting (see also bait netting)	Crabbing and oyster gatherin	Diving, boating and photography	Line fishing (bottom fishing, trolling etc)	Research (non-manipulative)	Research (manipulative)	Spearfishing	Tourism and education (facilities and programs)	Traditional hunting (fishing and gathering)	Trawling
General Use A Zone	**Yes**	Permit	Limited	Permit	Yes	Yes	Yes	Yes	Yes	Permit	Yes	Permit	Permit	Yes
General Use B Zone	**Yes**	Permit	Yes	Permit	Yes	Yes	Yes	Yes	Yes	Permit	Yes	Permit	Permit	No
Marine Park A Zone	**Yes**	Permit	No	No	No	Limited	Yes	Limited	Yes	Permit	No	Permit	Permit	No
Marine Park B Zone	No	Permit	No	No	No	No	Yes	No	Yes	Permit	No	Permit	No	No
Scientific Zone	No	No	No	No	No	No	No	No	Permit	Permit	No	No	No	No
Preservation Zone	No	No	No	No	No	No	No	No	Permit	Permit	No	No	No	No
Replenishment Zone	No	No	No	No	No	No	No	No	Permit	Permit	No	No	No	No



Exercise 118 Management strategies

See students answers.

Exercise 119 Why are MEPA's necessary?

1. IUON - internal union for the conservation of nature.
2. MEPAS Marine Protected areas -regulations controlling what happens in the area are set down by the law.
3. Longterm solutions

   Port Noalunga

   - Council in Port Noalunga needs to build another sewage treatment plant, all houses are to be linked to the sewage treatment plant.
   - Storm water also needs to be treated

   Green Island

   - Treated sewage should be shipped back to the mainland where it could be used as fertilizer for farms etc.
   - Continue with management plant

3. This is a local question

Extension activities

1. You may wish to invite one of these community groups to speak at your school.

Exercise 120 Trade waste

Students complete table from class visit.

Exercise 121 Local management issues

Students answer questions after watching the video.

Exercise 122 Adopt an NGO

Students join an NGO and interpret information received.

Exercise 123 MESA Seaweek and Ocean Care Day

Students participate in Seaweek and Ocean Care day.

Exercise 124 Live fish exports

Video Port Lincoln Fishing Industry

Port Lincoln Apex Club

P.O Box 625

Port Lincoln SA 5606

Questions are answered on the video - however video is not easy to get.

Exercise 125 Oil and gas

See answers in booklet and student research responses.

Exercise 126 Locations of Australian fisheries

Students use book to complete project.

Exercise 127 Conservation principles

See student responses.

Exercise 128 Riparian habitat assessment

1. Its a catchment area.
2.
   - Riparian zone is zone beside creek including all the trees
   - Verge vegetation is trees/scrubs nearest creek - not the tall trees
   - Floating vegetation - draw plants floating in water
   - Emergent vegetation - reads whose roots are in the creek bed but grow out of the water
   - Submerged vegetation - plants growing under the water - algae
3. Silt could cover them up
4. Sand would blow in from the beach and cause beach erosion
5. Allows animals to move from tree to tree - recognise migration trails, leave scent trails

Exercise 129 Water velocity in the catchment

The graphs show that the land with high surface run off has the greatest speed.

Land which can allow water soak in allows water to filter before reaching the stream and therefore the sea.

Exercise 130 Sourcing litter pollution

Students complete exercise to collect litter.

Exercise 131 Conflicts

1. The building blocks of modern society
   - Improved technology has lead to increase in water production.
   - Species is not concerned with pollution problem/does not care for environment.
   - The species produces large amount of wastes in Australia.
   - Some waste materials may be toxic.
2. Other characteristics of *Australia humanii*
   - Lazy need to not rely on technology.
   - Likes to control the environment.
   - Use earth resource with little consideration for the future.
   - Uses fertilizers, pesticides toxic compounds.
   - Introduces exotic species.
3. Future of *Australia humanii*
   - Use of land with dump sites.
   - Increase pollution of rivers and land.
   - Earth will become one big nest.
   - Pollution may effect food source.
   - Tighter government controls may be needed.
4. To improve the future.
   - Educate the species.
   - The species needs to start recycling.
   - To make biodegradable materials.
   - To make better use of resources.
   - To research methods of reducing.
   - Waste production.
   - Go back to basics.

- The impact is that humans want the good life and the technology that leads to the destruction of the environment but also want a pristine environment.
- People in the march have all the picking of a modern society.
- Cameras, sunglasses, foot wear, clothing with stencilled paint, have used paints on placards, have probably driven to march but want a pristine environment.

Conflict internationally

- Japanese process whales for meat (religious reasons prohibit some from eating meat from four legged animals)
- This group of people want it to be stopped

The conflict is how we use the environment and still preserve it. Marches highlight the issues so that the general public become aware of the problems.

Exercise 132 Dilemma exercise

1. a. Going to the beach is everyone's right.
   b. The coast provides so many resources that there is enough for everyone.
   c. Water is 'common' property and belongs to everyone.
   d. The government and the local authority have a duty to tidy things up.
   e. We should all save water, cleanup litter and avoid pollution, but everyone has to do it.
   f. Freedom of action is my right, so long as it doesn't harm anyone.
   g. If you have to pay to go anywhere like the beach, then that is penalising the poor and makes the beach elitist and for the rich.
   h. I know what to do to conserve the coast's so I can't be doing any harm.
   i. Beauty is in the eye of the beholder - everyone likes different things.
2. a. Cleanliness leads to dirty water - everyone causes pollution.
   b. No ecosystem exists by itself because the ecosystems of the world integrate together.
   c. 'Waste not - want not' keep it to our basic needs.
3. Class opinion may vary on this topic. Suggestion - site should be identified, a billboard educating the public about the significance of the site, the history of the site, the aboriginal heritage and importance of the site. It could be placed on the council's tourist guide to the area.
4. a. provide bins on the jetty that are emptied regularly.
   b. form a 'Save the Jetty' group which will look at regular maintenance and cleanups.
   c. The council should be asked to complete regular cleanups of the area.
   d. Erect sign to educate the public and instill a pride in the jetty.
   e. Hold a fishing contest on the jetty to raise money to help with the cost of maintaining and cleaning up the jetty.

Exercise 133 Writing a newspaper article

You may wish to write an article on a major problem facing Hypothetical bay

e.g a. Oil tanker sinks off Jensen River.
   b. Toxic compounds kill fish in Hyer River.
   c. Piranha found in Lynch River.
   d. Crown of terms found on Rogers Reef.
   e. Make mariner for Jensen River.
   f. Jensen River to be dregded.
   g. Cols Reef to be set up as a resort.
   h. Batestown council to develop a garbage tip in mangroves at mouth of Lynch River.

Exercise 134 Future problem solving

Case 1

Who	Fishing People
What	Compensation
Where	The estuary of the Derwent River, downstream from Hobart
When	When their catch is condemned
How	How did the mercury get into the fish?

Identify the problem - statement

The fishing people want compensation by someone when their catch from the estuary of the Derwent River, downstream from Hobart, is contaminated because of high mercury content

Underlying problem identifiedA 'How question'

How can we find the source of the pollution so the people responsible for polluting the river can compensate the fishing people when their catch from the estuary of the Derwent River, downstream from Hobart, is condemned due to high mercury content.

Solution

- The local government should be responsible for regular water testing to determine who caused the high mercury reading in the river and where and when it was first released into the river
- The state co-ordination committee needs to collect data on fish from other areas in the state to see if this problem is state-wide.
- The government control officers so that these problems are recognised before they become a health risk. This could be financed from fines levied on companies causing pollution.

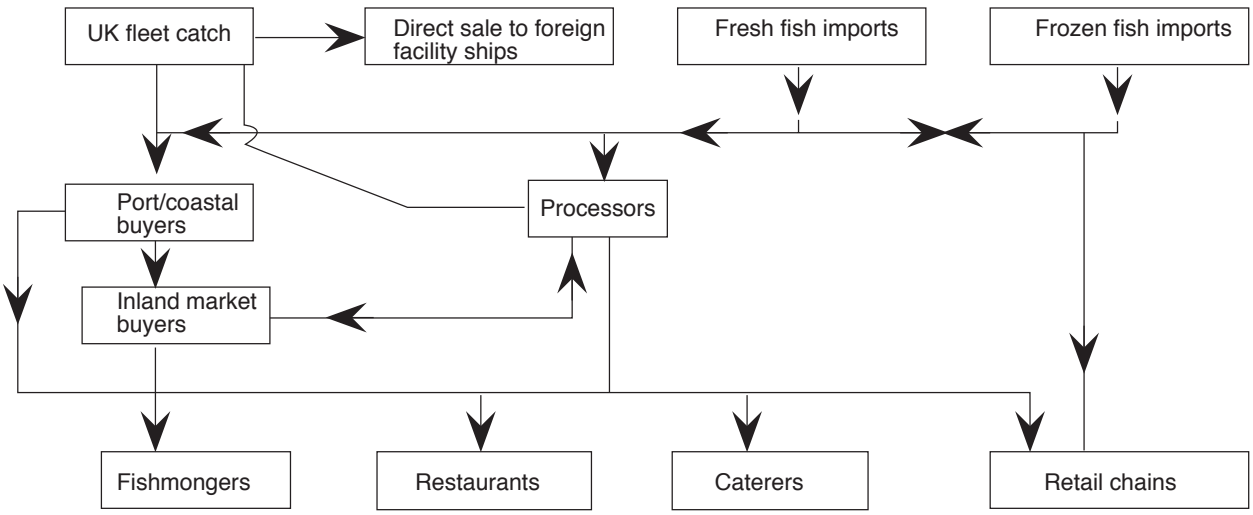
Exercise 135 Venetian Island

1. a. The site is an island on the Gold Coast Broadwater near Sovereign Island. The island is covered by mangroves.
   b. 1. A bridge from island to Paradise Point
      2. A 396 room international hotel
      3. 396 condominiums
      4. A 80 berth marina
      5. 20 boutique shops, five restaurants, tennis courts.
   c. The Japanese development company Alpha Corp. will develop the resort. The Raptis Group Ltd will build the bridge. Neumann contractors will complete the work. Noel Robinson architect designed the project.
   d. The resort will feature canals, gondolas and piazzas and have the style and ambience of the Mediterranean.
   e. No mention of protection of the natural environment was made in the article.
   f. Since it was 2 years in the planning you would expect an environmental impact study would have been completed.
   g. It was not a fast tracked development
      • Fast access bridge.
      • Architectural designed.
2. A local based question
3. a. A strategy is the planning and directing of a campaign, it is a blueprint for the development. It has a policy and a programme
   b. 1. We need knowledge to make a better strategy
      2. To learn from your mistakes and take advantage of previous studies. To involve the community will give a wide range of opinion.
      3. To better use the resources without destroying the resources.
      4. To let the experts who have the knowledge make the decisions not the politicians.
      5. To develop an overall strategy.
   c. We need to conserve not reserve an area.

Exercise 136 Tweed river walls

1. • Accumulation of sand at the southern end of the Tweed River
   • A deficit of sand on the Southern Gold Coast Beaches
   • Destruction of the Kirra Camp ground
   • Without the depth of water in Rainbow Bay
   • The waves stuck the beach with great force and at an angle ripping the sand away
2. a. (i) and (ii) Unknown - possibly Training walls
   b. (iii) Unknown - possibly since (iv) Since Not easy questions to answer
3. a. Since the development of the Kirra Point Groyne, erosion has occurred at Kirra Beach
   b. The Kirra Groyne had to be build to fix the erosion at Kirra Beach. This caused erosion on the Northern side of the Groyne
   c. The sand nourishment program began to fix the problem of the southern Gold Coast Beaches
   d. The sausage groyne was put into place to fix the problems caused by the Kirra Groyne.
   e. The Vlaanderon XX operation deposited sand on the offshore bars and some on the beach
   f. The beach nourishment program was caused by the Tweed River walls
3. See students answers.

Exercise 137 Managers and user groups



Source - Australian Fisheries Dec-Jan 1995

2. Australia has exactly the same problems.
3. Reduce cost
   a. Have a large processing ship as a mother ship to reduce travel cost with the trawler having to go to and from port
   b. Use satellite information to detect good fishing areas
   c. The new technology to process fish.
4. Effects
   - Has fresh fish for sale/more processed fish
   - Equipment and trawler casts increase

   Social problems
   - Greater tool burden on workers.
   - Increased crime.
   - Increase high density housing.
5. - Species and products not now sold (by product) could be marketed to increase profits
   - Greater percent of fish in the diet
   - Marketing research
     - could be paid for by the Government
     - A levy could be placed on the profit makers in the fishing industry

Extension question

1. Australian fisheries booklets are a good source.

Exercise 138 Management proposals

Management Proposals

1. Editors note: (I did not know fish had tongues)
   - The water quality in this area is poor
2. Bay limit on fish
   - Reduce fishing pressure
   - To stop overfish
   - To stop wastage of catches

Limit development

- To stop sewage entering the coastal water
- To reduce marine pollution

Tertiary Treatment

- Reduce nutrients entering the marine environment

Establish marine protected area

- to provide for the protection, wise use and management of this natural resource

3. Use your imagination
4. Students design word puzzle
5. Draw up a board game with a circuit and squares

   Design and create captions e.g
   - Oil spill from shipwreck go back 5 spaces
   - Storm water drain nearby go back 2 spaces
   - Recycling plant set up go ahead 6 spaces
   - Marine protected area advance 8 spaces
   - See Exercise 108. Commercial fishing games.

6 & 7,The poster could be on a sea week theme

Exercise 139 Hypothetical bay 2010

1. a. New breakwater at mouth of Lynch River
   b. Freeway to new airport
   c. New airport
   d. establishment of Steggles Beach Marine Reserve
   e. Dredging of Watson Bay
   f. Merino Wharf
   g. Proposed harbour town on Lynch River
   h. Fishers Wharf
   i. Building of O'Connor Bridge
   j. Development of Marina city
   k. New resort on island near Wright Point
   l. New marina near mouth of Lynch River
   m. Boat ramp on Collins Creek
   n. Developing McRobbie causeway
   o. Developing Watson Bay National Park
   p. Developing Pattern Reserve
   q. Developing Cadell National Park
   r. Holthouse Flats development
   s. Developing Harding Island
   t. Lynch River was dredged
2. This is a sand dune area and is continually being eroded and built up again by nature. If development was to occur this would need development of sand stabilizing measures. It is a very fragile area.
3. No. This would cause pollution problems in the waters of the area.
   1. Recycled - used a fertilizer on land
   2. Undergo tertiary treatment
4. 1. Increased noise may effect the natural fauna
   2. The parrots of Smith's National Reserve may be killed by planes or chased from the area
   3. Site work may affect fauna
   4. Pollution may also be caused
5. 1. More tourism
   2. Better boat anchorages
   3. Maybe more trawlers visiting the area and a fish market may be established
   4. More revenue in local economy
6. a. Marine Park A zone which allows
   - No collecting
   - Diving, boating and photography
   - No commercial netting
   - No spearfishing
   - No line fishing and crabbing
   - Camping is permitted
   - Research is permitted

   This zone will allow use of the area but not destruction of the area. If it was zoned - preservation this would not allow any ecotourism in the area.

   b. Government agency to implement zoning

c. After 25 years of Marine Park A zone I would hope that the reef is in a similar state as it is today. Only Preservation Zoning would guarantee it to remain in a pristine state. Pollution so the seas may also affect the area.

7. The freeway will cause growth of Marina City.
8. Water is 'common' property and belongs to everyone. If the resort went ahead I believe the beach and tidal zone should have public access.
9. With the increase in population there will be an increase in boat usage and Perry Shoals will need to be zoned.
10. 1. A population cap be given to the area
    2. Increase research on coastal habitats to investigate long term effects of the population increase
    3. Establish a better system for setting up coastal reserves
    4. Provide advise and expertise to local government authorities so development decisions can be made.

Exercise 140 Controversy at Hypothetical Bay?

See students responses.

Exercise 141 Best environmental practices

See students responses.

Exercise 142 Problem solving

See students responses.

Exercise 143 Images essay

Suggested ideas overall

1. Humans are prepared to sit back and not care or give a damn about the environment.
2. Pollution is killing our oceans.
3. Our planet is dying.
4. We need to educate humans about pollution guide

Guide

1. a. I wish I could drink what the human is drinking
   b. Wondering why the human on beach does get up to help us.
   c. Discussion on water quality
   d. I wish the human had to drink this!
2. a. Someone sending a message to clean up the place
   b. Message asking for help as the planet is dying
   c. S.O.S message on pollution
   d. Message asking humans to stop polluting ocean. Message from king Neptune
3. a. Ocean is being used as a garbage tip
   b. Pollution placed in oceans over time are now killing the marine life
   c. People do not care
   d. People do not consider the consequence of action taken when polluting
4. a. Disgusted at levels of pollution
   b. Anger at stage of environment destruction
   c. Helplessness
5. a. Both are living things and how equal rights to life in the oceans
   b. What each contributes has a human bias to how they help humans

   Fish
   - Food
   - Importance in food chain
   - Recreation
   - Help control detritous matter in ocean

   Dolphin
   - Tourist attraction
   - Importance in control of fish numbers
   - Mammal warm blooded more important then cold blooded

6. Management
   - No human waste to be place in the sea
   - Pick up rubbish and remove from island
   - Complete water tests to determine source of pollution

   Legislation
   - Fines for littering
   - Introduce recycling
   - Lean dangerous chemical and products containing these chemicals
   - Contracts not to pollute island must be signed by visitors
   - Educate the public on the consequences of pollution
   - Fines on pollution

Exercise 144 Whale Bay game

1. Students read information sheet C and mark map
2. Students use map to circle locations
3. See map on page 318
4. Fishing, tourism
5. Antarctica and return in September and October
6. Distance boats can approach whales, no trash in the sea, water quality monitoring
7. See students answers

Exercise 145 Traditional management methods

Students to complete from talk given in class.

Exercise 146 Drain stencilling

Students design drain sprays and use them.

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