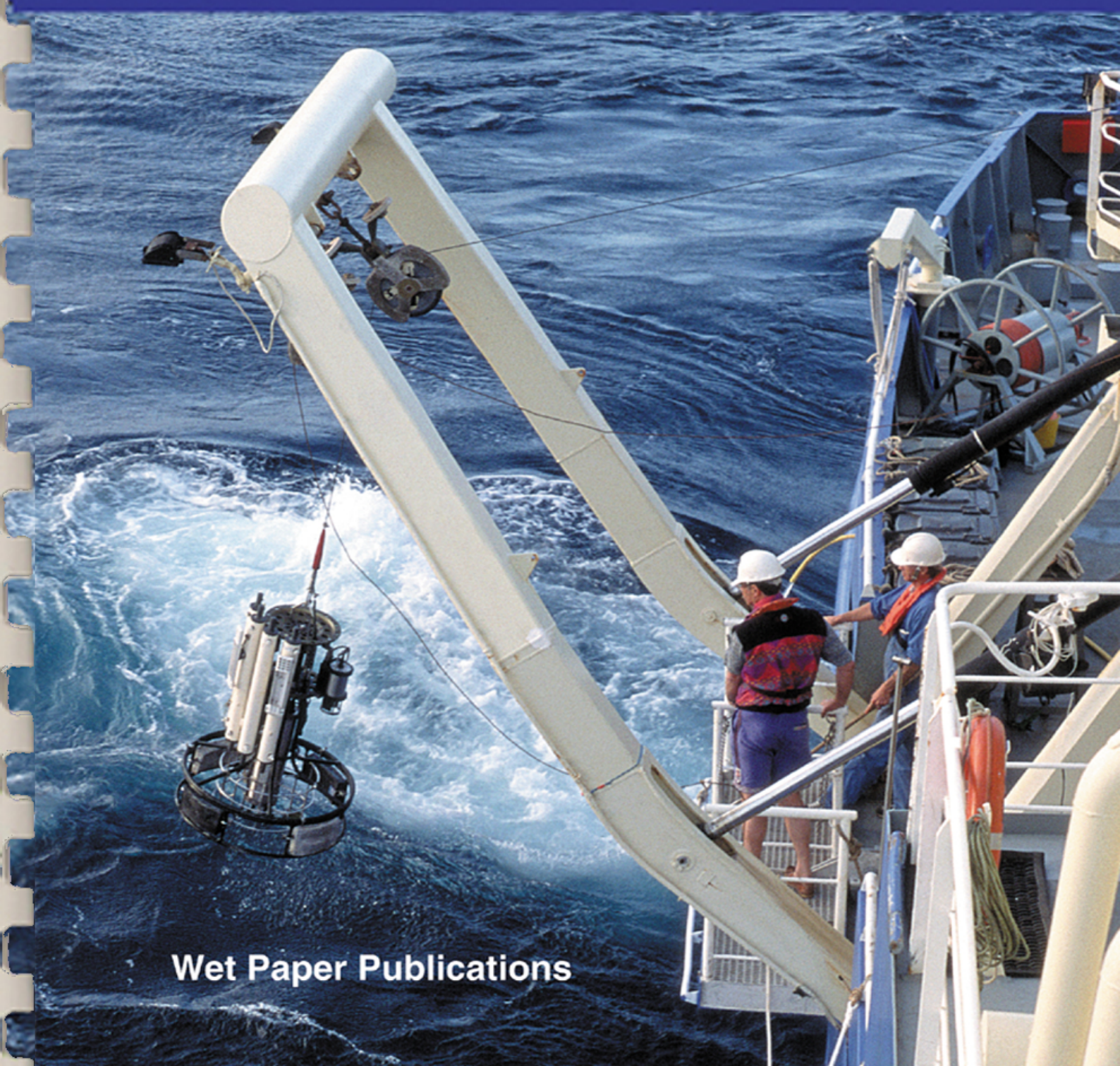
Marine Science
For Australian Students

Chapter Questions



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Contents

Chapter 1 Questions

Page 15 Questions

1. Explain the principle of the echo sounder used to determine the depth of water in an area.
2. Draw a labelled diagram of the ocean floor. Suggest a reason why the continental shelf is normally flat.
3. Distinguish between the terms asthenosphere and lithosphere. Draw up a table to define the terms and illustrate them with a diagram.
4. How much of the earth's surface is made up of deep ocean basin floor? What are the two main regions of the deep ocean basin?
5. Compare the slope of the continental slope and the continental rise.
6. Describe the submarine canyon appearance. Where are they found and how may they have been formed?
7. Explain how the bathyscape, Trieste was able to descend into the depths of the ocean.
8. Draw a diagram of a cross-section through the earth showing its composition and structure.
9. Compare sial and sima. Why will sial float on sima?
10. Discuss the link between of the Law of the Sea 1982, plate tectonics and what Australia can claim as its own territory.

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1. Describe what happened in this article.
2. Explain the terms *Gondwana, abyssal plain, metamorphic rock, hydrocarbon deposit, seismic profile*.
3. Examine illustration 13.1B on page 13. Now redraw the illustration and shade in where the *RV Franklin* probably was when seismic profiling was done.
4. How far does the eastern offshore margin of Tasmania extend?
5. Explain what type of data could be derived from the deployment of a one-tonne piston corer with a ten metre long sampling pipe.

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1. How could knowledge of the variations in the earth's magnetic and gravitational fields help our understanding of the formation of the sea floor?
2. In what way will these studies increase scientific understanding of Australia's offshore environment?
3. Define the terms bathymetric data and sedimentary strata.
4. To what depth can multi-beam sonar systems map? How much of the sea floor has been mapped by the methods described here so far?
5. Who should pay for this research if it is made public and commercial enterprises can be developed to this baseline research? Where has most of the exploration of the marine environment occurred?
6. Redraw Figure 30.2 and explain how each of the various pieces of equipment work.
7. What do you understand by the term — sea bed habitat map and why are such maps important?
8. What would a typical habitat description include?
9. Calculate the number of square kilometres that could be mapped in a month using the methods described in this article.

Page 32 Chapter questions

1. Who proposed the theory of continental drift? List some of the evidence to support the idea of continental drift.
2. What was the name given to the super continent when it was believed all continents were joined together?
3. When and where did ancient large marine reptiles inhabit Australia?
4. List the world leading techniques being developed by the CSIRO to rapidly assess sea bed environments.
5. What happens when the plate has a weak spot on it?
6. How fast is the Australia plate moving and in which direction are we moving?
7. Define the following terms: subduction, earthquakes, transverse faults.
8. What are land bridges and how have they affected the distribution of animal species? Why did they not affect the distribution of plant species?
9. Draw a diagram of Australia 220 mya showing its nearest neighbours.
10. Describe the dust cloud hypothesis.
11. There are many marine fossils and coal deposits in Queensland. Suggest an explanation to account for their presence.

12. Draw a cross-section through oceanic crust to distinguish between oceanic and continental crust.
13. Explain how modern day reefs came to be in northern Australia.
14. Explain how the ocean plates are thought to move. How do mid ocean ridges form? Describe the age of rocks found at the midocean ridges.
15. Draw a diagram to explain the formation of volcanic island chains that are found in the Pacific Ocean.
16. Describe the Rainbow Serpent story and its significance for Aboriginal people.
17. Fossils of tropical plant species have also been found in the Antarctic. How do you explain the presence of these fossils?
18. Explain the glacial evidence that supports the idea of continental drift.
19. Use your knowledge of plate movements to explain the formation of the Great Dividing Range and the Kimberleys in WA.
20. Summarise the benefits of mapping Australia's ocean territory.
21. How can the discovery of mineral nodules on the ocean floor demonstrate that the sea floor is spreading?
22. Suggest why earthquakes occur more frequently in Los Angeles than in Sydney.
23. Similar fossils are found in Australia, South America and South Africa. Suggest what this may indicate.
24. Many mineral resources are being found in undersea surveys. Outline some of the problems that might surface in developing deep ocean mining. Suggest some environmental problems that deep sea mining might cause. Do you believe off-shore oil resources, if found around the Australian coastline should be exploited?
25. Compose a rap, poem or rhyme to illustrate the difference between an earthquake and a volcanic eruption in terms of plate subduction.
26. Build a model to explain the difference between mountain building and ocean building plates.
27. Research earthquakes in newspaper cuttings. Can you relate these to plate movements?
28. Extrapolate the question "What studies are necessary for environmental monitoring to ensure that marine industries develop sustainably?"
29. Outline the reasons why the deep sea environments should be protected. Who should be in charge of the policing of this protection? Suggest some policies that should be included in this protection document.
30. Outline the reasons for the need to study plate tectonics and the Law of the Sea declaration.

Chapter 2 Questions

Page 40 Questions

1. If a surfer counts 50 waves washing onto the beach in 15 minutes, calculate:

   a. The wave period (time between waves in seconds).

   b. Wave frequency.

2. If a fisher counts 180 waves washing on the beach in 1 hour, calculate the wave's:

   a. Period

   b. Frequency

3. If waves in the sea have a length of 30 metres and a velocity of 28 m/sec, calculate the wave period.

4. A Tsunami that was caused by an undersea earthquake that occurred off the coast of North America reached Christmas Island in the Pacific Ocean in 6 hours. It was estimated it had travelled 5,000 km

   Calculate the speed at which the wave moved.

   Calculate the time it would have reached the Hawaiian Islands, which are located 2,000 km from the epicentre of the earthquake.

   Calculate how long it would be before the next wave hit the island if the wavelength was 300 km.

5. Why would larger waves overtake smaller waves at sea?

6. Who might be interested in these observations or calculations and why?

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1. What was the percentage of wave height recordings that ranged between 1 – 2 metres?

2. A total of 1102 observations were recorded. What should have been the total number of observations made and how many observations were not recorded? Suggest an explanation to account for the difference.

3. Identify the variables that the oceanographers need to consider in this experiment.

4. How many days were the wave height recordings over 4 metres?

5. On how many days were the sea conditions ideal for boating? (0 –0.5m waves) Express this as a percentage of the year.

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6. From Figure 44.2 determine the highest offshore wind speed and the date on which it occurred.
7. Determine the highest on-shore wind speed and the date on which it occurred.
8. Determine the highest wave height that occurred in July. On which date did it occur?
9. Suggest a reason for the decrease in wave heights from 6th to 10th July.
10. A student formulated a hypothesis that the speed of offshore winds had no effect on wave height. Do you agree with this hypothesis? Support your argument with data from the graph.
11. Analyse the graph and suggest what conditions are needed for large waves to occur.

Page 45 Questions

12. How did the sea conditions in August compare with the July readings?
13. On 23th August what was the wind speed and direction and what effect did it have on the sea conditions?
14. How do you explain the wave heights recordings on the 28th to 29th of August?
15. Given this data extrapolate the wave height you might expect if the following conditions occurred: offshore winds blowing at 40 knots for 2 days followed by on-shore winds blowing at 20 - 25 knots for 3 days.

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These questions refer to Figure 45.1.

16. What was the largest variation that occurred between the estimated and the actual wave heights in January? Which was highest, the estimated or the actual height?
17. What percentage of the time was the estimated wave height higher than the actual wave heights?
18. Suggest some of the factors that may have caused the forecaster to “not get it right”.
19. Could you suggest that the forecasters did a good job for this period?
20. The forecast for a day you were intending to go boating was for sea heights to 2.5 metres in height.

    These conditions are the maximum conditions for safe boating in your vessel.

    Would you go to sea?

    Explain your answer with the support of the data in Figure 45.1.

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Study the two satellite images above and answer questions 1-8 below.

1. Convert 10.4 metres per second to kilometres per hour.
2. Where were the winds the strongest off the Australian coast and what were their speeds?
3. Locate the areas off the Australian coast that were experiencing wave heights of 3 to 4 metres.
4. Describe the area of the ocean that had wave heights over 5.0 metres. How do you account for these conditions?
5. The patterns vary for the two images. Suggest an explanation for these differences.
6. Analyse the information in Figures 46.1 and 46.2 and draw conclusions about the effect of the wind on sea waves.
7. Construct a graph to illustrate the relationship between wind speed and latitude.
8. Formulate a hypothesis about wave height and wind speed for the Western Australian coast.

Page 56 Questions

1. What are waves affected by as they approach the beach?
2. Name three types of wave and use drawings to illustrate your answer.
3. What is a rip? Use a drawing to illustrate your answer.
4. What is an onshore wind and what type of surf does it create?
5. Define the following terms

   - Orthagonals

   - Fetch

   - Seismic sea waves (tsunamis)

   - Storm surge
6. What is a *convergence* and how does it affect marine life on the coastline adjacent to it?
7. Where is the Leeuwin Current?
8. Beaches with a sand sea floor have a different wave-breaking pattern than beaches with a reef or rock sea floor. Write a paragraph explaining why.
9. Why does the wave shape change with the tide?
10. How do waves affect marine life?
11. Interpret the statement that — the bigger the fetch and the stronger the wind, the bigger the waves.
12. If waves in the sea have a length of 40 metres and a velocity of 30 m/sec, calculate the wave period.
13. As waves approach the shore, sand causes them to slow down and bunch up. Illustrate this with a diagram.

14. Examine Figure .1 below and determine where wave refraction, diffraction and reflection are most likely to occur.
15. Use an example to show that the energy in a wave moves forward but the particles in a wave move up and down in a circular motion.
16. Compare a high tide in a local area, with a high tide when a low pressure is just offshore.
17. What are 2 similarities and 2 differences between surging and spilling waves.
18. Distinguish between wave reflection and wave refraction.
19. Identify places in your local area or where you have been on a school excursion, where surging waves can occur.
20. Explain the concept that wind-driven continental shelf waves affect inshore currents in most Australian States.
21. Devise a formula to show that as waves approach the shore they slow down. Use wavelength and velocity.
22. Predict the effects of a cyclone on your local area. What types of precautions need to be taken by local shipping? Is there a local storm or cyclone counter disaster plan?
23. Argue the point that waves have a number of mathematical characteristics which can be clearly defined in physics.
24. Assess the Australian coastline for places where a wave power station could be built.
25. Decide if localised seasonal upwellings of nutrient rich water contribute to increased productivity in some Australian states. Base your decision on the fact that Australian oceans are largely nutrient poor allowing seagrasses and coral reefs to dominate.

Chapter 3 Questions

Page 67 Questions

1. Where do adult Australian herring live?
2. When are the commercial and recreational fishing seasons in Western Australia and South Australia?

   When do you think the best time would be to go fishing in Victoria?
3. Why don't the fish get to Tasmania?
4. Where do the juveniles develop? What do they feed on?
5. Why do we have to keep pollution out of our coastal waters?
6. How long does it take for a herring to grow to an adult?
7. Draw a diagram to show how a fisher would catch a school of herring from the beach with a seine net.
8. Develop a plan to protect the Australian Herring Fishing Industry. Do you believe this should be a state or commonwealth initiative? Would a closed season be part of your protection plan?

Page 67 Questions

1. Define the terms

   a. Thermoclines

   b. Eddies
2. In what time of the year is a Leeuwin Current formed? Why is this current important to some marine life?
3. List the major warm currents found around Australia. How are these currents important to the ecology of those areas?

Page 68 Questions

Part A

1. What happens to water as it cools down from the tropics to the poles?

2. What happens to water as it moves into the tropics?

Part B

1. What happens to the dye in the tray?
2. Design an experiment to test the hypothesis that longshore drift is determined by depth.
3. Design an experiment to demonstrate refraction and diffraction (See Chapter 2).

Page 71 Questions

1. Currents that move up rivers depend on 2 factors. What are they? How can the current's speed be calculated?
2. List the 5 major factors affecting local currents.
3. List the 6 different types of local currents.
4. Rips can be both useful and dangerous, use a diagram to explain how these rips can be formed.
5. Identify the 4 types of rips that can occur.
6. What are 2 types of current measuring devices? How has satellite imagery helped us understand the oceans?

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4. When your partner is ready, release the drogue and observe what happens.
5. Use the hand bearing compass to determine the direction of the current.
6. Using the formula: Speed = distance / time calculate the speed of the current and record it.
7. Repeat your experiment twice and average your results.
8. Make a summary detailing how fast the current was, which direction it was flowing, the possible cause of the current and how the current may change during the day.

Page 77 Questions

Use Figure 77.1 below to answer the following questions

1. Suggest the sea water temperatures for a position 30 km off the coast in February at the following places:

   a. Brisbane

   b. Sydney

   c. Melbourne

   d. Hobart

   e. Perth

   f. Shark Bay

   g. Broom

   h. Darwin
2. What are the coldest sea temperatures on mainland Australia in August and where were these cold waters found?
3. Suggest why the waters in the Spencer Gulf are 20OC yet off the Kangaroo Island they are 18O in February.
4. The lines joining sea temperatures flow southward down the Western Australian coast to Perth. Suggest a reason for this phenomenon.

5. Pure water freezes at 0OC, yet some of the areas show water temperatures below this temperature. Explain these temperature readings.
6. Suggest a reason for the fact that the seawater temperatures at the same latitude are not always the same.
7. Suggest how this data may have been gathered?
8. Conduct an analysis of the data and suggest why this type of data may be useful to navigators in the Sydney – Hobart Yacht Race. If you were to complete the journey in February, what path would you take? Do you believe the current will assist you on your journey? Explain the reason for your answers.
9. Explain the change that occurred between February and August. Suggest a reason for the change.
10. How might the figures change from an El Nino pattern to a El Nina pattern? Explain your answer fully.
11. Suggest why shipwreck survivors can survive up to 40 hours in the waters off Brisbane but only 6 hours off southern Tasmania.
12. How would a plankton density map compare with this image?

Page 78 Questions

1. What was Mr Jones's major achievement as suggested in the article?
2. Calculate the distance he travelled in kilometres on his epic journey.
3. Calculate the average speed at which he travelled on his crossing of the Pacific.
4. What do you think a typical diary entry would be for day 150 of the trip?
5. Suggest the list of gear and quantities of items he would have had to carry on 'Le Turtle'.

   What safety equipment do you think he would have carried?
6. It was stated that for safety reasons he only slept for a few hours at a time for the entire journey. Why do you believe this was necessary?
7. Since 1896 there have been more than 100 attempts to row across oceans with only 50 of the rowers surviving the ordeal. The British made most of these attempts. Make a list of probable causes for the failures. Rate these causes from most likely to least likely.
8. What do you believe would have been the seawater temperature changes over the journey if he had taken daily seawater temperature readings?
9. Suggest why the boat survived the high swells and strong winds of the Pacific storms but was rolled 50m from the shore of Ballina in 1.5m seas.
10. Did he row or was he pushed? Do you think he would be able to complete a return trip? Explain your reasoning.
11. Everyone has goals or dreams. Do you believe you could spend over 200 days alone? What are your goals in life? Can you visualise yourself doing this activity? What might inspire you to make such an epic journey?

Page 79 Questions

1. How much water does the Leeuwin Current move as it heads south?
2. Who was the first person to record the effect of the Leeuwin Current?
3. Explain why the study of the Leeuwin Current is important.
4. Identify the methods that are now being used to study the Leeuwin Current.
5. Describe the life cycle of the western rock lobster.
6. Formulate an hypothesis to account for the effect of the Leeuwin Current on the number of puerulus settling.
7. In what years were the western rock lobster puerulus settlement index the highest?
8. Develop an experimental method that could be used to test the idea that western rock lobster larvae grow faster and have a higher survival rate in warmer waters.
9. Explain how the El Nino effect influences the western rock lobster catches.
10. Speculate on the effect of a mean sea level of 80 cm being recorded in Fremantle in 2020 on the settlement of the puerulus. Suggest the southern oscillation index for the sea level of 80 cm to occur.
11. Predict the trend for the settlement of puerulus over the next five years. Explain the reasoning behind your forecast.

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1. Describe a tracker buoy.
2. Name three types of currents discussed in this chapter.
3. List four major influences that create ocean currents.
4. Where is the Leeuwin current?
5. Name five places in the world where there are major upwellings.
6. Name the rising of the water from the bottom of the oceans.
7. State the name for the circular patterns of currents in the ocean.
8. Tell the story of Jim Jones and his rowing expedition from the case study on page 78.
9. Write a sentence describing a geotrophic current.
10. Convert 10 km/hr to m/sec.
11. Draw a diagram to show that you can distinguish between a land and a sea breeze.
12. Describe an experiment with an aquarium, some ice and food colouring that will show the difference between warm and cold water movement in the ocean.
13. Distinguish between an eddy and a convergence.
14. Interpret today's weather map for sea conditions in your local area.
15. Explain why ocean currents of the world long influenced trade routes.
16. Draw a quick sketch of Australia and mark in the East Australian current and eddies, the Flinders current and South Equatorial currents.

17. If a constant wind of 10 km/hr over a 24 hour period will move the water approximately 5 kilometres, calculate how far water in a current will move in 4.3 months.
18. Rate the following currents from 1 (largest amount of water movement) to 5 (least amount of water movement. East Australian current; Inshore rip current; River current; Creek current; Overflow current
19. Construct a map of the world showing the Atlantic Ocean and mark in the Coriolis currents.
20. Examine the barometer in Figure 73.4 and draw a diagram to show the difference in size of the vacuum box for low and high pressures.
21. Draw a plan view of a local beach and illustrate where rips could occur as a result of wave action.
22. Record the maximum and minimum temperatures for a week and plot a graph to show the difference. (Explain why this difference with reference to the weather map).
23. Distinguish between the West Australian current and the Leeuwin current.
24. Examine the weather map on page 74 and answer the questions below.

Chapter 4 Questions

Page 90 Questions

1. If the field of view Figure 89.2 (previous page) ie the distance across the photo shown measures 1.2mm or 1200µ metres, estimate the size of grain No 3.
2. Describe the shapes of grains 2 and 3. What are the obvious differences in shape?
3. What caused the breakdown of grain 1? Describe how this breakdown occurred.
4. Use your scientific knowledge to explain how extremes of hot and cold erode rocks.
5. How does the author explain the formation of Fraser and Moreton Islands?
6. Sketch a graph showing how the sea levels may have changed over the last 500,000 years. Explain your reasoning.
7. How and when was sand grain 3 formed? If this grain was placed on a beach for a long period of time how might its shape change?

   Explain.
8. Propose an explanation for the strength and direction of the wind during the Ice Ages.

Page 91 Questions

9. Using Figure 91.1 what can gravel beaches consist of and what will be the average slope of this type of beach?
10. What is the range of size of grains of sand?
11. Organise the data on grain diameter and average slope of the beach into a graph. From the graph predict the slope of a beach if the diameter of the particles on the beach averages 100mm.
12. Explain the interrelationship between sand type and beach shape.
13. A student visiting a beach found by doing a sand analysis that the average size of grains was 1 mm yet the beach slope was measured to be 15 degrees. Propose an explanation for this result.
14. Study the sand grains A-C opposite and use the table below to classify the class of sediment.

Page 99 Questions

Your results

1. Is the beach eroding or accreting? How can you tell from your graph?
2. How wide was the swash zone? How will this change over time?
3. Make a prediction of how this profile will change over the year.
4. Work out the profile angle and compare it with others in your class. Are they all the same?

Sand grain analysis

1. Look at the classification of particles on page 91. What types does your sand sample contain?
2. Draw the different materials in your sample.
3. Name any non-carbonate component and say where it came from.
4. Can you see any minerals in the sample? What do they look like?
5. Use pieces of sticky tape to collect a sample of your sieved sand and stick it into the space below giving them names.
6. Attempt to grind up your sample. How hard is your sample?
7. Design an experiment that will allow you to test chemically if a sample contains calcium carbonate.

Page 101 Questions

9. Calculate the percentages using the formula: Per cent = weight of sample x 100 total weight of sand
10. Record these in the table (you will have to take a screen shot and type in answers).

Page 102 Questions

1. Sand is composed of different grain sizes. Do your results agree with this statement?
2. Why are smaller grain sizes found at the top of the beach?
3. Which type of vegetation is responsible for capturing this type of sand grain?
4. Why are dunes fenced and covered with cloth as part of dune management practices?
5. Large sand grains are found in the surf zone. Why?
6. Sand is composed of different grain sizes with the greatest percentage of large grain sizes at the bottom of the beach. (Your sieve sizes have to match the range of grain sizes you are working with. Coral Islands will have different sieves for coastal beaches with low wave action.)

   a. Where was the greatest percentage of larger sand grains on your beach?

   b. Is this consistent with the statement at the beginning of this section? Account for any differences.

Page 103 Questions

1. Is there a difference between the percent composition of sands on the beach?
2. Is the beach eroding or accreting? Give reasons for your answer.
3. Where do you think the sand has come from for James Beach?
4. Compare the absorption times for the different stations on the beach.
5. Predict the effect of the newly built training walls at the mouth of Lynch River on the beach profile during storms over say 10 years.
6. If you were a beach engineer what design would you put in place to compensate any environmental damage caused by the walls at Lynch River.
7. Predict where diffraction, refraction and reflection of waves would occur. (refer back to Chapter 3)
8. What engineering features would be necessary for the airport just north of the sample site?
9. Explain the apparent discrepancies in the data at stations 13 and 14. What may have caused this to occur?
10. Propose two reasons for there being no sand at Steggles Beach.

Chapter 5 Questions

Page 116 Questions

1. Does the graph show a cyclic pattern of sand movement ie more sand moved in the summer months than the winter months?
2. What was the highest monthly volume of sand moved by the sand bypassing system?
3. How many 10 litre buckets would a cubic metre of sand fill?
4. Why will regular surveys and aerial photography of the area need to be made?
5. Suggest why Wave Break Island was built inside the river entrance (see Figure 115.3).
6. Where are the reclaimed areas and how do you suggest these reclaimed areas could be stabilized?
7. Explain the economic importance of the Gold Coast Seaway.
8. The design was based on Australia's longest record of reliably recorded wave and other coastal data collected by the Beach Protection Authority of Queensland. Why was this data necessary for the construction for this unique feature?
9. The planning and design of the various components of the project were based on results of 4 separate model studies relating to the entrance layout, stability of training walls and wave effects.

   Suggest why there may be a need for these 4 model studies.
10. Explain the advantage of a quantitative approach to studying coastal processes.
11. Why is it recommended that coastal management programs be coordinated at the Federal level of government?

Page 121 Questions

1. How much did the Narrowneck project cost? How much do the researchers believe the asset will be worth to the community?
2. Describe the sand bags that were used to form the reef. What might you compare the size of these bags to?

   Describe how the bags were transported and placed into position on the sea floor. How heavy were these bags and describe the method used to find their final resting position?
3. Do you believe that this engineering structure will be safe from cyclonic forces?
4. Why do the engineers believe that the artificial reef will produce excellent surfing conditions?

   Describe how this artificial reef forms a double sided underwater headland.

   If a surfer was to paddle out and catch a wave produced by the structure what would be the best place to paddle out?
5. What effect will this underwater structure have on the ecology of the area?

6. Explain why collecting and analysing the data is vital for clients' projects and the establishment of numerical models.
7. Discuss the processes that were involved in the development of the project.
8. Design an investigation into geotextile bags to see if they were the most suitable material to store the sand.

Page 124 Questions

1. Make a comparison of Hypothetical Bay on page 55, Chapter 3 and Hypothetical Bay on page 125 opposite. Now describe at least 20 changes that are proposed.
2. Why did the regional government ban all development along the coastline from Steggles Beach Reserve to Farmer Beach?
3. Is it a good idea to have all the sewerage effluent from the city pumped out into the ocean at King Point? What could be done with the sewerage?
4. What effect will an international airport have on the proposed Watson Bay National Park?
5. If Fishers Wharf is planned, what will be the effect on the township of Holthouse Flats?
6. Massive ecotourism is set to develop in the Bay. The reefs off Steggles Beach reserve are pristine and need management.

   - What zoning or management proposals do you suggest?

   - How will you go about zoning the reef?

   - What is your vision for the reef 25 years after you draw up these management plans?
7. How will the freeway affect Mariner City?
8. How do you feel about an exclusive resort being developed in Lynch River? If the resort went ahead, what types of access do you think the general public would have to the resort?
9. Will Perry Shoals suffer from increased use and will the whole of Hypothetical Bay have to be zoned?
10. Propose a management plan for Hypothetical Bay in Figure 139.2.

CLASS REPORT

1. Divide the class into nine groups.
2. Make a copy of Figure 126.1 cut the outside nine boxes up and place in a hat. Each group elects a leader who selects a topic.
3. Discuss the topic for ten minutes, make notes, elect a spokesperson and deliver a three minute summary on your notes.

Page 127 Questions

1. Find out when the act was presented to Parliament, by which political party and for what purpose. A telephone call is all that is required here to the authority that manages the act.
2. Copy down the headings of the main sections of the act and form groups of 3-5 to make a detailed study of three or four sections.
3. What authority or government department will manage the act? Find out their address and get one member of the class to write for a copy of their annual report. When this arrives, divide up into groups to make a study of the relevant sections.
4. Make a detailed summary of the sections your group has been allocated.
5. Make contact with the authority and find out if there have been any breaches under the act and, if so, what types of infringements occurred. Don't ask for names, dates and respect privacy. Make a list.
6. Present your report to the class under the following headings:

   • Section/s of act researched

   • Aspects covered and relevance to coastal zone management

   • Recorded breaches under the act

   • Your opinion on the usefulness of this section - what you think the strengths are and what are the weaknesses - what changes you would make – the reasons for the changes.
7. Compile these summaries and present them to your class.
8. Arrange an excursion to see how the members of parliament or local councillors debate aspects of coastal zone management and the processes by which coastal zone legislation is drafted .

EXTENSION

- Design a poster that tells people why we need beach protection. Make sure your poster contains a message and plenty of colour to bring life to your art work.
- Compile the summaries and present them to your local parliamentarian and find out when aspects of coastal zone management are next to be debated in parliament.

  Alternatively, arrange a visit to the local council or shire meeting to bear how environmental issues are debated and proposed developments are discussed.

  Arrange an excursion to see how the members of parliament debate.

Page 127 Questions

Knowledge

1. List two types of sand accumulators used to re-establish coastal dunes.
2. Name three major methods of artificial dune construction.
3. State how coastal dunes can be stabilized.
4. Define the terms – coastal engineering beach nourishment method.

Understanding

5. Outline what is meant by the saying "Beach erosion is a natural process". Why is this natural process a problem on so many of our beaches?

6. Explain why training walls have been built at the mouth of so many of our rivers.
7. List any six coastal engineering structures not mentioned in this chapter.

Applying

8. How do offshore artificial reefs help beach construction?
9. Show that you understand what a groyne is and why they are they constructed. Why are they ineffective in preventing beach erosion during severe storms?
10. Explain why the building of physical barriers reduced the width of the beach.
11. Describe any two types of models which are used in coastal engineering.
12. Explain how the artificial reef in Queensland will protect Narrowneck beach from erosion.

Analysing

13. Name two beach erosion control measures used on your local beach.
14. What are two similarities and two differences between breakwaters and groynes? (Compare and contrast)
15. Distinguish between the beach nourishment methods shown in the figure below.

16. Explain the measures we can take to prevent dune damage.
17. Discuss the accretion and erosion processes associated with a groyne.

Creating

18. Create a sand tray model to show what a beach and sand dune system looks like on your local beach?
19. Design the perfect artificial offshore reef break.

Evaluating

20. Two waves are approaching a beach. One is in shallow water and the other in deeper water. Compare the speeds and shapes of the waves as they break on the beach.
21. It has been suggested that the sand budget is “in the red”. Assess this statement and explain why it is “in the red”.
22. How might a scientist evaluate the effect of an artificial structure on the coastline?
23. Debate the use of four wheel drive vehicles on sand dunes.
24. Discuss beach erosion on the Gold Coast and decide if all the money that has been spent over the years has been worth it. Give reasons for your answer.

Chapter 6 Questions

Page 137 Questions

TESTING AN UNKNOWN SAMPLE

1. Collect samples of water from an open beachand samples from a place some distance up river so that the salinity can be compared and determined using your new calibration curve.
2. Use the same technique as described above to obtain an end point.

   Record the number of drops you used in Data Table 2, Figure 137.2 and read off the salinity from your calibration curve.
3. Summarise your results from different locations giving reasons for possible changes.

Page 138 Questions

1. Describe the appearance of the dry salt.
2. Could you see a difference in the four samples? Is there a difference in weight?
3. What happened to the salt in the bottom of the flask when the liquid was almost dry?
4. How do table salt companies obtain salt from the sea?
5. Does salt affect the temperature at which water freezes?
6. Mist and ice formed on the side of the beaker above the ice. Where did this water come from?
7. Trawler operators often throw salt over the ice used for storing prawns. Why do they do this?
8. Do you think sea water will freeze at a higher or lower temperature than fresh water?
9. Which has the greater density — fresh or saltwater ice blocks? Explain your answer.

Page 149 Questions

1. Plot a graph of the standard solution (x axis) versus the hydrometer reading (y axis). Describe how the graph changes.
2. What does a hydrometer measure?
3. Which is more dense, salt water or fresh water?
4. If the tide was coming into a river, would the sea water be found on the top of the fresh water or the bottom?
5. What do you think a salt water wedge is in an estuary?

Page 155 Question

Look at table 155.3. How much oxygen is in hot fresh water?

Page 158 Questions

Knowledge

1. Explain the meaning of the following terms:

   polar covalent water molecules, hydrogen bonding, surface tension, viscosity, density, heat capacity, salinity, evaporation, diffusion, photosynthesis, aerobic organisms, autotrophic nutrition, temperature gradient, metabolic rate, spectrum, pH, photic zone.

2. What is the formula for salt?

Understanding

3. Write the formula for photosynthesis in your own words.
4. What differences exist between the salinity at the poles compared to that of the equator? Compare also the salinities at the surface with that at 4,000 metres.
5. Draw a diagram of a water molecule to show the polar covalent bonding. What special properties does this bonding give water?
6. Write a definition for latent heat.
7. Distinguish between the biological significance of the latent heat of vaporization and melting.

Applying

8. Calculate the number of drops that would be needed to reach the end point of a silver nitrate titration on fresh water.
9. Plan an experiment to show that the density of water is higher at the bottom of an estuary compared to the surface waters.
10. Draw a diagram to show how you could measure pressure with a syringe and a house brick.
11. Examine Figure 153.2 on page 153, and explain why a coral trout appeared black when it was speared but red when it was brought out of the water.

Analysing

12. Analyse Figure 154.1 and provide evidence to support the hypothesis that water temperature decreases with depth. Justify your answer with temperature data.
13. In the experiment on Boyle's Law, are there any other possible outcomes than those described? If so, list at least one; if not say why.
14. Construct a graph to illustrate the relationship between water temperature and longitude (see page 154, Figure 154.1A).

Questions 15 and 16 refer to the table on Page 155.

15. How much oxygen can dissolve in a brackish water estuary of salinity 15.68 and temperature 19 degrees?
16. The water temperature of a mangrove swamp is 21 degrees and salinity of 15.75. Could fish survive in the swamp? Give a reason for your answer.

Creating

17. In Exercise 6.1 you worked out how to determine the salinity of a sea water sample. Can you propose how you could improve this experiment?
18. Create a powerpoint presentation to show a group of new students how to perform Boyle's Law.
19. Read about Archimedes and write a short play on how he solved the King's problem of the solid gold crown. Avoid displays of nudity as they may offend!
20. Construct a model of a salt molecule.

Evaluating

21. Assess the problem of eutrophism (page 156) and choose a better solution to paddle wheel aeration.
22. Do you believe that dilution is the solution to pollution? Justify.
23. How ineffective are secchi disks in the measurement of light penetration in sea water?
24. What is the most valuable physical property of sea water?
25. Prepare a list of equipment to be used by a marine scientist to judge if the salinity of a river changes over 24 hours.

Research projects

1. Find out about the electro-chemical series and explain how sacrificial anodes work on a boat with steel hull.
2. Explain how rust occurs using chemical equations.
3. Research modern materials that are used in marine industries to prevent corrosion.
4. Find out what osmosis is and how it affects boats.
5. The use of antifouling chemical is now carefully controlled. Find out what these strict controls are and the problems they are creating for marina operators.
6. Find out what research is currently being done by the CSIRO research vessel Southern Surveyor.
7. Find out about the effect ocean acidification will have on marine life.

Chapter 7 Questions

Page 173 Questions

1. How many outfalls sites exist along Sydney's urban coastline; what is the range of depths of these outfall sites?
2. The value of less than 300 Faecal Coliform per 100 millilitres is the level that has been set by the NSW department of health as a safe level for bathing waters. What was the beach worst affected by pollution by Faecal Coliforms and how many times did it fail to meet these standards? What was the cleanest beach?
3. From the data displayed in Figure 172.2 , what has been the effect of deep-water outfalls since their introduction in September 1990?
4. The number of Faecal Coliforms increased between January 1990 and May 1990. Suggest an explanation for this increase.
5. What was the effect of the deep-water outfall on the concentration of chlordane in oysters found in that area? Why do you believe that marine scientists study the contamination in oysters and not the amounts in larger animals such as whales?
6. Why will continual monitoring of the marine environment be required into the future? What should they monitor and how will they complete this monitoring?
7. Do you believe that there will be a long-term effect of deep-water outfall from the figures shown here?
8. Do you believe councils should be allowed to pump sewage that has had no treatment other than removal of the 'bits that float and sink' into the oceans?
9. Some people believe that the pumping of sewage into the ocean is a method of improving the productivity of the sea. Do you agree with this idea, suggest research that could be undertaken to see if productivity has increased.
10. How do you believe Sydney's sewage should be treated and disposed of?
11. Evaluate the data shown in the previous figures. Do you believe that one government department should be the testing body for the performance of another government body?
12. Why do you believe that the researchers used geometric means and not average results?
13. Extrapolate the effectiveness of this system being used in the year 2030.

PRACTICE ESSAY ON BEACH POLLUTION

Based on original exercise by Gwen Connolly.

METHOD

- There is some concern about pollution of our beaches. Some have problems while others seem to be relatively free of pollution. Select one local beach and explain its present problems and how these problems are being overcome.

  Then conclude your essay by recommending how protection of your beach can be achieved in the future.

1. Use the guide to construct a draft copy first, then write your final essay.

2. Both the draft copy and the final essay are to be submitted. (Show your teacher your draft copy before writing your final copy.)
3. Information for this exercise would come from:

   a. class work

   b. field trip to beaches

   c. library information on your local beach

Page 176 Questions

1. How does the concentration of mercury in sediments in 1975 compare with 1996?
2. What was the approximate zinc concentration in the sediments located at a distance of 40 kilometres from New Norfolk? (Note the graduations on the vertical axis.)
3. Evaluate the distance from New Norfolk when the concentration of mercury in the sediments was the highest. Suggest a reason why the concentration is high in this area.
4. Compare the amount of mercury in flathead in Ralph's Bay in 1995 with the amount in the same Bay in 1981. Explain the results.
5. The value of 0.5mg/kg has been accepted as the maximum value of mercury allowed in fish deemed safe for human consumption. From what areas should flathead in the Derwent River not be eaten?
6. Suggest why the amount of zinc is a lot higher in the mussels than the level of heavy metal mercury in the flathead.
7. What conclusion can you draw about the recorded levels of zinc in oysters over the 22 year period?
8. The NH&MRC suggests values over 1000mg/kg wet weight of zinc in oysters are unsafe for human consumption. In what areas of the Derwent River are oysters unsafe to eat?
9. Suggest how fish such as flathead may have absorbed the mercury into their flesh.
10. Suggest a method of decreasing the amounts of heavy metals such as mercury and zinc in the sediments. Outline an experiment that may test the method.
11. Zinc continues to be released from the sediments to the water above because the sediments are so saturated with zinc. Who should pay for the clean-up of the Derwent River? Debate this question within your class.

Page 177 Questions

12. Study Figure 177.3 data for trace metal concentrations in marine organisms from Australian coastal areas and answer the questions below.

    a. Use an atlas to find Cockburn Sound and suggest a number of possible sources of contamination.

    b. Compare the trace elements of cadmium and zinc in fish of the Derwent River and Cockburn Sound.

    c. Calculate the median concentration of copper in plants in Cockburn Sound.

    d. What does the term ND mean in Figure 177.3?

    e. In which animal group was zinc the highest?

13. You have been asked to attend a taskforce meeting to clean up the Derwent River. Thousands of jobs are at stake if the pulp and zinc works are closed down and you are to present some suggestions at an initial taskforce meeting to save jobs but bring in new environmental guidelines.

    a. What guidelines should the taskforce bring in for the paper and zinc plant?

    b. Which would be the highest priority?

    c. When should they be implemented and why?

    d. Who should take responsibility for paying for the cleanup?

Page 178 Questions

1. What values of per cent saturation did your other group members get?
2. What could cause levels of per cent saturation to fall?
3. How can we manage the marine environment to prevent decreases in oxygen levels?

Page 189 Questions

1. Which method was most successful?
2. Do you believe this method could be used to remove oil from the ocean? Could this method harm the marine environment?
3. Suggest other methods that could be used to remove the oil. You may attempt some of these methods with your teacher's approval.
4. Oil is an organic compound. Do you believe bacteria or other micro-organisms could use oil as food?
5. The detergent works the same way as a dispersant, used to deal with large oil spills at sea.

    a. What effect do you think dispersants may have on marine plants and animals?

    b. What is the danger of using detergents?

Page 190 Questions

Application

1. From the table of data in the figure below, answer the following questions:

    a. Which estuaries are regarded as unpolluted and which are nitrogen enriched?

    b. Which river had the highest level of nitrogen (mg/l) and what was this value?

    c. Graph the value for the Logan River for the period of 1980/81 and 1983/4. How have the values changed? Propose a suggestion to explain these values.

    d. Attempt to explain the reason why the nitrogen levels are generally higher in the upper estuaries than the lower estuaries.

    e. Where may the sewage be entering the creek? Explain.

    f. Suggest other nutrients which may have shown similar trends to the nitrogen in the table in Figure .2.

2. Muswellbrook, Singleton, Maitland and Newcastle are towns situated on the Hunter River system of NSW. Each town is approximately 50 kilometres apart on the Hunter River and used the water for domestic, agricultural and industrial purposes.

   What problems may be caused by having all four towns on the same river? Will it make the detection of the source of pollutants harder to track down?

3. Refers to the figure below for Lynch River

   a. Organisms which can only live in special environmental conditions are said to be indicator species. These organisms have a low tolerance range. Which of these species is an indicator species?

   a. catfish b. mullet c. yellow belly

   b. Why will the oxygen concentration decrease as you progress from position 1 to position 5?

   c. Discuss the water clarity, based on secchi disc readings, from position 1 to 5. What may have happened between position 1 and 2?

   d. What effect might the increase in mineral ion concentration have on the aquatic life from positions 3 to 5?

Creating

4. You and a group of friends are planning a peaceful protest rally against whaling (or an issue of your choice) in the Pacific, Indian or Southern ocean that has a police permit, your parents and all local government approvals.

   a. design six protest placards that you could use in the rally to get the attention of the world media;

   b. prepare a one page press release stating why you are opposed to whaling;

   c. write six chant slogans that you can give to the microphone leader to yell out during the march.

Chapter 8 Questions

Page 199 Questions

1. At what level are the following groups of organisms most alike?

   a. Order

   b. Phylum

   c. Species

   d. Class

2. Suppose that a bird such as a finch lived in six different areas around Australia. In each area the finches are quite different.

   - One population lives on Kangaroo Island in SA

   (Population A).

   - One population lives on Rotnest Island in WA

   (Population B).

   - One population lives in the Torres Strait Islands in NT (Population C).

   - One population lives on Fraser Island in Queensland (Population D).

   Suppose the following interbreeding occurs.

   - Group A can mate with Group B only.

   - Group B can mate with Group A, C, D and E.

   - Group C can only mate with Group B and likewise for group D.

   - Group E can interbreed with Groups B and F.

   - Group F can interbreed with Group E.

   a. How many species are there?

   b. If group F only died out how many species would there be?

   c. If group B only died out how many species are there?

   d. If group E only died out how many species are there?

3. Which of the following organisms are most alike?

   a. Achyopa niger

   b. Haliotis rubra

   c. Pastromateus niger

   d. Haliotis laevigata

4. A horse and a donkey, when induced to mate, produce a mule, which is infertile. Are the horse and the donkey in the same species?

5. Many organisms reproduce asexually, some with very little sexual reproduction. How do you think this might affect their chances of survival as a species?

6. Research the meaning of the following terms:

- Mutation
- Gene pool
- Natural selection
- Endemism.

7 Search the web for taxonomic classifications of "new" species.
- What was the basis for classifying these species?
- Who gets to name a new species?
- Is there any check on irresponsible naming?

Page 201 Questions

1. Write definitions for the following terms mentioned in the article:
   - Taxonomist
   - Endemism
   - Species
   - Seamount
   - CSIRO
   - Submersible
2. You want to dive on the reefs mentioned in the opening paragraph. Why couldn't you use conventional SCUBA gear?
3. Make a list of the different types of species referred to in the article?
4. Why is the statement "These new species are found on these particular seamounts and nowhere else, not even off the coast of New Zealand", so surprising?
5. Tropical northern Australia has low levels of endemicity (10%) compared to temperate waters (80- 90%). Why do you think this is so?
6. How different genetically does an organism have to be before it is a new species? The fact that genetic isolation is occurring despite living together also needs to be taken into account.
7. What would happen if a polystyrene coffee cup was placed on the seafloor ?
8. The smaller Trevalla population was found to be a new species. How did the marine scientists determine this?

Page 203 Questions

1. Can anybody else use your key?
2. Can you use the keys that other students have constructed?
3. What are the best/easiest characteristics to use when constructing a key?
4. What advantages would there be for scientists using such a key for classifying animals or plants?
5. Are there any other possible outcomes to your answer? If so name one.

Page 212 Questions

1. The poster depicts a range of marine organisms in various habitats spanning coastal dune to intertidal zone, rock pool, reef and open ocean, through the zone of light and into the zone of perpetual darkness.

   What does your group think of the graphic, its characteristics and setting in attempting to explain species diversity?

   a. Make a list of the types of animals and plants you can identify.

   b. Classify them as best you can using the tree of marine life (Page 207).

   c. Make a list of the external features for each organism.

   d. Make suggestions on ways to improve the graphic.

2. What is the difference between genetic, species and ecosystem diversity? Use the illustrations in the graphic to give an example of each.

3. Use the key on page 202 to devise a new key for the vertebrates shown in the graphic.

4. Draw up a two column table with temperate and tropical as headings. Now list under each heading where you think the animals and plants in the graphic would be found.

5. Study the images on pages 214 - 215 .

   a. Make a copy of each illustration and draw food webs for each.

   b. Using the tree of marine life, classify into animal and plant groups each of the marine organisms shown.

   c. Draw up a table to distinguish between the four different ecosystems shown.

   d. For each ecosystem, make a list of at least 4 individuals not shown.

6. Explain this statement:

   Food webs are one important type of interaction, but species can provide an attachment base for other species, can alter current or light patterns, provide camouflage or other forms of shelter or compete for space.

   (See page 210, para 5, for context).

7. What are the five kingdoms of marine life depicted and what characteristic/s separates them from each other?

8. Name one or more animals from the following groups in the illustration

   • Mammalia

   • Reptilia

   • Osteichthyes

   • Chondrichthyes

   • Amphibia

   • Mollusca

   • Cnidaria

   • Arthropoda

   • Mollusca

   • Echinodermata

   • Plantae

Page 217 Questions

YOUR TASK

- Look up the SA gov web site (or other Tas, Vic or NSW): www.environment.sa.gov.au/coasts/ marine_biodiversity.html and complete the following:

1. Write a report or prepare a brochure which conveys detailed information about the:

   • Biodiversity of the South Australian Region (plants, animals, fungi & micro-organisms);

   • Distribution of species;

   • Threatened species; and

   • Management actions coordinated by present authority who manages the coast protection act (1972). In 2003 it was the Coast Protection Board.

2. Detail some of the ways this board has

   • protected the coast from erosion, damage, deterioration, pollution or misuse;

   • restored any part of the coast which has been subject to any of the above;

   • developed any part of the coast for the purpose of aesthetic improvement, or for the purpose of rendering that part of the coast more appropriate for the use or enjoyment;

   • carried out research into matters relating to the protection, restoration or development of the coast.

Page 226 Questions

1. Explain why mangroves are of major ecological and economic importance to an area.
2. How many species of mangroves are found in Australia?
3. Define the terms (a) meiobenthos, (b) macrobenthos. Give examples of each.
4. How many square kilometres of mangrove forest are found in Victoria? What percentage of the total area of mangroves in Australia are found in Victoria? How does this compare with Western Australia?
5. Analyse the figures showing the mangrove plant richness around Australia and estimate the number of species of mangroves found in Darwin. Repeat the exercise to predict the number of species of mangroves expected to be found in your local area.
6. Make a generalisation about the distribution of mangrove species around Australia using the information in Figure 224.2.
7. Suggest an hypothesis to explain the distribution of mangrove species.
8. How many species of mangroves are found in South Australia?
9. What are the major threats to the mangrove species and in what areas are they most likely to be lost?
10. How are mangrove communities now managed? Do you believe that this level of protection is adequate?

Pages 227 - 228 Questions

Knowledge

1. List the four major reasons why biologists have developed a system of classification.
2. Name the five kingdoms of marine life and state what characteristics separates them.
3. Name the two marine bioregions in Australia and describe how they are separated.
4. Define the following terms-

   a. species

   b. taxonomy

   c. identification key

   d. biodiversity

   e. biogeography

   f. binominal naming system

   g. kingdom

   h. intertidal zone

   i. habitat

   j. ecosystem
5. Give the names for the parts of the marine environment labelled as E, F, G, H and I in the figure above.
6. Describe the colour of the abyssal zone in one word.
7. Name 8 types of habitat and list one species of marine or coastal organism found in each habitat.
8. What is a holdfast?

Understanding

9. Draw diagrams to show the differences between a sandy beach on a high energy coast and a mangrove ecosystem.
10. Why is detritus found in every ecosystem?
11. Why is the science of classification fundamental to all scientific research?
12. What is the fundamental principle in the design of a dichotomous key?
13. Biodiversity in its simplest form refers to what?
14. Why does a broader definition of biodiversity go beyond simply counting species?
15. Outline the reasons for biologists using Latin words or words written in a Latin form as scientific names, and not English or French names.
16. Why did Linnaeus develop the binominal nomenclature? Explain how this system works.

17. Name any two animals from the following classes of Vertebrates:
    - Mammalia
    - Reptilia
    - Osteichthyes
    - Chondrichthyes
    - Amphibia
18. What do the grass sweetlip, red-finned emperor, brown kelp fish, brown morwong, coral bream, piggy, red throat, and squire all have in common?
19. Distinguish between the following in the figure below.

    - C and D, A and B
20. Distinguish between the following in in the figure below.

    - A, D and E

    - B and C

Applying

21. Classify the following into phylum and class levels

    - shark

    - turtle

    - penguin
22. Give an example of a species that could interact with two different ecosystems.
23. Which of the following habitats would have the highest species diversity?

    a. Temperate and tropical reefs

    b. Sand dune and estuary

    Give a reason for each of your answers.
24. Examine the illustration of mangrove distribution in the figure below and answer the following questions.

    a. Why are there no mangroves on the shores of the Great Australian Bight?

    b. How many mangrove species are found in Tasmania?

    c. Which State has the greatest number of mangrove species?

    d. What is the difference between the summer rain and winter rainfall figures?

    e. How many species are found in your State?
25. The boundary between the tropical and warm temperate provinces coincides approximately with 18-20oC winter minimum surface temperature. What significance does this have for the types of species found in your State? Give reasons for your answer.
26. Why are nutrients usually high in estuaries?

Analysing

27. Compare a system of using common names to identify a fish with that of using scientific names.

Creating

28. Design a new marine creature and classify it completely.
29. Can you imagine an ecosystem that had no decomposers? Paint or sketch a diagram.

Evaluating

30. Argue the case for the conservation of an area based on genetic diversity.
31. Decide on the boundaries of ecosystems for your next or previous field trips.
32. Evaluate the statement that "Genetic diversity is an investment in the survival of a species. It involves all the past evolutionary selection processes."
33. Justify the inclusion of macroalgae as protoctista.
34. Evaluate the statement – high biodiversity is regarded as an important attribute for the protection of our marine environment.
35. People who care about the environment feel strongly that other living things have the right to survive alongside people. To them other living things do not need to benefit humanity directly to have a right to exist. Discuss this statement.
36. The SOMER 1996 report suggests that tropical coasts can be divided on the basis of water turbidity: northern Western Australia, Northern Territory and Queensland where high monsoonal summer rain and dry winters result in grey mud sediments inshore and well developed mangrove creeks; and northwestern Western Australia where rainfall is low and irregular, with occasional cyclonic disturbances and flash flooding resulting in brown sediments.

    Compare this view with the methods of dividing Australia into Northern and Southern biogeographic regions shown in the figure below.

Chapter 9 Questions

Page 239 Questions

1. Scientists use the words high and low energy areas to indicate forces in nature caused by waves. On your model, what forces of nature would cause high energy areas and where would they occur?

   How does the island protect the mangroves from these high energy areas?

2. What types of weather would cause increased silting of mangrove areas?

Page 241 Questions

1. Identify the colours you have used to indicate the following habitats

   • Coastal dune plants

   • Seagrass beds

   • Mangroves

   • Saltmarshes

   • Melaleuca swamps.

   Now redraw and colour in Figure 240.1 matching the colours with the habitats.

2. Compare and contrast the formation of sand and mud. Use your model to explain your answer.

3 The seagrass beds are to the North. Identify clearly N,S,E and W on your model.

4. The offshore island has the highest sand dunes in Australia to the south. 1 million years ago the sea level was 200 nautical miles to the east. What direction would the prevailing winds have blown from and why are the dunes so high? Your answers should compare the speed that wind blows over the land with that over the sea.

5. Identify where the high tide mark is on your model. Does seagrass grow above this level?

6. Design the ideal mangrove for seagrass bed, mud and saltmarsh. You should draw your mangrove for each of the three areas and justify your design.

7. Your model needs a scale. Decide on what would be appropriate and determine the number of nautical miles or square kilometres per cm. Once you have decide this calculate:

   a. the area of the offshore island

   b. the size of the seagrass bed

   c. the total number of mangroves that could be found on the mud if the average number of adult mangroves is 1 every 3 metres.

8. Where would the following plants most likely be found on your model?

   a. Bacteria

   b. Zooxanthellae

c. A lichen

d. The mangrove Avicennia sp

e. A seagrass

f. A blue green algae

g. A pandanas tree

h. Trichodesmium

9. Discuss the role plants play in coastal ecosystems. Your discussion should include reference to the following:

   • Dune systems

   • Nitrogen fixation

   • Trees on coral cays

   • One of your choice

DESIGN (OPTIONAL)

Use your model as a base for the design showing

a. where the best place to build the eco-ark is; and

b. the types of plants you would use to provide the greatest biodiversity for the animals you would introduce.

Page 241 Questions

1. Use the map of phytoplankton distribution to answer these questions.

   a. Use the scale to determine where there are lots of phytoplankton.

   b. In general, where do you find areas with higher phytoplankton levels? In the middle of the ocean or close to the continents?

   c. Based on information you have from the satellite images predict where you would find major fisheries of the world (where there are cold water currents or cold water upwellings).

   d. Research the locations of major fisheries of the world (Peru and Chile share one of these). Compare your research findings with your predictions.

   e. In Australian summer many whales migrate to the Southern Ocean around Antarctica to feed on the plankton rich water.

   f. What reasons can you give to explain the plankton blooms that occur in Antarctic water each year?

2. Use the following information to answer the following questions.

   a. In comparing northern and southern hemispheres which has the greater overall levels of productivity?

   b. If we translate productivity to think about fisheries which hemisphere is likely to support larger numbers of fish?

   c. What implications does this have for fisheries managers in the Southern Hemisphere?

   d. What issues of productivity have been ignored by fisheries managers in the Northern Hemisphere in the last few decades?

e. Compare the northern and southern hemisphere. Which hemisphere has more land? Which oceans are likely to receive the most amounts of soil and nutrients coming from the land via streams and rivers?

f. Can you think why the oceans in the Northern Hemisphere may have much larger numbers of fish than the Southern Hemisphere?

g. Biodiversity is largely influenced by the productivity of the system. In general where productivity is lower there is greater evolutionary pressure on organisms, particularly animals, to become different to one another to take advantage of different food types. Southern Australia has some of the highest levels of biodiversity ever found on the planet. How can this be explained using the phytoplankton density data?

3. Read the article below and make a three paragraph report on the latest research.

Chapter 10 Questions

Page 255 Questions

1. Which plant is dominant:

   a. nearest the sea?

   b nearest the land?

2. Explain the relationship between size of plant and position on the profile.
3. Which is the best plant at holding the sand together?
4. Is there any evidence of beach erosion? Give reasons for your answer.
5. Is there any evidence of pollution? Give reasons foryour answer.
6. Does the amount of organic matter change as you go inland?
7. Draw a graph of your beach profile marking in clearly where each plant species is found.

Page 266 Questions

1. Prepare a report under the following headings.

   - Aim

   - Method

   - Classification key

2. Comment on the value of a herbarium collection and the ethics of collecting marine specimens.
3. Comment on the value of the information recorded on the label of the seaweed specimen.

Page 268 Questions

Knowledge

1. Name the plant parts A-G on the diagram below.
2. List five abiotic features of the dune system.
3. List six animals that live in a seagrass bed.

Understanding

4. Explain the meaning of the following terms:

   • Ecological succession; Pioneer vegetation; Nitrogen fixation; Synthesis of animal protein.

5. Describe, with the aid of a diagram, the phosphorous cycle in a beach/dune system.
6. Draw a diagram to show the nitrogen cycle in a dune system using a she oak, sand and the atmosphere. Label your diagram.

Applying

7. Construct a diagram of a mangrove swamp using the results from a field trip.
8. Complete a diagram of a seagrass bed to show the following animals and plants.

   a. Benthic carnivores such as flathead hide in between the seagrass waiting for small fish as prey.

   b. Epifaunal suspension feeders attached to the seagrass such as hydrozoans catch small plankters.

Analysing

9. What do you think are the names of plants A and B? Give reasons for your answer.
10. Compare the winds velocities on either sides of the plants as wind speed increases.
11. If there was sand in the wind, which plant would survive best in the sand dunes?

    Give one reason for your answer.
12. Which habitat do you think plant B is most suited to? Give two reasons for your answer.
13. A dam was placed in a fast flowing river that lead to the sea. Make a flow chart to predict possible consequences on coastal sand dune systems.
14. A sand spit formed on a coral cay, but after 10 years plants had failed to grow. Explain why.

Creating

15. You have been asked to research local sand dunes. Write a series of (at least 6) questions that you may ask yourself at the beginning of the research.
16. Plan an experiment to show how you would design the perfect plant to live in the mud.

Evaluating

17. Predict 6 consequences of an algal bloom on the sea grass beds.
18. Evaluate the statement — Without seagrasses, our inshore seas would be like underwater deserts and would not contain the basic food supplies for our billion dollar fishing industry.

Chapter 11 Questions

Page 274 Questions

1. Look up the web site or watch the video and describe what happened next.
2. Why was it so important for Isobel to study marine invertebrates?
3. What is a ship's log and why was it important to find the sketches of whales in it?
4. Calculate how old Isobel was when she moved to Sydney.

   a. What mode of transport may she have used in 1928?

   b. List five things she may not have liked about moving?

   c. If you studied the plant chapter, what types of things may not have been studied in the Biology classes of 1923?

   d. Isobel was offered a job in Canberra. Why do you think her father would not let her go? Justify his reasons.
5. Isobel is one of Australia's most distinguished and best-known marine biologists. What do you think her most valuable contributions to Marine Science have been?
6. You have been asked to introduce Isobel as guest speaker at your schools Marine Science week to which the media have been invited.

   a. Prepare a 2 minute introduction you will read to the audience.

   b. Write a one page media release about marine science at your school and three possible quotes on marine conservation that Isobel may make.

c. What are three questions you would like to ask a world famous marine scientist? Justify your reasons for asking them.

Page 281 Questions

1. Make a table of the structural characteristics that separate the protozoa, porifera and cnidaria.
2. Give example of animals from each of the phyla mentioned above.
3. Distinguish between corals and sea anemones.
4. Describe the life cycle of an animal from the class scyphozoa.
5. How does a sponge get its food?
6. Describe the special relationship between the clownfish and the anemone.
7. What's the treatment for a box jelly fish sting?
8. What's the signs and symptoms of an Irukandji sting and what treatment would you recommend to a tourist if stung?
9. How do corals reproduce?
10. Draw a diagram of a cross-section of a sponge showing the relationships between the various cellular layers.
11. Distinguish between the medusa and polyp stage of a cnidarian giving an example.

12. Discuss possible reasons for considering the Protozoa as the most basic form of life.
13. What is phagocytosis and how is it important to the Protozoa?
14. Compare and contrast the digestive processes of sponges and jellyfish.
15. Mutualism is one form of symbiosis - name two others (see chapter 15).

Page 286 Questions

PART A UNDERSTANDING THE ARTICLE

1. Coral bleaching involves stress leading to the death of the coral polyp. How does this occur?
2. What were the criteria used to report low, moderate and high levels of bleaching from aerial surveys?
3. Draw a graph of the change in temperatures on Agincourt Reef. Express as a percentage how much the above average temperatures were for the 11 January and 11 February.
4. What was the major goal of the underwater survey program?
5. Suggest a possible reason for high rates of coral bleaching in shallow depths.
6. The rate of calcium carbonate deposition may be affected by temperature. How could this kill the coral polyp?
7. In 1998 and 2002 the worst affected reefs were those closest to the mainland. Suggest two possible reasons for this.
8. Are coral species known to differ substantially in their susceptibility to bleaching? If so list the corals that are most affected/least affected.
9. Design an experiment to show the effect of increasing water temperature on the different species of corals you have just described.

Optional (web access needed)

Make a summary of the NOAA data presented in the web images of sea temperature.

PART B COMMUNICATIONS ASSIGNMENT

- Make a poster called coral bleaching to be used in a display to explain to the general public how this occurs. Your poster should include:

1. A drawing of a coral polyp to indicate the process by which coral bleaching occurs. The diagram should show
   - the structure of a coral polyp;
   - the method by which corals take up calcium carbonate;
   - where zooxanthellae occur and what happens to them;
   - a list of possible stresses on coral polyps.
2. A summary graph in colour showing the temperature changes on Agincourt Reef.
3. A recommendation for new strategies to be adopted by Australia to reduce global warming.

Page 297 Questions

1. Identify the differences between the tentacles and arms. Explain why they are different.
2. Compare and contrast the differences and similarities between squid and human mouths.
3. Explain how the squid uses the funnel and mantle for locomotion.
4. Analyse how squid get oxygen from water.
5. Explain how squid reproduce.
6. Analyse the importance of chromatophores to squid.
7. Recall who the squid's relatives are and why?
8. Explain the function of the fins.
9. Imagine you are Poseidon (or Neptune), and are designing a new improved version of a squid.

   Draw your updated squid, and explain the improvements you have made.

Page 298 Questions

Questions Ex 11.4

1. What do all protozoans have in common?

2. What different shapes of protozoans did you see?

Questions Ex 11.5

1. Why do you think the sponges would have structures such as these?
2. Did all of the sponges have the same shaped spicules?
3. What do you think the spicules are made of?

4. Did all of the sponge spicules seem to be made of the same sort of material?

Page 299-300 Questions

Knowledge

1. Describe the structural characteristics for each of the following Phyla: - Cnidaria, Annelida and Mollusca.
2. List the internal organs of a generalised mollusc.
3. What dangers could you face if you picked up a cone shell?
4. Name a polychaete.
5. Retell the story of a diver who captured a small blue-ringed octopus in Darwin in your own words.
6. State the first aid procedure if stung by a sea jelly. Compare this with the procedure if stung by a box jelly.
7. What is the technique nudibranchs have perfected to make themselves unpalatable to any potential predator?
8. Write a paragraph on the reproductive cycle of a mollusc.

9. How do free swimming marine worms feed?
10. What is a radula and how is it used?

Understanding

11. Draw a diagram of a cone shell showing the following parts: venom bulb and duct, radula teeth, siphon, tentacles, proboscus, foot and pharynx.
12. Draw a diagram to show you can distinguish between the terms radial and bilateral symmetry.
13. Describe the role zooxanthellae play in the life of a coral and outline what happens when temperature rises.
14. Distinguish between the classes Rhizopoda, Ciliata and Flagellata.
15. Draw a diagram of a sponge showing different types of cells. Indicate how water gets in and out and describe how a sponge gets its food.
16. A surfer paddled out through a group of jellyfish-like animals but did not get stung. Which Phyla do you think they were from and why?
17. Identify the animals A-F in Figure .1
18. Outline why worms form an integral part of the benthic ecosystem.

Applying

19. Classify the animals A-F in Figure .1 as far as you can and make a dichotomous key.
20. Construct a diagram for the life cycle of a sea anemone.
21. Explain how retractor muscles help an anemone.
22. To make a new jellyfish a specialized process called strobalization occurs. Examine the photo of the sea jelly in Figure 279.2 and draw a diagram to explain how this process applies to this animal.
23. Write two similarities and two differences between the tentacles of the animals in A and B.
24. Describe how animal D feeds.
25. Write two similarities and two differences between the shells of the animals in D and E. Which could hang on to rocks better? Give reasons for your answer.
26. Describe how animal B feeds.
27. How does animal F reproduce?

Application

28. The results indicate:

    a. Temperature had no effect on growth.

    b. The growth rate was most rapid at 29 degrees centigrade for the first 12 days.

    c. A disease affected the aquarium at 20 degrees on the 12th day.

    d. Light, not temperature, affects growth.

29. The coral was then placed in the dark and the experiment was repeated. The expected results would be:

    a. No change as corals are animals and are not affected by light.

    b. The corals would lose weight at a constant rate because of respiration.

    c. The water would become dark and murky.

d. Growth rates would increase for the first few nights as corals normally feed at night.

30. Organisms such as limpets and other molluscs that live on a rocky shore live in a harsh environment.

    a. What differences would there be between the environments of a limpet on a rock on a hot summers day when the tide is in, compared to when the tide is out?

    b. How could a shower of rain affect the living conditions on the rock?

31. Compare the processes of ingestion and digestion in Porifera and Cnidaria. Identify polyp and medusa.

32. What are the advantages of the molluscan shell? What are the disadvantages? Identify radula, mantle and foot.

Creating

33. Design a marketing brochure for a touch tank in a marine aquarium using the invertebrates in this chapter. Which animals would you have difficulty displaying?

34. Estimate the amount of food you would need for an aquarium of octopus in a display aquarium.

35. Plan a display of marine sea jellies. What material would you use and where would you put them in a public aquarium?

36. Predict what would happen if you were bitten on the hand by a blue ringed octopus. Describe how you would create a makeshift splint from snorkelling gear.

37. Propose a conservation strategy for people who love collecting shells.

38. Conduct a survey of people in class who have been stung by a sea jelly. Write a short story about the accident.

39. Create a dichotomous key for the corals on page 282.

Evaluating

40. Evaluate the statement that the invertebrates are grouped according to their structural characteristics with each phylum sharing certain basic features. Give examples of the basic design of any three animals which determines where the organisms live by restricting them to a particular part of the environment.

41. Choose any phyla in this chapter and make a list of what extra information would be relevant to you if you were to become a tour guide.

42. In an open circulatory blood system, moving blood flows from the vessels and into sinuses bathing the internal organs eventually seeping back to the heart. Decide if a closed system could work in this way.

43. Determine if the animals in this chapter with bilateral symmetry have sensory organs concentrated in the head. List the phyla.

44. Justify with examples, the statement that the evolution of the invertebrates can be traced by their increasing complexity of digestion, transportation and other body systems.

Chapter 12 Questions

Page 307 Questions

1. Read the information in Figure 307.1.
2. Elect a class co-ordinator who is to divide the class into six mixed groups.
3. One of the groups is to be the control group while the other five are to select controlling factors.
4. Each group is to discuss and design a method to test their factor by modification of the standard procedure.
5. Write out your group's method and add your results when they become available.
6. Combine your results into a class data table like the one shown in Figure 307.2.
7. Formulate and write a conclusion on all the factors that have been tested in your final report.

Page 323 Questions

1. Barnacles live near the surface in what could be considered a harsh environment. What adaptations has enabled the barnacle to survive and discuss these in relation to their feeding habits.
2. Sea grass beds are considered to be of great ecological importance. Many crab and prawn species spend considerable time in these beds. How could a major change to the environment, such as a marine development, affect the life cycles of seagrasses and prawns?
3. Some echinoderms undergo an unusual process when they lose a portion of their body. Outline this process and discuss its significance to medicine.
4. Distinguish between bilateral and radial symmetry indicating where it occurs on the tree of marine life.
5. Distinguish between the sac like digestive system of the lower invertebrates and the one way tube of the higher invertebrates.
6. Why have invertebrates with three cell layers had to develop organs as part of their body plan?
7. Compare segmentation in worms and crustaceans noting similarities and differences.
8. Why are all echinoderms marine?
9. What is an open blood vascular system and how is oxygen transported to cells in it?
10. Distinguish between molting and metamorphosis in crustaceans.
11. Why are barnacles classified as arthropods?
12. Sand crabs and mud crabs are alike in many ways.

    a. In what ways are they alike?

    b. What features distinguish the two crabs from each other?

13. Why does a sea cucumber get rid of its stomach when attacked?

14. Discuss ways a barnacle larvae could get back to shore from its planktonic existence.
15. Check out the virtual rock pool: http://www.mesa.edu.au/friends/seashores/page1.html or visit a real one as shown in Figure 323.1.
16. Research the development and use of the box jellyfish antivenom (Figure 323.2).

Page 325-326 Questions

Knowledge

1. Describe the life cycle of a crab.
2. What is an exoskeleton?
3. List the characteristic features of the Phylum Echinodermata.
4. Locate the external features labelled A-H on the copepod drawn below.
5. Name the parts of the prawn labelled A-J below:

Understanding

6. Sketch the difference between male and female crabs.
7. Draw the life cycle of a barnacle.
8. Describe how a barnacle feeds.
9. Distinguish between the function of the telson and the uropod in a prawn.
10. Express 150 in mm.
11. Outline the steps you would take to grow artemia shrimp.
12. Why are the cucumbers said to be a weird lot?
13. What are filter feeders and how can they be affected by sediments from the land?
14. Why is ballast water a problem?
15. What is an introduced species and why are they a problem?

Applying

16. Calculate the size of a copepod in mm that was measured at 1,000.
17. Classify the animals A and B into their phylum and class and if possible, order.
18 Interpret this diagram

Analysing

19. A marine biologist conducted a growth study on an intertidal species of crab over a 9 month period. Her measurements of carapace width through time are shown below:

    a. Draw a line graph of these results. Axes should be labelled and the graph titled.

    b. According to your graph, when is the greatest rate of growth?

    c. Bearing in mind the type of animal that was being investigated in this growth study, give an explanation for the shape of your graph.

20. Write two similarities and two differences between each of the following pairs of animals:

    a. prawn and crab;

    b. sea urchin and sea star;

c. feather star and barnacle;

d. sea cucumber and brittle star;

e. soldier crab and Japanese sea star;

f. crayfish and prawn.

21. Explain how the water vascular system of an echinoderm works.
22. Explain how to make a microscope slide that can be used to measure plankton size.
23. Distinguish between a metre and a mu ().
24. Compare the shell of a crab with the shell of a limpet.
25. Compare the different habitats of krill and prawns.
26. Identify the species below and predict what they will turn into.

Creating

27. Compose two verses of how a barnacle feeds.
28. Research ballast water on the internet.
29. Create a new arthropod.
30. Design a new mollusc.
31. Devise a new method for measuring size under the microscope.
32. Estimate the number of brine shrimp that could be cultured from a teaspoon of eggs.
33. Formulate a plan to grow prawns in a pond.
34. Imagine you had an unlimited budget and were asked to design a house with invertebrate art. Draw a floor plan of what you would do.
35. Invent a device to peel prawns.
36. Plan an excursion to a rocky shore to study marine life.
37. Predict what would happen if all the krill died in the Antarctica.
38. Propose a solution to people taking undersized crabs.
39. Conduct a survey in your class to see who likes various types of seafood.

Evaluating

40. Argue a case for a national plan to fund marine aquariums in schools.
41. How can we assess the damage caused by people over collecting shells.
42. Choose an invertebrate from this chapter and write a short talk for a year 5 class at your local primary school.
43. Decide if ships entering ports in Australia should have their ballast water decontaminated.
44. Determine if your local council has any plan to protect invertebrates in your local area.
45. Evaluate this chapter in terms of things you need to know if you were to become an ecotourism guide.
46. Justify the study of crustaceans in a course on aquaculture.
47. You are charged with saving the world. Prioritise which invertebrates in the chapter for which you would collect and harvest DNA samples.
48. Rate your beach in terms of species biodiversity.
49. Recommend the types of signs that should be placed to stop people over collecting invertebrates from rock platforms.

Chapter 13 Questions

Page 307 Questions

1. Set up an aquarium and keep some fish for a term.
2. Visit a local marine aquarium or zoo and study marine life there.
3. Write a poem or song about life in the sea. Suggestions: Read the Rhyme of the Ancient Mariner, a poem by Coleridge. Download The Simpsons 'Under the sea' song from the Internet.
4. Invite a marine scientist to your class. Ask for a discussion on the research he or she is doing into the marine world. Suggestions: Ask parents for help or ask your local aquarium, sea life park or education advisor.
5. Run a marine photographic competition. Use a digital camera to capture images and make a web page.
6. Use the library to compare drawings of fish scales and shark teeth.
7. How do sharks reproduce?
8. What impacts have humans had on shark numbers worldwide? Suggestions: Locate a fisheries officer, shark contractor or search the internet for information on sharks.
9. Compare and contrast the behaviours of the grey nurse and whaler sharks. Use http://www.oceanstar.com/shark/ to research your answer.
10. Use the following reference to make a power point presentation on fish nurseries:

    http://www.dpi.qld.gov.au/extra/nnn/default.html
11. Make a wall chart of shark anatomy from the following web site: www.ucmp.berkeley.edu/vertebrates
12. Write two letters to the editor. One saying shark nets should be removed to protect the by-catch and the other from the government defending their placement for the tourist industries. Organise a class debate in your English class.

Page 346 Questions

PART C FISH GUT ANALYSIS REPORT

1. Location
2. Date/Time
3. Tail Shape
4. ID
5. Family
6. Genus/Species
7. Common Name
8. Length (cm)
9. Weight (gm)

10. Sex
11. Niche
12. Teeth
13. Gut length (cm)
14. Food/site
15. Feeding habit
16. Parasite/site

PART D QUESTIONS

Write a paragraphs on any of the following:

1. Discuss general fish feeding habits - whether herbivorous, carnivorous or omnivorous, diurnal or nocturnal and a comparison between male and female species.
2. Discuss the position of the fish in relation to the food chain, energy flow and food web.
3. Compare and contrast fish digestive systems, including teeth patterns.

RESEARCH

1. Discuss evolutionary trends in fish feeding habits.
2. Describe the feeding patterns of fish families.

Page 347 Questions

Exercise 13.2 Osmosis

PART D QUESTIONS

Write a paragraphs on any of the following:

1. Discuss general fish feeding habits - whether herbivorous, carnivorous or omnivorous, diurnal or nocturnal and a comparison between male and female species.
2. Discuss the position of the fish in relation to the food chain, energy flow and food web.
3. Compare and contrast fish digestive systems, including teeth patterns.

RESEARCH

1. Discuss evolutionary trends in fish feeding habits.
2. Describe the feeding patterns of fish families.

Exercise 13.3 Streamlining

1. Which shape is the best for swimming through water quickly?
2. Name any four fish that are shaped this way.
3. Fast swimmers usually have forked caudal fins. Why is this?
4. Make up a table for the fish in Figure 347.2 below showing where the fish could live and which would swim the fastest.

Page 348 Questions

1. Classify each of the fish in Figure 348.1 by using the key on Page 349. To use the key, select a fish. Start at number 1a and read the statement. If it applies then go to the number allocated. Continue down the key until you reach the species name.
2. When you finish, write out the steps you used in your notebook (see example)

Page 350 Questions

1. Make a drawing of the trawler naming the following parts: bow, stern, deck, winch, gantry, sorting tray, wheelhouse, net, cod end, tickler chain, otter boards, warp, storage.
2. How does the trawler rig work?
3. Draw a diagram showing how the net operates under water and how the net can catch fish, prawns. You may like to ask the skipper how this happens.
4. What is the name of the fishing method used.
5. What fish are caught and when?
6. What was the trawler fishing on its most recent trip?
7. What was caught ?
8. What was the catch worth?
9. What price did the fisherman receive for the catch?
10. Did the catch cover the costs of the trip?
11. What is the trawler worth?
12. How is the catch marketed?
13. What methods are used to prevent the catch from spoiling?
14. How are prawns cooked?
15. What is added to prevent spoilage?
16. How are fish stored before marketing? What happens to the fish at the wharf and then in the fish processing rooms?
17. How are the fish prepared for sale. What fish are for sale and how much are they per kilogram ? How does this compare with the price of a “big mac”?

Extension questions

1. Which fish population appears to be most stable?
2. What natural and human events may have accounted for the decrease in fish #2's catch between years 2 and 4, and 16 and 18?
3. What effect did the introduction of fish #4 appear to have on the other fish species?
4. What actions did the regulating body take to maintain the catch size of fish #2?
5. What natural and or human events may have caused all the fish species to die in year 2000?

Page 352 Questions

Knowledge

1. Draw a labelled diagram of an ascidian showing the following parts - pharynx, gill slits, tunic, heart, intestine, gonads, stomach, in-current and ex-current siphons.
2. What is a denticle and what makes them different from human teeth?
3. How do shark repellent devices work?

Understanding

4. Draw a diagram to show the difference between a drum line and a shark net.
5. What type of bait would be used on a drum line?
6. What differences exist between sharks and rays?
7. Outline the main reasons for classifying sharks and fish in different classes.
8. Describe the role of capillaries in a shark's respiration cycle.
9. Describe how a shark's neuromast system works.
10. Describe how a saltwater fish osmoregulates.
11. Describe how a barramundi reproduces.

Applying

12. Prepare a flow chart of the steps involved in a molecule of oxygen getting from the gills of a shark to the pectoral fin. Then draw a flow chart to show how a molecule of carbon dioxide gets back to the gills.
13. Draw pictures to show you can distinguish between gannoid, ctenoid and cycloid scales.
14. Distinguish between the afferent and efferent arteries in sharks.
15. Draw diagrams comparing the male and female urinogenital systems.

Analysing

16. What type of sharks do you think shark nets and drum lines should catch? Give reasons for your answer.
17. Discuss the problems a shark may experience when attempting to feed in a low visibility environment.
18. Consider the various commercial fishing techniques that make use of nets. These nets may cause environmental damage. Discuss the advantages of each method and outline procedures which could be implemented to protect the environment.
19. Many dolphins are killed each year by the accidental trapping in nets even though they have the ability to easily locate objects as small as 1 mm in diameter. Dolphins are generally regarded as intelligent so explain why they fail to jump clear of the fishing nets?
20. Discuss the following statements about Coral trout and their relationship with reefs:

    - Adult Coral trout are non-nomadic and overall, do not range far.

    - Coral trout spawn (ie release eggs and sperm) in early summer on the southern Great Barrier Reef.
21. Write an essay on Electro-reception in Elasmobranchs (sharks, skates, and rays).
22. To the fishery biologist, the fish scale represents a valuable tool in the investigative process. The biologist can choose to use the scale to determine the age of the fish.

This information can be used as an interpretation on the life history of some fish. In addition, scientists use scales in the identification classification of fish. It should be mentioned, however, that not all fish have scales, and those having scales do not all have the same type. Scales are not exclusive to fish.

Collect some fish scales and use them to determine the age of a fish by counting scale rings.

Creating

23. Are you afraid of sharks? Devise a simple questionnaire with six questions to see if you and your class mates are afraid of sharks and to test some understanding of shark behaviour. You might like to use questions like - are all sharks dangerous?

    Calculate percentages from your survey and illustrate them either in a graph or as a table.

Evaluating

24. Recommend new strategies to be adopted by the government of your state based on your strategic plan to review shark meshing.
25. Write a letter to the editor of the local newspaper complaining about the number of dolphins caught in shark nets. Then write a response from the local minister justifying the shark nets.
26. Justify the inclusion of sea squirts in the Phylum Chordata. Use a diagram of a larval sea squirt to support your argument comparing it with that of a fish.
27. Evaluate the statement about chordates that “a coordinated nervous system has allowed for the development of highly specialised organs which perform specialised functions to extend the life of the animal into many decades and allow it to grow a lot bigger than invertebrates”.

Chapter 14 Questions

Page 382 Questions

Knowledge

1. A bird has a crop and a stomach. What are these used for?
2. Birds can feed on prey in the water in 12 different ways. Name any ten ways and describe how the bird catches the food.
3. How are whales and dolphins protected under Australian law?
4. What is baleen?
5. How do dolphins breathe?
6. Name the parts of the bird labelled A-S below.

Application

7. Which is more closely related: an octopus and a scallop, or a bony fish and a bird? Give reasons for your answer.
8. A saltwater fish was swimming up a river. What problems would it experience and why?
9. Why should you not frighten birds resting on a beach?
10. How can you tell the age of a crocodile?
11. Describe the features which make the crocodile such an efficient predator.
12. Describe ways to avoid a crocodile attack.
13. Explain why sea-snakes are not regarded as a serious threat to humans.
14. Explain how a baleen whale feeds.
15. How is a laparoscope used in turtle research?
16. Draw a flow chart to explain turtle reproductive cycles.
17. If you are walking around a beach with a torch and see a turtle coming up the beach, what should you do? Why?
18. Why is turtle conservation important?
19. Suggest possible reasons for bird migration.
20. What practical conservation steps must you follow if you were the skipper of a boat approaching a whale?
21. What is echolocation and how is it used to locate food?
22. Why can't dolphins breathe underwater?
23. How do dolphins communicate with each other underwater? Use a diagram to explain your answer.

Analysing

24. One year no turtles came to nest on a beach. Which events could have happened to cause this and why?
25. Distinguish between dugongs, seals and dolphins. Draw up a table to show similarities and differences.
26. Make a flow chart to show the food sources for sea birds.

Creating

27. Propose a design solution to turtles being caught in prawn nets.
28 Develop a proposal which will keep conservationists and shark contractors happy.
29. Predict what might happen if some countries continue taking whales for scientific research.
30. Create a new product for farmed crocodiles and plan a marketing campaign renaming the meat and how it would be advertised in restaurants.
31. Design a turtle or bird tag. Describe what materials you would use and how it would be fitted.
32. Suggest ways to improve the management of RAMSAR sites (these are international bird protected areas).

Evaluating

33. Plan and conduct an experiment to test echolocation in dolphins.
34. How would you defend your position in relation to a ban on all world whaling?
35. Choose a better solution to prawn trawling.
36. Do you believe that whales should be killed for scientific purposes? Explain.
37. How would you feel if you were a commercial fisher who had to sell his business to protect a marine park?
38. What are the pros and cons of Marine Parks?
39. Why do whales breach?
40. Seagrasses are important to dugongs. Excessive nutrients cause algae to grow on the seagrass and kill it. Why can't dugongs just change their diet and eat the algae?

Chapter 15 Questions

Page 393 Questions

Knowledge

1. Describe the number of stations measured, the distance covered and the animals and plants in the data presented.
2. Define the words habitat, limits of tolerance, buoyancy.
3. Describe the features of the shore at stations 2, 4, 5 and 7.
4. Define the terms abiotic and biotic giving examples of each from the data presented.

Understanding

5. Describe possible methods for determining the abiotic data and biotic data.
6. Provide an example of a herbivore.
7. What do you think could have happened to the data when the tide came in?
8. Draw pictures to show you know the difference between a barnacle and a chiton.
9. Give an example of an echinoderm and an cnidarian.
10. Prepare a flow chart of the steps involved in drawing the rocky shore profile.
11. Outline the main reasons for the collection of data of this type.
12. Make a list of all the biotic and abiotic factors that were studied.
13. Which animals and plants would be affected by buoyancy?
14. Which animals and plants would be affected by wave action? When and why?
15. Where would temperature pose the greatest problems for rocky shore organisms and why?
16. Name one predator from the data.
17. What could cause the salinity in a pool to drop?

Applying

18. Calculate average temperature on the rocky shore.
19. Classify the blue grey periwinkle into kingdom, phylum and class.
20. Construct a food web for the pool at station 7.
21. A metre square with 100 mm divisions was used to collect the biotic data. A randomly selected 100 mm x 100 mm square was sampled in station 8 and 435 barnacles counted. Calculate the number of barnacles in the metre square.
22. You are told that the dissolved oxygen is 0 ppm and that the temperature is 17oC. Where are you standing?

Analysing

23. Examine all the data and answer questions a-c below.

    a. Explain what happens to the nitrate levels as you go from the sea to the top of the headland.

    b. Identify the least favourable habitat.

    c. Where are barnacles most dominant? Suggest a reason for this.

24. Analyse the data from stations 3 and 7 and answer questions a-e below.

    a. Which are the dominant species?

    b. What abiotic feature affects them the most?

    c. Which is the hottest, saltiest station?

    d. Compare the phosphate and nitrate readings at each and suggest reasons for the differences.

    e. Describe the changes in dissolved oxygen levels and suggest a possible reason for the difference.

Creating

25. From the data presented, create an animal that could live in every station.

Evaluating

26. Analyse both sets of data for station 3 and answer questions a-c below.

    a. Which are the dominant species

    b. Which species are not present and why?

    c. Identity the most favourable habitat justifying your answer using biotic and abiotic data.

27. Why are chitons only found in some places on the rocky shore?

28. Determine which abiotic factor and biotic factor would have the greatest and least effect on the organisms mentioned in the study.

29. What opposition would you expect from the green lobby? Who would you employ to defend your case and what would you ask them to report to you on?

Page 404 Questions

1. Make a list of the words in the Read this box that tells you that there are differences between the flounder and the bream.
2. The table below represents the differences between the two types of fish. Make a copy of this table in your note book and use the information in the passage to complete the table.
3. Write a paragraph composed of five sentences. These sentences must show the differences between the flounder and the bream.
4. Copy and complete this table in your notebook

Page 408 Questions

1. Now use your index to locate the chapters and pages that discuss the survival of organisms to write definitions of the following key terms:

   - population
   - community
   - adaptation
   - predator
   - prey
   - omnivore
   - bioaccumulation
   - producer
   - consumer
   - decomposer
   - scavenger
   - benthic
   - territory
   - migration
   - mimicry
   - genetic diversity
   - schooling
   - respiration
   - habitat

2. Use your index to construct a table to distinguish between the following terms:

   - megaplankton
   - ultraplankton
   - microplankton
   - mesoplankton
   - nannoplankton
   - macroplankton

Page 409 Questions

1. Where do adult Australian herring live?
2. When are the commercial and recreational fishing seasons in Western Australia and South Australia?

   When do you think the best time would be to go fishing in Victoria?
3. Why don't the fish get to Tasmania?
4. Where do the juveniles develop? What do they feed on?

5. Why do we have to keep pollution out of our coastal waters?
6. How long does it take for a herring to grow to be an adult?
7. What is a spawning run and where does it go to?
8. What is the idea behind a fishing season?
9. Why have a fishing season at all?
10. Draw a diagram to show how a fisher would catch a school of herring from the beach with a seine net.
11. What is the legal catch size of Australian Herring?

Page 410 Questions

Knowledge

1. What is the environment of a marine organism?
2. Define the terms abiotic and biotic giving examples of each.
3. Give two definitions of a niche.
4. Define what a scavenger organism is and does.

Understanding

5. List 8 abiotic features and give an example of each.
6. Describe some animals and plant tolerances to pH.
7. Distinguish between the following terms:
   - Predator - prey;
   - Symbiosis and competition;
   - Structural, behavioural and functional adaptation.
8. Distinguish between the following terms, giving an example of each.
   - Mutualism;
   - Commensalism;
   - Parasitism.
9. Describe how water temperature can exert a major control over the distribution of marine organisms.

Applying

10. Use your knowledge to defend the argument that territoriality is an important adaptation for damselfish.
11. Examine the illustration in Figure .1 and describe the type of habitat each fish would occupy. Give reasons for your answers.

Creating

12. Compose a rhyme to help class members remember the difference between mutualism, commensalism and parasitism.

Analysing

13. Analyse the two paragraphs below to describe examples of symbiosis and predator-prey relationships:

    The giant clam (Tridacna gigas) is only found in shallow, warm tropical waters of the Indo-Pacific region. Like reef-building corals, clams depend on microscopic zooxanthellae for their main source of nourishment.

    These plant cells are 'farmed' within the clam's body. Clams supplement this farmed food by filter feeding, gaining nourishment by straining microorganisms and algae particles from the water. Recent research indicates the giant clams may not actually filter food at all, but rely wholly on zooxanthellae.

14. The male stickleback (a freshwater fish of the Northern Hemisphere) constructs an elaborate nest to protect the eggs. The male does a zig-zag dance when a female of breeding age enters his territory. The male then fertilizes the eggs and continues to watch over the eggs until they hatch. Give possible reasons for these behaviours.

Evaluating

15. Write an essay on the adaptations of animals and plants on the rocky shore.

    Identify the biotic and abiotic factors that affect the animals and plants and rate each in order of effect on a marine organisms.

    Give at least one example from each of the following phyla - cnidaria, arthropoda, mollusca, osteichthyes, aves, angiosperm, algae and decide which would have the greatest chance of survival from human influences.

Chapter 16 Questions

Page 417 Questions

1. What is the ultimate source of energy for the oceans?
2. Write word equations for the processes of photosynthesis and respiration.
3. Distinguish between the terms herbivore and carnivore. Give 3 examples of each.
4. Explain why it is unusual to find a community without any producers. Can you think of a community without producers – think deeply.
5. Only 10% of energy is passed on in the food chain from one consumer to another. Why is this so? What happens to the other 90% of this energy?
6. Define the terms

   a. ecology

   b. ecosystem

   c. heterotrophs

   d. bioaccumulation
7. Explain the difference between a food chain and a food web. Give an example of a food chain.
8. Do you believe a food web for a community will change ...

   a. during a 24 hour period?

   b. from season to season?

   Give examples to explain your answer.
9. Predict the effect on the food web shown in Figure 414.2 if crabs were removed from the area.
10. Which group of organisms in the sea would you expect to have the highest concentration of pollutants within their body?
11. Accumulation of pollutants occurs in each level of the food chain. How could organochloride used to control termites have appeared in mother's milk?

Page 418 Questions

1. Why do you think scientists describing the problems of DDT talk about the 'poison pyramid'?
2. Insects eventually became resistant to DDT even when the original recorded kills were 99%. Explain how this could have happened.
3. How was it possible for DDT to save over millions of lives in malaria affected countries? How could DDT affect the transfer of infectious diseases? Why are some of the effects of DDT on human population not yet known? Why has it taken so long to find out?
4. By how much does the concentration of DDT increase as you move up the food chain?

5. Propose a definition for the term - bioaccumulation.
6. Propose how could we control insect pests if we are not to use chlorinated hydrocarbons?
7. Another chlorinated hydrocarbon in the news lately is Dieldrin. Where has this chemical been a problem?
8. What steps must be taken if history is not to repeat itself with the introduction of new and different insecticides?
9. Who should pay for the cost of cleaning up the DDT mess?
10. The amount of chemicals that is poured into the oceans is enormous. It has been estimated that for the last 25 years, 400,000 tonnes of DDT eventually found its way into the sea.

    How much DDT would now be in the sea?

Page 424 Questions

1. How did the numbers of the three discs change?
2. What problems did you experience using this sampling method?
3. Did the temperature change from one sample site to another?
4. What other types of data would be useful to collect in a transect?

Page 425 Questions

1. It should be evident from your field study that mangroves have very large, well developed root systems. What are the two main reasons for this?
2. Mangroves live in salt water. Salt is a toxic substance to most plants and if it was allowed to build up to a large amount inside the mangrove tree it would prove fatal. Outline the various ways mangroves reduce the amount of salt present inside the tree.
3. Mangroves also face problems when reproducing. The intertidal environment, with the tide washing in and out twice a day, makes it difficult for seeds to gain a hold in the mud without getting washed away.

   Outline the various ways mangroves cope with this problem

Page 426 Questions

1. What percentage of Northern Territory's coast is mud/ mangrove shoreline? What region of the Queensland's coastline is most likely to have mud/mangrove shoreline?

   Explain your reasoning.
2. Which state or territory of Australia has the highest percentage of mud/mangrove shorelines?
3. What percentage of Victoria's coast is mud? Suggest why this value for Victoria is a lot higher than other states.
4. The table shows the total value of 59 for Queensland shore types. Why is this value not 100 as is the case for New South Wales and South Australia?
5. Draw a pie graph showing the proportion of shore types for NSW?

6. Shores are often the most obviously degraded parts of Australia's marine environment. Using the information supplied in the table and your knowledge of coastlines around Australia, predict which type of coast and which areas would be most prone to degradation. Explain.
7. Although a small number of hard and soft shores around Australia have been specifically designated as marine protected areas, shores are generally not adequately protected. Debate this statement.

FOR RESEARCH

Study the article in the hard copy of SOMER and answer the following questions.

8. Describe the effects of toxicants on our shores (see Page 48 of the report).
9. Draw a graph of the relationships between intertidal zones, tidal levels and degrees of water movement (see page 48 of the report).
10. Comment on jurisdictional difficulties in managing Australian marine ecosystems (see page 49-50 of the report).

Page 427 Questions

1. Why do the scientists believe that the dramatic increase in methane levels after 1800 was due to human activities?
2. How much does the gas methane contribute to the greenhouse effect?
3. Evaluate the growth rate of total methane in 1980. What was the total methane emission in 1980?
4. Estimate the increase in total methane emissions from 1940 to 1980. Where do you believe the methane could have come from?
5. Suggest how the study of methane, by analyzing carbon isotope ratios, may help in the explanation of methane stabilization.
6. How does David Etheridge explain the puzzling trend in atmospheric methane concentrations stabilization since 1980?
7. Discuss the statement "understanding the past will help us predict the future."
8. Explain how the methane growth rate has decreased sharply since 1980 yet the total emissions are still increasing.
9. If the continued trend in stabilization of methane gas continues, suggest methane concentrations for the year 2010. How much higher will these be than the values in the year 1900?

Page 428 Questions

Knowledge

1. Describe a natural ecosystem and name their four requirements/criteria.
2. Name any five communities that may exist in an estuarine ecosystem.
3. Write a definition for biomass and give an example.
4. Define the terms – community, autrotroph, acid rain, denitrifying bacteria, hydrological cycle.

Understanding

5. Draw a diagram to show you can distinguish between the terms community, population and individual, in a biotic environment.
6. Draw the phosphorus cycle using sand dune plants as an example.
7. Draw diagrams of the carbon and nitrogen cycles to show you can identify the major components for each.
8. What is the greenhouse effect and how might this affect sea conditions around the world?
9. Distinguish between the terms producer, consumer, scavenger and decomposer.
10. Redraw Figure 414.2 as a food chain.
11. Restate the pyramid of numbers as shown in Figure 416.1 in 3-4 sentences.

Applying

12. Calculate the percentage of bioaccumulation of DDT for each of the trophic levels in Figure 417.2.
13. Redraw Figure .1 below and construct a food web for the marine organisms shown.
14. Complete an energy pyramid of the food web as constructed in the previous question.

Analysing

15. Explain the role plants of the sea play in the carbon cycle and the nitrogen cycle.
16. Identify the form in which carbon is taken up by phytoplankton from their surroundings. How do fish obtain their carbon?
17. 79% of air is nitrogen gas yet some plants growing on the sand dunes grow poorly because of shortage of nitrogen. Explain this phenomena.
18. Explain why the sulphur cycle is not balanced.
19. Explain the statement — An ecosystem contains organisms capable of capturing (this) energy to manufacture organic molecules.

Creating

20. Use the map of Hypothetical Bay on Page 55, Chapter 2, to estimate some of the number and types of communities that may exist within the bay ecosystem.

Evaluating

21. Argue a case in 2 paragraphs for the ban of DDT giving an example.
22. Evaluate the statement — the higher levels of a food chain will contain smaller amounts of biomass.
23. Why is there a need for a definition of large marine ecosystems?

Chapter 17 Questions

Page 449 Projects

1. Map coastal and environmental information for your local area (web site 1).
2. Examine today's satellite weather images for Australia, and note the forecast for land and sea conditions in your area (web site 2).
3. Compile information on the tides, ocean temperatures and other oceanographic properties of your area (web site 4).
4. What are the recent temperatures of the surrounding ocean? Are any currents visible? If so, what can they tell us about local circulation? (web site 3)
5. How productive is the surrounding ocean? Is it good for offshore (tuna) fishing? (web site 5)
6. Try to locate a satellite image of your area that shows land features and uses, and the coastline and nearby sea. (explore web sites 9-11). Can you relate the different colours on the satellite images to features such as land uses?
7. What's the weather probably going to be in the next few months? (web site 8).
8. How does el Nino affect your local rainfall? Plot Southern Oscillation Indices (SOI) for the past 20 years and compare with your local rainfall and bushfires. Is there a relationship? (web sites 2 and 8)
9. What is the general condition of the coastal and marine environment in your local area? (What does the State of the Marine Environment report for Australia say about your State?)

Page 450 Questions

1. Look carefully at the illustration opposite and identify the numbers 1-18.
2. Now list all the activities which may affect water quality of the estuary and waters of Hypothetical Bay.
3. Which 2-3 do you think are the most serious?
4. What are the main 'pointsource' sources of pollution?
5. What are the main 'diffuse sources' of pollution?
6. What activities might affect fish populations?
7. How do the issues here compare with those in your local area?
8. Compare and contrast the good catchment with the bad catchment by drawing up a table and summarising your points from question 2.

Page 452 Questions

1. After reading the research article describe what you believe is a seamount. How many seamounts are thought to exist in the world? When were they thought to have evolved?

2. Suggest how the environmental conditions on a seamount will differ from life on a rocky shoreline.

   Explain why these seamounts have such a different array of life forms. List some of the filter feeders in these unique biological communities.

3. Do seamount food chains contain producer organisms? From where do they get their energy?
4. How many new species have been discovered living near the seamounts?
5. Propose an explanation for the presence of organisms considered to be living fossils surviving in these areas. Do you believe conditions have changed much in these areas over the past few million years?
6. Draw up a facts chart on seamounts of Australia.
7. Write a brief interest paragraph radio or television that will help educate the public about the presence of seamounts and their importance as a natural resource.
8. Commercial fishermen have depleted the fish stocks of some of the seamounts off Tasmania. How long do you think they can remain in pristine condition? Give a reason for your answer.
9. Do you agree with the formation of the two management zones?
10. How are ocean trenches formed and where is Australia's deepest trench (hint watch the Oceans video)

Page 452 Questions

Questions - Set A

1. What is the issue?
2. Where does it occur?
3. How is it caused?
4. Why is this issue a concern for the Great Barrier Reef?
5. What aspects of society have an impact on this issue?
6. What are some of the points of view that relate to this issue?
7. How has this issue developed over time?
8. What are the solutions?

Questions - Set B

1. What different types of water quality issues are impacting on the Great Barrier Reef?

   a. Where do they occur?

   b. Why do they occur?

   c. How is the marine pollution caused?

   d. What are the consequences?

   e. What are the alternatives? Are they viable alternatives? What are the social, economic, environmental and health consequences of these alternatives?

2. How can you find out more about these issues?
3. How can you judge the reliability/validity of the information you use on this issue?

4. What are the solutions?

Questions - Set B

1. What different types of water quality issues are impacting on the Great Barrier Reef?

   a. Where do they occur?

   b. Why do they occur?

   c. How is the marine pollution caused?

   d. What are the consequences?

   e. What are the alternatives? Are they viable alternatives? What are the social, economic, environmental and health consequences of these alternatives?

2. How can you find out more about these issues?
3. How can you judge the reliability/validity of the information you use on this issue?
4. What are the solutions?

Page 454 Questions

Knowledge

1. Define an estuary, name three types and recall a reason why they are so productive.
2. Define the term UNCLOS and list its web address.
3. List the web addresses for the National Oceans Office and the SOMER 1996 State of the Marine Environment.
4. Locate the dates when new laws and new agencies were created to protect their environments.
5. Name the commercial fisheries that existed in Australia before Europeans arrived.
6. State the percentage of estuaries in Australia that have been cleared for agricultural or urban use and recall one major problem clearing creates.
7. State why it is difficult to assess, simply and accurately, the general condition or environmental ‘health’ of Australia’s marine environment.
8. For how many years have Aboriginal people harvested shellfish?

Understanding

9. Why does Australia’s marine environment have great global importance?
10. Draw a map to show Australia's claim to world oceans.
11. Describe how acid sulfate soils occur and their effect on marine life.
12. Describe the effects of increased nitrogen (N) and phosphorus (P) in coastal streams, on seagrass beds.
13. What is an ICOLL and what effect does it have?
14. Describe the conditions necessary for coral reefs to grow.
15. Why has fishing has been banned in a deep water marine protected area off Tasmania?
16. Outline what happened in the 1960's to fish resources in the sea and compare this to the 1970's and 80's.

Applying

17. Classify the 7 major issues affecting Australia's marine environment into commonwealth, state and local government responsibilities.
18. Create a report card for your local marine environment using Figure 443.1 as a guide.
19. Calculate the number of surfers in the take off zone in Figure 447.2.

Analysing

20. Analyse the statement on Page 433 that "the ocean and its fish were seen as a 'common property', owned by all."
21. Write 4 similarities and 4 differences between temperate and tropical reefs.
22. How are the cultural values of the sea different for Aboriginal, European, Mediterranean, Torres Strait Islander and Asian people?
23. Identify possible benefits to the discovery that in the deeps off Norfolk Island there are undersea vents which sprout superheated water and dissolved minerals.

Creating

24. Research early aboriginal use of the sea in your area.
25. Create a mural for a Seaweek theme.
26. Imagine you are a part of a group of greenies and you have to improve membership numbers.

    a. Plan a membership drive by designing a brochure for general use.

    b. Invent a media event, predict the likely consequences and estimate how many media will turn up.

    c. After all you did no one turned up. Suggest ways to improve you media event.
27. Propose a solution to the Crown of thorns and Drupella problems on our reefs.

Evaluating

28. Use the economics associated with loss of tourist revenue on our reefs to argue the case for reduced greenhouse emission gases.
29. Use the report card on Page 443 to assess your local area.
30. The challenge of the new millennium, for future generations, is to reverse the problems caused by the unsustainable development of the past century. Determine who should do this and rate the chance of success.
31. Determine if mangroves are under threat from statements made on page 438.
32. Re-read Chapter 10, pages 256-258 on seagrasses and study pages 438-439 and judge which is the more crucial issue - seagrass management or mangrove protection.
33. For many years beach erosion has been a problem. Re-read Chapters 2 and 5, and page 439 and use this information to determine if coastal erosion is still a problem. If erosion is a problem in your area rate the chances of a coastal engineering solution as being successful. Find some old photos of the beach like that in Figure 447.1 and compare the dune systems with those of today.

Chapter 18 Questions

Page 477 Questions

LEVEL 1 (LITERAL): READING FOR ACCURACY

Be able to show where these statements appear in the

article. Use P for paragraph and L for line.

1. ___ The claim for the Island of Mer arose out of the refusal of Murray Island people in 1982 to accept a lease over the islands from the Queensland Government.
2. ___ The Crown acquired 'radical title' (i.e. ultimate control) to land on colonisation, actual ownership and use rights were removed from Aboriginal people parcel by parcel.
3. ___ Native title to the sea, sea-bed and marine resources has been recognised by courts in England.
4. ___There is nothing in the Mabo judgement which would seem to preclude the application of native title principles to the sea-bed.
5. ___ In October 1990, the Murray Island Council made claim to Sea Rights.
6. ___ The High Court has now established that the Meriam people of Mer hold a 'native title' to their island under customary law which is recognised under Australian common law.

LEVEL 2 (INTERPRETIVE): DRAWING

7. ___ Sea rights have not yet been settled in court.
8. ___ Many Aboriginal people regard estuaries, bays and waters immediately adjacent to the shore as being part of their land.
9. ___ The limited recognition of Aboriginal interests in the sea provided by sea closures under Northern Territory legislation has been shown to be inadequate in achieving harmonious management of the Top End coastal waters.
10. ___ It now seems unlikely that a 2 km buffer zone alone would have fully protected the legitimate interests of Aboriginal people.
11. ___ Another term used in dealing with sea rights is customary marine tenure (CMT).
12. ___ Native title only applies to Australian indigenous people.

LEVEL 3 (APPLIED): DEFENDING YOUR OPINION

13. Why does a proposed buffer zone fail to recognise the coastal sea as an integral, inseparable part of Aboriginal Country?
14. The purpose of the Racial Discrimination Act of 1975 was to protect the rights of Aboriginal people. How did the then Queensland Government contravene it?
15. Why should Aboriginal and Torres Strait Islander people have a right to hunt by traditional methods?

Page 481 Questions

What is your initial reaction to the content of this case study?

1. What were some of the motives behind the visitation restrictions put in place by the Qld EPA? In table 1 why are the visitors at one time less than the visitors per day?
2. Why are water, sewerage and fuel lines suspended under boardwalks?
3. What minimal impact features have been done to allow free roaming of native animals and reducing compaction of island sand and soil?
4. As a building subcontractor you have been told not to concrete around the pool. What must you use instead of concrete and why?
5. You are the manager and guests complain about getting wet from no gutters. You apply to install gutters and are refused permission. Why?
6. As a room cleaning sub-contractor, you have been told to bring all your water from the mainland. Water is sold to commercial operators at $1.10 per kilolitre.

   Each room has one bathroom, toilet, shower, vanity basin and 14 squares of living space. On the mainland you charge $4 per square cleaning fee. How much extra will you have to charge to clean a room on the island?
7. Normally fresh water is used for flushing a toilet. Draw a plumbers map to show how you can flush a toilet with waste water from the 46 showers in the resort and what type of energy you would use.
8. On the mainland they use secondary treatment of sewerage. How is Green Islands sewerage system different and why?
9. Explain the difference between precycling and recycling?
10. Draw a diagram to show what you think a refrigerated garbage compactor would look like.
11. A big problem exists with tourists who smoke. You are the guest liaison officer. What pro-active steps would you take to stop cigarette butt litter?
12. You are in charge of eco-tours and have been given the task of making two interpretative signs to show how the garbage pulper and worm farm work. Design two signs 2mx1m for this purpose.
13. You have been told that you are to introduce Robyn Aiello (the author of this case study), a keynote speaker at the Sustainable Use of Marine Resources Conference and by now you have read her paper. Write an introduction to the audience of 200 Year 12 students as well as writing a thank you address summarising her paper and how as concerned year 12 students, we can do something about our marine environment.

Page 484 Questions

Knowledge

1. Describe what happened in the ‘Mabo case’ in the 1990s.
2. Name 3 environmental concerns associated with ports and port development.
3. List six benefits of marine ecotourism.
4. Define ESD and name the four basic principles for decision-making.
5. What is a stakeholder and what do they do?

6. State three differences between commercial and recreational fishing.
7. Define the terms biosecurity, EEZ, ecosystem management and multiple use.

Understanding

8. Make a copy of the EEZ on 435 and use colours to distinguish between the proposed marine jurisdiction zones around Australia and its territories.
9. What is the difference between recreation and tourism?
10. Describe two reasons for the marine environment having a particular spiritual, cultural and social importance to indigenous people living on coasts and islands.
11. Distinguish between renewable and non-renewable resources.
12. What did the 'Offshore Constitutional Settlement' do for State rights in 1979?
13. Write a media release interpreting the national plan for marine environmental management as set out on page 470.
14. What is a zoning plan and how is it used?
15. Outline the importance of recording local indigenous stories about marine management or use of the sea.
16. What are the four principles associated with multiple use management and how are they effective in managing the marine environment?
17. Billions of dollars have been spent in the past decade on the repair of the land, but it will take tens of billions more. Why?

Applying

18. If tourism increased by 2% each year, calculate the value to the economy in 2010.
19. If the fishing industry is worth $125 million, calculate the difference. Now examine this difference and give reasons why this may not be a realistic figure. Why can statistics like this not give an accurate picture?
20. List any six ecotourism ventures and rate them from lowest to highest in economic return.

Analysing

21. Why is a precautionary approach needed where there is scientific uncertainty about the effects of a development?
22. Explain why a new fisheries agreement has to be renegotiated with the new nation of East Timor.
23. Identify at least six government agencies involved in marine environmental management. Draw up a table showing their roles.
24. Investigate how many agencies manage the environment on your local beach. Contact your local councillor to determine the role of the local authority in this marine environmental management.

Creating

25. Create a better sign than 471.3 to get across the message.
26. Formulate a series of research steps that could lead to a biodegradable fishing line.
27. Conduct a survey to see if people value the environment over national security. Record all anecdotal statements.

Evaluating

28. The problem of unsustainable use of environmental resources is now widely recognised. What are you personally doing about it?
29. Debate the proposition that the Great Barrier Reef be returned to Queensland State control. (The team arguing the case for the affirmative could consider discussing the benefits for the Queensland Economy and the team for the negative could consider the Queensland political history of the 1970's).
30. Research for marine environmental planning and management typically involves 7 different processes. Decide how many of these are applied on your local beach and determine their effectiveness.
31. Is ESD feasible? Critics say it is illogical. We cannot continue to 'develop' (consume) natural resources forever. They must run out sometime. Optimists say it could be achievable if we control our population, adopt renewable and non-polluting energy sources, and recycle manufactured material.

    Decide if you agree or disagree with ESD summarising your answers as dot points.

Chapter 19 Questions

Page 501 Questions

1. How many fur seals were observed with neck collars in the four year period?
2. What was the rate of entanglement in the population? Suggest why in reality, these figures may have been a lot higher.
3. How do the figures in the pie graph compare with the values given in the text for the four year period?

   Did the values change over the last two years of the study? Use data supplied to support your answer.
4. What percentage of juveniles and subadults were entangled? Suggest a reason to explain this result.
5. Analyse the information to explain the change in numbers being entangled.
6. Devise an educational campaign for encouraging positive behaviour for student

Page 502 Questions

1. What is the scientific name for the northern hemisphere starfish?
2. Suggest how this starfish may have been transported to Tasmania.
3. It is stated that 'Astereas amurensis' is a voracious species. Explain the meaning of the term 'voracious species'.
4. Predict the effect of this species on the aquaculture, other fisheries and the marine environment.
5. To what group or phylum do the starfish belong?
6. Attempt to define the term 'exotic species' from the way the term is used in the article.
7. Where and when was the first confirmed recording of 'Asterias amuresis' in Tasmania?
8. How can the species 'Asterias amurensis' be distinguished from other starfish?
9. The article suggest that governments should spend more money completing base line surveys of material fauna.

   How would this help in our battle against exotic species?
10. Define the job description of a taxonomist. Why does the article suggest there is a need for more taxonomists?
11. Discuss the biology of the species 'Asterias amurensis'. Include its habitat, diet etc.
12. Do you believe that the species 'Asterias amurensis' will eventually threaten the scallop industries in Queensland.
13. Suggest steps needed to be taken to evaluate the magnitude of the problem.
14. Suggest possible methods to control the population of 'Asterias amurensis'.

15. Outline the measures governments need to take to stop the introduction of other exotic species.

Page 504 Questions

Knowledge

1. Define the term population and give an example.
2. What is the minimum population size for survival?
3. Define biodiversity in its simplest form.
4. Define the term biogeographic region and give an example.
5. Locate an endemic species in this chapter and define the term.
6. Name two causes of terrestrial extinction.
7. How much of a bioregion should be protected?
8. State why the leafy sea dragon is greatly affected by loss of habitat.
9. Give examples of two marine invertebrates at risk.
10. Write the correct Commonwealth Government environmental web site address for threatened marine species.

Understanding

11. What is a TED and how does it work?
12. Describe how Wandering albatrosses are killed by longline nets.
13. Give examples of a K and R selected species.
14. Give an example of how a diverse habitat is a characteristic of marine biodiversity.
15. Distinguish between the terms vulnerable, endangered, critical and extinct.
16. Which species of shark is critically endangered in New South Wales and why?
17. What is the Dugong's greatest enemy? Explain your answer.
18. Outline the method Nick Gales used for determining what whales have been eating using DNA.
19. What is a keystone species and give an example of how they are important in protecting an ecosystem.
20. How many marine protected areas do we need and how large should each protected area be?

Applying

21. Study Figure .1 opposite and decide what you would attempt to do in a television add to save seals.
22. What species of fish will be affected in the Derwent Estuary if the numbers of the imported starfish increase and why? Decide if this species is vulnerable, endangered, critical or extinct.

23. Examine the statement that “ecosystem management is the management of ecosystem values and uses recognising the interactions with the environment, and responding to signals from the ecosystem to control anthropogenic activities and uses”.

    a. What are ecosystem values and uses. Give an example.

    b. What are anthropogenic activities and give an example.

    c. State why these two issues need to be managed.

Analysing

24. Analyse the Blue whale population statistics in this chapter and decide if it could be classed as endangered.
25. Name two similarities and two differences involved in seagrass and whale conservation.
26. Distinguish between the terms generic, species and ecosystem diversity.
27. Identify four issues involved in habitat conservation and survey your neighbours’ knowledge of them.
28. Explain conservation strategies for whales and dolphins.

Creating

29. Devise an alternative to shark fin medicine.
30. Improve on the design of a TED.

Evaluating

31. Assess what would happen to Green turtle populations if all animals under 34 died.
32. Decide why there have been no known marine extinctions in Australia.
33. Loss of a marine organism’s habitat can be disastrous. Decide if this applies to any animals you have read about in this chapter. Give an example.
34. Discuss the statement ¬— protection of a marine species requires protection of many different habitats, often great distances apart, and key nursery habitats such as seagrass and wetlands.

Chapter 20 Questions

Page 509 Questions

1. Make a list of all the seafood products sold and the price per kg. Is it fresh or frozen? What is its quality? (Bright eyes? Fresh smell?)
2. Make a time that is convenient to the shop owner (try to avoid lunch times or weekends when the owners are flat out trying to make a quid) and match the products that are sold with the places they come from.
3. Find out how the products are transported and stored at the shop.

   Use the map in figure 509.1 to mark where the fish come from.
4. Ask the owners to list the most popular sales and the quantities they order and to tell you any problems they have with supply.
5. Collect any other information your group may feel relevant.

Page 517 Questions

- Write a two page essay on recreational fishing in your area. Use the following questions as a guide.

  a. How many of the class go fishing each year?

  b. About how many times?

  c. How does this compare with the average local fishing family?

  d. What fishing gear do they use?

  e. Where do they fish?

  f. What do they fish for?

  g. On average, how many fish do they catch?

  h. What is the most common catch?

  i. Would they be willingly to pay $25 a year for a fishing licence if the money went in to managing the fishery?

Page 531 Questions

Knowledge

1. Complete the sentence — In 1999-2000 the gross value of Australia's fisheries production, including aquaculture, increased by an estimated ..... What dollar value does this represent?
2. True or false? Protected species such as turtles, sharks and seabirds may be caught or killed incidentally by fishing activities.
3. True or false? Around 3600 of Australia's estimated 4500 fish species have been described, but the status of most is unknown.
4. Name 6 environmental issues of most importance to fisheries in Australia.

Application

5. Why is the status of most bycatch species uncertain?
6. The Western Australian Lobster Industry is the first fishery in the world to attain certification under the Marine Stewardship Council (London) as well managed and sustainable. What was the fishery required to do?
7. Concerns held by members of the fishing industry in Tasmania saw the introduction of a quota system in what type of marine species in 1985? What was the reason for this?

Analysis

8. What was the weight of fish caught in Australia in 1999-00? Compare this to 1996 as an expression of percentage increase or decrease.
9. Which is the greater catch size - molluscs or crustaceans?
10. Which fisheries are over-fished and in what states?
11. Name the fisheries in Bass Strait.
12. Compare the fisheries in Queensland with those of Western Australia. Are they similar or different? In which bioregion are they found?

Creativity

13. Develop a plan to increase the eastern Gemfish catch in figure 530.2.

Evaluation

14. Distinguish between good news, uncertain news and bad news fisheries management.

    a. Which state do you think is managing their fisheries the worst/best?

    b. Write a letter to your local state parliamentarian and ask for an update on related fishing legislation and implementation.

Page 532 Questions

Knowledge

1. Name any one destructive fishing technique.
2. List 9 commercial fishing methods and draw a sketch of each.
3. Describe the Aboriginal mullet fishery in Tallebudgerra Creek Queensland as related to Kombumberri Elders in stories.

Understanding

4. Draw a plan vie of a trawler to show where prawns are sorted, cooked and iced down.
5. Explain the term maximum economic yield and give an example.

Questions 6 - 11 refer to the graphs in Figure .1 and the statement below.

Applying

6. Determine the catch of banana prawns in 1990 -2001.
7. What percentage of the total number of prawns caught that year were banana prawns?
8. Suggest two hypotheses to account for the fluctuation in catch size over the last ten year period.

Analysing

9. The Gulf fishing area has a limited entry with about 290 vessels. How do you think this can be monitored? What options do authorities have if they determine the fishery at risk?

Creating

10. Design a campaign to promote the eating of aquacultured prawns.

11. Design an economic method for spotting and recapturing ghost fishing nets.

Evaluating

12. In many Australian States, governments are using revenue from recreational fishing licences to buy back commercial prawn trawling licences.

    a. Discuss the value of this.

    b Evaluate what problems it is likely to cause.

13. Who is to blame for reduced fish numbers in your area – recreational or commercial fishers or both? Locate some local fish catch statistics and justify your answer.

Chapter 21 Questions

Page 547 Questions

Knowledge

1. Of the approximately 60 different aquaculture species farmed in the last 30 years, name the five most successful species.
2. State why Australia is so fortunate in being able to farm fish species.
3. Name a species of fish that have been fattened in sea cages off Port Lincoln since 1994.
4. Describe a pilot-scale culture in Tasmania that was grown to commercial scale.
5. Name the seven major environmental issues for aquaculture identified in this case study.

Understanding

6. Give one example of a land-based practice that may have adverse effects on aquaculture operations.
7. Where aquaculture operations depend on wild-caught juvenile fish, there can be an effect on the wild stock populations. Explain.
8. Outline the suggested cause of death of tuna in Boston Bay, Port Lincoln, in 1996 and how do you think this occurred?

Applying

9. Calculate the total value of aquaculture sectors in Figure 545.1.
10. Calculate the amount of nitrogen effluent produced by 500 hectares of prawn farms in the Logan River catchment in southern Queensland.

Analysing

11. Compare the increase in aquaculture production tonnage and dollar value in 1988-89 with 1998-99.
12. Explain the need for many industry associations to develop codes of practice for their particular aquaculture operations.

Creating

13. Design an aquaculture seacage for open sea capable of withstanding cyclones.
14. Propose a solution to water quality issues associated with sea cage farming.

Evaluating

15. Estimate the cost of the design for question 13.
16. Justify the need for State and National aquaculture legislation.
17. Recommend guidelines for the introduction of overseas fish for aquaculture in Australia.
18. Prepare first speaker notes for a debate on the future of our seafood - on the side of pro-aquaculture.

Page 547 Questions

PART A GET YOUR FACTS RIGHT

Prepare a fact sheet on each of the following 9 points by completing the following tasks.

1. Look at the illustration below and decide on possible locations.
2. Define which nutrients will be produced and work out the impact of these. Calculate the size of 1 cage and research the amount of nitrate and phosphate produced by similar cages in the first year of operation.

   Make a statement predicting the effect of these nutrients on the natural cycles (see pages 419-421). List each cycle.
3. Define eutrophication and make a statement on its possible effects.
4. Discuss sediment re-suspension, and excess particulate matter effects on turbidity
5. Establish where seagrass beds are and discuss the effects on seagrasses.
6. Make a statement on the potential for an algal bloom.
7. List the effect of aquaculture on endangered species such as dugongs and handfish.
8. Research herbicides and pesticides used on other farms including those to stop antifouling of cages.
9. Discuss the on-site effects of human wastes, gutting of catch etc.
10. Identify the potential economic benefits of such a project.

PART B DEFEND YOUR ROLE IN A ROLE PLAY

In a class role-play, present the arguments of

a. the developer

b. neighbouring property owners

c. the local business community

d. local recreational and commercial fishers

e. the Environment Protection Agency

f. the local conservation society.

Page 550 Questions

Knowledge

1. Recall Australia's top aquaculture industry (by value).
2. List four Japanese aquaculture industries.
3. Name four Australian cultured molluscs.
4. Name four ways of minimising effluents from aquaculture farms.
5. State what a wild fishery is.
6. Define the term aquaculture.
7. State the food conversion ratio for aquaculture.

Understanding

8. Draw a plan view of a fish pond.
9. Prepare a table, listing the main environmental factors required by an oyster, mud crab, mullet, snapper and tuna.

   a. Which species would be the easiest and cheapest to aquaculture?

   b. What are the problems in culturing high-order predators such as coral trout and tunas?
10. Describe what polyculture is and give two examples.
11. Describe what happens in a hatchery.
12. Describe either Tuna 'ranching' or Barramundi farming.
13. How can we apply our knowledge of food chains to polyculture? Give possible examples.
14. From your studies on marine food chains, suggest species which might be cultured with oysters, prawns, snapper and tuna.
15. Why is it important to maintain genetic variation in populations?

Applying

16. Calculate the percentage wild catch of fish in 1997 from Figure 535.1.
17. About what weight of food do you eat a week?

    What would you weigh at the end of the year if your 'food conversion ratio' was 2:1?

Analysing

18. Why is Australia free of serious aquaculture diseases?
19. Compare the percentage of wild catch to aquafarmed fish in 1997 with 1950 in Figure 535.1. What is the difference?
20. Name two similarities and two differences between 'extensive' and 'intensive' aquaculture.
21. Compare the methods of growing prawns and oysters. List two similarities and two differences between the two methods.
22. Every aquacultured species has its particular dietary requirements, but it is often not possible (or profitable) to feed them a natural diet in aquaculture so most foods are artificially produced.

    a. Distinguish between the terms profitable and non-profitable foods.

    b. Identify an aquacultured species in this chapter and discuss its food requirements.
23. In North America, scientists have spliced genes from Atlantic cod into salmon to create a very fast growing, giant salmon. Identify one advantage and one disadvantage of this technique.
24. Compare the costs of canned Tuna with wild-caught fish. (Ask your local fish shop).

Creating

25. Research the life histories of an oyster, ocean prawn and tuna. How would a hatchery produce them artificially?
26. Design a sea cage that could withstand large ocean swells and still be used to fatten wild caught fish.
27. Devise a polyculture method for sea cages to minimise nutrient effects.
28. Estimate the daily amount of food required for a tuna pen with 5000 tuna.

Evaluating

29. Why is there is a risk of consumers catching diseases from eating oysters off local rocks?
30. Discuss the scientific and ethical arguments for and against genetic engineering in aquaculture in relation to human health.
31. Examine Table 543.1 and rank each of the positives and negatives from highest to lowest.

    Give a reason why for your highest and lowest choice.

Chapter 22 Questions

Page 575 – 576 Questions

1. If an area experiences average rainfalls of 1000 mm per year suggest the percentage of mangroves expected in estuaries in that area.
2. Propose a hypothesis from the information provided on the figure to explain the effect of rainfall on the proportions of mangroves and saltmarshes found in an area. What is the average rainfall in your local area?

   Do you believe you have the proportions suggested by the figure in your local area? If not, suggest a reason for these discrepancies.
3. Outline other factors, which may affect the proportion of mangroves to saltmarshes in an area.
4. Formulate a plan or method of investigation that could be used to tabulate these factors.

Part B: Distribution of estuarine habitat

1. Which State contains the largest estuarine system? What is the area in square kilometres of estuarine systems in this state? How does this compare with the total area of the state of Victoria? (If this area had a square shape how long would it take driving at 80 km/hr to travel around this area?)
2. The area of mangrove systems varies from state to state. Which state has the largest area of mangrove systems?
3. Which state has the largest seagrass areas?

   Suggest a reason to explain this occurrence.
4. Identify the differences between intertidal and subtidal seagrass beds.
5. Locate areas in your local estuarine system that contain saltmarshes.
6. Calculate the percentage of the total saltmarsh areas of Australia that are found in Western Australia.
7. Suggest why areas in Western Australia and Northern Territory have such large intertidal areas.

Questions: Case study 22.1 Estuarine management

1. Suggest some reasons to explain the large number of estuarine systems on the Queensland coast. How many estuarine systems can be found in Queensland?
2. Which state has the greatest percentage of catchments cleared of natural vegetations? What percentage of the estuaries in Australia have greater than 75% of its vegetation cleared? Suggest some reasons for the clearing of this vegetation and propose some of the consequences of these actions.
3. Determine the percentage of estuaries in Victoria that have less than 50% catchments cleared of natural vegetation.
4. In Queensland a large number of estuaries have insufficient information on clearing of some estuaries, yet in New South Wales and Victoria all estuaries have data. Suggest reasons to account for these discrepancies.

Page 585 – 586 Questions

Knowledge

1. Describe what a multiple use zone is. What types of activities does it include and which are completely excluded?
2. Find Shark Bay on a map. What environmental protection does it have?
3. List three major issues facing the great Barrier Reef.
4. Locate a marine park in this chapter and write two sentences on each of the following:
    a. Biodiversity values;
    b. Human values and uses;
    c. Economic values;
    d. Management goals and arrangements;
    e. Issues and their management.
5. Define the term marine protected area.
6. What two issues affect the Solitary Islands Marine Park?
7. Why was Queensland the first state to declare a marine park?

Understanding

8. Describe the location of a marine park in your state.
9. Name a marine protected area in your state.
10. Why has the Commonwealth established its own marine protected areas?
11. How can shipping affect a marine protected area?
12. Use the futures wheel in the appendix to predict effects of increased tourism in a marine park.

Applying

The 4 criteria for world heritage listing are:

a. Outstanding examples representing the major stages of the earth's evolutionary history;

b. Outstanding examples representing significant ongoing geological processes, biological evolution and human interaction with the natural environment;

c. Containing unique, rare or superlative natural phenomena, formations or features of exceptional natural beauty;

d. Important and significant habitats where threatened species of animals and plants of outstanding universal value from the point of view of science and conservation, still survive.

13. Locate a marine park map in your state or local area and identify where each of a-d above could occur.
14. Make a list of the activities that could occur in the park and list the types of regulations that may be necessary to control.
15. During your time in Marine Studies you should have been snorkelling and boating. Make a list of best environmental practices that should be associated with these activities.

16. Make a list of best environmental practices for recreational fishing.
17. How could you best control shell collectors and four wheel drivers in this world heritage area?
18. Are there any RAMSAR sites in the park?

Analysing

19. Write 4 four similarities and four differences between the two groups.
20. The artist has drawn 10 people. Locate the 10 and predict their occupations/interests.
21. Now answer the following questions a-k.

    a. Analyse the map for zones or multiple use areas. Make a list of which zones are there and the 4 types of activities permitted in each zone or area.

    b. Arrange the zones in order of least restrictive to most restrictive.

    c. Categorise the activities into destructive, semi destructive, little or no impact.

    d. Compare the zoning plan to that of another state. List three similarities and three differences.

    e. Distinguish between colours/shading used in the maps. How effective are the 4 maps in explaining activities to the general public.

    f. Examine the maps for navigation marks. How do people know if they are in a particular zone? How effective do you think the map is in informing people what they can and cannot do in a particular area?

    g. Explain the use of symbols in the marine park map.

    h. Identify areas that could be affected from the land. Explain these effects and possible consequences for marine life.

    i. Investigate if large scale ecosystem biodiversity has been taken into account. Do you think biodiversity is being protected? Justify.

    j. Make a list of all the features in the map. Separate the good features from the bad features. Make a list of recommendations to the map makers of how the maps could be improved.

    k. Survey your local street to see how may people use the marine park and how many know the zones. Summarise your data and post it back to the management authority with an analysis of their marine park map.

Creating

22. Compose a television jingle informing the public of a seasonal closed fishing zone.
23. Create a media release for the announcement of a proposal for a new marine park in a traditional country coastal town.
24. Design a park sign showing zoning.
25. Propose a solution to cigarette butts in marine parks.
26. Estimate the number of people who would use your local beach in summer.
27. Formulate a plan to zone the school into areas for each year level.
28. Plan a development of a low impact eco-resort in a marine park. Predict what elements of the plan would be necessary to satisfy a variety of user groups.

Evaluating

29. Assess the effectiveness of well known sports people in the public rally. How effective do you think they are in gaining media attention?
30. Determine what alternatives the group planned.
31. Build 4 life size placards for the rally.
32. Write a media release for the rally.
33. Justify rallies such as this given the high proportion of youth unemployment in Exmouth.

Exercise 22.2: Prepare a Zoning plan

For the new Hypothetical Bay Marine Park.

From all the studies you have done on the oceanography and marine biology of Hypothetical Bay, develop a zoning scheme which protects its biodiversity while allowing ecologically sustainable uses.

Produce a series of maps of Hypothetical Bay which overlay:

a. the main estuarine and marine habitats and communities;

b. the different uses of areas;

c. the sustainable and unsustainable uses;

d. hotspots or areas of overlap;

e. a zoning plan which protects key biodiversity while allowing sustainable uses. (Don't forget land uses, and the big issue of runoff and water quality.)

f. Identify all the user groups and others who should be consulted. Members of the class might 'role play' to represent the interests of the various commercial and recreational fishers, divers, water sports (surfing, sailing, canoeing water and jet skiing), conservationists, tourist operators, shipping operators and general community. Try to reach agreeable compromises to come up with an acceptable plan for all users.

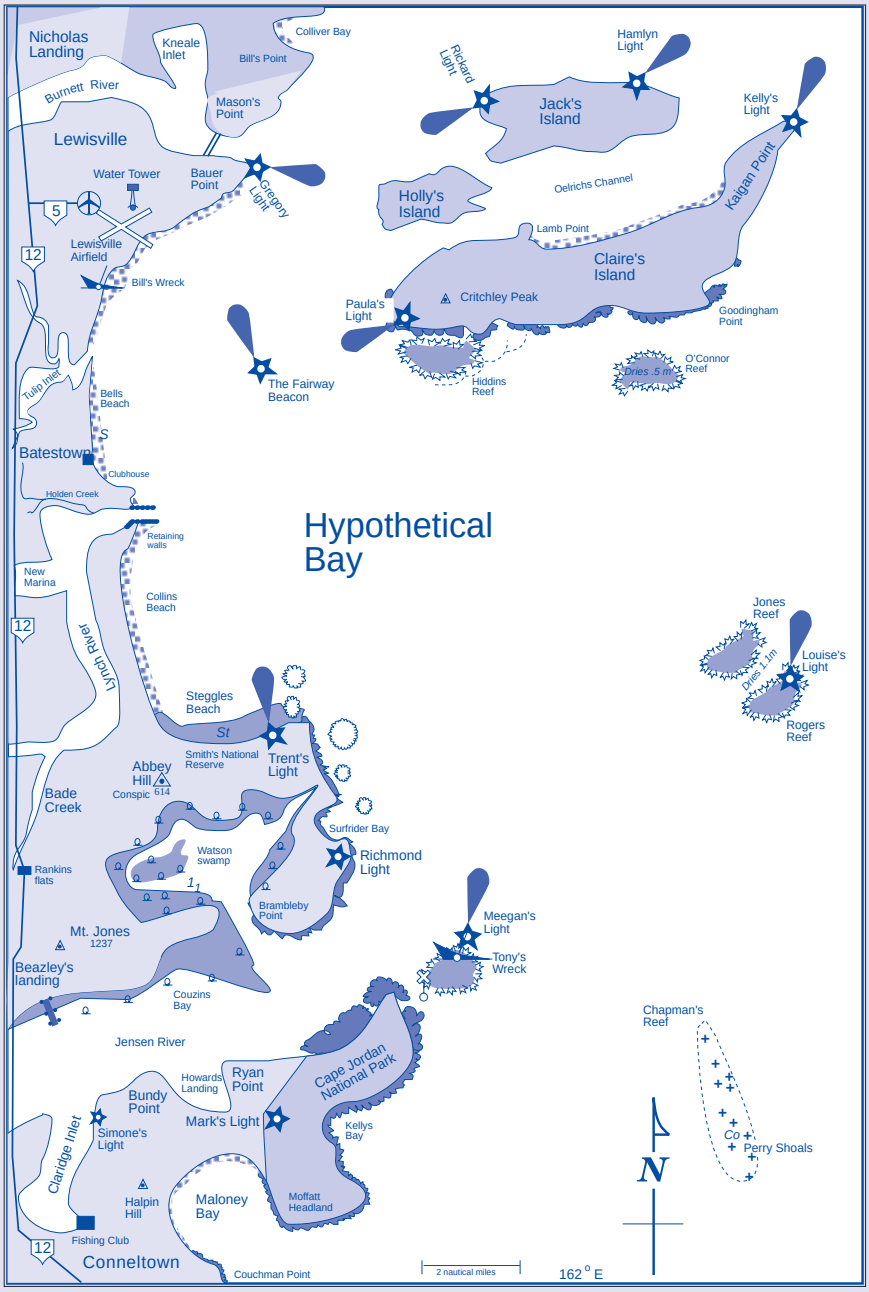

Figure 577.1 Hypothetical Bay 2008
(Illustration Bob Moffatt)

Exercise 22.3 Managing a Great Barrier Reef World Heritage Area

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Zoning - a management tool for multiple-use resources

The problem with managing the Great Barrier Reef World Heritage Area:

There are many different user-groups (specific groups of people) who want to use the Marine Park for a variety of uses. These user-groups may conflict with each other and damage the reef itself. The Great Barrier Reef Marine Park Authority has to come up with a plan that allows everybody access to different parts of the Marine Park, but ensures that these groups use the reef in a sustainable manner.

What are User Groups?

User-groups include people such as recreational fishermen, tourists, international and local shipping, divers, commercial fishermen, indigenous communities and others. It is hard to put a dollar value to the Great Barrier Reef (GBR) as so many different people use it, but generally speaking tourism activities based in the Great Barrier Reef Marine Park (GBRMP) contribute over $1 billion per year to the Australian economy. Commercial fishing in the region brings in an additional $250 million and other activities such as recreational fishing, sailing and local industries contribute another $750 million. Furthermore, container and oil ships must pass through the Great Barrier Reef to reach ports in Queensland. These ships often load up coal and other natural products for overseas markets and thus, the reef is indirectly involved in Australia's export trade. The activities and use of the Great Barrier Reef often have a huge influence over local economies and thus, can affect the well being of local towns and cities.

Aside from its economic value, the ocean has a great social value to Australian culture. Over three quarters of all Australians live within a half hour drive of the coast and people living further away often holiday on islands or beach resorts. Sailors, divers, surfers, recreational fishermen, local tourists and many others use the Great Barrier Reef Marine Park on a daily basis. Indigenous Australians also place a high value on areas of the Great Barrier Reef Marine Park. Coastal Aboriginal and Torres Strait Islander peoples have been living on the reef for 40,000 to 50,000 years and have strong cultural ties to the sea. These communities rely on the sea for cultural activities, recreation and for the hunting of traditional foods such as turtles and dugong.

Threats to the Living Reef

There are many different threats to the Great Barrier Reef due to human activity. As representatives of different user groups, you should find out as much as you can about how your activities, and those of other groups, can damage the reef. There is a brief description of the concerns of each group in the group descriptions. However, generally speaking the most commonly encountered problems are:

1. Overfishing. Some fish species on the Great Barrier Reef may be threatened by overfishing from both commercial and recreational fishermen.
2. Coastal development. The rapid development of coastal regions may be washing pollutants into the Great Barrier Reef and destroying mangroves and sea grass beds, valuable nurseries for many marine fish.
3. River runoff. It is possible that nutrients washed off farms and into rivers along the coast may be dumping large amounts of nutrients into the relatively nutrient free waters of the Great Barrier Reef. This can potentially cause entire reef systems to collapse.
4. Tourism. It is feared that the rapid growth of tourism, and the use of previously undisturbed areas, will introduce pollution, physical damage and disturb endangered species.
5. Biodiversity. The Great Barrier Reef Marine Park includes habitats used by many endangered species such as dugong, whales and sea turtles.

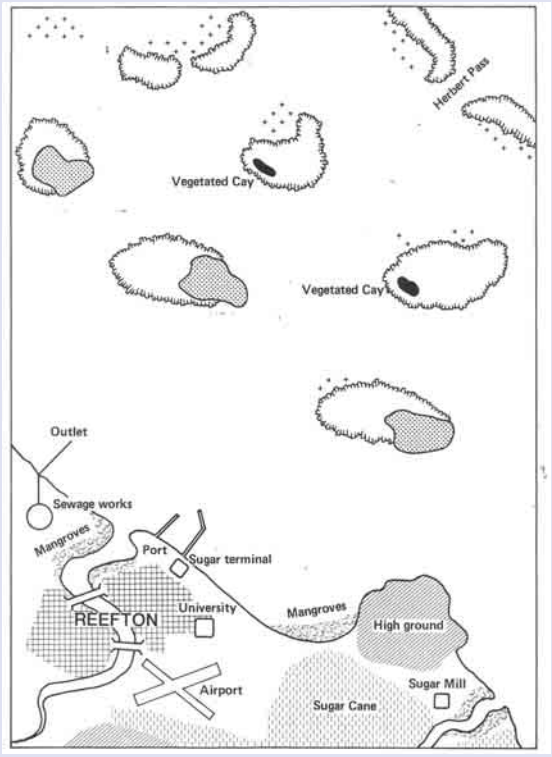


Figure 578.1 Redraw this map on a A4 sheet so you can prepare an overhead transparency for your group

Human use of these areas, ranging from commercial fishing to tourism can potentially kill these animals, or disturb their breeding cycles.

6. Shipping. The movements of large ships through the reef present the possibility of oil spills. There have been many incidents of ships running into reefs in the Marine Park. Ships also carry animals and plants from other ports in their ballast water. These organisms are discharged into the water in Australian ports where they can overgrow and wipe out native animals. This has happened in Tasmania and in the Northern Territory.

The need for management

In order to conserve this huge natural treasure, the Great Barrier Reef Marine Park Authority (GBRMPA) was formed in 1979. The Great Barrier Reef Marine Park Authority was charged with the management of the Marine Park with the goal to "Provide for the protection, wise use, understanding and enjoyment of the Great Barrier Reef in perpetuity through the care and development of the Great Barrier Reef Marine Park." The Great Barrier Reef Marine Park Authority has to ensure that everyone has the opportunity to use the reef for recreation or work, but in a way that minimises damage. This is the concept of Ecologically Sustainable Development (ESD). The term is a little bit misleading, as it doesn't actually mean building new developments in an eco friendly way, it really means using resources so that the environment is not harmed and can continue to be used.

This may mean closing off areas to use or reducing access to these areas. Ensuring the ecologically sustainable use of the Great Barrier Reef is a complicated and difficult task as people's needs are always changing, and cooperation between all the user groups is not always easily achieved. However, the Great Barrier Reef Marine Park Authority has tackled the problem by dividing the Great Barrier Reef Marine Park into different sections and preparing zoning plans for each section. These zoning plans describe what activities are allowed around the reefs and islands of the section, the aim is to balance human use with the conservation of the Reef and its animal and plant life.

A description of what is and isn't allowed in each zone is outlined below:

General Use 'A' Zone (light blue on zoning maps)

The least restrictive of the zones, this provides for all reasonable uses, including shipping and trawling. Prohibited activities are mining, oil drilling, commercial spear fishing and spear fishing with underwater breathing apparatus.

General Use 'B' Zone (dark blue on zoning maps)

Provides for reasonable use, including most commercial and recreational activities. Trawling and general shipping are prohibited as well as those activities not allowed in General Use 'A' Zones.

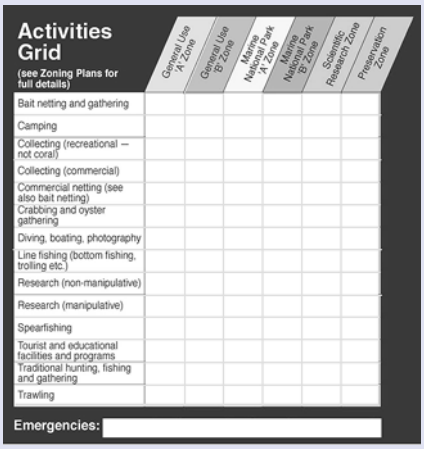


Figure 579.1 Make a copy of this Activities grid

(Illustration copyright GBRMPA, reproduced with permission, may be copied by schools for educational purposes)

Marine National Park 'A' Zone (yellow on zoning maps)

Provides for appreciation and recreational use, including limited line fishing. Fishing is restricted to one line with one hook per person. (When trolling from pelagic species more than one line may be used.) Spear fishing and collecting are prohibited, as well as those activities not allowed in General Use 'B' Zones.

Marine National Park 'B' Zone (green on zoning maps)

Provides for appreciation and enjoyment of areas in their relatively undisturbed state. It is a 'look but don't take' zone. Fishing and all other activities that remove natural resources are prohibited. The development of permanent structures is also restricted except for safety or research: eg, radio towers, navigation buoys, weather stations.

Scientific Research Zone (orange on zoning maps)

Set aside exclusively for scientific research with a permit. Entry and use for other reasons is prohibited.

Preservation Zone (pink on zoning maps)

Provides for the preservation of areas in an undisturbed state. All entry is prohibited, except in an emergency, with the exception of permitted scientific research that cannot be conducted elsewhere.

This Activities Grid clearly specifies what types of activities can occur within the Central Section of the Great Barrier Reef Marine Park and you will need to draw one up like the one shown in Figure 579.1

Your challenges

Reefton (shown on the map provided) is a coastal town located adjacent to the Central Section of the Great Barrier Reef World Heritage Area. You will have to find out all you can about how different organisations and user-groups use the Great Barrier Reef Marine Park. You will be assigned a role as one of the user-groups and using your research, you will present arguments for the types of zoning you want established in the Marine Park.


(Illustration Kerry Kitzelman)

Figure 580.1 You may want to use your deBono hats in this exercise
(Illustration Kerry Kitzelman)

Step 1 Draw the map of Reeftown

Firstly read all the information provided.

- Redraw Figure 578.1 to develop your user-group's preferred Zoning Plan.
- You will be called upon to argue your case during a user-group meeting attended by all organisations in your user-group and then in a public meeting attended by students representing other user-groups.

Step 2 Compile an Environment Impact Assessment

Each user-group is expected to compile an Environment Impact Assessment (EIA) for the activities that they want to do.

The following key issues and questions need to be answered when compiling Environmental Impact Assessments:

- Title: Your activity needs a title so people will recognise the area you are assessing.
- Description of activity: Briefly outline the activity and when the activity will take place. (Include diagrams of facilities/structures and their location.)
- Need: Why is the activity necessary?

  Impacts:
  - What are the likely impacts on the flora, fauna and ecological processes?
  - What will be the impacts on water, air or surface quality?
  - What are the likely impacts on the heritage, wilderness and/or aesthetic value of the area?
  - What wastes will be generated, how will they be handled and what are the impacts of handling them this way?
  - What cumulative impacts could arise from this activity given other existing or planned activities?
  - What is likely to be the most significant negative impact of this activity?
  - Are there any impacts not addressed above and/or are there any other comments you wish to make?
- Mitigation measures: What action, if any, will be taken to mitigate the impacts of the activity?
- Alternatives: What alternatives to the activity would involve less environmental impact?
- Conformity with management plan: How does the activity accord with any management plan prescriptions applicable to the location?
- Possible public concerns: What public concerns could be expressed about this activity?
- The Environment Impact Assessment must then be signed and dated.
- The Assessment will receive a negative or positive recommendation.
- Finally, the Assessment will receive a Determination stating whether or not the activity will be allowed.

Step 3 Design a set of criteria

- Discuss and negotiate between groups making sure all user-groups are happy with compromises to agree on a zoning plan.
- Now develop a set of criteria, which could be used to evaluate a management plan proposed in Step 5.
  - The management plans should reflect your set of evaluation criteria.

Step 4 Design a management plan

Design a management plan for the proposed activities in the area:

- Formulate a management plan by deciding how and by whom the issues should be managed; and
- Justify your management plan using the criteria you initially developed.

Some questions to be answered when formulating a management plan.

Are you going to ...

- Allow the activity unconditionally?
- Prohibit the activity completely?
- Allow the activity but with some restrictions (certain areas? Certain restrictions or requirements?)

Some decisions to make concerning your plan.

You must decide:

- Who is going to be allowed to engage in the activity.
- How do you propose to monitor the activity and its impact?
- What time span will your plan cover?
- How the issues could or should be managed in the long term.

There may be other factors that you consider important in your management plan. Remember you are the creator of the plan and so it is only limited by your imagination, your analysis of the issue and the set of criteria you have developed.

Background information needed for step 4

The following are user-groups with vested interests in the Reefton area. Assign students to each of these user-groups. Each user-group has a general overview and range of participants.

Group 1 Tourism operators

The tourism industry is one of the most dynamic and largest of the user groups. The industry generates up to $1 billion dollars every year to the Australian economy and the number of tourists has increased over ten times since the early 1980's. Tourism technology has also rapidly advanced and fast, modern catamarans and seaplanes can carry tourists to remote locations in a matter of hours. In 1985, boats could travel at 10 knots and reach reefs 20 nautical miles away in 2 hours. Today, tourists can get to reefs 50 nautical miles away at 25 knots. Large tourist vessels are capable of speeds of over 50 knots that can reach reefs 100 nautical miles away.

This means that the area tourists are be able to reach has increased from 4% to 81% of the Marine Park. The number of coastal and island based tourists resorts has also grown, allowing tourists to spend more time on the reef, and in greater comfort.

In this section of the Marine Park, the tourist user group includes:

Sea Spray Cruises

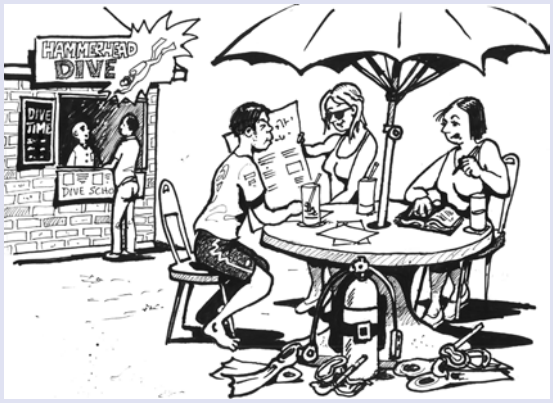
You operate a fast catamaran from Reefton. The trip takes your guests out to a pontoon off Two Spot Reef where they can snorkel, dive, fish and take glass bottomed boat trips. You want to see the fish and reefs around your pontoon protected so that your clients have the opportunity to see as much-undisturbed reef as possible. This means you want to exclude commercial fishing and shipping from the areas around your pontoon.

Hammerhead Divers

You operate a dive boat that takes divers out on three day/two night trips, diving all the reefs and islands of the central section. You have two moorings installed at Bommie, Crescent and Keeper Reefs. You want as many reefs protected as possible so that your divers can visit undisturbed reefs. You want to exclude shipping and commercial fishing around as many reefs as possible, but you want to be able to visit islands where you conduct shore based activities.

Sunrise Beach Resort Developers

You want to build a new tourist resort on the designated high ground. You need to be allowed to clear the surrounding area and build roads to and from your resort. You want to prevent shipping and commercial fishing in the waters near the resort.



(Illustration Kerry Kitzelman)

Three Tree Island Resort

Your resort is already built and has been operating on Three Tree Island for many years. You also run an education centre to inform guests about the Great Barrier Reef but your energy generation and waste treatment and removal facilities use old, 'dirty' technology. You want to exclude shipping and commercial fishing from the area. However you want your guests to be able to visit other nearby islands and reefs.

Group 2 Conservationists & Indigenous Peoples

Conservation groups are generally non-profit organisations, which aim to protect animals, plants and their habitats from human disturbance. They rely on public support and funding to lobby government organisations, and to increase the environmental awareness of the general public. They realise that people should still be allowed to experience the beauty of the reef, but their priority is still protection and conservation of the animals, plants and their habitats. They will support the use of some areas for recreation but will keep a close eye on the impact to these areas. This user-group includes:

The Nature Council

Your group is concerned with protecting habitats and you work to establish new marine parks and island national parks. You want these areas to be protected from commercial fishing, shipping and uncontrolled use by tourists, recreational fishermen and the general public. These user groups may damage the area and disturb the wildlife. However you will support tourist operators who are committed to minimising their impact on the environment and who actively educate and manage their guests.


(Illustration Kerry Kitzelman)

Reefton Preservation Society

You are interested in preserving the mangroves, beaches and offshore islands in the area. You have no problem with limited access to these areas by members of the public, but you are concerned that commercial shipping, commercial and recreational fishing and tourist development may damage these areas. You also want to see certain areas completely closed to all users, especially sea bird and sea turtle nesting sites, and sea grass beds that are habitats for dugong. Access to these areas should be for scientific research only.

Reefwatch

You are interested in preserving the coral reefs of the surrounding islands as well as off-shore reefs. You want to see shipping and commercial fishing excluded from these areas, but you will support a certain level of tourism that will not damage the fragile corals. However, you are concerned that too many tourists, recreational and commercial fishers and divers may damage the reef. As such, you feel that further tourist developments should be halted. You are also worried about the damage to the reefs caused by boat anchors. As such you want to see certain areas closed to general boat operators, but open to operators who already have pontoons or special underwater moorings.

Wanawanga tribe

Your community has resided in this section since the Dreamtime. For generations you have explored the coastal islands, built communities on these islands and hunted and fished the surrounding waters. You are still permitted under state law to hunt traditional foods such as turtles and dugongs in the marine park. Turtle Island provides very important cultural links to your community including burial grounds, stone-fish traps and middens. You believe that it is very important for people to understand and learn about your culture. You are interested in protecting and conserving endangered species.

Group 3 Fishers

The fishers user group can be divided into two broad categories, commercial and recreational fishers. Commercial fishers use different equipment depending on what they wish to catch. Prawn trawlers drag nets across the sea floor to catch prawns and scallops. However they catch a lot of other animals that are thrown away as by-catch. Near the coast, commercial fishers are allowed to set crab pots and gill nets. Along coral reefs, fishers use hand lines or fishing rods to catch reef fish like coral trout or snapper. A newly developing industry is the live fish trade. When reef fish are caught, they are kept alive in holding tanks on the fishing boats. The live fish are then exported to Asia where they are considered a delicacy. All commercial fishermen have to buy expensive fishing licences to allow them to fish in the Marine Park and in most cases, only a certain number of licensed fishers are allowed to operate at any one time. The commercial fishing industry is very important to the Queensland economy, adding over $250 million annually to local economies. The availability of fresh seafood is also of cultural importance, for example, fresh prawns for the traditional Australian Christmas BBQ. Local food industries may rely on a supply of high quality seafood.

Recreational fishers are another large user group. Over 35% of people living near the coast fish for recreation and the traditional holiday or the weekend fishing trip is an important feature of Australian culture. The recreational fishing and boating industry also generates business for coastal communities. Charter boats take paying clients out to the reef for recreational fishing. It is illegal for these fishers to sell their catch. All fishers have to comply with bag limits, which control the number and sizes of the fish they catch. Certain species such as Barramundi have closed seasons where any fishing for these species is illegal. This allows fish stocks time to recover and may protect them during important breeding seasons.

This user-group includes:

Newhaven Fishing Club

Your club consists of members who own their own boats and fish in the marine park for recreation. You would like to see these areas managed so that the fishing remains good and that not too many fish or crabs are removed. You support the enforcement of bag limits and closed seasons, but you still want to be able to access most areas for line fishing. However you are worried that commercial fishing and crabbing may strip areas clean, leaving none for you to catch. You are also worried that coastal development

(Illustration Kerry Kitzelman)

near mangroves and sea grass beds will destroy these habitats, which are vital nurseries for juvenile fish. You are also concerned that pollution washing down from rivers and streams will kill the fish in estuaries and mangroves.

Commercial Fishers Guild

You represent a group of commercial fishers who are involved in trawling and line fishing for reef fish. The fishing industry provides valuable income and jobs for the local community. Your members are regular people with bills to pay and families to support, and you know that the Marine Park is supposed to be available to all users. You are also worried that recreational fishermen are taking too many fish, and that some are selling their catches illegally. Furthermore, you feel that the clearing of mangroves and sea grass beds will wipe out larval fish nurseries, which can cause fish stocks to collapse. Closing large areas off to commercial fishers will result in lost jobs and will damage the local economy. This is especially damaging if closures occur around peak periods when demand for you product is highest, for example, at Christmas time. You need access to fishing grounds to stay in business.

Black Fin Fishing Charters

You operate a fleet of charter fishing boats, which take tourists and visitors on short fishing trips. You sometimes catch big game fish like marlin and sailfish, but when you do you tag and release them. When fishing for smaller reef fish, you make sure your guests stick to bag and size limits. Your major concerns are that commercial fishing is depleting fish stocks and harming fish habitats. However you support the growth of tourism as this brings more overseas clients to your operation. You want to see the reefs you visit protected from commercial fishing and trawling but open to tourists and recreational fishers.

The Crab Claw Company

Your company conducts commercial crabbing operations in the estuary and mangroves. You already have to follow strict guidelines and bag limits, which manage the crabbing industry. You are concerned that recreational crabbers are taking too many of your crabs, and that residential and tourist developments are causing loss of mangrove and pollution of estuaries which is affecting your catch. You want to see these areas protected from uncontrolled pollution and development, but you want to be allowed access to these areas, even if it means getting special permits.

(Illustration Kerry Kitzelman)

Group 4 Ports and Shipping

Ports and shipping are a very important user group in the Great Barrier Reef Marine Park. They use the park when their ships travel through it, and the ports are often on the edge of the Marine Park. That means that pollution and run off from the port (which can contain oils and other toxic chemicals) quickly enters Marine Park waters . Harbours must also be dredged to remove the sand and silt which builds up on the bottom. This dredging stirs up lots of sediment, which is washed into the Marine Park, killing corals and sea grass beds by smothering them.

Ships also have to navigate through a whole string of treacherous reefs, which have sunk many ships in the past. This poses a potential danger to shipping, although modern navigation aids and equipment have greatly reduced this threat.

However, ships still run aground on the reefs and this can threaten the lives of the crew, and cause serious environmental damage through oil spills and other chemical pollutants.

Recently there has been a great deal of concern about the effects of shipboard pollution and the introduction of foreign organisms through bilge water. Shipboard pollution occurs when ships dump rubbish and waste at sea, and during activities such as washing the decks.

This user-group includes:

Reefton Port Authority

Your job is to ensure that shipping through Reefton Harbour and the surrounding waters is safe and efficient. Commercial ships need to unload and load up new cargo as quickly as possible, and they want the safest and quickest shipping routes available. You also have to maintain ships and harbour equipment in top condition, which means using chemicals and detergents, which will pollute the water. You will also have to dredge the harbour to make sure it is deep enough for ships to enter. You want a General Use 'A' zone but you will have to commit yourself to minimising your impacts in and around the port, and in the shipping lane itself.

Orion & North Star Lines

You run a container ship company, which operates three tankers and two cargo/container ships between Reefton and major cities in other states. Your tankers move oil and refined petroleum, while your cargo ships move raw sugar. To get cargo to its destination on time, you need the

fastest but safest shipping lane available through the reefs and islands to Reefton port. You realise that your ships may pose a danger to the reefs but you believe that you can safely navigate the reefs. You are concerned that the declaration of large areas as anything other than a General Use 'A' Zone will force you to go all the way around the Marine Park which takes a lot longer.

Step 5 Come to a consensus

Each group could elect a member to a reef consultative committee whose role is to lead the groups to a consensus and have a management plan with agreed zones and criteria.

The conclusion of the exercise is the publication of the plan with relevant media releases and documentation.

Extension Activities

1. Design a marketing campaign that would be used to communicate the new plan and its zones to the general public. It could include the following communication tools:

   Web site, brochures, maps, signs, television and radio adds, school education program, shopping centre displays, user group meetings, trade and conference displays, power point presentations for keynote speakers.

2. Investigate how Great Barrier Reef Marine Park management decisions are made. Visit www.gbrmpa.gov.au to find out how it is managed. Construct a flow chart showing how decisions are made.
3. Analyse the contribution the Great Barrier Reef Marine Park makes to biological diversity, Australia's economy, society and environment.
4. Undertake a cost-benefit analysis to identify all the costs and benefits the Great Barrier Reef Marine Park makes to our society, environment or economy.

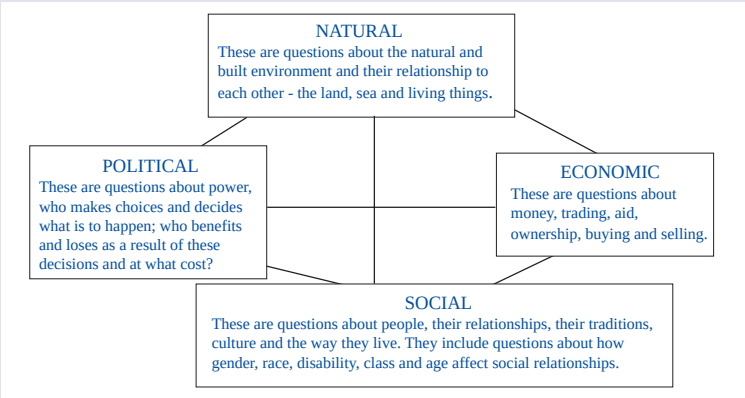


Figure 584.1 Use the following concepts to undertake a cost benefit analysis
(Illustration Fred Nucifora)

If the benefits exceed the costs the cost-benefit analysis is said to indicate an overall gain to society, and vice versa.

- Choose an issue related to the Great Barrier Reef Marine Park and complete a cost-benefit analysis on it. Present your findings to the class for discussion.

5. Debate topics such as:
   - Oceans are for everybody. People should be able to take as much as they want from the ocean.
   - Humans need energy to survive. We should mine the Reef for oil and natural gas.
   - Tourism makes money. More tourists should be allowed to travel within the Great Barrier Reef Marine Park.

Tip

Use the following key concepts to help you undertake a cost-benefit analysis (see Figure 584.1).

Natural

These are questions about the natural and built environment and their relationship to each other - the land, sea and living things.

Economic

These are questions about money, trading, aid, ownership, buying and selling.

Political

These are questions about power, who makes choices and decides what is to happen; who benefits and loses as a result of these decisions and at what cost?

Social

These are questions about people, their relationships, their traditions, culture and the way they live. They include questions about how gender, race, disability, class and age affect social relationships.

(Illustration Kerry Kitzelman)

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