Ways and means—mangrove adaptations

**Purpose**
- To investigate structural (anatomical), functional (physiological) and behavioural adaptations of some of the organisms in a mangrove ecosystem.
- To consider patterns of saltmarsh zonation.

**Background Information**
In southern Australia, the white mangrove (Avicennia marina var. resinifera) is the only remaining species of the very diverse 'mangrove communities' that line the sheltered coasts and estuaries of northern Australia. The biodiversity of these communities decreases with increasing latitude (distance from the equator) until the white mangrove reaches its southernmost limit along the coast of Victoria. The main remnants of these communities can be found in the sheltered waters of Corner Inlet (near Wilsons Promontory) and around the northern end of Westernport Bay.

Some people believe that the only thing to do with the muddy, foul-smelling, mosquito-infested mangrove swamps is to fill them in and develop the reclaimed land. As scientists learn more about these ecosystems they are coming to understand just how important they are to the health of our bays and estuaries and to the food webs in them. Indeed, it is thought that their biological importance extends well beyond their actual boundaries.

There have been, and will probably continue to be, major environmental confrontations over how we treat our mangrove ecosystems.

Because mangroves are able to survive in a harsh and constantly changing environment, they must be very well adapted. They form the seaward edge of the salt marsh fringe around the north end of Westernport Bay. This fringe is itself a good example of zonation and succession (Figure 2.15).

Adapted from *The Western Catchment Resources Inventory*, vol. 1, Westernport Catchment Co-ordinating Group, 1979.

![Figure 2.15](image_url)

**Figure 2.15**
Mangrove–saltmarsh zonation at Westernport Bay.

1. What are some of the environmental conditions you would expect mangroves to experience:
   a. daily?
   b. seasonally?
2 The diagram of the mangrove–saltmarsh zonation pattern is a ‘snapshot in time’. If all the environmental conditions remained the same, suggest what changes you might observe if you returned to the same location many years later. Outline your reasons.

3 Many saltmarsh plants such as beaded glasswort and shrubby glasswort are described as succulent plants.
   a. What are succulent plants?
   b. Suggest how this adaptation might help their survival in the saltmarsh environment.

4 Quite often there is bare ground and a crust of white salt crystals at the boundary between the swamp paperbark and the saltmarsh zone. From the information in Figure 2.15, suggest an explanation for this observation.

Mangroves grow at or just below mid-tide level and extend landwards along drainage depressions in the salt marsh to just below mean spring-tide level. Their growth habit is fairly stunted and they only reach a height of about 4 metres. (Those growing on the seaward side are much smaller.) At high tide the lower parts of the trunks are covered by sea water, while at low tide it is almost impossible to walk on the deep oozing mud that is exposed. This mud is very rich in organic matter from fallen leaves, the algae that grow on the mud, and the organic matter brought in by the tide and trapped there. The mud is permanently waterlogged and, because it is made up of sand and very fine trapped silt, there are no air spaces. Anaerobic (without oxygen) decomposition of organic matter is common, resulting in the production of poisonous, foul-smelling gases such as methane and hydrogen sulfide (rotten egg gas).

The open space under the canopy and between the trees is a mass of very specialised ‘peg roots’ or pneumatophores (pneuma means air) which grow up vertically from the main root mass beneath the mud. At low tide they extend up to 20 centimetres into the air above the mud. The lower parts of the trunks and the pneumatophores are covered with a film of algae.

Animal life in the mangrove community is very diverse. Birds shelter, feed and nest in the canopy. Fish swim among the trunks and pneumatophores, seeking food and shelter. Acorn barnacles are permanently attached to the mangrove trunks. At low tide they are exposed to the air and so remain tightly closed. With the high tide they open up and feed by filtering microscopic plankton from the water. The black-mouthed coniwink is one of the few sea snails found in the mangroves; it can only breathe underwater. So before low tide it returns to the same location and firmly cements itself to the mangrove trunk. As the tide comes in it moves around freely, grazing on the algae growing on the trunks and on the pneumatophores. The southern mud whelk grazes over the surface of the mud, and worms and snapping shrimps burrow into the mud.
The white mangrove community. Mangroves have biochemical mechanisms that enable them to tolerate internal salt concentrations 100 times higher than those of normal plants. The roots also have special mechanisms that allow the plant to take in fresh water and essential nutrients while keeping out most of the salt.
Although mangroves are adapted to salt water, the process of seed germination and seedling establishment is not at all tolerant to salt. White mangroves have overcome this problem by evolving a viviparous habit. The seed germinates while still attached to the parent plant and the germinated seedlings are already partly developed before they are dropped. They drift with the currents until they lodge in a suitable muddy environment, where roots and leaves quickly establish.

5. Use the written and illustrated information about the mangrove community including the adaptations featured by different organisms to complete the summary table of adaptations. These adaptations can be classified as being one of three types: structural (anatomical), functional (physiological or biochemical) or behavioural.

<table>
<thead>
<tr>
<th>Description of adaptation</th>
<th>Survival value of adaptation</th>
<th>Type of adaptation</th>
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Use all of the information provided and any further information you have to complete the table. You should be able to identify at least seven or eight significant adaptations within the mangrove community. You might prefer to present your findings as a poster, a model or an electronic presentation.

6. Explain what is meant by the term adaptation.

7. Outline the differences between structural, physiological and behavioural adaptations. Include an example of each to illustrate your explanation.

8. Summarise the changes in the type of organisms that occur along mangrove–salt marsh zonation discussed at Westernport Bay. Use your understanding of adaptation to account for these changes.