

Mangroves of Victoria

INFORMATION KIT



Sea Search

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WHAT ARE MANGROVES?

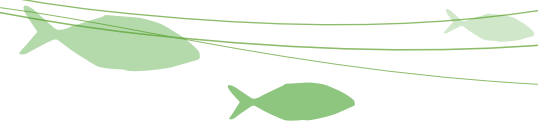
Mangroves are small trees that usually grow in the area between the low and high tides. They usually grow in soft sediments on tidal flats of sheltered estuaries, inlets, or bays but can sometimes be found growing in other environments, such as amongst basalt rocks in the Jawbone Marine Sanctuary at Williamstown. Together with another salt tolerant plant community known as coastal saltmarsh, mangroves live on the edge of the sea and are an important link between the land and sea.

Mangroves can generate a range of responses with some people loving them and others hating them. They have in the past been poorly regarded but are better appreciated now because of their contribution to the ecology of marine, coastal and estuarine environments and the protection they provide to coastlines.

The Sea Search Mangroves of Victoria information kit was developed by the People & Parks Foundation and is funded by ExxonMobil Australia. This kit is designed to assist volunteer and community groups learn about these special habitats, and to encourage monitoring the health of mangrove communities.

ExxonMobil Australia provides funds for community projects in areas where it operates and has supported the Sea Search initiative to promote the conservation of marine parks and sanctuaries in Victoria since 2004. Further information about ExxonMobil's involvement with the community is available at www.exxonmobil.com.au

◀ Young mangroves growing seawards onto soft tidal flats at Jacks Beach in Western Port. Mangroves are unique because they are the only woody plants growing in saltwater, experiencing both high and low tides and grow best in both muddy-sand and sandy-mud soft sediments in coastal bays, inlets and estuaries where they are sheltered from high wave energy.



WHERE DO MANGROVES OCCUR?

When one thinks about mangroves the usual vision is that of the tropics with steamy mangrove jungles, tangles of roots and lots of mud. While this is true, it is surprising to find that mangroves also occur in relatively cool temperate climates such as in Victoria.

Australia has the third largest area of mangroves in the world after Indonesia and Brazil, totalling 9,910 km² representing 6.5% of the total proportion of the world's mangroves.

In Australia, mangroves reach their greatest species diversity in the tropics with 41 species reducing to a single species in Victoria and South Australia where only the White Mangrove, *Avicennia marina* var. *australasica*, occurs. There are no mangroves in Tasmania.



▲ Mangroves can be found close to the centre of Melbourne in the Stony Creek Backwash of the Yarra River, beneath the West Gate Bridge.

In cool temperate areas such as Victoria, mangroves grow best in water with salinity close to that of seawater (35ppt), and to survive need to experience both regular inundation at high tide and exposure to air at low tide.

MANGROVES IN VICTORIA

Victoria has approximately 51km² of mangroves with most located across the central coastal area of the State.

From west to east they occur at the following locations:

- The Barwon River estuary, Barwon Heads/Ocean Grove;
- Limeburners Lagoon near Corio Bay, Geelong;
- Kororoit Creek at Williamstown;
- The Jawbone Marine Sanctuary at Williamstown;
- Stony Creek Backwash, under the Westgate Bridge Melbourne;
- Western Port including parts of the west, north and east shorelines, the northern shoreline of French Island and Rhyll at Phillip Island;
- Andersons Inlet near Inverloch;
- Corner Inlet and Nooramunga Marine and Coastal Park in South Gippsland.

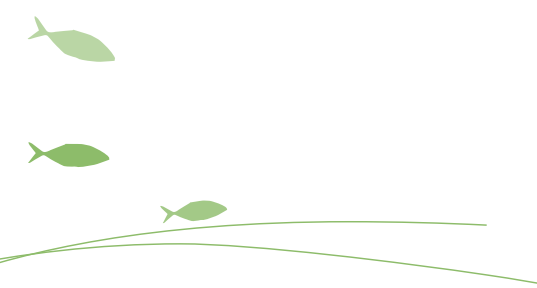
More recently mangroves have also been found at Swan Island near Queenscliff and in Cunninghame Arm at Lakes Entrance. The plants at

Lakes Entrance are understood to be a result of plantings that occurred in the late 1980s early 1990s.

The southernmost mangroves in the world are found at Millers Landing on the northern section of Wilsons Promontory National Park at 38° 45' S. Low temperatures and frosts limit the extent of mangrove distribution and at its southernmost range the White Mangroves are stunted, often less than two metres tall, when compared with their tropical cousins which grow to become large trees over ten metres high.



▲ The world's most southernmost limit of mangroves can be found at Millers Landing in southern Corner Inlet within the Wilsons Promontory National Park.



DISTRIBUTION OF MANGROVES

The factors affecting mangrove distribution and condition are diverse and include climate, soils, physiography, tidal range, wave energy, rates of sedimentation, changes in sea level and land level, salinity, frequency of tidal flooding and drainage patterns.

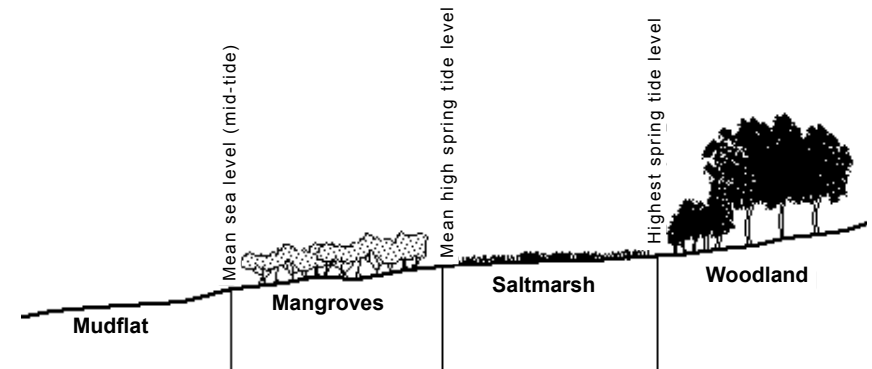
A typical cross section from landward to seaward (reflecting soil salinity changes) comprises Manna Gum (*Eucalyptus viminalis*) followed by Swamp Paperbarks (*Melaleuca ericifolia*), various coastal saltmarsh species particularly Shrubby Glasswort (*Tecticornia arbuscula*) and Beaded Glasswort (*Sarcocornia quinqueflora*), followed by White Mangroves (*Avicennia marina*), and finally seaward, either bare mudflats or seagrass (*Zostera* sp.).



▲ Mangroves are often associated with coastal saltmarshes such as Beaded Glasswort (*Sarcocornia quinqueflora*).



▲ Shrubby Glasswort (*Tecticornia arbuscula*) on the left can often match the growth form of the White Mangrove.



▲ A typical cross section of the tidal zone from seaward to landward - Gould Coastal Wildlife (1993).

▼ Rhyll Inlet Mangrove Saltmarsh Cross Section. A typical cross section of tidal vegetation including mangroves, saltmarsh and terrestrial vegetation communities from seaward to landward.



Features of mangroves

In Victoria the White Mangrove is a tree or shrub that grows between 0.3 metres to 4 metres in height with a well defined trunk and numerous breathing roots called pneumatophores. These rise some 25 to 30cm above the surface and have a corky, water resistant bark and a spongy interior where oxygen is absorbed.



▲ Jam Jerrup Red Bluff mangroves are of a bonsai size with a radiating network of pneumatophores or breathing roots.

White Mangroves have a shallow but large lateral root system that spreads out from the trunk offering support in the soft sediment within which they grow. The lower branches tend to grow horizontally at a level where the high tide just immerses them. Lichens often cover that part of the trunk out of water, while the submerged part provides a surface for a host of marine invertebrates and algae.



▲ A larger White Mangrove showing the exposed shallow lateral root network including pneumatophores.

The leaves are leathery, dark or olive green above with a glossy surface and grey or whitish underneath. They are oval shaped and approximately 4 to 7cm long and up to 4cm wide and occur opposite one another on the stems.



▲ A closer view of the mangrove trunk clearly showing trunk rootlets and surrounding maze of pneumatophores.



▲ A healthy mangrove showing yellow leaves ready to shed and along with them some of the excess salt taken up by the plant.



▲ The leaves and flowers of the White Mangrove.

To cope with living in a salty environment the White Mangrove has the ability to exclude, secrete and accumulate salt. It is a salt tolerant plant (halophytic) that can both accumulate and exclude salt. It does this through excluding some of the salt through the root system and by secreting excess salt either through glands on the underside of the leaves or by dropping yellowish leaves where salt has been accumulated. These adaptations for living in a salty environment provides the mangrove with an evolutionary advantage of being able to out-compete terrestrial and other wetland plant species in such harsh environments.

In Victoria, the White Mangrove produces clusters of small orange-yellow flowers, each one 5 to 7mm in diameter produced over a period that can range from about August through to June. The flowers produce a sweet and pleasant scent and are popular with bees for honey production.

Following flowering White Mangroves produces embryonic seedlings called propagules while attached to the tree that are able to establish as small plants within a few days of being released. This is different to some other species of mangrove such as Stilt Mangroves (*Rhizophora stylosa*) which actually produce partially grown seedlings before they drop off the plant.

Seeds of the White Mangrove develop from September and mature and drop onto mudflats in January and February. Large numbers of propagules are usually produced every two years and have a fleshy capsule with a single seed. When the propagule falls from the mangrove tree it floats on the tidal currents until the outer covering ruptures and falls off and the seed settles and takes root, in all taking around 5 days to complete. Most seeds are washed high on the shore close to the parent plant. Only a few seeds or seedlings have been found travelling distances of more than 10 km.

In this way mangroves are capable of reproducing in an efficient and effective manner that capitalises on tidal water movement and allows for seedlings to establish themselves a little distance from the parent tree wherever suitable substrate and tidal conditions allow.



▲ Lichen growth on mangrove trunk.



▲ Mangrove seeds or propagules still attached to the tree ready to drop and be carried away on the tide to establish a new generation of mangroves in Victoria.



▲ Mangrove propagule settling and taking root into the sediment surface. The cotyledon is seen spreading ready for the first leaves to shoot. It is the engine room for the development of the seedling from the propagule.



▲ Mangrove seedling beginning to develop with first shooting of leaves. The large cotyledon is used as an initial source of energy for the young seedling.



▲ Young mangrove seedling established in the sediment and developing its first couple of leaves. The seedling is still utilising energy from the cotyledon.

Why are mangroves important?

Mangroves were important to Aboriginal people and early settlers, and remain extremely valuable to the environment and communities of today.

Mangroves were valued for subsistence living by Aborigines. Some Aboriginal people depended almost entirely on the fish and shellfish that flourished in mangrove habitats for their subsistence. Species such as mullet, flathead, whiting, flounder and leatherjacket were caught or speared while crabs were collected to be eaten in communal feasts as evident by the many middens that can be found around estuary foreshores.

Mangroves were used by early settlers for lime burning, boat building and soap making. Soap was a scarce and expensive commodity in early Melbourne but by the early nineteenth century soap was being manufactured locally and marketed as being of equal quality to that received from England. This was possible because ash, known as barilla, was obtained by burning mangroves from Western Port and used to make soap.

Mangroves provide important habitat values including shelter for the juveniles and adults of many fish species, including commercially and recreationally important species such as mullet, bream, whiting, luderick, flathead, flounder and shellfish such as crabs and prawns.



▲ Greenback Flounder (*Rhombosolea tapirina*) are found amongst and around mangroves and use them for habitat purposes particularly at a juvenile stage.

Mangroves and coastal saltmarshes and associated tidal flats provide roosting and foraging opportunities for birds and bats and with their lower branches, trunks and root network provide a complex habitat for other organisms such as crabs, snails, worms and insects.



◀ Dusky Flathead (*Platycephalus fuscus*) are an important commercial and recreational target fish found in and around mangroves.



◀ A White-faced Heron (*Ardea novaehollandae*) on a mangrove boardwalk on the Barwon River estuary at Barwon Heads.



◀ A Sentinel Crab (*Macrophthalmus latifrons*) found on the mudflats of mangroves. Typically, they have eyes on long stalks and are common with the Semaphore Crab (*Heloeiclus cordiformis*).



◀ Mangrove pneumatophores provide an attractive habitat for barnacles.



▶ Birds like the Little Pied Cormorant (*Phalacrocorax melanoleucos*) are often associated with and use mangroves for roosting.



▶ Mottled Shore Crab (*Paragrapsus laevis*) are commonly found on mangrove mudflats.



▶ A Soldier Crab (*Mictyris longicarpus*) found on mud and sand flats in mangrove areas. They march like armies feeding on the outgoing tide.



▲ Old shipwrecks in mangroves can be viewed as interesting additions to a landscape or as intrusive unnatural elements to a mangrove ecosystem. Often such judgement is 'in the eye of the beholder'.

Mangroves and their adjoining saltmarshes, seagrass meadows, sand flats and mudflats are among the most productive of environments. They contribute large amounts of organic matter, known as detritus (leaves and other plant debris), to their environment. In turn detritus is colonised by fungi, bacteria and animals such as amphipods which assist in decomposition. Other animals such as annelids and molluscs assist in this process and feed on the decomposed fragments. These animals are the food source for animals higher in the food chain.

leaves mangroves in one year provide the ecosystem with up to four times as much nitrogen, and half as much phosphorus, as can be found in the bay water itself.

Mangroves are also very important in erosion control. Rehabilitating coastal areas by transplanting or seeding with mangroves is much less expensive than building sea walls, reclaiming land or using other engineering solutions. Mangroves can trap sediment by reducing water velocities with their trunks, twisting roots and pneumatophores allowing sediment to fall out of suspension in the water and settle around the trees.

In Western Port through their fallen

Mangroves act as filtering systems, trapping sediments and other materials such as plant litter. In this way mangroves assist in maintaining water quality by providing a natural safeguard against excessive water turbidity and nutrient enrichment.

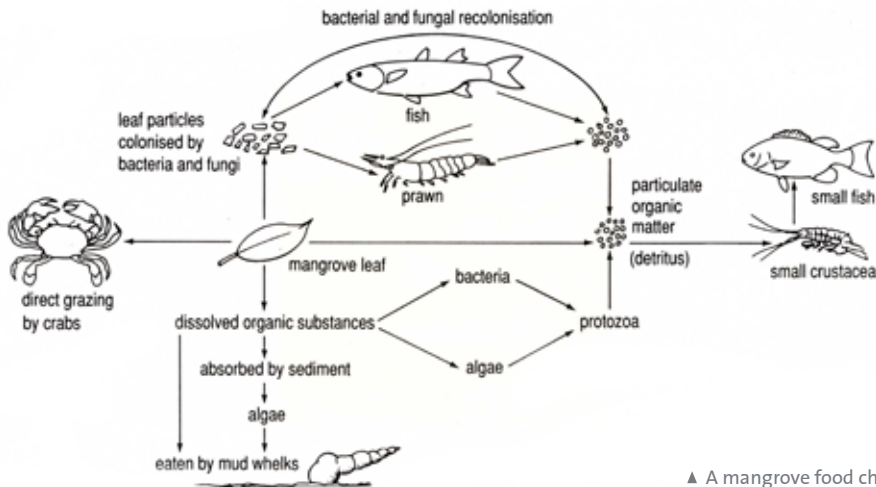
vegetation change along the intertidal gradient provides an important gauge on how a rise in sea levels may impact on the coast and its coastal ecosystems.

Mangrove wetlands are areas of scenic attraction and their ability to withstand extreme conditions (including salt tolerance) makes them particularly useful for scientific investigation and environmental education.



▲ Mangroves provide unique areas to appreciate the environment and to take in the view.

Mangroves are very likely to respond to the effects of climate change and sea level rise. Because mangroves are intimately linked to tidal inundation any rise in sea levels as a result of climate change will increase opportunities for mangroves to adapt by migrating landward. Measuring mangrove



▲ A mangrove food chain.

Threats to mangroves

Threats to mangroves partly arise from poor public appreciation of their values and a perception that the waterfront land they occupy could be used for some other, more 'valuable' purpose.

Threats to mangroves include:

- Tidal barriers, drainage, flood mitigation and foreshore protection works which restricts or eliminates tidal water movement results in mangrove dieback. Protective works such as seawalls can result in either permanent inundation or none at all and can also prevent seedling distribution and hence regeneration threatening the ability for mangroves to remain productive and provide habitat. Trails and boardwalks also have potential to disconnect mangroves from regular inundation if not constructed to allow for tidal movement.

► Mangrove health can be judged by the extent of dieback (dead branches). In this case high salinity due to lack of inundation may be a cause.

- Uncontrolled or inappropriate stock access. Stock eat leaves, and their movement around mangroves compacts sediment, kills young seedlings, impacts on the root systems, and creates pugging resulting in water ponding on ebb tides and creates mosquito breeding areas.

- Foreshore development and uninterrupted water views. Mangrove wetlands are sometimes valued for development opportunities with water frontages viewed as prime real estate placing pressure for reclamation of mangrove areas for housing or other uses. Mangrove habitats have been reclaimed for playing fields,

industrial and residential development and have been used for the disposal of dredge spoil. Mangroves are also sometimes cleared by owners of waterfront properties to obtain water views and access.

- Construction activity in/or adjacent to mangroves involving soil excavation can expose the naturally oxygen poor (anaerobic) acid sulphate soils occurring in the mangroves to air, generating toxic sulphuric acid. Exposed acid sulphate soils can be toxic to vegetation and estuarine life including fish.

▼ The demand for water views is so strong that damaging mangrove removal often results.



- Use of off-road vehicles and the riding of trail bikes. Damage can include loss of vegetation and compaction of soil. In these areas regeneration is slow or may never occur if traffic continues.

- Dumping of rubbish/waste and land fill sites can be highly destructive. Examples of former mangrove and coastal saltmarsh areas being used for landfill and later converted into parkland are at Hastings in Western Port Bay.

- Oil spills and toxic chemicals, particularly near urban settlements, leaching from rubbish or washed into estuaries from catchment areas and drains, can be highly destructive and clean-up work within these habitats is difficult.

- Trampling by humans can damage root systems and seedlings if uncontrolled. The use of boardwalks to allow appropriate access into mangrove wetlands is a much better way of providing access into these environments.



▲ Drains discharging stormwater in a concentrated flow can upset the salinity balance, scour mudflats, cause erosion and deposit high nutrient loads.



▲ Jetties and shacks increase pressure for access through mangroves.



▲ Boardwalks carefully sited and constructed offer great opportunities for appreciation of these unique environments.



▲ Insect damage to leaves can sometimes be extensive and result in poor tree health.



▲ High nutrient loads can result in excessive growth of algae such as *Ulva* sp. which can smother pneumatophores.



▲ Development pressure and tension between private and public land: a fenceline dividing land tenure that cuts through a mangrove wetland.

- Impacts from insect damage such as moths and flies, plant disease such as *Phytophthora cinnamomi* root rot fungus and excessive algal growth such as *Ulva* sp. Pollution events, including the influx of large nutrient loads, can stress the metabolism of mangroves and plants may become weakened and more susceptible to other forms of attack.

- Sea level rise as a result of climate change or other factors. An increase in the extent and area of tidal water movement and higher inundation may result in mangroves migrating landwards. Where natural or human physical structures such as steep slopes, road embankments or seawalls exist, mangroves may be lost due to 'coastal squeeze'. Mangroves may survive by keeping pace with the rate of sea level rise in those areas where the rates of sedimentation are sufficient to create new sediments upon which mangroves can colonise.

Looking after our mangroves

The White Mangrove (*Avicenna marina*) is listed under the Advisory List of Rare and Threatened Plants in Victoria 2005 as rare in Victoria which means that the White Mangrove is rare but not considered otherwise threatened. This is a reflection of the fact that mangroves are not extensive across the State and occur in restricted environments associated with mangroves growing in tidal environments that are sheltered from wave energy and experience large tidal ranges.

Mangroves are for the most part greatly assisted in being protected through good coastal management. As most of the Victorian coastline is in public land ownership, these areas are generally managed to protect their values as coastal Crown Land are managed by Parks Victoria, elected Foreshore Committees of Management, the Department of Sustainability and Environment, or Local Government.

Some mangrove areas are protected within declared Marine National Parks and Marine Sanctuaries including Yaringa, French Island and Churchill Island Marine National Parks in Western Port, Corner Inlet Marine National Park, or the Jawbone Marine Sanctuary at Williamstown. Others occur within coastal parks and reserves such as the Northern Western Port Conservation Reserve or Lake Connewarre State Game Reserve.

◀ Participating in mangrove replanting can be effective, and muddy.



10 SIMPLE WAYS TO HELP MANGROVES

1. Don't walk, ride or drive through mangrove areas at low tide.
2. Stick to boardwalks or trails when moving through mangroves to avoid damage to mangrove roots.
3. Dispose of rubbish, oils and chemicals in the correct manner.
4. Participate in or assist in organising a mangrove planting day or awareness program.
5. Avoid damaging mangroves and their roots when boating or fishing.
6. Learn about mangroves and share your knowledge with friends and family.
7. Collect images of mangrove habitats and share these in your community.
8. Fence off the inland side of the intertidal zone to prevent stock access to mangrove areas.
9. Design structures such as jetties, boardwalks, or boat ramps to avoid or minimise impacts to mangroves.
10. Report any activities harming mangroves to your nearest Department of Sustainability and Environment, Parks Victoria, Committee of Management, or Local Government office.

MONITORING OUR MANGROVES

The Sea Search Mangrove Monitoring program was trialled in Western Port Bay during 2010. The method is a rapid qualitative method where features of the mangroves at the site are recorded and photos are taken from marked photo points to build up an historical record of the site over time.

Features of the mangroves and the site that are recorded include recognising features such as flowers, fruits, bark condition, aerial roots and their shape, canopy condition. 6 sites were monitored seasonally during 2010: Churchill Island, Queensferry Road (Grantville), Tooradin, Warneet, Blind Bight and Jacks Beach.

Data pegs to mark the photo point are all you need to start monitoring mangroves.

For more information on mangrove monitoring opportunities contact the Parks Victoria Information Centre on 131 963 or visit www.parkweb.vic.gov.au.

... more features of mangroves



◀ A Sentinel Crab (*Macrophthalmus latifrons*) entering a burrow.



▶ Twisted or curled pneumatophores.



◀ Snails (*Bembicium* sp.).



▶ Mangrove seedlings emerging from the mud.



◀ A blue marking tag used to monitor mangrove areas.

▶ Successful planting of mangroves.



PROGRAM CONTACT

Parks Victoria (Volunteering)

131 963
www.parkweb.vic.gov.au

Coast Action/Coastcare Facilitator

03 9296 4532

BIBLIOGRAPHY

Available at:
www.peopleandparks.org

RESOURCES

Sea Search

www.peopleandparks.org

DSE – Mangrove Information

www.dse.vic.gov.au

Mangrove Watch

www.mangrovetwatch.org.au

Western Port Seagrass Partnership

www.seagrass.com.au

OTHER MONITORING KITS

Victorian Subtidal Marine
Monitoring Kit – Sea Search &
Reefwatch Victoria

Feral or In Peril Victorian Monitoring
Kit – Reefwatch Victoria

Sea Search in Schools Marine
Monitoring Kit – Sea Search

USEFUL CONTACTS

Coast Action / Coastcare and Marine Pest Monitoring (DSE)

136 186
www.dse.vic.gov.au/coasts

EPA Victoria – Pollution watch line

03 9695 277 / 1800 444 004
www.epa.vic.gov.au

Fisheries Victoria

Office Reporting 13FISH (133 474)
www.dpi.vic.gov.au

Dolphin Research Institute

1300 130 949
www.dolphinresearch.org.au

ReefWatch Victoria

03 8341 7446
www.reefwatchvic.asn.au

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