Monitoring mangroves

Mangroves play an important ecological role in many of Western Australia's tropical and sub-tropical environments. In several areas, mangroves also have strong social and cultural significance. DBCA's Biodiversity and Conservation Science is carrying out a State-wide monitoring program to keep a long-term watch on the health and extent of mangroves, to observe changes in their condition caused by factors associated with climate change, and in order to respond to direct human-caused threats.

by Kevin Bancroft

Previous page
Main Mangrove forests line the Kimberley coast.
Photo – David Bettini
Inset left DBCA scientists are monitoring the health of mangroves throughout the State.
Photo – Kathy Murray/DBCA
Inset right Mangrove heron.
Photo – Jiri Lochman

Above left Grey mangroves are found in Bunbury.
Photo – Cliff Winfield

Above Some mangroves species have special above-ground roots.
Photo – Kevin Bancroft/DBCA

It is estimated that there are 352,000 unique flowering plant species on Earth, of which approximately 140 species are found in marine environments. True mangroves – plant species that occur only in mangrove forests and are not found in terrestrial communities – account for 69 of these species. Of these, 41 are found in Australia, and nearly half in Western Australia.

SPECIES DIVERSITY

Mangroves have adaptations that enable them to survive in salty environments. For example, special glands in their leaves excrete excess salt, and enable mangroves to expel up to 90 per cent of the salt content taken in through their root systems. Also, some species have special above-ground roots, called pneumatophores, which transport oxygen throughout the plant to regions located in low-oxygen muddy sediments.

Mangroves occur in both tropical and subtropical areas. They vary in height from less than a metre up to 20 metres tall, and usually occur above mean sea level in the intertidal zone of marine and estuarine environments. However, the most inland occurrence of mangroves in WA is at Mandora Marsh wetlands in Walyarta Conservation Park, approximately 60 kilometres inland from Eighty Mile Beach.

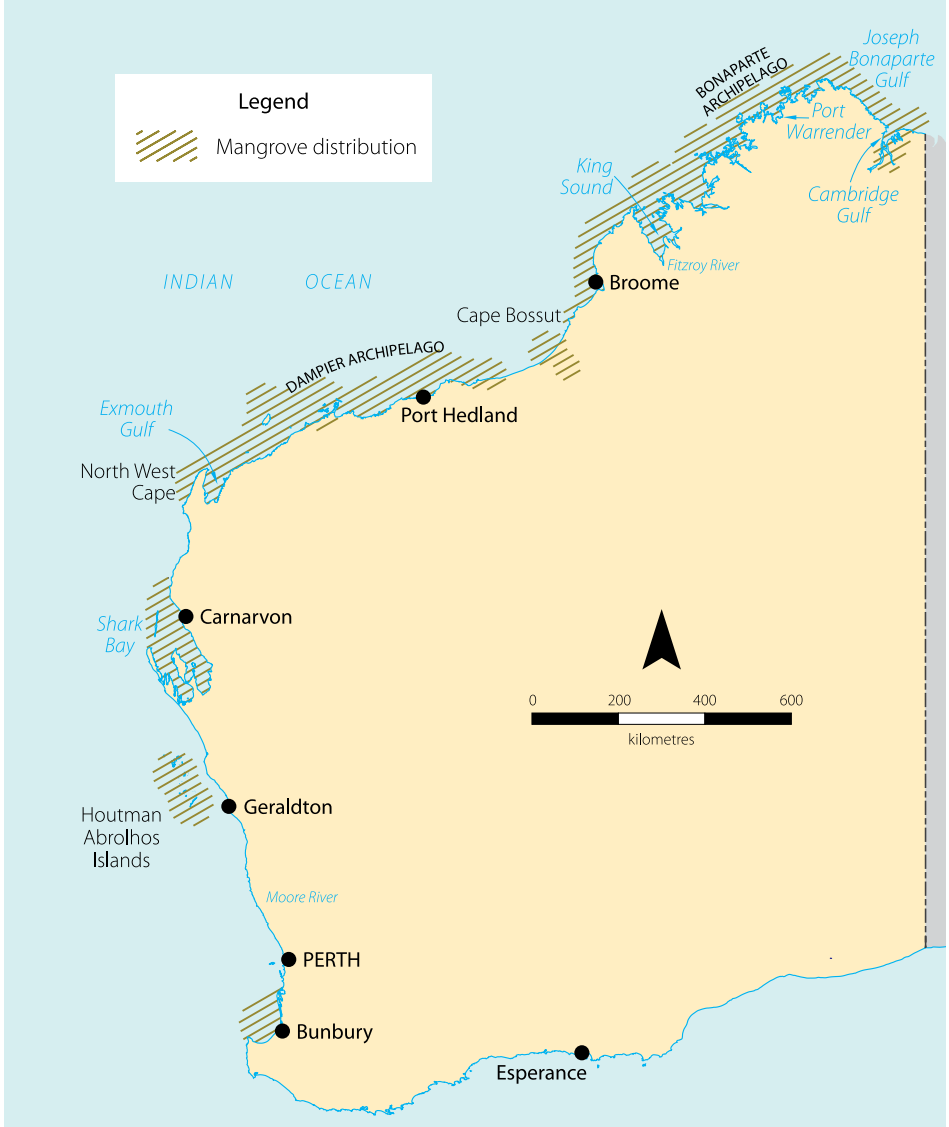
In WA, mangroves occur in stands of a single species, such as the grey mangrove (*Avicennia marina*) found in Bunbury (see also 'Kaleidoscope' on page 53), the Abrolhos Islands and Shark Bay areas, or in multispecies assemblages of up to eight or even 20 species in the Pilbara and Kimberley regions, respectively. Structurally, mangrove areas range from sparsely treed stands no taller than five metres in Shark Bay, to dense forests of up to 20 metres tall in the Kimberley.

UNSUNG HEROES

Mangroves serve an important ecological role. They protect the shoreline from coastal erosion, particularly in the tropical areas where cyclones and severe monsoonal storms routinely occur. They also have a substantial capacity to convert atmospheric carbon dioxide and other greenhouse gases into oxygen and can fix the carbon in the muddy, oxygen-poor substrate that supports them, for thousands of years. They also have the potential to sequester (capture) up to six times more carbon than rainforests. Indeed, the average carbon captured by one hectare of mangroves, including soil carbon, has been estimated at around 1000 tonnes – about the same amount as the annual carbon emission of approximately 700 cars.

The structural complexity of mangroves provides nursery habitat, shelter, nesting and foraging habitat for numerous resident and transient invertebrate, fish, bird, reptile and mammal species, including prized recreational species such as barramundi (*Lates calcarifer*), mangrove jacks (*Lutjanus argentimaculatus*) and mud crabs (*Scylla serrata* and *S. olivacea*). Other species that utilise mangroves include the estuarine crocodile (*Crocodylus porosus*), green turtles (*Chelonia mydas*), flying foxes (*Pteropus* spp.), microbats such as the northern pipistrelle (*Pipistrellus westralis*) and the mangrove free-tailed bat (*Ozimops cobourgianus*), northern brushtail possums (*Trichosurus arnhemensis*), native rodents such *Melomys burtoni* and more than 200 bird species such as the great-billed heron (*Ardea sumatrana*), mangrove heron (*Butorides striata*), the mangrove kingfisher (*Halcyon chloris*), pied cormorant (*Phalacrocorax varius*) and the mangrove flyeater (*Gerygone levigaster*).

Mangroves also have cultural significance and are used for food, medicines, shelter and as a wood resource. Traditional owners harvest the mangrove snail (*Nerita* spp.), 'long bums' whelks (*Telescopium telescopium* and *Terebralia* spp.), fish, turtles and mud crabs for food, while the leaves of the mangrove myrtle (*Osbornia octodonta*) are rubbed on the skin to repel insects and chewed to relieve toothaches. The Aboriginal people of the Dampier Peninsula traditionally sought out a particular mangrove – the kapok



Above Mangrove loss.
Photo – Kevin Bancroft/DBCA

mangrove (*Camptostemon schultzii*), and used its wood to construct rafts, paddles, and spears for hunting of dugong, fish and turtles.

MONITORING MANGROVES IN WA

DBCA's Biodiversity and Conservation Science has established a State-wide monitoring program, to evaluate the condition of mangroves and to detect the effects of pressures on mangrove communities. WA mangroves are subject to lower levels of human-caused pressures, such as from coastal development and nutrient enrichment and sediment run-off from agriculture and industrialisation, than other more densely populated areas in Australia. The main pressure on Western Australian mangrove communities comes from long-term changes in climate conditions, such as rising sea levels, rising seawater and air temperatures, changing rainfall patterns, and increased storm intensity and frequency. With the exception of the Rowley Shoals Marine Park, mangroves are present in all CALM Act marine conservation reserves north of and including Shark Bay Marine Park. In each of the reserves, the department uses satellite imagery and aerial photography together with on-ground surveys to assess the health of the mangroves, based on two key condition indicators – spatial extent (area) and canopy density.

EVALUATING CHANGES

Routine monitoring between 2010 and 2015 in Shark Bay Marine Park highlighted losses in spatial extent and in canopy density, particularly along the Carnarvon coast. In 2010, Carnarvon coast mangroves spanned approximately 850 hectares, but, by 2015, this was reduced to approximately 720 hectares – a loss of about 15 per cent.

Further investigation of satellite data showed this loss was not gradual, and a significant mortality event occurred in February 2011. Carnarvon climatology and environmental data suggests that the loss of mangroves coincided with four environmental pressures. Firstly, there were record-high sea levels peaking in 2011, which would have drowned the mangroves that were already at their maximum depths. Secondly, prolonged record-high air temperatures were experienced, and sustained high seawater temperatures would have added further pressure to the already-

Hear about mangrove monitoring

Scan this QR code or visit Parks and Wildlife Service's '*LANDSCOPE*' playlist on YouTube.

"DBCA's primary focus for mangrove conservation is to minimise the loss of diversity and spatial extent, caused by human activity."

stressed mangroves. Lastly, the worst flooding of the Gascoyne and Wooramel rivers since 1960 eroded mangrove habitat and smothered other areas with terrestrial sediments. Prolonged high air and seawater temperatures, and low rainfalls would have further hampered recovery in some areas.

A minor mangrove loss (less than two hectares) was also observed at Big Lagoon, in Francois Peron National Park, during routine monitoring. Subsequent field investigation revealed that the cause was a flock of nesting cormorants that were directly impacting the mangroves through defoliation and by depositing high levels of nutrients via their guano.

Losses in mangrove spatial extent in Ningaloo Marine Park in 2015 and 2016 were attributed to a short-term drop in sea level and increasing sediment interstitial water salinity – the water in between sand grains. Declines in mangrove spatial extent and canopy densities have been observed in the Montebello/Barrow Islands Marine Conservation Reserves since 2011. These are more than likely related to a short-term drop in sea level, increasing sediment porewater salinity and higher-than-average atmospheric temperatures since 2012.

In contrast to these Gascoyne and Pilbara reserves, the mangroves in the Kimberley (Eighty Mile Beach and Lalang-garram / Camden Sound marine parks), experienced increases in distribution and in canopy cover. Between 1989 and 2015, there has been an increase of 214 hectares (about 25 per cent) and 2909 hectares (about 12 per cent) at Eighty Mile Beach and Lalang-garram / Camden Sound marine parks, respectively. In both marine conservation reserves, significant increases in rainfall and moderate air temperatures have provided optimum growing conditions for the mangrove communities.

GROWING FORWARD

WA's mangrove communities, in general, are not under immediate direct threat from human activity. However, they are susceptible to human-induced climate change. DBCA's primary focus for mangrove conservation is to minimise the loss of diversity and spatial extent caused by human activity.

In the same way that humans monitor their blood pressure to identify heart disease, DBCA researchers will continue to monitor changes in mangrove spatial extent and canopy density to indicate the health of these ecosystems. Further research is required to understand the potential effects of sea level rise, sediment interstitial salinity, and to obtain estimates of the area of inundation from rising sea levels, which may influence mangrove inshore migration. DBCA is currently exploring the use of remotely piloted aircraft technology (drones) to obtain valuable on-ground data at larger spatial scales and at sites inaccessible by field staff. Ongoing monitoring using established techniques, combined with these innovative new approaches, will enable the continued evaluation of these valuable mangrove ecosystems.

Above left Grey mangroves at Roebuck Bay in Broome.
Photo – Damon Annison

Top Kevin Bancroft and marine ranger – vessel mate Adrian Lane examining mangroves.
Photo – Daniel Barrow/DBCA

Above Club mangroves.
Photo – Kevin Bancroft/DBCA

Below Stilted mangrove is one species that grows in WA.
Photo – Sue Osborne/DBCA

Kevin Bancroft has been involved in marine conservation and management with the department and its predecessors for 20 years. He can be contacted on (08) 9219 9792 or by email (kevin.bancroft@dbca.wa.gov.au).