

The Kimberley Coast

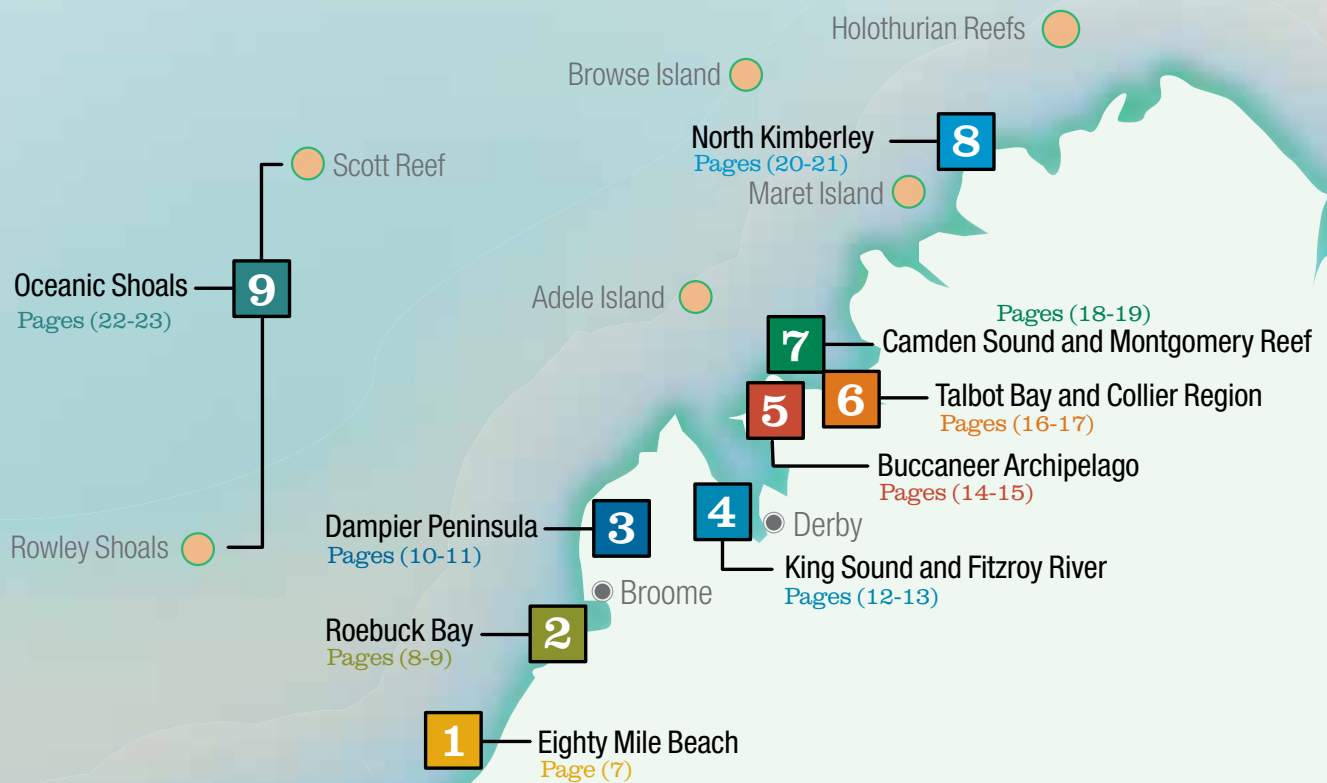
The Last Sanctuary
Nine Iconic Places



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Terminology

Marine Protected Area (MPA)

– a collective term for marine conservation reserves with varying levels of protection.

Marine Park

Unlike terrestrial ‘national parks’, marine parks generally contain different zones, many of which can allow for a range of extractive industries including commercial and/or recreational fishing, e.g. general use.

Marine Sanctuary Zone

– the highest level of protection afforded to marine environments in Western Australia; only non-extractive uses permitted (also referred to as ‘no take’ zones).

The Kimberley Marine Environment: A Natural Wonder of the World

There are few marine and coastal environments left on Earth that are as ecologically intact, stunningly beautiful and remote from destructive human pressures as the Kimberley region in northern Western Australia.

The first global analysis of human impacts on marine ecosystems (Halpern *et al.*, 2008) recognised northern Australia, including the Kimberley, as one of the world's last, relatively undamaged coastal areas. The only other large marine areas identified in a similar condition were the remote reaches of the Polar regions. The Kimberley is a global treasure of comparable importance to the World Heritage-listed Great Barrier Reef and Ningaloo Marine Parks and features similar internationally significant ecological, scientific and cultural values.

The Kimberley has outstanding Indigenous cultural values - with Traditional Owners' ancient connections to their country continuing strongly through to the present day. These unique connections as well as intricate ecological and geographic knowledge of their lands, seas and biota has grown with them over thousands of years. It provides Traditional Owners with a highly valuable 'cultural map' of their country.

The Kimberley marine environment is vast, extending north from Eighty Mile Beach and east to the Northern Territory border covering an area of 630,000 square kilometres. Unsurprisingly such an enormous seascape contains waters controlled by both the Western Australian (WA) and Commonwealth Governments. This report documents the outstanding conservation values of the state waters of the Kimberley which extend from the shore out to three nautical miles and include several offshore islands, reefs and atolls under State jurisdiction.

Fringing Reefs of Global Importance

The Kimberley's extensive fringing coral reefs with their extraordinary diversity are further evidence of the region's global conservation significance. Together with its offshore atolls, the scale of reef development and the diversity of coral species recorded so far, the Kimberley's coral reefs are of international importance (Wells *et al.*, 1995; Masini *et al.*, 2009). Indeed, the Kimberley region was highlighted as a core part of one of just 18 hotspots for coral reef diversity worldwide (Roberts *et al.*, 2002).

While our understanding of coral reefs in the Kimberley coastal bioregion continues to develop, a total of 318 species of reef-building hard corals have already been recorded from intertidal and subtidal coral reef habitats, pertaining to 74 genera (AIMS, 2011). As prominent marine scientist Dr Barry Wilson notes, this represents a "greater diversity of coral species in Kimberley reefs than in oceanic atolls or the Great Barrier Reef" (Science Network WA, 2011). The reefs in the Kimberley are largely in excellent condition (Wood and Mills 2008; Masini *et al.*, 2009) and their conservation significance is all the more outstanding given that more than half of the world's coral reefs are threatened or already destroyed (Wilkinson, 2008).

A Refuge for Threatened and Endangered Species

The Kimberley is one of the last remaining large and healthy refuges in the world for many threatened and endangered marine species. For example, the region features critical habitats for a number of vulnerable, endangered or critically endangered shark species (DEWHA, 2008; Stevens *et al.*, 2008). The Kimberley also supports six of the world's seven species of marine turtle.

In addition to healthy populations of various marine mammals, including dugongs and numerous species of whales and dolphins, the Kimberley includes the calving and nursery grounds of one of the largest humpback whale populations in the world. More than 20,000 humpback whales migrate to the Kimberley from Antarctica each year (Hedley *et al.*, 2009).

The Kimberley: Under Threat

Up until now, the remoteness of this beautiful environment has protected it from the harmful impacts felt elsewhere in Australia. It has been spared the damages of habitat loss, pollution, land reclamation, overfishing, urbanisation and oil and gas industry development. However, just as the Kimberley is coming to national and indeed international prominence for its scientific, natural and cultural values, proposals for industrialisation and expanded natural resource extraction are gathering pace across the region.

A wide range of projects are now being considered in the marine and coastal environments of the Kimberley. Individually and cumulatively, these could have profound and irreversible impacts on the natural and cultural values of the region. These developments range from expanded mining in the Buccaneer Archipelago to proposed new industrial port infrastructure in King Sound and from liquefied natural gas (LNG) processing on the Dampier Peninsula to new trawling fisheries in waters off Ashmore Reef.



An aerial view of the massive water movement at the Horizontal Falls in Talbot Bay
- Annabelle Sandes

A New Hope – The Great Kimberley Marine Park

Both the WA and the Commonwealth Governments have separate marine park planning processes for the Kimberley marine environment. The WA Government has committed to creating four marine parks in its coastal waters: Eighty Mile Beach; Roebuck Bay; Camden Sound and North Kimberley. With attention firmly now on the Kimberley, there is a real opportunity to ensure comprehensive protection for all state waters through the creation of a Great Kimberley Marine Park.

The signatories to this document welcome the WA Premier Colin Barnett's concept of creating the "Great Kimberley Marine Park" (DPC, 2010). Such a park could rival the best MPAs in the world and in our region, including the Great Barrier Reef Marine Park.

To fully realise this vision, the Great Kimberley Marine Park should encompass all Kimberley State waters within its boundaries, including the four parks already proposed. In doing so, the WA Government can deliver sound, science-based conservation outcomes and provide both long-term protection for the Kimberley marine environment and certainty for all stakeholders in the region. Such a visionary approach would be a welcome and timely departure from the current ad-hoc manner of planning and development in the Kimberley.

The idea of protecting all State waters in the Kimberley in a marine park is not new. The WA Marine Parks and Reserves Authority recommended in its 2008/09 Annual Report that the WA Government:

"...urgently protect the Kimberley through the establishment of a multiple use marine park over the whole of State waters in the Kimberley with the full reservation of currently identified iconic areas by an appropriate zoning system in the broader multiple use marine park" (MPRA, 2009).

Such a marine park should include a significant network of sanctuary zones. The Great Barrier Reef and Ningaloo Marine Parks have set a benchmark for sanctuary zones within Australian MPAs: 33% of the Great Barrier Reef marine parks and 34% of Ningaloo Marine Park have been fully protected (GBRMPA, 2004; DEC, 2005). The vibrant tourism industries (including recreational fishing) in and around both these parks demonstrate that strong marine conservation can support healthy local economies built on sustainable nature and culture-based tourism.

Current Kimberley Marine Sanctuary Protection

The proposed level of marine sanctuary protection, including the new Camden Sound and Eighty Mile Beach Marine Parks announced so far, will be five per cent of all State waters in the Kimberley (Centre for Conservation Geography, Daniel Beaver, per comms.). The establishment of the Great Kimberley Marine Park with world class marine sanctuaries would lift this level to a stronger science-driven benchmark.



Aerial view of Turtle Reef in Talbot Bay on the Kimberley coast - Annabelle Sandes

The Case for Marine Sanctuaries

Marine sanctuaries have been shown to dramatically increase the size, diversity and abundance of marine life compared with adjacent fished areas. A recent study of 124 marine sanctuaries from both tropical and temperate waters around the world showed that on average the mass of marine life increased by 450%, density by 170%, body size by 30% and number of species by 21% (Lester *et al.*, 2009). Sanctuaries have also been shown to help protect threatened species like dugong and marine turtles (McCook *et al.*, 2010).

Why Do We Need Marine Sanctuaries?

Just like national parks on land, a network of sanctuary zones is essential to protecting and conserving the diversity of our marine life and areas of high conservation value in our oceans. In addition, sanctuary zones help to insure against overfishing by providing a refuge where marine life can breed and mature undisturbed. They also help us better understand the impacts of human activities like fishing by providing scientific reference areas free from direct interference.

Fishing and Offshore Development in the Kimberley

The WA population is projected to grow dramatically over the next few decades from the current population level of 2.35 million. (ABS, 2012). One ABS survey has suggested it could reach 4.3 million people by 2056. (ABS, 2008). The Department of Fisheries (2010) has acknowledged that in key areas "...there is now considerable fishing pressure ... out to the 200m isobath. This trend is due to the growth in ownership of larger, faster boats and people willing to travel greater distances to catch fish."

Whilst the Kimberley has so far escaped the fate of the southwest, where declining fish stocks have led to significant cuts to both commercial and recreational fishing, increasing resource development is bringing greater population and wealth to the region. Subsequently the pressure on fish stocks is expected to increase. Mining and oil and gas development is also growing dramatically in the Kimberley, including on islands and in coastal waters. This will put increased pressure on marine life. It is important that we put in place sanctuaries now to ensure the unique marine life of the region is preserved and fish breeding areas are protected.

Recent studies show that sanctuary zones are not an impediment to continued enjoyment of recreational fishing. Recreational fishing continues to flourish in marine parks that include large sanctuary zones including at Ningaloo. (Northcote and Macbeth, 2006).

Scientists Agree – Sanctuaries Work

In 2009 more than 50 eminent Australian marine scientists issued a consensus statement of criteria for marine protected area planning and design, outlining scientific 'Principles for Design of Marine Protected Areas in Australia' (The Ecology Centre, UQ, 2009). The Australian Marine Science Association has also supported a network of sanctuaries (AMSA, 2008). There are also many international statements, including a 'Scientific rationale for the designation of very large marine reserves' (Global Ocean Legacy, 2010) signed by 271 leading international marine scientists.

According to scientists, sound marine conservation planning requires that marine sanctuary zones must:

- Be larger rather than smaller, and represent the full range of habitats in an area, including spawning, feeding and high density areas for ocean life;
- Feature simple shapes for easy understanding by visitors and users to minimize edge effects;
- Be close enough together to foster larval dispersal and connectivity of the ecosystem; and
- Be integrated with other management systems, such as fisheries management, to minimize threats from beyond sanctuary boundaries.

There are numerous studies showing that existing sanctuaries in Australia are effective. These findings include twice as many large fish on the Great Barrier Reef (McCook *et al.*, 2010), up to eight times dhufish density at the Abrolhos Islands (Watson *et al.*, 2007) and 50 times higher density of legal size western rock lobster at Rottnest Island (Babcock *et al.*, 2007). There are also benefits to large marine predators such as sharks that underpin some ocean ecosystems and protect threatened species (McCook *et al.*, 2010).

Can Sanctuaries Help Improve Fishing?

Increasingly, scientific research is showing that sanctuaries benefit fishing. Examples of recent research include:

- Tagging programs showing that fisheries have benefited from the spillover of juveniles, eggs and larvae in the Sea of Japan, Newfoundland, Kenya and New Zealand (Gelland and Roberts, 2003).
- Research showing spillover has the potential to match the loss of catch from fisheries displaced by the creation of marine sanctuaries (Halpern and Warner, 2003).
- A long term study of lobster in Spain showing that a marine sanctuary produced an annual net benefit of 10% of catch by weight (Goñi *et al.*, 2010).
- A parallel study of the same sanctuary showed that although the reserve only covered 18% of local lobster habitat, it contributed 80% of local egg production (Diaz *et al.*, 2009).

Saltwater Country

Opportunities for Co-management

The Kimberley is one of the world's last remaining cultural and natural landscapes not yet industrialised. Half the Kimberley's population is of Indigenous descent and English is not the first language of many people from remote towns and communities. Traditional Owners retain strong ties to Aboriginal law, language and traditional country, all of which make up a vibrant and living cultural heritage. On the Kimberley coast – Saltwater Country – this living history stretches back at least 30,000 years (O'Connor, 1994) beyond the last Ice Age and before the time of marine flooding of the Kimberley region.

An intricate ecological and geographic knowledge of their land and sea country provides Traditional Owners with a highly valuable 'cultural map'. Indigenous Saltwater people live in coastal environments, with associated cultural responsibilities as custodians for the environment. 'Country' is a physical space, a place that provides food, water and shelter, a personal spiritual place and a site of spiritual connotations and history (Woolagoodja, 2011).

Traditional Owners have repeatedly expressed their strong desire to continue this connection through engagement in contemporary land and sea management across the Kimberley.

Traditional Owners are the principal land managers in the Kimberley and have an integral role to play in the management of the natural values of their country. This authority to fulfill management responsibilities must be reflected in planning, policy and legislation. A strong collaborative relationship through Indigenous Protected Areas (IPAs), joint management and other partnerships with Governments and private landholders, can deliver this management capacity. These relationships provide significant benefits to Traditional Owners, Governments and the wider community (NRETAS, 2007).

In 2009, a *Saltwater Country Plan* was developed by North Kimberley Traditional Owners to explain the cultural and natural values of the region and identify ways for Governments and other stakeholders to support the aspirations of Traditional Owners in looking after Country.

In summary the plan's priorities are:

- **Adequate consultation** with Traditional Owners on all matters relating to their ancestral lands and seas.
- **Recognition of Traditional Owners' aspirations** arising from customary rights and duties.
- **Support for the development of sustainable Sea Ranger Units.**
- **Technical support** from stakeholders to look after Country using both Indigenous knowledge and Western scientific knowledge.

(North Kimberley Saltwater Country Steering Committee, 2010).

For Traditional Owners, caring for Country is about much more than conservation planning alone. As the Saltwater Plan North Kimberley Saltwater Country Steering Committee (2010) states, it's a matter of survival: *"Our marine resources, such as turtle, dugong, shellfish and fish have sustained us for thousands of years. Our future depends on how our Saltwater Country is used and managed by us and by others whose lives and livelihoods have come to depend on this region in recent times."*

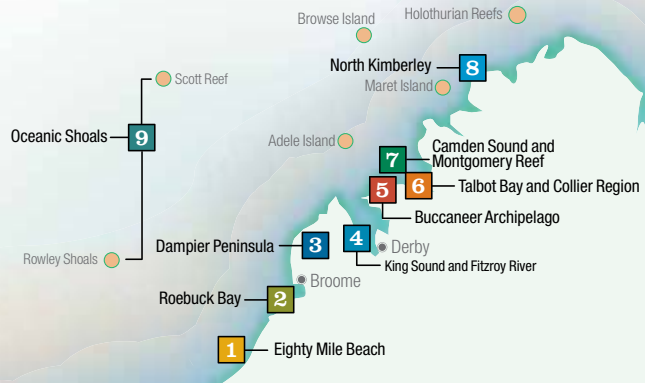
Co-management can provide significant and long term social and economic benefits for local communities. It can provide training programs and opportunities for existing indigenous ranger teams and create employment in the management of new marine parks and reserves. It is also another avenue for engaging indigenous youth.

The Kimberley Land Council has developed a policy which clearly outlines what is required for successful co-management. Fundamentally, all parties must be committed to the co-management relationship as an ongoing, evolving process rather than a static set of guidelines or legal procedures. Successful co-management requires, *"committed, flexible approaches that match the capacity of the parties, provide adequate recurrent resources and operate within policy frameworks that are supported by legislative mechanisms"* (Kimberley Land Council, 2010).

The proposed new marine parks on the Kimberley coast provide a real opportunity for the WA Government to deliver on its declared commitment of co-management with Traditional Owners. This would signal an exciting new era in flexible, adaptive and culturally appropriate models of management.



Eighty Mile Beach



Eighty Mile Beach lies about half-way between the towns of Broome and Port Hedland. It is a unique part of the coast where the Great Sandy Desert meets the Indian Ocean. This appeal makes it an outstanding example of a major beach with associated inter-tidal mud flats and coastal floodplain in the arid tropics (Lane et al., 1996; Bryant 2001;). Eighty Mile Beach forms part of the traditional lands of the Nyangumarta and Karajarri peoples.

Eighty Mile Beach has extraordinary natural values and is recognised as one of the world's richest tropical intertidal wetlands (Pearson, 2005). The very wide tidal range (greater than 10 metres) exposes enormous mudflats up to four kilometres wide at low tide (Pearson et al., 2005). These mudflats are rich in invertebrates, and more than 200 species of large invertebrates such as snails and burrowing sea anemones have been recorded here (Lavaleye et al., 2005).

Eighty Mile Beach, with its rich benthic (mud-dwelling) food resource, is one of the most important migration stop-over areas for shorebirds on the East Asia-Australasia Flyway. It regularly supports more than 450,000 birds (Hale and Butcher, 2009) and is an essential landfall for birds that have migrated south from their breeding grounds 15,000 kilometres away in Siberia and Alaska (Wade and Hickey, 2008). At times, Eighty Mile Beach can host many more birds: in February 2004 more than 2.5 million oriental pratincoles (*Glaucopis maldivarum*) were observed (Sitters et al., 2004). This number of shorebirds has not been exceeded elsewhere in Australia; in fact these are the highest counts for waders anywhere in the southern hemisphere (DCLM, 2003).

Ninety-one bird species have been recorded at Eighty Mile Beach, including 41 species of shorebird (Pearson et al., 2005). There are some species for which the beach is particularly important; in annual counts, more than half the world's population of red knots (*Calidris canutus*) have been recorded there (Piersma et al., 2006). Some 1,750 square kilometres of the beach, together with the adjacent mudflats Mandora Marsh, forms a recognised 'Wetland of International Significance' under the Ramsar Convention (DCLM, 2003), principally for its role in supporting so many species of resident and migratory birds.

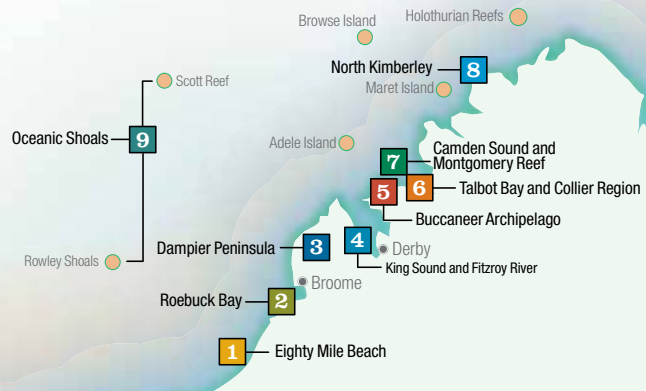
Eighty Mile Beach is also recognised as an important turtle nesting site. The flatback turtle (*Natator depressus*) is nationally listed as 'vulnerable', and initial surveys indicate that many hundreds of these turtles nest along the beach (Pendoley, 2005). Unlike all other marine turtle species, flatback hatchlings are not ocean-going, but remain within 10-100 kilometres of their natal beaches and feed on invertebrates in low energy, shallow environments (DEC, 2008).

In addition to its value as a migratory shorebird and turtle nesting site, Eighty Mile Beach is inhabited by dugongs, whales, dolphins and seabirds (Jenner et al., 2001; Marsh et al., 2002; Mustoe and Edmunds, 2008). All four species of Australian sawfish are found there: the narrow sawfish (*Anoxypristis cuspidata*), green sawfish (*Pristis zijsron*), dwarf sawfish (*Pristis clavata*) and the freshwater sawfish (*Pristis microdon*) (DEC, 2011). All four sawfish species are protected in Western Australian waters (DEC, 2011), and the three *Pristis* species are protected under the federal Environment Protection and Biodiversity Conservation (EPBC) Act (DSEWPAC, 2011).



Flatback turtle nesting, Eighty Mile Beach - Jenita Enevoldsen

Roebuck Bay



Roebuck Bay is at the southern end of the Dampier Peninsula next to the popular tourist town of Broome. Roebuck Bay is part of the ancestral home of the Yawuru people. Yawuru have strong and enduring cultural, social and economic ties to their land and sea country. Roebuck Bay also has significant heritage values for many other Indigenous groups including the Karajarri, Mangala and Walmajarri peoples.

Eight times the size of Sydney Harbour, Roebuck Bay is an enormous seascape with one of the largest tidal ranges on Earth. Spring tides, those with maximum range, expose almost half the bay, or about 190 square kilometres of mudflats.

These extraordinary mudflats are recognised as some of the most productive in the world (Pepping *et al.*, 1999). Up to 500 species of benthic invertebrate have been recorded in the mud of the bay, in some instances living in communities of more than 1,200 individuals per square metre (Bennelongia, 2009). This benthic community in turn supports one of the largest aggregations of shorebirds found anywhere in the southern hemisphere (Watkins, 1993). It is estimated that up to 300,000 birds forage on the mudflats annually.

Described as the “Shorebird Capital of Australia”, Roebuck Bay is the first stop over for many birds undertaking the East-Asia Australasia Flyway. The birds migrate between Australia and their breeding grounds, which are located as far away as Alaska and Siberia (Lambert and Elix, 2004).

Though Roebuck Bay is internationally renowned for its birds, the soft coastal mudflats, creeks, estuaries and mangrove forests of the bay support a number of marine species of high conservation significance. These include dugongs and several turtle and sawfish species (Prince, 1986; RBWG, 2011). Humpback whales are also sometimes seen in the bay on their northern migration to calving grounds further along the Kimberley coast.

There are three dolphin species known to inhabit the bay, including Australia’s only endemic dolphin, the Australian snubfin dolphin (*Orcaella heinsohni*). This is the first new dolphin species to be recognised worldwide in over 50 years (Beasley *et al.*, 2005). Remarkably, the largest known aggregation of this EPBC-listed Australian species is found in Roebuck Bay, with 154 individuals recorded to date (Thiele, 2010).

An essential element of the Roebuck Bay ecosystem is the extensive mangrove community lining its shores. These mangroves are an important nursery area for prawns, mud crabs and fish (RBWG, 2011). Along with the supratidal flats above the high tide line and plains behind them, the mangroves provide a significant proportion of the raw energy that fuels the food chain of the bay.

Large sea grass communities found throughout Roebuck Bay are essential to its productivity. Sea grass is food for many species including dugongs, which eat up to 40 kilograms of sea grass a day (Mellors and McKenzie, 2009), green turtles (*Chelonia mydas*), snails, crustaceans and other invertebrates. Sea grass beds are also critical in providing habitat and shelter for many marine species, with significantly higher numbers of species recorded in sea grass meadows than in bare sand (RBWG, 2011).

Ramsar Wetland

In recognition of its international significance as a wetland, much of Roebuck Bay (360 square kilometres) has been listed as a Ramsar site. As a signatory to the Ramsar Convention (1971), Australia has committed to ensure that our internationally important wetlands are conserved. Since the bay was listed under the Ramsar Convention, further research has identified new dimensions to its ecological significance. Simply put, Roebuck Bay is one of the world’s most outstanding natural icons in terms of its biodiversity and productivity.



Australian Snubfin Dolphin - Simon Allen

Wet season rain clouds cast dramatic shadows over Roebuck Plains in the Kimberley wet season. Water from the plains drains into Roebuck Bay, bringing an inundation of fresh water - Annabelle Sandes

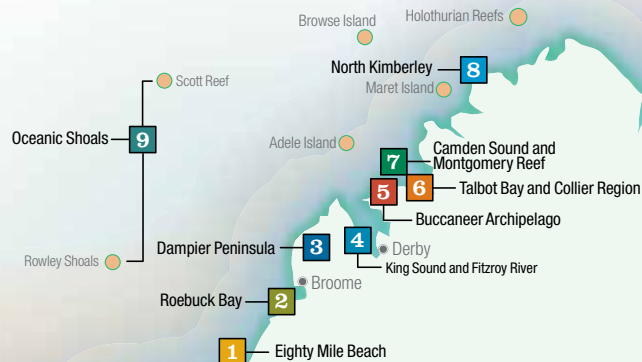


An Eastern Reef Egret - Annabelle Sandes



A flock of migratory shore birds rise at Crab Creek, south of Broome, near the Broome Bird Observatory. Crab Creek is on the shores of Roebuck Bay, one of the world's great bird aggregation areas - Annabelle Sandes

Dampier Peninsula



The Dampier Peninsula stretches 300 kilometres north from Broome to Cape Leveque with a coastline that has been described as “spectacular and fragile” (Taggart, 2009). This coastal habitat, based on sandstone with tidal creeks, is important for many marine species. The biological productivity of Kimberley waters is driven by episodic injections of nutrients from terrestrial runoff following storms and re-suspension of sediments from the large tides and huge sub-sea waves (DEWHA, 2008).

Quondong Point and James Price Point

The waters off Quondong Point have been identified as one of the most important ecological sites of the North-west marine region (DEWHA, 2008). A unique combination of sea floor ‘shape’ (bathymetry) and ocean movements (oceanography) appears to enhance Quondong’s biological productivity, but the underlying processes are unclear. Nevertheless, surrounding waters attract an abundance of baitfish, which in turn attracts aggregations of seabirds and other marine life, including large predatory fish, cetaceans, turtles and dugongs (DEWHA, 2008).

A ‘snapshot’ study of the fish-habitat associations found in the vicinity of James Price Point identified 116 species of fishes, sharks, rays and sea snakes. Indeed, this survey found that the ichthyofauna (fish life) in the study area at James Price Point had a much higher diversity and abundance than equivalent areas of the Great Barrier Reef using comparable survey techniques (Cappo *et al.*, 2011).

Flatback turtles (*Natator depressus*) tagged as part of the 2009 Chevron Barrow Island Turtle Management Plan were found to use Quondong as their most frequented foraging ground (Chevron, 2009). Quondong appears to be a calving nursery and a high-density area for northbound humpback whales (*Megaptera novaeangliae*), as well as false killer whales (*Pseudorca crassidens*), pygmy blue whales (*Balaenoptera musculus brevicauda*) and several resident dolphin species (DEWHA, 2008, DEH, 2005).

The North-west is one of three hotspots for sponge biodiversity in Australia, with over 600 species recorded (Hooper *et al.*, 2002, in Keesing *et al.*, 2011). The Dampier Peninsula is particularly rich, with one survey recording 275 species (Keesing *et al.*, 2011).

Local fish communities off James Price Point include a higher proportion of small pelagic baitfish and more mobile predators, such as mackerel, than fish communities elsewhere at a similar latitude and distance from shore (Cappo *et al.*, 2011).

Seasonally abundant sea grass communities are patchily distributed across large areas along the Dampier Peninsula, from the lower intertidal zone, out to a depth of approximately 20 metres (Masini *et al.*, 2009). These sea grass meadows support a rich diversity of sea life including dugong (*Dugong dugon*) which have been reported feeding in the vicinity of James Price Point (Prince, 1986).

Bays on the Peninsula

The sheltered embayments along the west coast of Dampier Peninsula, particularly Carnot Bay, Beagle Bay and Pender Bay, support extensive mangrove systems (Kenneally, 1982), which are important fish nursery habitats. Beagle Bay and Pender Bay are also significant for bottlenose dolphins (*Tursiops spp.*), Indo-Pacific humpback dolphins (*Sousa chinensis*) and Australian snubfin dolphins (*Orcaella heinsohni*) (DEWHA, 2008).

Pender Bay is recognised as an important staging area for the southern migration of humpback whales, and more recent work has found that this deep embayment is likely to be significant for their calving, breeding and resting (McKay and Thiele, 2008; Double *et al.*, 2010). Other recent cetacean survey work shows that the range of important habitat for this population is likely to extend from Gourdon Bay south of Broome to Camden Sound in the north (Costin and Sandes, 2009, 2010). Importantly, whales were surveyed calving between Broome and Cape Leveque on the Dampier Peninsula, as well as further north at Pender Bay and Camden Sound.



Whale tail, James Price Point - Jenita Enevoldsen



Clown fish - Jenita Enevoldsen

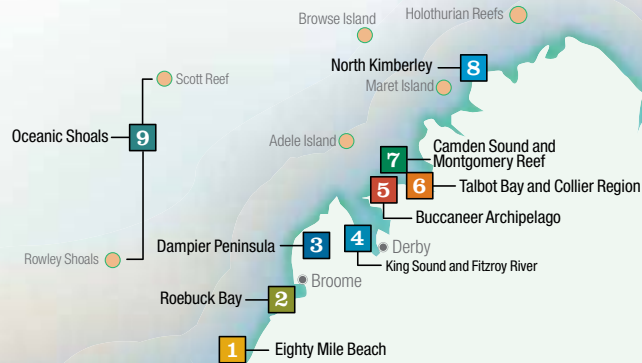


Pelagic Trevally schooling - Jenita Enevoldsen



James Price Point - Adam Monk

King Sound and Fitzroy River



King Sound, encompassing Stokes Bay and the tide-dominated delta of the Fitzroy River, is a globally singular system. Most of the Sound remains a wilderness set in a monsoonal, semi-arid climate. This large water body is fringed by broad tidal flats with low energy seas dominated by an extreme tidal regime.

King Sound

King Sound functions as a seasonal estuary and is the receiving basin for the Fitzroy, May and Meda Rivers (MPRSWG, 1994). The Fitzroy River delta has the largest tidal range of any tide-dominated delta in the World (Semenuik and Brocx, 2011). Freshwater in the fractured bedrock discharges into the tidal zones of the region in the wet season and continues into the dry season. This is a globally significant process, controlling the occurrence and maintenance of mangroves in the high tidal zone (Cresswell and Semenuik, 2011).

The tidal mudflats and mangroves provide nursery habitat for a wide variety of fish (Loneragan *et al.*, 2002) and crustaceans, which are important prey for inshore dolphins. Australian snubfin dolphins (*Orcaella heinsohni*) and the Indo-Pacific humpback dolphin (*Sousa chinensis*) use the tidal rivers, while bottlenose dolphins (*Tursiops spp.*) are found out in the embayment (Thiele, 2008).

King Sound and the adjacent Fitzroy River are the only known nursery areas for freshwater sawfish (*Pristis microdon*) in the Kimberley and are a significant stronghold for this and other sawfish species worldwide (Thorborn and Morgan, 2005a, 2005b). The Fitzroy features four of the world's most endangered fish: the freshwater sawfish (*P. microdon*), the dwarf sawfish (*Pristis clavata*) and the northern river shark (*Glyphis garricki*), all of which are listed as critically endangered by the IUCN. The fourth species, the freshwater whipray (*Himantura chaophraya*), is IUCN-listed as vulnerable (Morgan *et al.*, 2004; Thorburn *et al.*, 2004; Thorburn and Morgan, 2005a, 2005b; IUCN, 2011). These may be some of the world's only remaining viable populations of some of these species (Morgan *et al.*, 2011).

The organic mound-springs complex known as Big Springs, on the eastern shore of King Sound, provides a significant area of habitat and refuge. The complex includes dense wet rainforest species, dominated by forests (20 metres tall in some places) of *Terminalia microcarpa*, a species not otherwise known south of Walcott Inlet. Big Springs is a rare feature in this region and the best example of seepage rainforest in the Dampierland bioregion (May and McKenzie, 2002). It is listed on the National Directory of Important Wetlands.

Mangrove Communities

Mangroves are very well developed in the Kimberley and noted internationally for their relatively pristine condition (IUCN, 1981). Unlike elsewhere in the world, they have not been subject to broad-scale deforestation nor fragmentation through coastal development and are noted for being a rare system of mangroves set in a tropical, largely macrotidal environment (Cresswell and Semenuik, 2011). King Sound alone supports 13 mangrove species (Semenuik, 1980); the mangrove habitats of King Sound are extensive, healthy, diverse and largely intact.

The Fitzroy River

Over 700 kilometres long, the Fitzroy River is the largest free-flowing river in WA. The Fitzroy has 20 tributaries within a catchment of over 95,000 square kilometres (DW, 2009). Its major floodplains meet Ramsar criteria for listing as an internationally important wetland (ATRG, 2004). The ecological values of the Fitzroy River and its associated floodplains underpin significant cultural, social and economic values.

The Fitzroy River supports a high level of fish diversity by Australian standards (Doupe and Lenanton, 1998 in Storey, 2005; Morgan *et al.*, 2004) and includes a number of endemic and threatened fish species. Twenty-nine species of freshwater fish are known in West Kimberley rivers, including the Fitzroy; a number equal to that found in the entire Murray Darling Basin (ATRG, 2004). The Fitzroy's freshwater fish assemblages have been shown to be significantly different across the lower, middle and upper reaches of the river channel (Morgan *et al.*, 2004).

The lower reaches of the Fitzroy floodplain are an important site for waterbirds; 67 species of waterbirds have been previously recorded on the Camballin floodplain, a wetland designated as nationally significant (DEC, 2009). Nineteen of these bird species are listed on the international Japan-Australia Migratory Bird Agreement and China-Australia Migratory Bird Agreement treaties concerning migratory birds (DEH, 2007).



Flooding creates intricate patterns in the landscape- Annabelle Sandes

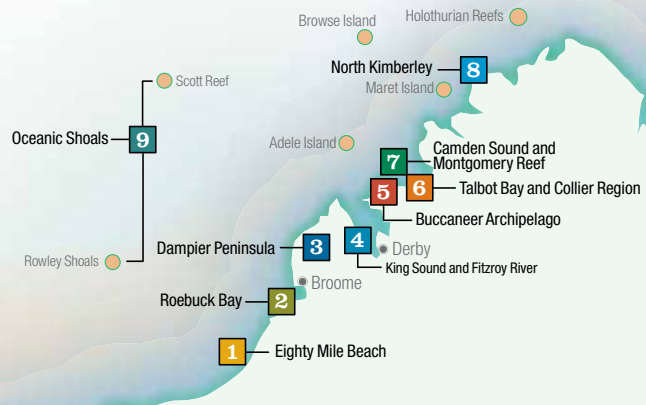


An aerial view of the King Sound mud flats - Paul Gamblin



Freshwater Sawfish - D. Morgan

Buccaneer Archipelago



The stunning Buccaneer Archipelago consists of more than 900 rocky islands with small embayments and secluded white sandy beaches, scattered at the northern end of King Sound.

The Buccaneer Archipelago's marine environment is diverse, featuring rocky island shores, coral reefs, algal reef flats and shallow sandy banks with extensive sea grass beds. On land, each of the geological surfaces of the islands supports a different vegetation community, from low open eucalypt forests to shrublands, grasslands and mangrove communities (Burbidge *et al.*, 1991).

Outstanding Geo-Heritage

The Buccaneer Archipelago is part of the world-class 'ria' (submerged river valley) coastline of the Kimberley and is outstanding in the global context for its size, extent, style of development and variability (Brocx and Semenuik, 2011). The Buccaneer Archipelago's coastline, with its characteristic marine inundated ridge and basin topography is also among the most spectacular found in the whole of the Kimberley.

The Buccaneer Archipelago features extensive fringing reefs, which support a high abundance and diversity of coral. Part of the archipelago is coming to be seen as a Kimberley coral province of global importance (Wells *et al.*, 1995; Maisini *et al.*, 2009).

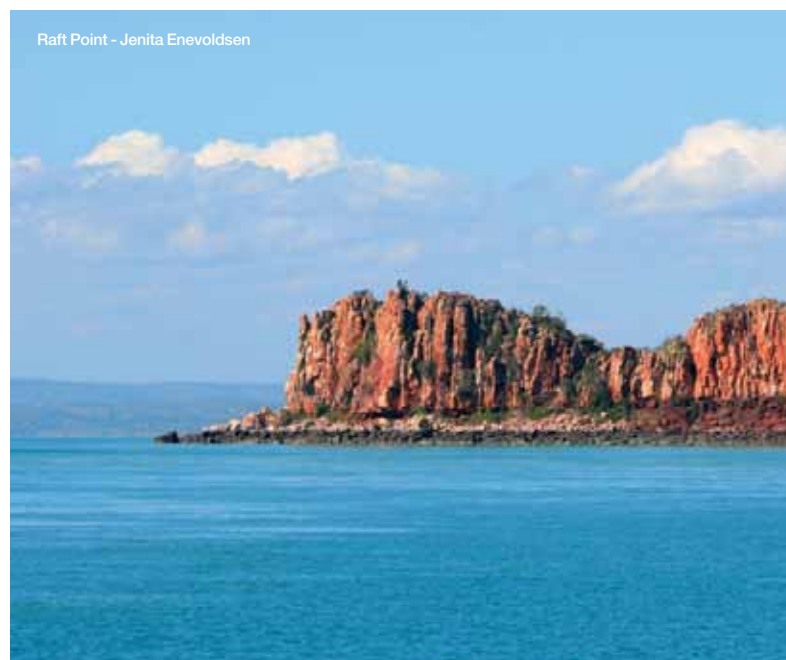
Supporting an Abundance of Marine Life and Fauna

Sea snakes, sharks, swordfish and a great variety of tropical fish are found in the pristine waters and coral lagoons of the Archipelago. The estuarine crocodile (*Crocodylus porosus*), commonly known as the saltwater crocodile, is also found in the waters and mangrove fringes of this area. Across the Archipelago, 25 species of reptiles, as well as 19 species of native mammals are found, including the golden-backed tree-rat (*Mesembriomys macrurus*), ghost bat (*Macroderma gigas*) and the imaginatively named lesser warty-nosed horseshoe bat (*Hipposideros stenotis*) (Burbidge *et al.*, 1991). The Archipelago also supports breeding populations of the crested tern (*Sterna bergii*); a species listed under the EPBC Act (DEWHA, 2008).

Rich Cultural History

In May 2011, the native title rights of the Wanjinja Wunggurr Dambimangari were recognised across 27,932 square kilometres of land and sea Country (ATNS, 2011). The claim included much of the Buccaneer Archipelago. Traditional owners from several language groups have lived in the Archipelago for many thousands of years and maintain a rich cultural connection with this land and sea Country.

Traditional Owners' use of rafts (made from mangrove logs) and canoes to travel between the islands has been recognised in the recent announcement of National Heritage values of the West Kimberley (AHC, 2011).





Islands and reefs of the Buccaneer Archipelago - Annabelle Sandes



Tawny Nurse Sharks - Jenita Enevoldsen

Talbot Bay and Collier Region



Talbot Bay, Turtle Reef, Horizontal Falls, Walcott Inlet and Doubtful Bay

Talbot Bay

Talbot Bay is an almost landlocked bay with extreme macrotidal variation (greater than 10 metres), extensive reefs and rich, diverse corals. The geomorphology and extensive fringing reefs of Talbot Bay are, to date, little studied, but are thought to be unique in Australia (Wilson *et al.*, 2011).

Talbot Bay features the habitat of one of six known Kimberley populations of Indo-Pacific humpback dolphins (*Sousa chinensis*) (DSEWPAC, 2011) and one of eight Kimberley populations of Australian snubfin dolphins (*Orcaella heinsohni*) (Thiele, 2008). Populations of each of these species in Talbot Bay are considered biologically important (DSEWPAC, 2011) and use the area for foraging, breeding and calving (Thiele, 2011). Talbot Bay supports known populations and habitat of dugong (*Dugong dugon*) and a number of turtle species (Mustoe and Edmonds, 2008).

The important Talbot Bay estuary ecosystem, located south west of Montgomery Island, features bedrock, channel and tidal sandbanks. These estuarine habitats are dominated by intertidal flat and mangrove habitats (Mustoe and Edmonds, 2008). Recent surveys of the coral reefs of Talbot Bay indicate there is a dynamic, interactive relationship between the massive mudbanks and the coral reefs found there. The processes of mud deposition and the connectivity and recruitment of coral communities are thought to be determined by the complex tidal currents of the bay (Wilson *et al.*, 2011).

Turtle Reef

Located in Talbot Bay, Turtle Reef is a terracing algal reef of approximately 25 kilometres in size (Wilson *et al.*, 2011) with open patches of sand and permanent pools of salt water. The reef is rich in marine life, with a mass of corals, including gorgonian fans, bryozoans, sponges, clam, rhodoliths and small mussels, crustaceans, crocodiles, sharks and turtles. There are several deep blue holes in the reef, which are landlocked once the tide recedes.

One of the most remarkable features of Turtle Reef is its ability to cope with turbid inter-tidal conditions. These conditions challenge current scientific understanding that corals need clear oceanic waters to grow and prosper. Preliminary observations by marine scientists suggest further studies of Turtle Reef "are likely to reveal highly unusual reef building processes and dynamic interactions between mud deposition and coral reef development that are perhaps without parallels on the Australian coast." (Wilson *et al.*, 2011) This is an exciting development and reflects one of the unique features of the Kimberley coast.

Horizontal Falls: A Natural Monument

The Horizontal Falls are created by a very fast-moving tidal flow being forced between two narrow gorges of the McLarty Range in Talbot Bay. Massive tides create intense currents between these gorges and results in a waterfall effect that is horizontal rather than vertical. This waterfall phenomenon has been recognised by David Attenborough as one of the great natural wonders of the world (Ford, 2002).

Doubtful Bay

The estuaries of Doubtful Bay South and East provide globally significant critical habitats for many species. The extensive mangrove systems found there are important for ecological processes, including the provision of vital nursery areas for a range of juvenile fish and crustaceans. Doubtful Bay is an important habitat and nesting site for saltwater crocodiles (*Crocodylus porosus*) (Mustoe and Edmonds, 2008). The entire areas of Doubtful Bay and George Water were recommended for further study prior to reservation for conservation (MPSRWG, 1994).

Walcott Inlet

Walcott Inlet is a constricted bay on the Kimberley coast, featuring spectacular tidal currents and whirlpools, sandstone escarpments and gorges, floating fern banks, waterbird lagoons, rainforest patches and black soil plains (Burbidge *et al.*, 1991). Walcott Inlet is a key estuarine environment in the region, likely to contain high numbers of unusual species and assemblages. It is one of only two known estuaries in the Kimberley bioregion to contain mapped flood- and ebb-tide deltas (Dyall *et al.*, 2005).

The tidal mudflats of Walcott Inlet are up to five kilometres wide, variably inundated by large tides with an effective range of 11 metres (Burbidge *et al.*, 1991). This estuary features important mangrove habitats and the largest mapped areas of saltmarsh habitats found anywhere in the Kimberley (Dyall *et al.*, 2005). These saltmarsh habitats feature salt-tolerant vegetation, including significant mangroves, rainforests, savannas and sandbanks (Burbidge *et al.*, 1991; Mustoe and Edmonds 2008). The area supports a rich and intact fauna, including a wide range of infaunal and epifaunal invertebrates and low-tide and high-tide visitors, such as fish and waterbirds (Gibson and Wellbelove, 2010).

Walcott Inlet, like Talbot Bay, also has a population of Australian snubfin dolphins (Nias *et al.*, 2009). Both Walcott Inlet and Secure Bay were recommended for consideration for conservation in the Western Australian Government's Marine Areas of Conservation Interest Report (DEC, 2009).



Aerial view of the Horizontal Waterfalls in Talbot Bay on the Kimberley coast - Richard Costin

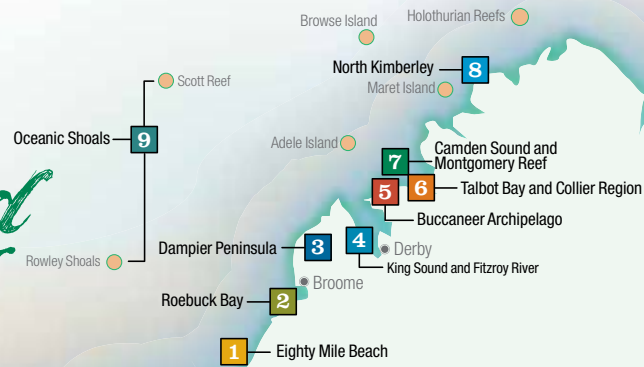


Mangroves, Walcott Inlet - Jenita Enevoldsen



Turtle on Turtle Reef, Talbot Bay - Annabelle Sandes

Camden Sound and Montgomery Reef



Despite being remote – 300 kilometres north of Broome – Camden Sound has gained public prominence in recent years for its stunning marine life.

Camden Sound

Camden Sound is now understood to be a principal calving nursery for the 25,000-strong Western Australian population of humpback whales (*Megaptera novaeangliae*), and likely to be the largest humpback population in the world (Jenner *et al.*, 2001). The whales visit the Kimberley coast each season after feeding in the waters of the Southern Ocean off Antarctica (DEC, 2010).

Besides its importance to iconic species like the humpback whale, Camden Sound should be recognised for its role in the ecological processes and biodiversity values for which the Kimberley marine environment as a whole is renowned (Halpern *et al.*, 2008; Masini *et al.*, 2009).

Preliminary research by Thiele (2011) at Camden Sound has found the Australian snubfin dolphin (*Orcaella heinsohni*) in low numbers, with widely separated resident groups. There is a very strong association between mangrove embayment habitats and snubfin presence, residency and/or foraging, socialising and other biologically important dolphin behaviours. These embayments tend to have high levels of nutrients and are high environmental flow areas (Thiele, 2011).

The EPBC-listed Indo-Pacific humpback dolphin (*Sousa chinensis*) is also found here in widely scattered groups that have small home ranges and regular foraging tracks and areas (Mustoe and Edmunds, 2008). Preserving connectivity between key habitats is important in instances of small populations of snubfin and Indo-Pacific humpback dolphins spread over wide areas. Without protection, these populations may otherwise be vulnerable to decimation over a relatively short timeframe (Parra *et al.*, 2006; WWF-Australia, 2010; Thiele, 2011).

The Champagne Islands

The Champagne Islands make up some of the 2,000 islands of the Bonaparte Archipelago and bound Camden Sound to the north. These islands are known turtle nesting sites and feature a large fringing intertidal reef across a variable depth range on both the seaward and landward side of the islands. Scientists believe the intertidal and subtidal reef platforms of the Champagne Islands may reveal many coral and sponge species new to science (DEC, 2010).

Montgomery Reef - a Coral and Geological Wonder

Montgomery Reef is recognised as one of the most significant geological marine environments of the Kimberley bioregion. Research suggests the rock platform upon which these Holocene reefs have accreted may be up to 1.8 billion years old, overlying ancient limestones rich in fossil stromatolites (Wilson and Blake, 2011). These stromatolites belong to the taxon Conophyton and may prove to be an entirely new species in the west Kimberley (DEC, 2010).

Montgomery Reef and the surrounding area are highly productive, with a wide diversity of habitats, including coral reefs, mangroves and tidal waterfalls (DEC, 2010). The 350 square kilometres of lagoons and pools of the reef are a highly significant and extensive benthic primary production habitat, which may explain the abundance of green turtles (*Chelonia mydas*) and dugong (*Dugong dugon*) in the area (Wilson and Blake, 2011).

Indeed, the area is brimming with marine life: large populations of fish, sea snakes, sharks and perhaps the largest saltwater crocodiles in the Kimberley are found at Montgomery Reef. Seabirds, including white-breasted sea eagles (*Haliaeetus leucogaster*), nest on the reef's islands and forage on the reef-top and surrounding waters (DEC, 2010).



Green-Turtle on Montgomery Reef - Jenita Enevoldsen



Breaching whale, Wilson Point - Annabelle Sandes

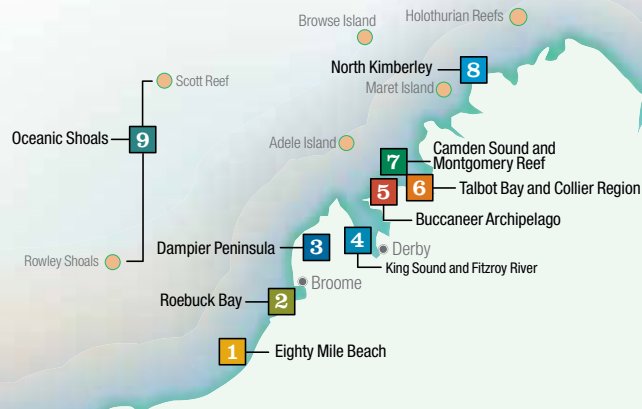


Montgomery Reef aerial - Annabelle Sandes



Corals of Montgomery Reef - Jenita Enevoldsen

North Kimberley



The north Kimberley marine environment is spectacular, remote and in exceptionally good condition on a global scale (Halpern et al., 2008).

The north Kimberley includes unique mangrove forests, fringing coral reef systems, hundreds of islands and a long, diverse coastline. Some of the major biogeographical features of the North Kimberley include Admiralty Gulf, Long Reef and Napier Broome Bay. Land and sea in the North Kimberley are intricately connected, with extreme tidal ranges of up to 11 metres and strong tidal currents of up to 10 knots. These are some of the largest tides in the world and the largest tidal range experienced by any coral reef systems on the planet (KMRS, 2012).

Islands like Bigge Island in the Bonaparte Archipelago are crucial refuges for endangered species including terrestrial mammals like the northern quoll (*Dasyurus hallucatus*), monjon (*Petrogale burbidgei*), golden-backed tree rat (*Mesembriomys macrurus*) and scaly-tailed possum (*Wyulda squamicaudata*). These species are in serious decline on the mainland (CCWA, 2010) and to date the north Kimberley has experienced no known plant or animal extinctions (DEC, 2009).

The north Kimberley coastline contains a globally unique system of mangroves, which inhabit a wide range of coastal settings from rocky shores and beaches to large tidal flat expanses. These mangroves belong to the 'Old-world mangroves', which are the most species-rich in the world (Cresswell and Semeniuk, 2011). The diversity of species generally increases with a trend towards the areas that have higher rainfall or are further north. It is for these reasons that these complex mangrove habitats are of "international conservation significance" (Cresswell and Semeniuk, 2011).

A Place of New Discoveries

Recent marine biodiversity surveys of the north Kimberley continue to reveal new and undescribed species, as well as new records for the Kimberley region. The latest discoveries include new sponges, soft corals, rolloliths and a particular species of algae which has been nicknamed 'rasta weed'. Surveys have also found a new species of bearded velvet fish (*Pseudopataceus* sp.) and a new swimmer crab (*Portunus spiniferus*) (WA Museum, 2012).

Coastal Reefs and Islands

There are 2,633 Kimberley islands representing a third of Australia's total number. From aerial surveys, signs of marine turtle nesting have been identified on the majority of the islands, which are also important breeding sites for sea- and shorebirds (KMRS, 2012). Only 12 small Kimberley islands are currently protected or reserved for conservation, and some of these do not have the highest level of statutory protection extending to the low water mark (CCWA, 2010).

The emergent and fringing coral reefs around coastal islands off the north Kimberley are particularly well developed and comprise some of the region's most important marine ecosystems. Many species rely on coral reefs for sustenance and refuge at particular life stages, migrating between coral reefs and other habitats (Moberg and Folke, 1999).

A recent survey of fringing reefs in the north Kimberley identified over 280 species of coral from at least 55 genera recorded; making it the most coral-diverse area in WA (DEC, 2009).

Historically, coral reefs are found in nutrient poor, clear waters, deriving the majority of their food via photosynthesis from the algae living within their tissues. However, studies of the fringing coral reefs in the north Kimberley have shown that the corals in this region not only survive, but thrive in the turbid nutrient-rich marine conditions.

Traditional Owner Management

The north Kimberley is home to the Wanjin Wunggurr Traditional Owners comprising several different nations including Wunambal and Gambera, Dambimangarri and Willinggin. In 2011, a major new Commonwealth IPA, including marine and island environments, was negotiated between the Wunumbal Gambera people and the Commonwealth Government in the north Kimberley. This IPA, called Uunguu ('Living home'), covers approximately 340,000 hectares. It includes funding for Indigenous Rangers in a vast area which otherwise has little protection from unmanaged visitation and the resulting damage to natural and cultural values (Commonwealth of Australia, 2011). This IPA is an important step, not just towards better protection of the natural values of this truly unique region but also in acknowledging the strong cultural connections between this region and Traditional owners.



The mangroves of Hunter River - Richard Costin

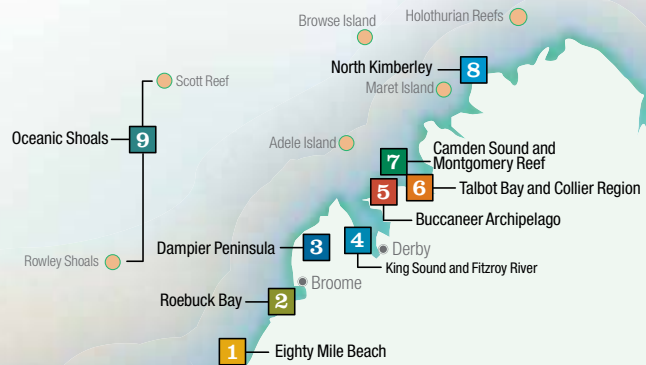


Osprey, Hunter River - Annabelle Sandes



Kimberley charter boat SPV Great Escape in Prince Frederick Harbour at the mouth of the Hunter River - Annabelle Sandes

Oceanic Shoals



Rowley Shoals and Scott Reef

Scott Reef

Together with the adjacent Seringapatam Reef, Scott Reef, approximately 260 kilometres off the Kimberley mainland, is a coral-dominated reef regarded as a hotspot of fish diversity (AHPI, 2011). It supports a range of pelagic and benthic marine species and some of the species of fish, mollusc and echinoderm are found nowhere else in WA (DEWHA, 2008).

Scott Reef is a significant component of a disjunct chain of shelf-edge reefs separated from Indonesia by the Timor Trough. The place is regionally significant both because of its high representation of species not found in coastal waters off WA and for the unusual nature of its fauna, which has affinities with the oceanic reef habitats of the Indo-West Pacific and the reefs of the Indonesian region (AHPI, 2011).

A number of species at Scott Reef are at, or close to, the limits of their geographic ranges (DSEWPAC, 2011), including fish known previously only from Indonesian waters, such as truncate cardinalfish (*Cheilodipterus singapurensis*), azure damselfish (*Chrysiptera hemicyanea*), schroeder's combtooth-blenny (*Escenius schroederi*) and several gobiids. In addition, some species of corals may be endemic to Scott Reef. The isolation and extent of the Reef may predispose it for the evolution of genetically distinct subspecies or endemic species. A number of species are only known from Scott Reef, including 51 species of fish, 14 species of molluscs, six species of echinoderms and the sea grass *Thalassia hemprichii* (AHPI, 2011).

The deep ocean canyons that fringe Scott Reef are likely to be an important driver of pelagic ecosystem processes, supporting primary productivity throughout the year. The numerous cetacean species thought to frequent the waters of these reefs are indicators of this richness, including sperm whales (*Physeter macrocephalus*), cuvier's beaked whale (*Ziphius cavirostris*) and other small toothed cetaceans (DSEWPAC, 2011). The largest known animal to have lived, the blue whale (*Balaenoptera musculus*), is found in these waters. Blue whales reportedly move between Scott Reef and Browse Island during July (northern migration) and again from October to November as part of a southern migration (DEWHA, 2008).

Scott Reef supports a small but genetically distinct breeding population of green turtles (*Chelonia mydas*) (Dethmers *et al.*, 2006 in DEWHA, 2008) and is a major staging post for migratory shorebirds. A number of seabirds are thought to use Scott Reef for foraging, including roseate terns (*Sterna dougallii*), lesser frigatebirds (*Fregata ariel*), brown boobies (*Sula leucogaster*) and wedge-tailed shearwaters (*Puffinus pacificus*) (Donovan *et al.*, 2008).

Scott Reef also supports a number of species of seasnake, including the horned seasnake (*Puffinus Acalyptophis peronii*), dubois' seasnake (*Aipysurus duboisii*), dusky seasnake (*Aipysurus fuscus*), turtle-headed seasnake (*Emydocephalus annulatus*) and the slender-necked seasnake (*Hydrophis coggeri*), to name a few. Although it is Ningaloo Reef to the south that is famous for its whale sharks (*Rhincodon typus*), – the world's largest fish, – these impressive creatures are also known to migrate north-west to Scott Reef and the Rowley Shoals (DEWHA, 2008).

The Rowley Shoals

The Rowley Shoals are one of the key topographic features of the Northwest Transition Provincial Bioregion and are made up of the Mermaid, Clerke and Imperieuse Reefs. They are of national and international significance for their near pristine character, geomorphological interest and diverse fauna (DEWHA, 2008).

More than 680 species of fish, both small pelagic and tropical reef species, as well as groupers, emperors, dolphinfish, marlin and sailfish, tuna and sharks have been recorded at the Rowley Shoals. In addition, a rich diversity of coral is present, with 233 species recorded, including at least 28 species of staghorn coral (Commonwealth of Australia, 2003).

Mermaid Reef features a diverse shark fauna, including grey reef sharks (*Carcharhinus amblyrhynchos*) and silvertip whaler sharks (*Carcharhinus albimarginatus*) (DEWHA, 2008).

The reefs of the Rowley Shoals have been listed on the IUCN List of Coral Reefs of International Significance and are considered to be the best examples of shelf-edge oceanic reefs in Australian waters (DEWHA, 2008).



"Cuddles" the Potato Cod poses for a photo at Cod Hole on Mermaid Reef - Annabelle Sandes



Colourful corals underwater at the Rowley Shoals - Annabelle Sandes

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Crab Creek - Annabelle Sandes



The Kimberley Coast

The Last Sanctuary

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