Yawuru Nagulagun / Roebuck Bay Marine Park

Joint management plan 2016

Management plan 86

GOVERNMENT OF WESTERN AUSTRALIA

Conservation and Parks Commission

Department of **Parks and Wildlife**

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WARNING: This plan may contain names and images of deceased Aboriginal people

This management plan was prepared by the Department of Parks and Wildlife's Planning Branch with the Yawuru Park Council working group, and on behalf of the Yawuru Park Council and the Conservation and Parks Commission.

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Front cover artwork:
Nagulagun-buru - Saltwater Country by Martha Lee.

Yawuru dedication

'The Yawuru story is one of resilience and pride. We recognise all the old people who carried the stories from *Bugarrigarra*, walked our lands, fished and hunted and survived from the water places. Those who gave evidence in court and worked tirelessly to negotiate the Yawuru Native Title Global Agreement we acknowledge with pride. We owe the benefits of today to our senior people who have gone before us. In the face of policies and practices of successive governments who sought to destroy our culture and extinguish our traditional rights, Yawuru people across many generations continued to practice customary law, speak our language and draw on the wisdom and knowledge of our traditions and customs. The Yawuru people have managed our country, including our waters, and cared for our society from time immemorial.

The senior people are the heroes of the Yawuru story and it is because of them that the younger Yawuru people living today are able to feel the pride and strength of being part of the community of Yawuru native title holders. While we are many individuals with strong associations to family it is the connection to each other as a community that gives us the strength to carve out our future destiny in a modern world to achieve *mabu buru, mabu liyan, mabu ngarrangunil*.'

by Patrick Dodson, October 2013

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Above: Snubfin dolphins. Photo – Alex Brown, MUCRU/WWF-Australia

Above: *Man-galagun* (Crab Creek), Roebuck Bay. Photo – NASA

Summary

For thousands of years Yawuru people have lived along the foreshores of Roebuck Bay, part of the Yawuru traditional estate. Roebuck Bay is *Yawuru Nagulagun*, which means Yawuru sea country, and is a place of exceptional value. Traditional ownership of this land and sea country has been recognised through the determination of Yawuru native title over much of the area, including the intertidal zone. Lying within these traditional lands and waters, Roebuck Bay's diverse heritage has been influenced by its abundance of marine resources, the safe anchorage afforded by its protected waters, and the many cultures that participated in the development of the pearling industry since the 1860s.

Roebuck Bay has some of the most productive tropical intertidal flats in the world, making it very important for Yawuru fishing, hunting and gathering of sea foods. It is one of the most important staging sites for migratory *gamirda-gamirda* (shorebirds) globally and for this reason it was declared a Ramsar wetland of international significance in 1990 and is a significant tourist destination. Seagrass and macroalgae communities provide food for protected species such as the *nganarr* (dugong) and flatback turtle. Marine mammals such as the Australian snubfin dolphin and Australian humpback dolphin frequent the waters of Roebuck Bay and humpback whales pass through on their annual migration.

Roebuck Bay lies on the doorstep of Broome, the largest town in the region and gateway to the Kimberley. Active enjoyment of the natural environment is an important part of the local lifestyle for Broome's vibrant and culturally diverse population. 'The Bay', as it is known locally, is a place of great value to the community of Broome for recreational activities including fishing, boating and nature appreciation such as viewing the Staircase to the Moon. The 2013 State Government decision to purchase and retire the two commercial Kimberley Gillnet and Barramundi Managed Fishery licences operating in Roebuck Bay received strong community support, and customary and recreational fishers report that fishing in the bay has improved significantly as a result. The main commercial uses in Roebuck Bay include port activities, pearling and a burgeoning marine nature-based and cultural tourism sector. Pearling and the Port of Broome have played vital roles in the development of Broome and its character. The port is the only all tide port in the Kimberley, and its ongoing operations and growth are essential to the local and regional economy, as well as the future infrastructure capacity of the Kimberley. Acknowledging the many uses of the bay and ensuring broad community support for ongoing management

Above: Staircase to the Moon. Photo – Tourism WA

were important factors in the design and establishment of the marine park. This joint management plan for the Yawuru Nagulagun / Roebuck Bay Marine Park aims to conserve and enhance the outstanding ecological, recreational and commercial values in the bay, including the sustainability of Yawuru native title rights, for the benefit of present and future generations as the town of Broome continues to grow.

The Yawuru Indigenous Land Use Agreements (Yawuru Agreements) provide for the establishment and joint management of reserves over the lands and waters in and around Roebuck Bay and Broome, collectively referred to as the Yawuru conservation estate. While reserve type and vesting arrangements differ, the intent is to manage the areas from the offshore waters to the Roebuck Bay hinterland as one ecological system. The marine park will be jointly managed by the Yawuru Registered Native Title Body Corporate (RNTBC) and the Department of Parks and Wildlife (Parks and Wildlife) through the Yawuru Nagulagun / Roebuck Bay Marine Park Joint Management Body (Joint Management Body). Day-to-day management activities will be coordinated through the Yawuru joint management program located in Parks and Wildlife's West Kimberley District Office in Broome.

This joint management plan details how the Yawuru Nagulagun / Roebuck Bay Marine Park will be jointly managed to enhance nature conservation, preserve and promote Yawuru culture and heritage, and provide for a range of opportunities for sustainable commercial and recreational use. The joint management plan is one component of a comprehensive joint management package that will cover the entire Yawuru conservation estate. The development of this joint management plan is in accordance with the Yawuru Agreements and legislative requirements of the *Conservation and Land Management Act 1984* (CALM Act).

The marine park will also contribute to fulfilling State Government commitments under the *Kimberley Science and Conservation Strategy*. Released on 17 June 2011, a key part of this strategy is the Kimberley Wilderness Parks initiative. Proposed to cover about five million hectares, this initiative will create the State's largest system of marine and terrestrial reserves, including six marine parks which will contribute to the representative system of multiple-use marine parks and reserves in WA.

This joint management plan identifies key cultural, ecological and social values of the area, seven management programs to be applied, and targets and performance measures to track progress against the stated management objectives over the life of the management plan. It is an outcome-based plan that provides a robust framework to support adaptive management.

The *Walyjala-jala buru jayida jarringgun buru Nyamba Yawuru ngan-ga mirli mirli* - Planning for the future: Yawuru Cultural Management Plan (*Yawuru cultural management plan*), developed by the Yawuru RNTBC, informed the development of this joint management plan, as required under the Yawuru Agreements. The Yawuru RNTBC Land and Sea Sub-committee played an integral role in the development of this plan. Management plans for the other reserves of the Yawuru conservation estate are similarly informed by the *Yawuru cultural management plan* and the Yawuru RNTBC Land and Sea Sub-committee.

The main outcomes in this joint management plan are listed as follows.

- The establishment of the marine park as a Class A reserve over the subtidal and intertidal areas of Roebuck Bay (excluding Kimberley Ports Authority waters), to be jointly managed via the Joint Management Body.
- The acknowledgement and continued exercise of relevant Yawuru native title rights, and preservation and promotion of Yawuru cultural and heritage values of the marine park.
- The establishment of a joint management framework for the marine park between Parks and Wildlife and Yawuru RNTBC, in accordance with the requirements of the Yawuru Agreements.
- The establishment of seven management programs with prioritised strategies to focus implementation of the management plan and to help achieve defined management objectives for the marine park.
- An improved conservation framework to help ensure the critical ecological components and processes that contribute to the international recognition of Roebuck Bay are conserved and the existing and future pressures on the cultural and ecological values are appropriately managed.
- The continuation and enhancement of opportunities for social benefits and enjoyment including cultural and recreational uses.
- The ongoing operation of appropriate commercial uses.

This joint management plan was developed by Parks and Wildlife in partnership with Yawuru RNTBC on behalf of the Joint Management Body and the Conservation and Parks Commission. The marine park, in combination with other well-advanced reserve proposals in the Kimberley region will make a valuable contribution to the statewide reserve system, providing significant social, cultural and nature conservation benefits.

1. Yawuru Nagulagun / Roebuck Bay management context

1.1 *Yawuru buru, Yawuru ngarrungunil* – Yawuru country, Yawuru people

For thousands of years Yawuru people have lived along the shores of Roebuck Bay, across the pindan plains, as far inland as the *Walan-garr* (Edgar Ranges) and along the fringes of the Great Sandy Desert. Yawuru country is land and sea moulded by the cycle of seasonal change. It is a living cultural landscape with which Yawuru people have a dynamic and enduring relationship and responsibility of care. In Yawuru law, everything comes from *Bugarrigarra* (the Dreaming), the time when creative beings traversed the country, naming the landscape, defining the languages and setting down rules and customs. Created and given form by *Bugarrigarra*, country is the source of spirit, culture, language, and is where spirits return on death. From *Bugarrigarra*, Yawuru people have responsibility to look after the country and to ensure that their traditions are passed on to future generations. Every time Yawuru people go out on country, hunting and fishing, they live culture – these activities are an expression of culture and enable Yawuru people to reconnect with country, spirit places, ancestors and *Bugarrigarra* (Yawuru RNTBC 2011).

The relationship of Yawuru people to country is at the heart of their cultural responsibilities and being. This is expressed through *liyan*. *Liyan* comes from Yawuru people's connection to country, ancestors and Yawuru way of life. It reflects a sense of belonging to Yawuru society, and represents the feeling people hold, individually and collectively, particularly when they are on their country.

Mabu (good) *liyan* expresses Yawuru emotional strength, dignity and pride. The guiding principle for good management of Yawuru country is that Yawuru people have to maintain good, clear *liyan* with the country within the modern, ever-changing world. To ensure Yawuru people can keep *mabu liyan* they have to:

- visit country
- respect spirits abiding in country
- continue cultural traditions
- respect *Bugarrigarra*

'*Liyan* is about relationships—with country, family, community. It is what gives meaning to people's lives. Yawuru peoples' connection to country and joy of celebrating our culture and society is fundamental to having good *liyan*.'

Patrick Dodson
(Yawuru RNTBC 2011)

Above: Neil McKenzie recording his father's history under the old tamarind tree at Waterbank. Photo – Sarah Yu

- look after all the plants, animals and other resources that are part of country
- maintain and protect sacred places
- foster relationships with country
- assume cultural responsibility as individuals and collectively for the future use and development of Yawuru country
- achieve balance between keeping things as they are and managing Yawuru country.

Yawuru people want to generate an understanding in the wider community of how they feel about and relate to country, with respect for *Bugarrigarra* and cultural traditions and practices and how non-Yawuru people can respect this (Yawuru RNTBC 2011).

For countless generations Yawuru people managed country in a sustainable way, relying on their intimate knowledge of the natural environment, and applying customary law, protocols and practices passed down from ancestors. Ancestors hold the collective communal wisdom and knowledge passed down through families and Yawuru responsible leaders. As Yawuru people have always done, this knowledge is passed on to children when they go hunting, fishing, gathering and camping. Understanding the subtle changes in country and following the seasons is part of Yawuru cultural heritage and provides Yawuru people with a guide as to where and how to harvest and look after the resources of country. As Yawuru activities change in response to the annual cycle of the seasons, Yawuru people believe their way of living has minimal impact on the environment (Yawuru RNTBC 2011). This plan is underpinned by this knowledge and its use, and aims to further integrate Yawuru knowledge and use with conservation science to support the successful management of Yawuru land and sea.

In recent times, Broome has undergone massive transformation as its population, infrastructure, housing and industry have expanded. Yawuru people, as the native title holders of their country, are well aware of the many challenges such changes present for managing country and, in a mutually respectful partnership with others, are well placed to meet them.

Nagula is Yawuru sea country, constantly changing with the tides and the seasons. Rich in stories and resources it has sustained Yawuru people for thousands of years. From *Bugarrigarra* it is Yawuru responsibility to look after their sea country. As Yawuru people see the changes to Roebuck Bay, the heart of Yawuru sea country, they will work together with government, scientists and the wider community to protect the bay for our future generations (Yawuru RNTBC 2011).

Top: Birding near mangroves in Roebuck Bay. Photo – Hazel Watson
Above: Yawuru Rangers working on country. Photo – Parks and Wildlife

'History hasn't always been kind to Yawuru people. We had no say when our land, our home, was taken from us and we were pushed towards the edges. But we stayed strong and true to our culture. We can now take our rightful place in the Broome community.'

Gajai Frank Sebastian
(Yawuru RNTBC 2011)

1.2 Native title determination and the Yawuru Agreements

With the High Court decision in Mabo and Wik the Commonwealth Government introduced the *Native Title Act 1993* (NT Act). Subsequently, Yawuru began a 12 year journey to lodge and determine their native title rights by way of court action and negotiations with the State Government. On 28 April 2006, the Federal Court of Australia determined Yawuru people to be the recognised native title holders of the lands and waters in and around Broome. Exclusive native title rights were determined over two thirds of the claim area, with non-exclusive native title recognised over the intertidal areas of Roebuck Bay. Although native title rights do not formally extend to the subtidal areas of Roebuck Bay, the connection and significance of this sea country to the Yawuru people is acknowledged, and is reflected in the commitment for this area to be jointly managed by the Yawuru RNTBC and Parks and Wildlife. To the Yawuru people, the waters of Roebuck Bay have always been *nagula*—Yawuru sea country.

An Indigenous Land Use Agreement (ILUA) is an agreement under the NT Act between a native title group and others about the use and management of lands and waters. Once registered, an ILUA is legally binding for all parties to the terms of that agreement (National Native Title Tribunal 2011).

In February 2010, the Yawuru RNTBC, the State Government of Western Australia, the Shire of Broome and other relevant parties signed two ILUAs. These ILUAs were a settlement of native title issues and clarified that native title was not extinguished over the Yawuru conservation estate, as well as resolving heritage issues over land required for the future development of Broome. In September 2016, Yawuru RNTBC, the State Government of Western Australia and other relevant parties signed an ILUA to provide for the creation of the marine park over specified intertidal areas of Roebuck Bay (marine park ILUA). Together, these ILUAs can be referred to as the Yawuru Agreements.

The Yawuru Agreements provide for the establishment and joint management of the Yawuru conservation estate, comprising marine and terrestrial reserves in and around Broome and Roebuck Bay. A Joint Management Agreement forms part of the marine park ILUA, and provides detail on management and administrative arrangements for the marine park, including establishment of the joint management body, joint management objectives, roles and responsibilities for each party, decision-making processes and administrative functions.

Above: Yawuru people value their country as a living cultural landscape. Photo – Querida Hutchinson

More information on native title, the Yawuru journey for native title determination and the Yawuru Agreements can be found on the website for the National Native Title Tribunal (www.nntt.gov.au), the Yawuru website (www.yawuru.com) and in the *Yawuru cultural management plan* (Yawuru RNTBC 2011).

1.3 *Walyjala-jala buru jayida jarringgun buru Nyamba Yawuru ngan-ga mirli mirli* – Planning for the future: Yawuru cultural management plan

The *Yawuru cultural management plan* (Yawuru RNTBC 2011) was developed by the Yawuru RNTBC as a foundation document to guide the planning and management of the Yawuru conservation estate. As prescribed under the Yawuru Agreements, this document describes Yawuru people's customs and practices as well as customary law, and provides detail on Yawuru policies, visions and requirements to be taken into account during the development of management plans for the Yawuru conservation estate.

As a comprehensive articulation of the aspirations and responsibilities of Yawuru native title holders, the *Yawuru cultural management plan* is an authoritative information source for joint management partners and the wider community. The development of the *Yawuru cultural management plan* involved all facets of the Yawuru organisational system and is a key document for the joint management of the Yawuru conservation estate.

The *Yawuru cultural management plan* was a primary information source during the development of this joint management plan and many of the culturally based concepts and values outlined here are explored in greater detail within it. Copies of the *Yawuru cultural management plan* may be obtained through Nyamba Buru Yawuru Ltd.

1.4 Connectivity and holistic management across Yawuru conservation estate

1.4.1 Component management plans for Yawuru conservation estate

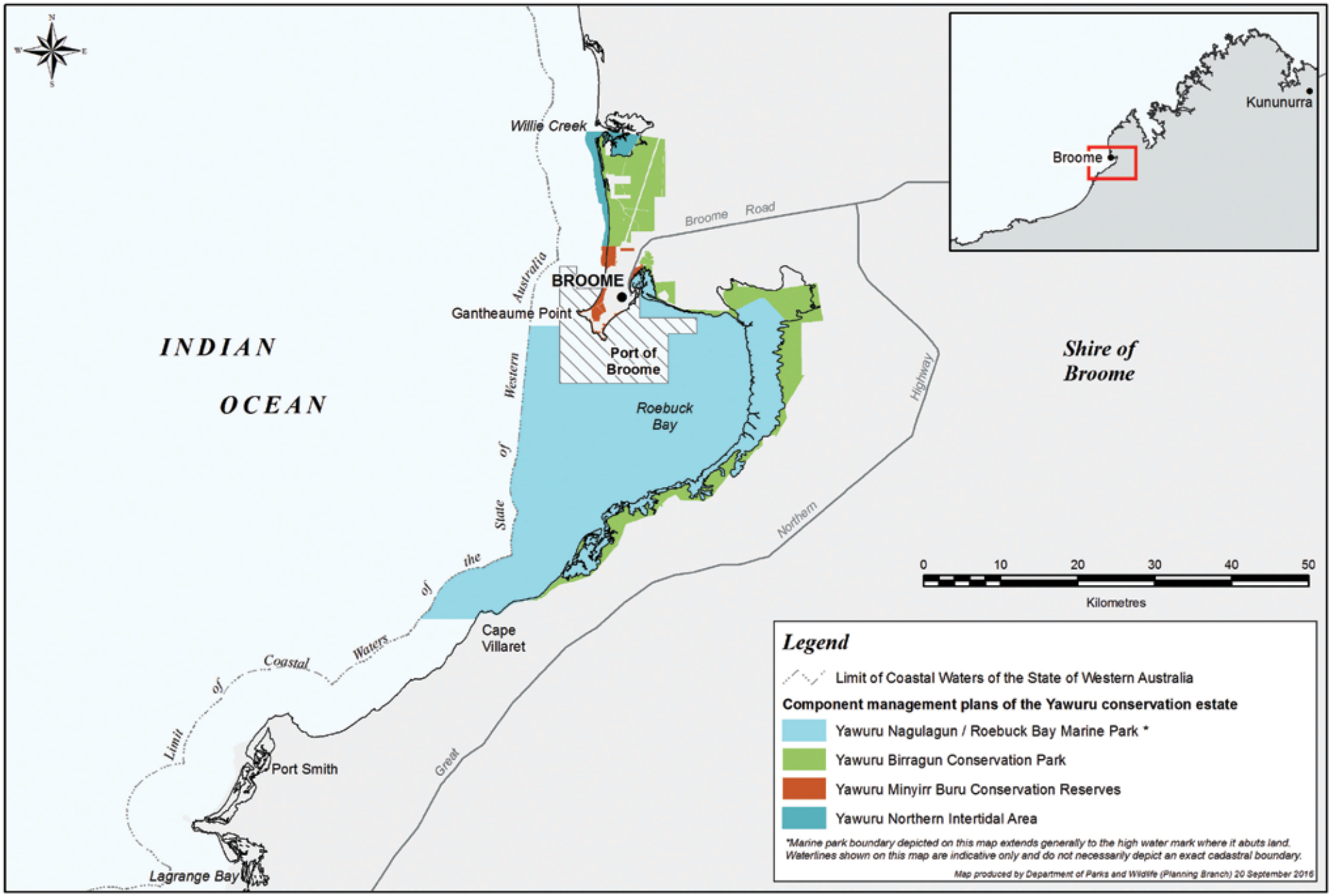
The cultural, ecological and social values of the marine and terrestrial reserves that are proposed under the Yawuru Agreements are linked and interdependent. The subtidal and intertidal areas of Roebuck Bay and the lowlands of *Gumaranganyjal* (Roebuck Plains) form interconnected components of the wider 'Roebuck Bay system' (see Yawuru RNTBC 2011 and Bennelongia 2009 for a full description). As such, a highly integrated management approach capable of protecting and managing the values in a culturally appropriate manner is being facilitated by joint management partners working closely together to develop a suite of management plans for the Yawuru conservation estate. Management objectives, strategies, performance measures and targets identified in this joint management plan will complement those for other plans and are designed to enable a holistic management approach to the wider Roebuck Bay system.

The component management plans (and joint management partners) for the Yawuru conservation estate will be comprised of:

- **Yawuru Nagulagun / Roebuck Bay Marine Park Management Plan (Yawuru RNTBC and Parks and Wildlife)***
- Yawuru Birragun Conservation Park Management Plan (Yawuru RNTBC and Parks and Wildlife)*
- Yawuru Minyirr Buru Conservation Reserves Management Plan (Yawuru RNTBC and Shire of Broome)*
- Yawuru Northern Intertidal Area Management Plan (Yawuru RNTBC, Parks and Wildlife and Shire of Broome)*

*Official names to be confirmed.

Figure 1 The Yawuru Nagulagun / Roebuck Bay Marine Park and other areas of the Yawuru conservation estate



Above: Yawuru Ranger Curtis Robinson and mangroves. Photo – Chris Nutt/Parks and Wildlife

1.4.2 Joint management

The lands and waters of the marine park are highly significant to Yawuru people's culture and heritage. Joint management will provide the opportunity for Parks and Wildlife and Yawuru people to work together, with the wider community, to achieve the cultural, ecological and social management objectives set out in this joint management plan. Yawuru traditional knowledge and understanding of Roebuck Bay will be incorporated into the management of the marine park, and Yawuru people will be actively involved in managing Yawuru country.

This management plan requires the CEO of Parks and Wildlife to jointly manage the marine park with the Yawuru RNTBC. Joint management of the marine park is given effect under the CALM Act through the section 56A joint management agreement attached to this management plan.

Joint management of the marine park will be administered through the Joint Management Body in conjunction with Parks and Wildlife and the Conservation and Parks Commission (Commission), and in accordance with this joint management plan. As detailed in the joint management agreement, the Joint Management Body will comprise three Yawuru representatives appointed by the Yawuru RNTBC and three representative members appointed by Parks and Wildlife. The Joint Management Body will oversee the management of the marine park, make management decisions and provide strategic input into how management actions are implemented over the marine park, but will not be involved in day-to-day management. Operational responsibility will be coordinated by the Yawuru joint management program within Parks and Wildlife under the guidance of the Joint Management Body (see section 5.1).

Management of the marine park will also be supported by relevant state government agencies and the community. The roles and responsibilities of the joint management partners and other stakeholders for the marine park are described in Table 2.

1.5 Legislative context

The marine park will be created under section 13 of the CALM Act which specifies the purpose of marine parks as:

…allowing only that level of recreational and commercial activity which is consistent with the proper conservation and restoration of the natural environment, the protection of indigenous flora and fauna and the preservation of any feature of archaeological, historic or scientific interest.

Section 56(2) of the CALM Act states:

In preparing a management plan for any land, the responsible body for the land shall have the objectives of…protecting and conserving the value of the land to the culture and heritage of Aboriginal persons…in a manner that does not have an adverse effect on the protection or conservation of the land's fauna or flora.

In June 1990 Roebuck Bay was declared a Wetland of International Importance under the Ramsar Convention and currently meets seven of the nine assessment criteria (Department of Environment and Conservation 2009). These criteria are detailed in the *Ecological character description for Roebuck Bay*[1] and include being recognised as an internationally important site for shorebirds (Bennelongia 2009). Requirements under the Ramsar Convention are given effect through the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and include describing the ecological character and developing a management plan for all listed sites.

[1] *Ecological character description for Roebuck Bay* can be found at http://www.dpaw.wa.gov.au/images/documents/conservation-management/wetlands/ramsar/roebuck-bay-ecd_final-with-disclaimer.pdf

Above: Flock with several species of shorebird. Photo – Hazel Watson

The legal protection afforded to Australia's Ramsar sites under the EPBC Act is based on maintaining their ecological character (specifically sections 16 and 17). Section 16 (1) states:
A person must not take an action that:
(a) has or will have a significant impact on the ecological character of a declared Ramsar wetland; or
(b) is likely to have a significant impact on the ecological character of a declared Ramsar wetland.

Whilst the Ramsar site occurs across marine and terrestrial reserves (see Figure 2), it is primarily associated with the marine park. Values, objectives and strategies outlined in the ecological character description (Bennelongia 2009) are encompassed within this joint management plan. This plan, along with the ecological character description, addresses the set of 14 management principles established by the Australian Government to guide the development of a Ramsar site management plan (Department of Sustainability, Environment, Water, Population and Communities 2013a).

Parts of the west Kimberley were added to the National Heritage list in 2011 with over 40 cultural, social and ecological values being recognised for their outstanding national heritage value. National Heritage places and the values they contain are afforded protections under the EPBC Act, including sections 15B and 15C. The portion of the marine park that is recognised as part of the West Kimberley National Heritage listed place, and the associated values, will be managed in accordance with the EPBC Act and regulations. Further information on the West Kimberley National Heritage listed place can be found on the Department of Environment website for the Australian Government (http://www.environment.gov.au/heritage/places/national/west-kimberley).

Additionally, this joint management plan should not be viewed in isolation, but as an integral part of a suite of complementary management mechanisms within and adjacent to the marine park including heritage protection, fisheries management, wildlife protection, industry regulation, pollution control, environmental impact assessment, maritime transport and safety measures, and community cooperation and participation. Table 2 describes the responsibilities of the main relevant bodies and government agencies.

1.6 Regional significance

The cultural and ecological values of Roebuck Bay are recognised as being regionally, nationally and internationally significant. This combined value was further acknowledged in August 2011 when much of the Roebuck Bay intertidal area was included in the West Kimberley National Heritage listing. National Heritage values found in Roebuck Bay include fossils preserved in the Broome Sandstone (including dinosaur trackways), important bird habitats (including intertidal sand and mudflat communities) and the regular presence of migratory, protected or endangered birds.

Roebuck Bay is the heart of Yawuru country and its productive and diverse shores sustained the Yawuru people for thousands of years. Roebuck Bay contains significant places for Yawuru people and other neighbouring groups. In Yawuru country, the *Bugarrigarra* laid down three traditions of law, which hold esoteric knowledge of country and guide customary practices. The Northern Tradition is allied with the northern and coastal people, particularly the Bardi people. The Southern Tradition is associated with the people further south and inland including the Karajarri, Nyikina, Mangala and Nyangumarta people. The third tradition arises in Broome itself and travels east toward the desert and Uluru in central Australia. Knowledge and practice of all traditions are shared with groups outside Yawuru country (Yawuru RNTBC 2011). The cultural significance of the area was articulated in an expert report to the Federal Court during the first Yawuru native title hearing:

"…the Broome region, in religious terms, [is] intensely crowded. It may not be an exaggeration, and may give some indication of its uniqueness, to say it is something of a Jerusalem, Mecca or Varanasi [for] a significant part of Aboriginal Australia." (Sullivan 1996, cited in Yawuru RNTBC 2011)

Roebuck Bay is the most significant embayment between Cape Leveque at the northern tip of the Dampier Peninsula and Cape Lambert to the south in the Pilbara. The marine park is the only state marine reserve in the Canning bioregion of the Interim Marine and Coastal Regionalisation (IMCRA) (Interim Marine and Coastal Regionalisation for Australia Technical Group 1998). The Interim Biogeographic Regionalisation for Australia identified the lands adjacent to Roebuck Bay as the Pindanland subregion (Department of Sustainability, Environment, Water, Population and Communities 2012). The recognised special values of the Pindanland subregion that relate to Roebuck Bay include the extensive intertidal flats of Roebuck Bay, the enormous numbers of migratory birds found at Roebuck Bay, and the vast grasslands of the *Gumaranganyjal* (Roebuck Plains) (Graham 2001). Roebuck Bay is also the only tropical marine embayment to be listed as a Ramsar site in Western Australia.

The unique Roebuck Bay and *Gumaranganyjal* environment ('the Roebuck Bay system') is formed by a natural lowland between the northern Dampier Peninsula and the Edgar Ranges, and an ancient drainage system (Brunnschweiler 1957, cited in Gibson 1983; Pepping *et al.* 1999; Semeniuk 2008; Vogwill 2003). Hydrogeological studies have further identified the potential position of an ancient river channel through *Gumaranganyjal* and linked it with the now drowned river valley of Roebuck Deeps (Vogwill 2003; Wallace 2000). Less than 2km from shore and reaching depths of 100m, the Roebuck Deeps is a unique geomorphic feature which focuses tidal flows and exerts a strong influence on the nature of Roebuck Bay. This natural structure lies outside the marine park and provides the deep water access required for the principal port serving the Kimberley.

The evolution of the internationally recognised *jalbarl-barl* (intertidal flats of Roebuck Bay) is a function of the broad geological inheritance (as described above), a significant rise in sea level (over 100m in the last 20,000 years) and a unique geomorphic and climatic setting that provided little run-off or terrestrial sediment input. As a result, modern day Roebuck Bay is regarded as having one of the most biologically diverse and productive tropical intertidal flats in the world (Bennelongia 2009), which in turn supports the internationally significant numbers of migratory *gamirda-gamirda* (shorebirds) and other waterbirds. Research and initial investigations indicate that Roebuck Bay:

- is internationally significant for 22 species of waterbirds (Bennelongia 2009)
- is likely to be internationally significant for the Australian snubfin dolphin (Thiele 2010; Brown *et al.* 2016)
- is likely to be regionally significant for *nganarr* (dugongs) listed as Vulnerable on the IUCN Red List of Threatened Species (Marsh 2008) and as Other Specially Protected Fauna under the *Wildlife Conservation Act 1950* (Wildlife Conservation Act) Wildlife Conservation (Specially Protected Fauna) Notice 2012(2)
- contains discrete genetic stocks of king and bluenose threadfin salmon (Welch *et al.* 2010)
- is likely to be a regional driver for productivity (Wright & Pyke 2009).

The marine park is also adjacent to the Port of Broome and the Broome town site. With a resident population estimated at 12,766 people (Australian Bureau of Statistics data 2011), Broome is the largest town in the Kimberley and regionally important for the provision of transport, health, education, financial, tourism and other services. Broome's vibrant and culturally diverse population enjoys an active outdoor lifestyle and benefits greatly from living right on the shores of Roebuck Bay. Activities such as nature appreciation, enjoying the coastal environment and recreational and customary fishing are highly valued by the local community.

The Port of Broome has played a vital role in the development of Broome and as the only all tide port in the Kimberley, its ongoing operations and growth are essential to the local and regional economy. Land and seaside developments associated with both the port and town site of Broome may occur during the life of this plan and will be important components of the future infrastructure capacity of the Kimberley.

Tourism is an important and growing sector in Broome and the wider Kimberley. Between 2014 and 2015 the estimated average number of visitors per year to the Kimberley was 383,000, with 59% (227,000) from WA, 31% (129,500) from interstate and 9% (35,500) from overseas (Tourism Western Australia, 2016a). It's estimated that almost half of these visitors (185,400) included holiday or leisure as a purpose for their visit (Tourism Western Australia, 2016a). Total visitor spend in 2015 for Australia's North West was $1.148 billion (Tourism Western Australia, 2016b).

Top: Bar-tailed godwit. Photo – Ric Else
Above: Rising full moon. Photo – Hazel Watson

Figure 2 Marine bioregions and regional setting for the Yawuru Nagulagun / Roebuck Bay Marine Park

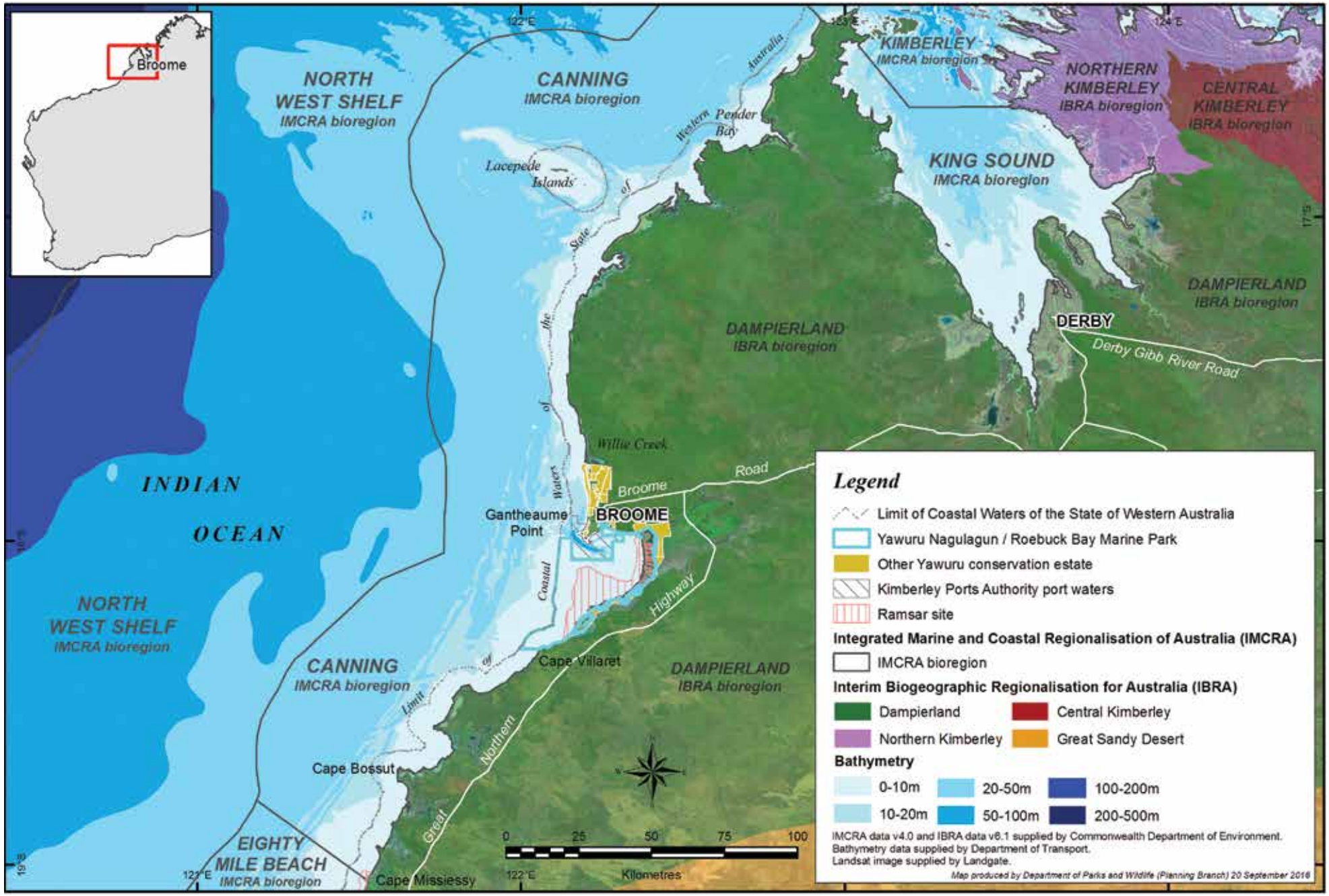
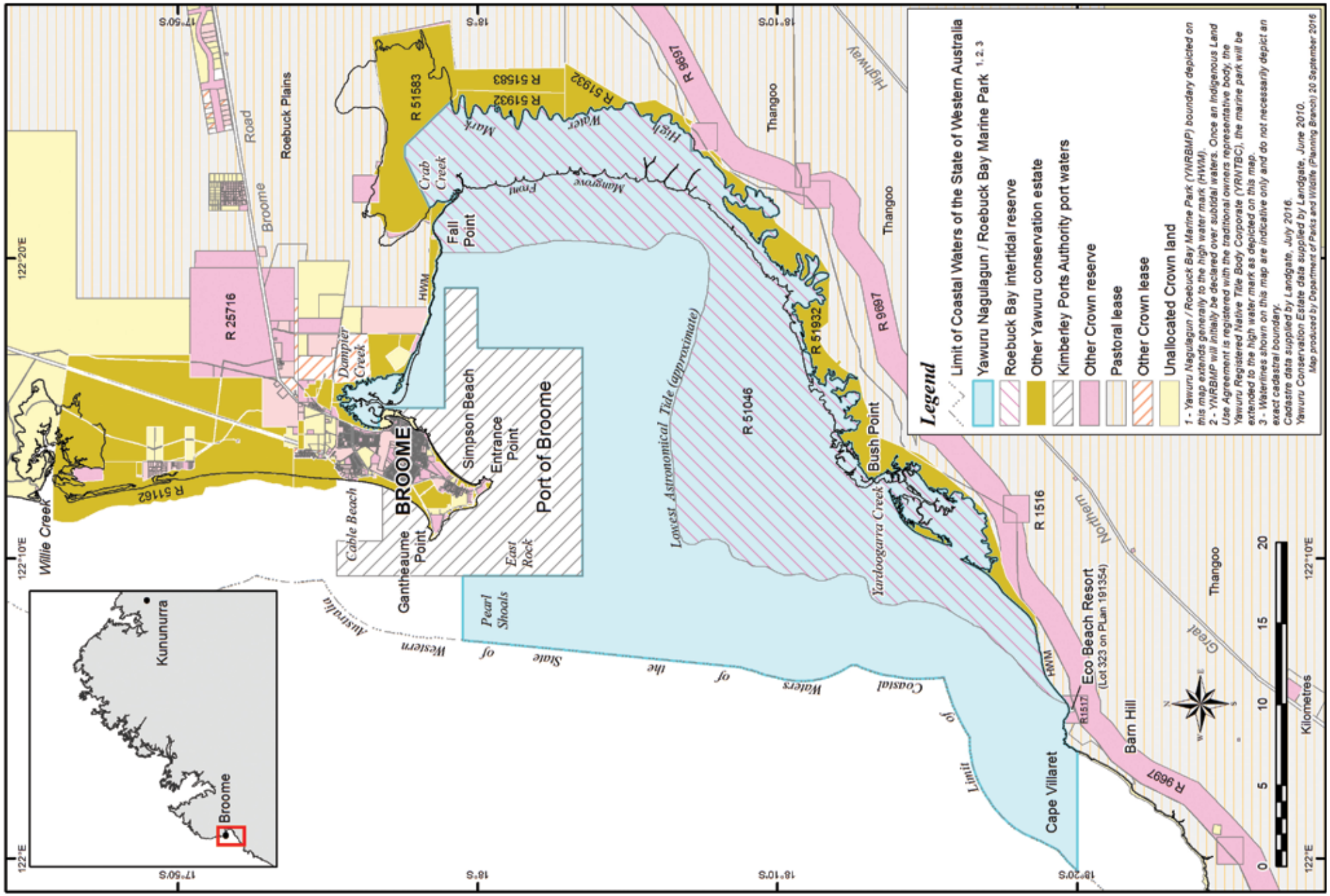


Figure 3 Tenure within and adjacent to the Yawuru Nagulagun / Roebuck Bay Marine Park



Above: Aerial image. Photo – Steve Lloyd Smith

2. Definition of the area

The Yawuru Nagulagun / Roebuck Bay Marine Park is located immediately south of the town of Broome, in the Kimberley region of WA. The marine park covers an area of approximately 78,800ha from *Minyirr* (Gantheaume Point) in the north to *Miriny* (Cape Villaret) in the south, and includes subtidal and intertidal areas between the seaward limit of Western Australian waters (three nautical miles from the territorial baseline) to the high water mark (Figure 3). The marine park is reserved as Class A and vested in the Commission under the CALM Act. Class A affords the greatest level of protection for reserved lands and waters, requiring the approval of Parliament to amend or cancel a reserve's purpose or significantly alter its boundary.

The boundaries of the marine park and surrounding tenures are outlined in Figure 3. Sections of the marine park are adjacent to other areas of the Yawuru conservation estate.

3. Vision and goals

Roebuck Bay is the heart of *nagula*, Yawuru sea country. Yawuru people have customary responsibility to look after their country, which is also recognised in their native title rights which extend over intertidal areas. Roebuck Bay is recognised internationally for its unique ecological values, and provides social and commercial benefits for the local community and a growing number of national and international visitors.

The vision for the marine park is:

> Yawuru people and their partners working together with the wider community to restore, protect and sustainably maintain the cultural and natural values of Roebuck Bay for the enjoyment and benefit of present and future generations of Yawuru people and the wider population.

Above: Park managers with Jimmy Edgar on a planning day field trip. Photo – Chris Nutt/Parks and Wildlife

A set of strategic goals has been developed for the marine park to guide management towards achieving this vision. These goals were adapted from the over-arching strategic objectives adopted for all of Western Australia's marine parks and reserves and provide a link between the vision statement and the desired outcomes expressed through the objectives for the values (section 4) and management programs (section 5).

The strategic goals for the marine park are listed below.

- Uphold and respect Yawuru people's culture and knowledge of the land and sea.
- Provide for sustainable customary use.
- Achieve a sustainable balance between the customary, recreational and commercial uses of Roebuck Bay.
- Ensure healthy ecosystems and no loss of biodiversity in Roebuck Bay.
- Maintain and provide opportunities for the Broome community and visitors to enjoy and benefit from Roebuck Bay.
- Contribute to international, national and regional conservation initiatives.
- Encourage collaborative scientific research and education programs.

4. Management of Yawuru Nagulagun / Roebuck Bay values

Conservation and management of the key cultural, ecological and social values is a primary aim for the marine park. While it is understood that many of these values are tightly linked, for the purpose of this management plan they have been addressed under the separate headings of cultural, ecological and social values. This helps with the development of clear management objectives and strategies for each key value, and allows for transparent and accountable management audit and review processes.

Many of the values of Roebuck Bay, the pressures that impact on these values and the appropriate management actions to respond to these pressures, occur across the wider marine and adjacent hinterland areas. This reiterates the importance of careful integration between the four management plans for the Yawuru conservation estate and cooperative management of trans-boundary issues to ensure the values are protected and managed effectively and efficiently. Where appropriate, a description of the values and pressures will be made in this broader context to facilitate improved linkages and integration between the management plans and adjacent lands and waters. This approach also reflects the Yawuru people's holistic view of their land and sea as one country.

Capitalising on opportunities to maintain and improve the identified values of an area, including through the mitigation of pressures (or potential pressures), is a core principle of protected area management. While it is important to recognise and understand the impacts from global and regional pressures such as climate change, these pressures are largely outside the control of managers, and strategies are best focused on increasing the health and resilience of ecosystems through the sound management of human uses and local pressures (Lough *et al.* 2007); and undertaking local adaptive management as climate change effects become evident.

In this document, the term 'major pressure' refers to one or more specific human uses or local pressures that are current and known, with a high level of confidence, to be significantly impacting on an identified value of the marine park. 'Existing and potential pressures and/or uses' refers to those human uses and local pressures that are likely to impact on an identified value in the marine park during the life of the plan, but the level of impact is deemed to be less significant or the likelihood is lower. The stated management objectives were developed following an assessment of this information and, together with the targets, represent the desired management outcomes for the specified values of the marine park.

Performance measures will be monitored to track progress towards achieving these outcomes and inform management decisions. Specified targets and performance measures for a selection of values are used as key performance indicators (KPI) to aid in the assessment of management effectiveness. The KPIs chosen to assess the effectiveness of this management plan reflect the highest conservation and management priorities of the Commission, Yawuru RNTBC, Parks and Wildlife and the community. The management objectives, management strategies, performance measures and targets form the basis of a robust, outcome-based, adaptive management approach for the sound management and long-term protection of the marine park values.

Yawuru RNTBC and Parks and Wildlife, as the joint management partners, have the primary responsibility for coordinating and implementing the management strategies listed in the management summary tables under each value. The Yawuru RNTBC has a particularly important role regarding the implementation of management strategies listed in the Yawuru cultural values section (section 4.1). Where other agencies or bodies are required to contribute to the implementation of a strategy they are listed in brackets at the end of the strategy. The name appears in bold where an agency or body is required to take the lead role in strategy implementation (see page 104 for the full title of agencies and bodies attributed responsibility for specific management strategies).

Management strategies within the plan are prioritised as high (H), medium (M) or low (L) to indicate their relative importance and are all intended to be implemented over the life of this management plan. Management strategies considered to be critical to achieving the strategic goals of the management plan are presented as 'high-key management strategies' (H-KMS). The prioritisation of strategies is based on the best available information and may change during the life of the plan. Strategies that are listed under section 4 of this plan relate specifically to a particular value but will be implemented under one of the seven management programs listed in section 5 (management frameworks; education and interpretation; public participation; patrol and enforcement; visitor risk, access and infrastructure; research; and monitoring).

4.1 Yawuru cultural values

Yawuru cultural values stem from the relationships between Yawuru people and Yawuru country. Like the country itself, the cultural values arise from *Bugarrigarra*, which gave form to the land and seascape, determined law and gave Yawuru people the responsibility for looking after Yawuru country.

This section draws from the values described in section 2.3 of the *Yawuru cultural management plan*. Further information on Yawuru values and concepts is presented in the *Yawuru cultural management plan* (Yawuru RNTBC 2011).

Many culturally significant sites and concepts outlined in the *Yawuru cultural management plan* are associated with the coastal zone adjacent to the marine park and will be addressed through complementary management arrangements for the Yawuru conservation estate, as outlined in section 1.4.

4.1.1 Living cultural landscape (KPI)

Yawuru country is a living cultural landscape founded in Bugarrigarra.

According to Yawuru law everything comes from *Bugarrigarra*, the creative epoch in which the world was given form and meaning. During this time, ancestral beings travelled through country naming places and creating the features of the land, waters and skies, introducing rules and rituals associated with particular areas, the regional languages, and the seasons and their cycles. *Bugarrigarra* narratives form an intricate network of 'songlines' and 'Dreaming tracks', which traverse Yawuru country, including the sea.

In this way *Yawuru buru* (Yawuru country) means much more than just the physical land to which the Yawuru people belong. *Buru* is the physical expression of *Bugarrigarra*, in which the features of Yawuru country were formed. As *Bugarrigarra* beings created and named places, they endowed them with significance. The associated narratives and rituals recount their activities and link Yawuru people to particular areas of country for all time. These narratives ascribe metaphysical meaning to all aspects of physical reality – the landscape, under the ground, the sky, the water and the diverse plants, animals and ecosystems.

Like all living things Yawuru people are believed to arise from country. Certain places in Yawuru country have *rayi*, a life-giving essence that creates Yawuru spirit children. This connection of a spirit child to a specific place, its *bugarri*, is typically discovered through dreams or unusual events. Throughout life, a Yawuru person remains connected to their *rayi* place, the place that gave them life.

Other metaphysical beings are known to be linked to certain places, but can also move around and be unpredictable. *Jurru*, for example, are snake-like beings associated with both salt and fresh water, which protect Yawuru country.

'The sandbars across the bay are connected through rituals. The whole bay is full of significant cultural places; some are public and not others.'

Jimmy Edgar
(Yawuru RNTBC 2011)

'When we die our *rayi* return to that place in our country. When we visit places we know the *rayi* of our ancestors are there, guiding us and looking after country, watching the behaviour of our people.'

(Yawuru RNTBC 2011)

Above: Jimmy Edgar and granddaughters. Photo – Sandy Harris

Bugarrigarra is not detached from contemporary life. It continues to exist and is the spiritual force that shapes ongoing cultural values and practices, relationships, obligations and responsibilities. Life since colonial times has contributed to the continuing evolution of the living cultural landscape that is Yawuru country. The influence of the pearling industry was particularly strong, bringing Indigenous and Asian people together as indentured labour, living and working together and intermarrying. These events and other heritage areas that shaped the lives of Yawuru people have become part of the story.

Management of this cultural value will focus on raising awareness and respect for the marine park as part of the living cultural landscape of Yawuru country.

Summary of management arrangements for living cultural landscape (KPI)		
Requirements	• Recognition of the marine park as part of the living cultural landscape of Yawuru country. • Equal involvement of Yawuru people in planning and management of the marine park. • High water quality, healthy biological communities and functioning ecosystems. • Protection of Yawuru heritage sites and cultural knowledge.	
Management objectives	1. To ensure that activities within the marine park do not adversely affect opportunities for Yawuru people to have ongoing cultural connection and expression. 2. To promote increased understanding and respect for Yawuru living cultural landscape values and concepts of the marine park.	
Management strategies	1. Ensure cultural heritage sites in the marine park are protected, in particular, highly significant and sensitive sites at risk. 2. Undertake and support cultural mapping projects that spatially and conceptually characterise Yawuru cultural values applicable to the marine park and broader Yawuru conservation estate. 3. Assess the nature and level of impact from human activities within the marine park that may inhibit the promotion of the area as part of a living cultural landscape, and implement management strategies to mitigate or stop any impacts as appropriate. 4. Develop and implement education and interpretation programs to inform users of the marine park about the value of the area as a Yawuru living cultural landscape, with Yawuru people having a primary and active role.	H-KMS H-KMS H-KMS M
Performance measures	1. Yawuru RNTBC level of satisfaction that opportunities for ongoing cultural connection of Yawuru people are not significantly disrupted because of management activities (or a lack of appropriate management activities) in the marine park. 2. Living cultural landscape information incorporated into education and interpretation programs for the marine park.	
Targets	1. Yawuru RNTBC is satisfied that opportunities for ongoing cultural connection of Yawuru people to country are maintained. 2. Yawuru RNTBC is satisfied that visitors have been provided with opportunities to increase their understanding that the marine park forms part of the living cultural landscape. 3. 50% of surveyed users of the Yawuru conservation estate are aware that the area forms part of the living cultural landscape of Yawuru country within the first five years following release of the management plans.	
Reporting	Annual, or as required (see section 6).	

4.1.2 Traditional ecological knowledge (KPI)

Yawuru traditional ecological knowledge is an important foundation for ecologically sustainable resource management.

Like many Indigenous people across the globe, Yawuru people have a deep understanding of the plants, animals, landscape features, seasons and cycles that make up their country, and changes that have occurred over time. Developed over millennia, this knowledge is deeply embedded within Yawuru culture and is often expressed through the stories and law that govern the relationships between people and country. Having used this knowledge to live off the land, and to sustain this lifestyle for thousands of years, there are opportunities for traditional ecological knowledge to feed into and inform conservation science.

As coastal people, much of Yawuru traditional ecological knowledge relates to the abundant marine resources that can be found in Yawuru country. Like other aspects of Yawuru life and resource harvesting, knowledge of marine resources is largely underpinned by the six Yawuru seasons and the life cycles of individual species (see Figure 4). Cultural rules and responsibilities established from this knowledge provide guidance on the use of country, such as what and when particular species should be harvested, how to tell they are 'fat' or 'ready', who should not eat certain resources, and not wasting what can be eaten.

Management of this value will focus on gaining a better understanding of Yawuru traditional ecological knowledge applicable to the marine park, and investigating opportunities for integration with conservation science and management.

Summary of management arrangements for traditional ecological knowledge (KPI)		
Requirements	• Increased understanding and support within the community for Yawuru people's traditional ecological knowledge and its application to park management. • Increased understanding and support for Yawuru people's spiritual and cultural values and traditional usage.	
Management objective	To apply Yawuru traditional ecological knowledge and integrate it with conservation science and management of the marine park.	
Management strategies	1. Undertake and support research to gain a better understanding of Yawuru traditional ecological knowledge applicable to the marine park, and develop a database to capture this knowledge. 2. Investigate opportunities and develop a process for integrating Yawuru traditional ecological knowledge, and knowledge holders, with conservation science and management applicable to the marine park (DoF). 3. Develop and implement education programs to inform users of the marine park about Yawuru traditional ecological knowledge and its use as a foundation of Yawuru sustainable traditional harvesting and resource management, with Yawuru people having a primary and active role.	H-KMS H-KMS M
Performance measure	Yawuru RNTBC level of satisfaction that traditional ecological knowledge is being consulted and, where relevant, integrated into management of the marine park.	
Target	Yawuru RNTBC is satisfied traditional ecological knowledge is integrated into management of the marine park.	
Reporting	Annual, or as required (see section 6).	

Figure 4 Yawuru saltwater seasons (from the *Yawuru cultural management plan*)

Saltwater seasons

The six saltwater seasons guide Yawuru people to understand what the local marine life is doing. It informs us where certain animals are, when they are mating, and when they are fat and ready to be eaten. This local knowledge allows our people to read the indicators in the landscape, recognise the changes in the seasons and know what marine species to harvest.

Man-gala
The WET
December – March
Reef & Creek

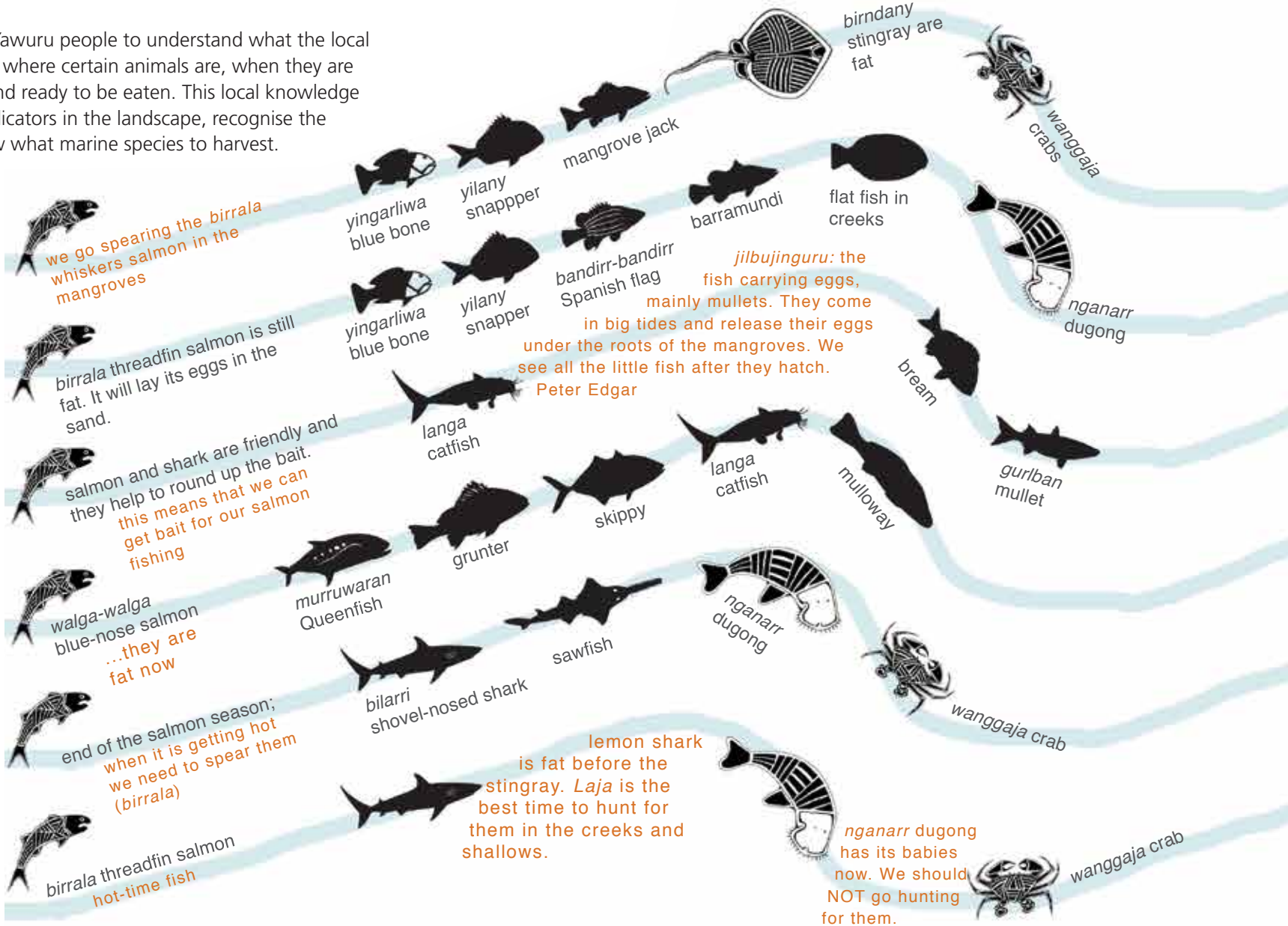
Marrul
CHANGING season
April – May
Reef & Creek

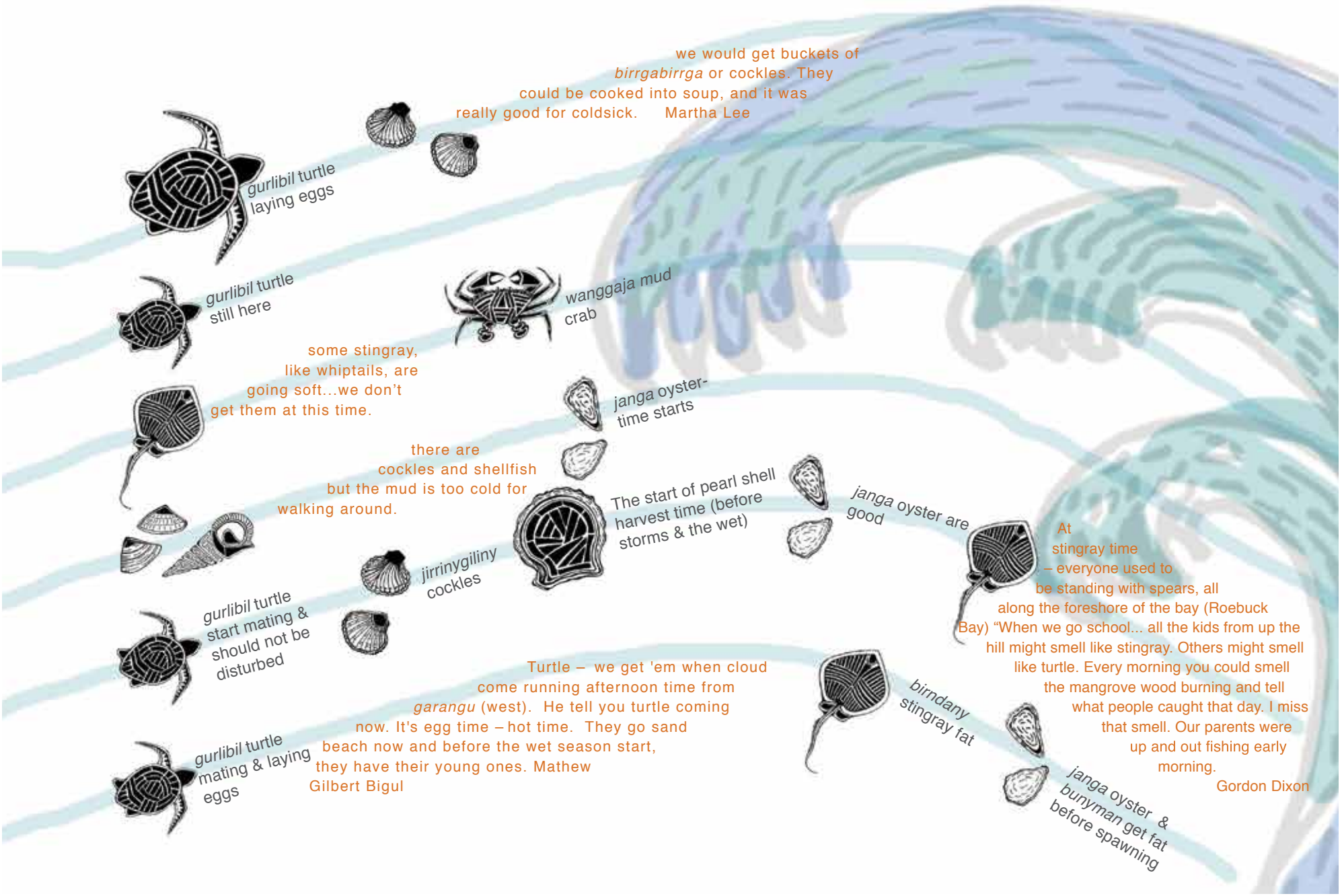
Wirralburu
COOLING season
May – June
Beach & Creek

Barrgana
COLD season
June – August
Beach & Creek

Wirlburu
WARMING UP season
September – October
Creeks

Laja
Proper HOT time
Late September – November
Beach & Reef




we would get buckets of
birrgabirrga or cockles. They
could be cooked into soup, and it was
really good for coldsick. Martha Lee
gurlibil turtle
laying eggs
gurlibil turtle
still here
wanggaja mud
crab
some stingray,
like whiptails, are
going soft...we don't
get them at this time.
janga oyster-
time starts
there are
cockles and shellfish
but the mud is too cold for
walking around.
The start of pearl shell
harvest time (before
storms & the wet)
janga oyster are
good
At
stingray time
– everyone used to
be standing with spears, all
along the foreshore of the bay (Roebuck
Bay) "When we go school... all the kids from up the
hill might smell like stingray. Others might smell
like turtle. Every morning you could smell
the mangrove wood burning and tell
what people caught that day. I miss
that smell. Our parents were
up and out fishing early
morning.
Gordon Dixon
jirrinygiliny
cockles
gurlibil turtle
start mating &
should not be
disturbed
Turtle – we get 'em when cloud
come running afternoon time from
garangu (west). He tell you turtle coming
now. It's egg time – hot time. They go sand
beach now and before the wet season start,
they have their young ones. Mathew
Gilbert Bigul
birndany
stingray fat
janga oyster &
bunyman get fat
before spawning
gurlibil turtle
mating & laying
eggs

'We took the boys out to *Kunin* today. I had the best day. I feel so good. I been on country today and I will sleep good tonight.'

Gajai Frank Sebastian
(Yawuru RNTBC 2011)

Above: Customary fishing. Photo – Chris Nutt/Parks and Wildlife

4.1.3 Enjoyment of country and customary practices (KPI)

Accessing country is vital to the sustainability of Yawuru culture.

Although Yawuru country extends inland for over 100km, the Yawuru people consider themselves to be saltwater people, as they would travel and live along the coast, utilising the resources of *nagula*—their sea country—according to seasons. Therefore, their ability to access the coast and sea within the conservation estate for customary practices is particularly important.

As the recognised native title holders of Yawuru country, Yawuru people have the right to enjoy Yawuru country and maintain their customary practices. In particular this refers to rights of access to country to:

- work on Yawuru country
- use the resources of Yawuru country
- pass on knowledge to future generations
- continue customary practices
- benefit from Yawuru country and create opportunities for Yawuru people.

Much of the coastline in Yawuru country is either difficult to access or already being utilised for a variety of purposes. Providing appropriate access to areas where Yawuru people can continue to undertake cultural activities and responsibilities in privacy is an important requirement for the management of this value (Yawuru RNTBC 2011).

Access restrictions to some terrestrial areas are proposed in the adjacent Yawuru Birragun Conservation Park. This includes land areas adjacent to the special purpose zones (cultural heritage) of the marine park (see section 6.1.1 and the *Yawuru Birragun Conservation Park management plan*). These measures are provided for under the Yawuru Agreements and seek to establish land-based 'cultural purposes only' areas to allow Yawuru people to undertake customary practices on country in privacy. While the special purpose zones (cultural heritage) within the marine park do not restrict broader community use, marine park users are asked to respect the Yawuru people's request for privacy while undertaking cultural activities, particularly in these zones.

Management of this value will focus on providing for, recognising and maintaining the rights of Yawuru people to enjoy country and undertake customary practices.

Summary of management arrangements for enjoyment of country and customary practices (KPI)		
Requirements	• Recognition of, and support for, Yawuru people's rights as native title holders to enjoy country and maintain customary practices. • High water quality, healthy biological communities and functioning ecosystems. • Access and privacy for traditional hunting, use of significant sites and undertaking cultural activities. • Equitable distribution of marine resources within a sustainable framework.	
Management objective	Recognition of and support for the right of Yawuru people to continue customary practices and to benefit from their country, consistent with the purpose of the marine park.	
Management strategies	1. Ensure access to the marine park for the enjoyment of country and customary practices is considered during the development and implementation of access management arrangements outlined in the *Yawuru Birragun Conservation Park management plan*, particularly in relation to the special purpose zones (cultural heritage). 2. With Yawuru people having a primary and active role, develop and distribute educational material to inform park users about respectful behaviour in Yawuru *nagulagun* (sea country), particularly in relation to special purpose zones (cultural heritage) . 3. Assess the nature and level of human activities within the marine park that may significantly impact on the rights of Yawuru people to enjoy country and maintain their customary practices, and implement management actions to mitigate or stop any impacts as appropriate. 4. Develop and implement education and interpretation programs to inform users of the marine park about Yawuru rights, as the recognised traditional owners, to enjoy Yawuru country and maintain their customary practices, with Yawuru people having a primary and active role.	H-KMS H-KMS H-KMS H
Performance measure	Yawuru RNTBC level of satisfaction that they have been able to continue customary practices and benefit from country consistent with the purpose of the marine park.	
Target	Yawuru RNTBC is satisfied that they have been able to continue customary practices and benefit from their country consistent with the purpose of the marine park.	
Reporting	Annual, or as required (see section 6).	

'The people, the land, and the Law are three aspects of the same thing. We have a duty to look after them all, and looking after one means looking after the other two as well'.

Joseph Nipper Roe Ngulibardu
(Yawuru RNTBC 2011)

4.1.4 Responsibility for country (KPI)

As the recognised native title holders Yawuru people are responsible for looking after Yawuru country.

As described in section 4.1.1, Yawuru customary law and responsibility for country is derived from *Bugarrigarra*. Through this, Yawuru people maintain the right to 'speak for and look after' Yawuru country. These rights and responsibilities have been recognised in Australian law through a native title determination process (see section 1.2 and the *Yawuru cultural management plan*).

The relationship of Yawuru people to their country is dynamic and the country is considered to be animated, and often unpredictable. The country itself, and the forces that lie within, must be respected and it is the responsibility of the Yawuru to use its resources sustainably and ensure the protection of the country and family and others who visit. This goes to the heart of maintaining good *liyan* with the country. If Yawuru people or others do the wrong thing on country there will be serious consequences for Yawuru people and their families.

In particular this refers to Yawuru people's responsibilities for:

- using resources sustainably
- educating others about the country and their responsibilities to it
- managing and looking after Yawuru country
- looking after strangers on Yawuru country
- caring for the Yawuru community.

Central to this is protecting sacred and significant areas. To Yawuru people, significance refers to cultural heritage in the broadest terms to include the intangible values of country and heritage. Such areas include:

- cultural (*Bugarrigarra*) areas (sites, tracks and areas), which may have cultural restrictions
- registered sites
- areas adjacent to cultural sites
- *rayi* sites (birth and origins – where spirit-children arise from the country)
- burial sites
- seasonal hunting, fishing and harvest areas for specific species
- traditional camping areas
- water sites
- historic sites
- archaeological sites.

Under the Yawuru Ranger Program, a key commitment in the Yawuru Agreements, Parks and Wildlife and Yawuru RNTBC employ and train Yawuru community members to patrol and undertake on-ground works in the Yawuru conservation estate. To undertake fisheries compliance support activities and gain experience in law enforcement training, Yawuru Rangers will be required to complete the Certificate II in Fisheries Compliance Support.

Management of this value will focus on promoting the recognition of these responsibilities, within the marine park, and ensuring they are maintained.

Summary of management arrangements for responsibility for country (KPI)		
Requirements	Recognition and acceptance of Yawuru people's rights as native title holders to speak for and look after Yawuru country.	
Management objective	To facilitate and maintain the opportunity for Yawuru people to undertake their role as protectors and managers of their country and culture.	
Management strategies	1. Refer to management program strategies in section 5 and specific value strategies in section 4.	
	2. Continue to develop the Yawuru Ranger program and authorisation of officers under the CALM Act and *Fish Resources Management Act 1994* (FRM Act) for patrol and enforcement (DoF).	H-KMS
	3. Ensure management activities comply with, and facilitate adherence to, the cultural protocols as stated in the *Yawuru cultural management plan* (DoF).	H-KMS
	4. Develop and implement sustainable management arrangements for vulnerable marine species subject to customary harvesting (see also section 4.2), with Yawuru people having a primary and active role (DoF).	H-KMS
	5. Investigate examples of successful integration of traditional and western approaches to natural resource management with mutually beneficial outcomes, and implement strategies where appropriate.	H
	6. Investigate opportunities to increase the number of Yawuru RNTBC members involved in management of the marine park (including for example exploring opportunities for traditional owners to undertake caretaking and mentoring roles, and act as cultural rangers).	H
	7. Develop and implement education and interpretation programs to inform park users about significant Yawuru areas, appropriate behaviour and personal safety in the marine park, with Yawuru people having a primary and active role.	H
	8. Support Yawuru RNTBC to declare the Yawuru conservation estate, including the marine park, as an Indigenous Protected Area.	M
Performance measure	Yawuru RNTBC level of satisfaction that they have been able to undertake their role as protectors and managers of their country and culture in the context of jointly managed conservation estate.	
Target	Yawuru RNTBC is satisfied that they have been able to undertake their role as protectors and managers of their country and culture in the context of jointly managed conservation estate.	
Reporting	Annual, or as required (see section 6).	

4.2 Ecological values

Ecological values are combinations of the key physical, chemical and biological characteristics of an area. These values can be significant in terms of the biodiversity they represent (i.e. representative, rare or unique) and the role they play in maintaining ecosystem integrity.

Cultural and ecological values are tightly interlinked in land and sea country, so for Yawuru people they are one and the same. Traditional knowledge, along with research based information, tells us that the ecology of Roebuck Bay and the customary use of the area by Yawuru people have developed in unison. Yawuru people and their ancestors have lived in and managed this area for many thousands of years but Roebuck Bay, as we know it today, only developed over the last 2,000 to 3,000 years. As expressed through their cultural beliefs and protocols, Yawuru people are integral to the 'healthy' functioning of Yawuru land and sea country.

The ecological values of the marine park include:

- geomorphology
- water and sediment quality
- seagrass and algae communities
- *gundurung* (mangrove communities)
- *bundu* (saltmarsh and saline grassland communities)
- filter feeding communities
- intertidal sand and mudflat communities
- invertebrates
- waterbirds including migratory *gamirda-gamirda* (shorebirds)
- finfish
- marine mammals
- *gurlibil* (marine turtles).

Above: Heron in flight, while a lone ibis perches atop an outcrop of 135-million-year-old Broome Sandstone in Roebuck Bay. Photo – Tourism WA

4.2.1 Geomorphology

Roebuck Bay is a tide dominated tropical coastal embayment with a range of geomorphic features including extensive intertidal sand and mudflats, intertidal creeks, fossil dinosaur footprints, carbonate shoals and the Roebuck Deeps.

Roebuck Bay is a large curved embayment in the Canning Basin of northern Western Australia, with intertidal sand and mudflats crossed by tidal creeks (Bennelongia 2009). Roebuck Bay as we know it today was formed over the last 10,000 years through the deposition and re-working of carbonate muds (Semeniuk 2008). This geomorphic structure underpins the ecological processes that support high biodiversity, high productivity and internationally significant populations of waterbirds.

Importantly for Roebuck Bay's ecology, erosion associated with the scouring of tidal channels transports fine carbonate-rich sediments from *Gumaranganyjal* (Roebuck Plains) which are then deposited on the intertidal flats (Semeniuk 2008), helping to create one of the most biodiverse and productive tropical intertidal flat communities in the world (Bennelongia 2009). Sediments of these flats consist of skeletal remains of marine organisms and terrestrial soils that have been washed into the bay. There is a general trend from finer sediments in the northern and eastern parts of the bay to coarser sediments in the southern flats, however, there is significant variation within these areas (Pepping *et al.* 1999, Oldmeadow 2007).

Limited information is available on the subtidal geomorphic features in the marine park. Relatively flat, undulating carbonate shoals and low relief reef is thought to form much of the sea floor in the subtidal sections of the marine park, particularly in offshore areas (Oldmeadow 2007). Areas of mobile and semi-mobile sediment are also expected to be found throughout the marine park, with more exposed areas in the south containing coarser, more mobile material, with features such as sand ripples and waves. Rubble and stone has also been recorded from offshore areas in the south (Fry *et al.* 2008). Outcrops of higher relief rock and reef are expected, particularly offshore from *Minyirr* (Gantheaume Point) around features such as Roebuck Deeps, North Rock and Escape Rock.

Roebuck Deeps itself is an exceptional geomorphic feature, thought to be the remnant of an incised valley system, now scoured by tidal currents and reaching depths of up to 100m. It is regionally unique with no other remotely comparable geomorphic feature known from the IMCRA Canning meso-scale bioregion. Although little is known about Roebuck Deeps, its ecological communities are likely to differ from those found elsewhere in the park. Its ecological importance to Roebuck Bay is also likely to be significant, particularly in regard to its effect on mixing and circulation patterns of coastal waters. This area is also associated with culturally significant *Bugarrigarra* sites (see section 4.1.1 and the *Yawuru cultural management plan*). A small portion of Roebuck Deeps is included in the northern section of the marine park, with most of it lying in the Port of Broome waters.

Fossil dinosaur footprints are preserved in rocks in the intertidal areas of the marine park, however, the significance, condition and locations of these features are not currently well known. These footprints, along with other fossils found in the Broome sandstone, were recognised for their outstanding heritage value when the west Kimberley was added to the National Heritage List in 2011, and are protected under the EPBC Act.

There are currently no major pressures on the geomorphology of the marine park. Anecdotal evidence suggests there has been an increase in sediment cohesiveness (or firmness) in the *Man-galagun* (Crab Creek) area (Bennelongia 2009). Possible causes for this change include changes to sediment supply from erosion of the pindan cliffs and shoreline retreat along the northern shores and/or increased bacterial and algal growth (G Pearson 2011, pers. com.; Hassell pers. com.; Bennelongia 2009). Further investigation is required to confirm this change in cohesiveness, any factors that may be contributing to the change and any ecological significance. Inappropriate access, including from vehicles, may be contributing to the erosion of landforms in some localised areas within and adjacent to the marine park. Other existing and potential pressures that may impact on the geomorphology include direct physical disturbance to landforms, or disruptions to the sedimentary and hydrological processes that maintain them. Exploration and extraction of mineral sand and hydrocarbon resources in and adjacent to the marine park, if they were to occur, have the potential to affect the geomorphology of the marine park. Hydrological and sedimentary processes may also be affected by the establishment of coastal infrastructure and urban development, dredging and dredge spoil dumping, and urban drainage networks.

Management of this value includes: ensuring that urban and resource development proposals for the area that have the potential to disturb the geomorphology of the marine park are assessed in accordance with the *Environmental Protection Act 1986* (EP Act); undertaking research to increase understanding of the geomorphology and its function within the wider Roebuck Bay system; and education to increase awareness of the importance of the marine park's geomorphology.

Summary of management arrangements for geomorphology

Current status	Apart from some observed degradation in localised areas, the current status of geomorphology in the marine park is unknown but assumed to be in generally undisturbed condition.			
Existing and potential uses and/or pressures	• Changes to sediment supply from erosion and/or increased bacterial and algal (diatom) growth in the *Man-galagun* (Crab Creek) area (e.g. potentially causing changes to sediment cohesiveness). • Changes to sediment supply from coastal erosion, urban development, agricultural and industrial activities (e.g. increased sediment loads in urban drainage networks, dredging). • Mineral sands and hydrocarbon exploration and extraction. • Establishment of coastal infrastructure and urban development (including marinas, dredging and dredge spoil dumping, and urban drainage networks).			
Current major pressures	None currently identified.			
Management objectives	1. To ensure that the seabed structural complexity and geomorphic processes are not significantly impacted by human activities within the marine park. 2. To identify, and where possible seek to address, human activities occurring in adjacent areas that may have adverse impacts on the geomorphology within the marine park.			
Management strategies	1. Assess the nature and level of impact of human activities that may affect the geomorphology (including fossil dinosaur footprints) in the marine park, and implement management strategies to mitigate or stop any impacts as appropriate. 2. Establish a collaborative approach with neighbouring land and water managers to minimise offshore, catchment and urban-based inputs that have the potential to affect the geomorphology in the marine park. 3. Ensure that urban and resource development proposals for the area that have the potential to disturb the geomorphology of the marine park are appropriately assessed in accordance with the EP Act. 4. Investigate the observed changes in sediment characteristics in the *Man-galagun* (Crab Creek) area, likely causes for these changes and their ecological significance. 5. Undertake and/or support research to characterise the geomorphic features and processes of the Roebuck Bay system and their associated ecological functions.			H-KMS H-KMS H H M
Performance measure	Area of seabed disturbance (ha).	Desired trends	Constant or negative.	
Target	No significant change in seabed structural complexity, coastal landforms or geomorphic processes as a result of human activity in the marine park[a].			
Reporting	Annual, or as required (see section 6).			

[a] Excludes change of a minor or transient nature.

4.2.2 Water and sediment quality (KPI)

High water and sediment quality is essential to the maintenance of healthy marine ecosystems.

Oceanographic processes, including currents, winds, wave action and tidal flow, influence water and sediment quality by impacting on transport, dispersal and mixing of sediments, biological organisms and pollutants. The South Equatorial Current and Indonesian Throughflow supply warm, low salinity, nutrient poor water to northern Western Australia (Suthers & Waite 2007). The expansive continental shelf in the area, however, reduces the ability of these broadscale regional currents to make significant incursions into nearshore waters. Nearshore water movements and mixing patterns in Roebuck Bay are thought to be driven primarily by the large tidal ranges, seabed topography and local winds. Although the tidal and wind driven circulation patterns remain largely unknown it is generally understood that strong tidal currents flow through the Roebuck Deeps from north-west to south-east and back on flood and ebb tides respectively (Wallace 2000). Research indicates that despite the large tidal ranges, some areas of the bay are not well 'flushed' and modelled retention times for nutrients in the water column can be more than 20 days at certain times of the year (Gunaratne 2015). The protected waters of Roebuck Bay are relatively turbid due to the area's shallow bathymetry, strong tidal flow, wave action and fine carbonate sediments.

Surface water input into Roebuck Bay is largely limited to sheet flow and storm water run-off associated with wet season rains as there are no permanent river or creek systems flowing into the bay (Bennelongia 2009). Groundwater flows generally to the south and the west due to the south-westerly dip of the Broome Sandstone (Vogwill 2003). Near the coast, and extending several kilometres inland, a wedge of salt water lies beneath the fresh water in the Broome Sandstone (Laws 1991). Fresh water also occurs in the coastal limestone, coastal dunes and the Pleistocene red sand dunes. Depending on local conditions (such as the presence of mud, or variations in the topography of the Broome Sandstone) this water may be in connection with, or separate from, the Broome Sandstone groundwater (V & C Semeniuk Research Group 2011). Groundwater also flows on to the low tidal and rocky shore zone in areas, commonly creating brackish water microhabitats which support species such as white mangrove (*Avicennia marina*) and sedges (Mathews *et al.* 2011). Hydrological and ecological studies have shown that the marine environment of Roebuck Bay and the adjacent terrestrial environments are closely connected and form part of a broader, integrated Roebuck Bay system (Gunaratne 2015; Estrella 2013a; V & C Semeniuk Research Group 2011; Bennelongia 2009; Oldmeadow 2007; Vogwill 2003; Pepping *et al.* 1999).

Above: The Yawuru Rangers have been regularly monitoring *Lyngbya* since 2011. Photo – Querida Hutchinson

Nutrient concentrations from Roebuck Bay have been recorded as substantially exceeding water quality guidelines for coastal and estuarine systems and have been linked to blooms of the cyanophyte *Lyngbya majuscula* that have been occurring annually since 2005 (Estrella 2013; Bennelongia 2009). A number of research projects have begun investigating the causes, extent, seasonality and ecological impacts of these blooms and indicate that there is a strong link to the elevated nutrient levels recorded from the water column and sediments in the bay (Estrella 2013), and from groundwater and storm water flowing into the bay (Gunaratne 2015, Diedre 2015; Hearn 2014). Other factors that work in combination with elevated nutrient levels (particularly sediments rich in ammonia and phosphorus) to cause the blooms include the timing of the first rains in the wet season,

Left: Pop-eyed mullet. Photo – Hazel Watson **Right:** Flame fiddler crab (*Uca flammula*). Photo – Ric Else

temperature, turbulence intensity (of the water column), tidal asymmetry (i.e. the ebb and flood magnitudes are different), tidal exposure, photosynthetic active radiation and water retention time (e.g. 'flushing') (Gunaratne 2015; Estrella 2013a).

Identified potential sources of the excess nutrients detected in the surface and groundwater networks include urban storm water run-off (particularly from older areas), seepage from the Broome South Waste Water Treatment Plant and the use of treated waste water for irrigation (e.g. Broome golf course) (Gunaratne 2015, Diedre 2015; Hearn 2014). In 2012 the Broome South Waste Water Treatment Plant was classified as 'possibly contaminated – investigation required' under the *Contaminated Sites Act 2006* due to the detection of elevated nutrient levels beneath the site. Following further investigation the site was classified in 2015 as 'contaminated – remediation required' and the Broome golf course, adjacent to the site, was classified as 'possibly contaminated – investigation required'. Since 2012 a significant portion of waste water has been diverted to the Broome North Waste Water Treatment Plant and remedial works and further investigation are now being planned and undertaken, as required under the *Contaminated Sites Act 2006*. The Department of Environment Regulation will monitor the progress of these works and results are due to be reported in 2017.

Studies have shown that the incidence of *Lyngbya majuscula* blooms has affected the distribution and abundance of benthic intertidal fauna (e.g. crustaceans, bivalves, gastropods and marine worms), which has then affected the foraging behaviour of shorebirds (Estrella 2013; Estrella 2011). It has also been suggested that increased nutrient loads may be indirectly linked to an observed increase in sediment cohesiveness in the *Man-galagun* area, however, further investigation is required to confirm this and the likelihood of similar impacts on other areas within the marine park. The Roebuck Bay Working Group developed a contingency management plan for *Lyngbya majuscula* in 2009 (RBWG 2009) and a monitoring program was developed in 2013 (Estrella 2013b).

Other factors that may affect the water and sediment quality include acid sulphate soils and metal based toxicants. Sediments such as those found in mangrove habitats are linked with potential acid sulfate soils. These are soils which, when disturbed or subjected to prolonged drying and aeration, have the potential to

generate increased acidity and mobilise heavy metals that may be harmful to plants, animals and human health. Oldmeadow (2007) found concentrations of a number of metal and metalloid toxicants in the intertidal areas were above recommended guidelines, particularly in the vicinity of Dampier Creek and *Man-galagun* (Crab Creek). Various current and past industrial and urban activities may be potential sources for these toxicants, such as the historic pearl lugger industry in Dampier Creek (Oldmeadow 2007).

The Environmental Protection Authority (EPA) has a responsibility to protect the quality of the marine environment in Western Australia. The framework for fulfilling this role is set out in the *Environmental Assessment Guideline for Protecting the Quality of Western Australia's Marine Environment* (EPA 2015). The EPA expects proponents to demonstrate how their proposal will meet the EPA's objective to "maintain the quality of water, sediment and biota so that the environmental values, both ecological and social, are protected".

The *Strategy for Management of Sewage Discharge from Vessels into the Marine Environment* (Department of Transport 2009) outlines guidelines for marine sewage discharge. Three zones apply in state coastal waters:

Zone 1 – no discharge

Zone 2 – discharge only using approved treatment systems

Zone 3 – open for discharge of untreated vessel sewage.

All waters within the marine park are 'Zone 1' - no discharge.

Vessel sewage within the adjacent port waters is managed as per the requirements set by the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78). The Broome Port Authority Local Marine Notice 'management and discharge of shipboard waste' summarises the regulations on the management and discharge of shipboard waste to Port of Broome waters.

With continued growth in the region, the Broome Port is servicing an increasing number of local and international vessels, with an associated potential increase in risk to water and sediment quality, including accidental spillages and the introduction of toxicants from anti-fouling. Vessel operators must comply with the Code of Practice for Anti-Fouling and In-water Hull Cleaning and Maintenance (ANZECC 1997). Environmental management plans covering Kimberley Ports Authority lands and waters are developed under the Kimberley Ports Authority strategic management plan as required by the *Port Authorities Act 1999* (Broome Port Authority 2009). A memorandum of agreement between the Kimberley Ports Authority and Parks and Wildlife has been developed to ensure complementary management arrangements for cross-boundary pressures and values, including water and sediment quality.

Urban and agricultural development, shipping and industrial activities (e.g. installation of coastal infrastructure) have the potential to increase turbidity and introduce pollutants and nutrients through surface drainage networks (Bennelongia 2009). Water and sediment quality could be affected by altering surface and subsurface water flows through actions such as over-extraction or the creation of water-resistant barriers. Other potential pressures on water and sediment quality include pollution of groundwater and surface drainage networks due to leakage from contaminated sites (Oldmeadow 2007); increased use of pesticides/larvicides for mosquito and midge control (Bennelongia 2009); and litter and debris from a range of marine and terrestrial sources (as observed during site visits to the southern intertidal area of the marine park in July 2014).

Future management will increase our understanding of components and processes that contribute to water and sediment quality in Roebuck Bay. This will include establishing water and sediment quality baselines; further identifying sources and pathways of nutrient and toxicant inputs; and developing a better understanding of circulation patterns in Roebuck Bay. Noting the strong hydrological connection within the broader Roebuck Bay system, marine park managers will also need to work together with neighbouring land and water managers to address human activities in adjacent areas that have the potential to adversely impact on the water and sediment quality within the marine park.

Summary of management arrangements for water and sediment quality (KPI)		
Current status	Not well understood. Water quality monitoring in the northern section of Roebuck Bay recorded elevated levels for some nutrients (total phosphorus and total nitrogen) when compared to ANZECC guidelines.	
Existing and potential uses and/or pressures	• Physical disturbance to hydrological and sedimentation patterns due to changes in surface and groundwater flows (including over-extraction). • Discharge of toxicants[a] and physical and chemical stressors[b] from: – leakage into groundwater and surface drainage networks – increased use of pesticides/larvicides for mosquito and midge control – increased turbidity from coastal erosion, urban development, agricultural and industrial activities (e.g. increased sediment loads in urban drainage networks, dredging, shipping) – accidental spillage of oils, fuels and other chemicals – bilge water and sewage discharge from vessels – leaching of toxins from antifouling coatings. • Debris.	
Current major pressures	Elevated nutrient and toxicant levels recorded from the marine park and adjacent areas are current major pressures, and may contribute to the observed *L. majuscula* blooms.	
Management objectives	1. To ensure that water and sediment quality is not significantly impacted by human activities within the marine park. 2. To identify, and where possible seek to address, human activities occurring in adjacent areas that may have adverse impacts on the water and sediment quality within the marine park.	
Management strategies	1. Develop and implement a marine research program (section 5.6) that: a. provides an understanding of the background water quality, variability, circulation and mixing b. establishes baselines for water and sediment quality c. provides a water balance model for Roebuck Bay to identify points of inflow for contaminants, including assessing inflow from uncontrolled drains (DoW, Shire of Broome) d. provides an understanding of the spatial and seasonal bioavailability of dissolved inorganic nutrients (NO_x, NH_4, PO_4), nutrient loads and residence times, and relative contribution of various point and diffuse sources to nutrient loads e. provides an understanding of the relationship between water quality and *L. majuscula* blooms within Roebuck Bay f. provides an appropriate understanding of the background sediment quality and variability g. provides an understanding of the subterranean groundwater regime and freshwater seeps, and their ecological function within the marine park (DoW) h. investigates the observed changes in sediment cohesiveness in the *Man-galagun* (Crab Creek) area, likely causes for these changes and their ecological significance.	 H-KMS H-KMS H H H-KMS H M H

Management strategies	2. Assess the nature and level of impact of human activities that may affect the water and sediment quality within the marine park, and implement management strategies to mitigate or stop these impacts as appropriate.			H-KMS
	3. Establish a collaborative approach with neighbouring land and water managers to minimise offshore, catchment and urban-based inputs that have been shown to affect or have the potential to affect the water and sediment quality in the marine park.			H-KMS
	4. Develop and implement an education program and patrol and enforcement program (section 5) to enforce the sewage discharge arrangements in the marine park.			H
	5. Support and contribute to, where possible, efforts to reduce the amount of floating, submerged and beached debris in the marine park (DoF, KPA, Shire of Broome, pearl producers, others as appropriate).			H
	6. Establish and maintain a pollutants database for the marine park.			M
	7. Undertake a baseline debris survey in areas of current and predicted high use/impact.			L
Performance measures	1. Nutrients: *Chlorophyll a* and nutrient concentrations in water (NO_X, NH_4 and PO_4) and in sediments (TOC, TN and TP).	Desired trends	1. Constant or negative.	
	2. Toxicants: concentration.		2. Constant or negative.	
	3. Pathogens: faecal coliform concentration.		3. Constant or negative.	
	4. Debris: mass (kg) of debris at selected monitoring sites.		4. Negative.	
	5. Occurrence and extent of *L. majuscula* blooms.		5. Negative.	
Target	Maintain or improve water and sediment quality in the marine park at 'background levels'[c] as per the environmental quality management framework referred to in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC & ARMCANZ 2000).			
Reporting	Annual, or as required (see section 6).			

[a] Toxicants are chemical contaminants that have the potential to exert toxic effects at concentrations that might be encountered in the environment due to human activity (modified from ANZECC & ARMCANZ 2000).

[b] Physical and chemical stressors is used here to describe a number of naturally-occurring physical and chemical stressors that can cause degradation of the marine environment when ambient values are too high or too low as a result of human activity (modified from ANZECC & ARMCANZ 2000).

[c] Background levels are determined from an appropriate undisturbed reference site, as per the environmental quality management framework referred to in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC and ARMCANZ 2000).

4.2.3 Seagrass and algae communities (KPI)

A variety of marine plants found in the park provide essential primary production and create important habitat and refuge areas for fish and invertebrates.

Seagrass and macroalgae communities are critical components of the Roebuck Bay system. They provide energy and nutrients in the form of detritus, and food for protected species such as *gurlibil* (green turtle) and *nganarr* (dugong). Dense seagrass meadows and macroalgae increase structural diversity of marine habitats and stabilise soft substrates. They vary seasonally in response to water temperature, day length, reproductive cycles, physical disturbance and regrowth (Fulton *et al.* 2006; Kirkman 1997). Areas devoid of seagrasses or macroalgae are often covered with a surface film of microorganisms, including microalgae that provide food for invertebrates and help stabilise soft sediments.

Seagrasses form extensive meadows in the lower intertidal areas of Roebuck Bay, dominated by oval-leaved paddleweed (*Halophila ovalis*) and narrow-leaf seagrass (*Halodule uninervis*) (McKenzie and Yoshida 2013; Walker and Prince 1987). Small leaf paddleweed (*Halophila minor*) and needle seagrass (*Halodule pinifolia*) are also recorded from Roebuck Bay (McKenzie and Yoshida 2010; Walker and Prince 1987). Seagrasses are important contributors of energy (carbon) to the ecosystems (Estrella 2013) and play a critical role in regulating atmospheric carbon dioxide concentrations by storing carbon (Macreadie *et al.* 2015; Mcleod *et al.* 2011). The subtidal extent of these seagrasses is still to be established. Oval-leaved paddleweed has greater tolerance of low light conditions and stands may potentially be found in deeper or more turbid areas of the marine park (Dr B Prince 2011, pers. com.). The distribution and condition of seagrass communities in the marine park is largely unknown, but a high degree of spatial and temporal variability is likely. Seagrass monitoring on the northern shores of Roebuck Bay since 2007 indicates meadows of highest density are in areas that pool at high tide, and the greatest abundance (% cover) of seagrasses occur in the Yawuru seasons of *Laja* (September–November) and early *Man-gala* (December–March) (McKenzie and Yoshida 2013).

Photographic records from benthic habitat mapping in the southern section of the marine park show brown algae are the most abundant macroalgae, with *Sargassum*, *Dictyopteris* and *Padina* species dominant. The most common green algae are the articulate coralline *Halimeda* spp., while prominent red algae include crustose corallines, non-corallines and algal turf (Pendoley and Fitzpatrick 1999; Wells *et al.* 1995). However, the diversity, distribution and biomass of macroalgal communities in the marine park remain largely unknown.

Diversity and densities of phytoplankton and benthic microalgae in the marine park are not well understood but they are known to be important primary producers and contribute a significant amount of energy to the Roebuck Bay system (Bennelongia 2009; Estrella 2013). Recent studies have shown that planktonic and benthic microalgae form an important food source for invertebrates that inhabit the intertidal flats in Roebuck Bay (Compton *et al.* 2008; Estrella 2013a). In turn, these invertebrates are an important food source for internationally significant populations of migratory shorebirds, illustrating the ecological importance of phytoplankton and benthic microalgae to the Roebuck Bay system. Phytoplankton and benthic microalgae also play important ecological roles cycling and locking up important chemical elements and nutrients. Due to the important ecological functions that phytoplankton and benthic microalgae perform, significant disturbances to them can potentially have cascading effects through the broader ecosystems of Roebuck Bay (Estrella 2013).

Seagrasses and algae are protected under the Wildlife Conservation Act. In addition, development proposals that may impact on algae and seagrass communities may be subject to an environmental impact assessment by the Environmental Protection Authority (EPA) in accordance with the EP Act. Values and ecological characteristics recognised under the National Heritage and Ramsar listings are protected under the EPBC Act.

Monitoring of seagrass on the northern shores of Roebuck Bay since 2007 (outside the marine park) suggests seagrass communities in the area are in 'fair' condition but gradually declining (McKenzie and Yoshida 2013). Yawuru people have also suggested that seagrass meadows within Roebuck Bay are diminishing, but the extent and cause of this reduction is not currently known. There are concerns over the potential impacts of *Lyngbya majuscula* blooms on seagrass health in Roebuck Bay, particularly along the northern shores during *Man-gala* (the wet season). More information is required to determine the effects of *Lyngbya* blooms on the health of seagrass meadows in Roebuck Bay and to assess if this represents a current major pressure. Other existing and potential pressures are generally associated with water and sediment quality (section 4.2.2), but also include propeller scour and anchoring.

Management will focus on gaining a better understanding of the existing and potential impacts of *L. majuscula* blooms and human activities, and improving knowledge of diversity, abundance and distribution of seagrass and algae communities within the marine park, to inform future decision making. Given the strong hydrological connection within the broader Roebuck Bay system, marine park managers will also need to work with neighbouring land and water managers to address human activities in adjacent areas with the potential to adversely impact on the seagrass and algae communities within the marine park.

Summary of management arrangements for seagrass and algae communities (KPI)

Current status	Little known, but assumed to be in generally undisturbed condition. Seagrass communities in areas next to the marine park and closer to Broome are reported as being in 'fair' condition but gradually declining.			
Existing and potential uses and/or pressures	• Eutrophication and smothering from periodic *L. majuscula* blooms. • Physical disturbance from: dredging and dredge spoil dumping; industrial/resource/aquaculture development activities; and/or vessel activity (e.g. anchoring, propeller scour, hovercraft operation). • Discharge of toxicants and physical and chemical stressors from: increased turbidity from coastal erosion, urban development, agricultural and industrial activities (e.g. increased sediment loads in urban drainage networks); accidental spillage of oils, fuels and other chemicals; leakage into groundwater and surface drainage networks; and bilge water and sewage discharge from vessels.			
Current major pressures	None currently identified. Further investigation is needed to determine if *L. majuscula* blooms are having a significant impact on seagrass and algae communities in the marine park.			
Management objectives	1. To ensure that seagrass and algae communities are not significantly impacted by human activities in the park. 2. To identify, and where possible seek to address, human activities occurring in adjacent areas that may have significant impacts on the seagrass and algae communities in the marine park.			
Management strategies	1. Assess the nature, extent and level of impact of *L. majuscula* blooms on seagrass and algae communities in and adjacent to the marine park, and implement strategies to mitigate or stop identified issues where appropriate. 2. Undertake and support research to characterise the diversity, density, abundance and distribution of seagrass and algae communities in the marine park. 3. Assess the nature and level of impact of human activities that may significantly affect seagrass and algae communities in the marine park, and implement management strategies to mitigate or stop any impacts as appropriate. 4. Establish a collaborative approach with neighbouring land and water managers to address human activities that have the potential to significantly impact on seagrass and algae communities in the marine park. 5. Ensure the development of the public participation and monitoring programs (sections 5.3 and 5.7) considers supporting and expanding existing community-based monitoring of seagrass and algae communities in Roebuck Bay.			H-KMS H-KMS H H M
Performance measures	1. Species diversity. 2. Density and abundance.	Desired trends	1. Constant. 2. Constant (or positive in areas identified as degraded).	
Targets	1. No loss of seagrass or algae diversity as a result of human activity within and adjacent to the marine park. 2. No significant loss of seagrass or algae density and abundance as a result of human activity within the marine park[a].			
Reporting	Annual, or as required (see section 6).			

[a] Excludes loss of a minor or transient nature.

Top: Mangroves at Yardoogarra. **Above:** Blue-spotted mudskipper. Photos – Ric Else

4.2.4 *Gundurung* (mangrove communities) (KPI)

Gundurung *within and adjacent to the marine park provide critical habitat for many important marine and terrestrial wildlife species.*

Gundurung are common over much of the eastern and northern shores of Roebuck Bay, with the majority around Dampier Creek and *Man-galagun* (Crab Creek). Eleven mangrove species have been identified within Roebuck Bay, occurring within two distinct mangrove community types; one in the north, and one in the south around Bush Point and Sandy Point. *Gundurung* range in width from a few trees in the north-west and sections of the south-east shoreline, to more than 1km along the eastern shore (Bennelongia 2009).

Gundurung provide critical habitat for both terrestrial and marine wildlife species and mangrove detritus is a food source for animals within the marine park (Bennelongia 2009, Compton *et al.* 2008; Estrella 2013a). *Yalwarr* or sawfish (*Pristis clavata*), western king prawns (*Penaeus latisulcatus*), mud crabs (*Scylla serrata*, *Scylla olivacea*) and other fish, invertebrate and crustacean species also use *Gundurung* as nursery areas (Bennelongia 2009). *Gundurung* also provide important roosting sites for shorebirds and habitat for a range of terrestrial wildlife including bats and several species of birds that are considered to be mangrove dependent (Bennelongia 2009, Yawuru RNTBC 2011; Johnstone 1990). *Gundurung* play a critical role in regulating atmospheric carbon dioxide concentrations by storing carbon in the plants themselves and the sediments below them (Mcleod *et al.* 2011).

Gundurung hold cultural significance for the Yawuru people, providing *mayi* (food), shelter and wood supplies during *Wirralburu* (May–June) (Yawuru RNTBC 2011).

Local knowledge suggests that *Gundurung* extent and density has increased between the Broome Bird Observatory and the mouth of *Man-galagun*, which may be impacting on the birds which use the area for roosting. Anecdotal observations of sediment in the area becoming firmer and allowing seedlings to establish may be a possible contributor (C Hassell 2012, pers. com.).

Gundurung are protected under the Wildlife Conservation Act and native vegetation clearing provisions of the EP Act. Development proposals that may impact on *Gundurung* may be subject to an environmental impact assessment by the EPA in accordance with the EP Act. Values and ecological characteristics recognised under the National Heritage and Ramsar listings are protected under the EPBC Act.

Gundurung can be impacted by both natural and human induced pressures, including physical disturbance and variations in water and sediment quality. Physical disturbance, due to mining and exploration, establishment of coastal infrastructure and urban development, has the potential to impact directly on *Gundurung* or to impact indirectly through changes to hydrological and sedimentary processes.

Management will focus on establishing baselines and monitoring the condition of *Gundurung* within the marine park as well as assessing and monitoring associated pressures and management responses as required.

Summary of management arrangements for *gundurung* (KPI)				
Current status	Little known, but assumed to be in generally undisturbed condition.			
Existing and potential uses and/or pressures	• Variations to water and sediment quality from urban drainage networks and other urban or agricultural sources. • Physical disturbance from mining and petroleum exploration and development. • Changes to hydrological and sedimentary processes through establishment of coastal infrastructure; urban development; and exploration and extraction of mineral sand and hydrocarbon resources.			
Current major pressures	None currently identified.			
Management objective	To ensure that *gundurung* are not significantly impacted by human activities within the marine park.			
Management strategies	1. Assess the nature, level and potential impacts of human activities on *gundurung* in the marine park, and implement management strategies to mitigate or stop any impacts as appropriate. 2. Undertake and support research to increase the understanding of the current and historical diversity, canopy cover (%) and distribution of *gundurung* within the marine park and to establish a baseline for future monitoring.			H-KMS H
Performance measures	1. Species diversity. 2. Spatial extent. 3. Canopy cover (%).	Desired trends	1. Constant. 2. Constant (or positive in areas identified as degraded). 3. Constant (or positive in areas identified as degraded).	
Targets	1. No loss of diversity in *gundurung* as a result of human activity in the marine park. 2. No loss of spatial extent or canopy cover (%) in *gundurung* as a result of human activity in the marine park[a].			
Reporting	Annual, or as required (see section 6).			

[a] Excludes loss of a minor or transient nature.

4.2.4 *Bundu* (saltmarsh and saline grassland communities)

Saltmarsh and saline gurljul buru *(grassland) communities play an important ecological role in the Roebuck Bay system including binding soil and providing habitat for shorebirds.*

The Yawuru term *bundu* encompasses the patchwork of connected habitats extending landward from the *gundurung* (mangrove communities), across saltmarshes and grasslands, to the base of the *bundurr-bundurr* (pindan country) (Yawuru RNTBC 2011). In some areas *bundu* country extends inland from the mangrove belt for up to 30km and is characterised by rich alluvial grasslands, such as those that form *Gumaranganyjal* (Roebuck Plains). Little is known of the role these habitats play in tropical Australia, however, it is likely some fish and invertebrates use these areas when seasonally flooded or tidally inundated (Connolly & Lee 2007). Local knowledge indicates that *bundu* country through *Gumaranganyjal* is important to a number of marine species during seasonal flooding and tidal inundation (A Richardson 2014, pers. com.; J Cooper 2014, pers. com.). *Bundu* country provides important waterbird habitat, particularly after big rains, and a number of waterbirds breed in these areas including magpie geese, ducks and grebes (Chris Hassell pers. com. 2016). The hydrological connectivity between *Gumaranganyjal* and Roebuck Bay suggests *bundu* country is likely to form an important component of the wider Roebuck Bay system (Bennelongia 2009). This joint management plan will focus on the *bundu* country within the marine park. Complementary management arrangements for other areas of adjoining *bundu* country can be found in the management plan for the Yawuru Birragun Conservation Park (see section 1.4.1).

Saltmarsh communities in Roebuck Bay generally fringe the landward side of the extensive mangrove communities. Dampier Creek and *Man-galagun* (Crab Creek), in particular, are fringed by extensive systems of saltmarshes. The plants in these marshes can survive extended dry periods when the soil becomes extremely saline. They are also adapted to high-tidal inundation by seawater and freshwater flooding from seasonal rains. Plant species in these communities include a range of succulents, such as the *wirn-gi* (samphires), *Tecticornia* spp. and *Sarcocornia* spp., sedges and grasses such as *Sporobolus* spp. (Bennelongia 2009).

Saltmarshes play an important role in binding soil during periods of flood, reducing wind erosion and contributing energy to the Roebuck Bay system in the form of organic carbon and phosphorous (Bennelongia 2009). Saltmarshes provide important habitat for many shorebirds, including the little curlew, Pacific golden plover and sharp-tailed sandpiper and several terrestrial birds closely associated with marshlands, such as the yellow chat (Rogers *et al.* 2003). Coastal vegetation communities such as saltmarshes and saline grasslands play a critical role in regulating atmospheric carbon dioxide concentrations by storing carbon in the plants themselves and the sediments below them (Mcleod *et al.* 2011).

For Yawuru people, *bundu* country is an important area for customary activities and contains many significant sites, law grounds, *jila* (living water) sites and flora and fauna, such as *yirraman-ga* (hermit crabs) which are used for bait, *gudurrwarany* (brolga), *mirdimarlu* (red kangaroo) and *barrgara* (bush turkey) (Yawuru RNTBC 2011).

Above: The *wirn-gi* Kimberley seablite (*Suaeda arbusculoides*) surrounded by marine couch (*Sporobolus virginicus*).
Photo – Greg Keighery/Parks and Wildlife

Saltmarsh and saline grassland communities are protected under the Wildlife Conservation Act and native vegetation clearing provisions of the EP Act. Development proposals that may impact on saltmarsh and saline grassland communities may be subject to an environmental impact assessment by the EPA in accordance with the EP Act.

There are no major pressures currently identified for *bundu* country in the marine park, however, there is concern over localised degradation at specific sites due to vehicle access (e.g. around Dampier Creek). As well as destroying or damaging vegetation, this activity causes localised soil compaction and erosion, changes surface water run-off, disturbs wildlife and increases the risk of spreading introduced plants. Other potential pressures include activities or developments

that could significantly alter the hydrological regimes that support the ecological integrity of *bundu* country.

Management will focus on addressing localised pressures and targeting research to better understand the ecological importance of *bundu* country for the marine park and potential pressures that may impact on its ecological integrity.

Summary of management arrangements for *bundu* country

Current status	Little known, but communities are assumed to be in generally undisturbed condition apart from some observed degradation in localised areas.			
Existing and potential uses and/or pressures	• Physical disturbance from vehicles; grazing; and industrial and coastal development. • Changes in hydrological regimes.			
Current major pressures	None currently identified.			
Management objective	To ensure that *bundu* country is not significantly disturbed as a result of human activities in the marine park.			
Management strategies	1. Restrict vehicle access in the marine park to designated areas only (e.g. at *Gurlbanwila* (Dog Rock) for boat launching). 2. Assess the nature, level and potential impacts of other human activities on *bundu* country in the marine park and implement strategies to mitigate or stop any impacts as appropriate. 3. Undertake and support research to fill gaps in knowledge on the diversity, natural variability and ecological function of *bundu* country in the Roebuck Bay system. 4. Establish a collaborative approach with neighbouring land and water managers to address human activities that have the potential to significantly impact on *bundu* country in the marine park.			H H M M
Performance measures	1. Diversity at appropriate taxonomic level. 2. Areal extent. 3. Area of *bundu* country disturbance (ha)	Desired trends	1. Constant. 2. Constant (or positive in areas identified as degraded). 3. Negative	
Targets	1. No loss of *bundu* country diversity as a result of human activity in the marine park. 2. No significant loss of *bundu* country areal extent as a result of human activity in the marine park[a].			
Reporting	Annual, or as required (see section 6).			

[a] Excludes loss of a minor or transient nature.

4.2.6 Filter feeding communities

A diverse range of filter feeding communities exists in the marine park.

Filter feeding communities are those communities comprising species from phyla and classes such as Porifera (*wurrja*, sponges), Tunicata (sea squirts) and Anthozoa (soft and hard corals). They are generally found in areas with strong water currents and hard underwater surfaces (e.g. rocky sea floor), although some types such as sea pens are found in soft sediment habitats. Filter feeding communities provide important habitat and are lower trophic level consumers and primary producers. An Australia-wide assessment of sponge populations by Hooper *et al.* (2002) found that the North-West Shelf of Western Australia was one of five regions in Australia with more than 250 species.

There is little information on the filter feeding communities of Roebuck Bay, although habitat surveys in the southern section of the marine park identified sponge and gorgonian communities as dominant in deeper waters over hard substrate (Fry *et al.* 2008). The photographic record from these surveys also showed small numbers of hard corals. The sediments of Roebuck Bay are partially derived from silica sponge spicules and locals have described the subtidal environment as being covered by calcareous corals, sponges and seagrass (Oldmeadow 2007; Wallace 2000). Diversity, distribution and abundance of filter feeding communities remain poorly understood.

Filter feeding communities are protected under the Wildlife Conservation Act. Development proposals that may impact on filter feeding communities may be subject to an environmental impact assessment by the EPA in accordance with the EP Act.

Filter feeding communities in the marine park are likely to be undisturbed. There are currently no major pressures on filter feeding communities identified within the marine park, however, they may be susceptible to existing or potential pressures from dredging and dredge spoil dumping, industrial and resource development activities, anchoring, introduced marine pests, nutrient input from vessels and terrestrial activities.

Management will aim to better understand diversity, distribution and abundance of filter feeding communities and their ecological significance within the marine park and wider Roebuck Bay system.

Above: Filter feeders in Roebuck Bay. Photo – Kandy Curran

Summary of management arrangements for filter feeding communities

Current status	Little known, but populations are assumed to be in generally undisturbed condition.			
Existing and potential uses and/or pressures	• Physical disturbance from: – dredging and dredge spoil dumping – industrial/resource development activities – anchoring and the installation of moorings, markers and aquaculture infrastructure. • Discharge of toxicants[a] and physical and chemical stressors[b] as a result of: – leaching of toxins from antifouling coatings – increased turbidity from urban development, agricultural and industrial activities (e.g. increased sediment loads in urban drainage networks, dredging) – accidental spills of oils, fuels and other chemicals – leakage into groundwater and surface drainage networks (including from the southern wastewater treatment plant) – bilge water and sewage discharge from vessels. • Introduction of marine pests. • Large-scale aquaculture and commercial trawling.			
Current major pressures	None currently identified.			
Management objective	To ensure that filter feeding communities are not significantly impacted by human activities within the marine park.			
Management strategies	1. Undertake research to characterise the diversity, distribution and abundance of filter feeding communities within the marine park. 2. Assess the nature and level of impact of human activities on filter feeding communities within the marine park, and implement management strategies to mitigate or stop any impacts as appropriate.			H-KMS H
Performance measures	1. Diversity at appropriate taxonomic level. 2. Abundance of indicator species.	Desired trends	1. Constant. 2. Constant (or positive if baseline determined as low).	
Targets	1. No loss of filter feeding community diversity as a result of human activity within the marine park. 2. No loss of filter feeding community abundance as a result of human activity within the marine park.			
Reporting	Annual, or as required (see section 6).			

[a] Toxicants are chemical contaminants that have the potential to exert toxic effects at concentrations that might be encountered in the environment due to human activity (modified from ANZECC &ARMCANZ 2000).
[b] Physical and chemical stressors is used here to describe a number of naturally-occurring physical and chemical stressors that can cause degradation of the marine environment when ambient values are too high or too low as a result of human activity (modified from ANZECC & ARMCANZ 2000).
[c] Excludes loss of a minor or transient nature.

4.2.7 Intertidal sand and mudflat communities (KPI)

Intertidal sand and mudflats form a major habitat and significant component of the Roebuck Bay system, supporting invertebrate communities essential to sustaining shorebird populations.

Roebuck Bay's system of intertidal flats is among the widest in Western Australia, extending up to 13km offshore, and forms the largest habitat in the marine park, covering approximately 45% of Roebuck Bay (Bennelongia 2009). They provide habitat for a high diversity of invertebrates, including crabs, other crustaceans, bivalves, gastropods and marine worms, which in turn support globally significant numbers of migratory *gamirda-gamirda* (shorebirds).

At least 205 benthic invertebrate species occur on the intertidal flats (Bennelongia 2009, Pepping *et al.* 1999, Piersma *et al.* 2006 unpublished). Surveys suggest marine worms are the most abundant, with bivalves, crustaceans and gastropods contributing a lower proportion of biomass (Pepping *et al.* 1999). The intertidal sand and mudflat communities provide an important food source for migratory and resident shorebirds as well as roosting habitat at low tide (Bennelongia, 2009).

Characteristics of the sand and mudflats such as the composition of sediment sizes and types, cohesiveness (or firmness) and nutrient availability have a major influence on the diversity, distribution and abundance of benthic fauna and the productivity of the flats (Bennelongia 2009; Compton *et al.* 2008; Estrella 2013a; Oldmeadow 2007). Anecdotal evidence suggests that there may be an increase in coarse sediment supply to the intertidal sand and mudflat communities around the Broome Bird Observatory and *Man-galagun* (Crab Creek) areas, and that the sediment is getting firmer as a result (G Pearson 2011, pers. com.) This change in supply and cohesiveness has potential to impact on the benthic invertebrate fauna and should be investigated further (see section 4.2.1).

The *gidi-gidi* (sandbars) and *jalbarl-barl* (sand and mudflats) are important to the Yawuru people for food and bait. Traditional stone, brush and stick fish traps were used in these areas, with sandbars stretching across the bay connected through rituals and having cultural significance (Yawuru RNTBC 2011).

Invertebrates such as *guwarn* (the South Sea pearl oyster *Pinctada maxima*), *janga* (oysters, Family Ostreidae), *jirrinygiliny* and *birrga-birrga* (cockles, particularly *Anadara granosa*), *mala* (conch) and *wanggaja* (crab) are important marine species with particular cultural significance for Yawuru people. The sustainable harvest of these species has been important for indigenous sustenance for thousands of years, as shown by the extensive middens around Roebuck Bay. Yawuru people traditionally harvest shellfish and crustaceans during times when they are 'fat' and plentiful through the warmer seasons of *Wilburu* (September), *Laja* (late September–November) and *Man-gala* (the wet) (Yawuru RNTBC 2011).

Prawns, crabs, oysters, sea cucumbers, specimen shells and hermit crabs are targeted by recreational and commercial fishers in the region. Species taken for recreational or commercial purposes are managed by DoF under the FRM Act via a range of tools, including size and bag limits, gear restrictions, licences and closed seasons. Values and ecological characteristics recognised under the National Heritage and Ramsar listings are protected under the EPBC Act.

There is growing concern within the Yawuru community that stocks of *birrga-birrga* (cockles) have declined and in some places have disappeared, although causes remain unknown (Yawuru RNTBC, 2011). Piersma *et al.* (2006) found that in 1997 blood cockles (known locally as bloody cockles) (*A. granosa*) were in relatively high densities on the Dampier Flats (around Dampier Creek) and parts of *Man-galagun* (Crab Creek) but in 2002 and 2006 had become very rare. This decline may be due to natural fluctuations in abundance over decades rather than human impacts and is consistent with anecdotal reports of decline at Cape Preston in recent years (Bennelongia 2009).

Research in Roebuck Bay indicated that where *L. majuscula* blooms occurred in high densities, the abundance and diversity of intertidal benthic invertebrates was significantly affected (Estrella 2013). Future monitoring and research will assess if this represents a major pressure on intertidal sand and mudflat communities in the marine park. Other potential pressures for intertidal sand and mudflat communities include sedimentation, pollution (including petrochemical spills) and habitat disturbance from industrial or urban/coastal development, vehicles, and trampling by people; customary, recreational and commercial fishing; alteration of community structure and biomass from fishing; shell collecting; and introduced species (e.g. invasive species). Due to their unique character and risk of degradation, the intertidal sand and mudflat communities of Roebuck Bay are ranked as vulnerable on Western Australia's threatened ecological communities list.

Maintaining the health of these communities is critical to maintaining the high biodiversity values of the marine park, including the significant shorebird populations that these communities support. Assessing the potential for human impact, and monitoring of water and sediment quality, invertebrate health and associated shorebird populations, will be a key focus for management and important to maintaining the ecological character of the Ramsar values.

Another key management strategy will involve educating users of the marine park on the importance of the intertidal sand and mudflat communities and how to avoid impacts on these communities.

Summary of management arrangements for intertidal sand and mudflat communities (KPI)

Current status	Believed to be in generally undisturbed condition, although changes to community composition have been observed in localised areas and populations of blood cockles may be declining.			
Existing and potential uses and/or pressures	• Physical disturbance from industrial/urban development, vehicles, digging for bait and fossicking. • Changes in hydrological and sedimentary regimes (e.g. changes in sediment cohesiveness). • Discharge of toxicants[a] and physical and chemical stressors[b] from: accidental spillage of oils, fuels and other chemicals; shipping-related wastes and discharges (e.g. anti-fouling agents, ballast and bilge water discharge); industrial discharges; sewage discharge from vessels and mainland facilities. • Increased nutrients and associated algal blooms (*L. majuscula*). • Commercial, recreational and customary fishing (including for bait and live shells). • Introduction of marine pests from ballast water and hull fouling. • Large-scale aquaculture and commercial trawling.			
Current major pressures	Further investigation is needed to determine if elevated nutrient levels in water and sediments and *L. majuscula* blooms are having a significant impact on the intertidal sand and mudflat communities in the marine park.			
Management objectives	1. To ensure intertidal communities are not significantly impacted by human activity in the marine park (non-target species). 2. To manage species targeted by fishers for cultural and ecological sustainability.			
Management strategies	1. See section 4.2.9 Invertebrates for management objectives, strategies and targets for targeted species. 2. Investigate whether changes in water quality and *L. majuscula* blooms are having a significant impact on intertidal sand and mudflat communities in the marine park. 3. Assess the nature, level and potential impacts of other human activities on intertidal sand and mudflat communities in the marine park and implement management strategies to mitigate or stop any impacts as appropriate. 4. Research the ecology of blood cockles in Roebuck Bay to better understand population drivers and fluctuations (**DoF**). 5. Undertake research to fill gaps in knowledge on the biodiversity, and natural variability of intertidal sand and mudflat communities in the marine park. 6. Consider supporting existing community based monitoring programs to monitor the health of intertidal communities and to continue fostering international collaboration.			H-KMS H-KMS H-KMS H-KMS H H
Performance measures	1. Diversity at appropriate taxonomic scale. 2. Abundance.	Desired trends	1. Constant. 2. Constant (or positive if baseline determined as low).	
Targets	1. No loss of intertidal sand and mudflat community diversity as a result of human activity in the marine park. 2. No loss of non-targeted intertidal sand and mudflat community species abundance as a result of human activity in the marine park[c].			
Reporting	Annual, or as required (see section 6).			

[a] Toxicants are chemical contaminants that have the potential to exert toxic effects at concentrations that might be encountered in the environment due to human activity (modified from ANZECC &ARMCANZ 2000).
[b] Physical and chemical stressors is used here to describe a number of naturally-occurring physical and chemical stressors that can cause degradation of the marine environment when ambient values are too high or too low as a result of human activity (modified from ANZECC & ARMCANZ 2000).
[c] Excludes loss of a minor or transient nature.

4.2.8 Waterbirds including migratory *gamirda-gamirda* (shorebirds) (KPI)

Waterbirds in the marine park are highly diverse and include a number of nationally and internationally important populations of migratory species.

Roebuck Bay and its adjacent wetlands support at least 122 waterbird species (Birds Australia Atlas data) including 14 resident shorebird species, 38 migratory shorebird species, 11 species of gulls and terns and 19 waterfowl species (C. Hassell pers. com. 2016). Many of the migratory species breed in the northern hemisphere as far north as the Arctic and use Roebuck Bay during the austral summer as a non-breeding site on the East Asian–Australasian Flyway (Bennelongia 2009). The bay is also used all year round by young migratory bird species which remain in Roebuck Bay during their first and sometimes second austral winter (Bennelongia 2009).

Roebuck Bay is one of the most important migration stopover areas for *gamirda-gamirda* in Australia and globally, some of which fly non-stop between continental East Asia and Australia (Department of Environment and Conservation 2009). The bay is the main arrival and departure point for large numbers of the Australian populations of several of these *gamirda-gamirda* species, such as the bar-tailed godwit (*Limosa lapponica*) and the great knot (*Calidris tenuirostris*) (Department of Environment and Conservation 2009). The wetlands of Roebuck Bay regularly host more than 100,000 shorebirds per day, with the highest numbers between late October and early March (Rogers *et al.* 2009); and also regularly support more than 1% of the East Asian–Australasian population of at least 22 wader species (20 migratory and two resident species) (Bennelongia 2009). The international importance of Roebuck Bay for birds was officially recognised in 1990 when much of the area, including the intertidal flats, mangroves and subtidal fringe, was declared a Ramsar wetland of international significance (see Figure 2). *Gamirda-gamirda* predominantly feed in Roebuck Bay's intertidal areas, particularly around Bush Point and the northern beaches (Rogers *et al.* 2009 unpublished).

Habitats such as the grassland and saltmarsh along the coastal area of Roebuck Bay are also used for breeding by a variety of bird species including red-capped plovers (*Charadrius ruficapillus*), masked lapwings (*Vanellus miles*), black-winged stilts (*Himantopus himantopus*), pied oystercatchers (*Haematopus longirostris*), whiskered terns (*Chlidonias hybrida*), ospreys (*Pandion haliaetus*) and little terns (*Sterna albifrons*) (C. Hassell pers. com. 2016). Surveys in 2008 recorded internationally significant numbers of little terns and gull-billed terns (*S. affinis*) in Roebuck Bay (Rogers *et al.* 2009 unpublished).

Other waterbirds and raptors that use the marine park include crakes, rails, cormorants, darters, *bilari* (Australian pelicans), *jirrinymal* (terns), *dara* (silver gulls), magpie geese, black swans, ducks, harriers and eagles (Bennelongia 2009).

All birds are protected under the Wildlife Conservation Act, with some of the waterbirds also protected under the Commonwealth EPBC Act. Forty seven migratory bird species are covered by international treaties with Japan (JAMBA), China (CAMBA) and South Korea (ROKAMBA) and Australia has obligations to protect species listed under these treaties. The waterbirds and associated habitats were recognised for their outstanding heritage value when the west Kimberley was added to the National Heritage List in 2011, and protected under the EPBC Act. A number of important bird sites occur in the Kimberley Ports Authority area. A memorandum of agreement between the Kimberley Ports Authority and Parks and Wildlife has been developed to ensure complementary management arrangements for cross-boundary pressures and values, including waterbirds.

Research indicates a number of migratory shorebird populations at Roebuck Bay are declining, with a smaller number increasing slightly (Rogers *et al.* 2009 unpublished). It is thought the declines are primarily due to habitat loss in northern hemisphere countries along the East Asian–Australasian Flyway (Piersma *et al.* 2016; Rogers *et al.* 2009 unpublished). In the marine park physical disturbance by vehicles, people, dogs, helicopters and other craft are the main potential threats. Physical disturbance causes birds to move or take flight, which costs energy and reduces roosting opportunity, and may impact on the ability of migratory species to put on enough weight to migrate successfully. Although shorebirds are present in highest numbers between late October and early March, physical disturbance can be a year-round issue because many young birds remain in Roebuck Bay during the winter when visitor numbers are highest (Bennelongia 2009). Monitoring suggests disturbance has increased since 2000 and shorebird numbers have declined on the northern beaches (Rogers *et al.* 2011).

Other potential pressures come from loss or degradation of habitat caused by infrastructure and urban development, litter and pollution. Nutrient enrichment leading to cyanobacteria blooms may have influenced benthos composition and changed the foraging behaviour of waterbirds such as the bar-tailed godwit (Estrella *et al.* 2011 and Estrella 2013). There is also concern that *gundurung* extent

and density has increased between the Broome Bird Observatory and the mouth of *Man-galagun*, and may affect the suitability of this area as roosting and feeding habitat for *gamirda-gamirda*. Causes for this increase are not currently known and it may be within the range of natural variation. Observations of sediment in the area becoming firmer and allowing seedlings to establish may also be a possible contributor (C Hassell 2012, pers. com.). Further information is required to assess the scale and cause of the mangrove encroachment and any impacts that this may be having on the migratory and resident birds.

Although the risk of a serious oil spill is considered low, the nature of the intertidal habitats and bird dependence on these habitats means the consequences of such a spill could be catastrophic. The Department of Transport and Kimberley Ports Authority have developed a range of emergency and oil spill response plans, providing a high level of preparedness and capacity to respond quickly should a spill occur.

While it is important to manage human pressures on the marine park and adjacent areas, these pressures are likely to be low compared to those pressures found in other parts of the East Asian–Australasian Flyway. These issues call for coordinated responses across local, national and international scales and jurisdictions. Management will focus on assessing and managing human and introduced animal disturbance in the marine park that may impact on waterbirds; continued collaboration with appropriate bodies to support local, national and international shorebird conservation initiatives; and educating marine park users about limiting human activities that may impact on waterbirds.

Summary of management arrangements for waterbirds (KPI)	
Current status	Declines (likely to have been caused by external pressures in other areas of the East Asian–Australasian Flyway) in a number of migratory shorebird species populations have been reported. The current status of the remaining waterbird populations found in the marine park is unknown, but assumed to be in a generally undisturbed condition.
Existing and potential uses and/or pressures	• Disturbance to roosting shorebirds from people on foot; dogs, vehicles (cars, motorbikes, quad bikes); vessels (boats, jet skis etc.); helicopters; livestock; and introduced animals. • Loss or degradation of critical habitat (e.g. shorebird roosting beaches, mangroves and intertidal sand and mudflats). • Impacts on food sources critical to migratory birds including benthic food items as a consequence of invasion of *Lyngbya majuscula* onto shorebird feeding grounds and changes to the distribution of prey items in response to localised changes in sediment structure. • Accidental spillage of oils, fuels and other chemicals. • Entanglement and ingestion of litter. • Loss of roosting habitat through mangrove encroachment.
Current major pressures	None currently identified. Further investigation is needed to determine if water quality, *L. majuscula* blooms or disturbance from human activities and dogs are having a significant impact on waterbirds in the marine park.
Management objectives	1. To ensure waterbirds are not significantly disturbed by people, dogs, vehicles or vessels in the marine park. 2. To identify, and where possible seek to address, human activities occurring in adjacent areas that may have significant impacts on waterbirds within the marine park. 3. To support international programs and agreements to conserve migratory shorebird populations.

Management strategies	1. Investigate whether changes in water quality and *L. majuscula* blooms are having a significant impact on waterbirds in the marine park.			H-KMS
	2. Restrict vehicle access in the marine park to designated areas only (e.g. at *Gurlbanwila* (Dog Rock) for boat launching).			H-KMS
	3. Restrict access for dogs in the marine park to designated areas and on vessels only (consistent with Parks and Wildlife Policy Statement No. 18).			H-KMS
	4. Assess the impact of other human and introduced animal activities on waterbirds in the marine park, and implement management strategies to mitigate or stop any impacts as appropriate (including temporal closures).			H-KMS
	5. Ensure requirements for the management of migratory shorebirds subject to international agreements are considered when developing management programs (see section 5).			H
	6. Investigate the causes, scale and level of impact that mangrove encroachment may be having on shorebirds in the *Man-galagun* area.			H
	7. Collaborate with neighbouring land and water managers to address human activities with the potential to significantly impact waterbirds in the marine park (e.g. maintain collaborative approach with Broome International Airport to limit disturbance to waterbirds).			H
	8. Ensure the education and interpretation program (section 5.2): a. increases awareness of the national and international significance of waterbird populations (including shorebirds) in and adjacent to the marine park b. informs visitors about impacts some human activities can have on waterbirds, and steps they can take to minimise these c. informs users that vehicles and dogs are only permitted in designated areas in the marine park.			H
Performance measures	1. Survival rate of migratory shorebirds. 2. Disturbance levels (number of alarm flights).	Desired trends	1. Constant (or positive if current survival rate identified as low). 2. Negative.	
Targets	1. No decline in survival rate of migratory shorebirds as a result of human activities in the marine park. 2. No significant disturbance to shorebirds as a result of human activities within the marine park.			
Reporting	Annual, or as required (see section 6).			

4.2.9 Invertebrates

The marine park contains a high diversity of marine invertebrates.

Marine invertebrates are those marine animals without a backbone and include crabs, other crustaceans, squid, cuttlefish, other shellfish, corals, sponges, *wanbiny* (sea jellies), anemones, sea squirts, echinoderms and marine worms. Habitat forming invertebrates such as corals, sponges and sea squirts have been described under filter feeding communities in section 4.2.6, and benthic invertebrate fauna strongly associated with intertidal sand and mudflats are discussed in section 4.2.7.

A significant amount of research has been undertaken to characterise the invertebrate fauna associated with the intertidal flats of Roebuck Bay, however, limited information exists for other invertebrate populations. Benthic habitat surveys in the southern subtidal section of the marine park identified crinoids (heart urchins in particular) as the most abundant animals (Fry *et al.* 2008). Invertebrates are likely to be found in all habitats of the marine park, providing food for fish and birds.

Prawns, crabs, squid, octopus, oysters, sea cucumbers, specimen shells and hermit crabs are targeted by customary, recreational and commercial fishers in the region. These fisheries are managed by DoF under the FRM Act, using a range of management tools, including size and bag limits, gear restrictions, licences and closed seasons.

Potential pressures for invertebrate species include customary, recreational and commercial fishing; alteration of community structure as a result of fishing; and introduced species, sedimentation, pollution and habitat disturbance from industrial or urban/coastal development activities.

Management will focus on better understanding invertebrate populations in the marine park and assessing the level of existing and potential human pressures.

Top: Colourful invertebrate community. Photo – WAMSI
Above: Octopus. Photo – Dave and Fiona Harvey, Naturalist Volunteers

Summary of management arrangements for invertebrates

Current status	Little known, but populations are assumed to be in generally undisturbed condition.			
Existing and potential uses and/or pressures	• Physical disturbance from: – shell collecting (e.g. specimen shells and hermit crabs) – customary and recreational fishing (e.g. prawns, squid, octopus, lobster) – bait collecting – degradation of critical habitat as a result of human activities (e.g. reef walking, dredging, pipe-laying and construction activities). • Accidental spillage of oils, fuels and other chemicals. • Sewage or contaminated waste discharge from vessels and mainland facilities. • Introduced marine pest species from ballast water and hull fouling.			
Current major pressures	None currently identified.			
Management objectives	1. To ensure non-targeted invertebrate species are not significantly impacted by human activities within the marine park. 2. To manage targeted invertebrate species for cultural and ecological sustainability.			
Management strategies	1. Undertake research to characterise invertebrate diversity, distribution and abundance in the marine park (DoF). 2. Assess the nature and level of impact of human activities on invertebrates within the marine park, and implement management strategies to mitigate or stop any impacts as appropriate. 3. Monitor the condition and level of recreational and customary take for species susceptible to localised depletion, and in consultation with relevant stakeholders, implement additional management measures (e.g. restricted bag and/or size limits, seasonal closures etc.) if take is found to be locally unsustainable (**DoF**).			H-KMS H M
Performance measures	1. Diversity. 2. Abundance.	Desired trends	1. Constant. 2. Constant (or positive if baseline determined as low).	
Targets	1. No loss of invertebrate diversity as a result of human activity in the marine park. 2. No loss of non-targeted invertebrate species abundance as a result of human activities in the marine park[a]. 3. Management targets for targeted invertebrate species to be determined by DoF.			
Reporting	Annual, or as required (see section 6).			

[a] Excludes loss of a minor or transient nature.

4.2.10 Finfish (KPI)

The marine park contains a diversity of finfish species that provide an important ecological function and opportunities for customary and recreational fishing.

Roebuck Bay is believed to contain a diverse range of finfish, sharks and rays. While finfish assemblages in Roebuck Bay have not been studied, there have been a small number of surveys in similar habitats across the region. A 2000-2002 survey across the north-west coast recorded 352 species, from 194 genera, in 82 families from reef and soft substrate habitats in water depths of 5–30m (Travers *et al.* 2003). Finfish assemblages changed markedly depending on habitat, but the most common families were Carangidae (trevally/queenfish), Serranidae (cods), Bothidae (flounders), Lutjanidae (snappers) and Tetraodontidae (puffers). Many finfish species use distinct habitats during particular seasons and life cycle stages (Pember *et al.* 2003; Pember *et al.* 2005).

The region's inshore waters, including Roebuck Bay, support important nursery areas for many finfish species (J Cooper 2010, pers. com.; Newman *et al.* 2003). Recent research indicates *walga-walga* or bluenose salmon (*Eleutheronema tetradactylum* - also known as blue threadfin, or four finger threadfin) and *birrala* or king threadfin salmon (*Polydactylus macrochir* – also known as giant or whiskery threadfin) show strong site fidelity, with genetic differences and variability in life history observed between stocks separated by only tens of kilometres (Welch *et al.* 2010). Roebuck Bay is particularly important for *walga-walga*, which may comprise a discrete stock from neighbouring areas (Welch *et al.* 2010).

Roebuck Bay has diverse and abundant *jurrawayi* (shark) and *birndany* (ray) populations dominated by whaler sharks (*Carcharhinus* spp.); lemon sharks (*Negaprion acutidens*); hammerhead sharks (Family Sphyrnidae); shovelnose rays (Family Rhinobatidae); *bilkirrin* or tiger sharks (*Galeocerdo cuvier*); and *yalwarr* or sawfish (*Pristis clavata*, *P. microdon*, *P. zijsron* and *Anoxypristis cuspidate*) (McAuley *et al.* 2005; Morgan *et al.* 2009). Roebuck Bay may also contain the most northerly population of the grey nurse shark on the west coast (R McAuley 2007, pers. com., cited in Department of Environment, Water, Heritage and the Arts 2008). Roebuck Bay may be regionally significant for ray populations including devil rays (*Manta birostris* and *Mobula eregoodootenkee*) and eagle rays (Family Myliobatidae) (RPS 2010a).

Finfish with particular significance for Yawuru people include threadfin salmon species, *gurlban* (mullet), *langa* (catfish), *murruwaran* (queenfish), *yingarliwa* (bluebone or blackspot tuskfish) and *yilany* (snapper). Yawuru traditional ecological knowledge describes threadfin salmon, mullet and catfish as 'fat' during the *Barrgana* (June–August) when the south-easterly winds blow, the nights are cold and *Gumanyba* (the Seven Sisters star cluster) shines brightly. *Barnany nyurdany warli* (reef fish) begin to get 'fat' during *Wirlburu* (September) and are ready to harvest through *Laja* (late September–November) and *Man-gala* ('the wet', December–March) (Yawuru RNTBC 2011).

Rays also hold cultural significance for Yawuru people. Yawuru traditional ecological knowledge describes rays as 'fat' during the *Laja* when the winds strengthen from the west and north-west, and the *yamiyarri* or Kakadu plum (*Terminalia ferdinandiana*) and *gunurru* or ghost gum (*Corymbia flavescens*) are in flower. The warming season of *Wilburu* (September) is the right time for shovelnose rays, while lemon sharks are 'fat' during the season of *Laja* (Yawuru RNTBC 2011).

Under the FRM Act, DoF is responsible for managing the commercial, recreational and customary take of finfish. Fish stocks are managed through a wide range of tools, including size and bag limits, gear restrictions, licences and closed seasons. In 2013, with strong community support, the State Government purchased the two commercial gillnetting licences operating in Roebuck Bay and closed this part of the Kimberley Gillnet and Barramundi Managed Fishery. Commercial shark fishing is not currently permitted within a large portion of northern Western Australian waters, including Roebuck Bay (Fletcher and Santoro 2013). See section 4.3 for further information on commercial, recreational and customary fishing.

Potato cod, humphead maori wrasse, Queensland groper and all *yalwarr* or sawfish species are protected under Western Australian fisheries legislation. Nine shark and ray species likely to frequent the marine park are protected under state and/or commonwealth legislation, highlighting the significance of the area for these species.

Existing or potential pressures on finfish in the marine park include harvesting, and loss and degradation of critical habitat. Important species for customary fishers are detailed above. Recreational fishers target threadfin salmon species, barramundi (*Lates calcarifer*), triple tail (*Lobotes surinamensis*), black jewfish or northern mulloway (*Protonibea dicanthus*), emperors (*Lethrinus* spp.) and cods (*Epinephelus* spp.).

Management needs to consider the viability of the populations of targeted species in the context of maintaining the values of the marine park. DoF manages fishing activities within the park in accordance with sustainable development principles and is currently working with Yawuru people to develop and implement a customary fishing protocol, including management arrangements for the customary use of gillnets. Management of finfish will also focus on educating marine park users about sustainable fishing practices in the marine park.

Summary of management arrangements for finfish (KPI)

Current status	Little known, but populations not targeted by fishers are assumed to be in a generally undisturbed condition. Prior to the closure of the Kimberley Gillnet and Barramundi Managed Fishery Yawuru people and other local community members reported difficulties in catching threadfin and bluenose salmon, and suggested local populations were in decline. Anecdotal reports indicate significantly improved catches of threadfin and bluenose salmon since the closure of the commercial fishery.			
Existing and potential uses and/or pressures	• Extraction of targeted species by commercial, recreational and customary fishers. • Bycatch of non-targeted species by commercial, recreational and customary fishers. • Loss and degradation of critical habitat (e.g. nursery areas, aggregation areas) as a result of human activities in high use sites. • Accidental spillage of oils, fuels and other chemicals.			
Current major pressures	None currently identified.			
Management objectives	1. To maintain finfish species that are not targeted by fishers in a generally undisturbed condition. 2. To manage finfish species that are targeted by fishers for cultural and ecological sustainability.			
Management strategies	1. Assess the nature and level of impact (or potential impact) of human activities on finfish and critical habitat within the marine park, and implement management strategies to mitigate or stop any impacts as appropriate (including temporal closures) (DoF). 2. Work with Yawuru people to develop and implement sustainable management arrangements for the customary harvesting of finfish (**DoF**). 3. Undertake and support research to characterise finfish diversity, abundance and critical habitat in the marine park (DoF). 4. Develop culturally and ecologically sustainable management arrangements for targeted finfish species in consultation with relevant stakeholders (**DoF**). 5. Ensure the education and interpretation program (section 5.2) educates marine park users about: a. the marine park's finfish species and their ecological importance (DoF) b. relevant fisheries' regulations and appropriate behaviour (**DoF**) c. Yawuru saltwater seasons and customary fishing practices (DoF). 6. Monitor the condition of finfish populations and level of recreational and customary take for species susceptible to localised depletion, and in consultation with relevant stakeholders, implement additional management measures (e.g. restricted bag and/or size limits, seasonal closures etc.) if take is found to be locally unsustainable (**DoF**).			H-KMS H-KMS H-KMS H H H
Performance measures	1. Diversity. 2. Abundance.	Desired trends	1. Constant. 2. Constant (or positive if baseline determined as low).	
Targets	1. No loss of finfish diversity as a result of human activity in the marine park. 2. No loss of non-targeted finfish species abundance as a result of human activities within the marine park[a]. 3. Management targets for targeted finfish species to be determined by DoF.			
Reporting	Annual, or as required (see section 6).			

[a] Excludes loss of a minor or transient nature.

4.2.11 Marine mammals (KPI)

Dugongs, Australian snubfin dolphins, Australian humpback dolphins, Indo-Pacific bottlenose dolphins and humpback whales utilise the waters and resources of Roebuck Bay.

Nganarr or dugongs (*Dugong dugon*) occur throughout the subtropical and tropical Indo-West Pacific, with most of the population distributed across northern Australia. They are regularly seen in the marine park, and limited research indicates Roebuck Bay may be a regionally significant area for *nganarr* (RPS 2010b, Holley and Prince 2008; Prince 1986). *Nganarr* survey work in 1984 suggested a population of 50–100 individuals (Prince 1986), however, more recent research indicates the methodology used in the 1984 survey may have underestimated the population size (Holley and Prince 2008). *Nganarr* prefer certain seagrass species, in particular paddleweed *(Halophila* spp.) and narrow-leaf seagrass (*Halodule uninervis*), both of which are abundant in Roebuck Bay (Mackenzie and Yoshida 2010; Walker and Prince 1987). Oval-leaved paddleweed (*Halophila ovalis*) exhibits a greater tolerance to low light conditions and stands may potentially be found in the marine park in sufficient abundance to support *nganarr* foraging (R Prince 2011, pers. com.). Local knowledge suggests the intertidal south-eastern waters of Roebuck Bay, adjacent and north of the *Janyjagurdiny* (Thangoo) area, may be of relative importance for *nganarr* (J Cooper 2010, pers. com.; Lambert and Elix 2004). During surveys in October 2013 associated with dolphin research, *nganarr* were regularly encountered in small groups throughout the northern third of Roebuck Bay (Brown *et al.* 2014). As highly mobile animals, it is likely they move in and out of Roebuck Bay depending on resource availability. *Nganarr* numbers in Roebuck Bay are not currently known but anecdotal information suggests they may have declined in recent years (Bennelongia 2009; J Cooper 2010, pers. com.; Lambert and Elix 2004).

Nganarr are an important food resource and hold particular cultural significance for Yawuru people. They are hunted mainly for special cultural occasions, but less frequently and at a lower intensity than other marine species. Yawuru traditional ecological knowledge informs that *nganarr* are getting 'fat' during the Yawuru season of *Barrgana* (June–August) when the south-easterly winds blow, the nights are cold and *Gumanyba* (the Seven Sisters star cluster) shines brightly. Customary hunting can continue through *Wilburu* (September), a short warming season when *yaman* (west winds) begin to blow. *Nganarr* give birth to their young in *Laja* (late September–November) and the hot build up to *Man-gala* (the wet), and customary hunting should not occur during this time (Yawuru RNTBC 2011).

The Australian snubfin dolphin (*Orcaella heinsohni*) is reported as endemic to the northern tropical waters of Australia (Beasley *et al.* 2005) but may also occur in southern New Guinean waters (Alex Brown pers. com.). Research suggests that Roebuck Bay supports regionally and nationally significant numbers of this species (Thiele 2010; Brown *et al.* 2016). Recent surveys of approximately 100km^2 of Roebuck Bay estimated there were around 133 Australian snubfin dolphins (excluding dependent calves) using the area (Brown *et al.* 2016). This is one of the largest reported populations in Australia and is the highest density of snubfin dolphins reported to date (Brown *et al.* 2016). The data also provides preliminary evidence of site fidelity by snubfin dolphins within Roebuck Bay (Brown *et al.* 2016). Results of genetic analyses suggest that snubfin dolphins within Roebuck Bay are distinct from the geographically closest documented population of snubfin dolphins at Cygnet Bay (about 250km to the north); there appears to be limited connectivity between the two populations and they should be managed as independent populations (Brown *et al.* 2016). Distribution information, although limited, suggests Australian snubfin dolphins are present in high densities throughout the majority of the northern third of Roebuck Bay, particularly the deeper channel of the inner anchorage, with many animals also observed throughout the extensive intertidal and shallow subtidal area in the eastern side of the bay (Thiele 2010; Brown *et al.* 2014a). Further research is required to determine temporal and spatial patterns in habitat use for Australian snubfin dolphins in Roebuck Bay.

Other dolphins known to utilise the waters of Roebuck Bay include the Australian humpback dolphin (*Sousa sahulensis*) and Indo-Pacific bottlenose dolphin (*Tursiops aduncus*). Preliminary research suggests these species prefer the more open coastal waters such as those in the south of the marine park near Cape Villaret (Allen *et al.* 2012), however, distribution and abundance of these dolphins remain largely unknown.

Yari or humpback whales (*Megaptera novaeangliae*) are often sighted offshore of Roebuck Bay, including in the marine park. Since they were protected in Australian waters in 1963, and worldwide in 1965, numbers of humpback whales have been increasing. The humpback whale population that winters off Western Australia (the group D population) has recovered from an estimated low of 800 individuals to current estimates of close to 30,000 (D Coughran 2011, pers. com.; Kent *et al.* 2012; Jenner *et al.* 2001). The group D population undertakes an annual return migration from the summer feeding grounds in Antarctic waters to the coastal calving areas of the Kimberley. This means a significant number of humpback whales pass Roebuck Bay twice each year (between June and November) on

Above: *Nganarr* (dugong). Photo – Felix Smith, MUCRU/WWF-Australia

their northward and southward migrations. According to Yawuru traditional ecological knowledge humpback whales begin to arrive from the south on their northward migration during *Barrgana* (June–August). Roebuck Bay is not known as a significant staging or resting area (Jenner and Jenner 2010), however, humpback whales are consistently seen during the season, and in 2011 a whale watching tour observed a mother and newborn calf in the marine park (D & F Harvey 2010, pers. com.).

All marine mammals in Western Australian waters are protected under the state Wildlife Conservation Act and commonwealth EPBC Act. The Wildlife Conservation Act provides for the sustainable take of *nganarr* for Aboriginal customary purposes.

Existing and potential pressures on marine mammals include physical disturbance from vessel strike, entanglement and inappropriate human interaction; customary harvesting, loss and degradation of critical habitat through coastal development and pollution (e.g. environmental contaminants); and reduced access to prey resources through recreational and commercial fishing, and pearling and aquaculture activities (Watson-Capps and Mann 2005). These pressures have not been quantified or examined spatially but as the population of Broome continues to grow, they will need to be managed carefully. In particular, the potential impact of coastal zone development on inshore dolphins has been identified as a key issue in north-west Australia (Allen *et al.* 2012; Bejder *et al.* 2012; Brown *et al.* 2012).

Preliminary research suggests that rates of injury to Australian snubfin dolphins in Roebuck Bay from vessel strike and entanglement may be unusually high and potentially a serious issue for this population (Thiele 2010). This pressure is of most concern in shallow, turbid waters. Further research is required to confirm the extent of the issue and to inform the implementation of appropriate management strategies (e.g. vessel speed restrictions in certain areas).

Management will focus on assessing the impact of human activities on snubfin dolphin and *nganarr* populations; facilitating sustainable customary hunting of *nganarr* with Yawuru people; gaining a better understanding of the regional importance of Roebuck Bay for marine mammals and how they use the bay; and minimising impacts to marine mammals from human activities in and adjacent to the marine park.

Summary of management arrangements for marine mammals		
Current status	Largely unknown. The snubfin dolphin population in the northern portion of Roebuck Bay is considered regionally and nationally significant and is estimated at 133 individuals (minus dependant calves). Anecdotal evidence indicates the *nganarr* (dugong) population may be declining.	
Existing and potential uses and/or pressures	• Physical disturbance from: – vessel traffic and boat strike – entanglement (e.g. discarded or lost line and ropes) – coastal development – ingestion of litter – industrial activities (e.g. blasting, dredging, pipe-laying, seismic exploration) – inappropriate human interaction – acoustic disturbance. • Loss and degradation of critical habitat from: – coastal development – industrial activities (e.g. blasting, dredging, pipe-laying, seismic exploration) – accidental spillage of oils, fuels and other chemicals – sewage or contaminated waste discharge from vessels and mainland facilities. • Possible decreased access to prey resources from: – recreational and customary activities – exclusion from areas used for pearling or aquaculture.	
Current major pressures	None currently identified. Anecdotal evidence indicates elevated levels of injury and mortality to Australian snubfin dolphins may be occurring.	
Management objectives	1. To ensure marine mammals are not significantly disturbed by human activities occurring within the marine park[a]. 2. To manage customary hunting of *nganarr* for cultural and ecological sustainability.	
Management strategies	1. Assess the nature and level of impact on marine mammals from human activities in the marine park (including the potential for elevated levels of injury and mortality to marine mammals from vessel strike and entanglement) and develop and implement management strategies to mitigate or stop any impacts as appropriate (e.g. the use of temporal closures and/or restriction of vessel speeds). 2. Work with Yawuru people to ensure the research and monitoring programs (sections 5.6 and 5.7) provide information to facilitate the development and implementation of sustainable management arrangements for customary *nganarr* hunting. 3. Work with Yawuru people to develop sustainable management arrangements for customary hunting of *nganarr*.	H-KMS H-KMS H

Above: Snubfin dolphin with an injury caused by a boat strike. Photo – Marguerite Tarzia

Management strategies	4. Undertake and support research (sections 5.6 and 5.7) to: a. provide an understanding of the diversity, abundance and distribution of marine mammals b. establish appropriate baselines c. assess the regional importance of Roebuck Bay for marine mammals, in particular, *nganarr* and snubfin dolphins.			H
	5. Ensure the education and interpretation program (section 5.2) educates marine park users about: a. the guidelines for interacting with marine mammals b. the importance of the marine park for marine mammals c. customary practices and rights relating to nganarr harvesting.			H
	6. In liaison with charter tour operators ensure commercial tourism activities do not significantly impact on marine mammals (including through licence conditions and compliance monitoring).			H
	7. Establish a collaborative approach with neighbouring land and water managers to address human activities that have the potential to significantly impact on marine mammals in the marine park.			H
	8. Maintain a database of marine mammal strandings and observations of injury and mortality from human activities.			M
Performance measures	1. Marine mammal diversity. 2. Marine mammal abundance.	Desired trends	1. Constant. 2. Constant (or positive if baseline determined as low).	
Targets	1. No loss of marine mammal diversity as a result of human activities within the marine park. 2. No loss of marine mammal abundance as a result of human activities within the marine park[a]. 3. Management targets for customary harvesting of *nganarr* to be developed in collaboration with Yawuru RNTBC.			
Reporting	Annual, or as required (see section 6).			

[a] Excludes loss as a result of sustainable customary take.

4.2.12 *Gurlibil* (marine turtles)

Five species of marine turtles frequent the waters of Roebuck Bay. Flatback turtles nest in and adjacent to the marine park.

Of the seven marine turtle species found globally, five are known to inhabit the waters of the marine park: the flatback (*Natator depressus*); green (*Chelonia mydas*); loggerhead (*Caretta caretta*); olive ridley (*Lepidochelys olivacea*); and hawksbill (*Eretmochelys imbricata*) (Limpus 2009; McFarlane 2013). Northern Australia holds significant conservation value for flatback turtles as it contains all known nesting sites in the world (Mast *et al.* 2009).

Flatback turtles are the only species recorded as nesting in Roebuck Bay, with the primary nesting sites on the beaches between *Miriny* (Cape Villaret) and *Yinanamana-gada* (Jacks Creek). Turtle monitoring in this area during 2010, 2011 and 2012 recorded 65, 67 and 55 nests respectively; high hatchling emergence rates (79–87% from exhumed nests); and high rates of tagged individuals nesting on an annual basis (72% in 2012) when a 2–5 year cycle is expected for this species (McFarlane 2011; McFarlane 2012; McFarlane 2013). This flatback turtle rookery is considered relatively small in comparison to others in the region, some of which have recorded up to 1,600 nests annually (Chatto and Baker 2008).

It has been suggested that small numbers of green turtles may also nest in or next to the marine park, however, none have been recorded to date (McFarlane 2011). Green turtles forage over seagrass in Roebuck Bay (Bennelongia 2009), and preferred habitat and prey of loggerhead turtles are found in the area (RPS 2010c). It is likely that hawksbill turtles use the reefs further offshore in this region (T Tucker 2014, pers. com.).

Gurlibil are important marine harvest species with particular cultural significance for Yawuru people, who spear them from reefs and boats as part of ongoing customary practices.

All marine turtle species found in Western Australian waters are protected under the state Wildlife Conservation Act and the commonwealth EPBC Act. The Wildlife Conservation Act provides for the sustainable harvesting of turtles for Aboriginal customary purposes. Values and ecological characteristics recognised under the National Heritage and Ramsar listings are protected under the EPBC Act.

Existing or potential pressures on marine turtles include physical disturbance from vessel strike, entanglement, dog and fox predation (eggs and hatchlings), stock trampling (eggs), ingestion of litter and pollution (e.g. oil spill); customary hunting (turtle and eggs); changes in light horizons from facilities or recreational usage; and habitat loss and degradation from coastal development and pollution (e.g. oil spill).

Top: Flatback turtle hatchlings on Eco Beach. Photo – Dave and Fiona Harvey, Naturalist Volunteers
Above: Green turtle. Photo – Kandy Curran

Summary of management arrangements for *gurlibil* (marine turtles)

Current status	Largely unknown. Monitoring of Eco Beach since 2008 suggests the nesting population of flatback turtles is relatively stable.			
Existing and potential uses and/or pressures	• Physical disturbance from: – vessel strike – entanglement in, and ingestion of, marine debris – predation and trampling by livestock, pets and introduced animals (including dogs and foxes) – pollution (e.g. oil spill) – changes in light horizons – customary hunting and egg collection. • Loss and degradation of critical habitat (e.g. seagrass meadows, mangroves) from coastal development, pollution (e.g. oil spill) and dredging and dredge spoil dumping.			
Current major pressures	None currently identified.			
Management objectives	1. To ensure marine turtles are not significantly disturbed by human and introduced animal activities occurring within, and immediately adjacent to, the marine park[a]. 2. To manage customary harvesting of *gurlibil* for cultural and ecological sustainability.			
Management strategies	1. Undertake and support research (section 5.6) to characterise the abundance, diversity and location of critical areas for *gurlibil* in and adjacent to the marine park. 2. Assess the nature and level of impact of human and introduced animal activities on *gurlibil* within the marine park, and implement management strategies to mitigate or stop any impacts as appropriate. 3. Work with Yawuru people to ensure the research and monitoring programs (sections 5.6 and 5.7) provide information to facilitate the development of sustainable management arrangements for customary harvesting of *gurlibil* and eggs. 4. Work with Yawuru people to develop sustainable management arrangements for customary harvesting of *gurlibil* and eggs.			H-KMS H H H
Performance measures	1. Species diversity. 2. Abundance.	Desired trends	1. Constant. 2. Constant (or positive if baseline determined as low).	
Targets	1. No loss of *gurlibil* diversity as a result of human activities in the marine park. 2. No loss of *gurlibil* species abundance as a result of human activities in the marine park[a]. 3. Management targets for customary harvesting of *gurlibil* and eggs to be developed in collaboration with Yawuru RNTBC.			
Reporting	Annual, or as required (see section 6).			

[a] Excludes loss as a result of sustainable customary take.

Above: Tide receding, birds feeding. Photo – Hazel Watson

4.3 Social values

Conservation reserves, such as marine parks, help to satisfy an important public demand for outdoor recreation and nature-based tourism, and in so doing contribute significantly to the social, psychological, physical and economic wellbeing of the community (Department of Environment and Conservation 2006). Providing for the ongoing sustainable use of the marine park values is a key component of this plan and recognises the importance of the area to the community of Broome. Managing use of, and visitation to the marine park is guided principally by the zoning scheme and permitted uses (section 5.1.1), the management objectives, strategies and targets in sections 4 to 5 and by the provisions of the CALM Act and *Wildlife Conservation Act 1950* and other relevant legislation relating to marine management. The department's *Policy Statement 18: Recreation, Tourism and Visitor Services* provides specific guidance for recreation, tourism and visitor services within CALM Act reserves (Department of Environment and Conservation 2006).

Within this setting, a range of social values is recognised and will continue, consistent with management targets set for cultural and ecological values in the marine park.

4.3.1 Maritime heritage

The interesting and unique maritime heritage of Roebuck Bay is a result of the abundance of its marine resources, safe anchorage afforded by protected waters and the establishment of the pearling industry in the 1870s.

Extensive shell middens, exposed in the dunes and cliffs that line Roebuck Bay, are evidence of the thousands of years that Yawuru people have been harvesting the maritime resources of their traditional country. Numerous archaeological sites comprising tools, hearths and other remnants of Yawuru culture can be found along the foreshore.

Yawuru people, like all Indigenous Kimberley groups, were part of a traditional exchange network known as *yinyali* that existed for more than 19,000 years. In particular, they exchanged carved and plain pearl shell (*Pinctada maxima*). The shells were harvested from reefs and shell beds, cleaned and shaped, and often decorated with special designs. They were worn on ceremonial occasions and exchanged via traditional networks that traversed the Australian continent. When Europeans travelled along the Kimberley coast in the 1870s and 1880s, engraved pearl shell was one of the first items to be traded with them for rations and other goods. This tradition continued until the 1970s.

Early European explorers to the region included the Dutch mariner Abel Tasman (1644) and Englishman William Dampier, initially a buccaneer aboard the *Cygnet* in 1688 and later on commission to the Royal Navy aboard the *Roebuck* (after which Roebuck Bay was named). Portuguese mariners may also have visited the region from trading posts in Timor during the 1500s. Later European visitors included the Frenchmen Nicolas Baudin and Louis de Freycinet (1801–2), aboard the *Géographe* and *Naturaliste*, who left a profusion of French names in the region including Cape Villaret and Gantheaume Point. In August 1821, Phillip Parker King visited the area aboard HMS *Bathurst* and named the embayment Roebuck Bay (Edwards 1984, 2009).

The abundance of 'trepang' or sea cucumbers (class Holothuroidea) in Australia's northern waters attracted Macassan fishermen from Sulawesi, Indonesia to the region during the 1700s (Macknight 1986). The fishermen referred to the Kimberley region as *Kayu Jawa* and left their mark through language, traded items and introduced species such as the tamarind tree (Macknight 1986).

At 9:30am on 3 March 1942 during World War II, a squadron of Japanese 'Zero' fighter planes launched an attack on 16 Allied flying boats that were refuelling in Roebuck Bay. All 16 were destroyed along with an additional seven aircraft on the Broome airstrip. Official figures placed the death toll at 31, however, it is thought that more than 100 people perished, as many of the flying boats contained refugees that had just arrived from Indonesia (Edwards 1984, 2009). It is still possible to see the wreckage of some of these planes within the marine park. These are protected under the *Heritage of Western Australia Act 1990*. Under this Act, all development proposals regarding places on the State Register of Heritage Places must be referred to the Heritage Council of Western Australia for advice.

Due to the maritime history of Broome and Roebuck Bay, it is possible that unidentified shipwrecks may be present in the Bay. All shipwrecks over 75 years old are protected under the Commonwealth *Historic Shipwrecks Act 1976*. The Western Australian Museum has statutory responsibility for the management of these wrecks.

The main management issues with regard to maritime heritage in the marine park are potential human impacts on important sites (e.g. litter, physical disturbance).

Summary of management arrangements for maritime history		
Requirements	Identification and protection of historic sites.	
Management objective	To ensure that human activities do not significantly impact on historic sites in and adjacent to the marine park.	
Management strategies	1. Identify sites with maritime heritage value within the marine park to facilitate long-term management (WAM, Heritage Council of WA). 2. Provide visitor facilities and/or interpretive information to enhance visitor enjoyment of, and where appropriate to mitigate or stop impacts on, maritime heritage values in the marine park	M M
Target	No deterioration of historic sites as a result of human activities in, or adjacent to, the marine park.	
Reporting	To be developed as required.	

4.3.2 Seascapes

Natural vistas of turquoise waters, shoals and reefs, rocky shores, intertidal flats, mangroves and beaches with abundant wildlife.

Roebuck Bay has pristine and isolated seascape values which offer a wilderness experience to visitors. Seascapes afford panoramic vistas of environments including turquoise waters, reefs, rocky shores, intertidal flats, mangroves and beaches, all with abundant wildlife. These attributes can be enjoyed from the beach, higher vantage points along the coast, from the window of a plane or from a vessel. They also provide commercial value to the tourism industry as they are a significant drawcard for visitors.

Structures along the coastline and in surrounding waters, including signage, lighting, jetties and marinas, have the potential to degrade the seascape values of the marine park. The department's *Policy Statement 34: Visual Resource Management on Lands and Waters Managed by CALM* aims to ensure that all management of lands and waters is planned and carried out in a way that sustains the beauty of the natural environment (Department of Conservation and Land Management 1989). The Department of Planning and the Western Australian Planning Commission also have a range of policies, guidelines and manuals relevant to the management of seascape values across Western Australia (e.g. State Coastal Planning Policy Guidelines). Litter, pollution and development in and around the marine park have potential to impact on seascape values. The degradation of seascapes in the marine park has the potential to impact on other values including tourism and coastal use, and sites for recreational fishing where a wilderness experience is sought.

Summary of management arrangements for seascapes		
Requirements	• High quality environment (e.g. no litter, high water quality). • Undisturbed coastal and marine vistas. • Sensitively designed and located coastal and marine infrastructure.	
Management objective	To ensure areas with high seascape quality valued by the community are not significantly impacted by visual intrusions or human activities in the marine park.	
Management strategy	Identify the key characteristics and map the spatial extent of important seascapes within the marine park.	H
Target	Limit visual intrusion on, or disturbance to, areas of identified high seascape value in the marine park.	
Reporting	To be developed as required.	

Above: Sunset. Photo – Dave and Fiona Harvey, Naturalist Volunteers

4.3.3 Nature-based and cultural tourism

The undisturbed natural environment of Roebuck Bay offers a variety of attractions and cultural opportunities for visitors to the area, with popular activities including whale watching, cruising, sailing, kayaking, beach walking and wildlife appreciation.

Roebuck Bay offers a range of attractions and opportunities for nature-based and cultural tourism. Its natural rugged beauty, spectacular turquoise waters and abundant wildlife provide valuable opportunities for visitors to enjoy the natural environment. Activities include whale watching, cruising, sailing, kayaking, beach walking, wildlife appreciation, cultural tours and nature-based educational tours (e.g. bird tours run by the Broome Bird Observatory). Broome is an internationally renowned tourist destination and gateway for tourists wanting to explore the wider Kimberley region.

Tourism Research Australia statistics indicate the average annual number of overnight visitors to the Broome Shire has been increasing over the last decade and the average annual figure for the 2008–2010 period was about 216,300 (Tourism Western Australia 2011). Estimated annual visitor expenditure for the Broome Shire averaged over the 2004/5, 2005/6 and 2006/7 financial years was $242 million, a significant contribution to the local economy (Tourism Western Australia 2010). Earlier surveys indicated a significant percentage of visitors took part in nature-based activities; 48–63% for domestic visitors and 83–98% for international visitors (Tourism Western Australia 2006). The percentage of these tourists who visited the marine park is unknown.

Nature-based tourism in the marine park, and tourism in general, occurs primarily through the seasons of *Wirralburu*, *Barrgana* and *Wirlburu* (May–October) coinciding with dry season peak visitation and the annual humpback whale migration. A growing number of people are visiting during *Man-gala* (the wet season) to observe the vast flocks of migratory *gamirda-gamirda* (shorebirds) that congregate in the intertidal areas at that time.

A number of Broome tour operators offer nature-based tourism packages that provide for one or a combination of the activities described above. Specific areas of importance for these activities are yet to be documented.

An ever-increasing number of visitors to Western Australia experience marine parks and reserves using the services of commercial operators. The CALM Act and Wildlife Conservation Regulations 2002 (Wildlife Conservation Regulations) require commercial businesses operating within marine parks and reserves to be issued with a licence by Parks and Wildlife, which carries specific conditions. The department's *Commercial Operator Handbook – Marine* (Department of Environment and Conservation 2011) provides specific information for commercial businesses operating in a marine park or reserve. For example, commercial operators are required to hold a wildlife interaction licence to interact with *yari* (whales), whale sharks, dolphins, *nganarr* (dugongs) and *gurlibil* (turtles) on land. Wildlife viewing is also controlled by a code of conduct, which includes minimum approach distances, maximum boat speeds and use of lights in the vicinity of wildlife (Department of Environment and Conservation 2011). In addition, DoF manages charter fishing activities through a system of fishing tour operator licences (Department of Fisheries 2012a).

Commercial licences are granted where the activity is of a transient nature or usually involves no permanent infrastructure within a marine park or reserve. Most commercial licences are related to tourism. As stated in the Joint Management Agreement, any sub-leases, licences for use of the land, or permits required under the CALM Act in relation to the marine park shall not be granted unless Yawuru RNTBC has provided written consent.

The Yawuru community has identified that the Yawuru conservation estate, including the marine park, may provide opportunities for developing cultural heritage and ecotourism businesses and training opportunities (Yawuru RNTBC 2011). It should be noted that the Joint Management Agreement includes the following objective: *commercial and economic opportunities being made available to the Yawuru Community and the Prescribed Body Corporate in preference to any other applicants, subject to such activities being consistent with the management of the Marine Park*.

The establishment of the Yawuru conservation estate provides opportunities to develop new cultural tourism and ecotourism products that cater for visitors that seek to learn more about traditional and contemporary Aboriginal culture in the Broome area. Importantly, the development of these products has the potential to provide commercial, employment and training opportunities for Yawuru people, and to contribute to the local economy through increasing the number and range of tourism opportunities available to visitors.

Both eco-cultural tourism and nature-based tourism have the potential to make an important contribution to protecting the region's ecosystems by fostering greater

cultural and environmental understanding of the area and attaching value to it. However, visitation needs to be carefully managed, particularly as numbers of visitors continue to increase.

The management strategies for this value focus on providing for nature-based and cultural tourism opportunities, while ensuring the cultural and ecological values of the marine park are not significantly impacted.

Summary of management arrangements for nature-based and cultural tourism		
Requirements	• High water quality. • High seascape quality of environment (e.g. no litter, undeveloped marine and coastal areas). • Equitable access to natural values of the marine park. • Provision of areas free of human impacts for nature appreciation. • Conservation of plant and animal species of interest.	
Management objectives	1. To provide for nature-based and cultural tourism activities and ensure that they are managed in a manner that is consistent with maintaining the cultural, ecological and social values of the marine park. 2. To maintain the cultural, ecological and social values of the marine park that are important to nature-based and cultural tourism.	
Management strategies	1. Ensure the granting and renewal of commercial tour operator licences is consistent with the management plan and contains appropriate conditions, including, where appropriate, a requirement to report on activities to inform management (Commission, Joint Management Body). 2. In collaboration with Tourism Western Australia (TWA), and where appropriate, develop codes of conduct for nature-based and cultural tourism operations in the marine park that are consistent with the park's objectives, targets and performance measures (TWA, DoF). 3. Support Yawuru RNTBC to identify and develop cultural heritage and eco-tourism businesses and training opportunities consistent with the management plan.	H H H
Target	All tourism operators that operate within the marine park have the required licences and permits and adhere to Yawuru protocols.	
Reporting	To be developed as required.	

4.3.4 Pearling and commercial fishing

*The warm tropical waters and large tidal range of the marine park provide optimal conditions for the production of high quality pearls from the South Sea pearl oyster (*Pinctada maxima*) and support limited commercial fishing.*

Roebuck Bay has been synonymous with pearling since the 1870s and was widely known as the pearl capital of the world, with 403 luggers operating out of the bay at its peak in the years leading up to World War I (Edwards 2009).

In the early days of pearling, many Aboriginal people from the region were forced into labour, risking their lives for little return. As the industry developed, Malay, Timorese (then known as 'Koepangers'), Filipino and Japanese people comprised the majority of the workforce, with many losing their lives in the quest for pearl shell. Loss of consciousness, sharks and cyclones were the main causes of death. A November 1910 cyclone in Roebuck Bay claimed 40 lives and sank 26 pearl luggers (Edwards 1984, 2009). Aboriginal people continued to work in the industry, engaged as navigators, divers, tenders, carpenters, shell graders and undertaking other general duties. Pearling has shaped the character of Broome and remains an important aspect of the local economy and an identifying feature of Roebuck Bay and Broome.

Initially the pearling industry was based on naturally occurring pearls, but now pearls are cultivated by seeding pearl oysters, either harvested from wild stocks or grown in hatcheries, and suspending them in panels in the water column in areas of warm, protected waters. Roebuck Bay is an ideal location for pearl oyster farming and associated activities, with strong tidal currents that provide a flow of nutrients and carry waste away. It is a necessity that pearling operations have access to pristine conditions. There are currently seven pearl leases in the central part of Roebuck Bay, with two completely within the marine park and five partially overlapping (Figure 5). Additionally, there are a number of pearl farm sites leased further offshore, and the Port of Broome is a primary service point for pearling operations in the area.

In 2013 the State Government purchased the two commercial gillnetting licences operating in Roebuck Bay which were available for sale and closed the area to this fishery to provide greater opportunities for recreational and customary fishing. This was the only major commercial fishery operating in Roebuck Bay, however, a limited amount of commercial fishing activity remains in the marine park. This includes the specimen shell and marine aquarium managed fisheries, and the collection of hermit crabs under exemption authorisations. The current level of effort in the marine park for these fisheries is low.

Pearling and commercial fishing in Western Australia is managed by DoF under the *Pearling Act 1990* and the FRM Act. Pearling is primarily managed through licencing, quotas and size limits on the collection of wild oysters, restrictions on hatchery production and restrictions on allowable distances between leases to minimise disease transfer. Ministerial Policy Guideline Number 8 (Department of Fisheries 1998) sets out guidelines for assessment of pearling lease applications. Applications for new pearling leases within a marine park involve the referral of the application to Parks and Wildlife, EPA, the Commission and a range of other stakeholders. The approval of the Minister for Environment is also required. Where the establishment of a marine nature reserve or exclusion

Above: Pearls and pearl shell. Photo – Toursim WA

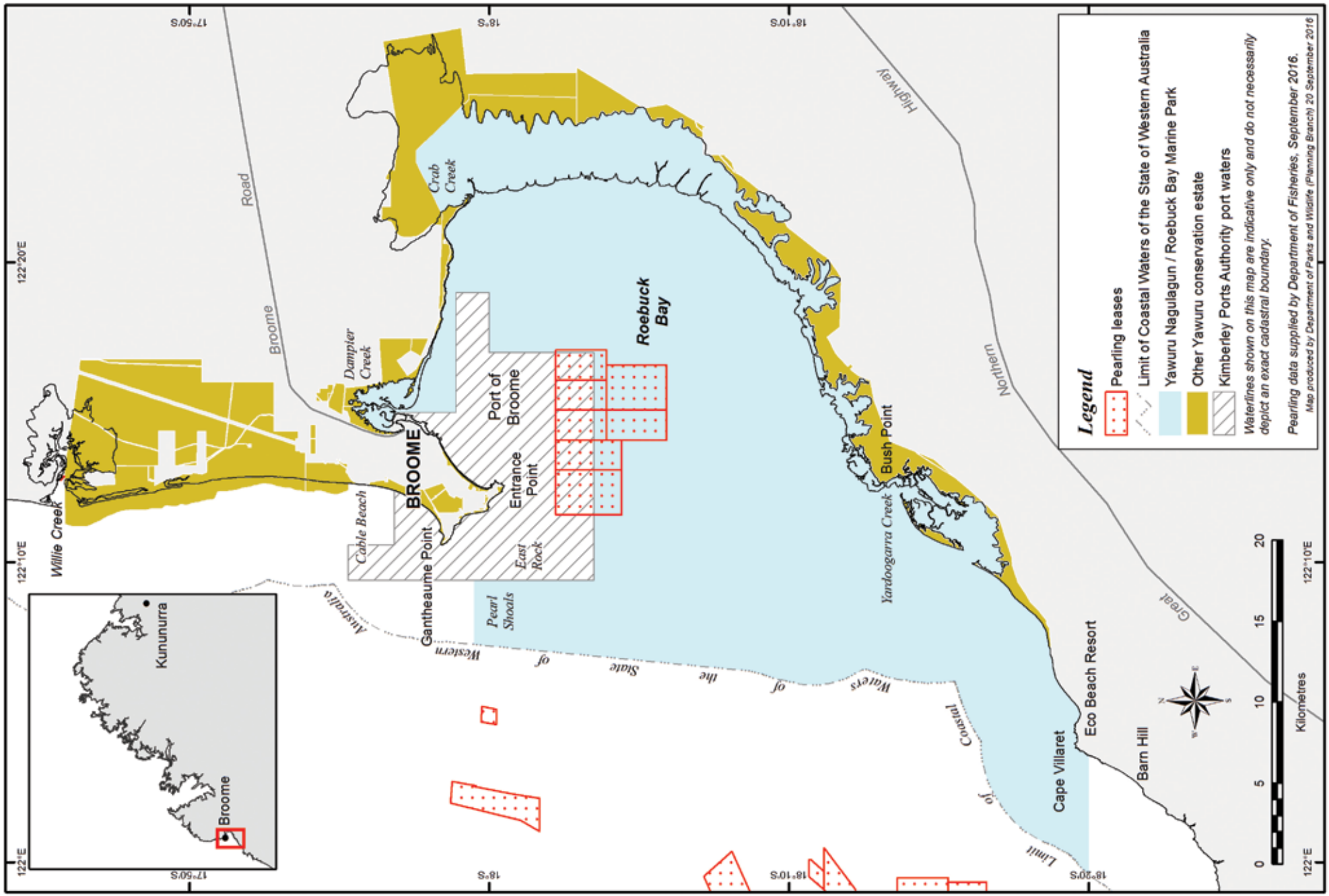
zone in a marine park is claimed to have reduced the commercial value of a pearling or commercial fishing licence or lease, the licensee or lessee may be eligible for compensation under the *Fishing and Related Industries Compensation (Marine Reserves) Act 1997*. DoF is responsible for administering this Act and the compensation process.

The management of human activities that affect the ecological values (i.e. high water quality) that are critical to the industry is a key issue for pearling. While there are concerns about the impacts of pearling, such as shading of benthic fauna by grow out panels, research to date does not support these concerns. Research into environmental impacts of pearling

(Enzer Marine Environmental Consulting 1998; McCallum and Prince 2009) concluded that, in general, the industry is environmentally benign, producing a high value product with minimal environmental disruption. However, activities associated with pearling need to be carefully managed to avoid negative impacts on the ecological and social values of the reserves. This could include impacts from lighting (potentially causing increased predation and disorientation of turtle hatchlings), loss of visual amenity, or conflicts with other users. The primary role of management in relation to pearling in the marine park is to work with the pearling industry to ensure pearling activities are culturally, socially and ecologically sustainable, and to help maintain the natural values on which the industry depends.

Summary of management arrangements for pearling and commercial fishing		
Requirements	• High water quality. • Maintenance of critical habitats for commercially targeted species. • Equitable access to appropriate locations within the marine park, subject to environmental assessment (including access between leases for pearl industry vessels) and where consistent with the objectives of the marine park.	
Management objectives	1. To maintain the ecological values of the marine park that are important to the continuation of viable pearling and commercial fishing industries. 2. To ensure that, in collaboration with the industry and DoF, pearling and commercial fishing are managed in a manner that is consistent with maintaining the values of the marine park.	
Management strategies	1. Ensure pearling authorisations are consistent with the management plan and include appropriate monitoring programs, lighting, navigational marking and site utilisation conditions (**DoF**, DoT). 2. Work with WAFIC, the Pearl Producers' Association (PPA) and DoF to ensure environmental best practice management is applied in the marine park. 3. Ensure that activities and proposals for industry operations and nature-based tourism do not affect the key ecological values of the marine park and the requirements (e.g. high water quality) for existing pearling and commercial fishery operations (EPA, DoF, PPA, TWA). 4. Ensure that pearling and commercial fishery licence holders operate in an ecologically sustainable manner and comply with reporting requirements in place under relevant fisheries legislation. DoF to relay any relevant information to the Joint Management Body and the Commission (**DoF**). 5. Provide formal advice to DoF and EPA, as appropriate, in relation to environmental assessment of pearling activity in the marine park (Joint Management Body, Commission). 6. DoF to consult with the Joint Management Body and the Commission in regard to the status of fisheries and any significant changes to management arrangements for commercial fisheries that operate within the marine park (**DoF**).	H-KMS H H H M M
Target	Implementation of the above management strategies within agreed timeframes as specified in the operational schedule.	
Reporting	To be developed as required.	

Figure 5 Pearling leases within and adjacent to the Yawuru Nagulagun / Roebuck Bay Marine Park



4.3.5 Recreational and customary fishing

A diverse range of quality recreational and customary fishing opportunities targeting a variety of marine fish in the marine park.

Recreational fishing is highly valued by the local community and is experiencing significant growth in the region driven by increased tourism, and an increased workforce from industrial developments in the region (Department of Fisheries 2010). Similarly, customary fishing is an extremely important traditional practice for Yawuru people. Effort of both sectors is largely concentrated around the intertidal areas of Roebuck Bay and Broome.

The key areas for recreational and customary fishing in the marine park include *Man-galagun* (Crab Creek) and Dampier Creek in the north and Yardoogarra and *Yinanamana-gada* (Jacks Creek) in the south. Most customary and recreational fishing in the intertidal areas occurs in channels and creeks, with fishers targeting *birrala* (giant) and *walga-walga* (blue) threadfin salmon, barramundi (*Lates calcarifer*), triple tail (*Lobotes surinamensis*), *gurlban* (mullet), *langa* (catfish) and black jewfish (*Protonibea dicanthus*) (Yawuru RNTBC 2011; Bennelongia 2009). Mud crabs (*Scylla serrata*, *Scylla olivacea*), *murruwaran* (queenfish), *yingarliwa* (bluebone or blackspot tuskfish) and *yilany* (snapper) are also culturally and recreationally important species (Yawuru RNTBC 2011; Bennelongia 2009).

Some recreational fishing also occurs within the subtidal areas of the marine park, predominantly over harder substrates targeting demersal species including emperors (*Lethrinus* spp.), sea perch, coral trout, blue bone groper and cod (*Epinephelus* spp.), along with some pelagic species such as tuna and mackerel (J Cooper and S Hennessy 2010, pers. com.). The coastal waters around Broome are also well regarded for game fishing, targeting species such as marlin and sailfish (family Istiophoridae), although it is unclear what level of game fishing occurs in the marine park.

Recreational and customary fishing are managed by DoF under the FRM Act. Some species, such as potato cod and all species of *yalwarr* (sawfish) are protected in all state coastal waters, including the marine park. In 2005, DoF released a five-year management strategy for recreational fishing in the Pilbara–Kimberley region. The review made recommendations on future management of recreational fishing, in particular the implementation of new bag and size limits, and other issues such as research, resource sharing, possession limits and protection of vulnerable species (Department of Fisheries 2005). On 1 February 2013 new recreational fishing rules came into effect across the state (see *Department of Fisheries' Recreational Fishing Guide*).

In 2009, DoF released a Customary Fishing Policy which acknowledged that Aboriginal people had rights to fish and hunt in accordance with ongoing tradition and culture. The policy recognised customary fishing as a separate sector to allow for the development of appropriate management arrangements that reflect customary fishing access rights, practices and sustainability requirements (Department of Fisheries 2009). This policy has been enshrined in recent amendments to the FRM Act, which enable customary fishing rights to be defined and protected, and the capacity to regulate customary fishing to ensure sustainability of fish stocks (Department of Fisheries 2012b). Aligned with this, there is a need for government to work with Yawuru people to consider future customary fishing arrangements, and improve community education around customary fishing practices in Yawuru sea country.

Above: Hand netting. Photo – Dave and Fiona Harvey, Naturalist Volunteers

Experiences and observations by the local community prior to the closure of the Kimberley Gillnet and Barramundi Managed Fishery suggested that threadfin salmon had become locally depleted in Roebuck Bay and Yawuru traditional ecological knowledge indicated it was much harder to catch salmon from the beaches (G Prunster 2011, J Cooper and S Hennessey 2010, pers. com.; Lambert and Elix 2004; Roebuck Bay Working Group 2009; Yawuru RNTBC 2011). It is anticipated that populations of certain finfish species will increase in coming years following the removal of commercial gillnetting from Roebuck Bay in 2013, with beneficial flow-on effects expected for cultural and recreational fishers. Scientific investigation may be required to further clarify these matters.

The potential pressures associated with recreational and customary fishing in the marine park are by-catch of unwanted non-target species and associated impacts on other ecological values (i.e. from litter and disturbance of sensitive habitats). With the continued population growth of Broome these pressures are likely to increase and should be quantified and managed appropriately so as to maintain the cultural, environmental and social values of the marine park.

Summary of management arrangements for recreational and customary fishing

Requirements	• High water quality. • Maintenance of critical habitats for species targeted by recreational and customary fishers. • Maintenance of sustainable fish stocks targeted by recreational and customary fishers. • Access to fishing areas within the marine park.	
Management objectives	1. To maintain the ecological values of the marine park that support recreational and customary fishing. 2. To ensure that, in collaboration with the community and DoF, recreational and customary fishing are managed in a manner consistent with maintaining the marine park's cultural and ecological values while providing for social uses and enjoyment. 3. To work collaboratively (agencies, stakeholders and community) to maintain and promote quality recreational and customary fishing opportunities in the marine park.	
Management strategies	1. Identify critical habitats for targeted species (e.g. nursery areas) (**DoF**). 2. Monitor recreational and customary fishing catch/effort within the marine park and report the results to the Joint Management Body and the Commission for annual and periodic reviews of the implementation of the management plan (**DoF**). 3. Ensure the education and interpretation program (section 5.2) educates marine park users about: a. relevant fisheries regulations and appropriate behaviour (**DoF**) (H) b. Yawuru saltwater seasons and customary fishing practices (DoF) (H).	H-KMS H-KMS H
Target	Implementation of the above management strategies within agreed timeframes as specified in the operational schedule.	
Reporting	To be developed as required.	

Top: Fishing charter. Photo – Dave and Fiona Harvey, Naturalist Volunteers
Above: Customary fishing, Roebuck Bay. Photo – Chris Nutt/Parks and Wildlife

4.3.6 Resources and infrastructure

The marine park is situated on the doorstep of Broome and the major port servicing the Kimberley.

Broome is the principal port servicing the Kimberley region and has one of the highest vessel visitation rates for regional ports in Western Australia (Broome Port Authority 2009). Although trade levels through the port decreased slightly between 2008–2010 they still remain high and are expected to increase as the Kimberley region experiences further industrial, agricultural, tourism and economic development. In the 2014/2015 financial year, more than 508,000 tonnes of high value cargo moved through the port. The continued operation of the Port of Broome is important for the local and regional economy; it provides important transport infrastructure, jobs and supports investment and economic growth.

The Kimberley region contains significant mineral, oil and gas resources. The undeveloped Browse and Canning Basins hold substantial reserves of natural gas and oil, and interest in accessing these resources would see Broome's population, port use and coastal infrastructure increase commensurately.

In May 2011, Buru Energy announced it had reached an agreement with Yawuru RNTBC to voluntarily relinquish its rights to explore for oil and gas in Roebuck Bay. A file notation was placed on Exploration Permit 473 to reflect the intention of this agreement. Under the zoning scheme (see section 5.1.1) ground-disturbing activities associated with mineral, petroleum and geothermal exploration and development will not be permitted in the marine park. Non-ground-disturbing activities, such as airborne electromagnetic surveys, will be permitted subject to assessment. Exploration and development of mineral, petroleum and geothermal resources below the marine park (i.e. 200m or greater depth below the seabed) could be achieved by directional drilling from sites outside the marine park.

Mineral, petroleum and pipeline activities are regulated by the Department of Mines and Petroleum (DMP) under the *Mining Act 1978*, *Petroleum and Geothermal Energy Resources Act 1967* and *Petroleum Pipelines Act 1969*.

Shipping and ports are managed through state and national legislation, and international agreements. The Departments of Transport and Planning are responsible for planning and development of coastal infrastructure, while port authorities are autonomous bodies operating under the *Port Authorities Act 1999*. This Act requires port authorities to protect the environment of the port, and minimise the impact of port activities on that environment. In 2001, the Australian Quarantine and Inspection Service introduced requirements for the handling and treatment of ballast water in ships entering Australian waters, to reduce the risk of introduced marine pests (Department of Agriculture, Fisheries and Forestry 2011).

As recognised authorities, the Shire of Broome and the Western Australian Planning Commission have certain responsibilities for planning and development proposals (Department of Planning 2014). Where required, mining, industrial or coastal development proposals may be subject to an environmental impact assessment by the EPA under the EP Act. Ministerial statements for approved proposals often prescribe conditions that the proponent must follow to minimise and/or monitor environmental impacts. Additionally, many companies have developed their own environmental and sustainability principles and commitments (Rangelands Natural Resource Management Coordinating Group 2005).

The Port of Broome operations occur continuously throughout the day and night which will result in machinery and night lights in order to maintain the port operations. With general port operations, an increase in resource activity and infrastructure associated with economic growth in the region may have the potential to impact on values of the marine park. Park managers will need to work collaboratively with port, industrial and coastal development proponents and operators to maintain the long term conservation and sustainability of the marine park values.

Above: Port of Broome. Photo – Kate Fitzgerald/Parks and Wildlife

Summary of management arrangements for resources and infrastructure		
Requirements	Equitable access for current and permitted activities within appropriate areas.	
Management objective	In collaboration with DMP, KPA and DoT, ensure that industry and associated activities in and adjacent to the marine park are managed in a manner consistent with maintaining the cultural, ecological and social values of the marine park.	
Management strategies	1. Provide formal advice to the EPA, DMP and DoT in relation to the environmental assessment of industrial and urban development proposals in and adjacent to the marine park (Joint Management Body, Commission). 2. Ensure a coordinated approach to industry assessment and reporting requirements in the marine park, taking into account cumulative impacts and the values, objectives, targets and performance measures of the marine park (DMP, DoT). 3. Where appropriate, liaise with industry to share information on ecological research and monitoring in the area.	H-KMS H M
Target	Implementation of the above management strategies within agreed timeframes as specified in the operational schedule.	
Reporting	To be developed as required.	

4.3.7 Research opportunities

The relatively undisturbed nature and variety of habitats and communities in Roebuck Bay, combined with the wide range of human activities undertaken there, provide unique opportunities for cultural, ecological and social research.

The culturally vibrant Yawuru community and evidence of Aboriginal settlement of the region dating back at least 30,000 years (Department of Indigenous Affairs 2010) provide excellent opportunities for social and traditional knowledge-based research.

Roebuck Bay contains many unique ecological and geomorphic features, and regionally, nationally and internationally significant populations of species and communities. Roebuck Deeps is a unique geomorphic feature that exerts a strong influence on local circulation patterns (Oldmeadow 2007). The intertidal flats are amongst the most productive tropical intertidal areas globally and one of the most significant staging points in the East Asian–Australasian Flyway (Bennelongia 2009). Over 30 years of research has been carried out on migratory shorebirds and terns in Roebuck Bay by the Australian Wader Study Group, Global Flyway Network and Broome Bird Observatory. The Broome region also supports 13 species of mangroves and is the southern limit of a number of species (Cresswell & Semeniuk 2011), although mangrove communities within Roebuck Bay itself are dominated by stands of white mangrove (*Avicennia marina*) (Semeniuk 1983). The Australian snubfin dolphin population is potentially globally significant. These features are likely to be interconnected and, combined with a range of human activities, make the coast a focus for scientific research.

Research on *nganarr* (dugongs) began in the 1980s, and since 1997 there has been a significant amount of research on the intertidal flats and migratory *gamirda-gamirda* (shorebirds) in the area. More recent research has focused on the intertidal seagrasses, drainage and nutrient inputs, *L. majuscula* blooms, snubfin dolphins and flatback turtle nesting. Knowledge gleaned through these research projects has been critical to developing this plan.

Very little research to date has occurred in the subtidal areas of the marine park. Additional studies of the biodiversity and environmental processes of the marine park will increase understanding of the ecological importance of the subtidal area and its ecological linkages with the adjacent intertidal and terrestrial environments. A good understanding of ecology and knowledge about the cumulative long-term impacts of human use on the values of the marine park are fundamental for

effective management. The amount of research undertaken in Roebuck Bay is expected to increase following the creation of the marine park.

Research and monitoring are important management tools included in management strategies for many of the other values.

All research within the marine park requires the appropriate research permit and approvals under the CALM Act, Wildlife Conservation Act, FRM Act, EPBC Act and/or *WA Animal Welfare Act 2003*. As stated in the Joint Management Agreement, permits required under the CALM Act in relation to the marine park shall not be granted unless Yawuru RNTBC has provided written consent. The *Yawuru cultural management plan* provides further information on requirements for undertaking research on Yawuru country (see also section 5.6).

Most scientific research programs have relatively benign sampling methods. However, the combined effect of many research projects has the potential to impact on the ecological values of the marine environment. Conflicts with other human activities can also be an issue for management, as scientific research has specific access requirements (e.g. access to representative areas free of major human influences for 'reference sites' and areas covering the range of major human activities for 'impact sites').

Summary of management arrangements for research opportunities

Requirements	• Access to representative sites in areas free of human impacts for reference sites and in areas with human activities for impact sites. • Equitable access to the marine park for cultural, ecological and social research opportunities.
Management objectives	1. To ensure the values of the marine park are maintained as an asset for scientific research. 2. To provide access and opportunities for ecological, cultural and social research in the marine park.
Management strategies	See overarching management strategies in section 5.6.
Target	Implementation of the above management strategies within agreed timeframes as specified in the operational schedule.
Reporting	To be developed as required.

Above: Crab. Photo – Dave and Fiona Harvey, Naturalist Volunteers

Above: Humpback whale. Photo – Dave and Fiona Harvey, Naturalist Volunteers

5. Management programs

The vision, objectives, management targets and performance measures described in sections 3, 4 and 5 provide the framework for the development of specific management strategies designed to conserve the cultural, ecological and social values of the marine park. These strategies are delivered under seven management programs:

- management frameworks
- education and interpretation
- public participation
- patrol and enforcement
- visitor risk, access and infrastructure
- research
- monitoring.

Above: Brown boobies. Photo – Querida Hutchinson

As with the management strategies listed under section 4, coordinating and implementing management strategies listed in this section will be the primary responsibility of the joint management partners. Where other agencies or bodies are required to contribute to the implementation of a strategy they are listed in brackets at the end of the strategy. The name appears in bold where an agency or body is required to take the lead role in strategy implementation (see pages 95–96 for the full title of agencies and bodies attributed responsibility for specific management strategies). Additional strategies may be required throughout the life of the plan, to ensure effective management of marine park values. Where new strategies are required, and it is appropriate to do so, key stakeholder consultation will occur prior to implementation.

5.1 Management frameworks

The legislative and policy context (including agency responsibilities and international, national and state policy context of management) under which marine park management sits, and the best practice outcome-based management model which is employed in this plan, is described online at www.dpaw.wa.gov.au/parks/management-plans/approved-management-plans.

The marine park will be jointly managed by Parks and Wildlife and Yawuru RNTBC, through the Joint Management Body. The Yawuru joint management program staff, and management infrastructure to service the implementation of the management plan, are located in Broome at the Parks and Wildlife West Kimberley District office and the Nyamba Buru Yawuru office. The Yawuru Rangers are an integral component of the Yawuru joint management program. Under the strategic guidance of the Joint Management Body, the Yawuru joint management program will have the primary responsibility for coordinating and undertaking day-to-day joint management activities associated with the marine park. Specialist branches in Parks and Wildlife provide support, direction and assistance in areas such as marine conservation planning, policy, wildlife management, licensing, data and information management, and research and monitoring. For example, the Marine Science Program coordinates and implements the biodiversity conservation research and monitoring required to support decision making for marine park management. Marine scientists from Parks and Wildlife will work closely with the Yawuru joint management program to undertake research and monitoring, and liaise with DoF in relation to complementary fisheries management research and monitoring.

The implementation of management frameworks is essential to ensure effective long-term management of the marine park. This particular management program consists of legal, administrative and human resource requirements, data management, licensing, performance assessment and operational functionality including implementation of zoning and procedures.

Management frameworks objectives, strategies and targets		
Management objective	To ensure the marine park has appropriate legal, administrative, financial and human resource frameworks in place so joint management can be applied within a collaborative setting in accordance with the Yawuru Agreements.	
Management strategies	1. The CEO of Parks and Wildlife will jointly manage the marine park with the Yawuru RNTBC in accordance with the Joint Management Agreement attached to this management plan.	H-KMS
	2. Implement all legal provisions necessary to establish and jointly manage the marine park including execution of the (CALM Act section 56A) Joint Management Agreement; gazettal of the zoning scheme under the CALM Act; and gazettal of fisheries orders under the FRM Act (Joint Management Body, DoF).	H-KMS
	3. Ensure the objectives detailed in the Joint Management Agreement are applied to all management activities in the marine park.	H-KMS
	4. Ensure management programs adhere to all Yawuru protocols (see Part 3, *Yawuru cultural management plan*) and best environmental management practices for activities in the marine park.	H-KMS
	5. Develop and implement a performance assessment process that is consistent with Parks and Wildlife and Commission policy (Commission, Joint Manage Body).	H-KMS
	6. Undertake a five-year review of the adequacy of management arrangements, including the zoning scheme, for the marine park (Commission, Joint Manage Body).	H-KMS
	7. Develop collaborative operational plans for implementation of relevant strategies in the joint management plan (DoF).	H-KMS
	8. Ensure that management programs for the marine park complement and integrate with those developed and implemented for other Yawuru conservation estate areas.	H
	9. Provide licences and permits with appropriate conditions where required (DoF, Commission, Joint Management Body).	H
	10. Provide necessary information and support for the performance assessment process (Joint Management Body, DoF, others as appropriate).	H
	11. Work collaboratively with the KPA under the memorandum of agreement to ensure effective and efficient management of cross-boundary values and pressures (KPA, Joint Management Body).	H
	12. Consider Ramsar and National Heritage related obligations in developing and implementing management programs and strategies, including those described in the EPBC Act.	H
Target	Implementation of management strategies within agreed timeframes as specified in the operational schedule.	

5.1.1 Marine park zoning and permitted activities

The implementation of an appropriate zoning scheme is an important strategy for the conservation of marine biodiversity, increased recognition and protection of culturally significant areas and customary practices, and the management of human use in the marine park. Importantly, the application of a zoning scheme should be viewed as one tool in a suite of complementary tools available to marine park managers to achieve desired cultural, ecological and social outcomes.

Section 13B of the CALM Act requires marine parks to be zoned as one or a combination of specific management zones, which are formally established as classified areas under Section 62 of the CALM Act. Changes to the zoning of a marine park during the life of the management plan can occur after meeting the statutory public consultation requirements and acquiring the relevant Ministerial approvals.

The development of this zoning scheme was based on the consideration of a number of factors including:

- providing a high level of protection for all areas of the marine park
- an integrated 'whole of country' approach to planning and management for the Yawuru conservation estate (which includes adjacent land areas)
- the unique nature of the Roebuck Bay system (e.g. extreme tidal regime, distinctive geomorphology and prevailing winds that make accessing certain areas of the marine park difficult for much of the year)
- the priority values, strategic objectives and management objectives of the marine park
- the major existing and potential pressures identified for these values, including the recognition that some pressures result from activities outside the marine park
- recognition of the positive effects of removing commercial gillnet fishing
- its close proximity to Broome
- the importance of the area as a recreation and tourism destination for the local and broader communities, particularly for recreational fishing
- the existing knowledge of habitats and important ecological features or areas
- the use of complementary management strategies in sections 4 and 5 to achieve the strategic and management objectives for the park.

Ground-disturbing mineral and petroleum exploration and development activities and commercial gillnetting were identified as the most significant pressures to be addressed through the zoning scheme. While these activities are already prohibited in Roebuck Bay through other mechanisms, the zoning scheme reinforces these outcomes for the long-term. It is considered that the objectives of the marine park can be achieved using a combination of special purpose zones and other management strategies. Targeted management strategies, such as temporal closures and speed restrictions (see section 5.5), may be required to work alongside the zoning scheme to enable effective and efficient management of the key values of the marine park. Adaptive management actions, such as altered bag and size limits for recreational fishing, may also be required during the implementation of this plan. As part of the integrated 'whole of country' approach to planning and management for the Yawuru conservation estate, the zoning scheme for the marine park should be viewed together with the management arrangements for the adjacent Yawuru Birragun Conservation Park.

Above: Whale watching tour. Photo – Dave and Fiona Harvey, Naturalist Volunteers

Research and monitoring programs implemented as part of this plan, and outcomes from the Kimberley Marine Research Program managed by the Western Australian Marine Science Institution (WAMSI), will improve knowledge of Roebuck Bay's habitats, biological communities and patterns of human use and provide information to assess the health of the environment over time.

This joint management plan provides the intent for the Commission and the Joint Management Body to comprehensively review the implementation of the management plan, including the adequacy of the zoning arrangements, in five years (see section 6).

Marine park zoning scheme

The zoning scheme for the marine park is shown in Figure 6 and Figure 7 and the activities permitted in each zone are summarised in Table 1. The zoning scheme comprises two special purpose zones (cultural heritage) covering approximately 11,850ha (or 15% of the marine park), and two special purpose zones (recreation and conservation) covering approximately 66,990ha (or 85% of the marine park).

The purpose of the special purpose zones (cultural heritage) is to protect and recognise areas of high cultural significance to Yawuru people and to protect key ecological values. The zones will also allow for compatible recreational and commercial activities (see Table 1). Access by the broader community to these zones is not restricted within the marine park, however, there are access restrictions for the adjacent terrestrial areas in the *Yawuru Birragun Conservation Park management plan*. While Yawuru cultural values apply across the whole of Yawuru country, these zones provide a focal point for education programs to increase the level of understanding and respect for these values within the wider community.

Special purpose zones (recreation and conservation) cover most of the marine park. The purpose of this zone type is to protect the ecological values of Roebuck Bay. The zones also acknowledge the high recreational and cultural value of the area. This zone type allows for compatible commercial activities such as pearling, which are important to the local economy and character of Broome (see Table 1).

Kunin special purpose zone (cultural heritage)*

The Kunin special purpose zone (cultural heritage) covers approximately 1,130ha or 1% of the marine park. This zone recognises the high cultural value of the *Lirragun*, *Kunin*, *Gabunyanya* and *Bugawamba* areas and complements the adjacent Yawuru cultural purposes zone in the Yawuru Birragun Conservation Park. The conservation purpose of this special purpose zone is to protect critical habitat for high priority fauna such as snubfin dolphins and migratory shorebirds, as well as fossil dinosaur tracks. Commercial gillnetting, recreational coral, live rock and live sand collection, ground-disturbing mineral and petroleum exploration and development activities (e.g. drilling), pipelines, large scale dredging and dredge spoil dumping and vessel sewage discharge are considered to be incompatible with the conservation purpose of this zone.

Jangu special purpose zone (cultural heritage)*

The Jangu special purpose zone (cultural heritage) covers approximately 10,720ha or 14% of the marine park. This zone recognises the high cultural value of the *Jangu*, *Marrar*, *Mari-marigun*, *Rawanganyjarl* and *Darrabanga ngaba* areas and complements the adjacent Yawuru cultural purposes zone in the Yawuru Birragun Conservation Park. The conservation purpose of this special purpose zone is to protect significant ecological values and areas of critical habitat for high priority fauna such as sawfish, snubfin dolphins, dugongs, turtles and migratory shorebirds, as well as the *gundurung* (mangrove communities) associated with the Yardoogarra and *Yinanamana-gada* (Jacks Creek) intertidal creek systems. Commercial gillnetting, recreational coral, live rock and live sand collection, ground-disturbing mineral and petroleum exploration and development activities (e.g. drilling), pipelines, large scale dredging and dredge spoil dumping and vessel sewage discharge are considered to be incompatible with the conservation purpose of this zone.

Roebuck Bay special purpose zone (recreation and conservation)

The Roebuck Bay special purpose zone (recreation and conservation) is the largest zone and covers approximately 66,250ha or 84% of the marine park. The conservation purpose of this special purpose zone is to protect representative areas of all habitat types found in the marine park including critical habitat for all priority fauna. Commercial gillnetting, recreational coral, live rock and live sand collection, ground-disturbing mineral and petroleum exploration and development activities (e.g. drilling), pipelines, large scale dredging and dredge spoil dumping and vessel sewage discharge are considered to be incompatible with the conservation purpose of this zone. Almost all subtidal areas of the marine park are found in this zone. *Man-galagun* (Crab Creek) is a high use site for cultural and recreational activities and is one of the few places accessible by land in the eastern portion of the marine park (limited during *Man-gala*, the wet season). This zone contains pearling leases and provides for the continuation of the pearling industry.

Dampier Creek special purpose zone (recreation and conservation)

The Dampier Creek special purpose zone (recreation and conservation) covers approximately 740ha or 1% of the marine park. The conservation purpose of this zone is to protect representative areas of mangrove, saltmarsh and intertidal sand and mudflat communities and critical habitat for threatened and priority fauna. Commercial gillnetting, recreational coral, live rock and live sand collection, ground-

*Official names to be confirmed

Above: Kayak tours. Photo – Dave and Fiona Harvey, Naturalist Volunteers

disturbing mineral and petroleum exploration and development activities (e.g. drilling), pipelines, large scale dredging and dredge spoil dumping and vessel sewage discharge are considered to be incompatible with the conservation purpose of this zone. This area represents the highest use site for visitors and the Broome community and is the most accessible part of the marine park from the town of Broome.

Research and monitoring will assist managers to determine what further management arrangements or zoning may be required in order to meet the objectives of the marine park, including for conservation, cultural and sustainable use outcomes.

Permitted activities for each zone type

Table 1 provides information on a range of permitted activities across the two zone types in the marine park. Many of the activities are also regulated under complementary legislation and regulations, for example, size and bag limits for recreational fishing are managed by the Department of Fisheries under the FRM Act and regulations.

A licence is required to undertake some activities in marine parks (e.g. commercial tourism). As stated in the Joint Management Agreement, any sub-leases, licences for use of the land, or permits required under the CALM Act in relation to the marine park, may only be granted if Yawuru RNTBC has provided written consent. See supplementary information online (www.dpaw.wa.gov.au/parks/management-plans/approved-management-plans) for further information on regulatory agencies or, where applicable, section 4 for more information on a particular activity.

The implementation of this joint management plan requires management actions such as temporal closures, speed restrictions and a mooring and anchoring plan. Development of these management actions will aim to limit any potential impacts to the permitted activities, whilst meeting the management objectives.

An activity proposed to be undertaken within the marine park that is listed with 'assess' indicates an assessment is required by the appropriate agencies in accordance with relevant legislation and cognisant of the management objectives and targets prescribed in this joint management plan.

Table 1 Summary of permitted activities for zone types in the marine park

Activity	Special purpose zone (cultural heritage)	Special purpose zone (recreation and conservation)
Recreation		
Nature appreciation and wildlife viewing	Yes [a]	Yes
Boating (motorised & non-motorised)	Yes [a]	Yes
Recreational fishing	Yes [a]	Yes
Coral, live rock and live sand collection	No	No
Customary		
Customary activities (e.g. hunting, fishing) [b]	Yes	Yes
Commercial		
Pearling	Yes [a]	Yes
Commercial gillnet fishing	No	No
Commercial fishing (other than gillnet fishing)	Yes [a]	Yes
Aquaculture	Assess [a]	Assess
Ground-disturbing mineral and petroleum exploration and development [c]	No	No
Non-ground-disturbing mineral and petroleum exploration and development	Assess	Assess
Pipelines	No	No
Dredging and dredge spoil dumping	No	Assess
Commercial tourism operators (including charter fishing)	Yes [a]	Yes
Other		
Vessel transit	Yes [a]	Yes
Navigation aids	Yes [a]	Yes
Marine infrastructure	Assess [a]	Assess
Vessel sewage discharge	No	No
Research	Yes [a]	Yes
Anchoring	Yes [a]	Yes
Permitted activities provisions		

[a] When entering these zones users are asked to respect the Yawuru people's request for privacy whilst undertaking cultural activities.

[b] Customary take is confined to traditional owners, subject to the rights and interests provided by the *Native Title Act 1993* and/or ILUAs, or where traditional owners have provided consent to another Aboriginal person or group.

[c] Ground-disturbing mineral and petroleum exploration and development activities include any activity that disturbs the seabed and/or subsoil within the marine park (e.g. drilling).

[d] Activities permitted if shown to be compatible with the specified primary purpose of the zone. Only small scale dredging for the purpose of public access and safety will be considered.

Figure 6 Zoning scheme for the Yawuru Nagulagun / Roebuck Bay Marine Park

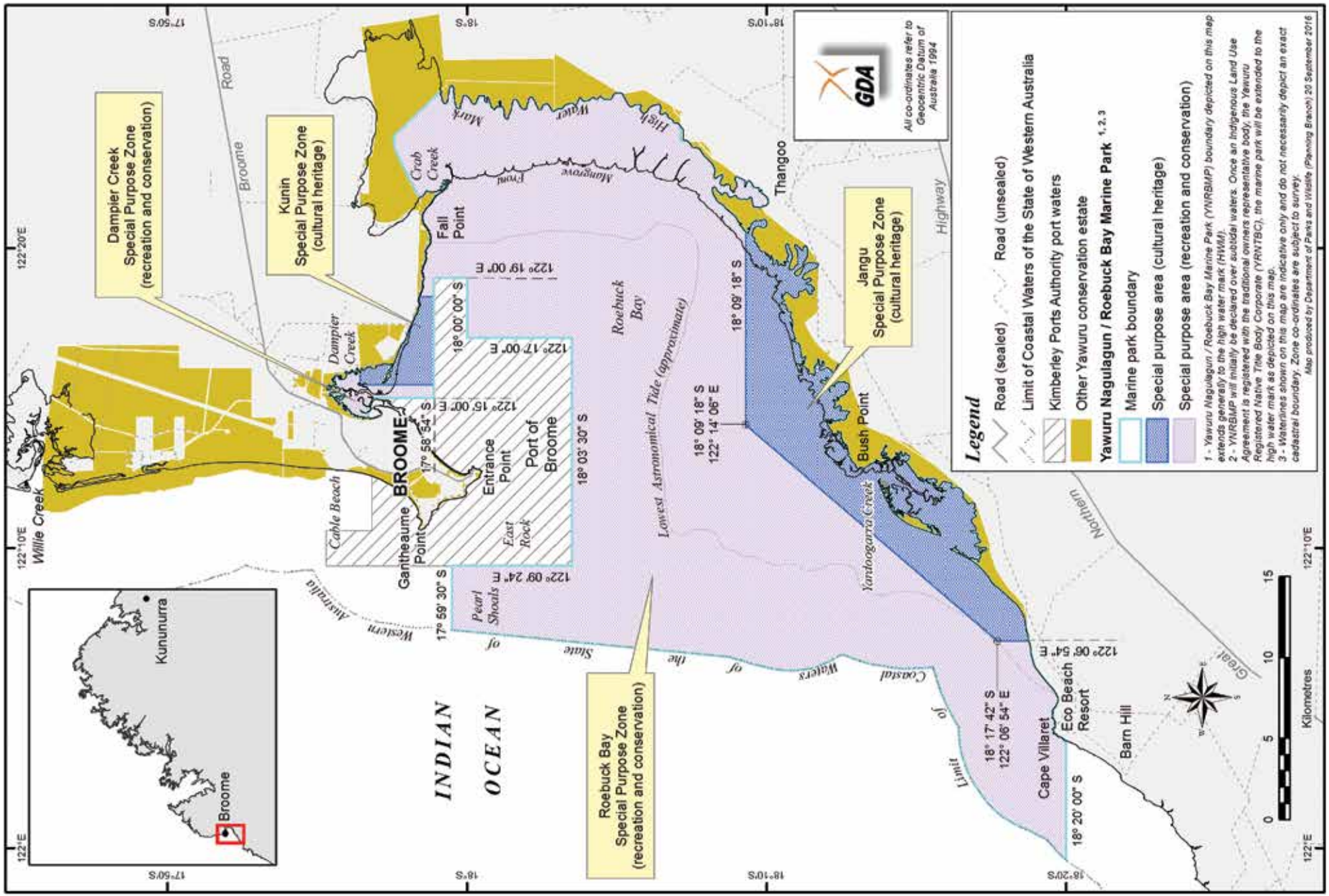
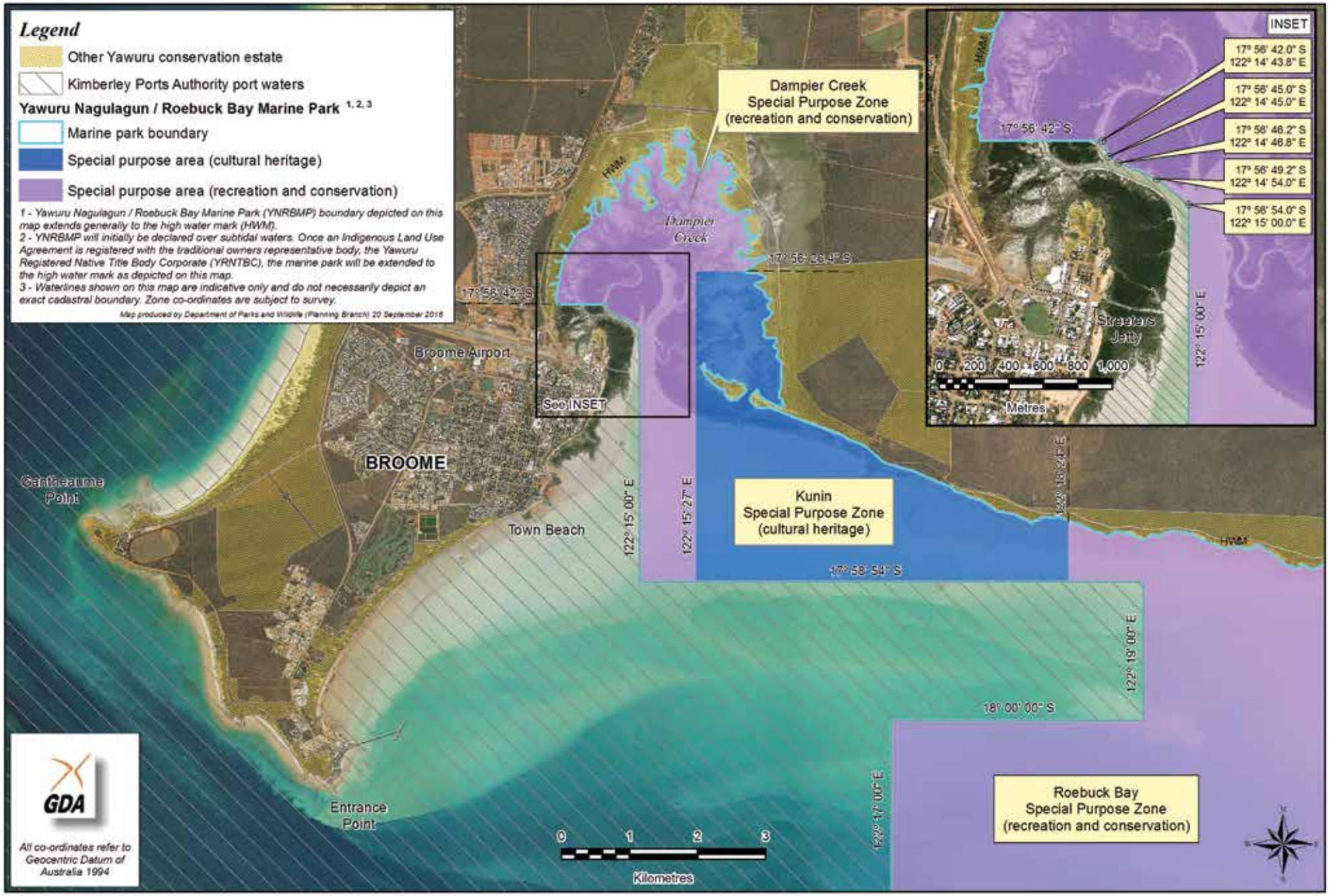


Figure 7 Zoning scheme for the Yawuru Nagulagun / Roebuck Bay Marine Park – Dampier Creek



5.2 Education and interpretation

The education and interpretation program will increase public awareness and understanding of conservation, Yawuru people and their culture, and management issues in the marine park. This increased understanding will help to develop a sense of community stewardship which will subsequently lead to better protection of cultural and ecological values, and responsible use of the area. An important component of the education and interpretation program is to promote the Aboriginal culture and heritage of Roebuck Bay. This program will complement and integrate with other education programs for the Yawuru conservation estate and draw heavily on the outcomes and messages from the *Yawuru cultural management plan*.

The education and interpretation program, developed to support the marine park's management, needs to be flexible and applied in ways that maximise the effectiveness of the program for various sectors and target audiences.

Education and interpretation program objectives, strategies and targets		
Management objective	To enhance community understanding of, and support for, the marine park and encourage appropriate visitor behaviour through education and interpretation programs.	
Management strategies	1. Develop and implement an integrated education and interpretation program that complements existing initiatives and aims to ensure users of the marine park understand the: a. importance of the cultural, ecological and social values of the marine park, especially those identified as key performance indicators that reflect the highest conservation and management priorities b. significant Aboriginal culture and heritage value of the area for Yawuru people c. appropriate behaviours to reduce human impacts, ensure public safety and respect culturally important sites and practices d. management zones and regulations and the reasons for these controls (DoF). 2. Ensure the education and interpretation program for the marine park is appropriately integrated with relevant outcomes and messages from the *Yawuru cultural management plan* and other component management plans for the Yawuru conservation estate. 3. Install educational signage for the marine park where appropriate (DoF, others as appropriate). 4. Encourage and assist the tourism industry to provide educational materials to their staff and customers to foster community stewardship of the marine park.	H-KMS H-KMS H M
Targets	1. Implementation of management strategies within agreed timeframes as specified in the operational schedule. 2. Fifty per cent of park users are aware of the existence of the marine park, its values and the management restrictions that apply within three years of the release of the management plan. 3. Ninety per cent of park users are aware of the existence of the marine park, its values and the management restrictions that apply within five years of the release of the management plan.	

Above: Children participate in a school holiday program with Yawuru Ranger Luke Puertollano. Photo – Querida Hutchinson.

5.3 Public participation

Public participation helps to build and sustain community support that is critical for effective implementation of the management plan. The establishment of a mechanism for stakeholder input into management of the marine park (e.g. a Community Advisory Committee) should be considered early in the implementation of the marine park management plan. The primary function of this type of mechanism will be the provision of advice and assistance to the Joint Management Body and the Commission, but will also provide an ideal forum for information sharing and an avenue for dissemination of information to the public. Such a mechanism would enable stakeholders to raise issues with the Joint Management Body, the Commission or the Minister in matters relating to the marine park's management, administration, zoning, conflicts in usage and any other management related issues that arise during the life of the management plan. In addition, effective communication and participation in management activities with a range of other community groups will help achieve management objectives and strategies.

Public participation program objectives, strategies and targets		
Management objective	To encourage and facilitate ongoing public participation in the management of the marine park.	
Management strategies	1. Develop and implement a public participation program for the marine park which encourages community involvement in management through a range of opportunities including education and monitoring programs and existing volunteer groups.	H-KMS
	2. Ensure the public participation program for the marine park is appropriately integrated with relevant outcomes and messages from the *Yawuru cultural management plan* and other component management plans for the Yawuru conservation estate.	H
	3. Consider options to establish a forum for community members, where appropriate, to be informed and consulted on park management.	H
	4. Maintain a record of public participation.	M
Target	1. Implementation of management strategies within agreed timeframes as specified in the operational schedule. 2. Annual increase in the level of public participation in the management of the marine park in the first five years following the release of the management plan.	

5.4 Patrol and enforcement

This joint management plan details a range of strategies relating to the management of particular human activities within the marine park. While users typically comply with management regulations when they understand why such controls have been implemented, there is always a need to monitor the level of compliance and take action to stop inappropriate or illegal behaviour. To achieve this, an appropriate level of 'on water' presence by authorised CALM Act and FRM Act officers will be necessary in the marine park. However, it is also necessary for users of the area (e.g. commercial fishers, charter and tourism operators and the general community) to play both a self-regulatory and peer surveillance role.

In 2005 a MoU was signed between the Minister for the Environment and the Minister for Fisheries to establish principles of cooperation and integration between Parks and Wildlife and DoF in the management of the state's marine protected areas. A collaborative operational plan will be developed between Parks and Wildlife, DoF and the Joint Management Body to ensure efficient and effective delivery of a range of programs where there is overlapping, shared agency responsibility or mutual interest, which includes patrol and enforcement activities, education, and research and monitoring. Specific actions include joint patrols, cross-authorisation of agency staff, and improved liaison and reporting arrangements.

As described in section 1.4.2, a ranger program for Yawuru community members has commenced and includes training participants towards becoming authorised officers under the CALM Act and FRM Act. This will allow Yawuru community members who gain authorisation to undertake patrol and enforcement duties throughout the Yawuru conservation estate.

Patrol and enforcement program objectives, strategies and targets		
Management objective	To achieve a high level of compliance with regulations, permitted uses and other management arrangements within the marine park.	
Management strategies	1. Refer to strategies in section 5.2.	
	2. Develop and implement a collaborative patrol and enforcement program to: a. ensure compliance with relevant regulations (DoF, DoT and other agencies as appropriate) b. maximise efficiency and effectiveness of patrol and enforcement activities (DoF, DoT and other agencies as appropriate).	H-KMS
	3. Encourage voluntary compliance and peer enforcement of regulations (DoF, DoT).	H-KMS
	4. Continue to train and mentor Yawuru park rangers and facilitate cross-authorisation of government enforcement officers as appropriate (DoF).	H-KMS
	5. Install zone markers and signage for the marine park where appropriate (DoF, DoT).	H
	6. Ensure that marine park users, including researchers, obtain and comply with appropriate formal permissions (DoF).	M
	7. Maintain a database of compliance statistics and issues which is available for management assessment (DoF, DoT).	M
Targets	1. Implementation of management strategies within agreed timeframes as specified in the operational schedule.	
	2. Within five years, more than 70% of department rangers undertaking patrols in the marine park will be Yawuru community members (as part of the Yawuru Ranger Program).	

5.5 Visitor risk, access and infrastructure

Visitor risk

Visitor risk management is an important focus for Parks and Wildlife. The remote nature of the marine park, combined with the large intertidal areas, strong tides and winds, occurrence of *linygurra* (estuarine crocodiles), irukandji box jellyfish, and tropical cyclones, pose a risk to visitors. This is particularly important for visitors who may be inexperienced in, or unprepared for, such conditions. As visitation to the marine park is likely to increase during the life of the management plan, an ongoing visitor risk management program will be undertaken to identify potential hazards and actions taken to minimise these. Risks to visitors are managed under the framework of the department's *Policy Statement 53: Visitor Risk Management Policy*. The Department of Transport is responsible for installing and maintaining navigation aids and other boating safety measures in all state waters.

Vehicle access and boat launching

At present, vehicle access within the marine park is relatively low and is predominantly for four-wheel driving or boat launching. Unmanaged vehicle access has the potential to impact on the ecological and cultural values of the marine park and adjacent conservation reserves. There are no 'permitted areas' for off-road vehicles under the *Control of Vehicles (Off Road Areas) Act 1978* within the marine park or the broader Yawuru conservation estate (e.g. unlicensed off-road motorbikes and dune buggies are not permitted).

Illegal use of unlicensed off-road vehicles and indiscriminate use of licenced four-wheel drives is particularly problematic between *Mirrda* (One Tree) and *Man-galagun* (Crab Creek). A network of haphazard tracks has formed from vehicles driving beyond the end of the formed road to obtain closer access to the creek, often to launch boats. This has resulted in damage to the fragile coastal vegetation and landforms. Due to the proximity of the *Gurlbanwila* (Dog Rock) boat launching area to *Man-galagun*, and the limited capability of the areas immediately around the creek to sustain vehicle use, vehicle access and launching of boats at *Man-galagun* will not be permitted. The *Yawuru Birragun Conservation Park management plan* proposes to upgrade the *Gurlbanwila* (Dog Rock) site to formalise the boat ramp, improve parking and pedestrian access, and install toilets, shelter and other visitor facilities.

Vehicle access will only be permitted within designated areas of the marine park and where necessary for management purposes.

This issue can be difficult to manage in areas where vegetation is low and open. Regular patrols and enforcement, as well as public education of vehicle access restrictions, are important requirements to effectively manage this matter. Vehicle access to the marine park will also be managed under the *Yawuru Birragun Conservation Park management plan*.

Development proposals and coastal infrastructure

Proposed developments, including exploration activities likely to have a significant effect on the environment, are referred to the Environmental Protection Authority and may be subject to the environmental impact assessment requirements of the EP Act.

Any environmental impact assessments for proposed developments within or in the vicinity of the marine park will generally be referred to Parks and Wildlife and the Commission for advice in the context of the management plan gazetted under the CALM Act. The Joint Management Body will also be notified and requested to provide advice in relation to development proposals as required. In addition, developers are required to satisfy the requirements of the *Aboriginal Heritage Act 1972* (AH Act) and the commonwealth *Native Title Act 1993* (NT Act) and all other legislation that may relate to their proposal.

During the life of this management plan there may be proposals for the installation and construction of infrastructure associated with pearling, tourism operations or public recreation. These could be major developments or minor works such as the installation of moorings or navigation markers. The nature of the development will determine the appropriate level of assessment. Proposals will be assessed in terms of potential impacts on the marine park's cultural, ecological and social values, and to determine whether they are consistent with the targets of the marine park.

It is important to allow natural coastal processes governing sand movement in the marine park to continue to function without mechanical intervention wherever possible. In the event that dredging may become necessary to maintain visitor access and public safety in the marine park, the situation will be assessed according to its necessity and potential to impact on the cultural, ecological and social values. In the first instance, dredging in the marine park will be discouraged unless undertaken to ensure that boat launching facilities and other coastal infrastructure remain functional.

Above: Estuarine crocodile in Dampier Creek. Photo – Parks and Wildlife

Marine oil pollution prevention and response

Although the risk of a serious marine oil pollution emergency is considered low, the nature of the habitats (e.g. large intertidal areas) and species that depend on these habitats (e.g. migratory shorebirds) means the consequences of such an event could be significant. As the lead agency for developing State policy to prevent and respond to such events, the Department of Transport prepared the *Oil Spill Contingency Plan 2015*. The aim of this plan is to outline the management arrangements for the prevention of, preparation for, response to and recovery from a marine oil pollution emergency to minimise the impacts of marine oil pollution from vessels, offshore petroleum activities and other sources in WA State waters. Parks and Wildlife, the Department of Transport and Kimberley Ports Authority have developed a range of emergency and oil spill response plans under this framework, providing a high level of preparedness and capacity to respond quickly should an event occur.

Mooring and anchoring

Mooring and anchoring are common activities in and around Roebuck Bay and Broome, with Dampier Creek offering one of the few safe anchorages along the coast during the cyclone season. With an expected increase in commercial and recreational vessels visiting and operating in Roebuck Bay it is expected that mooring and anchoring activities will increase over time. The marine park allows for ongoing mooring and anchoring activities, however, if not installed and maintained correctly, moorings may cause irreversible damage to the surrounding habitat and pose a risk to marine park users and property. The department's *Policy Statement 59: Mooring Policy* for marine parks and reserves aims to:

- maintain the ecological and social values of marine parks and reserves by minimising the detrimental impacts of uncontrolled mooring and anchoring
- improve user safety, access and equity in relation to moorings in marine parks and reserves
- provide a framework to accommodate present and future mooring use in marine parks and reserves.

A number of commercial and large recreational vessel moorings are located close to the marine park in Kimberley Ports Authority waters. The ongoing management of these moorings will be unaffected and, as with all port related activities, it will remain the responsibility of the Kimberley Ports Authority. A memorandum of agreement outlines the roles and responsibilities for management between the Kimberley Ports Authority and Parks and Wildlife.

A mooring plan for the marine park will be developed in consultation with key stakeholders and in line with Parks and Wildlife policies and guidelines. The plan will identify where moorings are considered acceptable and/or necessary from cultural, environmental, safety, social, equity and management perspectives. Depending on the level of demand, moorings in the marine park will be either private, public or rental.

Visitor risk, access and infrastructure program objectives, strategies and targets		
Management objectives	1. To provide facilities to enhance visitor enjoyment of, and minimise impacts on, the values of the marine park. 2. To identify and manage existing or potential human impacts on the cultural, ecological and social values of the marine park. 3. To take reasonable steps to minimise visitor risk within the marine park.	
Management strategies	1. In consultation with major users, provide visitor facilities to enhance enjoyment and reduce impacts on marine park values.	H-KMS
	2. Prepare a mooring plan for the marine park.	H-KMS
	3. Complete periodic assessments for visitor risk in the marine park, including from *linygurra* (estuarine crocodiles), and implement measures to address these risks where appropriate.	H-KMS
	4. Complete periodic assessments to identify existing and potential human activities that may affect the values of the marine park and investigate, and where appropriate implement, additional mechanisms such as temporal controls and speed restrictions to mitigate or stop these impacts.	H-KMS
	5. Maintain a quantitative and qualitative spatial database of human use within the marine park (DoF).	H-KMS
	6. Ensure that the cultural, ecological and social values of the marine park are included in predictive models and response plans for oil spills, including under the state's emergency management plan for marine oil pollution (Westplan), to assist in managing any significant pollution event that occurs within or adjacent to the marine park (KPA, DoT).	H
	7. Provide designated vehicle access to support launching of small boats at *Gurlbanwila* (Dog Rock).	H
	8. Close and rehabilitate (where feasible) the inappropriate access tracks in the vicinity of *Mirrda* (One Tree) and *Man-gulagan*.	H
	9. Ensure the education and interpretation program (section 5.2) educates users about vehicle access restrictions within the marine park.	H
	10. Provide advice on the cultural, ecological and social values, objectives and targets of the marine park to relevant authorities assessing development proposals and, where appropriate, ensure monitoring programs associated with approved proposals are undertaken and relevant information is provided to park managers (Commission, Joint Management Body, EPA, DoF).	H
	11. Undertake patrols to ensure compliance with vehicle access restrictions.	H
	12. Undertake periodic inspections and maintenance of department managed infrastructure within the marine park.	M
Target	Implementation of management strategies within agreed timeframes as specified in the operational schedule.	

5.6 Research

Developing an understanding of the cultural, ecological and social values of the marine park is critical to effective management. A comprehensive research program facilitates this understanding and provides background information necessary for an effective approach to the protection of cultural and ecological values and the responsible management of social values. Much of this information does not exist at this stage for the marine park, so research programs should be designed to fill key gaps in current knowledge relevant to management, including establishing the natural state of key ecological values and the processes supporting them, and the importance of the area for high priority flora and fauna.

Research within the marine park will require a licence to be issued by Parks and Wildlife. This enables Parks and Wildlife to:

- maintain an understanding of research effort
- direct research effort, where necessary, so it is relevant to management
- collaborate with researchers where possible
- share research outcomes with others.

As stated in the Joint Management Agreement, any sub-leases, licences for use of the land, or permits required under the CALM Act in relation to the marine park shall not be granted unless Yawuru RNTBC has provided written consent.

Permits may also be required through DoF if research is undertaken on fish as defined in the FRM Act.

As specified in the *Yawuru cultural management plan*, researchers should provide details of any proposed study, in accordance with the Yawuru protocols, to the Yawuru RNTBC prior to beginning their research. The proposal should include the purpose of the research, timeframe and locations, the number of people involved, funding and a clear description of methodology.

In culturally sensitive areas, Yawuru RNTBC may deem it appropriate for advisers to accompany researchers in their work. Findings from the research should be made available in full to Yawuru RNTBC and the Joint Management Body for review and any culturally sensitive matter deemed 'unsuitable for public view' omitted from publication.

A range of organisations have a role in promoting and undertaking research for the marine park and Yawuru conservation estate. Where required, specific research strategies are detailed for the cultural, ecological and social values in section 4. Research, in itself, is identified as an important social value of the marine park and is discussed in section 4.3.5.

Above: Broome Bird Observatory netting of shorebirds. Photo – Sara Katz and Glen Ewers

Research program objectives, strategies and targets		
Management objectives	1. To obtain an understanding of the biodiversity, cultural values and key ecological processes and socio-economic uses within Roebuck Bay to inform management decisions. 2. To promote ecological, cultural and social research that improves knowledge of Roebuck Bay to better inform management decisions.	
Management strategies	1. Ensure that all research projects undertaken by or on behalf of Parks and Wildlife comply with the department's Science Policy (No. 78) and associated guidelines.	H-KMS
	2. Prepare a coordinated and prioritised marine research program with a focus on addressing:	H-KMS
	a. baseline information for values, including benthic habitat maps	
	b. definition of condition, pressure and response indicators and metrics to support the monitoring program, including limits of acceptable change for Ramsar reporting	
	c. knowledge gaps for cultural, ecological and social values identified as key performance indicators (reflecting the highest conservation and management priorities)	
	d. knowledge gaps in relation to the significance of Roebuck Bay for certain marine fauna, including dugongs, snubfin dolphins and sea snakes (WAMSI, DoF, others as appropriate).	
	3. Ensure research outputs will contribute to a periodic (five-year) review of the adequacy and implementation of management arrangements, including in the context of the integrated management approach across Yawuru conservation estate (Joint Management Body, Commission, DoF).	H-KMS
	4. Undertake and facilitate cultural, ecological and social research within, or relevant to, the marine park in accordance with the marine research program (DoF, others as appropriate).	H-KMS
	5. Ensure the marine research program for the marine park is appropriately integrated with relevant outcomes from the *Yawuru cultural management plan* and other component management plans for the Yawuru conservation estate.	H-KMS
	6. Ensure research proposals and activities comply with the cultural protocols in the *Yawuru cultural management plan* and/or are provided for under a research agreement with Yawuru RNTBC (DoF, others as appropriate).	H-KMS
	7. Facilitate knowledge transfer and uptake of research program outputs to marine park management, planning and policy.	H-KMS
	8. Communicate the prioritised research program to appropriate research organisations and funding bodies (DoF).	H
	9. Assess the nature, level and potential impacts of pressures (from human activities and external pressures such as climate change) on cultural, ecological and social values within the marine park, and investigate effective and efficient mechanisms for their management.	H
	10. Ensure research licence conditions include the requirement for results, data and outputs to be provided to Parks and Wildlife, Yawuru RNTBC, the Joint Management Body and the Commission in a timely manner (Commission, Joint Management Body).	M
	11. Maintain a record of the historical and current research that has occurred within, or is relevant to, the marine park and its values.	M
Target	Implementation of management strategies within agreed timeframes as specified in the operational schedule.	

Above: Monitoring *Lyngbya*. Photo – Parks and Wildlife

5.7 Monitoring

Long term monitoring of the condition of the marine environment and the pressures that may impact on it are essential to assess the effectiveness of marine reserve management. Monitoring enables the early detection of detrimental impacts and provides the trigger for corrective management action before cultural, ecological and social values of a marine reserve become significantly degraded. Where changes have occurred and remediation measures are required, a monitoring program should also determine the rate of recovery of an affected area or value.

A systematic marine monitoring program is progressively being implemented by Parks and Wildlife across WA's network of marine parks and reserves (Western Australian Marine Monitoring Program) to improve the understanding of management effectiveness, and to inform future research, monitoring and decision making. Monitoring will focus on determining trends in key ecological, cultural and social values within a 'condition-pressure-management response' framework, that measures the 'health' of values against defined management targets. Where required, short term management targets may need to be developed or further refined to reflect meaningful interim steps in achieving the longer term management targets and objectives.

Parks and Wildlife's Marine Science Program will help determine appropriate performance measures, or surrogates, to monitor the ecological values of the reserve that will be used to assess whether the objectives of the management plan are being achieved. The delivery of the monitoring program will be undertaken in partnership with departmental staff from the West Kimberley district (including Yawuru Rangers) who are responsible for day-to-day management, DoF for fisheries related aspects, and through external providers such as the Commonwealth Scientific and Industrial Research Organisation, Australian Institute of Marine Science, universities, and community groups where appropriate. The detection of human induced changes requires an understanding of what is 'natural' as a benchmark and this information will be progressively established through ongoing monitoring of 'no-take' reserves, or low impact sites, and the research program.

Specific monitoring strategies are detailed for each cultural, ecological and social value in section 5, where appropriate.

Monitoring program objectives, strategies and targets		
Management objective	To monitor key cultural, ecological and social values in the marine park within a 'condition-pressure-management response' framework, to provide a basis to assess, adapt and improve management.	
Management strategies	1. Ensure that all monitoring activities undertaken by or on behalf of Parks and Wildlife comply with the department's Science Policy (No. 78) and associated guidelines.	H-KMS
	2. Develop and progressively implement a coordinated and prioritised cultural, ecological and social monitoring program for the marine park, including community-based monitoring, with a particular emphasis on reporting and assessment requirements (e.g. key performance indicators, adequacy of zoning) (DoF, others as appropriate).	H-KMS
	3. Facilitate knowledge transfer and uptake of monitoring outputs into marine park management, planning and policy.	H-KMS
	4. Ensure monitoring activities comply with the cultural protocols in the *Yawuru cultural management plan* (DoF).	H-KMS
	5. Develop and maintain a database of historical and current monitoring in the marine park, including a quantitative and qualitative spatial database of human use.	H
	6. Develop and implement a marine pest early warning and monitoring program (**DoF**).	H
	7. In accordance with the monitoring program, facilitate monitoring of cultural, ecological and social values by third parties (e.g. research, academic and educational institutions).	H
	8. Ensure the development and implementation of the monitoring program considers requirements under the Ramsar Convention, including defining and monitoring limits of acceptable change for the ecological character of the Ramsar site and reporting periods.	H
Target	Implementation of management strategies within agreed timeframes as specified in the operational schedule.	

Above: Aerial image. Photo – Steve Lloyd Smith

6. Performance assessment

Progress in implementing the management plan and in assessing management effectiveness against the stated objectives will be periodically reviewed through a formal process. Management targets of selected key cultural, ecological and social values of the marine park are used as 'key performance indicators' (KPIs) of management effectiveness. The KPIs for the marine park will be the management targets and performance indicators for:

- living cultural landscape
- traditional ecological knowledge
- enjoyment of country and customary practices
- responsibility for country
- water and sediment quality
- seagrass, macroalgae and other primary producers
- *gundurung* (mangrove communities)
- intertidal sand and mudflat communities
- waterbirds including migratory *gamirda-gamirda* (shorebirds)
- finfish
- marine mammals.

Annual review by Parks and Wildlife in partnership with the Yawuru RNTBC

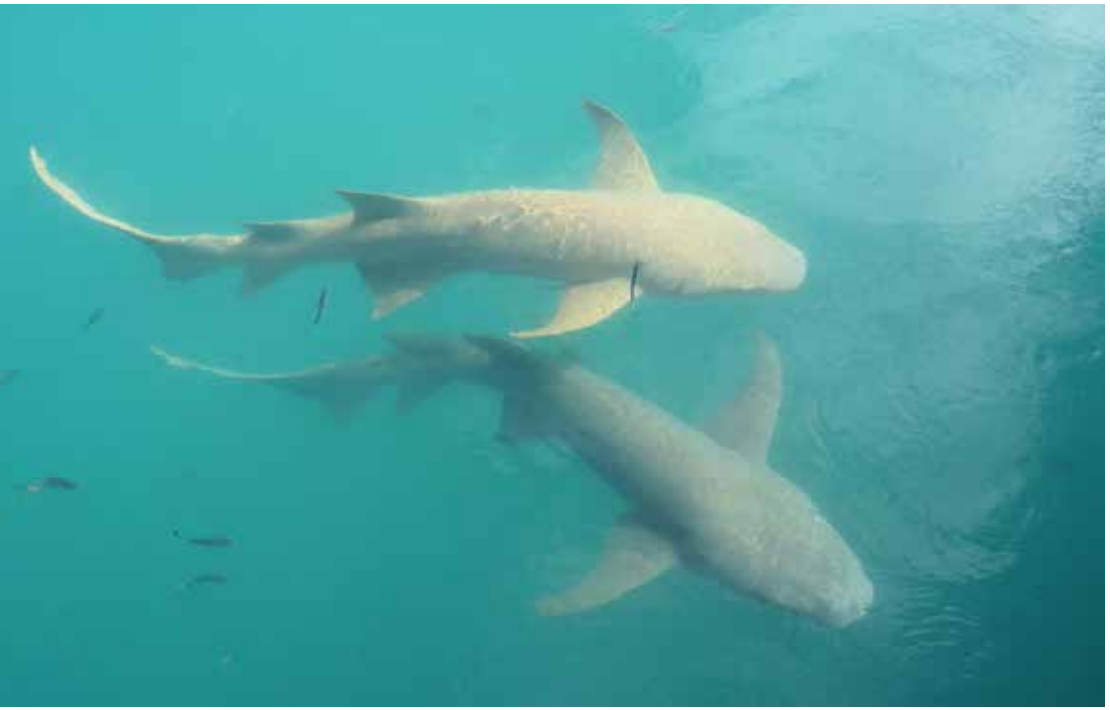
The prioritised strategies outlined in sections 4 and 5 of the management plan will be implemented primarily through the annual works programs of Parks and Wildlife's West Kimberley District (including the Yawuru Ranger Program), Marine Science Program and other specialist branches in partnership with the Yawuru RNTBC. The West Kimberley District will prepare an annual review of the implementation of the management plan for consideration by the Joint Management Body and the Commission, who will oversee the management of the marine park. Key parts of the annual review will include:

- identifying issues affecting implementation
- resource allocation
- progress in implementing management plan strategies
- the condition of cultural, ecological and social values against performance measures and targets.

As part of the annual review process, Yawuru RNTBC will provide an update to Yawuru community members on the implementation of the management plan.

Conservation and Parks Commission periodic assessments

The Commission has a statutory responsibility to periodically assess the implementation of management plans. This joint management plan provides the intent for the Commission, and Joint Management Body, to undertake a five-year review of the adequacy of management arrangements, including the zoning scheme, for the marine park. This assessment will be informed by new scientific research and information which will provide an improved knowledge base against which the adequacy of current management arrangements can be assessed and revised as necessary. This also provides the intention for joint management partners



Top: Sea star. **Above:** Tawny nurse sharks. Photos – Dave and Fiona Harvey, Naturalist Volunteers

to assess the implementation and adequacy of the joint management arrangements in the broader context of complementary and integrated management across the Yawuru conservation estate.

Revision of the management plan

The joint management plan will guide joint management of the marine park for 10 years, or until a statutory revision is undertaken and a new joint management plan is prepared. If such a revision does not occur by the end of the plan's specified lifespan, the plan will remain in force in its original form unless it is revoked by the Minister for Environment or a new plan is approved. Full public consultation will occur at the time of revision, and endorsement of a revised joint management plan will be sought from the Joint Management Body and Commission, and approval of the Minister for Environment following concurrence from the Minister for Fisheries and the Minister for Mines and Petroleum.

Ramsar reporting

The Australian Government works cooperatively with the States and Territories to meet its obligations as a Contracting Party to the Ramsar Convention. Article 3.2 of the Convention states that:

Each Contracting Party shall arrange to be informed at the earliest possible time if the ecological character of any wetlands in its territory and included in the List has changed, is changing or is likely to change.

To ensure these obligations are met, the Australian Government, through the agency of the States and Territories, conducts regular reviews of the status of Australia's 65 Ramsar listed wetlands, including Roebuck Bay. The review of the Roebuck Bay Ramsar site will be undertaken by the Wetlands Section of Parks and Wildlife every seven years and will complement those for the marine park, and provide updated information to inform the adaptive management of the ecological character and human use of the Ramsar site, as required under Ramsar Convention implementation guidelines. For up to date information on these guidelines see the websites for the Department of Environment (Commonwealth Government of Australia) and the Ramsar Convention on Wetlands.

Table 2 Bodies with responsibilities in the Yawuru Nagulagun / Roebuck Bay Marine Park

Conservation and Parks Commission	• vesting body for marine park • provides policy advice to the Minister for Environment • assesses management plan implementation
Yawuru Registered Native Title Body Corporate	• native title holders of the lands and waters in and around Broome and Roebuck Bay • joint management partner as prescribed in the Yawuru Agreements • responsible for the preparation of the *Yawuru cultural management plan* • provides guidance to the Joint Management Body and Yawuru Ranger Program
Yawuru Nagulagun /Roebuck Bay Marine Park Joint Management Body	• established under the 2016 marine park ILUA and comprises representatives appointed by the Yawuru RNTBC and Parks and Wildlife • responsible for the joint administration of the management of the marine park, including: – preparation of management plans for the management of the marine park – ensuring the management plans for the marine park are consistent with the visions and policies set out in the *Yawuru cultural management plan* – ensuring consistency between the management plans for the Yawuru conservation estate – strategically monitoring the management of the marine park including the implementation of management plans – giving advice to Parks and Wildlife, the Commission and other relevant bodies on all aspects of the use, management and development of the marine park – determining priorities for any matters required to be done in accordance with or in furtherance of the management plans.
Department of Parks and Wildlife	• joint management partner as prescribed in the Yawuru Agreements • manages marine parks and reserves vested in the Commission, including: – preparation of management plans – implementation of management plans – co-ordination of other agencies' involvement – implementation of education, public participation and monitoring programs – wildlife research and management – management of nature-based tourism – ensuring compliance with the CALM Act and Wildlife Conservation Act. • ensures integrated planning of the marine park with adjoining intertidal and terrestrial reserves • employs and trains Yawuru park rangers as Departmental field officers • assists the EPA in the process of assessing proposals that may significantly affect the marine environment, including marine parks and reserves • administers pollution control legislation

Department of Fisheries	• manages and regulates commercial and recreational fishing and aquaculture in all state waters, which includes the application of restricted seasons, bag and size limits amongst other management measures • manages aquatic biosecurity to protect state waters from the establishment of invasive marine pests • lead role in enforcing fisheries legislation • undertakes research and monitoring of fish populations • implements education programs
Department of Transport	• responsible for all boating regulations including licensing, safety standards, vessel navigation, marker buoys, moorings, jetties and support facilities such as navigation marks, navigation charts and harbour facilities (N.B. mooring controls can be delegated to other agencies) • chairs and supports the State Coordinating Committee which provides the mechanism to coordinate the management of marine pollution incidents • responsible for management of vessel navigation and for developing and managing support facilities • the hazard management agency responsible for marine oil pollution and marine transport emergencies, which includes the development of respective West Plans under the *Emergency Management Act 2005*
Environmental Protection Authority	• assesses, reports and makes recommendations on proposals that may significantly affect the marine environment
Kimberley Ports Authority	• responsible for managing and regulating all port related activities and all vessel movements within the port boundary
Department of Water	• responsible for licensing, regulation and allocation of water supplies • monitors streams, groundwater quality and flows
Department of Mines and Petroleum	• administers Acts that control mineral and petroleum exploration and development • regulates petroleum and mining industry operations
Department of Aboriginal Affairs	• protects Indigenous heritage and culture under the *Aboriginal Heritage Act 1972*
Western Australian Maritime Museum	• protects pre-1900 shipwrecks and artefacts under the *Maritime Archaeology Act 1973* (all shipwrecks over 75 years old are declared and protected under the *Commonwealth Historic Shipwrecks Act 1976*)

Yawuru language glossary

Spelling is based on advice from Yawuru RNTBC. Where appropriate, Yawuru names for places, plants and animals are included in the plan. All Yawuru words are italicised. It should be noted that Yawuru language can be spelt in alternative ways.

Word	Yawuru definition
barnany nyurdany warli	reef fish
barndarlmarda	bird
Barrgana	Yawuru cold season (June to August)
bilkirrin	tiger shark (*Galeocerdo cuvier*)
birndany	ray
birrala	giant, king or whiskers threadfin salmon (*Polydactylus macrochir*)
birrga-birrga	shellfish
bugarri	dream; totem associated with a child
Bugarrigarra	the Dreaming; Dreamtime/history before time began
buru	one's country; traditional country; land/earth/dirt/ground; can also mean time/place/season
gamirda-gamirda	shorebird
Gumanyba	Seven Sisters star cluster
gundurung	mangrove
gunurru	ghost gum (*Corymbia flavescens*)
gurlban	mullet
gurlibil	turtle (green)
guwarn	pearl oyster (*Pinctada maxima*)
jalbarl-barl	intertidal flats
Janyjagurdiny	Thangoo area
jirrinygirliny	bloody cockles (*Anadara granosa*)
Jurru	mystical being; serpent-like figure; snake (generic)
jurrwayi	shark
Laja	Yawuru season (late October/November to December)
langa	catfish
linygurra	estuarine crocodile
liyan	feelings that express emotional strength, dignity and pride
mabu	good; healthy; strong
mala	conch shell
Man-gala	Yawuru wet season (December to March)
Man-galagun	Crab Creek
Marrul	Yawuru season (April to May)
Minyirr	Gantheaume Point
Miriny	Cape Villaret
murruwaran	queenfish
nagula	ocean; sea country
nganarr	dugong
Rayi	spiritual essence; spirit being; child-spirit
walga-walga	blue or bluenose threadfin salmon (*Eleutheronema tetradactylum*)
wanbiny	jellyfish
wanggaja	crab
Wirlburu	Yawuru season (September to October)
Wirralburu	Yawuru season (May)
wurrja	sea sponge
yalwarr	sawfish
yaman	westerly winds
yaminyarri	Kakadu plum (*Terminalia ferdinandiana*)
yari	humpback whale
yilany	snapper
Yinanamana-gada	Jacks Creek
yingarliwa	bluebone or blackspot tuskfish

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Above: Shorebird monitoring. Photo – Parks and Wildlife

Abbreviations

ANZECC	Australia and New Zealand Environment and Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
KPA	Kimberley Port Authority
CALM Act	*Conservation and Land Management Act 1984*
CAMBA	China–Australia Migratory Bird Agreement
CAR	Comprehensive, adequate and representative
CEO	Chief Executive Officer (in this case the Director General)
Commission	Conservation and Parks Commission
DoF	Department of Fisheries
DMP	Department of Mines and Petroleum
DoT	Department of Transport
DoW	Department of Water
EP Act	*Environmental Protection Act 1986*
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
FRM Act	*Fish Resources Management Act 1994*
H	High priority management strategy
H-KMS	Key management strategy
ILUA	Indigenous Land Use Agreement
IMCRA	Interim Marine and Coastal Regionalisation for Australia
IUCN	International Union for the Conservation of Nature
JAMBA	Japan–Australia Migratory Bird Agreement
KPI	Key performance indicator
L	Low priority management strategy
M	Medium priority management strategy
NRSMPA	National Representative System of Marine Protected Areas
NT Act	*Native Title Act 1993* (Commonwealth)
PPA	Pearl Producers Association
ROKAMBA	Republic of Korea–Australia Migratory Bird Agreement
TFMPA	Task Force on Marine Protected Areas
TWA	Tourism Western Australian
WAFIC	Western Australian Fishing Industry Council
WAM	Western Australian Museum
WAMSI	Western Australian Marine Science Institution
Yawuru Agreements	Yawuru Indigenous Land Use Agreements
Yawuru RNTBC	Yawuru Registered Native Title Body Corporate (also known as Yawuru PBC)

Above: Red-necked avocets on the shore of Roebuck Bay. Photo – Hazel Watson

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