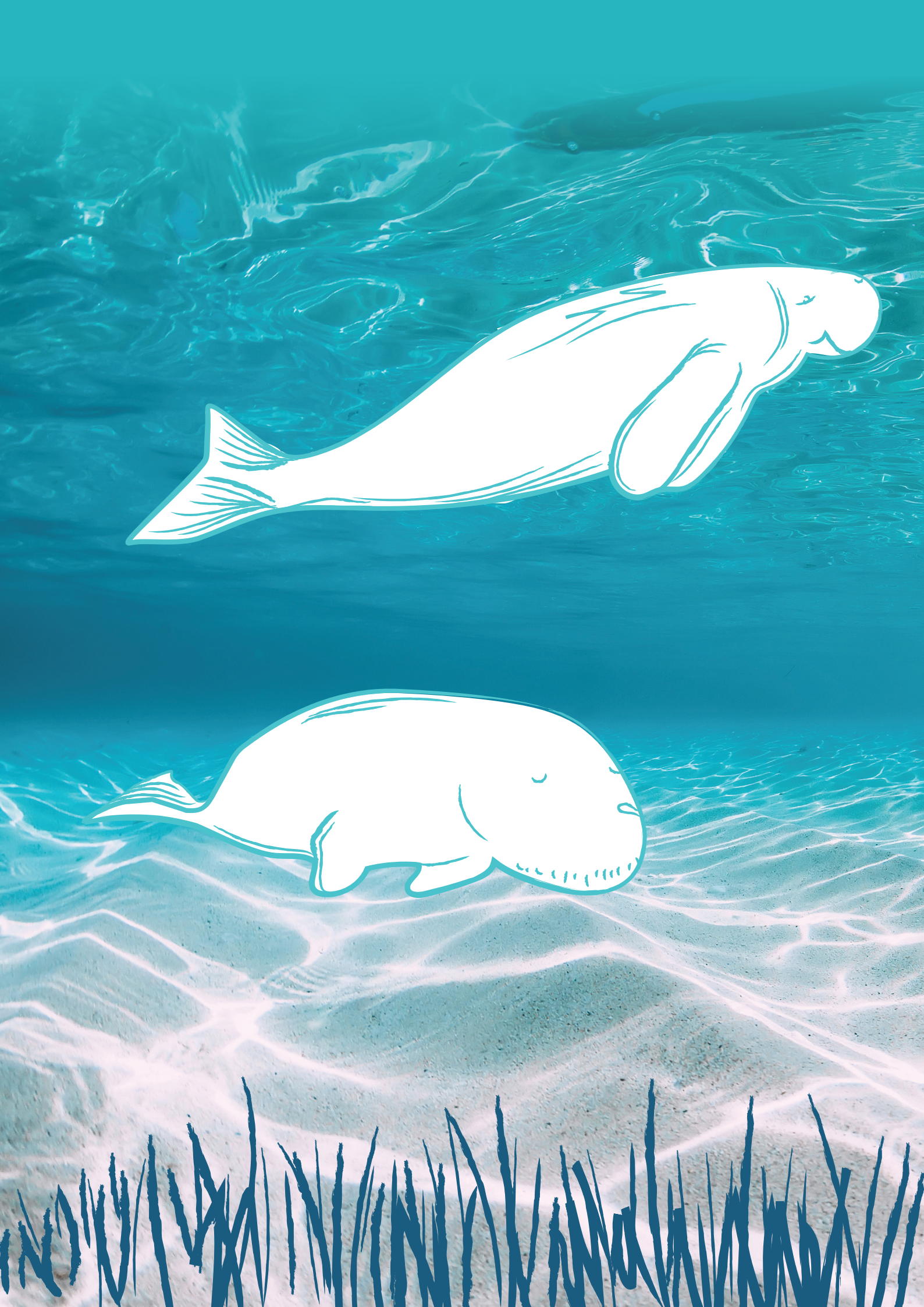
The Kimberley Indigenous Turtle & Dugong Initiative 2022–2032

a plan for Indigenous-led regional management

Implementation Plan

Coordinated by the Kimberley Indigenous Saltwater Advisory Group,
implemented by Kimberley saltwater communities, supported by Western Science partners



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Contents

Our Vision

Healthy and sustainable habitat and populations of sea turtle & dugong in Kimberley waters that support Indigenous livelihoods, culture and customary practices.

Our Statement of Intent

Kimberley-scale science and Indigenous knowledge for the collaborative management of sea turtle and dugong, providing local, regional, national and international benefits for the species and for Indigenous communities over the next 50 years.

Endorsements

The Kimberley Indigenous Turtle & Dugong Initiative ('the initiative') represents a significant step forward in regional-scale, coordinated science for long-term planning and management with benefit to both people and Country. It is an ambitious project bringing together Indigenous communities, Sea Country rangers, western marine science and management agencies and institutions. It focusses on shared knowledge priorities, builds Indigenous science capacity and addresses key management questions. This approach will provide tangible benefits to local communities, marine resource users and marine park management agencies. It has clear alignment with national species recovery priorities, native title rights and responsibilities, and Australia's international commitments.

The initiative is based on a strong foundation of documented Indigenous Sea Country management and knowledge priorities, proven collaborative science protocols, established networks and community-based participatory approaches. It places Indigenous people, culture and knowledge on equal footing with those of western scientists. The initiative will be coordinated by a peak regional Indigenous body with a proven record of delivering innovative, regional-scale collaborative science and cross-jurisdictional Sea Country projects.

The Kimberley Indigenous Turtle and Dugong Initiative has been formally endorsed by the Balanggarra, Wunambal Gaambera, Dambimangari, Mayala, Bardi Jawi, Nyul Nyul, Yawuru, Karajarri and Nyangumarta peoples through their representative Aboriginal Corporations.

Foreword

As Co-chairs of the Kimberley Indigenous Saltwater Advisory Group (ISWAG) we would like to thank community members and land and sea managers for their support in developing this Turtle and Dugong Initiative. The Initiative contributes to the long-term aspirations of Kimberley Indigenous saltwater people alongside our Western Science partners and acknowledges our traditional knowledge and practices passed on to us by our senior people.

Recognising our cultural rights to hunt and take turtles and dugong as a traditional resource we also feel the customary responsibility to look after and maintain these species with the best available knowledge. ISWAG is proud to have brought together the key stakeholders in saltwater science and management and developed this Indigenous led rights-based management framework for the long-term sustainable management of these culturally significant marine species.

The Turtle and Dugong Initiative provides a blueprint for research proposals which will provide critical data and knowledge and inform traditional owners and Western Science and managers on long term priorities.

In the development of their community based customary management plans for turtle and dugong across Kimberley saltwater Country our protocols and practices will be supported by research and monitoring programmes.

The Initiative also reflects the fact that as Traditional Owners of Kimberley saltwater Country, we aspire to build knowledge and capacity in managing the Sea Country estates through collaborations that meets community and science knowledge objectives.

We aim to inform government and local decision-making processes on sustainably managing local and regional population of turtles and dugongs and filling long term knowledge gaps.

ISWAG's ambition is that the Initiative will generate interest, understanding and commitment to shared values, principles and outcomes among our partners, along with investment into the research opportunities contained in the Initiative.

We believe it will present opportunities to build the capacity and knowledge of the Kimberley Saltwater Management Community including Marine Rangers and Traditional Owners using the Saltwater Resources. The Initiative will open the way for Science and Traditional Knowledge to provide well informed turtle and dugong research, monitoring and management as well as strengthening a network of community and science specialists to provide technical advice, resources and commitment in ISWAG's journey implementing the Initiative.

Special thanks for their contribution to the development of the ISWAG Kimberley Indigenous Turtle Dugong Initiative goes to:

Gina Lincoln - Mosaic Environmental; Will Durack, Zack Wundke - KLC; Scott Whiting, Tom Holmes, Holly Raudino - DBCA; Michelle Glover, Zoe Cozens, Bianca Priest and Jennifer Hoy - Parks Australia; Luke Twomey & Kelly Waples - WAMSI; Mat Vanderklift , Marlee Hutton and Peter Bayliss - CSIRO; Jim Underwood Martial Depczynski - AIMS.

Dean Mathews
Daniel Oades
ISWAG Co-chairs

Acknowledgements

The development of this plan was facilitated by the Kimberley Indigenous Saltwater Advisory Group (ISWAG) from 2019 to 2021. It was resourced through the in-kind contributions of Indigenous Sea Country managers from across the Kimberley region, with funding from the WA Department of Conservation, Biodiversity and Attractions (DBCA), Parks Australia and the Commonwealth Scientific and Industrial Research Organisation (CSIRO).

We acknowledge the significant investment of the nine participating saltwater communities, their community Indigenous governance bodies (Aboriginal Corporations and Prescribed Body Corporates) and their nominated ISWAG members:

- **Balanggarra**
- **Bardi Jawi**
- **Dambimangari**
- **Jabbir Jabbir**
- **Karajarri**
- **Mayala**
- **Nyangumarta**
- **Nyul Nyul**
- **Wunambal Gaambera**
- **Yawuru**

Their collective vision and innovative approach to pan-tenure Sea Country management delivering regional outcomes for all Kimberley saltwater Country and people remains the most critical component for the success of the initiative.

We would like to thank all Western Science contributors who provided valuable perspectives, insight and contributions to this document across specific themes, directly or indirectly through development, at a range of scales:

Seagrass: Matt Vanderklift (CSIRO); Gary Kendrick (UWA); Mathew Fraser (UWA)

Remote sensing (benthic habitat): Janet Anstee (CSIRO)

Coral reef: Thomas Holmes (DBCA); Jim Underwood (AIMS)

Turtle: Scott Whiting, Sabrina Fossette-Halot and Tony Tucker (DBCA)

Dugong: Marlee Hutton (CSIRO); Kelly Waples (DBCA); Helene Marsh and Frank Loban (JCU)

Genetics: Oliver Berry (CSIRO); Rik Buckworth (Sea Sense); Scott Whiting (DBCA)

Federal government: Michelle Glover and Bianca Priest (Parks Australia); Karen Arthur (DAWE)

State government: Chris Nutt, Craig Olejnik, Darren Stevens and Todd Quartermaine (DBCA)

Process: Bevan Bessen and Will Bessen (Tuna Blue); Gina Lincoln (Mosaic Environmental)

Section 1: Context

This plan builds on decades of foundational work by Indigenous and non-Indigenous marine scientists and managers towards the long term sustainability of dugong and turtle populations in north west Australia.

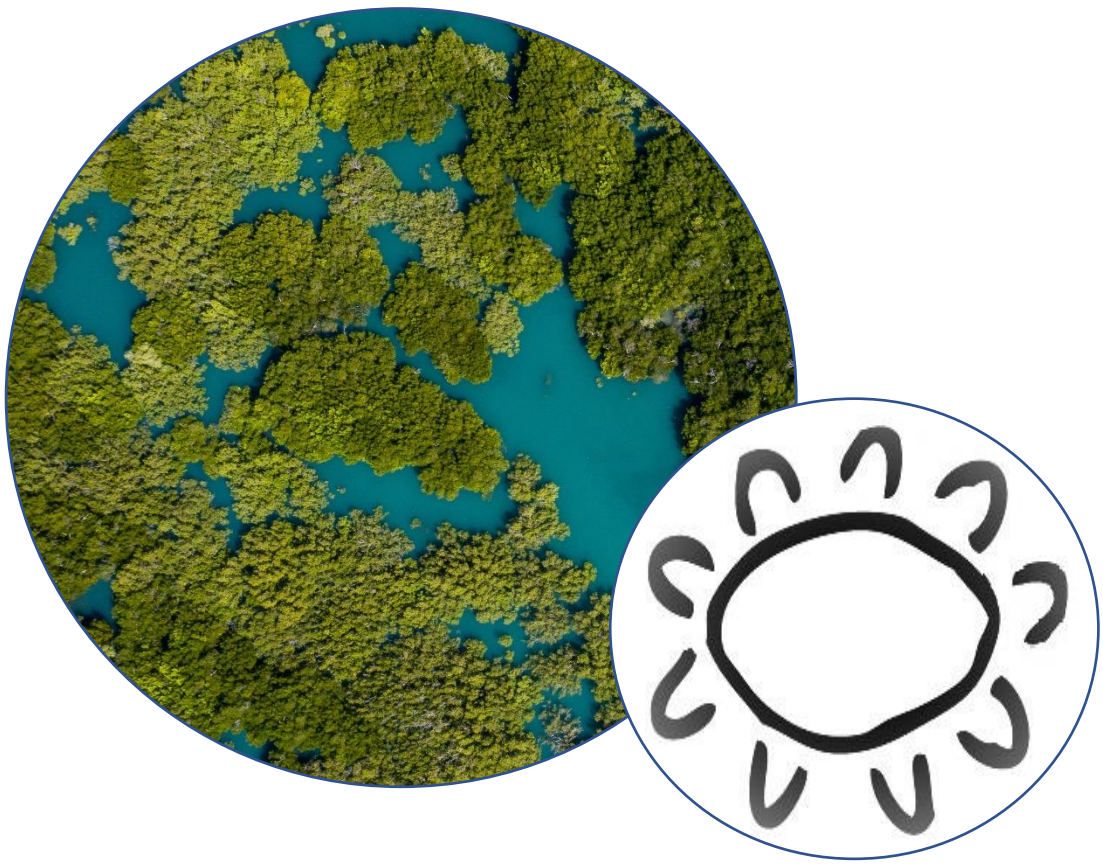
It does not replace or replicate the format or content of the suite of species recovery plans, Sea Country Plans, research papers or legal management instruments that focus on the conservation and management of dugong and sea turtle.

Instead, the initiative uses the knowledges represented by each of these products to build a regional, long term, partnership approach to species conservation and management, designed and led by Kimberley Indigenous saltwater managers.

The Kimberley supports nationally significant nesting and resident turtles that are ecologically and genetically linked to other parts of Australia, hence the success of this plan supports the success of national and international management approaches for these universally valued marine species.

This document is intended for use by the Kimberley Indigenous Saltwater Advisory Group (ISWAG) as a tool to both guide activities and as a resource to attain funding to implement activities. As such, the content is deliberately repetitive within sections four and five, allowing the details within each activity area to be extracted and applied to different funding opportunities, while retaining the required investment to Indigenous communities within each.

Given it's intended use by both practitioners and future funders, it uses plain English wherever possible and diagrams to represent concepts.



Background

Cultural knowledge

Turtle and dugong living in the Kimberley have very high cultural and conservation significance. They live and move between the traditional Sea Country and native title determination of numerous Indigenous communities along the length of the Kimberley coastline. They are key foci of all Kimberley saltwater Country plans[i].

Traditional Owners have had cultural responsibilities, relationships to, rights and custodianship of these species in their Sea Country since time immemorial. They share several millennia of accumulated knowledge about these species, their habitat, use and cultural values. The value of these cultural connections, traditions, practices and knowledge systems to the long term health and sustainability of these species cannot be overstated.

Western Science also has a wealth of detailed knowledge about these species and their habitats developed over decades of in depth research and observation. In recent years, western scientists and Indigenous communities have partnered in several key research projects in the region.

Conservation and Management

In contemporary Australia, sea turtle and dugong are subject to a complex range of different policy and planning frameworks. In the Kimberley, individual animals going about their normal lives may travel across several different management zones within state and commonwealth waters, each affording them different levels of protection under different management arrangements.

For example, they may live or traverse areas of ocean and coast vested with the Western Australian or Australian (federal) governments. State waters in the Kimberley are largely covered by State Marine Parks, with most managed under joint management plans. Each state marine park has its own detailed park management or joint management plan, providing varying levels of habitat protection through an assortment of management zones. Australian (federal) marine parks[ii] are also broken up into different management zones, affording different levels of habitat protection as described within Northwest and Northern Network Management Plans.

Like many marine creatures, these iconic species face increasing pressures and threats on land and sea. In the Kimberley, threats can be local or may be experienced across the whole region. At the coal face of implementing management actions to address these threats are Indigenous rangers, operating with the support of their communities, government agencies and in many places, their joint management bodies. The experience of Kimberley Indigenous rangers in science and management relevant to these species has increased dramatically over the last decade, most recently through participation in around twenty separate marine science research projects[iii].

KISSP

One of these projects was the Kimberley Indigenous Saltwater Science Project (KISSP) producing a number of key products that have evolved best practice saltwater science in the region. It also pre-empted the formation of ISWAG, the peak Indigenous saltwater science and management advisory group in the region.

Through KISSP and subsequent work, ISWAG looked carefully at the saltwater management priorities of their communities, through community consultation and an array of Sea Country Plans. Shared by all groups is a recognised need to manage and protect the turtle and dugong that live in and pass through their saltwater Country. Given the regional nature of these species, the costs of doing

science in the region, the opportunity that ISWAG provides for cost-effective coordinated management and the strengthened partnerships with science and government , the group recommends a regional approach to species and habitat management.

This plan

With investment from DBCA and WAMSI in 2018, ISWAG commenced work on the initiative. The group proposed the development of an implementation plan that builds on the existing strengths and partnerships and allows us all to work together towards shared priorities.

The plan would respond to the needs and aspirations of Traditional Owners; utilise Western Science and Indigenous knowledge to identify and fill gaps in our understanding relevant to important management questions; improve regional adaptive management practices; allow for greater efficiency of research and monitoring data collected; help key stakeholders to see how their work fits with the work of other partners; prevents duplication; enables better knowledge sharing; and where resourcing is the limiting factor, for the project plan to be used to seek support and funding for research, monitoring and management[iv] work from multiple sectors.

The following key outcomes sought from implementation of the plan include:

- Management strategies and outcomes aligining with Indigenous aspirations to manage and protect these species and their key habitat.
- Ranger and Traditional Owner groups coordinating their dugong and turtle science and management with state and federal science and agency support for regional outcomes.
- Research and monitoring projects developed collaboratively with Traditional Owners in State and Commonwealth waters.
- An active and effective knowledge sharing network between stakeholders for better management outcomes.
- Prioritised, costed management actions supported by state and federal government agencies with responsibilities for these species and their habitat.
- Adequate on-ground funds to implement strategic turtle and dugong management activities in the Kimberley.
- Well informed decisions being made regionally across the Kimberley about turtle and dugong management.
- Kimberley saltwater communities supported to develop sustainable harvest frameworks.
- Indigenous knowledge, rights and responsibilities to manage turtle and dugong populations are recognised, valued and supported by state and federal agencies.
- Ongoing opportunity for Kimberley Traditional Owners and other knowledge holders to contribute to state and federal decision making about turtle, dugong and their habitat.
- Resourced ranger development and training allowing Indigenous ranger groups to undertake management as prioritised by their communities.
- Capacity, education and community benefits throughout the project.

What is the Kimberly Turtle and Dugong Initiative?

The initiative is a decadal program facilitating smart investment in Indigenous knowledge, science capacity and two-way knowledge systems required to underpin long-term management approaches for sea turtle, dugong and their key habitat across the Kimberley region, one of the last near-pristine coastal environments in the world.

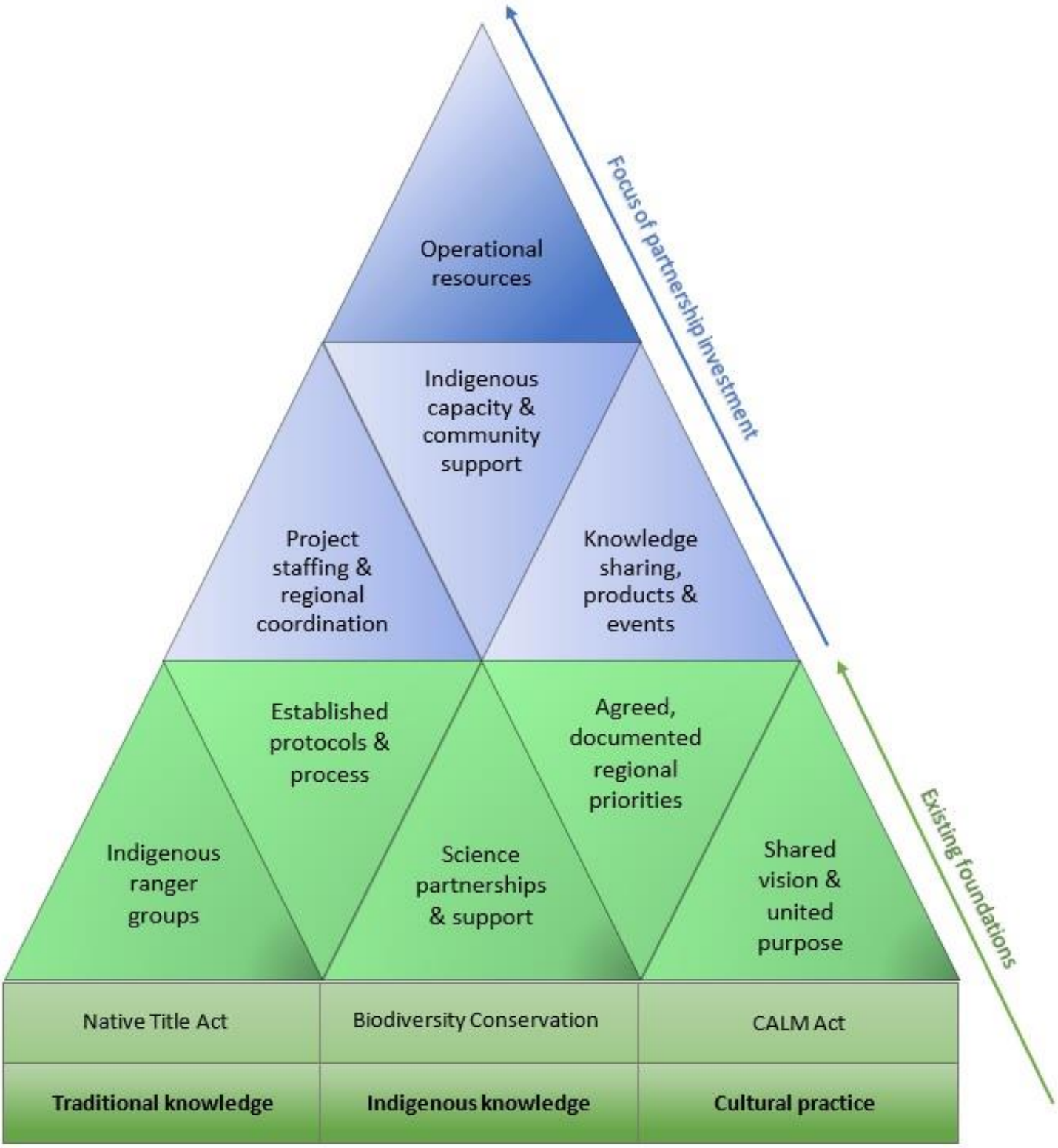
The initiative is based on the collective vision by nine established saltwater native title groups along the Kimberley coastline to work together to ensure sustainable populations of turtle and dugong species into the future.

Above: ISWAG member groups along the Kimberley coastline, their collective vision and intent for the turtle & dugong initiative.

From this vision, we commit to our Statement of Intent for the ten year initiative:

Kimberley-scale science and Indigenous knowledge for the collaborative management of sea turtle and dugong, providing local, regional, national and international benefits for the species and for Indigenous communities over the next 50 years.

The initiative puts into practice a suite of actions that strategically align with Australia's international commitments, native title rights and responsibilities, national species recovery plans, state priories, key Western Science knowledge gaps and local-to-regional Indigenous Sea Country management priorities.



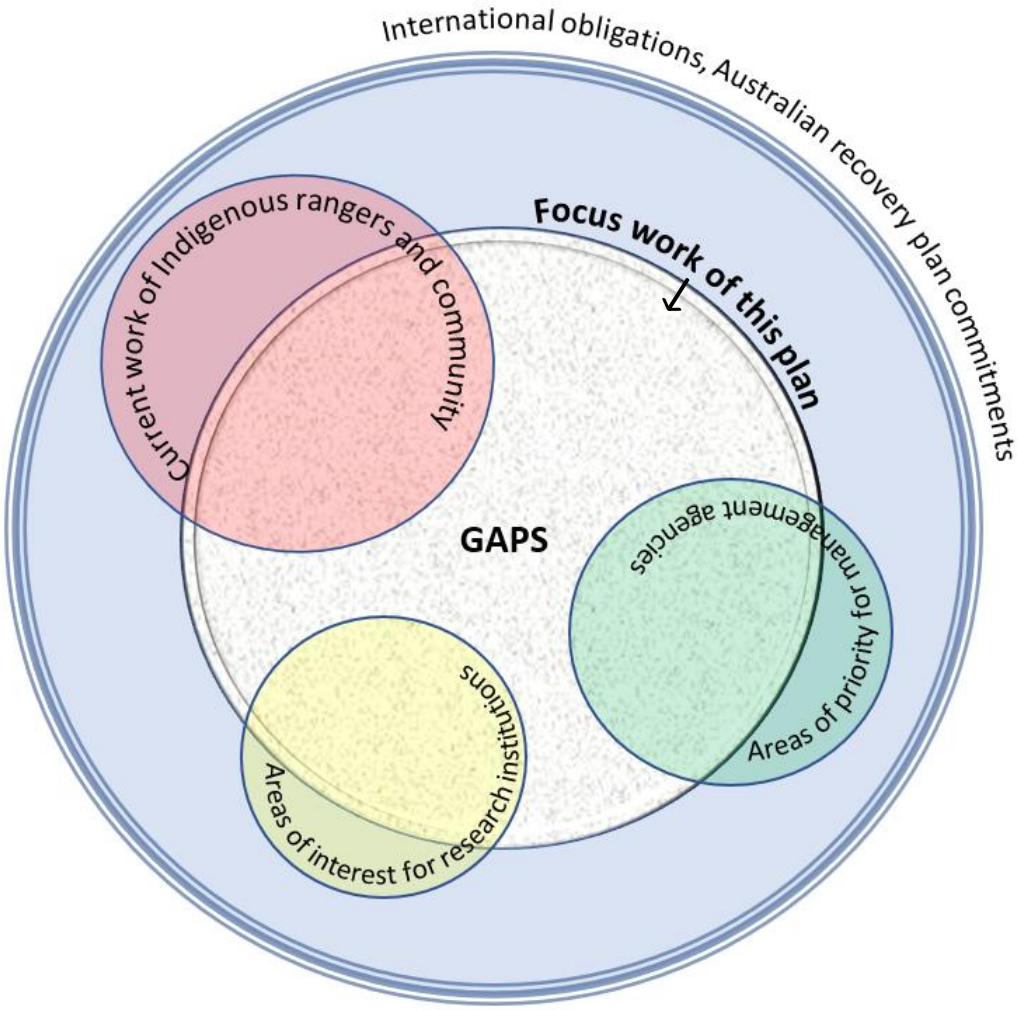
Above: Existing foundations to build from, and core resourcing requirements of the initiative

The initiative offers:

- ✓ Regionally prioritised research and monitoring components and deliverables required over time to fill essential, regional knowledge gaps.
- ✓ Engagement pathways for science and management activities with Indigenous groups.
- ✓ A regular forum for guidance and knowledge sharing between saltwater managers.
- ✓ Strengthened community involvement and capacity building in monitoring and management.
- ✓ Support to Indigenous communities to enhance Indigenous knowledge transmission and retention activities.
- ✓ Support to Kimberley Indigenous communities to ensure sustainable harvesting practices informed by community guidelines and Western Science.
- ✓ Improved career pathways for Kimberley Indigenous youth.
- ✓ A clear model for investment by government, community, philanthropic and industry.

Working with partners, focus and efficiencies

ISWAG recognises the work that is being done by Indigenous ranger groups, Western Science institutions, and state and federal government agencies in this area.



Above: Representation of the way in which stakeholders can contribute to the plan foci work areas

This plan does not seek to replicate, or duplicate these efforts, nor prevent Indigenous communities and their rangers from undertaking turtle and dugong work outside of the identified regional priorities. Instead, it offers a forum where efforts from different contributing bodies can be placed against the regional priorities identified within this plan, gaps identified and resources sought to help address these gaps. It also offers a forum where data collection tools and techniques used by various parties can be discussed and aligned to provide for regional pictures of species and habitat health.

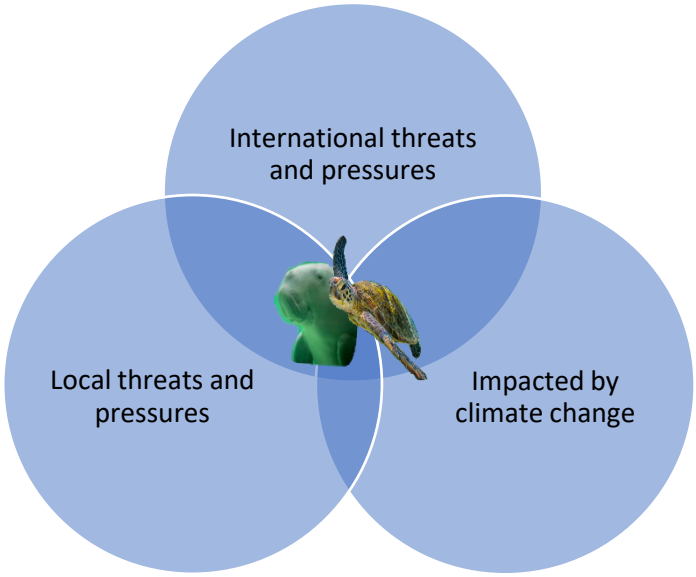
Why is this approach important?

Dugong and sea turtles are loved and revered around the world. They have remained culturally important animals for Indigenous peoples for tens of thousands of years and their utility continues to support the maintenance of traditional knowledge, laws and practices across the world.

We are all obligated to manage Sea Country to ensure dugong and sea turtle populations are healthy and sustained into the future.

All six species of sea turtles found in Australian waters are listed by the Australian Government as threatened migratory species. They face a daunting combination of threats and pressures from the local to international scale.

Because sea turtle and dugong are long lived, slow to breed creatures, the impacts of today's threats will be felt decades into the future. Climate change is a dangerous threat to these animals which already affects their ability to feed and breed in Australian waters.



Above: The cumulative threats and pressures on sea turtle and dugong give urgency to coordinated science and management initiatives climate change impacts

All Australian sea turtle species and dugong use the Kimberley to nest or calve, forage and move safely along their ancient migratory routes. It is critical habitat for breeding populations, foraging populations and migrating animals.

The management environment of Kimberley coastal waters and deeper oceans has changed in the last decade. Most nearshore waters are covered by jointly-managed state marine parks and most of these share their seaward boundary with federally managed Australian marine parks.

Marine parks play an important role in the conservation and protection of marine species and their habitats. These plans feature turtle and dugong and their key habitat in terms of both natural and cultural values. Management agencies engage with Traditional Owners in the management of parks and their values however, each park is covered by different management plans and composite management zones with different levels of protection, creating a complex management environment.

Further complicating the management of these species are the acknowledged challenges of marine science and management agencies working together across jurisdictions. Although this is slowly improving in the Kimberley at the insistence of Indigenous Sea Country managers, it is not changing fast enough to meet the science, capacity and management needs of sea turtle and dugong.

Kimberley saltwater managers and Traditional Owners have created this plan to take the lead in a regional, coordinated, Indigenous-led collaborative approach to meet these challenges for the next decade. It will fill important regional science and science capacity needs across Kimberley Sea Country for the long term management of dugong and sea turtle species and their key habitat.

Section 2: Delivery structure

Building on strong foundations

This initiative will take full advantage of a depth of experience, knowledge, relationships, capacity and time invested in collaborative science process and management outcomes.

Established steering committee

The initiative will be coordinated by the Kimberley Indigenous Saltwater Advisory Group (ISWAG), the region's peak Indigenous saltwater group. ISWAG is an independent body with representation from nine native title parent groups, providing a mechanism by which researchers and management agencies can engage. The group and its predecessor has a proven history of developing and delivering ground-breaking two-way science products and Indigenous capacity outcomes on time and within budget.

The Kimberley Indigenous Saltwater Advisory group (ISWAG) is both supported by the Kimberley Land Council, the Department of Biodiversity Conservation and Attractions, and the federal Department of Environment; yet remains an independent body responsible to its nine native title parent groups.

In 2017-18 the ISWAG membership took carriage of the Kimberley Saltwater Science Project (KISSP). Funded by the Western Australian Marine Science Institution as part of the Kimberley Marine Research Program, it delivered multiple outcomes and products with regional application and national significance. Beyond the described outputs of this project, the most significant legacy has been our understanding of what can be achieved through a regional, Indigenous-led approach to saltwater science and management, facilitated by regular speaking forums and an annual regional workshop.

At the time of writing ISWAG provides an Indigenous engagement platform for state and federal management agencies including DBCA and Parks Australia, and science institutions such as AIMS and CSIRO. One of its 2021 projects involves the coordination of a regional-scale green turtle genetics project funded by Parks Australia and supported by DBCA turtle scientists.

Above: How the Kimberley Indigenous Saltwater Advisory Group (ISWAG) model works

Governance

The initiative will be coordinated by ISWAG using its established and proven governance model. This model is simple and effective: it brings two nominees from each of nine saltwater peoples together regularly to talk, share, develop strategic approaches to best practice management of shared values and threats across the Kimberley region.

The group's authority is the cumulative authority of member group representatives to implement Healthy Country Plans and related saltwater science and management initiatives as described by strategic plan endorsed by all member groups. This approach maintains support from Kimberley saltwater communities, respects local Indigenous governance structures and supports the ongoing decision-making practices of our communities. ISWAG's parent Aboriginal Corporations remain the overarching authority for approval of research partnerships, policies, Future Acts, etc.

The well-established foundations of our governance model are strong leadership from our members, Indigenous saltwater ranger groups operating with authority of their native title communities, and strong Indigenous corporations with commitment, trust, vision and investment in the model.

The strategic plan (overpage) and terms of reference which guide ISWAG activities provides the group with a clear remit. The turtle and dugong initiative addresses a specific objective within the strategic plan:

"Facilitate a regional migratory species project with saltwater managers and collaborators across the Kimberley"

ISWAG Strategic Plan 2018-2023, Key Objective #4

ISWAG is actively supported by peak Indigenous bodes in the region including the Kimberley Land Council and Nyamba Buru Yawuru, as well as local, state and national government departments and science collectives. Representatives of these bodies attend ISWAG's annual workshops and regular phone meetings by invitation, contributing to the collective knowledge needed for decision making.

The ISWAG model appears to be unique in Australia. A grassroots, Indigenous-led initiative with direct contact to communities, which drives policy change and provides a strong and direct link for engagement with decision-makers and research bodies.

Kimberley Indigenous Saltwater Advisory Group (ISWAG)			Strategic Plan (2018 – 2023)
2028 Vision	A network of empowered Indigenous saltwater managers across the Kimberley		
Purpose	Provide a regional network to empower Kimberley saltwater managers to implement their Healthy Country Plans through collaborative research, policy and management.		
Focus Areas	Sharing experiences and best practice between saltwater managers	Facilitating collaborative regional projects and fee-for-service opportunities	Assisting saltwater managers to assert their authority for country and regionally
Objectives	1. Convene the ISWAG Annual Forum to share science and knowledge opportunities 2. Coordinate regular discussions between our remote members on saltwater topics using technology 3. Convene topic specific forums on a fee for service basis, as appropriate	4. Facilitate a regional migratory species project with saltwater managers and collaborators across the Kimberley 5. Facilitate specific fee-for-service opportunities aligned with Healthy Country Plans 6. Explore potential regional collaborative projects aligned with our shared priorities	7. Provide regional saltwater country advice and a conduit to PBCs for the Australian Marine Parks in the North West and North Networks with Parks Australia 8. Provide regional advice on best practice for consistent joint management of State Marine Parks with DBCA 9. Integrate Indigenous knowledge and management practices into Kimberley marine conservation and management through the KISSP products 10. Engage in the State Marine Blueprint initiative
Supporting Strategies	11. Ensure healthy relationships with Traditional Owners, Parent Aboriginal Corporations and other stakeholders	12. Maintain effective and resourced leadership and secretariat positions with supporting systems and processes	

Above: extract from the ISWAG Strategic Plan 2018-2023

Membership

To achieve described objectives, ISWAg's membership is drawn from nine Kimberley saltwater groups, representing Indigenous interests in saltwater science and management of over 90% of the Kimberley coastline.

Members are the two nominated representatives from each ISWAG member native title group: Balanggarra, Wunambal Gaambera, Dambimangari, Mayala, Bardi Jawi, Nyul Nyul, Yawuru, Karajarri, Nyangumarta. Membership may be offered to additional native title holders at the discretion of ISWAG on a project basis and/or to complete the representation of saltwater groups along the Kimberley coastline.

Above: the ISWAG team and partners at the 2019 turtle workshop, Broome

Financial management

ISWAG is, by design a non-incorporated body operating without the administrative burden of running an independent corporation. This allows members to concentrate on the business of looking after Sea Country.

For our financial management requirements, we utilise well-respected, proven and established Indigenous corporations who operate within the Kimberley to receive, administer, and report on the expenditure of funding received on behalf of ISWAG. This service is audited and is resourced through the application of a standard administration fee on all funds received.

The financial management of the initiative will be run in the same way. We enjoy the ongoing support of two peak Aboriginal organisation with well-established administrative and financial management branches for this service: the Kimberley Land Council and Nyamba Buru Yawuru.

Indigenous saltwater research protocol

Kimberley Indigenous Saltwater people are in a unique and enviable position of having established Indigenous research processes, principles and tools. These will be used by partners to inform the way in which collaborative research is done, and as the basis for assessment criteria by the steering group and community members.

Developed by ISWAG members through the Kimberley Indigenous Saltwater Science Project (KISSP) in 2017, it has since been used by saltwater Kimberley communities to guide scientists in how to respectfully approach collaborative research with Traditional Owners on Kimberley saltwater Country before, during and after research activity. The protocol includes an on-line registration and application form, sent directly to the relevant healthy country managers upon submission, for consideration by their local Aboriginal Corporation.

The process was designed with the intent to ensure 'free and prior informed consent', and to work towards collaborative or two-way research bringing together Indigenous knowledge and science with Western Science. Considered best practice by the Indigenous people of the Kimberley, it supports Indigenous land and sea management while also meeting the needs of Western Science partners and managers.

Above: The main phases of collaborative science on Kimberley Saltwater Country, extract from the Guide for Researchers V 17.01

Indigenous community priorities

The basis for this initiative lies within the Sea Country plans (Healthy Country, Indigenous Protected Area and Joint Management Plans) of nine native title groups with rights and interests along 90% of the Kimberley coastline. These plan express Indigenous community priorities around the health of their Sea Country, its cultural value and the capacity to manage it sustainably. Across the plans, turtle, dugong and their key habitat remain high priorities for knowledge, use, connection and management activities.

Above: Representation of the range of Kimberley Sea Country Plans

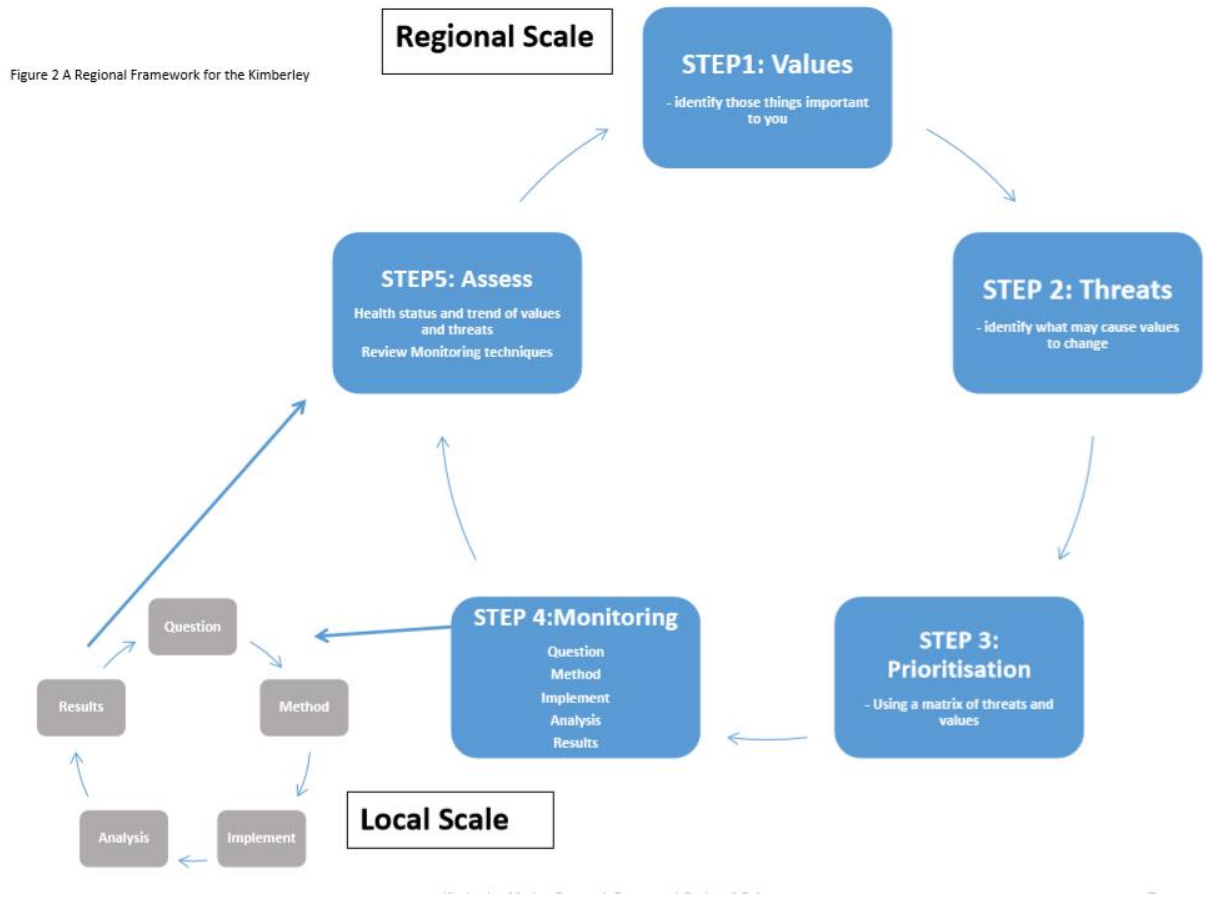
Monitoring framework

In 2017 the KISSP steering group oversaw the development of the saltwater monitoring framework, designed to make sure that monitoring data collected by ranger groups was done consistently and would develop standardised, regionally comparable data.

The framework aimed to:

- Review current monitoring methods
- Identify regional priorities
- Accommodate both Indigenous knowledge and Western Science based techniques
- Provide a gap analysis to inform future research and development of monitoring techniques

The result is a conceptual model which rolls up locally collected monitoring data, based on a specific management or interest question, into a regional picture of health. This framework and associated toolbox of Indigenous and western monitoring techniques are foundational products to the initiative and inform the selection of monitor tools and techniques (see Appendix 8).



Above: Regional monitoring framework for the Kimberley: extract from the KISSP monitoring framework

Guidelines for collaborate knowledge work

In 2017 the steering group oversaw the development of the Guidelines for collaborative knowledge work on Kimberley saltwater Country. The set of twenty guidelines will inform the collaborations arising from the initiative.

Stage of Collaboration	Alignment with Multiple Evidence Base Approach	Guidelines
Setting Up	1. Establishing dialogue & mobilising knowledges 2. Planning for an enriched picture	1. Build relationships and get local people involved 2. Empower Indigenous & intercultural institutions 3. Two-way free, prior & informed consent (FPIC) 4. Build & maintain two-way communication 5. Start with equity between knowledges
On Country	3. Building the knowledge base	6. Recognise Traditional Owner authority. 7. Follow protocols for entering, being on, and leaving Country 8. Include *all* knowledge holders 9. Include young people 10. Use local languages 11. Build balanced teams 12. Deliver training both ways 13. Stick to the plan!
Making New Knowledge	4. Analysing, interpreting & communicating	14. Use and store information properly 15. Interpret results together 16. Present achievements together 17. Make outputs accessible to all 18. Facilitate community feedback 19. Share benefits equally 20. Plan for the future together

Above: Twenty guidelines informing roll-out of the turtle & dugong initiative: extract from the Guidelines for collaborate knowledge work.

The multiple evidence based approach

At the same time as the guidelines were developed, a conceptual model of how to bring two knowledge streams (Indigenous and Western Science) together with a research project, was created. Called [Mobilising Indigenous Knowledge for the Collaborative Management of Kimberley Saltwater Country], this work gives ISWAG and partners a conceptual model to co-develop new knowledge that is respectful of different cultures, ways of doing and priorities. This way of looking at collaborative science gives opportunity for a raft of co-benefits from science projects, for all collaborators.

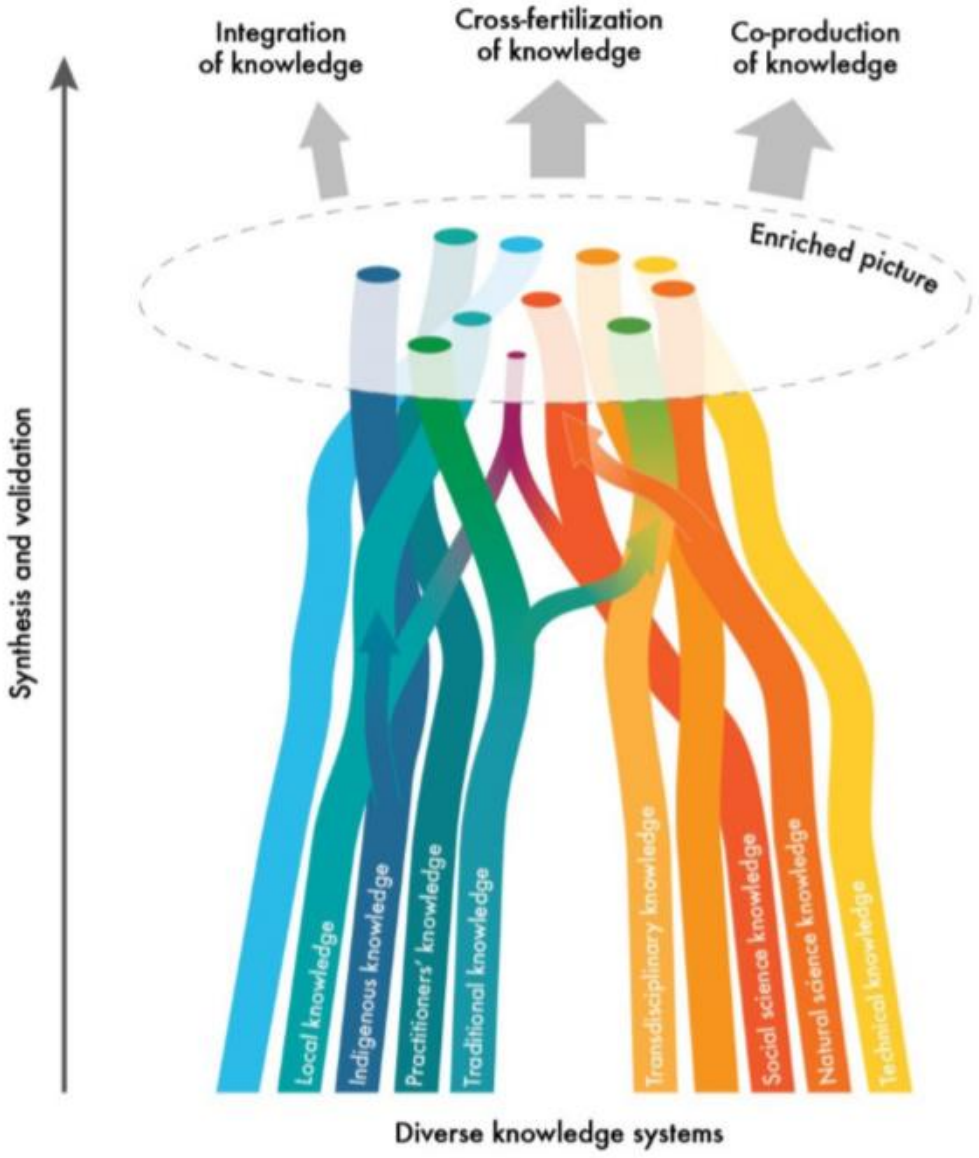


Figure 1. Illustration of multiple evidence base approach (Tengo et al. 2014).

Above: The multiple evidence based approach, abased on Tego et al.: extract from Mobilising Indigenous Knowlegde reoprt

Partnerships

The involvement of Western Science specialists from key science and management agencies across each key value work area is critical to the long term success of project objectives and collaborative process. Since science is subjective, publishing competitive and science knowledge iterative, champions and partners are needed from a diversity of institutions and organisations with a view to long term, mutually productive relationships.

The recommended model is two to three people, spanning two or three different science bodies with participation in one or more key value work areas. This allows a diversity of views and a measure of succession for mobile science careers. Limiting the number will also prevent imbalance by any particular science and management partner as well as allowing good space for effective two-way conversations. A project of this breadth will also require a pool of specialists who are willing to take phone calls and emails to provide advice on particular topics.

Western scientists specialising in the following areas are needed:

1. Seagrass ecology and biology
2. Reef ecology and biology
3. Turtle ecology and biology
4. Dugong ecology and biology
5. Remote sensing and mapping of benthic habitats - reef, seagrass
6. Genetics - genomes & isotope analysis
7. Social science – cross cultural & participatory knowledge processes

A network of science specialists has been developed in support of this plan, by building on existing relationships between a number of key Western Science specialists and Kimberley saltwater communities across all seven specialty areas. Key marine science institutions and management agencies who have supported the development of this plan and have expressed interest in supporting its outcomes include:

- Department of Agriculture, Water and the Environment - DAWE
- Parks Australia
- Australian Institution of Maine Science - AIMS
- Commonwealth Scientific Industrial and Research Organisation – CSIRO
- Department of Biodiversity, Conservation and Attractions – DBCA
- James Cook University – JCU
- University of Western Australia – UWA
- National Environmental Science Programme – NESP

Monitoring, evaluation, review and improvement

Monitoring, evaluation, review & improvement (MERI) is an important component of the initiative, providing space and time for reflection and application of adaptive management measures.

In the initiative, MERI will focus on the work that is being done, the approach to delivering a regional initiative, how the new knowledge being developed translates to improved outcomes for people and Country, and appropriate collaborative science processes.

Undertaking MERI will be done through a range of processes including those producing more familiar datasets as well as social science indicators, based on how community members are feeling about the work and how it is being done.

Components of the monitoring & evaluation approach:

Quarterly reporting

- Quarterly reporting to the steering group via the project manager by each Indigenous ranger group (or as aligned with existing reporting schedules for efficiency) on work done that quarter, the data contributed to a secure, central database; and expenditure summary.
- Quarterly financial statements utilised by Project Manager to monitor actual expenditure against projected expenditure per project area and participating group.

Annual

- Annual review of project progress against objectives by the steering group at annual forums based on the priority areas of science knowledge, science capacity and livelihood outcomes, and success criteria.
- Annual science return of the data collected and a summary of derived meaning at annual forums.
- Annual financial reporting to project steering group members including summary of expenditure against activities, resource allocation and alignment to projected expenditure models.
- Annual summary report of all review data by the data manager to the steering group, relevant project partners and funders.

Three year phase milestone

- Community member interviews towards the end of each three year project phase with on ground assistance from local Indigenous rangers and project staff, using established participatory techniques and with assistance from a respected social scientist (development, training and analysis).
- Major progress report including all of the above monitoring & evaluation datasets, assessed against project objectives, process, capacity and science outcomes.

Ten year initiative

- A decadal major report bringing together all aspects of the initiative released at a major, regional celebration event.

Section 3: Key values and activities

In this section we present the full range of knowledge and capacity activities as they relate to the key natural-cultural values of the initiative: dugong, turtle (green and other species), seagrass and macroalgae, reef systems, and mangrove.

Because this initiative takes a regional approach to species management for effective and efficient knowledge work, it is important to note that not all activities listed will be done by all participating Indigenous groups. The initiative accounts for differences between Indigenous communities, their remoteness, needs and capacities.

We also acknowledge that rapidly evolving technology will likely improve data collection efficiency and decrease data processing effort. While it is critical to maintain standard types of data being collected and to support Indigenous people to maintain local monitoring outcomes by regularly accessing their saltwater Country, it may be possible to adjust the tools and methods used to gather and process this data.

Delivery will take a pragmatic approach accounting for the seasonal, logistical and work program restrictions on Indigenous rangers groups in the Kimberley.

About the blue text in this section

Project activities unique to each species and habitat type are set out in black text. Activities common to all of these areas are described in blue text. All science work will need to be underpinned by investment into these foundational areas of project staffing, knowledge sharing, community involvement and regular forums which facilitate an Indigenous coordination of the initiative.

These foundations of any and all components of the initiative are key success criteria and will be reflected within the monitoring & evaluation, review & improvement processes. This will ensure a wholistic approach providing multiple benefits to the marine environment and its saltwater people.

Key value: Seagrass & macroalgae

Why is it important?

- Important cultural value
- Indigenous livelihood value
- A foundational marine ecosystem
- Stores significant amounts of blue carbon
- Provides key habitat for megafauna

What types of knowledge do we have about seagrass in the Kimberley?

- Generational and contemporary Indigenous knowledge about the values, uses and interconnectedness (ecological, hydrological, terrestrial, cultural) of seagrass systems.
- Western and Indigenous understandings of seagrass being the basis for entire food chains, depended on by marine fish, mammals, reptiles and more.
- The importance of seagrass to dugong, i.e. *Where there are dugong there is seagrass*. We understand that dugong prefer some types of seagrass more than others (palatability and nutrient content varies) and although it grows rapidly under the right conditions, it can be consumed by dugong just as fast.
- Specific knowledge from research projects on seagrass in the Kimberley, and about seagrass more generally. For example, seagrass meadows store vast amounts of 'blue' carbon in the soil beneath.
- National map-based information about Australia's marine environment including seagrass distribution maps and predictive models at a variety of scales.
- The relationship between water quality and health and growth of seagrass. It is susceptible to ocean warming (for example the 30% loss of seagrass in Shark Bay in 2011).
- It 'moves' from year to year on local scales as it establishes and re-establishes, particularly in the northern Kimberley.
- An understanding that Kimberley species are adapted to extreme diurnal temperature ranges in intertidal areas, and the implications of this in the context of climate change.
- Seagrass exists within both state and federal waters, largely within jointly managed marine parks.

Where does the knowledge come from?

- Generational traditional knowledge of the values, locations, changes, importance and use of seagrass by people and marine species.

- Contemporary Indigenous knowledge about the ecological, hydrological, terrestrial and cultural interconnectedness of seagrass systems.
- Local Indigenous observations providing long term, localised monitoring information and an early-warning inidcation of change.
- A range of research projects has given us specific knowledge around seagrass in the Kimberley and about seagrass more generally (for example, WAMSI projects, global models).
- Open data repositories such as Atlas of Living Australia, Integrated Marine Observing System, Pawsey Supercomputing Centre and the Australian Ocean Data Network.
- Predictive models of seagrass occurrence (UNEP seagrass model at global scale; and AIMS model for Australia, in development).
- A localised, long term program of monitoring of intertidal seagrass meadows in the southern Kimberly (Seagrass Watch, Roebuck Bay).

What are the current, regional knowledge gaps for Kimberley saltwater people?

- We have a limited understanding of the spatial extent of intertidal and subtidal seagrass meadows across the Kimberley:
    - Where does seagrass occur across the Kimberley (subtidal and intertidal)?
    - Is the net coverage of seagrass in the Kimberley stable over time? If not, why?
- How healthy is seagrass across the Kimberley (measured over time)?
- What areas of seagrass are most important for turtle and dugong (and if that changes, why)?

How can we collaboratively address these priorities and build long-term Indigenous capacity in marine science?

1) Build Indigenous capacity

a) Build technical proficiencies and cross-disciplinary knowledge required for Sea Country knowledge work by Indigenous rangers in partnership with Western Science partners.

b) Support the educational outcomes of existing and future Indigenous rangers and scientists for long-term outcomes for Kimberley Sea Country and people.

c) Raise local community understanding of the two-way science work on their Sea Country; its importance, the role of rangers and the new knowledge being made.

d) Engage local Sea Country experts in the process of collaborative science to foster community support of sustainable practices and create pathways to access local Indigenous monitoring data in real-time (e.g., as early warning/sentinel functions).

2) Develop data management systems

a) Collate and summarise existing seagrass knowledge and datasets to ensure research is targeted and monitoring data is regionally comparable.

b) Develop a structured and curated data storage facility, with culturally appropriate data access and sharing standards endorsed by contributing Indigenous groups.

c) Share appropriate data into national data platforms including AODN, Seamap Australia (habitat data), Squidle+ (towed video) and other relevant platforms.

3) Map the seagrass

a) Remote sensing imagery (June-Aug) paired with local Indigenous knowledge, satellite tag information from dugong/turtle and/or ground-truthing to map subtidal and intertidal seagrass and macroalgae at the regional scale.

AND/OR

b) Predictive modelling paired with local Indigenous knowledge, satellite tag information from dugong/turtle, aerial photography and/or ground-truthing to predict subtidal and intertidal seagrass and macroalgae meadows at regional scales.

Ground truthing for either of the above may include by foot or drone for exposed meadows, boat-towed video footage (logistics dependent) or via water quality monitoring.

4) Monitor seagrass condition and coverage

a) Twice-yearly intertidal seagrass monitoring at sites indicative of regional condition in the southern and northern Kimberley, using established western-Indigenous monitoring techniques including Seagrass Watch and Indigenous indicators (e.g., dugong use indicators).

b) Twice-yearly boat-based monitoring of subtidal seagrass (and macroalgae) coverage within known dugong and green turtle hotspots along the Kimberley coastline. Techniques may include collecting & analysing towed-video footage for subtidal meadows, or drop camera work for greater data where time and capacity allows.

c) A representative network of seagrass monitoring sites within State Kimberley Marine Parks using imagery-based and other tools[v].

d) Real-time local Sea Country monitoring knowledge (Indigenous ranges on patrol and other local knowledge holders) as a long-term monitoring dataset and early warning system of change to local seagrass health, extent and coverage; rolling this up into a regional story.

5) Communicate and share new knowledge, at scale

e) Communicate new knowledge to the wider community and Sea Country decision-makers (national).

f) Share knowledge and management implications between partners to ensure science investment provides tangible benefits to people and county (state).

g) Regional coordination and information exchange between Indigenous collaborators and Western Science partners (regional).

h) Knowledge return to Indigenous communities, their local governance bodies, rangers and schools in effective, innovative and culturally appropriate ways (local).

Every knowledge layer brings something to the greater knowledge. Traditional knowledge is the basis though and is extremely important. For us, the cultural link is [also] extremely important …as there are cultural management systems that are not well understood in Western Science. It is important that these are better known to others.

(Kimberley researcher, 2016)

Key value: Kimberley reef systems

Why are they important?

- Contain important natural and cultural values
- Significant livelihood and subsistence values
- Foundational marine ecosystems
- Reliable indicators & vulnerable to climate change
- Key habitat and food source for turtle, fish & shellfish species

What types of knowledge do we have about reef systems in the Kimberley?

- Generational and contemporary Indigenous knowledge about the values, uses and the interconnectedness (ecological, hydrological, terrestrial and cultural) of reef systems.
- A cornerstone of the Kimberley marine environment providing food and habitat for many marine species and seafoods for local communities.
- A range of reef systems are found in the Kimberley, for example rocky reef, macroalgae dominated, coralline algae dominated, soft coral and hard coral dominated reef systems[vi].
- Food sources and key habitat for sea turtles of different species across their lifecycle.
- Specific knowledge from research around reef in the Kimberley and about reef more generally. For example, Kimberley species are adapted to extreme tidal movements and diurnal temperature ranges in intertidal areas.
- National map-based information about Australia's marine environment.
- Coarse scale reef classification scheme and more detailed knowledge of 30 reef systems.
- Vulnerable to and impacted by climate change induced marine heatwaves and acidification.
- Increased public access to Kimberley Sea Country is putting increased pressure on reef systems and the recreational fishing species they support.

Where does the knowledge come from?

- Generational traditional knowledge of the values and use of reef systems by people and marine creatures, how they change and respond to environmental cues.
- Local Indigenous observations providing long term, localised monitoring information, including shellfish harvest and density as a measure of health.
- GIS mapping data for thirty major reef systems and reef classification scheme (ReefKIM).
- Coarse scale (500m resolution) global tropical reef GIS shapefle dataset.

- Open data repositories such as Atlas of Living Australia, Integrated Marine Observing System, Pawsey Supercomputing Centre and the Australian Ocean Data Network.
- A network of annual reef monitoring sites established within state Kimberley Marine Parks in 2020, using imagery-based and other tools.
- Annual monitoring of locally important (natural-cultural) reef areas proving a model of Indigenous-led reef monitoring (Dampier Peninsula group, supported by AIMS).
- Annual intertidal reef monitoring by Indigenous groups in partnership with UWA at two sites (southern Kimberley and Dampier Peninsula).
- Reactive, collaborative emergency coral reef bleaching assessments.
- A range of research projects has given us some specific knowledge about Kimberley reef systems (for example, WAMSI & WA Museum research projects).

What are the current, regional knowledge gaps for Kimberley saltwater people?

- Where do different reefs occur across the Kimberley (accessible mapping)?
- How healthy are reefs across the Kimberley (measured over time)?
- What areas of reef are most important for turtle (and if that changes, why)?

How can we collaboratively address these priorities and build long-term Indigenous capacity in marine science?

1) Build Indigenous capacity

a) Build technical proficiencies and cross-disciplinary knowledge required for Sea Country knowledge work by Indigenous rangers in partnership with Western Science partners.

b) Support the educational outcomes of existing and future Indigenous rangers and scientists for long-term outcomes for Kimberley Sea Country and people.

c) Raise local community understanding of the two-way science work on their Sea Country; its importance, the role of rangers and the new knowledge being made.

d) Engage local Sea Country experts in the process of collaborative science to foster community support of sustainable practices and create pathways to access local Indigenous monitoring data in real-time (e.g., as early warning/sentinel functions).

2) Develop data management systems

a) Collate and summarise existing reef knowledge and datasets to ensure research is targeted and monitoring data is regionally comparable.

b) Undertake a gap analysis of existing IPA and DBCA monitoring programs, and community conversations to identify important any additional monitoring locations, knowledge sharing or capacity outcomes required.

c) Develop a structured and curated data storage facility, with culturally appropriate data access and sharing standards endorsed by contributing Indigenous groups.

3) Map the reefs

a) Remote sensing imagery (June-Aug) paired with local Indigenous knowledge, aerial photography, satellite tag information from turtle and/or ground-truthing (e.g., by foot, drone or drop down camera at times of clear water (logistics dependent), and water quality monitoring) to teach the GIS mapping program what areas of reef look like in aerial photos and use this to create a regional scale map.

AND/OR

b) Predictive modelling paired with local Indigenous knowledge, satellite tag information from turtle and ground-truthing (e.g., by foot, drone or drop down camera at times of clear water (logistics dependent); water quality monitoring) to improve reef system distribution models across the Kimberley.

4) Monitor reef condition and coverage

a) Continuation (and extension where necessary) of existing annual reef monitoring within state marine parks by DBCA and joint managers.

b) Biannual[vii] boat-based monitoring in priority places outside of current monitoring networks (e.g. reef systems of regional significance to turtle, areas of cultural importance) using imagery-based tools during times of clear water.

c) Real-time local Sea Country monitoring knowledge (Indigenous rangers on patrol and other local knowledge holders) as a long-term monitoring dataset and early warning system of changes to local reef health; rolling this up into a regional story.

d) Stomach analysis of carcases available from cultural harvest to inform habitat use.

5) Communicate and share new knowledge

a) Communicate new knowledge to the wider community and Sea Country decision-makers (national).

b) Share knowledge and management implications between partners to ensure science investment provides tangible benefits to people and county (state).

c) Regional coordination and information exchange between Indigenous collaborators and Western Science partners (regional).

d) Knowledge return to Indigenous communities, their local governance bodies, rangers and schools in effective, innovative and culturally appropriate ways (local).

Key value: Mangrove systems (mangal)

Why is it important?

- An important a cultural value
- A foundational marine ecosystem
- Important habitat for green turtle
- Provides defence against coastal erosion
- A blue carbon resource

What types of knowledge do we have about mangrove systems in the Kimberley?

- Generational and contemporary Indigenous knowledge about the values, uses and the interconnectedness (ecological, hydrological, terrestrial and cultural) of mangal systems.
- The value of mangroves to important marine species including juvenile turtle, crab and fish has long been known by Indigenous saltwater communities .
- Widely appreciated for their value as critical fish nursery habitat.
- Specific knowledge from research around mangroves in the Kimberley and about mangroves more generally. For example, the complexities of mangrove habitats in the Kimberley[viii]; and the value of mangroves as a blue carbon storage system more significant than rainforests.
- National map-based information about Australia's marine environment.
- Mangroves protect the Kimberley coastlines from coastal erosion on a broad scale.
- A foundational marine ecosystem in coastal tropical waters around the world.
- Susceptible to ocean level rise and water quality changes form global warming.
- Models of the general location and boundaries of mangrove systems in the Kimberley.

Where does the knowledge come from?

- Generational traditional knowledge of the values and use of mangal systems by people and marine creatures, how they change and respond to environmental cues.
- Local Indigenous observations providing long term, localised monitoring information of mangrove condition.
- Open data repositories such as Atlas of Living Australia, Integrated Marine Observing System, Pawsey Supercomputing Centre and the Australian Ocean Data Network.
- Mangrove health monitoring by a Dampier Peninsula Indigenous Ranger group since 2018.
- Broadscale distribution models available through National Vegetation Information System.

- A range of research projects has given us some specific knowledge about mangrove plants and mangal systems.

What are the current, regional knowledge gaps for Kimberley saltwater people?

- Where do mangroves occur across the Kimberley (boundaries, size, location)?
- What is the condition of mangroves across the Kimberley?
- What areas of mangrove are important for turtle?
- Define the regional nursery value of mangal systems to turtles across the Kimberley.

How can we collaboratively address these priorities and build long-term Indigenous capacity in marine science?

1) Build Indigenous capacity
   a) Build technical proficiencies and cross-disciplinary knowledge required for Sea Country knowledge work by Indigenous rangers in partnership with Western Science partners.
   b) Support the educational outcomes of existing and future Indigenous rangers and scientists for long-term outcomes for Kimberley Sea Country and people.
   c) Raise local community understanding of the two-way science work on their Sea Country; its importance, the role of rangers and the new knowledge being made.
   d) Engage local Sea Country experts in the process of collaborative science to foster community support of sustainable practices and create pathways to access local Indigenous monitoring data in real-time (e.g., as early warning/sentinel functions).

2) Develop data management systems
   a) Collate and summarise existing mangrove knowledge and datasets to ensure research is targeted and monitoring data is regionally comparable.
   b) Gap analysis of existing IPA and DBCA mangrove monitoring programs, and community conversations to identify important additional monitoring locations or capacity outcomes.
   c) Develop a structured and curated data storage facility, with culturally appropriate data access and sharing standards endorsed by contributing Indigenous groups.

3) Map the mangrove forests
   a) Remote sensing or predictive models paired with Indigenous knowledge and ground-truthing (e.g. by land, boat, plane or drone) to improve maps of mangrove occurrence and density/coverage at the regional scale.

4) Do some specific research
   a) Use of mangrove systems by juvenile turtle at accessible sites in the southern, mid and northern Kimberly coastline.

5) Monitor mangrove condition and coverage
   a) Continuation of existing mangrove monitoring within state marine parks by DBCA and joint managers[ix].
   b) Biannual mangrove health monitoring at representative and important sites across the northern, southern and central Kimberley coastline outside of current monitoring networks (e.g. mangal systems of regional significance to turtle, local areas of cultural importance, areas outside of conservation estate), including Indigenous indicators of ecosystem health.
   c) Periodic[x] comparison of mangal systems to ascertain changes in extent and coverage visible from remote sensing maps.
   d) Real-time local Sea Country monitoring knowledge (Indigenous rangers on patrol and other local knowledge holders) as a long-term monitoring dataset and early warning system of changes to local mangrove health; rolling this up into a regional story.

6) Communicate and share new knowledge

a) Communicate new knowledge to the wider community and Sea Country decision-makers (national).

b) Share knowledge and management implications between partners to ensure science investment provides tangible benefits to people and county (state).

c) Regional coordination and information exchange between Indigenous collaborators and Western Science partners (regional).

d) Knowledge return to Indigenous communities, their local governance bodies, rangers and schools in effective, innovative and culturally appropriate ways (local).

"Our knowledge helps the science work because we know for example when we are doing our turtle transects, we already know if it is too windy or too choppy or if the water is too murky to see.

Even when we look from on top we can see which sex it is without catching it. We can tell by the way they swim. Hawksbill swim different to green and flatback. Using that knowledge makes it easier to record the data."

(Kimberley Indigenous Ranger, 2016)

Key value: Green turtle

Why are greens important?

- A primary regional cultural value
- Of international and national value
- Threatened globally and listed in legislation, recovery Plans, International agreements, MOUs
- A long lived, iconic marine species

What types of knowledge do we have about greens in the Kimberley?

- Deep, ancient to contemporary Indigenous knowledge around the connections of turtle with people and culture, livelihoods and spiritual belief.
- Lived Indigenous knowledge around the natural values and ecological connections of green turtle across time, sustainable harvest, seasonality and landscapes.
- Local knowledge of local abundance, behaviour, health, human interactions and harvest.
- Western Science knowledge of life cycle, threats, biology, ecology, diet and movement etc.
- Increasing knowledge based around rapidly evolving genetic sampling of green turtle, including broad information on genetic stocks.
- National map-based information about Australia's marine environment.
- Some data on the movement patterns of green turtle in the Kimberley and neighbouring countries, for example the location of green turtle 'highways' in Kimberley waters.
- Sea turtles are slow to breed, long lived species susceptible to a range of threats to their long term survival. For example, loss of habitat and breeding males and nesting beaches due to climate change.

Where does the knowledge come from?

- Generational local traditional knowledge and strong cultural connections to green turtle by all Kimberley saltwater peoples.
- Local Indigenous observations providing long term, localised monitoring information.
- A range of research projects has given us specific knowledge about green turtle, for example the boundaries of genetic stocks of green turtle and biological information important to sustainable traditional harvest practices in contemporary settings.
- Indigenous ranger monitoring is undertaken by several Kimberley saltwater groups during regular saltwater patrols.

- Open data repositories such as Atlas of Living Australia, Integrated Marine Observing System, Pawsey Supercomputing Centre and the Australian Ocean Data Network.
- Key recovery actions for the species are listed in the Australian government's Recovery Plan for Marine Turtles (see Appendix 2 for basic rookery information).
- Satellite tagging information collected in various places along the Kimberley coastline, at various times, by various Sea Country managers.

What are the current regional knowledge gaps for Kimberley saltwater people?

- Where do our turtles come from and who do we share them with (regionally, nationally and internationally)?
- What are their movement patterns within and outside of our region?
- How healthy are our breeding populations and what impacts them (long datasets)?
- How healthy are our foraging populations and what impacts them (long datasets)?
- Are there changes in the size and abundance of adults and juveniles (long datasets)?
- What is a sustainable rate of traditional harvest in contemporary times and how does this align with current rates of harvest?

How can we collaboratively address these priorities and build long-term Indigenous capacity in marine science?

1) Build Indigenous capacity
   a) Build technical proficiencies and cross-disciplinary knowledge required for Sea Country knowledge work by Indigenous rangers in partnership with Western Science partners.
   b) Support the educational outcomes of existing and future Indigenous rangers and scientists for long-term outcomes for Kimberley Sea Country and people.
   c) Raise local community understanding of the two-way science work on their Sea Country; its importance, the role of rangers and the new knowledge being made.
   d) Engage local Sea Country experts in the process of collaborative science to foster community support of sustainable practices and create pathways to access local Indigenous monitoring data in real-time (e.g., as early warning/sentinel functions).
   a) Support community-based sustainable marine resource use plans and practices in contemporary settings, fostering trust and two-way understanding, using old and new knowledge around green turtle population demographics and health.

2) Develop data management systems
   a) Collate and summarise existing, shareable green turtle knowledge and datasets to ensure research is targeted and monitoring data is regionally comparable.
   b) Develop a structured and curated data and tissue storage facility, with culturally appropriate access and sharing standards endorsed by contributing Indigenous groups.

3) Do some specific research
   a) Use of mangrove systems by juvenile green turtle at accessible sites in the southern, mid and northern Kimberly coastline[xi].

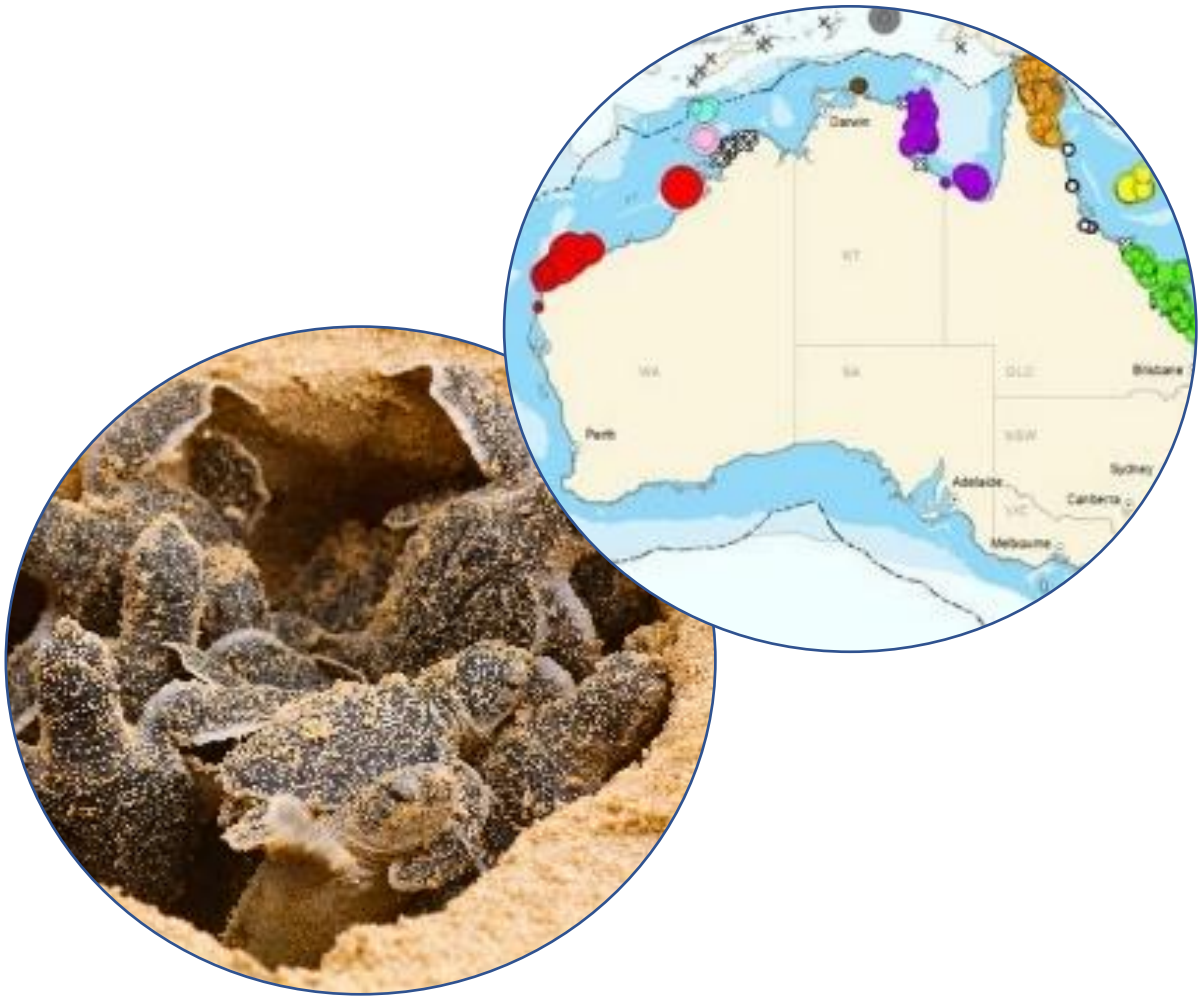
4) Monitor index nesting and foraging populations
   a) Long term (50 years +) annual monitoring of green turtles nesting at the Lacapede Islands, the key Kimberley rookery for our greens (an index site).
   b) Long term (50 years +) annual monitoring of green turtles at several foraging index sites in the southern and northern Kimberley (e.g. Montgomery Reef).
   c) Real-time local Sea Country monitoring knowledge (Indigenous rangers on patrol and other local knowledge holders) as a long-term monitoring dataset and early warning system of changes to local green turtle populations; rolling this up into a regional story
   d) Satellite tracking to identify changes to movement, shared populations, use of key foraging areas and improve the map of green turtle movements across the Kimberley.
   e) Boat based Indigenous ranger monitoring using established practices (e.g. the Wunambal Gaambera/NAILSMA turtle & dugong monitoring technique[xii]).

5) Communicate and share new knowledge
   a) Communicate new knowledge to the wider community and Sea Country decision-makers (national).

b) Share knowledge and management implications between partners to ensure science investment provides tangible benefits to people and county (state).

c) Regional coordination and information exchange between Indigenous collaborators and Western Science partners (regional).

d) Knowledge return to Indigenous communities, their local governance bodies, rangers and schools in effective, innovative and culturally appropriate ways (local).



Key value: Other turtle

Why are other species of turtle important?

- Important cultural values (e.g. traditional harvest of eggs, uses of shell, named in language, dreaming stories)
- International and national value
- Threatened globally and listed in legislation, Recovery Plans, International agreements, MOUs
- Heathy Country Plan values

What types of knowledge do we have about other sea turtles in the Kimberley?

- Deep, ancient to contemporary Indigenous knowledge around the connections of turtle with people and culture, livelihoods and spiritual belief.
- Lived Indigenous knowledge around the natural values and ecological connections of sea turtles across time, sustainable harvest, seasonality and landscapes.
- Local knowledge of local abundance, behaviour health, human interactions and egg harvest.
- The Kimberley is critically important for sea turtles. All seven species of sea turtle found in Australia are found in the Kimberley and each species use different Kimberley waters, islands and shores to move, feed, mate, lay eggs and live freely.
- Different levels of research and monitoring effort have been applied to different species, resulting in a range of Western Science information about their ecology, biology, how they use the Kimberley landscape and what areas are important for them in terms of safe passage, breeding and feeding etc.
- National map-based information about Australia's marine environment
- Key recovery actions for the species are listed in the Australian Government's Recovery Plan for Marine Turtles, 2017 (see appendix 2 for basic rookery information)

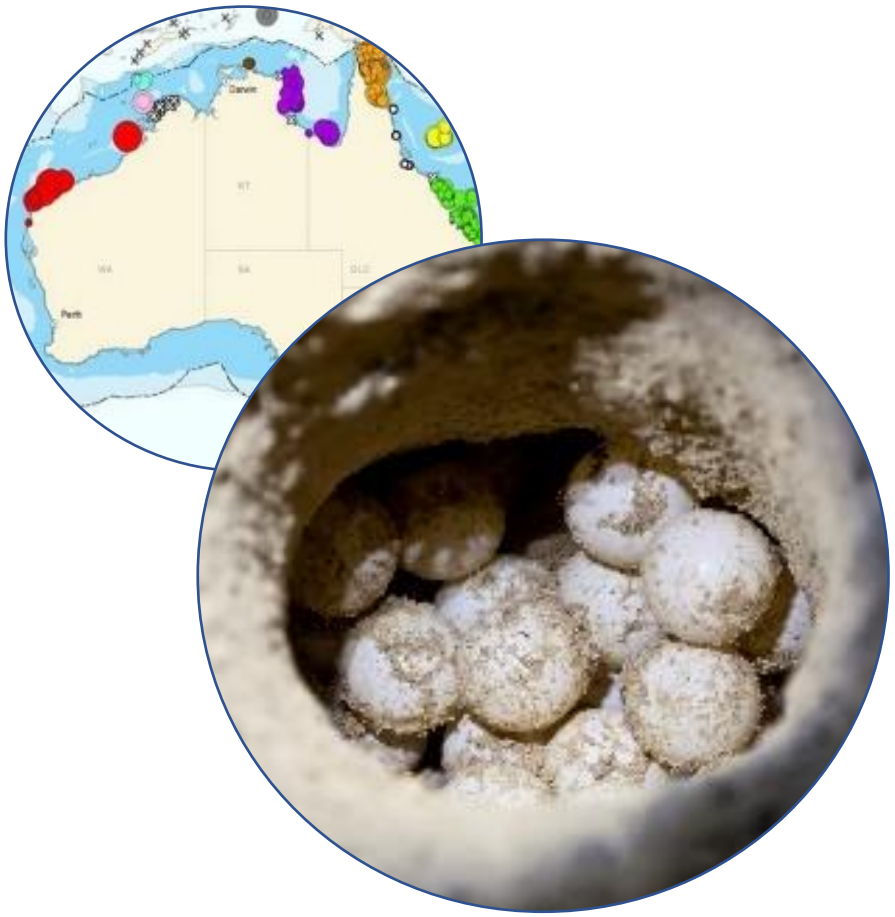
Where does the knowledge come from?

- Generational local traditional knowledge and the cultural connections to turtle species by Kimberley saltwater native title groups.
- Local Indigenous observations providing long term, localised monitoring information.
- A range of research projects within and outside of the Kimberley has given us specific knowledge about different turtle species.

- Indigenous ranger monitoring has been undertaken by some Kimberley saltwater groups during regular saltwater patrols and within collaborative research projects such as the Wunambal Gaambera/CSIRO/NAILSMA boat based survey project[xiii].
- Annual monitoring of flatback populations on nesting beaches has been undertaken by local Kimberley saltwater groups in partnership with DBCA.
- Satellite tagging information collected in various places along the Kimberley coastline, at various times, by various Sea Country users and managers.
- Open data repositories such as Atlas of Living Australia, Integrated Marine Observing System, Pawsey Supercomputing Centre and the Australian Ocean Data Network

What are the current regional knowledge gaps for Kimberley saltwater people?

- Where do hawksbill turtles nest in the northern Kimberley and how healthy are these nesting populations over time (long dataset)?
- What are the long term breeding population health trends of flatback turtle nesting in the Kimberley (some continuing work) and what impacts them?



How can we collaboratively address these priorities and build long-term Indigenous capacity in marine science?

1) Build Indigenous capacity
   a) Build technical proficiencies and cross-disciplinary knowledge required for Sea Country knowledge work by Indigenous rangers in partnership with Western Science partners.
   b) Support the educational outcomes of existing and future Indigenous rangers and scientists for long-term outcomes for Kimberley Sea Country and people.
   c) Raise local community understanding of the two-way science work on their Sea Country; its importance, the role of rangers and the new knowledge being made.
   d) Engage local Sea Country experts in the process of collaborative science to foster community support of sustainable practices and create pathways to access local Indigenous monitoring data in real-time (e.g., as early warning/sentinel functions).

2) Develop data management systems
   a) Collation and summary of existing, shareable sea turtle knowledge and datasets to ensure research is targeted and monitoring data is regionally comparable.
   b) Develop a structured and curated data and tissue storage facility, with culturally appropriate access and sharing standards endorsed by contributing Indigenous groups.

3) Monitor index nesting and foraging populations
   a) Long term (50 years +) annual monitoring of flatback turtle nesting populations along Eighty Mile Beach (existing monitoring program run jointly with DBCA) .
   b) Long term (50 years +) annual monitoring of hawksbill turtle nesting populations on islands and/or beaches in the northern Kimberly (location to be determined by current collaborative research).
   c) Ongoing satellite tracking of hawksbill to identify movement pathways, shared populations, use of key foraging areas in the Northern Kimberley species stronghold.
   d) Real-time local Sea Country monitoring knowledge (Indigenous ranges on patrol and other local knowledge holders) as a long-term monitoring dataset and early warning system of changes to local green turtle populations; rolling this up into a regional story.

4) Communicate and share new knowledge
   a) Communicate new knowledge to the wider community and sea Country decision-makers (national).
   b) Share knowledge and management implications between partners to ensure science investment provides tangible benefits to people and county (state).
   c) Regional coordination and information exchange between Indigenous collaborators and Western Science partners (regional).
   d) Knowledge return to Indigenous communities, their local governance bodies, rangers and schools in effective, innovative and culturally appropriate ways (local).

Key value: Dugong

Why are dugong important?

- A key regional cultural value
- Of local, national and international value
- Red-listed as vulnerable in IUCN Legislation; subject of international MOUs and a specially protected fauna species in state legislation.
- A consistent key natural and cultural value in Kimberley saltwater Heathy Country Plans.

What types of knowledge do we have about dugong in the Kimberley?

- Deep, ancient to contemporary Indigenous knowledge around the connections of dugong with people and culture, livelihoods and spiritual belief.
- Lived Indigenous knowledge around the natural values, sustainable harvest and ecological connections of dugong across time, seasonality and landscapes.
- Local knowledge of local abundance, behaviour health, human interactions and harvest.
- Some Western Science knowledge of life cycle, threats, biology, ecology, diet and movement, for example hotspots maps of dugong occurrence within the Kimberley developed from multiple data sources, and predictive seagrass habitat mapping from dugong data and other models.
- National map-based information about Australia's marine environment.
- The Kimberley provides an important safe haven for dugong and Northwest Australia houses one of the largest remaining populations of dugong in the world.
- Migratory species relying on seagrass, a food source vulnerable to development, human use and climate change.
- Multiple cumulative impacts such as habitat degradation, development pressures and impacts associated with population growth may threaten dugong.
- They can be used as an indicator of ecosystem health, in particular seagrass habitat[xiv].

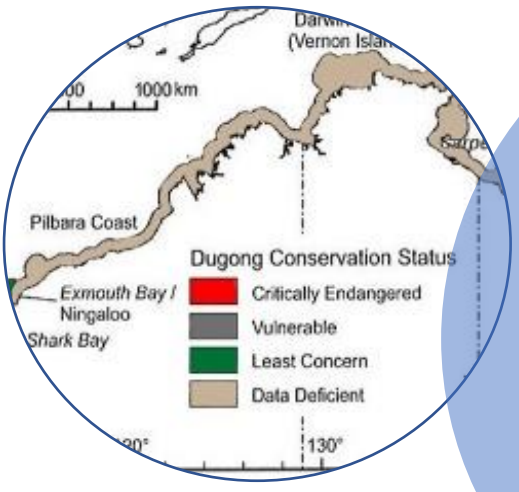
Where does the knowledge come from?

- Generational, localised traditional knowledge and cultural connections to dugong of Kimberley saltwater native title groups.
- Indigenous community observations providing long term, localised monitoring information of dugong.

- Indigenous ranger monitoring has been undertaken by some Kimberley saltwater groups during regular saltwater patrols and within collaborative research projects such as the Wunambal Gaambera/CSIRO/NAILSMA boat based survey project[xv].
- Relatively limited research projects have given us some specific knowledge about dugong (for example the WAMSI dugong report, which produced useful dugong movement and hotspot maps – see Appendix 6).
- Open data repositories such as Atlas of Living Australia, Integrated Marine Observing System, Pawsey Supercomputing Centre and the Australian Ocean Data Network.
- Satellite tagging information collected in various places along the Kimberley coastline, at various times, by various Sea Country users and managers.

What are the current regional knowledge gaps for Kimberley saltwater people?

- What is the population size of dugong in the Kimberley and is it stable over time?
- What is a sustainable rate of traditional harvest given contemporary pressures?
- What are the important calving precincts for dugong on a regional scale?
- What are the most important areas for Kimberley dugong in the wet and dry seasons?
- What are the movement patterns of our dugong within and outside of our region?
- Understanding more about the biology of dugong.



We are working with cutting edge methods, but we relied heavily on traditional knowledge to find the species we were working on. For some of the species we also relied on traditional knowledge to gain a better understanding of reproductive ecology - which is relevant to how we interpret results.

(Kimberley researcher, 2016)

How can we collaboratively address these priorities and build long-term Indigenous capacity in marine science?

1) Build Indigenous capacity
   a) Build technical proficiencies and cross-disciplinary knowledge required for Sea Country knowledge work by Indigenous rangers in partnership with Western Science partners.
   b) Support the educational outcomes of existing and future Indigenous rangers and scientists for long-term outcomes for Kimberley Sea Country and people.
   c) Raise local community understanding of the two-way science work on their Sea Country; its importance, the role of rangers and the new knowledge being made.
   d) Engage local Sea Country experts in the process of collaborative science to foster community support of sustainable practices and create pathways to access local Indigenous monitoring data in real-time (e.g., as early warning/sentinel functions).
   e) Support community-based sustainable marine resource use planning and practice in contemporary settings, fostering trust and two-way understanding, and use old and new knowledge around dugong population demographics and health.

2) Develop data management systems:
   a) Collation and summary of existing, shareable dugong knowledge and datasets to ensure research is targeted and monitoring data is regionally comparable
   b) Structured and curated data and tissue storage facility, with culturally appropriate access and sharing standards endorsed by contributing Indigenous groups

3) Do some specific research
   a) Genetic sampling to estimate population parameters (close kin analysis), genetic relationships and sub populations (mixed stock analysis).
   b) Ongoing satellite tagging to gap fill movement patterns and identify changes to these patterns over time
   c) Research to find out more about the biology of the species and inform management strategies

4) Monitor Kimberley populations
   a) A recurring five year, fixed-wing aerial survey across the Kimberley waters, accounting for seasonality to identity overall coarse-scale trends in abundance and location
   b) Biannual local monitoring surveys within known regional dugong hotspots in the southern, mid and northern Kimberley (e.g. by drone or by boat[xvi]) in the wet and dry season to monitor population health in real time and train the aerial survey data
   c) Real-time local Sea Country monitoring knowledge (Indigenous rangers on patrol and other local knowledge holders) as a long-term monitoring dataset and early warning system of changes to local dugong populations; rolling this up into a regional story

5) Communicate and share new knowledge
   a) Communicate new knowledge to the wider community and sea Country decision-makers (national)

b) Share knowledge and management implications between partners to ensure science investment provides tangible benefits to people and county (state)

c) Regional coordination and information exchange between Indigenous collaborators and Western Science partners (regional)

d) Knowledge return to Indigenous communities, their local governance bodies, rangers and schools in effective, innovative and culturally appropriate ways (local)

Section 4: Addressing shared priorities

This section maps out the links between, and benefits from this initiative to local, regional, state, national and international-scale priorities, commitments, obligations and legislation. It can be used by the ISWAG team to understand synergies with contemporary Western Science priorities and knowledge gaps and to support the development of specific resourcing proposals.

Under each key of the seven key knowledge areas (seagrass, reef, mangrove, dugong, green turtle, other turtle) links to priorities, obligations and commitments at the international, national, state, regional, and local scale are expressed as extracts from a range of key documents. Depending on the value, these may include:

- Links to Australia's international commitments
- Links to Australia's national priorities (where documented)
- Links to Western Australia's legislative responsibilities and plans (where documented)
- Links to regional science and management priorities
- Links to sub-regional and local-scale planning instruments

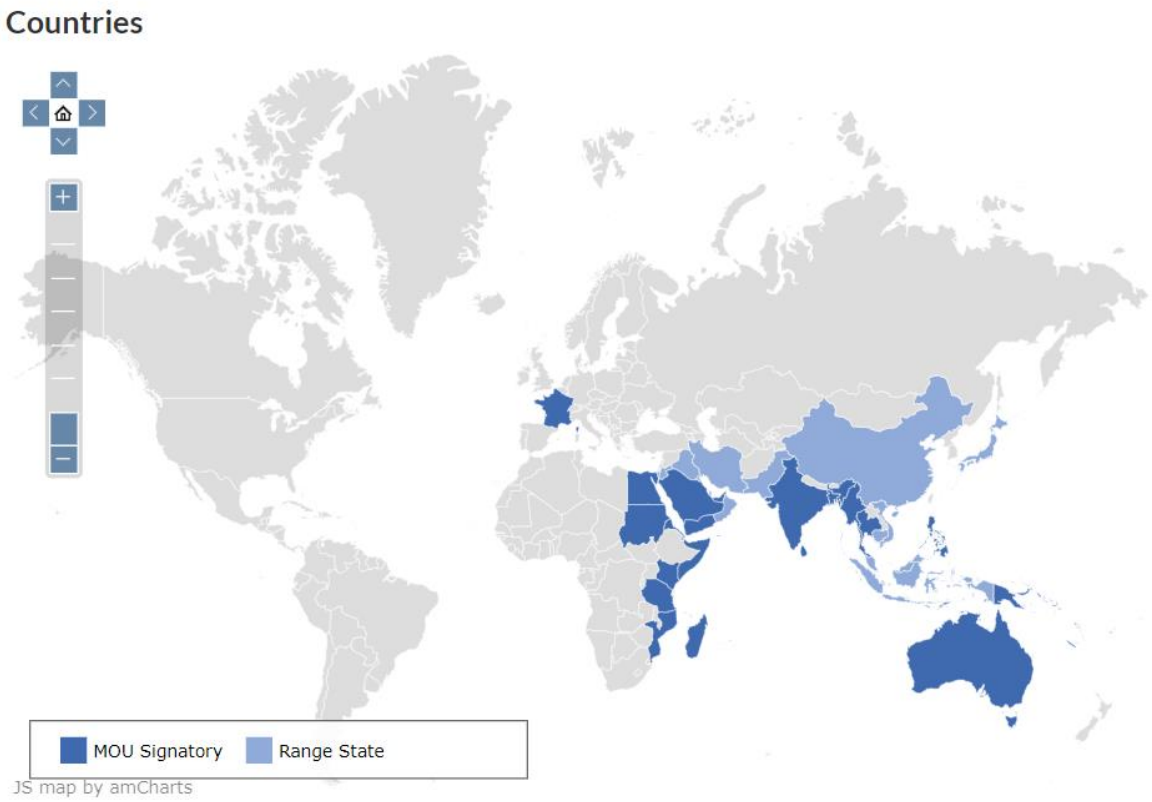
External links to these resources are also provided as in-text references and footnotes throughout.

Shared priority: Seagrass & macroalgae

Links to Australia's international commitments

International MOU

The Memorandum of Understanding on the Conservation and Management of Dugongs (Dugong dugon) and their Habitats throughout their range is '*designed to facilitate national level and transboundary actions that will lead to the conservation of dugong populations and their habitats'*.[xvii] It is signed by over twenty countries within their range, including Australia in 2007 (see map below).



Above: Dugong MOU signatories[xviii]

International Conservation & Management Plan

Conservation and Management Plan for the Memorandum of Understanding on the Conservation and Management of Dugongs (Dugong dugon) and their Habitats throughout their Range

- '*Objective 3 – Protect, conserve and manage habitats for dugong*
  - *Including 3.1 Identify and map areas of important dugong habitat such as sea grass beds*
  - *3.4 Identify and where appropriate, rehabilitate degraded dugong habitats*
- *Objective 4 – Improve our understanding of dugong habitats through research and monitoring*
  - *4.1 Conduct research into and monitoring of important dugong habitats*
- *Objective 6 – Enhance national, regional and international cooperation*
  - *6.2 Develop and implement mechanisms for effective exchange of information*
  - *6.3 Improve coordination among government and non-government sectors and communities in the conservation of dugongs and their habitats*

9.1 Promote capacity building at all levels to strengthen conservation measures'[xix]

Links to regional science and management priorities

Aligned priority research questions arising from the Kimberley Marine Research Program :

- *What is the areal cover of key habitats in the Kimberley region (e.g. mangroves, seagrass), and is it changing?*
- *What is the distribution and temporal variability of seagrass in the Kimberley?*
- *What are the ecological relationships between the population and harvesting dynamics of dugongs and the dynamics of seagrass habitat (biomass, species composition, productivity)? How can this knowledge be used to manage dugong populations (both harvested & unharvested) in the face of external pressures such as increasing development in the region and climate change?*
- *What are the most cost effective tools for Indigenous rangers to map and monitor the distribution of deep water seagrass and nearshore seagrass in the Kimberley Sea Country?*
- *'What is the spatial and temporal use of habitat by dugong populations in the Kimberley, including foraging, calving, mating?*
- *What are the ecological relationships between the population and harvesting dynamics of dugongs and the dynamics of seagrass habitat (biomass, species composition, productivity)? How can this knowledge be used to manage dugong populations (both harvested & unharvested) in the face of external pressures such as increasing development in the region and climate change?*[xx]

Aligned key recommendations from the Kimberley Marine Research Program :

- *Dugong: Monitoring*
    - *A monitoring program for dugong populations and associated seagrass habitat should be designed and implemented in smaller high priority areas at representative sites across the Kimberley, using standardised methodologies (e.g. small boat-based surveys) and, if necessary, trialling new survey methods (e.g. use of drones or helicopters).*
- *Monitoring the Marine Environment: General*
    - *Functional groups and system indicators may respond differently to different climate and development pressures. By the year 2050, the state of some groups (e.g. seagrass, turtles, dugongs) and system indicators may vary dramatically from scenario to scenario, while others (e.g. corals, snubfin dolphins, mammals, mangroves) may show little variation. Groups and system indicators which are expected to be most sensitive to different climate and development pressures should have high priority for long-term monitoring.'*[xxi]

Links to key residual regional knowledge gaps from the WAMSI Dugong report

- *What are the dugong stories told throughout the Kimberley by hunters, elders and the community who wish to share them? The stories capture deep local ecological knowledge and the occurrence of historical events of big changes in dugong distribution and abundance.*
- *What environmental and social factors explain the current regional-scale patterns of distribution and abundance across northern Australia and Torres Strait*
- *What are the ecological relationships between the population and harvesting dynamics (cultural take) of dugongs and the dynamics of seagrass habitat (biomass, species composition, productivity)? And how can this knowledge be used to manage dugong populations (both harvested & unharvested) in the face of external pressures such as increasing development in the region and climate change'.*[xxii]

WAMSI – Recommendations from all KMRP projects (pp152-161):

- *Benthic Biodiversity: Research and Monitoring*
    - *Remote sensing provides a useful and cost effective tool for assessing the presence, extent and changes to key benthic primary producers such as corals, algae and seagrass in intertidal and shallow subtidal waters to identify and monitor habitats, particularly if used at low tide.*
- *Dugong: Monitoring:*
    - *A monitoring program for dugong populations and associated seagrass habitat should be designed and implemented in smaller high priority areas at representative sites across the Kimberley, using standardised methodologies (e.g. small boat-based surveys) and, if necessary, trialling new survey methods (e.g. use of drones or helicopters).*
- *Herbivory: Monitoring*
    - *Some work is still needed to develop methods for monitoring that can be adopted and applied uniformly by Indigenous ranger groups for Healthy Country Plan monitoring, preferably one consistent with current state-of-the-art methods used for monitoring of marine protected areas.*
- *Herbivory: Marine park planning*
    - *Marine plants, especially seagrasses, are important to the diet of Kimberley marine fauna. Notably, seagrass consumption is high, and is a major component of the diet of several herbivores that are important to Indigenous communities as a seasonal food cultural resource (e.g. golden-lined rabbitfish (S. lineatus) and green turtles). Management plans for areas that contain seagrass beds or stands of macroalgae should consider these as Key Performance Indicators.*
- *Herbivory: Monitoring*
    - *Given the important ecological role that seagrass consumers play, monitoring abundances of these taxa is desirable. The imperative for monitoring the abundance of green turtles is also supported by their status as a protected species and their high value in monitoring and management of the Indigenous Healthy Country Plans for the region.*
- *Herbivory: Research*
    - *Studies of the movement of green turtles might help identify seagrass beds and other important primary producer habitats.*
- *Monitoring the Marine Environment: General*
    - *Functional groups and system indicators may respond differently to different climate and development pressures. By the year 2050, the state of some groups (e.g. seagrass, turtles, dugongs) and system indicators may vary dramatically from scenario to scenario, while others (e.g. corals, snubfin dolphins, mammals, mangroves) may show little variation. Groups and system indicators which are expected to be most sensitive to different climate and development pressures should have high priority for long-term monitoring.'*[xxiii]

Aligned key residual regional knowledge gaps from the WAMSI Seagrass & Macroalgae Report (Kendrick et al. 2016[xxiv]):

- '*Seagrass*
    - *For seagrasses we recommend monthly seagrass monitoring to quantify temporal patterns and reveal the likely causes of those patterns.*

    - *We recommend that future seagrass monitoring programs measure seagrass shoot density, biomass and growth rates. We also recommend coupling these measurements with environmental data to better explain the observed patterns in seagrass growth.*
    - *We recommend that future seagrass monitoring also include measurements of reproductive phenology*
- *Macroalgae*
    - *We recommend detailed sampling throughout the wet season, and a monthly sampling program.*
    - *We recommend extending the measurements from Sargassum linear extension to density, biomass and change in biomass (growth)*
    - *We also recommend extending the initial sampling on Sargassum to other macroalgal species, like Turbinaria, Lobophora and Gracilaria.*
- *Microbial processes*
    - *We recommend a more detailed study of microbial nutrient cycling among the major habitats to test if these systems are not phosphorus limited at certain times of the year.*
- *Grazing rates on seagrasses and macroalgae:*
    - *We recommend more tethering experiments monthly or bimonthly across the seasons combined with visual surveys of fish community structure.*
- *Tagging*
    - *We also recommend continued satellite tagging of turtle and that this be extended to dugongs where possible*[xxv].

Links to sub-regional and local-scale planning instruments

Healthy Country and Indigenous Protected Area Plans

The interconnected natural and cultural importance of turtle, dugong and their saltwater habitat are identified within all Indigenous Sea Country plans in the Kimberley region and specified in saltwater and livelihood targets therein:

- Balanggarra Healthy Country Plan 2012-2022

(mangrove, seagrass, reef, turtle, dugong and interrelated customary rights and practices)

- Uunguu Indigenous Protected Area: Wundaagu (saltwater) Indicative Plan of Management 2016-2020 & Wunambal Gaambera Healthy Country Plan

(mangrove, seagrass, reef, turtle, dugong and interrelated customary rights and practices)

- Dambimangari Healthy Country Plan

(mangrove, seagrass, reef, turtle, dugong and interrelated customary rights and practices)

- Mayala Healthy Country Plan

(mangrove, seagrass, reef, turtle, dugong and interrelated customary rights and practices)

- Bardi Jawi Indigenous Protected Area Plan

(mangrove, seagrass, reef, turtle, dugong and interrelated customary rights and practices)

- Nyul Nyul Freshwater Management & Monitoring Plan

(mangrove and interrelated customary rights and practices)

- Karajarri Healthy Country Plan

(mangrove, seagrass, reef, turtle, dugong and interrelated customary rights and practices)

- Nyangumarta Indigenous Protected Area Plan

(mangrove, turtle and interrelated customary rights and practices)

Marine Park and Joint Management Plans

Identified as important vales and as key performance indicators within Kimberley state marine park and joint management plans

- North Kimberley Marine Park Mark Management Plan
- (mangrove, seagrass, reef, turtle, dugong and interrelated customary rights and practices)
- Lalang-Garram Horizontal Falls Marine Park Management Plan & Lalang-Garram Camden Sound Marine Park Management Plan
  (mangrove, seagrass, reef, turtle, dugong, and interrelated customary rights and practices)
- Yawuru Nagulagun/ Roebuck Bay Joint Management Plan
  (mangrove, seagrass, reef, turtle, dugong and interrelated customary rights and practices)
- Eighty Mile Beach Marine Park Management Plan
- (mangrove, seagrass, reef, turtle, dugong and interested customary rights and practices)

Shared priority: Kimberley reef systems

Links to Australia's international commitments

The International Coral Reef Initiative

Australia is a member of the International Coral Reef Initiative which seeks to preserve coral reefs and related ecosystems around the world. It will implement its on-ground strategies through the Global Coral Reef Monitoring Network, which is developing an implementation and governance plan.

International MOU

Australia is a signatory to the CMS Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia (IOSEA MoU). Which aims to facilitate 'national level and transboundary actions that will lead to the conservation of turtle populations and their habitats.'

The objective of this Memorandum of Understanding is to protect, conserve, replenish and recover marine turtles and their habitats, based on the best scientific evidence, taking into account the environmental, socio-economic and cultural characteristics of the signatory States.'[xxvi]

The IOSEA MOU is implemented by a Conservation and Management Plan, including the following extracts:

- *'Objective 3. Improve understanding of marine turtle ecology and populations through research, monitoring and information exchange*
    - *3.1 Conduct studies on marine turtles and their habitats targeted to their conservation and management*
        - *a) Conduct baseline studies or gather secondary information on marine turtle populations and their habitats*
        - *g) Promote the use of traditional ecological knowledge in research studies*
    - *3.4 Exchange information*
        - *d) Disseminate traditional knowledge on marine turtles and their habitats for conservation and management*
- *Objective 4. Increase public awareness of the threats to marine turtles and their habitats, and enhance public participation in conservation activities*
    - *4.2 Develop alternative livelihood opportunities for local communities to encourage their active participation in conservation efforts'.*[xxvii]

Links to Australia's national priorities

National planning instruments

National Recovery Plan for Marine Turtles in Australia

The National Recovery Plan for Marine Turtles in Australia (2017) *'provides for research and management actions necessary to stop the decline and support the recovery of marine turtles so that their chances of long-term survival in nature are maximised*[xxviii].'

Extract of specific relevance, highlighting the ways in which this plan supports the objectives and strategies of the recovery plan are included below:

- *'B2 Understand population demographics at key foraging grounds*
    - *Identify important foraging habitat for flatback, hawksbill and olive ridley turtles and initiate foraging ground studies at key locations'.*

Australian Marine Parks (Commonwealth waters)

North-west Marine Parks Network Management Plan (North-west Network)

Reef habitats are a natural value of the Kimberley Marine Park and vulnerable to identified pressures within the North-west Network Management Plan including climate change, extractive industry, habitat modification, invasive species and marine pollution. Understanding of the importance of these habitats as natural and cultural values, and of the relationship to culturally important species such as turtle and dugong, is limited. Management programs and actions within the Plan, of relevance to this initiative are extracted below:

Indigenous engagement program and actions that recognise and respect the ongoing cultural responsibilities of Indigenous people to care for Sea Country and support multiple benefits for traditional owners. North-west Network specific actions include:

- *'collaborate with traditional owners, Indigenous ranger groups and relevant partners to undertake marine park management such as surveillance, monitoring and threat mitigation including marine debris removal, and implement actions identified in Sea Country plans where applicable*
- *identify opportunities and mechanisms to engage traditional owners and Indigenous rangers in the management of marine parks,*
- *increase understanding of traditional knowledge, map cultural values and manage culturally significant sites*
- *establish research protocols in association with traditional owners, like those in the Collaborative Science on Kimberley Saltwater Country - A Guide for Researchers'* [xxix]

Marine science program and actions to provide necessary scientific knowledge and understanding of marine park values, pressures, and adequacy of responses for effective management. National and North-west Network specific actions include:

- *'establish ecological, social and economic baselines to support evidence-based decision-making and adaptive management (National)*
- *collaborate with the science community (including through the National Marine Science Committee and the National Environmental Science Program) and other marine park users to assist in improving the understanding of marine park values, pressures and management effectiveness (National)*
- *collaborate with the science community and other government agencies to increase the use of innovative and effective technology and systems including sensor technology' (National)*
- *monitor social and economic uses and their benefits and impacts on marine parks in the Network (Network)*
- *monitor the condition of important habitats such as reef systems at Ningaloo, Mermaid, Kimberley, Ashmore and Cartier Marine Parks, and their vulnerability to climate change (Network)*
- *collaborate with other Commonwealth and state government agencies, marine park users and the science sector to support long-term monitoring'* [xxx]

Links to regional science and management priorities

Aligned key recommendations from the Kimberley Marine Research Program (pp152-161):

- *'Geomorphology: Marine park planning*
    - *A scheme of reef classification, with GIS database of habitats, (ReefKIM) includes georeferenced data and location of every significant reef in the Kimberley (Landsat resolution =30 m) and includes detailed substrate & geomorphology maps for 30 Kimberley reefs providing preliminary data on key habitats and the relative*

significance on the Kimberley Reefs. This database should be used to identify reefs with high conservation value for future planning and management.

- *Resilience: General*
    - *Kimberley corals are arguably Australia's most stress-resistant corals, have adapted their overall physiology to the naturally extreme environment of the Kimberley and should therefore be considered regional and national priorities for long-term coral health monitoring and further research into the mechanisms enabling such remarkable stress resistance in reef-building coral. Intertidal coral communities, in particular, should be the focus of awareness and protection efforts.*
- *Herbivory: Research*
    - *Studies of the movement of green turtles might help identify seagrass beds and other important primary producer habitats.*
- *Monitoring the Marine Environment: General*
    - *Functional groups and system indicators may respond differently to different climate and development pressures. By the year 2050, the state of some groups (e.g. seagrass, turtles, dugongs) and system indicators may vary dramatically from scenario to scenario, while others (e.g. corals, snubfin dolphins, mammals, mangroves) may show little variation. Groups and system indicators which are expected to be most sensitive to different climate and development pressures should have high priority for long-term monitoring.*
- *Turtles: Indigenous engagement*
    - *Two-way knowledge and the merging of Western Science, traditional knowledge and local knowledge is essential for continuing to improve our understanding of marine turtles across the Kimberley'*[xxxi].

Priority research questions – KMRP Synthesis report (pp165 – 172)

- *'How do we best use remotely sensed data sets, ships of opportunity and available field data to improve predictive modelling of benthic habitat in the Kimberley and identify important habitats characteristic of the region?'*[xxxii]

Links to sub-regional and local-scale planning instruments

Healthy Country and Indigenous Protected Area Plans

The interconnected natural and cultural importance of turtle, dugong and their saltwater habitat are identified within all Indigenous Sea Country plans in the Kimberley region and specified in saltwater and livelihood targets therein:

- Balanggarra Healthy Country Plan 2012-2022

(mangrove, seagrass, reef, turtle, dugong and interrelated customary rights and practices)

- Uunguu Indigenous Protected Area: Wundaagu (saltwater) Indicative Plan of Management 2016-2020 & Wunambal Gaambera Healthy Country Plan

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- Bardi Jawi Indigenous Protected Area Plan

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- Nyul Nyul Freshwater Management & Monitoring Plan

(mangrove and interrelated customary rights and practices)

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- Eighty Mile Beach Marine Park Management Plan
- (mangrove, seagrass, reef, turtle, dugong and interested customary rights and practices)

Shared priority: Mangrove systems

Links to Australia's international commitments

International MOU

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The objective of this Memorandum of Understanding is to protect, conserve, replenish and recover marine turtles and their habitats, based on the best scientific evidence, taking into account the environmental, socio-economic and cultural characteristics of the signatory States.'[xxxiii]

The IOSEA MOU is implemented by a Conservation and Management Plan, including the following extracts:

- *'Objective 3. Improve understanding of marine turtle ecology and populations through research, monitoring and information exchange*
    - *3.1 Conduct studies on marine turtles and their habitats targeted to their conservation and management*
        - *a) Conduct baseline studies or gather secondary information on marine turtle populations and their habitats*
        - *g) Promote the use of traditional ecological knowledge in research studies*
    - *3.4 Exchange information*
        - *d) Disseminate traditional knowledge on marine turtles and their habitats for conservation and management*
- *Objective 4. Increase public awareness of the threats to marine turtles and their habitats, and enhance public participation in conservation activities*
    - *4.2 Develop alternative livelihood opportunities for local communities to encourage their active participation in conservation efforts.'*[xxxiv]

Links to Australia's national priorities

National planning instruments

National Recovery Plan for Marine Turtles in Australia

The National Recovery Plan for Marine Turtles in Australia (2017) 'provides for research and management actions necessary to stop the decline and support the recovery of marine turtles so that their chances of long-term survival in nature are maximised.'[xxxv]

Extract of specific relevance, highlighting the ways in which this plan supports the objectives and strategies of the recovery plan is included below:

- *'B2 Understand population demographics at key foraging grounds*
    - *Identify important foraging habitat for flatback, hawksbill and olive ridley turtles and initiate foraging ground studies at key locations.'*[xxxvi]

Links to regional science and management priorities

Aligned key recommendations from the Kimberley Marine Research Program (pp152-161):

- *'Remote Sensing: Monitoring*

    - *Remote sensing technologies represent the lowest cost approach for routinely collecting scientific data at a regional scale and over long time series, allowing for an assessment of baseline environmental conditions against which change can be measured and should be considered for future research and monitoring programs.*
- *Herbivory: Research*
    - *Studies of the movement of green turtles might help identify seagrass beds and other important primary producer habitats.*
- *Monitoring the Marine Environment: General*
    - *Functional groups and system indicators may respond differently to different climate and development pressures. By the year 2050, the state of some groups (e.g. seagrass, turtles, dugongs) and system indicators may vary dramatically from scenario to scenario, while others (e.g. corals, snubfin dolphins, mammals, mangroves) may show little variation. Groups and system indicators which are expected to be most sensitive to different climate and development pressures should have high priority for long-term monitoring.*
- *Turtles: Indigenous engagement*
    - *Two-way knowledge and the merging of Western Science, traditional knowledge and local knowledge is essential for continuing to improve our understanding of marine turtles across the Kimberley*[xxxvii]*'.*

Priority research questions – KMRP Synthesis report (pp165 – 172)

- *'What is the areal cover of key habitats in the Kimberley region (e.g. mangroves, seagrass), and is it changing?*
- *What is the inherent temporal variation in mangrove structure and cover in the Kimberley and how is this influenced by climate change and anthropogenic disturbances?'*[xxxviii]

Links to sub-regional and local-scale planning instruments

Healthy Country and Indigenous Protected Area Plans

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- (mangrove, seagrass, reef, turtle, dugong and interrelated customary rights and practices)
- Lalang-Garram Horizontal Falls Marine Park Management Plan & Lalang-Garram Camden Sound Marine Park Management Plan
  (mangrove, seagrass, reef, turtle, dugong, and interrelated customary rights and practices)
- Yawuru Nagulagun/ Roebuck Bay Joint Management Plan
  (mangrove, seagrass, reef, turtle, dugong and interrelated customary rights and practices)
- Eighty Mile Beach Marine Park Management Plan
- (mangrove, seagrass, reef, turtle, dugong and interested customary rights and practices)

Shared priority: Sea turtle (all species)

Links to Australia's international commitments

International conservation listing

International Union for the Conservation of Nature (IUCN) lists all six species of sea turtle fund in Australia as having a global Status of Threatened Species.

International convention

'All marine turtles occurring in the Indo-Pacific region are a priority for conservation under the Convention on the Conservation of Migratory Species of Wild Animals (CMS, also known as the Bonn Convention)'[xxxix]

International MOU

Australia is a signatory to the CMS Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia (IOSEA MoU). Which aims to facilitate 'national level and transboundary actions that will lead to the conservation of turtle populations and their habitats.'

The objective of this MOU is to *'protect, conserve, replenish and recover marine turtles and their habitats, based on the best scientific evidence, taking into account the environmental, socio-economic and cultural characteristics of the signatory States.'*[xl]

The IOSEA MOU is implemented by a Conservation and Management Plan, including the following extracts:

- *'Objective 3. Improve understanding of marine turtle ecology and populations through research, monitoring and information exchange*
    - *3.1 Conduct studies on marine turtles and their habitats targeted to their conservation and management*
        - *a) Conduct baseline studies or gather secondary information on marine turtle populations and their habitats*
        - *b) Initiate and/or continue long-term monitoring of priority marine turtle populations in order to assess conservation status*
        - *c) Characterise genetic identity of marine turtle populations*
        - *d) Identify migratory routes through the use of tagging, genetic studies and/or satellite tracking*
        - *e) Carry out studies on marine turtle population dynamics and survival rates*
        - *g) Promote the use of traditional ecological knowledge in research studies*
        - *h) Review periodically and evaluate research and monitoring activities*
    - *3.2 Conduct collaborative research and monitoring*
        - *a) Identify and include priority research and monitoring needs in regional and sub-regional action plans*
        - *b) Conduct collaborative studies and monitoring on genetic identity, conservation status, migrations, and other biological and ecological aspects of marine turtles*
    - *3.3 Analyse data to support mitigation of threats and to assess and improve conservation practices*
        - *b) Identify population trends*

        - *c) Use research results to improve management, mitigate threats and assess the efficacy of conservation activities (e.g. hatchery management practices, habitat loss, etc.)*
    - *3.4 Exchange information*
        - *a) Standardise methods and levels of data collection and adopt or develop an agreed set of protocols for inter alia monitoring of nesting beaches, feeding ground studies, genetic sampling, and collection of mortality data*
        - *b) Determine the most appropriate methods for information dissemination*
        - *c) Exchange at regular intervals scientific and technical information and expertise among nations, scientific institutions, non-governmental and international organisations, in order to develop and implement best practice approaches to conservation of marine turtles and their habitats*
        - *d) Disseminate traditional knowledge on marine turtles and their habitats for conservation and management*
        - *e) Compile on a regular basis data on marine turtle populations of regional interest*
- *Objective 4. Increase public awareness of the threats to marine turtles and their habitats, and enhance public participation in conservation activities*
    - *4.1 Establish public education, awareness and information programmes*
        - *a) Collect, develop and disseminate education materials*
        - *d) Develop and conduct focused education and awareness programmes for target groups (e.g. policy makers, teachers, schools, fishing communities, media)*
        - *e) Encourage the incorporation of marine turtle biology and conservation issues into school curricula*
        - *f) Organise special events related to marine turtle conservation and biology (e.g. Turtle Day, Year of the Turtle, symposia, Track-a-turtle)*
    - *4.2 Develop alternative livelihood opportunities for local communities to encourage their active participation in conservation efforts*
    - *4.3 Promote public participation*
        - *a) Involve stakeholders, and local communities in particular, in planning and implementation of conservation and management measures*
        - *b) Encourage the participation of Government institutions, non-governmental organisations, the private sector and the general community (e.g. students, volunteers, fishing communities, local communities) in research and conservation efforts'*[xli]

Links to Australia's national priorities and legislation

National legislation

Protected under the Australian government's *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act). Leatherback, loggerhead and olive ridley are listed as endangered, green hawksbill and flatback are listed as vulnerable.

Rights to take protected within the Australian government's *Native Title Act 1993*.

'*Under the* Native Title Act 1993, *Traditional Owners have the right to take marine resources, including hunting of marine turtles for personal, domestic or non-commercial communal needs and in exercise and enjoyment of their native title rights and interests.*[xlii]'

National planning instruments

National Recovery Plan for Marine Turtles in Australia

The National Recovery Plan for Marine Turtles in Australia (2017) 'provides for research and management actions necessary to stop the decline and support the recovery of marine turtles so that their chances of long-term survival in nature are maximised[xliii]*.'*

Extract of specific relevance, highlighting the ways in which this plan supports the objectives and strategies of the recovery plan are included below:

- *'A10 Maintain and improve sustainable Indigenous management of marine turtles*
    - *Continue to support Aboriginal and Torres Strait Islanders to sustainably manage the traditional take of turtles and eggs through a collaborative approach between government agencies and Indigenous communities.*
    - *Support Indigenous ranger and community groups to implement management plans and other mechanisms, and build capacity to undertake monitoring, education, and compliance management regarding harvest of marine turtles and their eggs.*
    - *Ensure scientific information is shared with communities and government to inform management decisions.*
    - *Develop mechanisms by which conservation management and other skills are accredited and linked to vocational outcomes for Indigenous rangers.'*
- *'B1 Determine trends at index beaches*
    - *Maintain or establish long-term monitoring programs at index beaches to collect standardised data critical for determining stock trends, including data on hatchling production.'*
- *'B2 Understand population demographics at key foraging grounds*
    - *Maintain existing population demographic studies at key foraging grounds and expand to monitor high priority stocks*
    - *Identify important foraging habitat for flatback, hawksbill and olive ridley turtles and initiate foraging ground studies at key locations.'*
- *'B3 Address information gaps to better facilitate the recovery of marine turtle stocks*
    - *Fill knowledge gaps in the life history of all species such that threats can be assessed and addressed throughout the entire life cycle.*
    - *Finalise the genetic delineation of flatback, hawksbill and olive ridley turtle stocks in Western Australia.'*[xliv]

Sustainable harvest of Sustainable Harvest of Marine Turtles and Dugongs in Australia – A National Partnership Approach

This plan was developed by the Marine & Coastal Committee, itself a body of the Natural Resource Management Ministerial Council Taskforce on Dugong and Marine Turtle Populations in 2005. It was created in '*recognition of the investment required to develop the underpinning knowledge, communications and Indigenous capacity needed by local Indigenous groups to develop their own sustainable harvest plans and Indigenous capacity to facilitate community investment.*'

The following relevant parts of the report are extracted below:

- *'Goal 1 Improve the information base available to Indigenous communities for managing the sustainable harvest of turtles and dugongs*
    - *Objective 2: Collect and maintain baseline population information for turtles and dugongs*
- *Goal 2 Respect for Indigenous and non-Indigenous knowledge and management*
- *Goal 3 Improve Education and Awareness*

    Objective 3: Increase access by Indigenous communities to information collected/ developed through research into the biology and migratory nature of turtles and dugongs'[xlv]

National Dugong and Turtle Protection Plan 2014–2017

Although a national plan, the resources for its implementation was focussed on activities in far north Queensland and the Torres Strait, with the $5.3million of project funding delivered for these activities through the Reef 2050 and Reef Trust.

Links to Western Australia's legislative responsibilities

State wide legislation

Protected under the Western Australian *Wildlife Conservation Act 1950*; listed as specially protected fauna in 2018 (loggerhead and olive ridley listed as endangered reptiles; and green, leatherback, and flatback listed as vulnerable reptiles). The right to harvest dugong for food for Indigenous people and their families are protected within the Western Australian *Wildlife Conservation Act 1950* (section 23)[xlvi].

Links to regional science and management priorities

Aligned priority research questions from the Kimberley Marine Research Program

- *'What is the status of nesting green turtles in the Kimberley?*
- *What is the impact of big marine herbivore harvests, such as green turtles and dugong, on the sustainability of marine systems in the Kimberley?*
- *What are the gaps in understanding of marine turtles in the Kimberley and how can Indigenous ranger groups assist with the future research and monitoring of turtles in the Kimberley?'*[xlvii]

Aligned key recommendations from the Kimberley Marine Research Program (pp152-161):

- *'Herbivory: Monitoring*
    - *Given the important ecological role that seagrass consumers play, monitoring abundances of these taxa is desirable. The imperative for monitoring the abundance of green turtles is also supported by their status as a protected species and their high value in monitoring and management of the Indigenous Healthy Country Plans for the region.*
- *Herbivory: Research*
    - *Studies of the movement of green turtles might help identify seagrass beds and other important primary producer habitats.*
- *Monitoring the Marine Environment: General*
    - *Functional groups and system indicators may respond differently to different climate and development pressures. By the year 2050, the state of some groups (e.g. seagrass, turtles, dugongs) and system indicators may vary dramatically from scenario to scenario, while others (e.g. corals, snubfin dolphins, mammals, mangroves) may show little variation. Groups and system indicators which are expected to be most sensitive to different climate and development pressures should have high priority for long-term monitoring.*
- *Turtles: General*
    - *Marked variation in the temperatures of beaches used for nesting by marine turtles in the Kimberley region has been identified and highlights the need to manage populations at the level of individual rookeries. At a regional scale, retaining resilience is a key strategy, which can be achieved by protecting a broad nesting distribution across all habitat types, latitudinal ranges and including mainland and island rookeries. Localised management for female-biased sex-ratios and high mortality at particular nesting beaches could include artificial shading of natural nests (via shade cloth or vegetation plantings), or relocation of egg clutches to cooler*

sites or beaches. However, before such interventions are undertaken it will be prudent to collect further empirical data on the sex ratios of turtles hatching at major rookeries.

- *Turtles: Indigenous engagement*
    - *Two-way knowledge and the merging of Western Science, traditional knowledge and local knowledge is essential for continuing to improve our understanding of marine turtles across the Kimberley.*
- *Turtles: Monitoring*
    - *Turtle nesting locations of high management value that are recommended for regular monitoring include summer nesting green turtles at the Lacapede Islands, summer nesting flatback turtles at Eighty Mile Beach, and winter nesting flatback turtles at Cape Domett. Given the high nesting density at the Lacapede Islands, important population information would be gained from an intensive (2-3 week) tagging survey or track count program if partnerships can be developed with regional ranger groups and DBCA[xlviii].'*

Links to key residual regional knowledge gaps from the WAMSI Marine Turtle report

- *'Research is still needed to better understand connectivity between rookeries as well as between rookeries and foraging areas. Rookeries most at risk from anthropogenic and climate change pressures also need to be identified.*
- *The timing of the aerial surveys did not provide information on nesting of hawksbill or olive ridley turtles, even though both are reported in the Kimberley. Future surveys should be spatially and temporally targeted to fill this knowledge gap.*
- *The proportion of Kimberley stocks impacted by outside threats, such as illegal international harvest, should be quantified through genetics and surveys.*
- *Potential population threats that need better quantification for appropriate management include dingo predation of turtle eggs at mainland nesting beaches and the impacts on turtles from marine debris and Indigenous harvest.[xlix]'*

Links to Australian Marine Parks (Commonwealth waters)

North-west and North Marine Parks Network Management Plans

The Kimberley, Roebuck, Eighty Mile Beach (North-west Network) and Joseph Bonaparte Gulf (North Network) Marine Parks, provide important foraging and or interesting habitat for turtles species and the living cultural value of turtle, as a staple food source to Indigenous people of the region.

Turtle are listed as vulnerable to identified pressures within the North-west Network and North Network Management Plans including climate change, extractive industry, habitat modification, human presence, invasive species and marine pollution.

Management programs and actions within the Plan, of relevance to this initiative include:

Indigenous engagement program and actions that recognise and respect the ongoing cultural responsibilities of Indigenous people to care for Sea Country and support multiple benefits for traditional owners. North-west Network specific actions include:

- *collaborate with traditional owners, Indigenous ranger groups and relevant partners to undertake marine park management such as surveillance, monitoring and threat mitigation including marine debris removal, and implement actions identified in Sea Country plans where applicable*
- *identify opportunities and mechanisms to engage traditional owners and Indigenous rangers in the management of marine parks,*

- *increase understanding of traditional knowledge, map cultural values and manage culturally significant sites*
- *establish research protocols in association with traditional owners, like those in the Collaborative Science on Kimberley Saltwater Country - A Guide for Researchers'* [l]

Marine science program and actions to provide necessary scientific knowledge and understanding of marine park values, pressures, and adequacy of responses for effective management. National and North-west Network specific actions include:

- *establish ecological, social and economic baselines to support evidence-based decision-making and adaptive management (National)*
- *collaborate with the science community (including through the National Marine Science Committee and the National Environmental Science Program) and other marine park users to assist in improving the understanding of marine park values, pressures and management effectiveness (National)*
- *collaborate with the science community and other government agencies to increase the use of innovative and effective technology and systems including sensor technology' (National)*
- *monitor social and economic uses and their benefits and impacts on marine parks in the Network (Network)*
- *monitor the condition of important habitats such as reef systems at Ningaloo, Mermaid, Kimberley, Ashmore and Cartier Marine Parks, and their vulnerability to climate change (Network)*
- *collaborate with other Commonwealth and state government agencies, marine park users and the science sector to support long-term monitoring'* [li]

Links to sub-regional and local-scale planning instruments

Healthy Country and Indigenous Protected Area Plans

The interconnected natural and cultural importance of turtle, dugong and their saltwater habitat are identified within all Indigenous Sea Country plans in the Kimberley region and specified in saltwater and livelihood targets therein:

- Balanggarra Healthy Country Plan 2012-2022

(mangrove, seagrass, reef, turtle, dugong and interrelated customary rights and practices)

- Uunguu Indigenous Protected Area: Wundaagu (saltwater) Indicative Plan of Management 2016-2020 & Wunambal Gaambera Healthy Country Plan

(mangrove, seagrass, reef, turtle, dugong and interrelated customary rights and practices)

- Dambimangari Healthy Country Plan

(mangrove, seagrass, reef, turtle, dugong and interrelated customary rights and practices)

- Mayala Healthy Country Plan

(mangrove, seagrass, reef, turtle, dugong and interrelated customary rights and practices)

- Bardi Jawi Indigenous Protected Area Plan

(mangrove, seagrass, reef, turtle, dugong and interrelated customary rights and practices)

- Nyul Nyul Freshwater Management & Monitoring Plan

(mangrove and interrelated customary rights and practices)

- Karajarri Healthy Country Plan

(mangrove, seagrass, reef, turtle, dugong and interrelated customary rights and practices)

- Nyangumarta Indigenous Protected Area Plan

(mangrove, turtle and interrelated customary rights and practices)

Marine Park and Joint Management Plans
Identified as important vales and as key performance indicators within Kimberley state marine park and joint management plans

- North Kimberley Marine Park Mark Management Plan
- (mangrove, seagrass, reef, turtle, dugong and interrelated customary rights and practices)
- Lalang-Garram Horizontal Falls Marine Park Management Plan & Lalang-Garram Camden Sound Marine Park Management Plan
  (mangrove, seagrass, reef, turtle, dugong, and interrelated customary rights and practices)
- Yawuru Nagulagun/ Roebuck Bay Joint Management Plan
  (mangrove, seagrass, reef, turtle, dugong and interrelated customary rights and practices)
- Eighty Mile Beach Marine Park Management Plan
- (mangrove, seagrass, reef, turtle, dugong and interested customary rights and practices)

Shared priority: Dugong

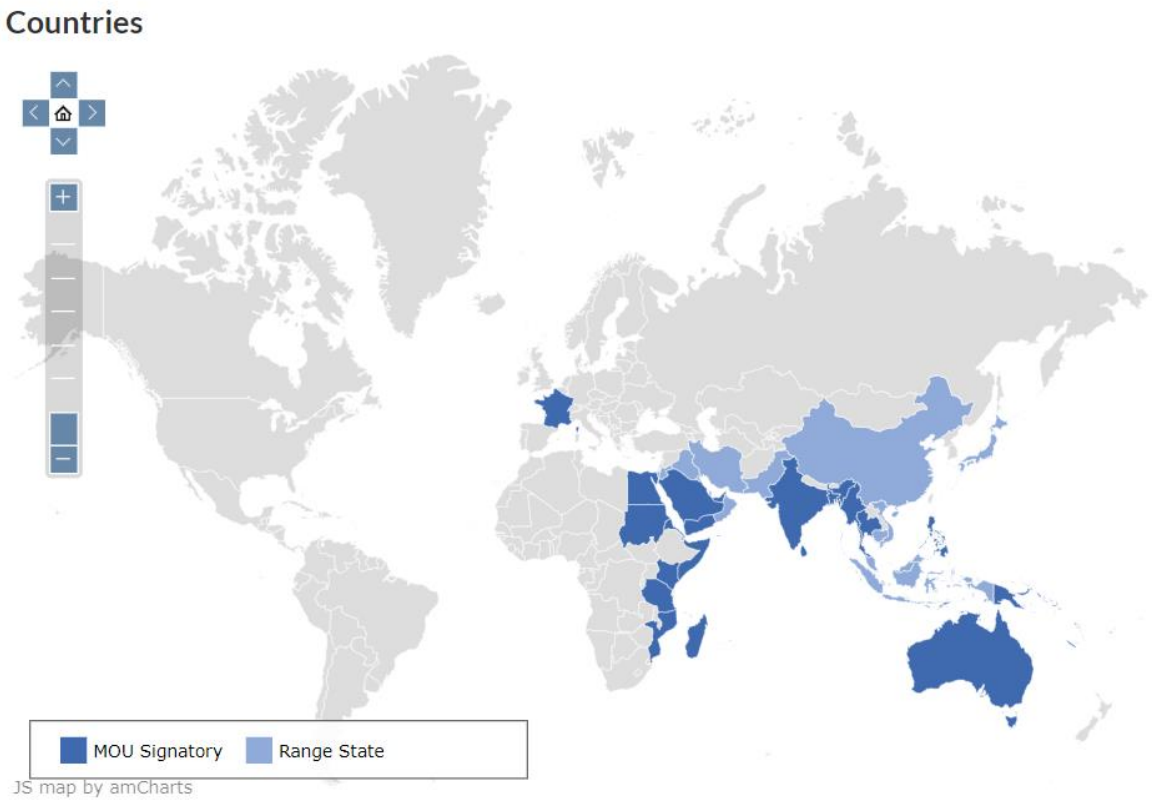
Links to Australia's international commitments

International conservation listing

International Union for the Conservation of Nature (IUCN) lists dugong as Vulnerable (Global Status: IUCN Red List of Threatened Species: 2020.2 list)

International MOU

Memorandum of Understanding on the Conservation and Management of Dugongs (Dugong dugon) and their Habitats throughout their range is 'designed to facilitate national level and transboundary actions that will lead to the conservation of dugong populations and their habitats'[lii]. It is signed by over twenty countries within their range, including Australia in 2007 (see map below).



Above: Dugong MOU signatories [liii]

International Conservation & Management Plan

Conservation and Management Plan for the Memorandum of Understanding on the Conservation and Management of Dugongs (Dugong dugon) and their Habitats throughout their Range

- *'Objective 1 – Reduce direct and indirect causes of dugong mortality*
  - *1.1 Identify, assess and evaluate the threats to dugong populations and develop appropriate measures to address these threats*
  - *1.5 Ensure that subsistence and customary use of dugong is sustainable in areas where it is permitted*
- *Objective 2 – Improve our understanding of dugong through research and monitoring*

- *2.1 Determine the distribution and abundance of dugong populations to provide a base for future conservation efforts and actions*
- *2.2 Conduct research and monitoring into dugong*

- *Objective 3 – Protect, conserve and manage s for dugong*
  - *Including 3.1 Identify and map areas of important dugong habitat such as sea grass beds*
  - *3.4 Identify and where appropriate, rehabilitate degraded dugong habitats*
- *Objective 4 – Improve our understanding of dugong habitats through research and monitoring*
  - *4.1 Conduct research into and monitoring of important dugong habitats*
- *Objective 5 – Raise awareness of dugong conservation*
  - *5.1 Establish education, awareness and information programmes*
  - *5.2 Consult with local communities to encourage their active participation in conservation efforts*
- *Objective 6 – Enhance national, regional and international cooperation*
  - *6.2 Develop and implement mechanisms for effective exchange of information*
  - *6.3 Improve coordination among government and non-government sectors and communities in the conservation of dugongs and their habitats*
  - *6.4 Develop and implement a regional database of relevant information in relation to dugong conservation and management*
- *Objective 7 – Promote implementation of the MoU*
  - *7.3 Seek resources to support the implementation of the MoU*
- *Objective 9 – Enhance national, regional and international cooperation on capacity building*
  - *9.1 Promote capacity building at all levels to strengthen conservation measures'*[liv]

Links to Australia's national priorities and legislation

National legislation

Protected under the Australian government's *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act), which lists them both as a migratory and marine species.

Listed as *Near Threatened* within the non-statutory Action plan for Australian mammals 2012.

Rights to take are protected within the Australian government's *Native Title Act 1993*.

- '*Under the Native Title Act 1993, Traditional Owners have the right to take marine resources, including hunting of dugongs for personal, domestic or non-commercial communal needs and in exercise and enjoyment of their native title rights and interests*[lv]*'.*

National planning instruments

The Sustainable Harvest of Marine Turtles and Dugongs in Australia – A National Partnership Approach (2005) recognises the investment required to develop the underpinning knowledge, communications and Indigenous capacity needed by local Indigenous groups to develop their own sustainable harvest plans and Indigenous capacity to facilitate community investment.

The following objectives were described in the report (extracts):

- 'Goal 1 Improve the information base available to Indigenous communities for managing the sustainable harvest of turtles and dugongs;
  - Objective 2: Collect and maintain baseline population information for turtles and dugongs
- Goal 2 Respect for Indigenous and non-Indigenous knowledge and management
- Goal 3 Improve Education and Awareness

- Objective 3: Increase access by Indigenous communities to information collected/ developed through research into the biology and migratory nature of turtles and dugongs'

The National Dugong and Turtle Protection Plan was developed in 2014 and completed n 2017. Although a national plan, the resources for its implementation were focussed on activities in far north Queensland and the Torres Strait, with the $5.3million of project funding delivered for these activities through the Reef 2050 and Reef Trust.

Links to Western Australia's legislative responsibilities and plans

State wide legislation

Protected under the Western Australian *Wildlife Conservation Act 1950*; listed as specially protected fauna in 2005.

Protected under the Western Australian *Biodiversity Conservation Act 2016*; listed as other protected fauna in 2018.

The right to harvest dugong for food for Indigenous people and their families are protected within the Western Australian Wildlife Conservation Act 1950 (section 23)[lvi].

Links to Kimberley regional science and management priorities

Aligned priority research questions from the Kimberley Marine Research Program

- *'What is the spatial and temporal use of habitat by dugong populations in the Kimberley, including foraging, calving, mating?*
- *What is the overlap between megafauna distribution with important areas of industry activity (shipping, seismic, infrastructure, fishing, etc.) and what is the cumulative risk to megafauna from this overlap?*
- *What is the connectivity between regional population centres of dugongs throughout the Kimberley? What implications does the extent of connectivity have for management at a range of spatial scales?*
- *What are the ecological relationships between the population and harvesting dynamics of dugongs and the dynamics of seagrass habitat (biomass, species composition, productivity)? How can this knowledge be used to manage dugong populations (both harvested & unharvested) in the face of external pressures such as increasing development in the region and climate change?*
- *How does abundance of dugong fluctuate through space and time in response to natural and anthropogenic pressures in the Kimberley?*
- *How can we maximise the use of drones and other new technology to monitor dugongs and other focal research species in the Kimberley region?*
- *Dugong stories told throughout the Kimberley by hunters, elders and the communities contain ecological knowledge on historical changes in dugong distribution and abundance. How can this information be collated and used for management?'*[lvii]

Aligned key recommendations from the Kimberley Marine Research Program :

- '*Dugong: Indigenous engagement*
  - *The following components of the WAMSI dugong project in the Kimberley should be continued in partnership with CSIRO, Indigenous ranger groups and DBCA-marine parks: the integration of TEK and scientific knowledge; monitoring trends in dugong distribution and abundance, both locally and regionally; and the long-term study of movement ecology.*
- *Dugong: Monitoring*

    - *The Bayesian method should be further developed and validated to integrate traditional and scientific knowledge of dugongs along with an integrated monitoring and risk assessment framework to manage cumulative risks to dugong populations from multiple pressures, including customary take.*
    - *A monitoring program for dugong populations and associated seagrass habitat should be designed and implemented in smaller high priority areas at representative sites across the Kimberley, using standardised methodologies (e.g. small boat-based surveys) and, if necessary, trialling new survey methods (e.g. use of drones or helicopters).*
    - *A long-term fixed-wing aerial survey monitoring program should be designed for Sea Country and co-managed marine parks that integrates data from regular (seasonal) small area local surveys.*
- *Dugong: Research:*
    - *A stakeholder and experts workshop should be held in the Kimberley (Broome) to discuss the potential of close-kin genetic methods to estimate critical population parameters of dugongs for their management.*
    - *The movement study commenced in the North Kimberley should be relocated to Roebuck Bay in the South Kimberley, based on management need and to significantly reduce logistical costs. This study could underpin a long-term study of dugong spatial ecology in full partnership with all Kimberley ranger groups, DBCA and CSIRO.*
- *Herbivory: Monitoring*
    - *Given the important ecological role that seagrass consumers play, monitoring abundances of these taxa is desirable. The imperative for monitoring the abundance of green turtles is also supported by their status as a protected species and their high value in monitoring and management of the Indigenous Healthy Country Plans for the region.*
- *Monitoring the Marine Environment: General*
    - *Functional groups and system indicators may respond differently to different climate and development pressures. By the year 2050, the state of some groups (e.g. seagrass, turtles, dugongs) and system indicators may vary dramatically from scenario to scenario, while others (e.g. corals, snubfin dolphins, mammals, mangroves) may show little variation. Groups and system indicators which are expected to be most sensitive to different climate and development pressures should have high priority for long-term monitoring*[lviii]*.'*

Links to key residual regional knowledge gaps from the WAMSI Dugong report (Bayliss et al. 2016[lix]):

- 'What is the connectivity between regional population centres of dugongs throughout the Kimberley, and its implication for management at a range of spatial scales?
- What are the dugong stories told throughout the Kimberley by hunters, elders and the community who wish to share them? The stories capture deep local ecological knowledge and the occurrence of historical events of big changes in dugong distribution and abundance.
- What environmental and social factors explain the current regional-scale patterns of distribution and abundance across northern Australia and Torres Strait
- What are the ecological relationships between the population and harvesting dynamics (cultural take) of dugongs and the dynamics of seagrass habitat (biomass, species composition, productivity)? And how can this knowledge be used to manage dugong

populations (both harvested & unharvested) in the face of external pressures such as increasing development in the region and climate change'.

Recommendations form DBCA marine megafauna specialist staff (workshop report 2019)

- It would be useful to have a literature review on dugong generally, including information from other areas, in particular on dugong biology (reproductive information and lifespan) as well as movement and spatial patterns of distribution.
- Hunters and community are a source of information on take (including numbers and effort) as well as known patterns of seasonal movement, important areas and relative indication of changes to numbers or movement.

Links to Australian Marine Parks (Commonwealth waters)
North-west Marine Parks Network Management Plan (North-west Network)

Dugong are listed as vulnerable to all listed pressured within the Northwest park network including climate change, hydrological changes, extractive industry, habitat modification, and pollution.

The Kimberley and Roebuck Marine Parks, provide important foraging habitat for dugong and the living cultural value of dugong, as a staple food source to Indigenous people of the region.

Dugong are listed as vulnerable to identified pressures within the North-west Network Management Plan including climate change, hydrological changes, extractive industry, habitat modification and marine pollution.

Management programs and actions within the Plan, of relevance to this initiative include:

'Indigenous engagement program and actions that recognise and respect the ongoing cultural responsibilities of Indigenous people to care for Sea Country and support multiple benefits for traditional owners. North-west Network specific actions include:

- *collaborate with traditional owners, Indigenous ranger groups and relevant partners to undertake marine park management such as surveillance, monitoring and threat mitigation including marine debris removal, and implement actions identified in Sea Country plans where applicable*
- *identify opportunities and mechanisms to engage traditional owners and Indigenous rangers in the management of marine parks,*
- *increase understanding of traditional knowledge, map cultural values and manage culturally*
- *significant sites,*
- *establish research protocols in association with traditional owners, like those in the Collaborative Science on Kimberley Saltwater Country - A Guide for Researchers*

Marine science—actions to provide necessary scientific knowledge and understanding of marine park values, pressures, and adequacy of responses for effective management.

- *establish ecological, social and economic baselines to support evidence-based decision-making and adaptive management*
- *monitor the condition of important habitats such as reef systems at Ningaloo, Mermaid, Kimberley, Ashmore and Cartier Marine Parks*
- *collaborate with other Commonwealth and state government agencies, marine park users and the science sector to support long-term monitoring*
- *collaborate with the science community (including through the National Marine Science Committee and the National Environmental Science Program) and other*

marine park users to assist in improving the understanding of marine park values, pressures and management effectiveness

- *collaborate with the science community and other government agencies to increase the use of innovative and effective technology and systems including sensor technology'*

Links to sub-regional and local-scale planning instruments

Healthy Country and Indigenous Protected Area Plans

The interconnected natural and cultural importance of turtle, dugong and their saltwater habitat are identified within all Indigenous Sea Country plans in the Kimberley region and specified in saltwater and livelihood targets therein:

- Balanggarra Healthy Country Plan 2012-2022

(mangrove, seagrass, reef, turtle, dugong and interrelated customary rights and practices)

- Uunguu Indigenous Protected Area: Wundaagu (saltwater) Indicative Plan of Management 2016-2020 & Wunambal Gaambera Healthy Country Plan

(mangrove, seagrass, reef, turtle, dugong and interrelated customary rights and practices)

- Dambimangari Healthy Country Plan

(mangrove, seagrass, reef, turtle, dugong and interrelated customary rights and practices)

- Mayala Healthy Country Plan

(mangrove, seagrass, reef, turtle, dugong and interrelated customary rights and practices)

- Bardi Jawi Indigenous Protected Area Plan

(mangrove, seagrass, reef, turtle, dugong and interrelated customary rights and practices)

- Nyul Nyul Freshwater Management & Monitoring Plan

(mangrove and interrelated customary rights and practices)

- Karajarri Healthy Country Plan

(mangrove, seagrass, reef, turtle, dugong and interrelated customary rights and practices)

- Nyangumarta Indigenous Protected Area Plan

(mangrove, turtle and interrelated customary rights and practices)

Marine Park and Joint Management Plans

Identified as important vales and as key performance indicators within Kimberley state marine park and joint management plans

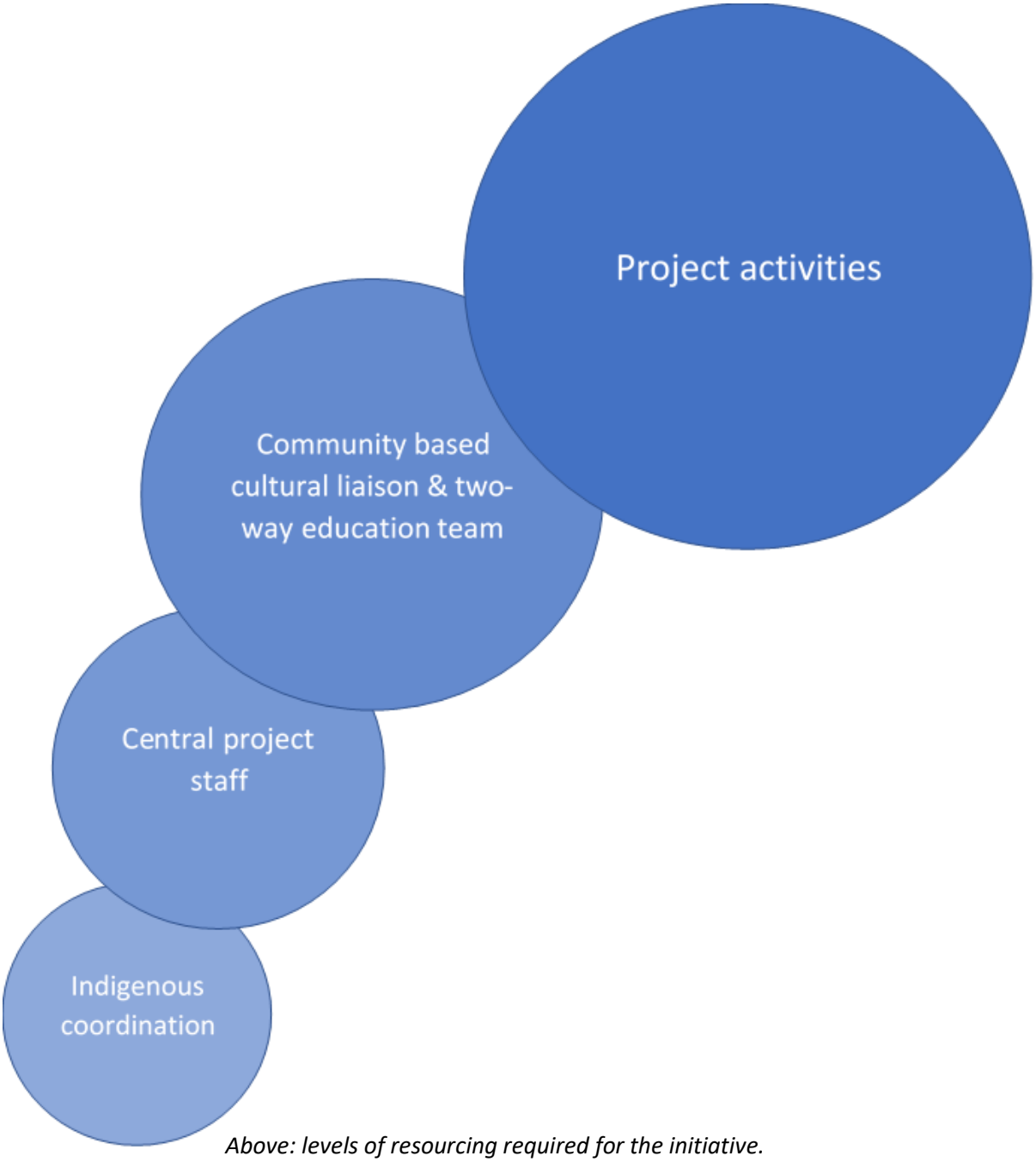
- North Kimberley Marine Park Mark Management Plan
- (mangrove, seagrass, reef, turtle, dugong and interrelated customary rights and practices)
- Lalang-Garram Horizontal Falls Marine Park Management Plan & Lalang-Garram Camden Sound Marine Park Management Plan
  (mangrove, seagrass, reef, turtle, dugong, and interrelated customary rights and practices)
- Yawuru Nagulagun/ Roebuck Bay Joint Management Plan
  (mangrove, seagrass, reef, turtle, dugong and interrelated customary rights and practices)
- Eighty Mile Beach Marine Park Management Plan
- (mangrove, seagrass, reef, turtle, dugong and interested customary rights and practices)

Section 5: Resourcing across themes

This section lists the individual work packages and items that will require external funding for the initiative, presented in a set of cross-cutting themes. These are linked to a project planning spreadsheet listing the same components as well as estimates of cost per item. ISWAG has carriage of this spreadsheet tool and will use it to develop funding models at various scales appropriate to funding avenues and final decisions about overall Ranger group works program commitments.

It is important to note that the scale of activities implemented across the region will be dependent on capacity (Indigenous ranger group, community, and funded project staff), as determined by the level and longevity of funding commitments.

Activities will be undertaken in a staged approach that supports the growth of capacity, cross-cultural understanding, community participation and two-way knowledge.



Above: levels of resourcing required for the initiative.

Theme 1. Holistic indigenous-led, adaptive project management

T1.A Indigenous coordination

- Operational cost: biannual planning, steering and review workshop.
- Operational cost: monthly phone/video meetings.
- Staffing cost: Co-leader service.
- Staffing cost: Executive Officer/Secretariat (p/t).

T1.B Central project staff (scalable)

- Staffing cost: Project manager.
- Staffing cost: Data, review & mapping lead.
- Staffing cost: Cross-cultural communications lead.
- Staffing cost: Social science lead (may be a hosted position in-kind by partner).

T1.C Community-based cultural liaison team

- Staffing cost: Casual employee in each partnering remote community (or more appropriate community-based funded mechanism).

Theme 2. Supporting community involvement in contemporary species science & management

T2.A Community-led sustainable saltwater resource management

- Operational cost: Community-based sustainable harvest frameworks.
- Operational cost: Community-based science outreach / two-way knowledge exchange events tailored to each community.
- Operational cost: opportunities for Indigenous knowledge to be passed down on Sea Country.

T2.B Data management and safekeeping

- Consultancy cost: develop appropriate data management and sharing arrangements between data custodians and marine science and management agencies (map out known data flow pathways, identifying places of known concern for Indigenous people and develop storage, access and permission protocol for data and tissue samples).
- Consultancy cost: Engage remote data storage specialist to develop off-site, secure storage functions for all groups.
- Consultancy cost: engage reputable, long-term, curated genetic tissue sample storage service with community-based control of access and use.

Theme 3. Providing benefits to indigenous livelihoods, education and career pathways

T3.A On-community two-way marine science education

- Staffing cost: Facilitate a two-way Science learning program at ten Kimberley saltwater communities, connecting Indigenous ecological knowledges of Kimberley saltwater Country with the Australian Curriculum. Based on the *Science Pathways for Indigenous Communities Program* run through the CSIRO 2016-2020.
- Staffing cost: regional school-based community education causal employees to support the on-country learning opportunities.

T3.B Saltwater career & leadership pathways

- Consultancy cost : mapping a range of career pathways from remote schools into marine science and management careers; identify gaps and recommend ways to address these

within existing tertiary and technical education settings or by specific innovation; in consultation with Indigenous scientists, rangers and managers.

- Operational cost: Future saltwater leaders and knowledge brokers fund to meet the on-costs of the travel, accommodation (and conference/meeting fees) for up and coming Indigenous community members/rangers to shadow existing leaders, learn the skills of developing presentations, co-presenting, attending regional, state and national decision-making forums and workshops and build their confidence and experience in engaging in these.
- Consultancy cost: partner with TAFE and marine specialist universities to develop technical bridging/enabling short courses , mapped to TAFE diploma level, to bridge the gap in select foundational first year university knowledge required by Indigenous rangers to participate more fully in collaborative science projects on Sea Country.
- Operational cost: support flexible delivery of course modules to participating Indigenous rangers.

Theme 4. Coordinated data collection and knowledge-making practices across Kimberley Sea Country

T4.A Seagrass (intertidal) mapping across Kimberley waters

- Operational cost: Mapping via predictive modelling / or remote sensing with local Indigenous knowledge, satellite tag information from dugong/turtle and/or ground-truthing (e.g. by foot/drone, boat-towed video footage, water quality monitoring).
- Science partner in-kind: data/imagery processing undertaken by partnering science agencies with involvement by technical specialists within local Indigenous Ranger groups.
- Operational cost: culturally appropriate, innovative return of seagrass knowledge summary to healthy country managers and communities at scale (e.g. arts-science outreach programmes, film, posters, ranger group presentations, PBC meeting, video conference etc).

T4.B Seagrass (subtidal) mapping across Kimberley waters

- Mapping via predictive modelling / or remote sensing with local Indigenous knowledge, satellite tag information from dugong/turtle and/or ground-truthing (e.g. by foot/drone, boat-towed video footage, water quality monitoring).
- Science partner in-kind: data/imagery processing undertaken by partnering science agencies with involvement by technical specialists within local Indigenous Ranger groups.
- Operational cost: culturally appropriate, innovative return of seagrass knowledge summary to healthy country managers and communities at scale (e.g. arts-science outreach programmes, film, posters, ranger group presentations, PBC meeting, video conference etc).

T4.C Seagrass (intertidal) monitoring at regional scale providing co-benefits to Indigenous communities

- Operational cost: biannual intertidal seagrass monitoring as sites indicative of regional condition in the southern and northern Kimberley (e.g. Seagrass Watch) including Indigenous indicators of ecosystem health (e.g. dugong use indicators).
- Operational cost: periodic information exchange events using appropriate communication tools, between collaborators and knowledge return to Indigenous communities, their rangers and schools.
- Science partner in-kind sought: data/imagery processing undertaken by partnering science agencies with involvement by technical specialists within local Indigenous Ranger groups.
- Science and agency partner in-kind sought: access to monitoring data and knowledge relating to key threats and pressures acting on seagrass, and statistical comparison to

seagrass condition to understand links and causation where seagrass monitoring shows a decline in condition. For example, water quality parameters

T4.D Seagrass (subtidal) monitoring at regional scale providing co benefits to Indigenous communities

- Operational cost: biannual boat-based monitoring of subtidal seagrass (and macroalgae) coverage during within known dugong and green turtle hotspots along the Kimberley coastline (e.g. by towed video footage or drop camera).
- Operational cost: periodic information exchange events using appropriate communication tools, between collaborators and knowledge return to Indigenous communities, their rangers and schools.
- Science partner in-kind sought: data/imagery processing undertaken by partnering science agencies with involvement by technical specialists within local Indigenous Ranger groups.
- Science and agency partner in-kind sought: access to monitoring data and knowledge relating to key threats and pressures acting on seagrass, and statistical comparison to seagrass condition to understand links and causation where seagrass monitoring shows a decline in condition. For example, water quality parameters.

T4.E Mapping reef systems across Kimberley waters

- Operational cost: predictive modelling or remote sensing paired with local Indigenous knowledge, aerial photography, satellite tag information from turtle and/or ground-truthing (e.g. reef work by foot, drone or drop down camera at times of clear water, and water quality monitoring) to map reef systems.
- Science partner in-kind sought: data/imagery processing undertaken by partnering science agencies with involvement by technical specialists within local Indigenous Ranger groups.
- Operational cost: culturally appropriate, innovative return of reef knowledge summary to healthy country managers and communities at scale (e.g. arts-science outreach programmes, film, posters, ranger group presentations, PBC meeting, video conference etc).

T4.F Monitoring reef systems at regional scale providing co benefits to Indigenous communities

- Operational cost: biannual boat-based monitoring in priority places outside of current monitoring networks (e.g. reef systems of regional significance to turtle, areas of cultural importance), using imagery-based tools.
- Science partner in-kind sought: data/imagery processing undertaken by partnering science agencies with involvement by technical specialists within local Indigenous Ranger groups.
- Operational cost: periodic information exchange events using appropriate communication tools, between collaborators and knowledge return to Indigenous communities, their rangers and schools.
- Science and agency partner in-kind sought: access to monitoring data and knowledge relating to key threats and pressures acting on reef systems, and statistical comparison to reef condition to understand links and causation where reef monitoring shows a decline in condition. For example, visitor use data.

T4.G Mapping mangrove systems across the Kimberley coastal environment

- Operational cost: Remote sensing or predictive models paired with Indigenous knowledge and ground-truthing (e.g. by land, boat, plane or drone) to improve maps of mangrove occurrence and density/coverage at the regional scale.

- Science partner in-kind sought: data/imagery processing undertaken by partnering science agencies with involvement by technical specialists within local Indigenous Ranger groups.
- Operational cost: research project to understand use of mangrove systems by juvenile green turtle at accessible sites in the southern, mid and northern Kimberly coastline.
- Operational cost: culturally appropriate, innovative return of seagrass knowledge summary to healthy country managers and communities at scale (e.g. arts-science outreach programmes, film, posters, ranger group presentations, PBC meeting, video conference etc).

T4.H Monitoring mangrove systems at regional scale providing co benefits to Indigenous communities

- Operational cost: annual monitoring of representative mangrove health and nursery value monitoring sites at important areas.
- Science partner in-kind sought: data/imagery processing undertaken by partnering science agencies with involvement by technical specialists within local Indigenous Ranger groups.
- Operational cost: periodic information exchange events using appropriate communication tools, between collaborators & knowledge return to communities, rangers and schools.
- Science and agency partner in-kind sought: access to monitoring data and knowledge relating to key threats and pressures acting on mangroves, and statistical comparison to mangrove condition to understand links and causation where mangrove monitoring shows a decline in condition. For example, climate change parameters.

T4.I Two-way knowledge for long term sustainable management of green turtle

- Operational cost: long term annual monitoring of green turtles nesting at the Lacapede Islands, the key Kimberley rookery for our greens (index site).
- Operational cost: long term biannual monitoring of green turtles at one foraging index site in the southern and northern Kimberley (e.g. drone based techniques or boat based Indigenous ranger monitoring (e.g. the Wunambal Gaambera/NAILSMA turtle & dugong technique).
- Operational cost: satellite tracking to identify changes to movement, shared populations, use of key foraging areas and improve the map of green turtle movements.
- Operational cost: genetic sampling to estimate population parameters (close kin analysis), genetic relationships and sub populations (mixed stock analysis).
- Operational cost: culturally appropriate, innovative return of seagrass knowledge summary to healthy country managers and communities at scale (e.g. arts-science outreach programmes, film, posters, ranger group presentations, PBC meeting, video conference etc).
- Science partner in-kind sought: data processing undertaken by partnering science agencies with involvement by technical specialists within local Indigenous Ranger groups.
- Science and agency partner in-kind sought: access to monitoring data and knowledge relating to key threats and pressures acting on green turtle, and statistical comparison to population health to understand links and causation where turtle monitoring shows a decline in condition. For example, temperature parameters.

T4.J Two-way knowledge for long term sustainable management of other sea turtle

- Science partner existing program: long term annual monitoring of flatback turtle nesting populations along Eighty Mile Beach (continued Indigenous ranger participation in existing monitoring program run by DBCA).
- Operational cost: long term annual monitoring of hawksbill turtle nesting populations on islands and/or beaches in the northern Kimberly (location to be determined by current collaborative research).

- Operational cost: satellite tracking hawksbill to identify movement pathways, shared populations, use of key foraging areas in the Northern Kimberley species stronghold.
- Science partner in-kind sought: data processing undertaken by partnering science agencies with involvement by technical specialists within local Indigenous Ranger groups.
- Science and agency partner in-kind sought: access to monitoring data and knowledge relating to key threats and pressures acting on other turtle, and statistical comparison to population health to understand links and causation where turtle monitoring shows a decline in condition. For example, temperature parameters.

T4.K Two-way knowledge for long term sustainable management of dugong

- Operational cost: a recurring five year, fixed-wing aerial survey across the Kimberley waters, accounting for seasonality to identity overall coarse-scale trends in abundance and location, including the identification of any potential calving precincts.
- Operational cost: long term biannual monitoring of green turtles at one foraging index site in the southern and northern Kimberley (e.g. drone based techniques or boat based Indigenous ranger monitoring (e.g. the Wunambal Gaambera/NAILSMA turtle & dugong technique).
- Operational cost: satellite tracking dugong to identify movement pathways, shared populations, use of key foraging areas across the Kimberley region.
- Operational cost: genetic sampling to estimate population parameters (close kin analysis), genetic relationships and sub populations (mixed stock analysis).
- Operational cost: research to find out more about the biology of the species and inform management strategies.
- Operational cost: Support community-based sustainable marine resource use planning and practice in contemporary settings, fostering trust and two-way understanding, and use old and new knowledge around dugong population demographics and health.
- Operational cost: culturally appropriate, innovative return of seagrass knowledge summary to healthy country managers and communities at scale (e.g. arts-science outreach programmes, film, posters, ranger group presentations, PBC meeting, video conference etc).
- Science partner in-kind sought: data processing undertaken by partnering science agencies with involvement by technical specialists within local Indigenous Ranger groups.
- Science and agency partner in-kind sought: access to monitoring data and knowledge relating to key threats and pressures acting on dugong, and statistical comparison to population health to understand links and causation where dugong monitoring shows a decline in condition. For example, visitation and human interaction parameters.

Appendices

Appendix 1 Links to key documents

International commitments:

- Conservation and Management Plan for the Memorandum of Understanding on the Conservation and Management of Dugongs (Dugong dugon) and their Habitats throughout their Range
- CMS Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia (IOSEA MoU).

National government plans

- National Recovery Plan for Marine Turtles in Australia
- Australian Marine Parks North-west Marine Parks Network Management Plan 2018
- Australian Marine Parks North Marine Parks Network Management Plan 2018

Healthy Country and Indigenous Protected Area Plans

- Balanggarra Healthy Country Plan 2012-2022
- Uunguu Indigenous Protected Area: Wundaagu (saltwater) Indicative Plan of Management 2016-2020 & Wunambal Gaambera Healthy Country Plan
- Dambimangari Healthy Country Plan
- Mayala Healthy Country Plan
- Bardi Jawi Indigenous Protected Area Plan
- Nyul Nyul Freshwater Management & Monitoring Plan
- Karajarri Healthy Country Plan
- Nyangumarta Indigenous Protected Area Plan

Marine Park and Joint Management Plans

- North Kimberley Marine Park Mark Management Plan
- Lalang-Garram Horizontal Falls Marine Park Management Plan & Lalang-Garram Camden Sound Marine Park Management Plan
- Yawuru Nagulagun/ Roebuck Bay Joint Management Plan
- Eighty Mile Beach Marine Park Management Plan

Kimberley Marine Research Project reports

- Strategic Integrated Marine Science for the Kimberley Region
- Dugong final report
- Turtle final report
- Seagrass final report
- Remote sensing for monitoring and management final report
- Indigenous knowledge final report
    - Kimberley Indigenous Saltwater Research Protocol
    - Guidelines for knowledge work
    - Saltwater Monitoring Framework

Methodologies and case studies

- Wunambal Gaambera turtle and dugong case study
- Marine Sampling Field Manual for Towed Underwater Camera Systems (NERP national monitoring guidelines, Chapter 7)

Appendix 2 Basic data about green turtles in Austalia

Below: Green turtle stock data summary interpreted from a number of sources including the *Recovery Plan for Marine Turtles* (2017)

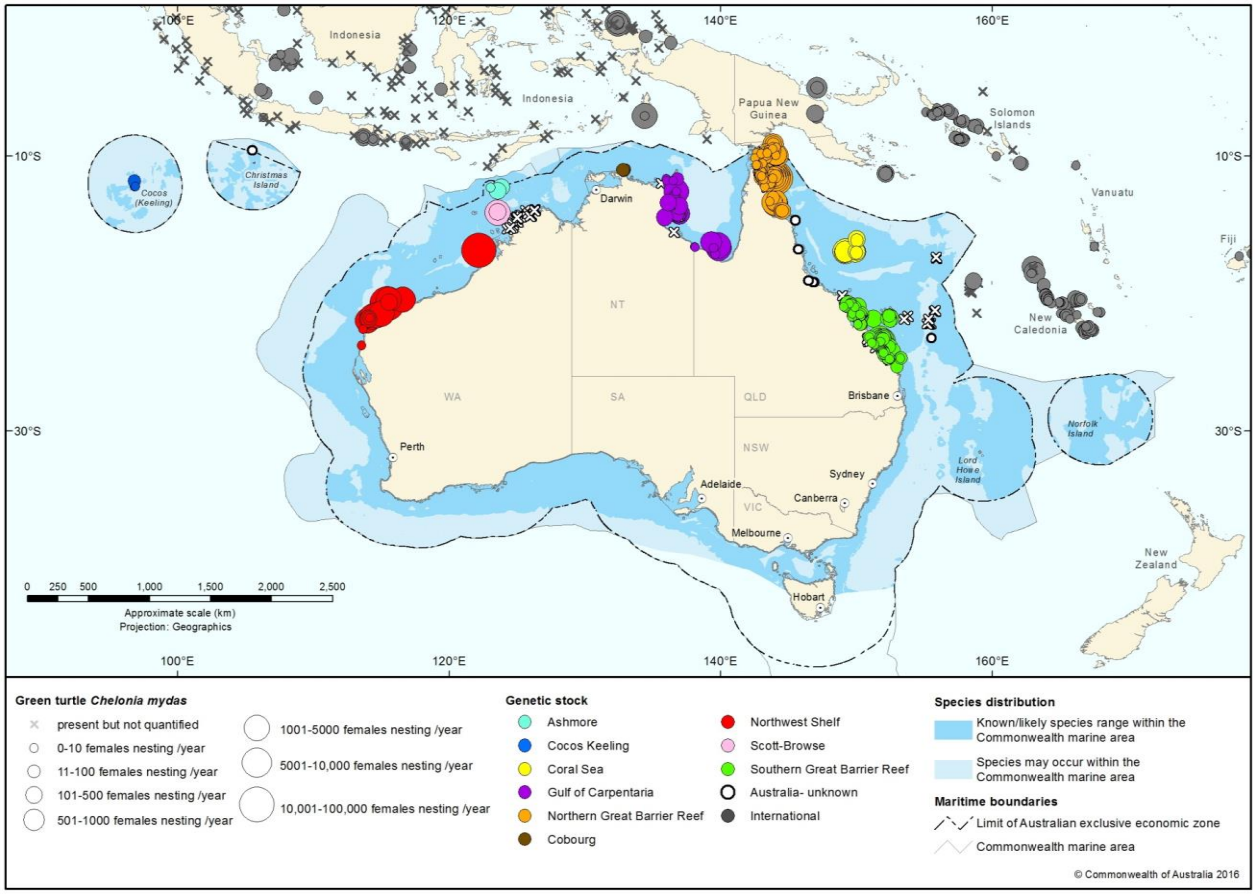
Kimberley genetic stocks	rookeries	Tenure type	Park/Reserve name	Closest language groups	Presence
North West Shelf	Adele Island	State (internesting buffer in places less than 20km, therefore extends into commonwealth waters)	?Adele Island Nature Reserve	Mayala, Dambimangari	Nov-Mar
North West Shelf	Maret Island	State	North Kimberley Marine Park (State)	Wunambal Gaambera	Nov-Mar
North West Shelf	Cassini Island	State	North Kimberley Marine Park (State)	Wunambal Gaambera	Nov-Mar
North West Shelf	Lacepede Islands	State	None	Nyul Nyul, Jabbir Jabbir	Nov-Mar
Ashmore/Cartier Reef area	Cartier Reef (closer to Timor-Leste and at extent of Australian waters)	Commonwealth	Cartier Island Marine Park	Wunambal Gaambera	All year (peak: Dec-Jan)
Ashmore/Cartier Reef area	Ashmore Reef (closer to Timor-Leste and at extent of Australian waters)	Commonwealth	Ashmore Reef Marine Park	Wunambal Gaambera	All year (peak: Dec-Jan)
Scott-Browse area	Sandy Island, Scott Reef	State (within Indonesian MOU area)	?None	Bardi Jawi, Mayala, Dambimangari	Nov-Mar
Scott-Browse area	Browse Island	State	?None	Bardi Jawi, Mayala, Dambimangari	Nov-Mar

Below: Green turtle northewst shelf genetic stock table: extract from the Recovery Plan for Marine Turtles (2017)

Green – North West Shelf (G-NWS)		**Stable[136]**
Threats	C. Chemical and terrestrial discharge – acute	High
	G. Light pollution	High
Important nesting areas		Internesting Buffer: 20 km
Major: Lacepedes, Montebello, Barrow, Muiron, Browse Islands and Northwest Cape[136]. *Minor*: Boodie, Middle, Serrurier, Thevenard, Lowendal, Rosemary, Legendre, Delambre Islands and various mainland beaches, Shark Bay to Ningaloo and Kimberley Coast[136]. *Index beaches monitored*: Gnaraloo Bay[94], Lacepedes (1990s-), Ningaloo Coast (2000s-), Montebello, Barrow[39], Muiron, and Browse Islands, Northwest Cape[136].		*Mating:* Sep–Dec *Nesting*: Nov–Mar (peak: Dec–Feb) *Hatching*: Jan–May (peak: Feb–Mar)
Foraging habitat		
Post-hatchling/young juveniles: Unknown. Likely to disperse through much of the Indian Ocean/Arafura Sea. *Juvenile-adult:* Tidal/sub-tidal habitats with coral reef, mangrove, sand, rocky reefs and mudflats where there are algal turfs or seagrass meadows present[18]. A proportion of turtles may also remain resident in the open ocean[92]. *Foraging grounds monitored*: Ningaloo[195], Uunguu Rangers monitor Wunambal Gaamera Sea Country using ITracker[114]. A small proportion of green turtles foraging at Cocos Keeling are from the North West Shelf stock[249].Genetic analysis[50] indicates this stock is found foraging at Ashmore Reef, Fog Bay, Cobourg and Field Island, and also at Shark Bay and Cocos Keeling[117]. *Distribution*: See Figure 9.		
Stock description		
The North West Shelf stock is one of the largest green turtle stocks in the world and the largest in the Indian Ocean[205]. Historically, green turtles were harvested in the region by early explorers and as part of a commercial fishery (1870 to 1973)[82] and a large number of juvenile and adult turtles died as a result of atomic bomb testing in the Montebello Island Group in the 1950's[181]. More recently, bycatch of turtles in trawls was problematic until the introduction of turtle excluder devices in trawl fisheries. Nesting occurs over a large geographic range with nesting on offshore islands and the mainland. Management is overseen by the Western Australian Government through the *Management Plan for the Montebello/Barrow Islands Marine Conservation Reserves 2007-2017*[46], *Barrow Group Nature Reserves Management Plan*[48], and *Eighty Mile Beach Marine Park Management Plan 2014-2024*[47]. Indigenous communities along the coast monitor foraging grounds through a variety of programs such as I-tracker[114]. Offshore nesting is considered largely secure from terrestrial predation. Mainland terrestrial predation is controlled through initiatives such as the Ningaloo Coast Fox Control Program. The stock appears stable[136], but given its range overlaps with high intensity oil and gas industry activities, it may be increasingly subject to impacts from artificial light[121], habitat modification and oil spills. The impacts of noise are poorly understood for marine turtles. This stock provides an opportunity to address this knowledge gap as it is subject to seismic and other industrial noise[175]. Many of the mainland beaches are subject to tourism activities such as beach driving, which has proven to be difficult to manage during the nesting and hatchling season. Turtles remain an important part of Indigenous culture and a food source for many communities across north-western Australia. Eggs are harvested at beaches and adult turtles are taken for meat when they return to foraging grounds. Anecdotal reports have noted a decrease in size of foraging turtles[ix]. Most Indigenous groups are actively managing or have started to manage community expectations about sustainable take. Turtles foraging out in the open ocean are also at risk from ghost nets carried along the currents from Indonesian waters towards the Gulf of Carpentaria[255]. The combined impacts of multiple threats may have a cumulative impact on the stock.		
Priority actions specifically required to recover this stock		Action Area

Green – North West Shelf (G-NWS)	Stable[136]
Artificial light within or adjacent to habitat critical to the survival of marine turtles will be managed such that marine turtles are not displaced from these habitats as per section 3.3 Table 6.	A8
Ensure that spill risk strategies and response programs include management for turtles and their habitats.	A4
Given this is a relatively accessible stock that is likely to be exposed to anthropogenic noise - Investigate the impacts of anthropogenic noise on turtle behaviour and biology and extrapolate findings from the North West Shelf stock to other stocks.	B3
Support the implementation of management plans and build capacity to undertake monitoring, education, and compliance management of marine turtles.	A1, A2, A3, A6, A10
Understand the threat posed to this stock by marine debris.	A3
Continue long-term monitoring of index beaches.	B1
Measure of success	
Trends in nesting turtle numbers for this stock continue to be stable or increasing	B1

Below: Australian green turtle nesting populatoins: extract from the [Recovery Plan for Marine Turtles (2017)]



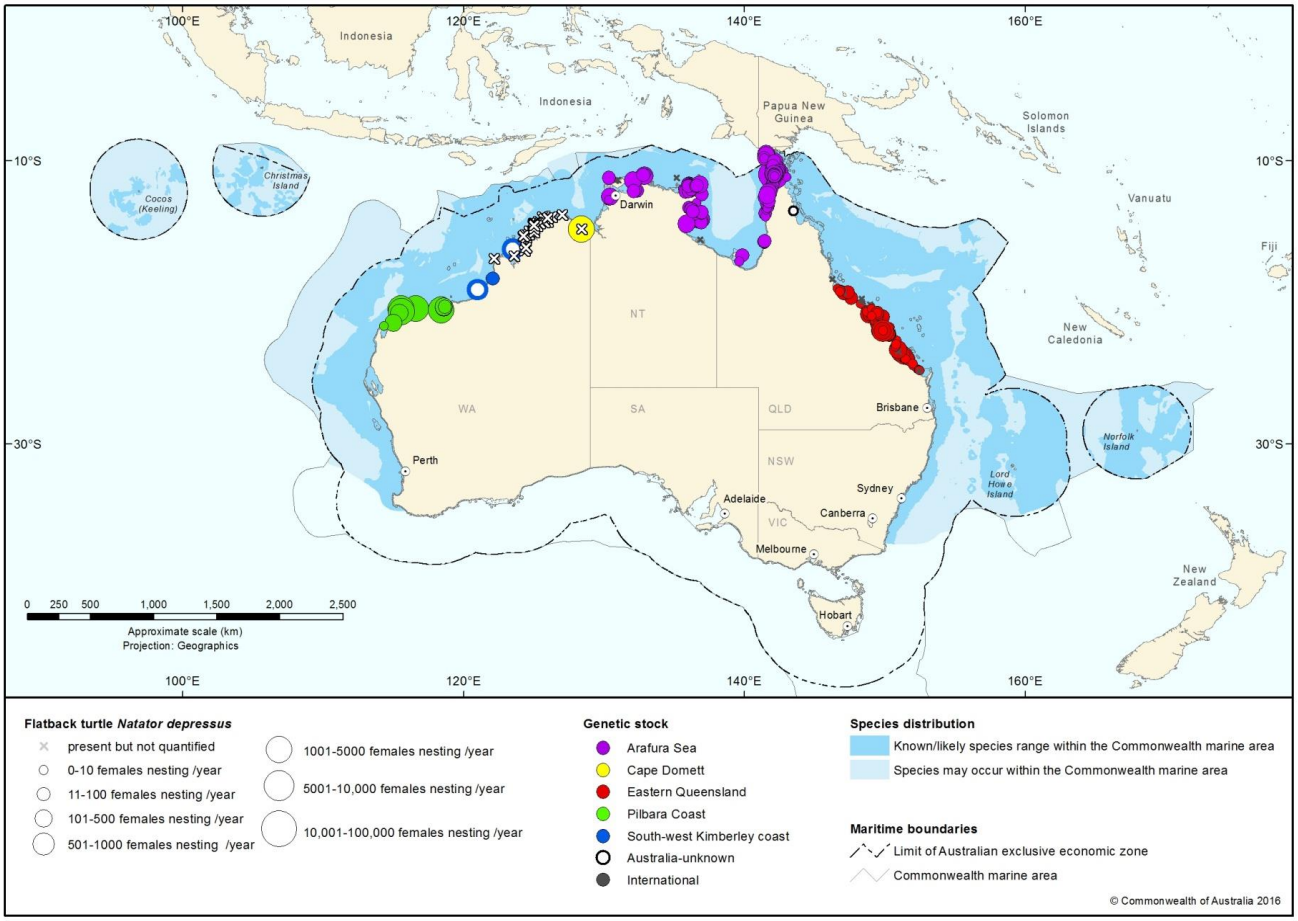
Appendix 3 Basic data about flatback turtles in Austalia

Below: Flatback turtle stock data summary interpreted from a number of sources including the Recovery Plan for Marine Turtles (2017)

Kimberley genetic stocks	Kimberley rookeries	Tenure type	Park/Reserve name	Closest language groups	Time of year
Cape Domett area	Cape Domett,	State (Comonwealth within 5km)	State: Crown Land/port area/Miriuwung Gajjerong NT area. Commonwealth within 60km buffer	Miriuwung Gajjerong	All year (peak: Jul-Sep)
Cape Domett area	Lacrosse Island	State	None	Miriuwung Gajjerong	All year (peak: Jul-Sep)
South-west Kimberley	Eighty Mile Beach	State to state extent then comonwealth	Eighty Mile Beach Marine Park (state); Eighty Mile Beach Marine Park (federal)	Nyangumarta, Karajarri	Oct-Mar (peak: Dec-Jan)
South-west Kimberley	Eco Beach	State to state extent then comonwealth	None	Karajarri	Oct-Mar (peak: Dec-Jan)
South-west Kimberley	Lacepede Islands	State	None	Nyul Nyul. Jabbir Jabbir	Oct-Mar (peak: Dec-Jan)
Unknown genetic stock Kimberley, Western Australia	Maret Islands	State	North Kimberley Marine Park (State)	Wunambal Gaambera	May-July
Unknown genetic stock Kimberley, Western Australia	Montilivet Islands	State	North Kimberley Marine Park (State)	Wunambal Gaambera	May-July
Unknown genetic stock Kimberley, Western Australia	Cassini Island	State	North Kimberley Marine Park (State)	Wunambal Gaambera	May-July
Unknown genetic stock Kimberley, Western Australia	Coronation Islands (includes Lamarck Island),	State	North Kimberley Marine Park (State)	Wunambal Gaambera	May-July

Unknown genetic stock Kimberley, Western Australia	West Governor Island (Napier-Broome Bay)	State	North Kimberley Marine Park (State)	Balangarra	May-July
Unknown genetic stock Kimberley, Western Australia	Sir Graham MooreIsland (Napier-Broome Bay)	State	North Kimberley Marine Park (State)	Balangarra	May-July
Unknown genetic stock Kimberley, Western Australia	Champagny Island (Camden Sound)	State	Lalang-garram (Camden Sound) Marine Park	Dambimangari	May-July
Unknown genetic stock Kimberley, Western Australia	Darcy Island (Camden Sound)	State	Lalang-garram (Camden Sound) Marine Park	Dambimangari	May-July
Unknown genetic stock Kimberley, Western Australia	Augustus Island (Camden Sound)	State	Lalang-garram (Camden Sound) Marine Park	Dambimangari	May-July

Below: Australian flatback turtle nesting populatoins: extract from the [Recovery Plan for Marine Turtles (2017)]



Below: Flatback turtle southwest Kimberley shelf genetic stock table: extract from the Recovery Plan for Marine Turtles (2017)

Flatback – south-west Kimberley (F-swKim)		**Unknown**
Threats	C. Chemical and terrestrial discharge – acute	High
Important nesting areas		Internesting Buffer: 60 km
Major: Eco Beach, Eighty Mile Beach. *Index beaches monitored*: Eco Beach (2008-)[162], Eighty Mile Beach (2008-)[47].		*Mating:* year round *Nesting*: all year (peak: Dec–Jan) *Hatching*: all year
Foraging habitat		
Post-hatchling/young juveniles: Unknown, likely to remain in waters over the Australian continental shelf. *Juvenile-adult:* Flatback turtles are known to favour soft sediment habitats that support benthic invertebrates[199]. Important foraging habitat has not been identified for this stock. *Foraging grounds monitored*: None. *Distribution*: See Figure 14.		
Stock description		
The genetic relationship between this nesting aggregation and the Cape Domett and Pilbara stocks is currently under review. Aboriginal communities whose sea and land country overlap at Eighty Mile Beach collaborate with the CSIRO and Western Australian Department of Parks and Wildlife to manage and monitor the south-west Kimberley stock. The *Management Plan for the Eighty Mile Beach Marine Park Reserve* also includes management and monitoring of turtles[47]. The likelihood of impacts from chemical and terrestrial discharge is rising due to the increasing number of oil and gas installations occurring along the Western Australian coast. While the risk of an oil spill is generally considered low, the consequences could be substantial and the risk increases with each activity. The consequences of an oil spill have implications for the immediate health of marine turtles and their nesting, future nesting, water quality and general turtle health[206]. Aboriginal communities have raised concerns regarding the increasing impacts of tourism, fishing and industrial developments on nesting turtle numbers[lxi]. Turtles nesting at Eco Beach demonstrate low embryonic mortality at high nest temperatures, suggesting some resilience to increased sand temperatures resulting from climate change[162]. Although important foraging areas for this stock have not been identified, it is likely that turtles from this stock encounter ghost nets when at sea as the prevalence of marine debris in the region is increasing from local and international sources[255]. Work undertaken as part of the North West Shelf Flatback Turtle Conservation Program to manage foraging grounds for the Pilbara stock are likely to benefit turtles from the south-west Kimberley stock as turtles will probably overlap at foraging grounds. Existing nest monitoring programs should continue to enable assessment of the efficacy of management programs.		
Priority actions specifically required to recover this stock		Action Area
• Determine the relatedness of genetic stocks among Western Australian flatback turtle rookeries.		B3
• Ensure that spill risk strategies and response programs include management for turtles and their habitats, particularly in reference to slow to recover habitats, e.g. seagrass meadows or corals.		A4
• Continue the implementation of the North West Shelf Flatback Turtle Conservation Program.		A1, A6, A8, A9, B3
Continue long-term monitoring of index beaches to assess trends in nesting abundance.		B1
Measure of success		
Trends in nesting turtle abundance are assessed for this stock		B1

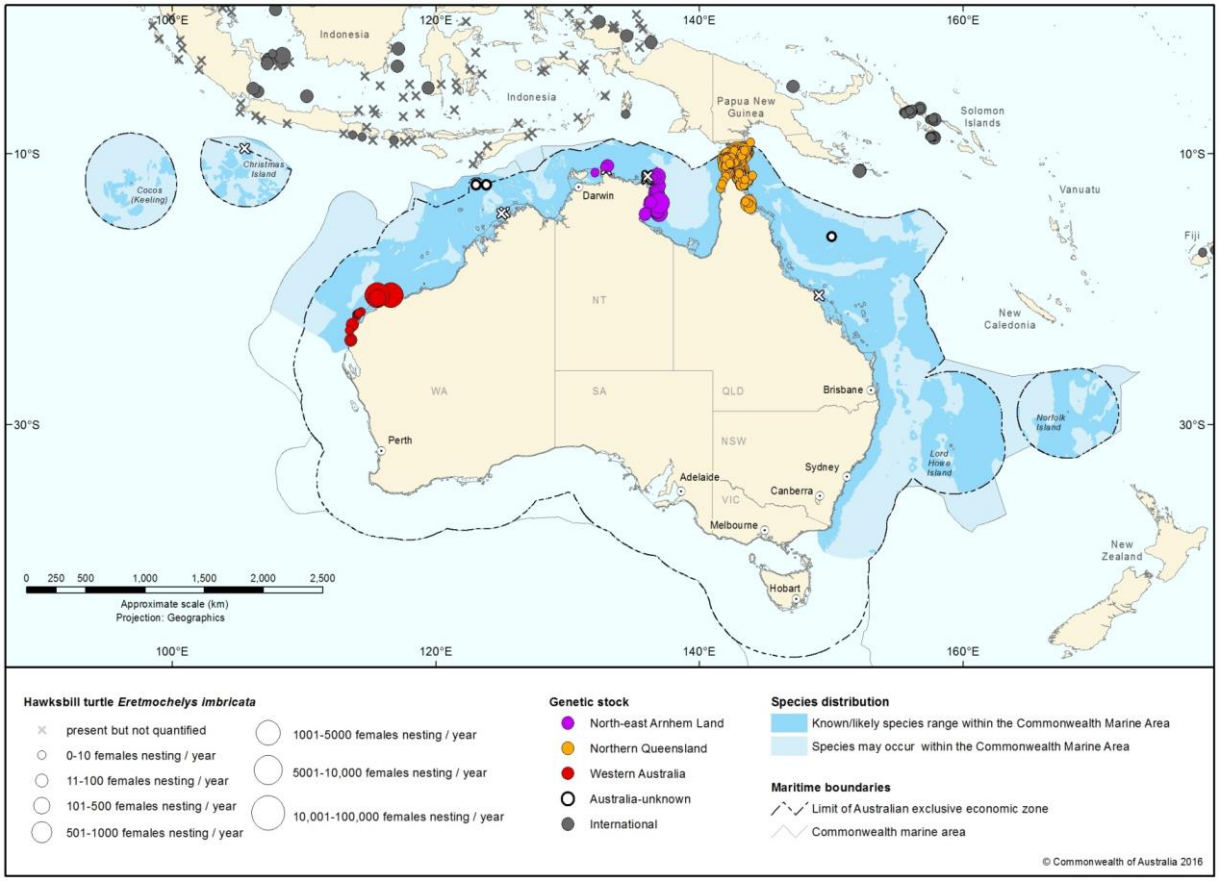
Appendix 4: Basic data about hawksbill turtles in Austalia

Below: Hawksbill turtle Western Australia genetic stock table: extract from the Recovery Plan for Marine Turtles (2017)

<table>
<tr><td colspan="2">Hawksbill – Western Australia (H-WA)</td><td>Unknown[136]</td></tr>
<tr><td rowspan="3">Threats</td><td>E. International take – outside Australia's jurisdiction</td><td>Very high</td></tr>
<tr><td>A. Climate change and variability</td><td>High</td></tr>
<tr><td>G. Light pollution</td><td>High</td></tr>
<tr><td colspan="2"><u>Important nesting areas</u></td><td>Internesting Buffer: 20 km</td></tr>
<tr><td colspan="2">Major: Dampier Archipelago (Rosemary Island), Delambre Island and Montebello Islands[136].
Minor: Ah Chong, South East and Timouille, Sholl Island, Lowendal Islands including Varanus, Beacon, Bridled, Barrow, Muiron Islands and mainland beaches from Cape Range to Ningaloo and Gnaraloo to Red Bluff[136].
Index beaches monitored: Varanus (1987-2015), Rosemary (1994-2015) Islands[136].</td><td>Mating: all year
Nesting: all year (peak: Oct–Jan)[189]
Hatching: all year (peak: Dec–Feb)</td></tr>
<tr><td colspan="3"><u>Foraging habitat</u></td></tr>
<tr><td colspan="3">Post-hatchling/young juveniles: Unknown.
Juvenile-adult: Tidal and sub-tidal coral and rocky reef habitats where they feed on algae, sponges and soft corals. Hawksbill turtles can be found in clear or turbid water, on reefs, seagrass meadows or on soft-bottom habitats[18].
Foraging grounds monitored: None.
Distribution: See Figure 13.</td></tr>
<tr><td colspan="3"><u>Stock description</u></td></tr>
<tr><td colspan="3">The Western Australia hawksbill turtle stock is one of the largest in the world and the largest in the Indian Ocean[136]. Most of the nesting for this stock is located in the Pilbara. Some hawksbill turtle nesting occurs at Scott Reef and Ashmore Reef, but genetic affiliations are unknown. The Dampier Archipelago has the largest nesting aggregation recorded with approximately 1000 nesting females per year at Rosemary Island[136]. Surveys undertaken at Varanus and Rosemary Islands suggest that survivorship of nesting females has remained high (0.95) and constant over the past 20 years[189]. A major proportion of nesting for this stock is protected within the Dampier Archipelago, Thevenard and Barrow Island Nature Reserves, and the Montebello Conservation Area. However, Delambre Island (major nesting) is not protected. Historically, there was a large-scale commercial harvest and trade of hawksbill turtles for tortoiseshell in east and northern Australia. The commercial harvest was smaller in Western Australia than in the Northern Territory and Queensland, however this stock may have also been affected[134, 136]. Due to substantial harvest of hawksbill turtles for the tortoiseshell trade in other jurisdictions throughout its range, it is likely that the greatest threat to this stock is the take outside Australian waters[136, 171].
Important foraging habitat has not been documented for this stock, however reefs within the Ningaloo Marine Park, Rowley Shoals Marine Park and the Montebello/Barrow Islands Marine Park likely provide protection for hawksbill turtles. This stock also occurs within areas of high industrial development, which is likely to continue to increase into the future. Associated changes in light horizons affect nesting beach selection and hatchling dispersal[121]. Changes in ocean circulation, ocean acidification and increased coral bleaching will directly affect the availability of hawksbill turtle foraging habitat and food availability[83].</td></tr>
<tr><td colspan="2"><u>Priority actions specifically required to recover this stock</u></td><td>Action Area</td></tr>
</table>

Hawksbill – Western Australia (H-WA)	Unknown[136]
• Maintain long-term monitoring programs at index beaches and establish monitoring at a key foraging area.	A5
• Work on a regional scale to understand market supply chains and to reduce unsustainable harvest and illegal and unregulated trade.	A4
• Manage artificial light from onshore and offshore sources to ensure biologically important behaviours of nesting adults and dispersing hatchlings can continue.	A8
• Quantify and model how changes in ambient temperatures (sand and water), sea level, frequency of extreme weather events, ocean circulation and acidification affect marine turtle nesting, sex ratios, hatching success, habitats, food availability and their ability adapt to these changes.	A2
• Understand foraging ground requirements and identify priority areas for protection.	B3
• Assess mixed stock genetics at foraging grounds.	B3
Measure of success	
Trends in nesting turtle abundance are stable or increasing	B1

Below: Australian Hawskbill turtle nesting populatoins: extract from the Recovery Plan for Marine Turtles (2017)

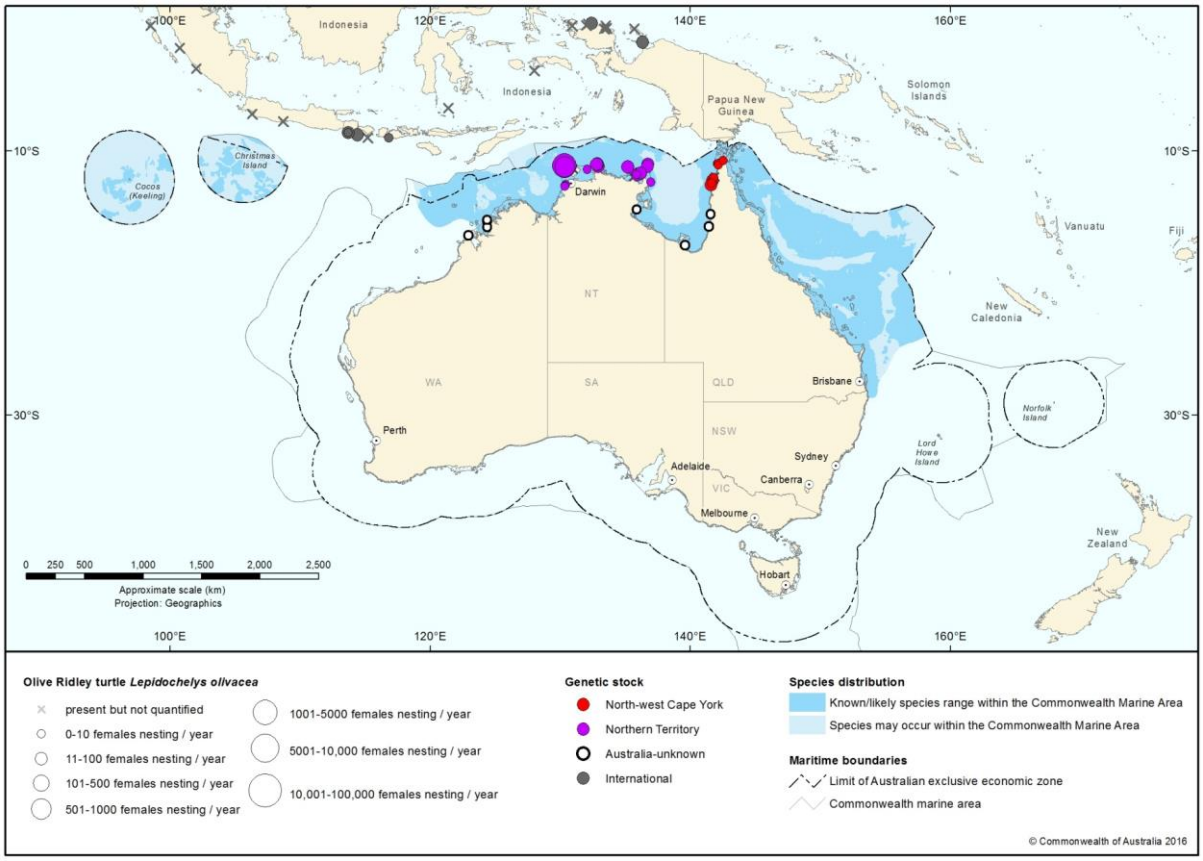


Appendix 5: Basic data about olive ridley turtles in Austalia

Below: Olive Ridley turtle stock data summary interpreted from a number of sources including the [Recovery Plan for Marine Turtles (2017)]

Kimberley genetic stocks	Kimberley rookeries	Tenure type	Park/Reserve name	Closest language groups	Time of year
Unknown genetic stock Kimberley, Western Australia	Prior Point	??	??	??	May-July
Unknown genetic stock Kimberley, Western Australia	Vulcan Island	??	??	??	May-July
Unknown genetic stock Kimberley, Western Australia	Darcy Island (Camden Sound)	State	Lalang Garram?	Dambimangari	May-July
Unknown genetic stock Kimberley, Western Australia	Llangi	??	??	??	May-July[
Unknown genetic stock Kimberley, Western Australia	Cape Leveque	State	None (Buccaneer Archipelago prposed)	Bardi Jawi	May-July

Below: Australian olive ridley turtle nesting populatoins: extract from the Recovery Plan for Marine Turtles (2017)



Appendix 6: Turtle distribution (hotspot) map

Extract from the [WAMSI turtle prject final report (2016)]

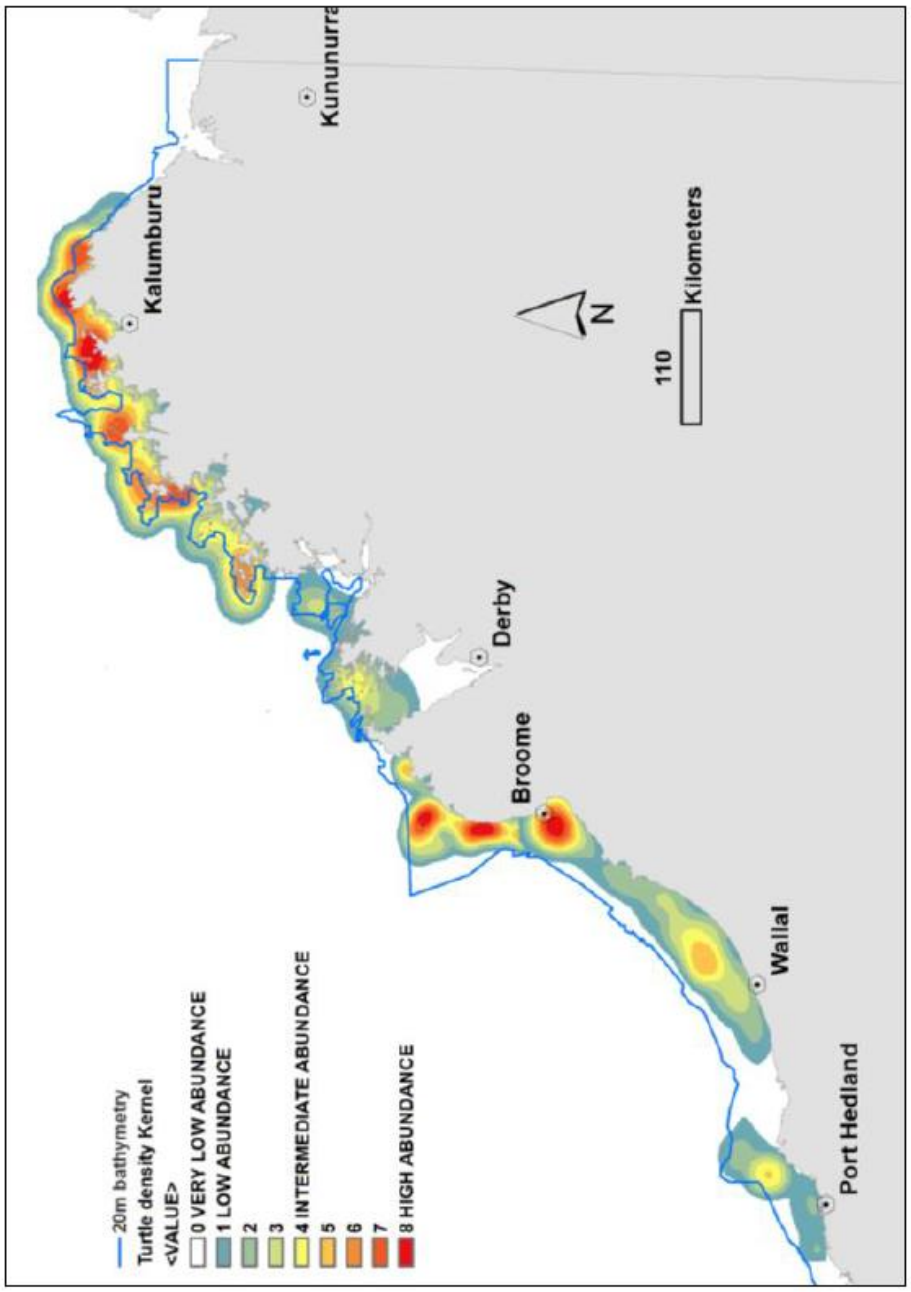
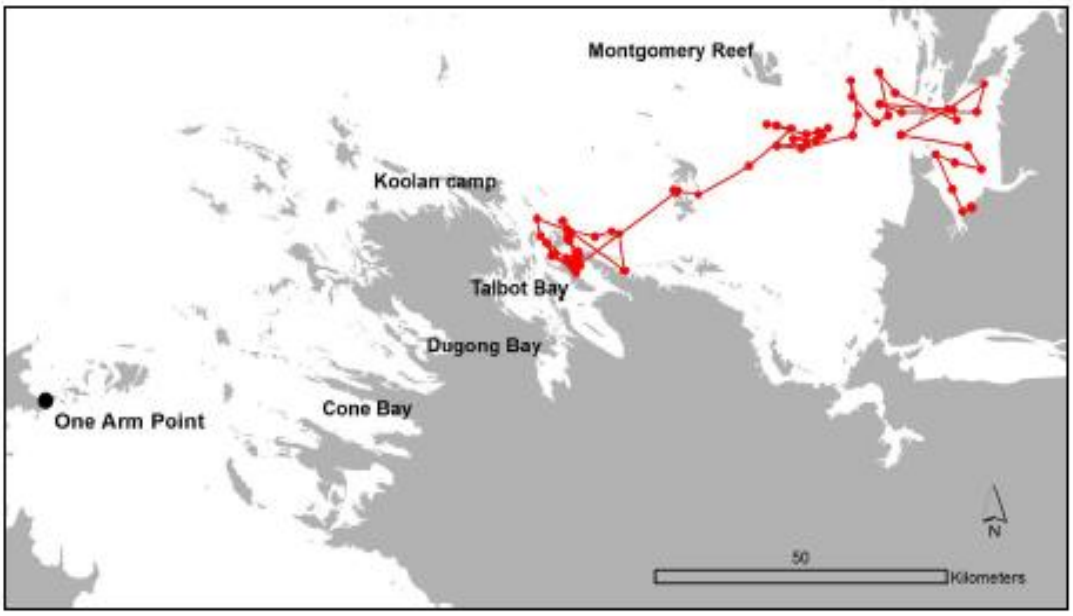


Figure 7a & b. TURTLES (a) Distribution of all turtle sightings (both on- and off-transects) by all observers during surveys in the Kimberley region. (b) Turtle abundance "hotspot" map. All sighting data were used to map smoothed and extrapolated Kernel densities across the 5-km aerial survey grid.

Appendix 7: Dugong distribution (hotspot) and movement figures.

Extract from the [WAMSI dugong project final report (2016)]

(a)



(b)

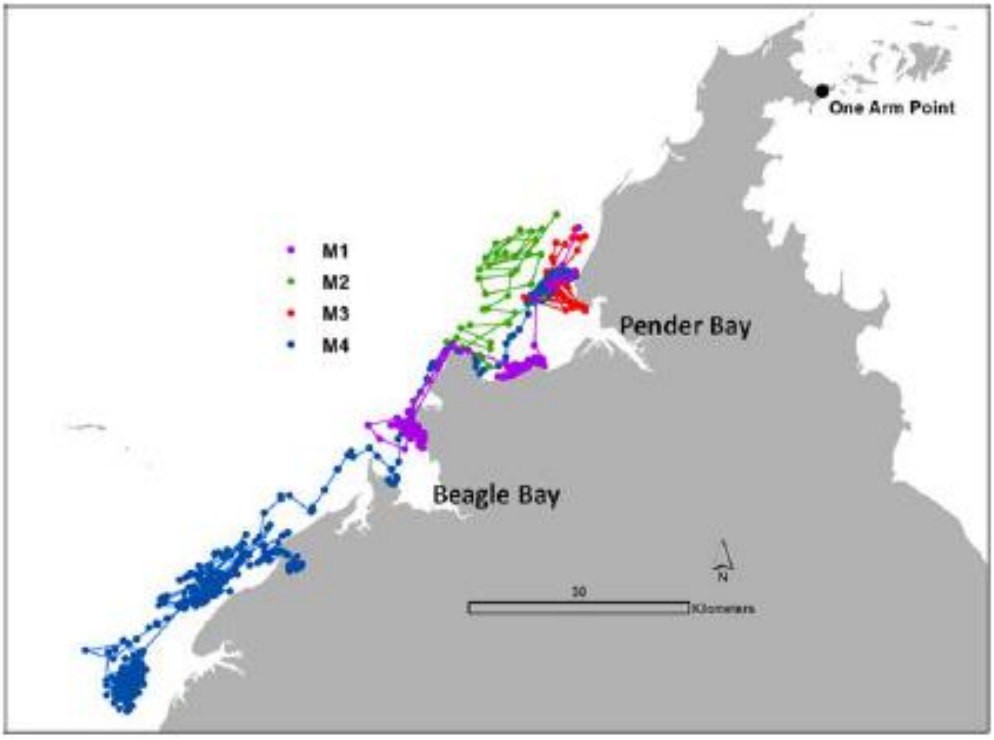
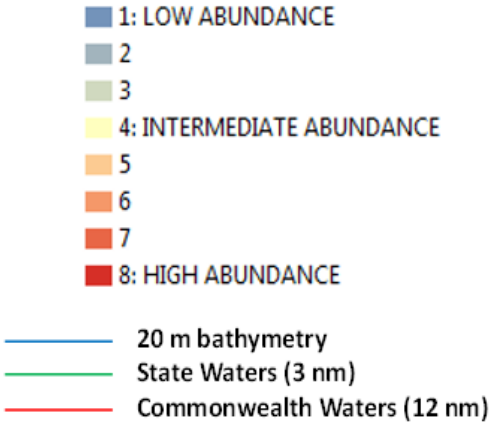
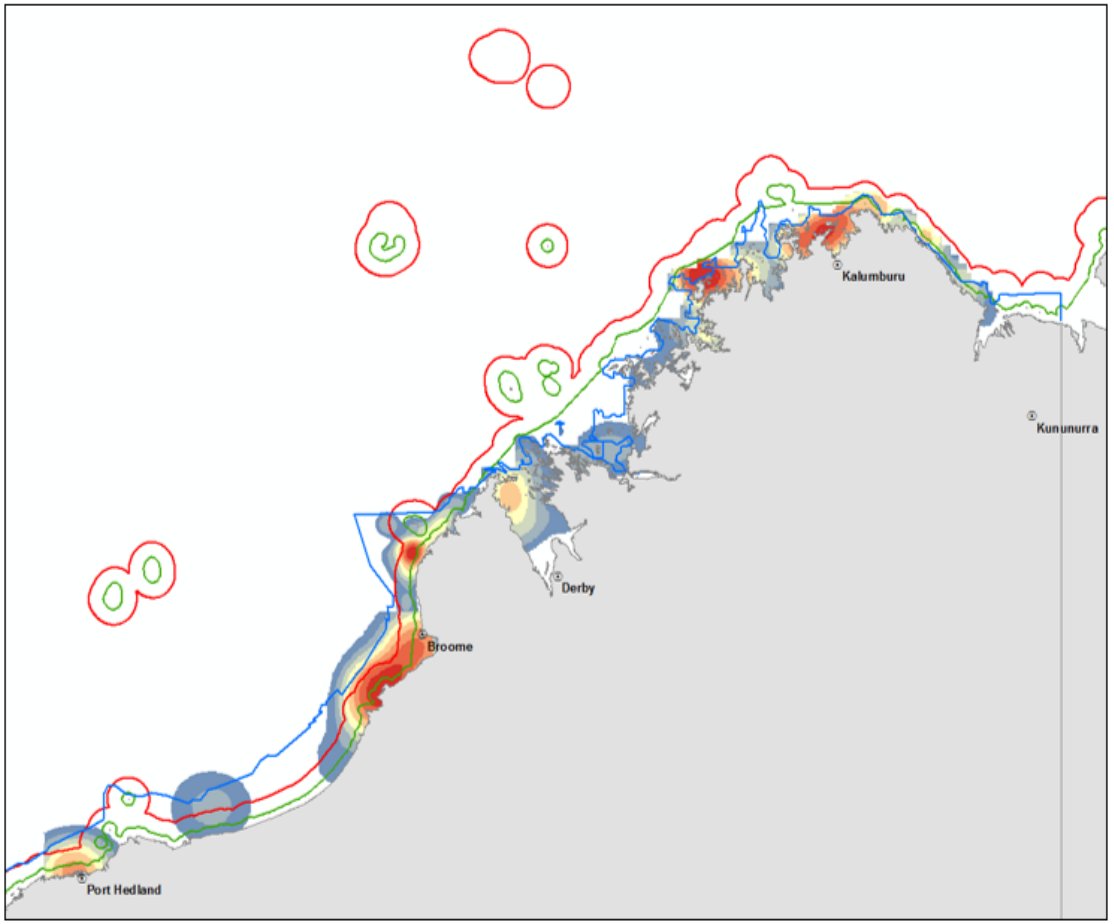


Figure 12a&b. Trajectories of tagged dugongs over variable tracking intervals between August 2016 and February 2017. (a) Adult female (F1) tagged at Talbot Bay (HFMP - Dambimangari sea country), and (b) young adult males (M1-M4) tagged north of Pender Bay on Dampier Peninsula (Bardi Jawi sea country).

North & South Kimberley dugong distribution & abundance "hotspots" vs. Commonwealth & State Waters



- Aerial surveys undertaken between 20m bathymetry & coast.
- N Kimberley surveys – east of Beagle Bay State Waters further offshore than 20m bathy & less than Comm. Waters; west of Beagle Bay 20m bathy further offshore than both Comm. & State Waters.
- Hotspot maps therefore only relevant to Comm. Waters west of Beagle Bay.
- Far offshore islands & shoals were not surveyed for dugong but may be abundance hotspots.



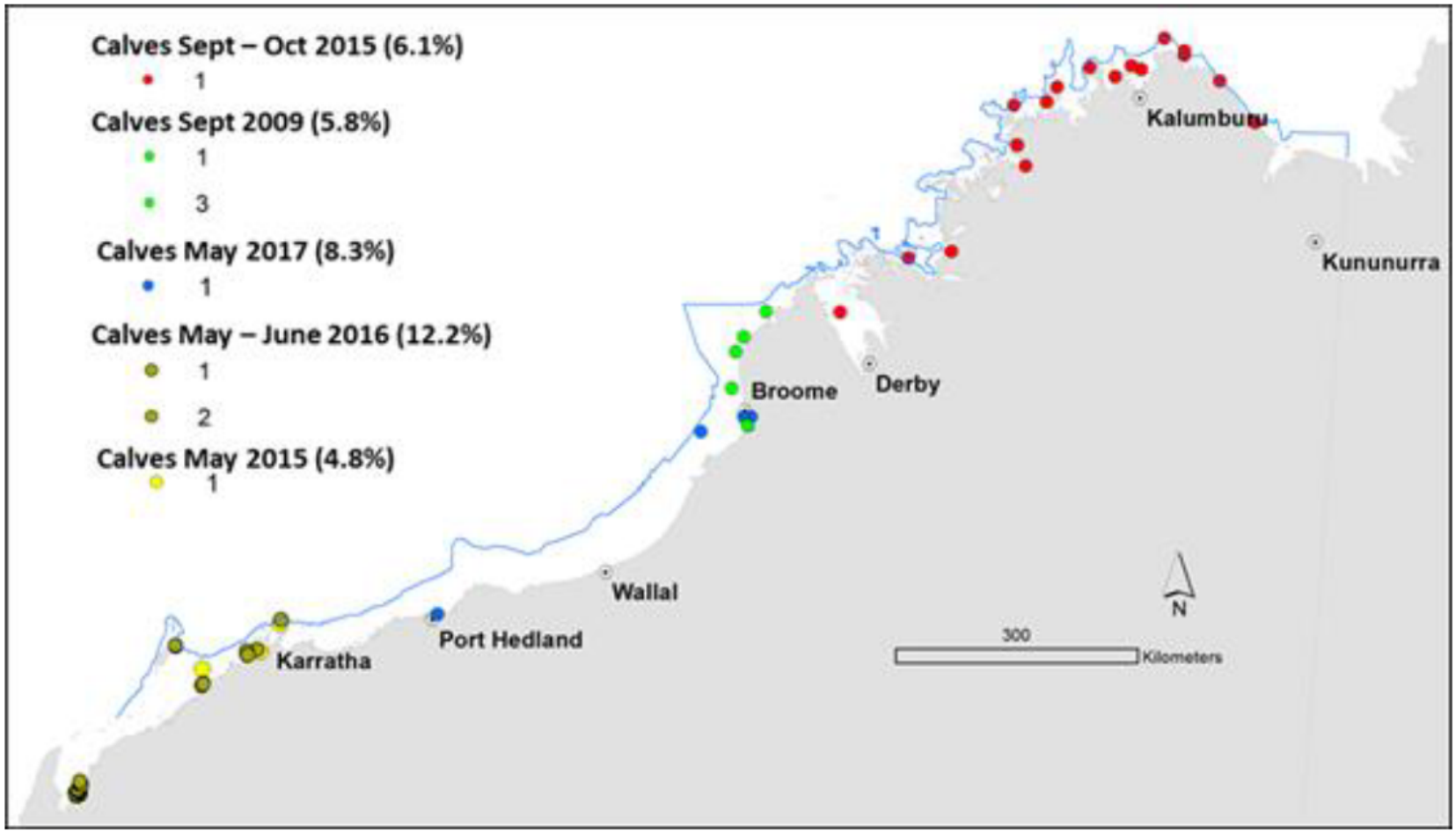


Figure 3. DUGONG CALVES. The location of calves sighted during aerial surveys in the Kimberley-Pilbara region between 2009 and 2017.

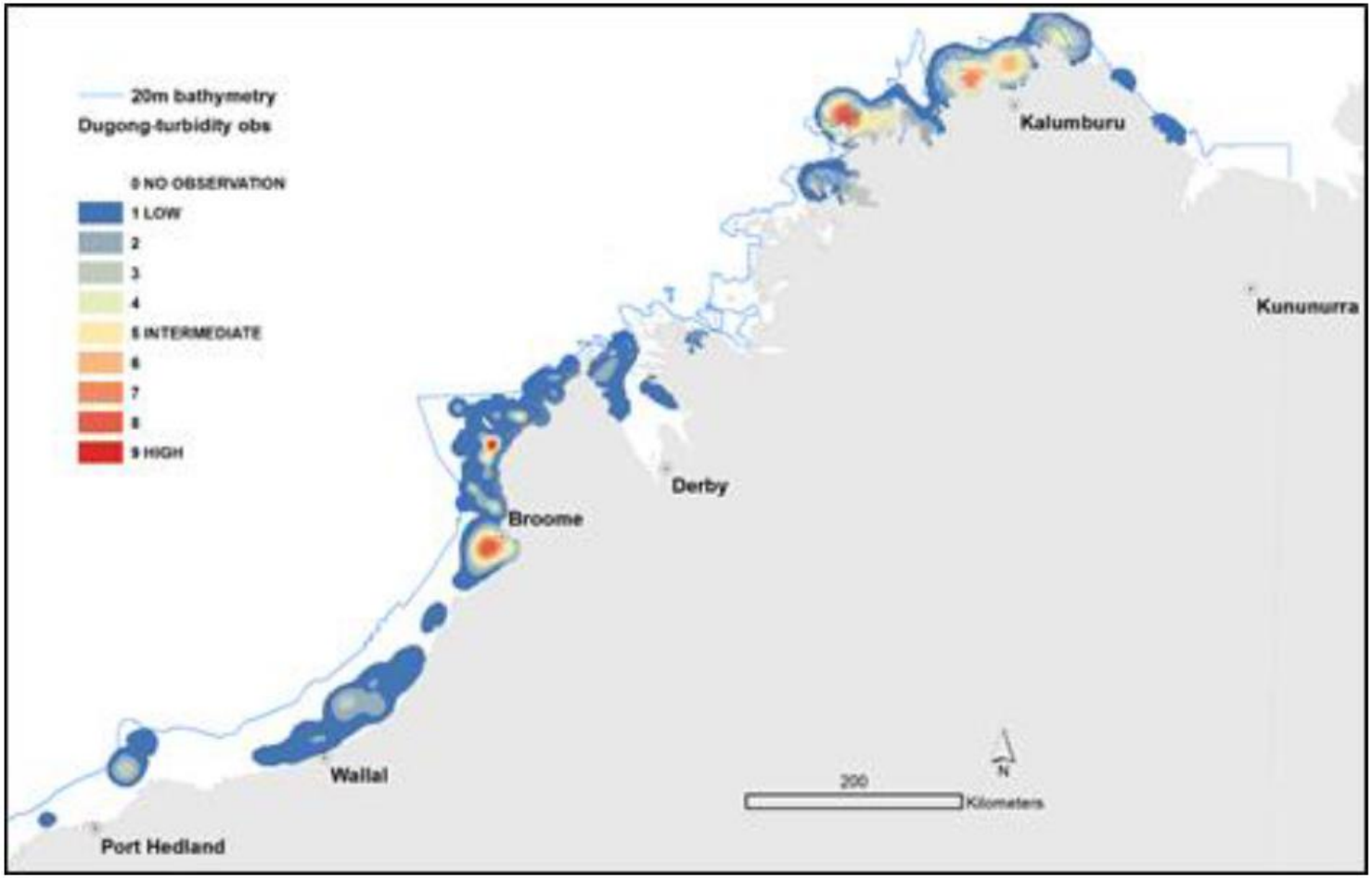


Figure 4. PAIRED DUGONG-TURBIDITY OBSERVATIONS. The distribution of turbidity "hotspot" (ranks: 1 clear to 4 muddy on survey) associated with dugong sightings in the North Kimberley (Sept-Oct 2015) and South Kimberley (May 2017) surveys mapped using Kernel extrapolation and smoothing methods. Eight turbidity classes were arbitrarily used to map Kernel density "hotspots" (range: zero, low-blue colour, intermediate and high-red colour). Dugongs were mostly observed in turbid water, even in the South Kimberley where water clarity was highest.

Appendix 8: Sea turtle, dugong and benthic ranger monitorg tools and techniques

(Extract from the KISSP Monitoring toolbox (2017)

VALUE	MONITORING TOOL	Knowledge systems	What is measured/monitored/recorded	RECORDING METHOD	TRIALS AND DEVELOPMENT	ANALYSIS / COMMENTS*
SALTWATER RESOURCES						
TURTLES	**BOAT BASED SURVEYS (transects)**	IK/WSK	**Changes in adult and juvenile turtle numbers at selected sites**	**I-Tracker - Turtle and Dugong Survey application** **NAILSMA (2015) - Field Manual**	Developed by NAILSMA and CSIRO and trialled with WG Uunguu Rangers and Dambi Rangers NAILSMA (2013) - Field Trials Jackson et al (2015) - Field Trip Report	Analysis spreadsheet currently developed for WG Main Contact - Peter Bayliss CSIRO
TURTLES	**CUSTOMARY HARVESTS**	IK	Information on customary harvest	Participatory Ranger Interviews with hunters	Individual groups have developed their own recording sheets including: date, time, hunter, location and fat content	Not developed*
TURTLES	**SALTWATER PATROL**	IK	Beach nesting surveys, Adult and juvenile turtle sightings, (sex, size, species and behaviour, injuries) Pressures including Ghost nets, animal deaths and feral animals	I-Tracker – Saltwater Country Patrol	https://www.nailsma.org.au/hub/programs/I-Tracker.html NAILSMA 2014 – Factsheet on V6 updates	Analysis tools within I-Tracker to map sightings
TURTLES	**VISITOR ACCESS PASS**	WSK	Pressures: Visitor access numbers and location	Not developed	Various groups implementing or developing (WG, Karajarri and Dambi)	Not developed*
TURTLES	**RANGER COASTAL PATROLS**	IK	Pressures: Visitor Access locations	Not developed	Not developed	Not developed*

TURTLES	**NAQS PATROL**	WSK	Pressures: Marine Debris and Pests	I-Tracker – Saltwater Country Patrol	https://www.nailsma.org.au/hub/programs/I-Tracker.html NAILSMA 2014 – Factsheet on V6 updates	Not developed* Data provided fee for service
TURTLES	**TANGAROA BLUE**	WSK	Pressures: Marine Debris	Tangaroa Blue Data Sheets	Tangaroa Blue (2012) Identification Manual	Not developed* Data provided fee for service
TURTLES	**GENETIC SAMPLING**	WSK	Skin samples taken to determine the genetics of turtle populations	Data sheets or the I-Tracker – Saltwater Country Patrol	WAMSI 1.2.2 Project	Through partnership with researchers Main Contact: Scott Whiting/DPaW
TURTLES	**TRACK SURVEYS**	WSK	The number of tracks on beaches across locations and time using Aerial Photography or On-ground Counts	Researcher Data sheets or I-Tracker – Saltwater Country Patrol	WAMSI 1.2.2 Project	Through partnership with researchers Scott Whiting/DPaW
TURTLES	**NEST SURVEYS**	WSK	The location and temperature of nesting sites	Data sheets or the I-Tracker – Saltwater Country Patrol	WAMSI 1.2.2 Some techniques could be turned into long term monitoring	**Main Contact: Scott Whiting (DBCA)**
TURTLES	**SATELLITE TAGGING**	WSK	Movement and behaviour of turtles	Satellite Tracking and Analysis Tool I-Tracker – Saltwater	Partnership between CSIRO, Bardi Jawi and DPAW Coyne et al (2005) – Paper on STAT	Through partnership with researchers Main Contacts: Mat

				country Patrol		Vanderklift (CSIRO)
TURTLES	**VIRUS SAMPLING**	WSK	Turtles with virus and type of virus	Samples	Bardi undertaking sampling	By partnership researchers
TURTLES	**INDIGENOUS INDICATORS OF HEALTH**	IK	Health of turtles	Data sheet	-	Not trialled*
TURTLES	**ART**	IK	Nesting habits and distribution	Artwork	Examples in Kimberley include Mahood (2014) Fire Scar Mapping	Not trialled*
TURTLES	**PARTICIPATORY RANKING**	IK	Population Health, Sustainability of Harvest, Health of cultural attributes associated with turtles, Changes in Pressures	Counters Data Sheets	Used by WG in HCP evaluation (Austin et al. 2017)	Not trialled Contact: Beau Austin (CDU)
TURTLES	**PARTICIPATORY MAPPING**	IK OR IK/WSK	The status of turtle populations The distribution of turtle populations Nesting Habits and distributions	Drawings Topographic maps Digital maps GIS	Some mapping done under WAMSI 1.2.2 Scott Whiting (not specifically monitoring but information combined with other techniques to give a broader picture (ie MEB approach)	Not developed
TURTLES	**STORIES**	IK	Many aspects of turtles and their habitats	Audio, video, drawings	See Vernes WWF (2016) Bilbies Paruku for an example	Not trialled*
TURTLES	**KNOWLEDGE HOLDER INTERVIEWS**	IK	Specific knowledge of turtles and their habitats held and maintained by knowledge holders	Written, video, audio	-	Not trialled*
TURTLES	**INTERVIEWS**	IK/WSK	Knowledge of turtles and their habitats	Written, video, audio	-	Not trialled*
TURTLES	**FOCUS GROUP DISCUSSIONS**	IK/WSK	Knowledge of turtles and their habitats	Written, video, audio	-	Not trialled*

VALUE	MONITORING TOOL	Knowledge systems	What is measured/monitored/recorded	RECORDING METHOD	TRIALS AND DEVELOPMENT	ANALYSIS / COMMENTS*
DUGONG	**DUGONG & SEAGRASS RESEARCH TOOLKIT**	WSK	Helps by guiding you to the techniques and tools most suitable to your team capacity, budget and timeline	N/A	The toolkit is available at http://www.conservation.tools/	N/A
DUGONG	**BOAT BASED SURVEYS (transects)**	IK/WSK	Changes in adult and juvenile dugong numbers at selected sites	I-Tracker - Turtle and Dugong Survey application NAILSMA (2015) - Field Manual	Developed by NAILSMA and CSIRO and trialled with WG Uunguu Rangers and Dambi Rangers (Not enough animals for some groups to adopt this technique) NAILSMA 2013 - Field Trials Jackson et al 2015 - Field Trip Report	Analysis spreadsheet currently developed for WG (require adapting for use by other groups) Main Contact - Peter Bayliss CSIRO
DUGONG	**CUSTOMARY HARVESTS**	IK	Recording information on customary Harvest	Participatory Ranger Interviews with hunters	Individual groups have developed their own recording sheets including: date, time, hunter, location	Not developed*
DUGONG	**SALTWATER PATROL**	WSK	Sightings (behaviour, size, numbers, sex)	I-Tracker – Saltwater Country Patrol	NAILSMA 2014 – Factsheet on V6 updates	Analysis tools within I-Tracker to map sightings
DUGONG	**SEAGRASS WATCH TRANSECTS**	WSK	Intertidal Seagrass status (Photographs, samples, and estimates of seagrass cover, canopy height and composition)	Seagrass Watch Data Sheets	Training needs to be undertaken and monitoring overseen by western scientist. EK (2014) – Factsheet Mckenzie and Yoshida (2014) – Information on Seagrass Watch in Kimberley	Data analysed by Seagrass Watch Main Contact – Environs Kimberley

DUGONG	**SEAGRASS BOAT BASED TRANSECTS**	WSK	Subtidal seagrass monitoring	Gopro or dropdown camera I-Tracker - Seagrass Mapping & Monitoring application	National Environmental Research Program (NERP) project collaboration NAILSMA, Wunambal Gaambera and CSIRO Field Manual – Subtidal methods and ID booklet NAILSMA	Post processing of photos recorded onto I-Tracker application (Opportunity in future to develop automated counting of imagery)
DUGONG	**VISITOR ACCESS PASS**	WSK	Pressures: Visitor access numbers and location	Not developed	Various groups implementing or developing (WG, Karajarri and Dambi)	Not developed*
DUGONG	**RANGER COASTAL PATROLS**	IK	Pressures: Visitor Access locations	Not developed	Not developed	Not developed*
DUGONG	**NAQS PATROL**	WSK	Pressures: Marine Debris	I-Tracker – Saltwater Country Patrol	https://www.nailsma.org.au/hub/programs/I-Tracker.html NAILSMA 2014 – Factsheet on V6 updates	Not developed* Data provided fee for service
DUGONG	**TANGAROA BLUE**	WSK	Pressures: Marine Debris	Tangaroa Blue Data Sheets	Tangaroa Blue (2012) Identification Manual	Not developed* Data provided fee for service
DUGONG	**AERIAL SURVEYS**	IK/WSK	Distribution and abundance of dugongs	Aerial Counts	WAMSI project 1.2.5 Rangers trained in technique Developed and refined based on IK Trials suggest that ongoing monitoring plan for dugongs needs to incorporate multiple tools (MEB approach)	Through partnership with researchers Main Contact - Peter Bayliss CSIRO
DUGONG	**SATTELITE TAGGING**	WSK	Dugong seasonal movement patterns in relation to sea grass habitat and behaviour (i.e. diving depths, breeding)	Satellite and audio tracking devices	WAMSI project 1.2.5	**Main Contact - Peter Bayliss CSIRO**

DUGONG	**ART**	IK	Distribution	Art	Examples in Kimberley include Mahood (2014) Fire Scar Mapping	Not trialled*
DUGONG	**PARTICIPATORY RANKING**	IK	The health of dugong populations The health of cultural attributes associated with dugongs	Counters Data Sheets	Used by WG in HCP evaluation (Austin et al. 2017)	Not trialled Contact: Beau Austin (CDU)
DUGONG	**PARTICIPATORY MAPPING**	IK OR IK/WSK	The distribution of dugong populations	Mapping	Participatory mapping with Peter Bayliss WAMSI project 1.2.5 (cultural maps of dugong hunting areas with three Ranger groups)	Not developed*
DUGONG	**STORIES**	IK	Many aspects of dugongs and their habitats	Audio, video, drawings	See Vernes WWF (2016) Bilbies Paruku for an example	Not trialled*
DUGONG	**KNOWLEDGE HOLDER INTERVIEWS**	IK	Specific knowledge of dugongs and their habitats held and maintained by knowledge holders	Written, video, audio	Some Interviews conducted for WAMSI project 1.2.5 to inform Dugong Research	Not trialled*
DUGONG	**INTERVIEWS**	IK/WSK	Knowledge of dugong and their habitats	Written, video, audio	-	Not trialled*
DUGONG	**FOCUS GROUP DISCUSSIONS**	IK/WSK	Knowledge of dugongs and their habitats	Written, video, audio	-	Not trialled*

MONITORING TOOL	Knowledge systems	What is measured/monitored/recorded	RECORDING METHOD	TRIALS AND DEVELOPMENT	ANALYSIS / COMMENTS*
DROP DOWN CAMERA TRANSECTS (Boat Based)	WSK	Habitat distribution and mapping & characterisation of underwater habitats (could be used in long term to look at change) coral bleaching	Underwater camera units from vessel	Methods refined by Dambi and WG Method instructions in "Listening to Sea Country: A monitoring manual for Indigenous Marine Rangers".	Photos currently sent for analysis Local analysis could be developed Main Contact: Andrew Heyward (AIMS)
TRANSECTS	WSK	Transects adapted using NERP freshwater vegetation technique	Data sheets	Method adopted by Nyul Nyul adapted from NERP Freshwater quadrats	Not developed*
DROP DOWN CAMERA TRIPOD	WSK	Shallow nearshore habitat (could be used in long term to look at change) Extent of coral bleaching	Underwater Photographs	Tripods developed and some training undertaken with groups	Not developed*, require partnership with researcher Contact: Andrew Heyward (AIMS)
PARTICIPATORY MAPPING	IK	Location of habitat types	Group workshop mapping	Trialled by AIMS researchers with Anindilyakwa Land & Sea Rangers (Groote Island NT)	**Main contact: Martial Depczynski (AIMS)**
SEDIMENT SAMPLING	WSK	Detection of physical, chemical or biological pollutants in sediments	Sediment samples & analysis	Method instructions in "Listening to Sea Country: A monitoring manual for Indigenous Marine Rangers" Developed by AIMS and trialled with Kimberley Groups	**Main contact: Martial Depczynski (AIMS)**
BENTHIC INVERTEBRATE MAPPING	WSK	The distribution and proportion of invertebrates on mudflats using grid sampling (1mm sieve sample)	Researcher datasheets	Mud samples and cores sieved and species identified (see AnnRoeBIM16, Piersma et al 2016)	Analysis by researchers
INTERTIDAL REEF – QUADRATS	IK/WSK	Quadrats of intertidal reef and interviews with TOs	Being developed	Developing Method with Jane Prince UWA to start long term monitoring	Not developed* Main Contact – Jane Prince (UWA)

MONITORING TOOL	Knowledge systems	What is measured/monitored/recorded	RECORDING METHOD	TRIALS AND DEVELOPMENT	ANALYSIS / COMMENTS*
SEAGRASS WATCH TRANSECTS	WSK	Intertidal Seagrass status (Photographs, samples, and estimates of seagrass cover, canopy height and composition)	Seagrass Watch Data Sheets	EK (2014) – Factsheet Mckenzie and Yoshida (2014) Requires Training and monitoring overseen by western scientist (some groups have found too labour intensive when limited volunteers)	Data analysed by Seagrass Watch Main Contact – Environs Kimberley
SEAGRASS BOAT BASED TRANSECTS	WSK	Subtidal seagrass monitoring (also intertidal seagrass, seagrass mapping)	Gopro or Dropdown Camera Recorded on I-Tracker - Seagrass Mapping & Monitoring application	National Environmental Research Program (NERP) - NAILSMA, WG and CSIRO Field Manual – Subtidal methods (Would need to modify the different seagrass techniques to make comparable – yet to be done)	Post processing of photos recorded onto I-Tracker application (Opportunity in future to develop automated counting of imagery)
SEAGRASS TRANSECTS	WSK	Seagrass	Data Sheets	Seagrass technique adapted from Seagrass Watch specifically for Bardi Rangers	Not developed*
SEAGRASS GROWTH and PRODUCTIVITY	WSK	**Seagrass Biomass and Productivity using hole punch technique** **(Data on growth rates of seagrass is more valuable than biomass measurements alone)**	Data sheets used by researchers	Research undertaken Bardi Jawi and CSIRO/UWA/ECU WAMSI project 2.2.4 The hole-punch technique could be developed for use by Rangers, and combine with reproduction (ie whether they are in bud or flowering) and seed bank.	**Main Contact: Gary Kendrick (UWA)**
BLOOD SAMPLES AND PHOTOGRAPHY	WSK	Seagrass Grazing	Blood samples of turtles and Photography of Seagrass	Research undertaken Bardi Jawi and CSIRO/UWA/ECU WAMSI project 2.2.4	**Main Contact: Gary Kendrick (UWA)**

Appendix 9: Standard collaborative research agreement conditions

Note: the following definitions and standards have been written in a way that allows them to be copied and inserted into research agreements arising. Conditions can be varied by the individual groups involved in specific science projects, for that groups participation in any project.

Definitions

Accompaniment

It is important to Indigenous Kimberley people that researchers are accompanied by the right Traditional Owner/s of the field work area. They can also be referred to as 'cultural advisors'. Depending on the area and cultural complexity, more than one Traditional Owner and Indigenous ranger may be required. There are many reasons for this, including the safety of the researcher, protection of Country and the cultural responsibilities of Traditional Owners to their Country.

Acknowledgement

Acknowledgement of the Indigenous contributors to a research project refers to formal acknowledgement within project outputs and products of the contributions of Indigenous participants who have been actively involved in the research project and have contributed to the creation of new knowledge or understandings about their Country and its biota.

Each person (or group) will be acknowledged appropriately for their contribution and their Indigenous knowledge is recognised. Whether it is more appropriate to acknowledge Traditional Owners or the language group as the source of information and co-authorship, will be decided by the Indigenous research partners. By being acknowledged as a co-author to a scientific paper, Traditional Owners are seen to have joint ownership of The Project IP.

Confidential Information

During The Project, visiting researchers may come across or be given confidential information that shouldn't be shared any further without the permission of the right Traditional Owners of that information. Confidential information is usually defined as information that is culturally sensitive, personal, commercial in nature, marked as confidential, restricted material, or any other information that could be reasonably thought of as confidential.

Intellectual Property (IP)

In research projects, there are three main types of Intellectual Property (IP) to be aware of: background IP, Indigenous or Cultural IP, and Project IP.

Background IP

Background IP is any IP held by researchers or by Indigenous research partners before the research started, or IP that is developed independently of the research project. It is the foundational knowledge that people bring to The Project, upon which new knowledge is built. It is important that background IP remains the property of whomever brought it to The Project. A local traditional seasonal calendar is an example of background IP owned by Traditional Owners. The design of a piece of scientific equipment made previously by the researcher is an example of background IP owned by that researcher.

Indigenous or Cultural IP

Indigenous or Cultural IP is IP of the many forms of Indigenous traditional culture and expression. Examples of Indigenous Cultural IP are things like art, songs, dance, ceremony, language, ceremonial grounds and documentation of Indigenous heritage in film, print or other recordings.

Project IP

Project IP is any new IP that has been created by the research project and is built upon the foundational background IP that people bring to The Project. Information on the genetic distribution of a coastal plant species, created during a research project is an example of project IP.

Liability Insurance

Appropriate liability and insurance is achieved when everyone involved in a research project is covered by liability insurance in case they, or another party is hurt somehow, or damages to property arises during The Project.

Party

In this agreement, 'party' means any group who has signed the agreement. 'Parties' refers to two or more groups who have signed the agreement.

Publishing readiness

From the perspectives of Indigenous parties, a product meets publishing readiness once they have ensured that any documents produced, talks given and media used (films, recordings, and pictures) are all appropriate for the general public to see, hear or read, from their perspective. Ensuring that the names of people and places are correct, that quotes and information about people or Country are appropriate, that Indigenous Knowledge and culture is respected and that confidential information isn't published are some components of publishing readiness.

RNTBC

When a native title determination is made under the *Native Title Act 1993*, Traditional Owners are required to establish a corporation to represent them with respect to their native title interests. The formal name for these types of corporation are Registered Native Title Body Corporates (RNTBC). People also refer to them as PBCs (Prescribed Body Corporates).

RNTBCs provide a legal entity to manage and conduct the affairs of native title holders, which can include for example the execution of research agreements affecting land or waters within native title determinations.

Standard conditions

Intellectual Property Standard Conditions

Each party agrees that:

- All IP held by any party before research starts remains the property of that party.
- Neither party has any claim, ownership or interest in the other parties background IP, but it can be used for The Project only, at no cost.
- All past, current and future Indigenous IP, cultural IP and secret or sacred material remains the property of Traditional Owners.
- Indigenous IP rights of parties will be respected and Indigenous IP is used strictly in accordance with the terms of this agreement.
- Project IP will either be owned by the participating Indigenous groups and shared with all parties, who may use it for non-commercial purposes OR co-owned by all parties to the agreement who may use it for non-commercial purposes, in accordance with the details of this agreement
- If any party wishes to use The Project IP for a commercial purpose, all parties will need to agree and sign a separate agreement or licence that shares any commercial return fairly.

Any conditions specific to an Indigenous party to this agreement as listed in Annexure 1 take precedence over these standard IP principles for that party's participation in The Project.

Confidential Information Standard Conditions

Each party agrees that:

- No party can pass on any confidential information owned by another party without their prior written permission.
- Researchers must return all Traditional Owner confidential information to the Traditional Owners at the end of The Project .
- Researchers to assume that any Traditional Owner information likely to be confidential is in fact confidential even if Traditional Owners haven't expressly said that it is confidential .
- Researchers to treat any culturally sensitive information and cultural IP as confidential information.

Any conditions specific to an Indigenous party to this agreement as listed in Annexure 1 take precedence over these standard confidential information principles for that party's participation in **The Project**.

Access and Publication Standard Conditions

Each party agrees that:

- Research should only be used for the purposes that parties have consented to within the research agreement. If researchers want to use it for any another purpose, they need to get the specific, written approval of the relevant RNTBC (or related Aboriginal Corporations) first.
- Either research partner must get permission from the other before publishing any document or product about the research project or the collaboration. Where permission is granted for a publication, it may be re-released in the same form.

- DBCA must give each Indigenous party 6 weeks to assess, approve or change each document written about the research review, to make sure it complies with the terms and principles of this agreement.
- Post graduate students can submit their thesis to their university for the purposes of marking but must address all Traditional Owner concerns around included information before being made publicly available.

Any conditions specific to an Indigenous party to this agreement as listed in Annexure 1 take precedence over these standard publishing principles for that party's participation in The Project.

Media Standard Conditions

Each party agrees that:

- Primary media products arising from this work (such as media releases) will require the approval of the Indigenous groups collaborating and/or featured in the media products, including where media includes group names, group logos or photos of the group's participants.
- Any secondary media products developed from the contents of primary media products will retain the same messaging and purpose. Any featured groups will be given 2 weeks prior notice to comment before they are made public.

Any conditions specific to an Indigenous party to this agreement as listed in Annexure 1 take precedence over these standard media principles for that party's participation in The Project.

Acknowledgement Standard Conditions

Each party agrees that:

- Indigenous contributors to the research project will be acknowledged according to normal conventions, including Indigenous Knowledge shared with the researcher about the topic.
- Key Indigenous collaborators whose knowledge is crucial for the research will be considered as co-authors and will be invited to co-present at events with as much notice as possible.
- Indigenous knowledge will be acknowledged, irrespective of whether it is provided verbally or in writing.

Any conditions specific to an Indigenous party to this agreement as listed in Annexure 1 take precedence over these standard acknowledgement principles for that party's participation in The Project.

Liability and Insurance Standard Conditions

Each party agrees that:

- The researcher or their institution must have appropriate personal and public liability insurance.
- Aboriginal Corporations with appropriate insurance will provide insurance cover for any Traditional Owners who are being paid through their payroll system to work on the research project.

Any conditions specific to an Indigenous party to this agreement as listed in Annexure 1 take precedence over these standard liability and insurance principles for that party's participation in The Project.

Accompaniment Standard Conditions

Each party agrees that:

- Researchers cannot visit certain areas as described by Traditional Owners at any time without the right Traditional Owners for that area accompanying them.
- Researchers cannot visit any cultural exclusion areas at any time.
- Researchers must have at least one Traditional Owner and one Indigenous Ranger with them at all times while on Country, unless otherwise specified within the details of this agreement.
- Traditional Owners accompanying researchers shall be compensated at agreed rates as specified within The Project agreement.

Any conditions specific to an Indigenous party to this agreement as listed in Annexure 1 take precedence over these standard accompaniment principles for that party's participation in The Project.

Communication Standard Conditions

Each party agrees that:

- Researchers will make a considered effort to effectively communicate the research concept to the Indigenous parties to the research project during project development phase.
- Researchers will make a considered effort to authentically involve the Indigenous participants in The Project to develop meaning from the research data in effective two-way conversations, events and/or dialogues.
- Researchers will make a considered effort to effectively communicate and discuss the research outputs, conclusions and implications for management, with the Indigenous research participants.
- Effective communication will employ a combination of concise, plain-English, visually rich communication aides shared with Indigenous participants at communication events, resourced at a scale appropriate to The Project and may be in person, by video conference or telephone as specified within the details of this agreement.

Any conditions specific to an Indigenous party to this agreement as listed in Annexure 1 take precedence over these standard communication principles for that party's participation in The Project.

Indigenous Capacity Support Standard Conditions

Each party agrees that:

- Researchers will provide on-the-job training and skills development to Indigenous rangers involved in The Project appropriate to the scale of the research project.
- Researchers will support, within their capacity and appropriate to the nature of The Project, the long-term capacity of Indigenous rangers involved in The Project through project planning, training delivery, and making meaning from the data, which may include provision of tailored ranger data collection/analysis tools.

Any conditions specific to an Indigenous party to this agreement as listed in Annexure 1 take precedence over these standard Indigenous capacity support principles for that party's participation in The Project.

Remuneration and Resourcing Standard Conditions

Each party agrees that:

- Within their project planning, researchers will account for appropriate levels of funding for the Indigenous partners in the research project, including but not limited to Traditional Owners, Cultural Advisors and Indigenous Rangers.
- Researchers will allocate sufficient time pre and post on-ground research activities to establish and maintain working relationships and a collaborative approach with the Indigenous parties to the research project throughout.

Any conditions specific to an Indigenous party to this agreement as listed in Annexure 1 take precedence over these standard Indigenous capacity support principles for that party's participation in The Project.

Native Title Standard Conditions

Each party agrees that:

- Nothing in this Agreement is intended to affect any customary or native title rights or interests, including any procedural rights that the RNTBC (or related Aboriginal Corporations) or the Traditional Owners may have in respect of a research project under the *Native Title Act 1993*.

Dispute Resolution Standard Conditions

Each party agrees that:

- If a dispute about this project arises, the affected party will send a written notice about the dispute to the other involved party's registered address (as listed in Annexure 1) and will give them 4 weeks to resolve the issue. This does not apply to breaches of the confidential information principles contained in this agreement.
- If the dispute requires mediation, DBCA will pay the cost of an independent mediator to assist the parties to negotiate a resolution in good faith.
- If the dispute cannot be resolved within 6 weeks of mediation, the parties may take appropriate action including legal proceedings.

Termination Standard Conditions

Each party agrees that:

- At any time during The Project any Indigenous group can stop their participation by clearly stating this decision in writing to the **ISWAG co-chairs and DBCA marine science branch Principal Turtle Scientist**. In this event, this group would not be entitled to submit an invoice to The Project in accordance with this agreement.

Force Majeure and Aboriginal Cultural Business

Each party agrees that:

- If a party to this agreement (the 'affected party') cannot perform its obligations under this agreement because of a Force Majeure or Aboriginal Cultural Business event, it must use reasonable effort to minimise the impact of this event on The Project, as well as immediately notify the other party/parties in writing.
- The written notice must include a description of the Force Majeure or Aboriginal Cultural Business; how long it is likely to affect The Project; any obligations under this agreement that are likely to be affected; and what is being done/ will be done to minimise these impacts.
- Once this written notice is received, this agreement continues and the affected party is not responsible for any delay in performing its work or obligations under this agreement for the duration of the Force Majeure or Aboriginal Cultural Business. The remaining milestone dates are automatically extended by the same amount of time.
- Once the Force Majeure or Aboriginal Cultural Business event finishes, the affected party must give immediate notice to the other party/parties when the event ends.
- An event of Force Majeure or Aboriginal Cultural Business does not relieve a party of liability for an obligation to pay money in a timely manner arising before the event.

Any conditions specific to an Indigenous party to this agreement as listed in Annexure 1 take precedence over these standard Indigenous capacity support principles for that party's participation in The Project.

Acronyms

AIMS – Australian Institute of Marine Science

CSIRO – Commonwealth Scientific and Industrial Research Organisation

DAWE – Department of Agriculture, Water and the Environment

DBCA – Department of Biodiversity, Conservation and Attractions

ISWAG – Kimberly Indigenous Saltwater Advisory Group

JCU – James Cook University

KLC – Kimberley Land Council

NESP – National Environmental Science Program

PBCs – Prescribed Body Corporates

TO – Traditional Owner

WAMSI – Western Australian Marine Science Institution

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Endnotes

[i] In this context, saltwater country plans refer to Indigenous Protected Area, Healthy Country and Joint Management Plans.
[ii] In general, State waters are from high water mark up to 5.5km offshore and Commonwealth water are from 5.5km to 370km from offshore
[iii] These were funded through the Western Australian Marine Science Institution as a response to the Kimberley Science and Conservation Strategy.
[iviv] Management includes on ground activities, education, communication and capacity building
[v] The DBCA and Indigenous-led components of a), b) and c) will need to be assessed at a Sea Country scale to ensure differing community priorities are met and duplication avoided.
[vi] SuppWAMuseum_2018_85_75to103_RICHARDSetal.pdf
[vii] Timing and frequency to be determined and costed
[viii] https://publications.csiro.au/rpr/pub?pid=csiro:EP111928
[ix] Details to be confirmed
[x] Appropriate interval to be advised
[xi] duplicate from mangrove survey section
[xii] Based on the Distance sampling (line transect) method and design developed by Jackson et al. (2016) for turtles in Wunambal Gaambera/Uunguu and Dambimangari Sea Country (here)
[xiii] See video here https://ictv.com.au/video/item/2408
[xiv] Pers comm M Hutton 2018
[xv] See video here https://ictv.com.au/video/item/2408
[xvi] Based on the Distance sampling (line transect) method and design developed by Jackson et al. (2016) for turtles in Wunambal Gaambera/Uunguu and Dambimangari Sea Country (here)
[xvii] https://www.environment.gov.au/marine/marine-species/dugongs
[xviii], From the Dugong MOU Dugong | Dugong (cms.int) accessed 20 11 22
[xix] https://www.cms.int/sites/default/files/document/Dugong_CMP_Eng_0.pdf
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[xxv] Kendrick GA,et al (2016) Benthic primary productivity: production and herbivory of seagrasses, macroalgae and microalgae. Report of 2.2.4 prepared for the Kimberley Marine Research Program, WAMSI, Perth, WA.
[xxvi] https://www.cms.int/iosea-turtles/en/page/mou-text-cmp
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