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A Regional Framework for Saltwater Monitoring in the Kimberley

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WAMSI Kimberley Marine Research Program

Final Report

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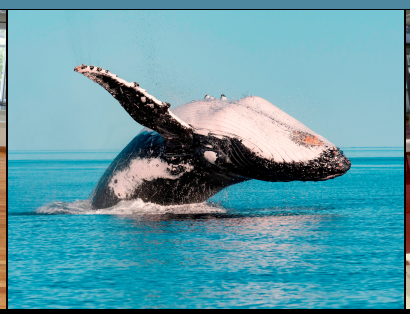


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WAMSI Kimberley Marine Research Program

Initiated with the support of the State Government as part of the Kimberley Science and Conservation Strategy, the Kimberley Marine Research Program is co-invested by the WAMSI partners to provide regional understanding and baseline knowledge about the Kimberley marine environment. The program has been created in response to the extraordinary, unspoilt wilderness value of the Kimberley and increasing pressure for development in this region. The purpose is to provide science based information to support decision making in relation to the Kimberley marine park network, other conservation activities and future development proposals.

Front cover images (L-R)

Image 1: Satellite image of the Kimberley coastline (Landgate)

Image 2: Indigenous Knowledge Group (L-R) (L-R) WAMSI Kimberley Marine Research Program Node Leader Stuart Field (DBCA), KISSP Project Leader Dean Matthews (Senior Project leader Yawuru for the last five years working closely with the state in developing the Yawuru conservation estate plans and the Yawuru Marine Park Plan), Manager Land and Sea Unit at Nyamba Buru Yawuru Julie Melbourne, report author Dr Rebecca Dobbs (UWA), report author Dr Beau Austin (CDU/CSIRO) and WAMSI Kimberley science coordinator Kelly Waples (DBCA) (Image: WAMSI)

Image 3: Humpback whale breaching (Image: Pam Osborn)

Image 4: Indigenous community representatives from the Karajarri and Yawuru peoples meet in Broome to workshop outcomes of the KISSP project at Notre Dame University Hall June 2016 (Image: WAMSI)

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Contents

Executive Summary

Effective management and monitoring of saltwater country requires an approach that supports Indigenous people and their partners to share, use and co-produce the best available knowledge-base for decision-making. Through the Kimberley Indigenous Science Project (KISSP), Traditional Owners of Kimberley saltwater country identified a need to 'bring together' monitoring and research activities and develop a strategic framework for monitoring and capacity building across the region. A regional monitoring framework was developed, based on a common adaptive management approach, yet designed to account for the diverse features and challenges in Kimberley Saltwater Country (including the need to engage both traditional and western science knowledge bases). The framework adopts an approach that is sensitive to the local aspirations, obligations and threats to people and country (integrated landscape), rather than an ecosystem approach typical of conservation planning. Application of the framework was trialled using the activities of the KISSP as a case study, providing a review of the local monitoring currently being undertaken to highlight areas where capacity building and support are required. A toolbox approach was developed to provide a comprehensive repository for saltwater monitoring tools and techniques, to allow Ranger groups to collaboratively choose the best monitoring methods available. The framework and the toolbox provide Ranger groups with an opportunity to build multiple lines of evidence to provide an enriched picture of country and support Rangers in ongoing monitoring and management of Saltwater Country.

1. Background

The Kimberley Indigenous Saltwater Science Project (KISSP) was a collaboration funded by the Western Australian Marine Science Institution (WAMSI) as part of their Kimberley Marine Research Program (KMRP). The KISSP was developed to improve the way natural and cultural resource management and research, involving Traditional Owners and the science community, is planned, assessed and undertaken on Kimberley Saltwater Country. Saltwater encompasses the traditional lands of saltwater peoples and includes the coastline, islands, and the seabed and marine environment (Lincoln et al. 2017). The KISSP was guided by a Working Group comprised of representatives from seven Kimberley saltwater groups (Balanggarra, Wunambal-Gaambera, Dambimangari, Bardi-Jawi, Nyul Nyul, Yawuru and Karajarri) and a project team, comprised of the University of Western Australia (UWA), Charles Darwin University (CDU), Kimberley Land Council (KLC) and Mosaic Environmental. The KISSP Working Group determined the project team based on their specific skills and capacity, including their experience working with Traditional Owners in the Kimberley Region.

The project objectives were identified by the Working Group to ensure a focus on local priorities and aspirations. The objectives sought to address some of the challenges experienced by researchers, Traditional Owners and Indigenous ranger groups when conducting saltwater research and monitoring activities. Through collaborations with the Kimberley Prescribed Body Corporate, Traditional Owners and Indigenous ranger teams, the KISSP aimed to:

1. Integrate Indigenous ecological knowledge and management practices into Kimberley marine conservation and management,
2. Develop a standard research protocol for land and sea research in the Kimberley,
3. Develop a framework for marine monitoring in the Kimberley, including development of a training package for agreed research targets for rangers.

This report forms part of the KISSP outputs and specifically relates to Objective 3, which aimed to:

Develop a Regional Framework to monitor Saltwater Country across the Kimberley.

Another two products were developed as part of Objective 3 of the KISSP and these should be read together with this report. They are:

1. A Toolbox for Saltwater Monitoring across the Kimberley,
2. Pilot Training Resource Saltwater Monitoring Fundamentals – Building a Knowledge Base Together.

The work presented in these reports is closely aligned with products produced for Objective 1 and Objective 2 of the KISSP (Figure 1). A summary of all of the KISSP outputs and the insights gathered through the KISSP have been provided in a Navigating Knowledge Currents report, to guide and support the on-going development of collaborative research, management and monitoring in Kimberley Saltwater Country (Austin et al 2017a). All KISSP products can be accessed at: http://www.wamsi.org.au/research-site/indigenous-knowledge.

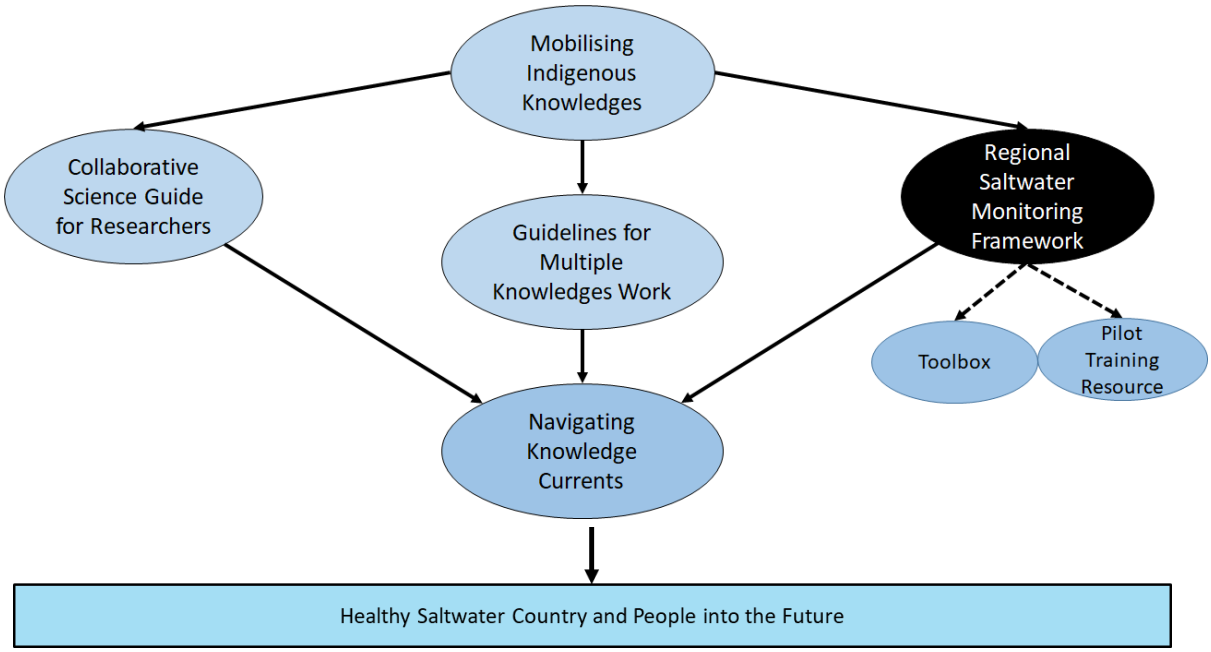


Figure 1 Products developed under the KISSP and their relationship to one another

2. Introduction

The marine environment of the Kimberley region is globally significant for its often-unique biodiversity, relatively undisturbed and intact ecosystems, and cultural, aesthetic and recreational values (Mustoe and Edmunds 2008; WA 2011; WWF 2012). The area is home to all six species of threatened marine turtles, as well as regionally important populations of manta rays and dugongs. It is also a major humpback whale nursery and supports important migratory shorebird populations (WA 2011). The region is amongst only 4% of marine ecosystems in the world to have experienced 'very low impact' from humans (Mustoe and Edmunds 2008; WA 2011). The continental shelf off the Kimberley coast includes more than 2,500 islands, coral reefs, seagrass beds and offshore shoals. These islands are vital habitat for the region's unique marine plants and animals and provide important refugia for many threatened species and ecosystems (WA 2011; Vigilante et al. 2013). Traditional Owners have custodial rights for, and responsibilities to, Saltwater Country, which entails obligations that are rooted in complex socio-political systems of association and responsibility (NKSCSC 2010). Subsistence harvesting of saltwater resources also makes a significant contribution to Traditional Owner livelihoods and wellbeing (Buchanan 2014). Natural resources also contribute significantly to the region's economy; tourism, mining, pearling, horticulture, oil, gas, agriculture and fishing generate more than $AU1.5 billion per annum (WA 2011). Future development and management of these resources in northern Australia requires concomitant management strategies that maximise social, cultural and ecological outcomes.

Management of the regions Saltwater Country and assets is the responsibility of both Traditional Owners and government agencies, each with their own strategies and obligations for monitoring and managing country. Indigenous people have been custodians of the marine and terrestrial environments of Australia for millennia and since settlement, they have articulated and argued their inherent aspirations and rights regarding the continual management of their traditional lands and seas (NAILSMA 2013). In the last decade there has been significant growth in community-based Indigenous natural and cultural resource management throughout northern Australia and these activities are supported, in part, through the establishment of formal ranger programs and indigenous protected area (IPA) agreements (Smyth 2007, NAILSMA 2013). Amongst others in the Kimberley region, fourteen Indigenous ranger groups are employed through the federally funded 'Working on Country' program to conduct land and sea management activities, with the support of the Kimberley Land Council (KLC). There is also a great deal of interest from the Australian public, and therefore government, in protecting saltwater natural values (Yu 2000; Fox and Beckley 2005; WA 2011; WWF 2012; Moritz et al. 2013; Possingham

et al. 2015). At present, there are 6 marine parks across the Kimberley, collectively called the Great Kimberley Marine Park (comprising the Lalang-garram/Camden Sound, Eighty Mile Beach, Lalang-garram/Horizontal Falls, Yawuru Nagulagun/Roebuck Bay, North Lalang-garram and North Kimberley marine parks), protecting over 3 million hectares of Saltwater Country.

Effective management and monitoring of saltwater country will require an approach that will support Indigenous people and their partners to share, use and co-produce the best available knowledge-base for decision-making, through monitoring and management of Kimberley Saltwater Country (Austin et al. 2017). Recent marine park planning, undertaken by the Department of Biodiversity Conservation and Attractions (DBCA, formally Department of Parks and Wildlife) has resulted in an increasing interest and investment in research on Saltwater Country in the Kimberley. The Western Australian Marine Science Institution's (WAMSI's) Kimberley Marine Research Program (KMRP) was established to increase the understanding of these systems from a Western Science (WS) perspective and support the management of these marine environments, especially the proposed state government marine parks (WAMSI 2011). Indigenous knowledge holders already have a vast knowledge and understanding of Kimberley Saltwater Country and the complex interaction between the landscape, ecological processes, socio-cultural institutions and economic development. Indigenous rangers are also experienced and interested in expanding their use of WS methods to build a richer knowledge-base about Country. Likewise, researchers, managers of national parks and private landowners can learn a great deal from the knowledge and experience of Traditional Owners.

There are currently a large number of saltwater research and monitoring initiatives being undertaken by scientists in collaboration with Indigenous rangers in areas of common interest across the Kimberley. Some of these are well developed, while others are being trialled. However, there are often inconsistencies in methods being used and monitoring approaches are poorly aligned across the region. Through the WAMSI Kimberley Indigenous Science Project (KISSP), Traditional Owners of Kimberley saltwater country identified a need to 'bring together' the variety of monitoring and research activities currently being undertaken across the region so that it could be used as a resource to assist in developing a broader regional strategy for planning and management. A strategic framework for monitoring and capacity building was seen by the KISSP Working Group as valuable for creating a collective voice on issues, and a standard comparable approach to monitoring that could allow knowledge sharing and robust management of the regions natural resources through collaboration of Traditional Owner and Western Science (WS) knowledge. It would also allow Traditional Owners to better visualise a regional picture of ecosystem health and build their capacity to articulate their aspirations and hence inform joint management partnerships.

Project Aims

This project was designed to develop a standardised monitoring framework to ensure consistency and validity in the monitoring being undertaken by Traditional Owners of Kimberley Saltwater Country. Through development of a framework the project aimed to:

1. Review current monitoring methods,
2. Identify regional priorities,
3. Accommodate both Indigenous knowledge and western science based techniques
4. Provide a gap analysis to inform future research and development of monitoring techniques

3. Developing the Framework (Methods)

3.1 Approach for developing the framework

The research approach for the KISSP was largely defined by the Working Group. Individual, 'On Country' workshops or meetings with Traditional Owners were undertaken to provide an opportunity for each of the seven communities (represented on the Working Group) to have input into the project. Local ranger groups, the KISSP Working Group representatives and the research team designed and organised each of the workshops with local Traditional Owners to maximise the outcomes from each meeting. They were equally resourced by the KISSP project to do this work. Each community decided how the research happened (i.e. workshop or interviews) and ensured that the 'right people' were involved in the workshops, which mostly included Traditional Owners, Rangers and Prescribed Body Corporate (PBC) staff. In total there were 103 Indigenous participants in five (5) Traditional Owner workshops and one Knowledge Holder interview. Workshops were held over two days at a location chosen by each of the Saltwater Groups.

Additional research activities are detailed below and included:

1. A review of previous monitoring and evaluation initiatives in the Kimberley,

A questionnaire to obtain information on current monitoring.

The Working Group and the research team also had regular phone meetings and face-to-face workshops to ensure a collaborative research approach and to facilitate discussions on saltwater research and monitoring issues at a regional scale. The Working Group provided an important conduit between Traditional Owner groups, their staff and the research community.

3.2 Building on previous work

Development of the framework has drawn on, and built upon, a large body of work already undertaken by the KLC and Traditional Owners in the region. Six of the seven ranger groups have established either Healthy Country Plans (HCPs) or Cultural Management Plans. These plans identify key cultural, ecological and social values, targets, threats, and management strategies (e.g. Yawuru Cultural Management Plan, Bardi Jawi Indigenous Protected Area Management Plan 2013-2023, Dambimangari Healthy Country Plan 2012-2022, Balangarra Healthy Country Plan 2012 - 22, Wunambal Gaambera Healthy Country Plan, Karajarri Healthy Country Plan 2012 -2022). These HCPs were developed over months of community consultation incorporating aspects of both the cultural and natural environment and assist groups in developing a long-term vision for country. Ranger teams governed by Healthy Country Advisory Committees (comprised solely of senior community leaders) work to achieve this vision either by enhancing the viability of identified targets or managing the target threats (KLC 2017). In addition to directing the annual work plans of ranger groups, these long-term management plans are invaluable in communicating priorities to external partners (Lincoln et al. 2017, KLC 2017). Yawuru, have adopted a different planning approach to HCPs, and have since undertaken a formal process of developing a joint management plan with DPaW (DPAW 2016). Also the North Kimberley Saltwater Country Plan (NKSCSC 2010) was developed to explain coastal and saltwater cultural and natural values and highlight local concerns to the wider Australian public. It proposes ways that government and non-government organisations can help north Kimberley Groups to look after their Country and fulfil their responsibilities.

Healthy Country Planning (HCP) is an adapted version of Conservation Action Planning (CAP), which was amended to incorporate Indigenous people and Indigenous values into conservation planning. The Nature Conservancy's CAP process was developed in the 1990s and is considered best-practice conservation planning and provides a process for undertaking adaptive management. In simple terms, CAP focuses attention on what needs to be done, how it should be done and, after management actions have been undertaken, monitors how successful these efforts have been. A Conservation Coaches Network exists to support CAP planning and implementation and various groups have been involved in 'implementation training workshops' focused on the tools needed to implement the HCPs. More recently, Kimberley saltwater groups have been involved in a number of regional planning meetings including the Regional Healthy Country Monitoring and Evaluation Workshops (KLC and CSIRO, 2014). These workshops, run by the KLC and the Commonwealth Scientific and Industrial Research

Organisation (CSIRO), were focussed on identifying indicators and WS monitoring techniques to measure key ecological attributes and hence the status of saltwater ecological assets.

3.3 Trialling the framework using the KISSP project as a case study

Sub sections of the framework developed here were trialled to aid in the development of tools, identify gaps, research opportunities and priorities, and to assist with its implementation. The methods and approach for trialling sections of the framework are described below:

Identifying values and threats across the region was as an essential first step in developing the regional monitoring framework. At a local scale, the Healthy Country Plans and the CAP planning process provide a mechanism for traditional owners to prioritise values and develop strategies and objectives. Prior to on-country workshops, Indigenous land and sea management plans were reviewed to identify priority targets and threats for each group. Summaries of these plans, and of the current Ranger monitoring activities, were presented at the on-country workshops. This provided an opportunity for Rangers and Traditional Owner's to revisit their plans and provide input into the review[1]. Following the workshop, each Traditional Owner group was provided with their own workshop report and given the opportunity to provide feedback, or make amendments. Saltwater values defined across the six management plans were then summarised and combined in a systemic way to provide a broader regional context of threats and values (see below).

Identifying Preliminary Regional Priorities. An analysis of HCPs across the region provided insight into regional priority values. Regional objectives for Saltwater Country were identified as those that were common across HCPS and were considered as priorities (for the regional framework) if activity by multiple groups could help achieve the objectives. Workshop discussions also provided some guidance on the issues and questions that groups thought should be considered at a regional scale, if they would like to share data at a regional scale, and if so how would they like to see this happen.

A review of local scale Kimberley Saltwater Country Monitoring. An understanding of local monitoring tools, and the key steps for undertaking adaptive management and monitoring at a local scale, are essential for a regional framework to be successfully implemented. The current status of local saltwater monitoring being undertaken by Rangers across the Kimberley, was reviewed to identify:

1. opportunities for local scale monitoring to feed into the regional framework,
2. key knowledge gaps,
3. future research needs and opportunities for capacity building.

Questionnaires were developed for Ranger coordinators to obtain background information on the current monitoring and research being undertaken by each group. Information from questionnaires, on country workshops and ranger discussions were compiled and reviewed to identify gaps in available methods, methods used/needed for remote ranger use, opportunities for data storage and analysis.

[1] One TO group, who hadn't had the opportunity to develop a HCP, utilised the workshop time for preliminary discussions around values and threats.

4. The Framework

Monitoring provides an important process for evaluating the effectiveness of management actions and is a key component of adaptive management. The process for establishing both scientific and community-based monitoring programs has been well documented (Danielsen et al. 2005, TNC 2007, Farhan et al. 2015). Although the proposed regional monitoring framework (Figure 1) is based on a common adaptive management approach, the framework and each of its steps has been designed to account for the diverse features and challenges in Kimberley Saltwater Country as well as the need to engage both traditional and western science knowledge bases.

One key challenge was to ensure that the framework identified the monitoring required to measure regional ecological benefits (to help inform Rangers of their management effectiveness), whilst also supporting finer-scale local monitoring. Although a regional perspective is important to identify and address threats that degrade ecological and cultural values in Saltwater Country, building on locally-based approaches increases the likelihood of the successful implementation of monitoring and management strategies (e.g. Danielsen et al. 2005; Dobbs et al. 2012; Ens et al. 2016). Figure 2 demonstrates how these two processes (regional and local scale) interact and are acknowledged under the framework, allowing Ranger groups to:

1. Monitor and report at a local scale,
2. Inform regional monitoring and priority setting.

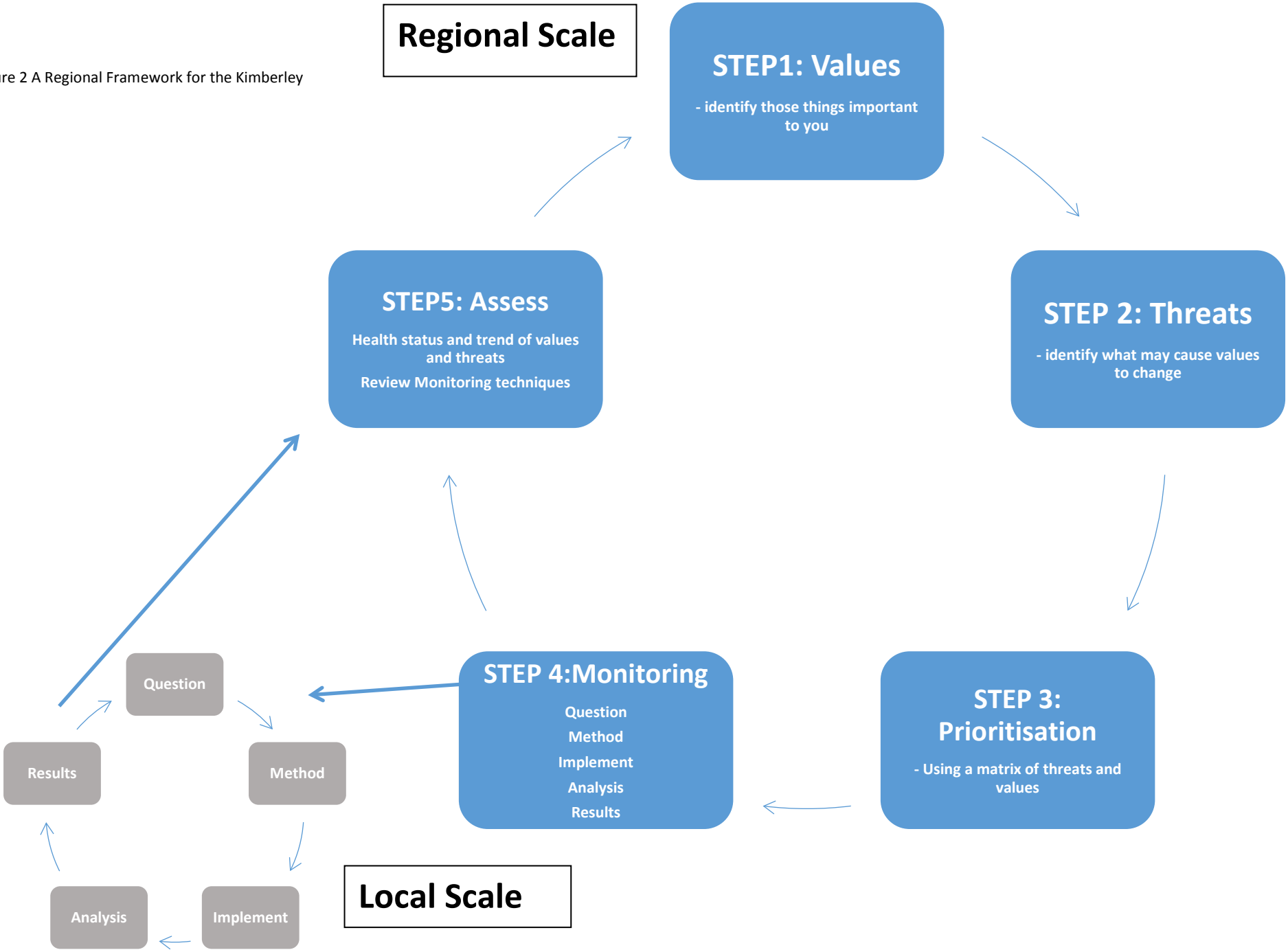
This approach ensures that the saltwater groups are able to build on existing monitoring without significantly increasing their work load, by taking what they are currently doing at a local scale and building on it to answer questions at a regional scale.

The five steps of the framework have been developed to align with a multiple evidence-based approach (Austin et al. 2017), ensuring that there are opportunities for both western science and Indigenous knowledge to inform the monitoring program. The framework adopts an approach that is sensitive to the local aspirations, obligations and threats to people and country (integrated landscape), rather than an ecosystem approach typical of conservation planning. However, due to the scope of project design by the Working Group, a saltwater focus has been necessary.

4.1 KISSP CASE STUDY -Testing and identifying gaps in the Framework

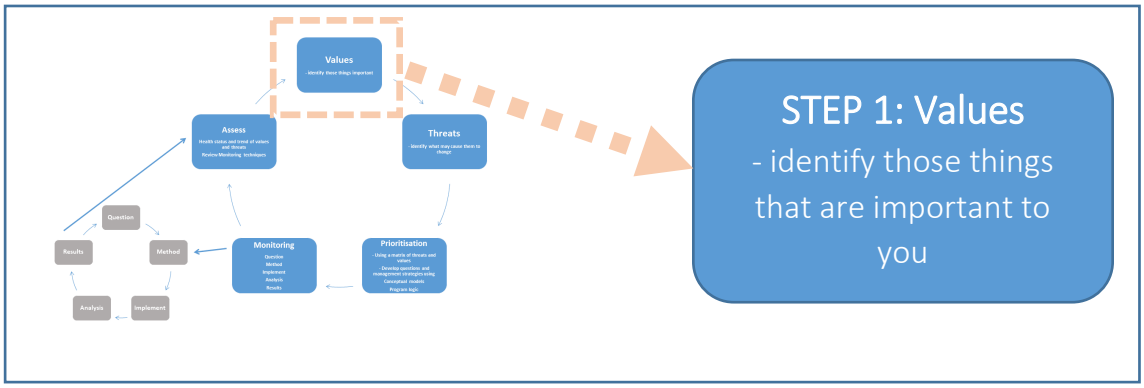
Each of the five steps in the framework are described in detail in the following sections. Application of the framework was trialled using the activities of the KISSP as a case study. Those steps of the framework that were advanced through the KISSP project are identified, including the tools developed (to assist with each step), and also the gaps/opportunities/limitations and hence future requirements for the role out of the framework.

Figure 2 A Regional Framework for the Kimberley



STEP 1 – Identifying Values

Clearly defining regional values (those things important to you) is the first step towards identifying and prioritising the things you may need to monitor and manage at a regional scale.



A regional monitoring framework needs to include and acknowledge all of the values, aspirations and practices that Traditional Owners consider in the management and conservation of Kimberley Saltwater Country. Ecological, cultural and social values identified in the workshops and HCPs were categorised into six broad groups, with one value (cultural practices) interconnected and relevant to all other values (Table 1). The inclusion of saltwater livelihoods highlights that values are not limited to a passive list of natural resources but that these assets can also be leveraged for economic development. More recently, HCPs are incorporating people (Traditional Owners) into their values.

Table 1 Summary of regional saltwater values

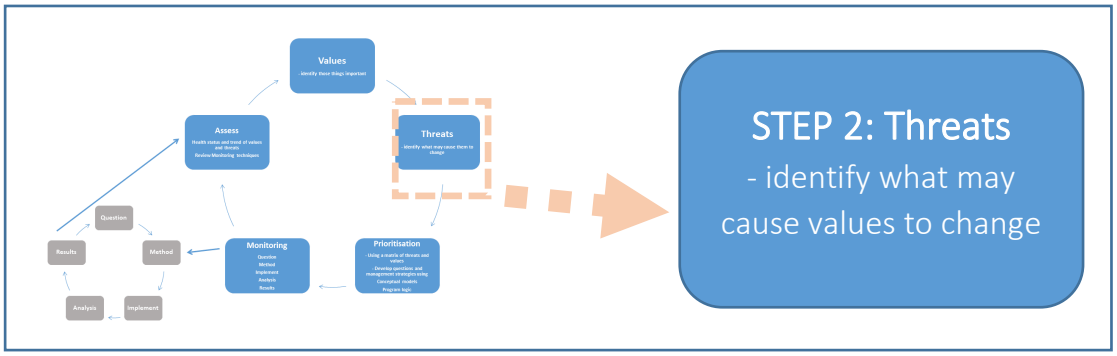
SALTWATER VALUES*		
CULTURAL PRACTICES *Law, ceremony, living on country, customary fishing/hunting, seasonal knowledge, storytelling, enjoyment of country, making hunting tools, language, intergenerational transfer of knowledge, responsibility for country, medicine, protocols, spiritual and physical connections*	**SALTWATER FOOD AND RESOURCES**	*Fish, shellfish, squid and octopus, sharks and rays, turtles, dugongs*
	CONSERVATION TARGETS	*Shorebirds, dolphins, whales*
	SIGNIFICANT AREAS AND PLACES	*Burial, camping, fishing, middens, creation story, seascapes, fossils, maritime heritage, fish traps, law grounds, boundaries and location, tracks, cultural areas*
	LIVELIHOODS SALTWATER	*Land and sea management, nature /cultural based tourism, and commercial, customary, recreational fishing*
	SALTWATER COUNTRY	*Saltwater (currents tides and quality), beaches, rocky headlands, intertidal mudflats, freshwater, Submerged springs, mangroves, saltmarsh, reefs, seagrass, deep sea, near shore pools, non-resource or conservation species***

*Saltwater values refer to those Saltwater things that are important or valued, these are referred to as "Targets" in some HCPs

**Species that do not have a utility or conservation value have been placed under saltwater country

STEP 2 – Identifying Threats

Identifying current and potential threats to your values will assist with prioritising monitoring and management actions that can be undertaken to mitigate threats (and hence protect values)



Traditional Owners identified threats specifically related to cultural protocols, connection and obligations to country (i.e. access to country, presence on country) alongside those more familiar to Western Science (i.e. feral animals, climate change) (Table 2). Mechanisms that interfere with groups meeting cultural obligations to country (including lack of culturally appropriate consultations with Traditional Owners and lack of infrastructure and land and sea capacity) are consistently the highest ranked threats in HCPs along with climate change and mining. All of these threats need to be considered in the regional monitoring framework to ensure that ecological values are not considered in isolation from cultural practices.

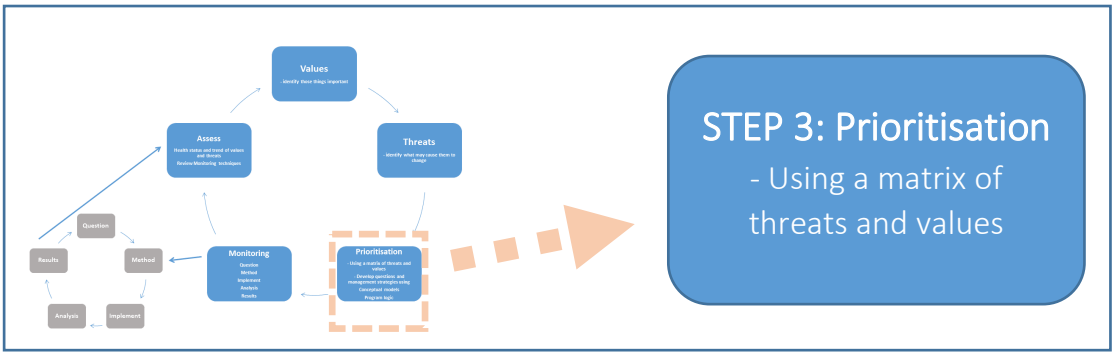
Threats will need to be updated regularly as new threats emerge or when existing threats increase in severity. Traditional Owners identified potential increases in fishing pressure (as a result of increased tourism and road access) along with a number of emerging threats including crocodiles (safety issues resulting from a significant increase in numbers) and coral bleaching (since HCPs were developed).

Table 2 Summary of regional saltwater threats

SALTWATER THREATS		
CULTURAL PRACTICES *Laws/ protocols & advice not being respected, lack of resources to access country reduced practicing of law on country and connections, lack of knowledge transfer (lost knowledge), Government policies (culturally inappropriate), lack of cultural programs in mainstream education*	**SALTWATER FOOD AND RESOURCES**	*Climate change, weeds, pollution, human pressure (overfishing- commercial recreational and customary fishers, & development), marine pests, unmanaged animals (destroying nests, egg predation)*
	CONSERVATION TARGETS	*Climate change, pollution (oil spills, debris), commercial, recreational and customary fishers (by-catch, boat strikes)*
	SIGNIFICANT AREAS AND PLACES	*Unmanaged visitors (damage, lack of respect), insufficient resources for accessing and managing country, lack of knowledge transfer (lost knowledge)*
	LIVELIHOODS SALTWATER	*Lack of accessibility to country (transport to visit country), lack of cultural knowledge transmission, human pressure (overfishing - commercial recreational and customary fishers, & development)*
	SALTWATER COUNTRY	*Development (GW abstraction, pollution), climate change, marine pests & debris, erosion, weeds, inappropriate access (locals and tourists), boats (damage, pollution)*

STEP 3 – Prioritising Monitoring

You can't monitor everything. Time, money and resources are limited and therefore you need to prioritise those things you want to manage and monitor – a matrix of threats and values, can help you decide on those things most important to monitor (and manage)



Although there was limited opportunity within the project to undertake a best practice prioritisation process (i.e. workshops that included Traditional Owners from across groups working together to prioritise the regional threats and values and decide on a course of management strategies and objectives) multiple sources of information were used to provide a preliminary regional prioritisation and therefore a way forward for adoption of the framework.

An analysis of HCPs across the region identified commonalities in the objectives and strategies for each set of regional values. Focusing on regional objectives that have already been prioritised within HCPs provides confidence that the regional priorities align with Traditional Owner decision-making. Assuming the HCP objectives are addressing the highest priority threats and the key attributes most in need of attention, this will direct the monitoring efforts to the most important indicators (TNC 2005).

Common objectives and strategies were summarized into five broad regional objectives considered as priorities for the regional framework based on whether working together on a regional scale could help achieve these objectives (rather than a local priority).

Objective 1: Traditional Owners and Rangers have access to western science, cultural and indigenous knowledge about plants animals and culture (producing and using)

Objective 2: Sustain animal populations (through managing customary harvest, and both human and introduced threats) – (workshops and HCPs indicate that the highest priorities are currently turtles, dugongs and fish)

Objective 3: Maintain biodiversity and habitats (most groups want to know more about the range of habitats on Country, and there was an increasing concern across groups about coral bleaching)

Objective 4: Maintain the health and condition of cultural sites

Objective 5 Maintain cultural practices and meet obligations to country (rules for governing country)

These objectives provide guidance on what should be considered in the regional monitoring framework and assist in narrowing the focus for a trial of the framework. Workshops and HCPs were also used to provide more information for each of these objectives. For example, under Objective 2, Turtles and Dugongs have the highest threat status and Turtle and Dugong were also the most common values mentioned in workshop discussions along with saltwater fish. The health of cultural practices (Objective 5), consistently scores "poor" or "fair" in the HCPs. For example, the biophysical health of a value such as saltwater fish may be considered good, yet the cultural aspect of such a value may be considered poor or fair. As one traditional owner expressed in the workshops:

"Turtles? Nothing wrong with turtles….. I'll tell you what's dying, law and culture that's what's dying" Kimberley Traditional Owner

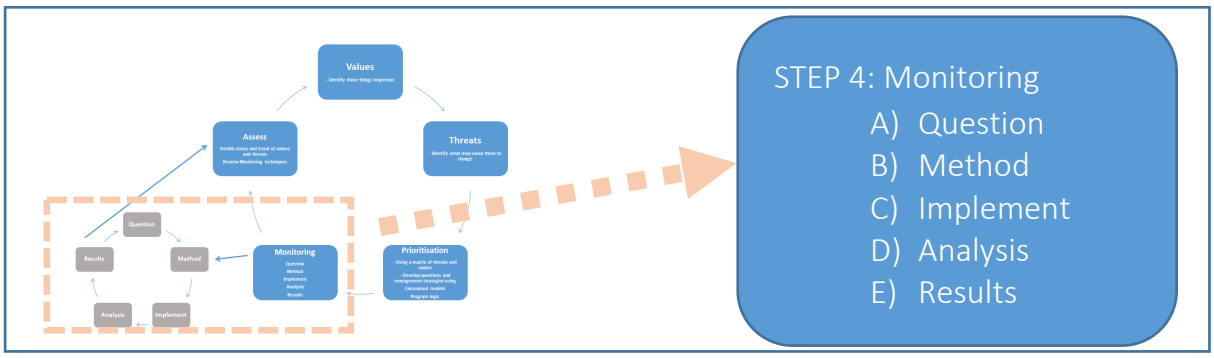
Within Ranger groups, there is currently a strong focus on monitoring of changes in the status of local values (See STEP 4). Figure 3 demonstrates that by focusing on objectives, rather than values, monitoring and management strategies can address multiple values and threats. In this case, four of the five regional objectives relate to more than one regional value, and therefore management actions undertaken to achieve these objectives are expected to have positive outcomes for several regional values (i.e. maintaining cultural values is relevant to all six regional value categories). Prioritising management actions (strategies) and monitoring based on objectives not only increases the effectiveness of management actions but can also help refine the selection of indicators and therefore save time and resources spent on monitoring (see Toolbox Dobbs et al 2017).

Figure 3 Regional objectives and the values that they address

	VALUES					
OBJECTIVES	**Saltwater Food and Resources**	**Conservation**	**Significant Areas and Places**	**Livelihoods Saltwater**	**Saltwater Habitat**	**Cultural Practices**
Objective 1: Traditional Owners and Rangers have access to western science, cultural and indigenous knowledge about plants animals and culture (producing and using)						
Objective 2: Sustain animal populations (through managing customary harvest, and both human and introduced threats) (priorities turtle, dugong, fish)						
Objective 3: Maintain biodiversity and habitats						
Objective 4: Maintain the health and condition of cultural sites						
Objective 5: Maintain cultural practices and meet obligations to country (rules for governing country)						

STEP 4 – Monitoring

As regional priorities have been derived from local priorities, local monitoring can be used to inform regional monitoring.



Local monitoring is incorporated into the regional framework to ensure saltwater groups build on existing monitoring (to address regional scale issues) without significantly increasing their work load. If regional monitoring is focused on locally driven objectives that will benefit from a regional scale approach (such as those defined in STEP 3), it can assist groups to address the local priorities in their HCPs or management plans, while providing meaningful information to support regional decision making. To ensure that local monitoring can effectively inform regional monitoring (or vice versa), both local and regional monitoring need to follow an adaptive management framework with questions clearly defined, results analysed, and monitoring and management actions evaluated. Following a review of current monitoring, a number of products have been developed to address current monitoring knowledge gaps or limitations, and support implementation of the Framework. These products have been compiled in a **Toolbox Report** (Dobbs et al 2017) comprised of seven 'tools', four of which assist with this step of the framework. The following sections provide information on why these products were developed and how they will assist with filling the current gaps for both local and regional monitoring.

A) QUESTION - Why are we monitoring?

Ranger research and monitoring activities were mapped to assist in categorising the types of saltwater monitoring currently being undertaken across the region (Figure 4). A wide range of research and monitoring projects are being undertaken including those driven by western scientists and their research agendas, projects that involve western scientists as co-researchers with local Traditional Owners, through to those undertaken by Ranger groups in direct response to local priorities and specific management issues.

A majority of the monitoring tools and techniques used by Rangers are currently focused on measuring the status of values. In contrast, Saltwater monitoring of Ranger management effectiveness is currently limited. It is important that ranger groups identify whether they are managing local scale threats effectively to ensure that time and resources are being efficiently allocated (adaptive management). Without this, then groups are:

1. Less able to demonstrate effectiveness of management actions,
2. Less able to learn from experience and across projects,
3. Risk duplicating efforts and reinventing the wheel,
4. Not able to gauge the extent to which funds are well spent,
5. Less able to show funding bodies utility in supporting the work (Hockings 2006; TNC 2005).

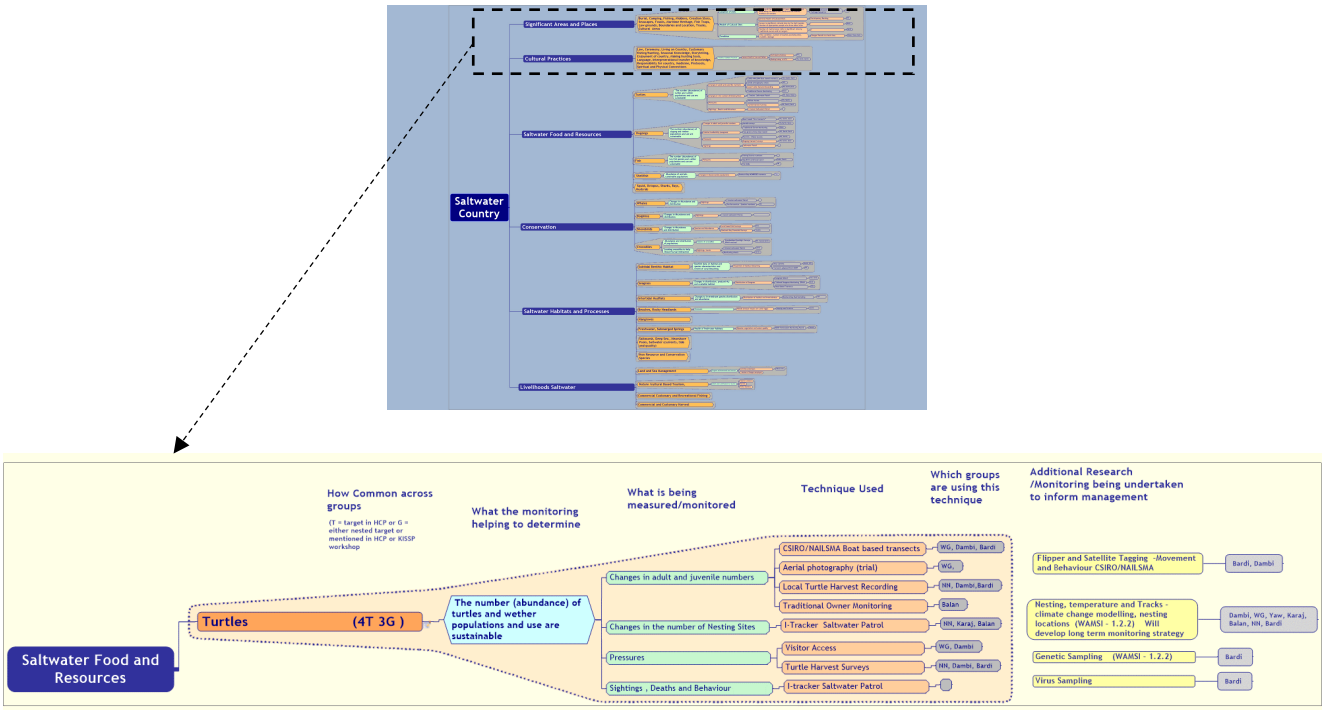


Figure 4 Provides an example of how information was compiled to develop a regional summary of Saltwater Country monitoring and research. This summary contributed to the Monitoring Toolbox by highlighting; the distinction between monitoring and research; techniques most commonly used; and how common the value was across the seven saltwater groups (see Toolbox Report Dobbs et al 2017 for more detail).

There are a number of reasons for this lack of effectiveness monitoring. Firstly, the seven saltwater groups are at different stages in the CAP process. For some groups, this is due to recently having developed their HCPs, whilst for others this is likely due to the complexity of CAP implementation. As monitoring is only one activity in Rangers work plans, many groups have limited capacity, time and resources to develop adaptive monitoring plans and assess their monitoring activities (see Step 5). Support is therefore required to assist groups in implementing a more complete adaptive management cycle. Secondly, there has been significant focus (and investment) on developing WS monitoring tools (i.e. I-tracker) or identifying WS techniques for monitoring the status of values (i.e. see KLC and CSIRO 2014). Whilst building the capacity of groups to undertake monitoring, this focus on values has resulted in some groups being faced with an overwhelming list of potential indicators and values to measure without a way forward to prioritise. Thirdly, the majority of funding for saltwater research and monitoring is derived from external (to the group in question) sources and therefore not always focused on answering questions that will help to inform monitoring and management questions specific to Ranger groups. Without a clear monitoring plan, Ranger groups become reactive to funding opportunities rather than having the capacity to drive or influence monitoring and research agendas on their own country.

Lessons can be learnt from those groups that have advanced further along the HCP CAP process, having had the capacity and access to resources to do so (see Monitoring and Evaluation case study in **Toolbox Report** (Dobbs et al 2017) and Austin et al. (2017)). As highlighted in STEP 3, rather than monitoring all of the values in a HCP, monitoring plans should be driven by objectives and strategies that help prioritise the values and indicators that groups should monitor. Draft conceptual models (Figure 5) have been developed (based on regional objectives and threats) providing an opportunity for groups to select appropriate monitoring to address regional scale issues. The conceptual models depict complex relationships between threats and values for each objective, and incorporate both ecological and cultural attributes. The models provide a basis for developing results chains or program logic. Results chains are pictures that explain how the work is going to be done to achieve objectives and make values healthier. They help identify the steps along the way that groups need to look at to see if they are doing their work, providing an opportunity to measure progress (see **Toolbox Report** (Dobbs et al 2017)). By approaching monitoring in this way groups can monitor their progress towards implementing strategies and management actions. It also allows groups to consider effectiveness monitoring which addresses the question: "Are our management actions having their intended impact?" and not just status (or baseline) monitoring which

focuses solely on answering the questions: “How are the values we care about doing?” and “How are threats to these values changing?” (TNC 2005).

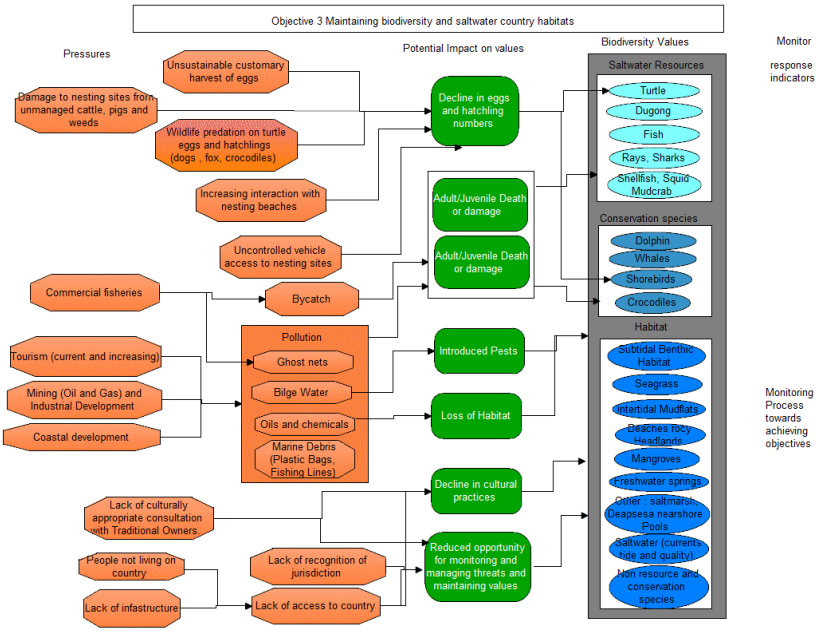


Figure 5 An example of the conceptual models developed for Regional Objectives – compiled to demonstrate techniques for building program logic to identify monitoring questions and monitoring indicators (see Toolbox Report Dobbs et al 2017 for more detail).

B) METHOD: What method will help us to answer our question?

Consistency in monitoring approaches allows for the collection of comparable data on values and threats among groups, in turn facilitating an opportunity to evaluate region-wide values and threats. Whilst the framework acknowledges that there is benefit in moving towards standardised techniques, this will not always be feasible as groups do not have the same capacity, local conditions, or resources to do so. For example, although all groups expressed interest in using the CSIRO/NAILSMA boat-based turtle and dugong survey methods (Jackson et al. 2015), not all groups have the capacity (access to a boat and certified drivers) or funding to do this. Other factors, including local conditions, priorities, preference for IK approaches over WS techniques and existing relationships that groups have with researchers, can also influence the type of method that each of the Ranger groups will adopt. Previous attempts to develop a standardised region-wide monitoring program (e.g NAILSMA I-tracker Saltwater Patrol) have since been adapted, or new techniques developed to meet individual groups’ needs or provide answers to locally relevant questions.

To address these challenges a toolbox approach was developed to provide a comprehensive repository for saltwater monitoring tools and techniques (see Figure 6, Dobbs et al. 2017). The toolbox provides groups with a summary of the techniques and tools currently available for monitoring of saltwater country and where and how to access information on these techniques (including data recording, analysis tools etc). By allowing Ranger groups to collaboratively choose the best methods available (rather than producing a framework that forces groups to use particular methods), the toolbox also provides an opportunity to build multiple lines of evidence to give a better picture of country. Other advantages of using a Toolbox approach include the opportunity to:

1. Share techniques and tools among groups (often developed with individual Ranger groups but suitable for use by other groups across the region),
2. Standardise monitoring techniques across the region (rather than reinventing techniques),
3. Monitor at both the local and regional scale (this was seen as beneficial and an outcome endorsed by the Ranger groups),

4. Incorporate both WS monitoring and IK to support decision making and the use of multiple tools and multiple lines of evidence (i.e. aligns with the multiple evidence based approach),
5. Identify where tools are required and where researchers can assist in developing new tools.

Regional Value - Saltwater Resources

Specific Value - Turtles

SALTWATER TOOLBOX TABLE 1: CHOSE A MONITORING TOOL (BASED ON YOUR QUESTION)

VALUE	QUESTION	MONITORING TOOL	GROUPS USING TOOL
SALTWATER RESOURCES			
TURTLES	What is the status of turtle population numbers?	BOAT BASED SURVEYS (transects) CUSTOMARY HARVESTS PARTICPATORY RANKING PARTICIPATORY MAPPING	WG, Dambi, Bardi NN. Dambi, Bardi - -
	Are populations genetically different?	GENETICS	Bardi, NN
	Is Indigenous knowledge for turtles being used?	PARTICPATORY RANKING	-

Information about what tool can help you to answer your question and who is using the tool

SALTWATER TOOLBOX TABLE 2: WHAT INFORMATION IS CURRENTLY AVAILABLE FOR EACH TOOL

VALUE	MONITORING TOOL	Knowledge systems	What is measured/monitored/recorded	RECORDING METHOD	TRIALS AND DEVELOPMENT	ANALYSIS / COMMENTS
TURLTES	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 (would require adapting for use by other groups) **Main Contact - Peter Bayliss CSIRO**

Figure 6 A TOOLBOX has been developed to assist groups in choosing tools and accessing information. Table 1 allows groups to choose a monitoring tool based on the question they would like to answer. It also highlights which groups are using the technique. The Toolbox of methods (Table 2) provides a summary of the knowledge systems, the recording method, information on trials and development and also the analysis tools available (see Toolbox Report Dobbs et al 2017 for more detail).

This toolbox of methods should be used with caution, with monitoring techniques developed and/or chosen with a clear understanding of why groups are monitoring (see section A above). To facilitate a question-driven approach, the toolbox presents groups with a range of tools based on the question they would like to answer. The Toolbox then provides a summary of each monitoring tool including; the knowledge systems incorporated; the recording method; trials and development; and analysis tools available. The Toolbox highlights that the majority of monitoring tools currently available are WS tools focused on measuring ecological attributes; only a few techniques have been trialled or developed that are suitable for measuring cultural attributes. A variety of methods are available for capturing IK including: questionnaires, interviews, workshops, participatory fieldwork, story-telling, participatory mapping, and the use of visual media such as photography and art (Huntington 2000; Walsh and Mitchell 2002; Maclean and Woodward 2013). Although these methods have been incorporated into the toolbox to support a multiple evidence-based approach to monitoring, future trial and development of these methods for monitoring in saltwater country will be required.

C) Implementing the Monitoring

The toolbox provides groups with the information and access to tools currently available to assist in implementing monitoring techniques. It also provides information on which techniques can be undertaken independently, which require support from researchers and also where there are gaps in the monitoring process or in information available (Figure 6).

D) ANALYSIS - Analysing the data

Groups typically rely on partnerships with natural resource management practitioners and researchers to undertake analysis of saltwater monitoring. Only two of the monitoring techniques identified in the toolbox assist Rangers in analysing and interpreting results. All other techniques either require data to be sent to researchers, or data is being collected but not analysed at present. Substantial benefits to regional monitoring can be achieved by building the capacity of groups to undertake this autonomously, or with limited input. Building the capacity of groups requires that collaborations hand over leadership, skills and tools to Indigenous groups, reducing dependence on external support (Woodward 2008). This includes the development of appropriate techniques to assist in evaluating the results of monitoring and thereby the efficacy of management strategies. The toolbox provides examples of analysis tools (Jackson et al 2015; Dobbs et al 2016) that have been developed to support remote ranger groups to analyse and interpret monitoring data with minimal external support. Development of these analysis techniques should be standard practice when developing new monitoring tools.

A regional approach to monitoring will also require coordination of data management. Although there has been significant investment in the last decade by NAILSMA and the KLC into the I-Tracker support network (which uses CyberTracker to collect and manage information) there is currently limited funding for ongoing support and training. A number of Kimberley groups are trialling alternative data management and recording platforms such as FULCRUM. FULCRUM can be used on both Android and IOS devices and provides a user-friendly way of developing forms and linking multiple data sets. A number of recent initiatives have also been aimed at providing a centralised approach to storing and analysing data for rangers. Although there are benefits to this approach, including that many groups may not be able to develop in-house capacity in the short-term, it also has the potential to move the knowledge production, further away from Traditional Owners and could potentially disempower them. Groups understand that these issues currently constrain on ground activities and represents a significant challenge that needs to be addressed in the future.

E) RESULTS - Interpreting the results

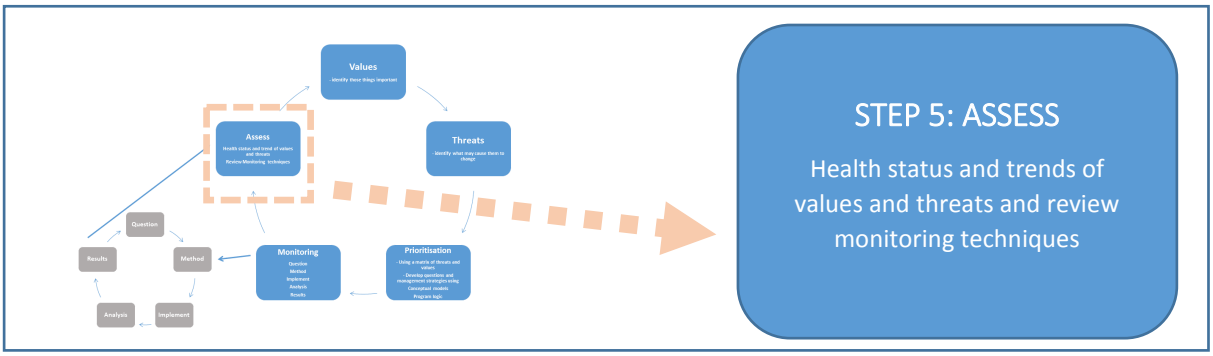
This stage is crucial to ensuring adaptive management and it is essential that once a year, groups allocate time to this process to avoid committing valuable time and resources to monitoring without tangible outcomes. Once data has been analysed, groups will need to firstly assess and interpret the findings based on the original objectives for monitoring (e.g. is this status of your value changing, are your management actions having the desired effect, are you achieving your management actions), and secondly integrate this assessment back into the adaptive management framework (e.g. make decisions about whether you are measuring the right indicators, is the indicator sensitive enough, do you need to change your management actions). This process will assist in answering questions at the local scale, but the findings can also be used to inform the regional framework (see assessment Step 5 below).

A case study has been provided in the **Toolbox Report** (Dobbs et al 2017) to demonstrate how one Traditional Owner group in the Kimberley (Wunambal Gaambera) have conducted a five year evaluation of their HCP and

developed a monitoring and evaluation (M&E) committee to assist in completing the adaptive management cycle and independently audit the monitoring and evaluation process (see also: Austin et al. 2017).

STEP 5 – ASSESS

Results at the local scale (Step 4) feed into the regional framework at this step.



The assessment phase is one of the most important steps of the Framework. It requires groups to come together and compare information, consider the health status of regional values and whether you're monitoring is informing management actions and effectiveness. Without this step then time and resources may be inefficiently allocated with monitoring efforts providing limited outcomes.

At this step in the Framework groups need to make an assessment using the new knowledge gained from the monitoring process. The assessment could include i) examination of the current 'status of the value in question (e.g. is it going up, is it going down, can this be attributed to management actions, threats or population wide trend) or ii) an assessment of the 'effectiveness of implemented management strategies. This allows groups an opportunity to integrate the outcomes of this assessment back into the adaptive management framework by revisiting the monitoring process (e.g.is the right indicator being used, do I need to change my management actions).

The toolbox provides case studies on participatory monitoring and evaluation. Lessons can be learnt from groups that have established monitoring and evaluation processes, having had the capacity and access to resources to do so. The success of a regional approach will rely on the working group trialling techniques that can assist in combining data derived from multiple tools or projects (allowing comparison of quantitative versus qualitative data) and across multiple knowledge bases. Some of the tools that may be useful for multiple knowledge bases include; participatory mapping; participatory ranking; participatory workshops and modelling; and participatory scenario planning (see Austin et al 2017). Participatory approaches have been used previously in Saltwater Country to understand the status of marine mammals (Grech et al, 2014), and to map dugong cultural hunting areas to define and develop aerial surveys (Bayliss et al 2017).

Another key challenge of a regional assessment is to define and negotiate how data will be shared. Previous efforts to centralise data storage at a regional scale have failed to successfully negotiate data sharing agreements (i.e. NAILSMA I-tracker Patrol). Through workshops, Traditional Owners provided initial direction on how the data could be shared in order for information to be assessed at a regional scale. Traditional Owners wanted to see information shared but they wanted to do it certain way and the key messages included:

1. General agreement across traditional owner groups that a working group for saltwater would be a good way to keep working at scale,
2. Data sharing should happen by sitting down, talking together (through the working group and also ranger exchanges, Ranger forums),
3. TOs wanted to have more input at these meetings where possible and would like TOs to attend to see how information gets shared,
4. Data sharing should occur through partnerships rather than setting up a "handing over of data" or a data repository and that it would require permission (from PBCs, etc.) and data sharing agreements.

Formation of the KISSP Working Group has already seen significant benefits for Saltwater Country in; sharing research projects, new monitoring techniques, management strategies, and outcomes and learnings associated with joint management issues.

5. Implementation of the framework

The intent of KISSP was to look at the current status of monitoring and research, and how this could be bought together to assist in developing a broader regional strategy for planning and management of saltwater country. A best practice framework has been developed to account for the unique features of the Kimberley that incorporates a MEB approach, and considers saltwater country as not only a marine ecosystem but a complex ecological social and economic system. The KISSP case study provided us with information for the longer term implications of rolling out the framework and highlights where investment is required. Implementation of the framework will allow Traditional Owner's to better visualise a regional picture of ecosystem health and facilitate knowledge sharing and robust Traditional Owner and Western Science (WS) management.

A summary of each stage including knowledge gaps and requirements and preliminary advice on implementation are provided below and in Table 3.

Step 1 and 2 Identifying Values and Threats

The HCPs provide a robust foundation for defining ecological, social and cultural values and threats. The framework acknowledges all of the values, aspirations and practices that Traditional Owners consider in the management and conservation of Kimberley Saltwater Country.

Implementation Requirements – Values and Threats have been identified. As HCP's are working documents and are revisited, reviewed, and updated, regional values and threats should be reviewed accordingly. This would require discussion at a meeting of the regional saltwater working group annually.

Step 3 Prioritisation

A preliminary prioritisation process has identified regional objectives.

Implementation Requirements – Start by considering the five objectives prioritised under KISSP. A research project could be developed to undertake a best practice prioritisation process, which would involve representatives and Traditional Owners from each of the saltwater groups.

Step 4 -Monitoring

A review of local monitoring has highlighted areas where capacity building and support are required. The monitoring toolbox has provided products and tools. In addition to these tools, a learning package has been developed to assist Rangers in undertaking regional monitoring (Lincoln, 2017). The regional working group should determine what the groups will monitor and what indicators should be used and consider other factors including what capacity groups have to report on these things, indicators that Rangers are currently monitoring and what can we afford to monitor at a regional scale.

Implementation Requirements – A staged approach to implementing the framework across the region will need to be developed. Choose one case study to consider at the regional scale (from the objectives identified), one or two indicators/ should be chosen and the current management actions and also the status of the value/objective should be discussed.

This step of the framework will require groups to have a centrally located database (the toolbox) which is updated with current research activity and also monitoring techniques and tools as they are developed. The toolbox should be updated every 6 to 12 months.

The key limitation expressed by Ranger coordinators was that time and resources are limited and Ranger groups will require assistance in taking the next step to ensure that their local monitoring plans are directed by objectives and strategies (and include monitoring effectiveness) and that monitoring data is assessed.

Step 5 – ASSESS

The success of the framework will rely on the working group trialling techniques that can assist in combining data from multiple tools (allowing comparison of quantitative versus qualitative data) and across multiple knowledge bases. Some of the tools that may be useful include; participatory mapping; participatory workshops and modelling; participatory scenario planning (SEE Austin et al 2017).

Implementation Requirements - Ongoing commitment, support and funding to form and maintain a Saltwater Working Group.

This will be essential to ensure that groups come together to assess monitoring on a regional scale. A trial of assessment and evaluation using multiple lines of evidence and multiple data sets.

Table 3 A summary of the FRAMEWORK including the results of the KISSP case study and the knowledge gaps and requirements for implementation

	FRAMEWORK	Best Practice	KISSP case study	Implementation of the Framework
STEP 1	**Values** - identify those things important TO YOU	Identified by Traditional Owners and Rangers Synthesis of values and threats at a regional scale	Identified by Traditional Owners and Rangers through HCP Analysis and review Ranger and Traditional Owner workshops Synthesis of these values undertaken at a regional scale - validated/confirmed and expanded through Workshops	Provides a robust foundation for defining ecological, social and cultural values and threats. Healthy Country Plans are working documents that are revisited, reviewed, and updated and therefore these regional values and threats should be reviewed accordingly. Requires an annual working group meeting.
STEP 2	**Threats** - identify what may cause Values to change			
STEP 3	**Prioritisation** - Using a matrix of threats and values, Decide on those things MOST IMPORTANT TO MONITOR	Prioritisation undertaken by Ranger and Traditional Owners to remove WS bias and allow focus on Looking after Country - link objectives threats and values across the region to provide monitoring approach/focus	Limited scope to conduct prioritisation workshops so preliminary prioritisation undertaken for the framework Prioritisation criteria: -Spatial (regional scale) -align with HCP objectives (HCP analysis of objectives relevant at a regional scale) and discussions in workshop around regional scale monitoring Working group input and feedback on chosen objectives	Consider the five objectives prioritised under KISSP. Ideally a research project should be developed to undertake a best practice prioritisation process, involving representatives and Traditional Owners.

	FRAMEWORK	Best Practice	KISSP case study	Implementation of the Framework
STEP 4	**Monitoring** Question Method Implement Analysis Results	Local monitoring follows adaptive management framework with questions clearly defined and monitoring and management actions evaluated Monitoring and evaluation allows for a MEB approach	Framework acknowledges that objectives, priorities and management strategies differ across groups and therefore promotes local scale monitoring that can feed into the regional framework Current state of monitoring defined (workshops, questionnaires) to: - identify gaps and research needs -provide groups with successful approaches/case studies Toolbox developed to : -provide groups with a summary of methods available -Identify gaps in techniques/research /tools to assist with future program alignment -Conceptual Models drafted to link objectives threats and values and provide monitoring approach/question Pilot Learning Package Provides Ranger training including how you – Implement, Analyse and evaluate results	Using the objectives and priorities identified through KISSP to choose one or two values that it addresses and trial the assessment phase (using the information provided from local monitoring) Limitations – There is currently a strong focus on monitoring the change in values, capacity building and training is required to ensure monitoring is focused on objectives and strategies, and incorporates management effectiveness (by development of results chains or similar). Gaps in adaptive management framework: -monitoring driven by larger scale research agendas and therefore not always linked to local priorities or questions - Support and training required to enhance the capacity of Ranger groups to analyse data and interpret results at both a regional and local scale. Gaps in tools and research - Toolbox highlights where tools need to be developed, where existing tools require further development (such as tools for groups to analyse and interpret results)

	FRAMEWORK	Best Practice	KISSP case study	Implementation of the Framework
STEP 5	**Evaluate/Assess** Health status and trend of values and threats Review Monitoring techniques	Viability Assessment Review of Regional Monitoring	Discussed in workshops The toolbox provides case studies on participatory monitoring and evaluation. Lessons can be learnt from groups that have established monitoring and evaluation processes, having had the capacity and access to resources to do so.	Ongoing commitment, support and funding to form and maintain a Saltwater Working Group. This will be essential to ensure that groups come together to assess monitoring on a regional scale. A trial of assessment and evaluation using multiple lines of evidence and multiple data sets.

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