



Mobilising Indigenous Knowledge for the Collaborative Management of Kimberley Saltwater Country

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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.

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Front cover images (L-R)

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

Image 2: Kimberley Saltwater Country (Image: Beau Austin)

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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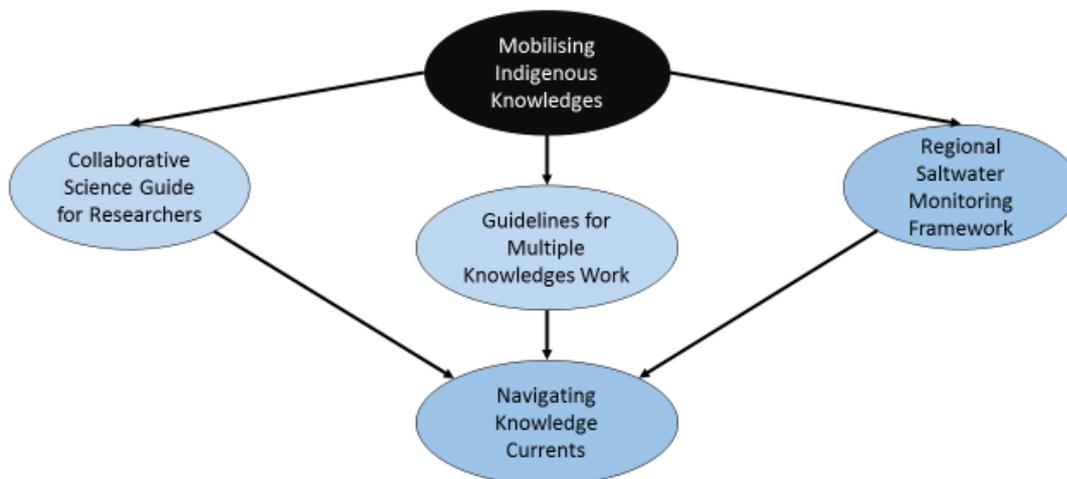
Executive Summary

In this report we propose a Multiple Evidence Base (MEB) approach to collaboratively mobilising Indigenous Knowledges, Western Scientific Knowledge and other knowledge practices to look after Kimberley Saltwater Country. It is one approach available to Indigenous people and their partners to share, use and co-produce the best available knowledge-base for decision-making, management and monitoring of Kimberley Saltwater Country.

The MEB is capable of producing transdisciplinary research and monitoring results that harness the strengths of both Indigenous Knowledge and Western Scientific Knowledge and are legitimate, credible, salient and useable in managing, conserving and looking after all values of Kimberley Saltwater Country. Further, if successful, knowledge integration and co-production exercises can increase stakeholder buy-in and the perceived legitimacy of decisions made and policy formulated.

However, implementing the MEB approach requires coordinated institutional support and sufficient resources to produce useful knowledge that is easily translated into programs of action. To ensure this, there is a fundamental requirement that Indigenous peoples, and their knowledges-practices-beliefs, are empowered and have sufficient capacity to collectively organise and mobilise at organisational and institutional levels.

We first attempt a definition of Indigenous Knowledge for Saltwater Country through the use of examples provided to us by Traditional Owners. Indigenous Knowledge is then compared with typical Western Scientific Knowledge approaches and the potential to apply the Multiple Evidence Base approach to collaborative ways of looking after Kimberley Saltwater Country discussed. Finally, steps for mobilising Indigenous Knowledge are outlined for the consideration of the KISSP Working Group, Traditional Owners, Indigenous land and sea managers, researchers, governments and NGOs who share responsibility for building the knowledge base to direct actions for management and care of Kimberley Saltwater Country.





1. Introduction

Indigenous peoples' *in situ* knowledges-beliefs-practices have the potential to make significant contributions to meeting contemporary sustainability and conservation challenges globally. However, they are often met with scepticism or simply overlooked as 'traditional' – i.e. belonging to the past. However, contemporary intercultural knowledge partnerships can underpin collaborative efforts to care for the Kimberley Saltwater Country if Traditional Owners, scientists and practitioners are supported through coordinated institutions and resources. This helps to enable knowledge integration and co-production in ways that can be translated into programs of action. The result of such knowledge partnerships is an intercultural knowledge system that can both mobilise IK and support the co-production of new knowledge rather than pitching knowledge holders and producers against each other.¹

In this report we present practical steps to guide saltwater managers (both Traditional Owners and their partners) in their collaborative efforts to share, use and co-produce the best available knowledge for decision-making, management and monitoring of the Kimberley Saltwater Country.

We begin by outlining key features of the Kimberley Saltwater Country region including an explanation of what 'saltwater country' means for the Kimberley's Traditional Owners. Examples of IK are presented to show WSK practitioners and other potential partners what IK entails and how it might be used to support coastal-marine environmental planning and management efforts. The examples provided should be seen as a good faith attempt by Traditional Owners to enhance collaborative partnerships in the Kimberley region, with a recognition that any knowledge partnership cannot be separated from local practices, beliefs and Saltwater Country itself.

We then introduce the Multiple Evidence Base (MEB) approach for weaving Indigenous Knowledge (IK), Western Scientific Knowledge (WSK) and other knowledges and practices into conservation planning and management decisions for Kimberley Saltwater Country. The MEB establishes theoretical context for the sharing and co-production of knowledge, which is followed by a brief outline of IK for Kimberley Saltwater Country.

Finally, we outline a stepwise process that applies the MEB approach to guide collaborative and adaptive management for the consideration of Kimberley Saltwater Country partners, such as the KISSP Working Group, Traditional Owners, Indigenous land and sea managers, researchers, governments and NGOs who all have obligations to create effective knowledge partnerships.

This report is intended to be read in conjunction with a set of guidelines for collaborative knowledge work (see Austin et al. 2017b). Together they outline a clear process for bringing Indigenous knowledges and western science together to establish the best available knowledge-base for the management of Kimberley Saltwater Country. This has significant implications for managers in the region as it mobilises a wealth of knowledges and practices that are vital to our capacity to make the best decisions to look after environmental, social, economic and cultural assets in the Kimberley, but have remained under-appreciated and under-utilised until now. However, the significance of this report in terms of management implications is dependent on the willingness and capacity of partnerships to adhere to good process. That is, the true test of the impact lies in the extent to which subsequent collaborations are implemented based on good faith, equity and transparency.

¹ See the work of Cornell et al. 2013 who describes how 'knowledge systems' are the agents, practices, and institutions that organise the production, transfer and use of knowledge and the work of Robinson and Wallington (2012) who explains how knowledge across Indigenous, scientific and management domains can be achieved through co-management in practice

This report is part of the Kimberley Indigenous Saltwater Science Project (KISSP)² and specifically relates to Objective 1 which asks Indigenous, scientists and practitioners to:

Integrate Traditional Ecological Knowledge (TEK) and management practices into Kimberley marine conservation and management.

Another product was developed as part of KISSP Objective 1 and should be read together with this report:

- *Guidelines for Two-Way Knowledge Work in Kimberley Saltwater Country*

Further, the work presented in these reports is closely aligned with Objective 2 and Objective 3 of the KISSP, which can be accessed at: <http://www.wamsi.org.au/research-site/indigenous-knowledge>.

It is important to acknowledge that this project is the result of decades of practice, advocacy, research and hard work by all of the stakeholders involved. As Natcher et al. (2005) rightly argue, managing natural resources is more about managing relationships. The KISSP was an opportunity to build on the working relationship of Traditional Owners and their partners in managing and conserving Kimberley Saltwater Country. It is in this spirit that the multiple evidence based approach to inter-cultural planning and management for Kimberley Saltwater Country is proposed.

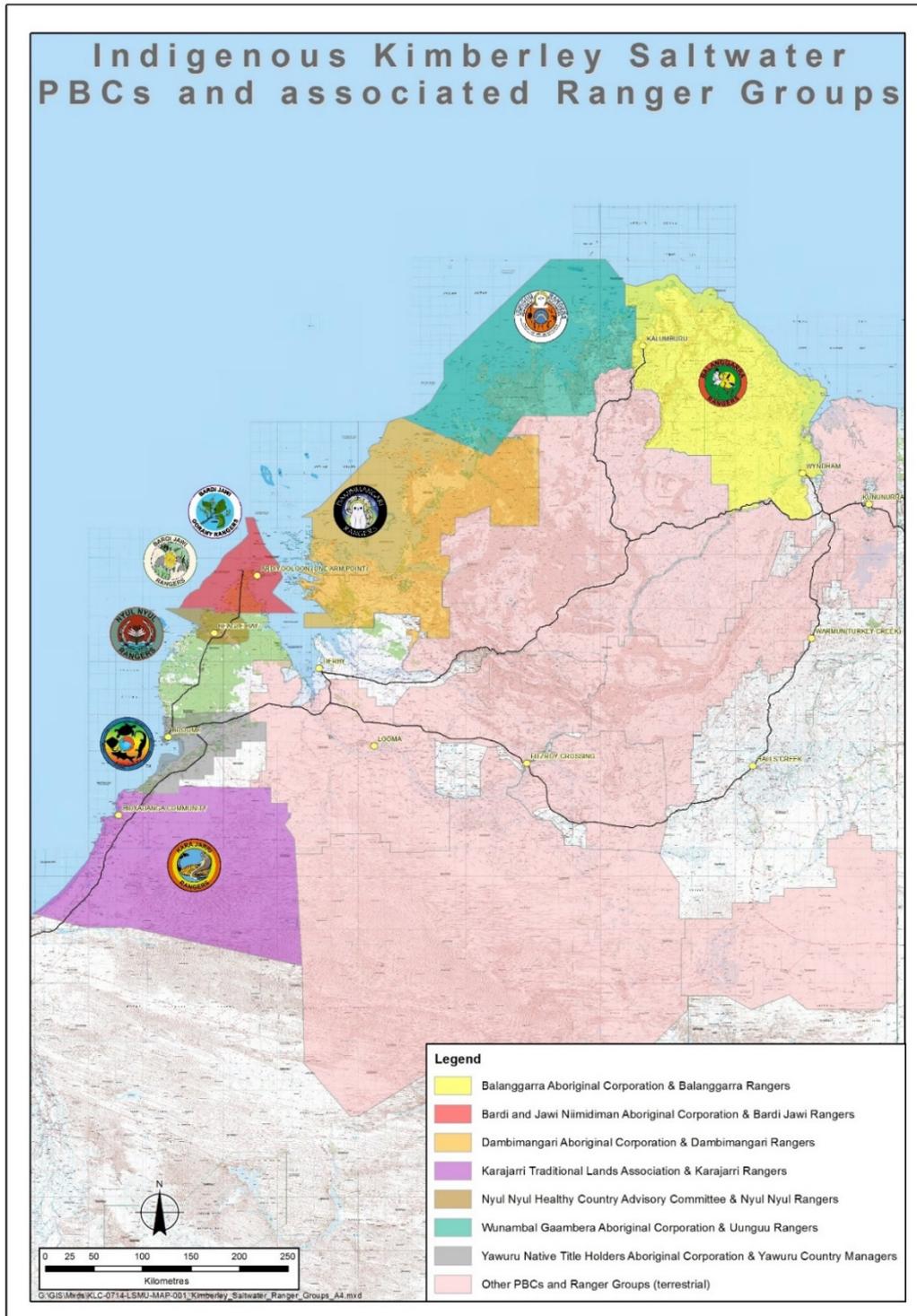
2. Kimberley Saltwater Country

‘Saltwater Country’ is a contemporary term used in the Kimberley to describe the area of Traditional Owners’ estates that relates in some way to the sea (i.e. saltwater). However, there is no clear delineation between Saltwater Country and any other part of Country³. In many ways, this is a term of convenience generally used to help define spatial geographies for management and governance. For our purposes in this report, we will define Saltwater Country as any part of the seven (7) participating Native Title holder groups’ lands & seas that consists of some or all of the following (among other things):

- The sea
- Reefs
- Seagrass
- Sand
- Mud/mudflats
- Rocks
- Beaches
- Headlands
- Cliffs
- Islands
- Estuaries
- Creeks
- Mangroves
- Freshwater springs/soakages
- Saltmarshes
- Brackish water
- Plants and animals, and
- Stories, ceremonies, significant/sacred sites that relate to any and all of the above

² The KISSP was funded by the Western Australian Marine Science Institute (WAMSI) and ran from February 2016 – July 2017. Further information on WAMSI is available at: <http://www.wamsi.org.au/>

³ Country is the English term used by many Indigenous Australians to refer to their ancestral estates (Smyth 1994). The term is capitalised as Country has agency in Indigenous Australian cosmologies and the relationship between people and environment is one of intertwined dualities (Rose 2000).



Map 1. Kimberley Traditional Owner groups participating in the KISSP.

To describe ‘Saltwater Country’ is not entirely satisfactory as it separates the coastal and marine environment from the rest of the entities and objects that comprise Country. However, this compartmentalisation of Country is here presented as a ‘good enough’ approximation of the relationships between Indigenous people and their Country that is related to the marine environment.

The Kimberley is home to a diverse cultural landscape dating back at least 40,000 years and was likely one of many locations for the first arrival of humans across the land bridge to the north of the continent at that time

(Mulvaney and Kamminga 1999). Indigenous rock art is a cultural treasure of global significance (WA 2011) and there are currently 22 Aboriginal language groups in the region (WA 2011). Visitors come to the Kimberley to experience this cultural heritage from all parts of the world, which adds significant value to the tourism industry in the region (WA 2011). Local Indigenous people are connected to the social-cultural-ecological landscape that is the Kimberley through intertwined dualities of people and place, which are ancient and central to Indigenous Australian worldviews (Rose 1988, 1996, 1999, 2000). Known colloquially as 'looking after Country', Indigenous relationships to land and sea generally involve the fulfilment of obligations to ancestors, kin, Country and ceremony (Smyth 1994; Hill et al 2013).

The marine environment in the Kimberley is globally significant for its biodiversity (some unique), relatively intact ecosystems, aesthetic and recreational values (Mustoe and Edmunds 2008; WA 2011; WWF 2012). The Kimberley is home to all six species of threatened marine turtles, manta rays, dugongs, a major humpback whale nursery and important migratory shorebird populations (WA 2011). The continental shelf off the Kimberley coast is made up of more than 2,500 islands, coral reefs, seagrass beds and offshore shoals that are vital habitat for the region's unique marine flora and fauna (WA 2011). This area is among only 4% of marine ecosystems in the world to have experienced 'very low impact' from humans (Mustoe and Edmunds 2008; WA 2011). The islands of the Kimberley region are also important refugia for many threatened species and ecosystems (WA 2011; Vigilante et al. 2013). There is a great deal of interest from the Australian public in protecting these natural values and, 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 (Yu 2000; Fox and Beckley 2005; WA 2011; WWF 2012; Moritz et al. 2013; Possingham et al. 2015).

Natural resources form a significant part of the Kimberley region's economy, with tourism, mining, pearling, horticulture, oil, gas, agriculture and fishing generating more AU\$1.5 billion per annum (WA 2011). One of the key considerations for natural resource management regimes in the Kimberley will be not only the accommodation of commercial fisheries and resource extraction industries, but also the capacity of Indigenous people to engage in development opportunities (Cox et al. 2010; CBD 2011; McShane et al. 2011; Berkes 2015). The preservation of species, biodiversity and ecosystems is not possible without consideration of social, economic and cultural factors that affect the success of natural resource management and conservation efforts (Sodhi and Ehrlich 2010; Berkes 2015; Diaz et al. 2015). Supporting the growth of Indigenous livelihoods (such as fishing [subsistence and commercial], tourism, natural resource management, research, etc.) is an important component of ensuring marine protected areas and other conservation mechanisms have the capacity to function effectively (Allison et al. 2012). Further, subsistence harvesting of these resources also makes a significant contribution to the livelihoods and wellbeing of Traditional Owners (Buchanan 2014).

In the last few decades, there has been an increase in the appreciation of the diverse knowledges local peoples use to make decisions about natural resources (Nadasdy 1999; Menzies 2006; Haggan et al. 2007; Lutz and Neis 2008; Hill et al. 2012; Bohensky et al. 2013; Sutherland et al. 2013; Tengo et al. 2014, 2017; Berkes 2015). As demonstrated by Ostrom's (1990) work, local people use sophisticated cooperative arrangements to manage resources. Local knowledge is at the core of local relationships, practices and beliefs and (when handed down through generations) Indigenous knowledge (Berkes 2008; Berkes 2015). Local knowledges are diverse by nature. They are constructed, deconstructed and revised in response to interactions of local knowledge holders/knowledge makers and their immediate social, cultural and environmental contexts.

As such our starting point in this report must be an acknowledgement of the diversity of knowledges present across the Kimberley region. It will be noted that although our primary focus is the combination of IK and WSK in two-way partnership, space has been marked for acknowledgement and use of other forms of knowledge (e.g. local knowledge, experiential knowledge, expert knowledge, practitioner knowledge, etc.) by employing a multiple evidence-based approach. It is from this standpoint of biological, ecological, geographic, cultural, linguistic, social, economic and political diversity that we embark on the challenge of enhanced integration of IK

and WSK in Kimberley Saltwater Country. It is this very diversity that holds the key to designing and implementing practical solutions to complex socio-cultural and ecological problems in the Kimberley into the future.

3. A Multiple Evidence Based Approach

Conventional biological training has focused our attention so single-mindedly on the rigorous quantitative description of marine resources before committing ourselves to managing them, that we are liable to feel guilty if we diverge from this track – and worse still, we may even criticise others who do so (Johannes 1998, p.245).

‘Evidence-base’ is a popular term used to describe the types of knowledge that can be seen as relevant, credible and useable for supporting decision-making and policy development. In contemporary western cultures, this has usually been restricted to knowledge produced through WSK and, more specifically, quantitative measures⁴ (Mascia et al. 2014). However, alternative knowledges to WSK can be highly useable and relevant in making decisions and policy in terms of managing complex social-ecological systems.

Tengo et al. (2014) present the Multiple Evidence Base (MEB) as an approach that can work with diverse knowledge systems to produce an enriched picture of any given phenomenon (see Figure 1). It depicts graphically the notion of ‘science *and* other knowledges’ being worked together to build a more comprehensive knowledge-base than could be achieved by any one knowledge system alone. In the October 2016 KISSP workshop in Broome, the various strands of knowledge that are depicted as being mobilised in this figure were described as being like a tree – each of the roots of knowledge growing together to support each other to produce fruit on the branches. It seems a good metaphor for the process that is at play. The purpose is to mobilise diverse and potentially otherwise disparate knowledge to co-generate mutual learning across knowledge systems.

⁴ For examples of this in the natural resource management and conservation fields refer to the following practitioner-oriented websites www.conservationevidence.com and www.environmentalevidence.com

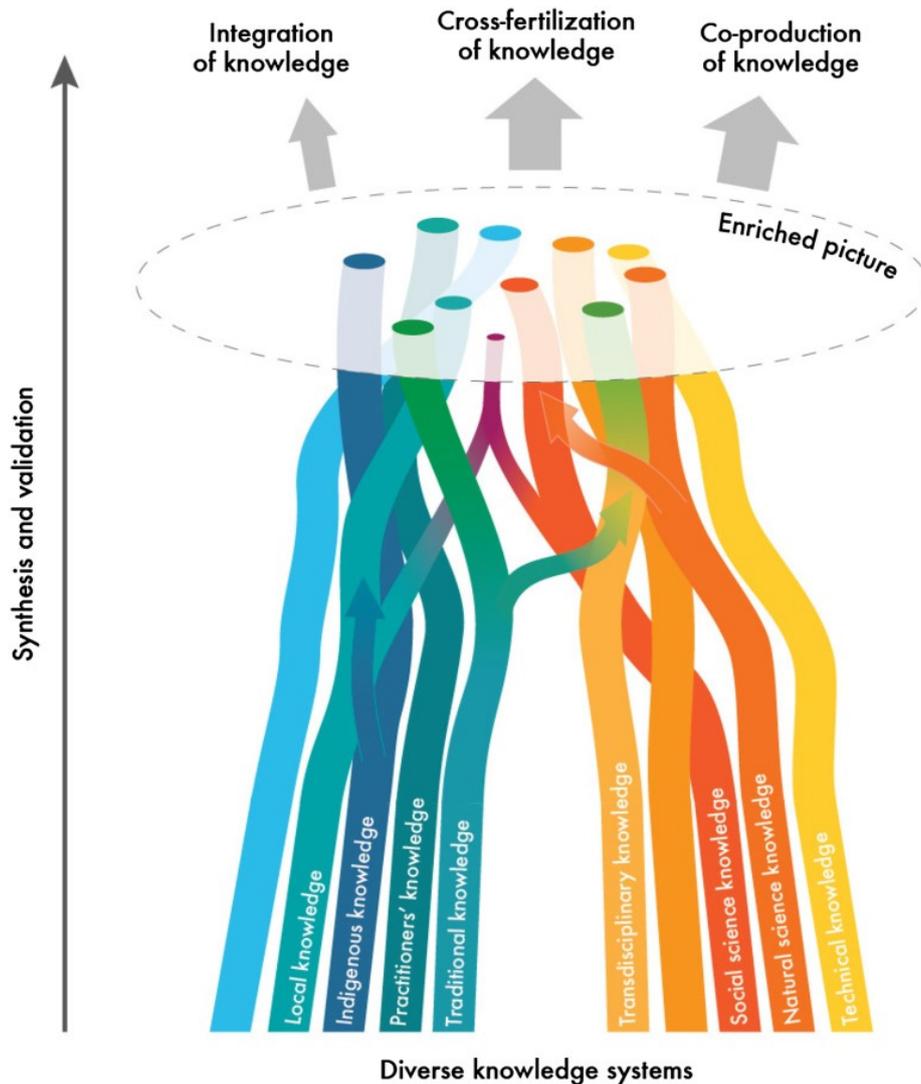


Figure 1. Illustration of multiple evidence base approach (Tengo et al. 2014).

MEB approaches are helpful to guide trans-disciplinary processes which require knowledge that is legitimate, credible, and salient, as well as usable for moving towards sustainability (Clark et al. 2016). Indigenous knowledge systems, and the holders of such knowledge, carry insights that are complementary to science, in terms of scope and content, and also in ways of knowing and governing complex and dynamic social-ecological systems (Robinson and Wallington 2016). The inclusion of Indigenous knowledge in transdisciplinary efforts to inform conservation emerged from a series of meetings being held under the framework of the *Convention on Biological Diversity*, specifically in relation to the need to incorporate Traditional and Local Knowledges in biodiversity assessments at the global level (e.g. Tengo et al. 2014). There are number of examples where the MEB is being used in bottom-up pilot projects in Australia (e.g. Austin et al. 2017a) and around the world (Ali 2016; Daguitan et al. 2016; Mburu 2016; Tengo et al. 2016; Trakansuphakon et al. 2016) and has helped frame the work of the *Intergovernmental Panel for Biodiversity and Ecosystem Services* (IPBES)(for example, see the recently published IPBES global assessment of pollination services and regional assessments; <http://www.ipbes.net/publication/thematic-assessment-pollinators-pollination-and-food-production>).

As with KISSP these efforts have been forged through a commitment by all participants to value diversity (social-cultural-ecological) and creating knowledge pathways and partnerships that link local, regional, national and global policy and management of biodiversity (Tengo et al. 2016). This is not without significant challenges

(Wohling 2009). Local case study evidence points to a range of barriers to weaving different knowledge systems to inform Indigenous conservation planning efforts. Structural barriers include power differences, centralisation and domination of decision making by government (e.g. Hill et al. 2015), as well as scientists' lack of respect for local and traditional knowledge (Houde 2007). Possible cognitive barriers have also been identified, such as the absence of shared worldviews (Berkes 2015).

The MEB positions Indigenous, local and scientific knowledge systems (among others) as “different manifestations of valid and useful knowledge that generates complementary evidence for sustainable use of biodiversity” (Tengo et al. 2016, p.2). It has a focus of “letting each knowledge systems speak for itself, within its own context, without assigning one dominant knowledge system with the role of external validator” (Tengo et al. 2014, p.584). The outcome can be thought of as knowledge weaving through collaborative pathways, activities and efforts that respects the integrity of each knowledge system (Johnson et al. 2016).

In a practical sense, the MEB approach allows for accurate, efficient identification of gaps in the knowledge base and opportunities for collaborative research engagements. Taking seriously all of the available sources of evidence from across multiple knowledge systems ensures that precious funds for research, monitoring and evaluation are not misspent on finding answers to questions for which we already have knowledge that can be used. This is especially relevant to knowledge work being conducted in Kimberley Saltwater Country as the area remains under-studied from a WSK perspective, though retains a rich and long history of IK through occupation and use over the last 50,000 years. It is not difficult to identify many topics of interest to WSK, and of importance to decision making and policy development, for which IK may be the only source of information in the Kimberley.

The fundamental requirement for the MEB to function effectively is empowerment and capacity development of practitioners from all participating knowledge systems (Christie 2006, 2007; Tengo and Malmer 2012; Tengo et al. 2014; Austin et al. 2017a). For the purposes of KISSP, given historic and contemporary power imbalances, this equates to ensuring that Indigenous knowledge holders are able to collectively organise and mobilise their knowledge appropriately at organisational and institutional levels. The articulation of knowledge across cultural boundaries requires conscious effort. However, as will be discussed later, the benefits of investing in IK are multiple and have the potential to inform better research, decision-making, and policy development for Kimberley Saltwater Country and People.

Perhaps the only point of conjecture for consideration by KISSP is the focus of the MEB on complementary knowledges, evidence and/or practices. As will be discussed, complementarity may not be necessary if relationships of ‘good faith’ and mutual respect are used as a base to mobilise IK (Verran 2013). Difference need not be a barrier to working together to look after Kimberley Saltwater Country.

3.1. Weaving Knowledge Systems

With new challenges in a rapidly evolving human-dominated world... the science-policy community needs to embrace a diversity of knowledge systems, and when connecting to knowledge from local or indigenous communities, it must think beyond aspects that can easily be fitted into conventional models and frameworks (Tengo et al. 2014, p.588).

Working with multiple knowledges is complex, but need not be complicated. Mistry and Beradi (2016) make the point that only *information* can be shared, and that the acquisition of *knowledge* entails processes of learning, re-framing and understanding. In this process of negotiation, tensions can arise at the interface between actors with different views of what constitutes reliable or useful knowledge. Those tensions must be managed effectively if the potential benefits of knowledge are to be realized (Clark et al. 2016).

The overarching aim of KISSP is to facilitate best-practice knowledge production to look after Kimberley Saltwater Country. As part of the *Kimberley Science and Conservation Strategy (KSCS)* (WA 2011) it was identified that integrating both Indigenous peoples' knowledge and western science is a key element to ensuring the best

outcomes for the management and conservation of the Kimberley coastal and marine environment into the future. As mentioned in the KSCS (WA 2011, p.20):

Immense traditional ecological knowledge has been handed down from generation to generation and this can be used in conjunction with modern science to inform land [and sea] management practices and decisions [*our additions*].

As the major strategic document shaping the Western Australian Government's investment in Kimberley science and conservation, the KSCS also places significant focus on acknowledging and integrating Indigenous perspectives. This requires a 'knowledge partnership' approach that is focused on collaboration and emphasises relationships as opposed to difference and/or incongruence (Berkes 2009).

Globally, there is increasing acknowledgement that a majority of the world's biodiversity, threatened species and ecosystem services exist within Indigenous estates (Maffi & Woodley 2012; Renwick et al. 2017). There seems to be a direct correlation between linguistic and cultural diversity and biodiversity (Gorenflo et al., 2012; Maffi & Woodley 2012; Poe et al. 2014), which hints at the role different knowledge systems can play in innovation and research. As such, though often contested (Nadasdy 1999, 2005; Natcher et al. 2005; Berkes 2008), arguments that Indigenous peoples' knowledge and practices play a key role in maintaining globally significant environmental assets are gaining strength (Danielsen 2009, 2014; Bohensky et al. 2013; Tengo et al. 2014; Berkes 2015). IK has the potential to provide useful/useable knowledge, methods, theory and practice to assist in the sustainable management of natural resources (Danielsen et al. 2009, 2014; Tengo et al. 2014). There are numerous relevant studies from Australia (Burbidge et al. 1988; Christie 1990; Baker and Mutitjulu Community 1992; Horstman and Whiteman 2001; Howitt 2001; Verran 2002; Prober et al. 2011; Bohensky and Maru 2011; Gratani et al. 2011; Hill et al. 2012; Butler et al. 2012; Ens et al. 2012; Robinson and Wallington 2012; Davies et al. 2013; Holmes and Jampijinpa 2013; Vigilante et al. 2013; Walsh et al. 2013; Ens et al. 2015; Gillespie et al. 2015; Robinson et al. 2016; Austin et al. 2017a) and abroad (see for example Mackinson 2001; Moller et al. 2004; Berkes 2008; Constantino et al. 2008; Gagnon and Berteaux 2009; Prado et al. 2013; Berkes 2015) that exemplify knowledge integration practice. However, there is no one knowledge integration process or practice that can be applied universally. Subjectivities related to context, aspirations, and the answers being sought determine each process (Reid et al. 2006; Berkes 2008; Danielsen et al. 2009, 2014; Staddon et al. 2014; Tengo et al. 2014). Further, effective integration is largely dependent on the degree to which partnerships are underpinned by good-faith (Nadasdy 1999; Verran 2002, 2008; Christie 2006, 2007; Muller 2014).

However, to suggest that IK has all the answers to the threats to healthy Saltwater Country in the Kimberley is naïve and not an opinion of the majority of participants in KISSP workshops. Issues such as climate change, invasions of feral animals and weeds, and tourism are new challenges that may require co-produced knowledge and management solutions. Given the resources, Indigenous people will in many cases be able to generate solutions to these problems on their Country, though may find WSK and management practices of use. Indigenous rangers are also now experienced in using WSK methods to build richer knowledge-bases about Country. Likewise, managers of national parks and private landowners will be able to learn a great deal from the knowledge and experience of Traditional Owners.

The harnessing of all available knowledge widens the scope, depth and value of knowledge that can be used to inform management, conservation and environmental monitoring in Kimberley Saltwater Country. However, IK is often referred to in an opaque way as an add-on to WSK in 'two-way' knowledge work. There is a need to clarify the nature of IK and position it as equal to WSK so as to realise the full potential of multiple evidence based approaches to governing natural resources.

3.2. Knowledge Definitions

There is a risk in all knowledge integration work that debates around definitions will become all consuming, thus preventing practical outcomes for management and conservation (Agrawal 1995, 2002; Nadasdy 1999, 2005; Berkes 2008, 2015). Several authors have declared that researchers have spent "...too much time on criticising

or defending traditional knowledge (and, for that matter, Western science)” (Berkes 2015; see also Agrawal 1995; Berkes and Folke 1998 and Tengo et al. 2014). However, as discussed in the first KISSP reference group workshop in Broome (February 2016), definitions matter in that they shape the way we *think* and *do* ‘looking after Country’ together.

As will be noted, KISSP Objective 1 uses the term ‘Traditional Ecological Knowledge’ (TEK). There is a significant body of literature on TEK (e.g. Sillitoe 1998; Nadasdy 1999; Moller et al. 2004; Menzies 2006; Berkes 2008; Gagnon and Berteaux 2009; Lauer and Aswani 2009; Bohensky and Maru 2011; CBD 2011; Bohensky et al. 2013; Gomez-Baggethun et al. 2013; IPBES 2012, 2013; Danielsen et al. 2014; Staddon et al. 2014; Sutherland et al. 2014; Tengo et al. 2014; Diaz et al. 2015; Berkes 2015). In effect, increased research interest in TEK along with strong advocacy of Indigenous rights has resulted in a significant shift in conservation thinking and practice and contributed to broad acknowledgment that the maintenance of ecosystem services we all rely on is significantly dependent on cultural diversity (including epistemic diversity) (Danielsen et al. 2005, 2009, 2014; Berkes 2009; Kareiva and Marvier 2012; Robinson and Wallington 2012; Gomez-Baggethun et al. 2013; Poe et al. 2014; Staddon et al. 2014; Tengo et al. 2014).

While the popularity of TEK is undoubted, and its utility for making environmental decisions is gaining support, when it comes to actually defining TEK, things become tricky. Though there is no universally accepted definition of TEK, probably the best known and most widely accepted definition comes from Berkes’ seminal work *Sacred Ecology*:

...a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment (Berkes 2008, p.7).

However, as Berkes acknowledges, there are some issues with the use of term TEK. Firstly, the word ‘traditional’ is controversial. For some people the word traditional means something like “time-tested and wise” (Berkes 2015, p.222). However, for others (authors of this report included) it connotes ‘ancient’, ‘old’, ‘distant’, ‘conservative’ and/or ‘rigid’ (Nadasdy 1999; Berkes 2008). This is problematic given the contradiction of constantly evolving and highly adaptive knowledge systems being described as ‘traditional’.

To avoid this possible contradiction, an alternative term we might like to consider for use in the KISSP project is Indigenous Ecological Knowledge (IEK). Removing the reference to ‘tradition’ and replacing it with ‘Indigenous’ allows acknowledgement of the deep historical connection of knowledge, practice and belief, however creates space for the significant change that Indigenous Australians have experienced in more recent times.

A second issue that is identified in the literature is the problematic nature of the word ‘ecological’ when discussing the knowledges-practices-beliefs of Indigenous peoples. Narrowing the scope of our work to *Ecological Knowledge* helps to simplify our task of knowledge integration as it refers specifically to that knowledge Indigenous peoples use to look after Saltwater Country. This allows us to ‘bracket off’ the vast wealth of knowledge held by Traditional Owners to avoid being overwhelmed (Berkes 2008). However, attempting to focus on the ecological could limit our ability to fully appreciate and acknowledge all of the values, aspirations and practices that Traditional Owners want included in the management and conservation of Kimberley Saltwater Country.

Thus, though it is agreed that Berkes’ definition of TEK above accurately describes most of the knowledges held by Indigenous peoples in the Kimberley that we will be referring to, we suggest that its references to ‘tradition’ and ‘ecology’ are problematic and serve to separate particular examples and types of knowledge from all of the other aspects of Indigenous knowledges-practices-beliefs. As such, we have adopted the term ‘Indigenous knowledge’ (IK) which, though itself not perfect, we use to refer to *all* of the knowledges-practices-beliefs held by Indigenous people today that have both been passed on from generation to generation *and* continue to be developed within the Indigenous domain.

Generally speaking WSK is quantitative, analytical, reductionist, experimental, individualist, written, spatially homogenous, realist and positivist (Guba and Lincoln 1994; Christie 2007). Western knowers tend to see themselves, and their knowledge, as separate to the natural world and, because of this, apparently able to perceive reality with more objectivity. Due to its focus on establishing dichotomous true-false in an objective manner, WSK can exclude the possibility of other ways of knowing without fair consideration of their legitimacy (Mackinson 2001; Moller et al. 2004; Christie 2007; Tengo et al. 2014).

On the other hand, *generally speaking* and as we have seen in KISSP, IK tends to be qualitative, intuitive, experiential, holistic, oral, adaptive, responsive, performative, collective, spatially heterogenous and constructed (Nadasdy 1999; Christie 2007; Tengo et al. 2014). Indigenous peoples' relationships to the environment involve specific places, specific connections and specific beliefs (Nadasdy 1999; Weir 2009; Lauer and Aswani 2009; Muir et al. 2010). They are generally holistic and do not involve a human/nature dichotomy (Nadasdy 1999; Berkes 2008). Indigenous knowledges are more about *a way of being, knowing and living*.

Nadasdy (1999, 2005) warns against overly simplistic comparisons of 'science' and 'IK' as, to an extent, the comparison itself assumes that 'integration' is merely a technical problem that is yet to be solved – thus subsuming all alternatives into the WSK project. This runs the risk of misrepresentation and not taking Indigenous knowledges seriously (Nadasdy 1999, 2005). However, as discussed previously, definitions and knowledge translations do matter – especially in cross-cultural context where terms such as 'knowledge', 'management', and 'conservation' are fundamentally contested (Nadasdy 1999, 2005).

A better way of looking at multiple knowledge collaborations is that they concern both parallel integration and/or co-production of knowledge. Knowledge integration refers to the process of bringing together two otherwise disparate knowledge systems to make a whole, in ways that do not lead to diminution of the integrity of either or harm to knowledge holders themselves (Nadasdy 1999, 2005; Christie 2007; Bohensky et al. 2013).

Parallel integration describes the operation of knowledge systems alongside each other that are seen to be legitimate in their own right, conduct independent internal validation and occasionally enriching each other through cross-fertilisation where appropriate and mutually beneficial.

Co-production speaks of the coming together of knowledge practitioners from diverse and potentially disparate knowledge traditions to identify ways to collaboratively produce new knowledge that does not belong to either knowledge system (Tengo et al. 2014). This co-produced knowledge has been described as a dynamic outcome of collaborative practice in that it contains elements of all participating actors though is a new knowledge form that is produced specifically to address a particular task (e.g. management of Kimberley Saltwater Country) (Robinson et al. 2016). Using co-produced knowledge in this manner can bring diverse and/or disparate actors together to establish a policy frame that strategically represents a relatively cohesive picture of true complexity of Kimberley Saltwater Country. Such a strategic framing is vital to ensuring that policy and decision-makers can support all actors accurately and appropriately to achieve the best outcomes for Kimberley Saltwater Country.

3.3. Justifications for Mobilising Multiple Knowledges

There are two practical arguments for the importance of decentralised pluralism in knowledge weaving practices. Firstly, the utility argument suggests that the mobilisation of IK for collaboratively looking after Kimberley Saltwater Country can be justified as it has multiple practical uses. For example:

- It may often be the only available source of data, information, evidence for many places and/or topics;
- Alternative perspectives to WSK are useful for detecting changes, threats and/or connections that may otherwise be unobserved or unnoticed;
- IK is better at identifying and linking together the connections between environmental aspects of Country and the social, cultural, economic and spiritual aspects.
- Is fundamental to incorporating and reporting on the health and trends of socio-cultural values of Country; and

- Offers opportunity for cross-fertilisation of knowledges to produce new knowledge, unique perspective and innovative solutions through co-learning.

Secondly, Indigenous peoples' way of life, including knowledge systems, ceremonies and beliefs, are protected under the United Nations Declaration on the Rights of Indigenous Peoples (UN 2008) and other international agreements to which Australia is a signatory. Knowledge integration work that helps to strengthen and enhance Indigenous peoples' capacity to maintain their own knowledge practices makes a significant contribution to meeting Australia's obligations and, further, may be useful in 'Closing the Gap'. Evidence of this is readily apparent in the multiple benefits currently being realised by Indigenous people through participation in fire management and the carbon market, which has been enabled by the presence and use of Indigenous knowledges (Robinson et al. 2016).

At the heart of 'two-way knowledge' work is the relationship of worldviews to knowledge, and how both in turn affect practices, beliefs and the types of worlds that are created (Christie 2006, 2007; Verran 2002; 2008). An MEB approach encourages the co-existence of a multiplicity of ways of being in the world, knowing the world and collaborating in the world.

3.4. Benefits of Using Multiple Knowledges

Integrated approaches to natural resource management, conservation, research and development offer several possible benefits to everyone who has an interest in Kimberley Saltwater Country, such as:

- Better understanding of dynamic and complex social-ecological systems;
- Optimisation of local, scientific and institutional expertise;
- Better decision-making and policy regarding natural resource management and conservation;
- Better governance linkages from local to regional, to national, and global;
- Potential cost efficiencies, especially when operating in remote marine areas;
- Enhanced equity through power, responsibility and risk sharing;
- Training, employment and livelihood opportunities for Traditional Owners.

Being able to bring diverse knowledges together in a collaborative way is fundamental to our capacity to learn from each other and to respond, given the best knowledge available, in ways that strengthen the resilience of Kimberley Saltwater Country as a social-cultural-ecological system (Berkes and Folke 2002). Collaborative integration, cross-fertilisation and/or co-production of knowledges offers opportunity for innovation and the imagination of preferred future scenarios for People and Country (Tengo et al. 2014). The enriched picture of Country (both present and future) that is subsequently produced allows for better understanding of the health status and trend of social, cultural and ecological aspects of Country and widens the scope, depth and perceived value beyond a narrowly defined geographic space (as viewed from a WSK perspective). It may also assist in understanding the interactions of actors and institutions across scales, especially in terms of understanding the implications of macro drivers of change on local contexts, and vice versa (Tengo et al. 2014). Further, in a pragmatic sense, research, M&E and management that embraces collaborative knowledge practices is more likely to enjoy increased perceived legitimacy by a range of stakeholders.

As explained in Figures 2 and 3 below, there are many potential benefits on offer to both Traditional Owners and WSK practitioners through collaborative knowledge integration initiatives in the short term. Indigenous knowledge holders offer a vast wealth of new knowledge and new methods to establish understanding of Kimberley Saltwater Country and the complex interaction between the landscape, ecological processes, socio-cultural institutions and economic development. Collaboration with Indigenous knowledge holders also increases the legitimacy, the accuracy, and the applicability of research outcomes and in-so-doing magnifies potential impacts.

For Traditional Owners and Indigenous Rangers, WSK offers new knowledge (or at least new perspectives on attributes and changes in Country) and supports enhanced decision making for both People and Country in the future. IK-WSK collaborations also provide opportunities to Traditional Owners for training and skill

development, employment and the ability to influence non-Indigenous/non-local organisations/institutions who can either support or hinder the aspirations of Traditional Owners for Country.

As mentioned previously, knowledge integration projects are complex and require dialogue based on ‘good faith’ to be successful (Verran 2013). It cannot simply be assumed the potential benefits of knowledge integration will flow smoothly without conscious, patient and deliberate investment in collaborative intercultural relationships and institutions. However, when successful, knowledge integration can increase stakeholder buy-in and perceived legitimacy of decisions made and policy formulated for Kimberley Saltwater Country. Further, it supports the development of enriched evidence bases that ensure planning and management is both credible, accountable and salient from the perspectives of both Traditional Owners and the broader public.

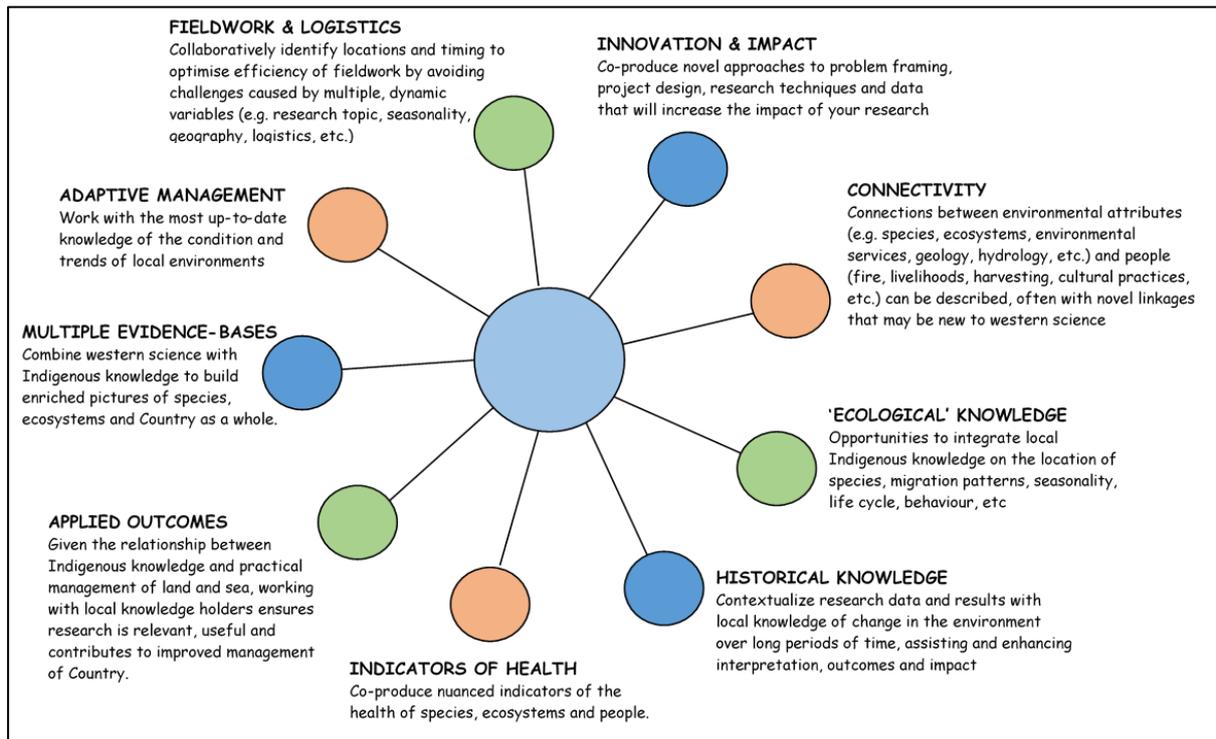


Figure 2. The range of potential benefits to biophysical researchers engaging in collaborative research with Kimberley Traditional Owners.

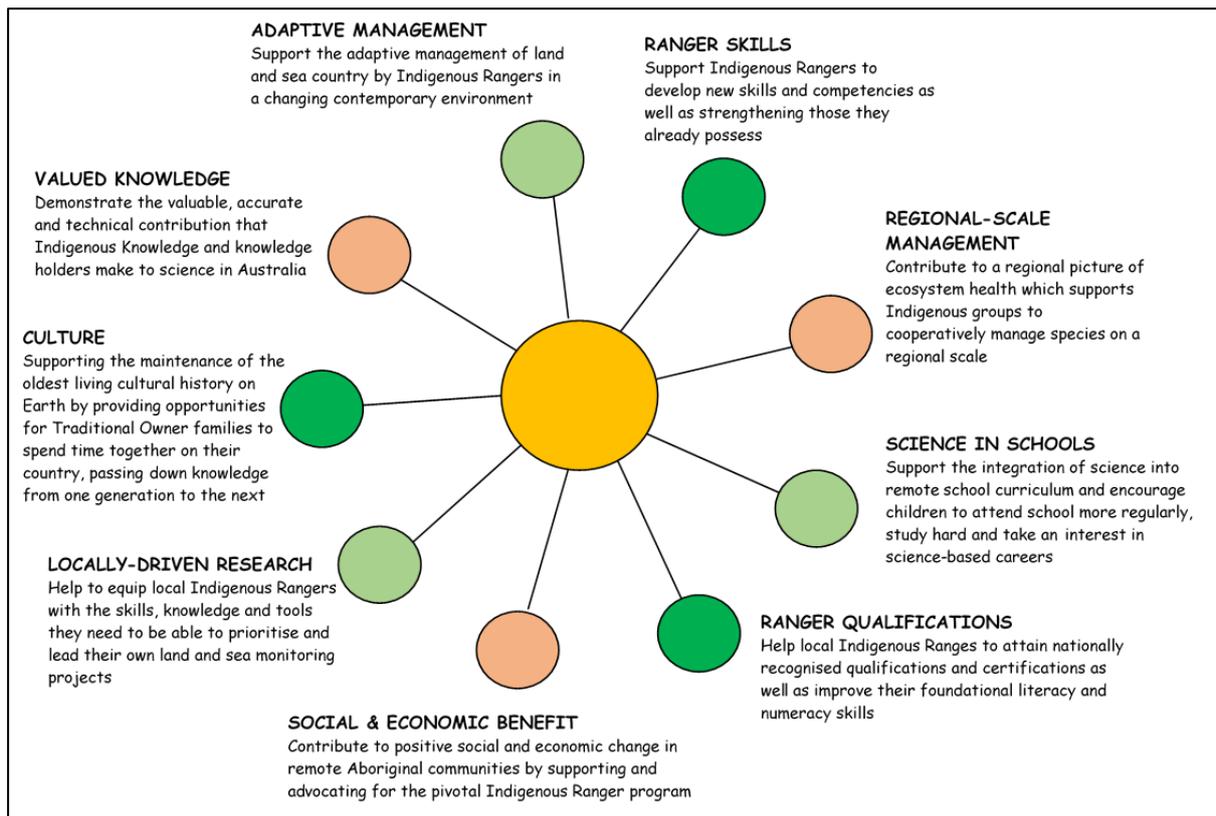


Figure 3. The range of potential benefits that land and sea research can have to Indigenous research partners and their communities.

Traditional ecological knowledge begins at the level of local and empirical knowledge of species and the environment. It proceeds to the level of practice, which requires understanding local ecological processes and how to live and work with them. Practice requires rules-in-use or institutions to guide how a group of people relate to their environment and resources. For a given group of people, practice and institutions are embedded in a particular worldview or belief system, which guides the way they interact with their environment (Berkes 2015, p.222)

3.5. Challenges of Using Multiple Knowledges

The main challenge when working with multiple knowledges concerns the fundamentally different natures of IK and WSK and the partial incompatibility that exists. To highlight this issue, it is useful to look at the three different types of knowledge in IK: as content; as process and as beliefs.

Knowledge as content is the most easily recognisable form of IK from the perspective of WSK. This refers to the knowledge/information held by Indigenous peoples that can be easily passed on from one person to the next (Berkes 2015). An example of this can be found in the abundant knowledge that local people have for local species such as their life cycles, their distributions and the type of habitat in which they live. Recent collaborative research and monitoring that has taken place in the Kimberley on the population and distribution of turtles and dugongs relies on IK as content to achieve results (Bayliss et al. 2015; Jackson et al. 2015). As will be discussed, the workshop results presented below (see Table 2) are mostly IK as content for very good reason. This form of IK is most likely to be seen as ‘acceptable’, ‘compatible’ or ‘aligned’ to WSK practitioner perspectives and, as such, is relatively simple to incorporate into collaborative knowledge initiatives.

Indigenous *knowledge as process* is less easily accommodated by WSK. Though similar in terms of being underpinned by a process of curiosity-observation-inference, the way that knowledge is constructed by Indigenous knowledge holders is fundamentally different to the scientific method (Berkes 2015). IK as process refers to the specific ways of observing, discussing and making sense of information that are passed on from generation to generation (Berkes 2012b). Indigenous knowledge holders use dynamic, experiential and highly adaptive mechanisms to construct knowledge that incorporates a significant component of learning-by-doing (Berkes 2015). Ways of knowing which things are important enough to be observed in Country, how to observe them, and how to make sense of observations, are passed on across generations. A useful example for highlighting the importance of IK as process, and the challenge of incorporating it in knowledge integration work, is Climate Change⁵. Though Climate Change is a relatively new phenomenon and, as such, Indigenous knowledge holders have little historical experience of it, the types of observations made, methods used, new knowledge formulated and implications may be different, though equally legitimate and useful to those of WSK (Berkes 2015). This process of constructing knowledge is Place and People specific and, for this reason, is difficult to accept for WSK practitioners who place emphasis on the absolute, universal and objective scientific method.

The third aspect of IK that poses considerable challenge for integration with WSK is *knowledge as belief*, which informs, is informed by, and is practiced by Indigenous knowledge holders. It is this idea that the worldview of Indigenous peoples shapes human-environment relationships and the types of 'environments' that are imagined and/or observed, that sits most uncomfortably with WSK (Berkes 2015). An example of this difference can be seen in the beliefs passed on through stories and other oral traditions by many Indigenous Australians that everything that exists on Country (including animals, plants, water, rocks, etc.) has its own agency. Humans are not offered a privileged place in most Indigenous cosmologies, having no special powers of objectivity, rational thought or special mastery of knowledge. Rather humans and non-humans cannot be separated and enjoy relationships of reciprocity and mutual respect. This is fundamentally different to WSK's claims that the material world is only knowable through careful and objective measurement that aims to limit the subjectivity inherent in human observations of the natural world. As such, accommodating this fundamental difference in worldview is a challenge for collaborative knowledge integration work. While many scientists can determine the implications that *knowledge as belief* represent, say for the discipline of ecology, for most it is not possible to fully embrace the possibility of alternate perspectives on reality. For example, the 'caring for country' aspect of Indigenous peoples' relationship to Country can be understood broadly by WSK practitioners as a holistic approach to managing natural resources. However, the concept that performing ceremony and other obligations to Country can have a direct, material influence over the presence or absence of particular species on Country is difficult for many scientists to believe as true.

Whether expressed publically or not, there is scepticism about the contemporary existence and/or effectiveness of IK (Nadasdy 1999, 2005). Equally, Indigenous people are often sceptical about the motives and intent of scientists who want to 'capture' or 'communicate' their knowledge (Nadasdy 1999; Christie 2006, 2007; Verran 2008). These are both valid concerns, influencing and being influenced by power relations. Knowledge integration projects must offer solutions to relative power imbalances between local Indigenous peoples' and their partners. Indeed, they must promote egalitarianism and ensure that all parties begin and remain on an equal footing (Agrawal 1995; Sillitoe 1998; Nadasdy 1999; Ribot 2002; Chalmers and Fabricius 2007; Derkzen and Bock 2007; Wohling 2009; Tengo et al. 2014; Berkes 2015). Ignoring power makes it increasingly likely that attempts at knowledge integration will reinforce rather than break down western cultural biases in natural resource management (Sillitoe 1998; Nadasdy 1999). There is much at stake for Indigenous people, whose knowledge continues to be colonised (Christie 2006).

⁵ Referring to the current rapid increase in global temperatures and the cascading effects, as opposed to long-term climate change experienced by Indigenous peoples in the Australian continent over the last 50,000+ years of occupation.

One way of dealing with this mutual scepticism is to employ ‘good faith’ in recognising different theoretical, methodological and practical approaches to understanding and interacting with the biophysical world (Verran 2002, 2013; Christie et al. 2006, 2007; Lyver et al. 2009; Brondizio et al. 2010; Bohensky and Maru 2011; Tengo et al. 2014). As Johannes (1998, p.245) rightly suggests, “Management should be judged by its fruits, not by its roots”. Thus, the effectiveness of Indigenous peoples’ knowledge-practices-beliefs should be assessed based on the outcomes of looking after Country activities, in truly postcolonial contexts where diverse ‘program logics’ or ‘conceptual models’ are accepted as legitimate and useful until proven otherwise.

A further challenge, and one that will in part be discussed under KISSP Objective 2, is ensuring that Indigenous people themselves (especially Indigenous rangers) are able to continue building their capacity to conduct WSK-based research and management for Saltwater Country. Indigenous rangers are now experts at ‘integrating knowledges’ in an embodied way, whereby they have the ability to both generate and gather data and information from both IK and WSK (and other knowledge systems) to build an enriched picture of Country and support best-practice two-way management. However, ensuring that research funding budgets and timelines incorporate sufficient resources to invest in ‘on the job’ knowledge and skills training and development for both Traditional Owners and Rangers that are involved as collaborators on research projects remains a challenge.

If Indigenous knowledge holders are to be able to participate on an equal playing field in collaborative knowledge making activities, they need to have capacity to mobilise their own knowledge systems – including the process and belief components – as IK content cannot exist without connections to practices and beliefs, in the same way that WSK is also culturally and cosmologically embedded. Taking this knowledge sharing seriously creates opportunity for innovative environmental management approaches. The cultural practices of science and IK could be used and adapted to confer normative authority on regional standard-setting in a way that resonated with local people, whose commitment might also ensure compliance. Further, questions about the quality of existing knowledge could be actively voiced and allow environmental issues to be embedded within other important Indigenous rights issues that are embedded in the local social-cultural-ecological context.

It must be reiterated here however that the goal of KISSP and the introduction of multiple knowledge base approaches to knowledge production and governance is not intended to solidify or create distance between knowledge systems, holders and practitioners. Knowledge is never produced in neat packages that can be categorised as perfectly scientific, or perfectly Indigenous or perfectly experienced. The reality is that knowledges weave in and out of each other, can be integrated or split apart, and can be complementary or opposing (Johnson et al. 2016). It is not the intention of KISSP to place knowledges and knowledge holders in neatly defined ‘black boxes’, thus precluding any possibility for exchange and/or co-production. Rather, the aim of mobilising IK and other knowledges alongside of WSK is to create space for multiple knowledges to participate in knowledge-making, decision-making and policy-making processes instead of relying on highly specific, though patchy and resource intensive scientific knowledge alone.

4. Recognising Indigenous Knowledges

There is a great deal of potential for collaborative knowledge work in the Kimberley region to produce better decision-making, policy and management mechanisms for Kimberley Saltwater Country and Traditional Owners. However, to fully appreciate this potential it is necessary to describe the types of knowledges Indigenous people can bring to collaborations and, to a limited extent, imagine how they could be beneficial. In this section of the report we provide an overview of KISSP participants’ perspectives on the types of knowledges-practice-beliefs they see as potentially appropriate for use in collaborative knowledge work. We do not provide a summary of complementary WSK as the focus of our report is on the mobilisation of IK. The nature of WSK (publically available texts) and the colonial legacy that has seen IK historically viewed as being of lesser value means that WSK knowledge products are much more visible and more often used for decision-making, policy and management of Kimberley Saltwater Country. The KISSP and participating Traditional Owner groups hope to contribute to remedying this inequality through the sharing of these examples of IK and the subsequent proposal for the adoption of MEB approaches to knowledge production.

4.1. Approach & Methods

The research approach for KISSP was largely defined by the project Working Group (see Appendix 2). All Traditional Owner organisations with an interest in saltwater Country were invited to attend a workshop held in Broome in October 2014. Attendees were tasked with forming a group to outline a collaborative approach, prioritise key topics to be researched, and governance arrangements for the project.

The newly established Working Group then identified a research process consisting of holding individual ‘On Country’ workshops with Traditional Owners. These workshops were organised by local Indigenous ranger groups in coordination with the KISSP Research Team, which was assembled under the authority of the KISSP Working Group. Expressions of interest to be involved in the project were sought from research practitioners that were known to various Working Group members based on their experience working with some of the Traditional Owners in the Kimberley region. Through a competitive selection process involving presentations of project proposals, the Working Group decided to appoint CDU, UWA, KLC and Mosaic Environmental jointly as the KISSP research team based on each of their specific skills and capacity.

Working within the research process identified by the KISSP Working Group it was decided that the best option for investigating the prospects and pathways for enhanced knowledge integration was to first establish an understanding of what exactly is meant by IK in Kimberley Saltwater Country. As such, the best approach to defining IK for Kimberley Saltwater Country is to present Traditional Owners’ own views of what IK they hold that is related to Saltwater Country. The examples provided to us by Traditional Owners paint a descriptive picture and, therefore, enable a better understanding of what is required for its integration with WSK.

Research participants were asked to describe what kinds of knowledge Traditional Owners embody for Saltwater Country, with the express intent of sharing these examples with researchers, scientists and other non-Indigenous people. It was made clear to participants that none of the specific details about their knowledge would be recorded or communicated. Rather, statements about broad categories of knowledge types would be listed. This could include any type of knowledge and, as will be seen below, many of the examples of ‘knowledge’ are inseparable from people, place, practice and belief.

The data collected from workshops and interviews consisted of:

- Co-produced guidelines that were written on large pieces of paper and reviewed by the whole group;
- Interview transcripts;
- Workshop notes kept by the research team.

The research team conducted a thematic analysis of these data using manual coding techniques.

Date	Traditional Owners	Location	Activity	# Participants
23-24 May 2016	Nyul Nyul	Beagle Bay	Workshop	21
25-26 May 2016	Dambimangari	Derby	Workshop	17
21 June 2016	Balangarra	Kalumburu	Workshop	15
17-20 June 2016	Wunambal Gaambera	Kalumburu	interviews	20
27-28 June 2016	Bardi Jawi	One Arm Point	Workshop	19
30 June- 1 July 2016	Karajarri/Yawuru	Broome	Workshop	23

Table1. Traditional Owner workshops and interviews held under KISSP

In total there were 103 Indigenous participants in five (5) Traditional Owner workshops and one (1) Knowledge Holder interview.

Workshops were coordinated through the Working Group and jointly planned with all co-investigators to maximise outcomes from each meeting. Each community decided how the research happened (i.e. workshop or interviews) and who attended. Local Ranger Groups and KISSP Working Group representatives designed and organised each of the workshops with local Traditional Owners. They were equally resourced by the KISSP project to do this work. The local organisers were also responsible for identifying who were the 'right people' to be involved in the workshops, which mostly included Traditional Owners, Rangers and PBC staff.

An informal, conversational style was adopted that allowed sufficient time and discussion between participants. As examples were given they were written down by the researchers on large pieces of paper for everyone to see. This list was checked on numerous occasions throughout the workshops/interviews both for accuracy and to provide opportunity for other related examples to arise throughout the conversation.

All Traditional Owner groups were provided with individual workshop reports and given a period of one (1) month to provide feedback, make amendments or add anything that was missing. These reports are not publically available, but have been returned to each of the PBCs/Ranger groups who have ownership of the reports.

4.2. Results

"In a way science is catching up to our knowledge. Collecting data makes it a bit easier to explain to scientists and put them in our shoes. Where knowledge is missing science can fill in the gaps." Traditional Owner.

"It makes us and the rangers work better and know about Country. And we might have similar thoughts." Traditional Owner.

"All the older people should be teaching the young ones at the same time as science is being taught to the young ones." Traditional Owner.

Traditional Owners want to work with both local knowledge holders and western scientists to make the best decisions for Kimberley Saltwater Country. In workshops all but a few participants agreed that the best way forward was a collaborative partnership approach. Responses varied from a cautious adoption of WSK to fill localised gaps in IK (majority view), enthusiastic support of knowledge integration (middle view), to and an outright rejection of WSK (minority view).

In total there were 92 individual examples of IK mentioned. The most commonly cited examples were:

1. Seasonal indicators (flowers, wind direction, temperature, etc.) (7).
2. Historical knowledge (to detect changes and new pressures/threats on Country e.g. bleaching, disease, erosion, pollution, tourism, etc.) (6).
3. Knowledge of tides and currents (for travel, safety, fishing, hunting, etc.) (6).
4. Hunting locations, seasons, nutritional content and laws/rules of key species (e.g. fish, turtles, dugong, shellfish, etc.) (6).
5. Location of cultural values, sites, boundaries and connections (e.g. clan estates, fish traps, ceremony sites, burial grounds, navigation markers, recreational places, hunting tracks, stories, spirits and Old People, etc.) (5).
6. Health indicators (species and ecosystems) (5).
7. Connectivity (social-cultural-ecological) (5).
8. Risk management on Country (crocodiles, weather events, cultural protocols, navigation, etc.) (5).

However, to interpret this as the ‘most valuable’ knowledge or ‘most widespread’ is both inappropriate and inaccurate. It is not difficult to imagine, and fairly safe to assume, that most TOs would recognise all of the examples raised for all groups. Instead, it may be more useful to look at the full list of examples of IK for saltwater Country (See Table 2).

4.3. Significance

These results tell us a number of things about IK for Kimberley Saltwater Country. The knowledge that Traditional Owners have is holistic, connected, diverse and adaptive. It does not purify nature and culture into separate categories, and is equally about human and non-human aspects of Country. Plants, animals and inanimate objects are afforded equal agency, and is as much concerned with matters of the spirit as much as pragmatic concerns for Country. It will also be noticed that this knowledge is deeply embedded in the local people and place, belonging to specific cosmologies that continue to be produced by Traditional Owners in the present.

These examples establish context for identifying the role of WSK on Country in that it facilitates the Traditional Owner-led mapping of knowledge ecosystems and networks. Subsequently, ‘knowledge gaps’ can be identified that offer opportunity for WSK practitioners to work in collaboration (either through parallel integration or co-production) to produce new knowledge and solutions for People and Country. Such a process will assist in identifying the actual potential for further knowledge ‘integration’ in Kimberley Saltwater Country and allow us to focus our collaborative efforts more efficiently and effectively in the areas of most need. There is a need to assist Kimberley Traditional Owners to mobilise their knowledge in appropriate ways at organisational and institutional levels to be effectively able to participate in knowledge collaboration projects. Efficient and effective knowledge collaboration between Indigenous peoples and western science is possible, but requires investment in appropriate methods (see 6. Applying a Multiple Evidence Base Approach).

Further, and perhaps most significantly, the results presented here demonstrate that there is real potential for co-learning and co-management of saltwater social-cultural-ecological systems in the Kimberley. There is an opportunity to engage in best-practice knowledge integration and co-production, especially within the Kimberley marine protected area network, to enhance resilience of ecosystems and thriving of Indigenous peoples and their estates.

Category	Examples
Seasonal indicators	<ul style="list-style-type: none"> • Blossoming of flowers • Fruiting of plants • Wind directions • Temperature
Intra-seasonal weather forecasts	<ul style="list-style-type: none"> • Direction and strength of winds • Rain and/or storms • Temperatures
Knowledge of tides and currents	<ul style="list-style-type: none"> • How to use currents to travel along the coast and between islands. • When and where dangerous currents are likely to be. • Seasonally dynamic interactions of fresh and saltwater.
Location and structure of seabed	<ul style="list-style-type: none"> • Whether the bottom consists of reef, mudflat, sand, etc. • Relationship of underwater geomorphology to significant creation stories.
Health of saltwater and freshwater in Saltwater Country	<ul style="list-style-type: none"> • Indicators of health such as colour, smell and taste of water. • Presence or absence of species in fresh water or saltwater. • The locations of springs/soakages in beaches, mangroves, springs, etc. • Interactions of saltwater and freshwater.
Hunting and harvesting knowledge	<ul style="list-style-type: none"> • Locations, distributions and population of key species on Country (such as fish, turtles, dugong, shellfish, etc.). • Seasonal migration. • Life cycles, particularly nesting and breeding. • Behavioural traits. • Habitats that key species live in and/or use. • Laws/rules governing hunting, harvesting and sharing. • Construction and use of tools used for hunting and harvesting. • Nutritional and/or medicinal of species. • Location and use of ochres.
Cultural values, sites, boundaries and connections	<ul style="list-style-type: none"> • Location of clan estates, fish traps, ceremony sites, burial grounds, navigation markers, art sites, recreational places, hunting tracks, stories, spirits and Old People in Country, etc. • Proper management of cultural values, sites, boundaries and connections in Country to make sure they are well looked after and passed on to younger generations.
Language for Saltwater Country	<ul style="list-style-type: none"> • Proper names for places. • Proper names for animals and plants. • Proper names for stories and spiritual aspects of Country.
Connectivity	<ul style="list-style-type: none"> • Relationships and interactions within and between ecological, social and cultural stocks and flows in Country.
Astronomy	<ul style="list-style-type: none"> • Using the stars and moon to navigate through Saltwater Country.
Right way fire	<ul style="list-style-type: none"> • Correct use of fire to manage and protect key ecological, social and cultural values in Saltwater Country.
Geography	<ul style="list-style-type: none"> • The location of coastlines, islands, topographical features, rivers, waterways, ecological types, boundaries, etc.
Health indicators	<ul style="list-style-type: none"> • What to look for to see if ecological, social and cultural of Country are healthy. • What to look for to see if people are healthy. • What to look for to see if values are getting worse or better and/or causation of trends.
Historical knowledge	<ul style="list-style-type: none"> • Knowledge of people and place that allows for detection of changes and new pressures/threats on Country. • e.g. bleaching, disease, erosion, etc.
Risk management on Country	<ul style="list-style-type: none"> • Locations of crocodiles and other threats to humans on Country. • Warning of and ways of dealing with extreme weather events. • Cultural protocols to follow. • How to navigate through Country.
Tourist sites	<ul style="list-style-type: none"> • Where tourists are visiting, their numbers and how to manage related pressures on Country.

Table 2. Traditional Owner identified Indigenous knowledge for Saltwater Country.

4.4. Limitations of Our Approach

One of the key messages from the workshops was that TOs knowledge for Saltwater Country comes from lived experience, stories passed on across generations, much of which is secret and/or sacred, and much of which cannot be separated from the actual practices and beliefs that ‘hold’ or ‘embody’ knowledge in people and in Country. Research participants described their knowledge as:

- “lived knowledge”
- “doing”
- “living our lives in the saltwater”
- “part of *liyarn burr*”
- “relationships”
- “looking after saltwater Country”.

This limits the capacity for conducting a WSK-style ‘stocktake’ of knowledge in that this requires the knowledge to be recorded as data, interpreted and written down. This turns it into something it is not – i.e. *Western Scientific Knowledge of Indigenous Knowledge*. Indigenous knowledge cannot be separated from local practices and/or beliefs that relate to Saltwater Country, which then has implication both for the potential of collaborative knowledge work and the approaches or methods employed.

There is a great deal of IK that has intentionally been left out by participants due to its secret, sacred or private nature. This knowledge is fundamentally important to Traditional Owners within their autonomous Indigenous space (Morphy and Morphy 2013). Though lacking a ‘utility value’ from a WSK perspective, this knowledge must be recognised, supported and *at the very least* not threatened by on-going collaborative knowledge work. Though it is expansive, Table 1 is certainly not exhaustive summary of IK for Kimberley Saltwater Country. Rather, as is the case for the visible attributes of ‘culture’ (see Figure 4), much IK that continues to be held and practiced by Traditional Owners remains, and will continue to remain, invisible to those outside of local Indigenous networks. As such, the contents of Table 2 are only the ‘tip of the iceberg’.

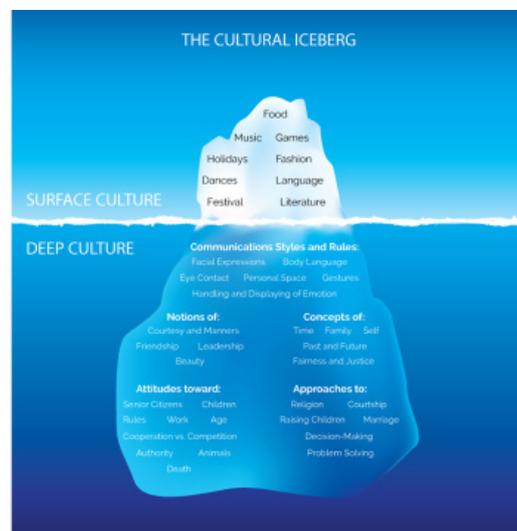


Figure 4. The Cultural Iceberg concept, as adapted from Rafaeli and Pratt (2006).

Another aspect of IK that is omitted from this assessment is knowledge that exists *as Country itself*. As opposed to WSK, IK can be situated in the various physical and/or ecological attributes of the landscape (Bawaka Country et al. 2014). The most famous example of this are songlines (Norris and Harney 2014), which, while manifest in the landscape itself, are tied intimately to looking after Country, specific ceremonies, and complex kinship relationships. Similarly, knowledge also exists in the landscape and ecological processes. For example, the flow regime of rivers can tell stories as metaphor that embody deep knowledge and codes of conduct (e.g. Buthimang 2008). The capacity to fully integrate IK in this form needs a more patient, rigorous and collaborative approach

than was possible under KISSP. It requires new, collaboratively identified ways of working and tools that are specific to knowledge brokering in this particular intercultural space.

5. Applying the Multiple Evidence Base Approach

The MEB approach suggests that collaborative research teams should focus on complementarities shared between knowledge systems and stakeholder interests when designing projects (Tengo et al. 2014). This is certainly a good starting point as working with relative similarity is much easier than working with disparate knowledges and/or interests. Further, as was discussed in terms of projects that rely on the relative familiarity of knowledge as content (e.g. Turtle and Dugong monitoring in the Kimberley; Bayliss et al. 2015; Jackson et al. 2015), starting with ‘comfortable alignments’ is conducive to success (Tengo et al. 2014). Success then leads to stronger relationships, co-produced knowledge/outcomes, and, importantly, enhanced levels of trust between Traditional Owners and their partners in looking after Country.

However, as alluded to previously, the challenge over the long-run for knowledge integration in Kimberley Saltwater Country is to work towards ‘doing difference differently’ (Verran 2013). The way IK operates is different to WSK in that processes used to construct knowledge are people, place and culture specific, and the beliefs that inform and provide context to knowledge are fundamentally different. Therefore, what is really required in the application of an MEB approach is to ensure that groups are either supported to validate the Others’ claims from within their own knowledge systems and under the rule of good faith, or to simply identify ‘good enough’ ways of working together *with difference* (Christie 2007; Danielsen et al. 2009, 2014; Rist et al. 2011; Shirk et al. 2012; Verran 2013; Tengo et al. 2014; 2017). The MEB approach creates space for various forms of knowledge to co-exist, cross-fertilise, co-produce, and/or integrate in truly collaborative ways. In this sense then, we can see that although complementarities and differences exist, they need not be barriers to collaborative application of multiple knowledges to the management and conservation of Kimberley Saltwater Country. In fact, it is this diversity of knowledges, cultures and ecosystems that is the key to optimising the social-cultural-ecological resilience of Kimberley Saltwater Country.

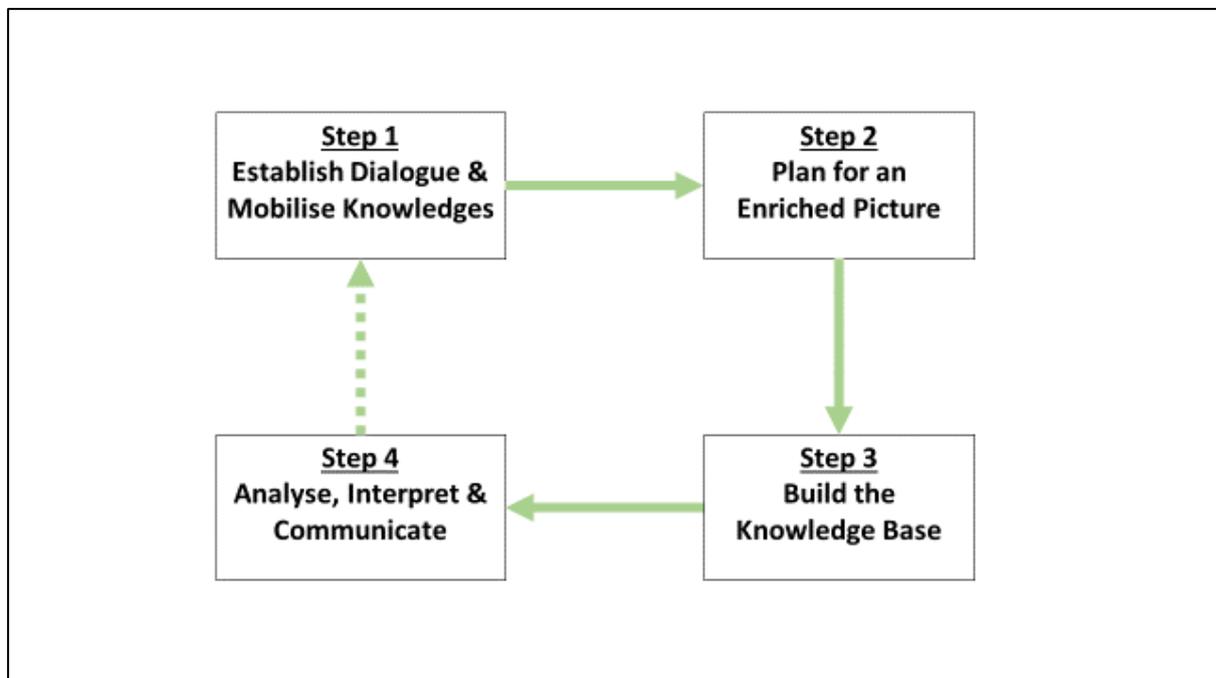


Figure 5. Steps for applying a multiple evidence-based approach in the Kimberley Saltwater Country

Step 1	<ul style="list-style-type: none"> • Establish and maintain meaningful dialogue. • Assess capacities for collaboration. • Identify goals that are mutually beneficial. • Mobilise all knowledge systems. • Discuss the relevance of ‘larger-than-local’ scales.
Step 2	<ul style="list-style-type: none"> • Collaborative identification of approach. • Decide on a co-production or parallel integration approach. • Collaborative identification of methods.
Step 3	<ul style="list-style-type: none"> • Implementation of knowledge production in line with agreed plans. • ‘Stick to the plan!’ • Collaborative analysis of results.
Step 4	<ul style="list-style-type: none"> • Collaborative interpretation of results from the perspective of all stakeholders. • Assess social, cultural, economic and environmental implications. • Identify similarities, complementarities and/or contradictions in research outcomes. • Collaboratively evaluate project performance. • Joint production of outputs and communication of results. • Celebrate success together.

Table 3. Summary Description of Steps in Multiple Evidence Based Approach in Kimberley Saltwater Country

5.1. Mobilising Multiple Knowledge Systems

Tengo et al. (2014; 2017) provide guidance on how to apply an MEB approach from their experience in collaboratively identifying priorities under the IPBES framework and CBD. At the most basic level, an MEB approach involves three (3) phases:

1. Defining problems and goals in a collaborative manner;
2. Bringing knowledge together on an equal platform;
3. Joint analysis and evaluation of knowledge and insights.

The research conducted through KISSP including our previously presented review of the literature, results and analysis allows us to extend the work of Tengo et al. (2014) and modify the approach to suit the specific needs and context of KISSP and Indigenous people in the Kimberley. Four (4) steps have been identified that need to be taken to apply an MEB approach for integrated management and conservation of Kimberley Saltwater Country (see Figure 5 above).

Step 1: Establish Dialogue & Mobilise Knowledge Systems

The first step to be conducted in transdisciplinary research projects that seek to integrate or co-produce knowledges is to collaboratively identify problems and goals. This will include all participating communities, organisations and/or institutions (e.g. PBCs, Ranger groups, representative bodies, etc.) and involves:

- initially, the establishment of mechanisms for respectful dialogue; and
- subsequently, on-going maintenance of dialogue throughout the duration of the partnership.

Following this, there should also be an assessment of differences in experiences, methods, goals, knowledges and power relations between all participating partners. Recognition of these differences, and the implications they have for working relationships, is crucial to mobilising all available knowledge/s.

Having established dialogue and considered capacity to participate as equals, the next task is to mobilise all available knowledges (in our case WSK and IK) to:

- define the scope of the project,
- map knowledge gaps, and
- identify research goals.

In WSK-based research this task is usually conducted by reviewing all available literature on the topic. Issues of validation of knowledge as useable and accurate are addressed by the review of literature that is sourced from scientifically credible publications such as academic journals, government and/or NGO reports, and other rigorously assessed grey literature. It is important that WSK practitioners are able to summarise and explain the literature to Indigenous colleagues and, thus, the nature of the knowledge gap that they are seeking to fill in a way that is comprehensible in an intercultural context. This may require some translation, not only of languages, but also of concepts, theories and beliefs.

Mobilising available IK will usually involve the participation of relevant IK holders, as identified by the local community, and who have access to relevant, useable knowledge on the topic. The local community will be able to identify the right people to participate as knowledge holders and, through this process, validate that the IK being mobilised is accurate and trustworthy. Indigenous partners will also need to be able to clearly articulate their knowledge gaps on the research topic, which requires a certain capacity to communicate effectively between cultures. Likewise, this will likely involve translation of languages, concepts and beliefs.

Having reviewed all available knowledge on the research topic, research partners will be able to then collaboratively identify the gaps in knowledge that need to be addressed for better decision making, policy development and management. It is often at this moment that knowledge holders can feel a desire to retreat into their own respective knowledge systems. Questions of validity and trustworthiness of knowledge often arise. However, to maintain a good faith approach, research partners must see each other's knowledge validation and communication approaches as equally legitimate. Only then will multiple knowledges begin to be truly mobilised.

Further, where projects involve multiple scales (which many projects will), collaborative consideration of linkages between/across scales should be considered. All knowledge is spatially and temporally bound, however IK is particularly bound to specific people and places. The implications of this aspect of knowledge for working across scales will need to be considered (see 5.4. below).

As will be discussed in 5.3., there is often an important role for intercultural knowledge brokers for facilitating effective communication at all steps in applying the MEB approach.

- Establish and maintain meaningful dialogue.
- Assess capacities for collaboration.
- Identify goals that are mutually beneficial.
- Mobilise all knowledge systems.
- Discuss the relevance of 'larger-than-local' scales.

Step 2: Plan for an Enriched Picture.

Here the project team will need to collaboratively identify how new knowledge will be made. Each knowledge holder/producer will bring with them their own knowledge content, knowledge producing processes and underlying beliefs, which are all fundamental to achieving enriched-picture results. WSK practitioners will need to clearly articulate their methods to Indigenous counterparts. In many cases, IK practitioners may be able to reciprocate by making reasonable effort to assure WSK partners of the legitimacy of the knowledge and/or participating knowledge holders as part of the partnership approach. However, the nature of some Indigenous knowledge is hidden from the public as it may involve secret or sacred knowledges, practices and or beliefs. This should not be seen as a lack of capacity or an issue of distrust by WSK practitioners. As long as the local community has been able to validate the knowledge being mobilised and/or the methods to produce new knowledge as legitimate by identifying the most appropriate holder of relevant knowledges to participate, then the matter should be governed by the principle of good faith.

At this step, a decision will need to be made by the team as to whether the work will use co-production or parallel integration to drive methods and data collection, and produce results. If co-production is identified as the best approach; the project team will need to collaboratively identify which methods they will employ to do the work. This usually involves the development of innovative methods that incorporate relevant mechanisms from both IK and WSK that are worked in a collaborative way. Here the focus should be on ensuring that working relationships are of an egalitarian nature, that comparative advantages of each knowledge system are leveraged, and that each member of the project has the capacity to participate equally.

If parallel integration is identified as the best approach, each of the knowledge holders/producers will be able to identify the most appropriate methods from their respective knowledge systems. However, the project team will need to clearly understand the types of results that will be produced and will need to identify appropriate mechanisms for integrating results during Steps 4 and 5. Project teams may choose to combine the various forms of knowledge to produce integrated reports or, alternatively, the results of each group of knowledge holders/producers can be presented alongside each other. The key here is to ensure that equal legitimacy is afforded to the knowledge produced, irrespective of the methods used to produce it.

At the end of this process, the collaborative research team should be able to set out the specific methods to be used to (co)produce new knowledge to address identified knowledge gaps that are mutually understood and authorised by all members of the research team.

At this point of the process a research agreement should be signed between all parties that sets out obligations and responsibilities in a transparent and accountable manner (see the KLC's Guide for Researchers).

- Collaborative identification of approach.
- Decide on a co-production or parallel integration approach.
- Collaborative identification of methods.

Step 3: Build the Knowledge Base.

The third step in applying the MEB approach to Kimberley Saltwater Country involves the implementation of identified project activities in line with research agreements. It was reiterated by Traditional Owners in KISSP workshops that it is vitally important that all project partners “stick to the plan!” There will be instances where adaptation will be necessary, however proposed changes will need to be approved through relevant institutional governance structures (in particular local Traditional Owner authorities).

It is vitally important that all knowledge holders are appropriately resourced to achieve the collaboratively identified goals of the research project. IK holders must have available resources to conduct all necessary fieldwork as required by their identified approach and/methods. It should not be assumed that all IK simply exists in the minds of a few Old People who need only to be consulted about ‘what they know’ and ‘how they know it’. People will often need time to talk with each other, to visit Country, to remember stories or ceremonies they may not have been recalled for a long time. Further, IK holders will need to consider how they can appropriately and safely communicate their knowledge for the specific purpose of the research project – a challenge of bridging epistemologies which very few IK holders would have previously encountered. Similarly, many WSK practitioners will be met with new challenges when constructing knowledge in Kimberley Saltwater Country. Often cited issues such as dealing with distances, climate, accessibility, costs and working alongside Indigenous peoples (which may be new for many) will be faced. Only by employing the guiding principle of good faith, acknowledging respective capacity deficits and power relationships, and ensuring that project budgets are sufficient to meet the requirements of all knowledge systems and practitioners can an enriched picture of Kimberley Saltwater Country be achieved.

Having established a new evidence base, it is possible to then collaboratively analyse and interpret results to construct an enriched picture of the matter of concern. As with other steps in the process, a focus here should

be on ensuring that mechanisms for analysing and interpreting results specific to each knowledge system are recognised, supported and employed by each of the knowledge holders/producers as appropriate. Again, respective capacity to participate in this stage of the process needs to be considered. There will be ample opportunity for co-learning and knowledge sharing in this process and deep translation of language, concepts, theories and beliefs may be required.

- Implementation of knowledge production in line with agreed plans
- 'Stick to the plan!'
- Collaborative analysis of results.

Step 4: Analyse, Interpret & Communicate.

The data and information produced in transdisciplinary, multiple evidence based projects may mean different things to the various individuals, communities, organisations and institutions involved in the work. This is due to the different knowledge systems and specific contexts of the individuals and groups to whom the new findings will be communicated and woven into local realities. As such, collaborative reflection on results will need to take place, taking into account implications for all participants across environmental, social, cultural, economic and any other relevant domain. To realise the most impact from integrated and/or co-produced outcomes, a conscious and good faith approach to examining the similarities, complementarities and/or contradictions of findings need to be discussed. This need not focus on achieving consensus, which can lead to adversarial or bad faith participation, but should focus on assessing what new insights have been produced, how they contribute to the enriched knowledge base and what knowledge gaps remain for further investigation. Again, crucial to this is the role of knowledge brokers who can assist in the translation of results, analysis and interpretations (see 5.3.).

The project team should collaboratively evaluate their performance as a transdisciplinary and multiple knowledge based group, in terms of what was good, what could be done better, and if/how future collaborations should take place. This will assist the team to understand the significance and/or limitations of the research outcomes from all perspectives. Knowledge produced should not be used by any of the research partners in ways that are beyond the scope of the project or make claims that cannot be justified by results.

All partners in the research should be involved in both the production of outputs and the communication of results. There will be a range of research outputs that need to be produced to meet the needs of various users of knowledge. For example, the WSK community will need clearly written and academically rigorous reports, journal publications and/or conference presentations to meet their audience. Indigenous partners may prefer products that contain less scientific jargon, more imagery, and communicate implications of research for local governance and practice. Using digital media products, such as film, websites and social media may also be useful for targeting multiple audiences. Irrespective of the nature of research products and communication strategies adopted, the key to ensuring relevance and effectiveness of delivering messages to key audiences will be ensuring that all stakeholders have meaningful roles to play in the production and communication process. Importantly, all outputs should be comprehensible to all of the participants in the research project, which may require patient translation by IK and WSK practitioners respectively.

It is important here to reiterate that all of the results, outputs and outcomes *need not be synthesised or aligned*. It may be the case that the conclusions of IK and WSK practitioners differ. This does not necessarily lead to conflict or invalidation of either set of results. Rather, guided by good faith, parties can collaboratively identify ways of moving forward while accommodating differences.

- Collaborative interpretation of results from the perspective of all stakeholders.
- Assess social, cultural, economic and environmental implications.
- Identify similarities, complementarities and/or contradictions in research outcomes.
- Collaboratively evaluate project performance.
- Joint production of outputs and communication of results.
- Celebrate success together.

Collaborative knowledge projects are complex and at times difficult, but that does not mean that they cannot be enjoyable. In fact, a key to ensuring successful collaborations is strong relationships between collaborators. At each step of the MEB process, especially at the end, participants should take the time to celebrate the success that has been achieved together. Not only is this an appropriate recognition of effort, but also an investment in on-going working relationships and future research opportunities as they arise.

5.2. A Need for New Tools

...the fishers did not consider spawning time as an opportunity for uncontrolled harvest; it was simply looked upon as a time when the fish would be caught more easily than other times... investigations in Palau and elsewhere in the Pacific in the 1970s found that reef and lagoon tenure systems had built-in harvest controls in the form of closed fishing areas and seasons; allowing escapement; bans on taking small individuals, nesting turtles and eggs; and restricting some fisheries for emergencies. "Almost every basic fisheries conservation measure devised in the West was in use in the tropical Pacific centuries ago" observed Johannes (Berkes 2015, p.225.).

To achieve each of these steps, there is a need for new methods that work knowledges together, in particular mobilising Indigenous knowledge and empowering Indigenous knowledge holders/producers. Some approaches exist that can offer useful support in mobilising IK and bridging with other knowledge systems such as WSK (see Appendix 1). However, there is also a need to work collaboratively with Traditional Owners and their organisations to develop new, more accurate and more context sensitive ways of understanding, communicating and mobilising IK for Kimberley Saltwater Country. After patient listening and observation (with long-term relationships providing familiarity) stories of sophisticated mechanisms for governing and managing landscapes can be recognised by WSK practitioners in the knowledge-practices-beliefs of Indigenous peoples, for example:

5.3. Intercultural Knowledge Brokerage

Fundamental to ensuring that an MEB approach is applied effectively for the Kimberley is the role of 'knowledge brokers'. Knowledge brokers are people (individuals/organisations, Indigenous/non-Indigenous) who have the capacity to create meaningful, appropriate and functional linkages and relationships between otherwise disparate knowledge holders/producers. These people or organisations need sufficient self-awareness and understanding of the nature and implications of their own knowledge system, plus sufficient understanding, sympathy and good faith relationships to Others and their respective knowledge systems (Robinson and Wallington 2012; Verran 2013). This is a demanding role that is often under-funded in collaborative knowledge projects, yet is crucial to optimising outcomes. Ensuring that knowledge brokers are in place will assist in more productive research collaborations that are able to fully mobilise all available knowledges for the production of cutting-edge research that enhances decision making, policy and management actions.

5.4. Indigenous Knowledges and Scale

There is a need to make IK matter at larger than local scales while avoiding the loss of legitimacy among knowledge holders as well as decision makers at different levels. However, given their deep embeddedness in

the local, a shared history of colonisation, and the highly heterogeneous social and cultural make up of local communities and their environments, Indigenous knowledges are difficult to 'scale up' (Nadasdy 1999; Gagnon and Berteaux 2009; Wohling 2009; Tengo et al. 2014). Scaling up is highly dependent on complementarities and relationships across 'locals' and varies depending on the issue being discussed, definitions of key terms, and the nature of identified outcomes (Reid et al. 2006; Tengo et al. 2014). Connections between neighbouring Traditional Owner groups of the Kimberley means that some knowledge-practices-beliefs are shared or related, however this is not necessarily the case. Ranging from minor variations in linguistic terminology to major differences in concepts and beliefs, there is a level of complex diversity among Kimberley Saltwater Country Traditional Owners that must be acknowledged. As such, attempts at doing knowledge collaborations at scale must proceed with significant caution, ensuring free prior and informed consent in every step of the process, as there is significant risk involved for Indigenous people (Agrawal 2002; Williams and Hardison 2013).

Top-down approaches are also being experimented with for scaling-up Indigenous peoples knowledge, research and monitoring. For example (Garnett et al. *in press*) are using a mapping technique to estimate the contribution of Indigenous peoples and local communities to the protection and maintenance of biodiversity, both in and outside of protected areas, at the global scale. In their analysis they employ fuzzy numbers that afford equal weight to differing views regarding boundaries. Maps are then used to calculate land area (upper and lower limits of land under different forms of management). These maps are then overlaid with a GIS layer (Ellis and Ramankutty 2008, Ellis et al. 2010) in which the terrestrial land surface has been categorised into 19 anthromes depending on the intensity of human use and have already been used to help set conservation priorities (Martin et al. 2014). These range from urban to wild and barren lands. Intensively used anthromes (urban, residential, irrigated agriculture) are assumed not to be managed in a manner consistent with biodiversity conservation. Groupings of less intensively used anthromes are used to define upper and lower levels of land use intensity with associated assumptions about biodiversity and human engagement in management. No anthrome layer is currently available for marine use and, for the analysis, it is assumed that all marine areas to retain some level of biodiversity value, even if greatly degraded.

Statistical analysis is commonly assumed to require precise numerical data. However, quantification is rarely precise, even measured with fine-scale instruments, and is always surrounded by uncertainty. The same is true when measurements are taken by people on country. Estimates of abundance in animals or plants are described in words meaning few or many in any language, and effectively convey relative commonness or rarity of a resource relative to what one might expect. Statisticians have learnt how to use such estimates just as effectively as they do more precise measures. A key concept is fuzzy numbers which allow you to use rough estimates while acknowledging the uncertainty (Gerla 2001). Fuzzy number theory has been developed to turn common language estimates into entities that can be analysed and has the great advantage that the theory holds across cultural barriers so that it does not matter what language the common quantitative terms are expressed in.

The other mathematical theory that has obvious application to cross-cultural estimation is Bayes theorem which says that it is better to test change against your expectations, based on what you know, than test differences from a null hypothesis (Bolstad and Curran 2017). Allowing people to use their existing knowledge opens the door to all forms of knowledge being able to inform the scientific inquiry, including any traditional knowledge that can be revealed about an issue. The interest then is whether the results were in line with expectations rather than ignoring existing knowledge. This has directly relevance and potential use for the scaling up of Indigenous knowledges for research and monitoring purposes in the Kimberley.

Though technical and algorithmic methods for scaling up have potential, they have not yet been scrutinised and approved by Indigenous peoples and local communities themselves. At this stage, the only realistic solution is to facilitate opportunities for 'scaling-up' through relationship building exercises, shared project activities and/or knowledge exchanges (between Indigenous groups, as well as with their non-Indigenous partners). This process is fundamental to supporting Indigenous peoples to build sufficient trust with other Traditional Owners and potential partners in knowledge collaboration work. Though this requires some patient investment, the capacity

that develops will enable the construction of collective, shared, accurate and rich evidence bases that have significant regional impact and buy-in from Traditional Owners and their partners.

The MEB approach offers a conceptual mechanism to support the building of meaningful relationships to link fine scale IK and WSK, across spatial and temporal boundaries, to better understand macro drivers of ecosystem change (Tengo et al. 2014). In addition, there are several initiatives/projects that seek to achieve largescale relevance and impact of IK (see Table 4) that can be looked to for guidance and advice.

Initiative/Project	Description
Community Based Monitoring and Information Systems (CBMIS)	Refers to a bundle of monitoring approaches being used by Indigenous peoples and local communities around the world as tools for managing and documenting their resources (e.g. biodiversity, ecosystems, land and waters, human well-being, etc. Tools are used as part of Indigenous governance and management systems over a long time or to respond to emerging needs (http://swed.bio/focal-areas/themes/biocultural-diversity/cbmis/ & http://www.forestpeoples.org/topics/environmental-governance/publication/2015/community-based-monitoring-and-information-systems-)
Convention on Biological Diversity (CBD) Working Group on Article 8j	The working group on article 8(j) was established in 1998. Parties to the CBD adopted the <i>Akwé: Kon Guidelines</i> for the conduct of cultural, environmental and social impact assessments regarding developments proposed to take place or which are likely to impact on sacred sites and on lands and waters traditionally occupied or used by Indigenous and local communities. They provide a collaborative framework to take into account traditional knowledge, innovations and practices as part of the impact-assessment processes and promote the use of appropriate technologies. The 8j working party is also developing: <ul style="list-style-type: none"> • indicators for the retention of traditional knowledge and methods and measures to address the underlying causes of the loss of such knowledge, • an ethical code of conduct to ensure respect for the cultural and intellectual heritage of indigenous and local communities relevant to the conservation and sustainable use of biological diversity, • contributing to the negotiation of an international regime on access and benefit sharing, and • research on the impact of climate change into highly vulnerable indigenous and local communities. (https://www.cbd.int/convention/wg8j.shtml)
Indigenous and Local Knowledges Centres of Distinction	Indigenous peoples and local community participants at the 4th Plenary Meeting of Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) informed the meeting about the formation of a network of Indigenous and Local Knowledge (ILK) Centres of Distinction. It is composed of organizations implementing programmes of work on traditional knowledge in different global regions and which have a long history of engaging within the United Nations system to deliver policy recommendations, implement projects and provide assessments, such as for biodiversity indicators and community-based monitoring systems. Each Center has its own distinct activities and strengths which by working together will provide a more comprehensive set of inputs to assessments and support implementation of the decisions of the IPBES Platform. This network is a support mechanism for delivering inputs into IPBES by indigenous and local knowledge holders themselves, and can identify other relevant knowledge holders and experts in their regions and areas of expertise. The network is open-ended and will operate in a transparent manner to facilitate the participation and contribution of diverse knowledge views and evidence from all regions.
Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES)	The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) is compiling the latest research – from science and other knowledges – on biodiversity and ecosystem services for policymakers. National governments, local and regional actors, as well as international biodiversity policy processes will benefit from the process. Under the IPBES, procedures and approaches for working with indigenous and local knowledge systems are being developed through the IPBES indigenous and local knowledges taskforce (www.ipbes.net).
Participatory Monitoring & Management Partnership (PMMP)	The Partnership for Participatory Monitoring and Management (PMMP) is an international collaborative initiative for local leaders and communities working with participatory monitoring and management of natural resources. Through improving the quality and extent of bottom-up approaches to resource management, the Partnership will transform the way the world monitors and manages natural resources. To accomplish this objective, PMMP will establish participatory monitoring and management in more areas and facilitate training, education, learning from practice and applied research (http://www.pmppartnership.com/).

Table 4. Examples of large-scale projects and initiatives seeking to aggregate Indigenous peoples and local knowledges.

6. Conclusion

Indigenous peoples' *in situ* knowledges-beliefs-practices have the potential to make significant contributions to meeting contemporary sustainability and conservation challenges globally. However, they are often met with scepticism or simply overlooked as 'traditional' – i.e. of the past. Acknowledging and dealing with intellectual baggage that ties many scientists, managers and policy makers to the past is a challenge for knowledge integration efforts.

This report outlines one approach available to Indigenous people and their partners to share, use and co-produce the best available knowledge-base for decision-making, management and monitoring of Kimberley Saltwater Country. The Multiple Evidence Base (MEB) approach facilitates the weaving of diverse knowledge systems to produce an enriched picture of Country. It describes a means by which Indigenous knowledge holders and scientists can collaborate to work with (rather than against) each others' truth claims by "letting each knowledge system speak for itself, within its own context, without assigning one dominant knowledge system with the role of external validator" (Tengo et al 2014, p.584). These kinds of intercultural knowledge partnerships form the backbone of collaborative efforts to look after Country.

The MEB is capable of producing transdisciplinary research and monitoring results that harness the strengths of both Indigenous Knowledge and Western Scientific Knowledge and are legitimate, credible, salient and useable in managing, conserving and looking after all values of Kimberley Saltwater Country. Further, if successful, knowledge integration and co-production exercises can increase stakeholder buy-in and the perceived legitimacy of decisions made and policy formulated.

However, implementing the MEB approach requires coordinated institutional support and sufficient resources to produce useful knowledge that is easily translated into programs of action. To ensure this, there is a fundamental requirement that Indigenous peoples, and their knowledges-practices-beliefs, are empowered and have sufficient capacity to collectively organise and mobilise at organisational and institutional levels.

It is important to acknowledge the thousands of years of hard work from Traditional Owners, knowledge holders, practitioners, advocates and researchers that has built the current research and monitoring capacity in Kimberley Saltwater Country. The KISSP has been an opportunity to build on the relationships of Traditional Owners and their partners. It is in this spirit that the Multiple Evidence Base approach to knowing, planning for, and managing Kimberley Saltwater Country is proposed

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8. Appendices

Appendix 1: Tools and resources for mobilising Indigenous knowledges

Tools	Examples/resources
Ethnoecology	<ul style="list-style-type: none"> • Calheiros, D. F., Seidl, A. F., & Ferreira, C. J. (2000). Participatory research methods in environmental science: local and scientific knowledge of a limnological phenomenon in the Pantanal wetland of Brazil. <i>Journal of Applied Ecology</i>, 37(4), 684-696. • Martin, G. J. (1995). <i>Ethnobotany: a methods manual</i> (Vol. 1). Earthscan. • Sieber, S. S., da Silva, T. C., Campos, L. Z. D. O., Zank, S., & Albuquerque, U. P. (2014). Participatory methods in ethnobiological and ethnoecological research. <i>Methods and techniques in Ethnobiology and Ethnoecology</i>, 39-58.
Storytelling & Art	<ul style="list-style-type: none"> • Bessarab, D., & Ng'andu, B. (2010). Yarning about yarning as a legitimate method in Indigenous research. <i>International Journal of Critical Indigenous Studies</i>, 3(1), 37-50. • Blodgett, A. T., Schinke, R. J., Smith, B., Peltier, D., & Pheasant, C. (2011). In indigenous words: Exploring vignettes as a narrative strategy for presenting the research voices of Aboriginal community members. <i>Qualitative inquiry</i>, 17(6), 522-533. • Castleden, H., & Garvin, T. (2008). Modifying Photovoice for community-based participatory Indigenous research. <i>Social science & medicine</i>, 66(6), 1393-1405. • Christensen, J. (2012). Telling stories: Exploring research storytelling as a meaningful approach to knowledge mobilization with Indigenous research collaborators and diverse audiences in community-based participatory research. <i>The Canadian Geographer/Le Géographe canadien</i>, 56(2), 231-242. • Christie, M. 2004. Computer Databases and Aboriginal Knowledge. <i>Learning communities: International journal of learning in social contexts</i> 1. www.cdu.edu.au/centres/ik/pdf/CompDatAbKnow.pdf • Cunsolo Willox, A., Harper, S. L., & Edge, V. L. (2013). Storytelling in a digital age: digital storytelling as an emerging narrative method for preserving and promoting indigenous oral wisdom. <i>Qualitative Research</i>, 13(2), 127-147. • Davies, R., & Dart, J. (2005). The 'most significant change'(MSC) technique. <i>A guide to its use</i>. https://www.kepa.fi/tiedostot/most-significant-change-guide.pdf • Gubrium, A. (2009). Digital storytelling: An emergent method for health promotion research and practice. <i>Health Promotion Practice</i>, 10(2), 186-191. • Iseke, J., & Moore, S. (2011). Community-based Indigenous digital storytelling with elders and youth. <i>American Indian Culture and Research Journal</i>, 35(4), 19-38. • Iseke, J. (2013). Indigenous storytelling as research. <i>International Review of Qualitative Research</i>, 6(4), 559-577. • Kerins, S. (2014). Challenging conspiracies of silence with art: Waralungku arts, Borrooloola, northern territory. <i>Art Monthly Australia</i>, (266), 48. • Kovach, M. (2010). Conversation method in Indigenous research. <i>First Peoples Child & Family Review</i>, 5(1), 40-48. • Kovach, M. E. (2010). <i>Indigenous methodologies: Characteristics, conversations, and contexts</i>. University of Toronto Press. • Lavallée, L. F. (2009). Practical application of an Indigenous research framework and two qualitative Indigenous research methods: Sharing circles and Anishnaabe symbol-based reflection. <i>International journal of qualitative methods</i>, 8(1), 21-40.

	<ul style="list-style-type: none"> • Maclean, K., & Woodward, E. (2013). Photovoice evaluated: an appropriate visual methodology for Aboriginal water resource research. <i>Geographical Research</i>, 51(1), 94-105. • Zurba, M., & Berkes, F. (2014). Caring for country through participatory art: creating a boundary object for communicating Indigenous knowledge and values. <i>Local Environment</i>, 19(8), 821-836.
<p>Participatory mapping/GIS</p>	<ul style="list-style-type: none"> • Ali, M.B. (2016). <i>Participatory mapping as a tool for mobilisation of indigenous and local knowledge and enhanced ecosystem governance in Ginderberet, Oroma region, Ethiopia</i>. A contribution to the Piloting of the Multiple Evidence Base Approach. Stockholm Resilience Centre, Stockholm http://swed.bio/wp-content/uploads/2016/11/MEB-Pilot-Report-Ethiopia_2016.pdf • Amazon Conservation Team. (2008). <i>Methodology of collaborative cultural mapping</i>. http://www.kaninde.org.br/wp-content/uploads/2015/11/methodology_of_collaborative_cultural_mapping_1_1334604193.pdf • Ansell, S and J. Koenig (2011). CyberTracker: and integral management tool used by rangers in the Djelk Protected Area, central Arnhem Land, Australia. <i>Ecological Management & Restoration</i> 12, 13-25. • Ens, E.J. (2012). Monitoring outcomes of environmental service provision in low socio-economic Indigenous Australia using innovative CyberTracker technology. <i>Conservation and Society</i> 10, 42-52. • Freitas, R. (2016). Cultural mapping as a development tool. <i>City, Culture and Society</i>, 7(1), 9-16. • International Fund for Agricultural Development (IFAD)(2009). <i>Good Practices in Participatory Mapping</i>. A report prepared for IFAD. https://www.ifad.org/documents/10180/d1383979-4976-4c8e-ba5d-53419e37cbcc • <i>Integrated Approaches to Participatory Development: Participatory Mapping Toolbox</i>. Website. www.iapad.org/toolbox.htm. • NAFI (online). <i>North Australia and Rangelands Fire Information</i>. http://www.firenorth.org.au/nafi3/ • NAILSMA (online). <i>I-Tracker</i>. Online resource supporting use of Cybertracker software use. https://www.nailsma.org.au/hub/programs/i-tracker.html • Participatory Avenues (online). <i>Integrated Approaches to Participatory Development</i>. Web resource for participatory mapping http://www.iapad.org/. • PPGIS.net (online). <i>PPGIS</i>. Online resource for participatory mapping. http://www.ppgis.net/ • Robinson, C. J., Maclean, K., Hill, R., Bock, E., & Rist, P. (2016). Participatory mapping to negotiate indigenous knowledge used to assess environmental risk. <i>Sustainability Science</i>, 11(1), 115-126.
<p>Participatory research</p>	<ul style="list-style-type: none"> • Chambers R. (2002). <i>Participatory workshops: a source book of 21 sets of ideas and activities</i>, Earthscan , London UK. • Davidson-Hunt, I. J., & Michael O'Flaherty, R. (2007). Researchers, indigenous peoples, and place-based learning communities. <i>Society and Natural Resources</i>, 20(4), 291-305. • Fals-Borda, O. (1987). The application of participatory action-research in Latin America. <i>International sociology</i>, 2(4), 329-347. • Institute of Development Studies (online). <i>Participatory Methods</i>. Online resource for participatory methods. http://www.participatorymethods.org/task/plan-monitor-and-evaluate

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Appendix 2: KISSP Working Group Members

Traditional Owner Group	Representatives
Balanggarra	Tom Nagle, Ranger Coordinator
Bardi Jawi	Daniel Oades, IPA Coordinator (<i>Deputy Chairperson</i>) Kevin George, Co-Chair & Head Ranger
Dambimangari	James Mansfield, Ranger Coordinator/IPA Manager
Karajarri	Sam Bayley, IPA Coordinator Joe Edgar, Traditional Owner Dooli King, Senior Ranger
Nyul Nyul	Mark Rothery, Ranger Coordinator Albert Wiggin, Ranger (<i>Deputy Chairperson</i>)
Yawuru	Julie Melbourne, Manager Land & Sea Unit Dean Mathews, Yawuru Project Officer (<i>Chairperson</i>)
Wunambal Gaambera	Tom Vigilante, Healthy Country Manager Rob Warren, Ranger Coordinator