


# Indigenous knowledge in conservation science and the process of a two-way research collaboration

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## Abstract

Environmental research often occurs in short bursts with the duration of fieldwork often governed by the time constraints of a funding body. Collaborations between academic researchers and Indigenous People have occurred for many years and the exchange of information can create value and knowledge for both participants in the collaboration. Indigenous People play a vital role as knowledge keepers in environmental science and can, in some instances, provide a more secure repository of local knowledge and conservation practice than digital archives. In this essay, Indigenous Rangers on Larrakia country in Darwin, Australia, and a non-Indigenous academic researcher describe how value-creation was increased for both parties involved in a collaborative project on the migratory shorebird far eastern curlew (*Numenius madagascariensis*). We share our experiences of expectations, the development of methods, the codeveloped goals and complementary ways of thinking to manage threatened species at a local scale, the scale at which the local Larrakia People operate. Through our collaboration, we show that both parties within the collaboration can benefit and create value for a species of conservation concern that has not typically been considered culturally important.

## KEYWORDS

academic research, first nations people, indigenous people, shorebird, traditional ecological knowledge, value-creation

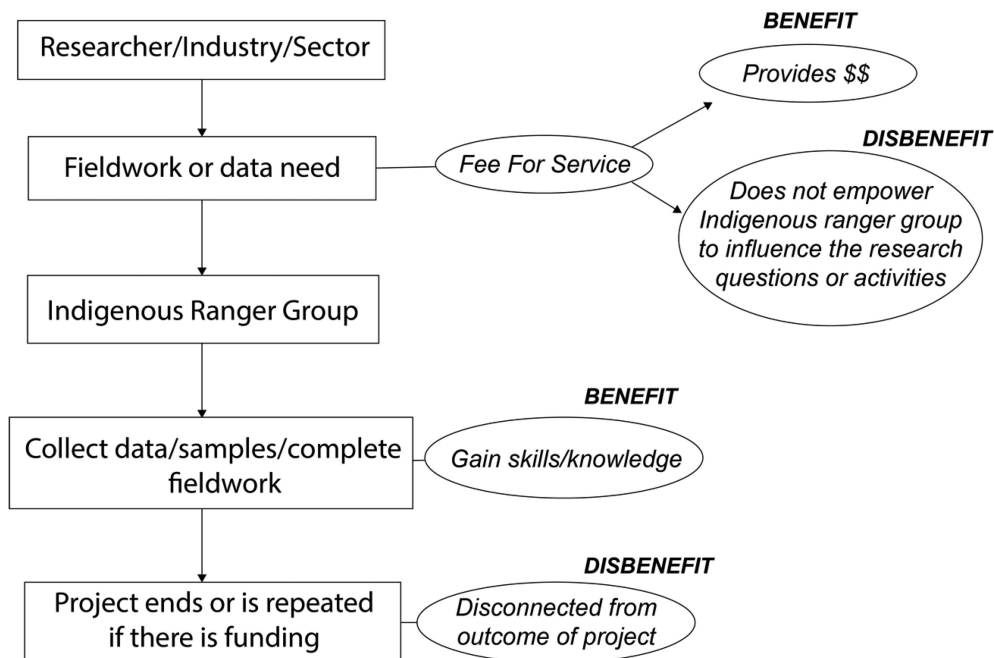
## 1 | COLLABORATIVE ENVIRONMENTAL SCIENCE RESEARCH WITH INDIGENOUS PEOPLES

Environmental academic research often occurs in short bursts with the duration of fieldwork often governed by

the time constraints of a funding body (generally <5 years) (Christie, 2006). In many parts of the world, researchers do, or at least could, work with Indigenous people on country they have occupied for millennia, even in places where the connections of Indigenous people have been disrupted by colonialism (Garnett et al., 2018). However, if academic researchers work in a region for

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**FIGURE 1** Flow chart showing a common process of engaging indigenous Rangers in a fee for service work arrangement with the benefits or disbenefits listed at each step

just a few years it can make it difficult to form relationships with Traditional Owners or custodians to establish meaningful research collaborations (Bessarab & Ng'andu, 2010; Coff & Lampert, 2019) or establish research goals with shared values and co-benefits (Berkes, 2009; Castleden et al., 2012; Jackson, 2019). Often Indigenous People are interested in a particular problem at a particular place which affects their community (Christie, 2006), and sometimes view problems through a holistic lens that does not separate human concerns from those of the environment. Some researchers from elsewhere, on the other hand, often visit an area, collect data for a component of an ecosystem, sometimes in an extractive way, then leave after a short period (Latulippe & Klenk 2020). While this process can provide some benefits to Indigenous Ranger groups, there are also disbenefits using this style of collaborative framework (Figure 1). When Indigenous Rangers are not engaged throughout the entire process, they can be left feeling disconnected from research or environmental management work being conducted on their country (Figure 1). Often academic conservation biologists are encouraged to frame their research in a global context for maximum impact in journals, a scope that is often beyond the geographic scale of land and sea management of interest to Indigenous people.

Collaborations between academic researchers and Indigenous People have occurred for many years and the exchange of information in a “two-way learning” or “learning both ways” model can create value and knowledge for both participants in the collaboration (Ens, 2012). This value-creation can improve new

knowledge required to tackle complex environmental issues (Robinson et al., 2021), and improve biodiversity conservation through the addition of long-term local knowledge from Traditional Owners. Some Indigenous rangers work across multiple research projects and combined with their holistic understanding of the natural world, provide valuable insight to research collaborations. Recent research has shown how collaborating with Indigenous rangers can provide direct benefits to western science and conservation outcomes (Ward-Fear et al., 2019). However, researchers representing a predominantly non-Indigenous academy working with Indigenous People, need to be careful not to treat Indigenous Knowledge as a way to fill knowledge gaps or extract it as a dataset (Klenk et al., 2017; Latulippe & Klenk, 2020). The aspirations and cobenefits should be stated early in the development of the research collaboration and reviewed regularly to ensure that all parties are benefitting.

Indigenous People play a vital role as knowledge keepers in environmental science by providing a more secure repository of local knowledge and conservation practice than digital archives. The transfer of knowledge between the Indigenous researcher and the academic researcher depends on agreed research processes by both parties and how that knowledge is generated and performed (Crawford, 2009). The coproduction of knowledge within any collaboration requires a foundation of legitimacy, expertise, trust, and inclusivity (Djenontin & Meadow, 2018). Environmental research collaborations between Indigenous People and western scientists fall under the umbrella of Indigenous Land and Sea

Management (ILSM), and it can provide a means for local Indigenous Peoples to re-assert control over their country (Austin et al., 2018). Some of the benefits of ILSM include strengthening local identity and cultural well-being for Indigenous rangers that work on the ground (Austin et al., 2018).

Relationships between Indigenous people and visiting environmental researchers can be conducted in a manner that benefits all parties. In this essay, we reflect on the collaboration between Indigenous Rangers on Larrakia Country in Darwin, Northern Territory Australia, and a non-Indigenous academic researcher and describe how value-creation was increased for both parties involved in a collaborative project on the migratory shorebird far eastern curlew *Numenius madagascariensis*. In doing so we hope to contribute to the benefits that both conservation science and Indigenous People can gain from working together despite differences in the temporal and spatial scale of their primary interests.

In this essay, we share perspectives from both the Indigenous Rangers and the academic researcher within each subsection, but we also use a collective voice at times. Because this is a reflective piece, we (the authors) have developed it together through open, semi-structured discussions and not interviews, thereby human ethics permission was not necessary.

## 2 | RESEARCH CONTEXT AND COLLABORATORS

*Larrakia Rangers: We are Indigenous Rangers from the Larrakia Nation Land and Sea Rangers, an urban-based Aboriginal ranger group in the Northern Territory of Australia. Larrakia land and sea country comprises much of the land and sea around Darwin, the capital of the Northern Territory, Australia. Although the Larrakia Nation Land and Sea Ranger unit is relatively young (approximately 10 years), the Larrakia People are saltwater people and have a strong cultural connection to the coastal environment, having lived on the coastal country for many thousands of years. This lived experience and knowledge tradition lives within the Larrakia and is passed on through generations of elders. Because Larrakia People do not own any land under the western system, we work in partnership with landholders to care for Larrakia country even though this country (primarily around Darwin city) has been intensively colonised for 150 years.*

*Academic Researcher: I started work on migratory shorebirds as an undergraduate, concentrating primarily on their biology. I had never previously worked with Indigenous people and my initial interactions were tentative as I did not know what was expected. During the early years of the collaboration I was always trying to operate at a fast pace and my research goals were rigid. I was wholly focused on the shorebirds and I did not consider the individual aspirations of the Larrakia Rangers. The main thing that has changed for me throughout the collaboration is the pace at which I work. I have learnt how to identify each person's individual interests and their goals while working as rangers and I find it a welcome challenge to engage with different people about the project by finding out what they would like to get out of the collaboration.*

## 3 | HISTORY OF THE COLLABORATION AND BUILDING TRUST

*Academic Researcher: I began working on shorebird research on Larrakia land in 2011. The project collaboration was established in 2013 from an agreement between the Northern Territory Government and the university. Migratory shorebirds became a focal point of the project because of their conservation status and the need for a greater understanding about their ecology in order to manage them in Darwin Harbour. The initial work contract was set up to provide advice on some industrial development in Darwin Harbour. As part of the project, the Larrakia Rangers were paid by the government to work across 8-10 different projects in the marine environment in Darwin, with 10 days per year allocated to work on migratory shorebirds in Darwin Harbour. All work was organized through a third-party governmental department and this created planning issues. While this prescriptive style of partnership allowed no time to foster collaborations or enable ownership of the project by the Indigenous Rangers, encounters between the rangers and I over this period allowed formation of working relationships and trust so that research on a subsequent project on the far eastern curlew could build*

*in Larrakia involvement from the start. The far eastern curlew is a critically endangered migratory shorebird and is protected under national and environmental legislation. Globally, the species is declining due to habitat loss across coastal ecosystems. Because of this, there has been much focus on understanding the species ecological requirements as a way to manage and conserve the species.*

Larrakia Rangers: Each environmental management collaboration is different and provides different benefits to our ranger group. We work on projects that interest us and help us continue to develop our skillsets. Our ranger group focuses on commercial work, employment, and training; we work with commercial businesses, universities, and research organizations using a fee-for-service model. This differs from many other ranger groups. It has been a good opportunity to work consistently on this project as the time allows each of us to build on the skills that we want to learn, and our understanding of the project is always increasing.

Our group has had some staff turnover throughout the years, including some rangers that have left to seek other opportunities but have come back to rangers, which has allowed them to re-engage with the project and bring in valuable new skills.

### 3.1 | Ongoing agreement about what sort of work we do

While the project on the far eastern curlew had explicit scientific aims, there was room to codevelop research goals that suited both sides of the collaboration. This was a developing process for us (both the rangers and researcher) as our knowledge of the study species and system increased. We recognize that it is best practice to agree on a knowledge system exchange protocol at the outset of the collaboration (Crawford, 2009), but we were happy to share different ways of learning and doing throughout the collaboration in a dynamic way. The financial agreement and the allocation of time for our research was considered against other agreements the rangers already had in place, but importantly, there was always flexibility in the work input, and this evolved over time. There was always payment for services, such as consultation about projects or proposals and grant applications, time on the boat or other

operational equipment. Payment for services can sometimes lead to an imbalance of power if the decision-making is controlled by the financial provider (Yunupingu & Muller, 2009). Payment for services to Indigenous ranger groups represents respect and acknowledgement of cultural knowledge that has been passed down through generations and shows that respect for understanding that there are other ways of thinking and doing in managing sea country (Yunupingu & Muller, 2009).

The field methods that were employed changed as individual aspirations evolved or were discovered through the ongoing partnership. We were also willing to abandon methods or aspects of the fieldwork if the methods did not align with the skills or ambitions of the rangers, and alternatively, we would codevelop fieldwork methods that suited both parties. This has been an important part of the knowledge production process as we have adapted to changing circumstances (Berkes, 2009). In this way, we have been following a framework that encompasses adaptive management (Nagarkar et al. 2016) and a cultural coproduction of knowledge framework.

*Larrakia Rangers: Over time, us rangers have gained a sense of ownership over the project and self-determination of tasks and roles such as dedicated rangers to skipper the boat and organise survey dates and times to suit the harbour tidal conditions, and dedicated rangers to enter data and manage the databases. This process has also included time for us to learn about the migratory shorebirds, where most of us did not have any knowledge of the birds until working on the project. Through the project, we have learned the story of these birds and can easily talk about the conservation issues the birds face and how to help the birds when they are in Australia.*

Academic researcher: This kind of evolution has only been possible because of the ongoing working partnership over many years and opportunities for the rangers to develop their knowledge on the birds and ecological system they exist within. Understanding the different western and Indigenous epistemologies has been an important benefit for the collaboration.

### 3.2 | Lessons learnt and value creation

There have been benefits to both the academic researcher and Indigenous rangers, that transcend the ethical

reasons to collaborate with local Indigenous People. We wanted to ensure that scientific knowledge would benefit Indigenous knowledge and cultural connections that already existed so using a knowledge coproduction framework allowed all sides of the collaboration to feel empowered (Latulippe & Klenk, 2020).

*Academic Researcher: Through the partnership, I strived to maintain a balance between achieving the ecological and conservation goals of the research and ensure that all rangers had opportunities to provide input into the methods of the on-ground research, the streams of communication of results of the work, and the direction they wanted future environmental research to go on Larrakia country. The Larrakia have aspirations for land management and conservation of biodiversity and landscapes in the Darwin region, but because of the reduction of language and the fact that Larrakia People do not own land under the western system, not all aspirations have been realised. There is still some way to go, and this research collaboration poses unique challenges to the common two-way knowledge exchange. Nevertheless, there has been benefits, such as insights into the wider ecological setting, relevant stories of related ranger work, knowledge exchange with other ranger groups, continuity with other researchers and species other scientists have worked on, benefits of connections with elders, and access to skills and navigating through and appreciating what might be seen as quite inhospitable environments (muddy mangrove environments with a large tidal range).*

For the rangers, the curlew project has contrasted with other projects with which they have been involved historically by enabling involvement in project governance, which is as important a component of any research as the knowledge gathering (Christie, 2006). This has contrasted with some other projects in which the Larrakia rangers have been involved which have been undertaken too hastily without the flexibility to receive input from rangers, leading to abandonment of working partnerships.

*Larrakia Rangers: In the past, some of us rangers have felt cut off from research being conducted on our country. Because most of our country is in the city, there has been nothing to stop researchers from working on*

*Larrakia country, but most give nothing back. Sometimes our ranger unit has been contacted after a project has started if an academic or government researcher requires help finding an animal or plant on Larrakia country. They come to us because they know we can provide knowledge that is not easily available to them.*

We openly work with people from universities and government on lots of different projects. We operate across the whole of the environment and we recognize that we have different knowledge to academic researchers and have a cultural connection to the land we work on. We value working with academic researchers because we get training opportunities, we get to spend time being outdoors, on the water, and we are lucky to work with university researchers and government workers. We have been fortunate to gain further knowledge in different areas from people we have collaborated with. We see our work as important because we get to manage the coast. Indigenous rangers have traditional knowledge about certain things that researchers can learn from and researchers can pass on scientific knowledge to us rangers. It is useful to work alongside scientists to get a different experience, gain different knowledge, use different techniques. Rangers can also pass on the western knowledge that we learn to other rangers in the team or other ranger groups at forums or in ranger exchange programs. We enjoy protecting the land and sea and we do it for our generations to come. It's also good for researchers to work with rangers as it helps create jobs for rangers.

### 3.3 | Co-producing knowledge together

Essential to our collaboration was using two forms of knowledge. The knowledge systems (or epistemologies) held by different cultures influence how individuals see the world and know about the nature of knowledge (Macdonald et al., 2021; Robinson et al., 2021; Verran, 2008). These different world views can be linked to different values in the protection and conservation of biodiversity or ecosystems, when compared to western science ecosystem health and values measures (Bangalang et al., 2022). This approach not only provides insights to our understanding of the curlew's ecology and

habitat use but also improved collaborators' understanding of this bio-cultural land/seascape.

*Larrakia Rangers: Our role in the project has been to act as a hub of social and environmental knowledge which we combine with cultural knowledge passed down from our elders. For example, we have guided aerial surveys of our country, so they don't disturb important dreaming sites around the harbour. We have also used this collaboration to engage with the wider community and also to connect with Larrakia elders. We created a poster (Coastal Birds of Larrakia Country) and a booklet for ranger groups and community members, and this educational work lead to more open communication with Larrakia elders and reinvigorated Larrakia language through accessing elders' knowledge.*

*Academic Researcher: My knowledge of the curlew is drawn from a much broader global knowledge base assembled in many parts of the species range in Australia and along the flyway. I can see how the curlew uses Larrakia country. I had only some knowledge of what those places mean to Larrakia people, particularly cultural significance from what I had read in books or reports. Learning directly from the rangers was much more meaningful.*

### 3.4 | Considerations during the collaboration

We are creating collaborative knowledge around the far eastern curlew and how to manage the species alongside coastal development and the human population. We have also used this opportunity to identify common threats to the coastal zone that Larrakia Rangers manage and the shorebirds that use that area. Climate change has been identified as a threat that could not only impact culturally important sites within mangroves and salt pans, but also reduce the area of habitat that shorebirds use. This observation aligns with other Indigenous ranger groups that have identified climate change as a threat to culturally important heritage sites (Carmichael, 2016). Conservation science and Indigenous land and sea management can be complementary to one another through the holistic nature at which both operate. Conservation biology is naturally a holistic science and is concerned with maintaining processes that support biosphere functions

(Given, 1993). Operationally, the scale at which conservation management frameworks exist (local, regional, national, international) differ from the scale at which ecosystems or their components exist (Nevins et al., 2009), and this also differs to the scales at which Indigenous People manage their land. Planning for environmental research with Traditional Owners should consider the scale of "country" to reflect the appropriate authority from Traditional Owner groups (Yunupingu & Muller, 2009). The issue of scale and land management is an important consideration in the conservation management of migratory shorebirds that migrate across hemispheres of the globe, transcending political and geographical boundaries and linking cultural communities. This aspect of the biology of the species has been a central point that has linked together the Larrakia Rangers with Indigenous rangers from elsewhere in northern Australia, and with people from elsewhere in the world (e.g.: at international conferences and during fieldwork expeditions to catch shorebirds).

### 3.5 | Planning research together

Identifying common goals within the collaboration has been an important aspect to our work. In our project, we identified common conservation goals that created benefits to both parties within the collaboration. Migratory shorebirds and the habitat they exist in could be considered "shared natural assets or resources" and the conservation protection and management of them for some people (whether Indigenous or non-Indigenous) is to maintain intergenerational equity.

*Larrakia Rangers: For many of us working at Larrakia Rangers, we did not have knowledge of shell middens [places where Indigenous People would meet and eat shellfish, the remains collecting over time providing a geographic marker for generations to come] and locations of these cultural sites in the coastal salt pan environment around Darwin until we started working on this project. We started working on shell middens in this project once we discovered from GPS tracking of the far eastern curlew that the bird was using coastal salt pans where shell middens exist. We realised that the bird overlapped in geographical space with important cultural sites and decided that we would incorporate patrols of salt pans into our fieldwork program. One outcome of this has been the documentation of*

*these important sites and we have stated this in a recent consultancy report to government. It has been beneficial to learn more about shell middens and to know that we can pass this kind of information and connection on to our future generations. For many of us at Larrakia Rangers, we feel proud to work on Larrakia country, even though not all of us are from Larrakia; we still feel a connection working on country and contributing to land management. Working at Larrakia Rangers has been good for opportunities to work with different groups including university and government, and with different people where we can learn new scientific and technical skills. Most of us did not know anything about migratory shorebirds before working on this project, but we are now proud that we can identify a far eastern curlew and some other migratory shorebirds and conduct surveys for these birds in Darwin Harbour. This work on the far eastern curlew and other shorebirds has been a good stimulus for engaging with Larrakia elders to hear more about various places and histories, and to develop our own emerging sense of local ecological knowledge, human geography, and responsible custodianship.*

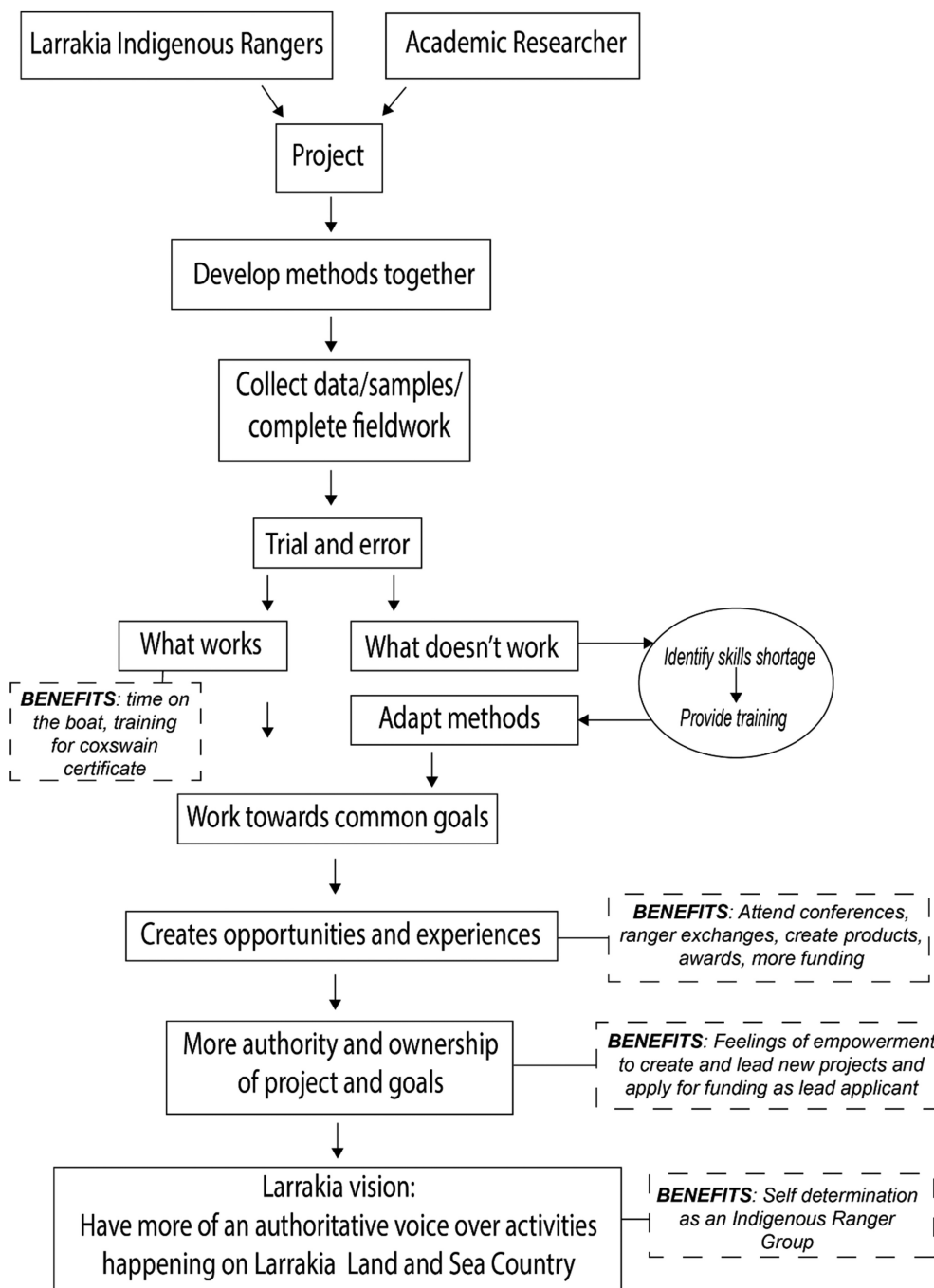
Academic Researcher: Working collaboratively on shorebirds with the Larrakia Rangers has been an incredibly beneficial process. There is a team of knowledgeable field workers that contribute to the decision-making and interpretation of the science. We discuss all processes of the fieldwork and how the management of shorebirds and the intertidal zone overlaps with the protection of important cultural sites. We work together to create a stronger voice for these areas, representing holistic views of the system in which we work. We use our experience to develop new aspects of research and develop projects that interest individual rangers within the organization. But all this takes time and has been greatly assisted by the fact that we all live within the area in which we work, allowing regular catch ups and ongoing fieldwork. I was fortunate to be able to drop by the ranger station every few weeks. This aspect is very different to collaborations where non-Indigenous researchers join remote Indigenous ranger groups for specific periods of time.

### 3.6 | What training and opportunities have been offered?

There have been opportunities for the rangers to upskill through workshops on shorebird identification and survey techniques, training courses on using Microsoft Excel, attending and presenting at national and international conferences, incorporating art and language into communication products, and opportunities to publicize the research collaboration through local media. We chose field methods based on our codeveloped goals, for example, we developed line transects to survey shorebirds from the boat in Darwin Harbor. This came after other attempts to work together in the field, including doing regular counts of shorebirds on the beach, measuring microclimate variables in salt pans. While these field methods worked, the engagement was not great, so we collectively came up with new methods. This boat survey method enabled us to collect data on shorebirds, patrol the marine environment for non-compliance activities, report on pollution, record sightings of marine megafauna, and all the while, most rangers spent valuable time on the boat which contributed to their accreditation hours for their coxswain maritime training. Developing these kinds of skills is an important aspiration for the Larrakia Rangers, both individually and as an organization, and allowed rangers to spend more time on their country, reinforcing their cultural connection and identity. In addition, there have been ranger exchange opportunities with multiple ranger groups across northern Australia and time to share knowledge with other Indigenous rangers at forums and conferences.

### 3.7 | Creating a legacy and delivering mutual benefits

We acknowledge that the working relationship was not static or uniform, but incredibly dynamic (Wohling, 2009). For example, fieldwork outside of normal working hours (early shorebird surveys on the beach or late night catching of shorebirds) was not as successful so we scheduled surveys to take place in normal working hours. Our working relationship evolved over time, particularly during busier times when we all spent more time together. Importantly, research with Indigenous People should allow time to develop methods collaboratively for the whole of the research process to allow rangers to gain ownership of the work. We all benefitted more from the collaboration through the evolution of field methods and acceptance that the working agreement would change over time, including sources of funding for the research (Figure 2). Rangers were always paid for their collaboration in a research project, as any research assistant or associate would be, and they were



**FIGURE 2** Flow chart showing the process used in the collaboration from this case study

not regarded as “citizen scientists” or “Indigenous volunteers.” This is an important distinction to make as these terms can de-value Indigenous people and their knowledge and contribution to the work taking place.

Working together has created mutual benefits and increased collaborations within the local community (Figure 2). Our collaboration has now reached a point where we can create products (such as posters and booklets) that combine our forms of knowledge and allow us to have impact in the applied conservation and protection of migratory shorebirds at a local scale. Our collaboration also allows us to collectively apply for funding and

project tenders and as a result our proposals are strengthened. For example, our collaborative boat surveys of shorebirds in Darwin Harbor were the only surveys of its kind for many years and because of this, we were approached by the Northern Territory Government to produce reports on the values and current knowledge of these birds in relation to an area that was proposed for development. It has also been beneficial that our project was awarded and recognized by the Territory Natural Resource Management awards as this prize has been included as an achievement on applications for funding and other proposals with different researchers.



### 3.8 | Continuity and succession planning

*Academic Researcher: Through the collaboration I have worked with the ranger manager to upskill individual rangers in tasks associated with monitoring migratory shorebirds in a coastal area that is threatened with ongoing development, placing pressure not only on the birds that use the habitat, but also the culturally important sites that represent the connection Larrakia People have to saltwater country.*

By training rangers in techniques to monitor and manage threatened migratory species, there is now an opportunity for these skills to be used to further the economic development of the ranger group. For example, these skills are highly sought after in consultancy work where developments may impact the coastal environment. This in turn will continue to allow rangers to use and apply traditional ecological knowledge and reinforce their cultural connections to country (Pert et al., 2020). Managing development and additional threats such as climate change to Larrakia sea country creates opportunities for Larrakia Rangers to develop their own research agenda that combines dual knowledges and provides benefits. Importantly, the benefits would flow back to the local Indigenous community, such as ways to retain cultural knowledge, protect important sites and conserve species have become important to Larrakia Rangers through creating value around them.

Since the production of this essay, I have left academia to work in Indigenous land and sea management but remain in touch with the Larrakia Rangers and have been told that the rangers still do monthly shorebird surveys in Darwin Harbor.

## 4 | CONCLUSION

Our experience working together as an academic researcher and local Larrakia Rangers on a collaborative research project has shown us that the knowledge systems held by Indigenous People can act as a secure archive of local ecological and conservation information as researchers come and go. One way to support Indigenous people hold onto this knowledge archive is to keep rangers supported in their jobs with the flexibility of

ranger groups to funded and resourced to continue work that is important to them. Ranger groups are also empowered through their management plans (or healthy country plans), but not all groups have these and without such a tool, it might be hard for the group to navigate research partnerships. The use of management plans provides clear details about the values that rangers want to focus on, which can in turn guide how researchers engage with Indigenous rangers. Our work that we present here is based on working together and the scale of work has been at a regional level at which the rangers work. We hope that the information provided is useful for conservation practitioners and managers that work or aim to work in collaboration with Indigenous People in a research collaboration or using a fee-for-service model. This could be a useful piece of information for developing co-lead research collaborations for urban Indigenous People. We show through our collaboration that working in a two-way system can create and enrich values for both sides of a collaboration.

### AUTHORS CONTRIBUTIONS

All authors contributed to the conception, flow, structure and style of this manuscript. All authors conceived the figures through workshopping and ongoing discussions. AL wrote the manuscript.

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### CONFLICT OF INTEREST

The authors declare no conflicts of interest.

### DATA ACCESSIBILITY STATEMENT

There is no relevant data associated with this manuscript.

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