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Using Participatory Action Research to Share Knowledge of the Local Environment and Climate Change: Case Study of Erub Island, Torres Strait

Karen Elizabeth McNamara and John Patrick McNamara
James Cook University, Queensland, Australia

Reading seasons and environments has been a long-held practice for Torres Strait Islanders through their close relationships with their islands and seas. This research project worked with elders on Erub (Darnley) Island, in the eastern group of islands in the Torres Strait, to document and synthesise their knowledge of seasonal patterns and indicators, and climate change. This knowledge varied from details on the migration and nesting patterns of the main totem birds, to the movement of the Tagai star constellation, to the onset of wind patterns indicating certain planting or fishing cycles. The importance of documenting and transferring such knowledge is that it continues the task of generating interest among the younger generation to 'read' their landscape, which is especially pertinent given the projected impacts of climate change. The ability of islanders to identify indicators and 'read' their country is an important tool in monitoring and adapting to environmental change, as well as maintaining culture, livelihoods and environment. This article outlines this knowledge, and documents the process of utilising this knowledge to develop a seasonal calendar, which was also transposed into a larger mural at the local primary school. The school children were involved in assembling the mural, and its contents will now form part of the teaching curriculum. It is hoped that by documenting and sharing such knowledge, younger generations can see its value, for instance in monitoring the impacts of environmental change, and in turn it will be valued by them.

■ **Keywords:** climate change, local knowledge, seasonal calendar, Torres Strait

Several diverse themes unite this article. The overarching objective of the research reported in this article was to document and synthesise local knowledge of environmental conditions, including seasons and climate, and transfer this to the younger generation in the local primary school. Knowledge gathered entailed details of the wet and dry seasons, wind patterns, fauna migration patterns, planting times and star constellation movements. The first aim of this article is to provide details of how existing knowledge was assembled into a seasonal calendar for one community in the Torres Strait region of Australia. By outlining this knowledge, this article offers insights into how 'reading' seasons and climate can be an important tool in monitoring and managing local environmental change in the future. Moreover, this article aims to illustrate how this

knowledge can be transferred to the younger generation through education and active participation.

The second aim of this article is to provide details on the mechanics of a research project, which has broadly focused on local knowledge in relation to climate and seasons. Delving into the *how* of research is important to consider not only for research pursuits, but also for any other potential education activities. The project adopted a participatory action research approach, and as such worked

ADDRESS FOR CORRESPONDENCE: Karen Elizabeth McNamara,
Pacific Centre for Environment and Sustainable Development,
University of the South Pacific, Suva, Fiji Islands. E-mail:
karen.e.mcnamara@gmail.com

extensively to ensure that elders were involved with the project throughout its duration. It is from this that we can learn that any education initiative needs to work closely and in partnership with the local community. The ways in which this project conducted much of its data collection was on-country, visiting sites around the island and off shore and witnessing first-hand changes in the landscape as a result of climate change and variability. This section explores the value of local knowledge and how this can value-add to our understanding of the impacts of climate change, and provides details of the study site.

Local Knowledge

In the Torres Strait, local knowledge of seasons and climatic events, impacts and changes has emerged through Islanders ongoing and direct interaction with their surrounding environment. Numerous authors refer to this knowledge under terms such as ‘traditional ecological knowledge’ (Berkes, 1999; Berkes, Colding, & Folke, 2000; Huntington, 2000) and ‘traditional environmental knowledge’ (Hunn, Johnson, Russell, & Thornton, 2003; Sherry & Myers, 2002). Specific knowledge about the environment and ecology by an Indigenous culture is often referred to as traditional ecological knowledge. For Berkes (1999), traditional ecological knowledge consists of:

a cumulative body of knowledge, practice, and belief, evolving by adaptive processes handed down through generations by cultural transmission, about the relationships of living beings (including humans) with one another and with their environment. (p. 8)

A core criticism, however, of these terms is that the attachment of the word ‘traditional’ can potentially fail to consider knowledge as fluid and ever-changing (Hunn et al., 2003). While knowledge has been produced and established through generations, it is our contention that it is continually being changed, added to and reconstituted. For this reason, we refer to such knowledge, which has been passed down through generations and continues to be built upon, as ‘local knowledge’ and will be used throughout this article.

This article provides an analysis of the role of local knowledge in providing details of seasonal and other environmental indicators. This knowledge is provided by elders in one community in the Torres Strait–Erub Island, located in the eastern group of islands in the region. As argued in a United Nations Environment Programme (UNEP, 1999) report on cultural and spiritual values of biodiversity, using local knowledge:

embraces information about location, movements and other factors explaining spatial patterns and timing in the ecosystem, including sequence of events, cycles and trends. Direct links with the land are fundamental, and obligations to maintain those connections form the core of individual and group identity. (p. 5)

This quote resonates with the local knowledge that is present in communities throughout the Torres Strait. This article seeks to provide an avenue for knowledge about seasons, and land and sea country to be transferred to the younger generation on Erub Island. Connections between environment and culture are key to identity and sustainability for Torres Strait Islanders. McNiven (2003) argued that central to Torres Strait Islander identity is a deep spiritual connection to the sea. Thus, this project goes some way in ensuring that knowledge about and indicators of seasons and climate are documented, safeguarded and transferred.

Climate Change

Climate change is projected to impact on the Torres Strait region in various ways (Green, Jackson, & Morrison, 2009). The growing concern over the exposure of the region and its communities to the impacts of climate change has been grounded in modeling studies and through the lived experiences of islanders themselves. Despite an uncertainty of magnitudes, climate change in the region is expected to result in the following alterations: increased temperatures; rising sea levels; increased ocean acidification; variations and changes in rainfall; and greater cyclone intensity (Green et al., 2009).

A number of climate change impacts have been projected and recorded in the scientific literature, and this is important for future adaptation planning (see Duce, Parnell, Smithers, & McNamara, 2010; Green, Alexander, et al., 2010). For instance, knowledge about future precipitation levels and hence the availability of fresh drinking water is important for Torres Strait communities. Based on modelling conducted by the Sharing Knowledge Project (Commonwealth Scientific and Industrial Research Organisation [CSIRO], 2007), it is projected that by 2070, wet season rainfall will be 0.8% to 13.2% higher (than 1990 levels) and dry season rainfall will be 3.9% to 23.1% lower (than 1990 levels). It is therefore expected that greater climate variability will be more pronounced between seasons (Duce et al., 2010).

Coupled with the recent acknowledgement by the Intergovernmental Panel on Climate Change on the value of ‘traditional’ knowledge, there is also a growing body of literature that is utilising this knowledge to better understand local climate change impacts and help develop adaptation initiatives (see Green & Raygorodetsky, 2010; Macchi, 2008; McNamara & Westoby, 2011a; Nuttall, 2001; Salick & Ross, 2009). Based on previous studies, accessing another knowledge system has demonstrated that Torres Strait communities have experienced an increase in inundation events, less predictable winds and currents, loss of cultural sites and reduced fresh water supplies (see Green, Alexander, et al., 2010; Green, Billy, & Tapim, 2010; McNamara & Westoby, 2011b; McNamara, Westoby, Parnell, 2010). This project therefore builds on the docu-

mentation of how communities themselves have experienced these changes and impacts. These experiences can be from the past and as such are recorded in the local knowledge systems of Indigenous communities, or from the present. This brief analysis is based on the results of in-depth interviews with elders on Erub Island.

Study Site

The Torres Strait region is located between the tip of Cape York on mainland Australia and the southern coastline of Papua New Guinea. Diverse traditions and histories constitute the Torres Strait region, which contains over 100 islands spreading beyond 48,000km². In 2009, there were approximately 7,105 Torres Strait Islanders living across 16 different islands (Human Rights and Equal Opportunity Commission, 2009) and over 33,000 Torres Strait Islanders living in mainland Australia (Australian Bureau of Statistics, 2006).

Erub Island is located in the eastern group of islands in the Torres Strait region (see Figure 1). It covers 570 hectares and was formed by volcanic action (CONICS, 2010). As a result of its volcanic origins and topography, Erub Island is considered a ‘high’ island when compared with other low-lying islands of the Torres Strait. Despite Erub Islands’ basaltic slopes and topography, considerable

villages and houses, cultural sites, and community, infrastructure lie on the low-lying coastal fringe (Australian Government, 2009b). Erub Island locals predominately live along this coastal fringe, which is made up of rocky headlands and small beaches. Consequently, the majority of Erub Islanders experience significant coastal erosion and the impacts of high tides. It is estimated that 400 people live on Erub Island, predominately in seven of the eight villages along the south and south-west coast. Only a small number of locals still speak the traditional language on the island, Meriam Mer, while Torres Strait Creole and English are the most widely-spoken community languages (Australian Bureau of Statistics, 2006; Torres Strait Regional Authority, 2011). While some knowledge of it is desirable, younger Erub Islanders do not appear to readily speak Meriam Mer, yet it is a compulsory school subject (as part of ‘cultural studies’) at the local school.

Research Approach

This research project sought to document, collate, analyse and assemble local knowledge from elders into a seasonal calendar specifically for Erub Island. Secondary materials were used to see if the knowledge recorded had been replicated elsewhere, and if so, these materials were utilised to verify elder accounts. This secondary literature included ‘The Stars of Tagai’ (see Haddon, 1901; Lawrie, 1970; Sharp, 1993), Edwards (2000) and Queensland Government (2009). The information from the seasonal calendar was simplified and transposed into a large-scale mural for the local primary school, described in further detail below. This research and article has also drawn on other work conducted on seasonal calendars, particularly in Indigenous communities (see Green, Billy & Tapim, 2010; O’Connor & Prober, 2010; Australian Government, 2009a, 2010; Australian Broadcasting Corporation, 2003).

‘Participatory’ Research

This first section describes why and how this project used ‘participatory’ research principles and the subsequent section will detail the ‘action’ components of this research. Pain (2004, p. 652) asserted that participatory research is ‘undertaken collaboratively with and for the individuals, groups or communities who are its subject’. Emphasis is placed on the participants themselves in adopting such an approach, whereby they are engaged in as many stages of the research as possible. Such an emphasis on the participants provides a framework for them to provide detailed and on-going accounts of their experiences, views and knowledge (Chambers, 1994; Mercer, Kelman, Lloyd, & Suchet-Pearson, 2008; Pain & Francis, 2003).

There are many advantages to adopting a participatory research approach. First, participatory research provides an avenue for collaborative research experiences and shared ownership over research projects (Mercer et al., 2008; Pain, 2004). For Kesby, Kindon, and Pain (2005, p.



FIGURE 1
The Torres Strait region, showing the location of Erub Island (McNamara, Smithers, Westoby, & Parnell, 2011).

164), using participatory research approaches can enhance data validity because ‘the methods and questions are appropriate, meaningful and relevant to those who will use and address them’. Knowledge, experiences and information can flow in both directions, between the researcher and participants, producing greater depth of understanding (Klocker, 2008). For Pain (2004), participatory research improves the research and benefits the participants by providing an avenue for their opinions and knowledge to be voiced freely in their own way and on their own terms. This process can facilitate both short and long-term change. For decades, community-led participatory research has been the basis for working on Indigenous issues (Howitt, Havnen, & Veland, 2011; Sherwood, 2010; Louis, 2007). This was to ensure that Indigenous communities were and continue to be actively engaged in the research process, including the delivery of outcomes (see Russell-Smith, 2009; Langton, 1998). Participatory research therefore provides the opportunity for the researcher and ‘researched’ to move towards cross-learning and the mutual sharing of knowledge and experiences (Petheram, Zander, Campbell, High, & Stacey, 2010; Suchet-Pearson & Howitt, 2006).

Participation in the research process varies and may be described as a continuum of nonparticipative to participative practices, based on the relationship between researchers and participants, as presented in Table 1. The methodological approach for this project adopted a ‘cooperation’ type of participation — in the centre of the continuum. Much effort was provided to ensure that participants were engaged in as many stages of the research project as possible, including data collection, interpretation and analysis, the compilation of results, and importantly, how this data should be utilised. However, the aims of this project were already predetermined by consultations between the funding body (Australian Government’s Marine and Tropical Sciences Research Facility) and key stakeholders such as the Torres Strait Regional Authority. As such, the project brief and key aims were set prior to the commencement of fieldwork. Consequently, it was not possible to include participants in these initial project planning stages; yet, all efforts were made to ensure that participants were involved in all remaining project components. A key concern for this project was the relationship between the researchers and participants. The following section will provide more details on the ‘action’ component of this project, a part of which was not in the original project brief but desired by key stakeholders in the community that is, the development of a mural, based on the seasonal calendar.

The methods employed, guided by a participatory action approach, build on the contribution that researchers have made in utilising seasonal calendars as a learning tool for both researchers and the community at large (Chambers, 1994; Green, Billy & Tapim, 2010;

TABLE 1

Continuum of the Relationship Between Researchers and Participants

Co-option	Leave it with me as I know what to do
Compliance	Work with me as I know how to help you
Consultation	Tell me what you think and I’ll analyse the information
Cooperation	What is important to you and I’ll provide input and suggestions
Co-learning	What does this mean for you and I’ll try and support you to change your situation
Collective Action	This project is community-led, so let me know if you need me

Source: Adapted from Klocker (2008, p. 33).

O’Connor & Prober, 2010). Seasonal calendars are particularly important in documenting issues relating to food security issues, agriculture, horticulture and health (Catholic Relief Services, 2004). In the development of a seasonal calendar for this research project, a number of methods and phases were employed. The methods adopted included in-depth interviews, panel review (by cultural advisors) and a visual design mural.

This article details the process and findings of one component of a larger project conducted on Erub Island, which focused on local knowledge, seasons and climate change adaptation. The outcomes of the other project components can be found elsewhere (see McNamara & Westoby 2011a; 2011b; McNamara et al., 2010). The overall project involved in-depth interviews with elders, Aunties and young Islanders ($n = 17$) and were conducted by one author (Karen McNamara). While an interview guide was developed, the interviews evolved into a more storytelling format, whereby the elders, aunties and young islanders described their memories, experiences and knowledge (Pile, 1992; Winchester, 2005). The interviews were thus more unstructured and open-ended in character, rendering them more conversation like (May, 1993; Minichiello, Aroni, Timewell, & Alexander, 1995; Rice & Ezzy, 1999).

Given the extensive amount of time required to gather this specific knowledge about seasons and environmental indicators, only three elders, representing particular clans on Erub Island, were specifically interviewed about this. These elders were recommended to the project leader by the community liaison officers with the Torres Strait Regional Authority, and also the Erub Island community forum committee. These three in-depth interviews were conducted by the research assistant for this project (Jonathan Sibtain), who gathered information on: the wet and dry seasons; trends in plant and sea life; fishing movements; planting and cropping times; bird nesting and migration patterns; movement of Tagai; seasons and wind patterns; and other environmental or landscape indicators. These interviews were conducted during fieldwork in November 2009. These three elders were also interviewed as part of the larger project as described above, and thus this interview material collected in November 2009 and May 2010 on experiences of climate change impacts and

adaptation will also be shared throughout this article to provide a greater understanding and context of local knowledge and climate change. A fourth elder was also included in this component of the project to review the seasonal calendar in May 2010. This review was conducted along with one of the original interviewees, the two of them making up the cultural advisors, further explained in the methodology below. Interviews with the three elders ranged from 30 to 100 minutes. One interview with an elder was completed 'on country' to demonstrate how they 'read' their landscape and environmental indicators. Two of the three interviews were digitally recorded. Prior to the interviews, all participants were asked for consent to use the digital recorder (see Dunn, 2005). Interviewees were also made aware that the recording could be paused or stopped at any stage of the interview, which could also be discontinued at any stage.

'Action' Research: The Development of the Calendar and Mural

This section details how this research project delivered a tangible 'action': a seasonal calendar (to be used as a teaching tool) and mural of the calendar at the local school. Two cultural advisors for the Darnley Island Arts Centre were asked to review and provide feedback on the material collected in the earlier research trips. Two elders from two of the four clans on the island made up these advisors (one of which was also an interviewee in November 2009). The feedback provided by these two elders was invaluable and included necessary changes and information to ensure the local knowledge assembled for the calendar was appropriate and accurate. This research project became more 'action' oriented through the desires of the elders involved and the school principal and teachers. Ongoing discussions throughout the project were had with all these stakeholders about how the seasonal calendar could be a useful teaching tool, and these stakeholders developed the idea of the mural as a way of actively involving the students. As emphasised by one elder: 'This knowledge needs to be taken to the school: the parents need to bring in the children to see their environment and they respect and learn laws, what traditional law connects to it' (personal communication, 2009). Incorporating the ideas of these stakeholders into the project was critical to considering and addressing the question posed by Jones et al. (2008): 'Why should Torres Strait Islanders support and participate in research if they do not see clear benefits in doing so?' (p. 2351). The development of the calendar and mural provided a clear pathway whereby both the researchers and participants could work cooperatively to produce tangible learning outcomes.

A field trip to Erub Island in May 2010 involved further consolidation of the seasonal calendar material and final product. Following this, the trip also involved the installation of the mural onto one of the outside school walls. The mural was 2.5 metres in diameter made from marine ply

wood. With the assistance of the local school and Arts Centre on Erub Island, the school children were involved in assembling the mural. All of the Island's clan totems were cut out of craft wood (by John McNamara) to be later fastened to the mural. Every student at the school painted one of these four totem animals — tern, booby, frigate bird or parrot fish — or a green turtle (a subtotem

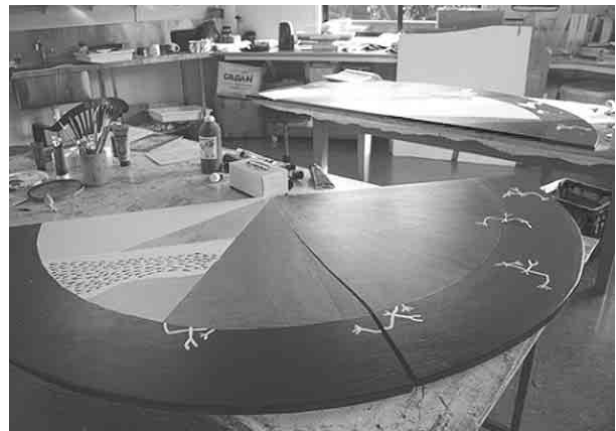


FIGURE 2

Plates 1, 2 and 3 are images of the development of the mural and the final mural (Photos: Emma Davidson).

for all of the four clans on the island; see Figure 2: Plates 1, 2 and 3, which document the creation of the mural). Following the completion of the mural, Tagai College (the local primary school on Erub Island) planned to turn this local knowledge of seasons and environmental changes and indicators into formal lesson plans.

Knowledge of Climate and Seasons: Document, Safeguard and Share

This section details how these three elders each described in interviews their knowledge of climate and seasons. To illustrate how the elders described their seasons, and land and sea country, we have provided the following quotes from these in-depth interviews. One elder described the weather, and how it has been changing over the last few decades:

The weather pattern, the weather change again. When I was a young boy, the weather was like this; wind, the tide and the rain, but since 1960 or '61 it started to change ... That weather been changed. The tide also, in that time, southeast wind will get high tide during the night time. (personal communication, 2010)

This elder discussed the changes to weather patterns, but also his observations of specific changes such as higher tides and declining coral reef health. Another elder mentioned climate change and how seasons have been shifting:

Whereas previous generation hardly seen change because of no greenhouse effect. The water was nice and clean and air ... So we knew now that scientists are definitely telling the truth there's a rise in the sea level, because we see the changes. (personal communication, 2009)

For this elder, rising sea levels was a key change that he has witnessed on Erub Island. It was also a core concern for the entire community, given the extensive housing settlements and infrastructure located in the low coastal fringe.

In terms of recognising indicators in the landscape, the key example given by the elders interviewed concerned the changing of seasons. Elders spoke of various indicators to illustrate the beginning of the monsoon, including: bird migration patterns; logs floating down from Papua New Guinea in the ocean; emergence of small clouds; sorbi and mango ripening; shifts in tides; and changes in the night sky. One elder described the role of the frigate bird as an indicator of the start of the monsoon season on Erub Island:

They [frigate birds] on the monsoon time: yeah, monsoon, when we see them come low, we know monsoon come close, when they way up in the sky that's sager time. They always glide and there small one on top. Sager is the south-east. Then they fly way up in the sky, then when north-west time now they come low. We know north-westerly. (personal communication, 2009)

This elder emphasised the pivotal role of the frigate bird in indicating an important seasonal shift for Erub Island.

The start of the monsoon brings with it a number of flow-on impacts including a greater frequency and intensity of rainfall and extreme weather events.

In another interview, an elder explained how he knows when the north-west or monsoon season (Koki) begins:

When you see the Maidu [a type of tree] go sailing passed here non-stop, that's when the tide is flowing out of the Fly [River], empties into the Torres Strait because they [Papua New Guinea] get the north-west first. (personal communication, 2009)

The importance of Papua New Guinea's role as an indicator of the forthcoming north-west season is further illustrated by this elder:

You can see the lid lid [small clouds] they sprang out of the horizon, and they disappeared, the lid lid they're linin' up [elder sings in Miriam Mer] a bit of lightning, you can listen the rumbling from Daudai, New Guinea men land. It's all happening. (personal communication, 2009)

This elder, during the interview, sang a traditional song in Miriam Mer, which functions as a 'seasonal map' of the impending north-west season:

Well it [the song] tells you about the beginning of north-west, you know the things that started to come into play, the clouds the wind and the thunder, they all usher in the new north-west. The big tides during the lull, the mango is ripening, the sorbi is ripening, they're all the signs that the north-west is coming. (personal communication, 2009)

A variety of indicators are used, according to this elder, to recognise the changing of seasons such as clouds, wind and ripening fruits. The importance of the astral and marine activity as indicators of seasonal change was also emphasised by this elder:

When they start to get the little rollers on the beach, its flat calm, and they watch the stars, when the top stars, they twinkle more quickly, when the others more slowly it tells you something. Anyway he read all the signs and said it's gonna blow shortly, and then they start to get the rollers ... Biru Biru is the one that flies out. They [booby] are signs of the north-west. (personal communication, 2009)

This elder drew on a variety of seasonal indicators in the landscape, which can be used for instance to understand when to plant, fish, crop, or prepare for the wet season.

These elders also provided detailed descriptions of bird migratory patterns and the mating season of turtles. One elder provided the following description of the 'weather bird':

When we seen sorts of birds come up here, coming in a group or something, we know the change of the weather, you see them birds come out here. They fly right up in the air there, right up. We know that's good weather right up there but, if they're down here lower, you know there's strong wind: they sort of weather bird. (personal communication, 2010)

In terms of other fauna-based indicators, this elder described the time for turtle mating and the best times, according to this mating, to hunt:

Turtle the same as everything. Turtle doesn't come any time. They got season for it, when it gets toward Naiger, that's the time for turtle for mating. Before the mating season we always go for the male one. They got more fat and more meat, better. After mating or time of mating they after them female ones ... Out in the seas like a butcher to use, we got fish, turtle, dugong and crayfish and then we go up in the garden and get all other stuff. That's how our life been, we live from the sea and from the land, you know. (personal communication, 2010)

This elder has illustrated how he 'reads' his sea country for signs, which indicate for instance when he should go out turtle hunting. This knowledge remains significant for Erub Islanders as subsistence fishing and hunting for both use and exchange is an important activity for the community. The flight patterns of birds also provides a key indicator for changing weather conditions.

Of further interest has been the ways in which knowledge about seasons has been both stored and transmitted through other forms of oral tradition, most notably in song. While on Erub Island in November 2009, we came across a book in the local library on *Songs from Darnley*

Island (Edwards, 2000). From this book of songs, the majority of which are written and sung in traditional language (Meriam Mer), a number were about changing weather patterns and seasonal shifts. One of these songs was called 'Metalug Nole Wagkak', meaning 'Calm Weather, Then South-Westerly Winds'. The song referred to the end of the wet season, and indicated that at this time the wind drops and sea becomes calm. With little rain also during this season, the grass becomes dry and fires emerge. With the rain and wind playing an important part in how and where islanders live and make a living, along with song and dance, it is no surprise there are songs from Erub Island denoting changing seasons. Another song was about the rain and wind, titled: 'Irmer', meaning 'Rain and Koki Wind'. This song is concerned with the wet season and north-west wind. Both the wind and rain play a pivotal role in the sustainability and lives of Erub Islanders.

Following on from the three interviews, the information and knowledge of seasons and wind patterns, bird migration, plant and sea life and the Tagai star constellation was compiled into a table (based on the 12 months of the year). This information was then further compiled into the shape of the familiar 12-month western calendar. The elders requested this design given that it was to be

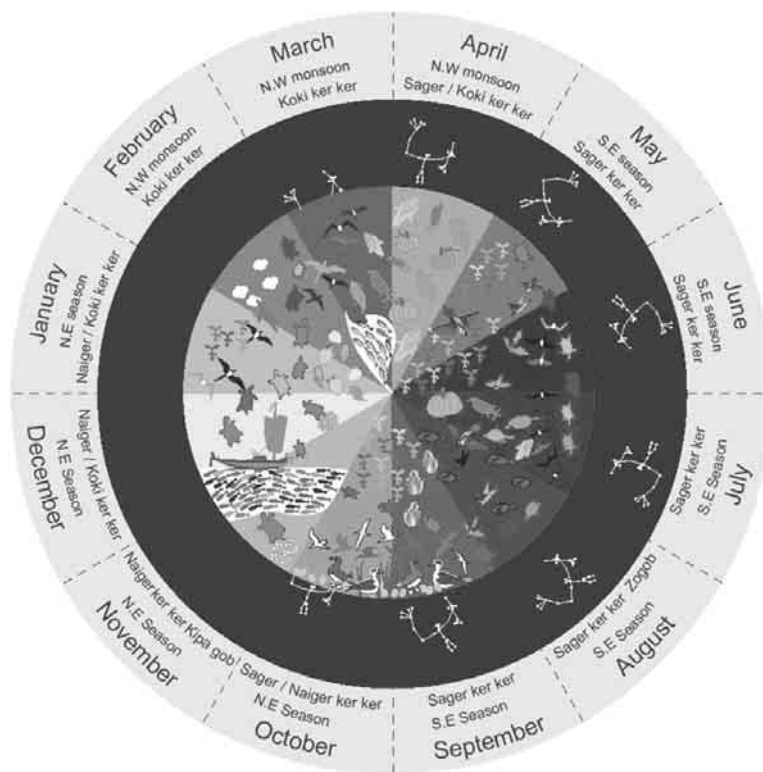


FIGURE 3

The final seasonal calendar for Erub Island (compiled by Emma Davidson). The outer circle indicates the time of year, the middle circle shows the movement of Tagai, and the inner circle summarises some key seasonal indicators (such as clouds, bird nesting and migratory patterns, turtle nesting, and when to plant crops and fish for certain species).

used as a teaching tool in the school and the students followed the 12-month calendar. While the final seasonal calendar indicates the 12 months as the major time intervals, the researchers made particular effort to work with time intervals that elders most recognised. Figure 3 provides a detailed illustration of the final seasonal calendar that will be used in the classrooms as a teaching tool.

Conclusion

This project set out to document and synthesis elders' knowledge concerning seasons and environmental indicators on Erub Island in the Torres Strait. This knowledge was gathered through a number of in-depth, unstructured interviews with elders on Erub Island during November 2009 and May 2010. The knowledge collected ranged from information about wind directions, wet and dry seasons, patterns in bird migration and nesting, and plant and cropping cycles. Moreover, knowledge about the islands major totems, and other plant and animal species that are seasonal indicators have also been important inclusions in the final seasonal calendar, as their inclusion provides a more holistic understanding about Islander knowledge of their environment. All of this collected knowledge, as explained in detail throughout the article, was then transcribed, collated and synthesised into tables, with the final product of a seasonal calendar and major school mural.

Similarly, another key objective of this project, along with documenting and synthesising this knowledge, was to provide another avenue for knowledge transfer to the younger generation on Erub Island. The purpose of this was to generate further interest and enthusiasm among the younger generation for 'reading' landscapes and identifying indicators for seasonal change. The involvement of the school principal, teachers and students was paramount to the success of this. With such support and involvement, the seasonal calendar will now be used as a component of the school teaching curriculum. Further, the production of the calendar into a large-scale mural on the school wall was also successful. Each student in the school painted a turtle, bird or fish onto craft wood, which was then mounted onto the mural. The benefits of this were twofold. First, it provided another way for students to learn about the importance of these species: in the broader landscape; as environmental indicators; and as integral parts of ecosystem functioning. Second, it is likely that this hands-on participation has provided another way for students to access the knowledge that is held by the community elders.

This article has provided insights into *how* the research for this project was conducted. This project adopted principles from the literature on participatory action research (Kesby et al., 2005; Pain, 2004). These principles guided the development and implementation of this project, which allowed for greater involvement, uptake and learning to occur. The extent to which the knowledge and capacities of participants are extended is a critical measure of the success

of a participatory action research project (Kindon, 2005). This research has illustrated the usefulness of adopting such an approach to ensure that partnerships and sharing can occur and future projects, especially those on focused on education activities, could draw upon.

It is hoped that this project (and its documentation in this article) makes one small contribution towards deepening our understanding of the interconnectedness between Torres Strait Islander livelihoods, culture and their local environment. The long tradition of Islanders to 'read', understand and listen to landscape changes reflects their close relationship with their island, land and sea country. This local knowledge value-adds to our understanding of the impacts of climate change at the local level. As such, the intergenerational transfer of this knowledge and ways of 'reading' landscapes is critical to further understanding the impacts of climate change and appropriate adaptations. The collation and sharing of this knowledge with the younger generation provides another avenue by which knowledge about seasons, landscapes and environmental indicators, specific to Erub Island, can remain useful and alive.

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About the Authors

Karen Elizabeth McNamara is a human geographer who gained a Bachelor of Environmental Science (Hons I) and a PhD from the University of New South Wales (UNSW). Karen has worked as a Lecturer at UNSW and Research Fellow at James Cook University and the University of the South Pacific. Karen's research interests include displacement from environmental change, climate change adaptation, social implications of environmental change, sustainable livelihoods and participatory action research methodologies.

John Patrick McNamara is a retired public servant, who spent 40 years working in various outdoor roles at the Liverpool Plains Shire Council in Quirindi, New South Wales. John is a trained mechanic and works overseas. While now retired, John still loves the outdoors — in the garden, working on the hobby farm, fishing and travelling. John volunteered his time and energy on this project in the Torres Strait.