Collaborative conservation on Ulithi Atoll, Federated States of Micronesia: Indigenous* leadership supported by Western* science promotes effective, adaptive stewardship

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Abstract

Ulithi Atoll is a remote set of outer islands of Yap State, Federated States of Micronesia. Ulithian people have a unique set of traditional management practices which, while fundamentally intact, are experiencing change. Recent declines in fish and reef health have prompted Ulithians to seek support, in particular to better understand drivers of change to their reefs. Some traditional management has been weakened, and modernisation and imports are bringing in new ways of life that are resulting in changes in fishing as well as the youth becoming less engaged in traditional practices. This case study highlights a collaboration (the 'we' herein) where Indigenous communities lead efforts to revitalise traditional management, while incorporating new approaches based on data and observations from a Western science team working with them. There is also a significant effort to engage youth and develop their leadership. This approach results in locally designed solutions that support cultural, social and biological integrity, and has resulted in remarkable resource and community resilience – highlighting the need to put conservation and management under local leadership.

Key words: Marine conservation; social-ecological systems; conservation equity; traditional knowledge systems; customary resource governance

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Introduction

This case study focuses on a unique collaboration between Western scientists and Pacific Island practitioners in the Yap Outer Islands (Federated States of Micronesia). It highlights a tightly linked social-ecological system, and the importance of local leadership in identifying and solving environmental challenges. The critical contribution of Indigenous peoples to conservation through their legacy of stewardship has gained recognition in the past two decades, but there is much work to

* '**Indigenous**', when used to describe outer islanders, refers to first peoples on these islands, who still maintain control over governance. '**Western science**' refers to knowledge brought by a primarily US- and European-based science team.

do to fully engage them and centre their knowledge in management planning efforts, including driving the planning itself (Apgar et al., 2011; Garnett et al., 2018). What may be overlooked in the efforts to involve Indigenous people in Western-driven conservation planning, however, is what that concept means to them. Conservation as described in literature is primarily a Western construct. For many Indigenous people, including Yap Outer Island people, their environment is not something separate that warrants protection. Rather, it is interwoven into their social relationships, stories and their sense of well-being (Cinner et al., 2009; Crane et al., 2018a; Lessa, 1966).

A changing social-ecological dynamic

Ecological and human social systems are undergoing rapid change globally, which has unique consequences for subsistence resource users who depend on wild resources for a variety of needs, including food, shelter, tools and customary trade. As the linkages that bind the social and ecological systems come under stress and weaken, both start to suffer (Mistry & Birardi, 2016; Sterling et al., 2017a).

Nowhere is the situation more apparent than places where coral reefs are found. Most are located in tropical and subtropical regions, where more than 75% of all people living within 100 km of coral reefs are in the 'poorest' developing countries (note that labels of poverty are not necessarily shared by the people labelled as such), and most live outside of urban areas with a high dependency on reef resources (Cinner et al., 2016). In many Pacific islands, people have a long history of successful traditional stewardship (von der Porten et al., 2019; One People One Reef, 2020). Patterns in coral reef characteristics can be linked to human use, even when the populations are small and the use is predominantly subsistence (Crane et al., 2017a; Houk et al., 2011). Despite signatures of use, there are examples of coral reefs that are healthier than 'expected', given widespread global decline, and those reefs are associated with specific social and governance conditions, including the presence of taboos/tenure (traditional management), community engagement and dependence on the resources derived from the reefs (Cinner et al., 2016; Kittinger et al., 2012). Yet there is a persistence of Western-driven conservation agendas in these regions, some leading to social-ecological disruption and unintended consequences highlighting conservation inequities.

In light of rapid change, there is a need to strengthen the effective Indigenous systems of environmental governance, while also recognising more contemporary external influences in the form of, for example, new fishing methods, motorboats instead of sailing vessels, freezers to store fish, and others. In some instances, a solution is for the collective conservation community to move forward in new collaborative ways, weaving knowledge of these contemporary factors and their impacts into traditional systems, and adapting with modified management frameworks. However, a key to the success of this capacity building is to be intentional about 'who' is leading and 'who' has agency in planning and implementation. In fact, much of the dialogue about Indigenous knowledge centres around incorporating such knowledge into Western management practices. One example is the global focus on marine protected areas, incorporating selected pieces of local knowledge and practice through community engagement (Andradi-Brown et al., 2023). The converse to this approach, and far more likely to be successful in traditional settings, is to find ways to weave Western

science and management into traditional frameworks. An example would be to identify successful local governance and management practices, and provide local practitioners with information about fishing pressure, including non-traditional methods, so they may incorporate that into their existing management (Crane et al., 2017b; Crane & Rulmal, 2014).

The Federated States of Micronesia (FSM) are recognised as part of the globally important Polynesia–Micronesia biodiversity hotspot (Federated States of Micronesia, 2019; Yap BSAP, 2018). Coral reefs are a defining feature of Micronesia, with Yap state containing over 259,000 km² of ocean and only about 129 km² of land mass (FSM Legislature, 2021). According to the International Union for Conservation of Nature (IUCN), 427 species of coral are listed in the FSM's waters, 100 of which are considered to be vulnerable and three endangered (Allen, 2007; FSM Legislature, 2021; Yap BSAP Committee, 2018). Yap state has been determined to have 32 areas of special biodiversity significance, with some of those specific to Ulithi Atoll (Allen, 2007). Data from surveys have shown that a high percentage of FSMs reefs – close to 50% – are considered 'effectively conserved', but that fishing pressure is a primary determinant of reef condition (Crane et al., 2018b). Securing and enhancing traditional knowledge has also been identified as a priority for the region (Yap BSAP Committee, 2018). Combining the ecological and traditional knowledge treasures of this region speaks to the importance of conserving both. Elucidating the strong social-ecological connections and underscoring the importance of those connections to effective stewardship in the region is an important story to elevate globally.

Ulithi Atoll: people and environment

Due to its remoteness, Ulithi Atoll has been an isolated social-ecological system in the West Pacific Ocean, and remains very traditional today, although not without its own colonial legacy and resultant pressures (Lessa, 1966; Lessa & Myers, 1962; Mitchell, 1983). Ulithi consists of a ring of about 40 small, low-lying islands, scattered along a coral reef that encloses a large lagoon (Figure 4.1). Although the total combined area of Ulithi's islands is only 4.5 km², the central lagoon they surround has an area of about 548 km² making Ulithi one of the largest atolls in the world. Inside the lagoon, water depth averages about 30 m but outside the reef drops steeply to depths of hundreds of metres.

There are four inhabited islands: Falalop (population 700); Mogmog (population 80); Asor (population 35); and Federai (population 120). The Indigenous Ulithians are linguistically and culturally related to the Caroline Islands (Crane et al., 2018a). They have a strong sense of cultural identity and differ significantly from the communities on the main island of Yap. Marine resources from the reefs provide the most reliable food security and reefs are the main source for protein, thus managing these resources is critical (Rulmal et al., 2019; One People One Reef, 2020). Contemporary reef surveys of the area indicate that the Ulithi Atoll reef resources were sufficiently abundant and well managed to support subsistence use for likely over 2,000 years, although recent declines in fish and coral health have raised concerns within the communities (Crane et al., 2017a).

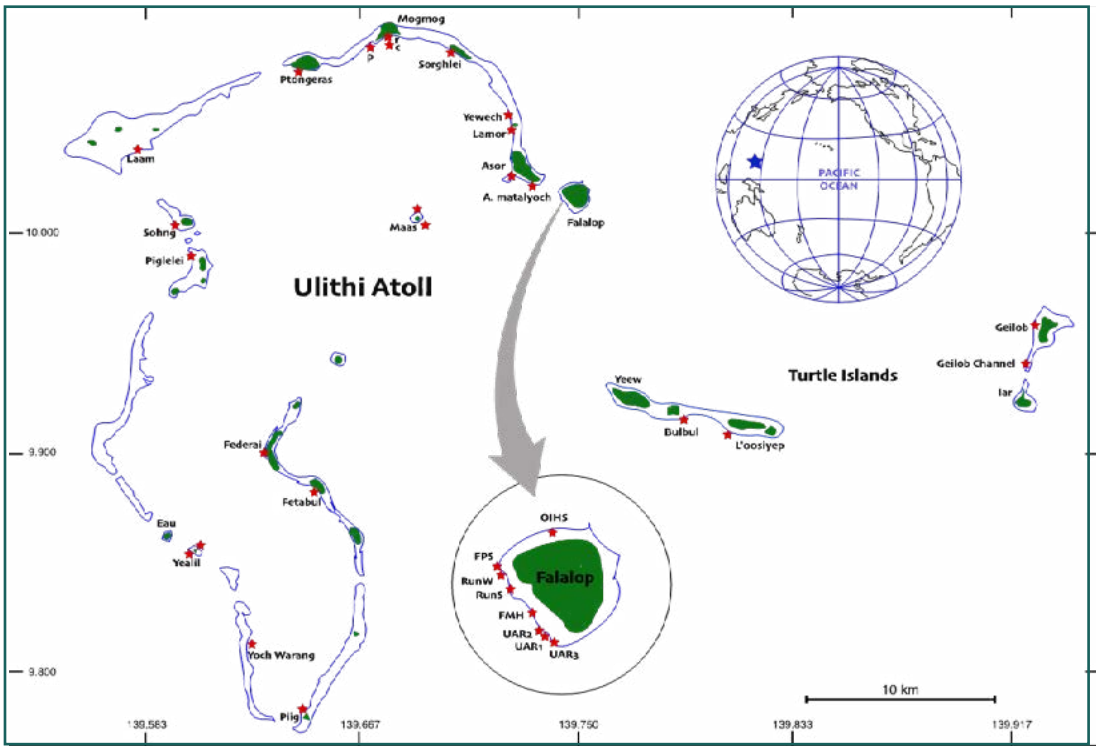

Figure 4.1
One People One Reef OPOR study site locations (coloured stars) at Ulithi Atoll and neighbouring Turtle Islands

Source: Crane et al. (2017a)

Today, each of the four inhabited islands has a medical dispensary, a nurse practitioner and a school from kindergarten to 8th grade, and the island of Falalop has a high school (one of two in the Yap Outer Islands). One doctor is available for the four islands. Transportation is limited, and so is access to imports, due to the limited frequency of a government supply ship which arrives every two to six months and, to a lesser extent, via more reliable twice-weekly flights between Falalop and Yap (also serving as medevac when needed). Small skiffs are used to travel between the four inhabited islands, and provide a means of resource distribution within the atoll (Crane et al., 2017a; One People One Reef, 2020).

There are several threats to the social-ecological well-being of the people of Ulithi. The changing ways of life, with more influence of money and Western goods and systems (including religious beliefs), are causing social change that is in turn changing resource use and management. Reef declines and dwindling fish populations raise concerns over food security, as well as reef health and integrity. Invasive species, such as rats and monitor lizards, contribute to gardens being abandoned on certain islands, such as Loosiap, and lower productivity on others. Sea-level rise associated with global climate change has also had a major impact on the very low-lying atoll islands. Rising sea water has displaced and contaminated much of the thin freshwater lens normally found just beneath the surface of the sandy soil, making it more difficult to obtain fresh drinking water and to grow staple crops such as taro. Sea-level rise has also resulted in alarming rates of shoreline erosion of these already spatially limited islands, in some cases leading to downed trees that subsequently abrade and damage reefs as they move with the waves. Because people rely on rainwater as the main freshwater source, droughts that happen periodically in March and April can be a serious threat, highlighting the need for secure water catchment. Finally, isolation caused by pandemics and storm severity can leave communities vulnerable, as they have become more dependent on imported fuel for their boats, and eating rice as an alternative to local food (Yap BSAP Committee, 2018).

A case for equitable collaboration: One People One Reef

The challenges and opportunities that communities of Ulithi face underline the importance of combining knowledge systems to solve complex problems, while ensuring local leadership in planning. Here, we present a unique collaboration between the people of the Yap Outer Islands (with a regional focus on Ulithi Atoll, FSM) and Western scientists in coral reef stewardship: One People One Reef (OPOR), or *Hofagie Laamle* (which translates roughly as 'unite this Atoll'). This collaboration intertwines traditional management with Western science to identify issues and set a foundation for locally driven solutions for sustainable coral reefs (Crane et al., 2017a; 2018b).

OPOR scientists were invited to Ulithi by the community in 2010 to help address the decline in marine resources. This came about as a result of a successful collaboration between Western scientists and the communities of Ulithi around sea turtle management. The OPOR programme grew from a mutual desire to learn from each other: scientists and community members came together to solve resource decline issues and learn more about the drivers of those declines. The Western science team learned about traditional management, changes in management, fishing techniques, and ecological trends. This greatly informed the interpretation of the ecological data and helped frame the appropriate ecological questions to ask to best assist communities. The communities sought knowledge related to reef ecology, management, impacts of fishing and effects of climate change. They were interested in their traditional management, how to enhance it, and how it could be assessed for efficacy. The science team was also able to support community outreach, science communications and learning among the youth. The people of Ulithi developed all subsequent management plans, which were founded on their traditional systems.

On Ulithi Atoll, reefs and fish assemblages cluster into general categories that are broadly related to proximity to villages, as well as physical factors (lagoonal vs. oceanic). Reefs that are exposed to open ocean and farthest from villages have the highest diversity and biomass of fish, and the most diverse coral cover (Crane et al., 2017a). By approaching the analysis of the reefs from a food security and resource perspective, as well as a social and cultural change perspective, OPOR has been able to identify some key drivers of change to the reefs. Aside from environmental drivers, such as those associated with climate change, these include a breakdown and weakening of traditional management, the introduction of non-traditional fishing methods including spearfishing, and the impacts of changed transportation (motorised vessels).

In the Outer Islands, high dependency on reefs, along with adherence to traditional management, leads to healthier reef systems capable of providing more resources for the people (Crane et al., 2018b). Conversely, a breakdown of traditional management, along with changes in fishing technology, even while keeping within a non-commercial and subsistence only context, has lead to more degraded reefs (Cinner et al., 2016). A mutual recognition of these social drivers and their impacts on the marine ecosystem allowed our team to begin addressing them together.

While the people of the Outer Islands of Yap still rely primarily on traditional management, there are new forms of fishing, such as spear guns, that have created challenges that do not necessarily fit within traditional frameworks. It is also important to note that while a Western lens looks at environmental problems through management solutions, for the people of the Outer Islands, stewardship is deeply culturally embedded and is not often called out in specific regulatory frameworks. Many of the taboos and practices are social in nature, with a strong stewardship application. For example, reserving some fish, such as large groupers in some islands, for chiefs only is a social construct that protects large breeding fish that are easily overexploited (One People One Reef, 2020).

Thus, Western-directed management will not only have limited success in these islands, but could undermine successful traditional systems and interfere with the existing fabric of the social-ecological system. The goal therefore is to combine knowledge systems into a novel biocultural approach that is culturally contextualised, takes into consideration the impact of introduced methods of resource extraction and is locally conceived and led.

Fisheries biologist Dr Peter Nelson from One People One Reef discussing catch with the community and local science team

Photo: Courtesy of Scott Davis Images

Traditional practices and natural resource governance

In Yap, the traditional customary management systems are recognised in the State Constitution, integral to the State government management systems. The Constitution allows for autonomous governance by each community to plan and execute management decisions per their own needs, and traditional leaders and estate owners have legal authority to manage specific areas and resources.[1] The elders of the village

1 Yap Constitution, Article XIII, Section 5: "The State recognizes traditional rights and ownership of natural resources and areas within the marine space of the State, within and beyond 12 miles from island baselines. No action may be taken to impair these traditional rights and ownership, except the State Government may provide for the conservation and protection of natural resources within the marine space of the State within 12 miles from island baselines". Yap State constitutional provisions on Traditional Leaders and Traditions are found in Yap Constitution, Art. III. Statutory provisions on Traditional Leaders and Traditions are found in Title 5 of the Yap State Code.

and the various traditional estates have their distinct roles and responsibilities dictated by the estates they represent. Private property is assigned for someone by birth to use and steward over their lifetime (FSM Legislature, 2011; Lessa, 1966). Each village has an estate or designated person(s) who calls the village together for meetings; men, women, or jointly. During these meetings, community issues/grievances/ideas/work are presented and discussed. Decision is usually by consensus and the chiefs make final decisions and proclaim them. The proclamations are treated as edicts or mandates of the community's will and respected as such under the traditional structure of the society. Violators stand to face the community and whatever punishment or restitution the community imposes as part of mitigating a violation of the community's will or disrespect towards the community (Crane et al., 2018a; Lessa, 1966).

Coral reefs of the Outer Yap islands

Photo: Courtesy of Scott Davis Images

Marine resource management in these Outer Islands is culturally embedded and includes practices that are sometimes incompatible with what Western managers might consider 'effective' (such as allowing unlimited fishing at times). Most management can be classified as 'partial protection', although this may also include temporary total fishing bans (Andradi-Brown et al., 2023). Each inhabited island within Ulithi Atoll has a management jurisdiction per their customary system and action plans for their islands. The governance ensures that the reefs, on which the livelihood of the Outer Islanders depend, are owned and taken care of by their responsible owners and those resources provide for the people. Mogmog, considered the highest island in terms of ranking chiefs, has a paramount chief who oversees all the islands. They are responsible for looking after the people of Ulithi and the Outer Islands and are central to inter-island decision-making.

Reef governance and 'management' is complex in Ulithi. Often, an uninhabited island and its reefs are 'owned' and managed by different inhabited island clans. For example, an island might be owned by Mogmog, but Federai has jurisdiction over the reefs, while Mogmog maintains managerial oversight. Certain reefs may be owned and managed by specific families, and in some cases, the back reef, reef crest and

fore-reef are owned and managed by different families. The realms of nature, such as the sea, the land and the sky, have spirits and there are customary practices to please the spirits for bountifulness. These practices have been integral to sustainable management, but the intervention of foreigners occupying or influencing the islands have led to an erosion of many of these beliefs and related cultural practices that supported sustainable reefs.

A critical element to effective contemporary management of reef resources in these islands has been the resurrection and re-implementation of some traditional practices. Many of the practices being re-implemented have been 'co-validated' by Western science teams as being effective from a data-driven perspective (Crane et al., 2017b and 2018b; One People One Reef, 2020), and enhancing traditional livelihood sustainability (Crane & Rulmal, 2014). These practices, historically, were an important part of management and as they break down, the resources that people depend on begin to decline.

The following are examples of management, and changes, from interviews and discussions with people from the Yap Outer Islands.

> **Ownership and use rights**. All islands, including uninhabited ones, are owned by someone. Traditionally, fishers needed to ask the owner to access part of the reef. This limits use, but is changing.

Example: Taboos of Turtle Islands
Giil'ab and Yaaor are among the Turtle Islands which belong to two clans on Falalop and are off-limits to most people. To fish there (which is generally uncommon), there needs to be permission granted, and a way to get there. These challenges limit the take of fish from these reefs.

To address these changes and strengthen traditional governance, we are working together to 're-draw' jurisdictions, which involves inter and intra clan discussions. The youth are heavily involved, ensuring they understand the system.

> **Spatial restriction.** Reef closures allow fish populations to recover from fishing pressure. They are put in place due to a death, dwindling resources, traditional rotations or any reason the owner decides. A closure generally means closed for some, but not all, occasions (e.g. subsistence fishing by community members (community fishing) is almost always allowed on closed reefs). Based on some of the data our Western teams have collected and shared, communities are deciding to reinstate closures and restrictions based on the traditional system.

> **Selective types of fish and seafood**. Some are restricted to certain groups of people. Many of these practices are not in place anymore:

- Certain fish, including large groupers and large male parrotfish, and fish with scales wider than three fingers are (used to be) reserved for chiefs. This limit helped conserve large females that produce the most eggs, or the largest male (parrotfish) with the most reproductive capacity. This practice had clear conservation implications.

  - On many islands it was taboo for women and children to eat certain kinds of fish, while other fish were reserved for them. Some fishes were reserved for only men. This is still practiced on some islands, but the degree varies.

OPOR is working with the communities to better understand these practices and which ones have diminished. Through our storytelling work, we have tied conservation outcomes to these cultural practices, and shared those stories with the youth. This emphasizes the importance of practices and traditional stories as conservation actions/messages.

> **Restriction of types and season of fishing** declared by the Chiefs, although the degree varies by island. Some of these have changed.
  - Net fishing used to be only for the community, and still remains on some islands.
  - Only pole fishing was allowed during closed seasons.
  - Seasonal openings depended on people catching particular fish and bringing it to the chief.
  - Season for collecting turtle eggs used to be from April to early May. This is the beginning of the turtle egg laying period, and taking of eggs during this time has a smaller impact on turtle populations compared with other times, since many of the early eggs do not survive as they are dug up by other turtles coming to the beach. More recently, eggs are collected throughout the summer and at other times.

  Our collaborative data collection on fish diversity and biomass, reef health and connectivity has led to traditional spatial regulations being reinstated, as well as new regulations such as limiting spear fishing and gill/throw nets (neither are traditional forms of fishing).

> **Catches of fish are checked** when they are landed, allowing reef owners and chiefs to 'keep track' of the fish caught, and that helps inform management decisions. This practice has stopped on many islands, though it is being reinstated on some. Traditionally, the first fish went to Mogmog from any Ulithi island, except Falalop. It allowed oversight of resources by the paramount chief who could then bring up problems or declines observed.

  Data collected through our collaboration has led to the implementation of a fish catch landings database where fishers measure and record catch. While this is a Western protocol, it fits within this traditional practice of 'showing' the catch. All data are recorded, analysed, and shared back with the communities so they can make decisions based on the data.

A united community is central to the well-being and survival for the people of the Outer Islands. Their socio-cultural systems are based on interdependence. For example, after a typhoon, leaders exert their power to keep the community together and work together. People start to clean up, reconstruct houses and plant foods right away. People learn from the elders that everything grows after a typhoon. After the typhoon, per custom, all reefs, including restricted ones, are open to fishing to ensure

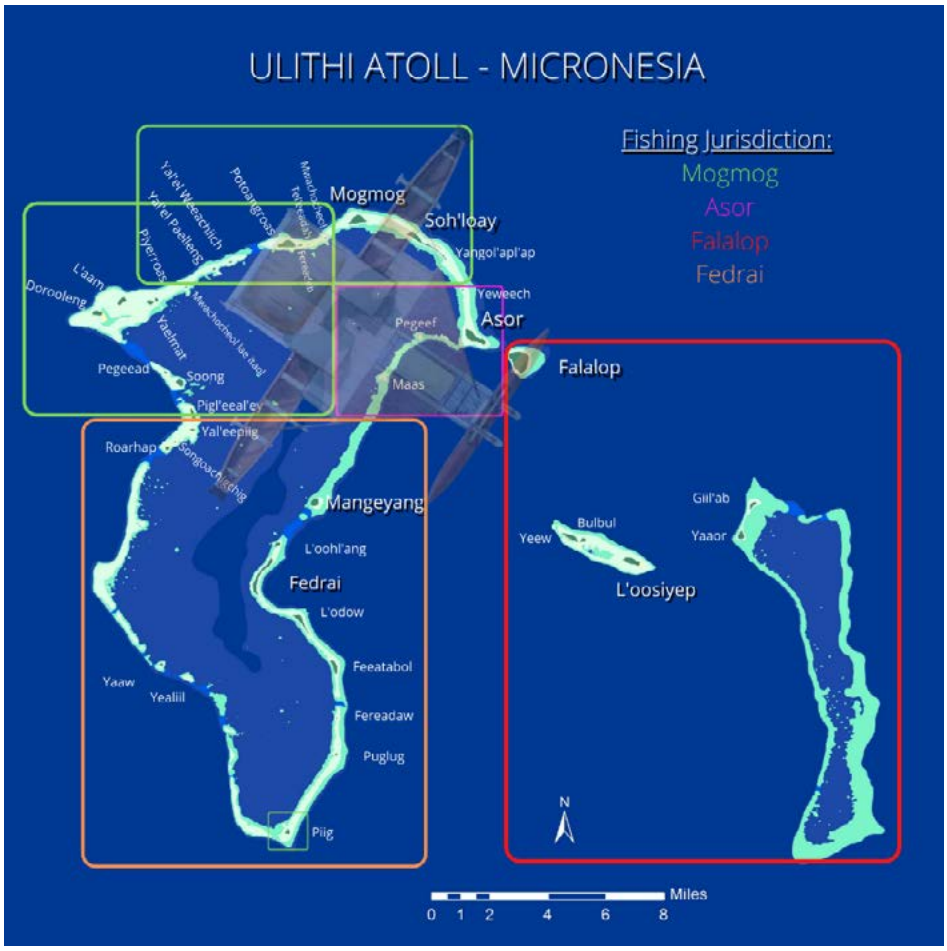

Figure 4.2
A map of Ulithi Atoll with fishing jurisdictions and an image of a voyaging canoe to symbolise the interconnection of clans and islands

Source: Courtesy of Nicole Crane and John Rulmal

that there are enough fish to feed all families immediately following the disaster.[2] Box 4.1 describes an analogy of this interdependence through the voyaging canoe and the essential role of all clans, while Figure 4.2 shows a map of Ulithi Atoll with fishing jurisdictions and an image of a voyaging canoe.

Changes in practices

Access by outsiders to Ulithi, and by Ulithians to the outside world, along with globalisation and a cash economy, have brought changes and challenges to the communities of Ulithi. A significant driver dated back to World War II when Ulithi Atoll was converted into a United States naval base for the Third Fleet, and a staging area for major battles for which some islands were cleared and levelled for construction of runways and military facilities. Contacts with explorers, traders, missionaries and others all brought significant impacts. Introduced technologies have resulted in more intensified modern fishing methods (such as motorboats, spear guns and cast nets) focusing on a smaller number of target species, compared with more diverse fishing methods in the past where there used to be many different kinds of fishing. For example, on Woleai Atoll, more than 78 fishing types have been documented (Smith & Dalzell, 1991), whereas now that number is far lower with the loss of some. Only a

2 For further examples, see https://blogs.ubc.ca/yangdidi/.

Box 4.1 The Micronesian voyaging canoe: an analogy for how collective benefits on Ulithi are achieved through social diversity and interdependence

In Ulithi, a canoe was the community lifeline. Each part of the canoe has different functions that are critical and indispensable to navigate successfully and safely to the destination. Figuratively, the canoe represents the community, the course represents the process, the destination represents the goal and the different parts of the canoe symbolise the clans within the Ulithi Atoll. Social diversity is evidenced by the different skill sets and expertise within clans, and those differences become the community backbone as they weave appreciations of interdependence into collective survival and achieving common goals.

Clans can be tied metaphorically to parts of the canoe – diverse components coming together to create a vessel capable of voyaging. Each Ulithian has a responsibility linked to the clan they are born or adopted into, and the person's name signifies the clan's expected responsibilities to the community. A person born in a leadership family is groomed to take specific leading roles. The family (clan) representing the canoe hull is in charge of bringing people (carrying the heavy load) to their destination, while the family representing the outrigger provides support to fulfill that task. Some social roles and responsibilities are gendered. Women are seen as the hull of the canoe and chiefdom is inherited through the maternal side. Men pass down to their children responsibilities associated with the upkeep of property and clan expectations, but the final decision regarding property is made by the women of the family who remain the property owners. Thus it is a role, rather than hierarchical rank that ensures success. If any part of the canoe fails it jeopardises all.

A model outrigger sailing canoe (E431500) made by Mau Piailug (Satawal Island, FSM) and donated to the Smithsonian in 2000.

Photo: Chris Urwin

The main hull of the canoe (*bbul*), which carries the people and bears the brunt of the waves, signifies leadership, and on Ulithi is representative of Mogmog Island (which is the island of the Paramount Chief). The outriggers (*da'm*) always stay parallel to the hull to provide stability and allow people to get on and off. Falalop Island and the resources they oversee represent the outriggers. The two ends of the canoe 'watch' (*matal wa*) the front where the canoe is heading and the back for security (stability). These ends are represented by Sogloi and Asor Islands (one end), and Mangyang and Federai Islands (the other end) which oversee and manage most of the inner lagoon fishing jurisdictions. The two ends have the flexibility to switch their front and back positions depending on the destination and wind directions. The two main beams that connect the outrigger to the main hull represent supporting clans (*Ra'ts*) located on Loosiap, Falalop, Mangyang, Sogloi and Mogmog islands. They are tasked with getting together periodically to discuss common atoll needs, advise the paramount chief on Mogmog, to serve as the messengers among the islands in the atoll, and are responsible for managing resources.

On an atoll like Ulithi, all resources – terrestrial, inner lagoon, reef and ocean – can be limited, depending on a myriad of factors, and each person – whether chief, resource owner, canoe builders or resource users – has a role in providing access to and caring for those resources, and ensuring their sustainability. Traditional rules of voyaging/travelling have to be strict, and it is important that everyone follows the protocols in order to reach the goal safely. The same applies to the resource management practices with which everyone must comply. The success is collective and this is recognised by the benefits being shared equitably. If particular groups or individuals exploit resources for their benefit without respecting the traditional values and practices, the entire community suffers as the resources are degraded. In much the same way, if a canoe has a strong hull, but the outrigger does not function properly, it will compromise the integrity of the canoe, which may not be able to reach its goal safely – or at all. The people of Ulithi base their traditions and social structure on the integrity of the community and shared goals, which can only be achieved by all individuals working together, just as every part of the canoe supports the whole vessel and its purpose.

few youth now know how to spearfish. The new methods are efficient but when used excessively have a big impact on the catch, which seem to have coincided with fish reduction and changes in reef health (Crane et al., 2018b; Houk et al., 2011). Storage technology, such as freezers, enables people to catch more than they can eat which can also deplete the resources (Cinner et al., 2016). A shift to motorboats has created a dependency on fuel that leads to overfishing on nearby reefs to limit high fuel cost. Motorboats are generally owned by individuals rather than clans or groups, which traditionally and collectively 'owned' canoes. This changes the balance of power over these essential assets and can also affect how the fish catch is distributed.
Despite the forces of technology, Westernisation and globalisation, the people of Ulithi have retained much of their traditional island culture, including their native Ulithian language, food-sharing practices and heavy reliance on their coral reef ecosystems for subsistence fishing. A household survey conducted in 2019 showed that all households on Ulithi are still involved in fishing and gardening activities and rely on local resources, but contemporary means of livelihoods have also become more common (although there are no commercial outlets on Ulithi except one small family run store for basic amenities). About 40% of the households have members who receive a salary from an employment with the government or private sector (a large number, for example, are employed as teachers) (Rulmal et al., 2019).

Today, many Ulithian youth move abroad and into contemporary lifestyles. As lifestyles change, some values and practices shift or are eroded. Facilitated focus group discussions and meetings conducted by OPOR with communities from 2013 to 2019 indicated that when youth who had left their communities (for school or other reasons) returned home, they were not always as aware of some of the local problems or how to address them with local knowledge or resources (Crane et al., 2018a). This disconnect can lead to a lack of engagement in their own island communities, where they are needed most during a time of such rapid and impactful change. Opportunities for the youth to interact with the elders and gain knowledge through experiential learning are becoming less. This is in part due to them leaving the islands and in part due to the educational system which has focused more on contemporary (and Western) content. In addition, the location of high schools on only two atolls (Ulithi and Woleai) means that many youth spend less time at home as they must travel to their schools for the school year. This has resulted in important knowledge not getting passed down to the younger generations, who then become less aware of, or disinterested in, traditional management practices and the reasons behind them (One People One Reef, 2020).

Key outcomes

Collaborating to strengthen and adjust traditional management of reefs and fisheries

The fact that some communities were able to open previously closed areas right after Typhoon Maysak in 2015, and gained access to needed resources as the COVID-19 pandemic hit, is a testament of the management benefits to community recovery and resilience in an unpredictable climate regime and disease landscape.

Among the communities, there has been a general consensus that traditional approaches and frameworks need to be better understood to adapt them to the current social and environmental context, enabling a 'modernisation' with a traditional

The collaborative management on Ulithi has had several important positive outcomes: it brings more fish to eat, it keeps reefs healthy, healthy reefs protect islands, and management brings communities together and strengthens leadership. Management requires leaders to bring communities together around the management plan, and how to enforce it. It also helps younger people better understand the importance of management, and the traditions that have kept the reefs strong. Communities have articulated that this work to improve management has required them to address leadership issues as well, and has necessitated the opening of dialogue between islands, as well as with the COT (outer island Chief leadership council).

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foundation: adaptive management. In 1991, in order to innovate its traditional governing system to be more participatory, the establishment of the leadership Council of Ten was created on Falalop Ulithi. The council consists of representatives of all 10 clans on the islands. Compared to the past where a decision-making table would be reserved to only two main clans, now everyone who belongs to one of the 10 clans on Falalop can be represented to manage more collaboratively. In 2014, representatives from the Outer Islands beyond Ulithi came together in an unprecedented gathering to discuss marine management together. They exchanged ideas, articulated challenges and learned from communities on Ulithi, as well as the OPOR science team, about new ways to approach management and resource tracking.

Reviving reef and fisheries management

Central to our collaborative effort has been identifying and maintaining traditional systems, and better understanding what has changed. We have been highly successful in enhancing fish abundance as well as community dialog around stewardship. All four inhabited islands on Ulithi, and several other Outer Islands, are now trying 'new' management plans which are based on traditional frameworks. Each island controls a fishing jurisdiction and focuses on managing the take of fish and fishing methods. Thus, Ulithi is the first atoll in Yap State to have revitalised a 100% community-designed and -led comprehensive management plan that includes closures, gear restrictions and species restrictions. It is also the first atoll to have implemented data collection of landed fish at all four main islands, which has enabled them to track the status of their fisheries (Crane et al., 2018a). There have been successes on multiple levels, including resource enhancement, as a result of these efforts (Crane et al., 2018b).

Falalop was the first to re-implement a traditional (partial) marine protected area in 2012. It has closed one area of the island to all fishing, except community fishing and fishing from shore (primarily by women). The other section of the island is closed to night spearfishing, and no gillnets or throw nets are allowed.[3] Mogmog followed in

3 Spears and gill nets are more contemporary methods of fishing.

2013, and closed the section of its most degraded reef in front of the island (south side) to any fishing except community fishing and fishing from shore. Gill nets and take of parrotfish by spear at night has been banned. They have also implemented a traditional custom of notification of 'first catch' to signal the opening of lagoon fishing. Likewise, starting in 2013, Asor implemented rotating closures on the south-facing side of the island (two areas are rotated, and a third area has been closed to all but community fishing). In 2014, Federai implemented rotating closures on the west-facing side of the main island, and has banned the take of bumphead parrotfish (*Bolbometopon muricatum*), which is designated as Vulnerable species by the IUCN Red List of Threatened Species™, and the humphead wrasse (*Cheilinus undulatus*), which is designated as Endangered by the Red List.

Slightly over half of the lagoon-facing reefs of the inhabited islands of Asor, Falalop, Mogmog and Federai are now under revised and/or new management as partial, near total and/or rotational closures. Other uninhabited but fished reefs have also received additional protection. Biological survey and social science data show clear positive social-ecological outcomes of the managed areas. Fish biomass has increased at all managed sites since the beginning of the OPOR work (Crane et al., 2018a; 2018b). It has brought back some larger fish and in turn the local food and the livelihoods of the Ulithi people have improved. By managing fish, reefs are being protected. With the banning of some fishing methods and site protection, herbivorous fish populations increased (along with all trophic levels of fish) which appears to have led to partial reef recovery at some sites (Crane et al., 2018b; Crane personal observation, 2023).

In 2016, *Montipora* dominated; low coral cover (left); in 2023, the same section of the reef dominance of *Acropora* species; high coral cover (right).

Source: Courtesy of Nicole Crane/ OPOR

In addition to partial closures, there have been measures taken to address the impacts of more modern fishing such as spear guns and gill/throw nets. Reef owners of all four islands have restricted spear fishing in some way. Some have banned it at night while others have banned it on certain reefs. Biological monitoring shows that the numbers of targeted fishes (mostly herbivorous fishes such as parrotfish-Mau) have increased, possibly as a result of management. In addition, corals such as *Acropora* seem to be returning to managed reefs (in Mogmog, for example). Throw nets target the algae eating fish, such as surgeonfish, especially the young ones, which can be a problem as these fish play an important role in maintaining reef health. On Mogmog, it is observable that banning throw nets has increased the numbers of surgeonfish which are important to reef health. Mogmog has also seen the fastest and most dramatic return of *Acropora* corals (see photos above).

All four islands participate in a programme to collect size, species, reproductive state and gear use data from landed fish (a data set they wanted to collect). The Western science team receives these data and presents the communities with the results. This has been an important way for local science teams to run their own data collection, and learn more about the fish their gear is targeting. It has been a catalyst for conversation around the impacts (and frequency of use) of certain gear. Spear guns (often used by the youth) have been at the centre of much of this discussion. People have become more aware of the extent of the impact of non-traditional gear types, and the need to adapt their management in light of this generational shift.

Community and youth involvement/leadership as an instrument for adaptive resource conservation

With the observable changes related to a decline in marine resources and the desire to implement better management, community members wanted to become more involved with resource management and conservation and to lead initiatives. They wanted to understand drivers behind the changes and what could be done to better manage resources for the future of their communities.

Furthermore, it became obvious that a sustainable future requires the youth to be engaged and learn about their local environment and resources, and how to best protect them. Although involving youth is a fairly new concept for many communities (traditionally, youth work their way up to involvement), the community has identified youth engagement in reef management as a major priority today to secure social-ecological integrity (One People One Reef, 2020). If the youth are not involved, they would not understand the issues or the management solutions. Many leave their communities, and the knowledge about traditional governance and management is not transferred to them. But these youth will be implementing management in the future, and it is important to educate them in more traditional ways. One meaningful way to achieve youth involvement is to work through the youth groups that are established on many islands. Federai, Mogmog and Falalop all have recognised youth groups and meet monthly. OPOR has worked to build a youth engagement programme around reef management, traditional storytelling and collaborative science.[4]

How governance processes have affected local well-being and conservation outcomes

In Ulithi, traditional governance and social-ecological well-being are intertwined. Changes in one have profound impacts on the other. Natural resource governance was a part of traditional governance that has remained a responsibility of the Chiefs and local leadership, and the well-being of the social-ecological systems of Ulithi has always been central to that. Understanding how the traditional ways of managing reefs and fisheries worked well in the past helps to co-identify traditional methods that could be brought back or further evolve, and discuss where to incorporate new ones building on what already exists. Partial protection MPAs, for example, are a long established method of marine resource management, albeit with local ‘definitions’, and

4 For further information, please see: https://onepeopleonereefstorytellingproject.org.

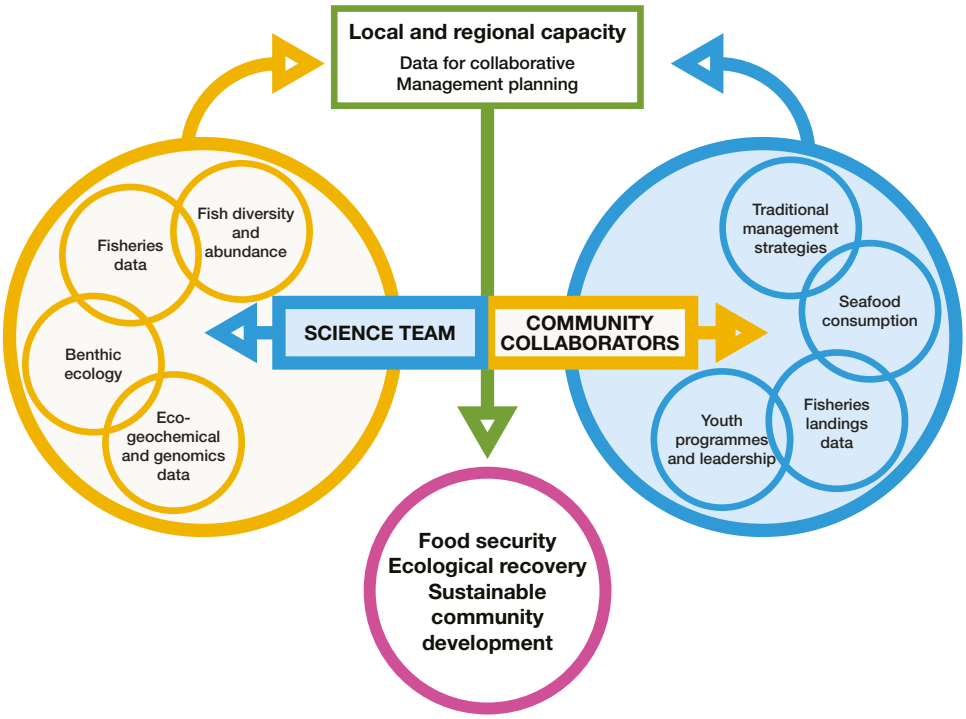

Figure 4.3
The governance model for conservation and well-being in Ulithi requires collaboration between community members, local leaders and scientists

Source: Crane et al. (2015, p. 4)

when presented as a traditional method communities embraced them as one of several strategies to enhance the reefs and associated resources (Andradi-Brown et al., 2023). An intertwining of Western and traditional monitoring has underpinned effective decision-making for both conservation of marine habitats and species, and well-being in terms of food security and social-ecological resilience (Figure 4.3). If foreign-led reconstruction and recovery programmes, climate adaptation programmes and other sources of support consider these social-ecological interrelated issues, Outer Island communities can advance their planning and implementation of climate adaptation, resilience building and sustainable management efforts, achieving both conservation and human well-being outcomes (Wongbusarakum et al. 2019).

Conclusion

Across vast areas of our planet, the most effective, equitable and sustainable way forward is to place Indigenous peoples and local communities, as well as their values, knowledge and customary institutions, at the centre of conservation efforts. This will ensure sustainable and mutually beneficial conservation outcomes. 'Protecting vulnerable resources for sustainable use' is more of a locally applicable concept than 'nature conservation' for many Indigenous peoples and local communities. This can be contrasted by the rapidly expanding marine protected area (MPA) initiatives. Many MPAs are exclusive of use, and neglect local knowledge systems, imposing Western designs that ultimately can lead to a lack of longevity and ecological and social degradation, reducing resilience and possibly violating human rights.

This case study reveals the power of collaboration, recognising the critical role of local leadership, and the centrality of local knowledge and social systems in planning as foundational to sustainable outcomes. Global targets need local level successes to meet their marks, and these are best accomplished through authentic collaborations that

put local people and their practices at the centre. For communities of the remote outer atolls of Micronesia, self-reliance and the sustainability of local resources are key to survival and well-being. Communities are aware that traditional management must evolve for them to not only survive under uncertainties but also to thrive.

Acting on that awareness, some traditional practices are being revived and some 'newer' approaches are being considered for integration into their local resource governance systems. By respecting local knowledge and traditional resource governance systems, including the decision-making rights of the communities, and by combining these with the committed collaborations among external scientists and local leaders, we can improve social-ecological sustainability for both current and future generations of the Ulithi Atoll, and serve as a successful global model.

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