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# Opportunities and challenges of managing spawning aggregations in Fiji

Margaret Fox<sup>1</sup>, Waisea Naisilisili<sup>1</sup>, Aisake Batibasaga<sup>2</sup>, Stacy Jupiter<sup>1</sup>

<sup>1</sup>Wildlife Conservation Society, Fiji Country Program, 11 Ma'afu St, Suva, Fiji

<sup>2</sup>Department of Fisheries, Central Division, PO Box 481, Nausori, Fiji

Corresponding author: [mfox@wcs.org](mailto:mfox@wcs.org)

**Abstract.** Coastal Fijian communities have historically fished spawning aggregation sites for subsistence. As market pressures have escalated, vulnerable aggregations are rapidly being extirpated. There are no provisions within the current Fiji Fisheries Act that provide legal controls on fishing aggregations. However, communities can set customary rules to manage spawning aggregations within local management plans covering their traditional fishing grounds. Their local knowledge can be used to determine the spatial placement of fisheries closures (e.g. across channels and/or on steep forereefs), as well as the timing of seasonal bans on harvesting spawning species. Although not legally binding, compliance is high when there is strong respect for decision-makers and broad participation in decision-making process. We present an example from Kubulau District, Bua Province, where communities banned grouper catch during the month of August but were more reluctant to protect a well-known mullet aggregation site due to the cultural practice of holding an annual feast associated with the congregation of two mullet runs. We further discuss the opportunities as well as limitations to developing nation-wide seasonal bans on aggregation species. For example, the word for grouper in Fijian (*kawakawa*) includes a number of different species which individually spawn during different months of the years in Fiji, with considerable geographic variation in the timing of spawning. However, these limitations could be addressed through a collaborative campaign between the Fiji Fisheries Department and NGOs to encourage a broad seasonal ban (e.g. July - November) on harvesting the most vulnerable species.

**Key words:** Spawning aggregations, Traditional knowledge, Customary rules, Seasonal ban, Fiji

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## Introduction

In terms of economic importance, fisheries are the third largest natural resource sector in Fiji, contributing approximately 2.5% of total gross domestic product (GDP) (Teh et al. 2009). In fact, this value is likely to be a vast underestimate, given growing dependency of coastal communities on fisheries resources for income. Local fishers sell over 70% of catch from coral reef and associated inshore habitats (IAS 2009). These contributions to livelihoods are not reflected in the national economy, but are having an increasing ecological impact on fish populations and habitats as fisheries resources become increasingly more monetized (Teh et al. 2009; Jupiter et al. 2012).

Historically, Fijian and other Pacific island communities fished coral reef fish spawning aggregation sites for subsistence, with pressures on the aggregating species related to human population density, abundance of other non-aggregating species and degree of awareness of the aggregation sites (Hamilton et al. 2005). Misuse of traditional knowledge of aggregation locations, increased availability of more efficient gear (e.g., spearguns) and increased access to local and globalized markets

have led to disappearance of fish from known aggregation locations throughout Fiji and the region (Sadovy and Domeier 2005). Intense exploitation of aggregations can lead to local extirpation of species, which may lead to indirect food web impacts on prey species and benthos (Sadovy and Domeier 2005). Effective community-based management can lead to recovery of vulnerable, aggregating species (Hamilton et al. 2011), however success is contingent on supportive legal and customary management frameworks. In this paper, we review the opportunities and constraints for the management of coral reef fish spawning aggregations in Fiji through community-based management using a case study from Kubulau District. We also draw attention to the challenges for management of spawning aggregations under the current national legal framework.

## Management Context

Historically, Pacific islanders used a variety of customary regulations to influence marine resource availability (Johannes 1978), primarily to ensure adequate supplies for social obligations or cultural functions (Foale et al. 2011). Chiefs used their customary powers to enact temporary fishing closures,

prohibitions on catching species, seasonal bans, gear control, access restrictions and quotas on total take (Veitayaki 1997). More recently, conservation and management partners have encouraged communities to adapt these traditional practices for the objectives of managing for longer-term food security. In the context of fish spawning aggregations, this often means establishing seasonal or permanent no-take areas over known aggregation sites once they have been validated (Weyman 2011). Such community-based approaches can be successful where there is strong respect for the management authority, broad awareness of management rules, adequate controls on the amount of permitted fishing and use of local knowledge to monitor resource conditions (Cinner et al. 2006). Yet these customary management frameworks may sometimes be at odds with national legal frameworks.

For example, although national legislation in many Pacific island countries recognizes indigenous land tenure, recognition of marine tenure is less frequent (Clarke and Jupiter 2010). The Fiji *Fisheries Act* was crafted under British colonial rule in 1942 and reflects the British worldview of open access to sea resources. While the Act grants indigenous Fijians traditional fishing rights within their fisheries management areas, ownership of seabed and above resources legally rests with state, and anyone can legally fish for subsistence anywhere in Fiji “with hook and line or with a spear or portable fish trap which can be handled by one person” (Fisheries Act s13(1a)). Furthermore, provisions for fisheries management are restricted to regulations for licensing and gear use (Teh et al. 2009), as well as minimum catch size limits that are not enforced in practice.

The implication of this discord between customary rules and national laws in Fiji is that the only way to legally prosecute traditional fishing rights owners or outsiders for fishing an aggregation site within a community-managed marine protected area (MPA) is to prove that the offenders were fishing with intent to trade or sell the catch without a permit. In reality, it is exceedingly difficult to demonstrate this intent, and the penalties for offenses under the current *Fisheries Act* are inadequate to deter repeated breaches (Minter 2008). Meanwhile, overall enforcement of fisheries regulations is weak to non-existent (Sadovy & Batibasaga 2006). Given this context, we now describe how the communities of Kubulau District in Bua Province are attempting to overcome these challenges. We then discuss potential opportunities to influence fisheries management reform in Fiji.

#### **Case Study: Kubulau District**

Due to concern about perceived decline in fisheries resources, the chiefs of the 10 villages of Kubulau

District banned commercial fishing from their traditional fisheries management area in 1997 (Clarke and Jupiter 2010). They were able to legally do this by declining to issue consent for commercial licenses issued annually by the Department of Fisheries. However, this did not stop Kubulau residents or outsiders for fishing for subsistence, and by the early 2000s, the high chiefs still perceived heavy resource use was driving down once abundant fish populations.

The chiefs appealed to the Wildlife Conservation Society (WCS) and other management partners within the Fiji Locally Managed Marine Areas Network (FLMMA) for assistance to implement marine management strategies to conserve fish stocks for the future. FLMMA partners comprise the Fiji Fisheries Department, NGOs (including WCS), and academic and private sector institutions that assist communities to implement marine management initiatives at various sites in Fiji through co-management arrangements. WCS staff used a combination of scientific and local knowledge, including fisher knowledge (through a participatory resource mapping exercise) of the locations of spawning aggregations derived from their underwater observations; identifying the 90m deep Naisonisoni Passage as an important spawning aggregation site for *Epinephelus sp.* and *Plectropomus sp.* (Fig. 1) known respectively as *kawakawa* and *donu* in the local dialect, to design a network of 20 marine protected areas (MPAs). This MPA network consists of 3 district-wide, no-take MPAs and 17 periodically harvested fisheries closures including the northern side of Naisonisoni Passage (Fig. 2) (Jupiter and Egli 2011). These MPAs, covering over 30% of the fisheries management area and the majority of aggregation sites identified by Kubulau fishers, provide considerable protection to species during spawning events.

WCS also assisted the Kubulau communities to develop management rules areas outside the MPA network as part of Fiji's first ridge-to-reef management plan (WCS 2009). With regards for rules to protect spawning aggregations outside of the MPAs, the communities of Kubulau identified August as the primary month for grouper spawning within their traditional fisheries management area. They therefore imposed a ban on harvesting any species of grouper during the entire month of August (WCS 2009). Broad stakeholder participation in the development of management rules, inclusion of traditional ecological knowledge and strong respect for traditional authority has resulted in a high level of ownership of the management plan and some degree of success in management implementation. By 2009, grouper biomass was significantly greater inside the Namena MPA than on adjacent fished reefs, though the difference was less pronounced from the other district

MPAs due to internal and external poaching which is currently being addressed (Jupiter et al. 2010; Jupiter and Egli 2011).

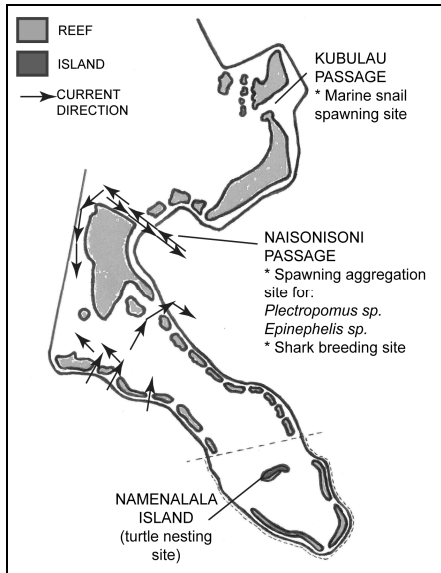


Figure 1: Map of Kubulau traditional fisheries management area recreated from local knowledge indicating unverified spawning aggregations and animal breeding sites and direction of prevailing currents.

Not all traditional ecological knowledge of spawning aggregations was used to inform management actions. For example, Kubulau elders recall plentiful congregations of two mullet runs around a rock located near Natokalau village that were traditionally harvested for a ritual feast (Askew et al. 2011). Despite calling the communities attention to the fact that mullet numbers have substantially declined to the extent that the annual mullet drive no longer can occur, they were reluctant to implement seasonal bans on harvesting the species. This is possibly due to a lack of awareness that their fishing practice contributed to the declines: community members consistently placed blame on fishers from neighboring districts for overfishing the mullet prior to their arrival in Kubulau (M. Fox, pers. comm.).

### National Scale Management

While a single month ban on harvesting grouper (or other taxa) could be effective in Kubulau to protect spawning species if local knowledge is correct in the timing of their aggregations, it will not work across Fiji as a whole. Data collected by the Society for the Conservation of Reef Fish Aggregations (SCRFA) and the Fiji Department of Fisheries based on interviews with local fishers suggest that the same species may spawn at different times of the year in different regions of the country (Table 1). Thus, only a broad seasonal ban on harvesting particular species (e.g. July – November) would likely be effective to cover the range of regional differences in spawning periods.

Furthermore, because different species aggregate to spawn during different months of the year, any proposed ban should apply to multiple taxa. However, there are some linguistic challenges associated with designing such a regulation. Most Fijians are unable to associate scientific names with particular species. Fijian names, meanwhile, can cover multiple species. For example, the Fijian name for both *Plectropomus areolatus* and *P. leopardus* is “donu”, however these species may have slightly different spawning seasons in different parts of Fiji (Table 1). Additionally, a single species may have different names in different Fijian dialects: for instance, *Epinephelus merra* can be referred to as “kawakawa” or “senikawakawa” and *E. malabaricus* may be alternately called “kerakera” or “kavu”.

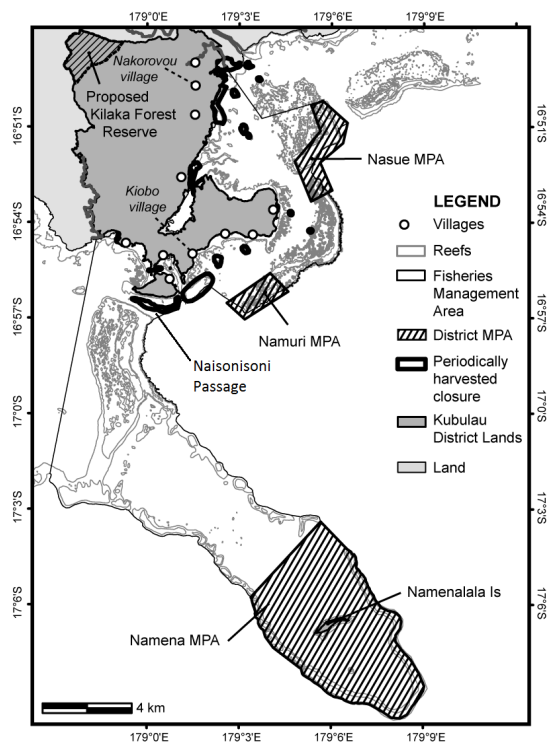


Figure 2: Design of Kubulau District marine protected area network endorsed by the high chiefs in 2005, including district-wide, no take MPAs (black diagonal stripe) and periodically harvested closures (thick black outlines).

Species	Viti Levu	Vanua Levu	Kadavu	Yasawas	Northern Lau	Southern Lau
<i>Epinephelus polyphekadion</i>	Sep-Oct	Jun-Jul	Jul-Sep	N/A	Jul-Oct	Jul-Sep
<i>Plectropomus areolatus</i>	Sep-Nov	Jun-Jul	Jul-Sep	Variable	Jul-Oct	N/A
<i>Plectropomus leopardus</i>	Sep-Nov	Jul-Oct	N/A	Sep-Nov	Aug-Nov	N/A

Table 1: Local knowledge regarding timing of spawning of three relatively common grouper species across regions of Fiji. Data source: Society for the Conservation of Reef Fish Aggregations (SCRFA) and Fiji Department of Fisheries, unpublished data.

Thus, to be effective, considerable effort would need to be made to determine the optimum taxa that would benefit most from protection and gather traditional ecological knowledge from across Fiji pertaining to their local name(s) and timing of aggregation so that a new regulation could be adequately communicated and understood by fishers. Follow-up surveys would be required to provide validation of the timing and location of aggregations (Sadovy 2006; Hamilton et al. 2012). To enhance successful implementation, the species selected for a broad-scale seasonal ban on catch and sale should be: those most vulnerable to extirpation because they form fewer, more concentrated aggregations (e.g. *E. polyphekadion*, *P. areolatus*); and also species with which Fijians have the strongest cultural and socioeconomic associations (Verissimo et al. 2011). These cultural associations could be highlighted in a national campaign to increase awareness of the benefits of healthy aggregations and consequent impacts of fishing aggregations in order to change fisher behavior. Our experience to date suggests that, once educated, local Fijian fishers easily comprehend the problems associated with removing all reproductive adults from the population. This bodes well for initiation of local management implementation even prior to any legislative reform. While a campaign alone is unlikely to prevent mobile, commercial fishers, who have no interest in long-term, site-specific management, from fishing aggregations, the Fiji *Fisheries Act* is currently under review, which presents timely opportunities for pushing new regulations for the draft *Inshore Fisheries Decree* through Cabinet, with stiff penalties for offenses.

In conclusion, despite current limitations in national legislation for protection of spawning aggregations, there are current actions that local communities can take now to improve management of aggregating species in Fiji. These actions rely heavily on incorporating local knowledge to identify vulnerable species and sites (Hamilton et al. 2005). However, we note that protecting spawning aggregations is only one of the many strategies required to ensure long-term food security: both customary and national regulations should be placed within an ecosystem-based management framework to minimize threats from all forms of disturbance (Hamilton et al. 2011).

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