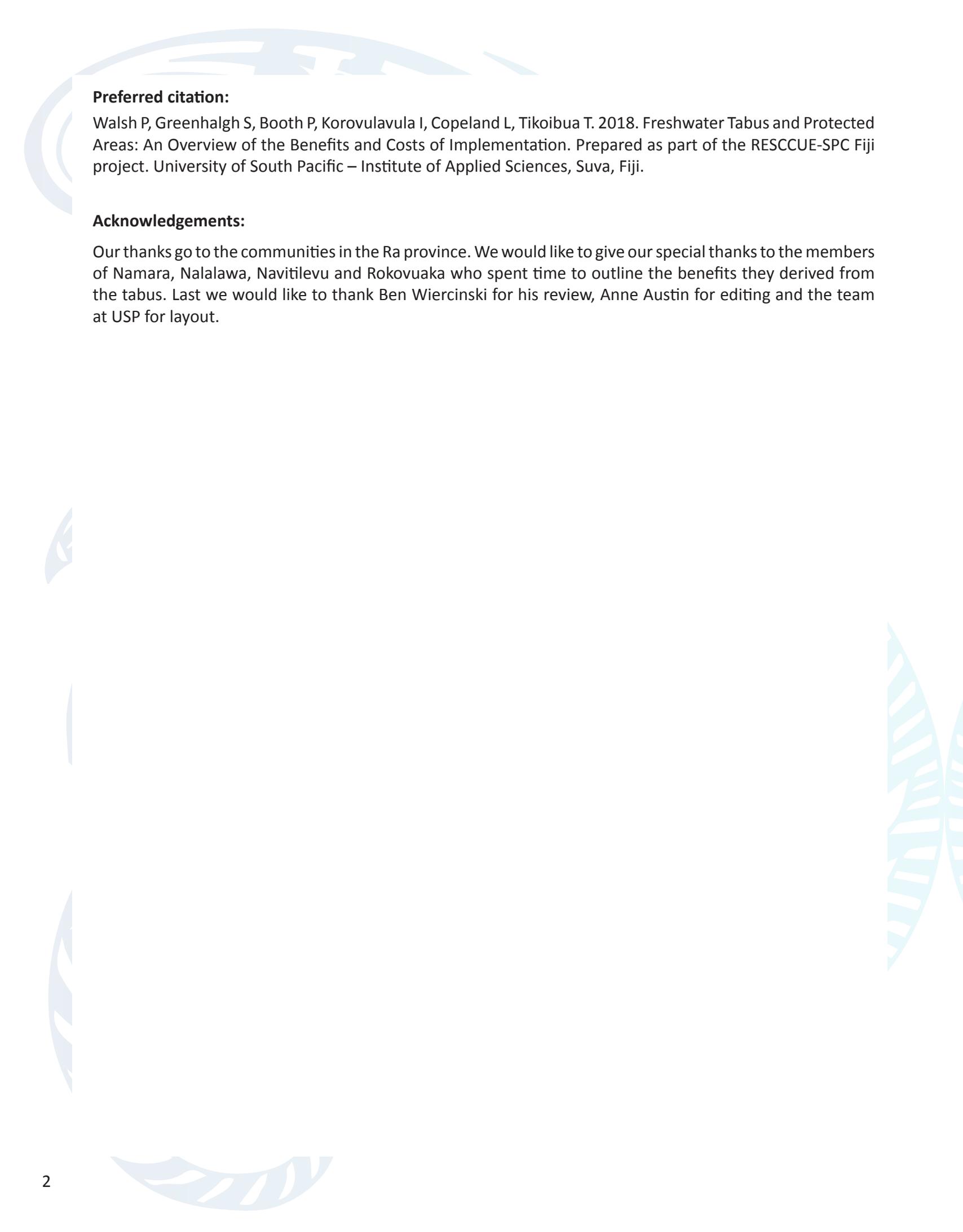


Freshwater tabus and protected areas: An overview of benefits and costs of implementation for practitioners



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Purpose

The purpose of this report is to provide information to Provincial Office staff and other practitioners in Fiji and elsewhere on the benefits and costs derived from freshwater tabus.

The information provided is not meant to be an economic valuation of tabus; rather it is aimed to provide information that could be used by Provincial Office staff to identify a wide range of potential benefits and costs related to managing freshwater using tabus.

Background

Destructive fishing practices are putting significant pressure on freshwater ecosystems in Ra Province. These practices, which include fish poisoning, overfishing, and illegal nets, produce immediate benefit to the user at significant cost to the nearby area and the downstream catchment. During workshops held in several Ra Province villages in March/April 2017, destructive fishing methods were regularly cited by villagers as concerns. RESCCUE-SPC Fiji is promoting the use of freshwater tabus to combat these practices and spread awareness. This report explores the more important benefits and costs associated with these freshwater management practices using data obtained through several workshops in Ra Province, as well as other literature from the Pacific (Copeland 2013).

Tabus

Tabus, which place a ban on fishing in a particular area, have a long history in Fiji, and have been used in both freshwater and marine settings. They have historically been used to commemorate the death of a village chief, whereby a ban on fishing was in place for 100 days (referred to as bogi drau). When the ban was lifted, the larger catch from that area was used in a commemorative feast. Permanent, or longer-term, tabus are now being used to protect freshwater and marine areas. The familiarity of communities with bogi drau can make workshops on implementing tabus and awareness activities easier.

Table 1 contains a list of villages that have used temporary tabus in the past in Ra Province (Korovulavula 2016). Permanent tabus are also finding support in the area for a variety of reasons, including:

- declines in the number of freshwater fish and other species caught
- declines in the size of fish and other species
- differences in taste/texture of fish and other species
- loss of species
- overfishing
- use of poisons (duva), fertiliser, and chemicals to catch fish.

Although marine tabus are also widely used in Fiji, this report will focus on freshwater protection.

Table 1: Villages in Ra Province that have used tabus in the past

Ra Province protected (Tabu) freshwater areas				
District	Villages	Reasons	Management status	River or creek
Nasau	Nasaukami Vanuakula Nauria Nukulau	Subsistence and economic livelihood or obligation	Temporary tabu open only for important traditional cultural event and then closed again	Lawaki Creek
Lawaki	Namara Sawanivo Nakorovou	Subsistence and economic livelihood	Temporary tabu open only for important traditional cultural event and then closed again	Lawaki Creek
Tokaimalo	Naraviravi	Subsistence and economic livelihood	Temporary tabu open only for important traditional cultural event and then closed again	Lawaki Creek
Nailuva	Nararavou	Subsistence and economic livelihood	Temporary tabu open only for important traditional cultural event and then closed again	Wainibuka Creek
Nababa	Rokovuaka Nalalawa Navitilevu	Subsistence and economic livelihood	Temporary tabu open only for important traditional cultural event and then closed again. Cultural and beliefs that it has spiritual healing power specifically in Rokovuaka.	Lawaki Creek

Current situation in Ra Province

To help plan initiatives related to freshwater management, RESCCUE-SPC Fiji conducted several workshops with villages in Ra Province during March/April 2017. A common theme in these workshops was destructive fishing methods (RESCCUE-SPC Fiji 2017), with significant local concern about declining fish stocks and ecosystem impacts. Some of the widespread concerns have a history in the area (RESCCUE-SPC Fiji 2015) and include fish poisoning (through duva, pesticides, and bleach), improper-sized nets, night fishing, dynamite, destruction of habitat with crow bars, gravel extraction, and catching fish smaller than legally allowed (also see Appendix 1).

Waterbodies in the area are under significant pressure from these fishing practices, and villagers report significant declines in fish catch and increases in fishing effort (Copeland 2013; RESCCUE-SPC Fiji 2017). Without intervention, the fishing practices in these areas will likely inflict long-term damage to the ecosystem. In several villages, fish were already being purchased to supplement local catch, and the catch effort was considerably higher than a few years ago. For instance, villagers in workshops in Namara and Nalalawa reported \$10 to \$15 extra was spent on fish per week, as compared with a healthy fishery.

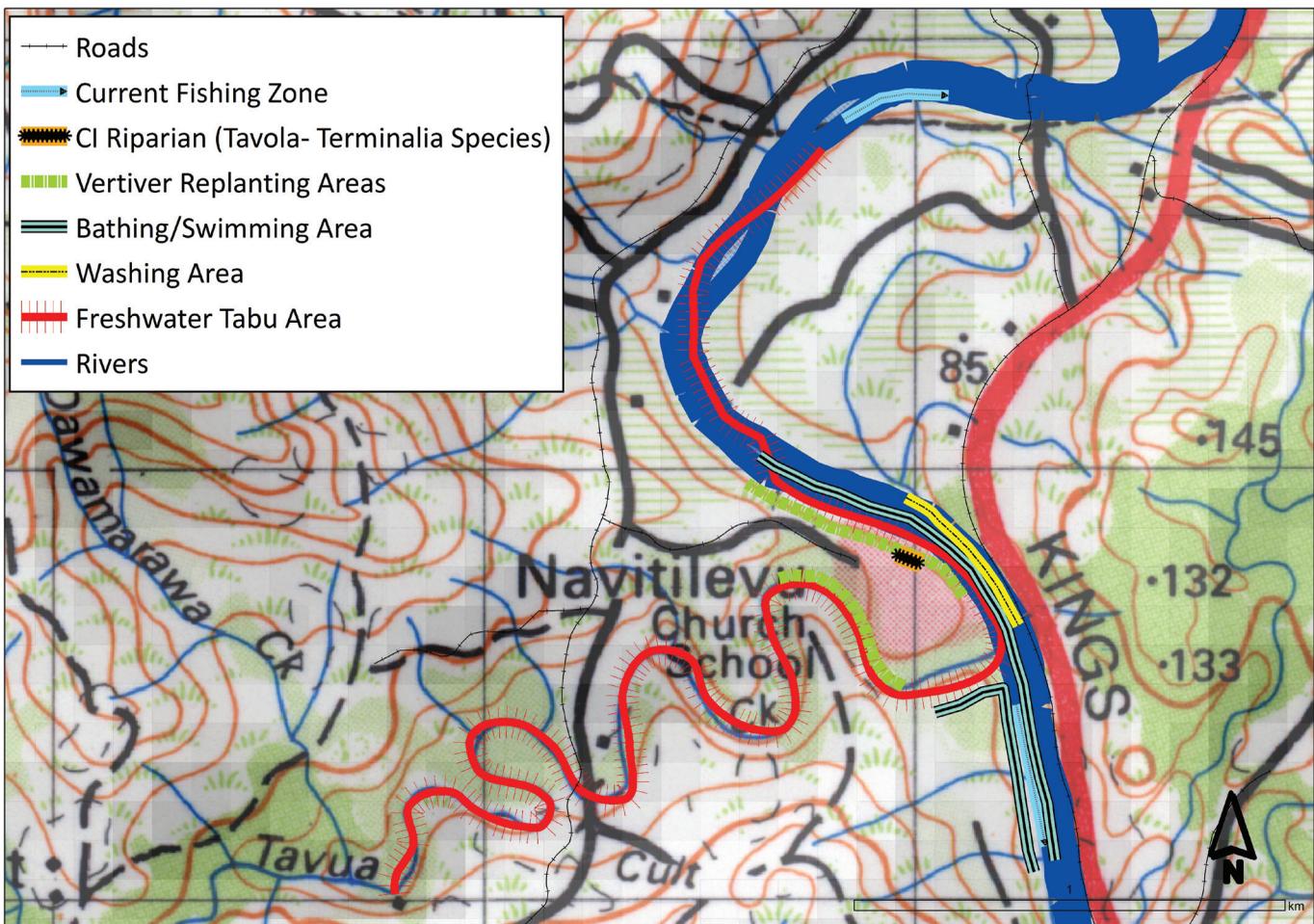
In coordination with other RESCCUE-SPC activities, such as afforestation and riparian management, several tabus were put into place in Ra Province. As a first step, several workshops were held to provide information about the state of the ecosystem and potential benefits from the interventions. These were conducted by RESCCUE-SPC partners in coordination with the local provincial offices and local officials. The tabus were then implemented in April–August of 2017, and villagers were consulted about initial impacts and opinions in November of 2017.

The value of tabus

Putting in place a tabu can have several significant impacts for a local community, so it is important to be mindful of these. These benefits and costs depend strongly on several factors detailed below, including prior knowledge of tabus, current ecosystem state, and support of local leadership. Based on village surveys and RESCCUE-SPC implementation reports, this report describes the main benefits and costs, as well as potential outcomes of freshwater tabus.

The benefits and costs were identified by members of the Namara, Rokovuaka, Navitilevu, and Nalalawa villages in Ra Province, Fiji in participatory ecosystem service assessment workshops and supplemented with information from other studies in the Pacific. The views on tabus expressed in Namara, Rokovuaka, Navitilevu, and Nalalawa villages aligned with other literature but provided more details on the scope of the benefit (or cost).

The 'financial benefits' (those benefits with monetary values) outlined below are likely to be highly variable and their estimation involves a number of assumptions. There are many benefits that could not be expressed in dollars, so in many cases the full set of impacts is likely much larger.



Benefits of tabu areas

There are several important benefits to tabus, which we classify as direct benefits to the village and indirect benefits to downstream areas. These benefits are summarized in Table 2. Note that the location of the tabu can be chosen with these benefits in mind to maximise its impact. For instance, fish spawning grounds might be explicitly incorporated into the tabu area.

Table 2: The benefits of implementing a tabu

Benefit	Description	Direct or Indirect
Larger fish catch	Tabus can result in increased fish catch, both within and outside the tabu area. Fishermen catching fish near tabu will need less effort	Direct
Larger fish	The tabu may include spawning areas which contain larger fish	Direct
Greater species diversity	Increases in fish and other species can occur after tabus are put in place	Direct and Indirect
More diverse diets	As fish catch decreases, more vegetables and fruits are often grown to compensate for less fish in diets	Direct
Improved health benefits	Diversified diets can improve health. For example, Nalalawa village reported a decrease in symptoms of type II diabetes	Direct
Improved conditions for swimming, bathing and washing	No duva, fertiliser, and bleach are used in tabu areas and has direct human health benefits	Direct
Diversified skillsets	More diversified and different skillsets for new income or food production activities to compensate for loss of ability to fish	Direct
Healthier ecosystem	As destructive fishing practices are reduced, the local ecosystem, including fish and other species that are not consumed, will benefit	Direct and Indirect
More cultural benefits	Several freshwater species have special cultural values to villages. For instance, prawns are a cultural totem for some villages in Ra Province and prawn habitat can be protected using tabus. In addition, some tabus are opened occasionally for village festivals, when there will be a larger catch	Direct
Complement to other activities	Tabus can be combined with other freshwater management interventions, e.g. riparian buffers, to maximise benefits	Direct and Indirect

1. Increased catch of fish, prawn, crab and other species

There are a variety of catch-related benefits from a tabu. If properly implemented, the tabu can help restore damage to local species resulting from past destructive fishing practices. Areas directly outside the tabu can have larger fish catch and larger individual fish being caught. It was reported by some villages with recently implemented permanent tabus that:

- fish catch and size had increased
- abundance of freshwater eels (anguillidae) had increased (Rokovuaka village)
- fish species that had not been present for several years, such as tilapia and grass carp, were now being seen. These species can be sold at market for \$10–15 per bundle.

These all provide a direct benefit to the village in the form of larger and more diverse species being caught than if there was no tabu in place. It should be noted that these are benefits noted within a few months of a tabu being implemented, and the scale of these benefits are expected to increase the longer a tabu is in place.

2. Ecosystem benefits

The tabu implementation process can improve local and downstream ecosystems in several important ways. The workshops to establish a tabu can highlight the importance of healthy and the wider impacts of destructive fishing practices. As the use of destructive fishing practices decreases, there will be less damage to habitats and poisoning of the water through the use of derris root (duva), fertilisers, bleach, and other chemicals/poisons. In addition to the toxic effects, these poisons can severely diminish water quality by decreasing dissolved oxygen and changing pH, making waters unsuitable for some species (Copeland 2013). Poisons can also drift downstream and have significant impacts on species in all lifecycle stages, from juveniles to adults (RESCCUE-SPC Fiji 2015). In Navitilevu, villagers were particularly concerned with destructive fishing methods and wanted the tabu to safeguard species for the next generation.

3. More diversified diets and improved health benefits

Diets can change after implementing tabus. For instance, there is an increase in vegetables, starches, and fruit to substitute for fish with the consumption of bele, taro leaves, and ota commonly increasing. This diversity of diet has the potential to improve health. For instance, the local nurse in Nalalawa noted a reduction in treatment for type II diabetes after diets changed.

4. Improved conditions for swimming, bathing and washing

Any reduction in use of poisons for fishing can reduce sickness and other negative effects that may have occurred when swimming, bathing, and washing. These benefits will be greater if the tabu is implemented where these activities occur. This has direct impacts for the village and indirect effects for downstream populations. In Ra Province, rivers and streams account for 46% of bathing, 16% of drinking water, 19% of cooking water, and 13% of latrine water. (Korovulavula 2016; Appendix 2).



5. Diversified skillsets

As a tabu is put into place, some villagers will substitute fishing effort for other skills, such as gardening, pig hunting, or aquaculture, which can produce additional food and income. In some instances, additional training is needed to learn any new skills for these activities.

6. More cultural benefits

Many of the tabus have provisions for the river to be opened briefly for fishing for cultural festivals. If a tabu is in place, then the catch from these areas should increase. Namara village noted a 25kg increase in their fish catch for a village festival, compared with before the tabu. The prawn is the village totem for Namara, so increases in freshwater prawns after the tabu was put in place was very important for the village.

7. Complementary benefits for other activities

The workshops and training used to establish the tabu can complement other initiatives, such as implementing riparian buffers. Discussions of both activities together can more effectively outline the individual and combined benefits of the two management activities. Another benefit noted by Nalalawa village was the information discussed in these types of workshops enabled them to resist development efforts by industry. Better understanding their freshwater resources meant they were able to rebuff the proposals of several industries who wished to use their land and water.

The size of these benefits depends on the existing state of the freshwater ecosystem. If the river ecosystem is already severely degraded, the villagers will already be travelling longer distances to find good fishing, and be expending more effort to catch fish. In these instances, villagers have probably already been diversifying their skills by planting gardens to supplement income and diet or other undertaking other activities.

Costs of tabus

The main cost categories for tabus are presented in Table 3. It is important with these costs to be mindful that many of them would also occur in the absence of the tabu. For instance, many tabus are placed in degraded ecosystems where fishing practices, farming runoff, and other stresses have already decreased fish catch. Therefore, even though tabus will require additional fishing effort, as people travel farther to fish, a degraded river would mean that people are already travelling further to fish. If implemented properly, the tabu should lead to a healthier ecosystem and reduced fishing effort. However, in the absence of the tabu the river is likely to continue to degrade if no other management changes are made, further increasing costs to the community.

Table 3: The costs of implementing a tabu

Cost	Description	Costs Exist without Tabu?
Increased effort to catch fish	People need to travel farther to get to fish	Without a tabu, more effort is needed as ecosystem degrades and fish catch continues to decline
More fish is purchased	As fish catch decreases, households may purchase fish to compensate for the lower fish catch	Where fish catches have declined without a tabu then fish may already be purchased
Time to learn new skills	Some fishermen will need to learn new skills, such as gardening, to supplement fishing activities	If fish catch is already reduced and fishing effort has increased, people may already be learning new skills
Fish stocking	Some communities may stock tabu areas with fish	Fish stocking may occur without the tabu

Cost	Description	Costs Exist without Tabu?
Implementation Costs		
Awareness workshops	To cultivate support for the tabu, workshops will be needed to promote awareness of tabu benefits	New cost
Implementation workshops	Workshops are held to setup the tabu, and train headsmen for enforcement	New cost
Ongoing costs		
Monitoring and enforcement time	Village headsmen will need to enforce a tabu. Additional time could be spent at village meetings to punish any offenders	New cost

1. Increased effort of catching fish

The tabu will close a part of the river for fishing, so fishermen will have to travel farther to fish. However, in the absence of the tabu, there would be additional fishing effort due to the the already degraded state of the fishery. In Rokovuaka village, for instance, 5–10 years ago it took 1-2 hours of fishing to catch enough fish for a family meal. More recently, however, it takes a full day of fishing to catch the same amount of fish. If properly implemented, the tabu could help the ecosystem recover.

2. Increased fish purchases

As fish catch declines, many villagers still want to eat fish. This has led to an increase of about one bundle of fish purchased every 1–2 weeks; increasing household costs. These costs are also likely to exist with tabu until the fishery has recovered. At \$10–15/bundle of fish and if half the households in a 50-household village were purchasing more fish, this would cost approximately \$250–375 every 2 weeks.

3. Time and cost to learn new skills

In areas where fishing is a primary occupation, time would be needed to learn new skills, such as pig hunting or gardening. These new skills may also involve additional costs, like hunting or farming equipment and supplies. Where fishing is not the primary income or food source then more time is likely spent on activities they can already do.

Should skills workshops be required these cost approximately \$2,000, covering trainer time, setup, and meeting expenses (Korovulavula 2016).

4. Fish stocking

Stocking of native species, such as gudgeons, might be considered to improve the local ecosystem. Stocking information can be part of a monitoring action plan set up in the initial workshops by RESCCUE-SPC.

Costs of implementing, monitoring and enforcing tabus

The costs of implementing a tabu can be divided into:

- Awareness and implementation workshops
- Tabu enforcement and monitoring workshops

The costs for these activities will vary from place to place depending on the size and location of the tabu areas.

To help estimate the cost of putting a tabu in place, the estimated time and costs are provided below. These costs are based on the costs associated with tabu implementation undertaken through the RESCCUE-SPC project in Ra Province, Fiji between 2016 and 2018. In some instances the costs below could be shared with other activities such as riparian restoration that could be undertaken in the same area.

Awareness and implementation workshops

To set up the tabu, several workshops are needed. Korovulavula (2016) contains estimates of these costs, which include:

- Participatory assessment and consultation on important freshwater areas and potential areas to have a tabu: \$2,000, including cost of external people to run workshops.
- Participatory workshops on developing community-based freshwater management plan: \$2,000–3,000, including cost of external people to run workshops.
- Assuming that a typical workshop requires half a day's attendance of approximately 40 people, there is a daily opportunity cost of village labour estimated at about \$600 (the value of the labour they are giving up to do the workshops). Some of these workshops may take more than one day (also see Appendix 3).

Tabu enforcement and monitoring workshops

To ensure tabus are effective, enforcement and monitoring are needed. Initial workshops and their costs are estimated in Korovulavula (2016), and include:

- meeting on conservation enforcement for community and local officials: \$1,000 including cost of external people to help with workshop
- training on setting up monitoring committee and developing an action plan: \$2,000 including cost of external people to help with workshop (also see Appendix 3).

These workshops may involve the Natural Resource Management Committee, village/clan leaders, and external organisations such as the University of South Pacific or Conservation International to ensure the appropriate people are at the workshops for future management and the right technical expertise is available.

The tabu will also require regular enforcement activities by village leadership, which include time for actual policing of the area, time at village meetings for reminders, and time at village meetings for any disciplinary actions. Village headmen are advised to remind people about the tabu at each monthly village meeting. Violators can be handled differently, depending on local preferences. Social pressure is often used, with violators identified at village meetings.

It should also be noted that these costs are often funded by external agencies that are helping communities put tabus or other types of freshwater management activities in place.

Appendix 1: Freshwater and other issues identified during RESCCUE-SPC workshops

The list below contains the broader set of issues raised during 2017 workshops to establish tabus in Ra Province and reflect concerns prior to any tabu areas being set up.

Nalalawa Village

- Use of fertilizers/weedicides/pesticides in rivers and streams:
 - o People are too impatient to catch fish using nets, so they use fertilizers/weedicides/pesticides
 - o People are unaware of the repercussions of using these chemicals in freshwater and marine ecosystems
- Reduced soil fertility of the land
- People are lazy about the manual clearance of their farms from overgrowth of paragrass
- Depleted fisheries resources:
 - o Using fishing nets not suitable for the particular streams/rivers
 - o Using fertilizers on land and in the streams/rivers
 - o Dumping rubbish in the river
 - o Use of duva
 - o Overfishing a fishing spot/area
 - o Fishing for large fish as well as smaller ones, not being mindful of the size of fish being caught
- Animals damaging crops and farmland:
 - o Gardens and farmland are not fenced off properly
 - o Owners don't secure their animals properly and in the correct area
- Premature deaths in village:
 - o Could be related to type of food eaten
 - o Environment they live in
 - o Not seeking advice about health conditions

Rokovuaka Village

- Limited water supply:
 - o Cutting down of forested area near water sources
 - o Forest fires
 - o Unsustainable farming practices
- Ignorance about depleting fisheries resources:
 - o Using fishing nets that are too small (fine spacing between the mesh)
 - o Use of duva
 - o Introduction of invasive tree species (mahogany)
 - o Night diving – SCUBA gear and drift nets allow severe overfishing
 - o Development that uses heavy machinery within the fishing area
 - o Improper disposal of rubbish into freshwater/marine areas
- The vision to maintain and manage the current natural resources in Rokovuaka cannot be achieved because people cannot work together towards this effort.

Appendix 2: Use of freshwater resources in Ra Province

Rivers and streams are important water sources for domestic use in Ra Province (Table 1A), including for drinking, cooking, bathing and latrines (Table 1B).

Table 1A. Water sources for domestic use in Ra Province

Water sources in Ra Province for domestic use	Percentage of villages in the province (n=95)
River and streams	94%
Well	24%
Spring water	46%
Rain catchment tanks	42%
Shared water pipe	42%
Individual water pipe	21%

Source: Ra Provincial Office (2016)

Table 1B. Use of different water sources by villages in Ra Province

Water sources	Percentage of villages in the province (n=95)					
	River streams	Well	Spring water	Tank water	Shared piped water	Piped water to individual households
Drinking	16%	7%	15%	15%	15%	5%
Cooking	19%	5%	13%	11%	11%	5%
Bathing	46%	5%	9%	8%	8%	5%
Latrine	13%	6%	9%	8%	8%	5%

Source: Ra Provincial Office (2016)

Appendix 3: Breakdown of costs to implement a tabu

The tabu implementation costs outlined below are in 2017 Fiji dollars.

Table 2A. Cost estimates for meetings and workshops to establish a tabu

Activity	Objective	Cost (FJ)
Participatory assessment and consultation on important freshwater areas and potential areas to have a tabu	Establishment and maintenance of freshwater protected area(s)	\$2,000
Participatory workshop in developing community based freshwater management plan for the fisheries tabu and riparian areas <ul style="list-style-type: none"> • Restrict pathways for horse access • Control the entry of human related waste, chemicals, or rubbish into stream • Reduce pathways for introduction and spread of invasive species 	Establishment and maintenance of freshwater protected area(s)	\$2,000– \$3,000
Conservation enforcement training for community and relevant government officials	Maintenance of protected area(s) through enforcement	\$1,000
Setting up riparian and freshwater tabu monitoring committee and developing monitoring action plan <ul style="list-style-type: none"> • Might also include stocking of native species, such as gudgeons 	Freshwater species monitoring committee capacity strengthened	\$2,000
Community training on freshwater bio-indicator for river health assessment using a bio-indicator tool kit. <ul style="list-style-type: none"> • Can integrate irrigation/aquaculture training as an alternative income source • Awareness campaigns can be integrated to familiarize the community 	Freshwater species monitoring committee capacity strengthened	\$2,000
Biodiversity management committees are established in each district for monitoring and act as watchdogs of activities and species that pose threat to the freshwater protected areas	Consultation and establishing biodiversity management committees	\$1,000

Source: (Korovulavula 2016)

Other assumptions

In calculating the half-day meeting cost, it was assumed that the average wage was equivalent to the opportunity cost of labour. Assuming an 8-hour day and using an average wage rate of \$3.77/hour (based on an adjusted 2012 average hourly wage rate of \$3.35 (Brown and Daigneault 2013)), the opportunity cost of a half day meeting is about \$15.08.

The wage rate was adjusted using Fiji CPI 2017 = 116.4 and Fiji CPI 2012 = 103.4 (Fiji Bureau of Statistics 2018).

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