Pacific Community
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RESCCUE

FRESHWATER COMMUNITY-BASED PROTECTED AREAS AND FISHERIES MANAGEMENT IN RA PROVINCE - DIAGNOSIS AND ACTION PLAN

AGENCE FRANÇAISE DE DÉVELOPPEMENT

FONDS FRANÇAIS POUR L'ENVIRONNEMENT MONDIAL

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Front cover photo: Degraded riparian area in Ra Province, *Institute of Applied Sciences*, 2016

Overview of the objectives and components of RESCCUE projet :

The *Resilience of Ecosystems and Societies to Climate Change* (RESCCUE) project is a regional project implemented by the Secretariat of the Pacific Community.

The overall goal of RESCCUE is to contribute to increasing the resilience of Pacific Island Countries and Territories (PICTs) in the context of global changes. To this end RESCCUE aims at supporting adaptation to climate change (ACC) through integrated coastal management (ICM), resorting especially to economic analysis and economic and financial mechanisms.

The RESCCUE project operates both at the regional level and in one to two pilot sites in four countries and territories: New Caledonia, Vanuatu, Fiji and French Polynesia.

RESCCUE is funded primarily by the *French Development Agency* (AFD) and the *French Global Environment Facility* (FFEM) for a duration of five years (01/01/2014 to 31/12/2018). The total project budget is 13 million Euros, including 6.5 million Euros from AFD/FFEM and about the same in co-funding.

RESCCUE Project sites in Fiji are RaProvince and Kadavu province. Ra has about 95 communties and Kadavu 73 communities. The following are the RESCCUEcomponents that will be implemented in these two sites

It is structured around five components:

Component 1: Integrated coastal management – supporting ICM implementation through ICM plans, ICM committees, and management activities concerning both terrestrial and marine ecosystems, capacity building and income generating activities.

Component 2: Economic analysis – using economic analysis to support coastal management and policy decisions.

Component 3: Economic and financial mechanisms – setting up economic and financial mechanisms to generate additional and sustainable funding for ICM: review of options (payment for ecosystem services, taxes, user fees, trust funds, quota markets, offsets, labels…); feasibility studies; implementation; monitoring.

Component 4: Capitalization, communication, dissemination of project outcomes in the Pacific – going beyond pilot sites activities in order to have impacts at the regional level, by fostering experience sharing between sites, cross-sectoral expertise, and communication and dissemination of the project outcomes.

Component 5: Project management – implementing and coordinating the project, by providing technical assistance, organizing local and regional steering committees, conducting audits and evaluations (mi-term and ex-post), etc.

Contents

Executive Summary

The two key objectives of the freshwater community-based protected areas and fisheries management in Ra Province - diagnosis and action plan report are:

- To examine and review past and current initiatives on freshwater protected areas and fisheries management; and
- To identify areas that RESCCUE can address, support and facilitate in strengthening freshwater fish and invertebrates protected areas management.

Ra communities have only one type of freshwater fish management system and these are customary traditionally temporary '*tabu* ' or protected Areas. The following are the communities that have temporary tabu areas:

- villages of *Nasau, Vanuakula, Nauria and Nukulau* (*Nasau* District);
- villages of *Namara, Sawanivo, Nakorovou* (*Lawaki* District);
- village of *Naraviravi* (*Tokaimalo* District)*;*
- village of *Naravoui* (*Nailuva* Distrct)*;*
- -villages of *Rokovuaka* and *Nalalawa* (*Nababa* District)*.*

Threats and issues of freshwater fish and invertebrates are:

- The use of derris sp. roots, weedicides and pesticides as means of harvesting fish resources from the rivers (Copeland 2013). The use of these poisonous plants and chemicals can change water quality by depleting oxygen and changing pH thereby providing an unsuitable environment for all aquatic life;
- Introduced fish species in the lower and middle reaches of the Nakorotubu such as *Oreochromis mossambicus* and *Gambusia affinis* feed on the fish larvae of the native species thus account for the poor fish abundance and diversity of native species;
- Algal bloom in the lower catchment due to high levels of nutrient input in rivers as a result of livestock, weedicides, pesticides and agricultural activities;
- The stream beds and accidental introductions of invasive invertebrates such as *viviparid* gastropods could potentially act as vectors for human-related illnesses;
- Continuous freshwater gravel extraction as in *Naseyani village*.

The following are key RESCCUE opportunities to facilitate the effective protection of key freshwater species, habitats and ecosystems in Ra:

RESCCUE main Key actions

The key RESCCUE actions for freshwater community-based protected areas and fisheries management will be implemented from January 2017 to May 2017. The following are the key areas that RESCCUE will address:

- work with the communities who have customary freshwater temporary *tabu* areas in developing freshwater resource management plans to protect freshwater fish and macroinvertebrate diversity;
- raise awareness in communities on those fish and macroinvertebrates that are bio-indicators of watershed health;
- have a series of community awareness campaigns and develop educational materials on the protection of *Achochlidium fijiense* one the rare and endemic species and other native fish species;
- develop environmental leaflets as well as have a series of community consultation on the environmental and social impact of gravel extraction;
- have awareness workshop as well as develop educational materials on the importance of freshwater infauna and the relationship of forest cover on these species habitats; and
- work with relevant government agencies in ensuring the legislations and related regulation provide the necessary freshwater resources protection from destructive anthropogenic resource use activities including gravel extraction. .

The following are the river and creek management measures that will support the protection of freshwater fish resources.

- Demarcate agricultural buffer zones in the highly erodible and flood- prone lower catchments to help improve the migration path from sea to freshwater estuaries and up into the middle and upper catchments, assisting a rehabilitation process for these inland freshwater fauna.
- Reduce pathways for introduction and spread of invasive species including:
    - Restricting horse access; and
    - Controlling the entry of human related waste e.g. chemicals or rubbish, into streams
- A concerted effort such as developing a "community based bio-security protocol" to prevent the introduction of any exotic aquatic fauna to the upper sections these rivers. Any introduction will likely further erode the ecological function of these waterways.
- Stocking of native species (e.g*. Gudgeons*) could be considered to improve the biodiversity of waterways.
- Integrated irrigation/aquaculture of prawns (*Macrobrachium sp*) to be an alternative source income and support subsistence livelihood.
- Conduct a series of community awareness campaigns and develop educational materials on the protection of *Achochlidium fijiense* one the rare and endemic species and other native fish species.

1. Background information on Freshwater biodiversity in Ra Province

1.1 Overview of Freshwater Fish and invertebrate biodiversity

The only two areas in Ra province that there has been any in-depth assessment of freshwater resources and related ecosystems are places within and below *Nakorotubu* range and *Nakauvadra* range. These two areas do provide a reasonable overall picture of freshwater resources and related ecosystems in Ra. However, there have been other minor studies conducted that focus on specific habitat and species relationship or just a specific species. The following sections will discuss in detail the status and key factors affecting or threat to these freshwater resources.

1.1.1 Nakorotubu range

i. Habitat and Catchment Description

The *Nakorotubu* watershed is covered with well vegetated lowland and upland tropical forest. The stream-bed habitats are covered with sand, small rocks/pebbles, gravels, fused rock bottoms and rocks and boulders on the sides. Morphology of the rivers and creeks vary widely and range from shallow to deep sections. The rivers and creeks have range from very narrow to very wide. As the water flow rates depend on the river and creek shape and size, the water flow rate of the rivers and creeks are slower in the wide and deeper section of the pools, and rapid in shallow and narrow sections. There are sections within the rivers that have cascades with rock pools.

The geomorphology of the *Nakorotubu* Range has rugged, mountainous steep slopes and deep weathering, highly erodible grassland soil, farmland and grazing along the mid- upper reaches of the *Uloa* and *Wailotua* rivers. There are feral cattle in the forest and along the edge of the *Uloa* and *Wailotua* rivers.

ii. Species richness and abundance

The main natives fish species found in *Nakorotubu* are *Bunaka grinoides* and *Ophioeleotris sp*. (*Eleotridae*); *Awauous guamensis*, *A. ocellaris*, *Glossogobius sp*., *Sicyopus zosterophorum* and *Sicyopterus lagocephalus* (Gobiidae); *Microphis leiaspis* (Syngnathidae); *Kuhlia marginata* and *K. rupestris* (Kuhliidae); the freshwater eels *Anguilla marmorata* and *A. megastoma* (Anguillidae), freshwater moray eel *Gymnothorax polyuranodon*; and the introduced *Oreochromis mossambicus* and *Gambusia affinis* (Brodie 2009). Streams and rivers in the *Nakorotubu* watershed showed low fish diversity ranging from 0 to 10 and this was based on the fish species collected which represented 9% of the total freshwater fish diversity of Fiji (Boseto 2006; Brodie 2009).

The introduced, exotic species were observed and recorded in the *Uloa* and *Wailotua* rivers were:

- Mozambique Tilapia *Oreochromis mossambicus*; and
- the mosquito fish, *Gambusia affinis*.

iii.Water quality and habitat characteristics

The water quality in rivers and streams in the *Nakorotubu* watershed area is still very much pristine as it flows through an intact forest system in the upper and mid reaches. However, in the lower reaches it flows through disturbed areas where agricultural activities and human habitation associated activities take place. The water and habitat conditions exhibit suitable conditions to sustain aquatic life: intact forest cover in the upper and mid reaches, the overhanging riparian plants, water temperature of 22-26°C, average water flow rate of 0.27m/s, over 70 % dissolved oxygen and very little turbidity (Boseto 2009).

1.1.2 Nakauvadra range

i. Catchment characteristics

The streams in upper catchment appeared to be in good condition primarily because the stream bank vegetation (riparian vegetation) is intact and the streams are well-shaded with high levels of organic debris such as leaf litter (Brodie 2009; Jenkins 2009) . Hence, it is vital to keep the natural vegetation intact and undisturbed along all stream banks since the overall health of the waterways is likely to be reliant on organic matter inputs from the surrounding forest. The *Vunilaci* and *Vuniqesa* rivers are small, tertiary catchments which drain into the *Wainibuka* River, a major secondary tributary of the Rewa River (296,000 ha), the largest catchment in Fiji. The *Wainibuka* River catchment (74,567 ha) is one of five major tributaries and drains the drier northeastern part of Viti Levu (Jenkins 2009). This catchment has around 64% forest cover with 47,362 ha of forest remaining intact. With relatively steep slopes and deep weathering, soil erodibility is generally high with the erodibility of grassland and grazing along the upper reaches of the *Wainibuka* classified as severe (Artherton et al. 2005). Contributing to this erodibility, this secondary catchment is also notable in having the highest number of river road crossings (i.e. bridges, culverts, fords) of any catchment in Fiji with a total of 1460 and the second highest length of roads in any catchment in Fiji (950 km) (Artherton et al. 2005). Both of the interior river catchments are still thick with native trees. These interior catchments are characterized by steep relief with many large barriers such as waterfalls and large metamorphic boulders, making it difficult for many fish to penetrate except for the *Gobiidae* (gobies) and *Anguillidae* (freshwater eel) families.

ii. Species richness and abundance

Overall a total of eight species freshwater fishes are found in *Vunilaci* and *Vuniqesa* Rivers, within the *Nakauvadra* Range interior forests of Ra province, Fiji. Two of these species, *Awaous guamnesis* and *Sicyopterus zosterophorum* were found from the upper catchments. Also found were three species of freshwater eels *Anguilla marmorata*, *A. obscura* and *A. megastoma*. The freshwater moray, *Gymnothorax polyuranodon* has been seen in the area as well (Boseto 2009). The lower catchment of the river system has been heavily populated by the introduced Mozambique Tilapia *Oreochromis mossambicus* and the mosquitofish, *Gambusia affinis*. The two catchments appear to be lack in variety of both diversity and abundance of fishes. There are no endemic or sensitive, rare fauna were observed. Although the natural riparian buffer zones on both of these upper catchments were largely still intact.

iii. Water quality and habitat characteristics

Overall, the quality of water in the two upper catchment areas appears to be high and reflects both the high level of remaining forest cover and the steeper topography of both the catchments. With altitudes ranging from 200- 280 meters above sea level (m. a.s.l) (Jenkins 2009)., the headwaters of both these catchments are in generally excellent condition to support aquatic life with mainly intact native riparian vegetation, shading waters to a cool 23-24°C, good average water flow of around 0.35m/s, generally over 70% dissolved oxygen and very little turbidity (Jenkins 2009).

1.2 Human use of freshwater ecosystems in Ra Province

Streams and rivers provide many essential ecosystem services for humans such as drinking water, subsistence and commercial fisheries, recreational (swimming, boating, fishing) and hydroelectricity power generation.

Water supply in most rural areas is sourced largely either from community-specific water catchments; typically a concreted section of a creek or catchment feeding supply to the nearby village or through a communal well. In Fiji, there are a total of 1,174 un-metered village water supplies. These community water supply initiatives are installed by the Water Authority of Fiji (and previously the Public Works Department) and then the communities are responsible for maintenance, management and routine upkeep of these systems (Kumar 2010). The villages lacking this communal infrastructure acquire water at the household level through rainwater harvest tanks or from rivers or creeks (Asia Development BanK 2003; Kumar 2010; Water Authority of Fiji 2012). According to the ADB survey, one third of all rural households in Fiji lack access to an improved water source (Asia Development BanK 2003).

i. Ra Province domestics water sources

The main water sources communities (villages and settlements) in Ra Province use or rely on are river and stream (creeks), well, spring water, rain catchment tanks, shared water pipe (water is supplied from Water Authority of Fiji reticulation system) and individual water pipes (water provided from Water Authority of Fiji r reticulation system).

In Ra the following are the **main water sources** that villages depend on and use on a daily basis for drinking, cooking, bathing and latrine.

Table 1 Water source for household use in Ra Province

Water Sources in Ra 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)

The following are the percentage of the main water uses from the various water sources in the villages in Ra Province

Table 2 Village water sources in Ra province

Percentage of villages in the province (n =95)						
Water sources	**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)

ii. Freshwater fisheries

There are about 12 native edible fish species as illustrated in Table 3 which are a source of livelihood for most of the villages in the inner parts of Ra province (Boseto 2006, 2009; Copeland 2013).

Table 3 Edible Fish Species – Support Community Livelihood

Edible Fish Species – Support Community Livelihood	
Scientific name	Local name
Anguilla marmorata	*Duna*
Anguilla obscura	*Duna*
Anguilla megastoma	*Duna*
Kuhlia marginata	*Ika droka*
Kuhlia munda	*Sakelo*
Kuhlia rupestris Qitawa	*Uruuru*
Lutjanus argentimaculatus	*Damu ni waidranu/ veidogo*
Butis amboinensis	*Vo Sa*
Eleotris fusca	*Vo, Deke, Dekedeke*
Eleotris melanosoma	*Vo qaruqaru*
Giuris margaritacea	*Kabau*
Awaous guamensis	*Beli*

Source: Copeland (2013), Boseto (2009) and Jenkins (2009)

In terms of edible freshwater invertebrates there are four main species that villages gather for either subsistence or economic uses and this is listed in Table 4 below.

Table 4 Edible Fish Species – Support Community Livelihood

Edible Freshwater invertebrate species – Support Community Livelihood	
Scientific name	Local name

Edible Freshwater invertebrate species – Support Community Livelihood	
Scientific name	Local name
Neritina pulligera	*takau, tabua, Sici bolo*
Melanoides aspirans	*moto*
Septaria livida	*kabikabi*
Septaria limpets	*Sici kai*
Macrobrachium cf. latidactylus	*Ura (Freshwater prawn)*

Source: Rashni (2014) and Brodie (2009)

1.3 Key Threats to Ra freshwater systems

- The use of Derris roots, weedicides and pesticides as means of harvesting fish resources from the rivers (Copeland 2013).
- The use of these poisonous plants and chemicals can change water quality by depleting oxygen and changing pH thereby providing an unsuitable environment for all aquatic life.
- The slow water flow, sediment deposits on the substrate and the presence of thick algae in the water are of concern as they will also alter the water chemistry.
- The presence of introduced fish species in the lower and middle reaches of the Nakorotubu Range is a major threat. The introduced species *Oreochromis mossambicus* and *Gambusia affinis* are known to feed on the fish larvae of the native species thus their occurrence here in large numbers can be account for the poor fish abundance and diversity of native species (Boseto 2006, 2009; Jenkins 2009).
- The other concern was the algal bloom in the lower catchment such as high levels of nutrient input in rivers (Brodie 2009). This is likely a result of livestock, weedicides, pesticides and agricultural activities. Algae can be very harmful to freshwater biodiversity by altering the physical water parameters and reducing the quality of the water by affecting levels of dissolved oxygen, water temperature and pH (Boseto 2006, 2009; Jenkins 2009).
- The stream beds and accidental introductions of invasive invertebrates such as *viviparid* gastropods could potentially act as vectors for human-related illnesses.
- Evidence of invasive weed species along the stream beds which implies there is strong potential for similar introductions of invasive freshwater fauna.

2 Policy and legislation on Freshwater resources

Water resources management in Fiji is defined as the active management of freshwater resources, whereby the government ensures that they are being exploited productively, fairly and sustainably and at the same time protected (SOPAC 2006). Water as a resource is governed by a number of Acts. The main legislation is the Water Supply Act which covers the management of usage, distribution and supply system of water to urban and rural areas.

The Rivers and Streams Act of 1882 and revised in 1985, originally a colonial ordinance, provides for the Lands department to approve water abstraction from rivers and also allows traditional activities to be conducted by native Fijians in small streams. However, this Act does not address critical components of river management namely the preservation of water quality and better controlling the extraction of water by adjacent land users.

There is the 1973 Irrigation Act which covers the use of water for agricultural activities specifically to facilitate government controlled agricultural schemes. In addition the Environment Management Act, 2000, introduced protection powers relating to water quality (both freshwater and marine) and the protection of features of environmental importance. It is important that a clear understanding be established as to the powers of the government to control and allocate water and its power to protect water resources, because native land owners are arguing for their own rights to determine how water is allocated. Altogether, the environment including water resources is governed by 54 different Acts managed by 15 Ministries. Land ownership also poses problems to economic development as 83 per cent is native-owned land with the rest State-owned or freehold.

Majority of conservation priority in the Fiji's National Biodiversity Strategy and Action Plan recommends protecting 40% of remaining natural forests to achieve the goals of the National Biodiversity Strategy and Action Plan and sustain ecosystem services for Fijian communities and economies. This directly would facilitate the protection of freshwater resources.

The Rural Land Use Policy for Fiji (Leslie and Ratukalou (2002)) advocated long term land use plans to guide farmers on the most appropriate crops suitable to different ecological geographies in Fiji. This policy also addresses buffer zones that is required to protect waterways and freshwater resources

The most recent legislation that would directly support the protection of freshwater resources is the 2009 Crimes Decree (arson clause). It has stricter punishments for burning forestry plots. Interesting in Ra there have been six cases of people convicted by this decree because of indiscriminate burning of land areas. However in other parts in Fiji enforcement has been difficult for various reasons such as lack of initiative by community leaders in reporting offenders or offenders seeking traditional reconciliation ceremony and lack of human resources or initiative by local police to investigate and prosecute.

The proposed RESCCUE freshwater community-based protected areas and fisheries management activities will endeavor to implement core principles of the policies outlined above in a simple and practical way in order to demonstrate that communities can be guides to make informed decision to better management available resources through sound social appropriate means, relevant economic solutions and ecosystem-based adaptation that mitigate ecological loss in a cost effective manner. As such, RESCCUE activities represent potential opportunities to increase the effectiveness of these existing policies.

3 Ra province community-based protected areas and fisheries management primary sites

There have been a number of communities in the following districts in Ra that have had imposed traditional cultural temporary *tabu* on freshwater waterways (rivers and creeks) and it is listed on Table5 below:

Table 5 Ra Province Temporary Tabu freshwater areas

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 river
Nababa	• Rokovuaka • Nalalawa • Navitilevu	Subsistence and economic livelihood	Open for important traditional cultural event and then closed again. Cultural and beliefs that it has spiritual healing power specifically in *Rokovuaka* that a portion of the creek that flows	Lawaki creek

Ra Province Protected (*Tabu*) Freshwater areas				
District*	**Villages***	**Reasons**	**Management status**	**River or creek**
			near the village is revered	

Source: Ravu (2016)

Note: * - refer to Appendix for the location of these districts and communities

4 RESCCUE intervention

Fiji RESCCUE will be focusing on the following villages in the respective districts in Table 6 below.

Table 6 RESCCUE sites in Ra

Districts	Villages
Tokaimalo	Nayaulevu, Mataveikai, Nabalabala, Vunisea, Vuniyaumunu, Nailwa, Naraviravi, Naivutu, Navavai
Nailuva	Nailuva, Nararavou, Balasere, Naqelecibi, Namasia
Lawaki	Nakorovou, Nawairuku, Namara, Sawenivo
Nasau	Nadawa, Ovalau, Vanuakula, Nubumakita, Nukulau, Nasukamai, Nauria
Nababa	Rokovuaka, Navitilevu, Nalalawa
Naiyalayalalevu (Tavua)	Nadrauniivi, Togavere, Naivunivuni, Narabolui, Naseyani, Nananu

Note: shaded in yellow are the villages that have had a temporary freshwater protected area

Shaded in blue is the village experiencing gravel extraction

Fiji RESCCUE will be focusing on riparian enhancement, addressing the negative impacts of the use of Derris sp., washing detergents, other forms of indiscriminate fishing practices as well as working collaboratively with the affected communities in identifying areas where they can declare a freshwater "*tabu"* or protected area.

One of the fundamental activities is community awareness on the importance of freshwater ecosystem and this will need to be conducted in communities in districts in Table 3. The sharing of experience amongst community members from the districts will be critical particularly for those districts or communities that neither have a freshwater *tabu* area nor a freshwater resources management plan. At the moment none of the communities have a management plan

It is important to note that all of this activities and action plans for establishing a protected freshwater area or areas in Ra will be begin in 2017. This is due to community rehabilitation work that is still underway due to the devastation caused by Tropical Cyclone Winston early 2016.

In terms of freshwater community-based protected areas and fisheries manag**e**ment, the following are the key areas that RESCCUE will address:

- work with the communities in Table 6 in developing freshwater resource management plans to protect freshwater fish and macroinvertebrate diversity;
- raise awareness in communities on those fish and macroinvertebrates that are bio-indicators of watershed health;

- develop environmental leaflets as well as have a series of community consultation on the environmental and social impact of gravel extraction;
- have awareness workshop as well as develop educational materials on the importance of freshwater infauna and the relationship of forest cover on these species habitats; and
- work with Fisheries department, department of Environment, Lands department and Mineral Resources department in ensuring the legislations and related regulation provide the necessary freshwater resources protection from destructive anthropogenic resource use activities.

The following are the river and creek management measures that will support the protection of freshwater fish resources.

1. Riparian forest plant rehabilitation on riparian system destroyed by TC Winston.
2. Demarcate agricultural buffer zones in the highly erodible and flood- prone lower catchments to help improve the migration path from sea to freshwater estuaries and up into the middle and upper catchments, assisting a rehabilitation process for these inland freshwater fauna.
3. Reduce pathways for introduction and spread of invasive species including:
    - Restricting horse access; and
    - Controlling the entry of human related waste e.g. chemicals or rubbish, into streams
4. A concerted effort such as developing a "community based bio-security protocol" to prevent the introduction of any exotic aquatic fauna to the upper sections these rivers. Any introduction will likely further erode the ecological function of these waterways.
5. Stocking of native species (e.g. *Gudgeons*) could be considered to improve the biodiversity of waterways.
6. Integrated irrigation/aquaculture of prawns (*Macrobrachium sp*) to be an alternative source income and support subsistence livelihood.
7. Conduct a series of community awareness campaigns and develop educational materials on the protection of *Achochlidium fijiense* one the rare and endemic species and other native fish species (as listed in Table 3) (Rashni 2014).

Figure 1 *Achochlidum fijiense*

5 Action plan and budget

Objective	**Activity**	**Target Group (District)**	**Cost (F$)**	2017				
				Jan	Feb	Mar	April	May

Objective	Activity	Target Group (District)	Cost (F$)	2017				
				Jan	Feb	Mar	April	May
Establishment and maintenance of freshwater protected area(s) supported	Participatory assessment and consultation on important freshwater areas and potential areas to have a *tabu*	Nasau, Lawaki, Tokaimalo, Nailuva, Nababa	2,000					
	Community participatory field assessment and activities on riparian forest plant rehabilitation	Nasau, Lawaki, Tokaimalo, Nailuva, Nababa who have their riparian system destroyed by TC Winston	4,000					
	Participatory workshop in developing community based freshwater management plan for the fisheries *tabu* and riparian areas **Key activities and areas to be covered:** i. Riparian forest plant rehabilitation on riparian system destroyed by TC Winston; ii. Demarcate agricultural buffer zones in the highly erodible and flood-prone lower catchments to help improve the migration path from sea to freshwater estuaries and up into the middle and upper catchments, assisting a rehabilitation process for these inland freshwater fauna; iii. Reduce pathways for introduction and spread of invasive species including; iv. Restricting horse access; and v. Controlling the entry of human related waste e.g. chemicals	Nasau, Lawaki, Tokaimalo, Nailuva, Nababa	3,000					

Objective	Activity	Target Group (District)	Cost (F$)	2017				
				Jan	Feb	Mar	April	May
	or rubbish, into streams.							
	Conservation enforcement training for community and relevant government officials	Nasau, Lawaki, Tokaimalo, Nailuva, Nababa	1,000					
Freshwater species monitoring committee capacity strengthened	Setting up riparian and freshwater *tabu* monitoring committee and developing monitoring action plan **Key activities and areas to be covered** i. A concerted effort such as developing a "community based bio-security protocol" to prevent the introduction of any exotic aquatic fauna to the upper sections these rivers. Any introduction will likely further erode the ecological function of these waterways. ii. Stocking of native species (e.g. *Gudgeons*) could be considered to improve the biodiversity of waterways.	Nasau, Lawaki, Tokaimalo, Nailuva, Nababa	2,000					

Objective	Activity	Target Group (District)	Cost (F$)	2017				
				Jan	Feb	Mar	April	May
	Community training on freshwater bio-indicator for river health assessment using a bio-indicator tool kit. i. Integrated irrigation/aquaculture of prawns (*Macrobrachium sp*) to be an alternative source income and support subsistence livelihood. ii. Conduct a series of community awareness campaigns and develop educational materials on the protection of *Achochlidium fijiense* one the rare and endemic species and other native fish species	Nasau, Lawaki, Tokaimalo, Nailuva, Nababa	2,000					
Communities are aware of the impacts of gravel extraction	Consultation and workshop on gravel extraction to communities affected by it	Nayalayalalevu Nasau, Lawaki, Tokaimalo, Nailuva, Nababa	1,000					
Biodiversity management committees are established in each district for monitoring and act as watchdogs of activities and species that pose threat to the freshwater protected areas	Consultation and establishing biodiversity management committees	Nayalayalalevu Nasau, Lawaki, Tokaimalo, Nailuva, Nababa	1,000					
Total F$			17,000					

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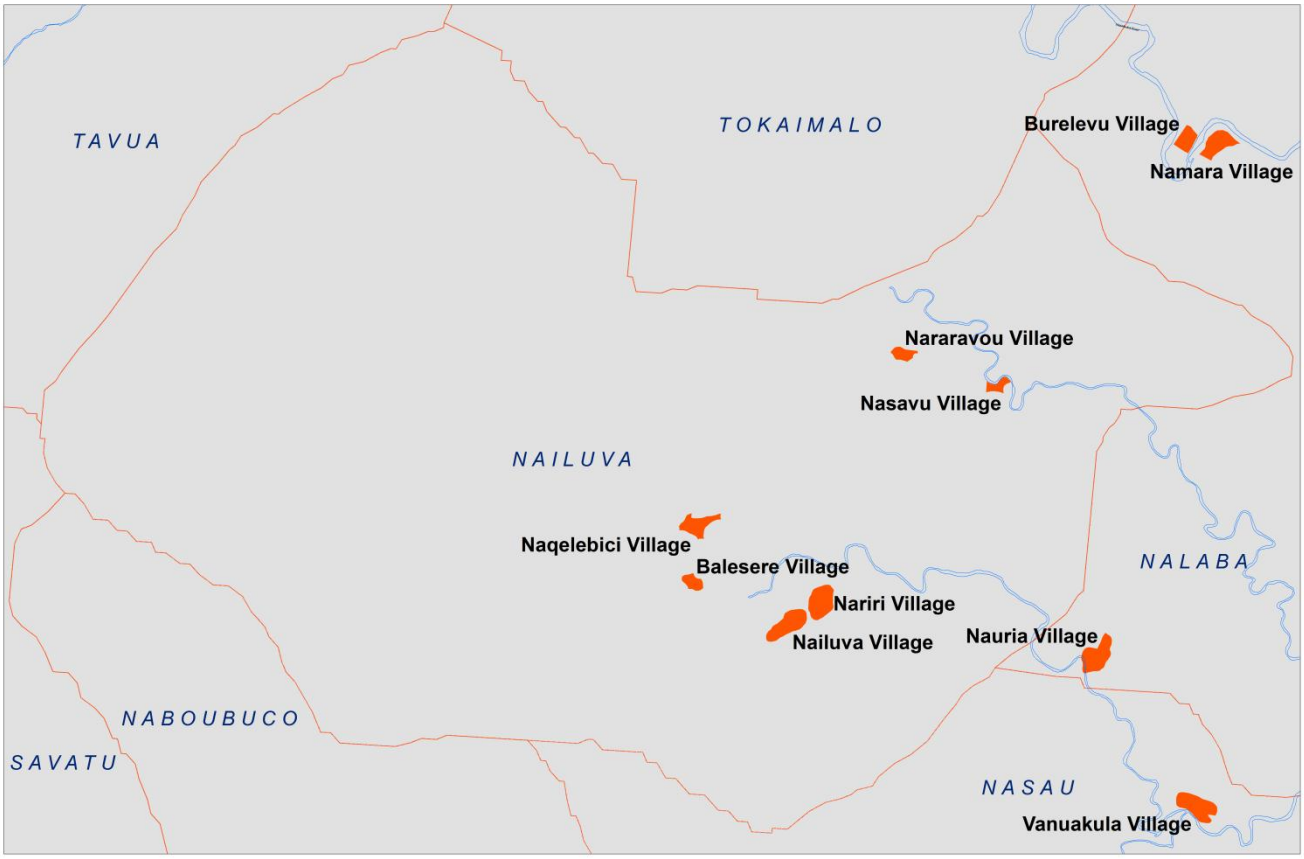
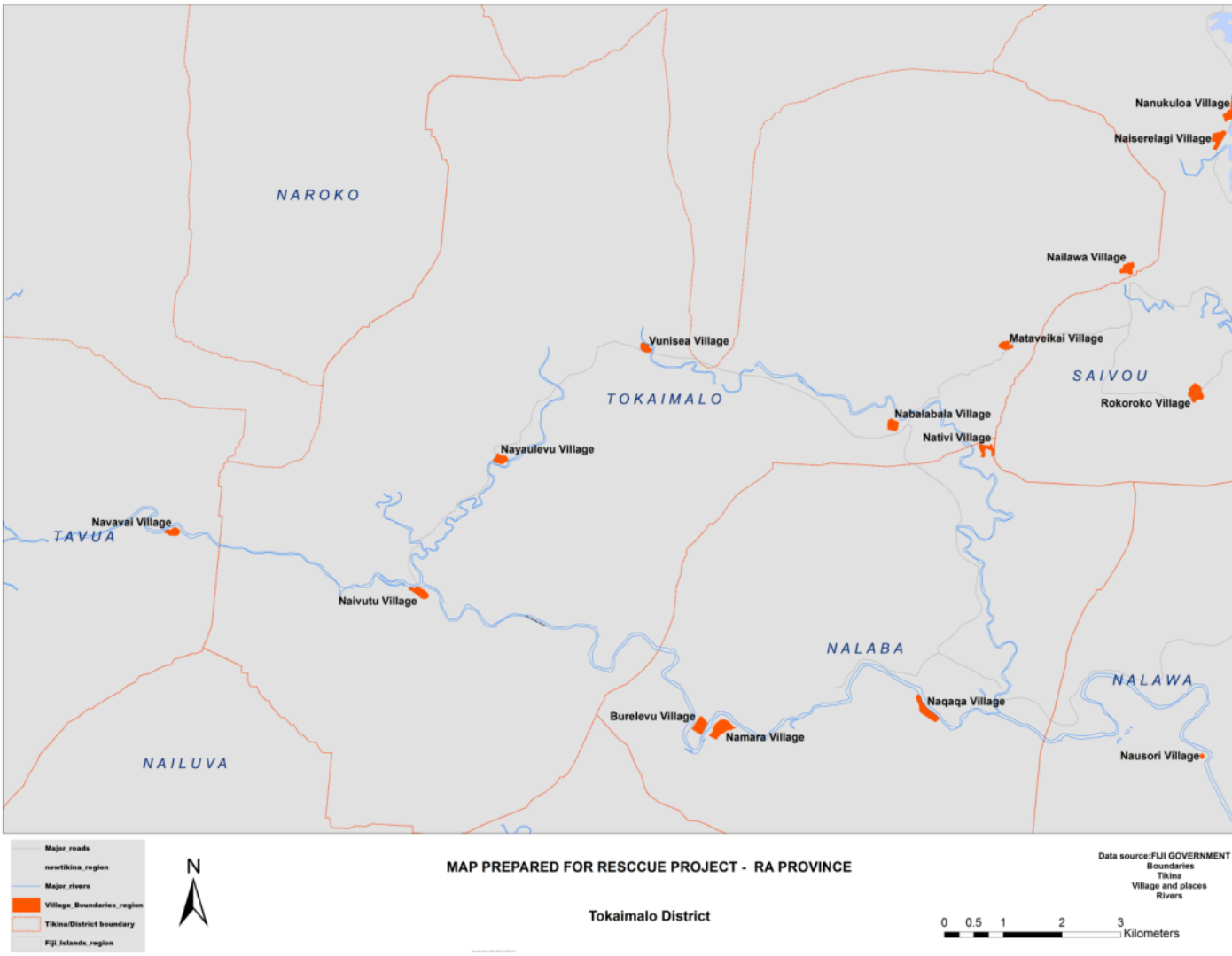
Appendix 1 Maps of Freshwater Fish and Invertevares Temporary Tabu (Protection) Sites


Navitilevu Village
NALAWA
Dama Village
NAKUAILAVA
Nalalawa Village
Rokovuaka Village
Korovou Village
NABABA
Manu Village
LAWAKI
Nabulini Village
Nailega Village
Naibita Village
NAILEGA
Bucalevu Village
NAGONENICOLO
Major_roads
newtikina_region
Major_rivers
Village_Boundaries_region
Tikina/District boundary
Fiji_Islands_region
N
MAP PREPARED FOR RESCCUE PROJECT - RA PROVINCE
Nababa District
Data source:FIJI GOVERNMENT -
Boundaries
Tikina
Village and places
Rivers
0 0.3 0.6 1.2 1.8
Kilometers


TAVUA
TOKAIMALO
Burelevu Village
Namara Village
Nararavou Village
Nasavu Village
NAILUVA
Naqelebici Village
Balesere Village
NALABA
Nariri Village
Nailuva Village
Nauria Village
NABOUBUCO
SAVATU
NASAU
Vanuakula Village
Major_roads
newtikina_region
Major_rivers
Village_Boundaries_region
Tikina/District boundary
Fiji_Islands_region
N
MAP PREPARED FOR RESCCUE PROJECT - RA PROVINCE
Nailuva District
Data source:FIJI GOVERNMENT -
Boundaries
Tikina
Village and places
Rivers
0 0.225 0.45 0.9 1.35
Kilometers


Togovere Village
Drauniivi Village
Rabulu Village
TAVUA
Nananu Village
Naseyani Village
SAVATU
Major_roads
newtikina_region
Major_rivers
Village_Boundaries_region
Tikina/District boundary
Fiji_Islands_region
N
MAP PREPARED FOR RESCCUE PROJECT - RA PROVINCE
Naiyalayalalevu District
Data source:FIJI GOVERNMENT -
Boundaries
Tikina
Village and places
Rivers
0 0.35 0.7 1.4 2.1
Kilometers


NAROKO
TOKAIMALO
SAIVOU
TAVUA
NALABA
NALAWA
NAILUVA
Nanukuloa Village
Naiserelagi Village
Nailawa Village
Vunisea Village
Mataveikai Village
Rokoroko Village
Nabalabala Village
Nativi Village
Nayaulevu Village
Navavai Village
Naivutu Village
Naqaqa Village
Burelevu Village
Namara Village
Nausori Village
Major_roads
newtikina_region
Major_rivers
Village_Boundaries_region
Tikina/District boundary
Fiji_Islands_region
N
MAP PREPARED FOR RESCCUE PROJECT - RA PROVINCE
Tokaimalo District
Data source:FIJI GOVERNMENT
Boundaries
Tikina
Village and places
Rivers
0 0.5 1 2 3
Kilometers


Naqelebici Village
Balesere Village
NAILUVA
Nariri Village
Nailuva Village
Nauria Village
NALABA
Ovalau Village
Vanuakula Village
Nasukamai Village
Nasau Village
Sawanivo Village
NASAU
Nubumakita Village
Nukulau Village
NABOUBUCO
LAWAKI
Nasoqo Village
NAGONENICOLO
Major_roads
newtikina_region
Major_rivers
Village_Boundaries_region
Tikina/District boundary
Fiji_Islands_region
N
MAP PREPARED FOR RESCCUE PROJECT - RA PROVINCE
Nasau District
Data source:FIJI GOVERNMENT -
Boundaries
Tikina
Village and places
Rivers
0 0.325 0.65 1.3 1.95
Kilometers

Appendix 2 Map of the "Ridge to Reef" river course way