WCS

EBM FIJI ISLANDS

WILDLIFE CONSERVATION SOCIETY
FIJI COUNTRY PROGRAM 2018

FROM THE DIRECTOR

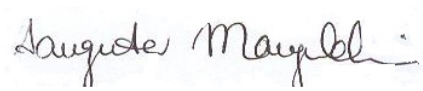
2018 has been a productive year for the Wildlife Conservation Society (WCS). We worked with a wide diversity of communities, government, provincial offices, NGOs and other partners on ridge-to-reef management, locally managed marine areas, forest conservation, gender and fisheries, improvement in coastal fisheries, offshore marine managed areas, and sustainable financing for protected areas.

We are learning to be more strategic and impactful with our science – ensuring that there is a strong link to local management and to national policy, and filling in key gaps in knowledge about Fiji's natural resources, and how people use them. For example, working closely with the Ministry of Fisheries, World Wide Fund for Nature and the University of the South Pacific, local fisheries scientists have been documenting the size of maturity of reef fish in Fiji, to help provide recommendations on changes needed to Fiji's outdated size limits.

This year we focused significant efforts on supporting resource management committees in Bua Province implement their ridge-to-reef management plan and implement funding received through the GEF Small Grants Programme. These management plans are now linked to a larger integrated coastal management plan for the entire Bua Province. In partnership with the Ra Provincial Office, local communities and tourism operators, a management plan and marine conservation agreement for the Vatu-i-Ra Conservation Park in Nakorotubu District. Eighteen education support grants were given out to tertiary level students from Nakorotubu District. We continued investment in our gender and fisheries program through improved sex-disaggregated data collection, gender analyses, supporting women mud crab fishers finalise a management plan for their fishery, and hosting a "Women in Fisheries Forum" in the Northern Division with the Ministry of Fisheries.

As we end 2018, we are saddened to lose two conservation champions in Bua Province. The WCS staff feel honoured to have known and worked with Taitusi Karalo from Kilaka Village who was instrumental in the dialogue to secure a conservation lease over the forest. We are also grateful to Alifereti Qio Matata, the District Officer at Lekutu who played a leadership role in the consultation and review of the Bua Province Integrated Coastal Management Plan, and community-based management efforts in Lekutu, Navakasiga and Bua Districts.

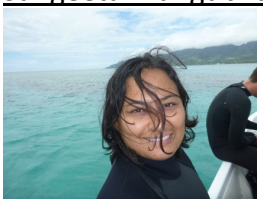
On behalf of the WCS Fiji team, we look forward to continuing to work with our partners in Fiji, regionally and nationally.



Sangeeta Mangubhai
WCS Fiji Director

THE WCS TEAM

Sangeeta Mangubhai, Director – Fiji Program



Dr. Sangeeta Mangubhai joined WCS-Fiji in 2014. She has worked on marine science and conservation in Australia, East Africa, Indonesia and the South Pacific. She completed her Ph.D. in 2007 through Southern Cross University in Lismore, Australia, looking at reproduction and recruitment of corals in Kenya. Since then she has been working on designing marine protected areas, marine spatial planning, coral reef and invertebrate fisheries, environmental policy, and climate change. She is a specialist in designing monitoring programs to understand impacts of disturbances on coral reef communities, and the return of investment of conservation strategies. She sits on numerous national government committees, and is an editor for the journal Pacific Conservation Biology and the Pacific Community's Women in Fisheries Information Bulletin, and an adjunct Associate Professor with Southern Cross University in Australia. Sangeeta received a Pew Marine Fellowship in 2018.

Stacy Jupiter, Director – Melanesia Program

Dr. Stacy Jupiter has been working with WCS since 2008, first as the Fiji Country Director and since 2014 as the Melanesia Director. As Melanesia Director, she oversees country programs in Fiji, Papua New Guinea and Solomon Islands, and is initiating work in Vanuatu. Her Ph.D. research through the University of California, Santa Cruz focused on linkages between land use and downstream impacts to water quality and nearshore coral reefs, topics which she continued to develop as a postdoctoral fellow with the ARC Centre of Excellence for Coral Reef Studies in Australia. Her work continues to focus on integrated catchment-to-reef management, though this has taken various forms, including: evaluating effectiveness of locally-managed marine areas and integrated island management projects; undertaking spatial planning to achieve biodiversity and livelihoods outcomes; assessing downstream impacts of catchment modification on biodiversity and human health; and understanding drivers of resilience in Pacific coastal communities.

Nischal Narain – Manager Finance and Administration

Nischal Narain has been with WCS-Fiji since September 2008 as Finance Manager. He holds a Masters in Business Administration (MBA) with University of the South Pacific. He previously worked with Pacific Theological College as Director of Finance and Administration and WWF South Pacific as Finance Manager. Nischal specializes in budget preparation, financial monitoring and reporting, cash flow, and cash forecasting. He looks after the after information technology and also involved in local corporate funding.

Upashna Prakash – Finance and Administration Officer

Upashna joined WCS in 2016 as Finance and Admin Officer, and supports the finance, administration and operations of the Fiji Country Program. She has a Post Graduate Diploma in Commerce from the University of the South Pacific (USP). She completed studies in Professional Development from the University of Southern Queensland, a Bachelor of Arts majoring in Accounting and Information Systems from USP and is currently pursuing her Masters in Commerce. She is a provisional member of the Fiji Institute of Accountants.

Akanisi Caginitoba – Community Engagement Coordinator

Akanisi Caginitoba joined WCS-Fiji in 2002 as an administration officer and is currently the Community Engagement Coordinator. Akanisi led a livelihood project to build the capacity of women in Vanua Levu to run small businesses to produce *kuta* weaving, honey and virgin coconut oil. She is a specialist in community ecosystem based management planning, community leadership and assists communities identify and develop community projects.

Epeli Manu Loganimoce – Community Engagement Officer

Epeli joined WCS in 2017 as a Community Engagement Officer. He has a Masters in Marine Biology and Ecology from the University of Porto, Portugal. In addition to working with communities to help them plan and manage their natural resources, he has implemented socioeconomic surveys in Fijian villages to assess conservation impact and establish baselines for new payment for ecosystem service initiatives.

Sirilo Dulunaqio – Community Liaison Officer

Sirilo Dulunaqio (Didi) joined WCS as a Community Liaison Officer in 2005. Originally from Kubulau, trained as a dive instructor, Didi provides a critical link between WCS activities and management implementation with the communities of Kubulau and adjacent districts, and provides technical and logistical support on biological surveys. Didi is now working with communities and dive operators in Ra Province to establish a marine protected area and a voluntary contribution to conservation scheme.

Yashika Nand – Marine Scientist

Yashika Nand joined WCS-Fiji in 2010 as a Marine Scientist. She has graduated with her Post-Graduate Diploma in Marine Science from the University of the South Pacific in 2008. Previously she worked for Fiji's Department of Fisheries as the lead coral researcher. Yashika manages all data from WCS' biological monitoring program, and helps integrate this into conservation planning in Fiji. Her expertise includes coral identification, coral health assessments, the aquarium trade fishery and more recently value chain analyses of coastal fisheries. She is currently completing a Masters in Coral Reef Ecology, focusing on coral disease at the University of the South Pacific.

Watisoni Lalavanua – Fisheries Officer

Watisoni joined WCS in 2016 as a Fisheries Officer. He has a Bachelor of Applied Science from Auckland University of Technology. Previously he worked with Partners in Community Development Fiji on climate change adaptation, disaster risk management, rural water security, food security and fisheries. He was a junior fisheries scientist with the Pacific Community working in Tuvalu, Kiribati, FSM and Papua New Guinea. He has experience in assessing fish, invertebrate and coral populations, socioeconomic survey and post-harvesting training.

Waisea Naisilisili – Fish Specialist / Operations Support Officer

Waisea Naisilisili joined WCS-Fiji in 2003 as a field collector and now works as a project officer and is part of the biological survey team. Waisea has previously worked at the Fiji Mineral Resources as a research assistant collecting mineral samples. Waisea specializes in coral reef fish surveys and community catch monitoring. He is also a specialist in community engagement and is currently leading WCS' island planning process and community engagement in the Lomaiviti Province.

Jone Tamanitoakula – Science Communication Officer

Jone joined WCS in 2017 as a Fisheries Officer. He has a Bachelor of Applied Science from Auckland University of Technology (AUT) and worked for the Ministry of Fisheries as a Project Officer and Fisheries Assistance Officer for five years before joining WCS. He has extensive experience marine surveys, socioeconomic monitoring, conducting CITES "Non-Detrimental Findings" and Fisheries Impact Assessments throughout Fiji. He has a keen interest in conservation and management of fisheries resources and ecosystems.

Kelerayani Gavidi – Gender Officer

Kelerayani joined WCS-Fiji as a Gender Officer in 2018. She has a Bachelor of Arts in law and social work and a Post-Graduate Certificate in Gender Studies from the University of the South Pacific. She is an experienced facilitator and researcher on social policy, grassroots level communities, youth, development and gender issues. She has worked previously for the Ministry of Heath, International Organization of Migration and Fiji Women's Rights Movement on gender mainstreaming and gender equality.

Mosese Naleba – Fisheries Assistant

Mosese Naleba interned with WCS in 2015 and joined the organisation as a Fisheries Assistant in 2018. He has a Bachelor of Science from Fiji National University. Mosese has conducted socioeconomic surveys on women in fisheries throughout Fiji and assisted with studies on coral reef fish. Prior to joining WCS, he worked as a Research Field Assistant for TeVa Consultancy, assisting with terrestrial, wetland and freshwater biological surveys, community consultation, and socioeconomic surveys. He has a keen interest in fisheries studies and gender inclusiveness in Fiji's coastal fisheries management.

Ingrid Qauqau – GIS Officer

Ingrid Qauqau has been working with WCS-Fiji as a GIS officer since 2003. She graduated with a Bachelor of Environmental Science in 2002 from the University of the South Pacific. She specializes in general mapping, image analysis, remote sensing, spatial analysis, and habitat mapping. Ingrid is also a member of the GIS user forum of Fiji.

Mohini Raj – Administration & Logistics Assistant

Mohini joined WCS as the Logistics and Administration Assistant in 2018. She holds a Certificate in Business (Banking), a Diploma in Business (Management), both from the Fiji Institute of Technology, and is completing a Bachelors in Management majoring in Human Resource Management and Industrial Relations. Mohini previously worked as Secretary to the Managing Director and Group CEO for Foods Pacific Ltd and has over 15 years of administrative experience with the private sector, government and tertiary education institutes.

Ruci Lumelume – Policy Advisor

Ruci Lumelume joined WCS-Fiji in 2015 as our Policy Advisor. Ruci is WCS' government liaison for WCS-Fiji, supporting the Fiji government in its international commitments and the development of new legislation and policies that address conservation and fisheries issues. Ruci has a Bachelor of Arts in geography, population studies and demography, and postgraduate degree in development studies from the University of the South Pacific. She worked previously for IUCN focusing on wetlands, and the Fiji Islands Trade and Investment Bureau.

Sahar Noor Kirmani – Technical Support Officer

Sahar joined WCS in 2017 as an Australian Volunteer International to provide technical support across two marine projects. She has a Bachelor of Science with first class honours in Biology and Marine Science from the University of Sydney, a certification in Spatial Information Systems from the National Environment Institue, New South Wales, and studied Development and Management from Lund University in Sweden. She has worked in species conservation and ecological monitoring, and is experienced in spatial analysis, and cartography.

Sulia Vorata – Office Cleaner

Sulia joined WCS in 2016 as an Office Cleaner. She looks after the care of the office and supports the staff in the preparation of field logistics and meetings.

COLLABORATING STUDENTS

Krystelle Danford

Krystelle is in the final year of her Master of Science at the University of the South Pacific on "Life history characteristics of two coral reef fish species in Fiji, Naso unicornis and *Siganus vermiculatus.*" She is also trying to understand geographic differences in life history traits between reefs, and its implications for setting revised size limits in Fiji. She is supervised by Drs. Susanna Piovano and Sangeeta Mangubhai.

Nicola Fraser

Nicola is in the first year of her PhD at the National Marine Science Centre, Southern Cross University, Australia. She has been awarded an Endeavour Fellowship to examine sea anemones in the marine aquarium trade, with a focus on Fiji. The overarching goal of this work is to address knowledge gaps to enable effective fisheries management, and establish aquaculture techniques for sea anemones to provide sustainable livelihoods for local communities and promote environmental stewardship. Her supervisors are Drs. Anna Scott, Sangeeta Mangubhai, and Karina Hall.

Brae Price

Brae completed his BSc (Honours) of Environmental Science at Curtin University, Australia in 2018. His research assessed the impact of cyclone Winston on habitat communities and fish assemblages in the Kubulau and Levuka districts, Fiji, and was part-funded by a grant from the National Geographic Society. The overall goal of the research was to assess the state of coral reefs post-cyclone Winston to determine possible implications to fisheries and livelihoods for nearby villages. His supervisors were Drs. Jordan Goetze, Sangeeta Mangubhai and Benjamin Saunders, and Professor Euan Harvey.

Ana Samperiz

Ana Samperiz is enrolled as a PhD candidate at Cardiff University from October 2018 and will be investigating signals of water quality and environmental change detected from long-lived coral records collected from the Coral Coast and Ra in Fiji. She will be trying to link long-term records with land use patterns and climate change impacts in adjacent catchments. Her supervisors are Drs. Sindia Sosdian (Cardiff University), Ken Johnson (Natural History Museum) Erica Hendy (University of Bristol), Eleanor John (Cardiff University) and Stacy Jupiter (WCS Melanesia).

WCS INTERNS AND FELLOWS

Emma Arnett

Emma has a Bachelor of Science (Marine Biology extended Major) and a Bachelor of Business Management (Business Economics) from the University of Queensland, Australia. Emma assisted in projects such as the mud crab Catch Per Unit Effort (CPUE) data entry, the editing of the upcoming Sustainable Fisheries Cookbook, community mud crab management plans and the women in fisheries socioeconomic surveys.

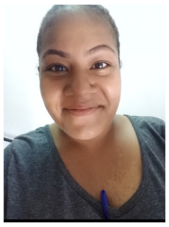
Kirisitiana Navuta

Kirisitiana Navuta has a Bachelor of Science and postgraduate Diploma in Climate Change from the University of the South Pacific, and a Graduate Diploma of Conservation Biology from Macquarie University in Sydney. She was an intern with WCS from April to July 2018, and completed a small consultancy with WCS to undertake a desktop study of coastal fisheries projects in Fiji, Solomon Islands and Vanuatu. She also developed a database to assess the diversity of articles published by the Pacific Community's Women in Fisheries Bulletin.

Alyssa Thomas

Dr. Alyssa Thomas started working with WCS in February 2017 initially as a volunteer and then as a consultant. She has a PhD in environmental studies from Victoria University of Wellington, New Zealand. Her PhD thesis was on the attitude and behaviour of fishers in a popular New Zealand recreational fishery. Alyssa's research interests revolve around the human dimensions of wildlife conservation.

Talei Vasu

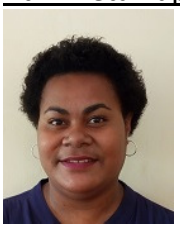


Talei Vasu Bachelor's Degree in Environmental Management from Fiji National University. Talei interned with WCS from August to October 2018, assisting in data collection and entry of surveys on women and their role in the fisheries sector. Talei also assisted in community work to support ridge-to-reef management, providing support for workshops and meetings held by senior staff from WCS.

Seini Miller Tubuna Cabebula

Seini has a Bachelor of Science (Environmental Science) from the University of the South Pacific. She was a local intern for WCS during November 2018. As part of her work for WCS, Seini travelled north to Vanua Levu to assist in conducting the women in fisheries socioeconomic surveys, and also assisted with the surveys in Suva.

Adi Arieta Tupou Baleivale



Arieta has a Bachelor of Environmental Science from Fiji National University and interned with WCS in November 2018. She travelled with the WCS team north to Vanua Levu. Her roles mainly consisted in assisting and conducting the socioeconomic surveys in the market places.

Laisani Camaitovu

Laisani Camaitovu has a Bachelor of Science from the University of the South Pacific. She interned with WCS in 2018, assisting in data collection and entry of surveys on women and their role in the fisheries sector.

Margaret-Pauline Seruvatu

Margaret-Pauline Seruvatu is undertaking a Bachelor of Arts in Environmental Management from University of the South Pacific. She is undertaking a broad range of courses in environmental law, ocean resource management and marine spatial planning. She interned with WCS from June-September 2018, assisting in data collection and entry of surveys on women and their role in the fisheries sector.

Mereseini Usamate

Mereseini interned with WCS March to April 2018. She has a Bachelor of Science in Environmental Science and a Post Graduate Diploma in Environmental Management from the University of the South Pacific. She assisted in the data entry of the Fijian women in the inshore fisheries sector socioeconomic surveys.

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EXECUTIVE SUMMARY

The Vatu-i-Ra Seascape is an area of unique ecological value located between Fiji's two main islands that incorporate the four provinces of Bua, Ra, Lomaiviti, and Tailevu, and their associated traditional fishing grounds and offshore channels. The Wildlife Conservation Society (WCS) is working with a diversity of partners to preserve the functional integrity of Fiji's Vatu-i-Ra Seascape to sustain biodiversity, fisheries, and intact linkages between adjacent systems from land to sea, thereby enhancing social-ecological resilience to disturbance, and improving quality and abundance of marine resources for Fiji's people and economy. This report highlights WCS Fiji Country Program's achievements from January to December 2018, under our three main themes of Science, Management and Communication. We also highlight our engagement with national and regional policy and planning, and the links to Fiji's national priority strategies.

In 2018, WCS Fiji's scientific studies included:

- Size at maturity and spawning potential ratios for coral reef fish;
- A value chain analysis of the coral reef grouper fishery;
- Gender assessments in Fiji and Solomon Islands;
- Assessment of the critical role of women fishers in the fisheries sector;
- Assessment of coral reefs around Ovalau Island, post-cyclone Winston;
- Biodiversity survey of Kilaka Forest Conservation Area;
- Biocultural indicators of Pacific Island resilience; and
- An evaluation of Marine Conservation Agreements in Fiji.

In our efforts to help strengthen community-based natural resource management in the Vatu-i-Ra Seascape WCS:

- Supported the districts Lekutu, Nadi, Navakasiga, Solevu and Vuya to implement their ecosystem-based management (EBM) plans that take a ridge-to-reef approach;
- Assisted Dama District in Bua Province complete its EBM plan;
- Finalised the Bua Province Integrated Coastal Management (ICM) plan that builds on the provinces nine district management plans;
- Continued to provide technical advice and support to the Ministry of Fisheries to improve of inshore coastal fisheries focusing on sea cucumbers, mud crabs and coral reef fish;
- Assisted women crab fishers to fatten and improve the quality of handling mud crabs; and
- Supported local communities and tourism operators set up a voluntary contribution to a conservation scheme around dive tourism in Ra Province.

In 2018, WCS produced 16 new scientific publications and 13 reports and informative articles, on a range of topics including groupers, sea cucumbers, coral bleaching, women in fisheries, marine conservation agreements, forest inventories, and land-sea island management. We continued to participate on a number of national committees and steering groups focusing on national objectives in biodiversity protection, conservation planning, coastal management, sustainable fisheries and climate change preparedness.

SCIENCE

The following sections present a synthesis of completed and ongoing science projects by WCS and partners for 2018. All reports are available online at https://fiji.wcs.org/Resources.aspx

A value chain analysis of the grouper fishery in Vanua Levu

STATUS: Completed

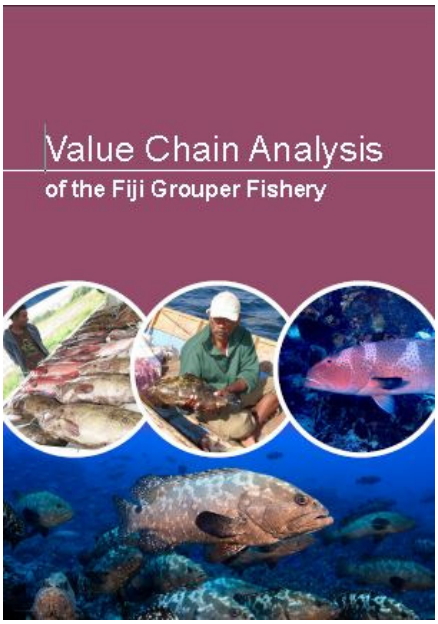
FUNDING: David and Lucile Packard Foundation (Grant #2017-66580, #2015-62920)

PARTNER ORGANISATIONS: Science and Conservation of Fish Aggregations (SCRFA), Ministry of Fisheries

OUTPUT

- *Report*: Sadovy de Mitcheson Y, Mangubhai S, Witter A, Kuridrani N, Batibasaga A, Waqainabete P, Sumaila R (2018) Fiji Grouper Fishery Value Chain Analysis. Report of Science and Conservation of Fish Aggregations (SCRFA), United States. 57 pp.

RESEARCH HIGHLIGHTS:



The management of the grouper fishery is a priority for the Ministry of Fisheries. However, there is very little data on the supply chain, and what is driving exploitation of this fishery. A value chain analysis for the coral reef grouper fishery in Fiji was conducted in September 2016 to April 2017 by SCRFFA, Ministry of Fisheries and WCS. The study aimed to understand the distribution of value gained from groupers along the trade chain, from fisher to consumer, and highlight the overall value of groupers in Fiji's coastal fishery and the importance of maintaining healthy populations. Based on our findings from socioeconomic survey questionnaires with fishers, middlemen, hotels, restaurants, and exporters involved in grouper fishery and trade, and referring to the literature, we described the trade chain as it applied to both domestic and export trade. We also gauged perceptions of resource condition and history as well as gathered opinions on possible management approaches.

Key findings from the study were:

- Most grouper fishers in Fiji target more than one species of grouper, using primarily hook and line, spear and/or speargun, with or without SCUBA for both food and income;

- The estimated total annual grouper catch volume according to daily catch rates and fishing frequency of interviewed fishers was estimated at 845,000 kg plus 245,000 bundles of unknown weight;
- The structure of Fiji's grouper value chain appears to resemble an hourglass shape – that is, many fishers, few exporters, and many consumers – similar to other small-scale developing country fisheries linked to international markets;
- The exporters interviewed in the study export approximately 70,080 kg of grouper per year (although the quantity could be much greater) from Fiji, mainly to New Zealand, the US, China (including Hong Kong), and South Korea;
- Fishers received more money for all grouper species when selling to customers at public markets than when selling to middlemen although the expenses associated with selling grouper by these two sectors need further clarification. Particularly high prices were gained for the leopard coral grouper, *Plectropomus leopardus*, because of high market desirability, both within Fiji and for the export market.
- While grouper had varying levels of monetary importance to respondents, most respondents from each link of the trade chain (or segment) reported that grouper represented less than 25% of their total income from seafood trade; and
- Several of the more sought-after grouper may need conservation attention due to declines, including *E. cyanopodus*.

Key recommendations

- To achieve higher values from groupers, particularly fishers, and reduce risk of overfishing in a situation in which unit prices vary by season, species, sales outlets, etc., it is important that market prices are better understood and the resources managed accordingly.
- Given the high values that groupers fetch and increasing market demand there is much opportunity for fishers, in particular, to gain more for their catches, given better organisation and information.
- To eliminate overfishing, improvement in the management of grouper in Fiji is fundamental. In addition, any harmful subsidies currently given to the fishing sector need to be redirected away from activities that promote overfishing. Priority should be given to national food security and no exports should be considered until and unless fishing pressure can be controlled and domestic grouper sales sustained.
- Species for which there is conservation concern, such as *E. cyanopodus*, should be closely monitored or put under moratorium until recovery. Highly valued species such as *P. leopardus* and *E. polyphekadion,* should be recognised and managed carefully to prevent depletion.

LINKS TO NATIONAL PRIORITIES:

NBSAP Implementation Plan Thematic Area (TA) 3 (Inshore Fisheries), Action 3.2b: Monitor core set of existing MPAs for biodiversity and fisheries resources compared with unmanaged sites; **Action 8.2a**: Perform stock assessment of inshore marine resources. **Green Growth Framework TA 3 (Sustainable Island and Ocean Resources)**: (i) develop a natural resource management system which is inclusive and integrated, and continue capacity building and awareness programmes with all communities, emphasising supporting resource owners on the importance of proper environmental stewardship.

Size of maturity and spawning potential ratios in coral reef fish

STATUS: Completed

FUNDING: David and Lucile Packard Foundation (Grant #2015-41007, #2017−66580)

PARTNER ORGANISATIONS: Biospherics, Ministry of Fisheries, World Wide Fund for Nature (WWF), University of the South Pacific (USP)

OUTPUTS

- *SPC Bulletin*: Prince JD, Hordyk A, Mangubhai S, Lalavanua W, Tamata L, Tamanitoakula J, Vodivodi T, Meo I, Divalotu D, Iobi T, Loganimoce E, Logatabua K, Marama K, Nalasi D, Naisilisili W, Nalasi U, Naleba M, Waqainabete P (2018) Developing a System of Sustainable Minimum Size Limits for Fiji. SPC Fisheries Newsletter. 151: 51−60
- Report: Prince JD (2018) Preliminary Report on the Assessment of Fijian Reef-Fish Stock. Biospherics.

RESEARCH HIGHLIGHTS:

Dr Jeremy Prince working with WCS staff at the Bailey Bridge market to collect size at maturity data. Sangeeta mangubhai/WCS

WCS, Ministry of Fisheries and WWF have collected data on fish size maturity for targeted species to review and improve the existing fish size limits under the Fisheries Act. The study adopts a robust methodology to assess length-based Spawning Potential Ratios (SPR) and gathers data on: (i) the length of the fish and its maturity phase; (ii) the sex of the species; and (iii) the SPR of the targeted species for specific fishing grounds.

The need for this kind of data is imperative in the Pacific, especially Fiji, given the high levels of non-compliance by fishermen and middlemen to the current fish and invertebrate size limits, and the increasingly high demand of fish as a source of protein. Dr. Prince (Biospherics) led two workshops in March and July 2018 to assist WCS, Ministry of Fisheries and WWF staff to calculate the size of maturity and SPR for key reef fish species in Fiji. The workshop was designed to build capacity of local scientists to do the analysis on their own.

Size at Maturity

Our results suggest that without management >57% of the potential reef fish yield and 38 of the 74 species in the modelled assemblage will be lost in Fiji, but that a system of six Minimum Size Limits set at 25, 35, 45, 55, 70 and 90 cm can protect ~93% of the yield and prevent extinctions. A summary of the size at maturity of 46 species from Fiji was presented to senior

staff from Ministry and a policy brief was sent to the Minister for Fisheries. The policy brief includes an outline of a communication strategy for a "Set Size" campaign to be led by the Ministry of Fisheries and cChange.

Spawning Potential Ratio

Local community members learning how to assess the size of maturity of fish they catch from their fishing

Since 2014 a Fijian program of reef fish catch sampling has measured 16,404 fish from 180 species. A new stock assessment technique called Length-Based Spawning Potential Ratio assessment has been applied to these data to develop stock assessments for 29 of the most common species in the catch.

More than half the species (17) are assessed as having <20% SPR, the international Limit Reference Point above which fish stocks should be managed to minimise the risk of stock decline. Fourteen of these species are estimated to having <10% SPR the international reference point for SPR_{CRASH} below which fish populations are expected to collapse. Closer examination of species with low SPR suggested that speargun fishing and gillnetting currently pose the biggest threat to reef-fish sustainability in Fiji. Our results suggest an urgent need to reform the management Fijian reef fish stocks so that fish are not caught before reproducing sufficiently to replace themselves and keep populations stable. To this end the existing regulation of minimum size limits and mesh sizes need revision, and the implementation of additional restrictions on fishing methods should be considered.

NEXT STEPS:

- Submission of a Policy Brief to the Minister for Fisheries on the results of the SPR analysis highlighting fish stocks in urgent need of management
- Supporting the Ministry of Fisheries and cChange implement a "Set Size" campaign to build awareness and compliance with size limits for fish and invertebrate species

LINKS TO NATIONAL PRIORITIES:

NBSAP Implementation Plan TA 3 (Inshore Fisheries), Action 3.2b: Monitor core set of existing MPAs for biodiversity and fisheries resources compared with unmanaged sites; **Action 8.2a**: Perform stock assessment of inshore marine resources. **Green Growth Framework TA 3 (Sustainable Island and Ocean Resources)**: (i) develop a natural resource management system which is inclusive and integrated, and continue capacity building and awareness programmes with all communities, emphasising supporting resource owners on the importance of proper environmental stewardship.

Jungle Histology: Biology-based conservation of Fiji's vulnerable coral reef fishes

STATUS: Ongoing

FUNDING: National Geographic Society, David and Lucile Packard Foundation (Grant #2017−66580)

PARTNER ORGANISATIONS: Bishop Museum, Windward Community College, Hawaii Institute of Marine Biology, USP

RESEARCH HIGHLIGHTS:

This project was led by colleagues from Bishop Museum, Windward Community College, Hawaii Institute of Marine Biology, and used a novel, inexpensive, field-based approach called "Jungle Histology" to describe the reproductive biology of four coral reef fish. The study species were: squaretail coralgrouper (*Plectropomus areolatus*), humpback red snapper (*Lutjanus gibbus*), Indian goatfish (*Parupeneus indicus*), and the steephead parrotfish (*Chlorurus microrhinos*). Fish were bought from Labasa and the Bailey Bridge markets over 4-6 months and frozen and stored at USP. In the laboratory, data were collected on length–weight relations, size-at-maturity, sexual pattern, sex-ratios, and length-batch fecundity relationships. Training was provided to 13 local scientists, which included two graduate students from USP, two fishery officers from Fiji's Ministry of Fisheries, one WCS staff, and one fisheries officer from the Republic of Kiribati.

Preliminary results from three species provided the opportunity to compare method (different methods used in the same location) and location effects (the same methods used in different regions). Prince et al. (2018)[1] conducted a three-year-long macroscopic analysis of Fijian reef fishes, including all of the species we analysed. The histology-based results suggest that males mature from ~ 1 cm (*P. indicus*) to >7 cm (*L. gibbus*) shorter than indicated by macroscopic analyses. For females, the different methods produced similar results for two species (*P. indicus*, *C. microrhinos*); however, our histology-based results suggest that *L. gibbus* matures ~7 cm shorter than was indicated by macroscopic analysis.

LINKS TO NATIONAL PRIORITIES:

NBSAP Implementation Plan TA 3 (Inshore Fisheries), Action 3.2b: Monitor core set of existing MPAs for biodiversity and fisheries resources compared with unmanaged sites; **Action 8.2a**: Perform stock assessment of inshore marine resources. **Green Growth Framework TA 3 (Sustainable Island and Ocean Resources)**: (i) develop a natural resource management system which is inclusive and integrated, and continue capacity building and awareness programmes with all communities, emphasising supporting resource owners on the importance of proper environmental stewardship.

[1] Size of maturity and spawning potential ratios in coral reef fish (See previous page)

Socioeconomic surveys of Fijian women in the inshore fisheries sector

STATUS: Ongoing

FUNDING: Flora Family Foundation (Grant #2017-3026), David and Lucile Packard Foundation (Grant #2017−66580), The Pacific Community (SPC)

PARTNER ORGANISATIONS: Conservation International, Fiji Locally-Managed Marine Areas (FLMMA), WWF, USP, Women in Fisheries Network-Fiji (WiFN-Fiji), Vatuvara Foundation, SPC

OUTPUT

- *SPC Bulletin*: Thomas AS, Mangubhai S, Fox M, Meo I, Miller K, Veitayaki J (2018) Quantifying and valuing the critical role women play in Fiji's inshore fisheries sector. SPC Women in Fisheries Information Bulletin. 28: 15−16

RESEARCH HIGHLIGHTS:

Women fishers significantly contribute to household protein requirements and/or income; but these contributions are often 'invisible' – overlooked, underestimated, and/or undervalued. A national socioeconomic surveys was completed from October 2017 to April 2018, to document the diversity of fisheries targeted by fisher women. A total of 1238 women have been interviewed across 11 of the 14 provinces in Fiji, including 47 districts and 110 villages. The survey covered fisheries across the full range of habitats – rivers, mangroves, seagrass, coral reefs and deeper pelagic waters.

Preliminary findings show that women fish in all habitats in their areas, ranging from freshwater streams to the intertidal area and the open ocean. Some of the women fish just for subsistence, but many of them sell at least a portion of their catch to support their household income. The information gathered from the surveys will assist stakeholders to better recognise the valuable contribution women fishers provide to food security and to the national economy. What is clear from this work is that fisherwomen are a critical backbone for their families, and to our society. However, it is not enough just to recognise the substantial role these women play. Ultimately, fisherwomen need to be provided the same opportunities as fishermen. This includes participation in fisheries planning and management, receiving training and support, and accessing projects and funding to improve their fisheries.

LINKS TO NATIONAL PRIORITIES:

NBSAP Implementation Plan TA 3 (Inshore Fisheries), Action 8.2a: Perform stock assessment of inshore marine resources. **Green Growth Framework TA 3 (Sustainable Island and Ocean Resources)**: (i) develop a natural resource management system which is inclusive and integrated, and continue capacity building and awareness programmes with all communities, emphasising supporting resource owners on the importance of proper environmental stewardship. **TA 4 (Inclusive Social Development)**: increase women's capacity to participate in decision making and leadership at all levels to development (from village to national government) by 2018. **Fiji National Gender Policy**: 5.7 Gender Statistics and Research, 5.19 Leadership, Training and Development.

Socioeconomic surveys of women market sellers in municipal markets

STATUS: Ongoing

FUNDING: David and Lucile Packard Foundation (Grant #2017−66580),

PARTNER ORGANISATIONS: United Nations Entity for Gender Equality and the Empowerment of Women (UN Women), Labasa City Council, Savusavu City Council, Suva City Council

RESEARCH HIGHLIGHTS:

In Pacific markets, 75-90% of sellers are women, and their earnings often make up a significant portion of household incomes in rural communities. Despite this, women are often excluded from market governance and decision-making. The "Markets for Change" program run by UN Women addresses barriers and constraints to women's economic empowerment. The program "aims to ensure that marketplaces in rural and urban areas of Fiji, Solomon Islands and Vanuatu are safe, inclusive and non-discriminatory, promoting gender equality and women's economic empowerment". As a result of the program, women have both increased sales and their representation on market committees. They have also been speaking up to ensure their needs are heard and met when it comes to allocating market fees to improve economic opportunity, and the safety, health and wellbeing of market vendors.

In Fiji this program has, to-date, only engaged with women selling fresh fruits and vegetables; those selling seafood have been excluded. This is despite the substantial contribution of coastal fisheries to household nutritional security and income. In early 2018, WCS partnered with UN Women and three municipal councils (Labasa, Savusavu, Suva) to better understand the economical influences and contribution of Fijian women in municipal markets.

The overall aim of this research is to improve gender equality and social inclusion for women seafood vendors in municipal markets in Fiji.

The objectives are to:

- Better understand the barriers and constraints faced by, and needs of, women seafood market vendors;
- Provide information that will assist policy makers in creating policy that is aligned with the needs of women seafood sellers;
- Assess women's level of dependency on selling seafood at markets; and
- Understand women's decision-making power regarding their seafood sales at markets.

The questionnaires were designed by representatives and gender experts from UN Women and fisheries experts from WCS. The survey was tested on women seafood vendors in a local village, prior to implementation in three markets. One-on-one surveys and focus group discussions were held in Labasa and Savusavu in November 2018. The questionnaires have been designed to gain information on the selling habits of these women, their needs in terms of being able to safely sell at the market, and their level of decision-making power. The interviews were conducted in the respondent's preferred language (*iTaukei*, Hindi or English), and attempts will be made to interview around half (at the larger markets) to three fourths (at the smaller markets) of the women seafood vendors at each of the study markets.

The results from these surveys will not only provide significant insight into the external and internal factors which greatest affect these woman, but also, will identify possible improvements and recommendations which will increase the economic efficiency of these women.

NEXT STEPS:

- Complete surveys for Suva markets
- Finalise reports for each of the three markets (Labasa, Savusavu, Suva)

LINKS TO NATIONAL PRIORITIES:

NBSAP Implementation Plan TA 3 (Inshore Fisheries), Action 8.2a: Perform stock assessment of inshore marine resources. **Green Growth Framework TA 3 (Sustainable Island and Ocean Resources)**: (i) develop a natural resource management system which is inclusive and integrated, and continue capacity building and awareness programmes with all communities, emphasising supporting resource owners on the importance of proper environmental stewardship. **TA 4 (Inclusive Social Development)**: increase women's capacity to participate in decision making and leadership at all levels to development (from village to national government) by 2018. **Fiji National Gender Policy**: 5.7 Gender Statistics and Research, 5.19 Leadership, Training and Development.

Mainstreaming Gender and Human Rights-Based Approaches into Coastal Fisheries

STATUS: Ongoing

FUNDING: Pew Charitable Trusts

PARTNER ORGANISATIONS: SPC, James Cook University

RESEARCH HIGHLIGHTS:
FAO released *Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication* (SFF Guidelines), to provide principles and guidance to countries on addressing small-scale fisheries. The SFF Guidelines reflect a growing acceptance and movement away from narrowly focusing on fisheries governance or "rights-based approach" (which largely deals with access rights to fishing grounds), towards a broader more inclusive "human rights-based approach" (HRBA) that recognises that human rights are integral to development outcomes.

The project aims to develop practical, context-specific guidelines, tools and policy recommendations to assist Melanesian countries to mainstream gender and human rights-based approaches into coastal fisheries management and development, for improved food security and livelihoods of local communities. The project has three main components:

(a) Firstly, to develop an understanding of the degree to which traditional and current gender equity and HRBA can be fully optimised to enhance coastal fisheries management and development in Melanesia to improve its effectiveness;
(b) Secondly, in close partnership with SPC and multi-sectoral partners, the development and testing of a locally-relevant, context-specific framework for evaluating how well gender and HRBA have been applied to coastal fisheries management and development projects in the Melanesian countries of Fiji, Solomon Islands and Vanuatu; and
(c) Thirdly, working with government and national practitioners in each of the countries, develop practical tools and policy recommendations to mainstream gender and HRBA into the fisheries sector to overcome barriers and obstacles in each of the three countries.

Over the last 12 months, WCS has been working with regional gender and fisheries experts to help develop a handbook for gender and social inclusion in the fisheries and aquaculture sector.

LINKS TO NATIONAL PRIORITIES:
Green Growth Framework TA 3 (Sustainable Island and Ocean Resources): (i) develop a natural resource management system which is inclusive and integrated, and continue capacity building and awareness programmes with all communities, emphasising supporting resource owners on the importance of proper environmental stewardship. **TA 4 (Inclusive Social Development)**: increase women's capacity to participate in decision making and leadership at all levels to development (from village to national government) by 2018. **Fiji National Gender Policy**: 5.7 Gender Statistics and Research, 5.19 Leadership, Training and Development.

National Study of Marine Conservation Agreements in Fiji

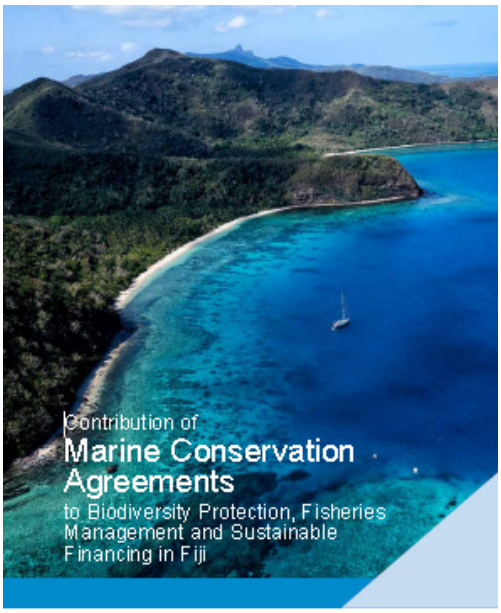
STATUS: Completed

FUNDING: John D. and Catherine T. MacArthur Foundation (Grant #16-1608-151132-CSD)

OUTPUT:

- Sykes H, Mangubhai S, Manley M (2018) Contribution of Marine Conservation Agreements to Biodiversity Protection, Fisheries Management and Sustainable Financing. Report No. 02/18. Wildlife Conservation Society, Suva, Fiji. 98 pp.

RESEARCH HIGHLIGHTS:



Marine Conservation Agreements (MCAs) are "*any formal or informal understanding in which one or more parties commit to delivering explicit economic incentives in exchange for one or more other parties committing to take certain actions, refrain from certain actions, or transfer certain rights and responsibilities to achieve agreed-upon ocean or coastal conservation goals*" (www.mcatools.org). MCAs can be entered into by governments, local communities, indigenous groups, private sector and NGOs, and there are increasing examples globally of MCAs making positive impacts, ecologically and socioeconomically. WCS conducted a national study in 2017 to document the degree and scale to which MCAs contribute to biodiversity conservation, fisheries and sustainable financing in coastal waters in Fiji. The study focused on MCAs involving local communities with land-sea tenure rights and the tourism sector. Key findings of this study were:

- Fiji is known as a leader in community-based marine conservation, but the contribution of MCAs has largely gone unrecognised. Fiji's social and customary tenure systems provide a unique foundation for the establishment of MCAs between traditional leaders and their communities and the tourism sector.

- A number of tourism operators and communities, and one non-profit organisation have worked on MCAs for many years, all of which include some type of Marine Protected Area (MPA). These agreements contribute to Fiji's national marine conservation goals, and protect specific areas important to vulnerable megafauna and sensitive ecosystems.

- Of the 81 tourism operators that participated in the survey, 56 (69%) had been involved, were involved, or were becoming involved, in some form of MCA, all of which focused on establishing temporary or permanent no-fishing zones or MPAs. Many of these are long-

term investments, some dating from the mid-nineties, with informal agreements originating before that, when the resorts were first built.

- Tourism-related MCAs included an estimated 266.25 km^2 (26,625 ha) of MPAs, of which 210 km^2 (21,000 ha) comprised deep water and offshore reefs within two large no-take reserves (Namena Marine Reserve and Vatu-i-Ra Conservation Park), and the remaining 56.25 km^2 (5,625 ha) comprised mostly shallow fringing reefs and slopes. An additional 400 km^2 of reef were within 15 MCAs established by a non-profit organisation Seacology who offered an exchange of benefits for conservation contracts.

- Only 16 (28%) of the tourism-related MCAs included explicit economic incentives to the resource-owning local communities such as some level of payment, provision of infrastructure, or employment opportunities directly related to marine conservation. The remaining 40 (72%) supplied less quantifiable benefits such as sustainable marine resources and/or general employment in the tourism sector.

- Most of the MCAs relied on verbal and written agreements from local resource-owners, utilising traditional practices such as no-fishing *tabu* areas over an indefinite period. Others had completely informal courtesy agreements that local people would not fish immediately in front of the resort. Only 9% were supported in law.

- Many tourism operators without MCAs were interested in starting new, or refreshing lapsed agreements, but were unable to find consistent and supportive advice on how to go about this. There is a need for national guidelines to assist both the tourism sector and local communities establish MCAs that create win-win situations for all those involved, while contributing to Fiji's national and international commitments towards biodiversity protection and sustainable fisheries.

NEXT STEPS:

- Develop guidelines for MCAs in Fiji

LINKS TO NATIONAL PRIORITIES:

Implementation Plan TA 6 (Protected Areas), Strategy 2: Expand protected area network in priority sites at the national level and provincial level to achieve national targets, **Objective 2.2**: By 2014, develop management structures and implement paths to gazettal at highest priority sites, **Actions 2.2b-c**; and **NBSAP Implementation Plan TA 3 (Inshore Fisheries), Strategy 4**: Design new ecologically relevant inshore MPAs, **Objective 4.6:** By mid-2014, 25% of the communities will have established new management structures for new MPAs, **Action 4.6a:** Consult with communities at priority regions outside of existing MMAs to establish new MPA management structures. **Green Growth Framework TA 3 (Sustainable Island and Ocean Resources)**: (i) develop a natural resource management system which is inclusive and integrated, and continue capacity building and awareness programmes with all communities, emphasising supporting resource owners on the importance of proper environmental stewardship, (ii) government to continue to work with community and civil society on initiatives such as the establishment of marine protected areas and community based fish wardens.

Understanding the links between local ecological knowledge, ecosystem services, and resilience to climate change in Pacific Islands

STATUS: In progress

FUNDING: U.S. National Science Foundation (Coastal SEES # 1325874)

PARTNER ORGANISATIONS: University of Hawaii, Natural Capital Project - Stanford University, USP

OUTPUTS:

- Dacks R, Ticktin T, Jupiter S, Friedlander A (2018) Drivers of household fishing in small-scale Pacific coral reef fisheries. Ecology and Society 23(1):37 [online]. https://doi.org/10.5751/ES-09989-230137
- Delevaux JMS, Jupiter SD, Stamoulis KA, Bremer LL, Wenger AS, Dacks R, Garrod P, Falinski K, Ticktin T (2018) Scenario planning with linked land-sea models informs where forest conservation actions will promote coral reef resilience. Scientific Reports 8(1), p.12465.
- Ticktin T, Dacks R, Quazi S, Tora M, McGuigan A, Hastings Z, Naikatini A (2018) Significant linkages between measures of biodiversity and community resilience in Pacific Island agroforests. Conservation Biology 32 (5): 1085-1095.

RESEARCH HIGHLIGHTS:

This collaborative project with University of Hawaii focused on social-ecological systems and how to promote resilience through integrated land-sea planning. This year three publications were produced that inform approaches to enhance both biodiversity conservation and community resilience in Pacific Island communities.

One part of the research focused on coastal agroforests in Fiji, which, like agroforests across other small Pacific Islands, are critical to food security, contain much of the country's remaining lowland forests, and have rapidly declining levels of native biodiversity. The study found that agroforests host important levels of biodiversity – our sample of 100 agroforests yielded 95 native tree species of which almost one-third were endemic, including many species that were threatened or endangered. Using structural equation models, the study showed that social variables important for community resilience— local ecological knowledge, social network connectivity, and livelihood diversity—had both direct and indirect positive effects on native tree species richness. This work demonstrated that building community resilience, specifically

increasing livelihood diversity, local ecological knowledge, and social network connectivity, can help conserve the rapidly declining biodiversity in the region (Ticktin et al. 2018).

A similar approach to understand social and ecological drivers of fishing in Fijian coastal communities was also used (Dacks et al. 2018). The study found, contrary to previous larger scale studies, that households further from markets had higher fishing frequency than those that are closer. This is largely due to the presence of middle men, whose role in these small-scale fisheries has been largely overlooked. Our findings emphasize the need for household-level analyses to better understand the complexities in coral reef social-ecological systems to more effectively manage small-scale fisheries in communities.

Finally, a linked land-sea modeling framework based on open-source remote sensing and empirical data was developed, which couples sediment export and coral reef models at fine spatial resolution (Delevaux et al. 2018). This spatially-explicit (60 × 60 m) framework simultaneously tracks changes in multiple benthic and fish indicators as a function of land-use and climate change scenarios. This was used to investigate the potential effects of logging, agriculture expansion, and restoration on coral reef resilience in Kubulau District, Fiji, now and in the future under projected climate change. This model was used to evaluate specifically where land-use change and bleaching scenarios would impact sediment runoff and downstream coral reefs to identify priority areas on land, where conservation or restoration could most effectively promote coral reef resilience in the face of climate change. This framework therefore serves as an important tool for conservation planning and is currently being applied elsewhere.

LINKS TO NATIONAL PRIORITIES:

National Climate Change Policy, Objective 5 (Adaptation) Strategy 2: Include vulnerability assessment and climate change impact projections into resource management planning, such as integrated coastal and watershed management plans; **Strategy 4:** Develop adaptation technologies that take traditional knowledge into account and are culturally acceptable; and **Strategy 5:** Support the ecosystem-based approach throughout Fiji, recognising that ecosystem services, such as food security, natural hazard mitigation and physical coastal buffer zones, increase resilience. **NBSAP Implementation Plan Thematic Area 1 (Forest Conversion), Action 3.1b:** Integrate appropriate traditional knowledge and skills into training courses, **Action 3.2m:** Encourage and assist landowning and TFRO communities to document their traditional knowledge of biodiversity and its uses and develop their own local strategies. **NBSAP Implementation Plan Thematic Area 3 (Inshore Fisheries), Action 6.1a:** Collate marine traditional and local knowledge and make available upon request to traditional owners for management and educators to aid in curriculum development.

Biocultural indicators of Pacific Island resilience

STATUS: Ongoing

FUNDING: Science for Nature and People Partnership (SNAPP), National Science Foundation Coastal SEES grants (1325874 and 1427091)

PARTNER ORGANISATIONS: American Museum of Natural History, University of Hawaii, The Nature Conservancy (TNC)

OUTPUTS:

- *Journal article:* McCarter J, Sterling EJ. Jupiter SD, Cullman G, Albert S, Basi M, Betley E, Boseto D, Bulehite ES, Harron R, Holland PS, Horning N, Hughes A, Jino N, Malone C, Mauli S, Pae B, Papae R, Rence F, Revo O, Taqala E, Taqu M, Woltz H, Filardi CF (2018) Biocultural approaches to well-being indicator development in the Solomon Islands. Ecology & Society 23(1): 32. https://www.ecologyandsociety.org/vol23/iss1/art32
- *Journal article:* Sterling EJ, Pascua P, Sigouin A, Gazit N, Mandle L, Aini J, Albert S, Caillon S, Caselle JE, Claudet J, Dacks R, Darling E, Filardi C, Jupiter S, Mawyer A, Mejia M, Morishige KK, Nainoca W, Parks J, Tanguay J, Ticktin T, Vave R, Wase, Wongbusarakum S, McCarter J (in review) Assessing the intersection of global sustainability goals and local well-being. Science
- *Journal article:* Dacks R, Ticktin T, Mawyer A, Caillon S, Claudet J, Fabre P, Jupiter S, McCarter J, Mejia M, Pascua P, Sterling E, Wongbusarakum S (in review) Developing biological indicators for resource management. Conservation Science and Practice

RESEARCH HIGHLIGHTS:

Pacific Island communities face unprecedented challenges in conserving natural resources and maintaining human health and well-being. Integrated social, economic, cultural, and environmental connections between people and nature are critical to improve and maintain the well-being of both human and ecological communities. Despite best intentions to measure progress, international frameworks like the Aichi Targets and Sustainable Development Goals (SDGs) were not necessarily designed to capture the complex linkages between humanity and nature and often miss opportunities to integrate diverse voices. This can result in goals, targets, and indicators that are not relevant to local viewpoints, aspirations, and cultural settings.

Since 2016, WCS has participated in an interdisciplinary working group of researchers, practitioners, policy makers, and community members who work on how nature, culture, livelihoods and their interactions can be appropriately measured taking a biocultural approach and communicated to ensure more resilient Pacific Island communities. A biocultural approach integrates goals and interventions that are culturally appropriate and built on worldviews and values of the local community. This approach focuses on the feedbacks and relationships between people and place. Our work is focused on adapting existing global (e.g., SDG) indicator sets to respond to Pacific worldviews and developing new indicators using Pacific values and visions of well-being and sustainable practices to fill gaps in existing frameworks. Our aim is to provide guidance on how to better articulate the complex connections between people and

nature through a series of outputs, which include: compiled case studies of biocultural approaches to inspire and empower local communities; guidelines for national agencies on reporting biocultural indicators to international conventions; and guidance for inclusion of biocultural indicators into multilateral conventions (e.g., CBD Strategic Plan).

To date we have published three papers that: (1) provide an overview of what makes biocultural approaches unique and advocates for their use; (2) discusses issues related to translating indicators across different scales; and (3) provides an example of biocultural indicator co-creation with communities in Solomon Islands. We have also identified a list of 8 overarching domains of resilience and 93 underlying sub-elements that characterise what it means to be resilient in the Pacific context. These domains include things like environmental state, access to natural and cultural resources, connectedness to people and place, and access to financial resources and infrastructure. We have cross-walked this list against SDG and Aichi target indicators to point out relevant gaps. In particular, we found that there are large gaps in characterising well-being based on "connectedness to people and place" and "indigenous and local knowledges, skills, practices, values and worldviews" (Dacks et al. in review, Sterling et al. in review), which means that international frameworks are missing indicators for key dimensions of how Pacific Islanders characterise well-being.

We are presently using the outcomes of this work to develop two guidance documents tailored to government staff with mandates to report on national-level indicators and regional organisations that are developing indicators to assess outcomes of their programming. The guidance documents will provide steps for developing biocultural indicators to fill gaps and will showcase some examples. We aspire to present the guidance to Pacific government staff and regional practitioners opportunistically during key meetings in 2019 (e.g., Pacific Resilience Meeting, Pacific Ocean Alliance meeting).

NEXT STEPS:

- Production and graphic layout of guidance documents for widespread dissemination in Fiji and across the Pacific.
- Presentation of outcomes of guidance documents at relevant regional meetings in 2019.

LINKS TO NATIONAL PRIORITIES:

Climate Change Policy 2017 objective to mainstream climate change issues in all environmental, social, and economic processes including enactment and amending of current legislations. Indicators against targets for development under Fiji's *5-Year and 20-Year National Development Plan*, including access to clean and safe water in adequate quantities, food sourced domestically compared to total food available, incidence of poverty, establishment of marine protected areas and forest areas under long-term conservation.

Watershed management for human and environmental health outcomes

STATUS: Ongoing

FUNDING: Bloomberg Philanthropies, Australian Government

PARTNER ORGANISATIONS: University of Sydney, Edith Cowan University, Ministry of Health and Medical Services, Fiji National University, World Health Organization (WHO), SPC, George Institute for Global Health

OUTPUTS:

- *Conference presentation:* Jupiter S (2018) Integrated watershed management for healthy environments and people. Invited keynote presentation. Oceania Planetary Health Forum, Nadi, Fiji, 5-6 November
- *Journal article:* Prasad N, Jenkins AP, Naucukidi L, Rosa V, Vitayaki J, Sahu-Kahn A, Kama M, Jenkins KM, Jenney AWJ, Jack SJ, Saha D, Horwitz P, Jupiter SD, Strugnell RA, Mulholland EK, Crump JA (2018) Epidemiology and risk factors for typhoid fever in Central Division, Fiji, 2014-2017. PLoS Neglected Tropical Diseases 12:e0006571. https://doi.org/0006510.0001371/journal.pntd.0006571
- *Journal article:* Brown CJ, Jupiter SD, Albert S, Anthony KRN, Hamilton RJ, Fredston-Hermann A, Halpern BS, Lin H-Y, Maina J, Mangubhai S, Mumby PJ, Possingham HP, Saunders MI, Tulloch VJD, Wenger A, Klein CJ (in review) A guide to modeling priorities for management of land-based impacts on coastal ecosystems. Journal of Applied Ecology

RESEARCH HIGHLIGHTS:

A large body of research identifies the mechanisms by which land-based runoff of point and non-point source pollution containing freshwater, sediments, nutrients, pathogens, and chemicals can damage and kill coral reef organisms. Land-based impacts are particularly problematic in areas where logging is prevalent and unmanaged, and where village and urban waste management systems are rudimentary. These impacts are pronounced in high island ecosystems where there is tight connectivity between land and sea. Poor land-use practices can have large impacts on coastal habitats and the communities that depend on them.

In Fiji, WCS and our partner researchers have demonstrated that the abundance of certain coral reef fish upon which local people depend for food and income, the larger-bodied predators and planktivores, is negatively affected by high turbidity linked to upstream catchment land use and coastal development. These responses in reef fish communities are due to deteriorating benthic habitat driven by poor water quality. We have further found that human modification of catchment land cover and hydrology facilitates increased transmission of waterborne bacterial disease in human populations. Thus, we now have a solid foundational understanding of how various catchment interventions could be applied to achieve multiple benefits for interlinked, system-wide ecological and human health and well-being.

WCS has been working in Fiji since 2005 to develop community-based, integrated ridge-to-reef management plans at the district and island scale. However, the actions in these plans are not

strong enough on their own to significantly reduce sediments, nutrients, and pathogens in waterways that run out to the reef, particularly with growing development pressure in Fiji. Practices in Fiji relating to logging and soil control need to be brought to international standards to reduce impacts to coral reefs. In 2018, we received funding from Bloomberg Philanthropies to undertake a suite of linked active interventions and strengthening of policy instruments to reduce the impact of land-based pollution on coral reefs and human well-being, coupled with improved local fisheries management to avoid reef tipping points into unfavorable states.

Complementary to our ongoing, ridge-to-reef conservation efforts in Fiji, we have a unique opportunity to collaborate on a national project to reduce water-related diseases through integrated upstream solutions. We will collaborate with researchers and practitioners from Fijian and Australian universities, the WHO, SPC, and the Fiji ministries of Health and Medical Services and Environment and Waterways on a three-year AU$2 million project (Watershed Interventions for Systems Health, WISH), funded by the Australian Government. We will collaboratively identify several target sub-catchments within Central Division (the core focus of the WISH project) for active ecological restoration as well as water, sanitation, and hygiene (WASH) activities. A national WISH project steering committee including key ministries will select the sub-catchments, thus giving the government strong ownership of the project.

Interventions will be determined in consultation with village committees, in partnership with WISH project staff. The creation of inclusive decision-making processes with government and local communities is essential for long-term implementation. We will also work in two separate target sub-catchments where WCS already has established relationships with local communities to strengthen implementation of ridge-to-reef management plans through the addition of active restoration and sanitation and hygiene measures. The sub-catchments selected will reflect a gradient from most heavily impacted to least impacted, and most important and resilient coral reefs. We will monitor terrestrial, water quality, coral reef, fisheries catch, and social well-being indicators in all target sub-catchments. Monitoring data will be shared regularly with village-level sanitation, hygiene, and resource management committees to make informed decisions on key adaptive actions required. At the national level we will undertake a gap analysis to inform development of policy briefs on opportunities for improved catchment management through strengthened policy implementation. Engagement with policy makers from the beginning, and targeted policy briefs will help Government officers aware of policy implementation gaps and actions identified to fill gaps.

LINKS TO NATIONAL PRIORITIES:

Fiji Climate Change Policy Objective 5 (Adaptation), Strategy 9: Build the capacity of the health and agriculture sectors to respond effectively to climate sensitive diseases, including the strengthening of disease surveillance and control systems, and early warning mechanisms for climate sensitive human and livestock diseases. **Fiji Ministry of Health Strategic Plan (2011 - 2015): Objective 2.3:** Reduce confirmed cases of typhoid by 75% by 2015; **Objective 2.7:** Reduce incidence rates of leptospirosis by 50% by 2015; and **Objective 7.1:** Increase the proportion of people with access to safe water. **Recommendation 2:** Develop ICM plans at the provincial levels which when considered together will suggest the make-up of the National ICM Plan.

Protecting Reefs of Hope

STATUS: Ongoing

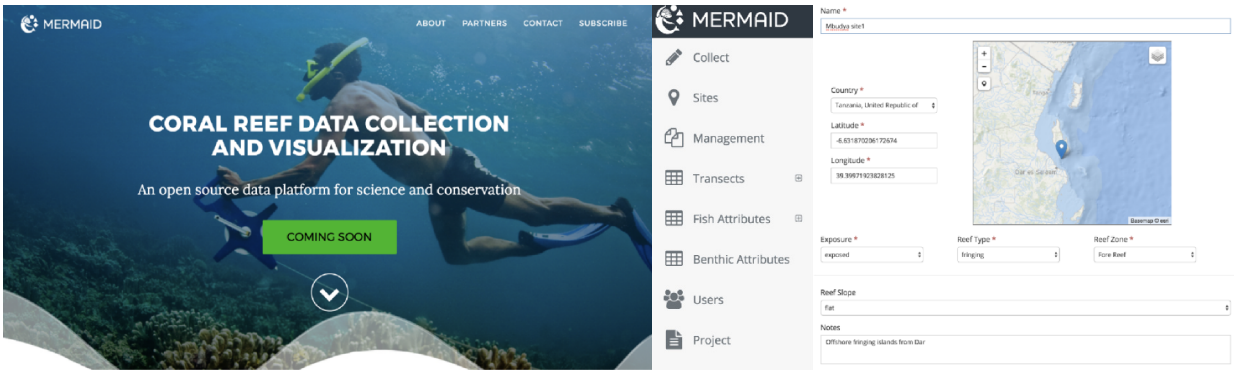
FUNDING: Flora Family Foundation (Grant# 2018 - 3152)

PARTNER ORGANISATIONS: World Wildlife Fund (WWF)

RESEARCH HIGHLIGHTS:

Coral reefs support critical ecosystem services of fisheries livelihoods, food security, coastal protection and cultural practices for millions of people around the world. Threatened by climate change and human stressors, coral reef conservation is at a crossroads. To increase reef resilience, global conservation initiatives are mobilising around the concept of 'climate refuges'– reefs that occur in climatically stable areas, or that have properties of resilience to climate disturbances. The current aim is to proactively identify and manage these global refuges, or 'reefs of hope' to ensure their resilience and maintain intact coral reef processes where possible. **To give coral reefs a chance to survive and adapt, WCS aims to identify 'reefs of hope': unique reefs with functioning coral communities that may have the best chance to escape the impacts of coral bleaching.** Identifying the environmental characteristics that create climate refuges through cooler waters, deeper reefs or more variable oceanographic environments allows us to prioritise these locations for protection from local stressors of overfishing, coastal development or land-based pollution.

New technological tools are needed by coral reef field scientists to accelerate the urgency of coral reef conservation under a changing climate. Since 2017, WCS, in collaboration with World Wildlife Fund (WWF) has been developing ***MERMAID – a Marine Ecological Research Management AID –*** to provide a long-term solution to collect and visualise the global coral reef monitoring data needed to identify reefs of hope. MERMAID provides field-ready technologies for scientists that can accelerate the transformation of data to decisions to save coral reefs. MERMAID allows coral reef scientists to identify reefs of hope to support rapid evidence-based decision making to preserve and manage coral reefs. By implementing MERMAID in Fiji, WCS will deploy a new technological tool to help identify and protect Fiji's 'reefs of hope' in the face of climate change.



MERMAID (www.datamermaid.org) is an online-offline web application and backend relational and non-relational database built on open-source tools to allow for the structured entry of coral reef transect monitoring data (left: example of site information entry).

The project has the following objectives:

1. Add the rapid assessment coral community survey as a 'monitoring template' in the MERMAID platform that can support real-time dashboards in Python programming language to visualise survey results in near real-time;
2. Train coral reef field monitoring experts using MERMAID by developing training materials and hands-on workshop skills;
3. Survey coral reef communities in four districts in Fiji (Bua, Kubulau, Levuka and Nakorotubu) with a rapid-assessment coral community survey and enter the data into MERMAID;
4. Visualise and communicate the findings of Fiji's 'reefs of hope' to key partners and decision makers; and
5. Add surveys to the growing global database of coral community surveys curated by the WCS to inform global coral reef conservation priorities of intact coral reefs.

In addition to the outcomes above, this project could lead to significant policy implications for Fiji. WCS's surveys to identify reefs of hope can feed into: (i) national policy or ridge-to-reef management plans to protect coral reefs; (ii) the design and placement of a national representative and resilient network of Marine Protected Area; and (iii) the review and adaptation of community Marine Protected Area networks to maximise ecological and social benefits. With greater political interest during the International Year of the Reef, this is the opportune time to increase investments in coral reef conservation.

LINKS TO NATIONAL PRIORITIES:

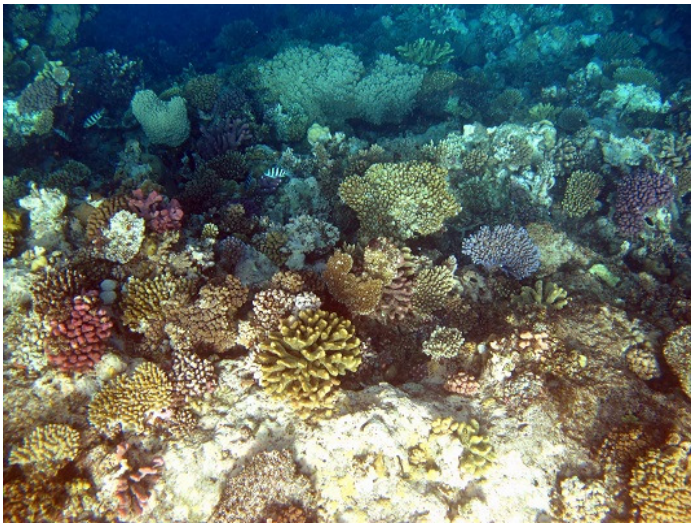
NBSAP Implementation Plan TA 3 (Inshore Fisheries), Action 3.2b: Monitor core set of existing MPAs for biodiversity and fisheries resources compared with unmanaged sites; **Action 8.2a**: Perform stock assessment of inshore marine resources. **Green Growth Framework TA 3 (Sustainable Island and Ocean Resources)**: (i) develop a natural resource management system which is inclusive and integrated, and continue capacity building and awareness programmes with all communities, emphasising supporting resource owners on the importance of proper environmental stewardship; and (ii) government to continue to work with community and civil society on initiatives such as the establishment of marine protected areas and community based fish wardens.

Assessment of coral reefs around Ovalau, post-cyclone Winston

STATUS: In progress

FUNDING: John D. and Catherine T. MacArthur Foundation (Grant #16-1608-151132-CSD)

RESEARCH HIGHLIGHTS:



On 20 February 2016, one of the largest cyclones on record in the Southern Hemisphere passed through Fiji, with winds up to 185 mph, and gusts of 225 mph. Category 5 Cyclone Winston left a trail of destruction, with some of the most impacted landscape and communities located in the Vatu-i-Ra Seascape. The objectives of these surveys were to: (a) assess state of coral reefs within community fishing grounds post-Cyclone Winston; and (b) provide recommendations to communities on the management of their traditional fishing grounds to support ridge-to-reef planning for Ovalau Island. Data were collected on the benthic cover, habitat structure, coral genera, and fish size and abundance. Surveys were done both inside and outside *tabu* areas within community fishing grounds. All results from the surveys will inform the development of an island-scale ecosystem-based management (EBM) plan for Ovalau Island being led by local communities and the Lomaiviti Provincial Office.

NEXT STEPS:

- Data are being analysed and a full report of the survey will be available in 2019.
- Presentation of results to Lomaiviti Provincial Office and to local communities.

LINKS TO NATIONAL PRIORITIES:

NBSAP Implementation Plan Thematic Area 3 (Inshore Fisheries), Action 3.2b: Monitor core set of existing MPAs for biodiversity and fisheries resources compared with unmanaged sites; **Action 8.2a**: Perform stock assessment of inshore marine resources. **Fiji Climate Change Policy Objective 5 (Adaptation), Strategy 5:** Support the ecosystem-based approach throughout Fiji, recognising that ecosystem services, such as food security, natural hazard mitigation and physical coastal buffer zones, increase resilience; and **Green Growth Framework Thematic Area 3 (Sustainable Island and Ocean Resources):** (i) develop a natural resource management system which is inclusive and integrated, and continue capacity building and awareness programmes with all communities, emphasising supporting resource owners on the importance of proper environmental stewardship, (ii) government to continue to work with community and civil society on initiatives such as the establishment of marine protected areas and community based fish wardens.

Biodiversity surveys of Kilaka Forest

STATUS: Completed

FUNDING: John D. and Catherine T. MacArthur Foundation (Grant #16-1608-151132-CSD)

PARTNER ORGANISATIONS: University of the South Pacific, BirdLife International, NatureFiji-Mareqeti Viti (NFMV), United States Geological Service (USGS)

OUTPUTS:

- *Report:* Kirmani SN, Brehme C, Cakacaka T, Dulunaqio S, Fisher R, Hathaway S, Koroi I, Loganimoce E, O'Brien M, Masibalavu V, Naikatini A, Segaidina M, Thomas N, Tikoca S, Tubuitamana P, Tuiwawa M, Vido S, Mangubhai S (in press) Terrestrial and Archaeological Surveys of Kilaka Forest Conservation Area. Wildlife Conservation Society. Report Report No. 04/18. Suva, Fiji. 57 pp.

RESEARCH HIGHLIGHTS:

Four moth species from Kilaka Forest © Clayton

Protected under a 99-year conservation lease between the Wildlife Conservation Society and *mataqali* Nadicake, the Kilaka Forest Conservation Area in Kubulau District, Vanua Levu, boasts a diversity of native, endemic and endangered flora and fauna. Herpetofauna, birds, bats and invasive mammal surveys were conducted between 12–16 February, 2018 and vegetation, flora and archaeological surveys were done on 28 April, 2018. This report presents the findings of terrestrial and archaeological baseline surveys conducted in the Kilaka Forest Conservation Area by experts from BirdLife International, NFMV, USP and USGA.

A total of 245 taxa of higher vascular plants were recorded during the survey, including 196 angiosperms, 44 ferns and fern allies, and 5 gymnosperm taxa. Endemism was 35% (87 species) for all higher vascular plants. The higher plants comprised of 100 families, 188 genera, and 214 species. The largest family was Rubiaceae (16 taxa), Orchidaceae (15 taxa), Euphorbiaceae (13 taxa). The largest genus was *Ficus* with 8 species in the Moraceae family, followed by Syzygium with 6 taxa in the Myrtaceae family, Cyathea in the Cyatheaceae family, and Asplenium in the Aspleniaceae family. Lowland rainforest was the principal vegetation or forest type in the Kilaka Forest Conservation Area. Three exotic plant species (1%) were recorded.

A total of 25 species of birds were recorded, of which 15 species are endemic to Fiji including the vulnerable shy ground-dove. The bird community in Kilaka Forest is indicative of a large island native forest community with species composition similar to Natewa on Vanua Levu. The near threatened Samoan flying-fox and the vulnerable Fijian blossom bat were recorded from diurnal surveys. Eleven of the 21 known herpetofauna species on Vanua Levu were recorded, including 2 species of native frogs, 5 species of native skinks (1 potentially new species undergoing further analysis), 3 species of native geckos and the invasive toad. A combination of three different trapping techniques was used to identify the presence of 5 invasive mammals in or along the boundary of the area. These include rats, mongoose, cats, pigs and cows.

Lepidoptera or moths were the only group of terrestrial invertebrates surveyed and experts found 27 species belonging to 7 families over the 4 nights of sampling. This represents 25% of the known species for Vanua Levu and a high rate (48%) of endemism. Four new moth species were found for Vanua Levu: *Adetoneura lentigiginosa* (Erebidae), *Thalassodes fiona* (Geometridae), *Aeolopetra palaeanthes* (Crambidae) and *Locastra ardua* (Pyralidae).

In addition to biodiversity surveys, two archaeological sites, an old village and house foundation, were mapped, documented and placed on Fiji's National Register.

Although short in duration, these surveys revealed a relatively high percentage of endemic or native flora and fauna, providing a baseline for further long-term research. Experts made a number of specific recommendations:

- conducting longer surveys over different seasons to capture and map a greater diversity of species;
- demarcating vegetation plots for long-term monitoring and research;
- investigate interactions between native herpetofauna and introduced mammalian predators to devise conservation and management strategies;
- include more terrestrial invertebrate taxa surveys; and
- conduct proper documentation of archaeological sites, including oral history.

LINKS TO NATIONAL PRIORITIES:

NBSAP Implementation Plan TA 6 (Protected Areas), Strategy 1: Identify gaps in biodiversity protection against national targets. **Strategy 2**: Expand protected area network in priority sites at the national level and provincial level to achieve national targets. **Green Growth Framework TA 6 (Freshwater Resources and Sanitation Management):** Adoption of watershed management plans using integrated water resources management principles for major rivers, waterways and drainage systems.

MANAGEMENT

The following sections present a synthesis of completed and ongoing activities that have strengthened and supported community-based natural resource management in Fiji in 2018.

Spreading District-Scale Ecosystem-Based Management in Bua Province

STATUS: Ongoing

FUNDING: John D. and Catherine T. MacArthur Foundation (Grant #16-1608-151132-CSD)

PARTNER ORGANISATIONS: Bua Provincial Council Office, *iTaukei* Affairs Board (iTAB), *iTaukei* Lands and Fisheries Commission (TLFC), c-Change, Bua Yaubula Management Support Team (BYMST), FLMMA

HIGHLIGHTS:

Over the last 12 months seven of the nine districts in Bua Province have been implementing their 5-year implementation plans for their district EBM plans. For example, they have been working to get community members to comply with the management rules that were developed for their respective districts, and apply best management practices (e.g. reduction in burning, improved farming techniques). Rather than investing in further training and capacity building, 2019 focused much more on implementation. Much effort has gone into supporting Resource Management Committees (RMCs) play their role, by strengthening their internal governance and their relationship with other government ministries (e.g. *iTaukei* Affairs Board, Forests, Fisheries, Agriculture, Health) and private sector. WCS also assisted improve communication and coordination between RMCs at the village, district and provincial level.

Communities are also interested exploring new opportunities for sustainable livelihoods like ecotourism, and rehabilitating damaged areas (e.g. cleared forests). WCS supported Vuya and Kubulau Districts Resource Management Committees access funds through the UNDP Global Environment Fund (GEF) Small Grants Programme. Kubulau will be focusing their funding on improving waste management across the district, and sharing lessons learned to other districts in Bua Province.

To date Dama is the only district in the province left to complete their EBM plan. Their plan was put on hold since 2016 due to internal conflict. However, this has now been resolved and the communities are now finalising their network of terrestrial and marine *tabu* (protected) areas. Once agreed upon, the final management plan will be presented to the Bose Vanua for endorsement.

Lastly, WCS has commenced discussions with Bua District that wants to review and update its EBM plan that was developed in 2007. The plan was originally developed in partnership with USP's Institute of Applied Science. A plan has been developed with the local community to begin the review and planning process to update the EBM plan in 2019.

NEXT STEPS:

- Support Dama District get their plan endorsed by the Bose Vanua and launched in 2019
- Assist Bua review and update their district management plan

LINKS TO NATIONAL PRIORITIES:

Recommendation 2: Develop ICM plans at the provincial levels which when considered together will suggest the make-up of the National ICM Plan. **Implementation Plan TA 6 (Protected Areas), Strategy 2**: Expand protected area network in priority sites at the national level and provincial level to achieve national targets, **Objective 2.2**: By 2014, develop management structures and implement paths to gazettal at highest priority sites, **Actions 2.2b-c**; and **NBSAP Implementation Plan TA 3 (Inshore Fisheries), Strategy 4**: Design new ecologically relevant inshore MPAs, **Objective 4.6:** By mid-2014, 25% of the communities will have established new management structures for new MPAs, **Action 4.6a:** Consult with communities at priority regions outside of existing MMAs to establish new MPA management structures. **Climate Change Policy Adaptation Strategy 5:** Support the ecosystem based management approach throughout Fiji, recognising that ecosystem services, such as food security, natural hazard mitigation and physical coastal buffer zones, increase resilience. **Green Growth Framework TA 3 (Sustainable Island and Ocean Resources)**: (i) develop a natural resource management system which is inclusive and integrated, and continue capacity building and awareness programmes with all communities, emphasising supporting resource owners on the importance of proper environmental stewardship, (ii) government to continue to work with community and civil society on initiatives such as the establishment of marine protected areas and community based fish wardens.

Provincial-scale engagement in Bua Province

STATUS: Ongoing

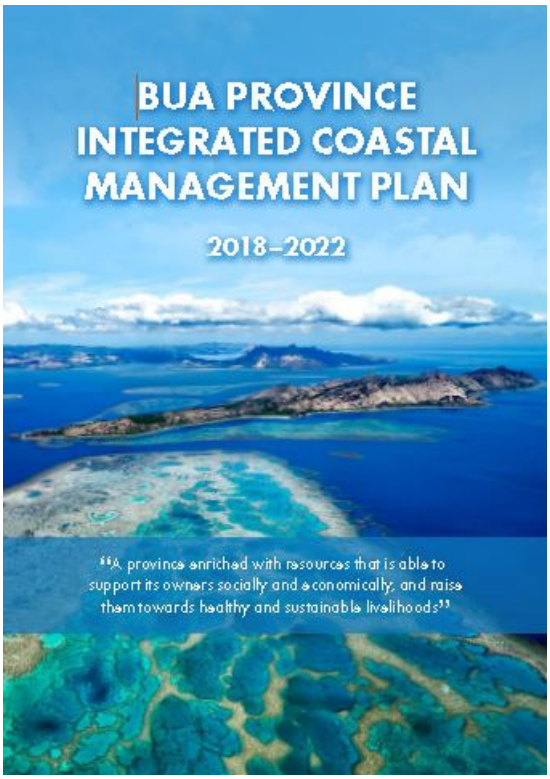
FUNDING: John D. and Catherine T. MacArthur Foundation (Grant #16-1608-151132-CSD), SNAPP, Australian Research Council (ARC) Linkage grant (LP150100934)

PARTNER ORGANISATIONS: Bua Provincial Council Office, Commissioner Northern Office, iTAB, Ministry of Fisheries, Ministry of Forests, Ministry of Environment, Department of Agriculture, BYMST

OUTPUTS:

- Wildlife Conservation Society (2018) Bua Province Integrated Coastal Management Plan: 2018–2022. Wildlife Conservation Society, Suva, Fiji. 56 pp.
- *Journal Article*: Delevaux JMS, Whittier R, Stamoulis KA, Bremer LL, Jupiter S, Friedlander AM, Poti M, Guannel G, Kurashima N, Winter KB, Toonen R, Conklin E, Wiggins C, Knudby A, Goodell W, Burnett KM, Yee S, Htun H, Oleson KLL, Wiegner T, Ticktin T (2018) A linked land-sea modeling framework to inform ridge-to-reef management in high oceanic islands. PLoS ONE 13:e0193230. https://doi.org/10.1371/journal.pone.0193230
- *Journal Article:* Brown CJ, Jupiter SD, Albert S, Anthony KRN, Hamilton RJ, Fredston-Hermann A, Halpern BS, Lin H-Y, Maina J, Mangubhai S, Mumby PJ, Possingham HP, Saunders MI, Tulloch VD, Wenger A, Klein CJ (accepted) A guide to modelling priorities for managing of land-based impacts on coastal ecosystems. Journal of Applied Ecology.

HIGHLIGHTS:



With the completion of eight of the nine district EBM plans for Bua Province in 2016, WCS has been working with the Bua Provincial Office and partners in Bua Province to integrate and synthesise these into a single ICM plan for the province. Copies of the draft ICM plan was widely distributed to stakeholders in Bua as well as the national level. All content for the Bua Province ICM Plan has now been reviewed and updated, and the final version of the plan was presented in to the Integrated Coastal Management Committee established under the Environmental Management Act (2005).

The Bua ICM Task Force with representatives from Bua Provincial Office (Roko Tui, Provincial Assistant), Ministries of Agriculture, Environment, Fisheries, Forests, Health, *iTaukei* Affairs, Water Authority of Fiji and National Disaster Management Office (NDMO) to oversee the implementation of the plan. A 5-year implementation plan has been

finalised and agreed upon by the Task Force. The Task Force members presented the ICM Plan and implementation plan to the Commissioner Northern's Office to also seek his endorsement and support.

Reviewing land-based activities in Bua Province ©Sangeeta Mangubhai/WCS

NEXT STEPS:

- Endorsement by the national Integrated Coastal Management Committee in early 2019
- Submission to Cabinet for approval
- Continue to support to the Bua ICM Taskforce to oversee the implementation of the plan

LINKS TO NATIONAL PRIORITIES:

Recommendation 2: Develop ICM plans at the provincial levels which when considered together will suggest the make-up of the National ICM Plan. **NBSAP Implementation Plan TA 4 (Coastal Development) Strategy 1:** Strengthen national guidelines for inter-sectoral coastal development, **Objective 1.3:** By 2014, a national coastal development plan to be developed to regulate/monitor coastal development activities; **Adaptation Strategy 5:** Support the ecosystem based management approach throughout Fiji, recognising that ecosystem services, such as food security, natural hazard mitigation and physical coastal buffer zones, increase resilience. **Green Growth Framework TA 3 (Sustainable Island and Ocean Resources)**: (i) develop a natural resource management system which is inclusive and integrated.

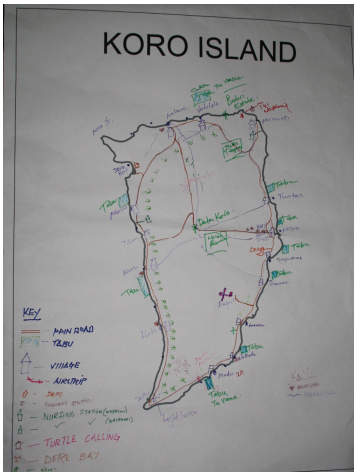
Island-scale EBM planning for Koro Island, Lomaiviti Province

STATUS: Ongoing

FUNDING: John D. and Catherine T. MacArthur Foundation (Grant #16-1608-151132-CSD)

PARTNER ORGANISATIONS: Lomaiviti Provincial Council Office, Lomaiviti YMST, Koro YMST

HIGHLIGHTS:



A workshop was held in June 2018 on Koro Island with representatives from each of the 14 villages. Workshop participants reviewed management rules for terrestrial and marine protected areas. The resource management committees were re-established with new members at the village and island-scale. There were greater efforts made to encourage and support improved inclusion of women on RMCs. The new fisheries training modules were tested on Koro Island. The most up to date fisheries information was provided to local community representatives to equip them better with the knowledge they need to develop a single fisheries management plan for the island, that will sit under the larger Koro Island EBM plan.

NEXT STEPS:

- Finalise management strategies with local communities
- Finalise draft EBM management plan for Koro Island
- Endorsement of the EBM plan by all villages, districts and traditional chiefs
- Launch management plan in 2019

LINKS TO NATIONAL PRIORITIES:

Recommendation 2: Develop ICM plans at the provincial levels which when considered together will suggest the make-up of the National ICM Plan. **NBSAP Implementation Plan TA 6 (Protected Areas), Strategy 2**: Expand protected area network in priority sites at the national level and provincial level to achieve national targets, **Objective 2.2**: By 2014, develop management structures and implement paths to gazettal at highest priority sites, **Actions 2.2b-c**; and **NBSAP Implementation Plan TA 3 (Inshore Fisheries), Strategy 4**: Design new ecologically relevant inshore MPAs, **Objective 4.6:** By mid-2014, 25% of the communities will have established new management structures for new MPAs, **Action 4.6a:** Consult with communities at priority regions outside of existing MMAs to establish new MPA management structures. **Climate Change Policy Adaptation Strategy 5:** Support the ecosystem based management approach throughout Fiji, recognising that ecosystem services, such as food security, natural hazard mitigation and physical coastal buffer zones, increase resilience. **Green Growth Framework TA 3 (Sustainable Island and Ocean Resources)**: (i) develop a natural resource management system which is inclusive and integrated, and continue capacity building and awareness programmes with all communities, emphasising supporting resource owners on the importance of proper environmental stewardship, (ii) government to continue to work with community and civil society on initiatives such as the establishment of marine protected areas and community based fish wardens.

Improving Effectiveness of Inshore Fisheries Management Systems in Fiji to Achieve Sustainable Ecological, Social and Economic Outcomes

STATUS: Ongoing

FUNDING: David and Lucile Packard Foundation (Grant #2017-66580), John D. and Catherine T. MacArthur Foundation (Grant #16-1608-151132-CSD)

PARTNER ORGANISATIONS: Ministry of Fisheries, Fiji Environmental Law Association (FELA), Biospherics, WWF, FLMMA

OUTPUTS:

- *Article*: Prince JD, Hordyk A, Mangubhai S, Lalavanua W, Tamata L, Tamanitoakula J, Vodivodi T, Meo I, Divalotu D, Iobi T, Loganimoce E, Logatabua K, Marama K, Nalasi D, Naisilisili W, Nalasi U, Naleba M, Waqainabete P (2018) Developing a System of Sustainable Minimum Size Limits for Fiji. SPC Fisheries Newsletter. 151: 51−60
- *Article*: Purcell SW, Lalavanua W, Cullis BR, Cocks N (2018) Small-scale fishing income and fuel consumption: Fiji's artisanal sea cucumber fishery. ICES Journal of Marine Science. 75(5): 1758-1767
- *Article*: Purcell SW, Fraser N J, Tagica S, Lalavanua W, Ceccarelli DM (2018) Discriminating catch composition and fishing modes in an artisanal multispecies fishery. Frontiers in Marine Science. 5:243. https://doi.org/10.3389/fmars.2018.00243
- *Article*: Lalavanua W, Johnson D, Naivalu K, Veeran R, Mangubhai S, Tuinamata A, Tamanitoakula J, Loganimoce E, Rosabula M, Lee S (2018) Revitalising the fish warden system in Fiji: Outcomes of the second Northern Division Fish Warden Forum. SPC Fisheries Newsletter. 156: 34–37
- *Report*: Sadovy de Mitcheson Y, Mangubhai S, Witter A, Kuridrani N, Batibasaga A, Waqainabete P, Sumaila R (2018) Fiji Grouper Fishery Value Chain Analysis. Report of Science and Conservation of Fish Aggregations (SCRFA), United States. 57 pp.

HIGHLIGHTS:

Size measurements of fish at Labasa markets. ©Sangeeta Mangubhai/WCS

Our fisheries work focuses around three key objectives: (1) improving fisheries management systems; (2) developing effective legislation, policy, and management frameworks; and (3) strengthening governance of inshore fisheries.

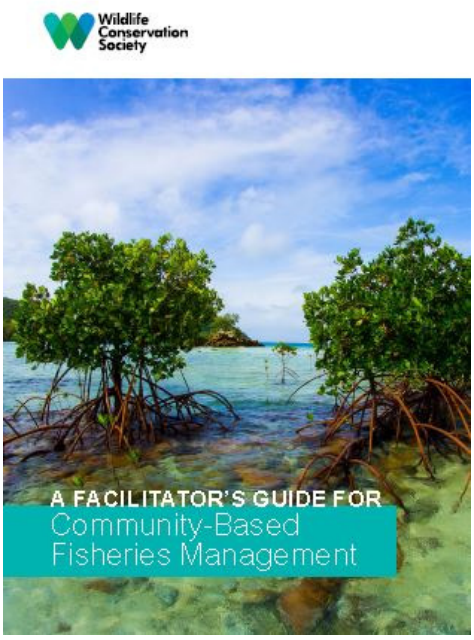
Sea cucumber fishery: Despite the ban on the sale of sea cucumbers, Natuvu (Wailevu District) and Saolo (Wainunu District) villages held consultations and finalised the content of their respective community sea cucumber plans. The plans include the implementation of minimum (wet and dry) size limits; prohibition on the collection of a list of non-permitted species developed by MoF and WCS; gear limitations (i.e. gleaning and breath-hold diving only); seasonal closures around spawning periods, where

known; and spatial protection (i.e. *tabu* areas). The plans have been reviewed and endorsed by the MoF's Northern Division. WCS staff are working with the communities to identify a launch date for the two plans.

Mud crab fishery: Mud crab fishers from Tacilevu and Waitabu villages (who share traditional fishing grounds in Bua District) have established a three-year fishery closure (*tabu*) with the endorsement of their council of chiefs. In addition to the *tabu*, their recently finalised management plan also includes minimum size limits and the prohibition of the collection of female egg-carrying ('berried') crabs. Tavea and Nadivakarua villages in Lekutu and Kubulau districts, respectively, are implementing rules from endorsed district-level ecosystem-based management plans targeting mud crab management, including rules to protect critical mangrove habitats, prohibitions on destructive gears, and size limits for mud crabs.

Staff from Ministry of Fisheries and WCS travelled to New Caledonia in September 2018 to work closely with SPC to draft 10-year national management plans for Fiji's mud crab and giant clam fisheries. Both are listed as a priority in the MoF's Annual Corporate Plan. The draft management plans contain objectives, guiding principles, management strategies and measures, and penalties, and will be used as a 'template' for future coastal fisheries management plans by the Ministry. The need for a National Inshore Fisheries Advisory Committee to oversee the implementation of the plans and broad technical assistance to the Inshore Fisheries Management Division was identified. A consultation strategy for the two plans has been outlined by Ministry, and according to the Ministry will be completed by June 2019.

Fisheries Curriculum: A "Facilitator's Guide for Community-Based Fisheries Management" has been distributed to FLMMA partners and Ministry of Fisheries for review. The curriculum, which was developed by Dr. Rebecca Weeks (James Cook University) and Dr. Stacy Jupiter (WCS Melanesia Regional Director), has five training modules: (i) objectives and tools for community-based fisheries management; (ii) fish habitat, climate change, natural disasters, and resilience; (iii) size limits and spawning aggregations; (iv) fisheries closure design; and (v) *tabu* area management for sustainable harvests. The curriculum has been designed to be taught by fisheries extension officers, representatives from the FLMMA network, and conservation officers, with training targeted at local communities to help promote awareness for improved fisheries management and governance.



Northern Fisheries Forum: The Third Northern Division Fisheries Forum took place in Labasa, Fiji from May 16-17, 2018 and was co-hosted by the Ministry of Fisheries and WCS. The 2018 forum focused on three thematic areas: (i) gender in fisheries and aquaculture; (ii) fisheries compliance and enforcement; and (iii) size limits as tools for fisheries management. Compared to the earlier two fora, the sessions provided more opportunity to share information on new work being undertaken by the Ministry, rather than specific recommendations from stakeholders. The forum had greater participation of women fishers, Indo-Fijian, and i-Kiribati fishers than previously, which provided a greater diversity of voices to the discussions. Forum participants highlighted a number of key needs, all of which require broad public support: (i) greater recognition of the role of women in inshore fisheries; (ii) a national management plan to support nearshore fisheries, such as mud crabs; (iii) a plan to "revitalise" Fiji's fish warden system; (iv) a national enforcement and compliance strategy; and (v) a review of Fiji's minimum size limit for coral reef fish.

National Fish Warden Strategy: WCS contracted Robert Gillett to undertake a review of Fiji's fish warden system since its inception in 1959, and to assist Ministry of Fisheries develop an improved fish warden strategy and system. The major issues identified were presented at the Second Northern Division Fish Warden Forum on May 15, 2018 in Labasa. MoF and WCS co-hosted the Second Fish Warden Forum for the Northern Division on May 15, 2018 in Labasa. The forum was attended by 45 participants from the Fiji police force, NGOs, fishers, fish wardens, and community management committee representatives. The main objective of the forum was to contribute ideas towards a "National Fish Warden Strategy for Fiji," and provide inputs into the fish warden manual that is being developed by the Ministry and FELA that will act as a training aid and information booklet for fish wardens and relevant authorities. Key issues to be addressed included: (i) low level of support of Ministry to fish wardens; (ii) lack of activity of most fish wardens; (iii) ineffective action on reports/arrests made by fish wardens by enforcement agencies; (iv) inadequate and insufficient training of fish wardens; (v) lack of gear provisioning for fish wardens; and (vi) the lack of payment to fish wardens. Recommendations were made for improvement, which are currently being addressed by the IFMD as part of a broader national compliance strategy that is being developed over the next 10 months. WCS is awaiting confirmation from the Ministry of Fisheries on the timing of a national workshop to get inputs into the drafting of a fish warden strategy for Fiji.

LINKS TO NATIONAL PRIORITIES:

NBSAP Implementation Plan Thematic Area 3 (Inshore Fisheries), Action 8.2a: Perform stock assessments of inshore fisheries. **Green Growth Framework TA 3 (Sustainable Island and Ocean Resources)**: (i) develop a natural resource management system which is inclusive and integrated, and continue capacity building and awareness programmes with all communities, emphasising supporting resource owners on the importance of proper environmental stewardship.

Supporting women in fisheries as a strategy to strengthen and expand marine conservation in Fiji

STATUS: Ongoing

FUNDING: Flora Family Foundation (Grant #2018 - 3153), David and Lucile Packard Foundation (Grant #2017-66580)

PARTNER ORGANISATIONS: Ministry of Fisheries, FLMMA, Women in Fisheries Network-Fiji (WiFN-Fiji)

OUTPUTS:

- *Article*: Thomas AS, Mangubhai S, Vandervord C, Fox M, Nand Y (2018) Impact of Tropical Cyclone Winston on mud crab fishers in Fiji. Climate and Development. DOI:10.1080/17565529.2018.
- *Article:* Thomas AS, Vandervord C, Fox M, Nand Y, Nalasi U, Mangubhai S (2018) Impact of Tropical Cyclone Winston on mud crab fishers in Fiji. SPC Women in Fisheries Information Bulletin. 28: 3–7
- Article: Thomas AS, Mangubhai S, Fox M, Meo I, Miller K, Veitayaki J (2018) Quantifying and valuing the critical role women play in Fiji's inshore fisheries sector. SPC Women in Fisheries Information Bulletin. 28: 15–16
- *Article*: Mangubhai S, Tabunakawai-Vakalalabure M, Fox M, Leweniqila L, Meo I, Naleba M, Thomas A (2018) Fiji's Northern Division hosts its first "Women in Fisheries Forum". SPC Women in Fisheries Information Bulletin. 28: 17–18

HIGHLIGHTS AND NEXT STEPS:

Waitabu and Tacilevu villages, collectively referred to as Navunievu community, have developed a three year (2018-2020) Community Mud Crab Management Plan with the support of the Ministry of Fisheries and WCS, the Bose Vanua – Bua District and Bua Provincial Office, to address the social, economic, and ecological issues associated with the harvesting and handling of mud crabs (*qari)* and to ensure the sustainability of their fishery for future generations.

Multiple consultations were held between December 2016 to June 2018 with community members in Navunievu community to identify key issues in the fishery and develop management arrangements to address them. Key issues identified by the community included: (i) a lack of consistency in prices for mud crabs, (ii) distance to markets to sell mud crabs, (iii) increased effort needed to collect enough mud crabs to sell, (iv) a lack of knowledge regarding mud crab post-harvest handling techniques to ensure product quality, and (v) a lack of knowledge of market prices to ensure fair prices to fishers.

To address the issues identified, the community of Navunievu has agreed to: (i) adhere to minimum legal catch size limits, including mud crabs collected for "fattening" prior to sale; (ii) prohibit collection of berried female crabs; (iii) establish and maintain a 3 year protected area over mangrove habitat; and (iv) maintain the existing mud crab fattening cage within the protected area. In November 2018 the mud crab fishers of Navunievu village, with the support of traditional leaders launched their management plan for their mud crab fishery.

The first Women in Fisheries Forum for the Northern Division took place in Labasa, Fiji, on 15 May 2018, hosted by the Ministry of Fisheries, WCS, FLMMA Network, and the WiFN–Fiji. The forum brought together 18 women from 16 districts across the provinces of Bua, Cakaudrove and Macuata. The forum, the first for the Northern Division, provided an opportunity for women fishers to meet to discuss, network and identify ways to increase the recognition of the important role they play in Fiji's coastal fisheries sector. The forum explored pathways or approaches to assist and empower women in the fisheries sector, to ensure their long-term contribution to food security, livelihoods and the national economy

In September 2018, WCS accompanied key staff from the Ministry of Fisheries to Noumea to work with SPC to draft national management plans for mud crabs and giant clams for Fiji. The visit provided the opportunity to understand and review how other Pacific Island countries were developing management plans. While the mud crab fishery is relatively healthy in Vanua Levu, there are signs of rapid depletion occurring in Viti Levu. In contrast giant clams are depleted throughout Fiji. Women are highly involved in these fisheries, dependent on them for both food and livelihoods for their families. The draft plans will go out for public consultation in 2019 to get the inputs of all relevant stakeholders involved in the fishery.

LINKS TO NATIONAL PRIORITIES:

NBSAP Implementation Plan TA 3 (Inshore Fisheries), Action 3.2b: Monitor core set of existing MPAs for biodiversity and fisheries resources compared with unmanaged sites; **Action 8.2a**: Perform stock assessment of inshore marine resources. **Green Growth Framework TA 3 (Sustainable Island and Ocean Resources)**: (i) develop a natural resource management system which is inclusive and integrated, and continue capacity building and awareness programmes with all communities, emphasising supporting resource owners on the importance of proper environmental stewardship. **TA 4 (Inclusive Social Development)**: increase women's capacity to participate in decision making and leadership at all levels to development (from village to national government) by 2018. **Fiji National Gender Policy**: 5.7 Gender Statistics and Research, 5.19 Leadership, Training and Development.

MAI KANA – Fiji's first sustainable seafood cookbook, celebrating the role women play in coastal fisheries

STATUS: Ongoing

FUNDING: Flora Family Foundation (Grant #2018 - 3153)

HIGHLIGHTS:

The recipe book aims to provide local and international food enthusiasts of the world with local, sustainable and educational seafood recipes. The recipe book celebrates women in coastal fisheries sector who contribute to the food security and the livelihoods of their families, and to Fiji's national economy. With their stories and traditional knowledge, these women will help educate the readers of this recipe book about the long-term health and sustainability of our freshwater and marine habitats.

Featuring original recipes from Chef Jason Allport, the recipe book is organised according to habitats from the ridge to the sea. In other words, recipes are organised around fish and invertebrates we get from rivers, mangroves, coral reefs and oceanic habitats. Each habitat was selected for, not only the vital role they play in Fijian culture and tradition, but also, the many ecosystem services which they provide. Keeping with the theme of sustainability, there will be a section detailing the legal requirements of each seafood ingredient which some would otherwise not know. For instance; the minimum legal size of a fish species. In addition, the recipe book will include background stories of local Fijian village women whose livelihoods are dependent on these habitats and the lengths they go to just to provide for their families.

All diet types will be catered for with the recipe book providing vegetarian options, and also dessert and accompaniment sections. Similar to the seafood section, these recipes will be based around an ingredient which is locally sourced and grown.

NEXT STEPS:

- The recipe book is in the final stages of editing and publishing.

LINKS TO NATIONAL PRIORITIES:

Green Growth Framework TA 3 (Sustainable Island and Ocean Resources): (i) develop a natural resource management system which is inclusive and integrated, and continue capacity building and awareness programmes with all communities, emphasising supporting resource owners on the importance of proper environmental stewardship. **TA 4 (Inclusive Social Development)**: increase women's capacity to participate in decision making and leadership at all levels to development (from village to national government) by 2018.

Sustainable financing for local community protected areas

STATUS: Ongoing

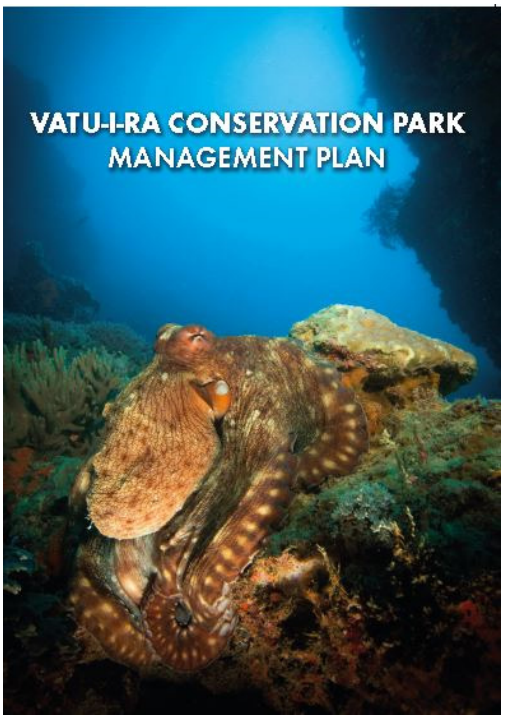
FUNDING: John D. and Catherine T. MacArthur Foundation (Grant #16-1608-151132-CSD), RESCCUE Project funded by the French Development Agency (AFD) and the French Global Environment facility (FFEM) and implemented by SPC

PARTNER ORGANISATIONS: Ra Provincial Council, USP, Volivoli Resort, Wananavu Resort, Nai'a Cruises, SPC, FELA, BirdLife International, Ministry of Environment and Waterways

OUTPUTS:

- *Management Plan*: Wildlife Conservation Society (2018) Vatu-i-Ra Conservation Park Management Plan. Wildlife Conservation Society, Suva, Fiji. 25 pp.
- *Report***:** Nand Y, Mangubhai S, Fox M, Dulunaqio S, Naisilisili W, Tamanitoakula J (2018) Ecological and socioeconomic surveys of the Vatu-i-Ra Conservation Park. Wildlife Conservation Society. Report No. 03/18. Suva, Fiji. 27 pp.
- *Report***:** Sykes H, Mangubhai S, Manley M (2018) Contribution of Marine Conservation Agreements to Biodiversity Protection, Fisheries Management and Sustainable Financing. Report No. 02/18. Wildlife Conservation Society, Suva, Fiji. 98 pp.

HIGHLIGHTS:



Management Plan

The management plan for the Vatu-i-Ra Conservation Park was finalised and endorsed by community leaders and the tourism operators on 3 May, 2018. A launch was held at the Ra Provincial Office with the Permanent Secretary for iTaukei Affairs acting as the Chief Guest. The management plan was also signed by the Ministry of Fisheries and Ministry of Environment. An English and Fijian version has been produced. The Park covers an area of 105.3 km^2, and includes highly diverse coral reefs that are popular amongst international divers, and a regionally significant population of seabirds on Vatu-i-Ra Island. The Management Plan establishes the vision, strategies and framework for sustainably managing Vatu Island, the surrounding customary fishing grounds *i qoliqoli* Cokovata Nakorotubu, and adjacent deeper waters.

Trust Deed

A Trust Deed was developed in partnership with the FELA and has received the endorsement of the Ra Provincial Office, tourism operators and leaders and representatives from Nakorotubu District. The Trust will be overseen by one representative each from the local community, from WCS and from the tourism sector. The Trust Deed sets out the rules, roles and responsibilities of the Board of Trustees and the Management Committee that will oversee the day-to-day management of the Park.

Education grants

The Management Committee for the Vatu-i-Ra Conservation Park advertised the scholarship between December 2018 to January 2019. Criteria were developed and applicants were assessed. A total of 18 students were granted FJ$400 each, totaling FJ$7200. The funds for this first round were provided through the RESCCUE project, as the dive operators commenced collecting funds in 2018. Once a bank account has been set up for the Trust Fund, all funds collected will be transferred to the account directly by the tourism operators on a quarterly or biannual basis. The frequency of deposits will be determined by the operators themselves.

Bachelor of Business (Accounting and Management)

Mereadani is 20 years old and a first year student at the Fulton College, in Sabeto, Nadi. She is from Saioko Village. As she grew up, she saw her mother running her small business on her own to support the family and all the struggles she went through. *"Seeing my mother struggling alone touched me, and I promised myself to study business so I have some knowledge of accounting and management and help her business productive and profitable. I can also help finance my mother's small business when I finish my studies and work".*

Bachelor of Arts Geography and History

Tevita Laso Savua is 21 years old and is from Tobu Village. He is starting the second year of his studies at the University of the South Pacific. Since primary school Tevita has enjoyed studying social studies and has been fascinated by the natural environment. *"I have my goals set on becoming an advocate on the conservation of our environment and climate change which is directly and negatively affecting our environment. Thus I intend to become a conservationist, a landscaper".*

Monitoring and evaluation

To ensure the Conservation Park achieves its ecological and socioeconomic objectives, a monitoring and evaluation framework was developed by WCS, in consultation with experts from Conservation International and JCU.[2] Ecological and socioeconomic surveys were

[2] Teneva L, Mangubhai S (2016) Monitoring and Evaluation Framework for Marine Conservation Agreements in Fiji. Wildlife Conservation Society. Report No. 06/16. Suva, Fiji. 17 pp.

undertaken in 2016 and repeated in 2018. Ecological surveys showed that while coral communities have not recovered from the category 5 Cyclone Winston that passed through Fiji in 2016, there is a lot of clean available substrate for recruits to settle on and low algal cover. Recovery of coral communities is likely to take 5−10 years given the damage the cyclone caused across Fiji. Fish populations however, appear to be healthy (>1000 kg/ha) and will be critical for the recovery of adjacent reefs within the larger customary fishing ground.

The results from the socioeconomic surveys highlight the complexity of establishing marine protected areas through marine conservation agreements in Fiji. There were clear contradictions in the information being provided during the surveys, which is not unusual for socioeconomic surveys, especially those trying to look at complex issues such as equity and how the Conservation Park has affected individual households and villages. For example, although more than 90% of respondents stated they do not fish in the Conservation Park, 23.1% felt the Park negatively affected them due to loss of income from fishing. The data also showed that women were less aware of the Conservation Park and the voluntary contribution to conservation scheme.

The Vatu-i-Ra Conservation Park and the user fund scheme is still a fairly new system for the communities of Ra Province and this study showed there is still a need for broad-scale awareness, particularly with women. Management needs to be adaptive, and therefore the following recommendations are made:

1) The results of the survey should be shared with the Management Committee for the Conservation Park;
2) Support the Management Committee develop an education and awareness strategy that includes specific actions to engage women;
3) Management Committee to disseminate information as wide as possible to their communities and districts;
4) Organise targeted/focused group meetings when visiting communities and disseminate information through these groups; and
5) Given the number of communities in Nakorotubu District and the poor dissemination of information by leaders and representatives, factsheets should be distributed to individual households.

LINKS TO NATIONAL PRIORITIES:

By providing means to alternate revenue streams, this activity in principle supports **NBSAP Implementation Plan TA 3 (Inshore Fisheries), Strategy 9**: Reduce demand for marine natural resources and biodiversity products. However, monitoring will be required to evaluate whether revenue is additive or alternative. **TA 3 (Protected Areas), Strategy 3:** Develop sustainable finance mechanisms for new and existing protected areas. **Action 3.1d:** Ensure meaningful participation and provide equitable incentives and remuneration to resource owners for Protected Area establishment and management.

Offshore Marine Managed Areas: Campaigning for the Vatu-i-Ra Seascape

STATUS: Ongoing

FUNDING: Waitt Foundation

PARTNER ORGANISATIONS: Ministry of Fisheries, Ministry of Environment, IUCN, WWF, Conservation International

OUTPUT:

- *Policy Brief*: Protected Area Financing in Fiji. For Discussion. (draft) Policy Brief of the national Protected Areas Committee.

HIGHLIGHTS:

WCS President and CEO meeting with the Prime Minister of Fiji and the Fiji Government delegation at the United Nations General Assembly in New York.

The Ministry of Fisheries and Solicitor General's Office drafted a regulation for the gazettal of the Central Viti and Bligh Water Marine Managed Areas (MMAs). The regulation addresses some of the key threats in the seascape, and contributes to a number of international commitments the Government of Fiji made at the Small Islands Developing States conference and at the United Nations Ocean Conference. WCS supported getting letters of support for the two MMAs and provided inputs into the regulation. Addition socialisation of the regulation was done in the provinces of Bua, Lomaiviti and Tailevu.

A policy brief on sustainable financing options for marine and terrestrial protected areas in Fiji was updated for the PAC. The brief focuses on the establishment, capitalisation and operationalisation of a National Protected Area Trust Fund for formally recognised protected areas.

LINKS TO NATIONAL PRIORITIES:

NBSAP Implementation Plan TA 6 (Protected Areas), Strategy 1: Identify gaps in biodiversity protection against national targets. **Strategy 2**: Expand protected area network in priority sites at the national level and provincial level to achieve national targets. **Green Growth Framework TA 3 (Sustainable Island and Ocean Resources)**: (i) develop a natural resource management system which is inclusive and integrated, and continue capacity building; (ii) establish deepwater MPAs targeting 30% of offshore areas by 2020.

Kilaka Forest Conservation Area

STATUS: Ongoing

FUNDING: Harvey and Heidi Bookman, John D. and Catherine T. MacArthur Foundation (13-104090-000-INP)

PARTNER ORGANISATIONS: Nadicake *mataqali*, *iTaukei* Land Trust Board (TLTB), Ministry of Forests, Ministry of Environment, Kubulau RMC

OUTPUT:

- *Journal article*: Mangubhai S, Lumelume R (in review) Achieving forest conservation in Fiji through payment for ecosystem services schemes. Pacific Conservation Biology.

HIGHLIGHTS:

Forest wardens' at their graduation with WCS Policy Officer Ruci Lumelume. ©Sahar Kirmani/WCS

The Kilaka Forest Conservation Area (KFCA) is a 402 hectare block of one of the last native rainforests on Fiji's second largest island of Vanua Levu, within the heart of the Vatu-i-Ra Seascape, where WCS focuses its conservation investments.

Given the level of commitment the community has shown to date to protect Kilaka Forest, WCS worked closely with the landowning unit, the Nadicake clan from 2015 to 2017, to secure a 99-year conservation lease for the forest through the *i-Taukei* Land Trust Board (TLTB). WCS signed a conservation lease with TLTB on June 22, 2017.

Two members from Kilaka village undertook a forest training program with the Ministry of Forests to become forest wardens for Kubulau District. The forest wardens were the first to go through a new course that has been developed by the Forestry Training Center (Ministry of Forests). Forest wardens have been actively reporting any breaches of the lease agreement to WCS, the local community and the Ministry of Forests.

LINKS TO NATIONAL PRIORITIES:

NBSAP Implementation Plan TA 6 (Protected Areas), Strategy 1: Identify gaps in biodiversity protection against national targets. **Strategy 2**: Expand protected area network in priority sites at the national level and provincial level to achieve national targets. **Green Growth Framework TA 6 (Freshwater Resources and Sanitation Management):** Adoption of watershed management plans using integrated water resources management principles for major rivers, waterways and drainage systems.

ENGAGING WITH NATIONAL AND REGIONAL POLICY AND PLANNING

The following sections present a synthesis of ways that WCS Fiji has participated in development of national and regional conservation and resource management policies and planning in 2018.

Protected Area Committee

WCS participated in three meetings of the national PAC under the Ministry of Environment, established under the Environmental Management Act (2005). WCS-Fiji Director, Dr. Sangeeta Mangubhai continued to chair the Marine Working Group for PAC. Discussions in 2018 focused largely around the Fiji Government commitment to protect 30% of its seas by 2020, and the development of a framework for protected areas for Fiji.

CITES Management Authority

WCS became a member of the Fiji CITES Management Authority in 2017 managed by the Ministry of Environment. Part 4 of the Act established the Authority and Part 6 outlines the functions. This body regulates CITES and Endangered and Protected Species Act-listed species through a licensing and quota system. The Authority is required to meet four times per year to discuss issues pertaining to the training of CITES and EPS-listed species.

Integrated Coastal Management Committee

WCS participated in the national Integrated Coastal Management (ICM) Committee under the Department of Environment, established under the Environmental Management Act (2005). The committee provides technical advice to ICM efforts in Fiji.

Marine Protected Areas Advisory Committee

WCS participated and provided secretarial support to the national Marine Protected Area Technical Advisory Committee chaired by the Ministry of Fisheries, established under the Offshore Fisheries Management Decree (2012).

Particularly Sensitive Sea Areas Task Force

WCS continued as a member of the national Particularly Sensitive Sea Areas (PSSA) Task Force, coordinated by the Maritime Safety Authority of Fiji (MSAF). A PSSA is an “area that requires special protection through action by the International Maritime Organization (IMO) because of its significance for recognised ecological, socioeconomic or scientific reasons and which is vulnerable to damage by international maritime activities”.

2018 PUBLICATIONS

Journal Articles

Brown CJ, Jupiter SD, Albert S, Anthony KRN, Hamilton RJ, Fredston-Hermann A, Halpern BS, Lin H-Y, Maina J, Mangubhai S, Mumby PJ, Possingham HP, Saunders MI, Tulloch VD, Wenger A, Klein CJ (accepted) A guide to modelling priorities for managing of land-based impacts on coastal ecosystems. Journal of Applied Ecology.

Mcleod E, Anthony KRN, Mumby PJ, Maynard J, Beeden R, Graham NAJ, Heron SF, Hoegh-Guldberg O, Jupiter S, MacGowan P, Mangubhai S, Marshall N, McClanahan TR, Mcleod K, Nyström M, Obura D, Parker B, Possingham HP, Salm RV, Tamelander J (accepted) The future of resilience-based management in coral reef ecosystems. Environmental Management.

Thomas AS, Mangubhai S, Vandervord C, Fox M, Nand Y (2018) Impact of Tropical Cyclone Winston on mud crab fishers in Fiji. Climate and Development. DOI:10.1080/17565529.2018.1547677

Larsen SN, Leisher C, Mangubhai S, Muljadi A, Tapilatu RF (2018) Fisher perceptions of threats and fisheries declines in the heart of the Coral Triangle. Ocean Life. 2(2): 41–46

Mangubhai S, Nand Y, Rotjan R (2018) Discovery of a recovering climax *Acropora* community in Kanton Lagoon in the remote Phoenix Islands Protected Area. Pacific Conservation Biology. https://doi.org/10.1071/PC18051

Mangubhai S, Obura DO (2018) Silent killer: Black reefs in the Phoenix Islands Protected Area. Pacific Conservation Biology. https://doi.org/10.1071/PC18048

Delevaux JMS, Jupiter SD, Stamoulis KA, Bremer LL, Wenger AS, Dacks R, Garrod P, Falinski KA, Ticktin T (2018) Scenario planning with linked land-sea models inform where forest conservation actions will promote coral reef resilience. Scientific Reports 8:12465. DOI:12410.11038/s41598-12018-29951-12460

Prasad N, Jenkins AP, Naucukidi L, Rosa V, Sahu-Khan A, Kama M, Jenkins KM, Jenney AWJ, Jack SJ, Saha D, Horwitz P, Jupiter SD, Strugnell RA, Mulholland EK, Crump JA (2018) Epidemiology and risk factors for typhoid fever in Central Division, Fiji, 2014-2017: A case-control study. PLoS Neglected Tropical Diseases 12:e0006571. https://doi.org/0006510.0001371/journal.pntd.0006571

Lee S, Ford A, Mangubhai S, Wild C, Ferse S (2018) Effects of sandfish (Holothuria scabra) removal on shallow-water sediments in Fiji. PeerJ. 6:e4773; DOI 10.7717/peerj.4773

Dacks R, Ticktin T, Jupiter SD, Friedlander A (2018) Drivers of fishing at the household scale in Fiji. Ecology and Society. 23: 37 https://doi.org/10.5751/ES-09989-230137

Delevaux JMS, Whittier R, Stamoulis KA, Bremer LL, Jupiter S, Friedlander AM, Poti M, Guannel G, Kurashima N, Winter KB, Toonen R, Conklin E, Wiggins C, Knudby A, Goodell W, Burnett KM, Yee S, Htun H, Oleson KLL, Wiegner T, Ticktin T (2018) A linked land-sea modeling framework to inform ridge-to-reef management in high oceanic islands. PLoS ONE 13:e0193230. https://doi.org/10.1371/journal.pone.0193230

McCarter J, Sterling EJ. Jupiter SD, Cullman G, Albert S, Basi M, Betley E, Boseto D, Bulehite ES, Fred B, Haroni R, Holland PS, Horning N, Hughes A, Jino N, Malone C, Mauli S, Pae B, Papae R, Rence F, Revo O, Taqala E, Taqu M, Woltz H, Filardi CF (2018) Biocultural approaches to well-being indicator development in the Solomon Islands. Ecology and Society. 23:32. https://doi.org/10.5751/ES-09867-230132

Brainard RE, Oliver T, McPhaden MJ, Cohen A, Venegas R, Heenan A, Vargas-Ángel B, , Rotjan R, Mangubhai S, Flint E, Hunter SA (2018) Ecological Impacts of the 2015–2016 El Niño in the Central Equatorial Pacific. Bulletin of the American Meteorological Society. S1-S6. DOI:10.1175/BAMS-D-17-0128.1

Ford AK, Eich A, McAndrews R, Mangubhai S, Nugues MM, Bejarano S, Wild C, Moore BR, Rico C, Ferse SCA (2018) Evaluation of coral reef management effectiveness using conventional versus newly developed monitoring metrics. Ecological Indicators. 85: 308−317

Book Chapters

Mangubhai S, Lovell E, Abeta R, Donner S, Fedfern F, O'Brien M, Aram KT, Rotjan R, Gillett R, Eria T, Teetu S, Bebe R (2019) Kiribati: Atolls and marine ecosystems. In C. Sheppard (ed.) World Seas: An Environmental Evaluation Volume II: The Indian Ocean to the Pacific. Elsevier.

Mangubhai S, Sykes H, Lovell E, Brodie G, Jupiter S, Lal R, Lee S, Loganimoce EM, Morris C, Nand Y, Qauqau I, Rashni B (2019) Fiji: Coastal and marine ecosystems. In C. Sheppard (ed.) World Seas: An Environmental Evaluation Volume II: The Indian Ocean to the Pacific. Elsevier.

SPC Bulletins

Lalavanua W, Johnson D, Naivalu K, Veeran R, Mangubhai S, Tuinamata A, Tamanitoakula J, Loganimoce E, Rosabula M, Lee S (2018) Revitalising the fish warden system in Fiji: Outcomes of the second Northern Division Fish Warden Forum. SPC Fisheries Newsletter. 156: 34–37.

Thomas AS, Vandervord C, Fox M, Nand Y, Nalasi U, Mangubhai S (2018) Impact of Tropical Cyclone Winston on mud crab fishers in Fiji. SPC Women in Fisheries Information Bulletin. 28: 3−7.

Thomas AS, Mangubhai S, Fox M, Meo I, Miller K, Veitayaki J (2018) Quantifying and valuing the critical role women play in Fiji's inshore fisheries sector. SPC Women in Fisheries Information Bulletin. 28: 15−16.

Mangubhai S, Tabunakawai-Vakalalabure M, Fox M, Leweniqila L, Meo I, Naleba M, Thomas A (2018) Fiji's Northern Division hosts its first "Women in Fisheries Forum". SPC Women in Fisheries Information Bulletin. 28: 17−18.

Prince JD, Hordyk A, Mangubhai S, Lalavanua W, Tamata L, Tamanitoakula J, Vodivodi T, Meo I, Divalotu D, Iobi T, Loganimoce E, Logatabua K, Marama K, Nalasi D, Naisilisili W, Nalasi U, Naleba M, Waqainabete P (2018) Developing a System of Sustainable Minimum Size Limits for Fiji. SPC Fisheries Newsletter. 151: 51−60.

Lee S, Ford A, Mangubhai S, Wild C, Ferse S (2018) Length-weight relationship, movement rates, and *in situ* spawning observations of *Holothuria scabra* (sandfish) in Fiji. SPC Bêche-de-mer Information Bulletin 38: 11−14.

Reports

Sadovy de Mitcheson Y, Mangubhai S, Witter A, Kuridrani N, Batibasaga A, Waqainabete P, Sumaila R (2018) Fiji Grouper Fishery Value Chain Analysis. Report of Science and Conservation of Fish Aggregations (SCRFA), United States. 57 pp.

Kirmani SN, Brehme C, Cakacaka T, Dulunaqio S, Fisher R, Hathaway S, Koroi I, Loganimoce E, O'Brien M, Masibalavu V, Naikatini A, Segaidina M, Thomas N, Tikoca S, Tubuitamana P, Tuiwawa M, Vido S, Mangubhai S (2018) Terrestrial and Archaeological Surveys of Kilaka Forest Conservation Area. Wildlife Conservation Society. Report Report No. 04/18. Suva, Fiji. 57 pp.

Sykes H, Le Grand J, Davey K, Kirmani SN, Mangubhai S, Yakub N, Wendt H, Gauna M, Fernandes L (2018) Biophysically special, unique marine areas of Fiji. MACBIO (GIZ, IUCN, SPREP), Wildlife Conservation Society and Fiji's Protected Area Committee, Suva.

Wendt H, Beger M, Sullivan J, LeGrand J, Davey K, Yakub N, Kirmani SN, Grice H, Mason C, Raubani J, Lewis A, Jupiter S, Hughes A, Ceccarelli D, Fernandes L (2018) Marine bioregions of Fiji. MACBIO (GIZ, IUCN, SPREP): Suva, Fiji. 52 pp.

Sykes H, Mangubhai S, Manley M (2018) Contribution of Marine Conservation Agreements to Biodiversity Protection, Fisheries Management and Sustainable Financing in Fiji. Report No. 02/18. Wildlife Conservation Society, Suva, Fiji. 98 pp.

Miller K, Nand Y, Mangubhai S, Lee S, Naisilisili W, Sykes H (2018) Marine Biological Surveys of the Northern Lau Group. Report No. 01/18. Vatuvara Foundation and the Wildlife Conservation Society, Suva, Fiji. 46pp.

Lee S, Lewis A, Gillett R, Fox M, Tuqiri N, Sadovy Y, Batibasaga A, Lalavanua W, Lovell E (2018) Fiji Fishery Resource Profiles. Information for Management on 44 of the Most Important Species Groups. Gillett, Preston and Associates and the Wildlife Conservation Society, Suva. 240pp.]

Conference Presentations

Mangubhai S, Thomas A, Fox M (2018) Gender-disaggregated impacts of a category 5 cyclone on rural fisher communities in Fiji. Gender in Aquaculture and Fisheries Conference. Asian Fisheries Society, Thailand, October 2018.

Jupiter S (2018) Integrated watershed management for healthy environments and people. Invited keynote presentation. Oceania Planetary Health Forum, Nadi, Fiji, 5-6 November

Brainard RE, Oliver T, Williams I, Steinberg CR, Bainbridge S, Brinkman R, Sweatman H, Cantin N, Souter D, Eakin CM, Heron SF, Skirving W, Bax NJ, Obura D, Cohen A, Sandin S, Rohwer F, Kelly LW, Duffy E, Kimball J, Lammers M, Burns J, Mangubhai S, San Diego-McGlone ML, Khokiattiwong S, Planes S, Croquer A, Tamelander J, Weijerman M, Couch C (2018). An international, integrated, interdisciplinary coral reef ecosystem observing system (i3-creos) to inform ecosystem-based management, conservation, and human well-being across scales from local to regional to global. OceanObs'19 Conference.