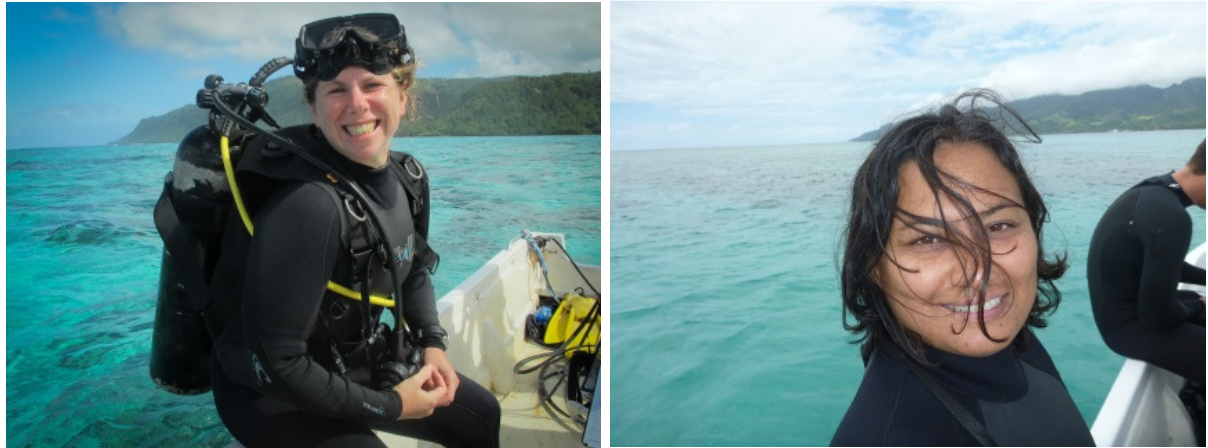




ANNUAL REPORT

WILDLIFE CONSERVATION SOCIETY
FIJI COUNTRY PROGRAM 2014

FROM THE DIRECTORS



2014 has been an exciting year for the Wildlife Conservation Society (WCS) Fiji Country Program, as well as one of transition. In February, Sangeeta Mangubhai joined the team as Deputy Director. Sangeeta brought a new energy to the Fiji Program which saw us more closely engaging and collaborating with government departments and bodies, such as Fisheries, Environment, Forestry, and iTaukei Affairs Board, as well as strengthening our engagement with partner NGOs and academic collaborators. We greatly thank them for all of their support.

WCS was also proud to be members of technical advisory committees to Department of Environment that helped move forward a provincial-level integrated coastal management plan template and develop a draft typology of protected areas for Fiji. Our management team aptly juggled consultation visits with community leaders in all districts of Bua Province to adapt and develop ecosystem-based management plans, and began engagement in Lomaiviti Province to develop complementary island-planning processes. Our communications and policy staff provided critical support to the Fiji delegation to the U.N. Small Island Developing States meeting in Apia, leading to a reaffirmation of Fiji's commitment to protect 30% of its seas by 2020.

Our science team continued collecting the final pieces of information on the impacts of periodic harvests from *tabu* areas which will be developed into guidance for best practice management that can be shared all across Fiji. In July we co-hosted with the Society for Conservation Biology Oceania chapter and the University of the South Pacific, a conference in Suva around the theme of "Resilient Island Ecosystems and Communities." Our publication output skyrocketed this year, with 15 journal articles on various aspects of conservation science and management in Fiji and across the Pacific, including a special-issue of Pacific Conservation Biology highlighting pressing conservation issues from the region co-edited by Fiji Director Stacy Jupiter.

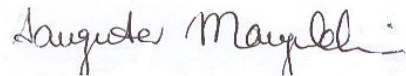
In November, in recognition of how much Stacy has built and grown the program in Fiji, she was promoted to the new position of WCS Melanesia Director. She will continue to be based in Fiji and provide support to the Fiji Program, as well as coordinate with the WCS Papua New Guinea program. She will work with government, regional and national partners to establish programs in Solomon Islands and Vanuatu. Sangeeta was promoted into the role of WCS Fiji Director.

On behalf of the WCS Fiji team, we look forward to continuing and strengthening our partnerships in country and the region, supporting integrated coastal management, strengthening protected area management and policy, and improving enabling conditions for sound coastal fisheries management in 2015.

Sincerely,



Stacy Jupiter
WCS Melanesia Director



Sangeeta Mangubhai
WCS Fiji Director

THE WCS TEAM

Stacy Jupiter, Director – Melanesia Program



Dr. Stacy Jupiter has been working with WCS in Fiji since 2008. After completing a Bachelor degree in biology at Harvard University, she worked as a U.S. Peace Corps volunteer in Gabon, teaching rural farmers how to build fishponds and develop sustainable agriculture. 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. With the WCS Fiji team, Stacy has been working on assessing the effectiveness of marine protected areas to increase the abundance and size of food fish of importance to local communities. In addition, she is trying to integrate connectivity science into development of a national system of protected areas for Fiji to preserve ecosystem services, livelihoods and human health. She will continue to integrate these topics across the Melanesia, while initiating new WCS programs in Solomon Islands and Vanuatu.

Sangeeta Mangubhai, Director – Fiji Program



Dr. Sangeeta Mangubhai joined WCS-Fiji in January 2014 as the Deputy Director, and was promoted in December to the Director's position. 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, community 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 is currently an editor for the journal *Pacific Conservation Biology*, an adjunct scientist for New England Aquarium, and co-chair for Ecosystem Services Partnerships for Oceania.

Nischal Narain, Finance Manager



Nischal Narain has been with WCS-Fiji since September 2008 as Finance Manager. He holds a Masters degree 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.

Ged Acton, Stakeholder Engagement Coordinator



Ged began working with Fijian communities in 1998, supporting village plans for sustainable resource management and delivering health, sanitation and income generation projects. With a Bachelor of Science Honours in Environmental Resource Science and a Postgraduate Certificate in Leading Sustainable Communities, Ged has managed development projects, supported regional partnership working and led research projects for councils and government departments in the UK. He returned to Fiji in 2011 and is supporting community stakeholder engagement processes for effective integrated management in Bua Province.

Akanisi Caginitoba, Community Engagement Officer



Akanisi Caginitoba (Cagi) joined the WCS-Fiji team in 2002 working as an administration officer. Cagi finished her secondary education in 1989 and has previously worked for the Asia Pacific Ltd. Since joining WCS-Fiji, Cagi was worked on a livelihood project that built 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. Previously, she was been part of the entomology team for Fiji arthropod survey initiated by the Schlinger Foundation. Cagi has also worked as a finance assistant for 3 years.

Waisea Naisilsisili, Field Officer



Waisea Naisilsisili 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 finished his secondary school education in 2000. Waisea has previously worked at the Fiji Mineral Resources as a research assistant responsible for collection for mineral samples. Waisea specializes in reef fish surveys and 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.

Kini Koto, Field Officer



Kini Koto previously worked for Wildlife Conservation Society from 2003 to 2006 before moving to Wetlands International-Oceania from 2007 to 2011. He completed a Diploma in Ocean Resource Management and Policies in June 2009, and is currently undertaking a Bachelor of Arts, majoring in Marine Affairs and Management. Kini has participated in terrestrial and freshwater water projects on designated areas for protection around the country, and liaised with communities on the establishment of the Waimanu Forest Reserve (traditional protected). He specializes in identifying freshwater fish in Fiji, and has co-authored a description of a new fish species in Fiji (*Hippicthy's albumaculousus*). Kini is also a specialist in community engagement and consultation.

Sirilo Dulunagio, Community Liaison Officer



Sirilo Dulunagio (Didi) has been working with WCS as a Community Liaison Officer since 2005 and is also employed part-time with the Coral Reef Alliance (CORAL). Prior to coming to WCS, Didi trained and work as a dive instructor. He received the opportunity through CORAL to visit Bonaire and observe their system of user tag fees, which he has helped to implement for the Namena Marine Reserve in Kubulau. As a Kubulau native, 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.

Margaret Fox, Conservation Officer



Margaret Fox joined the WCS-Fiji marine team in March 2010 as a conservation officer. She completed her Bachelor of Science degree in Marine Biology and Chemistry at the University of the South Pacific in 2002. She first joined WCS-Fiji in 2003 as a research assistant studying the distribution pattern of the *Merremia peltata*. Since then she has worked as a dive master intern with the diving industry and as a Marine Biologist with Turtle Island Resort, where she helped set up marine protected areas. Margaret's expertise includes coral identification, invertebrate identification, socioeconomic surveys, and community engagement and consultation. Margaret is helping WCS establish a women in fisheries project for WCS that will commence in 2015.

Yashika Nand, Marine Scientist



Yashika Nand joined the team in 2010 as a Marine Scientist. She has graduated with her Post-graduate Diploma in Marine Science specializing in coral reef ecology and biology with emphasis in climate change from the University of the South Pacific in 2008. She has previously worked for the Department of Fisheries in Fiji 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 and the aquarium trade fishery. She is currently doing a Masters in coral reef ecology, focusing on coral disease at the University of the South Pacific.

Dwain Qalovaki, Communication Officer



Dwain Qalovaki joined WCS-Fiji in 2013 having 9 years of experience as a marketing communications, project management, media and research professional across the private, public and non-government sectors. He has received specialist training in the area of development journalism, marketing, project management and digital communications both locally and abroad. Dwain is currently running a campaign to promote the Vatu-i-Ra Seascape and marine managed areas, and running WCS social media sites.

Ingrid Qauqau, GIS Officer



Ingrid Qauqau has been working with WCS-Fiji as a GIS officer since 2003. She graduated with a Bachelor's Degree in 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.

Gandercillar Vosaki, GIS/IT Support Officer



Gandercillar Vosaki joined WCS in 2012 as the Geographical Information Systems (GIS) and Information Technology (IT) support Officer. As part of the Fiji Program's Eco-health partnership with Edith Cowan University in Western Australia, Gander provides GIS support to investigate links between environmental change and water borne bacterial disease transmission and to build predictive models. She provides mapping support to the Vatu-i-Ra Seascape campaign and efforts to establish offshore marine managed areas.

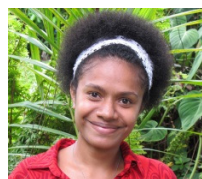
OUR VOLUNTEERS

Mosese Naleba, Fiji National University



Mosese Naleba is currently undertaking a higher education Diploma in environmental studies at Fiji National University, and is doing a six month internship with WCS. He has assisted with catch per unit effort training with local communities, data entry, translation of community management plans, and logistic and administration support for workshops and the WCS office in general. He also supported and helped to coordinate volunteers at the Society for Conservation Biology Oceania conference in Suva. More recently he assisted with the socialisation of island-scale planning in the Lomaiviti Province.

Lillikibau Tuilovoni, Fiji National University



Lillikibau Tuilovoni from Kubulau, is currently undertaking a Bachelor degree in banking and finance at Fiji National University. She completed a two month internship with WCS in 2014. She assisted with office finance and administration, and provided support for a national workshop hosted by the Protected Areas Committee.

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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, their associated traditional fishing grounds and offshore channels. The Vatu-i-Ra Seascape is considered to be one of the most productive areas in Fiji and therefore is of economic importance to the country. 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 2014, under our three main themes of Science, Management and Communication. We additionally highlight our engagement with national and regional policy and planning, and the links to Fiji's national priority strategies under the NBSAP Implementation Framework 2010-2014, as well as the National Climate Change Policy, to enable governments and partners to assess progress towards national targets.

Our Science, Management and Communication activities continue to focus on three main themes: (1) integrating ecosystem-based management and adaptation principles into planning for natural resource management; (2) designing protected area networks to confer resilience to climate change disturbance and preserve ecosystem services; and (3) strengthening local and national capacity for management planning and enforcement.

In 2014, WCS Fiji's collaborative scientific studies focused on:

- assessing the impact of periodic harvests of no-take fisheries closures (*tabu* areas) on reef fish populations;
- completing a social network analysis for districts in Bua Province;
- investigating the links between environmental change and waterborne bacterial disease;
- understanding the links between local ecological knowledge, ecosystem services and resilience to climate change;
- monitoring the impact of the MacArthur Foundation's 10 year coastal and marine strategy;
- an expedition to examine shark ecology and movements in Kadavu and Lomaiviti provinces; and
- an expedition to assess the health of coral reefs in the Vatu-i-Ra seascape.

In our efforts to help strengthen natural resource management across Fiji, WCS:

- worked with each of the districts in Bua Province on the development or implementation (for those completed) of district ecosystem based management plans. Currently, three districts are actively implementing their plans, four are awaiting final endorsement, and two are still in the process;
- began a collaboration with the Lomaiviti Province to support island-scale management planning on the islands of Koro and Ovalau;
- developed and printed a map of 33 ecotourism sites in Fiji;
- worked with local women in Bua Province to develop livelihoods around kuta weaving, honey and virgin coconut oil; and
- facilitated a workshop between local community representatives and tourism operators to explore opportunities to establish a voluntary contribution to conservation scheme, around dive tourism.

Our communication work focused on:

- building the foundation for a Vatu-i-Ra Seascape campaign, to support both inshore and offshore marine managed areas;
- co-hosting a successful Society for Conservation Biology Oceania conference in Suva, Fiji, on the theme of “Resilient Island Ecosystem and Communities”; and
- over 15 scientific publications, including a special issue of the journal *Pacific Conservation Biology* on “Conservation of biodiversity in the Pacific Islands of Oceania.”

Lastly, WCS Fiji continued to maintain a strong presence on national committees and steering groups including the: Protected Area Committee (PAC), Integrated Coastal Management Committee (ICMC), and Fiji Locally Management Marine Area (FLMMA) network. Through these organizations, WCS Fiji has worked to help achieve national objectives in biodiversity protection, conservation planning, coastal management and climate change preparedness.

Specifically, we helped the Department of Environment develop guidelines for the development of provincial integrated coastal management plans. Through the PAC we co-hosted a workshop to draft a typology for protected areas (terrestrial and marine) for Fiji. We also provided technical support for a regional “Pacific Beche-de-Mer and the Future of Coastal Fisheries Summit” hosted by Pacific Island governments and IUCN Oceania Regional Office. WCS staff joined the Fiji government delegation to the United Nations Small Islands Developing States conference in Apia, Samoa, where the government reaffirmed its commitment to protected 30% of Fiji’s seas by 2020.

SCIENCE

The following sections present a synthesis of completed and ongoing scientific activities by WCS and partners for 2014.

Assessing Impacts of Periodic Harvests on Reef Fish Populations

STATUS: In progress

FUNDING: David and Lucile Packard Foundation (2012-38137, 2014-39332)

PARTNER ORGANISATIONS: University of Western Australia (UWA), Fiji Locally Managed Marine Area Network (FLMMA), California Polytechnic State University San Luis Obsipo (CalPoly), The Nature Conservancy (TNC)

OUTPUTS:

- *Journal article:* Goetze JS, Jupiter SD, Langlois TJ, Wilson SK, Harvey ES, Bond T, Naisilisili W (2015) Diver operated video most accurately detects the impacts of fishing within periodically harvested closures. *Journal of Experimental Marine Biology and Ecology* 462:74-82
- *Journal article:* Jupiter SD, Cohen PJ, Weeks R, Tawake A, Govan H (2014) Locally-managed marine areas: multiple objectives and diverse strategies. *Pacific Conservation Biology* 20:165-179
- *Journal article:* Cohen PJ, Jupiter SD, Weeks R, Tawake A, Govan H (2014) Is community-based fisheries management realizing multiple objectives? Examining evidence from the literature. *SPC Traditional Marine Resource Management and Knowledge Information Bulletin* 34:3-12
- *Conference presentation:* Jupiter S, Cohen P, Weeks R, Tawake A, Govan H (2014) Locally-managed marine areas in the tropical Pacific: diverse strategies to achieve multiple objectives. 3rd International Marine Conservation Congress, Glasgow, Scotland, 14-18 August
- *Conference presentation:* Carvalho PG, Januchowski-Hartley FA, Jupiter SD, White C (2014) Effectiveness of periodically harvested closures in meeting fisheries and cultural objectives. Western Society of Naturalists, Tacoma, USA, 13-16 November.

RESEARCH HIGHLIGHTS:

Historically, Pacific island communities employed a variety of tools to control marine and coastal resource use. NGOs, resource management organizations, and donors have eagerly embraced this local willingness to implement resource management, and programs to revitalize customary management practice through locally-managed marine areas (LMMAs) have spread throughout the region. In the modern context, there are many ecological, socioeconomic, and cultural objectives associated with LMMA establishment and many different tools employed to reach those objectives. Periodically harvested closures (PHCs) are one of the most commonly

employed tools. While most LMMA communities express an interest in long-term sustainability of fisheries, in practice, many communities use PHCs within LMMAs as a “bank in the water” to ensure a ready supply of fish and invertebrates for special occasions. Such pulse harvests benefit fishers in the short term but could potentially enhance the likelihood of overharvesting, thus compromising long-term ecological and socioeconomic objectives.

In recognition that it is generally not socially acceptable to establish permanent no-take areas in many parts of the tropical western Pacific, there is an urgent need to address the following questions:

- under what harvesting regimes (frequency, intensity, duration) can PHCs be sustainably fished and what size do they need to be relative to the size of the LMMA to achieve both socioeconomic and ecological objectives? and
- what are the appropriate indicators of when PHCs can be opened and when they should be closed?

From October 2012 to the present, with support from the David and Lucile Packard Foundation, the Wildlife Conservation Society (WCS) has been leading research in Fiji to build credible, legitimate knowledge in order to provide guidelines to communities in the LMMA Network regarding optimum harvesting schemes for achieving ecological and socioeconomic objectives. In 2014, WCS and our partners at UWA, CalPoly, and TNC and collaborating researchers have:

- published the impacts of the October 2012 harvest from Cakau Naitaga in Kubulau District using data collected with three different methods;
- undertaken follow-up surveys to assess recovery from tabu harvests from Koro and Ovalau islands, plus conducted a second pulse harvest from Nakodu tabu on Koro;
- conducted a workshop to develop methods to incorporate fish behavior and local extrinsic factors into a modified fish vulnerability index;
- conducted socioeconomic surveys in communities at various sites across Fiji; and
- developed preliminary models to understand how PHCs can be used to optimize achievement of multiple objectives.

Each of these activities is discussed in brief below.

Impacts of the Cakau Naitaga *tabu* harvest measured with three different techniques

We found that the techniques underwater visual census (UVC), diver operated stereo video (DOV), and stereo baited remote underwater video (BRUV) varied in their ability to detect the impact of a harvest from Cakau Naitaga tabu in Kubulau District (harvested October 2012) on targeted fish assemblages. The DOV technique detected an impact of the harvest on the assemblage composition and abundance of harvested species, where *N. unicornis*, *H. longiceps* and *L. gibbus*, which were most numerous in the catch, decreased significantly after the harvest (Figure 1). The ability of DOV to detect the impacts of a moderate harvest suggests it will be a useful tool for investigating the effectiveness of PHCs as a fisheries management technique,

and it has been used in all subsequent experimental harvests. All results were presented back to the community of Kiobo in Kubulau, with management authority over Cakau Naitaga *tabu*.

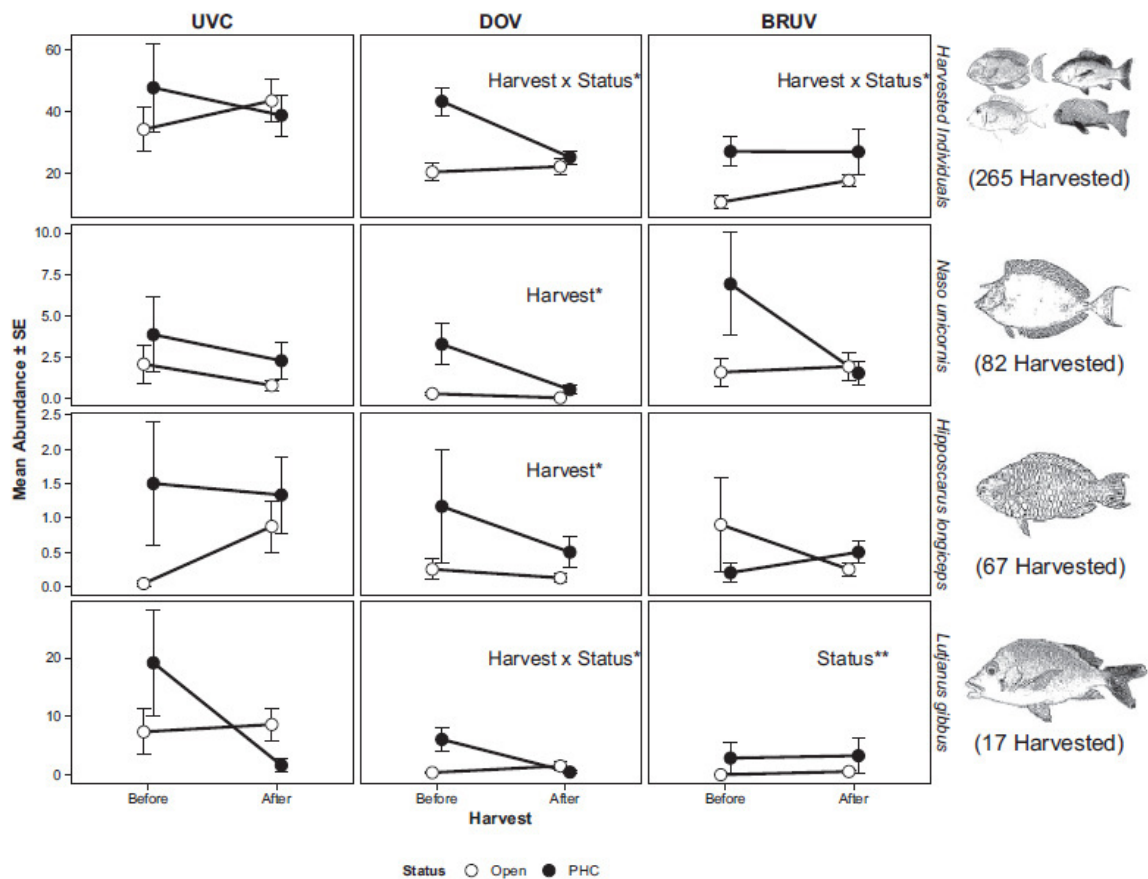
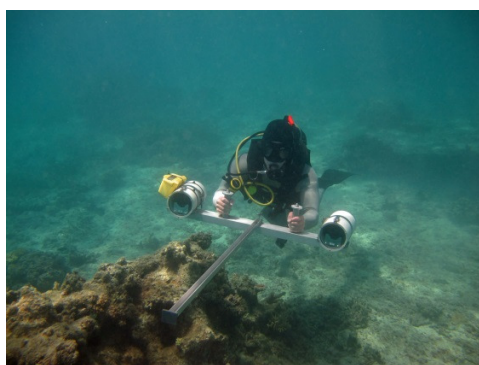


Figure 1. Ability of UVC, DOV and BRUV to detect change in fish species comprising the greatest proportion of catch harvested from the PHC. Figure from Goetze et al. (2015)

Follow up surveys to assess recovery from Koro and Ovalau harvests



In June 2014, WCS conducted follow up surveys using UVC and DOV to assess fish population recovery in PHCs associated with Tuatua and Nakodu village on Koro Island (Table 1). A second harvest was conducted from the Nakodu village *tabu* to assess the impacts of multiple disturbance. The *tabu* was opened on June 19 and 20 for fishing, with 1026 fish harvested. In October 2014, follow-up DOV surveys were conducted from Nauouo and Natokalau village *tabu* previously harvested in October 2013.

DOV surveys. ©Sangeeta Mangubhai/WCS

UVC surveys of the Nauouo village tabu were conducted in April 2014 (Table 1). These data will be used as part of a meta-analysis to examine the effectiveness of PHCs as a management tool for achieving fisheries and cultural objectives, and will also be used as input data to parameterize bioeconomic models being developed by CalPoly.

Table 1. Follow-up surveys from PHCs to gauge fish population recovery.

| Village, District, Island | Initial Pre-/Post-Harvest Surveys | Follow-up Surveys |
|----------------------------------|--|--------------------------------------|
| Tuatua, Mudu, Koro | April 2013 | DOV: June 2014 UVC: June 2014 |
| Nakodu, Mudu Koro | May 2013 | DOV: June 2014 UVC: June 2014 |
| Nauouo, Levuka, Ovalau | October 2013 | UVC: April 2014 DOV: October 2014 |
| Natokalau, Nasinu, Ovalau | October 2013 | DOV: October 2014 |

Fish vulnerability index workshop

WCS facilitated a workshop in August 12-13 2014, coupled with the International Marine Conservation Congress (IMCC) in Glasgow, Scotland, that brought together 15 experts to develop a fishing vulnerability index based on life history characteristics, behavior of targeted fish species, and local extrinsic factors (e.g. gear use, market access, fisher density, etc.). The goals of the analysis were to:

- (i) develop a modified index of fish vulnerability based on fuzzy logic sets of factors that describe life history characteristics, fish behavior and extrinsic conditions;
- (ii) highlight if any species are ubiquitously vulnerable regardless of extrinsic factors;
- (iii) identify how management implementation impacts on vulnerability estimates that can be used to model impacts on catch and fish community composition (e.g. the opening of a periodic harvest, implementation of gear restrictions);
- (iv) identify how changes in fishing gear and fish behaviour impacts vulnerability estimates; and
- (v) develop 'toy models' where local values for known extrinsic factors can be entered and vulnerability can be calculated.

The information generated from the products of this working group will be used to: parameterize the bioeconomic models being developed to provide harvest guidelines to communities; and develop communications products to help communities understand the combinations of fish species, gear types, and PHC management strategies that are sustainable and those that should be avoided.

Socioeconomic surveys to measure motivations and drivers for using PHCs

In 2014, WCS staff and community volunteers conducted focus group interviews (to obtain information about harvest regimes) and household surveys (to obtain information about drivers and mediating factors) between February and June 2014 in 21 villages and 1 settlement, including:

- 3 villages on Kia Island, Macuata Province
- 6 villages and 1 settlement in Bua District, Bua Province
- 2 villages in Wailevu District and 3 villages in Korolevu District, Cakaudrove Province
- 4 villages in Suva District, Rewa Province
- 1 village in Kubulau District, Bua Province
- 2 villages on Koro Island and 1 village on Ovalau Island, Lomaiviti Province

Questionnaires were designed with the assistance of social scientist Dr. Jack Kittinger of Conservation International’s Hawaii Fish Trust in order to tease out present-day motivations and mediating factors that define how communities are deciding how they harvest their tabu areas (Table 2).

Table 2. Variable framework to assess impact of independent drivers and mediating factors on PHC harvest regimes in Fijian villages.

| DEPENDENT VARIABLES <i>Harvest Regime</i> | MEDIATING FACTORS | | | INDEPENDENT VARIABLES <i>Drivers</i> | | |
|--|---|--|--|---|---|---|
| 1. Frequency (per unit time) 2. Duration (time open) 3. Intensity (gears, species) | Socioeconomic Status + Demographics <ul style="list-style-type: none"> • Demographics • Sources of income + Income/ occupational diversity • Resource Dependency • Changes in status | Fishery status <ul style="list-style-type: none"> • Perceptions • Changes in CPUE or catch (e.g., species availability) | Social mores <ul style="list-style-type: none"> • Equity | A) Institutions <ul style="list-style-type: none"> • Church • Other local institutions • School fees • State gov’t taxes (provincial levies) | B) External markets (external to village) <ul style="list-style-type: none"> • Middlemen/ Traders • Technology: [ice, refrigeration, outboard engines] • Price | C) Other <ul style="list-style-type: none"> • Food security • Research |

Preliminary models demonstrating optimum harvesting schedule for PHCs

Dr. Crow White at CalPoly is leading modeling assessments to determine optimum harvesting schedules for PHCs to achieve multiple objectives simultaneously, including maximizing catch per unit effort (CPUE), yield (in terms of profit), and sustainability of fisheries (indicated by maintaining biomass). Preliminary theoretical investigations, not yet parameterized to Fiji harvest data, indicate that under scenarios of optimal management (full compliance) and variable fish behavior in response to fishing, the optimum strategy is to close a PHC for 1-2 years and then open during 1 year for a short pulse. In scenarios where overfishing (non-compliance) is incorporated and fish behavior is accounted for, the optimum strategy to achieve multiple objectives shifts to closing a PHC for 3-10 years, then open during 1 year for a

pulse harvest before closing again for a similar duration. These preliminary investigations are now being refined and parameterized with local data from the Fiji experimental harvests.

NEXT STEPS:

- Conduct meta-analysis at workshop in Albany, Western Australia, in January 2015 to assess: (1) Are PHCs capable of providing for long-term sustainability of fisheries and short term provision for cultural use? (2) Can PHCs be used to achieve fisheries and ecological objectives by increasing and or maintaining the abundance/biomass of targeted species and species diversity? (3) Does the size of the PHC impact the provision of fisheries or ecosystem benefits? And (4) Do PHCs provide benefits to benthic species and non-targeted fish species abundance and diversity?
- Refine fuzzy logic sets and breakpoints for fish life history variables, behavioural characteristics, and extrinsic factors and trial with fish family data from Kenya, then comparative species level data from Fiji, Indonesia, Philippines and Vanuatu. Use fuzzy logic sets to develop toy models that fishers can use to look at changes to family and species-level vulnerability if certain management actions are taken.
- Develop models parameterized with empirical data from Fiji harvests and fish vulnerability parameters to assess the effectiveness of PHCs for meeting ecological and socioeconomic objectives under different fish harvest regimes and with varying sizes of periodically-harvested closures. A key output from this analysis will be identification of what sets of harvest/closure schedules and closure size characteristics best meet ecological (conservation) and socioeconomic (fishery yield) objectives. This output will be presented in a rules-of-thumb format (e.g., “Closure length should be x-fold longer than harvest length”) so that it can be communicated easily and effectively to communities.

LINKS TO NATIONAL PRIORITIES:

This project supports **NBSAP Implementation Plan Thematic Area 3 (Inshore Fisheries), Action 8.2a:** Perform stock assessments of inshore fisheries. The information collected through the scientific work will also support **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 **Strategy 13:** Implement best practice adaptation measures, based on sound scientific research, and lessons learnt from local, regional and international experiences.

Social Network Analysis

STATUS: In progress

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

PARTNER ORGANISATIONS: Conservation Planning Institute, University of Alaska

OUTPUTS:

- Completed a social network analysis questionnaires across eight districts in Bua province
- Produced social network analysis maps for all eight districts surveyed in Bua Province
- Gave a one day introduction to social network analysis at the Society for Conservation Biology Oceania conference in July in Suva, Fiji

RESEARCH HIGHLIGHTS:

Ken Vance-Borland, the Executive Director of the Conservation Planning Institute, assisted WCS in drafting a social network analysis (SNA) questionnaire. The questionnaire was pre-tested in Lekutu District in Bua Province in late 2013 by WCS and Master's degree candidate Brooke McDavid from the University of Alaska, Fairbanks. To our knowledge, this is the first time SNA has been done in Fiji to help improve community conservation outcomes. SNA surveys were completed for eight of the nine districts in Bua Province between April and October 2014 to find out whom people contact to receive information about different types of natural resource management and to whom they pass on information. Data collection in the final district was delayed by the involvement of key stakeholders in the national election and will be completed in the next quarter. Over 250 individuals were interviewed to date, including residents from 41 villages, government officers, and NGOs. The methodology is uniquely tailored to the local cultural context and communities, and has already shown great potential to be applied more widely in Bua to enhance communication and natural resource management.



Participants analyse social networks in Dama District.

Photo: © Ged Acton/WCS

Maps have been produced showing the social networks related to information flow for natural resource management for eight districts in Bua Province (for example see Figure 2). As well as identifying from where people get information and advice about natural resource management, the maps show: (i) which communities/agencies have worked together; (ii) which communities/agencies people would like to work with; and (iii) people who have been identified as key decision-makers in relation to natural resource management.

The SNA maps were analyzed with community representatives and other stakeholders through workshops between October and December 2014. As part of the workshops, WCS assessed whether communities are likely to support and want to participate in local “network weaving” activities to improve information flow for natural resource management implementation. The sharing of maps with communities to inform their activities is an innovative application of social network analysis, and Mr. Vance-Borland has asked WCS to share its approach with other global social network analysis practitioners through a newly developed Social Network Analysis Community of Practice.

Kubulau Network Map – Who do you get information/advice from about FISHING?

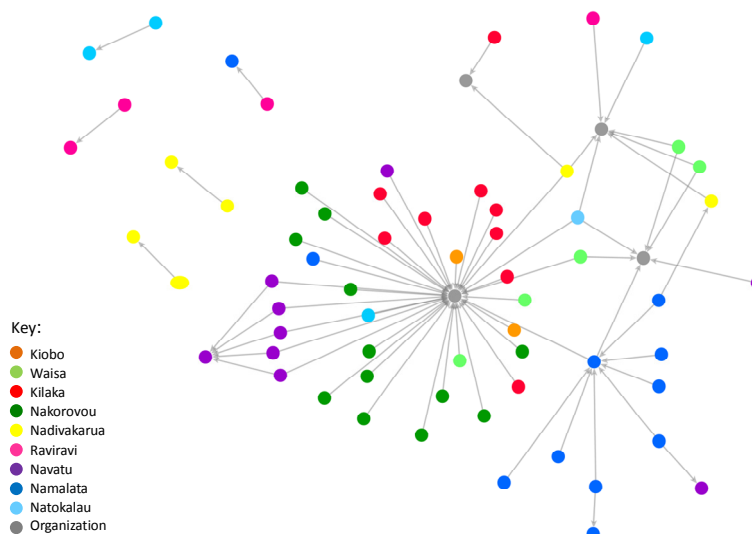


Figure 2. A network map generated from social network analysis research in Kubulau.

NEXT STEPS:

- Work with Seaweb Asia-Pacific to design network weaving activities to improve communication and information flows within communities.
- Produce SNA maps for eight districts and for the province of Bua as a whole.
- Facilitate feedback sessions to interpret network maps and identify network weaving opportunities with district resource management committees, Bua Yaubula Management Support Team (BYMST) and government officers based in Bua.

LINKS TO NATIONAL PRIORITIES:

This work also supports **Climate Change Policy Adaptation Strategy 5:** Support the ecosystem based management approach throughout Fiji, recognizing that ecosystem services, such as food security, natural hazard mitigation and physical coastal buffer zones, increase resilience.

Investigating links between environmental change and waterborne bacterial disease in Fiji

STATUS: In progress

FUNDING: Edith Cowan University Industry Linkage Grant

PARTNER ORGANISATIONS: Edith Cowan University (ECU), Ministry of Health

OUTPUTS:

- *Book chapter:* Jenkins AP, Jupiter SD (in press) Natural disasters, health and wetlands: A Pacific small island developing state perspective. In: Finlayson CM, Horwitz P, Weinstein P (eds), *Wetlands and Human Health*, Springer
- *Conference presentation:* Jupiter S, Jenkins A (2014) Investigating links between environmental change and waterborne bacterial disease in Fiji. World Parks Congress, Sydney, Australia, 12-19 November.
- *Conference presentation:* Jenkins A (2014) Floods, faeces & fishes: Managing island watersheds for sustainability and public health outcomes. EcoHealth, Montreal, Canada, 11-15 August.
- *Conference presentation:* Jenkins AP, Prasad N, Naucukidi L, Rosa V, Pravin S, Vosaki G, Kumar R, Cambemaiwai T, Kama M (2014) An interdisciplinary investigation of environmental, socio-cultural & behavioural determinants of typhoid fever in Central Division, Republic of Fiji. Otago International Health Research Network Conference, Dunedin, New Zealand, 13 November.

RESEARCH HIGHLIGHTS:

Over the past few years in Fiji, there have been noted spikes in cases of typhoid, leptospirosis and other waterborne bacterial diseases occurring 1-2 months after tropical cyclones or prolonged rainfall (Figure 3). We hypothesise that there may be environmental and climate determinates of the spread of waterborne bacterial disease in Fiji that are additionally associated with behavioural mechanisms. We predict that as land uses change, river water quality declines and sediment and fertilizer content increases, thus potentially increasing survivorship and spread of pathogenic bacteria (e.g. *Salmonella Typhi*) in water.

We are taking a two-phased approach to investigate in particular factors associated with the emergence of past and present typhoid cases in Fiji. This work is led by ECU PhD student Aaron Jenkins in direct collaboration with WCS. Phase I involves a retrospective assessment of past typhoid cases to see if there are any environmental characteristics related to incidence and prevalence. All 168 typhoid cases from Central Division in 2013 have been located to the place of residence where onset of fever occurred (Figure 4), and high proportions of cases from 2008 to 2012 have been spatially registered. We are currently assembling a database to assess non-spatial relationships between typhoid incidence and environmental and climate predictors, such as forest cover, road density and river crossings (which serve as points for sediment to get

into waterways), level of cultivation, rainfall and temperature. We will also undertake geospatial analyses of past presenting cases to assess for factors related to clustering.

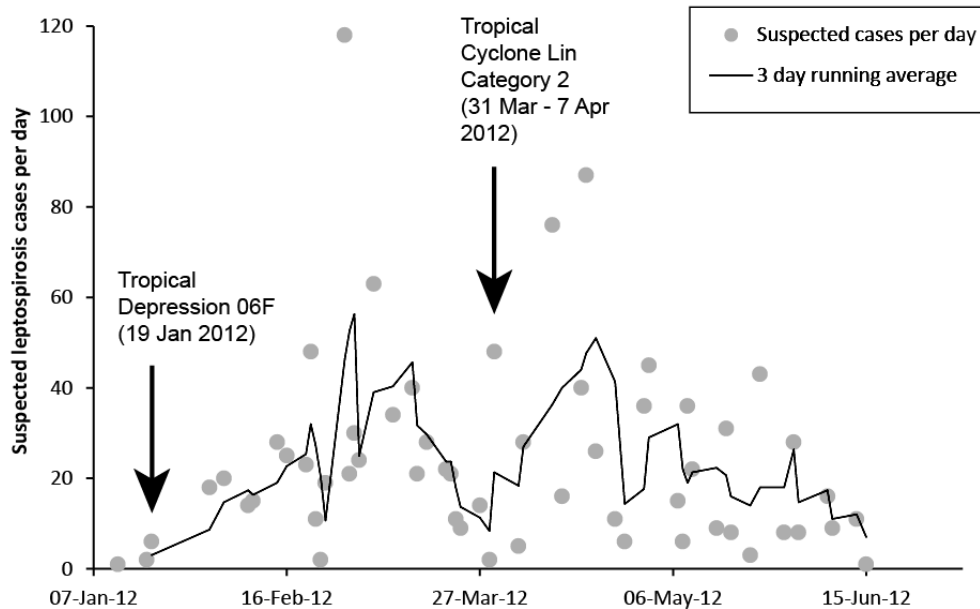


Figure 3. Suspected leptospirosis cases after sequential flooding disasters in Western Division, Fiji, 2012. Data reprinted with permission from World Health Organization. (from Jenkins and Jupiter in press)

Phase II of the investigation involves prospective case control sampling from new cases presenting from 2014 onwards in the Central Division of Fiji. To date, almost 10,000 potential cases were screened of which 67 have been confirmed for typhoid fever, and 46 of these have been enrolled in the case control study. Fifty percent of the cases are from urban areas, while 33% and 17% are from rural and peri-urban areas, respectively.

A household questionnaire has been done to cases and controls on various aspects of demographic, socio-economic, food, water, sanitation, hygiene and environmental risk factors. Preliminary analysis indicates five factors emerging as significant, including: history of fever in the household; purchasing beverages from street vendors; not washing of household vegetable produce before eating; not washing hands before eating; and heavy to moderate rainfall in last two months. Preliminary data show high levels of the fecal indicator *Escherichia coli*, particularly in near stream water and soil samples. While no significant difference was found between case and control counts, stored water and water directly from the source are both twenty-five times higher than safe drinking levels and nearby stream waters are about five times higher than recommended safe recreational swimming levels. Considering the significant case control finding related to washing household vegetable produce, it is interesting that similarly high *E.coli* counts were found from soil near the toilet, in the toilet drain and in the nearby house garden. Given the high levels of *E.coli* in the soil, it seems logical that soil is a source of contamination for water particularly during heavy precipitation and runoff events.

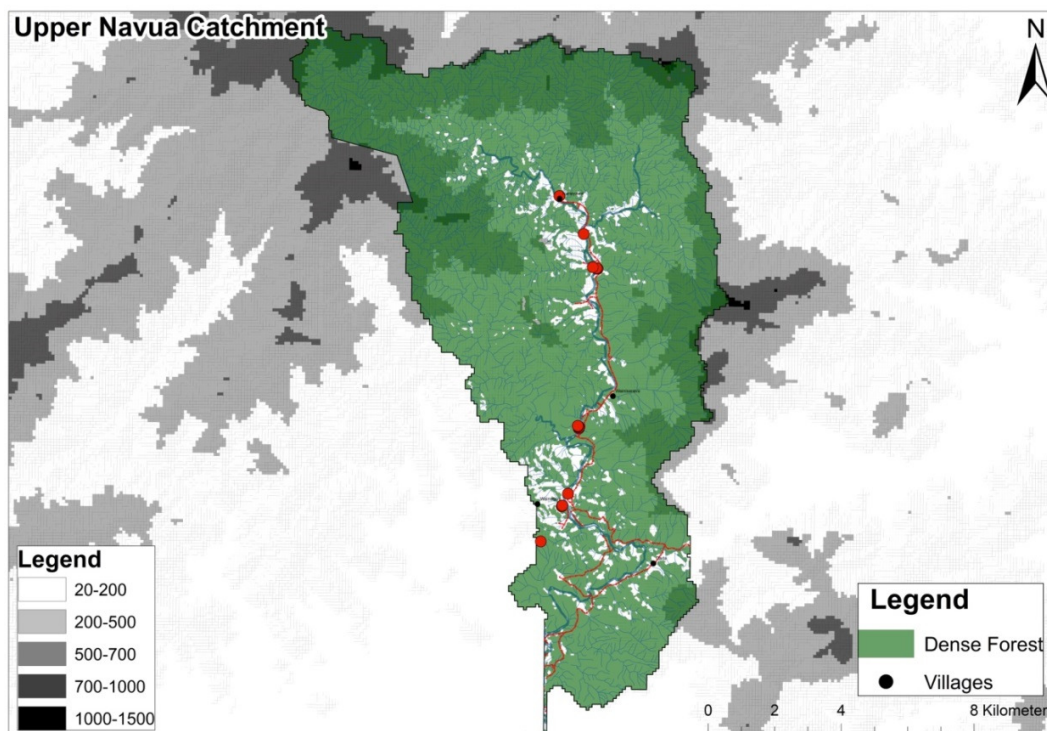


Figure 4. Map showing clustering of 2013 typhoid cases along river basin of the Upper Navua watershed.

NEXT STEPS:

- Completion of database for retrospective analysis of influence of environmental and climate variable on incidence and patterns of typhoid emergence.
- Completion of PCR analysis of environmental samples collected at case and control sites.
- Enrolment of additional case and controls into prospective survey to improve statistical power to detect behavioural and environmental determinants of typhoid emergence.

LINKS TO NATIONAL PRIORITIES:

The project supports the **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.** It additionally aligns to the **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.**

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 (UH), Natural Capital Project - Stanford University, University of the South Pacific (USP)

OUTPUTS:

- *Journal article:* McMillen HL, Ticktin T, Friedlander A, Jupiter SD, Thaman R, Campbell J, Veitayaki J, Giambelluca T, Nihmei S, Rupeni E, Apis-Overhoff L, Aalbersberg W, Orcherton DF (2014) Small islands, valuable insights: Systems of customary resource use and resilience to climate change in the Pacific. *Ecology & Society* 19(4): 44.
<http://dx.doi.org/10.5751/ES-06937-190444>
- *Training:* Field course on socio-ecological resilience for USP and UH postgraduate students
- *Conference presentation:* Ticktin T, Jupiter S, Dacks R, Burnett K, Friedlander A, McMillen H, Quazi S (2014) A ridge-to-reef approach to assessing the role of local ecological knowledge and management in enhancing adaptive capacity and resilience to climate change in Fiji. Society for Conservation Biology Oceania conference, Suva, Fiji, 9-11 July

RESEARCH HIGHLIGHTS:

Human and natural systems are interlinked in complex ways. Understanding how these ‘social-ecological’ systems are and can be resilient to climate change poses one of the most pressing problems of our world today. This is especially true for coastal communities in the Pacific Islands, which are extremely vulnerable to the effects of climate change. The local ecological knowledge systems developed by Pacific Islanders over millennia have historically allowed them to be resilient to the climate extremes that characterize their islands. However, the complex patterns and processes involved in these systems and their potential to enhance resilience to climate change are poorly understood.

This research is grounded in a conceptual framework that involves a novel integration of social-ecological systems and resilience theory, ethnobiology theory, ecosystem services modeling. It draws on a combination of long-term existing social and ecological datasets, new experiments, and state-of-the-art climate and ecosystem service modeling to: (1) learn about how knowledge systems and socio-economics of coastal communities influence resource use and affect ecosystem resilience in the land and in the ocean; and (2) model and test the relationships among local ecological knowledge systems and indicators of adaptive capacity and social-ecological resilience to climate change in coastal Fijian communities. The study will identify synergies and trade-offs among indicators of resilience, and different kinds of ecosystem

services, and determine which combinations of land-uses can best maximize and social-ecological resilience and sustainability.

Surveys were conducted in Fiji between July and November 2014, using household surveys and agroforest surveys across five provinces in Fiji (Table 3). Household surveys were conducted in a random selection of 20 households per village (or in villages with fewer than 20 households, all occupied houses with head(s) of household present). Questions were aimed at understanding socio-economics, farming practices, fishing practices, social networks, traditional knowledge, governance, and material assets. Agroforest surveys were conducted in five randomly selected plantations with farmers in each village. The objective was to gain an understanding of the woody species diversity and cover types of plantations, fallows, and forest areas that each farmer had access to. A mapping exercise was conducted with each farmer to help select which plantation should be visited. This involved walking through the sites, recording names of all crops and woody species in each land use type, and assessing the % covers of canopy, bare ground, and invasive species at set intervals. Researchers also conducted an interview with the farmer regarding their agricultural practices, knowledge, and observations on changes over time.

Table 3. Sites surveyed in 2014 to understand links between local ecological knowledge, ecosystem services and resilience to climate change.

| Province | District | Villages | Dates visited |
|------------|------------|------------|-------------------|
| Nadroga | Malolo | Solevu | July 28 – July 31 |
| | | Cubi | Aug 1 – Aug 5 |
| Bua | Kubulau | Waisa | Aug 7 – Aug 10 |
| | | Natokalau | Aug 11 – Aug 14 |
| | | Kiobo | Aug 15 – Aug 18 |
| | | Navatu | Aug 19 – Aug 21 |
| | | Raviravi | Aug 27 – Aug 30 |
| | | Namalata | Aug 30 – Sept 4 |
| Cakaudrove | Wainikeli | Kilaka | Sept 4 – Sept 7 |
| | | Waitabu | Sept 11 – Sept 15 |
| | | Vidawa | Sept 15 – Sept 17 |
| | | Korovou | Sept 18 – Sept 22 |
| Rewa | Suva | Kalokolevu | Oct 1 – Oct 4 |
| | | Togalevu | Oct 6 – Oct 9 |
| | | Muaivuso | Oct 13 – Oct 15 |
| | | Waiqanake | Oct 15 – Oct 18 |
| | | Nacobau | Oct 21 – Oct 24 |
| Ra | Nakorotubu | Namarai | Oct 24 – Oct 29 |
| | | Saioko | Oct 29 – Nov 1 |
| | | Verevere | Nov 1 – Nov 4 |

Preliminary results suggest there is high variability between villages in terms of major income sources, catch, sale and consumption of fish, levels of traditional knowledge, size, number and extent of plantations, length of fallow periods, and diversity of crop cultivars and trees. Researchers will further test if the variability is associated with reliance and proximity to markets and urban facilities.



Agroforestry survey and community mapping. © Shimona Quazi and Rachel Dacks, University of Hawai'i at Mānoa

NEXT STEPS:

- Data is currently being entered and analysis will commence in early 2015. Researchers will develop analyses to first characterize the main current land uses and land cover (forest/ crops/ agroforest/ pasture, etc.) and ocean uses.
- Scenarios of the ecosystem services will modeled under climate change will be explored.
- Identification of ways of sharing research findings with the communities (e.g. video, school materials, games/activity books).

LINKS TO NATIONAL PRIORITIES:

This work supports the **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. This project also supports **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, and **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.

Monitoring the impact of the MacArthur Foundation's 10 year coastal and marine strategy

STATUS: In progress

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

PARTNER ORGANISATIONS: WCS offices in Melanesia, Indonesia, East Africa, Caribbean

RESEARCH HIGHLIGHTS:

Large investments in time and money have been made to conserve coastal and marine resources. However, the effectiveness of the conservation actions that are undertaken is frequently unclear. To ensure that the limited resources available for the scale of the work required are used appropriately, systematic monitoring and evaluation should be carried out to determine whether conservation practitioners are having an impact (status), are implementing the correct strategies, and are achieving desired outcomes (effectiveness). Given these challenges, there is a need for a carefully designed and appropriately implemented monitoring program to demonstrate the impact of the investments made as part of the 10 year Coastal and Marine Grantmaking Strategy by the John D. and Catherine T. MacArthur Foundation.

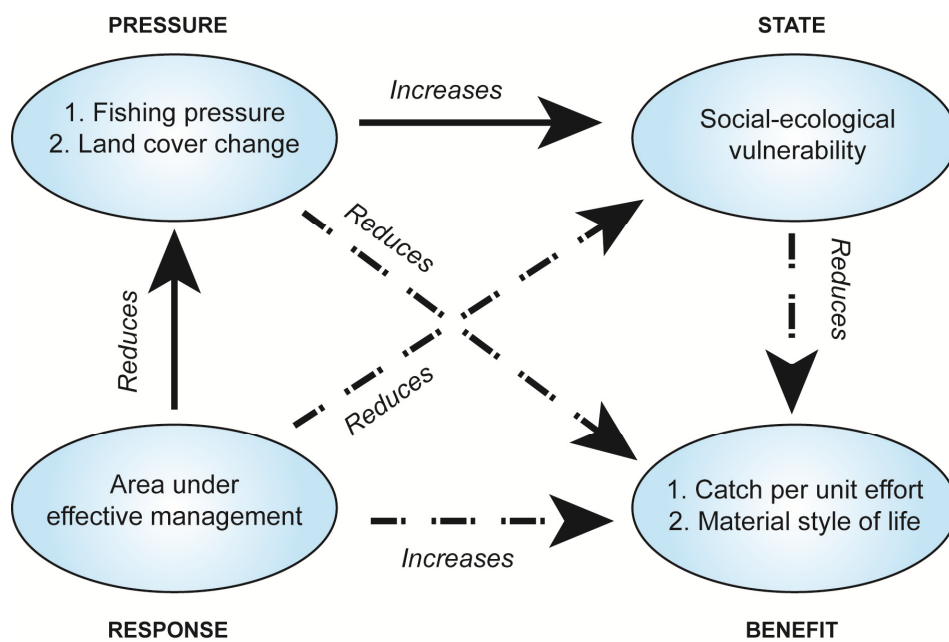


Figure 5. Core indicators proposed for measuring changes in pressure, state, response and benefits to assess progress against the MacArthur Foundation's long-term objectives for slowed decline of coastal fisheries productivity, reduced pressures on coastal systems, and improved social-ecological resilience to climate change impacts. Solid arrows indicate direct pathways; dotted arrows indicate indirect pathways.

A cost-effective program of work is proposed to deliver on the above portfolio of indicators (Figure 5) at three year intervals over the ten year program of work across targeted seascapes within the four priority geographies as articulated by the MacArthur Foundation: Melanesia, Indonesia, Western Indian Ocean (WIO), and the Caribbean.

NEXT STEPS:

- Finalization of biological and socioeconomic indicators for monitoring
- Socioeconomic questionnaires will be finalized and surveys conducted in early 2015, to fill critical gaps.
- Regional workshop to standardize methodologies, develop an integrated database, coordinate with partners, set workplans, develop regionally appropriate ecological effectiveness scores and best practice for management effectiveness.
- Year “0” baseline assessments drafted for Melanesia (Fiji, Solomon Islands) and the Western Indian Ocean, as the template for future triennial monitoring reports across the seven proposed indicators.

LINKS TO NATIONAL PRIORITIES:

This project supports **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.

Expedition: Shark ecology and movements in the Fiji Islands

STATUS: Field work completed, data analysis to be completed in 2015

FUNDING: Waitt Institute

PARTNER ORGANISATIONS: Stony Brook University, Oceans 5, Fiji Department of Fisheries

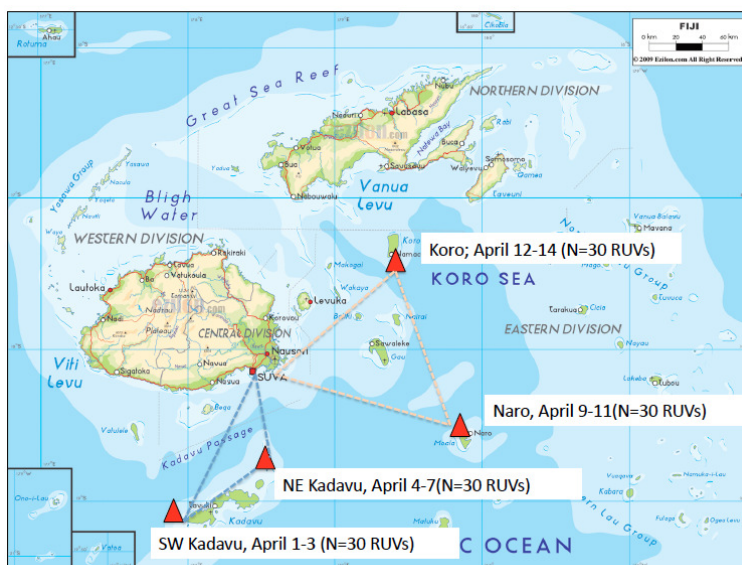
OUTPUTS:

- A short video was made from the expedition
- Blogs on National Geographic (<http://voices.nationalgeographic.com/2014/04/09/of-sharks-and-men-an-expedition-to-study-shark-ecology-and-movement-patterns-in-fiji/>) and WCS website (<http://wcsfiji.org.fj/the-fiji-shark-expedition-2014-what-do-sharks-do-and-where-do-they-go/>)

RESEARCH HIGHLIGHTS:

Research Objectives:

- i) Document the ecological and behavioral impacts of coastal sharks on reef fish.
- ii) Understand the movement patterns of large pelagic sharks around the Fiji islands assessed using pop-off archival satellite tags.

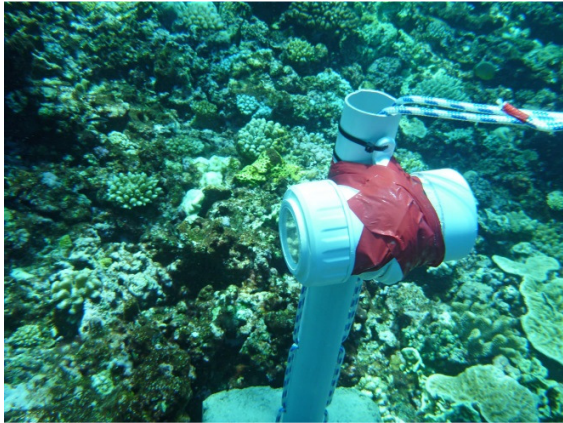


Sharks are important top predators found on coral reefs throughout Fiji that are increasingly being depleted through overfishing. Pelagic sharks migrate long-distances making it difficult to protect them, as they may move across multiple jurisdictions. Little is known globally on how sharks influence the behavior and density other reef fish species, and what impact their removal might have on coral reef ecosystems and the ecosystem services they provide.

Figure 6: Proposed sampling locations. No visits were made to the Lau group.

With the exception of Beqa lagoon and more recent work at the University of the South Pacific, there is very little information available on sharks in Fiji. From 1-15 April 2014, WCS and the Department of Fisheries supported researchers from the Stony Brook University in New York investigate the relative abundance and behavior of fish on coral reefs in Kadavu and Lomaiviti

Provinces, and install pop-up satellite archival transmitters (PSATs) in pelagic sharks (Figure 6). Six Go-Pro Hero 3 cameras were set each day at 5-15m depth at different locations to collect 6-7 hours of underwater footage. The video data are currently being analyzed for the presence of sharks, stingrays and parrotfish, to look at relationships between the abundance of sharks and each of the other two groups. At least one camera documented the presence of a scalloped hammerhead shark, which is protected on CITES Appendix II, and came into force in September 2014.



Go Pro cameras on mounts placed on the reef (left, ©Sangeeta Mangubhai/WCS). Tagging of silvertip shark (right ©Andy Mann)

Despite daily attempts to bait sharks in the deeper waters adjacent to coral reefs, only one small silvertip shark (*Carcharhinus albimarginatus*) was successfully caught and tagged. The tag was programmed to stay on the shark for 6-10 months before it detached and floated to the surface of the water. On reaching the water the tag transmitted the data to satellites. Researchers are currently analyzing the data to look at distances traveled by this one animal and depth movement patterns.

NEXT STEPS:

- Researchers at Stony Brook University are still analyzing the results of the surveys, and will submit a report to government in 2015.

LINKS TO NATIONAL PRIORITIES:

This project supports **NBSAP Implementation Plan Thematic Area 3 (Inshore Fisheries), Action 8.2a:** Perform stock assessments of inshore fisheries; **Thematic Area 5 (Threatened and Endangered Species), Action 1.1f:** Undertake conservation management-orientated research on prioritized species as identified in 1.1d and 1.1e.

Expedition: Assessing coral reefs in the Vatu-i-Ra Seascape

STATUS: Completed

FUNDING: Waitt Institute

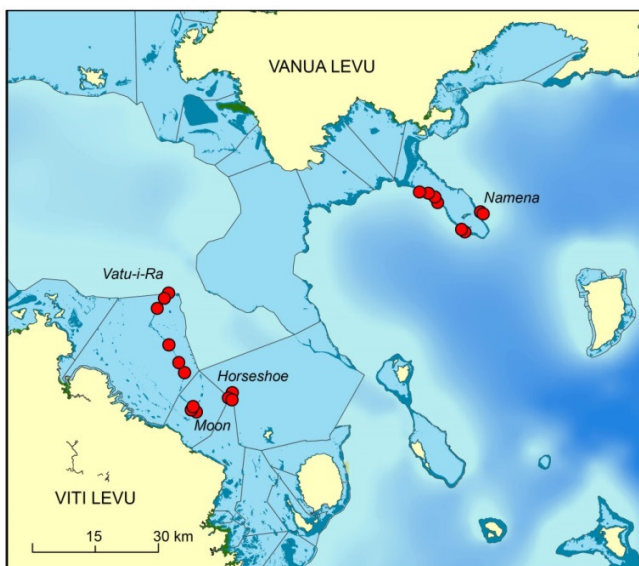
PARTNER ORGANISATIONS: Oceans 5, Edith Cowan University

OUTPUTS:

- *Expedition report:* Jupiter S (2014) Fiji's Vatu-i-Ra Seascape: Development of Offshore MPAs Supporting Seascape-scale Fisheries Management & Biodiversity Conservation. Expedition report to the Waitt Institute and Foundation. Wildlife Conservation Society, Suva, Fiji.

RESEARCH HIGHLIGHTS:

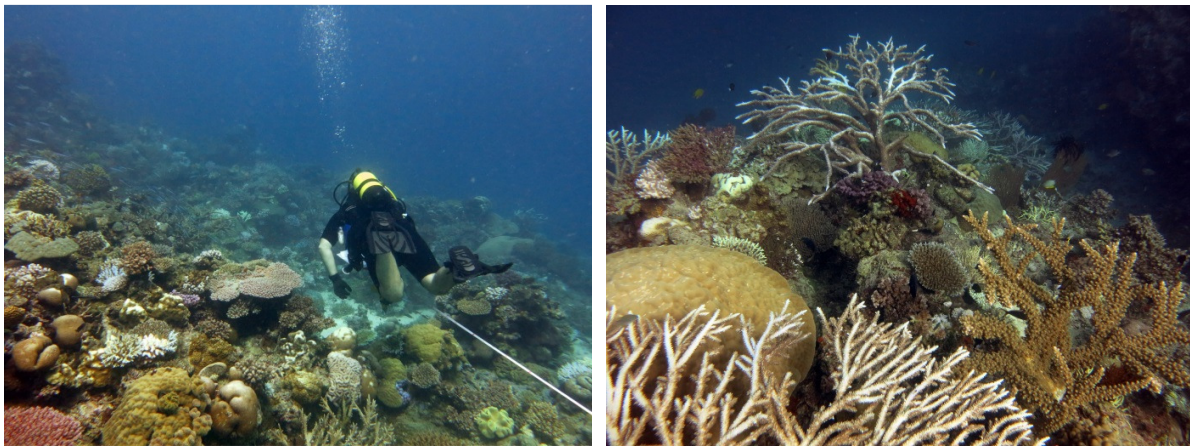
The Vatu-i-Ra Seascape, covering over 20,000 km² of relatively intact reefs, seagrass meadows, mangroves, rivers, and forest is considered one of Fiji's last great wild places. Between April 21-27, 2014, WCS and partner researchers from Edith Cowan University and Oceans 5 undertook underwater visual census surveys of fish and benthic condition to assess current management effectiveness of the Namena Marine Reserve, Vatu-i-Ra MPA, and Moon Reef, which are all protected areas of critical value for biodiversity and tourism within the Vatu-i-Ra Seascape and featured in the Roots to Happiness documentary. We chose complementary reefs (Cakaulekaleka in Kubulau, southern Vatu-i-Ra Reef, and Horseshoe Reef) that are open to fishing to assess the effectiveness of protection. The 2014 expedition builds on our prior 2013 expedition in September 2013, and will contribute to our larger campaign to promote Vatu-i-Ra Seascape as an area of national significance.



Researchers documented considerable coral bleaching at all survey locations, likely due to anomalously warm and still conditions in Fiji for a protracted period of time between December 2013 and mid-February 2014 (Figure 7). While some of the coral genera that were consistently bleached are known to stress easily (e.g. *Acropora*, *Stylophora*), other genera that are predicted to be more tolerant (e.g. *Pavona*, *Pachyseris*, *Leptoseris*, *Gardinoseris* of the family Agariciidae) appeared particularly affected by this event.

Figure 7. Location of UVC survey sites inside and adjacent to the Namena and Vatu-i-Ra marine reserves, and at Moon and Horseshoe reefs.

There was notably less bleaching on the offshore reefs surveyed during this expedition than at adjacent inshore sites surveyed by WCS between March 30 to April 13, 2014, likely due to increased water flow and proximity to deeper, cooler water. Our fish team noted the greatest fish abundance and size in the reefs adjacent to the Namena Marine Reserve that are open to fishing; this may be due to poaching within the reserve, different geomorphology of reef sites, or influences of time of day and tide that will need to be more closely investigated. Although we saw fishing boats within the Vatu-i-Ra MPA, there still seemed to be relatively high levels of fish density, likely because the area is naturally productive. Fish abundance and diversity at Moon and Horseshoe reefs appeared fewer, though this will need to be tested. Sites in the Namena Marine Reserve had the greatest density of juvenile corals, demonstrating suitable conditions for survivorship of coral larvae after they settle.



Diver surveying fish communities of Kubulau District, Fiji. Photos: © Stacy Jupiter/WCS

NEXT STEPS:

- Parts of the data will be further analyzed as part of a new project WCS for monitoring the impact of the MacArthur Foundation's 10 year coastal and marine strategy.
- Data will also contribute to a status of coral reefs in the Vatu-i-Ra Seascape, planned for 2015/2016.

LINKS TO NATIONAL PRIORITIES:

This project supports **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.

MANAGEMENT

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

Spreading Ecosystem-Based Management

Engaging districts of Bua Province

STATUS: Ongoing

FUNDING: David and Lucile Packard Foundation (2012-37915), John D. and Catherine T. MacArthur Foundation (13-104090-000-INP)

PARTNER ORGANISATIONS: Bua Provincial Council Office, Cakaudrove Provincial Council Office, iTaukei Affairs Board, iTaukei Lands and Fisheries Commission, SeaWeb Asia-Pacific, Bua Yaubula Management Support Team, Fiji Locally-Managed Marine Area Network, Institute of Applied Science-University of the South Pacific

HIGHLIGHTS:

In 2014, the Bua Provincial Council Office and WCS continued to work together to develop district-level management planning across six remaining districts (Figure 8) in the province of Bua without formalised ecosystem-based management plans. Each of six districts, Navakasiga, Lekutu, Nadi, Solevu, Vuya and Dama, are developing their own management plan through a tailored process, designed to build local consensus, secure commitment of resource owners and address locally specific challenges affecting management. WCS also facilitated an annual review and adaptive management for existing district management plans - Wainunu and Kubulau in Bua Province, and neighbouring Wailevu in Cakaudrove Province. Progress is described for each district below.

Vuya

WCS assisted representatives of Vuya Village to utilise their skills, experience and traditional influence to build the capacity of the other three villages (Wairiki, Nabouwalu and Navave) to engage with the management planning process. In February, WCS supported the endorsement and launching of an ecosystem-based management plan for Vuya Village, showcasing their achievements to the district high chief and invited representatives from other villages.

WCS staff engaged Vuya Village Management Committee in planning and co-facilitating a district management planning workshop. This included training to help representatives from the other three villages to: engage more people in their communities; build consensus around local management rules and new marine protected areas; and engage local chiefs. Consensus has now been established within communities and the district management plan is being

drafted. Chiefly endorsement will follow the ongoing process of succession to title of *Buli Raviravi*, one of two district high chiefs.

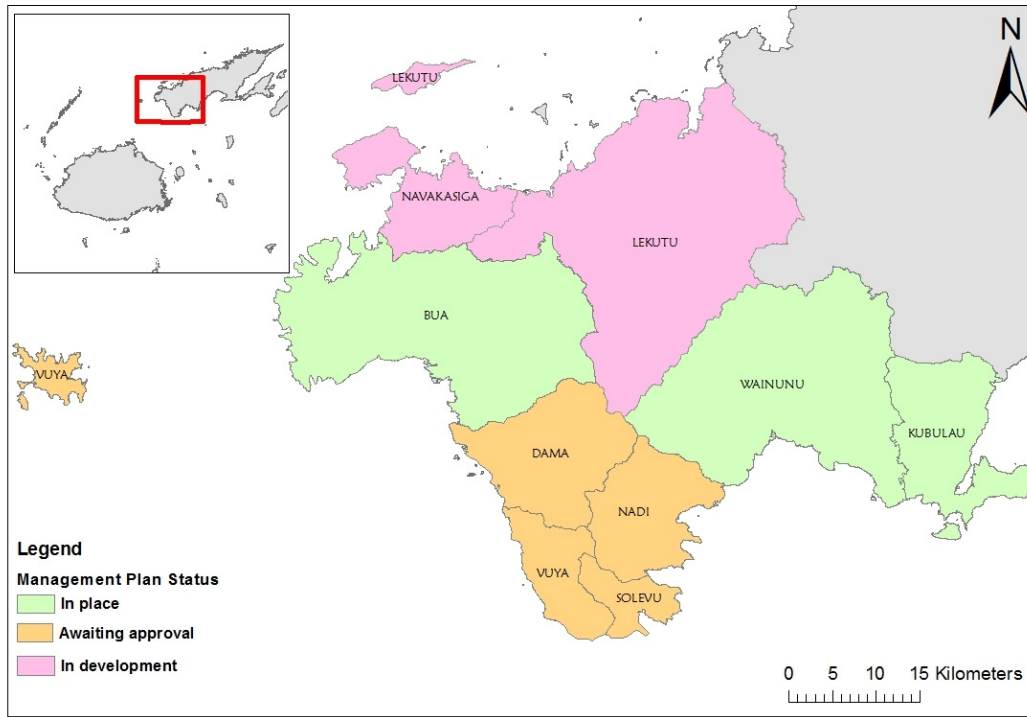


Figure 8. Current management status of districts in Bua Province. Green = management plans endorsed; orange = management plans nearly finalised; purple = management plans under development.

Dama

WCS facilitated a management planning workshop from in April in Dama Village to update threats to management goals, and provide training in communication skills and community engagement for village representatives. Community input was consolidated at a later workshop in Naruwai Village in July, to finalise proposed management rules and protected areas. Participants also developed a structure through which the district management plan will be implemented and monitored (Figure 9).

The WCS staff team facilitated a further workshop in Dama Village in November to present the results of the social network analysis to the community. During the workshop community representatives identified strengths and weaknesses within local networks as well as ways in which the flow of information could be enhanced to support better management.

In 2015, WCS will support final endorsement of the proposed management plan and governance structure through the traditional hierarchy council (*bose vanua*).

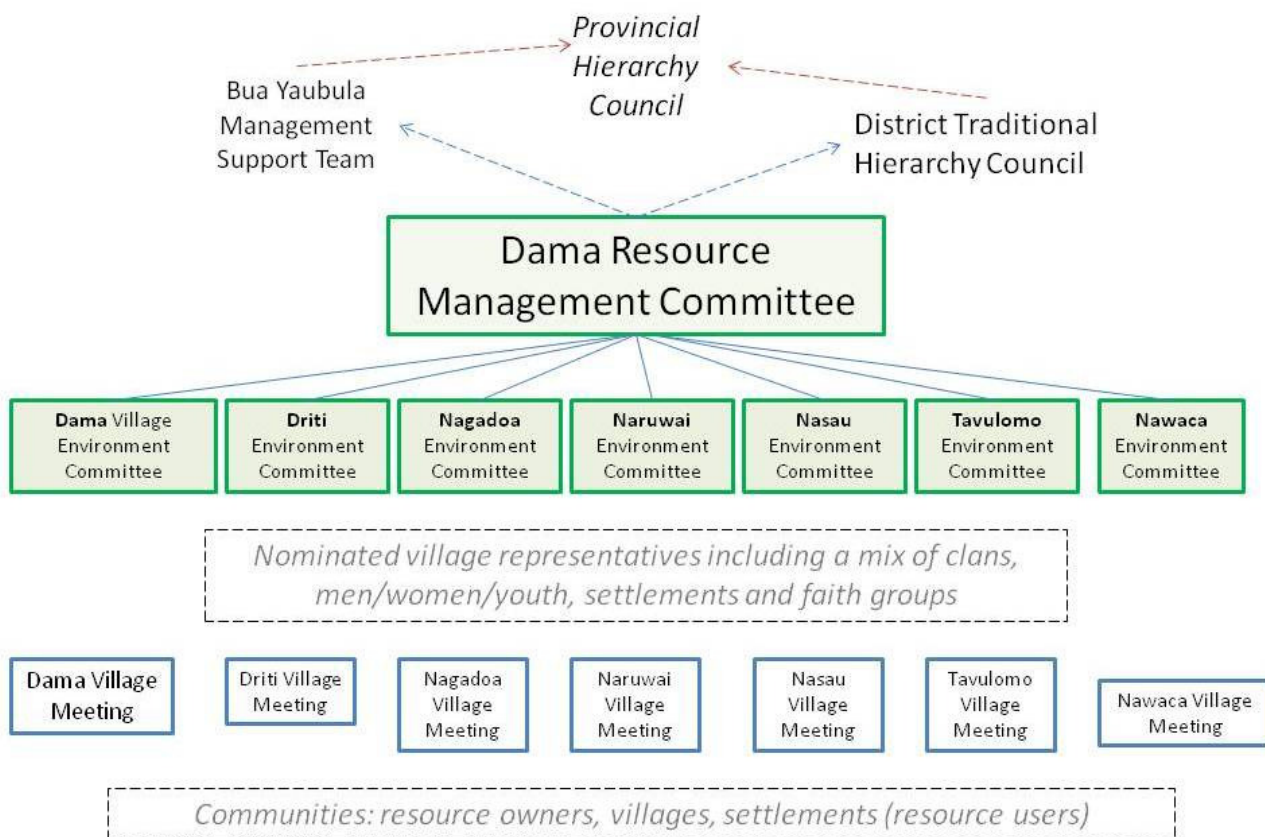


Figure 9. Proposed structure (new committees in green) to oversee implementation and monitoring of the district management plan, including communication links with existing governance bodies.

Lekutu and Navakasiga

The WCS team facilitated a first management planning workshop for Lekutu and Navakasiga districts, which share customary fishing grounds in February. With input from the Department of Forestry, a conceptual modeling exercise captured management goals and targets, identified threats and their underlying causes, and developed initial ideas for management strategies. Training was also provided to enhance participants’ communication skills and build their capacity to engage communities in the strategy development process. A subsequent management planning workshop in Nasarawaqa Village in August incorporated community input to update the conceptual model, accounting for emerging threats associated with mining and road building activities. Targeted strategies were developed, including proposed terrestrial, riparian and marine protected areas. These are a focus for consultation to facilitate further community input and endorsement in due course.

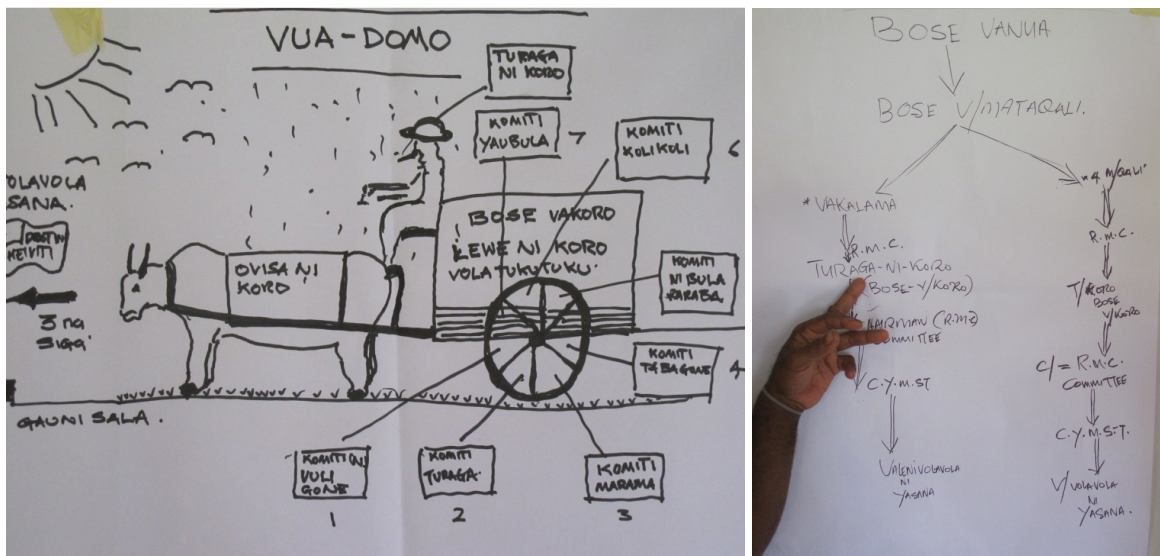
In 2015, WCS will support Lekutu and Navakasiga develop implementation and monitoring systems, and endorse and launch their management plans.

Nadi and Solevu

WCS facilitated a management planning workshop in Nawaido Village in February involving all landowning clans representing the three villages in Solevu District. This included a review of proposed management rules, protected areas and governance arrangements as well good governance training delivered by the iTaukei (Native) Affairs Board (iTAB) and the iTaukei Lands and Fisheries Commission (TLFC). The same partners helped deliver a similar workshop in Nadi in Nasolo Village in May, involving all district chiefs and their representatives (as members of the traditional hierarchy council) and inviting additional community input to be incorporated at a further workshop in Sawani Village in August. Both the Nadi and Solevu Management Plans have been redrafted and are awaiting endorsement following approval from the Provincial Council Office. The endorsement of district management plans for Nadi and Solevu was postponed due to sensitive local issues over local fishing rights and the succession of a chiefly title.

Wailevu

In partnership with Cakaudrove Provincial Council Office and SeaWeb Asia-Pacific, the WCS facilitated the first annual review of the Wailevu district management plan in Urata Village in February. Wailevu is Fiji's largest district and 69 representatives from its two area Resource Management Committees (RMCs) undertook a review of management rules, protected areas, management activities, governance structures and protocols. As a result, to generate more interaction the Wailevu West RMC formed smaller 'cluster groups' comprising of representatives from villages that are close enough to travel between by foot. The workshop also considered communication and decision-making structures in each village in order to identify how participants can effectively engage different stakeholders within their communities to raise awareness, generate support and drive local implementation of the management plan.



Village communication and decision-making structures mapped by participants at the Wailevu district management support workshop.

Wainunu

At the request of the District High Chief, the WCS facilitated a district management support workshop in Daria Village in August with local chiefs and their representatives as members of the traditional hierarchy council. This confirmed existing management rules and protected areas as well as a new governance structure in which the traditional hierarchy council will directly oversee the implementation and monitoring of their management plan.

Kubulau

WCS facilitated a workshop with members of the Kubulau Resource Management Committee (KRMC) to review progress with management activities and update their action plan accordingly in Namalata Village in November. This highlighted a range of new activities that KRMC is independently leading, including the cooperative production and sale of honey and establishment of a district nursery for native trees. They also confirmed plans to employ an officer to lead delivery of activities on their behalf and considered how data from a social network analysis (Figure 2), could inform enhanced management.

LINKS TO NATIONAL PRIORITIES:

This project supports **NBSAP Implementation Plan Thematic Area 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 Thematic Area 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. This work also supports **Climate Change Policy Adaptation Strategy 5:** Support the ecosystem based management approach throughout Fiji, recognizing that ecosystem services, such as food security, natural hazard mitigation and physical coastal buffer zones, increase resilience.

Island-scale planning in Lomaiviti Province

STATUS: Ongoing

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

PARTNER ORGANISATIONS: Lomaiviti Provincial Council Office, YMST-Koro, YMST-Ovalau and Moturiki, I-Taukei Affairs Board (Conservation Officer)

HIGHLIGHTS:

The Lomaiviti Provincial Office has invited WCS to support island-scale planning in Koro and Ovalau Island. Until recently, our engagement with communities in the province has been through our work on periodic harvest regimes (see details under Science). WCS conducted a short half day introduction to island-planning at the Lomaiviti Provincial Council meeting in Suva in November, just prior to the annual Lomaiviti festival. The workshop participants included the Roko Tui Lomaiviti, Chairman of the Council, Provincial Office staff, Turaga ni Yavusa, Mata ni Tikina, and representatives from Women and the Youth groups.

Workshop participants did some preliminary mapping of their islands, identifying important environmental features, as well as existing *tabus* or protected areas. The Conservation Officer for Lomaiviti is currently identifying a core team from the province to be trained in island-scale planning. The team will participate and learn how to do the training, as part of the planning process in Koro and test out the facilitator's guide WCS is currently finalizing. With their acquired skills and experience from Koro, the core team from Lomaiviti will be leading the planning process in Ovalau. This approach hopes to build long-lasting capacity within the province for island-scale planning, reducing their dependence on external NGOs to lead this work. In December, WCS staff and representatives from the Lomaiviti Province socialized the upcoming island-scale ecosystem based management planning work, with each of the 15 villages on Koro Island.

LINKS TO NATIONAL PRIORITIES:

This project supports **NBSAP Implementation Plan Thematic Area 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 Thematic Area 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. This work also supports **Climate Change Policy Adaptation Strategy 5:** Support the ecosystem based management approach throughout Fiji, recognizing that ecosystem services, such as food security, natural hazard mitigation and physical coastal buffer zones, increase resilience.

Provincial-scale engagement

STATUS: Ongoing

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

PARTNER ORGANISATIONS: (Main partners include) Bua Provincial Council Office, iTaukei Affairs Board, Bua Yaubula Management Support Team, SeaWeb

HIGHLIGHTS AND NEXT STEPS:

The establishment of management plans covering all nine districts in Bua will provide a foundation on which to build a provincial Integrated Coastal Management (ICM) plan. Our approach to ICM planning aims to ensure that local management priorities are incorporated at the wider scale and to facilitate well-informed 'bottom-up' input into district and provincial management planning processes.

The Bua Yaubula Management Support Team (BYMST) aims to enhance capacity for linking communities, government departments, NGOs and other agencies for management planning and implementation. Having helped facilitate the process to develop their remit, structure and terms of reference, WCS supported the Bua Provincial Office submit an application to fund BYMST activities to the Global Environment Facility's Small Grants Programme in January 2014. WCS facilitated a BYMST workshop in April 2014 to update members on the contents of the funding application, as well as plan how activities would be delivered to link 'bottom-up' district-level plans with 'top-down' government priorities (Figure 10) to develop a Provincial Integrated Coastal Management Plan (as required by the National Integrated Coastal Management Framework 2011, under the Environment Management Act 2005).



Left to right: Sharing lessons learned at a Bua Yaubula Management Support Team meeting (Photo © Ged Acton/WCS); Flipchart community education tool being trialed in Bua (Photo © Seaweb Asia-Pacific).

In May 2014 WCS staff co-facilitated a national workshop to develop guidelines on the content and process for developing provincial ICM plans (details on page 51). WCS sponsored the participation of stakeholders from Bua, including leading community representatives, traditional leaders, the Provincial Administrator and the Provincial Conservation Officer, facilitating their input and subsequent dissemination of the workshop outcomes.

In 2015 WCS will support Bua Provincial Council Office and BYMST to take forward provincial ICM planning and engage district high chiefs in order to enhance their engagement in local management processes.

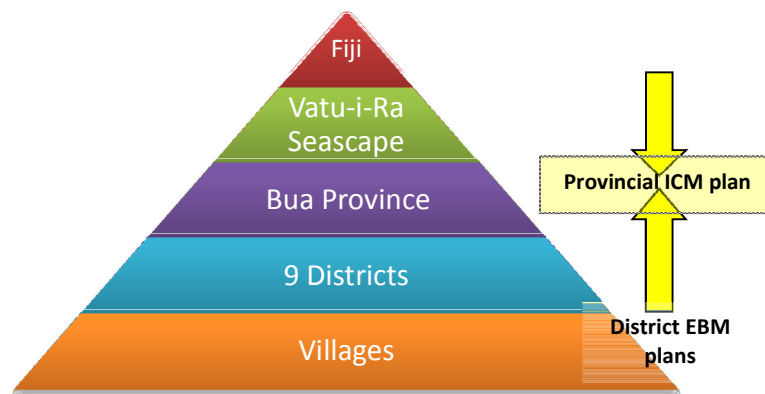


Figure 10. Schematic of relationship between ‘bottom-up’ and ‘top-down’ processes for integrated coastal management planning in Bua

LINKS TO NATIONAL PRIORITIES:

Strengthening of the Bua YMST will contribute to: **NBSAP Implementation Plan Thematic Area 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; **Action 1.3b:** ICMC will collate and develop the coastal development plan with relevant stakeholders targeted to mainstream all current and planned development activities; **NBSAP Implementation Plan Thematic Area 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; and **Climate Change Policy Adaptation Strategy 5:** Support the ecosystem based management approach throughout Fiji, recognizing that ecosystem services, such as food security, natural hazard mitigation and physical coastal buffer zones, increase resilience.

Supporting livelihoods and income generation

Livelihood development

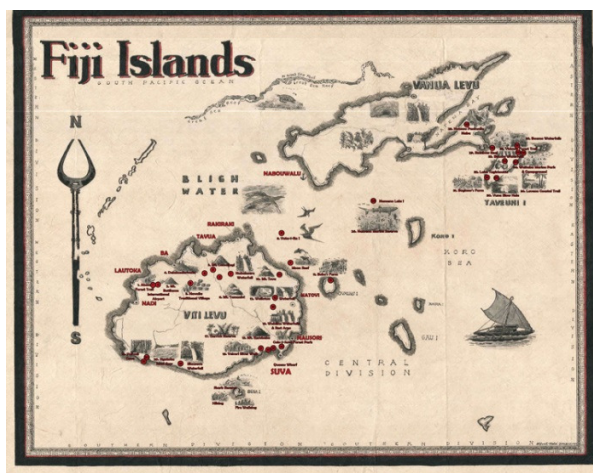
STATUS: Ongoing

FUNDING: Flora Family Foundation

PARTNER ORGANISATIONS: Tourism Fiji, i-Taukei Affairs Board

HIGHLIGHTS:

WCS has worked with local communities to establish over 182 km² of MPA and 96 km² of adjacent terrestrial and freshwater protected areas, which operate under ecosystem-based management plans. While this has resulted in measurable increases in fisheries resources, setting aside protected areas comes at a cost to communities through lost opportunities for income generation. In addition, the wide range of sustainable ecotourism options in Fiji is generally poorly publicized, limiting the potential revenue to local communities. To respond to this challenge, WCS undertook a two year project to promote environmentally and culturally sustainable enterprises and alternative livelihood opportunities.



Fiji Ecotourism map, drawn by Alifereti Malai.

In coordination with operators, and by applying a number of criteria (e.g. operators have obtained necessary licenses, quality of accommodation, quality of ecotourism activities, and reliability of services), WCS selected 36 ecotourism sites that are culturally and ecologically significant. These sites included waterfalls, peak climbs and dolphin tours, among others. Local artist Alifereti Malai drew the map on traditional *tapa* (bark) cloth. The map has been printed, and at least 250 copies will be distributed through Tourism Fiji, key vendors and tourism agencies in 2015.

Following a scoping study across Bua Province and Cakaudrove District to identify environmentally-friendly businesses, WCS commenced several initiatives with women focused on honey, virgin coconut oil and handicrafts woven from *kuta* (a fine-stemmed reed commonly known as bamboo spike sedge), to diversify and enhance communities' income streams. The women were provided training in sustainable management (e.g. of *kuta* plantations), markets and supply chains, and basic business skills. This work resulted in three localized *kuta* teams, each with a nominated leader, quality control process, and communications protocol to notify buyers when products are ready.



Left to right: Weaving kuta mats to support local livelihoods (©Ged Acton/WCS). Bee farming in Kavula village in Bua Province (© Sirkka Killmann).

In partnership with the Department of Agriculture, we arranged for a beekeeper training workshop with representatives from two villages in these districts in 2012. Women enhanced their beekeeping skills, learned how to increase production capacity, developed a marketing plan and identified additional buyers. Consequently women in Kavula then sold 60 litres of honey to a tourist resort on the island of Taveuni made a sale to a new buyer in Suva, Fiji's capital. The money earned helped pay for the annual primary school fees for five children.

WCS has provided training for 76 women from 23 villages across 7 districts in the Vatu-i-Ra Seascape. As well as supporting development of small scale businesses in rural communities, this has created a network for sharing knowledge and resources, promoting further collaboration to access new markets and increase production capacity. We have supported these women to participate in management planning at district level, enabling them to leverage their influence for protection of the wetlands and forest habitats they rely on for kuta and honey. We have also established a platform for developing benefit-sharing mechanisms that link women's businesses and community eco-tourism initiatives with local management and social projects.

LINKS TO NATIONAL PRIORITIES:

By providing means to alternate revenue streams, this activity in principle supports **NBSAP Implementation Plan Thematic Area 3 (Inshore Fisheries), Strategy 2: Promote biodiversity tourism. Strategy 9: Reduce demand for marine natural resources and biodiversity products.** However, monitoring will be required to evaluate whether revenue is additive or alternative.

Sustainable financing for local community protected areas

STATUS: Ongoing

FUNDING: Flora Family Foundation, John D. and Catherine T. MacArthur Foundation (13-104090-000-INP)

PARTNER ORGANISATIONS: National Center for Small and Medium Enterprises Development (NCSMED), Bua Provincial Council Office, Bua Yaubula Management Support Team (BYMST)

HIGHLIGHTS:

WCS engaged local stakeholders (traditional fishing rights owners, dive operators, local authorities, and resorts) to garner support to develop a mutually-beneficial voluntary user contribution scheme, and assist local community leaders and the Ra Provincial Council Office to develop a system that is transparent and equitably shares the benefits. An initial stakeholder workshop in April 2014 led to agreement by both communities and tourism operators to explore a voluntary dive tag scheme. WCS organised a follow-up consultation with local communities in July 2014 to:

- (i) get the endorsement of all communities with traditional fishing rights to establish a marine protected area over reefs north of Vatu-i-Ra Island;
- (ii) get community support for the establishment of a dive scheme with tourism operators; and
- (iii) (iii) begin discussions on the establishment of a transparent mechanism for providing and accepting voluntary contributions from divers.

The proposed boundaries of the MPA cover at least nine popular dive sites, and the voluntary dive tag scheme offers the potential for a steady stream of revenue to the local communities.

LINKS TO NATIONAL PRIORITIES:

By providing means to alternate revenue streams, this activity in principle supports **NBSAP Implementation Plan Thematic Area 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. **Thematic Area 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: IUCN, WWF, Conservation International, FLMMA

HIGHLIGHTS AND NEXT STEPS:

The Vatu-i-Ra Seascape, covering over 20,000 km² of relatively intact reefs, seagrass meadows, mangroves, rivers and forest, is considered one of Fiji's last great wild places. In 2003, WCS and collaborating researchers documented exceptionally high coral cover, fish diversity, and fish biomass compared with similar sites in the Indo-Pacific, as well as low amounts of discarded fishing gear. Relatively high densities of large, predatory fishes on reefs were noted, suggesting an urgent need for protection before fishing efforts begin to increase. The seamounts of the Bligh Waters that once supported some of the highest values of fish biomass recorded in the Vatu-i-Ra Seascape now appear empty. Communities are also venturing beyond their reefs targeting for pelagic fish, as inshore fisheries decline. Studies by regional organizations suggest that Pacific Islands will become more reliant on pelagic fish to meet their protein needs. In an effort to encourage the Fiji to take action to protect the remaining marine resources that support people's livelihoods, as well as the astounding biodiversity of the Vatu-i-Ra Seascape, WCS launched a campaign to establish offshore marine managed areas (MMAs), in proximity to community fishing grounds, to protect important fisheries and sensitive biodiversity within the Bligh Waters and Lomaiviti Passage. Highlights from the 2014 are below.

Economic valuation:

WCS engaged two consultants (a tourism expert based in Fiji and an ecosystem service expert based in Hawaii) to assist in an economic valuation of key ecosystem services, focusing on fisheries production and tourism, to estimate the value of the Vatu-i-Ra Seascape. Tourism data were gathered from 14 of the 16 hotel and dive operators operating in the Seascape, and fisheries data were gathered from government staff, local fisheries experts, and from WCS. The final report showed the annual value of tourism and fisheries in the seascape was US\$39,057,000. Approximately US\$25,690,000 is generated from tourism and US\$13,367,000 generated from fisheries annually. The report also highlighted the potential costs of mining that could be avoided by an investment in MMAs, for fisheries and tourism.

Supporting the Fiji Government's 30% by 2020 commitment:

In collaboration with partners, WCS has been engaging with the Fiji government to identify ways to achieve the *30% protection of Fiji's seas by 2020*, a commitment that the government made in 2005 at the United Nations Small Islands Development States (SIDS) conference in Mauritius. With the help of Graeme White of the New South Wales Department of Primary Industries in Australia, WCS did an analysis of existing laws and policies, and identified a *Policy*

Road Map for Offshore Marine Managed Areas Establishment in Fiji. The 2012 Offshore Fisheries Management Decree provides a potential mechanism for establishing MMAs in Fiji.



Left to right: Manoa Malani (Policy Advisor, WCS-Fiji), Pita Wise (Permanent Secretary, Fiji Ministry of Strategic Planning, National Development, and Statistics), Sangeeta Mangubhai (then Deputy Director, WCS-Fiji) and Jacob James (Waitt Foundation) at the 2014 U.N. Conference on Small Island Developing States in Apia, Samoa. Photo © Fiji SIDS Delegation.

WCS joined the Fiji Government Delegation to the United Nations Small Islands Developing States (SIDS) conference in Apia, Samoa in September. WCS also supported Mr. Aisake Batibasaga, Principal Research Officer for the Department of Fisheries, to attend the conference. During SIDS the Fiji Government, under the leadership of the Permanent Secretary for the Ministry of Strategic Planning, National Development, and Statistics, reaffirmed Fiji's commitment to protect 30 percent of its seas by 2020. During the Oceans, Seas, and Biodiversity Partnership Dialogue session the Fiji Government highlighted the progress Fiji has made in protecting marine and coastal ecosystems since SIDS 2005, and identified a two-pronged approach achieving this target: (i) to support and strengthen inshore LMMAs that are vital to the livelihoods and food security of the Fijian people; and (ii) identify and establish offshore, multiple-use marine protected areas (MPAs) to effectively manage the unique biodiversity, fisheries, and other ecosystem services the ocean provides.

WCS co-hosted a side event with the Waitt Foundation and the Fiji Government to recognize, share, and celebrate the achievements and commitments Fiji made at SIDS. The event was attended by the members of the Fiji Delegation, representatives from other nations, non-government partners, industry representatives, and members of the Fijian community residing in Samoa. WCS was able to secure the attendance of the honorable Mr. Kaliopate Tavola, a high-level representative of the Melanesian Spearhead Group and the previous Minister of Foreign Affairs and External Relations, who made the original 2020 commitment at SIDS in 2005.

LINKS TO NATIONAL PRIORITIES:

NBSAP Implementation Plan Thematic Area 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.

COMMUNICATIONS

The following sections present a synthesis of campaigns, completed and ongoing activities that WCS Fiji has undertaken to improve communication between our organization, community partners and external stakeholders.

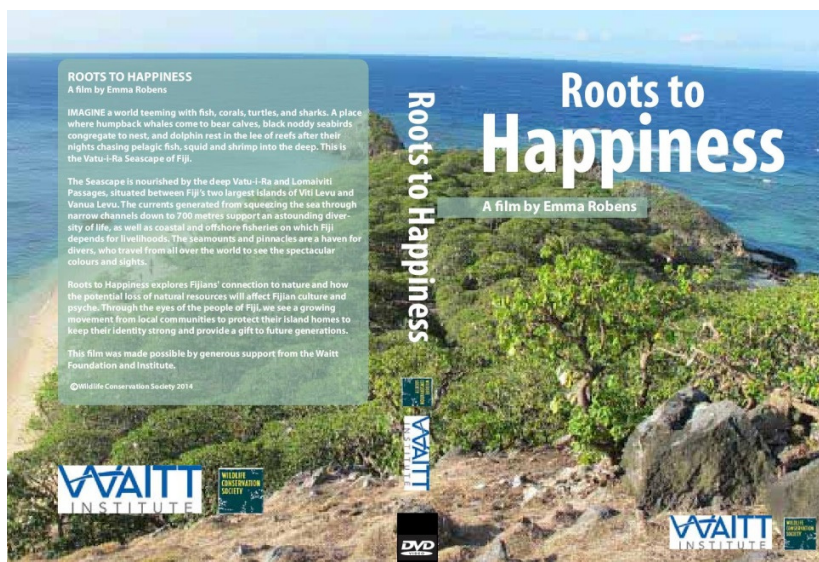
Campaign: Vatu-i-Ra Seascape

STATUS: Ongoing

FUNDING: Waitt Foundation, Waitt Institute

HIGHLIGHTS:

WCS Communications Officer Dwain Qalovaki led the development of a draft communications strategy aimed at creating nationwide support for the establishment of multiple use Marine Managed Areas (MMAs), including no-take zones, across 12,900 square kilometers of offshore waters within the Vatu-i-Ra Seascape by 2016. The communications strategy is designed specifically to advance steps under the policy roadmap, working to achieve two main goals that will create momentum for the eventual legal establishment of offshore MMAs (outside demarcated areas): (i) increase awareness of the ecological, social, and economic benefits of offshore marine managed areas; and (ii) engage and support dialog between policy makers, industry, and other relevant stakeholders. Key messages and target audiences have been identified, as well as key activities to raise awareness and support dialog among stakeholders.



On April 15, 2014, WCS, the Waitt Foundation and Institute, and Oceans 5 co-hosted a reception on board the Waitt Institute research platform with senior government officials, members of the diplomatic corps, representatives from NGOs and regional organizations, and program officers of The David and Lucile Packard Foundation. Video clips from the shark expedition and a trailer for the documentary *Roots to*

Happiness were showcased. Subsequently, WCS and the Waitt Foundation and Institute successfully launched *Roots to Happiness* with high-level decision makers, influential members of Suva society, and community representatives from the Vatu-i-Ra Seascape on April 17, 2014. The launch received coverage on national Fiji TV and in *The Fiji Times*. Fiji TV has agreed to

show the documentary more widely in the Pacific region, and to accept content from WCS for a series of environmental stories over the next 12 months. This will provide us a strong platform to not only disseminate information on the Seascape, but to build public support for the identification and establishment of MMAs in Fiji.

In the weeks building up to and during the SIDS meeting, WCS Communications Officer Dwain Qalovaki provided communications support in close coordination with the Fijian Ministry of Information in Suva. To support the Fiji Delegation, a number of factsheets and a banner were produced to highlight the unique biodiversity and productivity of the seascape, and the people who have strong cultural roots to the area. In the process, we secured approval from the Fijian Ministry of Foreign Affairs and International Cooperation to use the government coat of arms on all communication materials relating to the Vatu-i-Ra Seascape campaign.

The Vatu-i-Ra website (<http://fijiseascape.com/>) recently featured live blogs from Deputy Director Sangeeta Mangubhai during the SIDS conference. The website is still preliminary, and will be updated and modified depending on how popular it becomes and how frequently people visit the site. The site will have a number of key pages including: (i) *Talanoa* (Talk) Seascape – to capture the stories of the local communities living in the seascape; (ii) Seascape Science – to share information on the latest science and information on the seascape, and (iii) Stories from the Seascape – to capture stories on conservation efforts within the seascape by a wide diversity of partners. We will also be launching a photo competition in early 2015 to capture images of the seascape to use in the campaign. The Vatu-i-Ra Seascape website will provide a strong platform to not only disseminate information on the seascape, but to build public support for the identification and establishment of MMAs in Fiji.

LINKS TO NATIONAL PRIORITIES:

This work supports **NBSAP Implementation Plan Thematic Area 5 (Species Conservation), Strategy 5:** Improved communication amongst stakeholders (including communities) on threatened and endangered species; **Thematic Area 6 (Protected Areas), Strategy 2:** Expand protected area networks in priority sites at the national level and provincial level to achieve national targets, **Strategy 4:** Share best practices and lessons learned to improve management effectiveness and governance.

Society for Conservation Biology – Oceania conference

The Society for Conservation Biology (SCB) Oceania Chapter co-hosted the “SCB Fiji 2014 Conference” in collaboration with the University of the South Pacific (USP) and WCS in Suva, Fiji from the 9-11 July. The theme of the conference was “Resilient Island Ecosystems and Communities,” and attracted over 200 participants from 14 countries. The conference enabled the gathering a mix of early career researchers and professionals leading in their respective areas as well as policy makers, resource managers and university students. Sessions were scheduled under three sub-themes: (i) vulnerable ecosystems, communities and species; (ii) adaptive and community-based management of socio-ecological systems, and (iii) conservation in a changing Oceania.

The conference was opened by Associate Prof. James Watson, the past president of the SCB Oceania and President-Elect of the SCB Board of Governors. There were high caliber plenary speakers: Dr. Chris Filardi (American Museum of Natural History), Taholo Kami (IUCN-Oceania Regional Office), Prof. David Keith (University of New South Wales), Dr. Eve McDonald-Madden (University of Queensland), Prof. Bob Pressey (James Cook University), and Profs. Konai and Randy Thaman (University of the South Pacific). The conference was closed by Prof. Richard Kingsford, the current President of the SCB Oceania.

A number of pre-conference workshops were also offered on bridging the science-implementation gap, social network analysis, sea cucumbers, as well as scientific writing and presentations, three of which were co-hosted by WCS staff in Fiji (see below). The conference was a great success, with participants able to access the latest information on major issues affecting biodiversity from internationally renowned speakers as well as numerous symposia, concurrent sessions, workshops, short courses and field trips. It is highlighted by many participants to be an important global venue for presenting and discussing new research in the area of conservation science and best practice.

For a more personal account of the conference, please see blog by Dr Stacy Jupiter.
<http://wcsfiji.org/fj/reflections-on-organizing-the-scb-oceania-fiji-conference/>

Workshop 1: A hands-on introduction to applied social network analysis for community-based conservation

The theory and methods of social network analysis (SNA) have been under development since the 1930s, and in the past decade have begun to be applied to socio-ecological systems. SNA can identify properties of social networks such as which actors are in the center of ‘the action’ and which are peripheral; groups of actors who interact more with one another than with those outside their group; and which actor groups interact and which ones don’t (i.e., social boundaries or divides). Network ‘weaving’ processes to bridge divides and increase innovation and success have also been developed. A one day training led by Ken Vance-Borland (Conservation Planning Institute) and Ged Acton (WCS) provided both an overview of and hands-on learning in applied SNA for conservation. Participants learnt about the history, theory, and methods of SNA and practiced: (i) social network questionnaire development, (ii) network data collection, (iii) network mapping with the free visone software, (iv) social network analysis

with visone and R, (v) methods for network weaving, and (vi) how to plan and execute an applied conservation social network project.

Workshop 7: Working forward to implement more effective sea cucumber fisheries management in Pacific Islands

In Vanuatu, the Fisheries Department has been implementing a new total allowable catch (TAC) management system for sea cucumbers based on stock assessments. Rocky Kaku and Jayven Ham from the Vanuatu Fisheries Department led with the support of Dr. Stacy Jupiter (WCS) a workshop to share the experience from Vanuatu of managing cucumber stocks among interested Pacific Islanders and to initiate a technical working group on sea cucumber management in Pacific Islands. The workshop included presentations by Pacific Islanders involved in sea cucumber fisheries management and assessment, as well as practical data analysis using the established online BDMER database (bdmer-test.ird.nc) with practical examples of data collected from Vanuatu.

Workshop 8: Scientific Writers and Presenters Workshop: Two Essential Skills to becoming a Good Scientist



Co-hosted by WCS and James Cook University, a 2-day workshop was held to provide training on scientific writing and presentation skills to young aspiring Pacific Island scientists. The workshop was aimed at postgraduate students at the University of the South Pacific (USP), or recent graduates who have not had the opportunity to share or disseminate the results of their thesis work with their peers. Day 1 focused on teaching participants the key steps to preparing, writing and

submitting a scientific paper for publication in an international journal. Day 2 focused on presentation skills and gave participants the chance to practice their presentations in front of their peers and to the trainers, so that they learn to both give and receive constructive feedback. The workshop helped improve presentations, and increase their confidence at presenting at international conferences.

LINKS TO NATIONAL PRIORITIES:

This work supports **NBSAP Implementation Plan Thematic Area 5 (Species Conservation)**, **Strategy 1:** increase access to expertise/increased efforts made in the fields of quality research, **Strategy 5:** Improved communication amongst stakeholders (including communities) on threatened and endangered species.

Special issue of Pacific Conservation Biology on “Conservation of biodiversity in the Pacific Islands of Oceania”

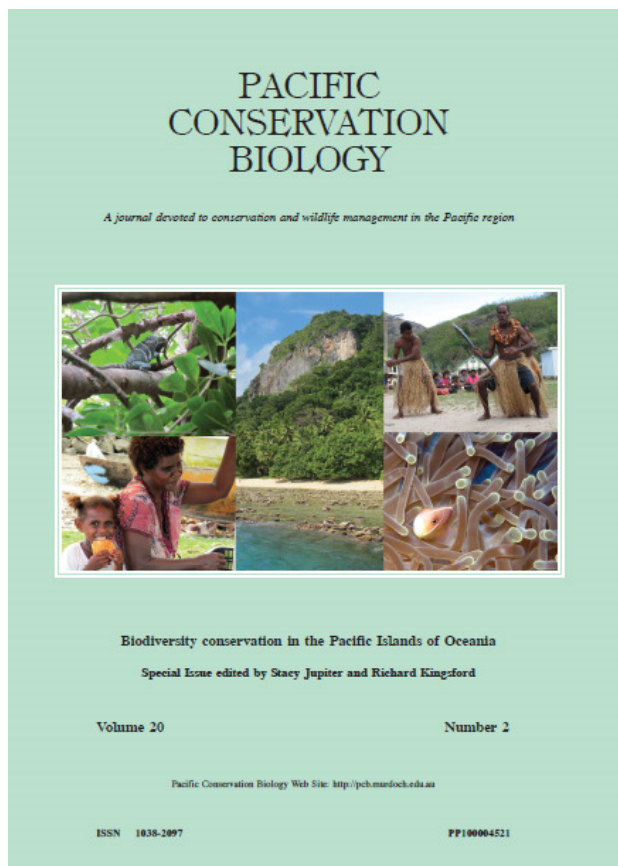
STATUS: Complete

FUNDING: n/a

PARTNER ORGANISATIONS: Society for Conservation Biology Oceania

OUTPUTS:

- *Journal volume:* Conservation of biodiversity in the Pacific Islands of Oceania, Pacific Conservation Biology volume 20, issue 2, co-edited by Stacy Jupiter and Richard Kingsford



In August 2014, Pacific Conservation Biology released a special volume spearheaded by co-editors Stacy Jupiter and Richard Kingsford on “Conservation of biodiversity in the Pacific Islands of Oceania”. A flier with an early release of the editorial and the paper abstracts was distributed at the Society for Conservation Biology Oceania conference at the University of the South Pacific in July. Papers included:

- *Conservation lessons from the Pacific Islands* (Editorial), by Richard Kingsford and Stacy Jupiter
- *Isolated and vulnerable: the history and future of Pacific Island terrestrial biodiversity*, by Gunnar Keppel, Clare Morrison, Jean-Yves Meyer, and Hans Juergen Boehmer
- *Critical issues and new challenges for research and management of invasive plants in the Pacific Islands*, by Jean-Yves Meyer
- *Locally-managed marine areas: multiple objectives and diverse strategies*, by

Stacy Jupiter, Philippa Cohen, Rebecca Weeks, Alifereti Tawake, Hugh Govan

- *Agroforestation and the loss of agrobiodiversity in the Pacific Islands: a call for conservation*, by Randolph Thaman
- *Principles for integrated island management in the tropical Pacific*, by Stacy Jupiter, Aaron Jenkins, Warren Lee Long, Sean Maxwell, Tim Carruthers, Kate Hodge, Hugh Govan, Jerker Tamelander and James Watson

- *Conservation of biodiversity in the Pacific Islands of Oceania: challenges and opportunities*, by Stacy Jupiter, Sangeeta Mangubhai, Richard Kingsford.

This special issue summarises the major conservation issues presently experienced in the Pacific Islands, and identifies opportunities for improved management through policy implementation, local action, research and knowledge networks. It will serve as a lasting resource for academics, government staff and managers in the Pacific.

PRESS RELEASE: Conservation of Pacific Island environments – lessons for the world

The world has an obligation to help the Pacific Islands conserve their unique ecosystems, because they are a vital reservoir of biodiversity and important source of natural resources, according to UNSW scientist Richard Kingsford.

Professor Kingsford is director of the UNSW Centre for Ecosystem Science as well as President of the Society for Conservation Biology (Oceania), an international professional organisation dedicated to promoting the scientific study of factors affecting the maintenance, loss and restoration of biological diversity.

Society members, including more than 200 scientists from Australia, New Zealand and the Pacific Islands, are gathering in Fiji this week to discuss how to address the many challenges to the environment in the Pacific region.

“Pacific Island environments capture the conservation challenge for humanity: can we really look after these wonderful environments, which are rich in biodiversity, given humanity’s increasing footprint?” says Professor Kingsford.

The conference coincides with a Special Issue on the conservation of biodiversity on the Pacific Islands to be published in the journal *Pacific Conservation Biology*, which includes an editorial written by Professor Kingsford and Dr Stacy Jupiter, director of the Wildlife Conservation Society in Fiji.

“There is much for us to be proud about our progress in the Pacific on conservation, but there are still big challenges. We need to better incorporate people as part of the solution, even though we know humans are having the greatest impact on the environment,” says Dr Jupiter.

The meeting of the society will be held at the University of the South Pacific in Suva from Wednesday 9 July to Friday 11 July.

Pacific Islands are relatively small land areas with many human pressures, including climate change, that continue to seriously affect the sustainability of many animal and plant species on land and in freshwater and marine environments of the region.

It was on these islands that the world first understood the destructive impacts of invasive species on native species poorly equipped to withstand the onslaught. Historical estimates for Pacific island extinctions that were directly or indirectly due to humans are devastatingly high.

“We are becoming increasingly better informed about the state of our biodiversity in the Pacific Islands and generally the news is not great but there are solutions. Some of these involve looking at past practices of Pacific societies who learned to effectively conserve their resources. We need to combine these lessons with more effective engagement by governments and our people throughout this the Pacific, working on long-term, locally-appropriate solutions,” says Dr Sangeeta Mangubhai, also of the Wildlife Conservation Society in Fiji.

Professor Kingsford says the Australian and New Zealand scientists will also give presentations at the conference on their countries, which face the same broad threats of habitat loss, invasive species, overharvesting, pollution and disease affecting biodiversity.

“Our countries are really just big islands and so we need to learn the lessons from the small Pacific Island nations,” he says.

“Also we are increasingly developing much of our land area and, in essence, creating natural islands within a mixture of urban, agricultural and mining developments.

“If we are going to effectively sustain our environments, we need to learn how to control our impacts and protect our natural systems, which are providing us with the quality of life and services on which we ultimately depend.”

LINKS TO NATIONAL PRIORITIES:

This work supports **NBSAP Implementation Plan Thematic Area 3 (Inshore Fisheries), Objective 5.5:** By 2014, report will be made of best available knowledge for dissemination to management units, **Thematic Area 5 (Species Conservation), Strategy 1:** increase access to expertise/increased efforts made in the fields of quality research, **Strategy 5:** Improved communication amongst stakeholders (including communities) on threatened and endangered species.

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 2014.

Protected Area Committee

Deputy Director, Sangeeta Mangubhai attended and provided inputs into the deliberations of the National Protected Areas Committee (PAC) which largely focused on the implementation of GEF4 funding, and a review of legislation relating to terrestrial protected areas. In December, PAC hosted a national workshop to “identify a typology (classification) for protected areas in Fiji.” The workshop was attended by representatives of the Office of the Prime Minister and a number of key ministries and departments, as well as NGOs and FLMMA representatives with expertise in terrestrial and/or marine protected area. In addition to drafting a typology for protected areas for Fiji, participants identified three key areas, for which further actions were required: (i) sustainable financing, (ii) Institutional structures, and (iii) legislation and policy.

A key recommendation of the workshop was the development of a national policy that would provide an over-arching framework for the establishment of a national network of terrestrial and marine protected areas, and provide the mandate for the Department of Environment to coordinate these efforts across different departments. In addition, the marine subcommittee of PAC, under the leadership of Director Stacy Jupiter identified a number of priorities for GEF6 funding, which has now been submitted to the Department of Environment for further action.

Integrated Coastal Management Committee



The Department of Environment, IAS-USP and WCS facilitated a three-day national workshop in May 2014 to define a process and the content for provincial ICM plans for Fiji to be implemented under the National ICM Framework for Fiji. Over 70 representatives from the government, NGOs, academic institutions, and the provinces of Bua, Ra, Lomaiviti, and Kadavu participated in the workshop, which was largely funded through the ADB-GEF Coral Triangle Project. The outcomes and decisions from the workshop

were presented to the National ICM Committee and shared with key stakeholders in Bua and Ra Province. The ICMC is currently supporting the Department of Environment to prepare a cabinet paper to gain endorsement of the outcomes of the national ICM workshop and the commencement of ICM plans for potentially the provinces of Bua, Ra, Macuata and Kadavu.

Fiji Locally Managed Marine Area Network

WCS Fiji continues to strongly support the Fiji LMMA network through our participation on the Executive Committee and multiple working groups (Learning Working Group, Communications Working Group, Design and Administration Working Group, Enforcement), as well as the broader parent LMMA network. Deputy Director Sangeeta Mangubhai is currently the chair of the FLMMA Learning Working Group. In December, we issued a consultancy to local consultants to work with FLMMA partners to develop a position paper for the network that can be used to engage policy and decision makers.



Participants at the 2014 FLMMA AGM meeting in Ra Province. Photos ©Dwain Qalovaki/WCS

FIJI RELEVANT PUBLICATIONS AND RESOURCES 2014

Book Chapters

Jenkins AP, Jupiter SD (in press) Natural disasters, health and wetlands: A Pacific small island developing state perspective. In: Finlayson CM, Horwitz P, Weinstein P (eds), *Wetlands and Human Health*, Springer

Journal Articles

Anthony KRN, Marshall PA, Abdullah A, Beeden R, Bergh C, Black R, Eakin M, Game ET, Gooch M, Graham NAJ, Green A, Heron S, van Hoodonk R, Knowland C, Mangubhai S, Marshall N, Maynard JA, McGinnity P, McLeod E, Mumby PJ, Nyström M, Obura D, Oliver J, Possingham HP, Pressey B, Rowlands GP, Tamelander J, Wachenfeld D, Wear S (2014) Operationalising resilience for adaptive coral reef management under global environmental change. *Global Change Biology* doi: 10.1111/gcb.12700

Cohen PJ, Jupiter SD, Weeks R, Tawake A, Govan H (2014) Is community-based fisheries management realizing multiple objectives? Examining evidence from the literature. *SPC Traditional Marine Resource Management and Knowledge Information Bulletin* 34:3-12

Goetze JS, Jupiter SD, Langlois TJ, Wilson SK, Harvey ES, Bond T, Naisilisili W (2015) Diver operated video most accurately detects the impacts of fishing within periodically harvested closures. *Journal of Experimental Marine Biology and Ecology* 462:74-82

Golden AS, Naisilisili W, Ligairi I, Drew JA (2014) Combining natural history collections with fisher knowledge for community-based conservation in Fiji. *PLoS ONE* 9:e98036
<http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0098036>

McMillen HL, Ticktin T, Friendlander A, Jupiter SD, Thaman R, Campbell J, Veitayaki J, Giambelluca T, Nihmei S, Rupeni E, Apis-Overhoff L, Aalbersberg W, Orcherton DF (2014) Small islands, valuable insights: Systems of customary resource use and resilience to climate change in the Pacific. *Ecology & Society* 19(4): 44. <http://dx.doi.org/10.5751/ES-06937-190444>

Jupiter SD, Cohen PJ, Weeks R, Tawake A, Govan H (2014) Locally-managed marine areas: multiple objectives and diverse strategies. *Pacific Conservation Biology* 20:165-179

Jupiter SD, Jenkins AP, Lee Long, WJ, Maxwell SL, Carruthers TJB, Hodge K, Govan H, Tamelander J, Watson JEM (2014) Principles for integrated island management in the tropical Pacific. *Pacific Conservation Biology* 20:193-205

Jupiter SD, Mangubhai S, Kingsford RT (2014) Conservation of biodiversity in the Pacific islands of Oceania: challenges and opportunities. *Pacific Conservation Biology* 20:206-220

Kingsford RT, Jupiter SD (2014) Conservation lessons from the Pacific Islands. *Pacific Conservation Biology* 20:134-135

Golden AS, Naisilisili W, Ligairi I, Drew JA (2014) Combining natural history collections with fisher knowledge for community-based conservation in Fiji. *PLoS ONE* 9:e98036

Klein CJ, Jupiter SD, Possingham HP (2014) Setting conservation priorities in Fiji: Decision science versus additive scoring systems. *Marine Policy* 48:204-205

Klein CJ, Jupiter SD, Watts M, Possingham HP (2014) Evaluating the influence of candidate terrestrial protected areas on coral reef condition in Fiji. *Marine Policy* 44:360-365

Reports

Kastl B, Gow S (2014) Economic valuation of tourism and fisheries in the Vatu-i-Ra Seascape, Republic of Fiji. Wildlife Conservation Society, Suva, 19 pp

Jupiter SD, Jenkins AP, Lee Long WJ, Maxwell SL, Watson JEM, Hodge KB, Govan H, Carruthers TJB (2013 – final report released in 2014) Pacific Integrated Island Management – Principles, Case Studies and Lessons Learned. Secretariat of the Pacific Regional Environment Programme (SPREP) and United Nations Environment Programme, Apia and Nairobi, 72 pp

Conference Presentations

Carvalo PG, Januchowski-Hartley FA, Jupiter SD, White C (2014) Effectiveness of periodically harvested closures in meeting fisheries and cultural objectives. Western Society of Naturalists, Tacoma, USA, 13-16 November.

Dacks R, Ticktin T, Jupiter S (2014) Characterising market influences on fishing and implications for resilience in coral reef social-ecological systems in Fiji. 3rd Society for Conservation Biology Oceania section conference, Suva, Fiji, 9-11 July

Fox M, Sadovy Y, Batibasaga A (2014) Implications of export trade for Pacific inshore coastal resources: the case of Fiji. Society for Conservation Biology Oceania conference, Suva, Fiji, 9-11 July

Jenkins A (2014) Floods, faeces & fishes: Managing island watersheds for sustainability and public health outcomes. EcoHealth, Montreal, Canada, 11-15 August

Jupiter S (2014) Pacific Integrated Island Management – Principles, Case Studies and Lessons Learned. Colloque: Agriculture Durable au Service de la Population. Territorial Government of Wallis and Futuna, Uvea, November 25-28.

Jupiter S (2014) A new framework for monitoring socio-ecological vulnerability of tropical coastal communities. World Parks Congress, Sydney, Australia, 12-19 November.

Jupiter S, Jenkins A (2014) Investigating links between environmental change and waterborne bacterial disease in Fiji. World Parks Congress, Sydney, Australia, 12-19 November.

Jupiter S, Cohen P, Weeks R, Tawake A, Govan H (2014) Locally-managed marine areas in the tropical Pacific: diverse strategies to achieve multiple objectives. 3rd International Marine Conservation Congress, Glasgow, Scotland, 14-18 August

Jupiter S, Klein C, Possingham H (2014) Policy and practice of integrated land-sea planning in Fiji. 3rd Society for Conservation Biology Oceania section conference, Suva, Fiji, 9-11 July

Mangubhai S (2014) Adaptive conservation planning for marine ecosystems in Oceania. Association for Tropical Biology and Conservation, Cairns, Australia, 21-24 July.

Mangubhai S, Acton G, Fox Y, Nand Y, Jupiter S (2014) Incorporating socioeconomic criteria and data into conservation planning: examples from Melanesia. Society for Conservation Biology Oceania conference, Suva, Fiji, 9-11 July.

McDavid BM, Acton G (2014) Using social network analysis and network weaving to increase effectiveness of integrated coastal management in Bua Province, Fiji

Nand Y, Bythell J (2014) Distribution and prevalence of coral disease in Fiji. Society for Conservation Biology Oceania conference, Suva, Fiji, 9-11 July.

Ticktin T, Jupiter S, Dacks R, Burnett K, Friedlander A, McMillen H, Quazi S (2014) A ridge-to-reef approach to assessing the role of local ecological knowledge and management in enhancing adaptive capacity and resilience to climate change in Fiji. 3rd Society for Conservation Biology Oceania section conference, Suva, Fiji, 9-11 July

Other

Jupiter S (2014) "Stepping up conservation in Fiji – in stilettos" Op-Ed on LiveScience (<http://www.livescience.com/44064-women-in-fiji-conservation.html>)

Jupiter S (2014) "As island full of life", Denarau: The Denarau Island Magazine, 11: 67-69