



# Fisheries *Newsletter*

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## Editorial

The number of active tuna fisheries observers in the Pacific islands region has been well over 400 per year since 2010, and keeps increasing (see article on p. 3). This is a direct consequence of the Western and Central Pacific Fisheries Commission's Conservation and Management Measure 2008–01, which prescribes 100% observer coverage of purse-seine vessels operating in the region. For an outside viewer it seems that all that needs to be done to achieve this goal is to hire people with a basic knowledge of what a fish looks like and send them on fishing cruises to record what they see. Piece of cake, right?

Not surprisingly, reality is quite different. A basic knowledge of what a fish looks like is clearly not enough when you need to identify dozens of different species, some of them looking very similar, and a fishing cruise is often anything but a cruise: it can be several weeks long in harsh and uncomfortable conditions among crew members who are not necessarily happy to be observed and may not speak the same language as the observer. Furthermore, accurate data is the cornerstone of good fisheries management, so the quality of the data provided by these observers, who are totally independent from the fishing companies, is essential for verifying the quality and accuracy of the data provided by the companies themselves.

Select the right people, train them to become qualified observers, verify the quality of the data they have collected at sea, organise the work of observers at the national and regional level — for all of these activities there is a need for qualified people. And this scale of qualifications has drawn a new career path (Observer–Debriefing–Trainer–National/Regional Coordinator) for young Pacific Islanders — an opportunity several of them have already firmly seized.

*Aymeric Desurmont*

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Observer training session on a purse-seine vessel bridge in the Marshall Islands (image: Peter Sharples).



Secretariat of the  
Pacific Community

### Mike Batty takes up a new challenge at FFA

Mike Batty left SPC in December 2013 after five years as Director of SPC's Division of Fisheries, Aquaculture and Marine Ecosystems (FAME). This period saw continued expansion of the work of the fisheries programmes, as well as some changes recommended by an independent review in 2009. These changes included adding economics and export facilitation to the work of CFP; and a new emphasis on electronic reporting from fishing vessels in the work of OFF. Outside of work he is a keen angler, and could often be seen in the evenings fishing at Anse Vata from a kayak.

Mike was recruited to SPC from the Forum Fisheries Agency in Honiara, and now returns to FFA to take up the position of Director of Fisheries Development. For most of his career he has worked in the area of fisheries development, and has spent a number of years in Solomon Islands on different fisheries projects — both national and regional.

Coming from Penzance in the southwest of England, he has worked for much of his 35-year career in the Pacific Islands, starting as a fisheries adviser in Tuvalu in 1982 (where his former counterpart is now Minister of Fisheries). Outside the region, his assignments have included periods of employment in Sudan, Namibia and Tristan da Cunha in the South Atlantic, as well in Britain, where he worked as a commercial fisherman.

Mike will continue to engage with SPC, particularly in the development area, with the joint FFA/SPC DevFish 2 project. One of his first tasks is to develop a proposal for EU funding for a comprehensive fisheries programme involving both agencies, which will build on the good results of both the DevFish 2 and SciCOFish projects.



### Moses Amos, new Director of SPC's FAME Division



In March 2014, Moses Amos joined SPC as the new Director of the Division of Fisheries, Aquaculture and Marine Ecosystems. Moses is from Vanuatu and speaks fluent English, Bislama and Melanesian Pidgin, and is conversant in French. He has a Master of Science degree in Biological Science from the University of Auckland and a Bachelor's Degree in Zoology from Otago University, both in New Zealand.

Moses was the Director of Vanuatu's Department of Fisheries for 12 years from September 1997 to December 2006 and from September 2010 until February 2014. From January 2007 to March 2010 he was Director of Fisheries Management at the Pacific Islands Forum Fisheries Agency (FFA) in the Solomon Islands.

Moses has worked both regionally and nationally, and is quite familiar with the economic, political and cultural dynamics of the region, as well as regional and country-specific policies, infrastructure and programmes relating to fisheries. His strong background in the development and management of fisheries policies and their implementation — at both the national and regional level — and his familiarity with and understanding of key fisheries issues (particularly from the perspective of SPC's island members) is a welcome asset.

Moses' previous role as a member of FFA's management team will further strengthen the relationship between SPC and FFA in fisheries, which in turn will strengthen the collective effort of both organisations to serve their mutual membership better.



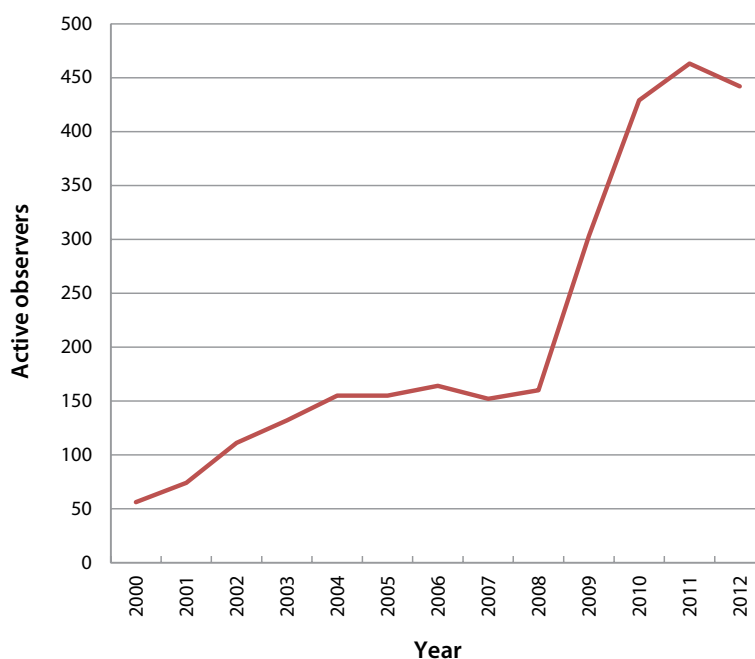
## Career paths for tuna fishery observers

*The chart below shows the number of observers that have provided data each year through the national and subregional tuna fishery observer programmes of Pacific Island countries and territories. Since 2010, in response to the Western and Central Pacific Fisheries Commission's Conservation and Management Measure 2008-01 — which prescribes 100% observer coverage of purse-seine vessels — the number of active observers has been well over 400 per year.*

An increase in active observers has not been the only effect of CMM 2008-01. With triple the number of active observers now, compared with the mid-2000s, there is also a need for more observer trainers who train observers before they become employed. Also needed are observer debriefers who debrief observers after each trip so that the quality of the data collected by the observer can be evaluated.

Who qualifies to become an observer debriefer or an observer trainer? As you might expect, debriefers must first be experienced observers, and trainers must first be experienced debriefers. This is now a potential career path that is available for anybody who is considering becoming an observer.

The prerequisites for becoming an observer, a debriefer or trainer are specified in the Pacific Islands Regional Observer (PIRFO) standards. PIRFO Certification and Training Standards are currently available at <http://www.spc.int/Oceanfish/en/certification-and-training-standards>.



*Number of observers that have provided data since 2000 through fishery observer programmes of Pacific Island countries and territories.*

### Becoming a PIRFO Observer

Let's start at the beginning. The minimum criteria to apply for PIRFO Observer basic training<sup>1</sup> are:

Education	Passed Higher Leaving Certificate or equivalent and able to carry out calculations on catch and other fisheries-related statistics.
Age	Minimum of 21 years old and mature enough to converse confidently with fishing vessel officers in difficult circumstances.
Health	Physically and mentally capable of carrying out observer duties, able to pass a seagoing medical clearance certificate issued by an authorised medical practitioner at any time, if required.
English	Able to engage in conversation in clear English.

**Writing** Can write comprehensive reports on activities aboard a vessel, in English.

**Conditions** Able to go to sea for long periods in foreign and (sometimes) unfriendly environments (sea time can be from 7 to 100 days but is generally from 30 to 60 days on purse-seine vessels and 10 to 30 days on longline vessels).

**Ethics** Has a clear police record with a history of strong socially acceptable ethical standards in the areas of honesty and public behaviour.

**Screening** Is available for a PIRFO pre-selection screening test.

Before being selected to attend the observer training course, a candidate must first pass a pre-selection test. The test typically includes 19 questions related to basic skills in writing, arithmetic, common sense, and observation skills, followed by a brief essay question to assess

<sup>1</sup> [http://www.spc.int/oceanfish/en/publications/doc\\_download/1202-minimum-criteria-to-apply-for-pirfo-observer-basic-training-vs1208.pdf](http://www.spc.int/oceanfish/en/publications/doc_download/1202-minimum-criteria-to-apply-for-pirfo-observer-basic-training-vs1208.pdf)

writing and communication skills. The candidate must achieve at least a 70% overall grade. Experience has shown that candidates that do not pass the pre-selection test rarely pass the observer training course, and because there are limited resources available for observer training, only strong candidates are selected.

Candidates who satisfy all the criteria, and pass the pre-selection test, undergo two or three weeks of basic training in general maritime safety and emergency response, and personal safety with regard to operational hazards onboard fishing vessels. This training includes both basic first aid and radio operations, both of which lead to certificates. If the basic training is successful, candidates are then able to attend the observer training course proper, which usually takes five weeks. Candidates become a certified PIRFO Observer if they can demonstrate proficiency in all the competencies listed in the PIRFO Observer standards. Because an observer works alone at sea, assessments during the training require a high level of performance and candidates are usually required to obtain a grade of at least 80% on each of the tests given.

### Becoming a PIRFO Debriefer

The criteria for becoming a debriefer are given in “The road to becoming a certified debriefer”.<sup>2</sup> To satisfy the prerequisites, a candidate must:

- be a fully certified PIRFO Observer in one or more of the following gear types: purse-seine, longline, pole-and-line;

- have a minimum sea-time experience of 150 days on a purse-seine vessel or 75 days on a longline vessel, or 40 days on a pole-and-line vessel;
- have collected near perfect data from a minimum of three observer trips on different vessels;
- provide a written recommendation from an Observer Coordinator or an Observer Manager (for which the observer has completed at least three trips on any gear type), stating that the observer has good communication skills, has the motivation to provide good and honest advice to colleagues, and is likely to continue with observer-related work; and
- be able to provide at least one other referee that will confirm that the applicant is of good character and has the communication skills and motivation to provide good and honest advice to their colleagues. This other referee could be an Observer Coordinator or Observer Manager from another programme (perhaps regional programme) with which the observer has worked, an observer trainer, some other senior fisheries staff member with which the observer has worked, or similar person.

Once observers have met the prerequisites and have been nominated by a national or regional observer programme manager or coordinator, they will begin a three-part Competency Based Training (CBT) programme that combines workshop training, on-the-job experience, and a final assessment.

Once all of the steps have been successfully completed, they are certified as a PIRFO Debriefer.



*Trainees learn how to measure fish (left), a skill they will often use if they become certified observers (right) (images: Peter Sharples).*

<sup>2</sup> [http://www.spc.int/oceanfish/en/publications/doc\\_download/1168-the-road-to-becoming-a-certified-debriefer.pdf](http://www.spc.int/oceanfish/en/publications/doc_download/1168-the-road-to-becoming-a-certified-debriefer.pdf)



*Sekonaia Balekana Naicovitabia (left), a Trainee Debriefing from Fiji, working with Harold Vilia (right), from the Solomon Islands, a very experienced Observer (and a Debriefing) just back from an 84-day fishing trip on a tuna longliner (image: Malo Hosken).*

### Becoming a PIRFO Trainer

The criteria for becoming a trainer are given in “The Road to Becoming a PIRFO Trainer and Assessor”.<sup>3</sup> To satisfy the prerequisites, the candidate must be:

- certified as a PIRFO Debriefing, and have debriefing experience;
- nominated by a recognised PIRFO observer programme; and
- approved by the PIRFO Certification Management Committee as a candidate in the PIRFO Trainer Development Programme (PTDP).

PTDP has two components:

1. Trainee Trainers attend six observer courses as attachments, with each course being about five weeks long. During the attachments, the trainee is progressively exposed to more involvement in observer training.
2. Following the attachments, the trainee is invited to participate in a recognised Train the Trainer workshop.

On satisfactory completion of the six attachments and the Train the Trainer workshop, a trainee is eligible for certification as a PIRFO Trainer. Attachments are only considered satisfactory if the supervising PIRFO Trainer at that training verifies that the candidate has

demonstrated the skills expected of them at that stage of the development programme.

Note, however, that a certified PIRFO Trainer is *not* eligible to supervise PIRFO Basic Training and so cannot deliver a training course alone, but must work under the guidance of a PIRFO Trainer and Assessor. Certified PIRFO Trainers who demonstrate that they have the aptitude, and who wish to upgrade their qualification, must undertake recognised certificate IV level vocational Train the Trainer and Assessor training. A PIRFO Trainer and Assessor can then be employed to oversee and coordinate the organisation and delivery of PIRFO Basic Training.

### Additional opportunities

The career path for observers outlined above may also lead to other opportunities. The national and sub-regional observer programmes employ managers, coordinators and other staff to run those programmes, positions for which senior observers, certified debriefings and observer trainers are well placed to apply. To further their career prospects as managers, they will soon have the opportunity to pursue the PIRFO Frontline Management Certificate, for which the standards are currently being developed.

<sup>3</sup> [http://www.spc.int/oceanfish/en/publications/doc\\_download/1167-the-road-to-becoming-a-pirfo-trainer-and-assessor](http://www.spc.int/oceanfish/en/publications/doc_download/1167-the-road-to-becoming-a-pirfo-trainer-and-assessor)



Observer trainers in a national programme may also have opportunities to conduct training courses in other countries and certified debriefers may be further qualified as Debriefers Assessors who are contracted to conduct on-the-job training of trainee debriefers. Working as an observer can, therefore, be a career in itself or it can be the first step in a career path. Many observers have used their observer experience to launch them into other fisheries-related work, such as fisheries compliance, and there are a growing number of senior fisheries staff and managers whose work as observers in the early parts of their careers has provided a valuable contribution to the knowledge and experience used in their work today.

### Stop Press!

On 7 May 2014, the Western and Central Pacific Fisheries Commission dispatched circular no. 2014/36, "Potential for the use of Port Coordinators in the WCPO". The Port Coordinators, which the Commission proposes to establish on a trial basis for two years in five ports — Pohnpei, Majuro, Tarawa or Christmas Island, Rabaul and Honiara — would have data-related responsibilities

concerning logsheets, unloadings forms, tag returns and rewards, biological sampling, monitoring of bycatch species, e-reporting, as well as "the placement and debriefing of observers with the national programmes and improving the timeliness and quality of the observer data provided to the WCPFC and SPC". Port Coordinators will be employed on local salaries, but with observer experience at the debriefer level.

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### 2013 PIRFO Trainers' Workshop

22<sup>nd</sup> July - 02<sup>nd</sup> August 2013, Noumea, New Caledonia

Regular workshops are organised for PIRFO Observer Trainers to ensure that observers operating under the PIRFO umbrella across the western and central Pacific Ocean receive consistent training. Trainers meet to share their experiences, be introduced to new tasks expected of observers, enhance their training skills, and help develop new and improved PIRFO training tools (image: Jipé Le-Bars).

## Introducing an online sea cucumber fishery management system in French Polynesia

*Sea cucumbers are a highly sought-after commodity on the Asian market and their value makes them an attractive resource in small Pacific Island communities where income-earning possibilities are limited. However, the fragile nature of this resource combined with intensive, often uncontrolled harvesting has led to increasing scarcity in stocks and fishing bans that last several years.*

In order to better manage sea cucumber resources, French Polynesia's Department of Marine and Mining Resources (DRMM) has implemented harvest quotas by species and fishing zone (lagoon or part of the lagoon), local monitoring by management committees, and a traceability system that follows the resource from harvest (fishing) to export.

During the first quarter of 2014, SPC's Coastal Fisheries Programme helped DRMM create an online database to record data gathered on logsheets, interisland shipping forms and export requests. This system makes it possible to monitor, on a daily basis, the percentage of the quota that has already been used and to limit fraud by comparing and validating data. Setting up a web-based solution allows exporters to submit their requests online and monitor, in real time, the situation with regards to the remaining fishing quotas by species in the various islands where fishing is allowed.

Problems in monitoring and controlling the harvest of this resource arise from the fact that data are not submitted at the same time or in chronological order (generally logsheets are only received well after sea cucumbers are shipped). In addition, once sea cucumbers have been processed (dried), they can be stored and then shipped at a later date, even during a limited time after the end of the fishery opening.

So the part of the quota that has already been used is estimated from both fisheries data and information provided on interisland shipping forms, which must be submitted to DRMM along with export requests, at the very least. This procedure provides data on the resource's harvest status for each export, and makes it possible to decide whether to ban fishing for a certain species or in a certain fishing zone, when needed.

The system is currently being tested during an open harvest period for five sea cucumber species in 10 atolls in the Tuamotu Islands, which have been divided into five sea cucumber management committees. If the system proves to be successful at the end of this first fishery opening, the plan is for SPC to extend the system to other interested countries to allow them to better manage their exported marine resources and improve their traceability.

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Ile	Espèce	Nombre requis <sup>(1)</sup>	Nombre retraits <sup>(2)</sup>	Nombre exportés <sup>(2)</sup>	Nombre stock <sup>(2)</sup>	Poids net requis <sup>(1)</sup>	Poids net retraits <sup>(1)</sup>	Poids net exportés <sup>(2)</sup>	Poids net stock <sup>(2)</sup>
Motu tapu	RTD	12	0	0	4	3.0	0.0	4.0 à 6.0	-1.0 à -5.0
Motu tapu	RTN	0	0	0	-15	2.0	0.0	5.0 à 12.0	-3.0 à -13.0
Motu tapu	RA	0	0	15	-15	0.0	0.0	4.0 à 9.0	-4.0 à -9.0
Motu tapu	RFI	4.0 à 9.0	0	45	-41.0 à -39.0	0.4	0.0	3.0 à 4.0	-3.0 à -4.0
	<b>Total</b>	<b>21.0 à 23.0</b>	<b>0</b>	<b>74</b>	<b>-53.0 à -51.0</b>	<b>5.4</b>	<b>0.0</b>	<b>16.0 à 34.0</b>	<b>-11.0 à -29.0</b>

■ Valeur rapportée   
 ■ Valeur estimée   
 ■ Valeur rapportée négative   
 ■ Valeur estimée négative

<sup>(1)</sup> Les quantités requises et retraits proviennent des déclarations d'expédition.  
<sup>(2)</sup> Les quantités exportées proviennent des certificats d'exportation dont l'avis a été donné et est favorable.  
<sup>(3)</sup> Le stock est quantifié requête moins les retraits et les exports.

Direction des ressources marines et minières - Tél (687) 50 25 60 - Email: drm@drm.gov.pf  
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One page of the sea cucumber fishery database web-based interface (name and figures are not real).



## A long-term fisheries training programme for the Pacific

*PFTP is an acronym that the fisheries sector in the Pacific Islands region will become more familiar with over the next four years. It stands for Pacific Fisheries Training Programme and is NZAID's latest package of fisheries training assistance to the region. The programme began in April 2013 and will conclude in March 2018. PFTP will be jointly implemented by the Pacific Islands Forum Fisheries Agency (FFA) and SPC, with each organisation implementing specific components of the programme.*

The goal of PFTP is to increase sustainable economic development through a greater contribution from the seafood sector, and the intended outcomes to be achieved are that Pacific Island men and women will be well qualified for work in the seafood sector, and that the competency of Pacific Island fisheries public sector officials to sustainably manage fisheries will be increased.

The seven training components (and the organisation responsible) under PFTP are:

1. Development of regional standards and training for Pacific Island regional fisheries observers (FFA).
2. Training in seafood market development (FFA).
3. Training in fisheries policy, investment appraisal and international seafood commerce (FFA).
4. Training in small vessel operations (SPC).
5. Training in seafood safety and tuna handling (SPC).
6. Practical training for fisheries extension officers (SPC).
7. Training in seafood sector business management for small and medium sized operators (SPC).

SPC is in charge of training components that its Nearshore Fisheries Development Section is already experienced in delivering to its members.

The programme requires both SPC and FFA to provide training to different countries each year under each of the seven components. For SPC, this means delivering in-country training in seafood safety and tuna handling (Kiribati covered in year 1), business management (Tuvalu in year 1) and small vessel operations (Kiribati in year 1). The practical training for fisheries extension officers is a regional training activity that members are well familiar with — the annual “SPC practical safety, fishing and financial management course” for fisheries officers that SPC and the Vanuatu Maritime College in Santo run annually.

### Completed training activities in Kiribati, Tuvalu and Vanuatu

The first year of project activities went smoothly with some relevant and useful training sessions delivered. At the same time that FFA has been working to develop new course curricula for its components, SPC has been fine-tuning existing training programmes and has begun to deliver training workshops.

Five seafood safety and tuna handling workshops (each two-days long) were conducted in Tarawa between 23 October and 2 November 2013 by SPC and the PNG National Fisheries College. In total, 88 people — including 75 fishers, 9 trainers and 4 fish processors — were



*Basic fire fighting is one of the training modules delivered during the SPC Practical Safety, Fishing and Financial Management Course for Fisheries Officers, Santo, Vanuatu, 2013 (images: William Sokimi, SPC).*



The NZAID-funded Pacific Fisheries Training Programme is monitored by a Project Steering Committee (PSC) that meets annually to review past activities under the programme and endorse FFA and SPC's annual work plans and budgets.

At its second annual meeting in Honiara in March 2014, PSC considered and approved SPC's planned activities under each of its four training components for the second year of the Programme (April 2014 to March 2015).

*SPC will facilitate the following training in 2014 and 2015:*

**Item 4:** Training in small vessels operations will be conducted in Funafuti, Tuvalu, during the first quarter of 2015. It is envisaged that instructors from the Kiribati Fisheries Training Center will introduce the BSSF course curriculum in Tuvalu jointly delivering the training with instructors of the Tuvalu Maritime Training Institute (TMTI);

**Item 6:** Practical training for fisheries extension officers will be conducted at the Vanuatu Maritime College in October 2014. The course announcement will be circulated in June and the top performing participants at the Fisheries Officers course currently being delivered in Nelson will be offered a seat on the SPC/VMC course. The participation of female Fisheries Officers will be actively encouraged.

**Item 7:** Training in seafood sector business management will be delivered by SPC staff in Rarotonga, Cook Islands, in June 2014. The course will target women involved in small and medium scale fishing or aquaculture operations in Rarotonga, Aitutaki and Manihiki. The training is being facilitated by the Ministry of Marine Resources and the Business Trade and Investment Board.

**Item 5:** The recipient country for training in seafood safety and tuna handling has not yet been identified so countries wishing to receive this training should contact SPC urgently. The training will consist of a series of short workshops enabling the participation of as many fishers as required. It is specifically targeting urban centers where local commercial tuna fishers have the opportunity to sell their catch to a large fish processor for exports. The training aims at improving tuna quality so that the catch of local fishers meets export standards for international markets.

taught seafood safety and tuna handling standards, as well as best practices to implement and maintain those standards. With the available training budget, SPC was in a position to subsidise insulated fish bags to make them more affordable to local fishers. As a result of the training and the use of fish bags, Betio-based tuna processor and exporter, Kiribati Fish Limited, has reported a sharp increase in the quality of tuna being supplied by local fishermen. A more detailed account of this training can be found in an article published in *Fisheries Newsletter* #142.

The first business management course for small and medium sized operators was delivered in Tuvalu from 29 January to 7 February 2014. Its objectives were threefold: increasing capacity in business, marketing and finance; writing business plans; and implementing business (financial and fishing data) record keeping. The training targeted private fishing businesses in Funafuti; 14 participants (including 12 women) were selected on the basis of their financial management role in their business. One important outcome of the training was that participants were able to write their own business plan and it is hoped that with improved financial record keeping and literacy resulting from the training, fishing business managers will maximise profits and will more easily access finance to upgrade or diversify their fishing business.

Two, two-week-long small vessel operation courses were conducted in Maiana and Abaiang atolls in Kiribati in March and April 2014. The courses were successfully

delivered by instructors of the Kiribati Fisheries Training Centre (KFTC) who taught their country fellow countrymen the existing Basic Sea Safety and Fishing (BSSF) course curriculum. While several of the BSSF courses had been conducted in Tarawa, this was the first time that KFTC had the financial resources to export their training to Kiribati's outer islands. The training budget enabled SPC to provide the local trainers and their trainees with some safety grab bags that were left on the islands after the training.

The practical training for fisheries officers took place in Santo, Vanuatu from 30 September to 25 October 2013, and was conducted by SPC and the Vanuatu Maritime College. As usual with this training, the course programme consisted in a mix of theoretical and practical subjects in safety at sea (one week), vessel and fishing operations and FAD rigging and deployment (two weeks) and financial and business management (one week). The course was attended by 12 fisheries officers from 8 countries.

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## New training video on sport fishing and catch handling

*Thrill seekers, especially those interested in sport fishing, will enjoy this new training video that was produced by SPC's Nearshore Fisheries Development Section. Filmed and produced in New Caledonia with funding assistance from the New Zealand Aid Programme, this 17-minute-long video uses beautiful images and scenery to provide information on safe fishing and best catch-and-release practises.*

The video is designed to be of interest to a wide audience, including recreational fishers but also apprentice and experienced guides who are involved in sport fishing-based tourism. It complements the "Handling guidelines for sportfish – part two: Giant trevally and other large fish" that SPC produced in plastic card form in 2013.<sup>1</sup>

While catch-and-release sport fishing is increasingly considered to be a suitable income-earning alternative to commercial fishing, it is important to ensure that the fish caught and released are given the best chance of survival. SPC intends to produce a second video to illustrate the handling procedures for bonefish, another

important recreational species in the Pacific, with established sport fisheries and experienced local guides in Kiribati and Nonouti Islands (Kiribati), Aitutaki (Cook Island) and Poingam (New Caledonia).<sup>2</sup>

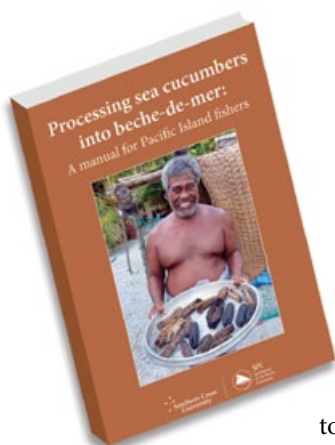


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## Processing sea cucumbers into beche-de-mer: A manual for Pacific Island fishers

*This manual, written by Steve Purcell and illustrated by Jipé Le-Bars, is designed for sea cucumber fishers in the Pacific Islands region. It has been produced by Southern Cross University and SPC with financial support from the Australian Centre for International Agricultural Research.*



"Processing" is used in this manual to mean all of the steps to transform the fresh sea cucumbers into the dried form called "beche-de-mer".

Processing includes cutting, salting, cooking, smoking and drying sea cucumbers.

The price given to fishers for dried sea cucumbers depends on the species they are selling, how big the individuals are, and how well they have been processed. This is because Asian consumers want to buy products that look nice, have an attractive appearance, and taste good when cooked. Therefore, prices in Asian markets are high for well processed sea cucumbers and much lower for ones that are poorly processed.

Many fishers are not aware of the best methods for processing sea cucumbers into beche-de-mer. As a result, they may get lower prices from buyers.

There are many different ways that sea cucumbers can be processed to obtain a good quality. This manual provides best practice methods that can be applied by fishers using resources in their own villages. The manual has been produced in English<sup>3</sup>, Fijian<sup>4</sup>, Kiribati<sup>5</sup> and Tongan<sup>6</sup> languages.

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<sup>1</sup> [http://www.spc.int/DigitalLibrary/Doc/FAME/Brochures/Anon\\_10\\_GiantTrevally.pdf](http://www.spc.int/DigitalLibrary/Doc/FAME/Brochures/Anon_10_GiantTrevally.pdf)

<sup>2</sup> See Carl McNeil's article on page 39 of this issue of the Fisheries Newsletter.

<sup>3</sup> [http://www.spc.int/DigitalLibrary/Doc/FAME/Manuals/Purcell\\_14\\_Sea\\_cucumber\\_processing.pdf](http://www.spc.int/DigitalLibrary/Doc/FAME/Manuals/Purcell_14_Sea_cucumber_processing.pdf)

<sup>4</sup> [http://www.spc.int/DigitalLibrary/Doc/FAME/Manuals/Purcell\\_14\\_Sea\\_cucumber\\_processing\\_Fiji.pdf](http://www.spc.int/DigitalLibrary/Doc/FAME/Manuals/Purcell_14_Sea_cucumber_processing_Fiji.pdf)

<sup>5</sup> [http://www.spc.int/DigitalLibrary/Doc/FAME/Manuals/Purcell\\_14\\_Sea\\_cucumber\\_processing\\_Kiribati.pdf](http://www.spc.int/DigitalLibrary/Doc/FAME/Manuals/Purcell_14_Sea_cucumber_processing_Kiribati.pdf)

<sup>6</sup> [http://www.spc.int/DigitalLibrary/Doc/FAME/Manuals/Purcell\\_14\\_Sea\\_cucumber\\_processing\\_Tonga.pdf](http://www.spc.int/DigitalLibrary/Doc/FAME/Manuals/Purcell_14_Sea_cucumber_processing_Tonga.pdf)



### The newly established Samoan multispecies hatchery is fully operational

*Samoa's aquaculture sector has been growing significantly in the past few years. To date, Samoa's fish farming sector has mostly focused on Nile tilapia farming, but local communities and independent farmers are now looking into different species, such as sea grapes (Caulerpa racemosa), giant clams, trochus and mullets. As a response to these national needs, the Fisheries Division of Samoa's Ministry of Agriculture and Fisheries decided to set up a new "marine multispecies aquaculture facility" in Toloa (around 10 km from Apia, the capital) because the only aquaculture facility that was currently operational in the country was relatively small and could only be used for freshwater species.*

Construction and equipment costs have been co-funded by the Samoan and Japanese governments. SPC's Aquaculture Section provided assistance in 2012 with finalising the design and technical specifications of the multispecies facility, and involving all relevant stakeholders.

In 2013, the Aquaculture Division of Samoa's Ministry of Agriculture and Fisheries took an active role in accomplishing the land acquisition, awarding the contractor to start construction, and signing all necessary documents to comply with Samoan government regulations.

As a result of these collaborative efforts, the hatchery construction was completed in January 2014 and the facility is now fully operational. The first spawning trials with several species of giant clams have been conducted and hatchery technicians have been trained in basic farming techniques.

The official opening of the hatchery took place on 21 February 2014, and was attended by relevant stakeholders and local communities that are involved in fish farming. The establishment of this facility is an important milestone for the future development of Samoa's aquaculture sector.



*The new hatchery in Toloa, Samoa has a sea view that many five-star hotels would envy! (images: Tim Pickering, SPC).*



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*Caulerpa racemosa (sea grapes) farming trials being conducted in some of the raceways (image: Tim Pickering, SPC).*

## Low-cost freshwater prawn aquaculture trial in Samoa

*Tim Pickering, SPC Inland Aquaculture Specialist*

*The indigenous freshwater prawn *ula vai* (*Macrobrachium* lar) is currently being farmed in Samoa on a pilot scale. This is an outcome of an SPC-funded training workshop in 2013 run by Glen Alo, who is an aquaculture staff member of the Vanuatu Fisheries Department. Glen has run similar trials in South Santo in conjunction with SPC and the Australian Center for International Agriculture Research.*

*Ula vai* was identified in Samoa's Aquaculture Management and Development Plan for 2012 as a potential species for aquaculture. Advantages of rearing *ula vai* include local markets where it can be sold, its high value, much traditional knowledge about its ecology and behaviour, its low place on the food chain, and the fact it is indigenous to Samoa. Disadvantages of rearing *ula vai* include a lack of technical knowledge, the need for special ponds with plastic sheet fences (otherwise the prawns climb out), and the scale of farming limited by the availability of captured juveniles.

In order to help overcome these disadvantages, SPC asked the Vanuatu government whether Glen Alo would be able to visit his Samoa Fisheries Department counterparts for a week. Under his guidance, a special pond was surveyed and constructed at the Lotofaga tilapia demonstration farm at Safata on Upolu Island. Alo demonstrated how to stock ponds with very small prawns that are captured from nearby streams.

These prawns are now well on their way to being a harvestable size. When staff from SPC's Aquaculture Section visited in April 2014, one pound of the largest

prawns had already been sold, at a price of WST 10/lb (equal to about USD 8.60/kg). This sale qualifies Samoa to be the second country in the world (after Vanuatu) to report to the Food and Agriculture Organization of the United Nations that there is commercial aquaculture production of *Macrobrachium* lar!

The pond is 6 m x 6 m in size and has clean clear, fast-flowing water piped in by gravity flow from the same stream where the juvenile prawns were captured. The prawns are being fed on a combination of tilapia pellets, grated coconut, papaya, cabbage (*pele*) leaf, and sweet potato (*umala*). When asked, "Does the farming of *ula vai* pose any problems?", the farm's owners Fa'aliga Lau Pepese and her son Viliamu answered, "Not really".

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*The special pond built for *Macrobrachium* lar capture-based aquaculture in Samoa, and the team behind its construction and operation. Front row (from left to right), Ferila Samuelu, Fa'aliga Lau Pepese, Sapeti Tiitii, Sesilia Luamanuvae. Back row, Unity Roebeck, Pati Fatutolo Lene, Mr Tuna, Viliamu Lau Pepesi.*



## Vanuatu Fisheries Department opens freshwater aquaculture centre



Hideaki Kuroki and Sompert Rena discuss larvae density (image: Tim Pickering, SPC)

*The Tagabe Fisheries Freshwater Aquaculture Centre was officially opened in February this year by Hideaki Kuroki, Second Secretary of Embassy of Japan in Fiji. The centre, which was created by remodelling an existing building and turning it into a prawn and tilapia hatchery, was built with funding from the Grassroots Human Security project of Japan.*

Designed and supervised by the department's Principal Fisheries Biologist, Sompert Rena, the hatchery provides Vanuatu with national capacity to hold broodstock for spawning and to rear tilapia fish and freshwater prawns for distribution to pond farmers.



Macrobrachium lar broodstock kept in a cement tank for spawning (image : Tim Pickering, SPC)

The aquaculture centre is near the international airport in Port Vila, and is supplied by a borehole water source from underground. Earthen ponds hold broodstock fish and prawns, and cement tanks are available for spawning and for nursery of fry. The hatchery building contains cement tanks with water heaters for growing prawns through their larval phases until ready for pond stocking.

The aquaculture centre represents a major leap forward in the Vanuatu government's capacity to provide services in support of a newly emerging fresh water aquaculture sector in the country, and is the fulfilment of a long-cherished dream for the Fisheries Department staff who will operate the centre.

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## Coral fish biodiversity loss: Humankind could be responsible

Source: Press release from the French Institut de recherche pour le développement (IRD) – 21 February 2014

*An international study, conducted by researchers from IRD's Indo-Pacific Coral Ecosystem Biocomplexity Laboratory and the CNRS/Ifremer/IRD/Montpellier Universities 1 and 2 Coastal Marine System Ecology Laboratory in partnership with the Australian Centre of Excellence for Coral Reef Studies and the Secretariat of the Pacific Community in Noumea, New Caledonia has for the first time revealed the effects of human activity on all facets of South Pacific coral reef fish community diversity. Scientists have shown that human population density has a more marked impact on the phylogenetic and functional diversity of species than it does on species richness. As well as causing species loss, man has thus considerably reduced the diversity of functions performed by fish communities and diminished the wealth of their evolutionary history. The results, emphasising man's impact on the tree of life, have been published in the 20 February 2014 edition of Current Biology.*

### Endangered ecosystems

Literal biodiversity reservoirs, coral reefs and associated ecosystems are in grave danger from natural and man-made disturbances. The latest World Resources Institute assessment is alarming with 75% of coral reefs reported as endangered worldwide, a figure that may reach 100% by 2050. The numbers are concerning, particularly as coral reefs provide sustenance and economic benefits for many developing countries and fish biodiversity on coral reefs partly determines the biomass available for human consumption.

### A multi-faceted biodiversity

While phylogenetic diversity in communities is acknowledged for its vital heritage value, illustrating, as it does, a "part" of the tree of life, ecosystem functional diversity has long been overlooked in impact studies. An ecosystem's richness is also measured both in taxonomic biodiversity terms (number of different species) as well as by the number of lineages or functions performed by many ecosystem goods and services.<sup>2</sup>

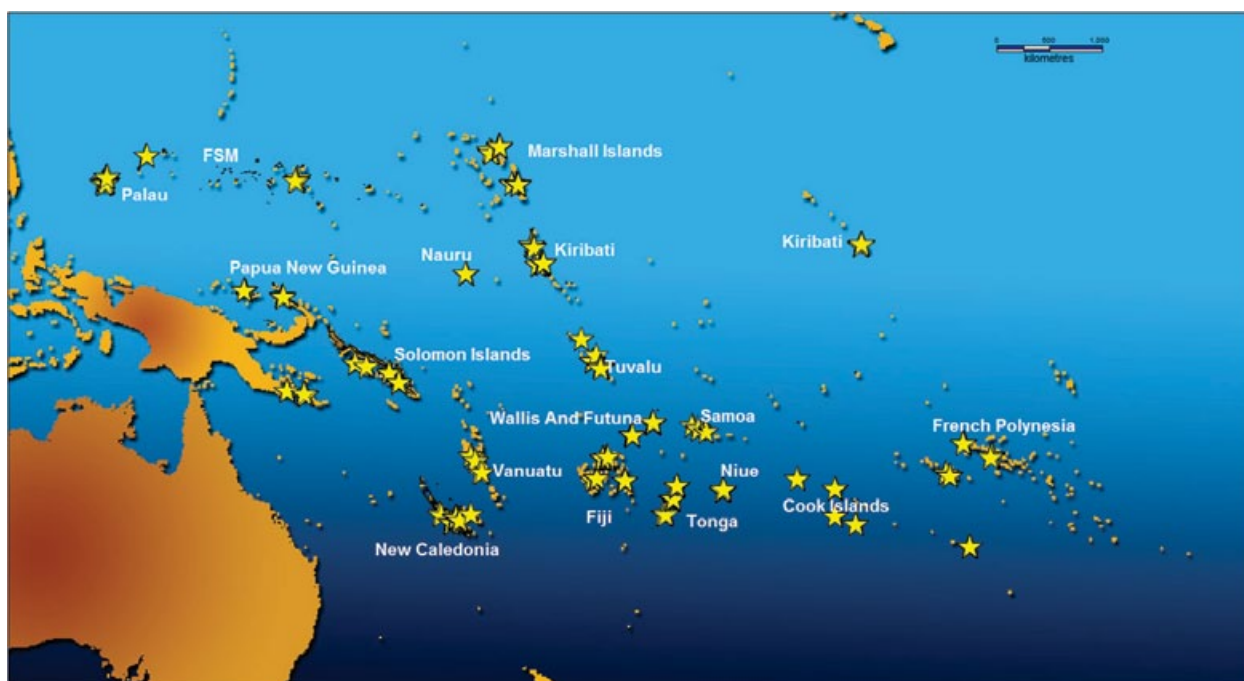


Figure 1. Locations of available data in the PROCFish and CoFish projects. © IRD/ L. Vigliola.

<sup>1</sup> D'agata S., Mouillot D., Kulbicki M., Andrefouët S., Bellwood D.R., Cinner J.E., Cowman P., Kronen M., Pinca S., Vigliola L. 2014. Human-mediated loss of phylogenetic and functional diversity in coral reef fishes. *Current Biology*, 2014. <http://dx.doi.org/10.1016/j.cub.2014.01.049>.

<sup>2</sup> Some reef fish species play key roles in ecosystem functions: regulating competition between algae and coral colonies; and creating areas that are conducive to recruiting coral larvae by bio-erosion, etc.



There have not as yet been any studies into the impact of human activity on coral fish community taxonomic, functional and phylogenetic taxonomic diversity loss.

## Functional and phylogenetic diversity loss revealed

After sampling 1,553 fish communities through underwater surveys in 17 Pacific countries (see Fig. 1), researchers assessed the taxonomic, functional and phylogenetic diversity levels of a group of species fished along a human density gradient ranging from 1.3 to 1,705 people per square kilometre of reef.

### Definitions:

**Phylogenetic diversity:**  
range of genes and lineages among species.

**Functional diversity:**  
value and range of functions performed by species.

The social and environmental data were collected under the PROCFish and CoFish projects co-ordinated by the Secretariat of the Pacific Community and funded by the European Union.

The results showed a sharp drop in functional and phylogenetic diversity levels, particularly above 20 people per square kilometre of reef, while species richness was barely affected along the gradient (Fig. 2).

When human population density reached 1,700 people per square kilometre of reef, the impact on functional and phylogenetic diversity levels (-46% and -36%, respectively) was greater than on species richness (-12%).

## A tree of life that needs protecting

The research shows that species numbers are a poor indicator of anthropogenic pressure, while two other biodiversity components are far more heavily affected by human density. These components make up the tree of life (i.e. the diversity of biological traits and phylogenetic lineages that are essential for coral systems to function).

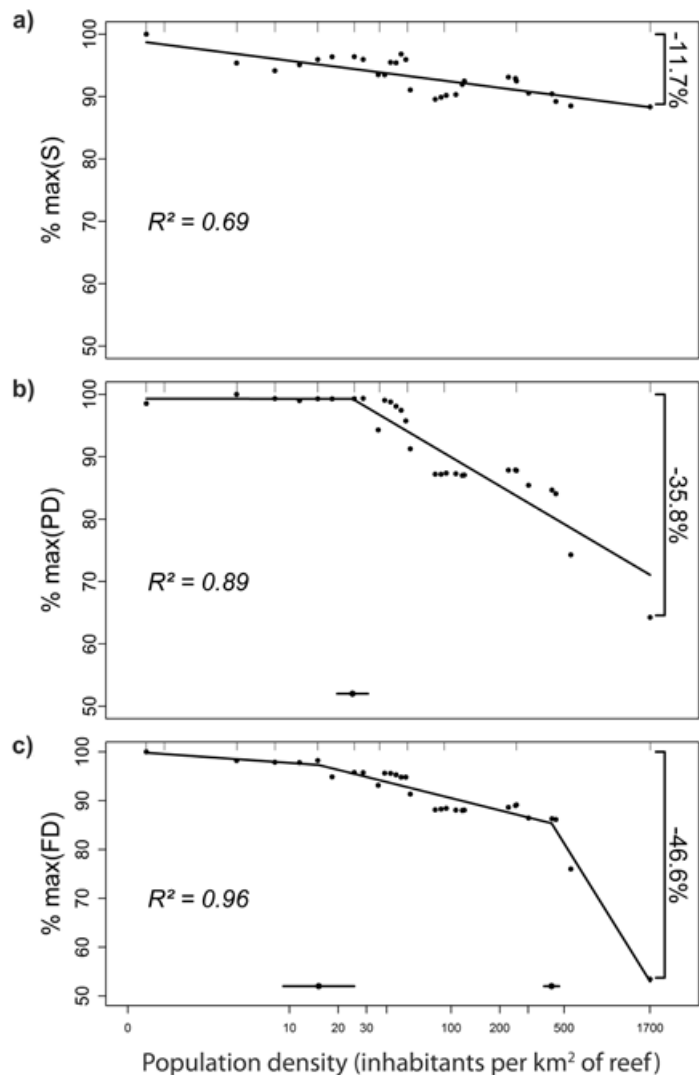


Figure 2. Effect of human density on three coral fish biodiversity components: species numbers (top), phylogenetic diversity (middle), functional diversity (bottom). © D'agata et al.

The researchers emphasised how important it was to conserve all the components of biodiversity. They also recommended using trait and lineage diversity as reliable and sensitive indicators of damage to species communities.

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## Combining natural history collections with fisher knowledge for community-based conservation in Fiji

*A team of researchers from Columbia University (USA) and Fiji has found a unique and time-effective way to improve the design of marine protected areas for coastal fisheries in Fiji and, potentially, around the world. This method, which was used to assess a proposed temporary fishery closure in the village of Nagigi, Fiji, is described in a study published in the open-access journal PLOS ONE<sup>1</sup> by Abigail Golden and colleagues from Columbia University, the Wildlife Conservation Society, and the University of the South Pacific.*

The researchers chose Nagigi Village because residents there had already made a proposal to set aside part of their fishery as a temporary marine protected area, or *tabu*, that could last anywhere from a year to ten years. Though the village's elected headman had already proposed a specific part of the reef to be part of the *tabu* area, that did not mean the project could not use some expert, targeted advice.

To figure out which species were most at risk of over-fishing and, therefore, should be a conservation priority in the *tabu* project, the researchers took a two-pronged approach to determine the reef's species composition: while collecting fish for a museum collection (destructive sampling) using scuba gear, they also interviewed local fishermen to find out what species they targeted. With this information, they could make recommendations about the size, duration, and location of the protected area based on at-risk species' life history and habitat use.

"The beauty of this technique is that the two methods we used — the sampling and the interviews — gave us very different results," Golden said. "If we'd only used one of these methods, we would have gotten half the picture."



*Nagigi's proposed marine protected area covers one square kilometre of reef flat and seagrass meadow directly in front of the village. Black dashed lines indicate fringing reefs, while the red dotted line indicates the marine protected area site proposed by the village's turaga ni koro (elected village headman).*



*A fisher and study participant holds bait for a Lethrinus harak fishing expedition. Populations of L. harak, or kabatia in Fijian, are declining in Nagigi (image: Abigail Golden).*

This combination of destructive sampling with fisher interviews can potentially be adapted to help develop protected areas for other small-scale fisheries around the world. The two methods combined may allow researchers to make recommendations about conservation projects much more quickly than either technique used alone, and make sure that the expertise of subsistence fishermen — who often possess rich, if undervalued, knowledge about their local ecosystems — is not neglected.

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<sup>1</sup> <http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0098036>



## The influence of processing techniques on the quality and nutritional composition of tropical sea cucumbers

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*Sea cucumbers in the Pacific Islands region are processed according to methods outlined by Chinese processors some two centuries ago. Sea cucumber tissue is composed of high quality nutrients that help maintain the well-being of human consumers. Processing sea cucumbers through a subsequent boiling and drying process, however, leads to the loss of vital nutrients such as omega-3 fatty acids and proteins. The current study is in progress at James Cook University in Townsville, Australia, and is investigating nutrient loss from sea cucumbers through various processing techniques used in the Pacific Islands region. The main outcome from this study is the development of a novel technique aimed at reducing nutrient loss during the processing stage, and increasing the income for Pacific Island communities.*

### Introduction

Holothurians (sea cucumbers) have been harvested for over two centuries and at least 58 species are currently harvested and traded around the world. Sea cucumbers are generally gutted, boiled (several times) and dried, and the final dried product is known as beche-de-mer. The current market mainly targets species from the genus *Holothuria* but also trades in species belonging to the genera *Actinopyga*, *Bohadschia*, *Stichopus* and *Thelephora*. *Holothuria* species such as *H. scabra*, *H. fuscogilva* and *H. whitmaei* are among the most highly valued tropical species on the Asian markets.

According to the available scientific literature, sea cucumber tissue is rich in protein (43%) but low in fat (2%). The edible tissue of sea cucumbers also serves as a tonic and traditional remedy for hypertension, asthma, rheumatism, cuts and burns, impotence and constipation. Sea cucumbers are also known for their unique biological and pharmacological activities such as their antiangiogenic, anticancer, anticoagulant, antihypertension, anti-inflammatory, antimicrobial, antioxidant, antithrombotic, antitumor and wound healing properties. In addition, sea cucumbers are well supplied with amino acids, collagen and fatty acids.

Some research has investigated the relationship between varying sea cucumber processing techniques and the chemical composition of the end-product, beche-de-mer. It is likely that the nutrient content of beche-de-mer is significantly affected by processing. Current processing techniques (cooking and drying), which have been used in the Pacific Islands since the 1800s, have been studied at the University of the South Pacific.

The results show that poor processing techniques lead to heavy losses in revenue, as could be expected with the trading of poor-quality products to Asian markets. The effects of improved and/or new processing methods on the physical characteristics, nutrient content and marketability of beche-de-mer have yet to be determined. This aspect provides a basis for this study, which investigates the impacts of processing techniques on the quality and nutritional composition of *Holothuria scabra* (sandfish). *H. scabra* was chosen for this study because it is the most valued tropical holothurian species, and can easily be handled in ponds for mass production.

### Research purpose

The traditional sea cucumber processing technique (which mostly involves gutting, boiling and drying) has been used in the Pacific Islands region since the 1800s with little to no innovations. It is still considered to be the best possible method for processing and preserving sea cucumbers. With this method, however, processors are unaware of the losses of essential nutrients such as important collagen, lipids and proteins due to the multiple times the sea cucumbers are boiled and dried. Therefore, the purpose of the current project is to determine a good quality yield when processing tropical sea cucumbers using the traditional drying and salting technique, and compare it with the one obtained when using newer techniques that are designed as a part of the current project. The essential nutrients within the processed sea cucumbers will also be analysed for all processing techniques used in the present study. It is hoped that the study will help elaborate a new technique that would suit the modern market and make a product that is marketable globally.

### Materials and methods

The study, which is being conducted at James Cook University in Townsville Australia, and will run from 2013–2017. It is funded by the Australian Centre for International Agricultural Research (ACIAR) project (FIS/2010/096), “Evaluating the impacts of improving postharvest processing of sea cucumbers in the western Pacific region”, which is administered by Southern Cross University, with James Cook University being a major research partner. This ACIAR project is aimed at raising awareness about the importance of sea cucumber processing for village communities that are dependent on this resource for income. The targeted research species, *H. scabra*, will be sourced from Fijian waters where it can be easily harvested or purchased from fishers and processed at the University of the South Pacific in Fiji. The target species will be subject to different treatments during processing, using modified processing conditions and flavourings together with the preservatives and packaged using a number of advanced packaging techniques. The newly developed sea cucumber processing method will enable beche-de-mer to have a longer shelf life, and better texture and taste.

### Expected outcomes and significance of the present study

The results from this study will provide an understanding of processing techniques that could be used to preserve the nutrient content of sea cucumbers and produce a better quality yield. These techniques could potentially eliminate the drying process because the new generations of Asian consumers are more inclined to use “ready-to-eat” sea cucumber products than going through the time-consuming rehydrating, preparing and cooking process. Successfully applying the newly developed processing method could lead to the development of new products and new markets for beche-de-mer. The introduction of novel techniques could also enable value adding to low-value species, thus providing better revenue for fishers in the Pacific. As an example, a processor in Tonga has increased the return value of *Holothuria atra* (lollyfish) by selling fresh vacuum-packed products, whole or shredded (see Fig. 1).

It is also hoped that the outcome of this study will create opportunities to increase food safety when processing sea cucumbers.



Figure 1. Frozen whole (left) and shredded (right) lollyfish (*Holothuria atra*).



## Rakahanga fishery officer shares skills with students

*Students in Rakahanga, Cook Islands, are taking part in fishery training as part of their Life Skills programme, with assistance from the Ministry of Marine Resources (MMR).*

Rakahanga fishery officer Tuteru Taripo is running weekly trainings that cover a range of fisheries skills for a dozen senior students from Rakahanga School aged 11–18.

In February of this year, students gained skills in tuna filleting, net mending and knot tying as part of their classes with Taripo.

Safety at sea and how to use a VHS radio are included in the skills that Taripo teaches students. “It’s the first time I’ve done this kind of training with the students and I want to extend this to the wider community in future,” he says.

Rakahanga School Principal, Bazza Ross, says that he has been impressed by the outcome of the training so far — with students now receiving requests from the community and from fishermen in Manihiki to help with net mending.

“Most of the families here rely quite heavily on nets for fishing in the lagoon. Some skills appear to have been lost over time, and the students are now being asked to help mend nets.”

Ross says the Life Skills programme includes learning using traditional and local techniques and resources. “We’ve focused our attention around marine resources because of our aquatic environment. Not all students have access to fishing skills like those that live with grandparents that don’t fish anymore. This is giving them skills they can use now and in the future,” says Ross.

He says Taripo has been a great tutor and very patient with the students.



*Rakahanga students have been learning a range of skills, including tuna filleting.*



*MMR fishery officer Tuteru Taripo teaching a senior student the art of net mending.*

The classes are benefiting the students in other ways too — some are already taking the net mending and knot tying skills and using them in craft making. Ross says they are planning to take up macramé — a form of textile art that involves knotting — to add to their craftwork.

Dried fish production is also something the students want to learn more about to contribute to this practice on the island, says Ross.

Taripo says the Rakahanga Island administration is working to raise funds through the export of fish, and many youth help with fishing on the island.

Last year, Taripo and Aitutaki fishery officer Alice Mitchell completed a five-month fishery officer course at Nelson Maritime School in New Zealand. They passed a wide range of certificates, including seamanship, marine electronics, safety and survival, outboard motor repair, surveillance, business management and fisheries science. Taripo says the course gave him the confidence and knowledge to do the training and is grateful to the New Zealand High Commission office for funding support.

A fishery officer on Rakahanga since 2002, Taripo’s role includes pearl farm support, working with the fishing community, and collecting data on fish catches.

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## Video technology improves data collection on longline fishing vessels



*The Yi Man #3 entering the port in Noro, Solomon Islands (image: Malo Hosken).*

***Earlier this year, two longline vessels departed from the Solomon Islands with the latest video technology onboard to improve data collection in the western and central Pacific tuna longline fisheries for albacore, yellowfin, and bigeye tunas.***

The Western and Central Pacific Fisheries Commission (WCPFC) calls for 5% observer coverage onboard longline vessels operating within the Pacific Islands region. However, challenges, including limited space onboard smaller vessels, logistics, and costs have limited human observer coverage on vessels to around 2%. Third-party data — that is, data collected from a source independent from the vessel — are, therefore, lacking on longline target catches, non-target catches, and overall operations. These data are necessary to improve scientific understanding of these fisheries, strengthen management tools, and promote better enforcement of existing national and regional conservation measures. The use of modern technology to supplement the role of human observers offers an opportunity to overcome these challenges in tuna longline fisheries, making this an important and pioneering effort.

This highly collaborative project was developed and launched by Tri Marine, National Fisheries Developments (NFD), Yi Man Fishery Company, Satlink, the Pacific Islands Forum Fisheries Agency (FFA), the Secretariat of the Pacific Community (SPC), and the Solomon Islands Ministry of Fisheries and Marine Resources (MFMR). Tri Marine and NFD are contributing to project management and the installation, maintenance and costs of the electronics. FFA, via the European Union-funded DevFish 2 project, is sharing equipment costs and is playing a major role in overall coordination.

Satlink is providing and covering some of the costs of the electronics, while also designating staff for installation, data monitoring and review. Yi Man Fishery Company offered the use of two of its vessels, and allocated valuable time to facilitate the installation, and limited vessel space and resources to accommodate equipment and observers. MFMR has provided observers to overlap with the electronics, while SPC assigned a Field Coordinator to assist with observer placement, data review, and project evaluation and reporting.

This multi-stakeholder effort will assess whether or not video cameras, electronic storage, and vessel monitoring systems (VMS), combined with at-port inspections, can generate information sufficient to fulfill the requirements of the WCPFC Regional Observer Program minimum data fields. Imagery collected will be reviewed after each vessel trip by MFMR, with FFA and Satlink involvement, using customised reviewer software. Human observers will also be onboard conducting regular observer duties, with results to be compared against those collected electronically. The project is being done with two vessels for two fishing trips that might last anywhere from six to ten weeks each, for a total of four trips. Early results will be presented at the WCPFC Scientific Committee meeting in August 2014, followed by a full report summarising the findings, including a cost-benefit analysis and recommendations for further development and implementation.



Although the project is unique and innovative in its application to distant-water tuna longline vessels in this part of the Pacific, it does fall within the broader framework of WCPFC electronic technology development. E-reporting to digitise and streamline data recording by vessel and fisheries department staff has been tested with NFD purse-seine vessels and is being expanded to other fleets. E-monitoring, or EM, is already applied under VMS requirements, and is now being broadened to incorporate video systems like the one being tested with this project. In late March 2013, WCPFC advanced these complimentary efforts by hosting an E-monitoring and E-reporting Workshop at FFA headquarters in Honiara. The objective is to gain member input into progressing E-technology and developing a related proposal for the next Technical Compliance Committee Meeting. An overview of the design and launch of this project has been presented at the workshop, and resulted in feedback to be applied for the second vessel trips.

Although tuna resources are under increasing amounts of pressure, collaborative efforts like this one between industry and fisheries managers provide tangible results that can guide improvements. Modern fishing technology is often blamed for negative impacts on the marine environment, but the strategic application of new innovations can also contribute to improved science, and the monitoring, control and surveillance needed for a more sustainable future.

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*Camera installation (image: Malo Hosken).*

# Territories Initiative for Regional Management of the Environment: A regional workshop for a common understanding of integrated coastal zone management

**Delphine Leguerrier<sup>1</sup>, Yolaine Bouteiller<sup>2</sup>, Julie Petit<sup>3</sup> and Caroline Vieux<sup>4</sup>**

*The Pacific Territories Initiative for Regional Management of the Environment (INTEGRE) project*

**INTEGRE, or the “Pacific Territories Initiative for Regional Management of the Environment”, is a sustainable development programme involving four European Pacific Overseas Countries and Territories (OCTs). Funded by the European Union from the 10<sup>th</sup> Pacific OCT Regional European Development Fund (EDF), the project is designed to promote integrated coastal zone management (ICZM) and strengthen regional cooperation in the area of sustainable development.**

Locally, it will support sustainable management or use of the environment in the OCTs for the benefit of their peoples. ICZM projects will be set up at nine pilot sites in the region. The methods used and the research carried out will be put to beneficial use throughout the Pacific, particularly through the active participation in related regional cooperation networks.

Selected by the territories as coherent management units that are representative of the region's high and low islands, and because of their major ecological importance, use by local communities and suitability as demonstration sites for integrated environmental projects, these sites are located in:

- French Polynesia: Opunohu Bay on Moorea, the Tahiti Peninsula and the islands of Raiatea and Tahaa and their lagoon;
- New Caledonia: the southern tip, the northeastern coast, and the coral atolls of Ouvéa and Beautemps-Beaupré in the Loyalty Islands;
- Wallis and Futuna: Wallis and its lagoon, and southwestern Futuna; and
- Pitcairn Islands as a whole.

The first in a series of workshops took place at the headquarters of the Secretariat of the Pacific Community in Noumea, New Caledonia from 18 to 20 February to launch the project, and brought together about 50 registered participants from government departments involved at each pilot site, specialists in integrated management and other areas of importance for the Pacific islands (e.g. waste, agriculture, fisheries, shipping), and nongovernmental organisations.

Through presentations, discussions and small group sessions, the departments involved gained a better understanding of each other's issues, shared their vision of INTEGRE, and benefitted from feedback on the experience of the specialists who attended the meeting, as well as gaining information on existing regional networks and the expertise available in the area of sustainable development.

The outcomes and lessons learned from the workshop are summarised below and form the “raw material” for implementing the project. The first building stage (i.e. project governance, including an overall steering committee and territory-based organisation down to local level), is currently in the process of being approved, and action plans are being developed for each pilot site using a methodology guide based on the discussions. The regional scope of the project was also defined in the proposed cross-sectoral activities at this scale described below.

## What is integrated coastal zone management?

ICZM is one response to growing pressures on coastal ecosystems, the increasingly fragmented approach to management (of both land and sea, increasing legal and political and/or administrative complexity) and the need to reconsider governance modes (e.g. top-down approaches have been questioned, while networks of associations have developed). Hundreds of ICZM pilot schemes have been conducted around the world since the 1992 Rio conference (Hénocque 2013). ICZM arose from a wide range of strategies influenced by the natural system involved, the national context, ICZM's

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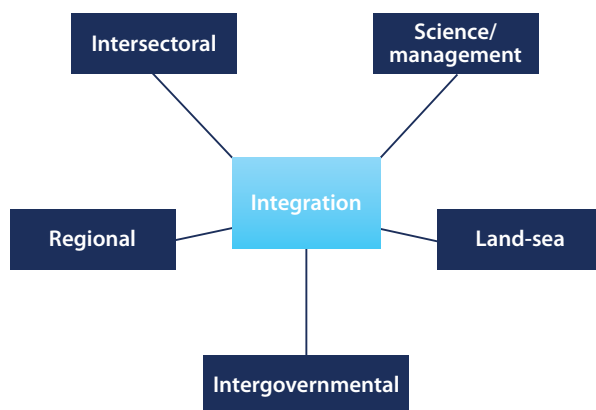


main beneficiaries and the issues it attempted to resolve (Olsen 2003, in Hénocque 2013). It is articulated in a quest for new forms of governance and the development of information and scientific data management capacities.

ICZM objectives<sup>1</sup>:

- Provide consistency to current management tools and facilitate change (manage conflicts!)
- Consolidate public policies
- Formulate a global strategy even if responses are most often sector-based
- Respond to expectations and needs — without creating new ones

## Integration prospects and key work areas<sup>5</sup>



ICZM action covers three main fields:

- regulating sectoral activities and adapting related policies;
- strategic planning; and
- governance (developing and organising participation).

## Why “participatory”?<sup>6</sup>

By involving all levels of governance in the decision-making process, plans can be implemented without resulting in a large number of isolated approaches unrelated to the action needed. It is an alternative designed to: avoid approaches that are perceived as “technocratic” and too complicated and, therefore, rarely used; get the people involved in the project to take ownership of it; and better identify any problems and the actions to be taken to deal with them.

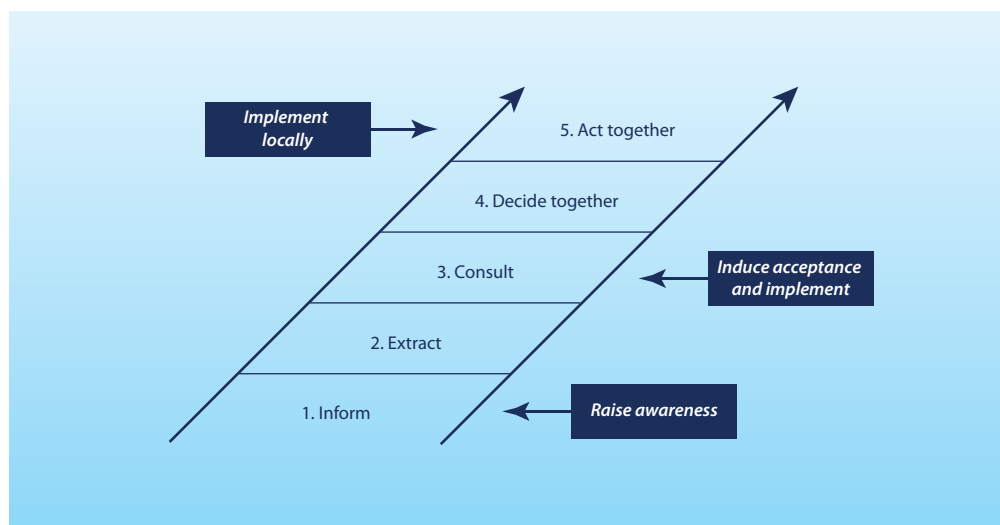
⇒ The most appropriate work level is not always the relevant biogeographical scale in terms of the environment but sometimes the governance level.

⇒ Both strong political involvement and the empowerment of recognised participatory bodies is needed.

## Different levels of participation are possible ...

when referring to the participatory scale (modified from Arnstein 1969) shown below:

⇒ Depending on the topic, one particular level will be more relevant ... the Level 5 ideal cannot always be attained.



Participatory scale (modified from Arnstein 1969)

<sup>5</sup> Presentation by Raphaël Billé, RESCCUE (Restoration of Ecosystem Services against Climate Change Unfavourable Effects) Project Coordinator.

<sup>6</sup> Presentation by James Comley and Hugh Govan (University of the South Pacific).

## Project pilot sites

One of the starting points for sharing and identifying synergies was to discuss each of the pilot sites, which led to improved mutual understanding of the project as a whole. This process will facilitate common efforts at identifying solutions and joint project implementation.

### Sites in French Polynesia

#### *Opunohu Bay, Moorea*

The Opunohu Bay and Valley area is on Moorea Island, and stretches over 1,000 ha in Papetoai township (population 2,300). Opunohu Valley is surrounded by a remarkable amphitheatre of mountains, the highest being Toheia at 1,207 m. Spreading out from the Opunohu River estuary, the bay swiftly widens to form a nearly 3,500 m funnel leading to the channel. The bay varies in depth from 15 m to 50 m.

The valley has the island's wettest microclimate, with significant annual rainfall ranging from 2,500 mm to 3,500 mm. The islanders consider the valley to be Moorea's "lung" and water reserve and there is scant urban development there.

More than a third of Moorea's known flora grows in Opunohu and 12 invasive species have been observed to jeopardise the area's biodiversity. There are still well-preserved specific coastal environments in the bay, including a narrow strip of coastal forest remaining between the lagoon and road that greatly helps maintain the shoreline. In specific marine biodiversity terms, the east coast at the foot of Mount Rotui is the richest. It is home

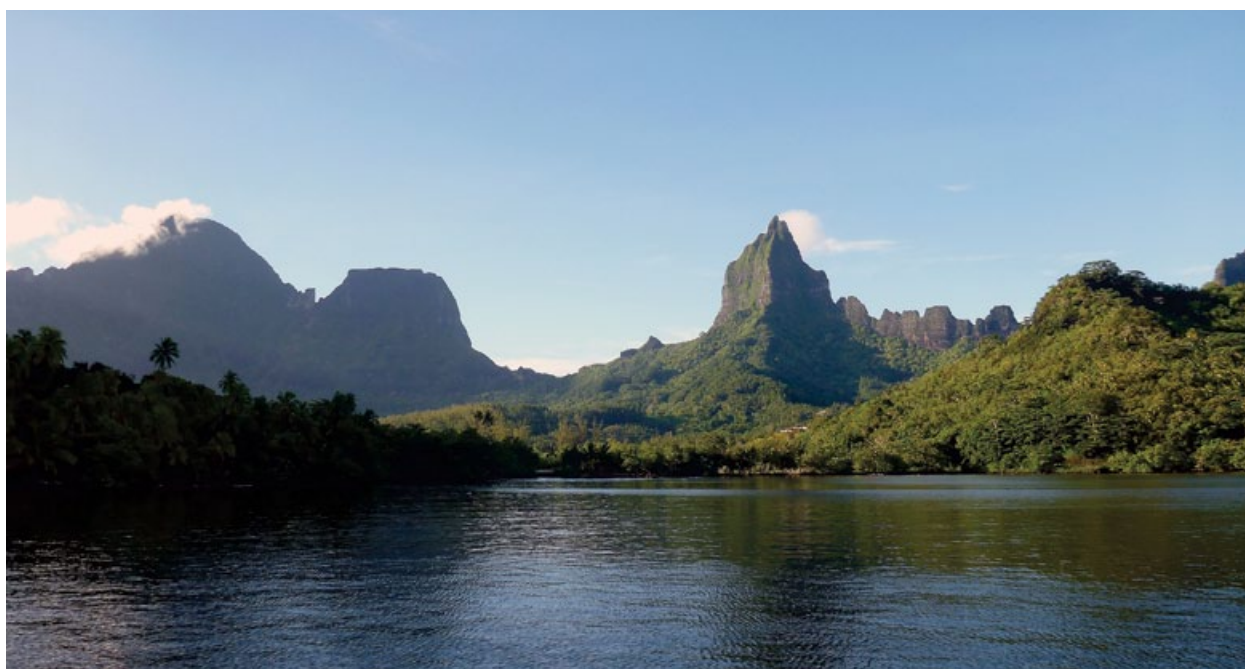
to harvested molluscs and hosts iconic species such as green sea turtles, dolphins and humpback whales.

In terms of economic activities, the Opunohu area is a popular fishing spot in Moorea and catches are often sold on the roadside at the head of the bay. The bay is a tourism hotspot that virtually all visitors to French Polynesia travel to. Both land and marine activities are offered, including treks, iconic species spotting and water sports. Pineapples are grown for the Rotui plant that purchased 1,450 mt in 2010 and the supplier, COPAM, provides incomes to 60 Moorea families (or approximately 300 people) who farm 150 ha. Cottage farming is also well developed and Opunohu Bay has two agricultural training centres.

#### *Tahiti Peninsula*

The peninsula is divided into two townships, East Taiarapu and West Taiarapu, and six associate municipalities covering 320 km<sup>2</sup> (population 18,545)<sup>2</sup>. Mount Roniu is the highest peak at 1,332 m. The Taravao Isthmus, which forms the peninsula's boundary with the rest of Tahiti, faces the Taravao plateau, a huge farming area with a cool climate and mountain flora. The landscape becomes less built up going towards the east and 20 km from Taravao, the terrain becomes wilder on both sides (i.e. the *fenua aihere*. The main access is usually by sea, although a small unsealed track also leads there.

In marine terms, Taiarapu primarily consists of standard high-island lagoon features with well-developed barrier and fringing reefs. The area, however, holds rich and varied habitats, including shoals (in northern Taravao and the Pari) and brackish water lagoons near the



*Opunohu Bay, Moorea, French Polynesia (image: Boris Colas).*

Taravao Isthmus. The peninsula is also one of few places in French Polynesia where sea fans are found.

Beyond the *fenua aihere* and lagoon area lies the Pari in the far eastern sector, a protected natural area since 1964. It is also the location of some extremely well-preserved cultural and archaeological heritage. In addition to the Pari, two category 3 natural monuments in French Polynesia's cultural heritage have been listed, namely Vahi Waterfall and Vaipouri Cave.

There is currently a broad range of industries on Tahiti-Ini based on extensive agriculture that encompasses the Taravao Plateau (egg production, dairy farming and animal feed) and the Tautira and Teahupoo Plains. The Tahiti Peninsula is also where the first aquaculture projects were set up and the Ifremer Tahiti Centre has been based at Vairao for 40 years. The country's Vaia CTA (aquaculture applied research facility) has also been operating within the aquaculture division there since last year.

The peninsula also has a recently built industrial area in Taravao Harbour. Homestay tourist accommodations are also well established there, because of the many trekking trails and dive and surf spots and the mythic Teahupoo wave.

#### *Raiatea and Tahaa islands, and their lagoon*

Located 210 km northwest of Tahiti, Raiatea is one of the Leeward Islands in the Society Islands group. It is the largest of the Leeward Islands at 238 km<sup>2</sup> and has a population of over 12,000. Encircling the volcanic mountains with their fertile plains and deep valleys lies the fairly narrow coastal plain where most human settlement is located. Mount Tefatoaiti (1,017 m) is the highest point and a few motus are dotted about the wide Raiatea Lagoon. The island is divided into three townships, Uturoa, Taputapuatea and Tumaraa. Uturoa, the Leeward Islands' main town, has a deep-water port where large vessels can anchor and berth. Taha'a, its sister island is enclosed in the same lagoon as Raiatea, has similar features but is spread over 88 km<sup>2</sup>. Tahaa is home to 5,220 people and its highest peak, Mount Ohiri, rises to 590 m.

The 90 km<sup>2</sup> navigable lagoon is up to 55 m deep has 10 channel openings making for easy access to the ocean and rapid water exchange. The many bays are blocked off by roads crossing them (some exogenous mangrove swamps) and isolating fringing reef areas have been damaged but hold potential for aquaculture operations (e.g. shrimp, crabs). Several *motu* can be found near the channels and off northern Tahaa; and there are still some well-preserved coral ecosystems, essentially along the barrier reef.

On land, there are many rivers, including the navigable Faaroa, many suitable sites for agricultural development, and environmentally and locally significant areas.



*Moetini Moutame, on his organic farm, Raiatea island, French Polynesia (image: Yolaine Bouteiller).*

Raiatea's economy is dominated by farming for the local market and Bora Bora hotels. Lagoon resources including fish, crustaceans, sea urchins, sea cucumbers and trochus and turbo shells are harvested and pearl farming is a major industry. Raiatea is a hub for marine leisure activities with French Polynesia's largest yacht charter companies operating from its three marinas. The trade is booming and contributing increasingly to the island's economic development. With an airport servicing daily flights to Tahiti and other islands in the group, plus five weekly round-trips by cargo-passenger ships from Tahiti, Raiatea is a bustling island.

Tahaa's economy is mainly based on Tahitian vanilla (its top producer), copra and subsistence food crops. Noni fruit (*Morinda citrifolia*) is also widely grown. Tahaa has no airport but there is a cargo-passenger ship wharf at Tapuamu and there are many smaller wharves around the island.



## Sites in New Caledonia

### Northeast coast

The northeast coast pilot site encompasses the watersheds and lagoon areas of Poum, Ouegoa, Hienghene, Touho and Poindimie townships. It extends over the maritime and terrestrial area known as the “northeastern coastal area” of the serial property included on the United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage list in 2008, together with its marine and land buffer zones. It covers 305,000 ha of land and 371,000 ha of lagoon.

The area is well known for its very rich environment. The marine area is exceptionally well preserved and has remarkable original features such as double barrier reefs to the east. The northeast coast is also well known for its seagrass beds and sea turtle and dugong populations. The Diahot estuary also has New Caledonia's largest and most diverse mangrove forest. The land area includes the Mount Panie system, which boasts the largest continuous forest in New Caledonia at 33,000 ha and remarkable altitudinal continuity (200 at 1,600 m). Such an environment is highly conducive to the exceptional plant, insect and freshwater fauna endemism level (64% for plants).



Edmond Ouillate and other members of the Hienghene local authorities were involved in the project discussions (image: Delphine Leguerrier).

In social and economic terms, the area is sparsely populated with approximately 15,000 people living mainly in Melanesian villages. Work generally involves subsistence-level food production by farming, fishing in the fringing lagoon, freshwater and estuaries and hunting and, to a lesser degree, small-scale tourism involving cottage inns, trekking and small hotels. Ecotourism is becoming increasingly well organised and showcases the

area's outstanding natural and cultural heritage. There is no industry or mining other than the Poum mine, and market gardening is low-key.

### Southern tip

The pilot site in New Caledonia's far south is made up of the land, coastal and marine environments found at the main island's southern tip. It straddles three townships (Mont Dore, Yate and Isle of Pines) and covers 841,800 ha, including approximately 140,000 ha of land, and encompasses the UNESCO World Heritage-listed Great Southern Lagoon.



From left to right: Yolaine Bouteiller (INTEGRE project), Olivier Auguin (SPC), Mecki Kronen (EU PTOM Office) and Emmanuel Coutures (Environment Department, South Province, New Caledonia) place the southern tip site on the map (image: Delphine Leguerrier).

The area's major environmental value has been acknowledged both in terms of the land (with its rich, original flora, many protected areas and Ramsar<sup>7</sup> project location) and sea with its highly diverse reef formation and many symbolically important species. Only the coast is settled with a population of 3,000 spread across various Melanesian villages along New Caledonia's east

<sup>7</sup> Ramsar sites are wetlands of international importance, recognised globally due to the Ramsar Convention, which is an international treaty for the conservation and wise use of wetlands (source : <http://www.biodiversity-z.org/areas/30>).



*Throw netting close to the Mouli bridge, Ouvea, New Caledonia (image: Delphine Leguerrier).*

coast, Ouen Island and the Isle of Pines. The main economic activities are based around mining, tourism and fisheries. The area also has a large number of mining sites, both operational and abandoned, and some very valuable and sought-after ore reserves. The Prony area is host to the vast Vale NC industrial complex that includes a nickel processing plant, harbour and the related 1,900 ha of nickel mines. The project employs 4,000 people (1,200 directly — mostly accommodated on site — and 600 local subcontractors). Tourism is well developed, particularly on the Isle of Pines, which is one of New Caledonia's leading holiday destinations, but also throughout the area, which has significant tourism potential. Fisheries take the form of commercial, game and subsistence fishing. The lagoon is an important fishing ground for fishers from the greater Noumea (capital) area, and the Isle of Pines supplies most of the rock lobsters harvested in New Caledonia. The area also contains a burgeoning forestry sector, low-key aquaculture (a single surgeonfish farm), and little or no agriculture other than kitchen gardens.

#### *Coral atolls of Ouvea and Beautemps-Beaupré*

The whole of both Ouvea and Beautemps-Beaupré atolls, which are part of the INTEGRE project for the Loyalty Islands, are UNESCO World Heritage-listed as serial properties (including their buffer zones) and extend over 137,000 ha, 14,400 of which are on land.

The area is well known for its rich marine environment and for having the Loyalty Islands' only mangroves.

Because the atolls are geographically isolated and host a variety of marine and coastal habitats, they are conducive to the breeding and growth of many iconic or endangered species, such as seabirds, sea turtles and sharks. It is also free of fish poisoning (ciguatera). On land, there is a well preserved primary forest that is home to species such as the Ouvea parrot (endemic to the islands), decollate snail, flying fox and coconut crab. The islands are also free of black rats (*Rattus rattus*) and fire ants (*Wasmannia auropunctata*).

Ouvea island covers 132 km<sup>2</sup>, rises to 46 m, and has a population of approximately 3,400 living in 20 Melanesian villages divided among five customary districts. There is no urban area and, as in the rest of the Loyalty Islands Province, land tenure is exclusively governed by custom.

Ouvea's economy is mainly based on tourism and fisheries. Far removed from mass tourism, the industry revolves around a handful of guest accommodations, including a large resort and homestays in Melanesian villages. Ouvea banned cruise ships in 2007 following damage to reefs inflicted by ships' anchors, which considerably heightened the fish poisoning hazard on the island, but there is considerable development potential. Fishing is organised by a union of some 15 licensed commercial fishermen and the industry is being developed around a seafood packaging plant at Takedji in the north of the island. Other developing businesses include sandalwood, copra (with an oil mill and soap factory in Wadrilla), and vanilla plantation.



## Sites in Wallis and Futuna

### Wallis and its lagoon

Wallis Island has a tropical wet climate and 78 km<sup>2</sup> of emerged land with the highest point being 150 m. The coast hosts a few mangrove areas, mainly in the west (IEOM 2014).

The 200 km<sup>2</sup> lagoon is enclosed by an unbroken barrier reef comprising four channels, and the island is surrounded by fairly extensive reef flats that contain sea-grass beds. Some 20 small coral and volcanic islands are dotted about the lagoon and coral barrier.



*One of the 20 small islands spread in the lagoon and on the barrier reef of Wallis Island (image: Delphine Leguerrier).*

In environmental terms, Wallis Island is characterised by a number of features, including secondary vegetation in the form of coconut plantations, ferny heaths, Caribbean pine plantations and food crops, crater lakes, surface lakes and primary forest remnants (Dentrand 2009). Home to many remarkable species, Uvea also has endemic species, including a cicada, land molluscs and a plant. Colonies of nesting seabirds take shelter on the small offshore coral and volcanic islands. The lagoon and its associated ecosystems in shoreline habitats, sea-grass beds and mangrove swamps do, therefore, raise major biodiversity challenges (Egretaud et al. 2007).

The population of 8,584 is mainly concentrated in the eastern part of the island. Some 2,108 people are employed, with the public sector (government and education) being the largest employer at 44% of jobs (IEOM

2014). Farming and fishing are at the subsistence level, with produce being eaten by the growers themselves or used in customary exchanges. Imports from Australia, New Zealand and France are the main economic activities. There is a trade deficit because the only exports are beche-de-mer and trochus shells.

The French government heavily funds the local economy to the tune of XPF 12.4 billion<sup>8</sup> in subsidies in 2013 (IEOM 2014). Emigration is very high, with 20,000 Wallisians and Futunans living in New Caledonia (i.e. twice as many as live in the territory).

### Futuna

Futuna Island covers 46 km<sup>2</sup>, lies 230 km from Wallis, is mountainous, rising to 524 m, and has both permanent rivers and temporary waterways. Alofi, the uninhabited neighbouring island (18 km<sup>2</sup>, 417 m) is located 1.8 km southeast of Futuna (IEOM 2014).

Futuna's deep, narrow valleys are covered in dense forest and the plateau in secondary forest is made up of coconut groves, ferny heaths, Caribbean pine plantations and food crops. Downstream from the water courses lie irrigated taro fields (Dentrand 1999).

Futuna and Alofi have outstanding endemic species rates with four bird subspecies, seven plant species, four freshwater fish species, and eleven land and freshwater mollusc species (Mary et al. 2005). Along Futuna's southwest coast, a fringing reef is formed by coral structures that were damaged in a 1993 earthquake. The chosen area is southwest Futuna Island and extends over 40 km<sup>2</sup>. The island sustained extensive physical damage caused by Cyclone Thomas in March 2010 that affected the northeastern coast even more severely, particularly in terms of infrastructure and housing.

The population is over 3,613 and is mainly on the island's southwest coast. The employment rate is 28% (45% on Wallis) and importing is the main economic activity on both islands. There are no exports. Farming and fishing are practised at the subsistence level (IEOM 2014).

### The site in Pitcairn: the islands as a whole

The site comprises four near-pristine small islands that are some of the most remote in the world. Pitcairn is a dead volcano with an approximate land area of 4.5 km<sup>2</sup> and rising to a height of 347 meters above sea level (government of Pitcairn 2012). It is the only inhabited island and has a population of 49 (United Nations General Assembly 2014). The climate is subtropical with rich volcanic soil and lush vegetation. Transport is by quad bike (there are no cars on the island), and the island is in a mainly unspoiled condition (particularly due to its remoteness and difficult access). Henderson is

<sup>8</sup> XPF 12.4 billion = ±USD 142 million (June 2014)



a raised fossilised coral atoll, designated as a UNESCO World Heritage Site. Ducie, the most southerly coral atoll in the world, has a central lagoon surrounded by four islets covering an area of 70 ha. Oeno is a low-lying coral atoll of 65 ha, and surrounded by a shallow lagoon and fringing reef.



*There is no safe and easy access to the sea around Pitcairn Island. Kids play in natural pools filled by waves breaking against the shore cliffs (image: Delphine Leguerrier).*

The only inhabited island, Pitcairn, has a permanent resident population of just over 50, composed of 50% males and 50% females. The current labour force consists of 31 able-bodied persons. Ten non-resident officials who are generally on one-year contracts add to this total. Government sector jobs consist of 82 part-time positions. The island receives £ 2.9 million<sup>9</sup> in aid from the British government (Department for International Development) to provide essential needs (39% for shipping, 14% for health, 12% for the Pitcairn Island office, and 10% for infrastructure and operations). Government income includes revenue from stamp and coin sales, landing fees, visa application fees, Domain name (.pn), registration fees, and passenger fares. It is difficult to quantify the private sector, as there is no taxation system. The islanders have developed tourism-related businesses such as trinket and souvenir sales, guided tours, homestay accommodations, and carving and artefact sales. Beekeeping, honey production, fishing, market gardening, animal husbandry and maintenance services help supplement household incomes. Cruise ships are also supplied and approximately 10 boats call every year.

The British government supports economic development initiatives, notably through funding provided by Her Majesty's Government, a business mentoring programme that has been established with a mentoring organisation based in Auckland (Business Mentors New Zealand). Small businesses on Pitcairn are able to access this individualised mentoring service free of charge through video link and email or phone.

## Lessons learned at the workshop

### *Four illusions to avoid*

Although it is important to set up participatory methods and consult properly so that plans can be implemented, the following pitfalls should not be overlooked.

1. *Using roundtable discussions to solve any and all problems.* Often, no consensus can be reached and this process does not eliminate the trade-offs that have to be made.
2. *An overly idealised vision of local communities.* Just because one possible solution is traditional does not necessarily make it the most appropriate one.
3. *Always trying to identify the "right scale" for a single management structure.* Coastal management is complex; rather than a single structure, it is necessary to try to establish proper coordination between existing structures.
4. *Considering scientific knowledge as the "be-all" and "end-all" of ICZM.* A lack of knowledge should not hamper action.

Drawing attention to these "illusions" should, if they are borne in mind, prevent their inherent consequences while developing future work methods (see also Billé 2006).

### *Keys to success ... lessons for INTEGRE*

A number of lessons were drawn from the discussions that followed the various expert presentations and these should be borne in mind while implementing the project. Apart from a definition of ICZM itself, there were presentations on ICZM's "health" by Hugh Govan and James Comley (University of the South Pacific), anthropological input when catering for local sensitivities (Pierre-Yves Le Meur (French Institute of Research and Development, IRD), Catherine Sabinot (IRD), Elisabeth Worliczek, Jean-Brice Herrendtschmidt (GIE Océanide), Pacific biodiversity and waste management issues and current attempts at identifying solutions by David Haynes and Pascale Salaun (Secretariat of the Pacific Regional Environment Programme), the Pacific Organic and Ethical Trade Company project for developing organic agriculture by Karen Mapusua (Secretariat of the Pacific Community, SPC) and maritime transport development prospects against a backdrop of emerging ICMZ in the Pacific by Marie Bourrel (SPC), the lessons learnt from the management of a European project based on the use of participatory methods by Frédérique Lehoux (SPC) and the regional and international positioning of French Pacific territories (François Bockel, Government of New Caledonia). Several

<sup>9</sup> £ 2.9 million = USD 4.94 million (June 2014)

lessons were drawn from the discussions and are summarised below.

- Take into account the territory's past and present (timing and history), along with the various time scales involved.
- Take into account the intercultural dimension (a sixth dimension of integration?).
- Bring about ownership through small visible actions: "deliver successful outcomes from the very start so as to create dynamics and lead to ownership".
- Get the private sector involved.
- From the planning stage on, think about how actions could continue after the project has ended.
- Use existing structures and ensure the legitimacy of the stakeholders involved.
- Know where you are starting from and where you want to go: importance of knowing the baseline status.
- Arrange for regional exchanges and share experience at all levels (elected officials, technicians, local stakeholders).
- Think about the concept of reproducibility and the need to serve as a demonstration, issues that are not always shared.

## INTEGRE's objectives and the activities to achieve

Through joint discussions, INTEGRE's objectives and expected outcomes were better defined, although the project governance arrangements require that the steering committee approve the project's basic content; the wording of this paragraph's two insets is, therefore, subject to change after this article has been published.

Components 1 and 2 of the project will feed into each other, Component 1 being networking and maximising results, and Component 2 piloting while implementing the action plan. INTEGRE's aim is to contribute to both general objectives, namely promoting ICZM and strengthening both regional cooperation and sustainable environmental management or use in OCTs for the benefit of communities. All four specific objectives assigned to the project by agreement were re-written in more operational terms that the players in attendance took ownership of more readily. They comprised strengthening cooperation between OCTs and Pacific ACP countries, implementing a communication and awareness policy, strengthening governance and capacities and improving environmental management for the good of the people.

Several types of actions have already been planned to provide the players with methodology support and obtain regional-level outcomes. The Component 2 Action Plan is currently being developed at each pilot site and is based on a drafting guide designed around the needs expressed on the ground (i.e. during workshops and meetings with the players).

The process of designing, monitoring and approving the implementation of the project is as yet in its early stages, as it needs to be adapted to each territory's governance mechanisms. It requires action plan development at the local level and scrutiny at the territorial level followed by approval by the regional steering committee chaired by French Polynesia, who is the 10<sup>th</sup> EDF's Regional Authorising Officer. Implementation of each action plan will then be monitored at each site, as close as possible to the local population.

## What are the major issues at each pilot site?

### SWOT charts

Charts showing the strengths, weaknesses, opportunities and threats at each site were drawn up in a specific and detailed manner, and group work identified the main common issues, in the form of the table of common issues (see next page: the colour bars indicate the frequency of that topic for each site):

### Lessons for INTEGRE


























While the risk of interference with the public policies in place or increased workload are sometimes highlighted, overall the project is seen as an opportunity, providing resources to the territories and a chance to take new approaches.

The cultural and natural capital of the different pilot sites was highlighted as a strong asset, under threat by both human pressure and rapid changes to society: preserving them is a priority emphasised by all involved.

Common issues can be found at most sites and provide opportunities for interesting discussions on topics such as waste management on islands, coastal erosion against a backdrop of climate change, soil erosion and pollution in the lagoon, invasive species, and managing tourism.

All of the projects can be supported by regulatory and planning mechanisms and solid administrative skills but all of the participants underlined the need for better coordination between department or different governance levels.

Participatory approaches have been used to varying degrees in the territories, everywhere local demand is high and forums for discussion do exist.

Strengths		Weaknesses	
Strong natural and cultural capital		Locally degraded environment	
Knowledge of the environment		Little government intervention, lack of co-ordination between departments and governance levels	
Discussion forums		Land tenure related problems (system, relocation)	
Local demand for involvement		Lack of human and financial resources	
Regulatory and planning tools		Data availability	
Political and institutional involvement		Local conflicts of interest	
Secure land tenure		Local community fears	
Opportunities		Threats	
Business dynamics, development potential		Human pressures	
INTEGRE, regional partnerships		Erosion	
Existing mechanisms that can be organised and used		Invasive species	
Training and knowledge transfer mechanisms		Social impact	
Air and shipping route development		Climate change	
		INTEGRE (workload increase)	

Summarised chart of strengths, weaknesses, opportunities and threats (SWOT)

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### Expected INTEGRÉ project outcomes

The project aims at achieving two general objectives that introduce two components, each feeding off the other:

- promote integrated coastal zone management (ICZM) and strengthen cooperation at the regional level; and
- contribute to sustainable environmental management and use in Overseas Countries and Territories (OCTs) for community benefit.

These objectives are broken down into specific objectives and expected outcomes that will be linked to performance indicators.

#### *Four specific objectives and expected outcomes*

##### *Specific objective 1:*

Strengthen cooperation between OCTs and the Pacific ACP countries in sustainable development

Outcomes:

- a regional framework proposed for ICZM
- OCTs integrated into regional sustainable development sharing and discussion networks
- sharing has occurred between the region's mirror sites.

##### *Specific objective 2:*

Implement an effective communication and awareness strategy on the INTEGRÉ project and ICZM for communities, institutions and regional partners

Outcomes:

- communication network and tools within and between OCTs operational
- civil society familiar with integrated coastal management principles
- Pacific OCTs familiar with integrated coastal management principles
- INTEGRÉ project visibility achieved
- ICZM project outcomes on the pilot sites maximised and developed (R3 of S1 crossed).

##### *Specific objective 3:*

Strengthen good governance in environmental management and reinforce managerial capacities

Outcomes:

- participatory governance bodies operational on pilot sites
- collaboration between entities managing the various sites and between their internal units improved
- management capacities strengthened
- integrated management process operational
- ICZM principles integrated into government policy.

##### *Specific objective 4:*

Contribute towards improving environmental management on pilot sites for the benefit of local communities

Outcomes:

- the main hazards identified and concrete management measures taken to deal with them in an integrated manner
- the environment is put to beneficial use through management approaches or sustainable economic activities
- sustainable economic alternatives developed by local communities in response to potential or actual destructive practices
- communities aware of and involved in sustainable environmental management.

### Cross-sectoral initiatives (Component 1)

- Component 1 is networking and outcome enhancement. Several types of action items have been planned to provide players with methodology support and achieve regional-level outcomes:
- A total of five workshops are scheduled during the project. In addition to this one, four thematic workshops will emphasise best-practice sharing.
- The project will support OCT participation in existing networks and help strengthen them.
- By leading the development of a regional ICZM framework and advocating it at the institutional level, the project will contribute to disseminating good practices at the regional level.
- Methodology support will help provide backing for planning processes and a participatory approach on pilot sites.
- The methods developed and implemented will be enhanced by analysing the lessons drawn from the operations.
- Support pilot site initiatives in the area of bilateral trade in the Pacific (including training).



*Fishing from the Mouli bridge, Ouvea, New Caledonia (image: Delphine Leguerrier).*

# Positive results of a FAD monitoring programme in Yap

**Michael Sharp**

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## Introduction

A nearshore fish aggregating device (FAD) is an anchored or drifting object that is placed in the ocean to attract fish.<sup>1</sup> Tuna and other pelagic fish gather around a FAD, making it easier to find and catch them. Nearshore FADs are deployed to improve the efficiency of small-scale fishers, but are also thought to provide other benefits, such as reducing fishing pressure on reefs, and providing a means to adapt to the predicted effects of climate change.

Six nearshore FADs were deployed in Yap State, Federated States of Micronesia in early 2013. The FADs were deployed as a component of the “Community-based Ecosystem Approach to Fisheries Management (CEAFM) and Climate Change Adaptation” project under the Secretariat of the Pacific Community (SPC) and the German Agency for International Cooperation’s “Coping with Climate Change in the Pacific Islands Region” (CCCPIR) project.<sup>2</sup>

In addition to the six FADs supplied under the CCCPIR project, SPC provided Yap State with sufficient materials to fabricate an additional six FADs in case some of the primary FADs were lost.

Through consultations with various communities in Yap, FADs were deployed because of<sup>3</sup>:

- human population growth leading to overfishing in coastal zones;
- declines in reef fish catch rates;
- the unhealthy state of some reefs in Yap and their predicted further decline as a result of climate change;
- a loss of mangrove habitats;
- blue holes<sup>4</sup> getting smaller and shallower; and
- the increasing local demand for fresh fish.

Four municipalities with access to the six FADs were selected to help implement a newly designed FAD monitoring programme<sup>5</sup> to collect data over a five-month period with the primary objective of gaining an understanding of their effectiveness. The preliminary results of the monitoring programme are presented below.

## Results

The monitoring programme consisted of interview-based, fisheries-dependent surveys, including fishing vessel counts and catch and effort interviews, and a household calendar survey that collected information on a household’s daily fishing activities, fish consumption and sales.

In total, 660 fishing trips were reported over the sampling period, and assuming that 100% of fishing trip coverage is reported, this amounts to an estimate of 1,496 fishing trips per year across all sampling sites (Table 1). This is likely to be an underestimate, but these are nonetheless used in the extrapolation of total effort estimates in the economic analysis presented thereafter.

*Table 1. Matrix of vessel-based fishing effort (fishing trips).*

	Paddle	Motor	Total
Total reported trips (8 April–8 September 2013)	185	475	660
Average trips reported per week	8	21	29
Estimated number of trips per year	419	1,077	1,496

About 63% of fishing events<sup>6</sup> by location occurred on the reef over the sampling period (80% of total reported

<sup>1</sup> Refer: [http://www.spc.int/DigitalLibrary/Doc/FAME/Brochures/Anon\\_12\\_PolicyBrief19\\_FADs.pdf](http://www.spc.int/DigitalLibrary/Doc/FAME/Brochures/Anon_12_PolicyBrief19_FADs.pdf)

<sup>2</sup> Refer: [http://www.spc.int/DigitalLibrary/Doc/FAME/InfoBull/FishNews/142/FishNews142\\_18\\_Brunken.pdf](http://www.spc.int/DigitalLibrary/Doc/FAME/InfoBull/FishNews/142/FishNews142_18_Brunken.pdf)

<sup>3</sup> Source: GIZ/SPC (2012), Community Fisheries Management Plans for the CCCPIR Project selected sites, Yap State

<sup>4</sup> Blue holes are holes in the reef that are productive fishing zones.

<sup>5</sup> See: [http://www.spc.int/DigitalLibrary/Doc/FAME/InfoBull/FishNews/140/FishNews140\\_08\\_Sharp.pdf](http://www.spc.int/DigitalLibrary/Doc/FAME/InfoBull/FishNews/140/FishNews140_08_Sharp.pdf)

<sup>6</sup> A fishing event is defined as a period when a single fishing method is practiced in a single location. When a new fishing method is practiced or the fishing location is changed, this constitutes a new fishing event. We report by fishing event so that fishing variables, such as catch rates at and away from FADs, can be delineated.



effort – hours), with FADs making up 22% of fishing events by location (10% of total reported effort – hours) and open water, mangrove and lagoon fishing making up the remainder (Fig. 1).

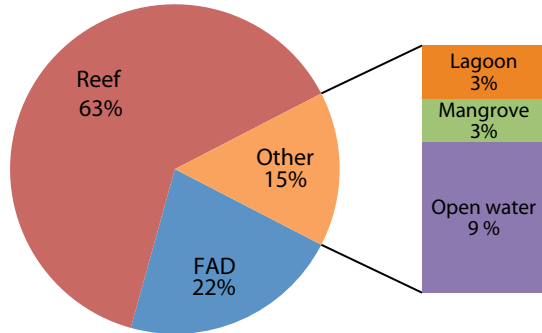


Figure 1. Proportion of fishing events by location.

Figure 2 presents the weekly frequency of fishing events ( $n = 336$ ) by fishing location, simply disaggregated as FAD fishing and non-FAD fishing<sup>7</sup> (660 trips were recorded through the vessel count, but only 245 catch-and-effort interviews were conducted, related to 336 fishing events).

Although there is no clear trend, there is a notable increase in FAD fishing effort in August and September (weeks 19–22 in Fig. 2). Catch and catch rates<sup>8</sup> are analysed below, but the time series is too short to provide an indication of whether this effort increase is seasonal, a lagged effect of the FAD fishing training, an indication that the FADs had reached “maturity”, or other dependent or independent factors. Additional data will improve the understanding of fishing behaviour and trends.

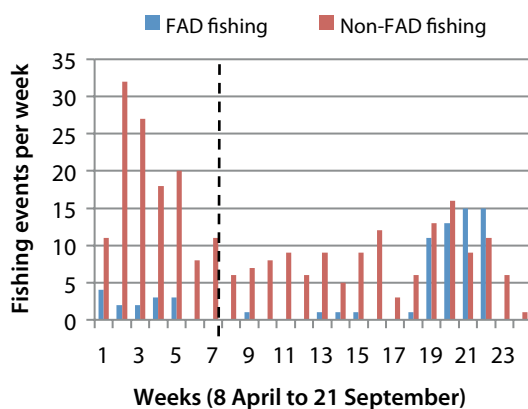


Figure 2. Weekly frequency of fishing events by location. The vertical dotted line is the time when a FAD fishing skills workshop was delivered in Yap.

There is a strong correlation between fishing effort (location) and catch category, hence total reported catch is dominated by reef fish (Fig. 3). However, FAD catch represents 20% of the total reported catch of 13,900 kg, when fishing effort at FADs only represents 10% of the total effort of 1,127 hours recorded over the sampling period.

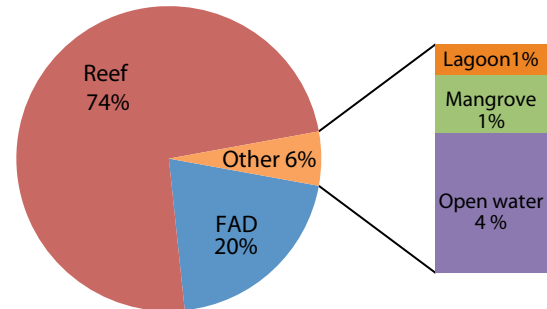


Figure 3. Fish catch (% of total catch) at different fishing locations.

This is due to the high catch rates obtained at FADs ( $\sim 25 \text{ kg h}^{-1} \text{ boat}^{-1}$ ) (Fig. 4), followed by open water and reef locations (each with  $\sim 12 \text{ kg h}^{-1} \text{ boat}^{-1}$ ). Catch per unit of effort (CPUE) is averaged over the whole sampling period and average non-FAD CPUE was  $\sim 12 \text{ kg h}^{-1} \text{ boat}^{-1}$ , which is used in the with-and-without analysis below.

Given that fish are typically priced and sold by weight, CPUE ( $\text{kg h}^{-1} \text{ boat}^{-1}$ ) is the logical proxy applied in the economic analysis.

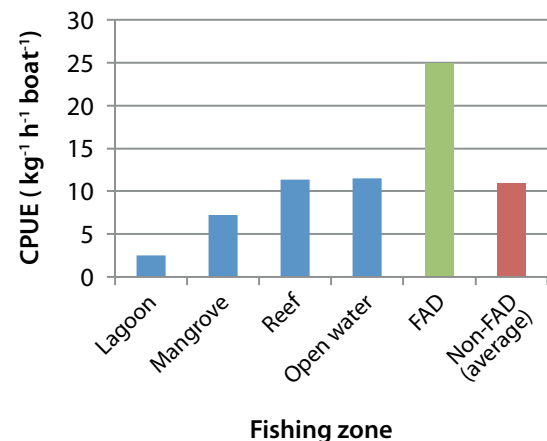


Figure 4. Mean catch rates (CPUE:  $\text{kg h}^{-1} \text{ boat}^{-1}$ ) by fishing location.

<sup>7</sup> Non-FAD fishing includes fishing on the reef, inside the lagoon, near mangroves and open water locations.

<sup>8</sup> Catch rates, or catch per unit of effort (CPUE), is given in kg per hour per boat. In Yap, coastal fishing boats usually carry one or two fishers.

### Results of the household socioeconomic survey

In total, 131 household completed the calendar-based questionnaires over three periods of four weeks each. Collectively, the calendar data amounted to 3,668 days, with 13 data units produced per household per day.

Figure 5 presents the results of the household fishing activity for calendar periods 1 to 3 (CP1 to CP3). The data indicate that households across all three sites go fishing ~40% of days, or 2.8 days per week. In CP1 and CP2, fishing occurs on the reef 86–88% of the time, while FAD and open water fishing (non-FAD) occurred between 6% and 8% of the time. In CP3, the proportion of fishing trips occurring on the reef declined to 61% while FAD fishing markedly increased to 29%; these results correspond to those presented in Figure 1, confirming the robust nature of the monitoring programme and similarly, the time series is too short to make inference about fishing trends.

Corresponding to the change in fishing location, analysis of the household calendar data revealed that there was a change in fish consumption (reef fish being consumed 84% of the time in CP1 and CP2, declining to 70% in CP3) and sales (reef fish being sold 85% of the time in CP1 and CP2, declining to 55% in CP3).

### Economic analysis

The fisheries-dependent and household socioeconomic data were collated to inform a mid-term economic analysis (consisting of “with-and-without”, “cost-benefit” and “what-if” analysis) of the FAD project in Yap.

#### With-and-without analysis

The change in the value of catch resulting from increased catch rates at FADs is estimated in order to determine the financial benefit of FADs in increasing small-scale fisher efficiency. This is done by taking the hours fished at FADs and applying an average non-FAD catch rate (Fig. 4) to compare the value of production with and without FADs. Assuming that, in the absence of FADs, fishing effort (hours) dedicated to FADs is applied to non-FAD locations, the difference between the value of the catch with and without FADs amounts to the financial benefit of the increased fisher efficiency resulting from FADs.

This is modeled under three scenarios using the FAD and non-FAD (average) CPUEs ( $\text{kg hr}^{-1} \text{boat}^{-1}$ ) presented in Figure 4. The scenarios are: actual reported fishing effort at FADs over the five-month monitoring period, and extrapolated<sup>9</sup> fishing effort for five-month and one-year periods (Table 2).

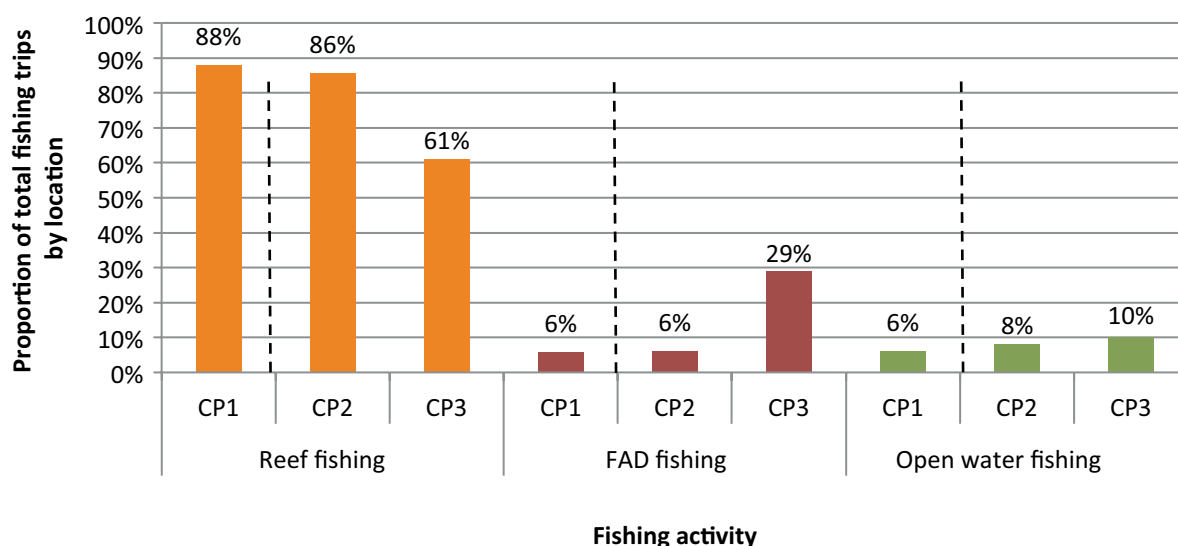


Figure 5. Household fishing activity by location from the calendar survey at all sample sites, CP1 to CP3. The vertical dotted line is the time when a FAD fishing skills workshop was delivered in Yap.

<sup>9</sup> Fishing effort is extrapolated by multiplying the estimated 1,496 fishing trips (Table 1) per annum by 22% (FAD fishing events), equating to 329.12 FAD fishing events per annum. Dividing this by 12 and multiplying by 5, we estimate 137.13 fishing events at FADs over the five-month sampling period. The average fishing effort at FADs of 1.56 hours is multiplied with the estimated fishing trips (137.13) to estimate our total FAD fishing effort of 213.93 hours over five months.

Table 2 demonstrates that the actual change in revenue to the fishing community resulting from increased catch rates at FADs after five months was ~USD 5,285, and when extrapolating, this amounts to ~USD 9,908 over the five-month sampling period. Over a year, this is estimated to increase catch value by ~USD 23,780 to the fishing community in the sample sites.

### Mid-term cost–benefit analysis

In calculating the economic return from the project, the project cost was approximately USD 20,000, with capacity building and monitoring costs treated as sunk<sup>10</sup>.

Accounting for the project cost and the benefits (cash inflow) presented in the with-and-without analysis (Table 2), and applying a 10% discount rate, the project generated a positive economic return (NPV) within a year; over a two-year period, it is estimated to have generated a net economic benefit of ~USD 21,272 (Table 3). That is, after investment costs for FAD materials and deployment are stripped out, the economic benefit amounts to USD 22,272, or an internal rate of return (IRR) of 84%.

This financial benefit omits other direct and indirect benefit of FADs, such as reduced fishing pressure on

Table 2. With and without analysis of the FAD project.

#### Scenario 1: Five-month period benefit of FAD (actual reported, no extrapolation)

	CPUE (kg hr <sup>-1</sup> boat <sup>-1</sup> )	Effort (h)	Total catch (kg)	Price (USD kg <sup>-1</sup> )	Revenue (USD)
With FADs	24.94	114.10	2,846	3.30	9,392
Without FADs	10.91	114.10	1,245	3.30	4,107
<b>Change in revenue resulting from FADs</b>					<b>5,285</b>

#### Scenario 2: Five-month period benefit of FAD (extrapolated)

	CPUE (kg hr <sup>-1</sup> boat <sup>-1</sup> )	Effort (h)	Total catch (kg)	Price (USD kg <sup>-1</sup> )	Revenue (USD)
With FADs	24.94	213.93	5,336	3.30	17,609
Without FADs	10.91	213.93	2,333	3.30	7,700
<b>Change in revenue resulting from FADs</b>					<b>9,908</b>

#### Scenario 3: Annual estimated benefit of FAD (extrapolated)

	CPUE (kg hr <sup>-1</sup> boat <sup>-1</sup> )	Effort (h)	Total catch (kg)	Price (USD kg <sup>-1</sup> )	Revenue (USD)
With FADs	24.94	513.43	12,806	\$3.30	42,261
Without FADs	10.91	513.43	5,600	\$3.30	18,481
<b>Change in revenue resulting from FADs</b>					<b>23,780</b>

Table 3. Mid-term cost–benefit analysis of the Yap FAD project.

	Year 0 (USD) (actual)	Five months (USD) (extrapolated)	Year 1 (USD) (projected)	Year 2 (USD) (projected)
Cash inflow (benefit)		9,908	23,780	23,780
Cash outflow <sup>11</sup> (project cost)	20,000			
Net cashflow	-20,000	9,908	23,780	23,780
Net present value (NPV)	-20,000	9,523	21,618	19,653
<b>Cumulative NPV</b>	<b>-20,000</b>	<b>-10,477</b>	<b>1,618</b>	<b>21,272</b>

<sup>10</sup> Sunk costs are non-recoverable costs that are omitted from investment appraisal (e.g., project-associated costs such as training, monitoring).

<sup>11</sup> Purchase of sufficient materials for 12 FADs, 1 container and shipping plus USD 3,762 for anchors, deployment and miscellaneous costs.



reefs, which leads to improved ecosystem services and climate change adaptation, which should be considered in a comprehensive cost-benefit analysis.

### What-if analysis

Figures 2 and 5 demonstrate that FAD fishing effort increased in the latter months of the monitoring period and from this, it can be inferred that fishing effort transfer occurred from non-FAD to FAD fishing locations<sup>11</sup>. Considering this, we conduct a what-if analysis to predict the financial benefit derived from increased fishing effort and catch rates at FADs should this trend of effort transfer continue. This is done by modelling three effort transfer scenarios where it is hypothesised that fishing effort at non-FAD locations is transferred to FAD locations with FAD catch rates applied. For the three scenarios 25%, 50% and 75% of total non-FAD effort transfer are modelled.

Under these scenarios and assuming that catch rates and fish price remain steady, 25%, 50% and 75% effort transfer from non-FAD to FAD fishing locations would increase revenue to the fishing community by USD 50,065 (24% increase in revenue), USD 100,130 (47% increase) and USD 150,195 (71% increase) over a one-year period, respectively.

Considering the trends presented in Figures 2 and 5, it is reasonable to assume that scenario 2 (50% effort transfer) is a likely scenario when hypothesising fishing effort transfer. Therefore, over the life of the FAD project (two years), it is estimated that effort transfer and increased catch rates at FADs may increase revenue to the fishing community by approximately USD 200,260 (47%).

### Conclusion

The interim results of the fisheries-dependent monitoring programme and household survey are indicative that both boat-based fishers and Yapese households utilise coastal areas (reefs, lagoons and mangroves) as their primary fishing grounds and source of food and income. This, in itself, demonstrates the importance for improved coastal fisheries management to build resilient coastal ecosystems under a scenario of climate change. It also demonstrates the need to provide alternative opportunities for Yapese fishing communities to continue their traditional fishing ways in anticipation of declining coastal fisheries productivity.

A FAD is identified as an infrastructure that facilitates the capture of pelagic fish, providing access to fish stocks, such as tunas, that are resilient to high levels of fishing pressure by small-scale fleets and are less susceptible to the projected effects of climate change. The analysis of the data derived from the FAD monitoring programme in Yap enables the following conclusions:

- FADs improve fisher efficiency, in terms of increasing catch rates.
- FADs may encourage household behavioural changes, in terms of diverting fishing activity away from the coast, and in changing fish consumption and sales from reef fish to pelagic fish that are typically associated with FADs.
- The financial cost incurred from procuring and installing FADs is significantly outweighed by the additional catch values generated.
- If fishing effort continues to be transferred from the reefs, lagoons, mangroves to open water area, catches and associated revenue to fishing communities will increase.

The above conclusions are not definitive due to the short time series and it is, therefore, recommended that the monitoring activity be extended for a longer period.

### Acknowledgements

Numerous stakeholders have been involved in the Coping with Climate Change in the Pacific Islands Region project and their contribution is gratefully acknowledged; however for the FAD monitoring component of the project, the contributions of the following individuals are greatly acknowledged and appreciated: the five data collectors Joseph Waayan, John Gamou, Joe Lukangaw, Paul Gorong, and John Yangruw; the fishers and households in the municipalities of Rumung, Maap, Gagill and West Fanif who provided their valuable data; Yap Community Action Programmeme (YapCAP), especially Julian Tewasilpiy, who administered the data collection programme; Yap's Marine Resources Management Division of the Department of Resources and Development, especially Mr James Pong, who oversaw the data collection programme; the New Zealand Aid Agency (NZAID) who funded the data collection; the German Agency for International Cooperation (GIZ), especially Fenno Brunken; and the Secretariat of the Pacific Community (SPC), especially Etuati Ropeti, Michel Blanc, William Sokimi and the Data Management Team.

<sup>12</sup> Figure 2 demonstrates that FAD fishing in the last two months of monitoring accounted for almost 50% of boat-based fishing activity, while Figure 5 demonstrates household FAD fishing activity (including non-boat based) was approximately 30% of total fishing activity in CP 3.

## The development of recreational sports fisheries in the Pacific

**Carl McNeil**

*Director, On the Fly Productions<sup>1</sup>*

*It is late December 2012, and I am in the Poingam region at the very northern tip of New Caledonia. I am here at the bequest of Michel Blanc, Fisheries Development Adviser with the Secretariat of the Pacific Community (SPC). This trip is the first practical step that Michel and I will take to assist and support the establishment of a recreational sports fishing operation in the area. We will be working with local Kanak guide Benjamin (Ben) Dahma, who is a well-respected local man and experienced fisherman. Ben wishes to develop a guided bone fishing operation that caters to anglers visiting the region, and it is our job to help him realise that goal.*

It is *Albula glossodonta* that we will be chasing, the short-jawed, or round-jawed bonefish. *Glossodonta* is perhaps the most widespread of all *Albula* species in the Indo-Pacific. It is a highly regarded sports fish species that fly-fishermen travel all over the world to catch, and we hope they will travel to Poingam.

Over the course of our 10-day trip much time was spent teaching Ben the multitude of things he will need to know as a commercial bonefish guide. Angler etiquette, basic English, various aspects of hospitality, first aid, knot tying, fly casting and fly tying are some of the many topics covered.

The grass in front of our bungalow is littered with coconuts, and this area is our classroom as we practice “out on the flats”, with the coconuts playing the part of the bonefish that our imaginary clients have come to catch. There is much role-playing, and we take turns as Ben practices calling out the location and distance of our coconut bonefish and the direction in which there they are swimming.

“Bonefish! 3 o’clock, 20 meters going left to right!” This is the catch cry of the seasoned bonefish guide, and in order to deliver results for clients, Ben’s ability to spot and call the location of a cruising bonefish to an



*Albula glossodonta*, short-jawed bonefish.

<sup>1</sup> On the Fly Productions is a media and fly fishing company based in New Zealand. Email: carl.mcneil@gmail.com



*Ben (right) enjoys learning how to tie his own flies — an important skill in an area without a tackle shop.*

expectant client will be one of the most important skills he learns and hones.

Our 10 days together come to a close all too soon and we leave Ben to get on with the job of buying and setting up a boat for fly- and cast-fishing, as well as making a start on establishing his operation. Michel and I will return in 14 months time.

## Sport fishing on the fly

Sport fishing using simple flyfishing gear is a form of recreational fishing where the primary reward is the challenge of finding and catching fish rather than the culinary or financial value of the fish's flesh.

"Catch and release" is practiced by most flyfishermen, with the target species usually safely released once successfully caught. Most practitioners employ techniques that will cause as little damage and stress to the fish as possible. Barbless hooks are common, fish handling is kept to a minimum, and "overplaying" fish is avoided as much as possible.

Bonefish feed on benthic worms, fry, crustaceans, and molluscs. Ledges, drop-offs, and clean, healthy seagrass beds yield abundant small prey such as crabs and shrimp.

Bonefish are often seen following stingrays to catch the small animals that the rays root out from the sand.

Interestingly, bonefish can tolerate oxygen poor water by inhaling air into a lung-like air bladder.

## New Caledonia as a bonefishing destination

New Caledonia has the largest coral reef lagoon in the world, and it is dotted with many small islands, each surrounded by soft, white sand beaches and coral reefs. In 2008, the United Nations Educational, Scientific and Cultural Organization listed 15,000 square kilometres of the lagoon as a World Heritage Site.

Over 40,000 hectares of the lagoon's reefs and islands are designated as special marine reserves. Locals and visitors alike find easy access to just about every kind of water sport imaginable.

The lagoon is of exceptional natural beauty. It features a great diversity of coral and fish species, and a wide range of habitats from mangroves to seagrass beds with the world's most diverse concentration of reef structures.

New Caledonia's lagoon contains intact ecosystems that host healthy populations of large predators and a diversity of big fish. The lagoon provides habitat to a number of emblematic or threatened marine species such as sea turtles, whales and dugongs (the third largest population in the world are found here).



It is no surprise then that New Caledonia's lagoon is also home to large numbers of some of the most popular gamefish in the world — the bonefish being among them.

My cohort Michel Blanc works within SPC's Division of Fisheries, Aquaculture and Marine Ecosystems (FAME), which promotes many types of sustainable fishing practices throughout the Pacific Islands region. On this field trip Michel acts as facilitator and "cultural attaché", but it is Michel, in his capacity at SPC that has instigated and driven this project.

I am a New Zealander and my French is limited to a few basic phrases. Ben, our trainee guide, has about the same level of English. Fortunately, we have two French interpreters to help us.

Completing our team on this trip is Etienne Picquel of Blue Calédonie Fishing Trips. Well known to gear anglers<sup>2</sup>, Etienne is an impressive character and a master of stand-up tackle for pelagic fish, both large and small. Etienne is responsible for some of the most impressive catches in the South Pacific, and he is an expert skipper and rigger.

My association with SPC, Michel and Etienne began in Aitutaki, Cook Islands, in 2009, where we met during the filming of our bonefish documentary "Itu's Bones". The film documents the development of a recreational bonefish fishery in Aitutaki's lagoon, and the narrative focuses on a young net fisherman who decides to hang up his gill nets in exchange for a flyfishing rod and sets up a guiding business.

SPC was instrumental in supporting the project with training and fisheries advice that led to the creation of what is now a world-class bonefish fishery.

The scenario we now find ourselves involved with in New Caledonia is a surprisingly similar situation.

## The importance of recreational fisheries to Pacific Island people

The negative effects of climate change and sea level rise aside, the Pacific Islands face numerous circumstances that will be familiar to many. Commercial investment has generally bought improvements in infrastructure, trade and commerce. However, large offshore commercial fishing operations have also contributed to the decline of fish stocks that have historically been part of the local diet and a revenue earner for local fishermen.

While tourism has experienced an increase in visitor numbers, these operations tend to be foreign-owned employing low-paid, largely unskilled labour, and mostly women. While it's certain that visiting tourists support and contribute to the local economy, larger resorts and hotel operations tend to derive income "in house" as much as possible. Food, drinks, entertainment, tours and even items in gift shops with "Made in China" souvenirs become increasingly self contained, seeing less of a flow-on effect into the hands of local people.

Life is changing rapidly in the Pacific Islands region, and if you are a young person looking for meaningful employment the situation is increasingly challenging.

SPC's core focus is all about improving the lives of Pacific Islanders, and fisheries development plays an important part in this strategy. While the scoping and development of recreational sports fisheries is but a small subset of this work these activities deliver surprisingly large returns for relatively low inputs. The Aitutaki experience has clearly borne this out.



*A typical scene from the lagoons surrounding the Poingam area.*

<sup>2</sup> Gear anglers use spinning reels, casting rods and plastic or metal lures with treble hooks, while fly anglers use center pin reels and flies made from fur and feathers carrying a single hook.

## The Aitutaki recreational bonefish fishery

In early 2009, the Cook Islands Ministry of Marine Resources launched an initiative to implement a substantial Fisheries Management Plan for the lagoon at Aitutaki, one of the northernmost Cook Islands. A major feature of the proposal was to implement a ban on the use of gill nets to catch bonefish within the lagoon and surrounding reef system.

Over a period of 20 years a small group of local fisherman became adept at gill netting bonefish. Although evidence was largely anecdotal, it was apparent that fish stocks were rapidly declining and with no legislation or management plan in place, any efforts towards conserving the resource had proven ineffective.



*Itu Davey, standing high on his boat, looking for bonefish, the “ghost of the flats”.*

In order to encourage local fisherman to conserve and better manage bonefish it was clear that alternative means to derive an income would need to be developed and made available.

Inspired by the success of the recreational bonefish industry on Christmas Island in Kiribati, it was envisioned that Aitutaki fishermen could be retrained and assisted to work in recreational fishing and charter businesses that cater to visiting tourists.

Led by SPC and the Ministry of Marine Resources, and supported by the Cook Islands Government, a major project was launched that would eventually assist in getting a comprehensive fisheries management Plan passed into legislation in 2011.

With many stakeholder and local community consultations, the negotiation and the eventual implementation

of the Aitutaki Lagoon Management plan was a complex and lengthy process.

SPC’s assistance was requested in order to provide expert advice and training in fisheries management and to facilitate and run a two-week-long training workshop for prospective fishing guides in June 2010.

The workshop was comprehensive, providing training in small boat operation and maintenance, fishing methods, fish handling, tackle and equipment maintenance, first aid, and VHF radio operation.

While the number of workshop participants that actually went on to establish small businesses was relatively small, the operators that took the opportunity have delivered startling results.

One such participant was Itu Davey, the focus of the aforementioned documentary. Prior to the introduction of the Fisheries Management Plan and delivery of the training workshop, Itu and his family were the main protagonists, indiscriminately gill netting in the lagoon, with large numbers of bonefish being harvested from fragile spawning and aggregation areas.

Prior to 2009, Itu was selling a string of five bonefish at the local market for around NZD 25. It is important to note that although bonefish were regarded as a delicacy by older people on the island, bonefish were not a core food species for most local people.

Today, Itu Davey’s recreational catch-and-release bonefishing operation runs three skiffs, with another inshore and offshore boat currently being built. The operation directly employs five men, and Itu’s wife, manages bookings and accounting. The operation is extremely successful. Itu’s small bonefishing operation sees many hundreds of thousands of dollars in offshore revenue delivered to the island each year. This revenue is shared by many businesses on Aitutaki and the overall benefits have been substantial.

Flyfishing anglers tend to stay in cheaper “mom-and-pop” accommodations, buy local produce that is grown and prepared by local people, and buy locally made souvenirs. And, the guide they come to fish with relies heavily on local businesses — everything from the cousin who is a small engine mechanic, to the aunty who bakes the local bread. In short, grassroots businesses involved in recreational angling do a great job of supporting local people and business, putting dollars directly into local economies.

The overall benefits derived from the development of the Aitutaki recreational sports fisheries clearly shows that if run and managed by local people, guiding operations certainly tick all the boxes and conform to what is an ideal small business model.

## Advantages of recreational sports operations

The benefits and advantages of a recreational sport fishing industry include the following.

- Direct, well-paid, skilled employment for local fishermen who are becoming increasingly constrained in their subsistence or commercial fishing operations.
- Experienced fishermen can leverage their existing knowledge and experience by switching over to guiding activities.
- Revenue goes directly into the hands of local people.
- Smaller businesses are both environmentally and commercially more sustainable than larger ones.
- Control and management of fisheries is placed where it belongs: in the hands of local villages and tribes.
- Gamefishing operations tend to be catch-and-release, particularly with regard to fly fishing-based operations.
- The effective value of a live fish is many times higher than if harvested for food.
- “Catch-and-release” recreational fisheries promote a preservation attitude toward fisheries resources in general. These operations offer a sustainable alternative compared with the more traditional fishing approach, which sees large quantities of low-value fish being harvested commercially.

## Challenges

There are a number of challenges relating to development work in the Cook Islands and New Caledonia. Some of these will be resolved in initial scoping work, while others require ongoing attention.

- Getting universal “buy in” and support from stakeholders, operators and local people can be a complex, political and lengthy process.
- To date, little in the way of data has been available on which to quantify and measure the state and health of coastal fisheries prior to establishing a sports fishing operation. This is an important requirement for informed resource management.
- Surveying and identifying spawning and aggregation areas are required in order to implement effective management and licensing systems. This was done in the Cook Islands and has had positive results.

- Angler and guide licensing can be used as effective survey and management tools. Simple and easily implemented systems need to be developed and implemented.
- Revenue from licensing can be used to assist with ongoing management and monitoring.
- A percentage of licensing revenue can be used as reparation for the *de facto* commercialisation of fisheries and delivered back to communities for “good works” projects, thus ensuring wider community support and acceptance.
- Monitoring, regulation and enforcement remains a challenge. Experience shows that local authorities tasked with enforcement find it challenging to cite or reprimand local people who are often relatives and/or family members. Effective monitoring and enforcement of regulations must be carried out by impartial third parties from outside the region.

## New Caledonia revisited

Michel, Etienne and I returned to New Caledonia in early March 2014. The purpose of this trip was to capture promotional media, check on Ben’s operation, and better understand how best to support these types of initiatives going forward.

We took photographs and gathered material for articles that will be used as promotional materials by various stakeholders, such as New Caledonia’s tourism agencies and associated operators. Included on the agenda is a feature article for an Australasian fly fishing magazine, and additional pictures placed on fishing-related websites, blogs and social media.

In addition to photographs, we shot a considerable amount of video because one of the main deliverables of the trip is to produce two short promotional video clips. These clips will be delivered to SPC and tourism agencies in New Caledonia, and made available to local tourism operators who wish to promote the region on their websites.

This promotional activity is a vital element for the successful development of the activity, intended to help raise awareness of Ben’s operation and the desirability of northern New Caledonia as a prime destination for anglers.

Promotional and awareness activity and marketing are vital and easily overlooked aspects of initiatives such as this one. For without promotion, paying customers will not come if they are not aware of what Ben and the region has to offer. And that, will be the measure of his success.





*Success! Ben assists his client with landing and releasing a bonefish.*

## Moving forward

Based on the experience with the Aitutaki and New Caledonia projects, it is clear that the development of recreational sports fisheries will afford multiple and broad-ranging benefits to communities and businesses.

Given time, and with sufficient promotion, financial benefits can be substantial, environmental benefits many, and social impacts huge.

While neither project is without ongoing challenges, progress is very encouraging.

For what are comparatively low inputs (as compared with many development projects), the successful establishment of a sustainable sports fishery provides multiple benefits across a broad range of stakeholders.

These types of projects fit well within Island communities and hold the promise of many more profitable, long-term and sustainable businesses for Pacific Islanders.

*All pictures in this article are by the author:  
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