

Report of the international workshop on

“Taxonomy, Biology and Ecology of Coral, and Reef Monitoring”

Seminars & Field training program (9th to 12th September 2014)

School of Marine Studies, University of the South Pacific - Fiji

The University of the South Pacific at Fiji (USP), the Secretariat of the Pacific Community in New Caledonia (SPC) and the French Institute for Pacific Coral Reefs at Moorea, French Polynesia (CRIOBE - IPCR) have joined in a partnership to develop and offer the *"Taxonomy, Biology and Ecology of Coral, and Reef Monitoring"* workshop. This workshop was funded by the French Embassy (Fond Pacifique) and the SPC. A total of 55 persons followed this workshop organized on the USP campus at Fiji from 9th to 12th September 2014. There were two key objectives to the workshop: 1/ to increase capacity at the level of USP, government and NGO staff already involved in coral taxonomy and coral reef monitoring (39 persons involved in this workshop), and 2/ to allow USP students to learn the different techniques of coral reef monitoring (16 students involved in this workshop); particularly with regards to recent knowledge on coral taxonomy and recent surveying techniques and data analysis tools. To achieve these objectives, the workshop was split into two parts:

1. Seminars were held at USP campus on Tuesday. These seminars were meant to provide a knowledge base in coral taxonomy, biology and ecology, and surveys methodology. Each oral presentation lasted about 20 minutes + 10 minutes for open discussion. The oral presentations were done by USP, SPC and IRCP - CRIOBE Professors and Staff.
2. A field training program was run at Muaivuso village on Wednesday and Thursday, and the data collected in the field were analyzed on Friday at USP campus. The training program provided a basic knowledge in "Recent techniques for coral taxonomy, description and monitoring". The training program was organized by IPCR - CRIOBE Professors and Staff.



Photo of the participants at the workshop " Taxonomy, Biology and Ecology of Coral, and Reef Monitoring" organized at USP

Workshop Program

Day 1: Tuesday 9th September, 2014 (*School of Marine Studies*)

8:30am - 9:00am – Welcome to USP (Prof. C. Rico [USP] & D. Lecchini [IPCR])

9:00am - 12:00am – **Coral research and Coral reef monitoring in the South Pacific**

1. 9:00 / 09:15 => Different research thematics of CRIOBE (C. Berthe - IPCR)
2. 09:15 / 09:50 => Research on the biology and the ecology of coral by CRIOBE (A. Puisay - IPCR)
3. 09:50 / 10:15 => Research on coral diseases in Fiji (Y. Nand - USP)

Coffee break => 10:15am / 10:30am

4. 10:30 / 11:00 => Different monitoring programs of CRIOBE in the South Pacific (V. Liao - IPCR)
5. 11:00 / 11:20 => Monitoring programs in Solomon Islands (T. Leve - WWF Solomon)
6. 11:20 / 11:40 => IUCN monitoring programs in South Pacific (V. Waqalevu - IUCN Fiji)
7. 11:40 / 12:00 => FLMMA monitoring programs in Fiji Islands (B. Carte - FLMNA Fiji)
8. 12:00 / 12:20 => Monitoring programs by Solomon Fisheries Department (J. Leqata - Fisheries Department Solomon)

02:00pm - 05:30pm - **Coral Taxonomy and Methods in coral reef monitoring**

1. 02:00 / 03:00 => Introduction to coral taxonomy (P. Bosserelle - IPCR)
2. 03:00 / 04:00 => Different methods of coral and substrate monitoring (V. Liao - IPCR)

Coffee break => 04:00pm / 04:30pm

3. 04:30 / 05:30 => General discussion and presentation of the training course (D. Lecchini - IPCR)

Day 2: Wednesday 10th September, 2014 (*School of Marine Studies and Muaivuso site*)

Team 1 (8:00am - 12:00am) - Training course on coral taxonomy at USP campus (D. Lecchini, P. Bosserelle - IPCR)

Team 2 (8:00am - 4:00pm) - Training course at Muaivuso site to practice the different coral reef monitoring methods (A. Puisay, V. Liao, C. Berthe - IPCR)

Day 3: Thursday 11th September, 2014 (*School of Marine Studies and Muaivuso site*)

Team 2 (8:00am - 12:00am) - Training course on coral taxonomy at USP campus (V. Liao - IPCR)

Team 1 (8:00am - 4:00pm) - Training course at Muaivuso site to practice the different coral reef monitoring methods (A. Puisay, P. Bosserelle, C. Berthe, D. Lecchini - IPCR)

Day 4: Friday 12th September, 2014 (*School of Marine Studies*)

9:00 – 12:00 - Analysis of results acquired during the training days (V. Liao, A. Puisay, P. Bosserelle, C. Berthe, D. Lecchini - IPCR)

02:00 – 04:00 - General discussion about the workshop (V. Liao, A. Puisay, P. Bosserelle, C. Berthe, D. Lecchini - IPCR)

Coffee break => 04:00pm / 04:30pm

04:30 – 05:00 - Official Closing of Workshop and Awarding of Certificates (D. Lecchini - IPCR)

05:00 – 07:00 - Farewell Party - Seafood Village at USP

Abstract of workshop

Since 2006, the USP and the IRCP have joined in a partnership to develop and offer several workshops on USP campus. These workshops were funded by the French Embassy (Pacific Fund). Two key objectives to the workshop: 1/ to allow USP students to learn the different techniques of coral reef monitoring (coral, fish and invertebrates); 2/ to increase capacity at the level of USP, government and NGO staff already involved in coral reef monitoring. The different workshops organized by the Criobe and USP are the follow:

2006 (Fiji): Examination of the effectiveness of different taxonomic survey intensities represented by different methodologies in understanding affects of Marine Protected Area designation on fish population abundance in a Fijian context ;

2008 (Fiji): Coral Reef Ecology and Survey Methods Workshop (size estimation of fish inside and outside MPA, and recent techniques for habitat description and monitoring) ;

2012 (Fiji): Monitoring & Survey Methods in Coral Reefs (fish and benthic invertebrates) ;

2013 (Solomon): Different survey methods for coral reef fish, including methods based on underwater video.

2014 (Fiji): Taxonomy, Biology and Ecology of Coral, and Reef Monitoring

During the workshop at Fiji in 2014, the first goal was to learn the taxonomy of coral to the staffs already involved in coral reef monitoring and also to USP student.

Coral Taxonomy was exposed both in the lab and in the field. Following an introduction to coral taxonomy on the first day, participants were able in the lab to practice recognition of skeletal morphological features used for coral identification (see table below) and to differentiate some of the most abundant coral genus of Fiji using an identification key designed for this workshop.

For this, participants were able to manipulate coral samples form USP collection. In the field, participants (with the help of organizers) tried recording genus present in the study site of Muaivuso. Finally, on the last day, a revision of coral genus seen on the field was realized.



Photo of the participants learning the coral taxonomy

Table used to identify coral genus

Family	Genus	Calice Size	Main Colony form	Corallite arrangement	Characteristics
Acroporidae	<i>Acropora</i>	small (< 2 mm)	Variable (arborescent to tabular)		Axial/Terminal corallites.
	<i>Montipora</i>	small (< 2 mm)	Variable: mainly encrusting or laminar at the base, with vertical expansions,	Plocoid	Rough (coarse), porous, irregular coenosteum Usually with small papillae or tuberculae.
	<i>Astreopora</i>	medium (2-7 mm)	Massif ou encroûtant	Plocoid	Well developed porous coenosteum. Superficial or conical corallites. Deep calices, diameter 3-4. mm, septa poorly developed.
Pocilloporidae	<i>Pocillopora</i>	small (< 2 mm)	Branching (non- <i>Acropora</i>) - short branches		Wart like growths on the skeleton (verrucae), Corallites look «empty»
	<i>Stylophora</i>	small (< 2 mm)	Branching (non- <i>Acropora</i>) - short branches		Blunt or flat-ended branches. Hoods on corallites
	<i>Seriatopora</i>	small	Branching (non- <i>Acropora</i>) – compact		Branch tips pointed or rounded with width smaller than the rest of branch. Corallites

		(< 2 mm)	bushes		arranged in rows.
Porites	<i>Porites</i>	small (< 2 mm)	Variable: Massive, Branching, Encrusting, Laminar, Columnar...	Plocoid (Br) Cerioid (M)	Smooth surface, sometimes vertical extension (when massive) might be several meter large.
	<i>Goniopora</i>	small (< 2 mm)	Massive, Branching, Columnar	Cerioid	Polyp often extended during the day, with 24 tentacles. Skeleton porous.
Merulinidae	<i>Montastrea</i> (<i>Phymastrea</i>)	medium (2-7 mm)	Massive	Plocoid	Usually circular regular Calice which can be crowded. Distinct Costae, slightly erected Wall. Extra-tentacular budding, coenosteum not well developed.
	<i>Favia</i> (<i>Dipsastrea</i>)	Medium (2-7 mm) Big (> 7 mm)	Massive	Plocoid	Usually circular regular. Distinct Costae, slightly erected Wall. Intra-tentacular budding, well developed coenosteum.
	<i>Favites</i>	big (> 7 mm)	Massive	Cerioid	Sub-circular to Polygonal Regular corallites. Thin septa, presence of septal dentation not sharp.
	<i>Cyphastrea</i>	medium (2-7 mm)	Massive, Encrusting	Plocoid	Conical corallites. Small spinules ornamenting coenosteum. Septa not numerous (Usually <26).
	<i>Platygyra</i>		Massive	Meandroid	<u>Medium Width Valley (4,5-8mm)</u> , variable Lenght, contain from 2 to 3 centres. Irregular septa, sometimes above the wall. Irregular

					septal dentation.
Dendrophylliidae	<i>Turbinaria</i>	medium (2-7 mm)	Laminar, Foliose	Plocoid	Circular calice, slightly prominent, even short septa, Well developed columella, porous and spongy coenosteum. Smooth aspect.
Euphylliidae	<i>Galaxea</i>	Medium (2-7 mm)	Massive	Phaceloid	Corallites well separated, vertically well developed; prominent septa above the wall
Agariciidae	<i>Pavona</i>		Variable : Massive, Encrusting, Foliose	Thamnasterioid	Septo-costae extending from one centre to another, wall absent or not very distinct. Septo-costae short, thick. Massive colony can develop columns or ridges.
Incertae sedis	<i>Leptastrea</i>	medium (2-7 mm)	Massive, Encrusting	Ploco-cerioid	Sub-circular crowded; indistinct Coenosteum (reduced to narrow furrow between corallites). Numerous septa (> 30).
Diploastreidae	<i>Diploastrea</i>	Big (> 7 mm)	Massive	Plocoid	Conical, polygonal Corallites with thick wall. Even aspect and colour.
Milleporidae*	<i>Millepora</i>	Very small pores	Variable : Massive, Encrusting, Branching		Smooth surface with fine transparent « hair ». Typical brownish-yellowish colour.

During the workshop at Fiji in 2014, the second goal of two field trip days were to compare four methods to survey benthic substrate (including coral) :

- **Line Intercept Transect (LIT)** : this method consist of measuring the length of every categories of substrate encounter on the transect of 25 m long. Each participant conducted at least two transects.



Photo of a participant using the Line Intercept Transect Method

Advantages	Limitations
<ul style="list-style-type: none"> + More information than P.I.T. at equal length. (Ex: size structure , number of individual etc...). + Better estimate of specific richness (number of coral genera) + Good estimation of coral cover + Few equipment needed 	<ul style="list-style-type: none"> - Time consuming

- Point Intercept Transect (PIT) : this methods consist of recording the substrate category at every 50cm at the vertical of the transect of 25 m long. Each participant conducted at least two transects.

Advantages	Limitation
+ Good estimate of coral cover. + Relatively fast method (allowing to survey large area) + Easy to replicate + Few equipment needed	-Rare species undetected. - Number of point required associated with spatial variability. - Variability between observers

- Point Intercept Quadrat : for this method, a rope is attached every 10cm (vertically and horizontally) within the quadrat. The category of substrate present at every intersection is then recorded. Each participant conducted at least two quadrats.



Photo of participants using the Point Intercept quadrat method

- Individual counting and cover estimate Quadrat: the percentage cover of every type of substrate is directly estimated within the quadrat and every colony of coral is counted. Each participant conducted at least two quadrats.

Advantages	Limitation
+ Easy to set up	- Small surface coverage
+ Use of a camera (allow non specialist to do it on the field)	-Not convenient for highly (3D) surface
+ Time saved underwater	- Information can be lost with low resolution pictures

Before applying those methods on the field, the four methods were presented to all participants during the seminars and the categories of substrate surveyed were also clearly define (Table below). During the field trips on Muaivuso, the 10th and 11th of September, every participant was able to do one 25m transect with the PIT and LIT techniques as well as several quadrats with both techniques.

CATEGORIES	DESCRIPTION
Live coral	Every hard coral alive, including fragment over 15 cm. Identification to genus level.
Dead Coral	Recently dead coral (Since less than 1 year), still attached to the substrate or recently broken.
Macro-algae	All non-calcareous algae over 5mm.
Pavement	All hard substrate, even covered by small algal turf (less than 5mm) or encrusting algae. Dead coral over 1 year are included in this category.
Rubble	Coral fragment non attached to the substrate and between 0.2 and 15 cm.
Sand	Sediment less than 0,2 cm that do not stay in suspension in the water column.
Mud	Sediment that remain in suspension and darken the visibility when in suspension.
Other	Other organisms (Anemone, shells, soft coral...)

Overall, the coral and substrate data collected in the field at Muaivuso were analyzed on Friday at USP campus by all participants and we compared the difference in coral abundance and species richness between the three techniques (LIT, PIT and quadrat). Moreover, each participant could give his opinion about the advantages and disadvantages of each technique.

Annex 1: List of participants

No.	Name	Organisation	Address of organisation
1	David Lecchini	IRCP / CRIOBE	Moorea
2	Vetea Liao	IRCP / CRIOBE	Moorea
3	Antoine Puisay	IRCP / CRIOBE	Moorea
4	Cecile Berthe	IRCP / CRIOBE	Moorea
5	Pauline Bosserelle	IRCP / CRIOBE	Wallis
6	Shirleen Bala	USP Institute of Marine resources	Fiji
7	Viliame Waqalevu	IUCN	Fiji
8	Ciro Rico	Professor	Fiji
9	Tingo Leve	WWF	Solomon
10	John Leqata	Ministry of Fisheries and Marine Resources	Solomon
11	Emmanuelle Charrier	French Embassy at Fiji	Fiji
12	Sri Nandini	USP	Fiji
13	Watisoni Lalavanua	Partners in Community Development Fiji	Fiji
14	Isimeli Loganimoce	USP Institute of Marine resources	Fiji
15	Brad K. Carte	Fiji Locally Managed Marine Area (FLMMA) Network	Fiji
16	Rosemary Dautei	USP Institute of Applied Science	Fiji
17	Dilpreet Kaur	Private Consultant	Fiji
18	Volau Tiko Titako	Ministry of fisheries and forests	Fiji
19	Apolosi Cokanasiga	Ministry of fisheries and forests	Fiji
20	Moqse Yabakiva	Ministry of fisheries and forests	Fiji
21	Unaisi Nalasi	Ministry of fisheries and forests	Fiji
22	Diana Valotu	Ministry of fisheries and forests	Fiji
23	Yashika Nand	USP Wildlife Conservation Society	Fiji
24	Epi Qalobula Batibasaga	Department of Fisheries	Fiji
25	Moape Yabakiva Kania	Department of Fisheries	Fiji
26	Navneel Singh	Fiji Fisheries	Fiji
27	Romuluse Raisele	Fiji Fisheries	Fiji
28	Kalisiana Marama	Fiji Fisheries	Fiji
29	Frank Jeremiah	Fiji Fisheries	Fiji
30	Viliame Salabogi	Fiji Fisheries	Fiji
31	Jone Tamanitoakula	Fiji Fisheries	Fiji
32	Pitila Waqainabete	Fiji Fisheries	Fiji
33	Tevita Vodivodi	Fiji Fisheries	Fiji
34	Ro Iva Meo	Fiji Fisheries	Fiji
35	Jone Kalakai jnr	Fiji Fisheries	Fiji
36	Shubha Singh	USP	Fiji
37	Bethlyn Ete	USP	Solomon
38	Lilly Loe	USP	Fiji
39	Suzanne Turaganiwai	USP	Fiji
40	Shivam Jalam	USP	Fiji
41	Kelly Raikivi	USP	Fiji
42	Jackson Toata	USP	Fiji
43	John Carreon	USP	Fiji
44	Anastasha Savura	USP	Fiji
45	Misila Tanoa	USP	Solomon
46	Celso Cawich	USP	Fiji
47	Wata Saubaleti	USP	Fiji
48	Ronal Lal	USP	Fiji
49	Melisa Poloso	USP	Solomon
50	Apete Dabea	USP	Fiji
51	Jacqueline Nalomaca	Fiji Fisheries	Fiji
52	Pretika Kumar	DOF	Fiji
53	George Tavo	Fiji Fisheries	Fiji
54	Paula Sabarta	USP	Fiji
55	Rahul Tikaram	USP Institute of Applied Science	Fiji