

CEPF SMALL GRANT FINAL PROJECT COMPLETION REPORT

Organization Legal Name:	Coral Reef Research Foundation
Project Title:	Documenting an Existing Invasion to Prevent Future Introductions of Non-Indigenous Species in the Island-like Marine Lakes
Date of Report:	31 May 2010
Report Author and Contact Information	Michael Dawson -- mdawson@ucmerced.edu

CEPF Region: Polynesia-Micronesia Biodiversity Hotspot

Strategic Direction: (1) prevent, control, and eradicate invasive species in key biodiversity areas

Grant Amount: \$17,653

Project Dates: 01 Feb 2009 – 31 Jan 2010

Implementation Partners for this Project (please explain the level of involvement for each partner): Koror State Government and Koror State Department of Conservation and Law Enforcement facilitated the research in Ongeim'l Tketau during the project period and were integrally involved with the design of posters and information booklet, providing feedback on content during the development of these publications and approving and endorsing final products.

Conservation Impacts

Please explain/describe how your project has contributed to the implementation of the CEPF ecosystem profile.

The project has “empower[ed] the stewards of the biodiversity of the Polynesia-Micronesia Hotspot ... to conserve biodiversity more effectively” (CEPF Ecosystem Profile Conclusion) by providing [1] additional information to Koror State Department of Conservation and Law Enforcement on the magnitude of the threat to the jellyfish lake ecosystem by the invasive anemone, [2] media to increase awareness in visitors to the region of the threats that they may unwittingly carry, and [3] further training to a Palauan marine scientist.

In terms of links to the CEPF Investment Strategy, we met each of the following goals:

1. “Strengthen defenses against the introduction and spread of invasive species and pathogens that threaten biodiversity” (CEPF investment strategy 1.1) by raising public awareness through public posters and a brochure.
2. “Control or eradicate invasive species in key biodiversity areas, particularly where they threaten native species with extinction” (CEPF investment strategy 1.2) by contributing to awareness of practices that will prevent introductions of species to other marine lakes.
3. “Perform research, provide training in management techniques, and develop rapid

response capacity against particularly serious invasive species” (CEPF investment strategy 1.3) by describing scientifically and quantifying experimentally the impact of the current invasion, and continuing training of Ms. Sharon Patris in marine science.

Please summarize the overall results/impact of your project against the expected results detailed in the approved proposal.

[1] Assessment of impact of taking no action.

Our surveys have shown continued expansion of the anemone population around the perimeter of the lake. From experiments and observations completed or underway (see below) we infer expansion will continue unless there is human or natural intervention and that such expansion could reduce population sizes of endemic populations, with attendant increased risk of extirpation due to stochastic environmental and population events.

[2] Comparison of efficacy of two treatment methods (in terms of removal of invasive and damage to natives).

This comparison was not undertaken due to logistical constraints.

As an alternative, we have begun an experiment to determine the extent of refuges for native species against invasive anemones (e.g. putatively shallow-water, shaded, rock surfaces). Due to difficulties getting invasive *Aiptasia* to settle on ceramic and plastic plates – the start of this experiment unfortunately coincided with the die-off of *Aiptasia* described in [6] below – the start of the transplant experiment has been delayed to summer 2011.

[3] Assessment of whether eradication is feasible (i.e. high chance of successful eradication or permanent diminution by a method that has acceptably small impacts on the native biota).

Our ability to answer this question is somewhat constrained by the lack of results from the original comparison planned for #2, above. However, given the current spatial extent of the anemone and the degree to which it co-occurs with native biota, oftentimes in structurally complex microhabitats such as mangrove root systems, it is evident that trying to control anemones using any approach that treats swathes of benthos would also remove endemic species. The magnitude of the effect on native biota (relative to no action) is yet to be calculated based on

[4] Greater diversity of media raising awareness of the anemone (posters, brochure, and consultation).

Production of posters and booklet (physical copies have been provided) will increase awareness, although the degree is as yet unquantified. Posters and booklets have been distributed to schools, tour agencies, government offices and posted in public areas in Palau (see attached lists; posters distributed to 85 locations; booklets distributed to 27 locations). These posters will be translated into additional languages (currently only in English) in the coming months, furthering their reach. In addition, existing signs have been replaced at Ongeim'l Tketau (see Fig. 1).

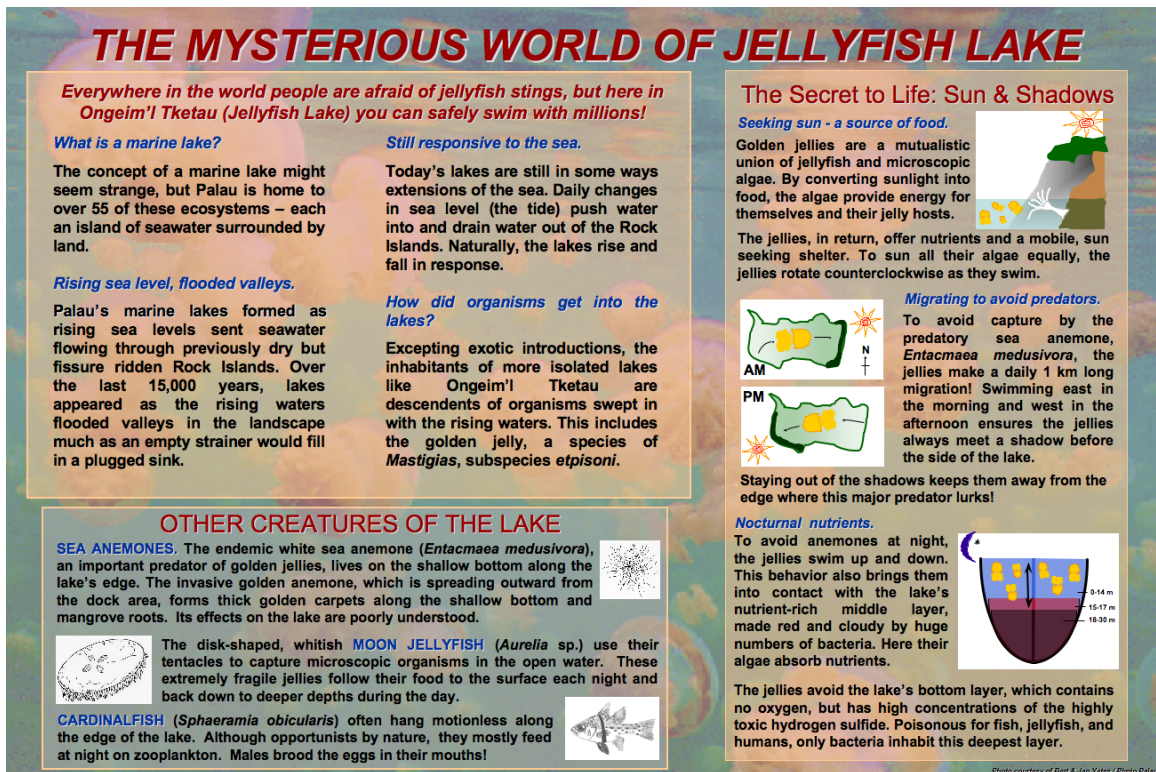


Figure 1. The information sign replaced at Ongeim'l Tketau as part of this project.

[5] *Description of the anemone distribution in 2009 and indications of altered distributions of native organisms.*

Preliminary analyses of quadrat and transect data indicate diversity of native species is inversely correlated with density of invasive *Aiptasia* anemones.

[6] *Anemone population response to natural environmental variation.*

During the award period, a warming event was observed in the lake. Coincident with this period, we observed a bleaching event in some patches of invasive anemones. Anemones died and/or decreased in size, and although patches were reduced they generally did not disappear completely. As the lake cooled, they subsequently regained the brown coloration typical of healthy zooxanthellate *Aiptasia* and again increased in size and abundance (see Fig. 2). We infer that natural events are most likely insufficiently extreme to cause extirpation of the invasive anemones. In fact, intermittent environmental stress which may exert a weak-to-moderate selective pressure, coupled with our observation that some anemones have symbionts similar to those in the endemic *Mastigias* jellyfishes, raises the possibility of local adaptation of the invasive anemones, including adoption of a new photosymbiont.

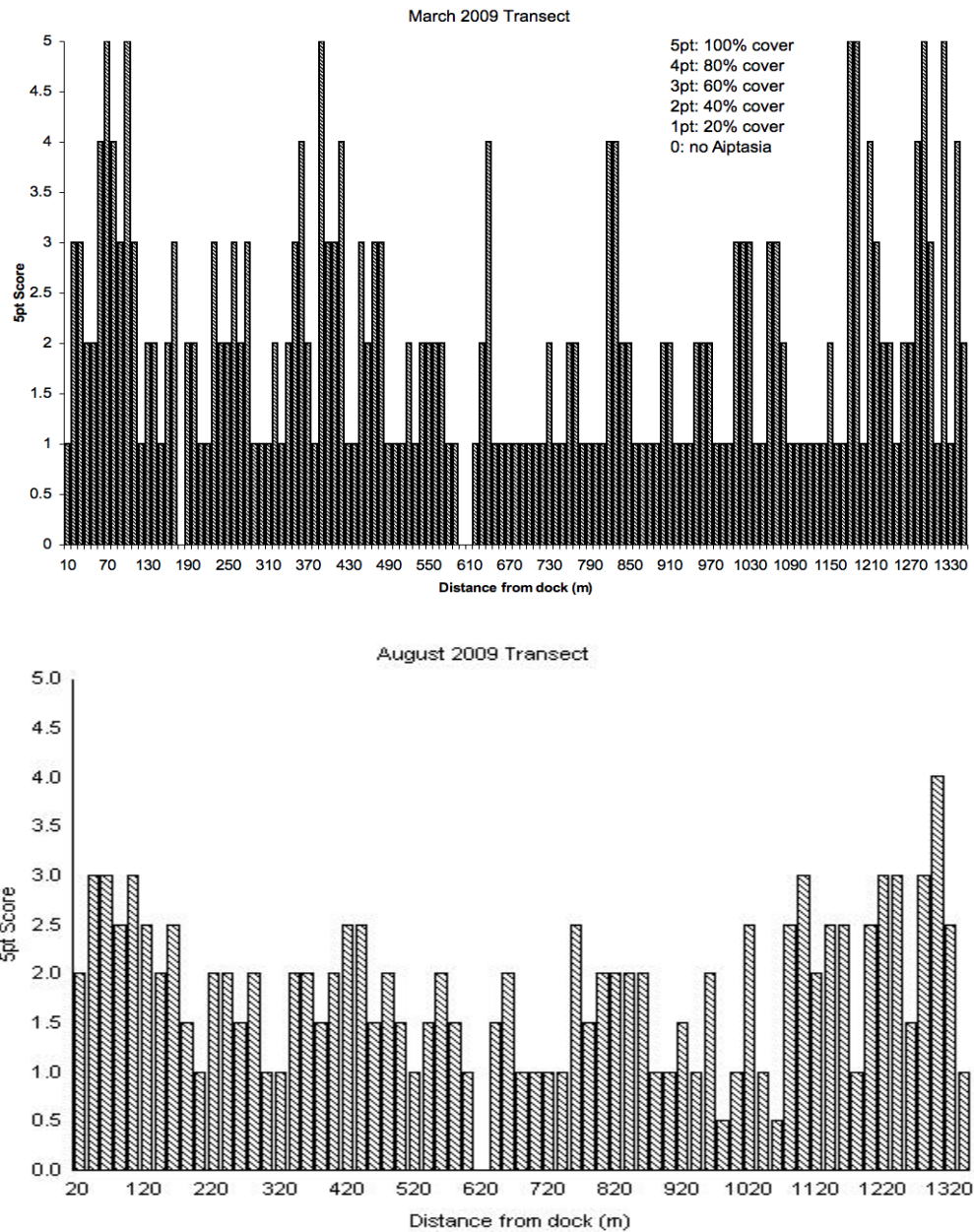


Figure 2. Temporary reduction in *Aiptasia* abundance due to a natural warming event in Ongeim'l Tketau. (Upper) The March 2009 transect around the lake perimeter shows *Aiptasia* occurs in low to high abundance throughout the lake, coincident with cool temperatures. (Lower) August 2009 transect shows *Aiptasia* abundance around the lake perimeter, coincident with warmer lake temperatures. Comparison of the two transects shows *Aiptasia* density (but not extent) was reduced in August, also coincident with bleaching of some anemones (see text [6] above).

Please provide the following information where relevant:

Hectares Protected: No additional area (not a goal of the project).

Species Conserved: Species to which this effort contributes protection include *Mastigias papua etpisoni*, an endemic subspecies of jellyfish. .

Corridors Created: None (not a goal of the project).

Describe the success or challenges of the project toward achieving its short-term and long-term impact objectives.

The project was successful in that continuing to document the invasion achieved the short-term goals, and describing the genetic diversity of the invasive zooxanthellae has revealed new avenues for studying the long-term impact of the invasive anemone on the native species in Ongeim'l Tketau.

Were there any unexpected impacts (positive or negative)?

Most invasive surveys done in Palau are on terrestrial species. This is the first quantitative survey on a marine invasive species, and this may serve as a guideline for future surveys. The invasive species in Jellyfish Lake serves as a model case study to show Koror State and public of the threat of invasive species, and may help in careful decision making of policies regarding the other 50 marine lakes that are currently closed.

Lessons Learned

Describe any lessons learned during the design and implementation of the project, as well as any related to organizational development and capacity building. Consider lessons that would inform projects designed or implemented by your organization or others, as well as lessons that might be considered by the global conservation community.

Project Design Process: (aspects of the project design that contributed to its success/shortcomings). There's no 'control' so it's impossible to say for sure, but probably helped by -- experience in topic, existing collaborations, proposal to meet specific need.

Project Implementation: (aspects of the project execution that contributed to its success/shortcomings) Again, there's no 'control' ... but probably helped by -- small group, existing collaborations, clear management structure, open communication.

Other lessons learned relevant to conservation community:

ADDITIONAL FUNDING

Provide details of any additional donors who supported this project and any funding secured for the project as a result of the CEPF grant or success of the project.

Donor	Type of Funding*	Amount	Notes
The David & Lucile Packard Foundation Western Pacific Program	A	\$15,087	Salary support for Ms. Sharon Patris, boat fuel & rental.
Koror State Department of Conservation and Law Enforcement	A	\$220	Purchase additional information booklets
UC Merced	A	\$3500	Contributed to bring sample sizes to publishable standard

**Additional funding should be reported using the following categories:*

- A Project co-financing (Other donors contribute to the direct costs of this CEPF project)*
- B Grantee and Partner leveraging (Other donors contribute to your organization or a partner organization as a direct result of successes with this CEPF project.)*
- C Regional/Portfolio leveraging (Other donors make large investments in a region because of CEPF investment or successes related to this project.)*

Sustainability/Replicability

Summarize the success or challenge in achieving planned sustainability or replicability of project components or results.

Methods are replicable. Experience gained making posters and booklet can be applied again in the future. True test would be transferring to other groups in other locations (not part of this project).

Summarize any unplanned sustainability or replicability achieved.

None.

Safeguard Policy Assessment

Provide a summary of the implementation of any required action toward the environmental and social safeguard policies within the project.

None.

Performance Tracking Report Addendum

CEPF Global Targets

(Enter Grant Term)

Provide a numerical amount and brief description of the results achieved by your grant.
Please respond to only those questions that are relevant to your project.

Project Results	Is this question relevant?	If yes, provide your numerical response for results achieved during the annual period.	Provide your numerical response for project from inception of CEPF support to date.	Describe the principal results achieved from Feb 1, 2009 to Jan 31, 2010.
1. Did your project strengthen management of a protected area guided by a sustainable management plan? Please indicate number of hectares improved.	N/A	N/A	N/A	
2. How many hectares of new and/or expanded protected areas did your project help establish through a legal declaration or community agreement?	N/A	N/A	N/A	
3. Did your project strengthen biodiversity conservation and/or natural resources management inside a key biodiversity area identified in the CEPF ecosystem profile? If so, please indicate how many hectares.	yes	Potentially strengthened existing 55000 sq.m.	Potentially strengthened existing 55000 sq.m.	Putatively have increased awareness of threats from introduced species. Impact has not been quantified in terms of # of people with raised awareness.
4. Did your project effectively introduce or strengthen biodiversity conservation in management practices outside protected areas? If so, please indicate how many hectares.	maybe	not quantified	not quantified	May have generally raised awareness of threats from introduced species. Visitors to Palau may return to their home nations with increased awareness, and apply this knowledge to their own neighborhoods.
5. If your project promotes the sustainable use of natural resources, how many local communities accrued tangible socioeconomic benefits? Please complete Table 1 below.	N/A	N/A	N/A	

If you answered yes to question 5, please complete the following table.

Additional Comments/Recommendations

Thank you for supporting our conservation research and outreach.

Information Sharing and CEPF Policy

CEPF is committed to transparent operations and to helping civil society groups share experiences, lessons learned, and results. Final project completion reports are made available on our Web site, www.cepf.net, and publicized in our newsletter and other communications.

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Booklets distributed to ...	#
Dolphin's Pacific	10
Palau International Coral Reef Center	5
Aqua Magic Palau	10
Carp Dive Tour	10
Cruise Control	10
Fish N' Fins	10
IMPACT Tour	10
Antelope Diving Shop	10
NECO Marine	10
Sam's Tour	10
Splash Dive Tour	10
Koror State Gov. (Conservation & Law Enforcement)	125
Marine Resources Office	5
Palau Conservation Society	5
PVA	30
Emmaus High School	20
George Bartow Harries Elementary School	20
Koror Elementary School	20
Meyuns Elementary School	20
Mindszenty High School	20
Maris Stella School	20
PCC (Library, Science Instructors)	20
Palau High School	5
Seventh Day Adventist Mission	20
Public Library	5
Continental Office	5
Ngchesar Head Start	3

Lagoon Poster distributed to ...	#	Batty Poster distributed to ...	#
PCC	5	PCC	5
KSG	20	KSG	20
Belau Nat'L Museum	5	Belau Nat'L Museum	5
GBH	5	GBH	5
KES	30	KES	30
MES	5	MES	5
MSS	5	MSS	5
Palasia Hotel	1	Palasia Hotel	1
Sea Passion	1	Sea Passion	1
Rose Garden	1	Rose Garden	1
Palau Royal Resort	1	Palau Royal Resort	1
SDA	5	SDA	5
PICRC	5	PICRC	5
Kings	2	Kings	2
NECO Marine	1	NECO Marine	1
Mini Mart	1	Mini Mart	1
Red Rooster/Kramers	1	Red Rooster/Kramers	1
M-Jay Store	1	M-Jay Store	1
Marine Club Antelope	1	Marine Club Antelope	1
Jive	1	Jive	1
Water World Tour	1	Water World Tour	1
Fish N' Fins	1	Fish N' Fins	1
Bai ra Ngedchibech	1	Bai ra Ngedchibech	1
NECO Plaza	1	NECO Plaza	1
Mid-Town Mobil	1	Mid-Town Mobil	1
PIDC Convenient Store	1	PIDC Convenient Store	1
Top-Side Mobil	1	Top-Side Mobil	1
Kwik Mart	1	Kwik Mart	1
Etpison Museum	1	Etpison Museum	1
WCTC Shopping Center	1	WCTC Shopping Center	1
Rose Garden	1	Rose Garden	1
Splash Dive Tour	1	Splash Dive Tour	1
Palau Pacific Resort	1	Palau Pacific Resort	1
Maml Divers	1	Maml Divers	1
Sams Tour	1	Sams Tour	1
Public Works Palau	1	Public Works Palau	1
PHS	5	PHS	5
Aqua Magic Palau	1	Aqua Magic Palau	1
Day Dream	1	Day Dream	1
Carp Dive Tour	2	Carp Dive Tour	2
Dolphin's Pacific	1	Dolphin's Pacific	1
Southern Marine Divers	1	Southern Marine Divers	1
RITC (Rock Island Tour Company)	1	RITC (Rock Island Tour Company)	1
Tree-D Motel	1	Tree-D Motel	1
Ashibi Restaurant	1	Ashibi Restaurant	1
Bem Ermii Koror	1	Bem Ermii Koror	1
Chinese Restaurant	1	Chinese Restaurant	1
Cocoro Hotel & Restaurant	1	Cocoro Hotel & Restaurant	1
High Tide Restaurant	1	High Tide Restaurant	1
Marine Resources Office	1	Marine Resources Office	1
Kramer's Café	1	Kramer's Café	1

Rock Island Café	1	Rock Island Café	1
Cliffside	1	Cliffside	1
The Carolines Resort	1	The Carolines Resort	1
V.I.P Guest Hotel	1	V.I.P Guest Hotel	1
Taj Restaurant	1	Taj Restaurant	1
Elilai Restaurant (Meyuns)	1	Elilai Restaurant (Meyuns)	1
Continental Office	1	Continental Office	1
Ocean View Hotel	1	Ocean View Hotel	1
Long Rainbow Tour	1	Long Rainbow Tour	1
Long Shoreman Restaurant	1	Long Shoreman Restaurant	1
Carp Restaurant	1	Carp Restaurant	1
Rangers Office	1	Rangers Office	1
Cruise Control	1	Cruise Control	1
PECI	1	PECI	1
7-Eat Restaurant	1	7-Eat Restaurant	1
Happy Fish Market	1	Happy Fish Market	1
Melusch El Dil	1	Melusch El Dil	1
West (Meyuns)	1	West (Meyuns)	1
Meyuns Shell Gas station	1	Meyuns Shell Gas station	1
Mingles ToToTo	1	Mingles ToToTo	1
M. Asanuma Enterprise	1	M. Asanuma Enterprise	1
Dollar 99 Store	1	Dollar 99 Store	1
Pacific Divers Oasis	1	Pacific Divers Oasis	1
Arirang Restaurant	1	Arirang Restaurant	1
Dragon Tei Restaurant	1	Dragon Tei Restaurant	1
Yano's Market	1	Yano's Market	1
PNCC Koror	1	PNCC Koror	1
Hanpa Mart	1	Hanpa Mart	1
PVA	1	PVA	1
Palau Conservation Society	1	Palau Conservation Society	1
Bank of Guam	1	Bank of Guam	1
Mindszenty High School	3	Mindszenty High School	3
Emmaus High School	3	Emmaus High School	3
Ngchesar Head Start	1	Ngchesar Head Start	1