



DATE: December 27, 2006

TO: NOAA

FROM: Ann Kitalong, Biologist
The Environment, Inc.
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RE: Sustainable management of a top target food fish,
rabbitfish, *Siganus fuscescens* (meas) in Palau

The Environment, Inc. in partnership with Ngarameliwei, Inc. has completed the implementation of the Rabbitfish Project. The following has been accomplished:

- ✓ Monthly monitoring of two sites at least 2 x a month has been ongoing since September 2005. In February through May, the group monitored for 5 days.
- ✓ Two “in-water” GPS units have been in use since January 2006. Data has been analyzed and mapped using this technique.
- ✓ 15 Ngarameliwei Members have been trained on fish calibration, and operation of the “in-water” GPS and data collection.
- ✓ A data acquisition and management system is developed.
- ✓ Training on the laptop is ongoing. Unfortunately this month, we had a power surge and the mother board was destroyed. We are in the process of repairing it.
- ✓ Sea grass baseline data was collected.
- ✓ Four community meetings have been conducted for Ngetkib, Ngeruluobel, Ngerusar and Airai
- ✓ A member of Ngarameliwei attended the 3rd Coastal Zone Asia Pacific Conference in Batam, Indonesia
- ✓ A draft Rabbitfish Action plan has been completed
- ✓ A meeting was held with the Governor of Airai and the Airai Legislature to present findings and Draft Action Plan.

Administration and Financial Reporting for the Rabbitfish Project

During the months of March 1 to September 30, 2006, a total of \$17,040.00 was received through the Voice Response System. Salaries and stipends and boat rental were dispersed. As of September 30, 2006, a total of **\$17,040.00** has been used to implement this project. Please refer to Appendix 1 for total breakdowns of expenditures.

Monthly monitoring of rabbitfish

Dr. Mark Tupper of PICRC advised on the size increments to construct the wooden fish models. In the field, six to eight wooden rabbitfish models were picked at random and sizes estimated to determine error margin for each swimmer. After size calibrations were complete, a horizontal Secchi disc reading was taken to determine the field of view before each survey. Once calibration of size and horizontal visibility were completed the survey began. During the months of March 1 to September 30, 2006, the TEI team and members of Ngarameliwei monitored rabbitfish with the GPS units. PALARIS provided large aerial maps of the site. The tracking data was in agreement with existing maps of the reef in this area (Figure 1.) During open season, rabbitfish were caught, measured and the sex and



gonad ripeness examined to confirm that the fish were



pre-spawning aggregations. Ripe male and female *Siganus fuscescens* were found year round. Sampled pre-aggregation schools consisted of ripe male and female fish.

Figure 1 below shows the locations of the largest pre-spawning aggregations. Schools ranging from 30-100 fish were most commonly seen at Site 4 and are shown in smaller pink dots. The largest pre-spawning aggregations (>400) are shown in large pink dots. Site 3 had the largest number and sizes of aggregations each year compared to Site 4. Site 6 (upper right hand corner) had a large school (>300) but the turbidity was so high, that visibility was poor and made monitoring difficult. A large pre-aggregation school was seen in the south channel (Site 7 at left side) in April 2006.

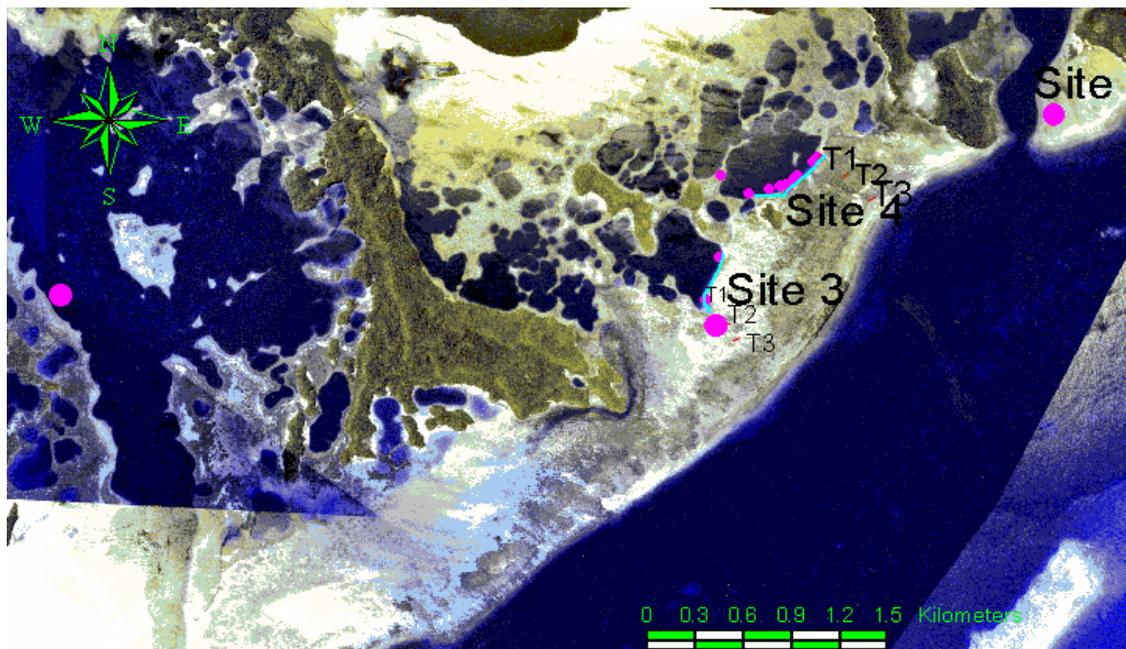


Figure 1. Pre-spawning aggregation schools of *Siganus fuscescens* largest pink dots represent schools >400. T1, T2, T3 represent seagrass monitoring transects.

Monthly Counts and Densities

The counts of the fish in the largest pre spawning aggregations and the total counts for the four largest pre spawning aggregations for the year 2004 and 2006 show a peak in school sizes during March and April followed by a smaller peak in October (Figure 2.) This collaborates with historical data for this fishery. This data was converted into biomass and shown in Figure 2 and 3.

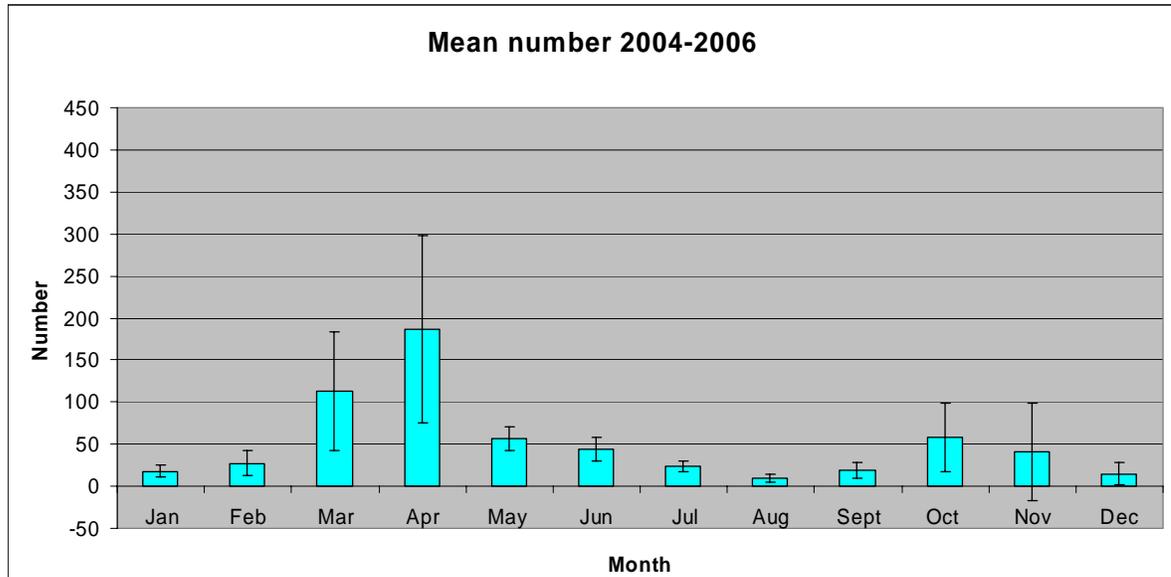


Figure 2. Total mean counts (95% confidence intervals) for the 4 largest pre-spawning aggregations from Jan 2004 to Dec 2006). No data for July, October and November 2006.

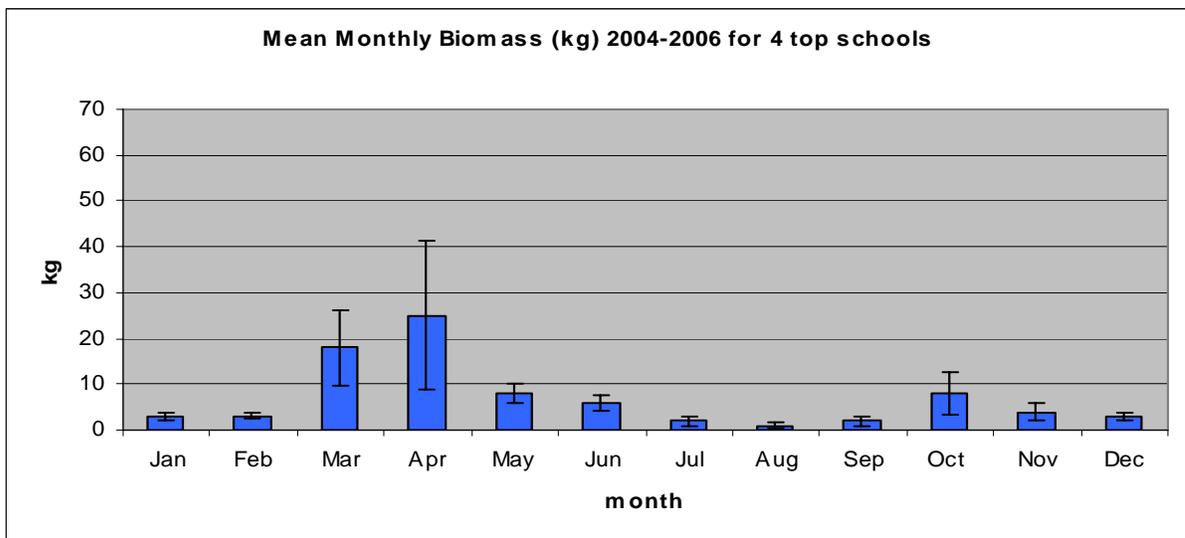
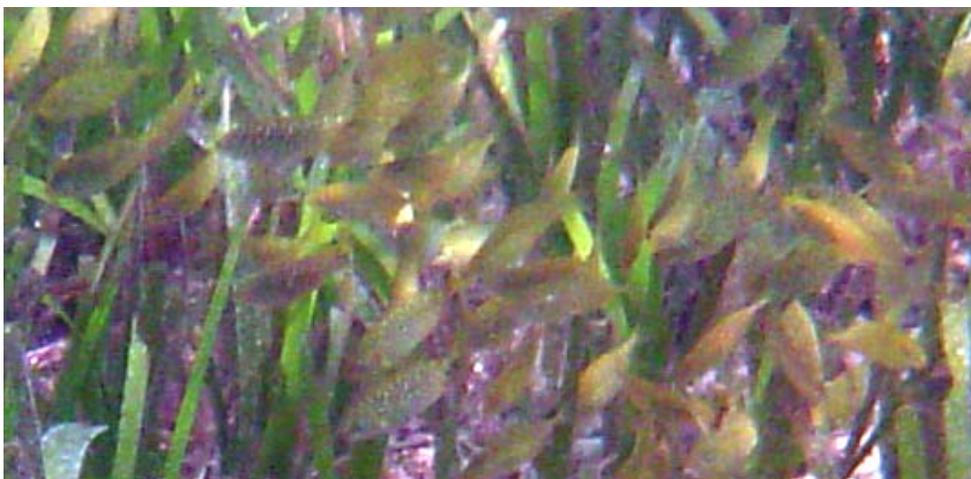
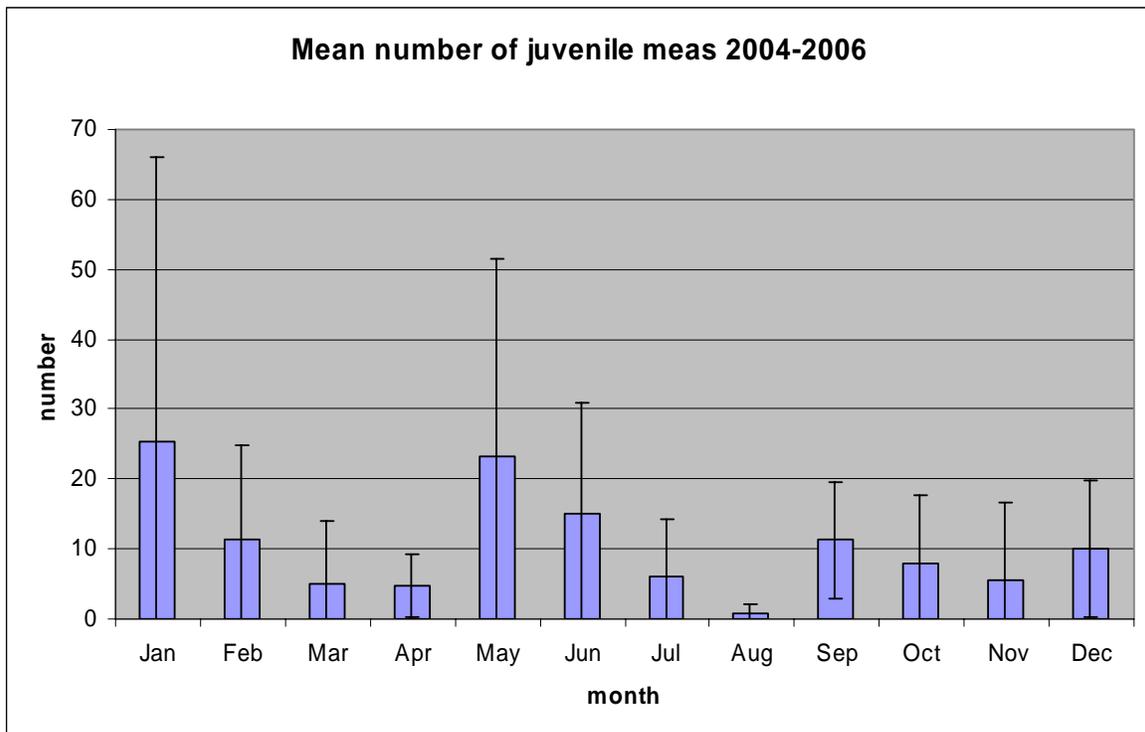


Figure 3. Total mean biomass with 95% confidence intervals for 4 top schools of meas (2004-2006.)

Juvenile Fish

Juvenile *Siganus fuscescens* (1 to 4 inches) were seen year round with more observed during January, May, June, September and December. Juveniles were usually seen in schools with juvenile parrotfish, surgeon fish, and goatfish. These groups of juveniles were observed feeding upon epiphytes on the seagrass.

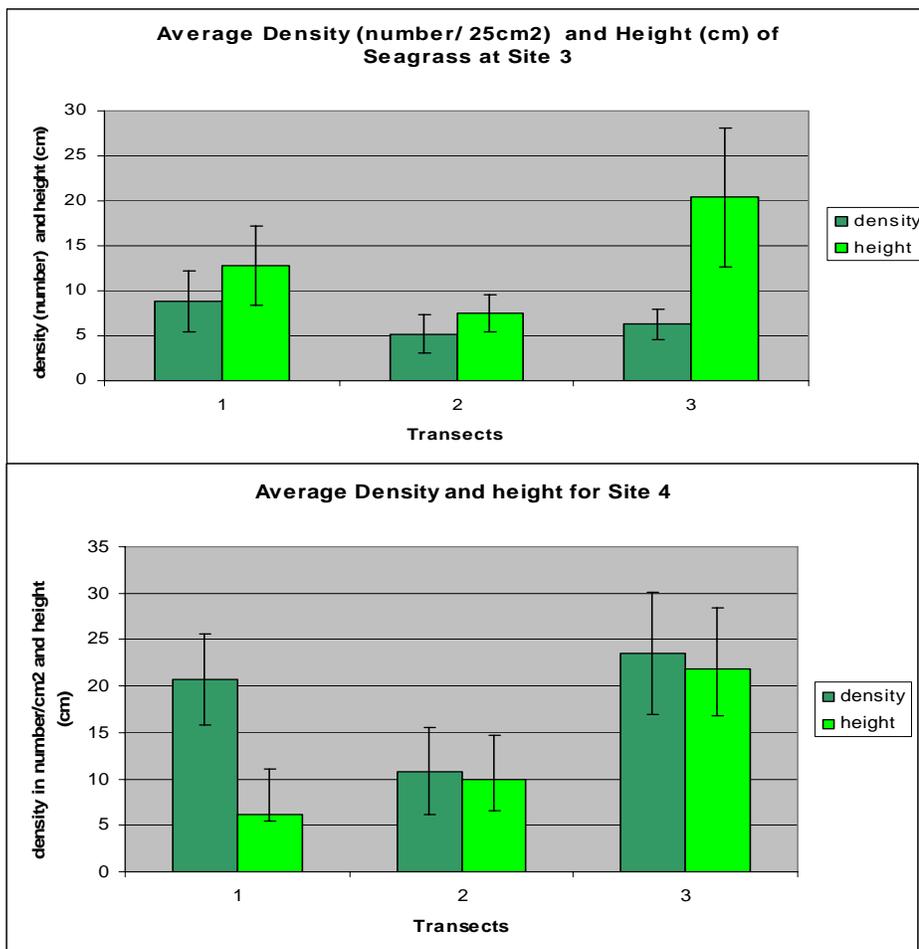


Seagrass monitoring

A modification of the Seagrass Watch method was used to collect baseline data at the two sites. Three transect lines were set 150 to 100 meters apart and parallel to the reef at the two study sites. A 25cm² quadrant was set 4 meters apart along each 50 meter transect line.

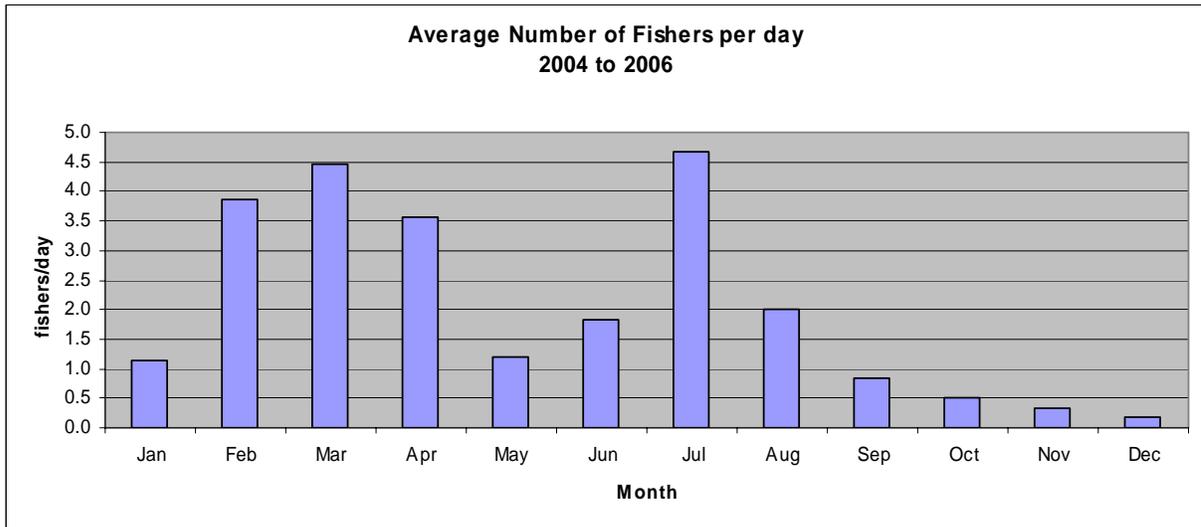


A photograph was taken of each quadrant. The seagrass stems were counted and height measured. Mean densities and heights were calculated. Flowering and fruiting seagrass were recorded. This data will serve as baseline for future monitoring. The southern site (Site 3) had lower densities of seagrass than the northern site (Site 4). Please refer to Figure 1. One set of baseline data was collected during this study, as we found that training for the fish counts took more time than anticipated.



Fishing Effort

Over 180 fishermen and fisherwomen were observed over the 3 year period. Most fishing activity occurred from February to April and in July. Monitored was more frequent during February and April. The closed season was from March to May. In 2006 the closed season was changed to February and March because February is traditionally known to be a breeding month for rabbitfish. The Environment, Inc. recommended an expansion of the closed season from February to May. It is important to document shifts in fishing effort and production to better understand the dynamics of this fishery. Currently, fishers were observed catching meas during the closed season from 2004-2006. It is important to have enforced closures otherwise this can not be an effective management tool. The Division of Fish and Wildlife were unable to patrol at all times during the closure based upon our



observations. There are only 6 to 8 national officers covering the entire main archipelago. Enforcement is also difficult as this site is only closed for rabbitfish and not other fish species. Therefore it is difficult to monitor what fishers are catching unless boats are inspected (Chin, pers. comm., 2006). Full closures of areas is a less difficult to enforce than areas where selective catch is permitted. Some of the fishermen were concerned that the monitoring would disturb the movement of fish. However, one fisherman told us in 2006 that they realized we did not have an impact on the fish movements and began to cooperate with us more readily. During the community presentations, many of the fishermen provided comments and encouragement.





Ngarameliwei members with presentation of study.

Participation

A total of fifteen members of Ngarameliwei have participated in this project. Their ages range from 13 to 51 years of age. In March, two older fishermen who regularly fish at the study sites were most cooperative. They said at first they thought our activities would reduce their catch. However they found that our monitoring activities did not impact their catch. Instead of waving us away, they waved for us to approach and they told us what they observed. Most members of Ngarameliwei work or attend school during the week and can only participate on weekends and holidays. Several members are full time fishermen who are available on most survey dates. Fisherfolk are relaying information about other pre-spawning aggregations they are observing in other areas of Palau for future investigation. The participants have been very enthusiastic about the program. Members are providing information about their observations outside our monthly survey dates.



Village Meetings



A total of 4 village meetings and one final meeting with the Governor and Legislatures of Airai State were held. A total of 91 participants were present at these 5 meetings. Refer to Tables 1-5. Several Ngarameliwei members were taught how to develop a power point and make a presentation using the laptop and the data acquired. With each presentation when questions were asked, the power point was modified. With additional life history information and results presented more clearly. Participants commented that they learned new information as well as exchanged information about the area.

Fishermen including the Ngerusar Legislator requested further investigation of the inner mangrove and adjacent seagrass areas because these areas are also important rabbitfish habitats. Several older fishermen commented that the mangroves have expanded over time.



They used the aerial maps to show the group where rabbitfish used to be found, however the mangroves have now expanded into some of these areas. The fishermen said that mangroves are now growing in good fishing habitats were seagrass used to be and somehow mangrove growth seaward needed to be controlled or managed. Aquaculture to breed and release juvenile rabbitfish was suggested.

Size limits on rabbitfish were recommended as well as imposing stiffer fines. The need to have Airai conservation officers to ensure the pre-spawning grounds are protected was recommended. Some wanted further investigation other areas and what is can be done to better manage the nearby mangroves. The Ngetkib Legislator said that the nearby area is already been approved as a conservation area. Participants asked about the seagrass and what is considered healthy and unhealthy. Several people wanted more work in the mangrove areas that are currently under protection but no studies have been done. Based upon these 5 meetings a draft action plan for Rabbitfish was developed. This draft action plan is currently being circulated and under review by the community and Airai State Government.



RABBITFISH ACTION PLAN

VISION: *Siganus fuscescens* (meas) populations are sustainable.

GOAL: To protect pre-spawning aggregation sites, nursery grounds and feeding grounds of *Siganus fuscescens* (meas) in Airai.

OBJECTIVE: To better manage and protect important sites for meas from overfishing and habitat degradation.

ACTIONS:

1. Set an annual budget of \$25,000 for the Airai State Conservation Program.
2. Hire an officer and one assistant and purchase boat, equipment and fuel to enforce laws and monitor protected areas.
3. Purchase buoys to delineate conservation areas in Airai.
4. Educate the community about national and state laws for protected areas and resources like meas.
5. Promote traditional bul system to maintain closures and protect areas.
6. Collaborate with National Fish and Wildlife to help enforce laws.
7. Draft a Memorandum of Understanding between National and State to assist in protecting Airai's meas during closure.
8. Enforce requirement for fishing permits and boat registration for Airai State.
9. Work closely with Koror and Ngchesar to protect Airai's waters.
10. Seek National & International funds to implement this Action Plan for meas and other important resources in Airai.
11. Protect the watersheds to prevent erosion and sedimentation into the lagoon.
12. Study the mangroves, seagrass and coral communities to provide updated information to the community of Airai and update this plan based upon new studies.
13. Assess potential for aquaculture of meas.

Table 1. Participants and comments at the Ngetkib Ngeruluobel Ngarameliwei meeting held on the evening of July 27, 2006.

Ngetkib- Ngeruluobel Ngarameliwei Club July 27, 2006

1	Spuns Takada	Size limit for meas made into law
2	Tim Ngirdimau	Total Closure during breeding season and conservation officers
3	Sky Ililau	
4	Dulei Ketebngang	
5	Christopher Ongrung	
6	Edchuul Secharraimul	
7	Zedro Postol	
8	Metokab Melwat	
9	Randon Saburo	
10	Tory Marugg	
11	Osilek McArthur	
12	Jay Secharraimuul	
13	Ngirakesolab Alfonso	
14	Kerruul Tmetuchel	
15	Bausouch Ngiramur	
16	McKnight McArthur	
17	Ann Kitalong	
18	Liz Matthews	

Table 2. Participants and comments at the Ngetkib Ngeruluobel Ngarabrekork meeting held on the evening of August 1, 2006.

Ngetkib Ngarabrekork August 1, 2006		
1	Nancy Mengloi	Close area during closed season and have a size limit
2	Rosania Masters	Hire our own conservation officer –only fish for consumption but not for sale
3	David Orrukem Ngetkib Legislator	Area has been approved by state to be a conservation area
4	Betty Salvador	Fine people who fish at this area and have an awareness program
5	Anne Mary Edyaoch	Penalize people by taking fishing equipment the first time
6	Kameril Sasao	Hire people to watch the boats and fishermen to make sure they don't go in the conservation area
7	Shelly Masashiro	Issue a letter to the community regarding conservation area and fines
8	Thresa Ililau	Must have people to watch the conservation area.
9	Dengir Masami	Second offense penalize \$100.00
10	Gemma Ngirchobong	Penalize people fishing during closed season.
11	Siang Yuzi	We must hire people as officers to watch day and night.
12	Ayano Baules	Do whatever is best for the community
13	Ann Lund	
14	Meria Lund	
15	Deadlyn Medalarak	
16	Sai	
17	Ann Kitalong	
18	Liz Matthews	
19	McKnight McArthur	
20	Bausouch Ililau	Good to have officers on 24 hr watch

Table 3. Participants and comments at the Ngerusar meeting held on the evening of 2006.

Ngerusar Community Group		
1	Vince Kautechang Blaiyok	Stop erosion and control mangrove as it is expanding into fishing grounds. Start aquaculture as I have a clam farm now.
2	Keria F. Ngirmekur	Control mangrove growth into fishing grounds and develop aquaculture to breed and release
3	Edmund Telmang	Hire a conservation officer and strengthen laws to really close area – strict- no take.
4	Collins Takao	
5	William Metes	
6	Techeltoech Kewii	
7	Holland Bilamang	
8	Aderdei (Gillian)	
9	Clarence Kitalong	
10	Ann Kitalong	
11	Liz Matthews	
12	McKnight McArthur	
13	Bausouch Ngiramur	

Table 4. Participants and comments at the Airai Village meeting held on the evening of November 20, 2006.

Airai Community Group Nov 20, 2006		
1	Cisinio	The use of fertilizer is killing the reef.
2	Raymund Rebluud	Overpopulation in Airai requires the need for conservation areas and farming fish.
3	Solomon Marino	Need boats to stay away or be prohibited from going into these areas. Juveniles feed in these areas after spawning occurs. Damaged reefs need to be rehabilitated
4	Robert Simeon	
5	Obichang Skebong	
6	Chrisopher Tkoel	
7	Sisinio	
8	Ngirachermang Kellis	
9	Sidney Rengulbai	
10	Stanley Rengulbai	
11	Frank Olkeriil	
12	Omtab Vincent	
13	Ellins Midas	
14	Tumakreng Johanes	
15	Nglodech Ignacio	
16	Norleen Kumangai	
17	Boisek	
18	Ongelungel Daniel	
19	Ellen Adelbai	
21	Gillian Johanes	
22	Omeruu Augustine	
23	Clarence Kitalong	
24.	Ann Kitalong	

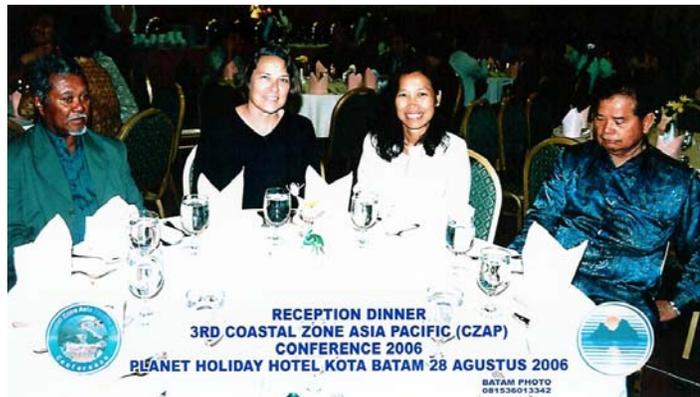
Table 5. Participants and comments at the Airai Village meeting held on the evening of November 27, 2006.

Governor and Legislature Meeting November 27, 2006		
1	Governor Vicki Kanai	Supportive of study and ideas put forth, needs assistance in demarking protected areas and enforcement.
2	Speaker Melwat Telei	Land and sea are the same, have to rotate plants on farmland, maybe need to rotate fish, different fish
3	Robert Ngereblekuu	Coral are taking over meas areas, need to space between them for fish. That is why people use coral for docks
4	Florence Ngirmekur	Need to spearhead aquaculture and control mangrove from taking over meas habitat
5	Techur Rengulbai	Laws to protect habitat and promote aquaculture and leave areas for community consumption and net mesh size of 3inches need to enforce
6	Jack Masters	Strengthen the watershed program and stop erosion and runoff.
7	Mason Surangel	Good presentation with good information, need for protected areas to either enlarge or minimize to accommodate species and need for net mesh size (restriction)
8	Raymund Rebluud	Not rotation of fish needed, problem is overfishing
9	Ivan Rudimch	Is the community aware of the Airai Law to conserve the area?
10	Dave Orrukum	Controlling, legislating and development that includes controlling the sediments and maintaining the mangroves.
11	Helbert Oimei	There are 4 factors killing meas 1. Oil pollution from the boats 2 Sediment pollution 3. Other fish predators like jacks 4. Humans –overfishing Stop first two first as they are the main causes than address fishermen
12	Secretary	
13	Wana	
14	Yalap Yalap	Draft an official letter of request for assistance for buoys to mark area.
15	Ann Kitalong	
16	Clarence Kitalong	

The 3rd Coastal Zone Asia Pacific Conference in Batam, Indonesia

Clarence Kitalong represented Ngarameliwei at the 3rd Coastal Zone Asia Pacific Conference in Batam, Indonesia from Aug 30 to Sept 2, 2006. He gave an oral presentation with a power point of the project. The meeting provided many opportunities to meet with resource managers and communities with similar issues. It was important to share our experiences in Palau and learn from countries such as Indonesia how they are developing effective and innovative ways to protect and better manage their vast and diverse natural and human resources. During Clarence's presentation, it was suggested to review historical data and address the maximum sustainable yields of *Siganus fuscescens*.

It was suggested that cyclic patterns in annual production may reflect that the MSY had been reached causing declines in subsequent year. Mr. Kitalong met many new community group members and scientists conducting work within the coastal areas including mangrove, seagrass and coral communities.



Summary

Pre-spawning aggregations of 300 to 400 fish were uncommon during this study. Most Pre-spawning groups were small and ranged in size from 30 to 100 fish per school. Ripe males, females and juveniles were observed year round at the sites, indicating that it is an important nursery area. The largest pre-spawning aggregations were seen during March and April. Historical data shows a peak during February and March. Closed season for meas was from March to May during this study. Yet, fishermen were seen fishing for meas year round. Management of this resource during breeding season is difficult as the area is open for fishing other species. Boat inspection is required to ensure rabbitfish are not harvested. Fishermen were at first concerned our monitoring would impact their fishing. However, in April 2006, they began to be more cooperative and shared information with us. There was a sedimentation problem at the north channel that limited visibility for consistent visual counts. The Ngarameliwei members had no difficulty with the techniques used in this study and were good representatives in village meetings talking to their elders and peers.

Key factors causing the decline of *S. fuscescens* (meas) in Airai Bay are sedimentation from development, boat traffic and boat oil, overfishing, lack of enforcement of existing State and National laws, natural predation. Recommendation included education and implementation of best land use practices for development and farming within the watersheds; funding for a State conservation program that includes an officers and equipment to enforce existing laws; awareness about existing protected areas using media, sign by the docks and buoys markers, and ongoing monitoring and studies of the mangroves, seagrass and coral. Based upon the recommendations from the meetings, a simple one page Rabbitfish Action plan was drafted. This Draft plan is currently under review by the participants and Airai legislation to be finalized and further discussed to set priority actions. Dialogue and work with the partner agencies has been rewarding and productive and an effective way to share a mutual message advocating habitat conservation. This study provides important baseline data on rabbitfish and seagrass for future work with the community to better manage and protect this valued resource.