

People's perception on the establishment of marine reserves: The case of Chamorro villagers in southern Guam

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Introduction

After the implementation of community-based marine protection areas in the south of Guam, this survey was undertaken to assess people's perceptions on the success of the development and implementation of the project, the challenges faced and the variables involved

Coral reefs play an important role in the lives of Chamorro villagers in the south of Guam. They have strong fishing traditions and heavy use of coral reef resources. Traditionally, the local Chamorro diet included coral reef fishery resources such as finfish, invertebrates and sea turtles (Amesbury and Hunter-Anderson 2003).

Because of the decline in the health of Guam's reefs over the past 40 years (Porter et al. 2005),

government of Guam agencies have worked hard to protect and manage Guam's coral reef resources. One of the steps taken to restore Guam's coral reefs was the establishment of several marine reserves. Over 10 per cent of Guam's coastline was incorporated into five marine reserves. They are Tumon Bay, Piti Bomb Holes, Sasa Bay, Achang Reef Flat and Pati Point. Achang Reef Flat Marine Reserve is located in southern Guam.

Interviews were conducted to gauge the attitudes and perceptions of Chamorros living in the south of Guam regarding the establishment of the Achang marine reserve. The surveys were carried out in the villages of Umatac, Merizo and Inarajan, home to the users of the areas surrounding the Achang Reef Flat Marine Reserve area. The survey solicited information on the cultural and ethnic background, gender, education and income of the interviewees.

Demographics together with other variables were used to measure people's perceptions of the marine reserves. The survey was supplemented with key informant interviews and focus group discussions.

From August to September 2005, interviews were conducted with 30 residents of the three villages. The sample population mainly consisted of ethnic Chamorros. Within each neighborhood, streets were randomly selected for surveying and on each selected street, houses were randomly selected. Interviews usually lasted more than 40 minutes and were conducted in both the Chamorro and the English languages.

The survey questions had three main parts. Part 1 addressed demography, household composition and other

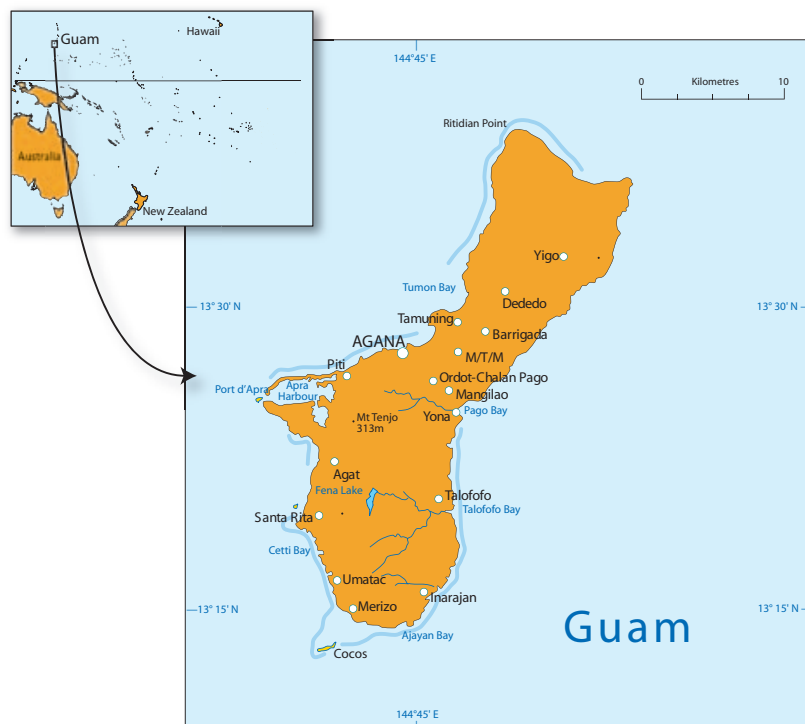


Figure 1. Guam

general issues such as environmental awareness and the importance of fishing. Part 2 of the survey focused on marine preserve laws, marine environmental stewardships, attitudes and perceptions on Achang Reef Flat Marine Reserve, sense of attachment to the marine preserve and attitudes on the creation of community based conservation areas. Part 3 consisted of closing questions regarding demographics and the education level of respondents.

Respondents' profiles

All (100%) of the respondents were originally from Guam and were native Chamorros. Thirty (30) respondents were chosen from Umatac, Merizo and Inarajan villages. The majority of the respondents had completed high school and some had finished university studies (Table 1).

Table 1. Level of education in southern Guam villages

Level of education	Share in total (%)
Elementary school	0.0
Some high school	10.0
High school	63.3
Some college or university	16.7
Finished college (bachelor's degree)	10.0
Advanced degree	0.0
Don't know/refused	0.0

When asked about their annual gross household income, 10 per cent of the respondents preferred not to reveal this information to the interviewers. The distribution of the remaining 90 per cent of the sample is shown in Table 2. Most of these incomes were from paid employment. A smaller proportion of the income (16.7%) was from agriculture and fisheries.

Table 2. Gross household income (USD per year) in southern Guam villages

Income group	Share in total (%)
USD 5,000 or less	16.7
USD 5,000 to 10,000	10.0
USD 10,000 to 20,000	23.3
USD 20,000 to 35,000	6.6
USD 35,000 to 50,000	16.7
USD 50,000 to 75,000	10.0
Over USD 75,000	6.6
No answer	10.0

Fishing and motivation of fishers

Fishing is traditionally and culturally important to the Chamorro people. A wide range of fishing techniques were used, with the most common being the hand-line method. Spear fishing, gillnetting and trolling were also often used. Fishing was conducted both day and night. Most respondents were skilled fishers and in the process of fishing passed on traditional fishing knowledge and skills to the younger generation.

There were various reasons why people fished (Table 3). They included fishing for leisure while passing knowledge to the younger generation (100%) and fishing as a pastime (93%). There were variations in people's perceptions about catches, with 86 per cent showing preference for catching certain fish sizes and another 86 per cent showing preference for certain fishing seasons.

Table 3. Motivations and fishing preferences

Motivations	Agree (%)	Disagree (%)
More fish I catch, the happier I am	92.9	7.1
Fishing trip can be successful if no fish are caught	68.9	31.0
Would rather catch one or two big fish than five smaller fish	85.7	14.3
Would rather fish during <i>atulai</i> , <i>tiao</i> or <i>manahak</i> seasons	85.7	14.3
Fish to pass traditional fishing knowledge and skills	100.0	0.0

Frequency and duration of fishing trips and boat ownership

On average, fishers go fishing a few days a week. Some fishers fished every day, while some fished two to three days a week. Some only fished once a fortnight or once a month, while some fished only during certain seasons (Fig. 2). These mostly included fishers from Umatac. More than 50 per cent of respondents fished for between two and six hours (Fig. 3). Fishing duration mainly depended on target species, the tides and fishing seasons.

Half (50%) of respondents did not own boats but used boats that belonged to other people. Another 44 per cent of respondents owned boats but these were mainly boats with 15 hp engines (Fig. 4).

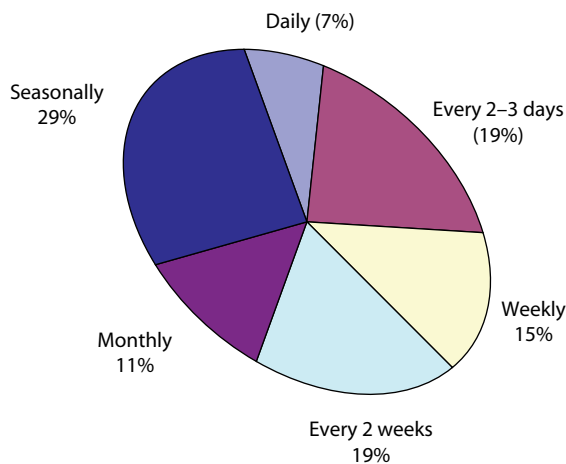


Figure 2. Respondents' frequency of fishing trips

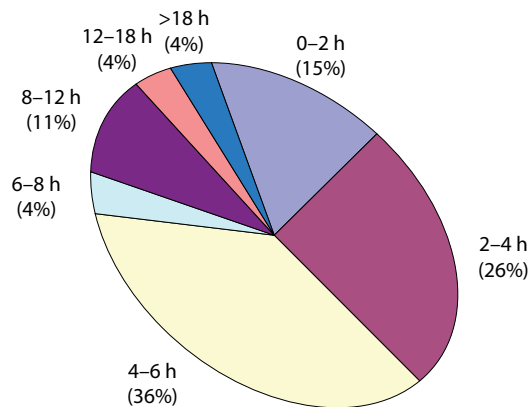


Figure 3. Respondents' duration of fishing trips

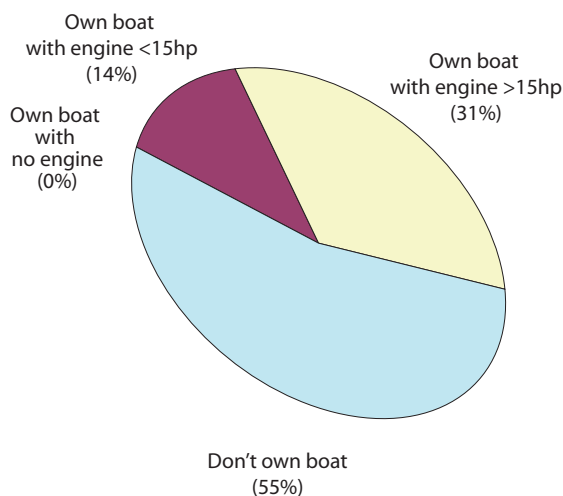


Figure 4. Respondents' boat ownership

Marine environment

Sources of information on causes of environmental changes

Nearly all (90%) respondents were well informed on the changes in Guam's marine environment through personal observation (fishing, swimming, snorkeling and diving) (Table 4). Some (6.6%) also obtained information on the environment from friends and family, while a small proportion (3.4%) from Inarajan stated that they got information on environmental change from the government through environmental awareness workshops.

Table 4. Sources of information on causes of environmental change in Guam's marine environment –southern Guam villagers

Sources of information	Importance (%)
Personal observation (swimming, fishing, snorkeling, diving)	90.0
Information from friends and family	6.6
Media (television, newspaper, radio)	0.0
Government	3.4

Note: The score represents the average importance that respondents assigned to each source of information to inform them on the causes of environmental change in the marine ecosystems of Guam.

Perceptions on changes in the quality of Guam's marine environment

Respondents expressed strong views about environmental impacts on the marine environment. Most of the respondents confirmed some decline or change in the environment, fish abundance, status and diversity. About 53 per cent of the respondents felt that sedimentation and sewer leaks/surface runoff had worsened in recent years. Only 21.4 per cent of respondents had witnessed improvements in sedimentation and only 16.7 per cent had seen improvements in sewer leaks. Between 10 and 18 per cent of the respondents did not observe any change.

About 45 per cent of respondents noted positive changes in fish sizes. This could be one of the best indicators of the success of marine conservation attempts in the sites studied. Fish sizes, fish abundance and fish species diversity were used to measure the success of marine conservation initiatives. About 37 per cent of respondents noted worse live coral abundance, with 41 per cent noting declining fish abundance. A further 53 per cent of respondents highlighted environmental problems such

Table 5. Perception of changes in Guam's marine environment in southern Guam villages.

Environmental problem	Improved (%)	No change (%)	Worsened (%)	Don't know (%)
Live coral abundance	26.7	6.6	36.7	30.0
Fish abundance	36.7	16.7	40.0	6.6
Fish size	45.2	19.4	35.4	0.0
Fish species diversity	32.3	32.3	25.8	9.7
Harmful algal growth	9.7	32.3	29.0	29.0
Sedimentation	21.4	17.9	53.6	7.1
Sewer leaks/surface runoff	16.7	10.0	53.3	20.0

as sedimentation, sewer leaks, or surface run off. It was noted that Umatac villagers were the most knowledgeable on the causes of the environmental changes, and this could be attributed to the increase in marine awareness programmes in that village.

Perceptions on causes of environmental changes in Guam

When asked about the most five common perceived causes of environmental change, the respondents stated that the reasons were poor development practices (19.7%), improper fishing techniques (18.4%), creation of marine conservation areas (17.1%), sedimentation due to intentionally lit fires (13.2%) and too many fishermen (10.5%). Overall, the respondents listed improved infrastructure (6.6%), improved fishing technology and techniques (6.6%), too many jet skis and motorised craft (6.6%) and too many divers and snorkelers (1.3%) as lesser important causes of environmental change. All respondents (100%) were aware of and had their own perceptions on the causes of environmental change. The details of perceived causes of environmental change from respondents are presented in Table 6.

There are possible management guidelines that could help improve Guam's marine environment. Education and awareness in schools and in the villages are considered priorities and are vital components of sound management of both the terrestrial and the marine environment. Improvement of the sewage system is an important measure to be taken to improve water quality. Changes in law enforcement should include stricter rules for development, enforcement of existing laws and increased penalties for violators. Other factors to be considered by managers are banning the intentional setting of fires that cause sedimentation, prohibiting jet skis in areas where they can damage the reefs, reducing pesticide/fertiliser use at golf courses and hotels, prohibiting the use of gillnets, opening marine

protected areas during certain periods of the year, limiting recreation activities in popular marine sites (i.e. diving, snorkeling), prohibiting spear fishing at night and introducing a user fee for foreign scuba divers and snorkelers.

Table 6. Perception of causes of environmental change in Guam's marine environment – southern Guam villagers

Perceived cause of environmental degradation	Importance (%)
Sedimentation due to intentionally lit fires	13.2
Poor development practices	19.7
Improved infrastructure	6.6
Improved fishing technology and techniques	6.6
Improper fishing techniques	18.4
Too many fishermen	10.5
Too many jet skis and motorised craft	6.6
Too many divers and snorkelers	1.3
Creation of marine conservation areas	17.1
Do not know	0.0

Note: The score represents the average importance that residents assigned to each of the proposed causes of environmental change in the marine ecosystems of Guam.

Marine reserves

Awareness of Guam's marine reserve laws

Levels of awareness of Guam's marine reserve laws are presented in Table 7. In general, 84 per cent of respondents stated that they understood Guam's marine reserve laws. High levels of understanding

were expressed by respondents from Umatac (89%) and Inarajan (100%). Only 64 per cent of Merizo’s respondents stated that they understood Guam’s marine reserve laws.

Most (68%) stated they understood why Achang marine reserve was created. Respondents from Merizo expressed the highest level of dissatisfaction with the creation of the reserve area. A large majority of Umatac and Inarajan respondents (78% and 89% respectively) said that they understood why Achang marine reserve was created. They also had lower levels of dissatisfaction.

A higher level (80%) of satisfaction was shown with the allowance of seasonal fishing in reserves. All (100%) of respondents from Inarajan and 89 per cent of respondents from Umatac were satisfied with the allowance of seasonal fishing in reserves. Half (50%) of Merizo respondents were satisfied with the allowance of seasonal fishing in marine reserves.

In contrast, a lower level (57%) of satisfaction was recorded regarding the no take regulations of marine reserves. The highest level of dissatisfaction (63%) was expressed by respondents from Merizo. On the other hand, 78% of Umatac and 60% of Inarajan respondents were satisfied with the no take regulations.

Table 7. Awareness of Guam’s marine reserve laws in southern Guam

Perceived level of awareness	Agree (%)	Disagree (%)
Understand Guam’s marine reserve laws	84.3	15.7
Understand why Achang marine reserve was created	68.0	32.0
Am satisfied with no take regulations of marine reserves	56.7	43.3
Am satisfied with the allowance of seasonal fishing in reserves	79.7	20.3

Attitudes and perceptions on Achang Reef Flat reserve

The attitudes and perceptions on Achang Reef Flat reserve varied (Table 8). In general, 80 per cent of respondents strongly support the establishment of Achang marine reserve. About 83 per cent believe that the reserve will improve the quality of fish stocks in the area. About 67 per cent believe that the reserve will negatively impact the Chamorro culture and tradition. Half (50%) agreed that they would discontinue recreational fishing if doing so would increase fish stock.

Table 8. Attitudes and perceptions on Achang Reef Flat reserve in southern Guam

Attitudes and perceptions	Agree (%)	Disagree (%)
Strongly support establishment of Achang marine reserve	80.0	20.0
Achang marine reserve will improve quality of fish stocks	83.3	16.7
Achang marine reserve will negatively impact our culture and tradition	66.7	33.3
Will discontinue recreational fishing if it would increase fish stock	50.0	50.0

Sense of attachment to Achang Reef Flat Marine Reserve

Overall, there were high levels of support and a sense of attachment to Achang Reef Flat reserve by the residents (Table 9). A large majority (89%) of the respondents disagreed that they should have the freedom to do whatever they want in the preserve. Majorities in southern Guam overall (63.6 per cent), Umatac (78%) and Merizo (63%) disagreed that there should be no restrictions in the reserve. Half (50%) of Inarajan respondents stated they would like no restrictions on the preserve. Most respondents (60%) from Inarajan also disagreed that people need to have the freedom to do whatever they want in the preserve.

Table 9. Sense of attachment in southern Guam

Sense of attachment	Agree (%)	Disagree (%)
Freedom to do whatever they want in the Achang Reef Flat Marine Reserve	20.7	79.3
No restriction on Achang marine reserve	36.4	63.6
No commitment to the Achang marine reserve	53.7	46.3
Achang Reef Flat means a lot to me	86.7	13.3
Am very attached to the area of the Achang Reef Flat	93.3	6.7

Stewardship and community based marine conservation

Level of stewardship

The perceived level of stewardship for Guam’s coral reefs by the southern Guam respondents was high, with most agreeing that the government should do more to protect the islands’ reefs. Nearly all respondents (94%) supported the idea of personally participating in implementation, awareness and

enforcement of community-based marine conservation areas on Guam. Overall, 81 per cent of respondents were satisfied with their personal level of stewardship and contribution to Guam's coral reef.

Table 10. Levels of stewardship in southern Guam

Perceived level of stewardship	Agree (%)	Disagree (%)
Guam's reef should be protected	99.7	0.3
Government should do more to protect reefs	99.7	0.3
Would participate in implementation, awareness and enforcement	94.0	6.0
Personal stewardship contributes to Guam's protection	81.0	19.0

Creating a community-based marine conservation area

All respondents agreed to support the control of water pollution, diving, collection and fishing bans and also agreed that more attention should be paid to habitat restoration (Table 11). Respondents all agreed that they would like to know more about fisheries management tools and agreed to participate in implementation, awareness and enforcement of community based marine conservation areas.

There was also a high level of support for using community based marine conservation areas as a fisheries management tool, and most supported restrictions and prohibitions on certain species (89%). There was a relatively high level of support (78%) by respondents for regulating or restricting types of fishing gear. In contrast, there was less support for discontinuing recreational fishing to increase fish stocks (67%). There was also less support for discontinuing subsistence fishing to increase fish stocks (56%).

Table 11. Creating a community-based marine conservation area in the village

Perception of creating a community-based marine conservation area	Agree (%)	Disagree (%)
Conservation as a fisheries management tool	88.9	11.1
Support regulating or restricting types of fishing gear	77.8	22.2
Support restriction/prohibition of certain species	88.9	11.1
Support control water pollution, diving, collection & fishing bans	100.0	0.0
More attention on habitat restoration	100.0	0.0
Support discontinuation of recreational fishing to increase fish stocks	66.7	33.3
Support discontinuation of subsistence fishing to increase fish stocks	55.6	44.4
Would like to know more about other fisheries management tools	100.0	0.0
Would participate in implementation, awareness & enforcement	100.0	0.0

Conclusion

In summary, there was strong support for the establishment of community-based conservation areas, restrictions on harvest of certain species and restrictions on certain gear as opposed to discontinuing recreational fishing or subsistence fishing. This was coupled with a high level of marine awareness and the indication of an interest by respondents to know more about fisheries management tools. The Chamorro communities of southern Guam strongly support the implementation of community-based management initiatives. There was also strong awareness of the environmental factors that affect fisheries resources. Thus in further work on management in southern Guam, practitioners could adopt an approach which includes environmental issues.

Acknowledgements

We wish to acknowledge the support given by Ms Evangeline Lujan of the Government of Guam and the US National Oceanic and Atmospheric Administration Office of Ocean and Coastal Resource Management (NOAA OCRM) Grant # NA170Z2332 for funding this research. We also thank the previous Director of the University of Guam Marine Laboratory, Mr Barry Smith, for logistical support. Our special thanks to the rural communities of southern Guam for their support and their participation in the surveys.

References

- Porter V., Leberer T., Gawel M., Gutierrez J., Burdick D., Torres V. and Lujan E. 2005. Status of the coral reef ecosystems of Guam. University of Guam Marine Laboratory Technical Report No. 113, October, 2005.
- Amesbury J.R. and Hunter-Anderson R.L. 2003. Review of archaeological and historical data concerning reef fishing in the U.S. flag islands of Micronesia: Guam and Northern Mariana Islands. Western Pacific Regional Fishery Management Council Final Report. 147 p.