

AN EVALUATION OF SOCIAL GOALS IN PHILIPPINE MARINE PROTECTED
AREAS

by

Alexandra Shah
A Dissertation
Submitted to the
Graduate Faculty
of
George Mason University
in Partial Fulfillment of
The Requirements for the Degree
of
Doctor of Philosophy
Environmental Science and Public Policy

Committee:

_____	Dr. E.C.M. Parsons, Dissertation Director
_____	Dr. Al Fuytes, Committee Member
_____	Dr. Larry Rockwood, Committee Member
_____	Dr. Diogo Veríssimo, Committee Member
_____	Dr. Albert Torzilli, Graduate Program Director
_____	Dr. A. Alonso Aguirre, Department Chairperson
_____	Dr. Donna Fox, Associate Dean, Student Affairs & Special Programs, College of Science
_____	Dr. Peggy Agouris Dean, College of Science
Date: _____	Fall 2016 George Mason University Fairfax, VA

An Evaluation of Social Goals in Philippine Marine Protected Areas

A Dissertation submitted in partial fulfillment of the requirements for the degree of
Doctor of Philosophy at George Mason University

by

Alexandra Shah
Master of Arts
University of Miami, 2004
Bachelor of Science
Eckerd College, 1999

Director: E.C.M. Parsons,, Professor
Department of Environmental Science and Public Policy

Fall Semester 2016
George Mason University
Fairfax, VA



This work is licensed under a [creative commons attribution-noncommercial 3.0 unported license](https://creativecommons.org/licenses/by-nc/3.0/).

DEDICATION

This is dedicated in memory of my father, Dr. Michael Didoha, a brilliant thinker, writer, conversationalist and helper to those in need.

ACKNOWLEDGEMENTS

I would like to first thank my advisor Dr. E.C.M. Parsons for continued support, constant communication, and positivity through this process. To my committee Drs. Al Fuytes, Larry Rockwood and Diogo Veríssimo for their comments, inputs and support. Xavier University- Cagayan de Oro especially Fra for assisting me with the logistics of my study. To Adah and Eden my translators, whose help was invaluable. To Ferdinand Cruz who helped me with making the connections to Xavier University and all my travel and research logistics. To Bing, serving as my guide while traveling in the Philippines. I am extremely thankful for family and friends especially Naren and Nancy Shah who supported me through this process. To my sister, Alexis Didoha who spent countless hours, days, and months caring for my children so I could work. To my children, Rohan and Priya for giving me the time to do my “school work”. To my husband Vijay Shah for supporting and giving me constant encouragement through this endeavor. Lastly, to my mother, Judy Didoha who was there in the beginning of this journey and always believed that I would accomplish this goal.

TABLE OF CONTENTS

	Page
List of Tables	viii
List of Figures	xiii
List of Abbreviations	xvii
Abstract	xviii
Chapter One: Introduction and Literature Review.....	1
Marine Protected Areas	1
Goals of MPAs	4
Biological Research of MPAs	5
Social Research of MPAs.....	6
Summary	18
Chapter Two: History of Philippine Marine Protected area Establishment.....	20
Philippine Marine Ecosystem.....	20
Governmental Legislation leading to MPA Establishment	21
History of formally established Philippine MPAs	25
Characteristics of Philippine MPAs	29
Chapter Three: Examination of the Social Factors, Attitudes and Perceptions of Residents from Tubajon Marine Protected Area in Tubajon, Philippines.....	34
Abstract	34
Introduction	35
Study Sites	36
Methodology	39
Data Analysis	46
Results	49
Quantitative Results	49
Qualitative Results	69
Discussion	80

Chapter Four: Examination of the Social Factors, Attitudes and Perceptions of Residents from Agutayan Marine Protected Area in Jasaan, Philippines	87
Abstract	87
Introduction	88
Study Site	89
Methodology	91
Results	92
Quantitative Results	92
Qualitative Results	113
Discussion	122
Chapter Five: Examination of the Social Factors, Attitudes and Perceptions of Residents from Duka Bay Marine Sancutuary in Duka Bay, Philippines	131
Abstract	131
Introduction	132
Study Site	133
Methodology	135
Results	135
Quantitative Results	135
Qualitative Results	155
Discussion	163
Chapter Six: A Comparison of the Social factors, Attitudes and Perceptions of Residents from Philippine Marine Protected Areas and a Non-Marine Protected Area in Misamis Oriental, Philippines	174
Abstract	174
Introduction	176
Non-MPA Site	180
Methodology	182
Results	184
Discussion	255
CHAPTER SEVEN: Conclusion and Future Research Needs	274
Limitations	276
Future research needs	280
APPENDIX ONE: HOUSEHOLD SURVEY FOR MARINE PROTECTED AREA SITES	283

APPENDIX TWO: HOUSEHOLD SURVEY FOR NON-MPA SITE	290
APPENDIX THREE: KEY INFORMANT INTERVIEW QUESTIONS	295
References.....	296
Biography.....	309

LIST OF TABLES

Table	Page
Table 1. Key Philippine legislation that was important to the establishment of MPAs throughout the Philippines.	21
Table 2. Expected benefits from established MPAs in the Philippines (adapted from White et al. 2002 and Padilla & Rosales 1997).	29
Table 3. Definitions of socio-economic factors used in household socioeconomic surveys.	46
Table 4. Household expenses for one month from the residents of Tubajon MPA.	52
Table 5. Percentage of specific household items and facilities found in the respondents homes in Tubajon (n = 150).	53
Table 6. Tubajon respondent's perception of the biological factors associated with the MPA (n = 150).	61
Table 7. Perception of the social benefits the MPA has provided to the community of Tubajon (n = 150).	62
Table 8. Tubajon household responses to MPA community participation questions. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis (n = 127.	64
Table 9. Tubajon household responses to the question regarding problems with their MPA. Total number of responses and number of cases is presented (n = 150).....	67
Table 10. Tubajon respondents' answers to questions about empowerment (n = 150). ...	68
Table 11. Household expenses for one month from the respondents in Agutayan (n = 150).	94
Table 12. Percentage of households in Agutayan (n = 150) with specific household items and facilities.	95
Table 13. Type of fish target by the fisherman from Agutayan (n = 105).	101
Table 14. Agutayan respondent's perception of the biological factors associated with the MPA (n = 150).	105
Table 15. Perception of the social benefits the MPA has provided to the community of Agutayan.	106
Table 16. Agutayan household responses to MPA community participation questions. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis.	108
Table 17. Agutayan household responses to the question regarding problems with their MPA. The total number of responses and number of cases is presented.	111
Table 18. Agutayan respondents answers to questions about empowerment (n = 150).	112

Table 19. Household expenses for one month of the respondents from Duka Bay (n = 150).	138
Table 20. Percentage of households in Duka Bay (n = 150) with specific household items and facilities.	139
Table 21. Fish targeted by fishermen from Duka Bay.	144
Table 22. Duka Bay respondent's perception of the biological factors associated with the MPA.	147
Table 23. Perception of the social benefits the MPA has provided to the community of Duka Bay (n = 147).	148
Table 24. Duka Bay's households responses to MPA community participation questions. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis).	150
Table 25. Duka Bay household responses to the question regarding problems with their MPA. The total number of responses and number of cases is presented.	153
Table 26. Duka Bay's respondent's answers to questions about empowerment in their community.	154
Table 27. A brief description of the three MPA study sites.	180
Table 28. Social factors evaluated for MPA Evaluation Scores with specific thresholds.	183
Table 29. The results of the Mann-Whitney U Test pairwise comparisons between age of respondents and sites. Significant p-values adjusted with Bonferroni correction at the $\alpha = 0.0083$ level are indicated with an *.	185
Table 30. Chi-square tests results of highest education in four sites with residuals and calculated <i>p</i> values. Significant p-values adjusted with Bonferroni correction at the $\alpha = 0.0025$ level are indicated with an *.	188
Table 31. Main household expenses listed in the three MPA sites and the non-MPA site from the respondents for one month.	192
Table 32. Percentage of household items and facilities in respondent's homes in each of the four sites.	193
Table 33. Chi-square tests results between fishermen and non-fishermen in four sites with residuals and calculated <i>p</i> values. Significant p-values adjusted with Bonferroni correction at the $\alpha = 0.00625$ level are indicated with an *.	198
Table 34. Average perception to the question, "Overall, how has the MPA impacted your livelihood?" (1= very negatively; 5= very positively)	204
Table 35. The results of the Mann-Whitney U Test pairwise comparisons between responses regarding the perception of how the MPA impacted their livelihood across the sites. Significant p-values adjusted with Bonferroni correction at the $\alpha = 0.0167$ level are indicated with an *.	204
Table 36. Descriptive statistics of years fishing in four sites.	205
Table 37. Chi-square tests results of fishermen whose father's that were fishermen and were not in the four sites with residuals and calculated <i>p</i> values. Significant p-values adjusted with Bonferroni correction at the $\alpha = 0.00625$ level are indicated with an *...	206

Table 38. Chi-square tests results of fishermen who used motor and non-motor boats in the four sites with residuals and calculated p values. Significant p -values adjusted with Bonferroni correction at the $\alpha = 0.00625$ level are indicated with an *.	208
Table 39. The results of the Mann-Whitney U Test pairwise comparisons between average number of days fished in a week in the sites during good weather. Significant p -values at the $\alpha = 0.0083$ level are indicated with an *.	211
Table 40. The results of the Mann-Whitney U Test pairwise comparisons between volume of fish caught in one week with good weather in a week in the sites. Significant p -values adjusted with Bonferroni correction at the $\alpha = 0.0083$ level are indicated with an *.	212
Table 41. The results of the Mann-Whitney U Test pairwise comparisons between percentage of fish catch consumed by the household in the sites. Significant p -values adjusted with Bonferroni correction at the $\alpha = 0.0083$ level are indicated with an *.	213
Table 42. The results of the Mann-Whitney U Test pairwise comparisons between responses regarding the perception of fish quantity five years ago across the sites. Significant p -values adjusted with Bonferroni correction at the $\alpha = 0.0083$ level are indicated with an *.	215
Table 43. Average perception to the question, "Compared to five years ago, what is the quantity of fish?" (1 = a lot less; 5 = a lot more).	216
Table 44. The results of the Mann-Whitney U Test pairwise comparisons between responses regarding the perception of general coral health across the sites. Significant adjusted with Bonferroni correction p -values at the $\alpha = 0.0083$ level are indicated with an *.	217
Table 45. The results of the Mann-Whitney U Test pairwise comparisons between responses regarding the perception of coral health five years ago across the sites. Significant p -values adjusted with Bonferroni correction at the $\alpha = 0.0083$ level are indicated with an *.	219
Table 46. Average perception to the question, "Compared to five years ago, what is the health of coral reefs in your community?" (1=a lot less; 5= a lot more)	220
Table 47. The results of the Mann-Whitney U Test pairwise comparisons between responses regarding the perception of increased fish catch since MPA establishment across the sites. Significant p -values adjusted with Bonferroni correction at the $\alpha = 0.0167$ level are indicated with an *.	221
Table 48. Average perception to the question, " Since the MPA has been established the fish catch has increased in the community?" (1=a lot less; 5= a lot more).	221
Table 49. The results of the Mann-Whitney U Test pairwise comparisons between responses regarding the perception of improved coral health since MPA establishment across the sites. Significant p -values adjusted with Bonferroni correction at the $\alpha = 0.0167$ level are indicated with an *.	223
Table 50. Average perception to the question, "Since the MPA has been established the quantity and quality of coral reefs has improved?" (1=a lot less; 5= a lot more).	223
Table 51. The results of the Mann-Whitney U Test pairwise comparisons between responses regarding the perception of increased number of tourists since MPA	

establishment across the sites. Significant p-values with adjusted Bonferroni correction at the $\alpha = 0.0167$ level are indicated with an *.	225
Table 52. Average perception to the question, “Since the MPA has been established are there more tourists visiting your community?” (1=a lot less; 5= a lot more)	225
Table 53. Chi-Square tests of independence results of the biological benefits perceived by the respondents in the Tubajon, Agutayan and Duka Bay. Significant <i>P</i> -values are shown in bold.	227
Table 54. Chi-Square tests of independence results of the social benefits perceived by the respondents in the Tubajon, Agutayan and Duka Bay. Significant <i>P</i> -values are shown in bold.	229
Table 55. The results of the Mann-Whitney U Test pairwise comparisons between responses regarding the overall perception of the MPA on the community across the three sites. Significant p-values adjusted with Bonferroni correction at the $\alpha = 0.0167$ level are indicated with an *.	231
Table 56. Average perception to the question, “Overall, has the MPA been good or bad for the community?” (1=very good; 5= very bad)	231
Table 57. Chi-square tests results of respondents who answered “yes” and “no”, regarding awareness of community meetings taking place in their community in the three MPA communities with residuals and calculated <i>p</i> values. Significant p-values adjusted with Bonferroni correction at the $\alpha = 0.0083$ level are indicated with an *.	233
Table 58. Chi-square tests results of respondents who answered “yes” and “no” regarding continued government involvement in their community in the three sites with residuals and calculated <i>p</i> values. Significant p-values adjusted with Bonferroni correction at the $\alpha = 0.00833$ level are indicated with an *.	236
Table 59. Chi-square tests results of respondents who answered “yes” and “no” regarding illegal fishing taking place in their community in the three MPA communities with residuals and calculated <i>p</i> values. Significant p-values adjusted with Bonferroni correction at the $\alpha = 0.00833$ level are indicated with an *.	239
Table 60. The results of the Mann-Whitney U Test pairwise comparisons between responses regarding the perception of continued government involvement in the MPA across the three sites. Significant p-values adjusted with Bonferroni correction at the $\alpha = 0.0167$ level are indicated with an *.	241
Table 61. Chi-Square tests of independence results of the MPA problems perceived by the respondents in the Tubajon, Agutayan and Duka Bay. Significant <i>P</i> -values are shown in bold.	243
Table 62. Chi-square tests results of respondents who answered “yes” and “no” regarding being involved in decisions in the four sites with residuals and calculated <i>p</i> values. Significant p-values adjusted with Bonferroni correction at the $\alpha = 0.00625$ level are indicated with an *.	245
Table 63. Chi-square tests results of respondents who answered “yes” and “no” regarding participation in marine decisions in the four sites with residuals and calculated <i>p</i> values. Significant p-values adjusted with Bonferroni correction at the $\alpha = 0.00625$ level are indicated with an *.	247

Table 64. Chi-square tests results of respondents who answered “yes” and “no” regarding participation in PO groups in the four sites with residuals and calculated <i>p</i> values. Significant p-values adjusted with Bonferroni correction at the $\alpha = 0.00625$ level are indicated with an *.	249
Table 65. The results of the Mann-Whitney U Test pairwise comparisons between People Organization meeting attendance in the four sites. Significant p-values adjusted with Bonferroni correction at the $\alpha = 0.00833$ level are indicated with an *.	251
Table 66. The results of Mann-Whitney U Tests on fisher verses non-fisher responses to perception questions in each of the three MPA sites. Significant differences are note with a *.	252
Table 67. The mean ranks of significant Mann-Whitney U tests on fisher verses non-fisher responses to perception questions in each of the three MPA sites.	253
Table 68. Results of MPA Evaluation Score for the three MPA sites (+) indicates the threshold was met and (-) indicates the threshold was not met. Evaluation MPA Scores: 0 is the lowest and 20 is the highest Score.	254

LIST OF FIGURES

Figure	Page
Figure 1. Location map of study site, Tubajon MPA in the Municipality of Laguindingan, Misamis Oriental, Philippines.....	38
Figure 2. Highest completed education by the respondents from Tubajon MPA (n=150)50	50
Figure 3. Percentage of the primary livelihoods of the respondents from Tubajon (n = 150).	55
Figure 4. Tubajon respondent's perception of how the MPA has impacted their livelihood (n = 150).	55
Figure 5. Percentage of MPA facilitated livelihoods Tubajon respondents were involved in after the MPA was established (n= 150).....	56
Figure 6. Percentages of fishing gear used by the fisherman from Tubajon (n = 114). ...	57
Figure 7. Perception of fish quantity and coral reef health five years ago in the community of Tubajon. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis (n= 127).	59
Figure 8. Perception of increased: fish catch, coral reef health and tourists after the MPA had been established in the community of Tubajon. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis (n = 127).....	60
Figure 9. Overall perception of the MPA in the community of Tubajon (n = 150).....	63
Figure 10. Types of illegal fishing that Tubajon respondents identified in their community (n = 27).	65
Figure 11. Perception of respondents in government's continued involvement in Tubajon MPA (n =150).	66
Figure 12. Number of people's organization group meetings the respondents from Tubajon attended (n = 24).....	69
Figure 13. Themes, codes, and key concepts identified from the key informant interviews.	71
Figure 14. Location map of the study site, Agutayan MPA in the Municipality of Jasaan, Misamis Oriental, Philippines.....	91
Figure 15. Highest completed education by the respondents from Agutayan MPA (n = 150).	93
Figure 16. Main livelihood of the respondents from Agutayan (n = 150).....	98
Figure 17. Perception of how the MPA has impacted their livelihood from the respondents from Agutayan (n = 150).	99

Figure 18. Percentage of MPA facilitated livelihoods Agutayan respondents were involved in after the MPA was established (n = 150).....	100
Figure 19. Perception of fish quantity and coral reef health five years ago in the community of Agutayan. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis (n = 113).	103
Figure 20. Perception of increased: fish catch, coral reef health and tourists after the MPA had been created in the community of Agutayan. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis (n = 113).....	104
Figure 21. The overall perception of the MPA in the community of Agutayan (n = 150).	107
Figure 22. Percentage of type of illegal fishing that Agutayan respondents identified in their community (n = 71).	109
Figure 23. Perception of Agutayan respondents on active government involvement in their community's MPA (n = 150).....	110
Figure 24. The number of people's organization group meetings the respondents from Agutayan attended (n = 30).....	113
Figure 25. Location map of the study site, Duka Bay MPA in the Municipality of Medina, Misamis Oriental, Philippines.....	135
Figure 26. Highest completed education by the respondents from Duka Bay MPA (n = 150).	137
Figure 27. Primary livelihoods of the respondents from Duka Bay (n = 150).	141
Figure 28. Duka Bay respondents overall perception of how the MPA has impacted their livelihood (n = 146).	142
Figure 29. Percentages of the type of fishing gear used by the fisherman from Duka Bay (n = 103).....	143
Figure 30. Perception of fish quantity and coral reef health five years ago in the community of Duka Bay. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis (n = 121).	145
Figure 31. Perception of increased: fish catch, coral reef health, and tourists after the MPA had been established in the community of Duka Bay. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis (n = 120).	146
Figure 32. The overall perception of the MPA in the community of Duka Bay (n = 147).	149
Figure 33. Percentage of type of illegal fishing that Duka Bay respondents identified in their community (n = 82).	151
Figure 34. Perception of Duka Bay respondents on the government's involvement in their MPA (n = 147).....	152
Figure 35. The number of people's organization group meetings the respondents from Duka Bay attended (n = 45).	155

Figure 36. Map of the non- MPA study site, Baluarte Reef located in barangay Baluarte, Municipality of Tagoloan, Philippines	181
Figure 37. Frequency distribution showing the age of respondents from the four study sites, Tagoloan (n =149), Duka Bay (n = 150), Agutayan (n = 150), and Tubajon (n = 150).	186
Figure 38. Percentage of highest education completed by respondents from Tubajon, Agutayan, Duka Bay, and Tagoloan.	187
Figure 39. Origin of respondents from the four sites, Tubajon (n = 150), Agutayan (n = 150), Duka Bay (n = 150), Tagoloan (n = 149).	189
Figure 40. Percentage of primary occupations in the three MPA communities (n = 447).	200
Figure 41. Percentage of MPA facilitated livelihoods respondents from Tubajon (n=150), Agutayan (n=150) and Duka Bay (n=147) respondents were involved in after the MPA was established.....	202
Figure 42. Respondents perception of how the MPA has impacted their livelihood in the three MPA sites.....	204
Figure 43. Percentage of fishing gear used in all four sites, Tubajon (n = 108), Agutayan (n = 105), Duka Bay (n = 89) and Tagoloan (n = 79).	207
Figure 44. Percentage of motor and non-motor boats used by respondents at the four study sites, Tubajon (n = 97), Agutayan (n = 78), Duka Bay (n = 88) and Tagoloan (n = 79).	208
Figure 45. Percentages of the type of fish targeted in each of the four communities.....	210
Figure 46. Percentage of fish catch consumed in the household in the four sites (n = 375)	213
Figure 47. Percentage of responses to households in the four study sites, on the perception of the quantity of fish five years ago. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis (n = 435).....	215
Figure 48. Overall perception from respondents when asked about the health of their coral reef in the four sites (n = 597).....	217
Figure 49. Respondents perception of the health of the coral reef five years ago. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis (n = 436).	219
Figure 50. Perception of increased fish quantity after the MPA had been established in the three sites. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis (n = 357).....	221
Figure 51. Respondents perception in three MPA communities on the health of the coral reefs since the MPA was established. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis (n = 357).	223
Figure 52. Respondents perception of an increase in tourists in the community after the MPA was established in the three sites. Respondents that were not living in the	

community and respondents who were not 18 years of age when the MPA was established were removed from the analysis (n = 357).....	225
Figure 53. Perceived biological benefits of the MPA from the respondents in each of the three sites	227
Figure 54. Perceived social benefits of the MPA from the respondents in each of the three sites.	229
Figure 55. Overall perception of the MPA in the communities Tubajon, Agutayan, and Duka Bay (n = 447).....	231
Figure 56. Respondents awareness of community meetings regarding MPA establishment in the three sites. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis (n = 241).....	233
Figure 57. Percentage of respondents who desired to have the MPA established in their community in the three sites. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis (n = 251).	234
Figure 58. Percentage of respondents in each of the three sites who felt the government was involved in the establishment of the MPA in their community (n = 253).	236
Figure 59. Percentage of respondents who were involved in environmental education programs before the MPA was established. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis. (n = 255).....	237
Figure 60. Percentage of responses regarding illegal fishing either taking place or not taking place in their community in the three sites (n = 450).	238
Figure 61. Percentages of the type of illegal fishing method respondents identified in their community (n = 180).	239
Figure 62. Perception of on the governments involvement in their MPA in the three sites (n = 447).....	241
Figure 63. Percentage of responses to the problems of the MPA in each of the three sites.	243
Figure 64. Percentage of respondents who are involved in decision making in their community across the three sites (n = 597).	245
Figure 65. Percentage of respondents who were involved in marine resource decision making in their community in the three sites (n = 596).	247
Figure 66. Percentage of respondents who participated in People Organization (PO) groups in the three sites (n = 448).....	248
Figure 67. Number of people's organization group meetings the respondents from Duka Bay attended (n = 164).....	250

LIST OF ABBREVIATIONS

Coastal Conservation Education Foundation	CCEF
Department of Energy	DOE
Department of Environmental and Natural Resources	DENR
Deputized Fish Warden.....	DFW
Fisheries Aquatic Resources Management Councils	FARMCs
Florida Keys National Marine Sanctuary	FKNMS
Local Government Unit	LGU
Marine Protected Area	MPA
National Atmospheric and Social Administration	NOAA
National Integrated Protected Areas Systems Act	NIPAS
Non-Governmental Unit	NGO
People’s Organization	PO
Philippine peso (exchange rate: 200 PHP=US 4.22 (2/16/2016, xe.com)	PHP
Protected Area Management Board	PAMB
Sagay Marine Reserve	SMR

ABSTRACT

AN EVALUATION OF SOCIAL GOALS IN PHILIPPINE MARINE PROTECTED AREAS

Alexandra Shah, Ph.D.

George Mason University, 2016

Dissertation Director: Dr. E.C.M. Parsons,

The Philippines has a long history of protecting marine resources and limiting resource extraction and has been a world leader in marine protected areas (MPA) establishment, with over 1800 MPAs (Cabral et al. 2014). Understanding the success or failure of MPAs depends on evaluating both the biological and social aspects of the MPA. However, there has been limited research into the social goals of MPAs. This study helps fill the critical research gap by examining the social goals of Philippines MPAs using a mixed method approach. In 2012, household socio-economic surveys were administered to residents via a questionnaire ($N = 599$) in three MPA communities in the Province of Misamis Oriental, Philippines. Tubajon MPA a local community initiated MPA (bottom-up MPA), Agutayan MPA a government initiated MPA (top-down MPA), and Duka Bay MPA a privately managed MPA (private MPA) and one non-MPA community: Tagoloan. Quantitative data from questionnaires were used to analyze and

statistically test similarities and differences in respondent's perceptions and attitudes of MPA performance both biologically and socially, involvement in decision making, problems with MPAs, and overall impacts of the MPA on their livelihood in each of three MPAs. Additionally, qualitative data was gathered via transcribed, semi-structured interviews ($N = 30$) with various local government unit officers, barangay captains (elected village leaders), Deputized Fish Wardens, and resort managers in each of the three MPA communities, to further understand MPA performance. Significant differences in perceptions were found between MPAs sites. Duka Bay (private MPA) respondents had more negative perceptions of the impact of the MPA on their livelihood, decreased fish catch since the MPA, and less government involvement. While in Agutayan (top-down MPA) and Tubajon (bottom-up MPA) respondents had significantly more positive views regarding the MPA's impact on their livelihood and improved health of their coral reef. All MPA sites were found to have limited involvement in decision-making except in Tagoloan (non-MPA site). Tagoloan (non-MPA site) was found to have a significantly higher percentage of respondents involved in making decisions including marine resource decision-making. Significant differences in perceptions were found between fisherfolk and non-fisherfolk, where non-fisherfolk perceived more biological improvements and increased social benefits (i.e. increased tourists). Negative attitudes from fisherfolk need to be addressed in all MPA sites because it has been found to be detrimental to the success of MPAs. Qualitative data revealed problems with enforcement and corruption of some MPA managers, but many informants commented on how the MPA has been beneficial regarding increased fish abundance and diversity,

improved coral health, and the presence of more tourists in their community. Future management strategies for MPAs need to consider the conservation objectives, location, and social situation of the MPA (i.e. highly dependent fishing communities).

Recommendations for all sites are the development of livelihoods alternative to fishing, holding of open forums and discussions to encourage communication between managers, local government units, and stakeholders to help maintain support, compliance, and a sense of empowerment for community members.

CHAPTER ONE: INTRODUCTION AND LITERATURE REVIEW

This dissertation aims to examine the socio-economic conditions and local perceptions of Philippine communities associated with marine protected area (MPA). A mixed method approach was used that utilizes both quantitative and qualitative tools, to examine if MPAs are providing significant socio-economic benefits to the local community and perceptions regarding MPAs. Findings from this examination can not only provide important insight to the hundreds of MPAs that exist in the Philippines, but can also aid MPA managers worldwide to understand how an MPA may influence a local community.

Marine Protected Areas

Half of the world's population is living within 200 kilometers of the coastline (Creel 2003), thus anthropogenic impacts to marine environments is inevitable. Human populations have already altered the marine environment through chemical pollution, fishing practices, energy methods, aquaculture, land use and land transformations, water use, and shipping practices (Lubchenco et al. 1995). The effects of such human practices have led to habitat degradation, increases in coral bleaching, increases in the introduction of hypoxic and anoxic water, invasive species, and the collapse of world fisheries (Botsford et al. 1997; Lubchenco et al. 2003). The marine environment has responded to these alterations by changes in species diversity, population abundance of fish and corals,

size and sex ratio of fish, as well as trophic changes within the ecosystems (Pauly et al. 1998; Myers & Worm 2003; Lubchenco et al. 2003, Roberts et al. 2005).

Fishing, specifically commercial and destructive fishing is considered one of the most damaging human activities to the marine environment (Weber 2008). In some areas of the world fishing has reduced the populations of top predators to such low levels that their ecological role is no longer existent (Dayton et al. 1995) leading to a downward spiral of the marine ecosystem (McClanahan & Shafir 1990; Sobel & Dahlgren 2004; McClanahan & Graham 2005) and trophic cascades (Pinnegar et al. 2000). Fishing disrupts the entire marine ecosystem when important groups of animals such as herbivorous fish or invertebrates are removed from the population (Hoegh-Guldberg et al. 2007; Hughes 2008). A summation of these effects (fishing, pollution, land transformations etc.) has led to a complete alteration of the marine environment and with continued persistence has the potential to forever change the marine ecosystem (Lubchenco et al. 1995).

Therefore, coastal and ocean managers are tasked with a major challenge, which is to effectively manage, protect and conserve the world's ocean for future generations. Several fishery management strategies have been utilized with limited success; closed and open seasons, size restrictions, and quota systems on total catch (Nowlis & Friedlander 2005). These management strategies are based on a single species approach and they do not provide habitat or ecosystem protection for fished populations (Botsford et al. 1997; Cicin-Sain and Knecht 1998; Mascia 2003; Nowlis & Friedlander 2005). Additionally, these conventional management strategies are not practical for developing

countries where there are large numbers of artisanal fisherman who rely on their “catch” for daily survival. In addition, enforcement of conventional management strategies is difficult in developing countries because of the lack of infrastructure and personnel (Walmsley & White 2003). An alternative fishery management strategy, is the establishment of Marine Protected Areas (MPAs).

MPAs are defined as:

“any area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment” (Resolution 17.38 of the IUCN general assembly [1988] reaffirmed in Resolution 19.46 [1994] (in Christie et al. 2009).

Other terms have been used synonymously with MPAs such as marine sanctuaries, marine reserves, or marine conservation areas (Sobel & Dahlgren 2004). The term varies with location. In MPAs, the level of protection can vary from prohibiting most extractive practices in a core zone commonly referred to as a no-take zone while allowing extractive activities to occur in the buffer zone. Alternatively, some MPAs do not have a core zone but prohibit any form of fishing in designated areas (Lubchenco et al. 2003). The IUCN has six categories that can apply to the whole or different zones of the MPA depending on the objectives and specific management approaches of the MPA (Day et al. 2012). The six area management categories are: Ia. Strict Nature Reserve, Ib. Wilderness Area, II. National Park, III. Natural Monument or Feature, IV.

Habitat/Species Management Area, V. Protected Landscape/Seascape, VI. Protected area with sustainable use of natural resources (Day et al. 2012).

The initial establishment of MPAs is generally the result of one of the three circumstances. The first is the establishment by a governing body; this can be from any level of the government, such as the national, provincial, or local government. The second is through the support from international donors and non-governmental organizations (NGOs) (Christie et al. 2003; Lowe 2003). The third is through a local community where local villages or fisherfolk communities initiate the establishment of a MPA. Some MPAs can be established by a combination of these circumstances, for example an NGO may conceptualize the idea of the MPA and then present the idea to the fisherfolk communities.

The focus of MPAs is not only on the protection and the management of marine resources but also involves the protection of the associated habitat and management of human beings (Charles & Wilson 2009).

Goals of MPAs

The goals of MPAs are typically both biological and social (Christie et al. 2003). Some of the major biological goals of MPAs include: the protection of marine resources; sustaining marine biodiversity; protection of habitat; restoration of degraded reefs; and providing an undisturbed area for natural scientific inquiry (Pomeroy et al. 2006; Christie et al. 2003). Social goals of MPAs include: promoting food security through the restoration of commercial, recreation, or subsistence fishing; or generating other alternative livelihoods; creating ecotourism experiences; poverty alleviation; improving

environmental awareness and knowledge; environmental justice, and empowering coastal communities (Christie et al. 2003; Pomeroy et al. 2006; Charles & Wilson 2009). The biological and social goals of MPAs can be conflicting because of differing constituency groups and contradictory objectives (Christie et al. 2003). The contradictory nature of MPA goals to the different stakeholder groups has led to great controversy and conflict causing a high-rate of MPA noncompliance -around 90% in some countries (White et al. 2002). Therefore, an evaluation of the goals of MPAs must be addressed appropriately to prevent such failure.

Biological Research of MPAs

The design and research of MPAs has been primarily focused on the biological goals of MPAs. Researchers have documented and found that after MPA establishment there have been significant increases in species richness and diversity, increases in trophic interactions, increases in coral diversity and percent hard coral cover within the protected areas (Allison et al. 1998; Roberts et al. 2001; Gell & Roberts 2003). Protection from fishing inside the MPA has led to increases in abundance of targeted fish species as well as increases in species richness (Walmsley & White 2003). Additionally, spillover effects from the MPA have been observed in outside reefs with increases in both species richness and abundance of marine organisms being reported in areas adjacent to MPAs (Walmsley & White 2003). This research has indicated that, initially, MPAs can serve as effective fishery management tools.

However, biological success is only one aspect of MPAs; they are the product of humans whose purpose is also to manage human behavior and use of the marine

environment (Bromley 1991). The success of the MPA is dependent not only on biological aspects but also on human compliance with the management from stakeholder groups, resource users, community members, governments, and international non-governmental units (Pomeroy et al. 2006). Christie et al. (2013) concluded that:

“a particular MPA may be both a biological “success”-resulting in increased fish abundance and diversity and improved habitat- and a social “failure”-lacking broad participation in management, sharing of economic benefits, and conflict resolution mechanisms. Short term biological gains will likely disappear unless the social issues are addressed” (Christie et al. 2013, p. 22).

The social factors of MPAs often become the overriding factors of whether they are successes or failures - not the biological or physical factors (Mascia 2003). Moreover, it is important to understand that MPAs are not just laws or regulations, but they are located “somewhere” and their unique location will probably impact the surrounding (human) community.

Social Research of MPAs

Social science research concerning MPAs has been very limited despite the importance of social factors determining the outcome of a MPA. The social science research that has been conducted is often performed either “too little or too late,” or is inadequate and misleading (Christie et al. 2003, p. 22). Human dimension research of MPA development and management is still lacking as indicated by the work of Pollnac et al. (2010) and Yates et al. (2014). One example of inadequate social science research was

the design of a MPA network in the Gulf of California. The design of the MPA network was based on a series of algorithms that incorporated numerous biological variables and one socioeconomic factor: fishing pressure (Sala et al. 2002). Fishing pressure was quantified as the density of small fishing boats (Sala et al. 2002). Sala et al. (2002) stated that the inclusion of this socioeconomic factor would “reduce social conflicts by minimizing the overlap between reserves and heavily fished areas,” thereby complementing fishery management. But commercial fishing pressure is only one of the many socioeconomic factors that can exist in a coastal community and addressing just one factor would not likely reduce social conflicts of the MPA. Some other potential socioeconomic factors that can impact a coastal community are tourism, shipping, coastal development, recreational fishing, and subsistence fishing.

In the past decade, there has been a push from scientists and governments to address and research the human dimensions of MPAs. In 2002, an MPA conference conducted by National Atmospheric and Social Administration (NOAA) set forth a research agenda to balance social and biological considerations into MPA planning and evaluation (NOAA 2002; Christie et al. 2003). This conference among several others has increased the growth of MPA social science research and has provided insight into some of the social factors of MPAs such as MPA governance, socio-cultural aspects, and socioeconomic factors of MPAs, but this research is minimal (Charles & Wilson 2008).

MPAs have become a popular management tool to address overfishing, habitat degradation, and to provide alternative livelihoods in both developed and developing countries (Christie & White 2009). Over 6,800 MPAs have been established worldwide

covering around ~2.86% of the ocean (Bennett & Dearden 2014) and ranging in size from less than one hectare (0.01km²) to more than 100,000 km² (Toropova et al. 2010). In 2016, Papahānaumokuākea Marine National Monument began the largest marine protected area in the world when President Obama expanded the area to 1, 508,870 km²(Eilperin 2016)

The Parties to the Convention on Biological Diversity realized the potential for MPAs to be a successful fishery and coral reef management tool, and as such they set a mandate to have six-fold increase in MPAs from 1.6% to 10 % of the sea by 2012 – although when this did not occur the target was reaffirmed for the year 2020 (Wood et al. 2008; Mascia et al. 2010; Toropova et al. 2010; Fox et al. 2012). However, with substantial increases in MPA establishment, and mandates from governments worldwide, there is a major concern for the success and effectiveness of both current and future MPAs because their social factors are still poorly understood and undocumented (National Research Council 2001; Mascia et al. 2010). Social science research documents the public’s perception of the MPA management and effectiveness by allowing the public the opportunity to suggest management changes and concerns (Pomeroy et al. 2006). In addressing management concerns this may lead to increased support from the surrounding community (Pomeroy et al. 2006). It is believed that MPAs will “fall short of biological and social goals unless social sciences are deliberately integrated in the design and evaluation process” (Christie et al. 2003, p. 23). By evaluating social factors that are or will lead to potential conflicts in the MPA, managers are provided with critical information that can lead to both biological and social success of MPA. However, despite

our understanding of the importance of social science research in MPA design and evaluation it is still the subject of limited scientific analysis (Walmsley & White 2003). Fox et al. (2012, p. 5) stated that the literature of MPA social science research is growing: “more peer reviewed evidence is needed regarding the magnitude of social impacts and how these impacts vary over time, across spatial scales and levels of social organization, across social domains, and within and among social groups”. Therefore, a detailed evaluation of the social factors impacting MPAs is greatly needed to fill this notable research gap.

Several social factors can influence the effectiveness of MPAs including: household socio-economics; community involvement; alternative livelihoods; enforcement; conflicts; empowerment; and local perceptions and attitudes, in particular of those involved with fisheries. These factors are discussed below.

Household Socio-economics

The primary social goal of MPAs is to improve food security through the protection and conservation of important marine habitats and to improve income levels by providing livelihood options. There have been a few studies documenting how household income and demographics can influence the effectiveness of an MPA. In Pollnac et al. 's (2001) study on community based MPAs in the Philippines it was found that an increased population density negatively impacted MPA success. In particular, an increased number of resource users made managing, enforcing, and monitoring a MPA extremely challenging (Cinner & Pollnac 2004). The origin of the population can also

influence the success of an MPA. For example, newly migrated community members in Mahahual, Mexico, were found to comply less with MPA rules and boundaries (Cinner & Pollnac 2004). Also, Thomassin et al.'s (2010) study of Reunion Island MPAs, found that place of origin and employment were more important than location of residence, for the MPAs social acceptability.

MPAs can also change the livelihood strategies of the community. Loss of fishing grounds may cause a different resource use patterns of the community or the adoption of other livelihood such as farming. It is important to monitor shifts in primary and secondary livelihood strategies to understand possible compliance issues with the MPA.

Community Involvement

One of the first and most important steps in MPA establishment is community involvement. The community should include all stakeholders that can be potentially impacted from the MPA and their involvement should begin in the conceptualization and planning of the MPA (Badalamenti et al. 2000). Involvement from local fishers can be extremely valuable in choosing a suitable location for the MPA because of their local knowledge of the area (Badalamenti et al. 2000). Several studies have found that involving the community early on, and including stakeholder input, helps with “buy-in” of the MPA, which in turn leads to better compliance (Himes 2007; Charles & Wilson 2009). The community should not only be involved with the initial establishment of the MPA but also in the decision-making and the design and adoption of rules governing the

MPA, both during and after establishment (Fox et al. 2012). Input from all stakeholders is critical because policy preferences will differ between individuals, and social groups, involved in the MPA (Pomeroy et al. 2006).

Enforcement

A MPA is established to govern how individuals interact in a specific area of the marine environment (Pomeroy et al. 2006). Enforcement of an MPA involves monitoring user behavior and punishing behavior that is prohibited by the rules or laws of the MPA (Pomeroy et al. 2006). Enforcement relies on the use of trained personnel and access to guard boats, fuel and or watch towers (Beger et al. 2004). However, such commodities require continued financial support, which is challenging, particularly in developing countries.

Enforcement was scored in various MPAs throughout the Philippines by Walmsley and White (2003). Good enforcement was found to be the best indicator of MPA effectiveness in terms of increased fish populations and richness. The results of Walmsley and White (2003) were consistent with other MPA studies, which found that enforcement and compliance are the most essential attributes of effective MPAs (Lundquist & Granek 2005; Claudet et al. 2011; Fox et al. 2012).

Conflicts

In the establishment of an MPA, fisherfolk may lose important fishing grounds, and this can result in conflict between the fisherfolk and MPA managers if not addressed

appropriately. Many MPA failures have often been the result of resource user conflicts (Christie et al. 2003; Thomassin et al. 2010). As discussed earlier, it is important to involve all stakeholders in the beginning of the MPA process in order to ensure every user has a voice in the establishment of the MPA. This can also help mitigate problems of resource user conflict. Moreover, the rules of the MPAs should be precise and specify “who may do what where, when and how” (Pomeroy et al. 2006, p. 163) in order to reduce any potential conflicts between stakeholders.

In the establishment of an MPA conflict resolution mechanisms should be detailed in the MPA’s mandate. Conflict resolution mechanisms can improve MPA performance by “giving a voice to the aggrieved parties and acknowledging their concerns, which increase the legitimacy of MPA rule and regulations” (Pomeroy et al. 2006, p. 165). However, very few MPAs have conflict resolution mechanisms detailed in their mandate, thus limiting their effectiveness as MPAs.

Alternative Livelihoods

In order to compensate for loss of fishing grounds and initially reduced fish catch, alternative livelihood programs should be offered. These programs are considered necessary not only from a financial perspective but also to foster concepts and ideas of environmental conservation to the surrounding MPA community (Pollnac et al. 2001). Examples of livelihoods directly related to MPA establishment are: dive guides; selling of tourist products (t-shirts and other souvenir items); and sea wardens (White et al. 2000). Additionally, in the establishment of some MPAs there is also a component

involving the development of specific livelihood opportunities. The community may be trained, or given funding, for alternative livelihood programs such as: basket and mat weaving; seaweed farming; livestock production; etc. Beger et al.'s (2004) research of alternative livelihoods offered to MPA communities in Philippines highlighted the importance of offering livelihoods that were feasible, and sustainable, once the initial funding and training has been completed.

Empowerment

Empowering the local community is a goal of many community based MPAs. Empowering the local community through MPAs may be through self-governance in the establishment of people's organization groups and conservation education programs (Beger et al. 2004). A first step in MPA establishment is educating the surrounding community about conservation and the importance of sustainable resource use (Beger et al. 2004). Educating the community increases the community's participation in management strategies, because they already have a basic understanding of the marine ecosystem and how their actions directly impact their marine environment (Berger et al. 2004). Pollnac et al. (2001) discovered that successful MPAs often were adjacent to communities that were empowered through education and self-governance (Pollnac et al. 2001).

Local perceptions

Local perceptions focus on the social and psychological needs of the community rather than just the material concerns of maintaining human life (Pomeroy et al. 1997). Social and psychological needs in the context of MPAs may be: empowerment, sense of ownership over the marine resources, or perceived benefits from the protected area. Research on perceptions is important because it can “inform course of actions through improved conservation and governance” particularly in the field of conservation (Bennett 2016, p. 582).

Evaluation of the social and psychological needs in scientific research has been conducted through investigation of local perceptions regarding a project. Webb et al. (2004) quantified local perceptions of the Sagay Marine Reserve (SMR) in Sagay, Negros, Occidental Philippines. Local perceptions were found to be generally positive towards the equity and efficiency outcomes of the reserve but had a somewhat negative perception of the sustainability of the reserve. Perceptions were also found to differ among stakeholders and were linked to economic opportunities and location of the SMR (Webb et al. 2004). Community members closest to the SMR perceived fewer benefits from the reserve as opposed to locals much further from the reserve (Webb et al. 2004). This discrepancy between stakeholder perceptions of MPAs has also been documented between resource users and managers in Kenyan MPAs, and in the Florida Keys National Marine Sanctuary (FKNMS) (McClanahan et al. 2005; Suman et al. 1999). McClanahan et al.'s (2005) study found that government officials perceived more benefits for the fishermen and communities than the fishermen nearest to the MPA. Furthermore, similar

to the findings of Webb et al. (2004), location was found to be a significant factor affecting local community perception, with fisherman farthest from the newest MPA in Kenya having significantly more positive perceptions of the MPA (McClanahan et al. 2005). Other factors found to influence positive perceptions of the MPAs in Kenya were employment and education level (McClanahan et al. 2005). In the FKNMS, fishermen had negative perceptions of establishment of larger and more no-take zones while dive operators had positive perceptions regarding the no-take zones (Suman et al. 1999). The National Atmospheric Ocean Administration (NOAA) addressed the negative perceptions of the fisherfolk in the final FKNMS management plan by reducing the size and number of no-take zones (Suman et al. 1999). NOAA managers felt that if the negative perceptions of the fisherman were not addressed the sustainability of the FKNMS would be threatened. Socio-economic variables can influence an individual's perception of the environment. Pollnac et al. (2001), and Thomassin et al. (2010) found that education, age, occupation, area of residence, income, and gender were found to influence perceptions of the marine environment, together with income (Cinner & Pollnac 2004). In Cinner and Pollnac's (2004) study of Mahahual, Mexico MPA, communities of wealthier residents had a better understanding of the indirect activities that could impact the marine environment, while poorer residents were most concerned about the marine environment providing their basic needs. The poorer residents were not as concerned about conservation objectives for their coastal environment (Cinner & Pollnac 2004).

Research on the local perceptions regarding conservation and management of MPA is limited; there is a need for more research on the community stakeholders who are

directly impacted by the MPA objectives and management decisions (Himes 2007). As stated earlier, a MPA may be successful biological, but socially a failure. Therefore, local perceptions or values are critical to measure because they can influence human behavior toward the MPA.

Additionally, local perceptions can offer important insight into the potential long-term, and short-term, success of the MPA by identifying areas of potential conflict that may threaten the longevity of the MPA. In understanding the community's perceptions, marine managers can use the information to alter management strategies based on the needs and desires of the community, possibly leading to long-term MPA success (Cinner & Pollnac 2004).

Fisherfolk Involvement, Perceptions and Attitudes

Fisherfolk are the stakeholder group that is most impacted by MPA establishment, especially in areas where there is a large number of artisanal fishers. The MPA will cause them to lose crucial fishing grounds and require them to abide by MPA rules and regulations, thus impacting the fisher, the fisher's household, and the fisherfolk community (Pomeroy et al. 2006).

MPA establishment needs to begin with fisherfolk education. Fisherfolk must first understand that the MPA has been established to help protect and increase fish populations inside the MPA as well as produce spillover effects to the surrounding areas which will increase their long-run total catch (Sanchirico & Emerson 2002). Fisherfolk should be involved in the planning process of the MPA as well as in its establishment,

management, and evaluation. Negative perceptions of the MPA from fisherfolk have been found to be detrimental to MPA success and very difficult to change once opinions have been formulated (Pomeroy et al. 2006). Perspectives and attitudes of fisherman will vary with age, dependence of fishing as a livelihood, origin, and fishing experience (Dimech et al. 2009; Hamilton 2012). Older fishers, in the case of the Florida Keys National Marine Sanctuary, believed that the sanctuary had a negative impact on their fishing activity, causing them to fish further away from their accustomed inshore coastal waters (Dimech et al. 2009). In addition, displaced older fishermen near Mombasa Marine Park in Kenya were typically not involved in alternative livelihood opportunities such as construction or tourism, thus leading to negative attitudes toward the marine park (Pomeroy et al. 2006).

The loss of fishing grounds imposed by an MPA can be a financial hardship to many local fishers, since they may not have the resources to fish in another location, possibly forcing them out of their primary livelihood (Sanchirico et al. 2002). Feasible and sustainable alternative livelihoods opportunities need to be available for such displaced fishers to compensate for their losses in livelihoods (Sanchirico et al. 2002). However, it can be difficult to convince local fisherfolk of the economic benefits to be gained from these alternative livelihood opportunities (Badalamenti et al. 2000).

The limited research of MPA fisherfolk perception highlights the importance in involving the fishers in the MPA process as well as understanding how fisher's attitudes may not be homogenous. Negative perceptions, especially from fisherfolk, can be

damaging to the MPA success and should be understood and strategies developed to help mitigate potential compliance issues.

Summary

The inclusion of social science research in MPAs is critical for their future.

Social science studies associated with MPAs can aid managers in identifying important factors and impacts on the potentially affected resource-users. The documented success of MPAs, from both a biological standpoint and the ability to utilize an MPA in developed and developing countries has led to MPAs being considered one of the most favored marine conservation tools. However, evaluation and monitoring of MPAs needs to focus not only on the biological impacts but also on the social impacts. Finding the balance between ecological and social research of MPAs will remain a challenge in the MPA world.

This dissertation aims to examine the socio-economic conditions and local perceptions of three Philippine MPA communities. In the next chapter, the history of MPA establishment in the Philippines will be documented and it will explore why the Philippines serves as both a positive and negative role model for future MPAs. In chapter three, research methodology will be explained alongside the results of household surveys and semi-structured interviews from the Tubajon MPA will be presented. In chapter four, surveys and interview results from Agutayan MPA will be presented, and the results of the Duka Bay MPA will be explored in chapter five. In chapter six, differences between the three MPAs and one non-MPA community, and similarities socio-economic conditions

and local perceptions, will be presented. The final chapter, presents the study's conclusions, discuss future research needs, and make recommendations.

CHAPTER TWO: HISTORY OF PHILIPPINE MARINE PROTECTED AREA ESTABLISHMENT

Philippine Marine Ecosystem

The Philippines Archipelago is comprised of 7, 107 islands with over 25,060 km² of coastline - which is effectively 9% of the total global coral reef area (Spalding et al. 2001). The marine ecosystem of the Philippines is within the so-called “coral triangle” an area which supports the highest diversity of fish, coral and invertebrate species in the world, and is recognized as *the* global center of marine biodiversity (Roberts et al. 2002). Over 1700 reef fish species are found in the Philippines (Allen 2008; Sala et al. 2002) along with 533 coral species (Veron et al. 2009). Of the 92 million citizens in the Philippines, over 60% live in close proximity to the coastline, and over half of the countries’ animal protein is derived from marine sources (Asian Development Bank 2014). Destructive fishing coupled with an open-access fishing regime, extreme poverty and a rapidly growing populations, has led to a rapid decline in fisheries and coral reef health in the Philippines (Pietri et al. 2009). In 2008, a study by Wilkinson (2008) found 40% of Philippine reefs to be in poor condition. Marine managers, like elsewhere in the world, have implemented conservation management strategies, including MPAs, to protect the declining marine resources in the Philippines.

Governmental Legislation leading to MPA Establishment

The concept of protecting marine resources in the Philippines, and limiting resource extraction, developed hundreds of years ago, before the Spanish colonization (1521-1898) and is characterized as traditional management (Dalby & Sorensen 2002). Prior to Spanish colonization, the village or *barangay* (meaning local village or district) controlled fisheries, by which islanders limited their resource extraction in order to insure future sustainability, a form of traditional fishery management (Pomeroy & Carlos 1997, Pajaro et al. 1999). During the Spanish rule, control of the coastal environment was given to the central government and remained in the government's control until 1991. There are four key pieces of governmental legislation that have played significant roles in the establishment of MPAs throughout the Philippines: Act. No. 3915, 1991 Local Governmental Code, the 1992 National Integrated Protected Area Systems Act, and the 1998 Fisheries Code (see Table 1 for details).

Table 1. Key Philippine legislation that was important to the establishment of MPAs throughout the Philippines.

Key Philippine MPA Legislation	Summary
1932 Philippine Act No. 3915	Allowed for the establishment of marine parks
1991 Local Government Code	Reinstated power back to local government units (municipal, city, and provincial) from National government
1992 National Integrated Protected Areas Systems Act	Allowed designation of national protected areas including land, sea and wildlife
1998 Fisheries Code Section 81, 16	Local government units mandated to protect 15% of coastal water as no take. Philippine Marine Sanctuary Strategy mandated to protect 10% of coral reef areas as no-take by 2020

Philippines Act. No 3915

The legal framework for marine conservation in the Philippines was established in 1932 with the passing of Act No. 3915, which allowed for the establishment of national parks (Alcala 1988, La Vina et al. 2010). Act. No 3915 initiated the declaration of the first marine park in 1940: Hundred Islands National Park (Alcala 1988; Horigue et al. 2012). Although for this marine park the protected area encompassed the islands, and adjacent shorelines, but not the coral reefs (White et al. 2006). The reefs of Hundred Islands would not become legally protected until 1992, with the passage of the National Integrated Protected Areas Systems (NIPAS) Act (see discussion about NIPAS below) (White et. al. 2006). Following the designation of the Hundred Islands area as a marine park, many other marine parks or reserves were established throughout the country in the 1970s and 1980s, but very few were effective fishery management tools as most were neglected, or abandoned, by the government (Alcala 1988). It would not be until the 1990s that marine parks and reserves would become effective fishery management tools, and they were placed at the forefront of government agendas (Dalby & Sorensen 2002).

1991 Local Government Code

The second government code that played a significant role in MPA establishment was the 1991 Local Government Code (Republic Act 7160). This code reinstated pre-Spanish colonization power back to local governmental units (municipal, city and provincial) from the national government (Dalby & Sorensen 2002; White et al. 2006). The 1991 Local Government Code made the Local Government Units (LGUs)

responsible for the management of their own natural resources (within 15 kilometers of the coast), but management would be overseen by the national government (White et al. 2002). This code also allowed for coastal municipalities to establish their own MPAs via the passing of municipal ordinances and, most importantly, without national government approval (Dalby & Sorensen 2002, White et al. 2002). The 1991 fishery law also enabled co-management between the LGUs and people's organizations (POs), which represented fisherfolk and various communities within the municipality (Pomeroy et al. 2010). Decentralizing the government and encouraging LGU's to manage their own coastal areas enabled MPAs to be established more quickly throughout the Philippines, because they were no longer hindered by the national government's bureaucratic processes.

NIPAS Act

The National Integrated Protected Areas System (NIPAS) Act (Republic Act 7586), of 1992, also aided in the establishment of MPAs in the Philippines. The NIPAS Act seeks to protect landscapes, seascapes, or wildlife sanctuaries (Dalby and Sorensen 2002; White et al. 2006). NIPAS are large areas encompassing thousands of hectares. However, marine areas are not differentiated within NIPAS, instead marine areas are portions of the larger protected area (Dalby and Sorensen 2002). The Philippine Government pushed for NIPAS in order to protect successful MPAs from the possibility that the local community may "turn its back on conservation objectives, and exploit the MPA for economic benefit" (see discussion below on Sumilon Island Marine Reserve) (Hind et al. 2010, pg. 55). Currently, there are twenty-nine NIPAs with marine

components (White et al. 2006). Any national parks, seascapes or wildlife sanctuaries that were protected prior to 1992, were retroactively designated as NIPAS. The management of NIPAS comes under the national government, specifically the Department of Environmental Natural Resources (DENR), despite 1991 Local Government Code (La Vina et al. 2010). All NIPAs are also managed and governed by the Protected Area Management Board (PAMB), which includes representatives from the DENR, and provincial, municipal, and barangay governments (Hind et al. 2010). Additionally, NIPA also requires the creation of an integrated protected areas fund, which can be used to finance the NIPA areas if external funding is withdrawn (White et al. 2002). Designating some protected areas as NIPAS has increased support and strength of the protected area network, but in other cases it has eroded successful community-based management and support (see Apo Island Marine Reserve discussion below) (Christie and White 2007).

1998 Fisheries Code

A third code, which prompted MPA establishment, was the 1998 Fisheries Code (Republic Act 8550) Section 81 and Section 16. In Section 81, LGUs - along with their respective Fisheries Aquatic Resources Management Councils (FARMCs) - were mandated to designate at least 15% of the coastal municipal waters (within 15km of the coastline) as no-take MPAs (Dalby & Sorensen 2002; Arceo et al. 2004). In Section 16, in addition to the 15% mandated by the code, the designation of small sanctuaries was encouraged for barangays. The sanctuaries could be one to fifteen hectares in size, and it

was the role of the FARMCs to determine which areas should be selected for protection (Dalby & Sorensen 2002). Additionally, the 1998 Fisheries Code also mandated the “Philippine Marine Sanctuary Strategy” to protect 10% of coral reef areas in no-take MPAs by 2020 (Arceo et al. 2004).

History of formally established Philippine MPAs

In order to cope with the declining fish populations throughout the Philippines, MPAs became one of the primary fishery management tools utilized throughout the country (White et al. 2006). The first formally established MPA in the Philippines was designated in 1974, with the establishment of Sumilon Island Marine Reserve (Alcala 1981; Alcala 1988; Alcala & Russ 1990). The Sumilon Island Marine Reserve was formed as the result of a collaborative effort between Silliman University and the Oslob Municipal Council (Russ & Alcala 1999). All extractive activities were prohibited within the reserve, and the area was monitored by a single caretaker who was stationed in a guard house in front of the reserve (Russ & Alcala 1999). Sumilon Reserve was initially deemed successful in terms of “biological” success, with increases in biomass and diversity of reef fish, as well as increases in live coral cover (Russ & Alcala 1999; White et al. 2002). Increases in fish catch around the reserve were also observed, increasing from 14 tons per square kilometer to almost 36 tons per square kilometer in a period of ten years (Russ & Alcala 1999). But the short-term biological success of the reserve disappeared when newly elected mayors did not support the reserve and did not prohibit fishing within the protected areas. The biomass and diversity of reef fish then decreased dramatically, since fishing was no longer prevented inside the reserve (Russ & Alcala

1999). Governmental support of Sumilon Reserve waivered throughout several decades, and this state of affairs ultimately led to little community involvement nor support for the reserve (Russ & Alcala 1999). The Sumilon Island Reserve case study clearly shows how marine reserves can fail if community involvement, ownership, and institutional support, are not obtained, or maintained, throughout the lifetime of a protected area. Several other reserves or MPAs were established throughout the Philippines, after the Sumilon Island Reserve, and all included “no-take” zones prohibiting all extractive activities, as well as a “sanctuary” zone which allowed traditional fishing activities (White et al. 2002). The most famous MPA established during this time was Apo Island Marine Reserve. Apo Island is a well-known protected area and has been estimated to provide financial benefits the adjacent community at a rate of US\$500 per hectare of reef (Russ & Alcala 1999; Alcala 1998). Apo Island Marine Reserve was established in 1982 by Silliman University and the Municipality of Dauin (Russ & Alcala 1999). The protected area encompasses 22.5 hectares and was initially managed by a Marine Management Committee that consisted of local residents, and was overseen by Siliman University. Community involvement extended from the beginning stages of the establishment of the reserve, and continued throughout its implementation, management and evaluation phases. The community support for Apo Island marine reserve has arguably been one of the key issues contributing to the success of the MPA. Coral cover is higher in the protected area than in neighboring reefs (Alcala & Russ 2006). Biomasses of four indicator fish species have also increased inside the reserve by 4.6 times (Alcala & Russ 2006) and predatory fish species have increased by a factor of 17.3, within just an 18-year period (Russ &

Alcala 2003). Adult “spillover effects,” which is defined as the “net export of adult (postsettlement) fishes from reserves to fished areas” (Russ et al. 2003) have been documented in Apo Island Reserve. Increases in catch per unit effort have been documented for targeted fish species - including the surgeonfish, *Naso vlamingii* - both within, and outside, the reserve (Russ et al. 2003). Economic benefits were noted for local families from Apo Island in the early 1990s, especially in terms of benefits from tourism (White et al. 2000). The positive effects of Apo Island Reserve in terms of fish and coral health, community support, and economic benefit, from MPA establishment, have had a tremendous impact on promoting and supporting MPA establishment throughout all of the Philippines (Alcala & Russ 1999). Despite Apo Island functioning as a successful community-based MPA, in 1994 Apo Island was designated by the DENR as a Protected Land and Seascape (AIPLS), and was to be managed under the NIPAS Act (Hind et al. 2010). The decision to declare Apo Island as a NIPAS location was believed to be an attempt to prevent what happened at Sumilon Island, and a way for the national government to use Apo Island’s funds to help secure other NIPAs areas that were not as financially stable, although these points have been debated (Hind et al. 2010).

Declaration and management of Apo Island as a NIPAs area has eroded some of the positive support by the community because they no longer feel as though they are involved in the management decisions of Apo. Thus, resentment is starting to build within the community (Hind et al. 2010). Apo is still functioning well, both biologically and socially, because of the “voluntary stewardship” of the local community - but there is concern about the longevity of this “voluntary stewardship” (Hind et al. 2010, p. 61),

especially with building resentment within the community due to the national governmental control of the protected area.

Since the establishment of the first MPA on Sumilon Island, the great success of Apo Island Marine Reserve, and the passing of key MPA legislation, MPAs have been implemented at an astounding rate in the Philippines. The current number of established MPAs in the Philippines varies from 202 locations cited in the Global MPA database (Wood 2007), to 985 in the Weeks et al. (2010) study on Philippine MPAs. The variation in the number of established MPAs is because their small size and the poor level of documentation (Weeks et al. 2010). Most of the MPAs in the Philippines have been established by either the local government, international organizations or NGOs, or by the local community, although an overwhelming majority of the MPAs have been established at the community level, rather than at the national level (Pollnac et al. 2001; Alcala & Russ 2006; Weeks et al. 2010). Increased MPA establishment was also facilitated by foreign development agencies and donor countries (White et al. 2002). Within an almost ten-year period, from 1984 to 1995, over 25 foreign development agencies and eight donor countries were supporting community-based coastal resource management projects, and specifically MPA establishment, in the Philippines (White et al. 2002).

Characteristics of Philippine MPAs

Establishment and Benefits

MPAs in the Philippines MPAs are primarily established for the conservation and protection of marine resources, but some MPAs have been established for cultural and historical purposes, aesthetic reasons, and/or for scientific and educational purposes (Miclat & Ingles 2004). The aims of, or expected benefits accruing from, MPAs throughout the Philippines are listed in Table 2.

Table 2. Expected benefits from established MPAs in the Philippines (adapted from White et al. 2002 and Padilla & Rosales 1997).

Biological Benefits	Social Benefits
Improved fishery yields	Tourism revenues
Biodiversity Improvement	Recreation
Gene resources and diversity	Scientific Research and Education
Species and ecosystem protection	Spiritual, cultural and aesthetic values
Ecological processes supported	Future Values
Flood and erosion reduction	

Location

MPA coverage in the Philippines is not equally representative of the marine bioregions of the Philippines. For example, the Visayan Sea bioregion contains over 67% of the MPAs in the Philippines (Weeks et al. 2010). This region includes some of the most heavily exploited fishing grounds in the country, and the majority of the MPAs were established at the community level by fishing groups, NGOs, and academic institutions (Campos & Aliño 2008). The Celebes Sea and Northern Philippine bioregions, which both contain important marine biodiversity corridors that are essential

for example larval transport, are poorly represented in terms of marine protection (Weeks et al. 2010). This is because MPA location in the Philippines is typically not based on a biological evaluation of potential sites, but rather the location of NGOs or academic institutions (Pollnac et al. 2001; White et al. 2002).

Size

Most of the MPAs in the Philippines are small: on average, less than ten hectares (Campos & Aliño 2008). Weeks et al. (2010) found the median no-take area of Philippine MPAs to be just 12 hectares. Two of the largest MPAs in the Philippines are Apo Island Marine Reserve (100 hectares) and Tubbataha Reef National Marine Park (130,028 hectares) (White et al. 2002). These two MPAs represent over 85% of the total no-take areas in the Philippines (Weeks et al. 2010). However, the majority of the 1800 Philippine MPAs are small. Therefore, this limits their ability to contribute towards the mandate of the 1998 Fisheries Code, which required 10% of all coral reef areas become MPAs by 2020. In order for the Philippines to meet this 2020 mandate, MPA overall size needs to increase, but this could have considerably bearing on the socioeconomic constraints of the local communities.

Another alternative to increasing MPA size, which is gaining more support, is the development of marine protected area networks. MPA networks are defined as: “a collection of individual marine protected areas operating cooperatively and synergistically, at various spatial scales, and with a range of protection levels, in order to fulfill ecological aims more effectively and comprehensively than individual sites could

alone. The network will also display social and economic benefits, though the latter may only become fully developed over long time frames as ecosystems recover” (IUCN-WCPA 2008, p. 3). MPA networks are still a relatively new concept in the Philippines, but there are currently a handful of networks in the planning and early implementation stages.

Effectiveness

The majority of MPAs in the Philippines are not effective because they are generally lacking in three areas: enforcement, and community and/or governmental support (White et al. 2006). A 1999 survey of 439 reserves in the Philippines found that only 10% of MPAs were well-enforced (Pajaro et al. 1999), and most existed as “paper parks” (Alcala 2001). Additionally, Pollnac et al. (2001) found that 80% of the MPAs in the Visayan region of the Philippines were not successful when analyzing each MPA based on six factors that were found to lead to “overall” MPA success. Most of the MPAs are local managed and there is no national agency monitoring the progress or effectiveness of the approximately 1800 MPAs (Cabral et al. 2014). Efforts have been made to improve MPA performance, however, with programs such as the Coastal Conservation and Education Foundation Inc. (CCEF), which monitors and evaluates MPAs in a shared database (White et al. 2006). This database also provides lists to marine managers on how to improve their MPA performance, but the database only includes a limited number of MPA (93 MPA entries) and, therefore, is not providing information on the remaining 800 plus MPAs in the Philippines (White et al. 2006;

Cabral et al. 2014). Recently, the “Philippine Marine Protected Database” was created to provide information to local governments and policy makers to improve planning and decision-making processes, as well as providing a tool for monitoring MPAs in the Philippines (Cabral et al. 2014). At present, this latter database has over 1800 MPA entries and provides information on location, boundary coordinates, MPA area, establishing ordinances and MPA evaluation (Cabral et al. 2014).

However, significant improvements in MPAs effectiveness were reported by White et al. (2006) in a 2003 assessment of 156 Philippines MPAs. White et al. (2006) found that 44.2% of the MPAs evaluated had a “good” to “excellent” level of management. Additionally, award programs such as the “Para El MAR” recognizes that the Philippine locations that are the “best-performing MPAs in the country” according to a set of three criteria: 1) management effectiveness (35%), 2) biophysical and ecological impacts (32%), and social and economic benefits (33%) (Cabral et al 2014, p. 306; DeJus 2016). The biennial award ceremony is a platform where government, non-governmental units, academic institutions and local partners come together to celebrate and share lessons and good governance practices regarding Philippine MPAs (DeJus 2016)).

Future of Philippine MPAs

Despite the improvements and ongoing initiatives, there is still a definite need for increasing MPA performance in the Philippines. A major way to improve MPA performance is to understand not only how the MPA is performing biological, but how it is performing socially. Detailed evaluations of the socio-economic and local perceptions

of those impacted by the MPA establishment are needed throughout the country's 900+ MPAs.

In the past decade, there have been efforts in the Philippines and globally to scale up MPAs by establishing MPA networks. Before, the scaling up MPAs into MPA networks occurs it is important that the social factors and perceptions of these small MPAs are documented and understood and what implications a network would have the surrounding community, region, or country. Baseline gathering of this information begins by documenting how these MPAs are functioning ecologically and socially and analyzing the variability in these factors across regional scales. Comparing social factors across regional scales will enable managers to make informed decisions that promote the success and sustainability of the small MPAs but also collectively in a MPA network.

CHAPTER THREE: EXAMINATION OF THE SOCIAL FACTORS, ATTITUDES AND PERCEPTIONS OF RESIDENTS FROM TUBAJON MARINE PROTECTED AREA IN TUBAJON, PHILIPPINES

Abstract

Tubajon (Misamis Oriental, Philippines) Marine Protected Area (MPA) was established by the adjacent community in 2002. It is a 22 hectare MPA that is situated adjacent to a coastal village where a majority of the residents are fisherfolk. In March of 2012, a household socio-economic survey was administered to residents ($N = 150$) near Tubajon MPA to determine demographics, socio-economics, attitudes and perceptions of Tubajon residents regarding the MPA. Additionally, ten key informant interviews were conducted with various local government unit officers, barangay captains (elected village leader), and Deputized Fish Wardens to further understand MPA performance in Tubajon. Overall, Tubajon resident felt the MPA was a positive marine resource management tool for their community. Residents reported both biological and social improvements since the MPA was established, but these social gains from the MPA were minimal. Changes in alternative livelihoods were only experienced by a few residents. Residents reported minimal involvement in the decision-making process in their community and very few were involved in environmental educational programs that would encourage community empowerment. Many key informants reported problems of poaching and the corruption of some MPA managers. Despite, negative MPA perceptions, lack of community involvement, and few alternative livelihoods, informants

repeatedly mentioned how Tubajon residents were proud of their MPA and believed that the MPA is beneficial to their community.

Introduction

Marine protected areas are marine environmental management tools that can help to conserve and protect marine habitats and fishery resources. The goals of MPAs are both biological and social (Christie et al. 2003). Some of biological goals of MPAs are sustaining marine biodiversity, protection of the marine habitat and enhancing marine species richness, diversity, size and density (Christie et al. 2003; Pomeroy et al. 2006; Lester et al. 2009; Bennett & Dearden 2014). The main social goals of MPAs include promoting food security through the protection of fisheries, generation of alternative livelihoods, improving environmental awareness and knowledge, and empowering coastal communities (Christie et al. 2003; Pomeroy et al. 2006; Charles & Wilson 2008). The design and research of MPAs have been primarily focused on the biological goals of MPAs, whereas the investigation of the social goals of MPAs has been limited. In the few studies that have incorporated both biological and social science research, such as in Christie's (2004) research of Philippine and Indonesian MPAs, findings indicated that the MPAs were "biological successes" through gains in increased fish abundance and diversity and restored habitat but "social failures," with poor community participation in MPA management, sharing of economic benefits, and the lack of conflict resolution mechanisms. Governmental organizations, NGOs and academia have realized the importance of more in depth social science research and have pushed for more detailed investigation of the human dimensions of MPAs (Mascia et al. 2010; Fox et al. 2012).

To begin to help fill this critical research gap, this study focused on evaluating the social goals of a MPA in the Philippines. The MPA, named Tubajon MPA is located in one of the three coastal communities of the Municipality of Laguindingan, Barangay Tubajon, in Northern Mindanao, Misamis Oriental. The MPA was established in 2002, and covers 22 hectares. It's managed by the Tubajon Coastal Dweller's Association. Using a household survey and semi-structured interviews, the aim of this research was to provide baseline information on household socio-economics, community involvement, empowerment, involvement in alternative livelihoods, possible conflicts, and residents' perceptions and attitudes about Tubajon MPA. In researching and analyzing how these social factors are negatively, or positively, impacting the residents of Tubajon, the ultimate goal was to better understand how to maintain longevity and success of Tubajon's MPA.

Study Sites

Four sites were chosen for research in this dissertation. A description of each site will be described in each respective chapter. The four study sites, are located in a major fishing area in the second largest island of the Philippines: Mindanao. The sites are situated in Northern Mindanao, along the coastline facing the Bohol Sea, in the Province of Misamis Oriental. Misamis Oriental is a "first class Province (average annual income of Php 450 million = ~\$10 million) and the population, in 2007, was 748,885, with an average household size of 5.03 individuals (Philippine Statistics Authority 2010). The labor force participation ratio (percentage of population economically active) of 71.2% (Province of Misamis Oriental 2011). Fishing is the major source of income in these

coastal communities, while the inland communities are supported by industries of agricultural, forestry, steel, and food processing (Department of Philippine Tourism 2009). Coral reefs are present along most of the coastline of Misamis Oriental, with major reef areas at Banbayan Point, Gorda Point in Balingasag, Constancia shoal, and Agutayan shoal in the Municipality of Jasaan (Department of Philippine Tourism 2009). Over twenty-one MPAs exist in Misamis Oriental, and all have been either established by the local government, international organizations or NGOs, or by the local community.

Tubajon, Marine Protected Area

Tubajon Marine Protected Area is in the fourth class (average annual income Php 25,000,000-34,999,999) Municipality of Laguindingan in the Barangay of Tubajon (Philippine Statistics Authority 2010) (Figure 1). The population of Barangay Tubajon was estimated to be 2,299 people in 2010 (Philippine Statistics Authority 2010). It is a large MPA (in the context of the Philippines), covering twenty-two hectares of water, and was established in 2002 by Ordinance No. 94 (Macajalar Bay Development Alliance 2016). The MPA is managed by the Tubajon Coastal Dwellers Association Inc., indicating a "bottom-up" form of management. In 2008, the MPA was rated by the Coastal Conservation Education Foundation (CCEF) and was given a rating of "good", which indicates that the MPA was well enforced (CCEF 2008). This assessment noted that Tubajon had three priorities for improved management: addressing the lack of sustainable financing mechanisms; investigating multiple resource use conflict; and tackling the need for management capacity development (CCEF 2008). In 2015, Tubajon

was rated using a Management Effectiveness Assessment Tool (MEAT) which uses the CCEF rating and additional biophysical and socio-economic impact indicators, Tubajon was rated a “Level 2” out of “Level 4” (MPA Support Network 2015). A “Level 2” indicated that the MPA has been established and is in the strengthening phases (it is patrolled regularly; violations have been documented and violators have been penalized) but ecological and socio-economic impact assessments need to be conducted (MPA Support Network 2015).

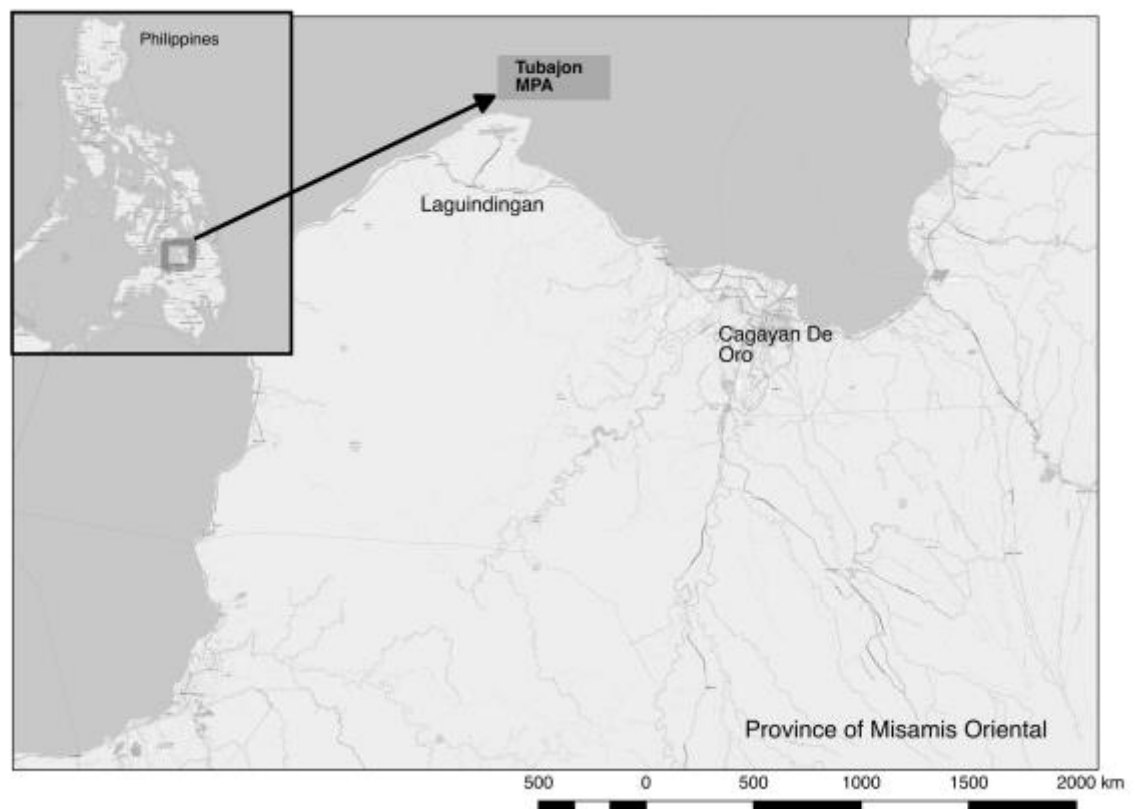


Figure 1. Location map of study site, Tubajon MPA in the Municipality of Laguindingan, Misamis Oriental, Philippines.

Methodology

Survey Methods

A survey instrument with 46 questions was developed using social MPA research techniques from Pomeroy et al. (2004) and Cinner (2005). The survey instrument was translated into the local dialect of Misamis Oriental, Visayan. The survey was reviewed by the local government unit and village leader and was also approved by the George Mason's Institutional Review Board for human subject research, prior to administering data collection in the community. In all research sites the respondents were persons living in the coastal community (*barangay*) adjacent, or near, to the protected area or reef.

Data collection took place between March 2012 and July 2012. Surveys were conducted face-to face and with one or two trained local assistants to aid with translation. Participants were asked if they would like to participate in a survey and then asked to sign a consent form authorizing the use of the information they provided. No specific individuals were sought for use in the survey and no incentive was provided. Moreover, participants were informed that their participation is strictly voluntary. Quantitative sampling was conducted in households for three MPA sites.

The sampling was systematic and involved sampling every household (e.g. 2nd, 3rd, 4th,) to obtain a survey sample size of at least 120 to give 7.5% precision and 90% confidence for a population of 5000+ (de Vaus 1991; Henry 1990; Cinner 2005). The heads of the household were generally sought for interview, either male or female. But if the head of the household was not available, another adult member of household was interviewed. The surveys generally took 30 minutes to complete.

There are numerous social factors that can influence the effectiveness of a MPA (see Chapter 1). For the purposes of this study, not all social factors were examined. The factors that were examined were selected based on the importance in previous social MPA research as well as the ability of the factors to be analyzed at the study's location. The social factors examined in this study included: participant demographics; household socioeconomics; living standards; livelihood options; marine resource use patterns; perceptions regarding marine resources; perceptions regarding the MPA; community participation; enforcement and conflicts; and empowerment. Explanations of what each of these factors are and how they were measured is outlined below. References to specific questions in the survey are accompanied by the question number, (Q#). The survey instrument used for this study can be found in Appendix 1-3.

Demographics

Demographic questions included information regarding the age, gender, education level of the participant (Q1-3). Demographics also included questions (Q4-6) regarding the participant's settlement patterns to determine if they are long or short-term residents of the area as well as reasons why they relocated to the area, when appropriate.

Household socioeconomics

The participants were asked a series of questions (Q7-8, 10-11) about their household and expenses to determine basic socio-economic information. Participants were asked about the number of adults and children living in home (Q7), if the

respondent rented or owned the home (Q8), and the household's total monthly income (Q10). Then they were asked to estimate how their income for one month was spent on basic household expenses such as: rice, protein, cooking materials, other grocery items, schooling, medicine, clothing, electricity, and rent (Q11).

Living standards or Quality of Life

In order to understand the quality of life of the community members, questions regarding household possession and amenities were asked of each participant (Q9). The presence and absence of items such as a television, refrigerator, or generator, was recorded as well as the type of amenities they have in their home for: lighting, cooking, roof cover, floor material; and wall material.

Livelihood options

The livelihood options available in the area were determined by asking the participants about jobs they perform to bring money or food to their household (Q12). The participants were asked to identify what is their primary source of income and the amount of income that is generated from that occupation. Respondents were also asked about additional livelihoods and to identify how much of their income was generated from each livelihood. The job categories the participants were asked about were: fishing, laborer, carpentry, selling of goods, farming, small village store, marketing of marine products, cash crops, salaried employment, tourism, and the sale of handicrafts. Changes in livelihood opportunities after MPA were established were also asked of the

participants, specifically livelihoods associated with: seaweed farming, tourism, selling of handicrafts, livestock, and serving as a MPA guard (Q31).

Marine resource use patterns

Participants who answered that they were involved in fishing were then asked a series of questions (Q13-19) about their fishing activity and practices, specifically the type of gear used, targeted fish, and the type of boat used. To determine fishing effort participants were asked about the average number of fishing trips per week, as well as number of fishing trips taken during the different seasons (Q16). Participants were also asked to estimate their catch during “good weather,” Northeast Monsoon, the Southeast Monsoon (Q17), and what percentage of the catch was consumed by their household and/or sold to the market (Q18-19).

Perceptions regarding the marine resources

Community perceptions of marine resources are critical for understanding past, current and future plans for marine resource management. Community members were asked a series of questions (Q20-23) regarding these. Participants were asked to compare the quantity of fish available five years ago using a five point Likert scale (Q20). Opened-ended questions of how they came to the conclusion regarding the availability of fish five years ago were asked (Q21). In addition, questions regarding the overall health of the reef (Q22) and how it has changed over the last five years (Q23) were posed. These

responses were scored using a five point Likert scale. Collectively these questions were used to determine overall perceptions of changes in marine resources in their community.

Perceptions regarding the MPA

To assess the community perceptions of the MPA, a five point Likert scale was used to determine if they felt the biological and social goals of the MPAs were being met. Participants were first asked if they were aware of the MPA in their community (Q26). Then the participants were asked about their perceptions of increases in fish catch, quantity and quality of the coral reefs, and increases in tourists, after the MPA was established (Q32-34). Opinions of how the MPA had biologically impacted their community were asked of the participants using specific categories: increases in fish abundance or fish size; fish species landed; fish moving closer; cessation of habitat destruction; and/or improved coral health (Q35). Opinions on how the MPA has socially benefited their community were asked using categories of: excludes outsiders, improving livelihoods, conserving resources for future generations, providing educational opportunities, removing bad gear practices, reduces conflicts, improves equity (Q36). Multiple response sets were created in SPSS using the above-mentioned categories for (Q35-36) in order to obtain descriptive statistics. Five point Likert scales were used to assess whether the MPA has been positive for their livelihoods and if the MPA has been beneficial to their community overall (Q38-39).

Community participation

A major factor in determining the success of an MPA is involving the community in the initial and ongoing process of MPA planning and establishment. Participants were asked about their initial involvement in the MPA by asking if they were involved in any meetings before the MPA was established (Q27). Participants were also asked if they had wanted the MPA established in their community (Q28) and who was involved in the establishment of the MPA (Q29). To determine if the MPA included information awareness programs, participants were asked if they knew about the MPA in their community and if they were involved in any environmental education programs before the MPA was established (Q30).

Enforcement and Conflicts

To understand possible problems with enforcement or conflict in the MPA, participants were asked about illegal fishing. Participants were asked if illegal fishing took place in their community and, if so, what type of illegal fishing occurred (Q24-25). To determine if the illegal fishing activity is being enforced properly, participants were asked if, in their opinion, the MPA's regulations were enforced, by the local, provincial, or national governments (Q37). Responses were scored on a five-point Likert scale. Participants were also asked (Q40) if the MPA had 'problems' and if so what were these (i.e. regulations not well enforced, causes conflicts, erodes traditional authority, etc.). Then a multiple response set was created in order to obtain frequency percentages for the respondents.

Empowerment

As discussed earlier, empowerment of the local community is one of the goals of MPAs. To determine if the MPA had empowered the local community, participants were asked about their involvement in the decision making process in their community, and whether they are now involved in the decision making for marine resource use, or in the management of the MPA within their community (Q41-43). Empowerment in a community is not only observed in decision making but also in their involvement in community organizational groups. Finally, participants were asked if they belonged to any organizations or groups, what type of group was it, how many meetings there have been in the last six months, and how many of those meetings they attended (Q44-46).

Semi-Structured Interview Methods

Key informants were selected by snowball sampling (Henry 1990). In snowball sampling a community member, NGO employee, or governmental worker suggests the appropriate informants to be interviewed. Semi-structured interviews were recorded and conducted with a trained Filipino environmental consultant to aid with translation and cultural barriers. The respondents were informed that there was no incentive for completing the interview, that they have the option to skip any question, and stop the interview at any time. Respondents were all informed that any information they provide will be documented and published anonymously. Semi-structured interviews lasted between 30 -60 minutes. The semi-structured interviews were in accordance and approved by the Human Subjects Review Board at George Mason University, Fairfax Virginia.

Data Analysis

All questionnaire data were entered into a Microsoft Excel spreadsheet and then imported into IBM SPSS, version 23 for statistical analysis (Table 3). Responses to the demographic questions were tabulated into means and standard deviations for continuous data and frequencies of occurrences were calculated for categorical data. “Yes”, “No” questions were presented as frequencies of occurrences and 5-point Likert-scale questions were presented as percentages.

Table 3. Definitions of socio-economic factors used in household socioeconomic surveys.

Factor	Description	Type of Data
Demographics		
Age	Age of respondent	Scale
Gender	Sex of respondent	Nominal
Education	Highest level of education	Ordinal
Migration	a) Whether the respondent emigrated	Nominal
	b) Years respondent resided in the community	Scale
Household Socioeconomics		
Home ownership	Whether respondent owns or rents home	Nominal
Number in household	Number of adults and children living in the home	Scale
Income	Monthly income of respondent	Scale
Living standards		
Material style of life	a) Presence or absence of material items (tv, boat, refrigerator)	Present/Absent
	b) Type of roof,	Present/ Absent

	flooring, etc. present	
Livelihood options		
Occupations	Primary and secondary jobs in household	Nominal
Alternative livelihoods	Whether respondent was engaged in alternative livelihoods after MPA was established	
Marine resource use patterns		
Type of gear	Method of fishing used	Nominal
Type of boat	Whether boat was a non-motor or motor	Nominal
Fishing effort	a) Number of fishing trips per week	Scale
	b) Estimated fish catch per week	Scale
Fish targeted	Type of fish targeted	Nominal
Level of subsistence	a) Percent of fish catch for family's consumption	Scale
	b) Percent of fish catch sold to market	Scale
Perception of marine resources		
Perceived trends in fish quantity	Perception of respondent of quantity of fish five years ago	Ordinal-Likert Scale
Perceived trends in coral reef health	a) Overall health of coral reef	Nominal
	b) Perception of respondent of coral reef health five years ago	Ordinal-Likert Scale
Perception of the MPA		
MPA awareness	Respondent aware of MPA	Nominal
Perceived trends in fish catch after MPA	Perception of respondent of increased fish catch after MPA established	Ordinal-Likert Scale
Perceived trends in coral reef health after MPA	Perception of respondent of improved coral reef	Ordinal-Likert Scale

Tourism	health after MPA established Respondents perception of increases in tourism after MPA was established	Ordinal-Likert Scale
Biological factors of the MPA	Respondents perception if MPA had positive biological factors	Nominal
Social factors of the MPA	Respondents perception if MPA had positive social factors	Nominal
Perception of MPA on livelihood	Respondents perception of the MPA's impact on their livelihoods	Ordinal-Likert Scale
Perception of MPA on community	Respondents overall perception of the MPA on their community	Ordinal-Likert Scale
MPA Community participation		
Meeting involvement	Respondents involvement in MPA planning process	Nominal
MPA establishment	Government involvement in MPA establishment	Nominal
Environmental education	Respondents involvement in environmental educational programs	Nominal
Enforcement and Conflicts		
Conflicts	Presence of illegal fishing	Nominal
Illegal fishing	Type of illegal fishing	Nominal
Enforcement	Perception of governments enforcement of the MPA	Ordinal-Likert Scale
MPA conflicts	Type of MPA conflicts	Nominal
Empowerment		
Participation in decision-making	Involvement in decision making in community a) general b) regarding marine resources	Nominal
People organization participation	Number of people originations groups involvement in, number of meeting attended	Scale

All semi-structured interviews were transcribed and then analyzed for relevant themes. The relevant themes were then coded in NVivo qualitative research software and scanned for repeated codes and or the lack of any codes. The information was then analyzed for key concepts, and how it related to other social science MPA findings.

Results

Quantitative Results

A total of 150 household surveys were completed in the adjacent community to Tubajon MPA. The 95% confidence interval for Tubajon population ($n=2299^1$) for this sample size is $\pm 7.74\%$. No individuals declined to participate in the survey, i.e., the response rate was 100% for Tubajon.

Demographics

The mean age of the respondents in Tubajon was 42.31 years ($SD=12.94$) with the youngest being 18 years of age and the oldest being 82 years of age. Age had a skewness value of 0.44. The percentage of respondents that were male was 40% ($n=60$) and 60% ($n=90$) of the respondents interviewed were female.

There were six educational categories ranging from “some elementary” to “college graduate” in the respondents from Tubajon. The majority of respondents from Tubajon were in one of two categories: high school graduates (35.3%, $n = 53$) or elementary school graduates (26.0 %, $n= 39$). Few respondents from Tubajon had higher

¹ Population based from May 1, 2010 Census of Population and Housing conducted by the Philippine Statistics Authority.

education, with only 4% having “some college” education and just 3.3% (n = 5) were “college graduates” (Figure 2).

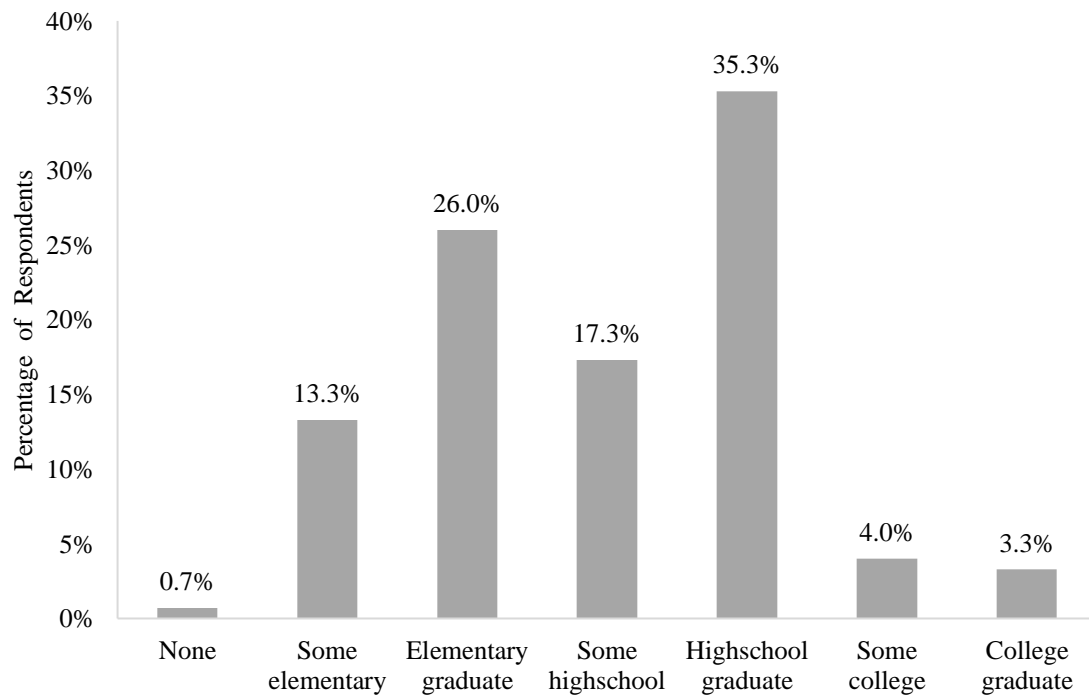


Figure 2. Highest completed education by the respondents from Tubajon MPA (n=150)

There was minimal immigration seen in the respondents: 74.0% (n=111) were originally from that community. In total, 26.0% (n=39) of all the respondents had emigrated from another community in Misamis Oriental, or from another region of the Philippines. Respondents who had immigrated into the community had done so because of marriage, family, or for employment reasons.

Household socioeconomics

Respondents were asked the number of adults and children living in their household. This ranged from two to nine adults. The mean number of adults living in the household for Tubajon was 3.0 (SE = 0.127). The majority of the households in Tubajon had two adults living in the household (58.7%, n=88). The number of children living in Tubajon households ranged from zero to seven children, with a mean of 2.29 (SE = 0.140). Most households in Tubajon had between zero and three children living in their household (76.0%, n = 115).

All respondents from Tubajon MPA owned their home 100% (n=150). Questions regarding monthly income were omitted because a majority of the respondents gave their income as daily income or weekly income and did not specify what unit they used.

When respondents in Tubajon were asked about their household expenses most respondents only noted their expenses for a few items (rice, fish, grocery, vegetables, school allowance, electricity) (Table 4). Most households spent their income on rice (₱1563.57, n = 144), fish (₱757.67, n = 58), and electricity (₱751.67, n = 134). The least amount of income spent, for the items specified, was on vegetables (₱252.03, n = 37). If less than 10 respondents noted the income spent on a specific category of item it was omitted from further consideration as the sample size was too small.

Table 4. Household expenses for one month from the residents of Tubajon MPA.

Expense	One Month
Rice	₱1,563.47 (n = 144)
Fish	₱757.67 (n = 58)
Groceries	₱506.82 (n = 33)
Vegetables	₱252.03 (n = 37)
Children's School Allowance	₱266.29 (n = 116)
Electricity	₱751.67 (n = 134)

₱= Philippine Peso exchange rate: 200 PHP=US 4.22 (2/16/2016, xe.com)

Living Standards

Households in Tubajon had some electrical appliances such as electric fans (31.33%), TVs (30.0%) and refrigerators (18.67%). The homes of most of the respondents had electricity (88.33%) with only 11.33% using kerosene as an energy source. The households in Tubajon had some modern characteristics with 50.67% having piped water into their home, 62.0% had metal roofs and 71.33% had a cement floor. But a majority of the homes still have some a low degree of modernization with the primary cooking material being firewood (100.0%), thatched roofs (42.0%), and wood walls 49.33%) (Table 5).

Table 5. Percentage of specific household items and facilities found in the respondents homes in Tubajon (n = 150).

Household items and facilities	Percentage	N
Generator	0.00%	(n= 0)
Electric Fan	31.33%	(n = 47)
Satellite dish	0.00%	(n = 0)
Wall clock	38.00%	(n = 57)
Water Tank	0.00%	(n = 0)
Radio/Cassette	57.33%	(n = 86)
Landline	0.00%	(n = 0)
Electric iron	22.00%	(n = 33)
Refrigerator	18.67%	(n = 28)
TV	30.00%	(n = 45)
Mobile phone	64.67%	(n = 97)
Non-motor boat	33.33%	(n = 50)
Air conditioner	0.00%	(n = 0)
VCR/DVD	18.67%	(n = 28)
Dining table	93.33%	(n = 140)
Motorized boat	22.67%	(n = 134)
<i>Lighting</i>		
Electricity	87.33%	(n = 131)
Flashlight	0.00%	(n = 0)
Air Pressure	0.00%	(n = 0)
Kerosene	11.33%	(n = 17)
Candle	0.00%	(n = 0)
Nothing	0.67%	(n = 1)
<i>Water</i>		
Piped water home	50.67%	(n = 76)
Open well	2.00%	(n = 3)
Piped water public	48.00%	(n = 72)
Privet flush toilet	78.00%	(n = 117)
Pump	1.33%	(n = 2)
Private closed pit	19.33%	(n = 29)
Open Pit	0.00%	(n = 0)
<i>Transportation</i>		
Walking	26.00%	(n = 39)
Vehicle	0.00%	(n = 0)
Bicycle	0.00%	(n = 0)
Jeepney	97.33%	(n = 146)
Motorcycle	81.33%	(n = 122)
Tricycle	0.00%	(n = 0)
<i>Cooking</i>		
Firewood	100.00%	(n = 150)
Charcoal	0.67%	(n = 1)
Kerosene	0.00%	(n = 0)

Gas/Electric	0.00%	(n = 0)
<i>Roof material</i>		
Thatch	42.00%	(n = 63)
Metal	62.00%	(n = 93)
Tile	0.00%	(n = 0)
<i>Floor material</i>		
Dirt	8.00%	(n = 12)
Tile	0.00%	(n = 0)
Bamboo	10.67%	(n = 16)
Plank wood	22.00%	(n = 33)
Cement	71.33%	(n = 107)
<i>Wall material</i>		
Bamboo	14.67%	(n = 22)
Cement	29.33%	(n = 44)
Wood	49.33%	(n = 74)
Stone block	2.00%	(n = 3)
Metal	0.00%	(n = 0)

Livelihood Options

Fishing was the main livelihood of most of the 150 respondents surveyed in Tubajon, with 67.3% (n = 101) either engaged in fishing, or it served as their primary occupation for their household. The other two most important occupations were salaried workers (8.0%, n = 12) and laborers (6.7%, n = 10) (Figure 3). Overall the MPA was seen as having a somewhat positive impact on the livelihoods of respondents in Tubajon (Figure 4), although 38.3% (n = 57) of the households said the MPA has been just slightly positive for their livelihoods. However, 26.2% (n = 39) said the MPA has been slightly negative toward their livelihood.

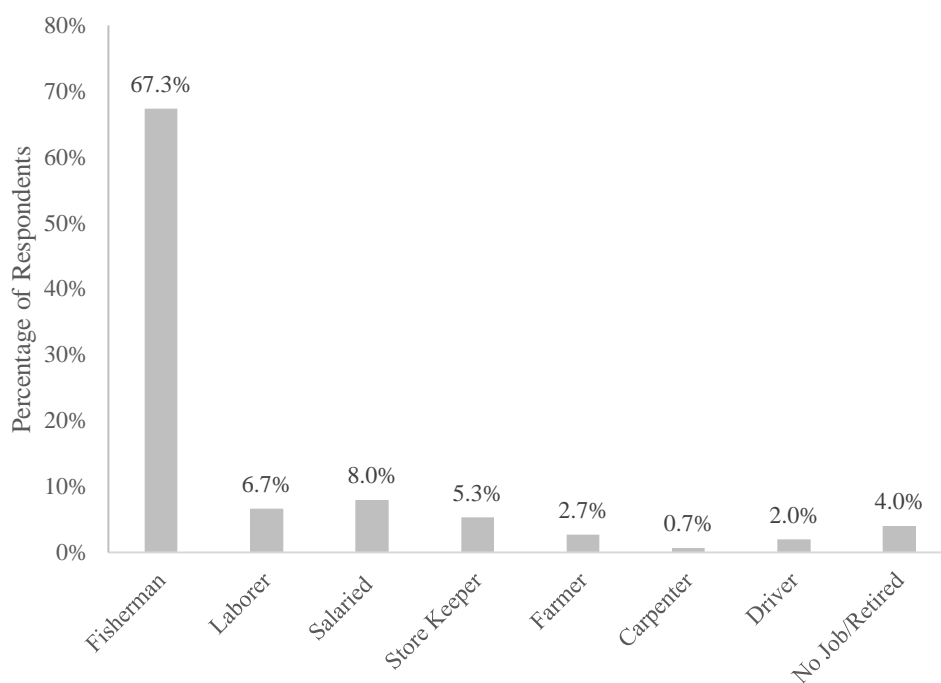


Figure 3. Percentage of the primary livelihoods of the respondents from Tubajon (n = 150).

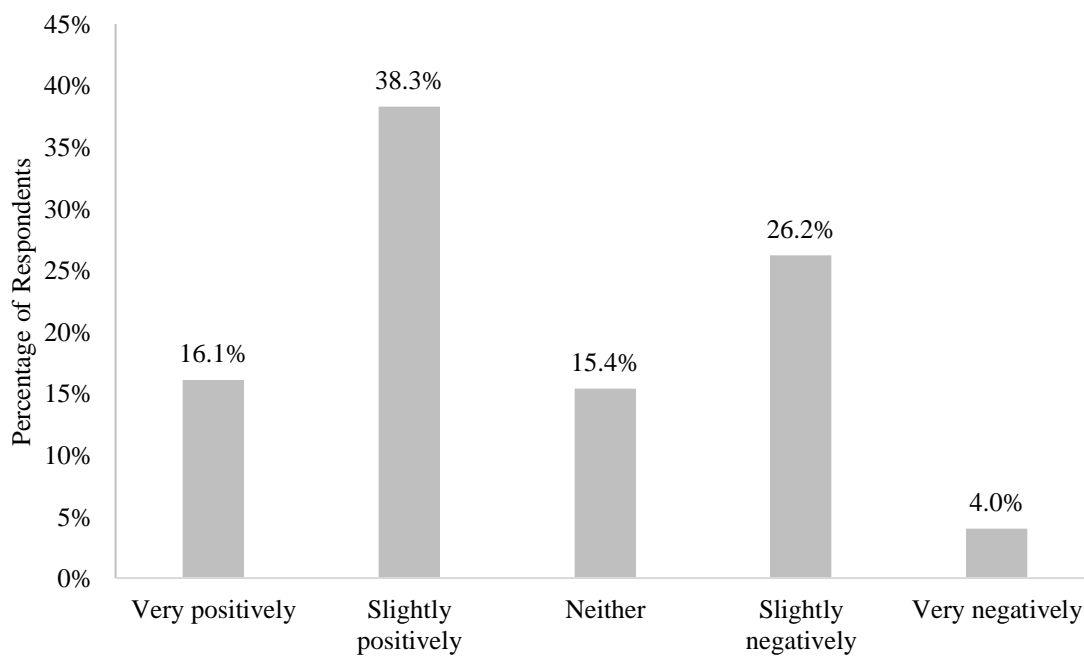


Figure 4. Tubajon respondent's perception of how the MPA has impacted their livelihood (n = 150).

Once the MPA was established almost all respondents from Tubajon reported no change in livelihood opportunities (83.3%, n = 125). The few respondents that did report a change in livelihoods after the MPA was established, noted opportunities in seaweed farming (10.7%, n = 16), and the selling of handicrafts (3.3%, n = 5) (Figure 5).

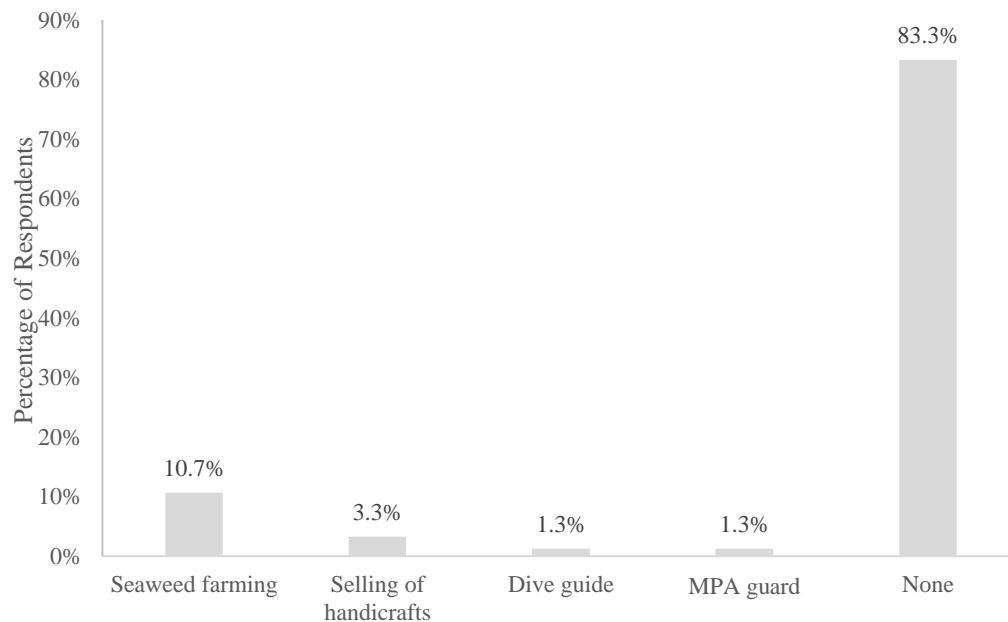


Figure 5. Percentage of MPA facilitated livelihoods Tubajon respondents were involved in after the MPA was established (n= 150).

Marine resource use patterns

As reported above, fishing was the primary occupation of the respondents from Tubajon. Most of the fishermen (all fishers in this study were male and will be referred to as fishermen) had been fishing most of their life, with the mean years of fishing being 27.9 (SD = 13.86, n = 108). The years of fishing ranged from two to 61. A majority of the fisher's fathers in Tubajon were also fishermen, 89.8% (n = 97).

The fishing gear mainly used in Tubajon was “net” (52.6%, n = 60) or “hook and line” (33.3%, n = 38) (Figure 6). Non-motor boats were the most common boat used by the fisherman (57.9%, n = 62). About a third (32.7%; n = 35) of the fishermen from Tubajon used motor boats and 9.3% (n = 10) of the fishermen did not use any vessel for fishing at all.

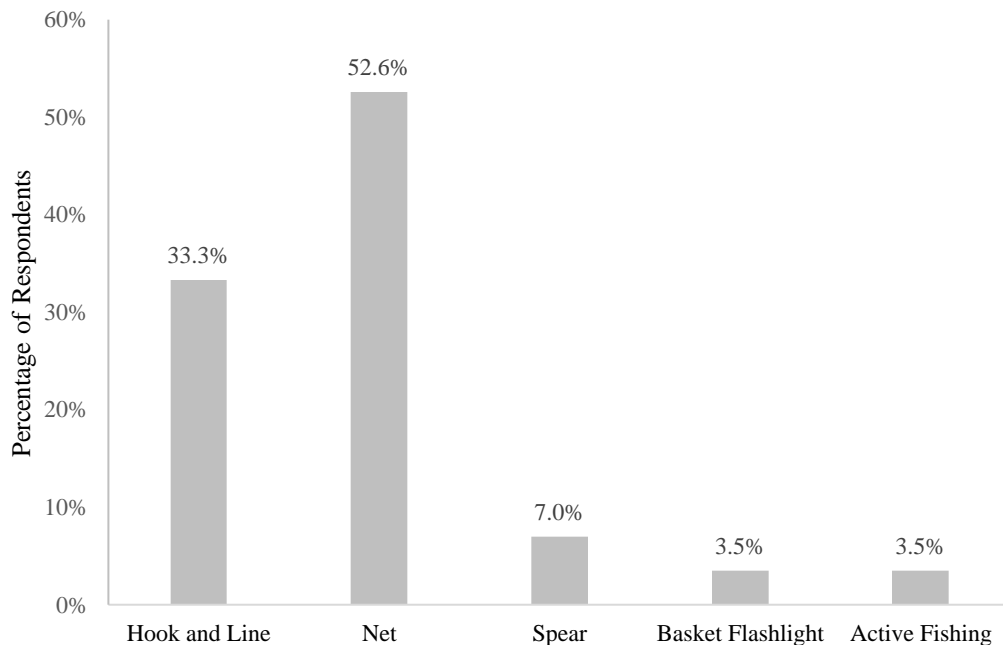


Figure 6. Percentages of fishing gear used by the fisherman from Tubajon (n = 114).

The primary fish targeted by fisherman were groupers (*Epinephelinae*) (43.6%; n = 48). Sardines (*Clupeidae*) were targeted by 15.5% (n = 17) of the fisherman and tuna (*Thunnini*) by 12.7% (n = 14). During good weather, households fished on average 6.1 (SD = 1.67) (n = 109) days a week. The majority of households in Tubajon (70.6%, n = 77) fished seven days a week during good weather. Fishing trips were reduced during the

Northeast Monsoon, to an average of 3.2 (SD = 1.89, n = 23) days a week, down to an average of 2 days (SD = 1.44, n = 34) a week during the Southwest Monsoon.

The estimated volume of fish caught during one week (with good weather) in Tubajon was on average 27.8 (SD = 27.73, n = 107) kilos. The catch volume was reduced during the Northeast Monsoon to an average of 2.7 (SD = 4.29, n = 21) kilos and to an average of 1.7 (SD = 3.34, n = 33) during the Southwest Monsoon. Northeast Monsoon weather is typically associated with heavier winds and rains, than the Southwest Monsoon in the Philippines. A small portion of the fish caught was used for family consumption: on average 24.7% (SD = 26.58, n = 108). Most of the fish caught in Tubajon was sold or bartered to a middleman, on average 79.15% (SD = 21.21, n = 104).

Perceptions regarding the marine resources

Respondents were asked how they perceived the condition of the marine resources five years ago in Tubajon. Specifically, what was the quantity of fish and the health of the coral reefs. Overall, respondents felt that quantity of fish available was lower (47.7%, n = 61) five years ago (Figure 7). Very few respondents felt that fish quantity was higher, with only 13.5% (n = 15) perceiving fish quantity as “more” five years ago and just 1.8% (n = 2) perceiving “a lot more” fish. Coral health was perceived as greater five years ago, with 48.4% (n = 62) perceiving “more” coral health. Only 10.2% (n = 13) of the respondents from Tubajon felt that there was “less” coral health five years ago. However, almost all of the respondents from Tubajon felt their coral reefs were

healthy with 94.7% (n = 142) stating that “yes” the coral reefs in their community were healthy compared to just 5.3% (n = 8) of respondents stating that they were not.

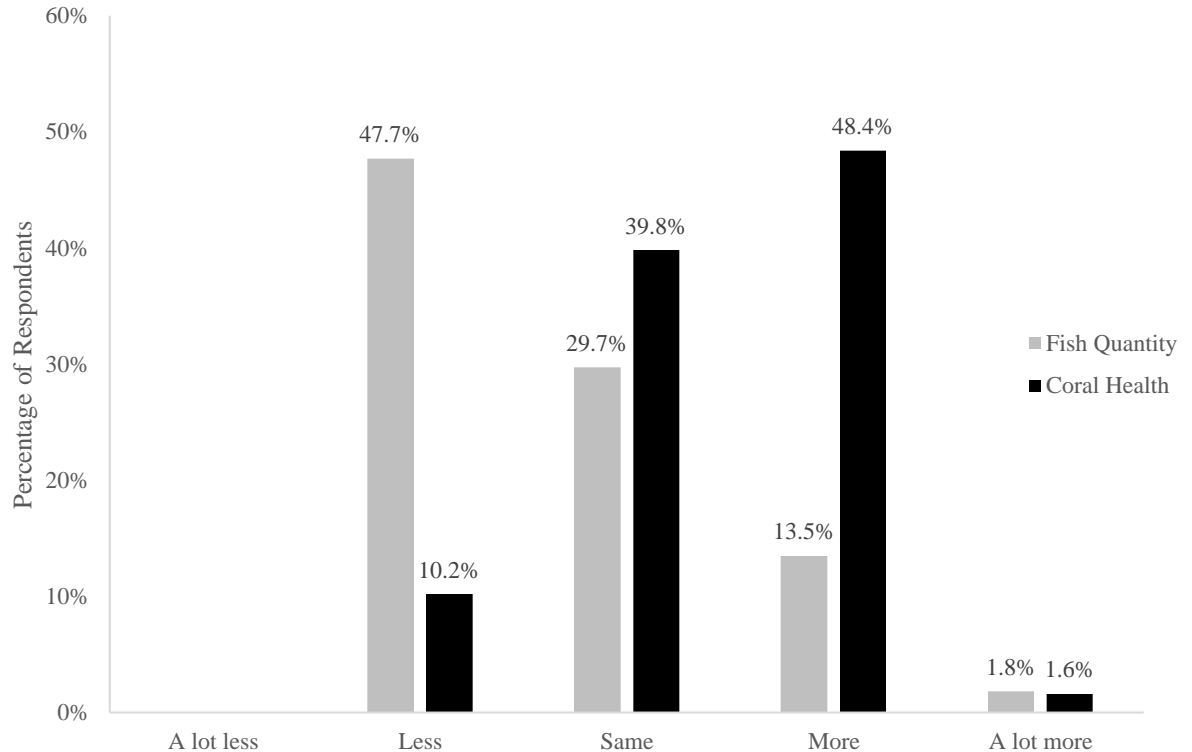


Figure 7. Perception of fish quantity and coral reef health five years ago in the community of Tubajon. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis (n= 127).

Perceptions regarding MPA

Unsurprisingly, all respondents (100%, n= 150) in Tubajon were aware of the MPA in their community. Respondents felt that MPA was providing both biological and social improvements, with 52.0% (n = 66) “agreeing” with the statement that fish catches had increased in the community since the MPA (Figure 8). Coral health was also seen as

improving, with many of the households 71.7% (n = 91) “agreeing” that quantity and quality of the coral reefs has improved since the inception MPA. But some respondents (31.5%, n = 40) did not feel that their fish catch has increased since the MPA’s designation. It is important to note that in the above section (perceptions of marine resources) respondents have reported a recent decline in coral and fish catch five years ago, but when asked about their MPA directly they perceive it has helping coral reefs and fish populations. Just under two-thirds (59.8%, n = 76) of the households in Tubajon felt that more tourists were visiting their community since the MPA was established.

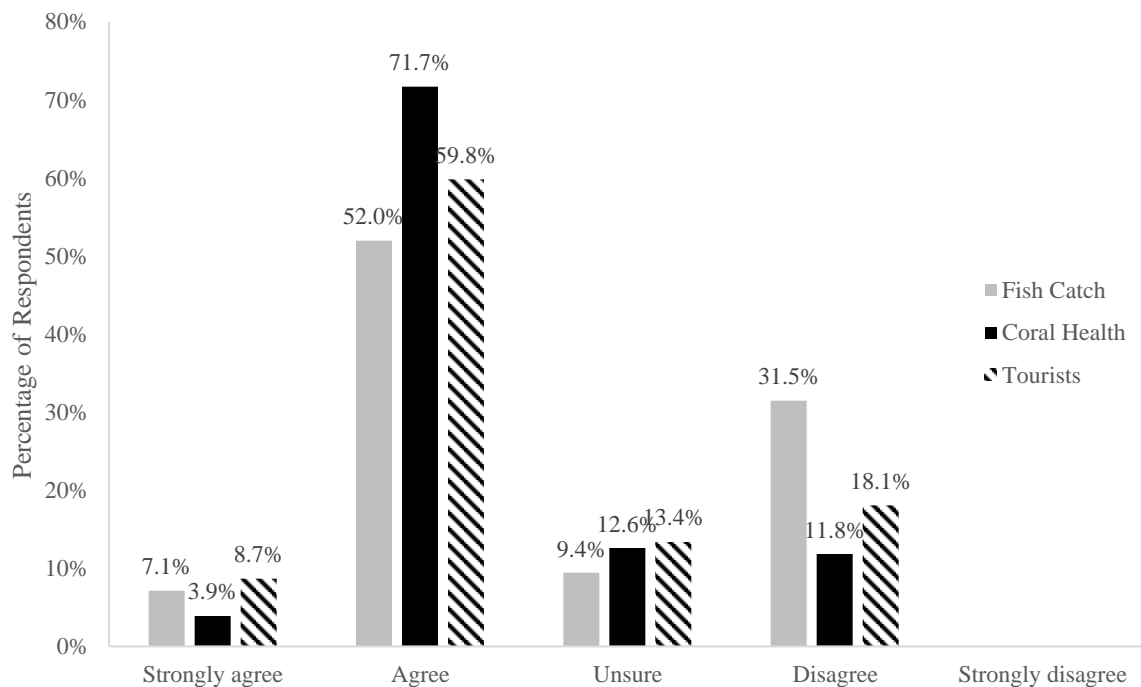


Figure 8. Perception of increased: fish catch, coral reef health and tourists after the MPA had been established in the community of Tubajon. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis (n = 127).

According to the households in Tubajon, positive biological impacts have been observed by the community (Table 6). Increased fish abundance was an important biological impact to (63.3%) of respondents. Respondents (56.0%) also felt that MPA had impacted their community by stopping habitat destruction.

Table 6. Tubajon respondent's perception of the biological factors associated with the MPA (n = 150).

Which of the following has the MPA had an impact in your community?		
	N	Percent of Responses
Increased fish abundance	95	63.30%
Increased fish size	67	44.70%
Stopped habitat destruction	84	56.00%
Brought fish species back	64	42.70%
Moved fish closer	55	36.70%
Improved coral health	61	40.70%
None	31	20.70%
Total	457	304.70%

There were both positive and negative opinions of the social benefits that the MPA provided to the community of Tubajon (Table 7). Positive benefits, included removing bad gear practices noted by (64.4%) of respondents). Also 61.1% of the households in Tubajon believed that the MPA was conserving resources for future generations. However, the MPA was generally not seen as providing much educational opportunity, nor was it seen as improving equity, with only 10.1% of the households perceiving these benefits arising.

Table 7. Perception of the social benefits the MPA has provided to the community of Tubajon (n = 150).

Which of the following benefits has the MPA provided to your community?		
	N	Percent of Responses
Improved fish catch	65	43.60%
Excludes outsiders	20	13.40%
Removed bad gear/practices	96	64.40%
Conserves resources for future generations	91	61.10%
Reduces conflicts	69	46.30%
Improves livelihoods	28	18.80%
Provides educational opportunities	15	10.10%
Improves equity	15	10.10%
None	30	20.10%
Total	429	287.90%

Overall the community of Tubajon perceived the MPA to be positive, with 45.3% (n = 68) of the households saying that it has been “slightly good” and 21.3% (n = 32) stating that it was “very good” for their community (Figure 9). However, there were some negative views of the MPA with 20.7% (n = 31) saying that the MPA has been “slightly bad”. Just 3.3% (n = 5) stated that it was “very bad” for the community.

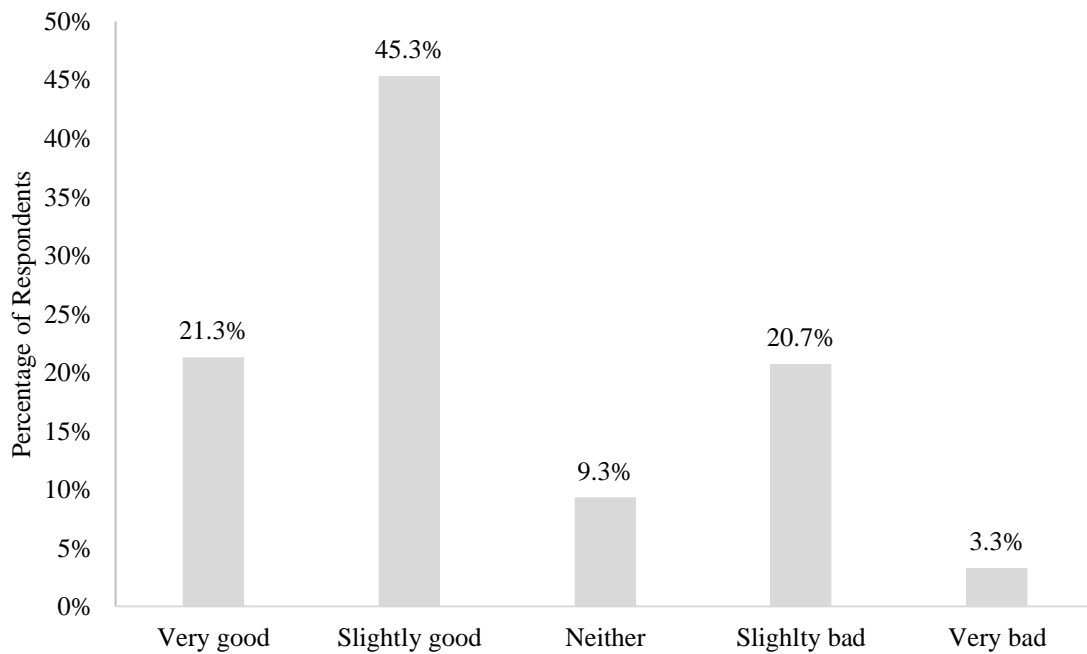


Figure 9. Overall perception of the MPA in the community of Tubajon (n = 150).

MPA Community Participation

Generally, the respondents of Tubajon felt they were involved in the establishment of the MPA in their community (Table 8). A majority of the respondents had wanted the MPA established (83.3%). Over a third (33.7%) of the households in Tubajon had not been aware of any community meetings before the MPA was established however. Almost all of the respondents (97.8%) did state the government or an NGO was involved in the MPA planning process and 55.1% of the households stated that they had been involved in environmental education programs before the MPA was established.

Table 8. Tubajon household responses to MPA community participation questions. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis (n = 127).

Question	% Response	
	Yes	No
Before the MPA was established were there meetings in your community regarding its establishment?	65.2% (n = 58)	33.7% (n = 30)
Did you want the MPA established in your community?	80.9% (n = 72)	19.1% (n = 17)
Was the local/provincial/national government/or NGO involved in the MPA establishment in your community?	97.8% (n = 87)	2.2% (n = 2)
Before the MPA was established did you or your family members participate in any environmental education programs?	55.1% (n = 49)	44.9% (n = 40)

Enforcement and Conflicts

As for illegal fishing, most Tubajon respondents (79.3%, n = 119) said that they did not think that illegal fishing took place in their community. But 20.7% (n = 31) of the respondents stated that it did take place. Respondent that answered “yes” to illegal fishing identified fishing with fine mesh nets (63.0, n =17%) and “active” fishing gear (22.2%, n = 6) -which includes bag net and tuna long lines – as the illegal fishing types. Both fine mesh and active fishing gear were identified as illegal fishing gear in the 1998 Philippines Fisheries Code, in Section 89 and 90 of the code (Department of Agriculture 1998) (Figure 10).

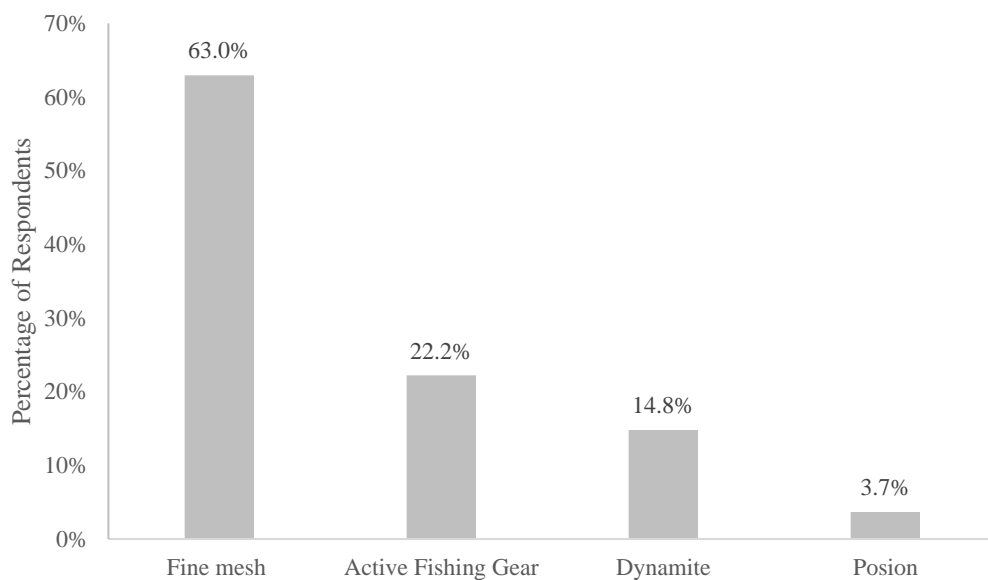


Figure 10. Types of illegal fishing that Tubajon respondents identified in their community (n = 27).

In terms of the government being actively involved in MPA management, most households in Tubajon felt that they were (66.7%, n= 100) with only 1.3% (n = 2) of the respondents stating that they were not actively involved (Figure 11).

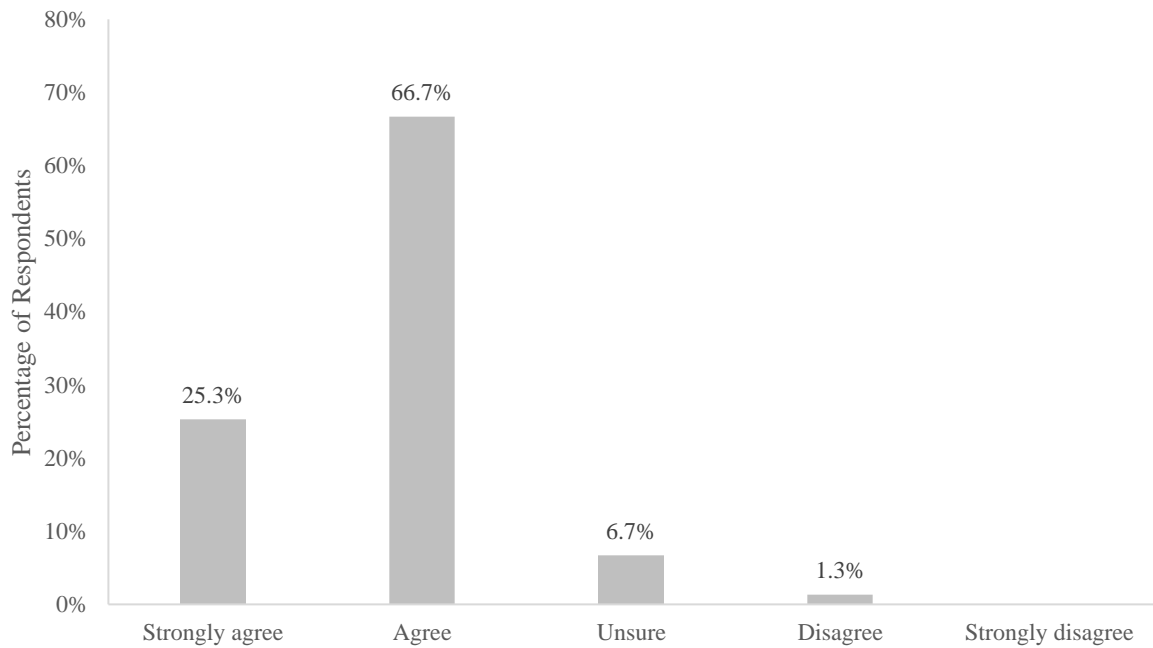


Figure 11. Perception of respondents in government’s continued involvement in Tubajon MPA (n =150).

When asked about specific problems with the MPA, 23.6% of the respondents felt that one of the problems with the MPA is that it “erodes traditional authority” (Table 9). Also, 21.2% of the respondents felt that MPA “had too many regulations” and those “regulations were not well enforced”. Funding did not appear to be an issue with the MPA in Tubajon, with only 0.3% of the respondents answering “no funding” as a problem with the MPA.

Table 9. Tubajon household responses to the question regarding problems with their MPA. Total number of responses and number of cases is presented (n = 150)

What are some of the problems with the MPA?		
	N	Percent of Responses
Too many regulations	63	21.2%
Regulations not well enforced	63	21.2%
Reduced catch	25	8.4%
Causes conflicts	39	13.1%
Erodes traditional authority	70	23.6%
Creates inequity	17	5.7%
No funding	1	0.3%
No problems	19	6.4%
Total	297	199.3%

Empowerment

The respondents of Tubajon were not involved much in the decision-making process in their community (Table 10). To the question “if there is a decision in your community are you involved in the decision” only 19.3% of the households answered “yes.” All respondents that did answer “yes” said they were involved in the decision making process by “voting”. However, a majority of the households (70.7%) stated that they were “not” involved in marine resource use decisions in their community. Moreover, only 16% of respondents belonging to a people’s organization/union/group.

Table 10. Tubajon respondents' answers to questions about empowerment (n = 150).

Question	% Responses	
	Yes	No
If there is a decision to be made in your community, are involved in that decision?	19.3% (n = 29)	80.7% (n = 121)
Are you involved in the decisions made about marine resource use or management in your community?	29.0% (n = 44)	70.7% (n = 106)
Do you belong to any people's organization groups?	16.0% (n = 24)	84.0% (n = 126)

Of these 24 respondents, the majority (n=18) belonged to a fisherfolk association. Other respondents were involved in educational support groups (n = 3) women's groups (n = 2) and a poverty alleviation cooperative (n = 1). Respondents who belonged to a people's organization group had mostly attended one meeting (n = 19) in the last six months. While other respondents had attended two meetings (n= 3) and eight meetings (n=1) in the last six months. Respondents reported attending "most" (45.8%, n = 11) or "all" (20.8%, n= 5) of the meetings (Figure 12).

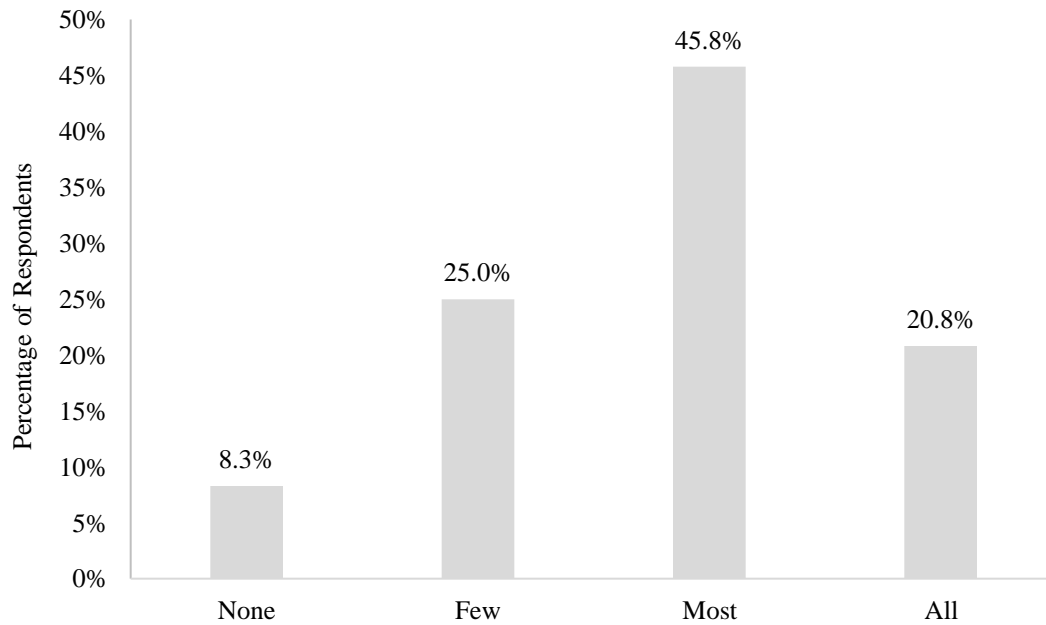


Figure 12. Number of people's organization group meetings the respondents from Tubajon attended (n = 24).

Qualitative Results

A total of ten key informant interviews were conducted within the village of Tubajon and in the Municipal office of Laguindingan between 19-2 March 2012. Three of the key informants were elected *barangay captains* and deputized fish wardens and one informant was the Vice President of the Fisherfolk Association of Tubajon. The other six informants were elected and appointed Local Government officials, specifically in the Department of Agriculture Office or under the Mayor's office of Laguindingan. The interviews lasted between 30 to 60 minutes and the gender ratio was 20 females/ 80 males

The results from the key informant interviews were separated into main themes related to three timeframes: before the MPA, during the MPA establishment, currently

impacting the MPA. Key concepts (i.e. condition of the reef) were identified in each time frame and qualitative interviews were scanned for codes (i.e. health of corals, description of the fisheries) and how they related to the key concepts (Figure 13).

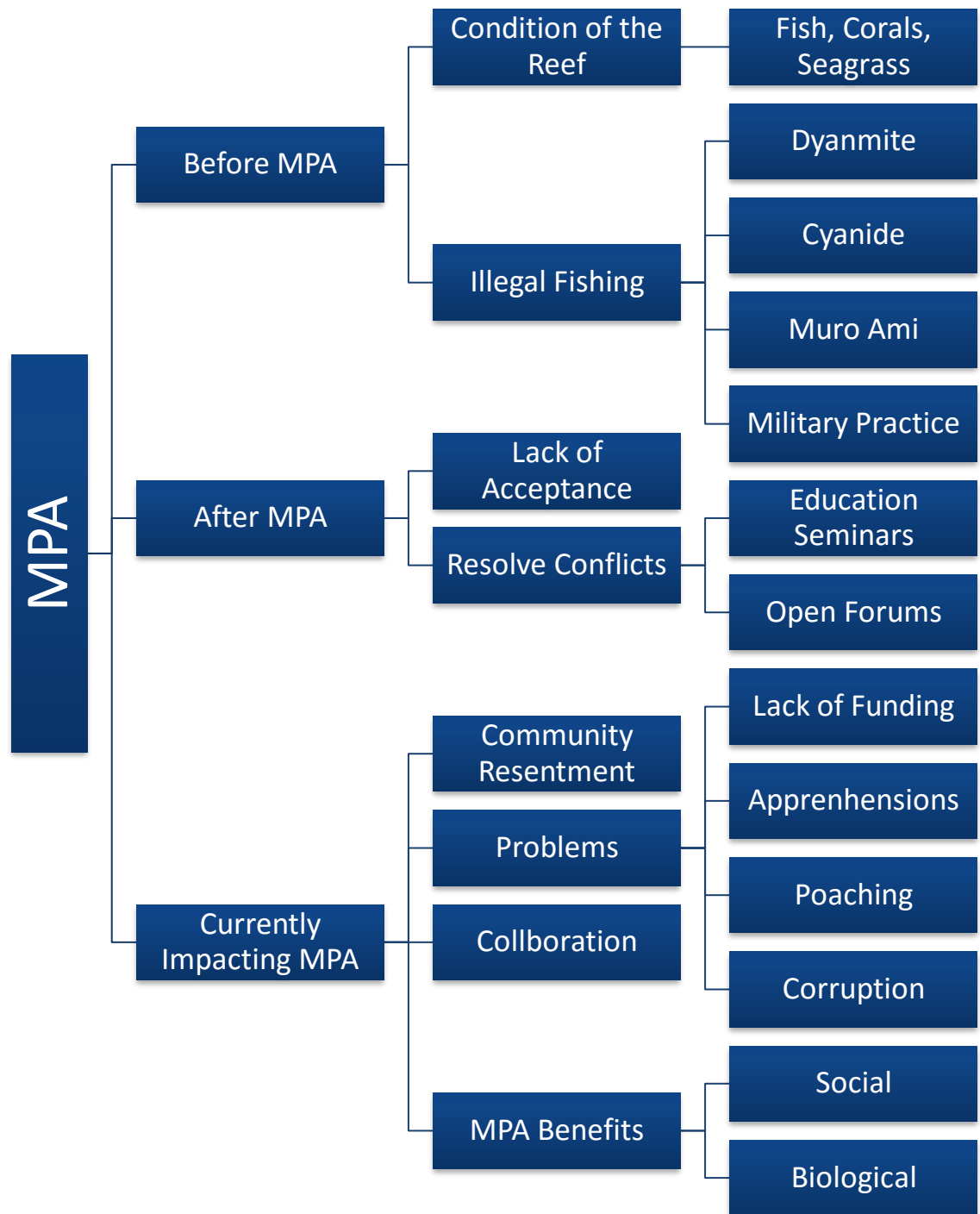


Figure 13. Themes, codes, and key concepts identified from the key informant interviews.

Before the MPA

Several informants described how during several decades in the '60s and '70s, the waters of Tubajon were flowing with a diversity of fish, invertebrates and coral species. At that time a thick blanket of seaweeds covered the ocean floor in Tubajon. A former Barangay captain and Deputized Fish Warden who lived in Tubajon his entire life spoke of Tubajon's historically abundant marine resources stating that:

In my youth, there are plenty of fishes here. The fishermen would not have a hard time in catching them because they would easily swarm on you, given that you would provide them bait. Before, the price of fish is really low. We would just shrug off from eating tuna because we had too much to eat.

A municipal agriculture officer also mentioned Tubajon's marine diversity saying:

The Laguindingan waters decades before was rich in terms of species diversity. So rich is its diversity that the Pillsbury even decided to import "Samo" or Sargassum for its products.

After the '60s, and into the late '70s and '80s the waters of Tubajon were no longer considered to be a healthy marine environment by those interviewed. All key informants described a destroyed marine ecosystem, where illegal and destructive fishing took place routinely in the waters of Tubajon. Many discussed how dynamite fishing left the once pristine habitat in a state of rubble with fewer and fewer fish.

A municipal agriculture officer from the LGU described the destruction by saying that:

When I still worked with the Department of Agriculture, Manticao and Laguindingan were our problem areas. So heavy was the destruction on these

areas that the blasts eventually created hollowed caves that used to be reefs for fishes.

An Agricultural Technologist also living in the area also described the destructive fishing occurring in Tubajon, she said:

Dynamite fishing was rampant and so was cyanide. These two are seen as the more notorious types but some others are equally destructive. It seems that the people have really exploited the vast resources that the Laguindingan sea had to offer.

A former Barangay Captain and Deputized Fish Warden described how illegal fishing became rampant in Tubajon and the end the result. They said:

As I have said, people have used many illegal types of fishing in this area during the last decade. This has greatly reduced the number of fishes in the area. By then and there, the fish catch has started to dwindle. The problem with the fishermen is that they wanted easy money so they opted to use explosives.

Other local villagers also talked about the illegal fishing occurring in their community and several of those interviewed admitting to doing such activities. One former Barangay Captain and Deputized Fish Warden recounted:

All of those types [of illegal fishing] that you can imagine. Those that explode, those that poison and those that simply scare off the fishes to drive them into nets—all kinds of them, I've seen it. I must admit that due to the lack of education, I too, have engaged into that since it has also become a norm before.

A now Agricultural Technologist working the LGU also admitted to illegal fishing by said that:

Tubajon before, it almost lost a sufficient amount of fishes in its seas, because of the maltreatment that the people are doing... even me, I was also engaging to those practices before.

During MPA Establishment

In 2002, the MPA of Tubajon was established, but the community had a hard time initially understanding the purpose and questioned who was benefiting from the MPA. It was difficult for the community to grasp that the MPA would not be an immediate benefit for them. A Barangay Captain said that:

There will always be people who'll react in a negative way because they can't experience its immediate benefits. They did not realize its long term benefits. But there are still people who are very selfish. People always want to have more than what others have.

Residents were most concerned about their loss of fishing grounds and not understanding the MPA could be beneficial to their fishing livelihood. A current employee of the Municipal Agriculture Office highlighted this problem by saying that:

When we proposed this project to the barangay Tubajon, we were with the authorities, DENR and BFAR; at first the people were vehemently against it because of the sea urchin populations [alibuho]. Their grazing areas were sure to be affected. But we explained that we would not take the whole area and would leave out some for them.

Another key informant, a Barangay Captain and Deputized Fish Warden also stated:

The people did not really understand the benefit of the MPA at first. All they knew is that it will curtail their forage area after its establishment. Since most of the people here see this [fishing] as their only source of income, it was almost natural for them to complain.

Tubajon has also been a research site for several agencies and nearby academic institutions. Researchers would often dive in the MPA and collect specimens for future researchers. These practices made the concept of the MPA more confusing because the

residents were not always informed or educated properly on such activities. One

Municipal Agriculture Officer expanded on this instance by stating:

Another recurring example is when researchers come in to visit. Naturally, they would want to go in to the MPA to establish the perimeters of their study. Usually, we inform the people that people from institutions [MMC, JICCA, MSU-IIT Naawan] are coming over to study; they would always nod in agreement. But later on, however, they would start complaining as to why the langyaws (i.e. people not from the area) were able to go in.

They went on to say:

There was once when MSU Naawan had to study the alibujo [sea urchin] in Tubajon. Researchers wanted to find out its life cycle patterns and understand when it would be the best time for the [resident to collect]. So, for some time, we asked them [residents] to refrain from taking the specimens. But as they have seen that the people from MSU collected some gallons of alibujo [for their specimens], the residents complained about it. Eventually, the council was pressured and the study was cancelled.

Another Municipal Agriculture Officer also commented on the confusion surrounding researchers and the MPA in Tubajon by saying that:

It took time; but yes, the people gradually understood the importance of the sanctuary. Their main argument was “why were other people allowed to enter [Xavier University, MSU-IIT, JICCA] and not us? Why are we sanctioned of illegal entry and not them?”. Though they still have this mentality, they have subsided.

Informing the residents through repeated meetings was essential for the MPA to gain acceptance in Tubajon. There was the time that the then elected Barangay Captain was so frustrated with the continued conflict about the MPA from the residents of Tubajon that he threatened to pull out the MPA. The people reacted vehemently and pushed for keeping the MPA. One Municipal officer recalls this instance by saying that:

The villagers do now have a positive outlook about the MPA. Before, out of frustration, we said to them that we would just pull out the MPA from the area but they insisted that it would remain there. Yes, the people have changed.

Another, LGU worker also recalls this instance stating:

Once, out of frustration, the Barangay Captain asked the people to just scrap the MPA. The people, instead of supporting the idea, they said no because they have realized that this sanctuary is for them also.

Currently Impacting the MPA

All key informants described the success of Tubajon's MPA and indicate, how proud they are of their MPA. Many interviews discussed how the fish and coral health has returned since the establishment of the MPA. They also enthused how the MPA has helped stop the rampant destructive fishing occurring in the reefs of Tubajon. A Municipal Agriculture Officer described the biological improvements of the MPA by saying:

...so far we have seen an increase of species diversity of all kinds of marine life and those that seemed to have been lost since the rampant dynamite fishing in the 80's are now slowly coming back.

Aside from biological improvements, key informants indicated an increase in tourism because of their MPA. Some of the residents have served as dive guides for the tourists and others have benefited from the tourists renting out their boats in order to explore their MPA. One Barangay Captain and Deputized Fish Warden mentioned the increased tourists:

Word has spread about the Tubajon Sanctuary so people especially those who are inclined to dive have come here. Last week, some Spanish divers took a swim here.

Divers said that they are amazed about the diversity of the fishes here. We want to show them that Laguindingan can belong to the top 10 MPAs in the country.

A Municipal Planning Officer also indicated the increased presence of foreigners in their community by saying that:

Aside from the increase of interested academe, we also attract local and foreign visitors in the area. The Tubajon MPA has sure caught fire and by word of mouth, our area is slowly but surely being known.

A Barangay Captain and Deputized Fish Warden (DFW) noted how the MPA is providing alternative livelihoods to some of the residents of Tubajon, recounting:

As a matter of fact, DFWs act as tour guide for them when they come here. Americans, when they come here, share the food with us—so we are happy.

An Agricultural Technologist also described this benefit by saying:

But they [tourists] usually rent out boats from the local fishermen here. So, through this, we can give an alternative livelihood other than fishing.

Many of the key informants expressed the need for continued collaboration in order for their MPA to be successful. The lack of resources from the LGU to fund the MPA was mentioned and, also, how NGOs and academic institutions are key for Tubajon. The Municipal Agriculture Officer indicated the need for outside support by saying:

Honestly speaking, the Laguindingan government's fund cannot suffice for the maintenance of the MPA. So, we try to establish collaborations with private institutions like MMC, JICCA, MSU-IIT Naawan and government sectors like BFAR and DENR to evaluate our MPAs. With this, we are supplied with relevant data that would help us make ordinances and strategies to improve the quality of our protected areas.

The zoning administrator of the LGU unit said:

The LGU has no capacity to conduct because we don't have enough gears/equipment. MPDA is being tapped. MMC is also doing some research in the MPA. We are also tapping some organizations for specializations to take care of (1) the mangroves, (2) the seabeds, and (3) seagrass.

Even Barangay Captains and DFW realize the importance of outside help. A

former Barangay Captain/DFW noted:

The local government is in-charge of giving incentives for the DFWs and also for the gasoline for the boats. Beyond that, we would require the aid of other agencies to push through with the plans. The government cannot really afford to conduct an evaluation by ourselves. So all we do is to help out Government [DENR, BFAR] and Non-government [XU, MSU] agencies in their studies. Manpower we give them and boat rides too.

Although, the Tubajon's residents MPA has been accepted and supported by the community there are still numerous problems. such as continued poaching inside the no-take zone of the MPA. Key informants mentioned that a majority of the poaching occurs during the Northwest Monsoon when the weather is not good for patrolling. The

Agriculture Technologist mentioned this problem when they said:

The perennial problem would always be the trespassers. And the sad thing about it is that most of them come from Tubajon. So when Habagat [Northwest monsoon] is up, some of them can sneak in. Of course, a single trip in the sanctuary would gain big profits for them. The problem with this kind of fishing is that once these trespassers have money, they feel like "one-day millionaires" and spend recklessly.

A Barangay Captain also stated:

When the weather is not good [that is when they steal]. The bantay dagat will have a hard time in guarding the area that's why the thieves will take advantage during bad weather. They don't think that they are being selfish. They are helping only themselves but not the whole community.

In addition to the poaching problems of the MPA there was also mention of corruption. A Zoning Administrator in the LGU mentioned one specific instance of corruption, saying:

There are people that are still going against the law. Two years ago, there was a guard who was caught fishing inside the sanctuary but it was already settled. So that person was removed as guard in the MPA.

A Barangay Captain also mentions such occurrences by stating:

I think problems are inevitable. There are many of those who still disobey the ordinance. So we bring them immediately to the municipal office and let the mayor give out their sanctions. There are also divers who ask permission to swim there but in actuality, they would attempt to spear fish there. Also, there have been instances when our very own DFW have been caught red-handed when he tried to fish in the area. We then decided to fire him.

Aside from the guards fishing inside the sanctuary there was also mention of the guards allowing others to do so. The Vice Mayor of Laguindingan specifically highlighted this:

Some bantay dagat are allowing secretly their relatives to catch fish illegally in the sanctuary.

Aside from the many ongoing problems of Tubajon's MPA, the people still believe that it is best for the conservation of their marine resources. One barangay captain said:

In my personal opinion, that would be a yes [MPA being beneficial to the community]. I have seen the difference and am a believer that this sanctuary is indeed a great help for the community.

Discussion

Livelihood Options

The research revealed that fishing (67.3%) was the major livelihood of the respondents which was expected since Tubajon is a coastal community. With the creation of an MPA the fisherfolk could lose critical fishing grounds and catches might initially be reduced, therefore alternative livelihoods should be offered. Pollnac et al. (2001) and Fox et al. (2012) stress the importance of not only offering alternative livelihoods to compensate for loss of fishing grounds, but also to aid garnering positive perceptions of the MPA from the local community. In Tubajon, respondents (83.3%) reported almost no change in livelihood opportunities after the MPA was established. Only a few respondents were involved in typical alternative livelihoods such as seaweed farming and the selling of handicrafts. Despite the lack of involvement in there alternative livelihoods options, 54.4% of the respondents did have a positive perception on how the MPA has impacted their livelihood. It is possible that the loss of fishing grounds has not reduced their fish catch significantly, or the community is already seeing positive biological effects from the MPA such as increased fish diversity, density, and size spilling over into adjacent fishing grounds.

Perceptions regarding marine resources and the MPA

The respondents believed that fish quantity was lower five years ago (47.7%) but coral health was believed to be higher (48.4%). It would not be expected that the perception of fish quantity and coral health would be differing especially when noting that a majority of respondents (94.7%) said that “yes their coral reefs are healthy.”

Tubajon respondents did feel that the MPA was providing both biological and social improvements to their community. Fish catch and coral health were perceived as improving after the MPA was established. The most important biological factors the MPA provided to the community were increased fish abundance (63.3%) and stopping habitat destruction (56.0%), which was also consistent with interviewer's comments regarding the performance of the MPA. The major social improvement observed after the establishment of the MPA was an increase in tourists visiting their area and this was reflected in informant interviews. Many informants mentioned an increased presence of foreigners wanting to dive in their MPA. The community benefits from these divers are when they hire boats for diving or when local people serve as a dive guides, but there is no entry fee collected by the MPA. However, respondents perceived no other social improvements from the MPA as reflected in their answers to question regarding "what social benefits does the MPA provide to their community?" Overall, the respondents felt the MPA was positive for their community (66.6%) but 20.7% that said the MPA was "slightly bad" for their community. Pomeroy's et al. (2006) found that negative perceptions from fisherfolk were detrimental to MPA success and are very difficult to change once opinions have been formulated.

Community participation

The study found that respondents from Tubajon were generally involved in the MPA establishment process. As documented in other MPA social research it is important to involve the community early on to help with the "buy in" in order to lead to better compliance (Himes 2007; Charles & Wilson 2008). Less than half of the respondents

(65.2%) from Tubajon were aware of community meetings regarding the MPA establishment while the remainder were not and therefore not involved in the initial planning process.

In addition to resident community involvement, it is also important to have government/NGO or academic involvement in the MPA planning, establishment, and ongoing support of the MPA. Almost all respondents (97.8%) said that the government and NGOs were involved in the establishment of the MPA. Government's involvement is crucial for making violators punishable by law. Governmental and NGO support is critical for absorbing the financial costs of maintaining, enforcing and conducting assessments of the MPA. Many key informants discussed the importance of Tubajon's MPA being a collaborative project between the community residents, LGU, academic institutions, and NGOs. Without the aid and help from these other organizations the informants stressed that community could not afford to patrol or have the skills to conduct assessments of their MPA.

Enforcement

The results from this study regarding enforcement indicated that most respondents (79.3%) did not believe that illegal fishing took place in their community. The qualitative survey painted a different picture however, with most key informants stating that use of dynamite and cyanide in the marine environment had been commonplace in their community, and that these threats had not been enforced until after the MPA was established. For respondents who did report that illegal fishing was still taking place in

their community, the most common type of illegal fishing was the use of fine mesh nets. Those key informants who were interviewed also reported that the use of illegal fine mesh nets was an ongoing problem in their community. These results show how a mixed method (qualitative and quantitative) data approach to surveying can provide a more accurate understanding of issues in an area.

Enforcement of an MPA relies on the use of the trained personnel with access to watch towers, guard boats and fuel to monitor the area (Beger et al. 2004). Tubajon informants did report that the Municipal Office of Laguindingan provided funding for fuel to the *bantay dagat* (sea wardens) but their resources were limited. There was also mention from several informants of problems corruption with some of the *bantay dagat* not obeying the law and fishing within the MPA. There were other reports of community members poaching in the MPA during bad weather, when it is difficult for *bantay dagat* to patrol the MPA. Good enforcement was found to be the best indicator of MPA effectiveness in terms of biological success in terms of increased fish abundance and diversity in several MPAs in the Philippines (Walmsley & White 2003). Results from the survey indicated that respondents (43.3%) felt that MPA regulations were not well enforced. The results via both survey methods indicate that Tubajon's MPA is not well enforced, which can have serious implications not only to the biological success of the MPA but also to the community support for the MPA.

Conflict

As stated earlier, when an MPA is established fisherfolk will lose critical fishing grounds and this can result in conflict between the fishing community and MPA managers. Before the MPA is established the community must understand the purpose of the MPA, the rules and laws that govern the MPA in order to prevent resource user conflict (Pomeroy et al. 2006). However, in Tubajon many interviewed mentioned the community's lack of understanding specifically about the rules of the MPA. Informants discussed how the community didn't understand why some researchers or tourists were allowed to enter the MPA, while they were not.

Empowerment

Empowerment from an MPA can begin with environmental educational programs that foster ideas of conservation and the willingness to save resources for future generations. In Tubajon, (55.1%) of respondents said they or their family members had participated in environmental educational programs but only a few respondents ($n = 3$) said they were still actively involved in such educational programs. Most respondents were not involved in any people's organization groups (84.0%), which indicates little empowerment from the environmental education programs initiated with Tubajon's MPA. Improving conservation education within the community of Tubajon can enable empowerment but also increase compliance within the community. When the community feels invested and is perceiving benefits from their MPA, compliance has been found to increase (Pomeroy et al. 2006).

The results from this study also indicate that most respondents from Tubajon were not involved in any decision making in their community (80.7%), which does not lead to empowerment. Most of the respondents said they were not involved in marine resource decision-making in their community. Aside from empowerment, this lack of involvement from the community in decision-making could be detrimental to continued success of Tubajon's MPA because stakeholders need to feel they have a voice in the rules governing an MPA. Pomeroy et al. (2006) discuss how stakeholder policy preferences can vary significantly between individuals and social groups and, therefore, each voice must be heard when making decision that will impact the community. The lack of involvement from certain stakeholder groups, especially fisherfolk in the decision-making processes can lead to problems with enforcement and lack compliance in the MPA.

Overall, the findings from this research indicate that Tubajon respondents generally have a positive opinion regarding the MPA. When MPA managers wanted to remove the MPA because of ongoing conflicts the community fought to keep it. Based on the surveys here are some suggestions for MPA management to be more effective:

- Development of alternative livelihood opportunities for the community.

Alternative livelihoods should have an established market and utilize the skills of the community as well as focus on the increased tourists visiting their community such as serving as dive guide or having their boat available for hire.

- Conducting environmental education seminars regarding the purposes, rules and expectations of the MPA. To address problems of confusion regarding visitors or researchers being allowed to dive in the MPA when they are not.
- Improving stakeholder participation in decision-making by having open forums and times to discuss what some of the issues are with the MPA.
- Changing negative fisherfolk opinions regarding the MPA-address the problems of the MPA and have stakeholders involved in developing solutions.
- Improving the enforcement of the MPA utilizing the *bantay dagat* but also with support from the Local Government Unit, in penalizing those apprehended.
- Increasing income generated from tourist with the collection of a MPA dive fee. Income could then be used to support to the *bantay dagat* in patrolling.

The application of such suggestions could be included as part of adaptive management strategies for Tubajon that could have help to insure the long-term success of the MPA.

CHAPTER FOUR: EXAMINATION OF THE SOCIAL FACTORS, ATTITUDES AND PERCEPTIONS OF RESIDENTS FROM AGUTAYAN MARINE PROTECTED AREA IN JASAAN, PHILIPPINES

Abstract

Agutayan Marine Protected Area (MPA) is a “top-down,” government-managed MPA that was established in 1996 in Misamis Oriental, Philippines. It is a small MPA covering 4.5 hectares encompassing an offshore sandbar, that is approximately five kilometers from the coast of Barangay Jampason. In April of 2012, a household socio-economic survey was administered to residents ($N = 150$) of Barangay Jampason to determine demographics, socio-economics, attitudes and perceptions of residents regarding the MPA. Additionally, ten key informant interviews - with various LGU officers, barangay captains (elected village leaders), *bantay dagats* (MPA guards), and fish vendors - were conducted to further understand MPA performance in Jampason. Overall, residents felt the Agutayan MPA was a positive marine resource management tool for their community. Residents reported both biological and social improvements since the MPA was established, but social gains from the MPA were minimal. Changes in alternative livelihoods were only experienced by a few residents. Residents reported minimal involvement in decision-making in their community and very few were involved in environmental educational programs that would encourage community empowerment. Enforcement appears not to be a problem, and this could be attributed to the active *bantay dagat* (MPA guard) presence 24-hours a day, at the MPA. Despite some negative MPA

perceptions from fisherfolk, lack of community involvement, or few alternative livelihoods being offered by the MPA, respondents repeatedly mentioned how successful their MPA has been in improving fish catches and coral health for their community.

Introduction

To help conserve and protect marine habitats and fishery resources, marine protected areas (MPAs) have been established throughout the world. Using MPAs as a fishery management tool has been especially attractive to developing countries where traditional fishing regulations such as closed and open seasons or the restrictions of total fish catch are not ideal because of a vast number of subsistence fishers (Nowlis & Friedlander 2005). There have been decades of biological and ecological research into effects of MPAs on sustaining marine biodiversity, protection of the marine habitat and enhancing marine species richness, diversity, size and density (Christie et al. 2003; Pomeroy et al. 2006; Lester et al. 2009; Bennett & Dearden 2014). But the understanding of the social implications and factors of MPAs on the local community has been minimal (Mascia et al. 2010). Developing more in-depth social scientific investigations of MPAs has been a priority for many governmental organizations, NGOs, and academic institutions in last decade (Fox et al. 2012; Mascia et al. 2010). The social scientific investigation should understand if the primary social goals of MPAs are being met. Some of the social goals which include promoting food security through the protection of fisheries, generation of alternative livelihoods, improving environmental awareness and knowledge, and empowering coastal communities (Christie et al. 2003; Pomeroy et al. 2006; Charles & Wilson 2008).

This study's purpose is to improve the social scientific understanding of MPA performance by examining the social goals of a top-down MPA in the Philippines located in the Region X of Northern Mindanao. The MPA, named "Agutayan MPA," is located in the Municipality of Jasaan, in the village of Jampason and encompasses an offshore sandbar that is approximately five kilometers from the coast of Jasaan. Established in 1996, and covering 4.5 hectares the MPA is a "top-down" (i.e. implemented and managed by Government) MPA, that is administered by the Municipality of Jasaan and the Municipal Agriculture Office. Using a household survey and semi-structured interviews, the aim of this study was to provide baseline information on household socio-economics, community involvement, empowerment, participation in alternative livelihoods, possible conflicts, and residents perceptions and attitudes of Agutayan MPA. The goal of researching and analyzing how these social factors are negatively, or positively, impacting Agutayan, is to provide recommendations to ensure the longevity, and success, of the MPA.

Study Site

Agutayan Marine Protected Area

Agutayan MPA is located in the second class² Municipality of Jasaan in the *barangay* (village) of Jampason (Figure 14) (Philippine Statistics Authority 2010). The

² Municipalities in the Philippines are divided into six main classes according to average annual income during the last four fiscal years. Second class municipalities have obtained average annual income (Php. 45,000,000 – 54,999,999) (Philippines Statistics Authority 2010).

population of Barangay Jampason was estimated to be 2,579 people in 2010 (Philippine Statistics Authority 2010). It is a small MPA covering 4.5 hectares of water, and it was established in 1996 via Municipal Ordinance No. 24-97 (Macajalar Bay Development Alliance 2016). Agutayan itself is an offshore sandbar that is approximately five kilometers from the coast of Jasaan (Philippine Statistics Authority 2010), and it can be reached via a 30-45minute motorized boat ride (Fabe 2015). The MPA is managed by the Municipality of Jasaan and the Municipal Agriculture Office, i.e., it is a "top-down" form of management. In 2008, the MPA was rated as "good" by the Coastal Conservation and Education Foundation (CCEF), indicating that the MPA was considered to be "well-enforced" (CCEF 2008). This assessment noted that MPA had three priorities for improved management: dealing with a lack of sustainable financing mechanisms; addressing the lack of supplemental and alternative livelihoods and tackling the need for management capacity development (CCEF 2008). In 2015, Agutayan was rated using a Management Effectiveness Assessment Tool (MEAT) which uses the above mentioned CCEF rating, and additional biophysical and socio-economic impact indicators. In this evaluation, Agutayan was rated a "Level 0" out of four (MPA Support Network 2014). "Level 0" indicated that the MPA had been established, and a management plan had been formed, but it had yet to be adopted (MPA Support Network 2014).

In addition, in 2015, a two-story watchtower and lighthouse were built on Agutayan Island to aid the protection of the island's coral reef and marine resources (Fabe 2015). Agutayan's watchtower and lighthouse were a collaborative project between the

provincial government of Misamis Oriental, the Department of Energy (DOE), STEAG State Power Inc. Mindanao (SPI), and the local government of Jasaan (Fabe 2015).

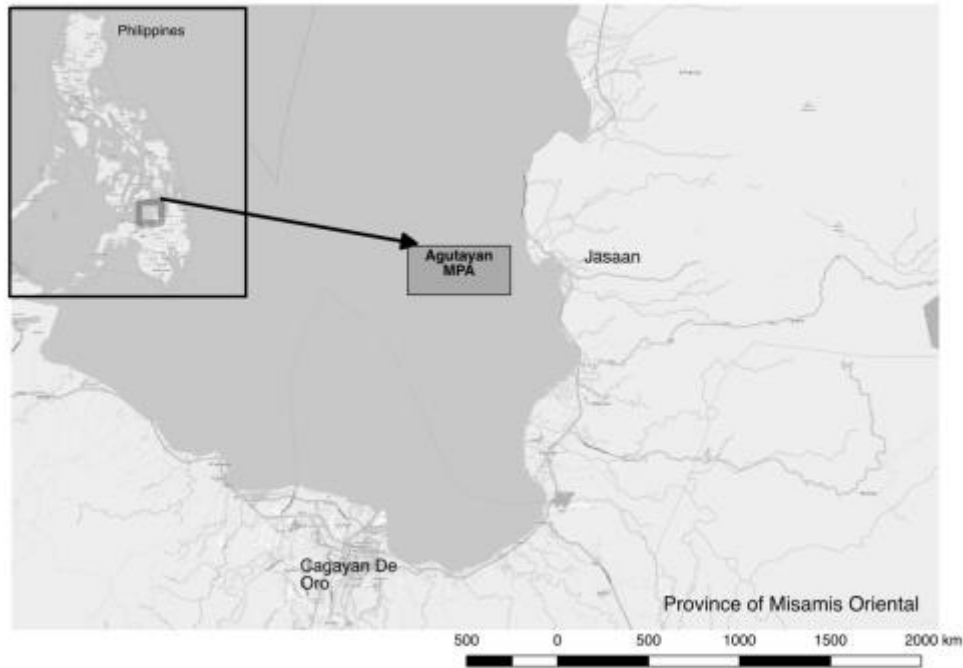


Figure 14. Location map of the study site, Agutayan MPA in the Municipality of Jasaan, Misamis Oriental, Philippines.

Methodology

Survey methods and analysis used in the examination of residents in Agutayan are detailed in Chapter 3 of this dissertation. Semi-structured interview methods of Agutayan are also described in Chapter 3. Before any surveys or interviews being conducted a governmental courtesy call was made to the Mayor of Jasaan, Redentor Jardin to ask permission for research to be carried out in his community.

Results

Quantitative Results

A total of 150 household surveys were completed in the MPA community of Agutayan. The 95% confidence interval for the Agutayan population (2579³ people) is $\pm 7.8\%$ for a sample of this size. No individuals declined to participate in the survey, i.e., the response rate was 100%.

Demographics

The mean age of the respondents from Agutayan was 44.93 years (SD=13.58), with the youngest being 18 years of age, and the oldest being 81 years of age. Age had a skewness value of 0.128. The percentage of respondents that were male was 64.7% (n=97), and 35.3% (n = 53) of the respondents interviewed were female.

There were six educational categories ranging from “some elementary” to “college graduate.” The majority of respondents from Agutayan were in one of two categories: high school graduates (30.7%) or elementary school graduates (29.3%). Respondents from Agutayan did have some higher education with 11.3% having “some college” and 2.7% were “college graduates” (Figure 15).

³ Population-based from May 1, 2010 Census of Population and Housing conducted by the Philippine Statistics Office Authority.

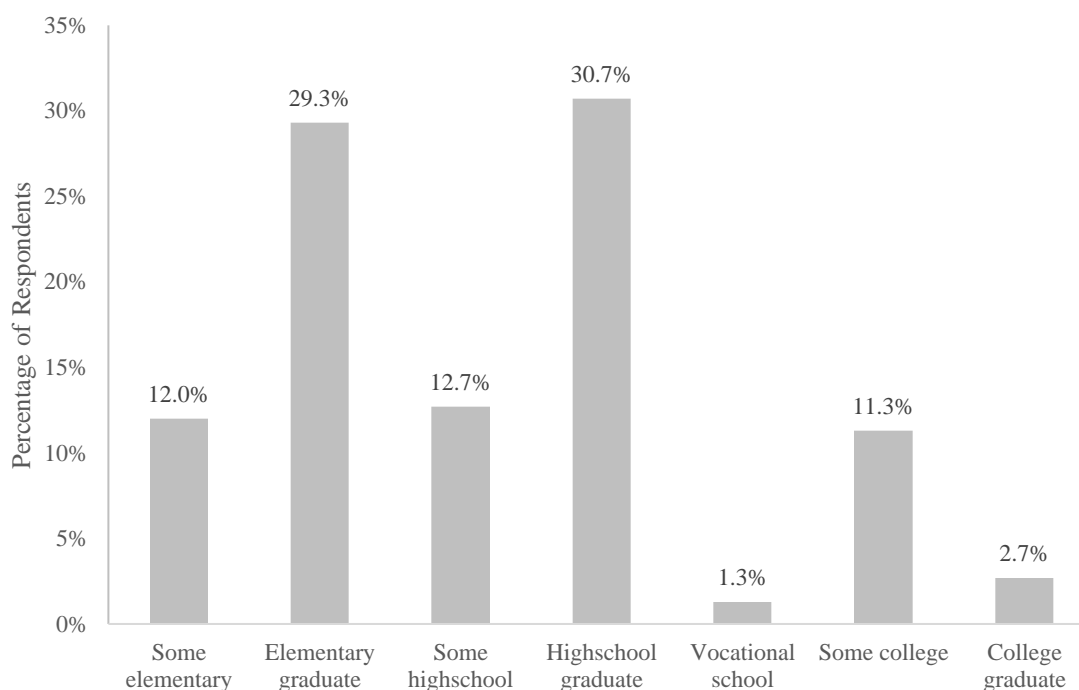


Figure 15. Highest completed education by the respondents from Agutayan MPA (n = 150).

More than half of the respondents were initially from the community (66.7%, n = 100) while 33.3% (n=51) of all the respondents had emigrated from another town in Misamis Oriental or another region of the Philippines. Respondents who had immigrated into the community had done so because of marriage, family, or for employment reasons.

Household socioeconomics

Respondents were asked the number of adults and children living in their household. They ranged from one to eleven adults. The mean number of adults residing in the household for Agutayan was 3.07 (SE =0.13). About half of the households in Agutayan have two adults living in them (51.3%, n=77). The number of children residing in Agutayan households ranged from zero to thirteen children, with a mean of

2.63 (SE = 0.16). Most households in Agutayan had between one and four children living in their home (74.7%, n=112). Almost all respondents from Agutayan MPA owned their home 98.0% (n=147) instead of renting, (2.0%, n = 3). Questions regarding monthly income were omitted because a majority of the respondents gave their income as daily or weekly income, and they did not specify what unit they used.

When respondents in Agutayan were asked about their household expenses, most respondents only noted their spending for a few of the items (rice, pork, beef, fish, grocery, vegetables, school allowance, and electricity) (Table 11). Most households spent their income on groceries (₱3065.50, n = 10), rice (₱1928.47, n = 150), and fish (₱666.96, n = 23). The smallest expenditure, for the items specified, was on vegetables (₱206.03, n = 58). If less than ten respondents noted the income spent on a specific category of item, it was omitted from further consideration as the sample size was too small.

Table 11. Household expenses for one month from the respondents in Agutayan (n = 150).

Household Expenses	One Month
Rice	₱1,928.47 (n = 150)
Pork	₱402.80 (n = 25)
Beef	₱436.25 (n = 16)
Fish	₱666.96 (n = 23)
Grocery	₱3,065.50 (n = 10)
Vegetables	₱206.03 (n = 58)
Children Allowance	₱416.27 (n = 51)
Electricity	₱346.41 (n = 109)

₱ = Philippine Peso exchange rate: 200 PHP = US 4.22 (2/16/2016, xe.com)

Living standards and quality of life

Most of the household's in Agutayan had modern items such as electric fans (59.33%), televisions (66.0%) and refrigerators (24.67%). The homes of most of the respondents had electricity (88.0%) with only 11.33% using kerosene or a flashlight as a light source (Table 12).

Table 12. Percentage of households in Agutayan (n = 150) with specific household items and facilities.

Household items	Percentage	N
Generator	0.00%	(n = 0)
Electric Fan	59.33%	(n = 89)
Satellite dish	0.00%	(n = 0)
Wall clock	41.33%	(n = 62)
Water Tank	0.00%	(n = 0)
Radio/Cassette	48.67%	(n = 73)
Landline	3.33%	(n = 5)
Electric iron	24.00%	(n = 36)
Refrigerator	24.67%	(n = 37)
TV	66.00%	(n = 99)
Mobile phone	64.00%	(n = 96)
Non-motor boat	21.33%	(n = 32)
Air conditioner	0.00%	(n = 0)
VCR/DVD	21.33%	(n = 32)
Dining table	100.00%	(n = 150)
Motorized boat	14.67%	(n = 22)
Lighting		
Electricity	88.00%	(n = 132)
Flashlight	11.33%	(n = 17)
Air Pressure	0.00%	(n = 0)
Kerosene	11.33%	(n = 17)
Candle	0.00%	(n = 0)
Nothing	0.00%	(n = 0)
Water		
Piped water home	95.33%	(n = 143)
Open well	0.00%	(n = 0)
Piped water public	4.67%	(n = 7)
Private flush toilet	0.00%	(n = 0)
Pump	0.00%	(n = 0)

Private closed pit	0.00%	(n = 0)
Open Pit	0.00%	(n = 0)
Transportation		
Walking	91.33%	(n = 137)
Vehicle	0.67%	(n = 1)
Bicycle	1.33%	(n = 2)
Jeepney	0.00%	(n = 0)
Motorcycle	7.33%	(n = 11)
Tricycle	0.00%	(n = 0)
Cooking		
Firewood	96.67%	(n = 145)
Charcoal	0.00%	(n = 0)
Kerosene	0.00%	(n = 0)
Gas/Electric	11.33%	(n = 17)
Roof material		
Thatch	20.00%	(n = 130)
Metal	90.00%	(n = 135)
Tile	0.00%	(n = 0)
Floor material		
Dirt	0.67%	(n = 1)
Tile	1.33%	(n = 2)
Bamboo	16.00%	(n = 24)
Plank wood	20.67%	(n = 34)
Cement	65.33%	(n = 98)
Wall material		
Bamboo	9.33%	(n = 14)
Cement	63.33%	(n = 95)
Wood	10.67%	(n = 16)
Stone block	7.33%	(n = 11)
Metal	0.00%	(n = 0)

The households in Agutayan have some modern characteristics 95.33% have piped water coming into their home, 90.0% have metal roofs, and 65.33% have a cement floor. Most of the respondents traveled by walking (95.33%) and 7.33% owned a motorcycle. Despite modern characteristics, some of the homes still exhibited a low

degree of modernization with the primary cooking material being firewood (96.67%), and some had thatched roofs (20.0%), bamboo floors (16.0%), and wood walls (10.67%).

Livelihood options

Fishing was the main livelihood of most of the 150 respondents surveyed in Agutayan, with 72.0% (n = 108) engaged in fisheries. The other two main occupations were salaried workers (9.33%, n = 14) and laborers (8.0%, n = 12) (Figure 16). Overall the MPA was seen as having a somewhat positive impact on the livelihoods from respondents in Agutayan (Figure 17). Thirty-four percent (n = 51) of the households said the MPA has been “slightly positive” for their livelihoods, but 10.7% (n = 16) said the MPA has been “slightly negative.” Thirty-four percent (n = 51) of the respondents did not feel that the MPA had been either a positive nor a negative impact on their livelihood.

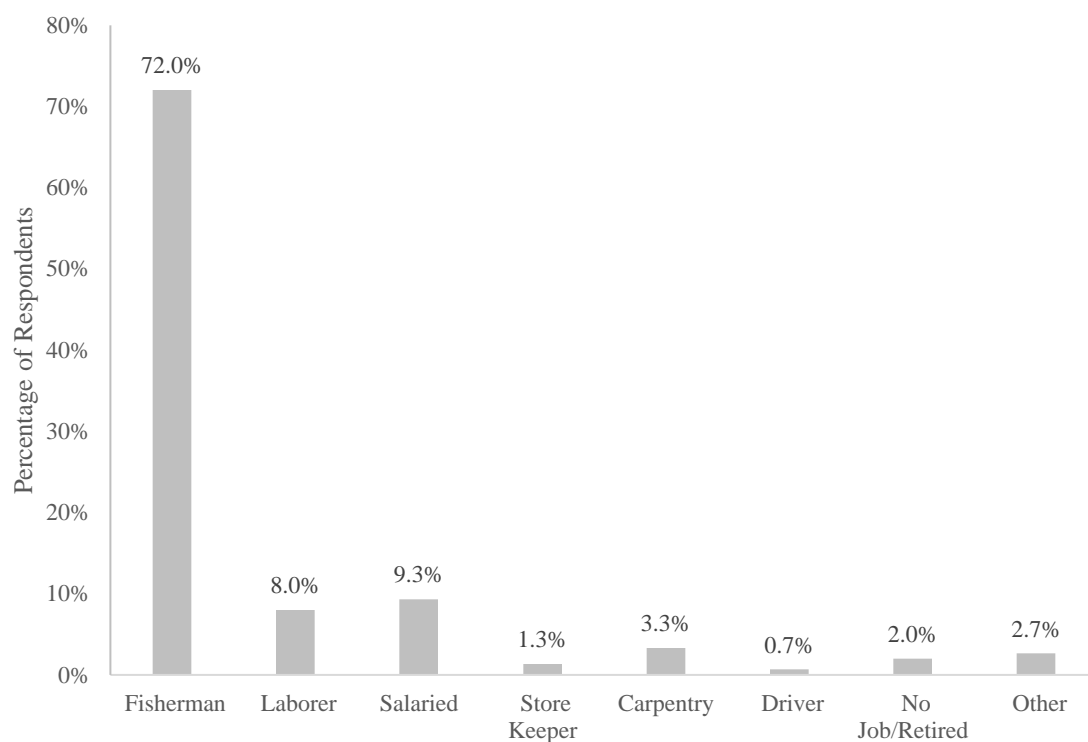


Figure 16. Main livelihood of the respondents from Agutayan (n = 150)

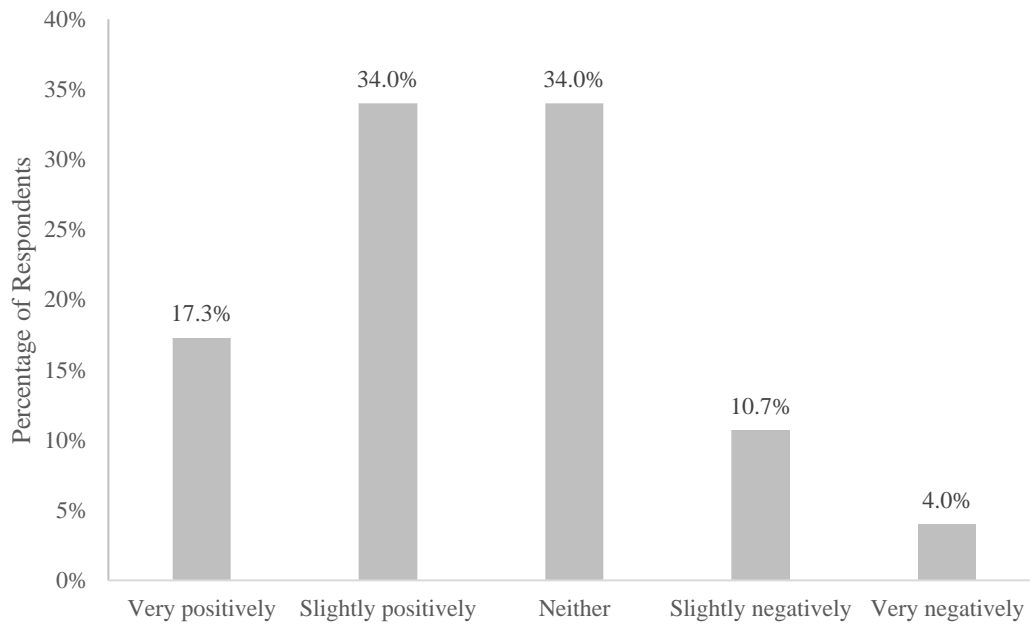


Figure 17. Perception of how the MPA has impacted their livelihood from the respondents from Agutayan (n = 150).

Once the MPA was established the majority of respondents from Agutayan reported no change in livelihood opportunities (88.7%, n = 133). The few respondents that did report a change in livelihoods after the MPA was established, noted opportunities in seaweed farming (5.30%, n = 8), and serving as MPA guards (3.30%, n = 5) (Figure 18).

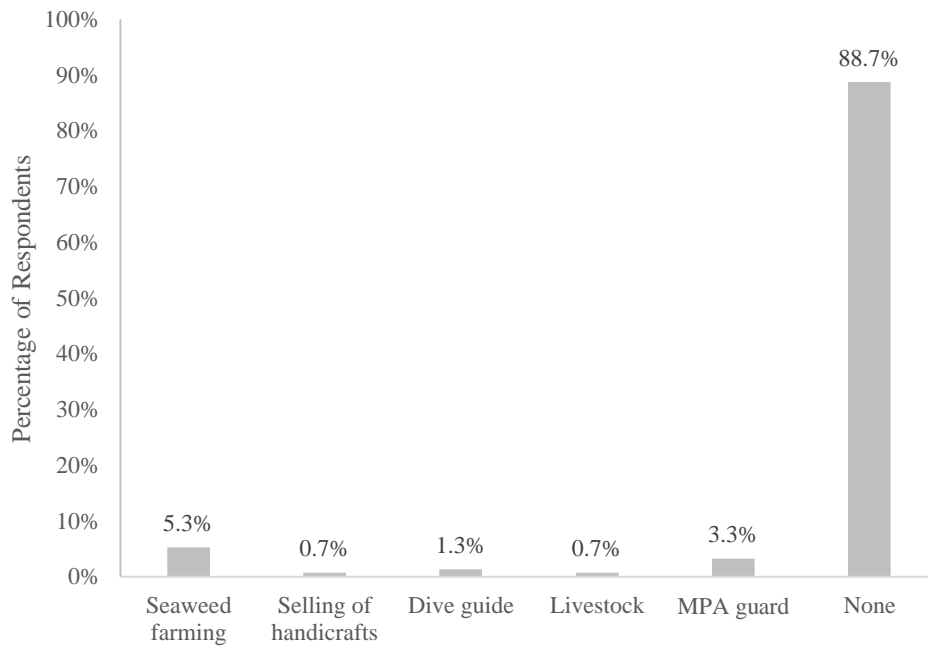


Figure 18. Percentage of MPA facilitated livelihoods Agutayan respondents were involved in after the MPA was established (n = 150).

Marine resource use patterns

As noted above, fishing was the primary occupation of 72.0% (n = 108) of the respondents from Agutayan. Most of the fishermen (all fisherfolk in this study were male and will be referred to as fishermen hereafter) had been fishing most of their life, with the mean years of fishing being 28.04 (SD= 15.14, n = 108). The number of years they had been fishing ranged from one year to 68. A majority of the fishermen's fathers in Agutayan were also fishermen: 83.2% (n = 89).

The fishing gear mainly used in Agutayan was "net" 76.9% (n = 83). Other fishing gear used in Agutayan was "hook and line" 17.6% (n = 19) and "spear" 5.6% (n = 6). Motor boats were the most common boat used by the fishermen 40.7% (n = 44) while

31.5% (n = 34) of the fishermen from Agutayan used non-motor boats. Some of the fishermen in Agutayan used large deep sea fishing vessels (26.9%; n = 29).

The primary fish targeted by fishermen were sardines (*Clupeidae*) (72.4%; n = 76) (Table 13). Groupers (*Epinephelinae*) were targeted by 20.0% (n = 21) of the fishermen and tuna (*Thunnini*) by 19.0% (n = 20). During good weather, households fished on average 6.7 (SD = 0.98) (n = 107) days a week. The majority of the households in Agutayan (90.7%, n = 97) fished seven days a week, during good weather. Fishing trips were not reduced much during the Northeast Monsoon: with fishermen stating that one average they fished 6.4 (SD = 1.56, n = 34) days a week, and 6.47 (SD = 1.50, n = 34) days a week during the Southwest Monsoon.

Table 13. Type of fish target by the fisherman from Agutayan (n = 105).

What is the type of fish you target?		
	N	Percent of Responses
Bigeye Scad (<i>Selar</i>)	2	1.90%
Cutlass (<i>Trichiuridae</i>)	1	1.00%
Groupers (<i>Epinephelinae</i>)	21	20.00%
Parrotfish (<i>Scaridae</i>)	3	2.90%
Sardines (<i>Clupeidae</i>)	76	72.40%
Tuna (<i>Thunnini</i>)	20	19.00%
Triggerfish (<i>Balistidae</i>)	1	1.00%
Total	124	118.10%

The estimated volume of food caught during one week (with good weather) in Agutayan was on average 1250.7 (SD = 1781.03, n = 107) kilos. The fisherman did not indicate if their catch was reduced during the Northeast Monsoon and Southwest Monsoon in Agutayan. Only a small portion of the fish caught was consumed by the

family: on average 5.9% (SD = 9.02, n = 108). Most of the fish caught in Agutayan was sold or bartered to a middleman: on average 94.0% (SD = 9.25, n = 108).

Perceptions regarding the marine resources

Respondents were asked how they perceived the condition of marine resources Agutayan five years ago. Specifically, what was the quantity of fish, and what was the health of the coral reefs, five years ago? Overall respondents (46.0%, n = 52) felt that the quantity of fish available was lower five years ago (Figure 19). Very few respondents from Agutayan felt that fish quantity was higher, with only 10.6% (n = 12) perceiving fish quantity as “more” fish five years ago. Coral health was perceived as being the same five years ago, with 48.7% (n = 55) perceiving the “same” coral health five years ago. Only 10.6% (n = 12) of the respondents from Agutayan felt that there was “more” coral health five years ago. There was a slight positive perception of the overall health of the coral in Agutayan with 54.7% (n = 82) of the respondents stating that “yes” the coral reefs in their community were healthy. But 45.3% (n = 68) felt that their coral reefs were not healthy.

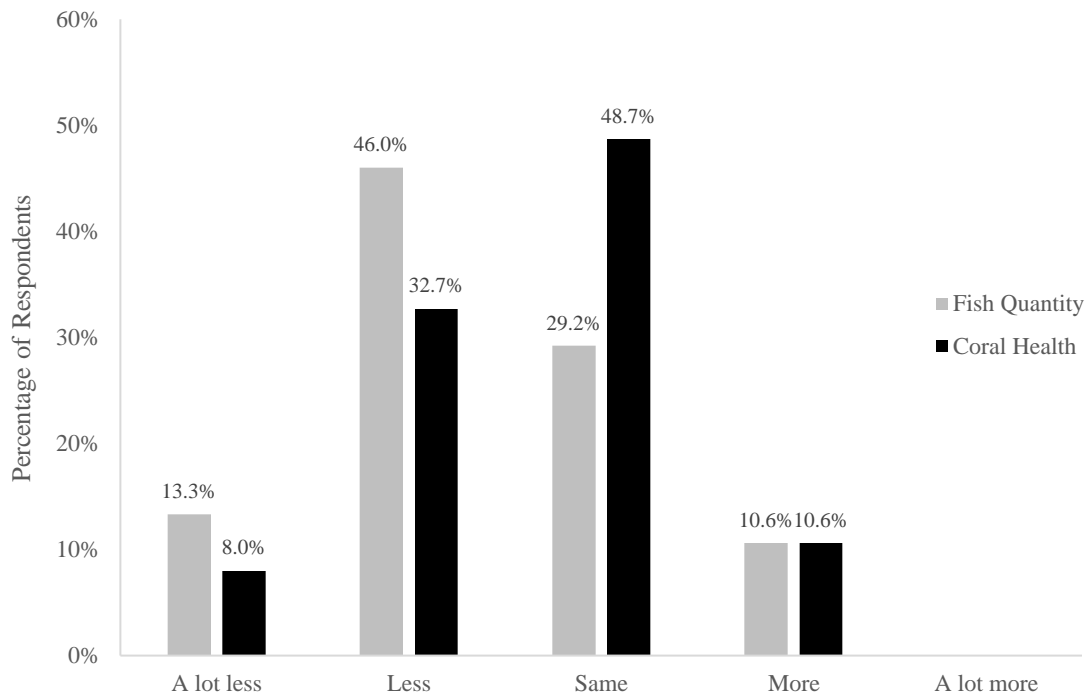


Figure 19. Perception of fish quantity and coral reef health five years ago in the community of Agutayan. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis (n = 113).

Perceptions regarding MPA

Unsurprisingly, all respondents (100%, n= 150) from Agutayan were aware of the MPA in their community. Respondents felt that MPA was providing both biological and social improvements. The fish catch was seen as not improving much with 49.6% (n = 56) of the respondents “disagreeing” with the statement that fish catch as increased in the community since the MPA (Figure 20). Coral health was viewed as improving, with 51.3% (n = 58) of the respondents, "agreeing" that quantity and quality of the coral reefs have improved since the MPA. The majority of households in Agutayan did perceive a greater social benefit from MPA with 46.0% (n = 52) “strongly agreeing” and 53.1% (n =

60) "agreeing" that there was an increase in tourists in their community since the MPA was established.

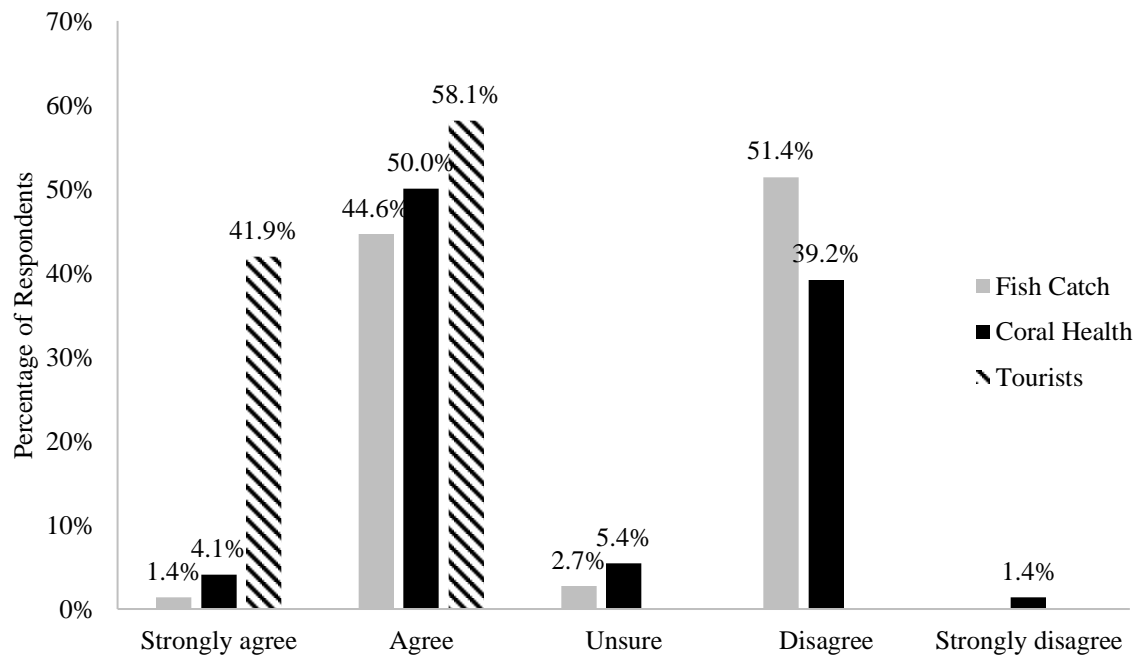


Figure 20. Perception of increased: fish catch, coral reef health and tourists after the MPA had been created in the community of Agutayan. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis (n = 113).

According to the households in Agutayan, positive biological impacts have been observed by the community. Stopping habitat destruction was seen as the most important biological effect from the MPA (50.7%) of the respondents. Respondents (36.7%) also felt that MPA has impacted the community by increasing fish abundance (Table 14).

Table 14. Agutayan respondent's perception of the biological factors associated with the MPA (n =150).

Which of the following has the MPA had an impact in your community?		
	N	Percent of Responses
Increased fish abundance	55	36.7%
Increased fish size	42	28.0%
Stopped habitat destruction	76	50.7%
Brought fish species back	39	26.0%
Moved fish closer	41	27.3%
Improved coral health	62	41.3%
None	54	36.0%
Total	369	246.0%

There were both positive and negative opinions of the social benefits that the MPA provided to the community of Agutayan (Table 15). Positive benefits included that (59.3%) households in Agutayan believed that the MPA was conserving resources for future generations. Additionally, 44.0% of the households noted positive benefits from removing bad fishing gear practices. However, the MPA was not seen as providing much educational benefit, with only 4.7% of the households perceiving this.

Table 15. Perception of the social benefits the MPA has provided to the community of Agutayan.

Which of the following benefits has the MPA provided to your community?		
	N	Percent of Responses
Improved fish catch	33	22.0%
Excludes outsiders	6	4.0%
Removed bad gear/practices	66	44.0%
Conserves resources for future generations	89	59.3%
Reduces conflicts	63	42.0%
Improves livelihoods	36	24.0%
Provides educational opportunities	7	4.7%
Improves equity	10	6.7%
None	45	30.0%
Total	355	236.7%

Overall the community of Agutayan perceived the MPA to be positive, with 40.7% (n =61) of the households saying that it has been “slightly good” and 17.3% (n = 26) stating it was "very good" for their community (Figure 21). However, there were some negative views of the MPA with 10.7% saying that the MPA has been "slightly bad."

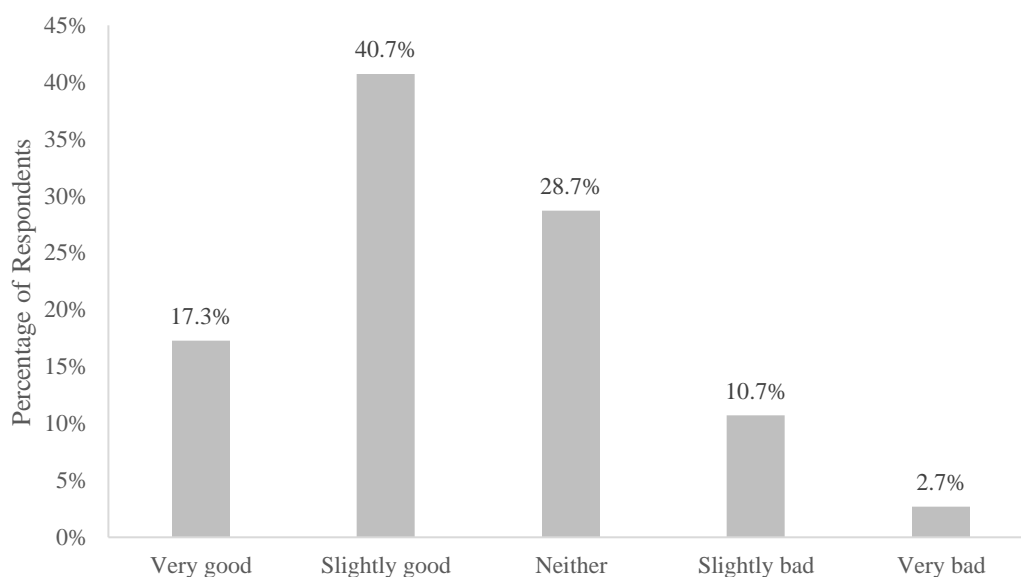


Figure 21. The overall perception of the MPA in the community of Agutayan (n = 150).

MPA Community Participation

The respondents of Agutayan did not have a positive view of community participation in the MPA (Table 16). Over 59.3% of the households were not aware, nor did they participate in meetings regarding the establishment of an MPA in their community. But a majority of the respondents did want the MPA established in their locale, (75.2%). Almost all of the respondents, (98.0%) did state the government or NGO was involved in the MPA planning process, and 46.0% of the households indicated that they had been involved in environmental educational programs before the MPA was established.

Table 16. Agutayan household responses to MPA community participation questions. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis.

Question	% Response		
	Yes	No	Don't know
Before the MPA was established were there meetings in your community regarding its establishment?	27.4% (<i>n</i> = 31)	59.3% (<i>n</i> = 67)	0% (<i>n</i> = 0)
Did you want the MPA established in your community?	75.2% (<i>n</i> = 85)	23.0% (<i>n</i> = 26)	0% (<i>n</i> = 0)
Was the local/provincial/national government/or NGO involved in the MPA establishment in your community?	98.0% (<i>n</i> = 111)	0% (<i>n</i> = 0)	1.8% (<i>n</i> = 2)
Before the MPA was established did you or your family members participate in any environmental education programs?	46.0% (<i>n</i> = 52)	54.0% (<i>n</i> = 61)	-

Enforcement and Conflicts

As for illegal fishing, respondents from Agutayan were split in their opinion.

More than half of the respondents (52.7%, *n* = 79) did not think illegal fishing took place in their community. But 47.3% (*n* = 71) of the community stated that it did. For respondents who answered “yes” to illegal fishing, the type of illegal fishing they identified was large fishing vessels (78.9%, *n* = 56). These large fishing vessels are viewed as illegal because they are encroaching on municipal waters (Figure 22).

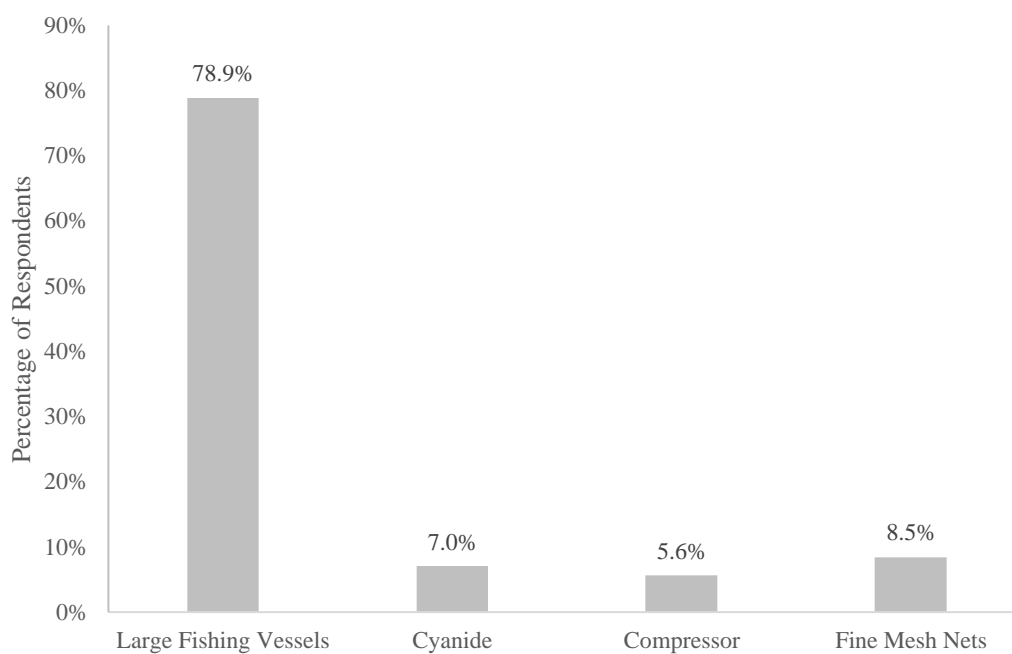


Figure 22. Percentage of type of illegal fishing that Agutayan respondents identified in their community (n = 71).

Regarding the government being actively involved in MPA management, most households in Agutayan felt that they were (63.3%, n = 95), with only 3.3% (n = 5) of the respondents stated that the government was not actively involved (Figure 23).

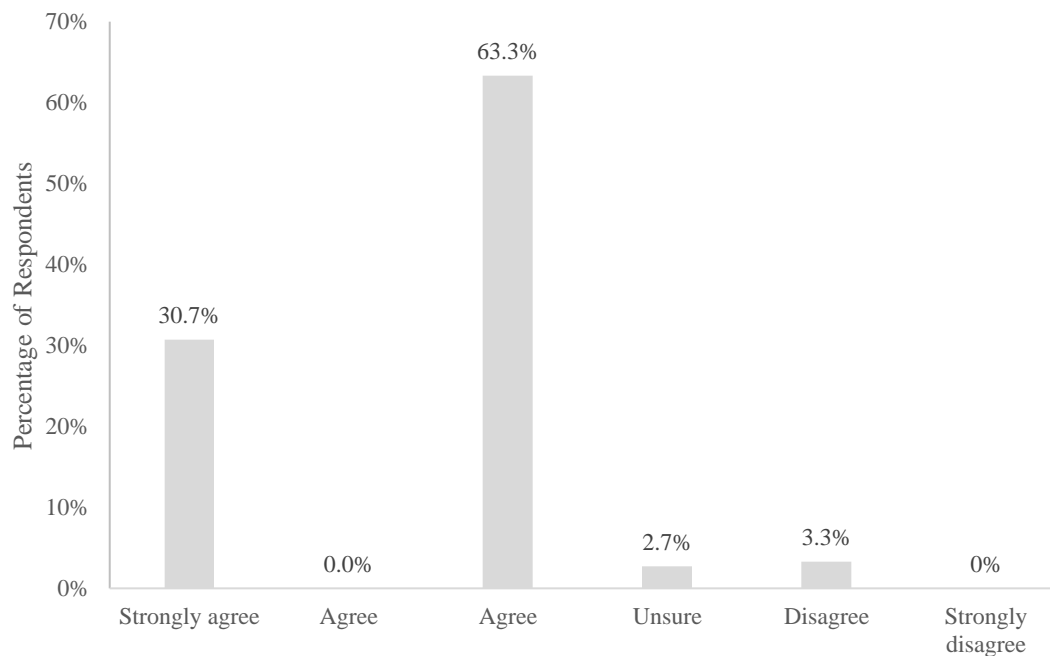


Figure 23. Perception of Agutayan respondents on active government involvement in their community's MPA (n = 150).

When asked about specific problems with the MPA, 50.3% of the respondents felt one of the problems was that it “erodes traditional authority” (Table 17). Other responses were: “too many regulations” (36.2%) and “regulations not well enforced” (35.6%). Funding did not appear to be an issue with the MPA in Agutayan, with only 4.7% of the respondents answering “no funding” as a problem.

Table 17. Agutayan household responses to the question regarding problems with their MPA. The total number of responses and number of cases is presented.

What are some of the problems with the MPA?		
	N	Percent of Responses
Too many regulations	54	36.2%
Regulations not well enforced	53	35.6%
Reduced catch	20	13.4%
Causes conflicts	49	32.9%
Erodes traditional authority	75	50.3%
Creates Inequity	21	14.1%
No funding	7	4.7%
No problems	24	16.1%
Total	303	203.4%

Empowerment

The respondents of Agutayan are not involved much in the decision-making process in their community (Table 18). Only 19.3% of the households answered “yes” to the question, “if there is a decision in your community are you involved in the decision?” All respondents that did answer "yes" said they participated in the decision-making process by “voting," and thus they were not involved *per se*. Moreover, a majority of the households (66.0%) stated that they were “not” involved in marine resource use decisions in their community. Also, only 20% of the respondents belonged to people's organization/union/group.

Table 18. Agutayan respondents answers to questions about empowerment (n = 150).

Question	% Responses	
	Yes	No
If there is a decision to be made in your community, are you involved in that decision?	19.3% (n = 29)	80.7% (n = 121)
Are you involved in the decisions made about marine resource use or management in your community?	34.0% (n = 44)	66.0% (n = 99)
Do you belong to any people's organization groups?	20.0% (n = 30)	80.0% (n = 120)

The 30 respondents who belonged to a people's organization, the majority (n = 27) belonged to a fisherfolk association. Other respondents were involved in educational support groups (n = 2) and a farmer's cooperative (n = 1). Respondents who belonged to people's organization groups had mostly attended six meetings (n = 27) in the last six months. While other respondents had attended twelve meetings (n= 2) and one meeting (n=1) in the last six months. Respondents reported attending "some" (60.0%, n = 18) or "all" (23.3%, n=7) of the meetings (Figure 24).

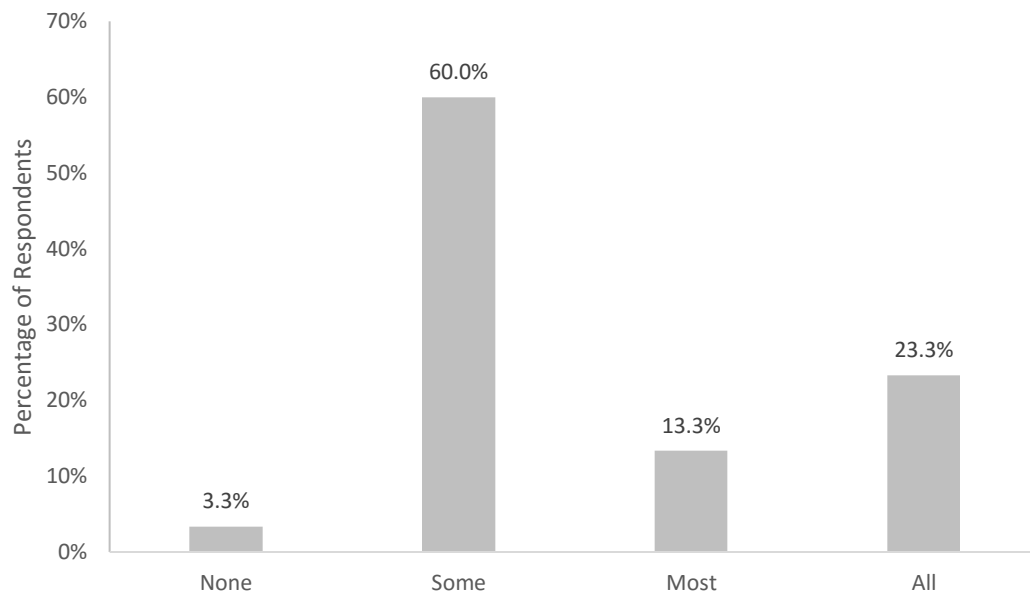


Figure 24. The number of people's organization group meetings the respondents from Agutayan attended (n = 30).

Qualitative Results

A total of eleven key informant interviews were conducted at the Barangay Hall of Jampason and in the Municipal Office of Jasaan between 20, March to 19 April 2012. Three of the key informants were elected were *bantay dagats* (MPA guards) with one of being the chairman of the *bantay dagats* in Jasaan. One informant was the current *barangay captain* of Jampason, and another informant was a fish vendor in Jampason. The other five interviewees were elected and appointed people in the Local Government Unit (LGU), specifically in the Department of Agriculture Office, Department of Tourism, or under the Mayor's office of Jasaan. The interviews lasted between 30 - 60 minutes, and the gender ratio was 6 females:16 males.

The results from the key informant interviews were separated in three time frames: before the MPA, during the MPA establishment, currently impacting the MPA. The themes will be discussed in each appropriate timeframe.

Before the MPA

The coastal waters of Jasaan around thirty to forty years ago were described as pristine reefs with an abundance of fish. Several informants reflected on the marine resources during their childhood. A barangay captain said that:

Jasaan had many fishes before. Even as a child, I could easily catch big fishes in the intertidal zones and gather clams as well. With that, we did not have any problem when it came to the food source.

A local government worker also spoke of Jasaan's productive marine waters by saying:

There used to be a lot of fishes here in my childhood. We could easily catch anything of our liking. So the prices were also low.

But after the 1970s and 1980s similar to rest of the Philippines illegal and destructive practices began to destroy the once productive waters of Jasaan. Dynamite and poison fishing became commonplace in Jasaan. A barangay captain summarized the illegal fishing occurring in the area by saying:

There were many types of illegal fishing before and that usually involved dynamite and the use of tree bark poison called, lantang. Fishes of all sorts and sizes would easily float. People then would just discard those that were too small to sell to the market.

Dynamite destroyed not only the marine habitat of Jasaan but also caused fatalities and amputations of fisherman which was mentioned by some informants. A market fish vendor described the poison fishing and the devastating effects that poison fishing has on the fish populations, she said:

...the illegal fishing is...the use of poison to catch fish. There are certain poisonous chemicals being placed in the food when feeding some fish by the fishermen so that they, who do it, could easily catch fishes because with that, the fishes then would float. And that method of fishing is really prohibited so it is considered illegal. What is dangerous in that method is that including the small fishes can consume those poisonous chemicals and they will eventually be caught also.

The coral reefs of Jasaan were not only destroyed by dynamite, but also several informants described how the offshore sandbars, in particular what is now part of Agutayan's MPA, before was used as a military target practice area. A local government worker talked about how the military practice in Agutayan by saying that:

Before, the military during the martial law used to aim at the White Island as a target for practice shooting. And oh, it was a spectacle. People used to see it as a fanfare and they would clap as if it was in the movies. The firing was during night and day before. Quite naturally, the gunners would miss the target and hit the corals instead.

A Municipal Agriculture Officer also commented on the military practices in Jasaan by saying that:

Because of the introduction of the explosives used by the military, it was there that the illegal activities in the sea started. The corals are plenty but as what I've told earlier, some were destroyed during the war. As early as the 1960s, cannons are being tested near the area. Sometimes the military hit the island but sometimes the corals are being hit by the cannons. It was really destroyed.

During the MPA

The MPA in Jasaan was established in 1996, and it took time for the people to accept it. Initially, there was not acceptance of the MPA because they needed to understand the purpose of the MPA and how and when they would benefit from the MPA. One Administrator at the LGU mentioned how it took time for the people to accept the MPA in Jasaan. They said:

I think it took us 15 years to finally let the people understand. But it was such a struggle before, especially if you would rid them of an area of their livelihood. It is much better now than before. At least, for now, the resistance is getting lesser due perhaps to their realization that the sanctuary would be helpful for them too.

The Municipal Environmental Officer also described how the people were initially against the MPA. They stated:

At first, there were negative reactions... but because it was constantly explained to them, the people were able to accept it as time goes by. There were really reactions coming from the people but in the long run, it became okay. It's for their own good... for the good of the community anyway so they were able to understand the principle behind it.

Jasaan helped mitigate the adverse reactions to the MPA by having many educational talks, open forum discussions, assemblies, seminars on what the purpose of the MPA is and also to provide a place where community members could voice their concern. An Administrator at the LGU spoke of the importance of educating the community in regards to the purpose of the MPA, they recounted:

That's only a natural phenomenon. In every course of action, there would be an equal cognitive dissonance. People would say, "Why would you do that? The sea is a common for everybody." When it is a common, there would be dissolution of responsibility; nobody would care until it would just be destroyed. Education really has created a great impact to the opinions of the people about the MPA. Though there would still be those who are adamant on their unbelief, there are

also those who share the vision that the MPA would create a sustainable development for them.

The chairman of the *bantay dagat* explained how the seminars helped the community realize the MPA would be beneficial to the community. They said:

...there were seminars being conducted before in order for them [community] to be aware. But in the long run, they have understood the purpose of the sanctuary. They know that the sea has been damaged before because of the explosives so the government made them understood the reasons for establishing the MPA.

The MPA educational meetings in Jasaan were a collaborative process that involved the LGU, other government agencies, and the universities. The Municipal Agriculture Officer commented on this collaboration saying that:

In every endeavor, there are trials... conflicts. But we conducted barangay assemblies, barangay forum, and sometimes we get negative results. Once you try to prohibit a certain area which is the best source of catching fish people will really be angry at you. So by the virtue of Sangguniang Bayan [LGU], Legislation and the DILG. Regular meetings and open forums were conducted with the assistance of LGU, DENR, XU-MMC (Xavier University), MSU (Mindanao State University)-Naawan and BFAR.

Aside from educational meetings and open forums, the LGU did have a variety of environmental rehabilitation projects for the coastal waters of Jasaan, aside from the MPA. The Municipal Agricultural Officer listed these projects by saying that:

We have some projects that are intended to improve the marine area... some of these are the artificial coral reefs, Fish Aggregating Device, Sea Ranching, Coral Transplantation, seaweeds production, seagrass propagation and management, mangroves.

Currently Impacting the MPA

After 15 or more years the community of Jasaan has accepted the MPA and the village have reported biological improvements. Several informants described how the

fish catch had increased as well as the size of the fish. A market fish vendor discussed the changes in fish catch. They said:

The MPA has been good to have that because there are a lot of fishes now in the community. It's better to have that so that these fishes will be preserved. The area is good because it is guarded, in that way the fishes will really be protected. They are not being harmed by illegal fishing.

They went on to say:

It helped the fishes in the community to be protected and with this the fishes that goes outside the area will be beneficial for the fishermen because they can catch those and those fishes will be sold in the market. Another thing is that, there is no more destructive fishing in the community. Illegal fishing is minimal.

A Municipal Agriculture Officer also described these biological improvements but also explained how this is benefiting the community. They stated:

First, there's an increase in fish catch. In the past, there are species of the fish that you cannot catch here. But because of the sanctuary, you can catch it here already. Another benefit is that it is income generating.

In addition, to biological improvements many key informants reported increases in tourists visiting their community because of the MPA. The Municipal Tourism Officer spoke of the tourism increases in Agutayan when they said that:

The MPA has more impact on the tourism because it is the one who facilitated in our visitors to coordinate, to entertain, to give way to our visitors who will come there in Agutayan. So they have more impact on our visitors. Ours is on improving the appearance of the island, while the department of agriculture helps in attracting the visitors by protecting and preserving the attractions under water such as the corals. [Tourists] are more from the neighboring towns... neighboring provinces. But sometimes there are foreigners...

Several of the key informants stated that most of the tourists that visit the MPA to scuba dive in the MPA but no dive fee is collected. One informant from the LGU said that:

There would be more than 2000 tourists in Agutayan yearly. And most of them are divers. Yes, we allow diving as long as it is for a rightful purpose.

A current *bantay dagat* also spoke of the tourists visiting the MPA by saying that:

Every month, there are really tourists. There are tourists who visit and see the giant clam we had there. There are really tourists who visit the place every month. Both foreigner and domestic.

Many of the informants spoke of the importance of the *bantay dagat* to the success of Agutayan MPA. In the Municipality of Jasaan, there are *bantay dagats* which patrol the nine coastal barangays several hours a day. Agutayan has four *bantay dagats* who patrol the area 24 hours a day. The Municipal Agriculture Officer spoke of the *bantay dagats*' role in monitoring the municipal waters of Jasaan, but also how the Government supports them, by saying:

We have a group called fish wardens. They are the ones who guards. They have boats and honorarium... and supplies. They apprehend all illegal activities. Our monitoring team is functional in all 9 coastal barangays. They submit a monthly report... submitted every 5th day of the month. They report to me every Monday.

The *bantay dagat* chairman also spoke of the *bantay dagat*'s roll in the Municipality of Jasaan, he said:

We are the ones who apprehend those that are being caught doing illegal fishing. We warn them... we talk to them... we apprehend them. We are being supported by the government. They [municipal] provide us gasoline. Our service is under the municipal office. We receive honorariums. There are 11 of us who receive honorariums. There are 11 bantay dagats. But the people who guard the sanctuary are another separate group.

The government's continued monetary support of the *bantay dagat* is not always consistent. Some of the guards commented on the lack of funding when they said:

We sometimes use personal money. There are times that there is shortage especially in the fuel fee. They [the LGU] already know but we will just spare our understanding because it is not only us who suffer shortage... almost all. There still problems. Scarcity of funds at times. There are places we can't guard because there are not enough funds sometimes, but if the budget is enough, we can guard it anytime.

Despite the lack of financing the *bantay dagat* try to patrol the area as best they can, but many informants mention the constant problems of encroaching fisherman. The Municipal Tourism Officer spoke of the encroaching fisherman by saying that:

In terms of the illegal, there are encroachers. Boats are entering here and they are not from our place. These big fishing boats sometimes outrank the small scale fishing in our community. It creates trouble because the small scale fishermen complain due to some territorial issues on fishing. But now, this is being controlled because there are already guards. This is why we have bantay dagat to monitor the activities in the sea especially the fishing activities within our vicinity.

An Administrator in the LGU also discussed the problem with encroaching fisherman in the area by saying that:

What is our primary headache nowadays are the poachers encroaching in our seas. About encroachment, supposedly, there is an ordinance for that. There is a supposed boat color coding for every municipality, but that has not been fully implemented yet. There would come a time when we would just turn the other cheek for them because we would know that they would just do that for a living; but if ever this has become rampant, we put sanctions. Running the bantay dagat operations 24/7 with 60L a day is not that cheap.

The *bantay dagat* have successfully apprehended some encroaching fisherman. The *bantay dagat* spoke of a recent apprehension by saying:

We caught some people... five people. They are not from here, they are from Balingasag. They did not ask permission. They used compressor. It was last year.

A case was filed against them... illegal fishing in sanctuary. The case was brought up to the hall of Justice. They were allowed to be freed in one condition. All the fishing materials they have were confiscated.

Even though there were admittances of the sometimes scarcity of funds from the LGU, many key informants commented on the importance of collaboration with other agencies, universities, NGOs, etc. One Administrator to the LGU said that:

There are four areas wherein we are constantly monitored at: corals, mangroves, seaweeds and water. Every assessment will cost hundreds of thousands of pesos. Thank goodness for McKeough and Naawan.

Another Administrator to the LGU also commented on the necessity of outside support when they said:

The good news is that more than ever, there are more and more agencies that are concerned with the health of the seas: the McKeough Marine Center, DENR, BFAR.

Overall, Agutayan's MPA has been very successful, and the community is very proud of it. Recently, the Jasaan was advanced to "Phase II" of the Coastal Resource Management (CRM) Project. In Phase II, the CRM plan detailed in Phase I must be adopted, and this includes enforcing established MPA as well as routinely monitoring protected areas in the community. The CRM planning process is a very exhaustive process, and many Municipalities have not been able to advance to Phase II; the LGU of Jasaan is very proud of this recent advancement. An Administrator to the LGU described this progress by saying that:

Jasaan has been accredited as Phase II in terms of the Coastal Resource Management Planning. In fact, Jasaan is the only municipality. This state of recognition is not that easy—it took us 15 years just to finish this. This thing is more like a thesis defense wherein we must face a huge crowd and they would grill us with questions. Because we are already Phase II certified, we are subjected to so many evaluations.

The Municipal Agricultural Officer also spoke of this honor when they recounted:

Right now, Jasaan is certified as Coastal Resource Management Phase II. We are the only one in the region who has got this far. That is by far the highest. We received the award 3 years ago from DENR Manila. We are awarded because of our activities in protecting the marine life.

The Municipal Tourism Officer summarizes the many benefits that MPA has already, and will provide, to the community by saying that:

The MPA has something to do with the Barangay itself and the municipality of Jasaan because this will increase our fish production, tourist attraction and livelihoods of our fishermen and others. The bantay dagat who are guarding the area have gained a livelihood by being the guards. In the tourism aspect again, this will really give a very big attraction especially to those students who are studying marine biology and also aquaculture. This also give a big concern to the community.

Discussion

Livelihood Options

The research revealed that fishing (72.0%) was the major livelihood of the respondents, this was expected since Jampason is a coastal community. A concern with the creation of an MPA is that fisherfolk will lose critical fishing grounds and catches might be reduced. One way in which MPA managers can help mitigate this problem is the offering of alternative livelihoods. Alternative livelihoods offered to the community could be seaweed farming, selling of handicrafts, or serving as a dive guide. The importance of alternative livelihoods is not only to compensate fisherfolk for the loss of fishing grounds but also to aid with positive perceptions of the MPA (Pollnac et al. 2001,

Fox et al. 2012). In Agutayan, respondents (88.7%) reported almost no change in livelihood opportunities after the MPA was established. Only a few respondents were involved in alternative livelihoods such as seaweed farming and serving as *bantay dagat*. Despite the lack of involvement in alternative livelihoods options, 51.3% respondents did have a positive perception on how the MPA has impacted their livelihood. But 34.0% of the respondents had neither a positive nor negative opinion of how the MPA changed their livelihood. It is important to note that Agutayan MPA is an offshore MPA that is not easily accessible to fisherfolk, so the loss of fishing grounds may not have been noticeable to the residents of Jampason.

Perceptions regarding marine resources and MPA

The results revealed that respondents believed that fish quantity (46.0%) and coral health (40.7%) was lower five years ago. But when asked about the current overall health of their coral reef after their MPA was established, 45.3% of the respondents believe that it is not healthy.

Biological and social improvements were perceived by the residents of Jampason but mainly with the coral reef and not fish catch. Respondents (49.6%) disagreed with the statement that fish catch has increased since the MPA; again this may be attributed to the fact that Agutayan MPA is offshore and also it is a relatively small MPA, four hectares. Interviews with community members, however, revealed that fish catch was seen as improving with several informants mentioning an increase not only in the abundance of fish but also in fish diversity because of the MPA. Household surveys

revealed the most important biological impact the MPA provided to the community was stopping habitat destruction (50.7%). This was consistent with interviewer's comments regarding past destructive fishing practices. Several informants discussed how past dynamite and military training practices destroyed the reefs of Jampason, but after the establishment of Agutayan MPA, these illegal fishing practices are minimal today.

The major social improvements observed after the creation of the MPA were an increase in tourists visiting their area, and this was also reflected in informant interviews. Many interviewees mentioned an increased presence of foreigners wanting to visit and dive in their MPA, an estimated 2000 visitors yearly. There is no direct monetary benefit from the divers in the community because there is no dive fee is charged nor was there mention of fisherfolk serving as dive guides or tourists hiring their boat for diving. A dive fee could be collected from the visitors entering the MPA, and this money could help with the patrolling and enforcement of the protected area.

Overall, the respondents felt the MPA was positive for their community (58.1%), but there is concern regarding the 13.4% that said the MPA was "slightly bad" to "very bad" for their community. Studies have indicated that education, age, occupation, area of residence, and gender can influence perceptions of the environment (Pollnac et al. 2001; Thomassin et al. 2010). In Jampason, gender, education, age, did not vary in respondents MPA perception scale. However, occupation was found to be significantly different in Tubajon with fisherfolk having a more negative opinion of the MPA than non-fisherfolk. Pomeroy's et al. (2006) found that negative perceptions from fisherfolk were detrimental to MPA success and are tough to change once opinions have been formulated.

Community participation

This study found that respondents did not appear to be involved in the MPA establishment process. Himes (2007) and Charles and Wilson (2008) documented that it is important to involve the community early on to help with the "buy in" to lead to better compliance. A majority of the respondents (60.7%) were not aware of community meetings regarding the MPA establishment. More than half of the respondents (56.7%) reported they were not involved in environmental education programs before the MPA. This lack of initial involvement of the community in planning and establishment process of the MPA is somewhat concerning because it may have attributed to a lack of understanding and time it took for the community to accept the MPA.

In addition to resident community involvement, it is also important to have government/NGO or academic participation in the MPA planning, establishment, and ongoing support of the MPA. Almost, all respondents (98.0%) said that the government and NGOs were involved in the creation of the MPA. Government's involvement is crucial for making violators held accountable and punishable by law. Also governmental and NGO support is critical for absorbing the financial costs of maintaining, enforcing and conducting assessments of the MPA. Several informants highlighted the importance of the *bantay dagat* in protecting and patrolling the MPA. The government supports the *bantay dagat* by providing salaries, patrol boats, and fuel so they can guard the MPA 24 hours a day. Some *bantay dagat* commented how there is sometimes a shortage for funds from the government for patrolling, but they use their personal money because they are

dedicated to the mission of the MPA. A praiseworthy act from the guards which illustrates their high level of commitment to the MPA.

The importance of Agutayan's MPA being a collaborative project between the community residents, LGU, academic institutions, and NGOs was commented on by many informants. Interviewees also discussed the importance of aid from other organizations to Agutayan with the recent advancement to "Phase II Coastal Resource Management Project." With a Phase II advancement, the LGU is responsible for regular assessments and surveys of protected areas. Therefore, a collaboration between academic institutions and NGOs is essential for helping with the financial, as well as scientific skills, necessary to conduct assessments of Agutayan's MPA.

Enforcement

The results from this study regarding enforcement indicated that respondents had a split opinion regarding illegal fishing with (52.7%) answering "no" and (47.3%) saying "yes" that illegal fishing takes place in their community. For respondents that did report that illegal fishing was still happening in their community, the most common type of illegal fishing was large fishing vessels encroaching in the municipal waters. Informants also commented on the difficulty of preventing encroaching fishermen, particularly large fishing boats who can easily enter the offshore waters of Agutayan's MPA. Since Agutayan is offshore, it is easier for large fishing boats to enter its waters.

Walmsley and White (2003) documented how good enforcement was found to be the best indicator of MPA effectiveness concerning biological success of increased fish

abundance and diversity in several MPAs in the Philippines. Results from the survey indicated that respondents (50.3%) felt that the MPA "erodes traditional authority" as well as 35.6% believe that the MPA is "not well enforced." Traditional authority and customary management of marine resources have a long history in developing countries. For example, in the Pacific members of the community may limit fishing in particular areas, time frames, gear used, who is permitted to fish, or prevent certain species from being harvested (Cinner & Aswani 2007). Fish diversity and biomass of fish was found to be increasing inside MPAs that used a combination of a modern MPA management approach and customary management (Aswani & Furusawa 2007). It is important that customary management and traditional authority be integrated into the modern management of MPAs because it has been documented that when customary management has been eroded, there was a decrease in marine productivity (Cinner & Aswani 2007). Additionally, there is a concern that the household surveys and interviews revealed that Agutayan's MPA was "not well enforced." This perception can have serious implications not only to the biological success of the MPA but also on social success concerning community participation and support of the MPA.

Conflict

The loss of fishing grounds can not only lead to a reduction in fish catch, but this can result in conflict between the fishing community and MPA managers. Before a MPA is established the purpose, rules, expectations, as well as the laws that govern the MPAs must be understood by the community to prevent resource user conflict (Pomeroy

et al. 2006). In Jampason there was a dispute between the MPA managers and the community, but eventually, after fifteen years the community has accepted and now support the MPA. Community acceptance and support of the MPA was fostered through numerous environmental education meetings and open forums conducted by the LGU, DENR, BFAR, NGOs and various academic institutions. These meetings and discussions helped the community understand the purpose, and short- and long-term benefits, of the MPA and also decreased conflict between fisherfolk and MPA managers. However, qualitative data showed minimal educational events highlighting the importance of incorporating both quantitative and qualitative data analysis in MPA evaluations.

Empowerment

In Agutayan, 54.0% of respondents said they or their family members participated in environmental educational programs, but only a few respondents ($n = 3$) stated that they were still actively involved in such educational programs. Empowerment from an MPA can begin with environmental educational programs, that foster ideas of conservation and the willingness to save resources for future generations. Most respondents were not involved in any people's organizations (80.0%) which indicate little empowerment from the environmental education programs initiated with Agutayan's MPA.

The results of this study also showed that the respondents from Jampason were not involved in any decision-making in their community (80.7%) which does not lead to empowerment. Aside from empowerment, this lack of involvement from the community

in making decisions could be detrimental to the continued success of Agutayan's MPA, because stakeholders need to feel they have a voice in the rules governing an MPA. Stakeholder policy preferences can vary substantially between individuals and social groups and, therefore, each voice must be heard when making a decision that will impact the community (Pomeroy et al. 2006). The lack of involvement from individual stakeholder groups, especially fisherfolk in the decision-making processes, can lead to problems with enforcement and compliance in the MPA.

Overall, the findings from this research indicate that Jampason respondents have a positive opinion regarding the MPA. The government of Jasaan plays a very active role in the management of Agutayan MPA by providing salaries and patrol boats to *bantay dagat*. Problems with enforcement appear to be minimal, and this may be attributed to the 24 hours patrolling of the MPA, as well as Agutayan being an offshore sandbar which is not easily accessible by all fisherfolk. With Jasaan entering Phase II of the CRM they will need to rely on the continued support from other organizations, government units, and academic institutions for regular assessments and monitoring of their protected areas. Based on the surveys and interviews here are some suggestions for MPA management to be more effective:

- Offering alternative livelihoods that have an established market in the community (dive guide, boat rentals and selling of handicrafts);
- Improving stakeholder participation in decision-making by holding open discussions and meetings which will provide an opportunity for the community to discuss with managers some of the issues with the MPA;

- Focus on changing negative fisherfolk opinions regarding the MPA by addressing the problems of the MPA through social marketing. forums. Also, hold public forums where stakeholders and managers can develop possible strategies and solutions for problems of the MPA;
- Enhancing the collaboration with the Department of Tourism and MPA managers to help increase tourism in Agutayan and mandate the collection of a dive fee from all visitors. Income generated from dive fees could be used also to maintain the patrolling and expenses of the *bantay dagat*;
- Integration of customary management into Agutayan MPA management plan, to help remove perceptions of the MPA eroding traditional authority.

CHAPTER FIVE: EXAMINATION OF THE SOCIAL FACTORS, ATTITUDES AND PERCEPTIONS OF RESIDENTS FROM DUKA BAY MARINE SANCUTUARY IN DUKA BAY, PHILIPPINES

Abstract

Duka Bay Marine Sanctuary is a privately managed Marine Protected Area (MPA) that was established in Misamis Oriental, Philippines, in 1997. It is a small MPA covering six hectares off the coast of Barangay Duka. In April of 2012, a household socio-economic survey was administered to residents ($N = 150$) of the village of Duka to determine demographics, socio-economics, attitudes and perceptions of residents regarding the MPA. Additionally, ten key informant interviews with various Local Government Unit (LGU) officers, *barangay captains* (elected village leaders), resort managers, and deputized fish wardens (DFW) were conducted to understand MPA performance in Duka further. Overall, residents generally felt the Duka Bay MPA was a positive marine resource management tool for their community. Residents reported both biological and social improvements since the MPA was established, but social gains from the MPA were minimal. Changes in alternative livelihoods after the MPA was established were not experienced by any residents. Residents reported minimal involvement in decision-making in their community and very few were involved in environmental educational programs that would encourage community empowerment. Enforcement appears to be a problem, and this could be attributed to the lack of financial support for DFW from the government. Duka Bay Marine Sanctuary is primarily

managed by a private resort, and this has caused conflict and resistance between the fisherfolk community and the resort. Efforts had to be made by the local government to suppress this conflict. These efforts were thought to be successful, but qualitative research revealed that there is still a lack of community support for the MPA. Local community members felt they were excluded from the decision-making process because a Municipal Ordinance establishing the MPA was passed without their involvement.

Introduction

The Philippines is the center of marine fish biodiversity (Carpenter & Springer 2005), but this ecosystem is being threatened because of a rapidly growing population that depends heavily on marine resources for their survival (Hoegh-Guldberg et al. 2009). The Philippine Bureau of Fisheries and Aquatic Resources (BFAR) reported in 2009 that the catch per unit effort had declined substantially (BFAR 2009). In order to help conserve and protect the declining marine ecosystem, marine protected areas (MPAs) have been implemented in the Philippines and throughout the world, as a fishery management tool. Considerable research has indicated that MPAs appear to be biologically effective by conserving marine biodiversity, protecting the marine habitat and species richness, increasing the diversity, size, and density of fish (Pomeroy et al. 2006; Christie et al. 2003; Lester et al. 2009; Bennett & Dearden 2014). But scientific research on the social factors MPAs have on the community has not been as extensive as biological MPA research. Governmental organizations, NGOs, and academia have

realized the importance for more in-depth research and have pushed for more detailed social scientific investigation of MPAs (Fox et al. 2012; Mascia et al. 2010).

The purpose of this study was to provide a social scientific evaluation of the social aspects, attitudes, and perceptions of privately managed MPA in the Philippines. The MPA, named Duka Bay Marine Sanctuary, is located in the province of Misamis Oriental in the Municipality of Medina, in the *barangay* Duka (village of Duka). Established in 1997, and covering seven hectares, the MPA is managed by Duka Bay Resort and the Municipality of Medina. The aim of this research was to provide baseline information on household socioeconomics; community involvement; community empowerment; involvement in alternative livelihoods as a result of the MPA; possible conflicts; and residents perceptions and attitudes towards the Duka Bay Marine Sanctuary by using household surveys and semi-structured interviews. In researching and analyzing the social factors, attitudes and perceptions of Duka Bay MPA residents, the goal is to understand better how to maintain longevity and success of this privately-managed MPA.

Study Site

Duka Bay Marine Sanctuary

Duka Bay Marine Sanctuary is located in the fourth class (average annual income Php 25,000,000 – 34,999,999) Municipality of Medina in the Barangay Duka (Figure 25), in a small rural coastal barangay (village). In 2010, the population of Duka was estimated to be 1,344 people (Philippine National Statistics Office 2010). Duka Bay Sanctuary is a MPA encompassing six hectares of water. It was established in 1997 via

Municipal Ordinance 97-199 (MPA Support Network 2004). The objectives of the MPA were to restore coral and fish diversity to the area, as well as provide local livelihoods and educational programs to the community (Alfeche 2003, Indab & Suarez 2004). Duka Bay marine sanctuary is protected and managed privately through Duka Bay Resort's Aqua Sports manager and Duka Reef Divers, albeit in collaboration with Xavier University and the Philippine Army (Alfeche 2003). In 2006, an international foundation (the Holcim Foundation) awarded Duka Bay Sanctuary a coral reef restoration grant (Alfeche et al. 2006). The funding of the restoration project initiated the development of a collaboration between the local government unit, universities, businesspeople, and the coastal community in Duka Bay (Alfeche et al. 2006). This restoration project sought to increase community participation, environmental education, and livelihood options for the people of Duka Bay. After three years, the biological success of the reef restoration was documented, with increases in fish abundance, fish diversity and coral reef health (Alfeche et al. 2006). However, the social impact of the restoration project, within the Duka Bay Sanctuary, was not studied.

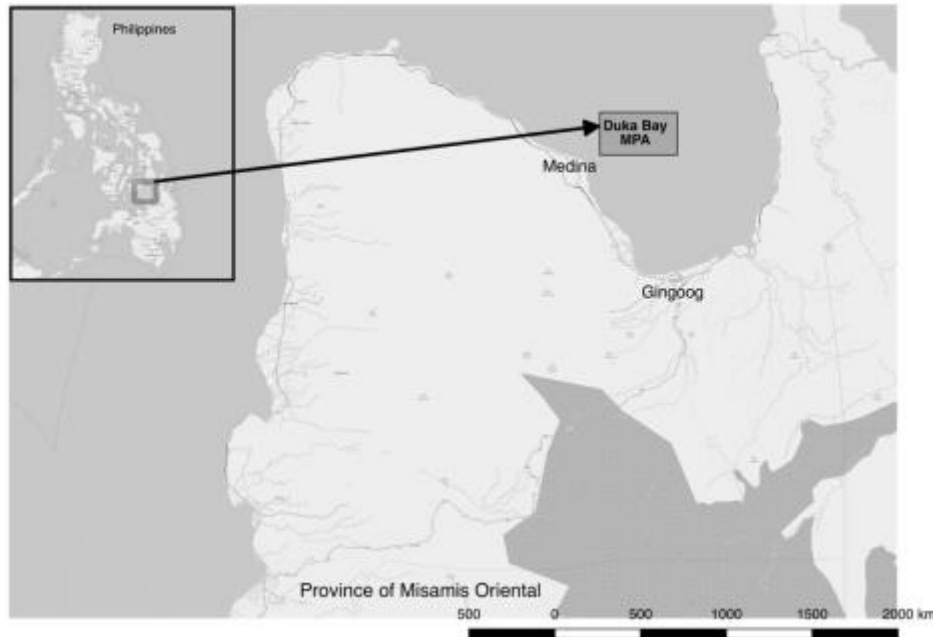


Figure 25. Location map of the study site, Duka Bay MPA in the Municipality of Medina, Misamis Oriental, Philippines.

Methodology

Survey methods and analysis used in the examination of residents in Duka Bay are detailed in Chapter 3 of this dissertation. Semi-structured interview methods of Duka Bay are also mentioned in Chapter 3. Before any surveys or interviews were conducted, a governmental courtesy call was made to the Mayor of Medina, Pacifico Tagaylo Puppos Jr. to ask permission for research to be carried out in his community.

Results

Quantitative Results

A total of 150 household surveys were completed in the Duka Bay community. The 95% confidence interval for a considering the survey sample size and Duka Bay's

population (1,344⁴) is $\pm 7.54\%$. No individuals declined to participate in the survey, i.e., the response rate was 100%.

Demographics

Duka Bay respondents in this study had a mean age of 44.62 years (SD=12.64), with the youngest being 18 years of age and the oldest being 79 years of age. Age had a skewness value of 0.065. The percentage of respondents that were male was 62.7% (n=94) and 37.3% (n = 56) were female.

The highest completed education of respondents from Duka Bay were in one of six educational categories ranging from “none” to “college graduate” (Figure 26). High school graduates were the most common education category with 48.0% (n = 72) of respondents. Elementary school graduates were the second highest percentage in Duka Bay with 21.3% (n = 32). Higher education was reported in some of the respondents with a 16.0% (n =24) of respondents having either “some college” or were college graduates.

⁴ Population based from May 1, 2010, Census of Population and Housing conducted by the Philippine National Statistics Office.

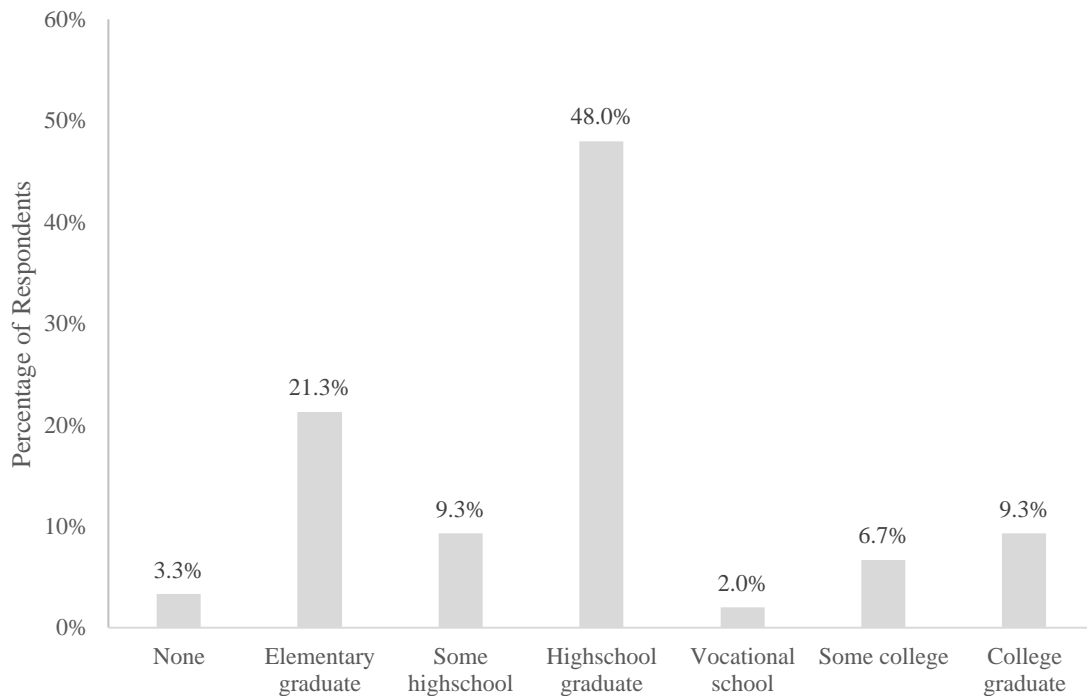


Figure 26. Highest completed education by the respondents from Duka Bay MPA (n = 150).

Seventy-seven percent (n=115) of the respondents were originally from the community. However, 23.4% (n=35) of all the respondents had immigrated into the community from another community in Misamis Oriental, or from another region of the Philippines. Respondents had immigrated to the community because of marriage or for employment.

Household socioeconomics

The number of adults and children living in the households in Duka Bay ranged from one to eight adults. The mean number of adults residing in the household for Duka Bay was 2.96 (SE = 0.124). Less than half of the households in Duka Bay have two

adults living in the home (44.7%, n = 67). The number of children residing in Duka Bay homes ranged from zero to twelve children. The mean number of children was 2.96 (SE = 0.12). Most households had between one and four children (63.4%, n=95). Very few respondents rented their home (5.3%, n = 8). Almost all respondents from Duka Bay owned their home 94.7% (n=142). Questions regarding monthly income were omitted because respondents did not indicate if they were reporting weekly or daily income.

When respondents in Duka Bay were asked about their household expenses most, respondents only noted their spending for a few of the items (rice, pork, fish, vegetables, children's school allowance, electricity) (Table 19). Most households spent their income on rice (₱1745.52, n = 149), and fish (₱689.27, n = 96). The smallest amount of income spent on the items specified was vegetables (₱239.85, n = 136). If less than ten respondents noted the income spent on a particular category item, it was omitted from the findings since the sample size was too small.

Table 19. Household expenses for one month of the respondents from Duka Bay (n = 150).

Household Expenses	One Month
Rice	₱1,745.52 (n = 149)
Pork	₱398.42 (n = 19)
Fish	₱689.27 (n = 96)
Vegetables	₱239.85 (n = 136)
Children Allowance	₱279.61 (n = 103)
Electricity	₱407.14 (n = 144)

₱ = Philippine Peso exchange rate: 200 PHP=US 4.22 (2/16/2016, xe.com)

Living standards and quality of life

Most of the household's in Duka Bay had modern items such as TVs (61.33%) and mobile phones (61.33%). The homes of most of the respondents had electricity (96.67%) with only 3.33% using kerosene as an energy source. The households in Duka Bay have some modern characteristics with 72.67% having piped water into their home, metal roofs (84.67%) and 80.0% had a cement floor. Despite modern features, some of the homes still exhibited a low degree of modernization with the primary cooking material being firewood (95.33%), and only 8.67% of the respondents had a private flush toilet. The material that the walls were constructed from was either cement (32.0%), bamboo (24.0%) or wood (21.33%). Most of the respondents traveled by walking (80.0%) very few had their own mode of transportation with only 7.33% owning a motorcycle. (Table 20).

Table 20. Percentage of households in Duka Bay (n = 150) with specific household items and facilities.

Household items and facilities	Percentage	N
Generator	0.00%	(n = 0)
Electric Fan	29.33%	(n = 44)
Satellite dish	0.00%	(n = 0)
Wall clock	46.67%	(n = 70)
Water Tank	0.00%	(n = 0)
Radio/Cassette	48.67%	(n = 73)
Landline	0.00%	(n = 0)
Electric iron	6.00%	(n = 9)
Refrigerator	30.67%	(n = 46)
TV	61.33%	(n = 92)
Mobile phone	61.33%	(n = 92)
Non-motor boat	22.67%	(n = 34)
Air conditioner	1.33%	(n = 2)
VCR/DVD	23.33%	(n = 35)
Dining table	98.67%	(n = 148)

Motorized boat	20.00%	(n = 30)
Lighting		
Electricity	96.67%	(n = 145)
Flashlight	0.00%	(n = 0)
Air Pressure	0.00%	(n = 0)
Kerosene	3.33%	(n = 5)
Candle	0.00%	(n = 0)
Nothing	0.00%	(n = 0)
Water		
Piped water home	72.67%	(n = 109)
Open well	0.00%	(n = 0)
Piped water public	22.00%	(n = 33)
Private flush toilet	8.67%	(n = 13)
Pump	4.67%	(n = 7)
Private closed pit	0.00%	(n = 0)
Open Pit	0.00%	(n = 0)
Transportation		
Walking	80.00%	(n = 120)
Vehicle	0.00%	(n = 0)
Bicycle	5.33%	(n = 8)
Jeepney	0.00%	(n = 0)
Motorcycle	14.67%	(n = 22)
Tricycle	0.00%	(n = 0)
Cooking		
Firewood	95.33%	(n = 143)
Charcoal	0.00%	(n = 0)
Kerosene	0.00%	(n = 0)
Gas/Electric	5.33%	(n = 8)
Roof material		
Thatch	16.67%	(n = 25)
Metal	84.67%	(n = 127)
Tile	0.00%	(n = 0)
Floor material		
Dirt	6.67%	(n = 10)
Tile	4.00%	(n = 6)
Bamboo	22.00%	(n = 33)
Plank wood	5.33%	(n = 8)
Cement	80.00%	(n = 120)
Wall material		
Bamboo	24.00%	(n = 36)
Cement	32.00%	(n = 48)
Wood	21.33%	(n = 32)
Stone block	7.33%	(n = 11)
Metal	0.00%	(n = 0)

Livelihood options

The primary livelihood of more than half of the respondents in Duka Bay was fishing (59.3%, n = 89). The other two primary occupations were salaried workers (13.3%, n = 20) and laborers (13.3%, n= 20) (Figure 27). Respondents viewed the MPA as having a negative impact on their livelihoods with 33.6% (n = 49) stating the MPA has been “slightly negative” and 11.6% (n = 17) stating that it has been “very negative” to their livelihood (Figure 28). No respondents (100%, n = 47) reported a change in livelihood opportunities after the MPA was established.

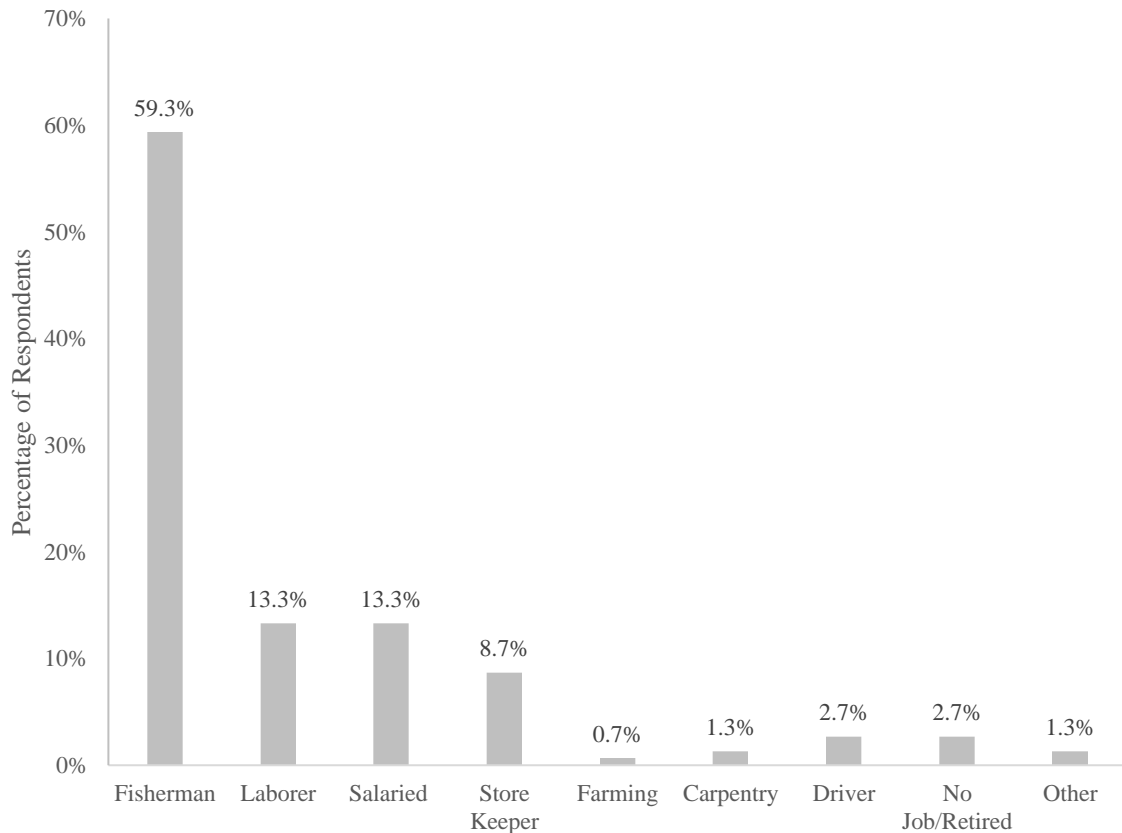


Figure 27. Primary livelihoods of the respondents from Duka Bay (n =150).

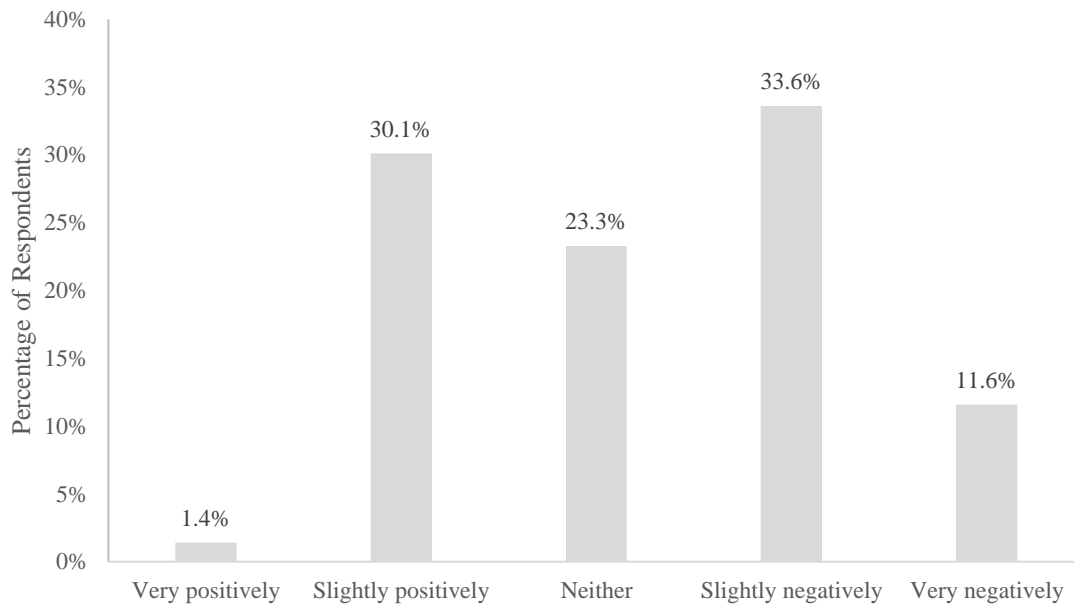


Figure 28. Duka Bay respondents overall perception of how the MPA has impacted their livelihood (n = 146).

Marine resource use patterns

As already indicated, fishing was the primary occupation of more than half of the respondents from Duka Bay. Most of the fishermen (all fisherfolk in this study were male will, therefore, be referred to as fishermen here on in) had been fishing most of their life, with the mean years of fishing being, 26.67 (SD= 11.04) (N = 90). The years of fishing ranged from four years to 50 years of fishing. Most of the fishermen in Duka Bay had fathers who also fished (65.5%, n = 59).

The fishing gear mainly used in Duka Bay was “net” (60.2%, n = 62) or “hook and line” (37.9%, n = 39) (Figure 29). Motor boats were used by a little more than half of the fishermen (53.3%, n = 48). While 45.6% (n = 41) of the fishermen from Duka Bay used non-motor boats and 1.1% (n = 1) of the fisherman did not use any vessel for fishing.

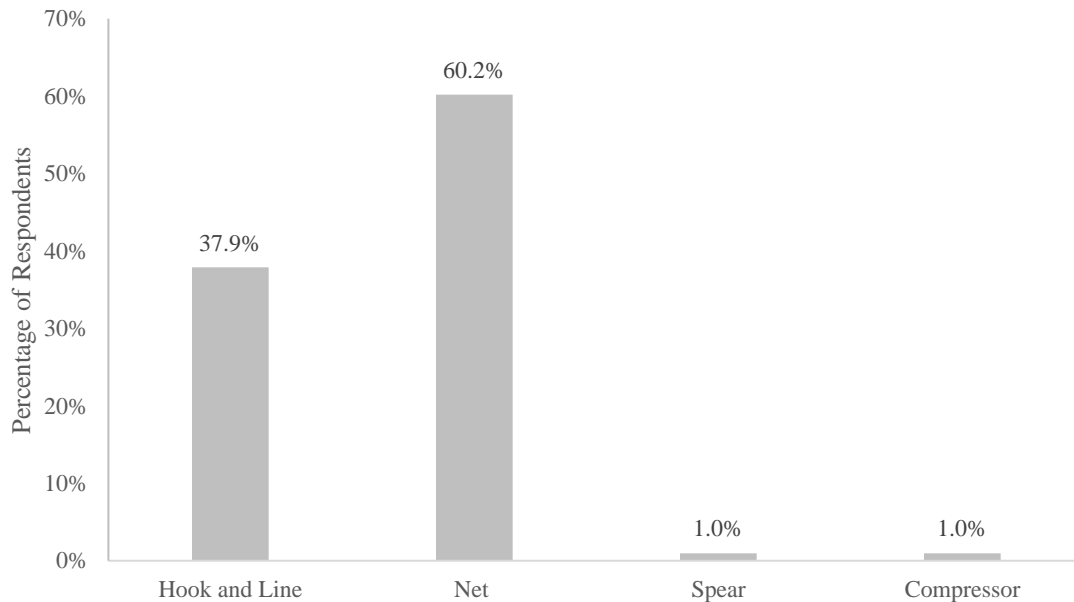


Figure 29. Percentages of the type of fishing gear used by the fisherman from Duka Bay (n = 103).

The primary fish targeted by fisherman were sardines (*Clupeidae*) (44.9%, n = 40) and groupers (*Epinephelinae*) (39.3%, n = 35) (Table 21). In good weather, households fished on average 6.51 (SD = 1.27) (n = 90) days a week. The majority of the homes in Duka Bay (82.2%, n = 74) fished seven days a week during good weather. During the Northeast Monsoon fishing trips were reduced to an average of 4.86 (SD = 1.86, n = 7) days a week, and to an average of 5.14 (SD = 1.68, n = 7) days a week during the Southwest Monsoon.

Table 21. Fish targeted by fishermen from Duka Bay.

What is the type of fish you target?		
	N	Percent of Responses
Bigeye Scad (<i>Selar</i>)	12	13.5%
Invertebrates	2	2.2%
Groupers (<i>Epinephelinae</i>)	35	39.3%
Sardines(<i>Clupeidae</i>)	40	44.9%
Tuna (<i>Thunnini</i>)	5	5.6%
Flying fish (<i>Exocoetidae</i>)	6	6.7%
Total	100	112.4%

In good weather the estimated volume of food caught during one week in Duka Bay was on average 44.32 (SD = 30.35, n = 90) kilos of seafood. During the Northeast Monsoon, the volume of catch was reduced to 33.71 (SD = 32.61, n = 7) kilos and to an average of 35.86 (SD = 32.17, n = 7) kilos during the Southwest Monsoon. The food caught by fishermen was mainly used for family consumption, on average 58.42% (SD = 36.72, n = 88). Less than half of the food caught in Duka Bay was sold or bartered to a middleman: on average 41.58% (SD = 36.72, n = 88).

Perceptions regarding the marine resources

The condition of the marine resources five years ago was asked of the respondents in Duka Bay. Respondents were asked how they perceived the quantity of fish and the health of the coral reefs five years ago. Respondents reported that the quantity of fish available was “a lot less” (52.9%, n = 64) five years ago (Figure 30). A few respondents from Duka Bay felt that fish quantity was higher five years ago, albeit only 2.5% (n = 3) of respondents. Coral was perceived to be less healthy, or not different, to five years ago (28.1%, n = 34 and 27.3%, n = 33 respectively) in roughly half the sample. However, a

little more than half of the respondents felt their coral reefs were currently healthy (58.7%; n = 88), with 41.3% (n = 62) stating that coral wasn't currently healthy.

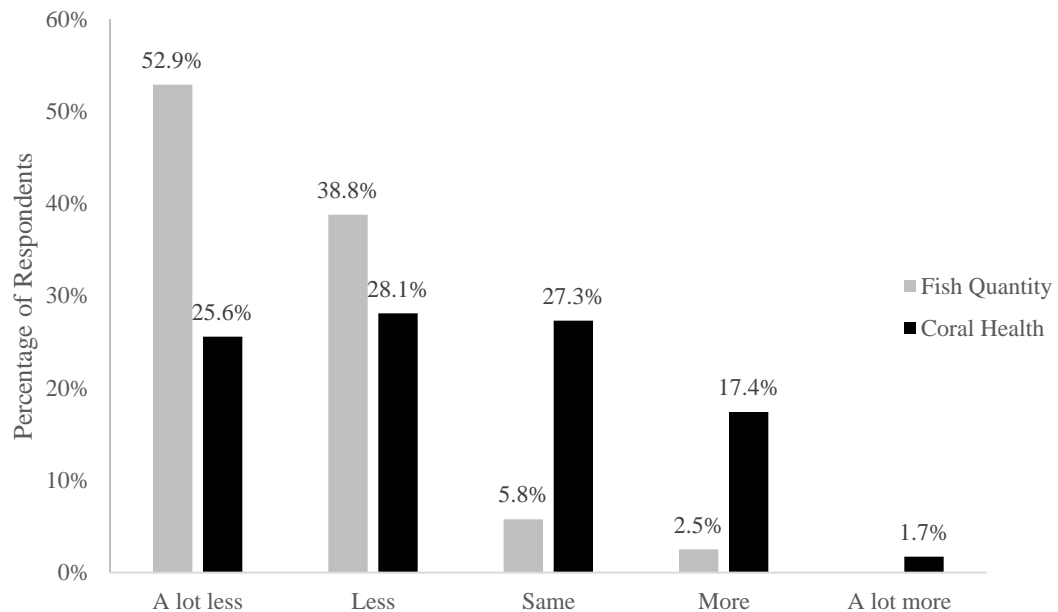


Figure 30. Perception of fish quantity and coral reef health five years ago in the community of Duka Bay. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis (n = 121).

Perceptions regarding MPA

Respondents were aware of the MPA in their community only 2% (n = 3) were not aware of the MPA. The MPA was perceived as having both biological and social improvements, with 59.0% (n = 69) “agreeing” with the statement that the quality of the coral reefs have improved since the MPA (Figure 31). Respondents did not perceive that fish catch was increasing, with 70.9% (n = 83) of the respondents “disagreeing” that fish catch has increased since the inception of the MPA. There were perceived social

improvements with (56.4%, n = 66) of the respondents "strongly agreeing" that since the MPA there have been more tourists visiting their community.

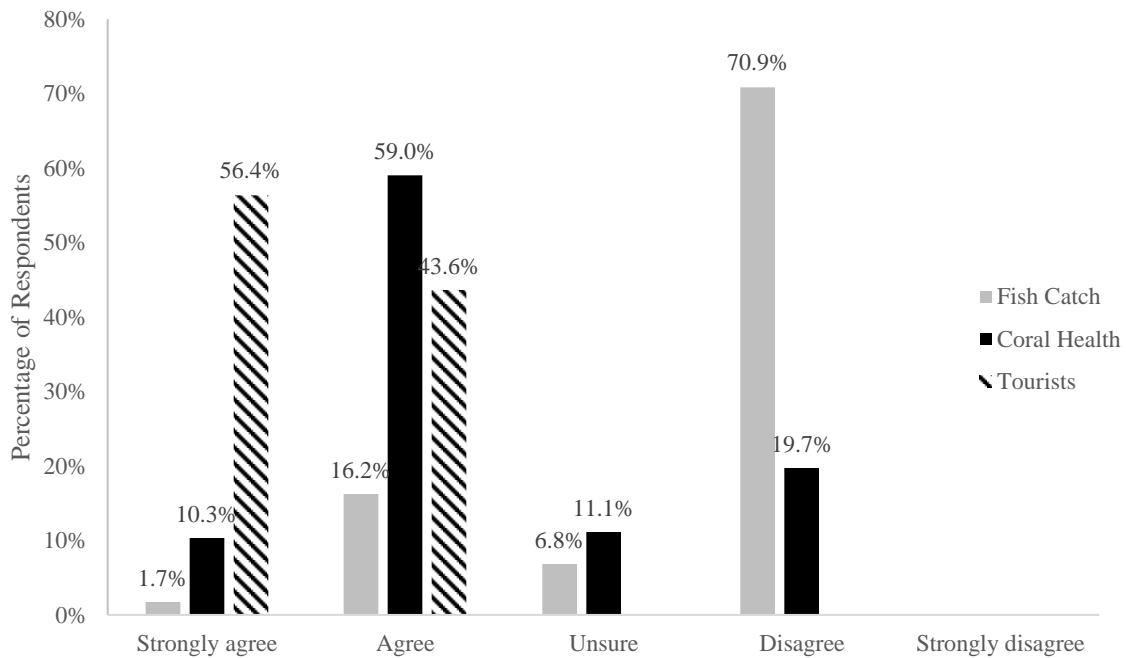


Figure 31. Perception of increased: fish catch, coral reef health, and tourists after the MPA had been established in the community of Duka Bay. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis (n = 120).

Positive biological impacts have been observed by the community in Duka Bay regarding the MPA (Table 22). Increased fish size was seen as an important biological effect (56.50%) from the respondents as well as the MPA stopping habitat destruction (52.4%).

Table 22. Duka Bay respondent's perception of the biological factors associated with the MPA.

Which of the following has the MPA had an impact in your community?		
	N	Percent of Responses
Increased fish abundance	78	53.10%
Increased fish size	83	56.50%
Stopped habitat destruction	77	52.40%
Brought fish species back	37	25.20%
Moved fish closer	38	25.90%
Improved coral health	60	40.80%
None	44	29.90%
Total	417	283.70%

The community in Duka Bay perceived both positive and negative social impacts regarding the MPA. (Table 23). Positive benefits included conserving resources for future generations, noted by 68.0% of the respondents. Also, 46.3% of the households in Duka Bay believed the MPA has helped remove destructive fishing gear practices. Negative social impacts observed by the community was the MPA not prohibiting outsiders (1.4%), nor improving equity.

Table 23. Perception of the social benefits the MPA has provided to the community of Duka Bay (n = 147).

Which of the following benefits has the MPA provided to your community?		
	N	Percent of Responses
Improved fish catch	17	11.6%
Excludes outsiders	2	1.4%
Removed bad gear/practices	68	46.3%
Conserves resources for future generations	100	68.0%
Reduces conflicts	21	14.30%
Improves livelihoods	22	15.0%
Provides educational opportunities	18	12.20%
Improves equity	0	0%
None	43	29.3%
Total	291	198.0%

Overall the community of Duka Bay perceived the MPA to be positive, with 45.6% (n = 67) of the households saying that it has been “slightly good” (Figure 32). However, there were some negative views of the MPA: 27.9% (n = 41) said that the MPA had been “slightly bad” and 8.8% perceived it as “very bad”.

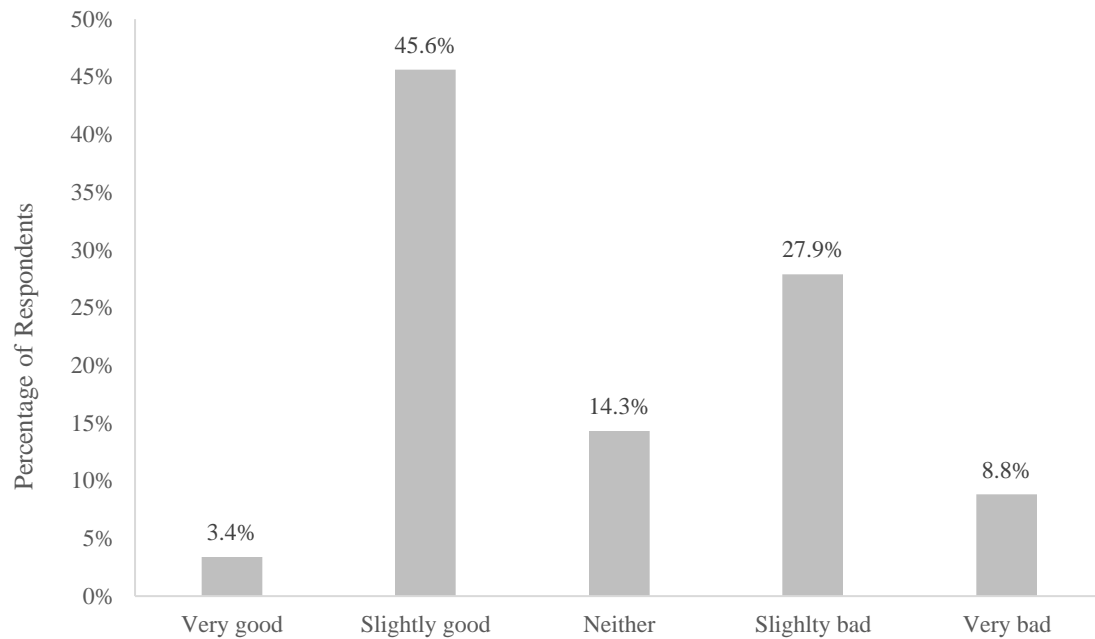


Figure 32. The overall perception of the MPA in the community of Duka Bay (n = 147).

MPA Community Participation

A majority of the respondents had wanted the MPA in their community (74.4%), and more than half of the respondents (55.4%) were aware of community meetings regarding MPA establishment (Table 24). The government and or NGO was perceived by most respondents as being involved in the planning process. Participation in environmental educational programs before MPA establishment was reported by a little less than half of the respondents (45.8%).

Table 24. Duka Bay’s households responses to MPA community participation questions. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis).

Question	%Response		
	Yes	No	Don’t know
Before the MPA was established were there meetings in your community regarding its establishment?	55.4% (n = 67)	35.5% (n = 43)	6.6% (n = 8)
Did you want the MPA established in your community?	74.4% (n = 90)	23.0% (n = 23)	4.1% (n = 5)
Was the local/provincial/national government/or NGO involved in the MPA establishment in your community?	76.9% (n = 93)	16.5% (n = 20)	4.1% (n = 5)
Before the MPA was established did you or your family members participate in any environmental education programs?	45.8% (n = 54)	54.2% (n = 64)	-

Enforcement and Conflicts

As for illegal fishing, a little less than half Duka Bay respondents (46.0%, n = 70) said that they did not think that illegal fishing took place in their community. But just over half (53.3%; n = 80) stated that it did. Respondents that answered “yes” to illegal fishing identified large-scale fishing (40.2%, n = 33) and a combination of large-scale fishing and compressor use (23.2%, n = 19) as the problem activities (Figure 33).

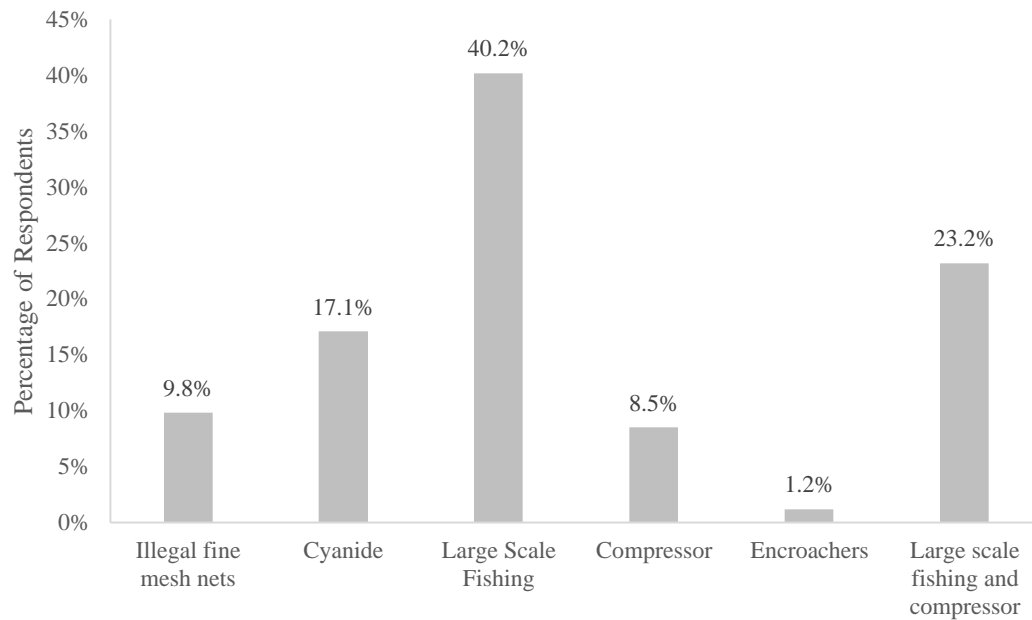


Figure 33. Percentage of type of illegal fishing that Duka Bay respondents identified in their community (n = 82).

Concerning the government being actively involved, most households in Duka Bay felt that the Government was “somewhat” involved in their community’s MPA. A total of 43.5% (n = 64) of the respondents agreed that the Government was involved, but 19.7% (n = 29) of the respondents the government wasn’t actively involved (Figure 34).

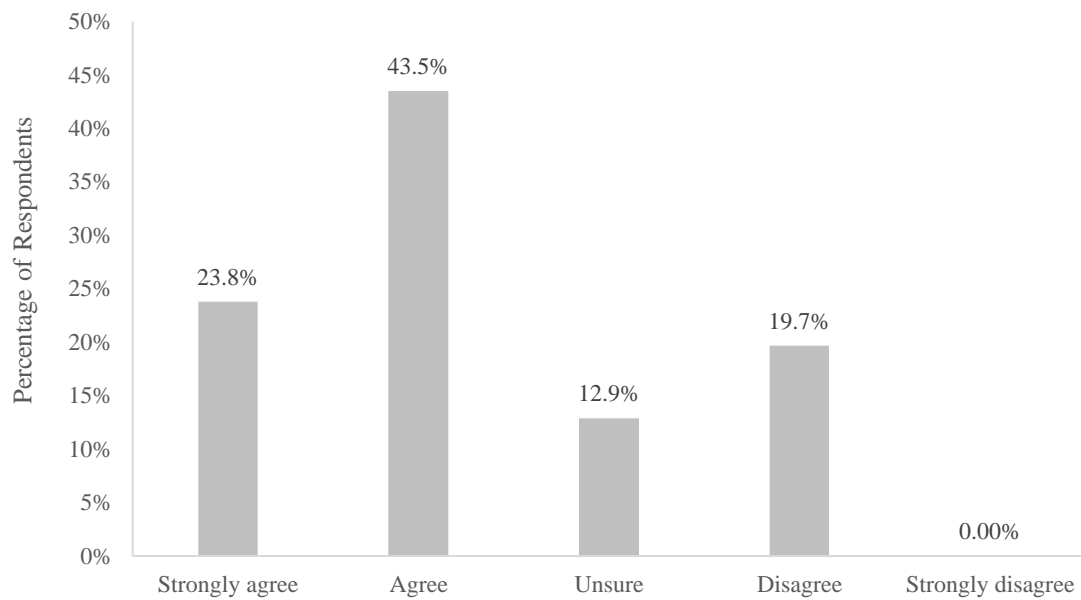


Figure 34. Perception of Duka Bay respondents on the government's involvement in their MPA (n = 147).

The respondents were asked about specific problems with the MPA, 49.0% of the respondents felt that one of the problems with the MPA is that it "erodes traditional authority" (Table 25). Also, 43.50% of the households felt that MPA "causes conflicts." Funding did not appear to be an issue with the MPA in Duka Bay with only 0.7% of the respondents answered that "no funding" as a problem with the MPA.

Table 25. Duka Bay household responses to the question regarding problems with their MPA. The total number of responses and number of cases is presented.

What are some of the problems with the MPA?		
	N	Percent of Responses
Too many regulations	13	8.80%
Regulations not well enforced	16	10.90%
Reduced catch	17	11.60%
Causes conflicts	64	43.50%
Erodes traditional authority	72	49.00%
Creates inequity	44	29.90%
No funding	1	.70%
No problems	24	16.30%
Total	251	170.70%

Empowerment

The respondents of Duka Bay were not involved much in the decision-making in their community (Table 26). To the question "if there is a decision in your community are you involved in the decision" only 0.7% of the respondents answered "yes." A majority of the households (77.7%) stated that they were "not" involved in marine resource use decisions in their community. More than half of the respondents (65.5%) did not belong to people's organization/union/groups in their community.

Table 26. Duka Bay's respondent's answers to questions about empowerment in their community.

Question	% Responses	
	Yes	No
If there is a decision to be made in your community, are you involved in that decision?	0.70% (n = 1)	99.3% (n = 148)
Are you involved in the decisions made about marine resource use or management in your community?	22.3% (n = 44)	77.7% (n = 115)
Do you belong to any people's organization groups?	34.5% (n = 51)	65.5% (n = 97)

The people's organization that the 51 respondents belong to was a fisherfolk association. Respondents who belonged to people's organization group all had attended six meetings (n = 50) in the last six months. A majority of the respondents reported to attending "all" (63.0%, n = 29) or "most" (34.8%, n = 16) of the meetings (Figure 35).

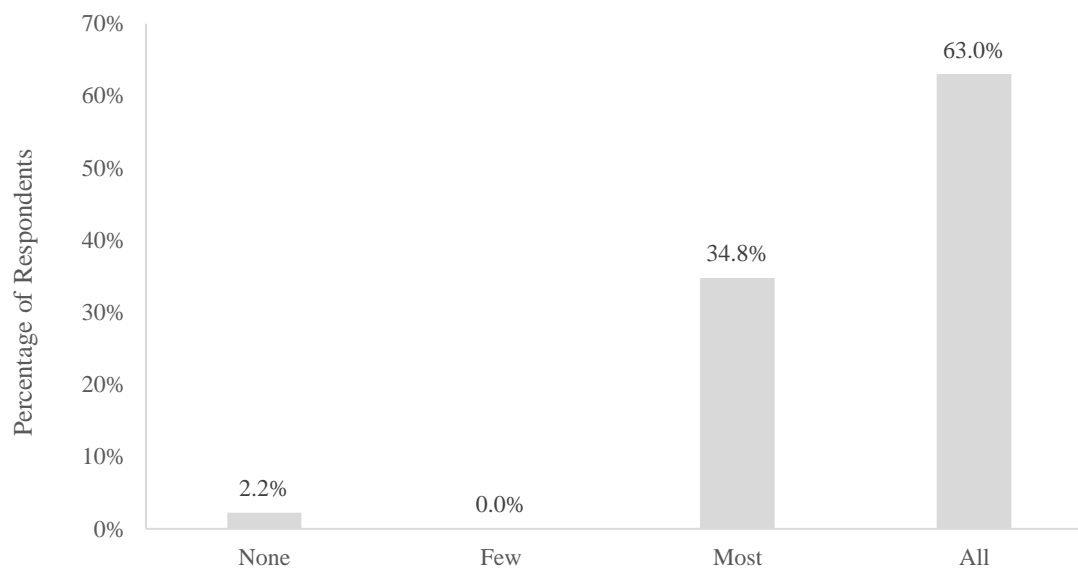


Figure 35. The number of people's organization group meetings the respondents from Duka Bay attended (n = 45).

Qualitative Results

A total of ten key informant interviews were conducted in the Municipal office of Medina, village of Duka, and at Duka Bay Resort between May 7, 2012, and May 10, 2012. Five of the key informants were elected and appointed people in the LGU. Two informants were *barangay captains* (village leaders) of Duka Bay. One of the informants was a Deputized Fish Warden. Two of the informants were working at Duka Bay Resort; one was a manager, and the other was a dive guide. The interviews lasted between 30 and 60 minutes, and the gender ratio was 4 females/ 16 males. The relevant themes were then coded into NVivo qualitative research software and scanned for repeated codes or lack of any codes.

The results from the key informant interviews were separated into three periods: before the MPA; during the MPA establishment; and currently impacting the MPA. The themes will be discussed in each appropriate timeframe.

Before the MPA

Several informants recalled how flourishing the marine environment of Duka was many decades ago. The informants spoke of how the corals were healthy and there was an abundance of marine life. The barangay captain spoke of this once healthy reef by saying that:

When you compare the situation of our seas before and now, the change is really big. Decades ago, most of the intertidal zones are filled with corals of varying sizes—hard and soft corals—you would just expect that the fishes were all over them.

A tourism officer also spoke of Duka's healthy reef where there was an abundance of marine life, saying:

Like most of the areas here, the shores in the past decades boasted an abundance marine life. The people, fishermen or not, has greatly benefitted from it. Because of that, the price of the fishes was also so affordable that we could manage to fill our heart's desire of marine food morning until evening.

In the late 1970s and 1980s, illegal and destructive fishing practices, such as dynamite and fishing with poison, became commonplace in the Philippines – including Duka Bay. Many informants discussed how these practices began to impact the marine ecosystem of Duka negatively. The Agriculture Technologist spoke of this change when they recounted:

Before, the fishes were really abundant. So, we did not really have a problem in affording to eat that. But when the illegal fishing methods, were introduced, things had become different.

A manager at Duka Bay Resort spoke of the dynamite fishing occurring in the area by saying that:

Before, dynamite was being used here. At that time, the 1950s – 1960s, the dynamite fishing was rampant. When my aunt became a mayor, she ordered to sanction all the people who do dynamite fishing. So at that time, the corals were able to recover, but the destructive fishing method continued... destroying some corals, spearing. This destroys the corals... spear fishing.

Other informants spoke of the poison fishing, both cyanide and *lagtang*, in which poison is extracted from a tree bark and then added to water, to easily collect fish. The tourism officer described cyanide fishing as well as another method of illegal fishing, muro-ami, when they said:

Fisherfolks contain cyanide in ketchup bottles and attempt to poison the fishes resting inside the reefs. Though milder, the Muro-ami practice is still a deliberate form of destruction wherein stones are wrapped inside cellophanes and are used to pound the seafloor to disturb the fish and scare them towards the nets. There was even a form of makeshift explosive using coconut husks before; even the shockwaves could agitate the fishes.

During MPA Establishment

To help mitigate the decreasing fish populations and destroyed reef, Duka Bay Marine Sanctuary was established in 1998. The fisherfolk in Duka Bay were very much against the MPA because of the loss of fishing grounds. The Chairman of the Agriculture and Aquatic Resources commented on the fisherfolk resistance when they said:

Yes, there is really conflict. Of course, the people reacted negatively. They were mad and against the establishment of the MPA. Their point was that, that is the

sea but then we don't allow them to fish in a certain area. There are really complaints and rumors.

The resistance from some of the fishermen was described as very hostile. The Tourism Officer who helped in the establishment of the MPA was met with a lot of resistance from the fisherman. They spoke of this resistance when they recounted:

All of the coastal areas in Medina were against this. Even the mayor was against it because the people were under his protection. We [LGU] even received death threats. Truth be told, I was even stabbed on my gut once [by a fisherman].

A barangay captain discussed why the people and even him were so against in the MPA. They said:

Even I was against on this before I became an official. The main argument was because of the Duka Bay fishing area. So limited was our fishing ground that it was difficult for us to succumb to their agenda. Right now, the MPA covered majority of the sea lot in Duka so the fishermen would not [be happy] with a small portion on the outskirts of the MPA.

To gain acceptance from the fishermen in Duka, educational programs regarding the purpose of the MPA and how it could benefit their community, were conducted.

Other representatives from the Local Government Unit (LGU), such as Department of Environmental and Natural Resources (DENR) helped with some of the information educational programs. A manager at Duka Bay Resort spoke of this processes when they said:

We also invited the DENR to explain to them [fisherman]. We had barangay assemblies and our personnel explained to the fishermen the advantages of having a protected area. We explained that there will be an increase of fish catch. If we will not enable them to catch fish inside the 30 hectares, there will be an increase in fish population and the fishes will go outside the area, these fishes can be caught by them.

In order to cope with the fisher folk's extreme resistance, two informants noted how they turned to the children of the fisherfolk to gain their trust, and then parents began to listen. The Tourism Officer spoke of this moment when they said:

We had heated debates for many years with the people. They couldn't really understand the situation here. What we did is to befriend the kids and gave them candies wherever we went. By that, the parents had no choice but to make peace with us.

The manager at Duka Bay Resort also discussed how they befriended the fishermen's children, saying:

There was a violent reaction. But what we did was, those employees, who are being hated by the people, befriended the children in the community. They give candies and chocolates to the children. So instead of their father will punch our employers, they can't do that anymore because their sons and daughters are already friends with the employees.

Despite the educational seminars, informational drives in Duka many fisherfolks were still against the MPA, but once it was established, via a Municipal Ordinance, many felt there is nothing they can do about it. The barangay captain spoke of this fisherfolk's feelings in regards to the MPA, saying that:

A lot are against the establishment but we can do nothing on it, so we are just up to complaining. We can't do anything else. It's already there, so we are already used to it. The people in the community don't like the MPA. They are against it.

Currently Impacting the MPA

The government supports the MPA by providing buoys to mark the MPA, as well as supporting deputized fish wardens (DFWs), but they do not provide a salary for them.

The government is not really involved in the daily operations of the MPA - the responsibility of managing is primarily done by Duka Bay Resort and DFWs. The tourism services officer discussed the government's involvement and role in the MPA when they said:

The government, on the other hand, has little involvement in the [daily] operations. But we were responsible in placing buoys to outline the area. We are the ones in charge in guarding the place 24/7 and are the ones responsible in penalizing illegal fishermen and encroachers.

The Duka Bay Resort Manager also commented on the LGU's and DFW's involvement in the MPA, by saying that:

We are closely coordinating with the government. The mayor in Medina is very supportive with our projects because he is also an environmentalist. We have a harmonious relationship with the LGU. Because we had one common goal, to protect the area and to expand and enhance the corals. The government is supporting with regards to personnel ...the Medina Association of Fishermen... They guard the area.

As stated earlier the DFWs are the individuals responsible for guarding the MPA. They must patrol the area 24 hours a day, which is difficult considering they are not given a salary, and their boats are sometimes inadequate. One DFW from Duka discussed the specifics of his job, they told me:

My role is to protect because if we will not protect and guard the area, the fishermen can get in and get fish inside the area. It might be that some of their ways of fishing might destroy the marine life... so it is essential for us to guard. We monitor it every day. We don't have honorariums. We monitor the area everyday but we don't have honorariums here.

Several informants realize the difficulty in patrolling the area for the DFWs, especially at night when the MPA often gets poached. A Dive Master and guard also commented on the challenges of guarding at night, when they said:

Honestly, we cannot guard this entire huge area all the time. If we sleep, there is no one who will guard the area. That's when stealing happens.

The Municipal Tourism Officer also spoke of this problem by saying that:

It's quite difficult to keep a lookout in the evening. To warn them, we fire warning shots. They attempt to blotter but to no avail because the police authority knows that we are on the right side. Sometimes, it really becomes frustrating when the place that you have protected so zealously is easily trespassed.

Frequently, the fishermen that are still using illegal fishing methods are not from Median. Encroaching fishermen remains one of the biggest problems for the community of Duka. The Agricultural Technologist highlighted this issue when they said:

Just recently, we caught a fishing liner encroaching in our area from Salay and Butuan city. Before, the explosive activities were rampant but now, the main problem would be the illegal fish net size. Also, there would always be encroachers from other places. They say that the fishes flock the Medina Sea so they go here. In their areas, all their fish resource is drastically diminished because of overfishing. In Medina, local fishermen cannot really compete with them because their fishing equipment is not as advanced as that of the latter. The fishermen are from: Magsaysay, Butuan, Agusan and Sta. Cruz.

Aside from the specific issues of guarding and encroaching fishermen there appears to be some resentment with the community with Duka Bay Resort. The Municipal Tourism Officer discussed this issue when they said:

The people now complain that the Duka Bay Resort is monopolizing the use of the MPA. They [Duka Bay Resort] let in tourists to snorkel, dive and do water sports in its vicinity. But when locals would try to fish on or near the area, the management would drive them away. Truth be told, Duka Bay Resort has become famous because of this [MPA] so they have really benefited from this.

Despite fishermen still being against the MPA, there were attempts to have another MPA in the area: a MPA that would belong to the community and not a resort.

The plan for establishment was stopped temporarily because of concern of what effect this may have on fishermen, i.e., losing more fishing grounds. The barangay captain spoke of this plan by saying that:

There was a plan before in Barangay Bulua but it was not pursued because of the relatively small sea lot allocated to Medina. If we would do so, the remaining area could not sustain the huge number of men who only depend on the sea for a living. So, I don't think that there'd be another one.

Contrastingly, the Chairman on Agriculture and Aquatic Resources still would like to establish more MPAs in Medina, they said:

We want to expand the MPA... especially right now that we are being challenged by the global warming. We want to preserve the riches we have in the sea... within the municipality.

Overall the Duka Bay Marine Sanctuary has provided both biological and social improvements. The coral restoration project has proven successful in Duka Bay, and many informants talked about the success of the project especially on Duka's coral reef.

An Agricultural Technologist discussed the coral restoration project when they stated:

Mr. Lemuel Alfeche; he's a marine biologist. He pioneered the idea of coral transplantation here in Medina, and by far, it has proven to be quite effective. So far, the LGU and Duka Bay is one for this project.

Increases in the volume and diversity of fish since the MPA was established in Duka were discussed by several informants. The Agricultural Technologist mentioned the biological improvements from the MPA when they said:

Unlike before that the coral area is largely disturbed, the variety and the health of the fishes and the corals have greatly improved now.

The Duka Bay Resort Manager also commented on the biological improvement in Duka by saying:

For so many years, we observed a volume of fish increased. Just four years ago, whale shark reached our area. If whale shark reaches your area, it means your ecological balance has already recovered, because there are already a lot of planktons

Aside from biological improvements, there has also been improvements to the tourism industry in Duka. The DFW mentioned the increases in tourists when they said:

[Increased number of tourists] especially divers because we have three dive sites here. There are also many foreigners who visit here.

An agricultural technologist also commented on tourism:

There are really many tourists there. There would even be times when they become fully-booked. One of the main attractions would still be the artificial corals planted in there.

Discussion

Livelihood Options

The respondents of Duka Bay are dependent on the marine resources for their livelihood with more than half of the respondents (59.33%) indicating fishing as their primary livelihood. Therefore, fishery management regulations and tools could have a direct impact on people's livelihoods. Respondents from Duka Bay did have a negative perception of the MPA impacting their livelihood: with 45.2% of the respondents saying that the MPA was either “slightly negative” or “very negative” to their livelihood. In the creation of protected areas, fishing grounds will be lost, and this can lead to a reduction in

catch and to compensate for a lower fish catch, fishers will increase fishing effort elsewhere. One way to compensate for the loss of fishing grounds reported in several studies is to offer alternative livelihoods (Pollnac et al. 2001; Fox et al. 2012).

Alternative livelihoods can not only help with the loss of critical fishing grounds but also to aid in garnering positive perceptions regarding the MPA (Pollnac et al. 2001). In Duka Bay, no respondents reported an increase in alternative livelihood opportunities as a result of the MPA being established, regardless of whether they were opportunities to provide either food or income to the family. The only job that was mentioned in the qualitative research was *bantay dagat* (MPA guards) but they receive no salary only patrol expenses. This result is unexpected because, in the establishment of the MPA, one of the additional projects for the MPA was the creation of livelihoods for the community of Duka.

Perceptions regarding marine resources and MPA

Fish quantity and coral health were believed to be lower five years ago by most respondents. But when asked about the current health of their coral reef, 41.3% of the respondents thought that it was not healthy, despite the several interviewees mentioning how healthy the reef had become after the coral restoration project in Duka Bay.

Overall biological improvements were perceived by the residents of Duka Bay but mainly with the health of the coral reef and not in the improvement of fish catches. Respondents (67.3%) disagreed with the statement that fish catch has increased since the MPA. Qualitative research results indicated a different perception with several

informants mentioning an increase not only in the abundance of fish but also in fish diversity because of the MPA. When asked about specific biological goals of the MPAs, household surveys revealed that the most important biological impact the MPA provided was increase of the fish size (56.5%) or fish abundance (53.1%). Improved coral health was the fourth most important biological effect of the MPA, which was different when respondents were asked about the overall fish and coral health after the MPA had been established. Coral health was mentioned several times in interviews as improving because of the ongoing coral restoration project in Duka Bay. Many informants were proud of the coral transplantation project and believed it had direct impacts on improving the overall coral reef health of Duka Bay. Research on the social impact of the coral restoration project by Alfeche et al. (2006) indicated that the community was skeptical at first, but when they saw improvements in coral health and increases in fish diversity and abundance, they became convinced that there were conservation benefits to such projects.

The major social improvements observed after the establishment of the MPA were an increase in tourists visiting their area, and this was also reflected in the interviews. Many informants mentioned an increased presence of tourists visiting the Medina, and this was mainly to visit Duka Bay Resort and dive in three reefs areas, including Duka Bay MPA. Informants indicated that what drew the tourists to Duka Bay was the coral transplantation project. Arias et al.'s (2015) study found that increased levels of tourism in MPA communities in Costa Rica had a positive relationship with perceived fisher's compliance. Increases in tourism levels can also help in providing

alternative livelihoods for the community but these benefits have yet to be circumstance in Duka Bay (Arias et al. 2015).

Other social benefits the MPA provided to the community were that it “conserves [marine resources] for future generations” (68.0%) and that it “removed bad gear practices” (46.3%). These results are consistent with qualitative research where many interviews discussed how rampant dynamite and poison fishing was in their community and how the MPA has helped curb some of those practices.

Overall, the respondents felt the MPA was positive for their community (45.6%), but there is concern regarding the 36.7% that said the MPA was “slightly bad” and “very bad” for their community. Studies have indicated that education, age, occupation, area of residence, and gender can influence perceptions of the environment (Pollnac et al. 2001; Thomassin et al. 2010). However, in Duka Bay gender, education, age, and occupation did not vary in respondents MPA perception scale.

Community participation

The study found that respondents did appear to be generally involved in the MPA establishment process. Himes (2007) and Charles and Wilson (2008) determined that involvement of the community at the beginning stages of a conservation project is essential because it can lead to greater acceptance of the project but also lead to better compliance. A majority of the respondents (57.8%) were aware of community meetings regarding the MPA establishment. A little less than half of the respondents (46.9%) reported participating in environmental education programs before the MPA. Interviews

also mentioned how there were numerous *barangay* assemblies and educational seminars that informed the residents about what benefits the MPA would provide to the community. Collectively when the majority of respondents report awareness and involvement in environmental education programs before the MPA typically indicates an effective MPA establishment program.

In addition to resident community involvement, it is also important to have a government, NGO or academic participation in the MPA planning, establishment, and ongoing support of the MPA. A majority of the respondents (78.9%), said that the Government and NGOs were involved in the establishment of the MPA in Duka. Respondents also felt this government involvement continued after the MPA was established with (67.3%) “agreeing” or “strongly agreeing” that the government is actively involved in the MPA. Governments’ involvement is crucial for making violators accountable and punishable by law and to aid in potential conflict between stakeholders (discussed below). Participation from the government in the decision-making of the MPA was found to lead to better community compliance with rules governing several MPA’s in Costa Rica (Arias et al. 2015), and similar findings would be expected in the Philippines, although this was not researched in this study. Also, governmental and NGO support is critical for absorbing the financial costs of maintaining, enforcing and conducting assessments of the MPA. However, the government in Medina has little financial involvement in Duka Bay MPA. The Government did provide buoys for marking the MPA boundaries and provides personnel for guarding the MPA through the Medina Association of Fisherman, but critically, no funding in terms of salary or patrol

boats is provided for the fish wardens. A majority of the daily operations including managing the patrolling of the MPA is left up to the Duka Bay Resort.

Enforcement

The results from this study regarding enforcement indicated that respondents had a split opinion regarding illegal fishing with 53.3% of respondents believing that illegal fishing took place in their community. For respondents that did report illegal fishing was still happening in their community, the most common type of illegal fishing was large fishing vessels encroaching in the municipal waters. Large-scale fishing in municipal waters is illegal, according to the 1998 Philippines Fisheries Code (in Section 89 and 90 of the Code) and it has been a difficult for a majority of the municipalities in the Philippines to curb this (Fisheries and Aquaculture Country Profiles Philippines 2014). Respondents, as well those interviewed, commented on illegal compressor fishing - which was usually done by fisherman from other Municipalities in Misamis Oriental. Compressors are often associated with cyanide fishing in the Philippines, thus explaining why it is illegal. Illegal fishing continues to remain a problem in Southeast Asia. A recent study by Petrossian (2015) documented that Southeast Asia has some of the highest degrees of illegal fishing in the world, and that is partly attributed to the large number of commercially attractive fish species available in the waters. Illegal fishing, in Duka Bay, will continue to be a problem, as long as resources for fishery monitoring and patrolling are limited and the demand for certain fish species remains high.

Walmsley and White (2003) found that good enforcement was the best indicator of MPA effectiveness when evaluating increases in fish abundance and diversity. Results

from the survey 35.6% of respondents feel that the MPA is "not well enforced."

Qualitative research indicated that there are problems with enforcement of the MPA - particularly at night. The deputized fish wardens (DFWs) revealed how they are they not paid a salary, so financially it is not feasible for them to always guard the area 24 hours a day. This lack of 24 hour patrolling can have serious implications, not only for the ecological performance of the MPA but also on the social success, in terms of eroding community participation and support of the MPA. Additionally, as noted above, a lack of patrolling can also exacerbate the problem and incidences of illegal fishing.

Other problems associated with enforcement in this study were that respondents felt the MPAs "erodes traditional authority." In developing countries such as the Philippines, there is a long history of traditional authority and customary management where members of the community may limit fishing in specific areas, time frames, gear used, who is permitted to fish, or prevention of certain species from being harvested (Cinner & Aswani 2007). Aswani and Furusawa's (2007) study found fish diversity and biomass of fish to be increasing inside MPAs that used a combination of modern MPA management approaches and customary management (Aswani & Furusawa 2007). Also, it has been documented that when customary management in a MPA community has been eroded, there was a decrease in marine productivity (Cinner & Aswani 2007). Therefore, it is important that customary management and traditional authority be integrated into the modern management of MPAs.

Conflict

As stated earlier, when a MPA is established fisherfolk will lose critical fishing grounds, and this can result in conflict between the fishing community and MPA managers. To prevent resources user conflict Pomeroy et al. (2006) concluded that it is essential for the community to understand the purpose of the MPA, and the rules and laws that govern the MPA. In this study, there was concern from respondent's surveys (43.50%) and interviews that Duka Bay MPA "causes conflict." Interviews highlighted a major and very hostile conflict between the MPA managers and fisherfolk. The Municipal government tried to deal with the conflict through *barangay* assemblies and educational seminars; but conflict persisted. Ultimately, the Local Government Unit (LGU) and resort managers reached out to the fisher folk's children. They gained the children's trust by giving them incentives, and in turn depressed the hostility of their (fisherfolk) parents toward the local government. Community acceptance and support did not appear to develop in Duka Bay, as revealed in the qualitative research, when several informants discussed how many fishermen still having feelings of resentment towards the MPA.

Empowerment

One way in which empowerment from an MPA can begin is with environmental educational programs that foster ideas of conservation and the willingness to save resources for future generations. A little less than half of the respondents or their family members participated in environmental educational. Some respondents (34.5%) were involved in people's organization groups, and this group was a fisherfolk association,

which existed before the MPA was established. Therefore, this indicates little empowerment from the environmental education programs initiated with Duka Bay's MPA. Empowering a community, by making them feel they are genuinely involved in the exchange of ideas and information, enabled stakeholders in a Marine Park in Portugal "to move from being part of the problem to part of the solution" (Vasconcelos et al. 2013, p. 52). Future efforts in Duka Bay need to be made by MPA managers to involve the community and get them feel as though their contributions matter.

The results from this study also indicated that the respondents from Duka Bay were not participating in any decision-making in their community (99.3%) which does not lead to empowerment. Aside from empowerment, this lack of involvement from the community in decision-making could be detrimental to the continued success of Duka Bay's MPA because stakeholders need to feel they have a voice in the rules governing an MPA. Pomeroy et al. (2006) discusses how stakeholder policy preferences can vary significantly between individuals and social groups and, therefore, each voice must be heard when making decisions that will impact the community. Qualitative research also indicated how the fisherfolk do not feel that they are, or were, involved in the decision-making of the MPA: a *barangay captain* discussed how there is already a Municipal Ordinance passed for the MPA so there is nothing the community can do about it. Additional interviews revealed a potential problem between the Duka Bay Resort managing the MPA and the community. The community, especially fisherfolk, saw the MPA as benefiting only Duka Bay Resort, and not the people. The lack of involvement

and persistent resentment from fisherfolk in the decision-making processes can lead to problems with enforcement, lack of compliance, and erode support of the MPA.

Overall, the findings from this research indicate that Duka Bay respondents have a somewhat positive opinion regarding the MPA. The Government of Medina initially was very involved in the establishment of the MPA, but after the MPA was established, the daily management was via Duka Bay Resort. Initially, and even now, there is a lack of community support for the MPA because it is viewed as a private MPA that only benefits the resort. Problems of poaching during night and encroachment from large fishing vessels still exist, and this may have serious implications for continued biological improvements for the MPA. Recommendations for improving the management of Duka Bay MPA based on the surveys and interviews from this study are:

- Efforts should be made to increase the Government's participation in the MPA - in both daily operations and compliance matters.
- More educational seminars should be held. Also, open forums should be offered to the community by the Local Government, with these being supported by Duka Bay Resort, NGOs and academic institutions.
- These public forums could be used as a platform to increase stakeholder involvement in the MPA management decisions. The community needs to feel that they are genuinely involved in the exchange of ideas and decisions regarding the MPA. This will empower the community, and hopefully promote MPA support and "buy-in."

- Develop viable alternative livelihoods by focusing on the tourism industry of Duka Bay. It is important to ensure that stakeholders, especially the fishermen, can receive the benefits from increased tourism in their community.
- Improve patrolling and monitoring of the MPA, through increased support by the Government, notably by giving the Deputized Fish Wardens (DFWs) salaries such that they can provide 24 hour guarding. The Government should also provide some aid with the help of Duka Bay resort for additional patrol boats and sufficient funds for fuel.
- Continue to monitor the social factors and perceptions of stakeholders, local Government and the private resort workers is required, as well as routine ecological monitoring of Duka Bay, to ensure the effectiveness of this private MPA.

CHAPTER SIX: A COMPARISON OF THE SOCIAL FACTORS, ATTITUDES AND PERCEPTIONS OF RESIDENTS FROM PHILIPPINE MARINE PROTECTED AREAS AND A NON-MARINE PROTECTED AREA IN MISAMIS ORIENTAL, PHILIPPINES

Abstract

Misamis Oriental is a Province located in Northern Mindanao, the second largest island of the Philippines. Coral reefs are present along most of the coastline and twenty-one marine protected areas (MPAs) exist. All MPAs have been either established by the local government, international organization or NGO, or by the local community. In 2012, household socio-economic surveys were administered to residents ($N = 599$) in three MPA communities in Misamis Oriental: Tubajon (bottom-up MPA), Agutayan (top-down MPA), and Duka Bay (private MPA) and one non-MPA community: Tagoloan. Household social surveys were conducted to investigate differences in demographics, socio-economics, attitudes and perceptions of residents regarding marine resources and their MPA between the non-MPA community and between MPA sites. This study found that respondents from all sites were similar in all demographic characteristics except Duka Bay respondents, which were found to have a significantly higher degree of education. Fishing was the main livelihood for all sites with Tubajon having a significantly higher percentage of fisherman and Duka Bay having a significantly lower percentage of fisherman than the other sites. Differences in Tagoloan (non-MPA site) were homes having a lower degree of modernization and respondents

participating more in community decisions including marine resource decisions than compared to the other sites. Perceptions of coral health were viewed as worse five years in all sites, but significantly lower in Tagoloan (non-MPA site). After the MPAs were established, fish and coral health were considered to be increasing and improving in all sites. Fish catch was perceived to be significantly higher in Tubajon (non-MPA site) after the MPA indicating the MPA is meeting its biological goal of increased fish abundance. Social benefits were observed in all MPAs, but respondents from Duka Bay (private MPA) reported a significantly higher percentage of tourists visiting their community after the MPA was established, which would be expected in a resort area. Perceptions of overall MPA performance were significantly different in sites with Tubajon (bottom up MPA) having a more positive picture of their MPA compared to Agutayan (top down MPA) and Duka Bay (private MPA). Duka Bay respondents had a significantly negative perception of their MPA's overall performance. This could be attributed to the lack of government support and problems with illegal fishing occurring in their MPA. At all sites, new livelihoods created by MPAs were only experienced by zero to a few respondents. Respondents in all MPA sites reported minimal involvement in decision-making in their community, and very few were involved in environmental educational programs that would encourage community involvement. Top-down, bottom-up, and private approaches to MPA management were found to have differing social impacts on the community. Management approaches need to take into account the conservation objectives, location, and social situation of the MPA (i.e. highly dependent fishing community). Recommendations for all sites were the development of MPA-related

livelihoods, holding of open forums to encourage discussion between managers, local government unit, and stakeholders, to help maintain support, encourage compliance and develop a sense of empowerment for community members.

Introduction

To cope with the continued alternation of marine environment because of anthropogenic disturbances, marine protected areas (MPAs) have been implemented to conserve and protect marine habitats, fishery resources, and ecological functions (NRC 2001). Aside from the ecological goals of MPAs there are social goals which include: poverty alleviation by promoting food security through the protection of fisheries; generation of alternative livelihoods; improving environmental awareness and knowledge; and empowering coastal communities (Christie et al. 2003; Gjertsen 2005; Pomeroy et al. 2006; Charles & Wilson 2009). The design and research of MPAs has been primarily focused on the biological goals of MPAs, whereas the investigation of the social goals of MPA has been very limited. In Mascia et al.'s (2010) study of the impact of MPAs on human well-being, it was found food security generally increases after MPA establishment, but some areas may suffer a decline in catch per unit effort. The MPAs may either empower the local community, or disempower, because of a loss of traditional authority regarding marine resource decision-making (Mascia et al. 2010). There can be major livelihood shifts with MPA implementation, especially if they are associated with tourists (Fox et al. 2012). But there is still minimal research and evidence about the magnitude of social impacts, or how they vary across several sites in a region or country, or countries (Mascia et al. 2010; Bennett 2016).

The initial establishment of MPAs is generally the result of one of three circumstances. The first is the establishment by a governing body; this can be from any level of the government, such as the national, provincial, or local government. This is characterized as a “top-down” approach. The second is through the support from international donors and non-governmental organizations (NGOs) (Christie et al. 2003; Lowe 2003). The third is through a local community where possibly local villages or fisherfolk communities initiate the establishment of a MPA. This is characterized as a “bottom-up” approach. Although, some MPAs can be established by a combination of these circumstances, for example, an NGO may conceptualize the idea of the MPA and then present the idea to the fisherfolk communities to implement. A “bottom-up” approach to MPA establishment and management has been seen to be effective in some communities with artisanal fishers (Fargier et al. 2014) who live near the protected areas (Bartlett et al. 2010). A top-down approach can also be effective in open ocean areas where the conservation management objectives are broader (Gaymer et al. 2014).

This research had two major objectives in this chapter are: (1) to provide a comparative study of the social factors of MPAs on communities and to understand how they may vary across a region; and (2) to determine if there are possible differences, or similarities, in a community’s social factors between MPAs established by a “top-down” or a “bottom-up” approach or “private approach”.

This study focused on comparing the social goals of three MPAs, and one non-MPA, in the Philippines. All sites were located in in the administrative jurisdiction of Region X of Northern Mindanao. The three MPAs were:

(1) Tubajon MPA is located in one of the three coastal communities of the Municipality of Laguindingan, Barangay Tubajon. Established in 2002, and covering 22 hectares, the MPA is managed by the Tubajon Coastal Dweller's Association ("bottom-up" approach).

2) Agutayan MPA, is located in the Municipality of Jasaan, in the Barangay Jampason and it's an offshore sandbar that is approximately five kilometers from the coast of Jasaan. Established in 1996, and covering 4.5 hectares, the MPA is managed by the Municipality of Jasaan and the Municipal Agriculture Office ("top-down" approach);

3) Duka Bay Marine Sanctuary, is located in the Municipality of Medina, in the Barangay Duka. Established in 1998, and covering 5 hectares, the MPA is managed by Duka Bay Resort, with some assistance from the Municipality of Medina (a privately managed MPA).

4) The non-MPA site was Baluarte reef in the Municipality of Tagoloan, Barangay Baluarte. Although not an MPA, the site is biologically important nonetheless.

The aim of this research was to compare the demographics, social household socio-economics, marine resource use, marine ecosystem perceptions, community involvement and empowerment in the human communities associated with three MPAs and one non-MPA area to determine if there are differences or similarities between the sites. This was done quantitatively via a household questionnaire survey. Additional, this

research also compared the involvement of respondents in alternative livelihoods, possible conflicts, and perceptions, attitudes and opinions in the three MPA to determine if there are significant differences or similarities that could provide insight in how to improve each MPA separately or collectively. In researching and analyzing how these social factors are negatively, or positively, impacting the residents in each of the areas, the goal is to better understand how to maintain longevity and success of each MPA, whether it be a bottom-up approach, top-down approach, or privately managed; and to provide important knowledge and insight for national and international MPA policies.

Study Sites

MPA Sites

The description of each of the MPA study sites are detailed Chapter 3, Chapter 4, and Chapter 5 of this dissertation (Table 27).

Table 27. A brief description of the three MPA study sites.

Municipality	Jasaan	Medina	Laguindingan
Name	Agutayan Marine Protected Area	Duka Bay Marine Sanctuary	Tubajon Marine Protected Area
Municipality Class	2nd	4 th	4th
Distance to Major City: Cagayan de Oro	36.2km	111.6km	36.2km
Year established	1996	1997	2002
Area (hectares)	4.5	6	22
Prohibition	No-take	No-take	No-take
Managed by	Municipality of Jasaan and Municipal Agriculture office	Local resort owner, Duka Bay Resort	Tubajon Coastal Dwellers Association Inc.
General description	Offshore sandbar 5 kilometers from the coast of Jasaan.	Initially established by the local community but was not well enforced until a local resort became involved.	One of the largest MPAs in the province.

Non-MPA Site

Baluarte Reef

Baluarte reef is located in the Municipality of Tagoloan in the Barangay (village of) Baluarte (Figure 36). The Municipality of Tagoloan is a “first class” municipality⁵ and Barangay Baluarte has an estimated population of 9,306 people (Philippine National Statistics Office 2010). Baluarte Reef serves as one of the three main fishing grounds in the Municipality of Tagoloan. The reefs of Baluarte are shallow and located near an

⁵ Municipalities in the Philippines are divided into six main classes according to average annual income during the last four fiscal years. First class municipalities have obtained average annual income (Php. 55,000,000 or more) (Philippines Statistics Authority 2016).

industrial area (Roa-Quiaoit et al. 2010). In a 2002 assessment of Baluarte's reef, it was documented as having 16% of live coral present, but over 62% of the coral cover was dead (Roa-Quiaoit et al. 2010). Coral reefs in Baluarte continue to suffer from high siltation rates and other pollution problems, but no coastal management plans have been initiated for the municipality (Roa-Quiaoit et al. 2010).

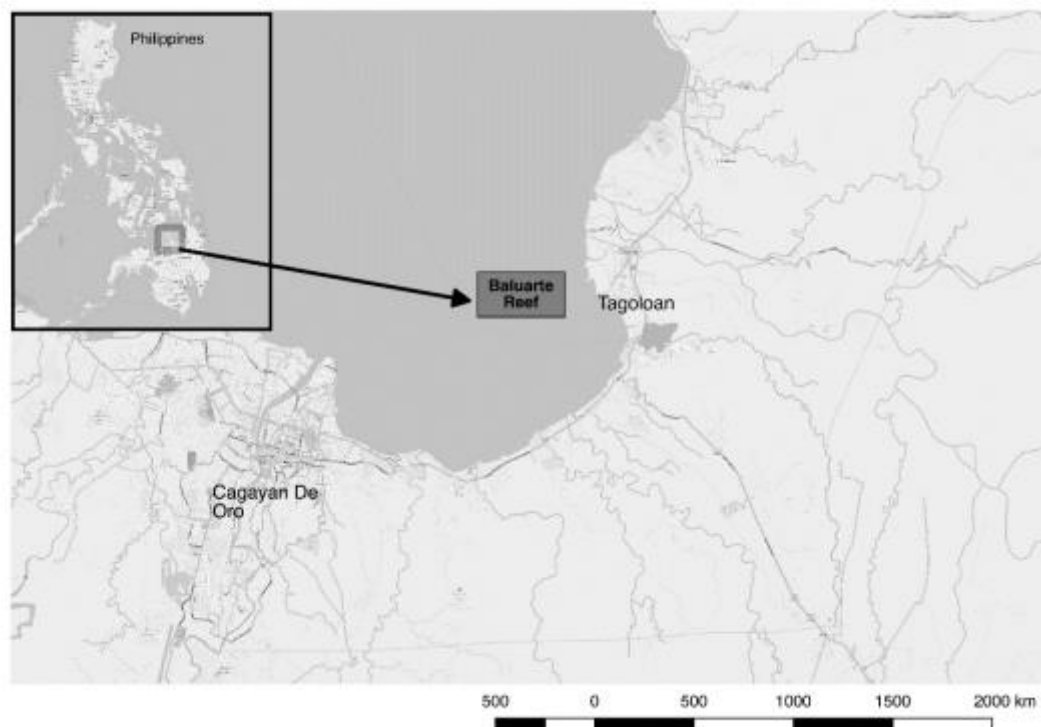


Figure 36. Map of the non- MPA study site, Baluarte Reef located in barangay Baluarte, Municipality of Tagoloan, Philippines

Methodology

Survey methods and analysis used in the examination of residents in Tubajon, Agutayan, and Duka Bay are detailed in Chapter 3 of this dissertation. Differences among MPA communities in demographic and socio-economic characteristics were tested with a non-parametric Kruskal-Wallis test followed by Mann-Whitney U tests to compare differences between groups. Perception questions using a 5-point Likert scale (ordinal data) were analyzed for differences between MPA communities using Kruskal-Wallis tests. Pearson chi-square tests for independence were used to compare differences in discrete variables between the four sites. If Pearson chi-square test of independence found significant differences between sites adjusted residuals were used for posteriori tests to identify frequencies that were responsible for significant chi-square values. Critical p-values were calculated from adjusted residuals and the alpha level of significant was adjusted using Bonferroni adjustment which involves dividing the alpha level, 0.05, by the number of hypotheses tested (e.g. 6 hypotheses tested; critical $P = 0.00833$) (Everitt 1992).

The percentage of social factors listed in Table 28 were evaluated for the specific thresholds and given a MPA Evaluation Score. If the threshold was met, then the factor was rated with a (+) and if it was not it was rated with a (-). Total number of positives were used to determine an overall MPA score with 0 being the lowest and 20 being the highest MPA Evaluation Score.

Table 28. Social factors evaluated for MPA Evaluation Scores with specific thresholds.

Factor Evaluated	Description	Threshold
Alternative livelihoods		
	Respondent involvement in alternative livelihoods after MPA	35% Answer: Yes
Perception of the MPA		
MPA awareness	Respondent aware of MPA	35% Answer: Yes
Perceived trends in fish catch after MPA	Perception of respondent of increased fish catch after MPA established	35% Answer: Slightly positive
Perceived trends in coral reef health after MPA	Perception of respondent of improved coral reef health after MPA established	35% Answer: Slightly positive
Tourism	Perception of increases in tourism after MPA was established	35% Answer: Slightly positive
Perception of MPA on livelihood	Perception of the MPA's impact on their livelihoods	35% Answer: Slightly positive
Perception of Government Involvement	Perception of the Government's involvement in the MPA	35% Answer: Slightly positive
Perception of MPA on community	Perception of the MPA on their community	35% Answer: Slightly positive
MPA Community participation		
Meeting involvement	Respondents involvement in MPA planning process	35% Answer: Yes
MPA establishment	Government involvement in MPA establishment	35% Answer: Yes
Environmental education	Respondents involvement in environmental educational programs	35% Answer: Yes
Enforcement and Conflicts		
Illegal Fishing	Presence of illegal fishing	30% or Less Answer: Yes
Too Many Regulations	Perception of governments enforcement of the MPA	30% or Less Answer: Yes
Regulations Not Well Enforced	Perception of regulations being enforced	30% or Less Answer: Yes
Causes Conflict	Perception of conflict	30% or Less Answer: Yes

Erodes Traditional Authority	because of the MPA Perception of traditional authority	30% or Less Answer: Yes
Creates Inequity	Perception of inequity related to the MPA	30% or Less: Answer: Yes
Empowerment		
Participation in general decision-making	Involvement in decision making in community	30% or Less: Answer: Yes
Participation in marine resource decision-making	Involvement in marine decisions in community	35% Answer: Yes
People organization participation	Respondents involvement in people organization groups	35% Answer: Yes

Results

Prior to any surveys being conducted, governmental courtesy calls were made to each respective Municipal Mayor to ask permission for research to be conducted in their community. A total of 149 household surveys were completed for Tagoloan (non-MPA site). The 95% confidence interval for Tagoloan ($n = 9,306^2$) and the sample size is ± 7.96 . A total of 599 household surveys were completed for this study. The 95% confidence interval for the four sites ($n = 15,528^6$) and this sample size is $\pm 3.93\%$. Percentage of respondents that were male were 54.4% ($n=326$) and 45.6% ($n=273$) of the respondents were female.

⁶ Population based from May 1, 2010 Census of Population and Housing conducted by the Philippine National Statistics Office.

Demographic Characteristics

The mean age of the respondents in all four sites was 43.33 (SD=13.21), with the youngest being 18 years of age and the oldest being 82 years of age. The mean age of the respondents was similar for all three MPA sites with Agutayan having a slightly higher mean with (44.93, SD=13.57) compared to Duka (44.62, SD=12.64) and Tubajon (42.31, SD=12.94). The non-MPA site, Tagoloan had a lower mean age (41.29, SD=13.58) (Figure 37). There was a significant difference in age across the four sites (Tubajon, $n = 150$, Agutayan, $n = 150$, Duka Bay, $n = 150$, Tagoloan, $n = 149$), $\chi^2 (3, n = 599) = 8.10$, $p = .044$. Pair-wise comparisons between age and site found no significant differences after Bonferroni adjustment was applied to the alpha level (Table 29).

Table 29. The results of the Mann-Whitney U Test pairwise comparisons between age of respondents and sites. Significant p-values adjusted with Bonferroni correction at the $\alpha = 0.0083$ level are indicated with an *.

	U-stat	Age		
		z value	r value	p-value
Tubajon vs. Agutayan	9939.5	-1.75	0.1	0.02
Tubajon vs. Duka Bay	9914.5	-1.78	0.1	0.075
Tubajon vs. Tagoloan	10726	-0.6	0.03	0.548
Agutayan vs. Duka Bay	11169.5	-0.107	0.006	0.915
Agutayan vs. Tagoloan	9515	-2.22	0.13	0.02
Duka Bay vs. Tagoloan	9556.5	-2.17	0.126	0.03

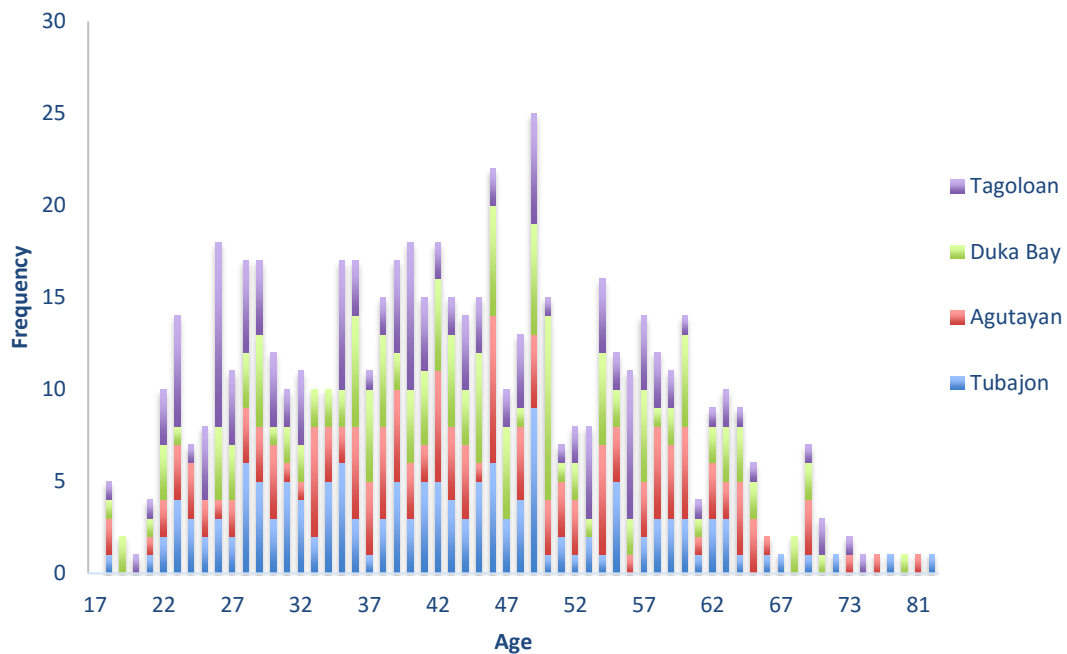


Figure 37. Frequency distribution showing the age of respondents from the four study sites, Tagoloan (n =149), Duka Bay (n = 150), Agutayan (n = 150), and Tubajon (n = 150).

Highest completed education levels were collapsed in five categories instead of eight because some categories had less than five respondents in that category.

Respondent's education levels in the four sites mainly fell into two categories:

elementary school graduates or high school graduates (Figure 38). Duka Bay had the

most respondents with higher education (16.0%, n=24), i.e., having "some college"

education or they were "college graduates". Tubajon had the smallest proportion of

higher educated respondents, with 7.3% (n=11). Respondents from the non-MPA site

were either "high school graduates" (38.3%, n = 57) or "elementary school graduates"

(22.8%, n = 34). There was a significant difference found between education levels and

the four sites (Tubajon, n = 150, Agutayan, n = 150, Duka Bay, n = 150, Tagoloan, n =

149) (χ^2 (12, $n = 599$) = 30.89, $p = 0.002$, $\phi = .227$). Chi-square posteriori tests using residuals revealed a significant difference in education levels of respondents from Duka Bay that were “high school graduates”, indicating that Duka Bay had significantly higher percentage of high school graduates than the other three sites (Table 30).

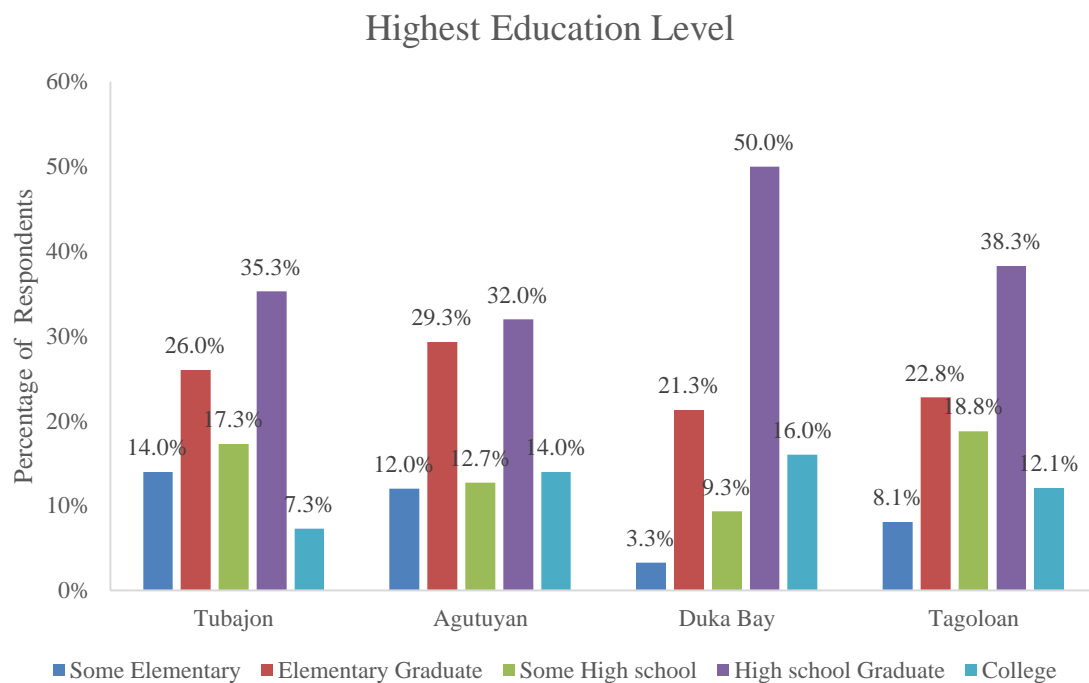


Figure 38. Percentage of highest education completed by respondents from Tubajon, Agutayan, Duka Bay, and Tagoloan.

Table 30. Chi-square tests results of highest education in four sites with residuals and calculated *p* values. Significant *p*-values adjusted with Bonferroni correction at the $\alpha = 0.0025$ level are indicated with an *.

Highest Education	Tubajon		Agutayan		Duka Bay		Tagoloan	
	RES	p-value	RES	p-value	RES	p-value	RES	p-value
<i>Some Elementary</i>	2.26	0.024	1.29	0.198	-2.92	0.003	-0.63	0.531
<i>Elementary Graduate</i>	0.37	0.713	1.46	0.145	-1.16	0.247	-0.67	0.503
<i>Some High school</i>	1.13	0.259	-0.75	0.456	-2.08	0.037	1.71	0.088
<i>High school</i>						0.001		
<i>Graduate</i>	-1.03	0.301	-2.00	0.045	3.22	*	-0.19	0.853
<i>College</i>	-2.16	0.031	0.71	0.479	1.57	0.117	-0.12	0.907

Abbreviations: RES, residuals.

There was little immigration of the respondents to the locales of the three MPAs from other areas, (72.4%, $n = 326$) were originally from the community, while the non-MPA site had 67.1% ($n = 100$) respondents from the community (Figure 39). In total, 28.8% ($n=173$) of all the respondents had immigrated from another community in the Misamis Oriental region, or from another region of the Philippines. Tagoloan had the most immigrants with 23.5% ($n=35$) of the respondents coming from another community in Misamis Oriental, while Agutayan had the most immigrants 11.3% ($n = 17$) coming from other regions of the Philippines. Duka Bay had the least number of immigrants with a total, 23.4% ($n = 35$) coming from another community in Misamis Oriental or region of the Philippines. Respondents who did immigrate to the community did so because of marriage, family, or for employment reasons. There were no significant differences found in the origin of the respondents between the four sites. (Tubajon, $n = 150$, Agutayan, $n = 150$, Duka Bay, $n = 150$, Tagoloan, $n = 149$; $\chi^2 (6, n = 599) = 0.23$, $phi = .12$).

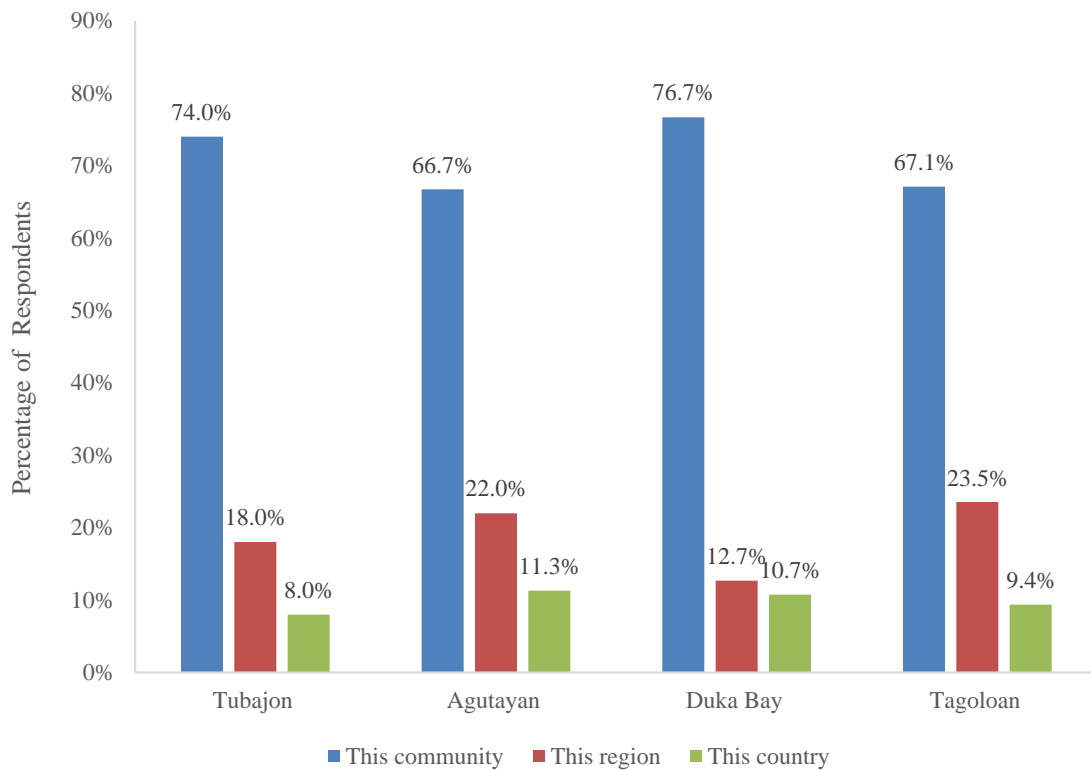


Figure 39. Origin of respondents from the four sites, Tubajon (n = 150), Agutayan (n = 150), Duka Bay (n = 150), Tagoloan (n = 149).

Household socioeconomics

Respondents were asked the number of adults and children living in their household. The mean number of adults and children living in the household for the three MPAs was 5.46 (SE = 0.10) with an adult mean of 3.01 (SE = 0.07) and a children mean of 2.46 (SE = 0.08). The mean number of adults and children living in the household for the non-MPA site, Tagoloan was 6.07 (SE = 0.17) with an adult mean of 3.07 (SE = 0.13) and a children mean of 3.00 (SE = 0.15). The number of people living in the households was collapsed into seven because some categories had less than five respondents in that category. There were no significant differences found in number of adults and children

living in the household across the four sites (Tubajon, $n = 150$, Agutayan, $n = 150$, Duka Bay, $n = 150$, Tagoloan, $n = 149$; $\chi^2 (18, n = 599) = 23.16$, $p = 0.184$, $\phi = .197$).

The number of adults for the three MPA communities ranged from one to eleven adults, while in Tagoloan it ranged from one to twelve adults. The majority of the MPA communities and in the non-MPA site had two adults living in the household but several households in Agutayan (30.1%, $n = 45$), Duka Bay (28.6%, $n = 43$) and Tagoloan (30.3%, $n = 45$) had four or more adults living in the household. The number of adults living in the households was collapsed into five categories because some categories had less than five respondents in that category. There were no significant differences found in number of adults living in the household across the four sites (Tubajon, $n = 150$, Agutayan, $n = 150$, Duka Bay, $n = 150$, Tagoloan, $n = 149$; $\chi^2 (12, n = 599) = 11.52$, $p = 0.485$, $\phi = .139$).

The number of children living in the three MPA communities ranged from zero to thirteen children, while in Tagoloan it ranged from zero to nine. Most MPA communities and Tagoloan had two to three children living in their household but Agutayan (28.7%, $n=43$), Duka Bay (23.4%, $n=35$) and Tagoloan (47%, $n = 70$) had four or more children living in their household. The number of children living in the households was collapsed into seven categories because some categories had less than five respondents in that category. There were no significant differences in number of children living in the household across the four sites (Tubajon, $n = 150$, Agutayan, $n = 150$, Duka Bay, $n = 150$, Tagoloan, $n = 149$; $\chi^2 (18, n = 599) = 21.67$, $p = 0.247$, $\phi = .190$).

Most respondents in the three MPA communities owned their home (97.6%; n=439) instead of renting 2.4% (n=11) and almost all respondents in Tagoloan owned their home too (97.3%; n = 145). All respondents owned their home in Tubajon, while only 2.0% (n=3) rented their home in Agutayan and 5.3% (n=8) rented their home in Duka Bay. There were no significant differences in number of home owners to renters across the sites (Agutayan, $n = 150$, Duka Bay, $n = 150$, Tagoloan, $n = 149$; $\chi^2 (2, n = 449) = 2.88$, $p = 0.237$, $\phi = 0.80$).

Questions regarding monthly income were omitted because a majority of the respondents gave their income as daily income or weekly income and did not specify what time period they used.

When respondents in all four sites were asked about their household expenses most only noted their expenses for a few of the items (rice, pork, beef, fish, vegetables, children's allowance, electricity) (Table 31). If less than 10 respondents noted the income spent on an item it was omitted from the findings since the sample size was too small. Households in the three MPA communities spent most of their income on rice (₱1745.52, $n = 443$), and this was also the same for the Tagoloan (₱1068.89, $n = 147$). Fish was the second highest expense item in the MPA communities (₱704.63, $n = 177$) while in Tagoloan it was pork (₱454.55, $n = 11$). The smallest amount of income in the MPA communities was spent on vegetables (₱232.64, $n = 231$) and in Tagoloan the smallest amount was spent on children school allowance (₱185.19, $n = 106$).

Table 31. Main household expenses listed in the three MPA sites and the non-MPA site from the respondents for one month.

Expense	Tubajon		Agutayan		Duka Bay		MPA Sites	Tagoloan	
	₱	N	₱	N	₱	N	Mean	₱	N
Rice	₱1,563.47	(n = 144)	₱1,928.47	(n = 150)	₱1,745.52	(n = 149)	₱1,745.82	₱1,068.89	(n = 147)
Pork	-	-	₱402.80	(n = 25)	₱398.42	(n = 19)	₱400.61	₱454.55	(n = 11)
Beef	-	-	₱436.25	(n = 16)	-	-	₱436.25	-	-
Fish	₱757.67	(n = 58)	₱666.96	(n = 23)	₱689.27	(n = 96)	₱704.63	₱232.92	(n = 108)
Vegetables	₱252.03	(n = 37)	₱206.03	(n = 58)	₱239.85	(n = 136)	₱232.64	₱191.63	(n = 123)
Children's School	₱266.29		₱416.27		₱279.61				
Allowance		(n = 116)		(n = 51)		(n = 103)	₱320.72	₱185.19	(n = 106)
Electricity	₱751.67	(n = 134)	₱346.41	(n = 109)	₱407.14	(n = 144)	₱501.76	₱319.20	(n = 124)

Abbreviations: ₱ = Philippine Peso, N = number

₱ = Philippine Peso exchange rate: 200 PHP=US 4.22 (2/16/2016, xe.com)

Living Standards or Quality of Life

Most of the household's in all four sites had technological items such as televisions and mobile phones (Table 32). Few respondents in Tagoloan had motorized boats (11.33%), although slightly more respondents did in Tubajon (22.67%) and Duka Bay (20.0%) had motorized boats. The main form of lighting in all sites was electricity with kerosene being the second most common form of lighting ranging from (3.33%) in Duka Bay to (19.33%) in Tagoloan. In the MPA communities the majority of homes had piped water in the homes, but in the non-MPA sites the homes mainly had public piped water (78.67%).

The main form of transportation were motorcycles and *jeepneys* (jeeps that are fitted with benches and utilized as public transportation) or walking. Respondents from Tubajon mainly used motorcycles (81.33%) or *jeepneys* (97.33%). In the three other sites which included the non-MPA site, the main form of transportation was walking. The use of firewood for cooking was the dominant method in all sites ranging from (100.0%) in Tubajon and Tagoloan to (95.33%) in Duka Bay. Homes in the respondents from Tubajon and Tagoloan were similar in that the roofs were made of either metal or thatch, while in the Agutayan (90.0%) and Duka Bay (84.67%) the roofs were made of metal. The floors of the respondents in the MPA communities were mainly cement while in Tagoloan, 58.67% of the floors were made of bamboo. Cement and wood walls were common to all three MPA communities but in Tagoloan, 58.67% of the respondent's homes had wood wall.

Table 32. Percentage of household items and facilities in respondent's homes in each of the four sites.

	Tubajon		Agutayan		Duka Bay		Tagoloan	
<i>Household items</i>	Percentage	N	Percentage	N	Percentage	N	Percentage	N
Generator	0.00%	(n = 0)	0.00%	(n = 0)	0.00%	(n = 0)	0.00%	(n = 0)
Electric Fan	31.33%	(n = 47)	59.33%	(n = 89)	29.33%	(n = 44)	36.00%	(n = 54)
Satellite dish	0.00%	(n = 0)	0.00%	(n = 0)	0.00%	(n = 0)	0.00%	(n = 0)
Wall clock	38.00%	(n = 57)	41.33%	(n = 62)	46.67%	(n = 70)	27.33%	(n = 41)
Water Tank	0.00%	(n = 0)	0.00%	(n = 0)	0.00%	(n = 0)	0.00%	(n = 0)
Radio/Cassette	57.33%	(n = 86)	48.67%	(n = 73)	48.67%	(n = 73)	32.67%	(n = 49)
Landline	0.00%	(n = 0)	3.33%	(n = 5)	0.00%	(n = 0)	0.00%	(n = 0)
Electric iron	22.00%	(n = 33)	24.00%	(n = 36)	6.00%	(n = 9)	12.67%	(n = 19)
Refrigerator	18.67%	(n = 28)	24.67%	(n = 37)	30.67%	(n = 46)	14.67%	(n = 22)
TV	30.00%	(n = 45)	66.00%	(n = 99)	61.33%	(n = 92)	56.67%	(n = 85)
Mobile phone	64.67%	(n = 97)	64.00%	(n = 96)	61.33%	(n = 92)	45.33%	(n = 68)
Non-motor boat	33.33%	(n = 50)	21.33%	(n = 32)	22.67%	(n = 34)	26.00%	(n = 39)
Air conditioner	0.00%	(n = 0)	0.00%	(n = 0)	1.33%	(n = 2)	0.00%	(n = 0)
VCR/DVD	18.67%	(n = 28)	21.33%	(n = 32)	23.33%	(n = 35)	13.33%	(n = 20)
Dining table	93.33%	(n = 140)	100.00%	(n = 150)	98.67%	(n = 148)	98.00%	(n = 147)
Motorized boat	22.67%	(n = 134)	14.67%	(n = 22)	20.00%	(n = 30)	11.33%	(n = 17)

	Tubajon		Agutayan		Duka Bay		Tagoloan	
<i>Lighting</i>	Percentage	N	Percentage	N	Percentage	N	Percentage	N
Electricity	87.33%	(n = 131)	88.00%	(n = 132)	96.67%	(n = 145)	77.33%	(n = 116)
Flashlight	0.00%	(n = 0)	11.33%	(n = 17)	0.00%	(n = 0)	0.67%	(n = 1)
Air Pressure	0.00%	(n = 0)	0.00%	(n = 0)	0.00%	(n = 0)	1.33%	(n = 2)
Kerosene	11.33%	(n = 17)	11.33%	(n = 17)	3.33%	(n = 5)	19.33%	(n = 29)
Candle	0.00%	(n = 0)	0.00%	(n = 0)	0.00%	(n = 0)	0.00%	(n = 0)
Nothing	0.67%	(n = 1)	0.00%	(n = 0)	0.00%	(n = 0)	0.00%	(n = 0)
<i>Water</i>								
Piped water home	50.67%	(n = 76)	95.33%	(n = 143)	72.67%	(n = 109)	2.00%	(n = 3)
Open well	2.00%	(n = 3)	0.00%	(n = 0)	0.00%	(n = 0)	0.00%	(n = 0)
Piped water public	48.00%	(n = 72)	4.67%	(n = 7)	22.00%	(n = 33)	78.67%	(n = 118)
Private flush toilet	78.00%	(n = 117)	0.00%	(n = 0)	8.67%	(n = 13)	2.00%	(n = 3)
Pump	1.33%	(n = 2)	0.00%	(n = 0)	4.67%	(n = 7)	23.33%	(n = 35)
Private closed pit	19.33%	(n = 29)	0.00%	(n = 0)	0.00%	(n = 0)	0.00%	(n = 0)
Open Pit	0.00%	(n = 0)	0.00%	(n = 0)	0.00%	(n = 0)	0.00%	(n = 0)

	Tubajon		Agutayan		Duka Bay		Tagoloan	
<i>Transportation</i>	Percentage	N	Percentage	N	Percentage	N	Percentage	N
Walking	26.00%	(n = 39)	91.33%	(n = 137)	80.00%	(n = 120)	88.67%	(n = 133)
Vehicle	0.00%	(n = 0)	0.67%	(n = 1)	0.00%	(n = 0)	0.00%	(n = 0)
Bicycle	0.00%	(n = 0)	1.33%	(n = 2)	5.33%	(n = 8)	18.67%	(n = 28)
Jeepney	97.33%	(n = 146)	0.00%	(n = 0)	0.00%	(n = 0)	0.00%	(n = 0)
Motorcycle	81.33%	(n = 122)	7.33%	(n = 11)	14.67%	(n = 22)	8.00%	(n = 12)
Tricycle	0.00%	(n = 0)	0.00%	(n = 0)	0.00%	(n = 0)	0.00%	(n = 0)
<i>Cooking</i>								
Firewood	100.00%	(n = 150)	96.67%	(n = 145)	95.33%	(n = 143)	100.00%	(n = 150)
Charcoal	0.67%	(n = 1)	0.00%	(n = 0)	0.00%	(n = 0)	0.00%	(n = 0)
Kerosene	0.00%	(n = 0)	0.00%	(n = 0)	0.00%	(n = 0)	0.00%	(n = 0)
Gas/Electric	0.00%	(n = 0)	11.33%	(n = 17)	5.33%	(n = 8)	0.00%	(n = 0)

	Tubajon		Agutayan		Duka Bay		Tagoloan	
<i>Roof Material</i>	Percentage	N	Percentage	N	Percentage	N	Percentage	N
Thatch	42.00%	(n = 63)	20.00%	(n = 130)	16.67%	(n = 25)	44.00%	(n = 66)
Metal	62.00%	(n = 93)	90.00%	(n = 135)	84.67%	(n = 127)	62.00%	(n = 93)
Tile	0.00%	(n = 0)	0.00%	(n = 0)	0.00%	(n = 0)	0.00%	(n = 0)
<i>Floor material</i>								
Dirt	8.00%	(n = 12)	0.67%	(n = 1)	6.67%	(n = 10)	1.33%	(n = 2)
Tile	0.00%	(n = 0)	1.33%	(n = 2)	4.00%	(n = 6)	0.67%	(n = 1)
Bamboo	10.67%	(n = 16)	16.00%	(n = 24)	22.00%	(n = 33)	58.67%	(n = 88)
Plank wood	22.00%	(n = 33)	20.67%	(n = 34)	5.33%	(n = 8)	16.00%	(n = 24)
Cement	71.33%	(n = 107)	65.33%	(n = 98)	80.00%	(n = 120)	26.67%	(n = 40)
<i>Wall material</i>								
Bamboo	14.67%	(n = 22)	9.33%	(n = 14)	24.00%	(n = 36)	4.00%	(n = 6)
Cement	29.33%	(n = 44)	63.33%	(n = 95)	32.00%	(n = 48)	30.67%	(n = 46)
Wood	49.33%	(n = 74)	10.67%	(n = 16)	21.33%	(n = 32)	58.67%	(n = 88)
Stone block	2.00%	(n = 3)	7.33%	(n = 11)	7.33%	(n = 11)	11.33%	(n = 17)
Metal	0.00%	(n = 0)	0.00%	(n = 0)	0.00%	(n = 0)	0.00%	(n = 0)

Livelihood Options

A total of 59.6% of the 599 respondents engaged in fishing and it served as the primary occupation for the households. Tubajon had the highest percentage of respondents who engaged in fishing for their primary source of income (72.7%), while Duka Bay had the lowest percentage of fisherfolk (40.0%). More than half of the respondents from Tagoloan (53.7%, $n = 80$) were fisherfolk. There was a significant difference found between the number of fishers and non-fishers in the households across the four sites (Tubajon, $n = 150$, Agutayan, $n = 150$, Duka Bay, $n = 150$, Tagoloan, $n = 149$, $\chi^2 (3, n = 599) = 46.3$, $p = < .001$, $\phi = .28$). Chi-Square test posteriori comparisons found Duka Bay to have a significantly lower percentage of fishermen and non-fisherman when compared the other sites (Table 33).

Table 33. Chi-square tests results between fishermen and non-fishermen in four sites with residuals and calculated p values. Significant p -values adjusted with Bonferroni correction at the $\alpha = 0.00625$ level are indicated with an *.

	Fisherman		Non-Fisherman	
	Residual	p-value	Residual	p-value
Tubajon	2.1	0.0351	-2.5	0.0124
Agutayan	2.0	0.0455	-2.4	0.0164
Duka Bay	-3.1	0.0019*	3.8	<0.0001*
Tagoloan	-.9	0.3681	1.1	0.2713

Additional livelihoods, other than fishing, were not recorded at Tagoloan, therefore, results of other livelihoods were only analyzed in the three MPA communities. Aside from fishing, other important occupations were laborers and salaried workers. Duka Bay had the highest percentage of respondents in other occupations with (13.33%,

n = 20) of the respondents being laborers and (13.33%, n = 20) salaried workers either in the local governmental unit or in the school system (Figure 40). The second primary occupation in Agutayan was salaried workers (9.33%, n = 14).

Primary Occupations

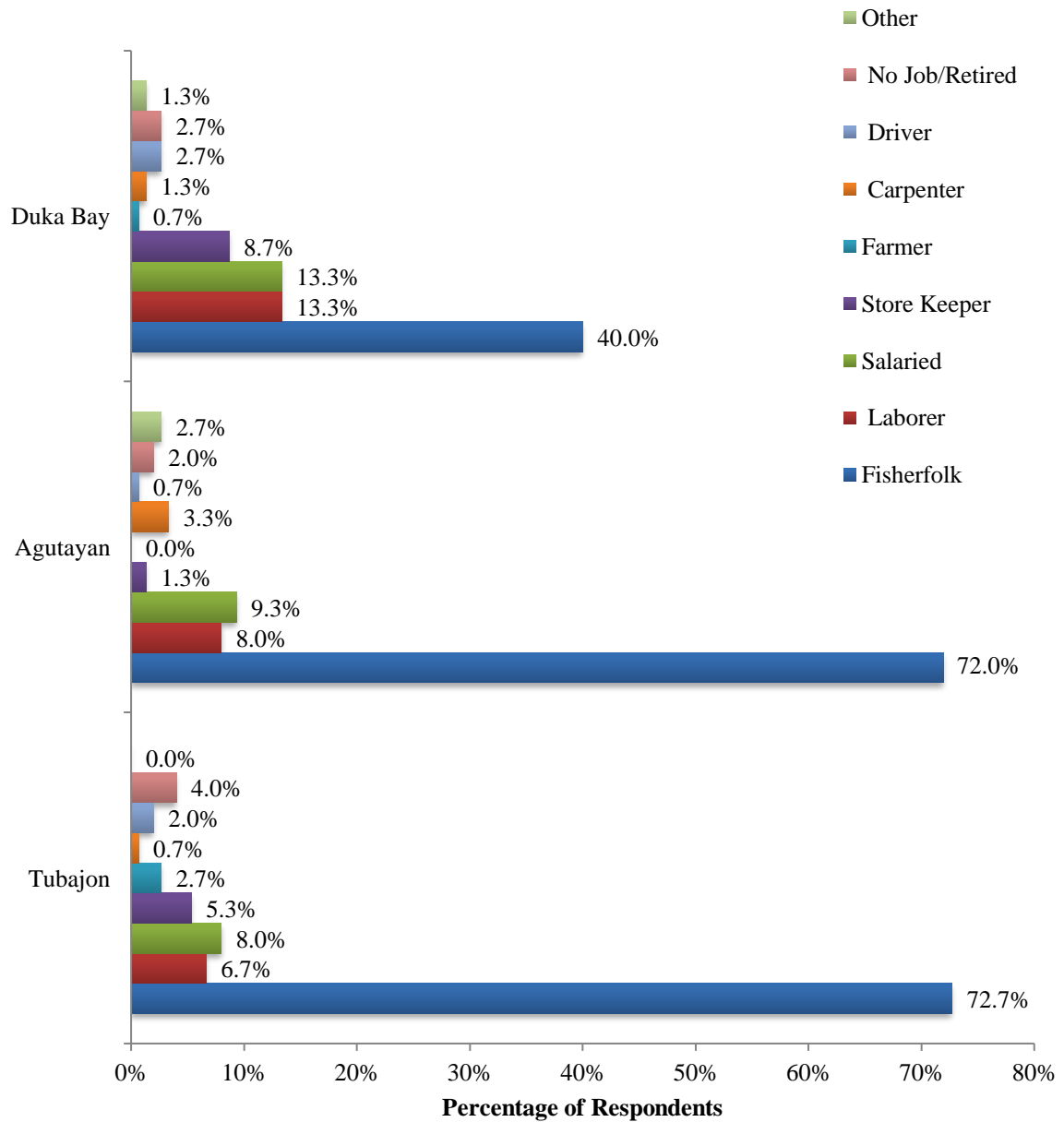


Figure 40. Percentage of primary occupations in the three MPA communities (n = 447).

Once the MPA was established, almost all respondents in the three MPA communities reported no change in opportunities of different livelihoods as the result of MPA designation (90%, $n = 405$) (Figure 41). The few respondents that did report a change in livelihood after the MPA was established were opportunities in seaweed farming (5.4%, $n = 24$), and opportunities to serve as a guard for the MPA (1.6%, $n = 7$). The respondents did not mention any available livelihood opportunities after the MPA in Medina, but Agutayan respondents reported changes in having the opportunity to engage in seaweed farming, (5.3%, $n = 8$), MPA guards (3.3%, $n = 5$), or serving as a dive guide for the MPA (1.3%, $n = 2$). Tubajon respondents had opportunities in seaweed farming (10.7%, $n = 16$), selling of handicrafts (3.3%, $n = 5$), and serving as a MPA guard or guide (2.6%, $n = 4$) after the MPA was established. Livelihood data after MPA established were collapsed into two categories (seaweed farming and other livelihoods) to allow for statistical testing. There were no significant differences found in livelihoods offered between the sites (Tubajon, $n = 150$, Agutayan, $n = 150$; $\chi^2 (2, n = 300) = 2.89$, $p = .089$).

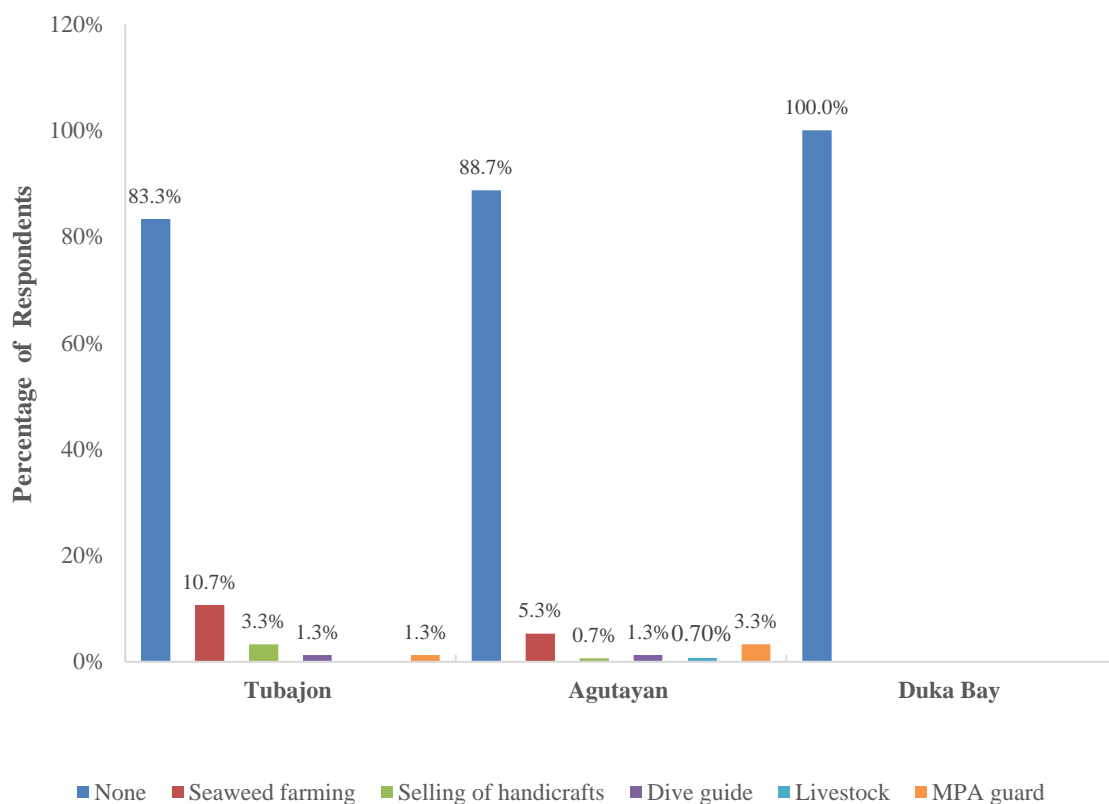


Figure 41. Percentage of MPA facilitated livelihoods respondents from Tubajon (n=150), Agutayan (n=150) and Duka Bay (n=147) respondents were involved in after the MPA was established.

In the three sites the MPA was viewed as impacting their livelihoods somewhat positively (Figure 42). Tubajon respondents perceived the MPA has having the most positive impact on their livelihood with (38.3%, n= 57) of the respondents answering “slightly positive”. Agutayan respondents perceived the MPA as “slightly positive” (34.0%, n = 51) or “neither” (34.0%, n = 51) for their livelihood. But in Duka Bay the respondents had a more negative perception of how the MPA impacted their livelihood with (33.6%, n = 49) answering “slightly negative”. Respondents from Agutayan had the highest average perception of how the MPA impacted their livelihood (3.50) and Duka

Bay had the lowest (2.76) with (1) indicating a very negative perception and (5) indicating a very negative perception (Table 34). There was a significant difference found in respondent's perception of how the MPA impacted their livelihood in the three sites (Tubajon, $n = 144$, Agutayan, $n = 150$, Duka Bay, $n = 146$), $\chi^2 (2, n = 445) = 34.53$, $p = <0.0001$. Specifically, there were differences in livelihood perceptions between Tubajon and Duka Bay and Agutayan and Duka Bay. Tubajon (bottom up) and Duka Bay (private) were found to have the greatest difference in respondent's perception of how the MPA impacted their livelihood when comparing z and r values (Table 35).

Overall impact of MPA on livelihoods

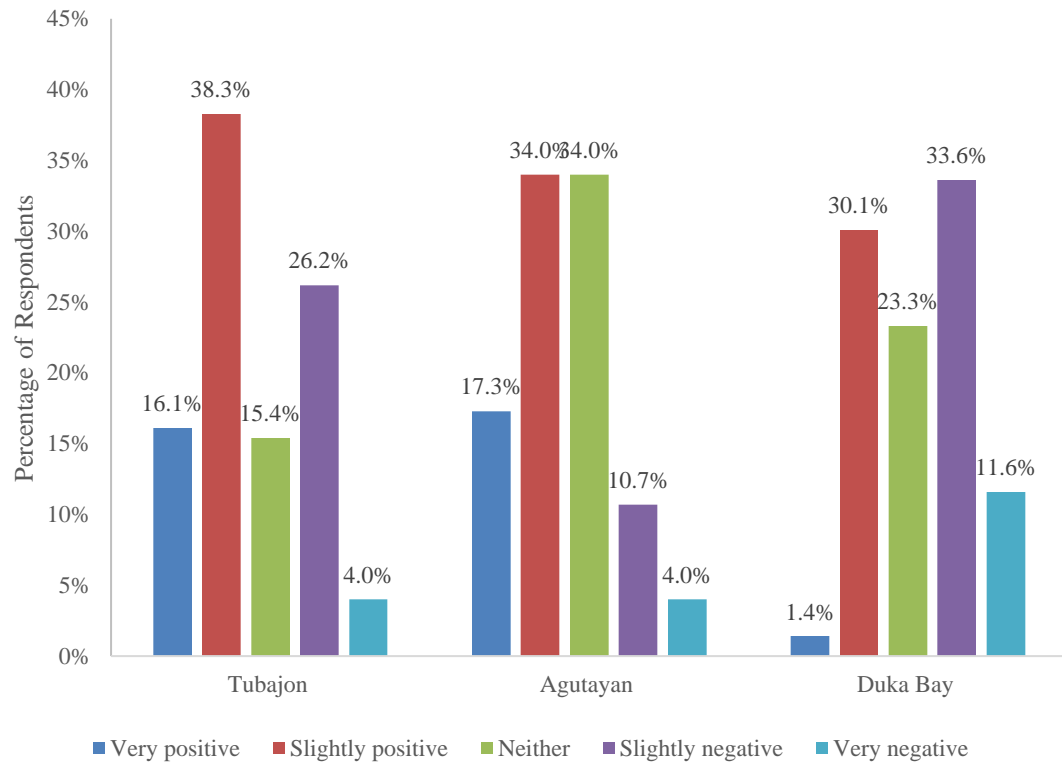


Figure 42. Respondents perception of how the MPA has impacted their livelihood in the three MPA sites.

Table 34. Average perception to the question, "Overall, how has the MPA impacted your livelihood?" (1= very negatively; 5= very positively)

MPA	Average Perception
Tubajon (<i>n</i> =149)	3.36
Agutayan (<i>n</i> =150)	3.50
Duka Bay (<i>n</i> =146)	2.76

Table 35. The results of the Mann-Whitney U Test pairwise comparisons between responses regarding the perception of how the MPA impacted their livelihood across the sites. Significant p-values adjusted with Bonferroni correction at the $\alpha = 0.0167$ level are indicated with an *.

	MPA Impact on Livelihood			
	U-stat	z value	r value	p-value
Tubajon vs. Agutayan	10559	-0.86	0.0	0.39
Tubajon vs. Duka Bay	7741.5	-4.45	0.3	<0.0001*
Agutayan vs. Duka Bay	6960	-6.62	0.4	<0.0001*

Marine resource use patterns

As indicated previously fishing was the primary occupation of all respondents in all four sites. Most of the fisherman had been fishing most of their life, with the mean years of fishing being, 27.70 (SD =13.78, $n = 379$) (Table 36). The years of fishing ranged from one to 68 years of fishing in the MPA communities while the range in the non-MPA site was one to 57 years of fishing. There were no significant differences found in the years fishing between the four sites (Tubajon, $n = 108$, Agutayan, $n = 108$, Duka Bay, $n = 89$, Tagoloan, $n = 74$; $\chi^2 (3, n = 379) = 0.368$, $p = .947$).

Table 36. Descriptive statistics of years fishing in four sites.

Years Fisherman			
Site	Mean	SD	N
Tubajon	27.87	13.86	108
Agutayan	28.04	15.14	108
Duka Bay	26.80	11.04	89
Tagoloan	28.03	14.74	74
Total	27.70	13.78	379

A majority of the fishermen's fathers in all three sites, Tubajon (89.8%, $n = 97$), Agutayan (83.2%, $n = 89$), and Tagoloan (88.5%, $n = 69$). Duka Bay had the lowest percentage of fishermen whose fathers who were also fishermen (66.3%, $n = 59$). There was a significant difference found in number of fishermen whose fathers also fished in the households across the four sites (Tubajon, $n = 108$, Agutayan, $n = 107$, Duka Bay, $n = 89$, Tagoloan, $n = 78$; $\chi^2 (3, n = 382) = 21.83$, $p < .001$, $phi = .24$). Chi-square

posteriori with residuals found Duka Bay to having a significantly lower number of fishers whose fathers also fished (Table 37).

Table 37. Chi-square tests results of fishermen whose father's that were fishermen and were not in the four sites with residuals and calculated p values. Significant p -values adjusted with Bonferroni correction at the $\alpha = 0.00625$ level are indicated with an *.

	Was your father a fisherman?			
	No		Yes	
	Residual	p-value	Residual	p-value
Tubajon	-1.9	0.0574	0.9	0.3681
Agutayan	-0.2	0.8412	0.1	0.9203
Duka Bay	3.6	0.0003*	-1.7	0.0891
Tagoloan	-1.3	0.1936	0.6	0.5485

The fishing gear primarily used in all four sites was “net” with Tubajon having the lowest percentage (55.6%, $n = 60$) and Agutayan having the highest percentage of fisherman using “net” (79.0%, $n = 83$) (Figure 43). “Hook and line” was the second most important gear type used in all four sites with Agutayan having the lowest percentage at (18.0%, $n = 19$) and Duka Bay having the highest percentage of fisherman using nets (43.8%, $n = 39$). Tubajon was the site with the most variety of fishing gear including: hook and line, net, spear, using a basket with a flashlight, and “active” fishing (trap).

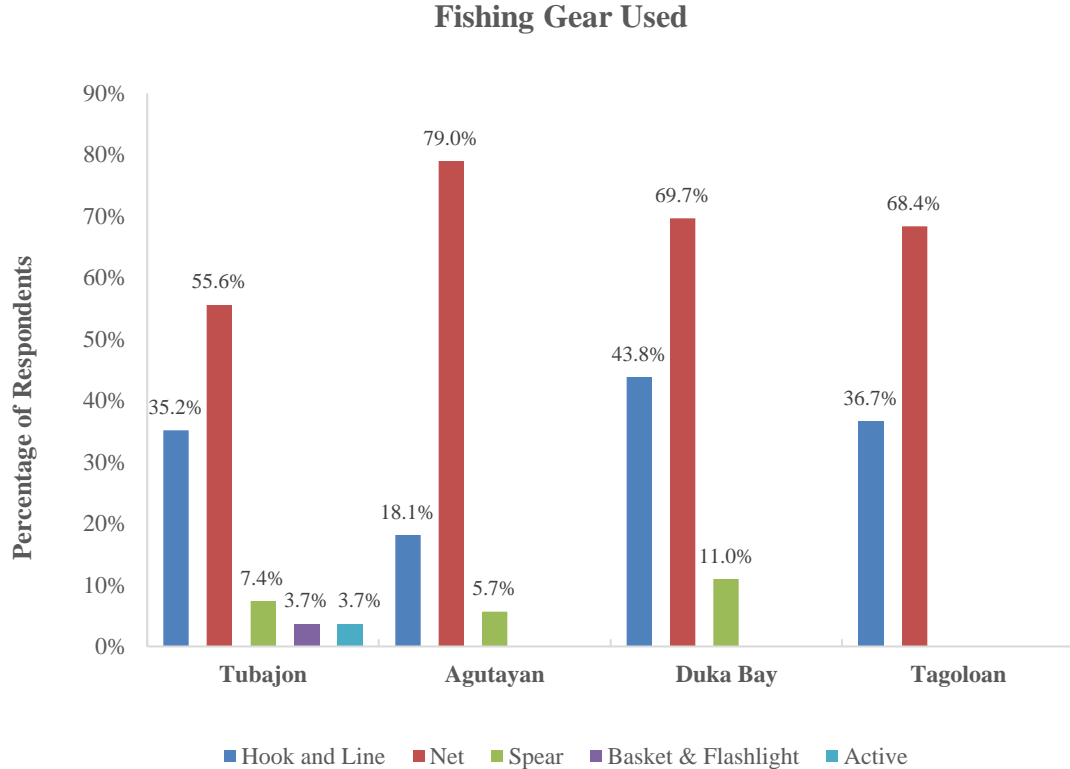


Figure 43. Percentage of fishing gear used in all four sites, Tubajon (n = 108), Agutayan (n = 105), Duka Bay (n = 89) and Tagoloan (n = 79).

In all four sites, motor boats were used by less of the fishermen than non-motor boats (Figure 44). Agutayan had the highest percentage of fishermen using motor boats (56.4%, n = 44), followed by Duka Bay with 53.4% (n = 47) of fishermen using motor boats. Most of the fisherman in Tagoloan used non-motor boats (70.9%, n = 56) as well as in Tubajon (63.9%, n = 62). There was a significant difference found in the number of motor and non-motor boats in the fishing households across the four sites (Tubajon, n = 97, Agutayan, n = 78, Duka Bay, n = 88, Tagoloan, n = 79; χ^2 (3, n = 342) = 17.62, p = < .001, phi = .23). Chi-square posteriori with residuals found no significant differences in

the percentage of motor and non-motor boats in the four sites after Bonferroni adjustment was applied to the alpha level (Table 38).

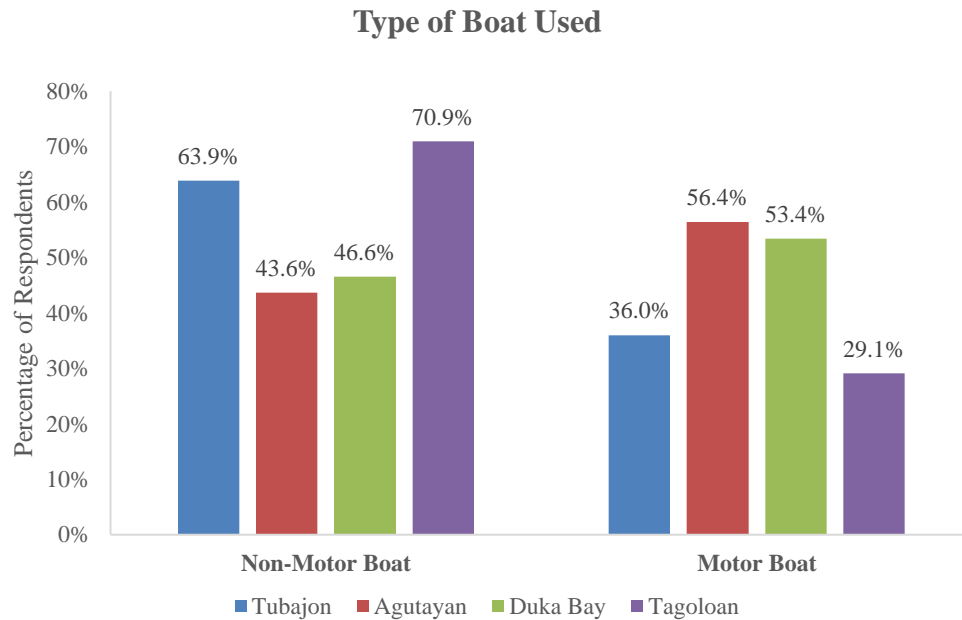


Figure 44. Percentage of motor and non-motor boats used by respondents at the four study sites, Tubajon (n = 97), Agutayan (n = 78), Duka Bay (n = 88) and Tagoloan (n = 79).

Table 38. Chi-square tests results of fishermen who used motor and non-motor boats in the four sites with residuals and calculated *p* values. Significant *p*-values adjusted with Bonferroni correction at the $\alpha = 0.00625$ level are indicated with an *.

	Non-Motor Boat		Motor Boat	
	Residual	p-value	Residual	p-value
Tubajon	1.0	0.3172	1.1	0.2713
Agutayan	-1.5	0.1336	1.7	0.0891
Duka Bay	-1.2	0.2301	1.4	0.1615
Tagoloan	1.7	0.0891	-1.9	0.0574

The primary fish targeted by fisherman in all sites were groupers (*Epinephelinae*) and sardines. Groupers (*Epinephelinae*) were highest percentage of fish targeted in Tubajon (47.5%, $n = 48$) and in Tagoloan (65.8%, $n = 50$) (Figure 45). In Agutayan fishermen targeted sardines (*Clupeidae*) (72.4%, $n = 76$) and in Duka Bay (45.5%, $n = 40$). Tuna (*Thunnini*) were also an important fish targeted in the Tubajon, Agutayan and Tagoloan.

During good weather households fished on average 6.38 (SD = 1.37) ($n = 386$) days a week. Fishermen in Agutayan had a highest average of 6.68 (SD = 1.01, $n = 108$) fishing days a week and Tubajon had a lowest average of fishing days 6.06 (SD = 1.67, $n = 109$). There was a significant difference found in the number of days' fishermen fished in a week across the four sites (Tubajon, $n = 109$, Agutayan, $n = 108$, Duka Bay, $n = 89$, Tagoloan, $n = 79$), $\chi^2 (3, n = 385) = 10.78$, $p = .013$. Specifically, Tubajon was found to be significantly lower from Agutayan in the number of days' fishermen fished in a week (Table 39).

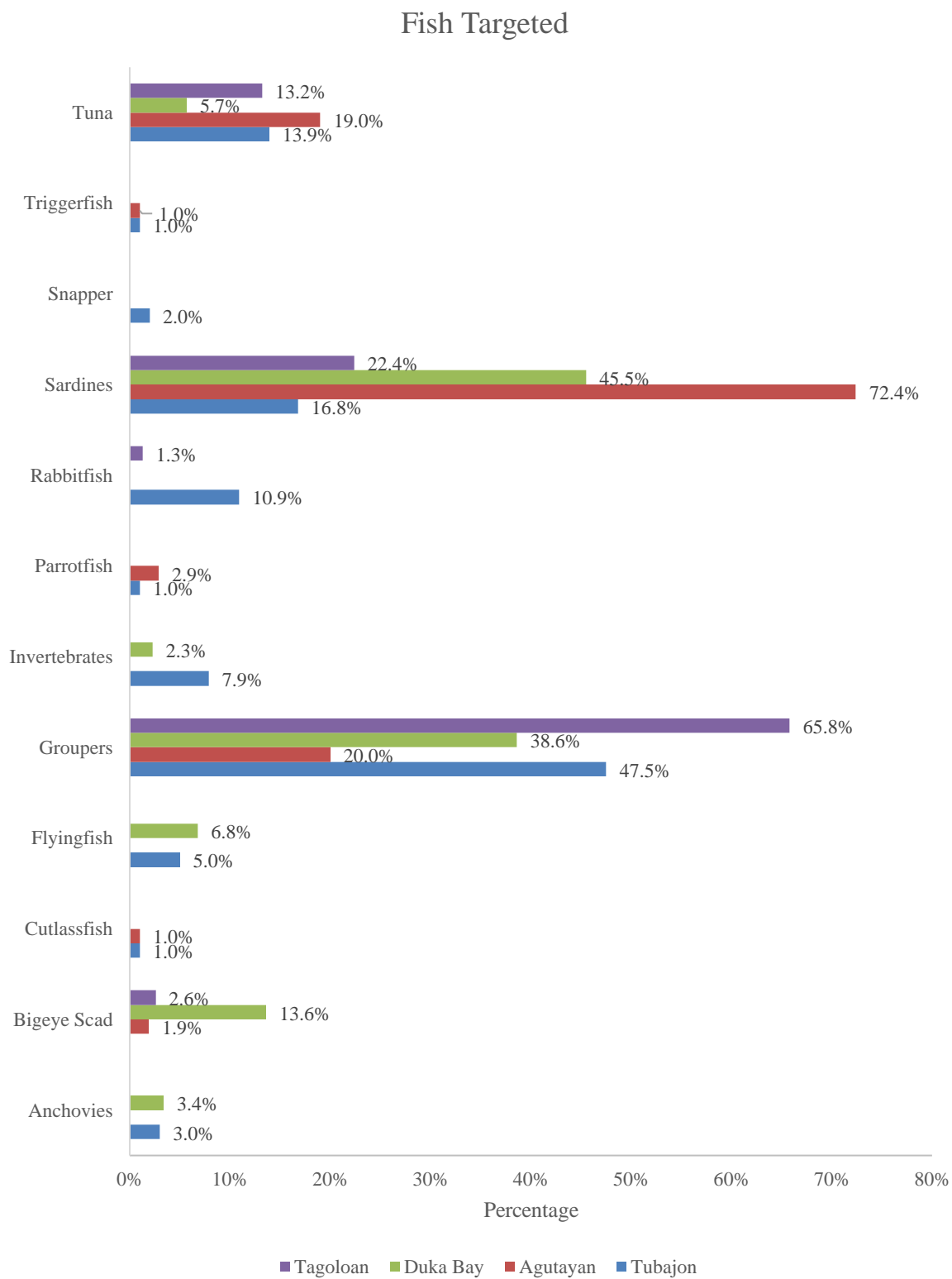


Figure 45. Percentages of the type of fish targeted in each of the four communities.

Table 39. The results of the Mann-Whitney U Test pairwise comparisons between average number of days fished in a week in the sites during good weather. Significant p-values at the $\alpha = 0.0083$ level are indicated with an *.

	Average Number of Fishing Trips in a Week			
	U-stat	z value	r value	p-value
<i>Tubajon vs. Agutayan</i>	4826.5	-3.24	0.2	0.001*
<i>Tubajon vs. Duka Bay</i>	4529.5	-1.03	0.1	0.304
<i>Tubajon vs. Tagoloan</i>	3887.5	-1.47	0.1	0.141
<i>Agutayan vs. Duka Bay</i>	4245.5	-2.14	0.2	0.033
<i>Agutayan vs. Tagoloan</i>	3862.5	-1.73	0.1	0.084
<i>Duka Bay vs. Tagoloan</i>	3423	-0.402	0.0	0.688

The estimated volume of food catch during one week in good weather in the four sites was 1250.66 (SD = 1781.03, $n = 107$) kilos in Agutayan, 42.57 (SD = 25.55, $n = 89$) kilos in Duka Bay, 38.94 (SD = 46.92, $n = 54$) kilos in Tagoloan and 27.77 (SD = 27.72, $n = 107$) kilos in Tubajon. There was a significant difference found in the volume of fish caught in one week across the four sites in good weather (Tubajon, $n = 107$, Agutayan, $n = 107$, Duka Bay, $n = 89$, Tagoloan, $n = 54$; $\chi^2 (3, n = 385) = 83.48$, $p = <0.0001$).

Specifically, significant differences in the volume of fish caught in one week were in:

Tubajon and Agutayan, Tubajon and Duka Bay, Agutayan and Duka Bay, Agutayan and Tagoloan, and Duka Bay and Tagoloan (Table 40). Tubajon and Agutayan had the greatest difference in the volume of fish caught in one week compared to the other sites, with Tubajon having significantly lower volume of fish caught in one week compared to all other sites.

Table 40. The results of the Mann-Whitney U Test pairwise comparisons between volume of fish caught in one week with good weather in a week in the sites. Significant p-values adjusted with Bonferroni correction at the $\alpha = 0.0083$ level are indicated with an *.

	Volume of fish caught in a week in good weather			
	U-stat	z value	r value	p-value
Tubajon vs. Agutayan	2120.5	-7.98	0.5	<0.001*
Tubajon vs. Duka Bay	2803.5	-4.96	0.4	<0.001*
Tubajon vs. Tagoloan	2526.5	-1.3	0.1	0.193
Agutayan vs. Duka Bay	2857	-4.83	0.3	<0.001*
Agutayan vs. Tagoloan	1269.5	-5.82	0.5	<0.001*
Duka Bay vs. Tagoloan	1638.5	-3.2	0.3	0.001*

Most of the food that was caught was not used for food consumption except in Duka Bay. In Agutayan the average percentage of catch that was consumed by the household was 5.89% (SD = 9.02), $n = 108$. However, in Duka Bay 59.03% (SD = 36.48, $n = 87$) of the catch was consumed by household. In the non-MPA site, Tagoloan 21.13% (SD = 13.92, $n = 72$) was consumed by the household (Figure 46). There was a significant difference found in the percentage of fish caught and then consumed by the household in the four sites (Tubajon, $n = 108$, Agutayan, $n = 108$, Duka Bay, $n = 87$, Tagoloan, $n = 72$), $\chi^2 (3, n = 375) = 156.28$, $p = <0.0001$. Pairwise comparisons found significant differences in the percentage of fish that was caught and consumed were found to be different in: Tubajon and Agutayan, Tubajon and Duka Bay, Agutayan and Duka Bay, Agutayan and Tagoloan, and Duka Bay and Tagoloan. Agutayan was the site with the greatest, significant, difference, with most fisherfolk selling their catch (Table 41).

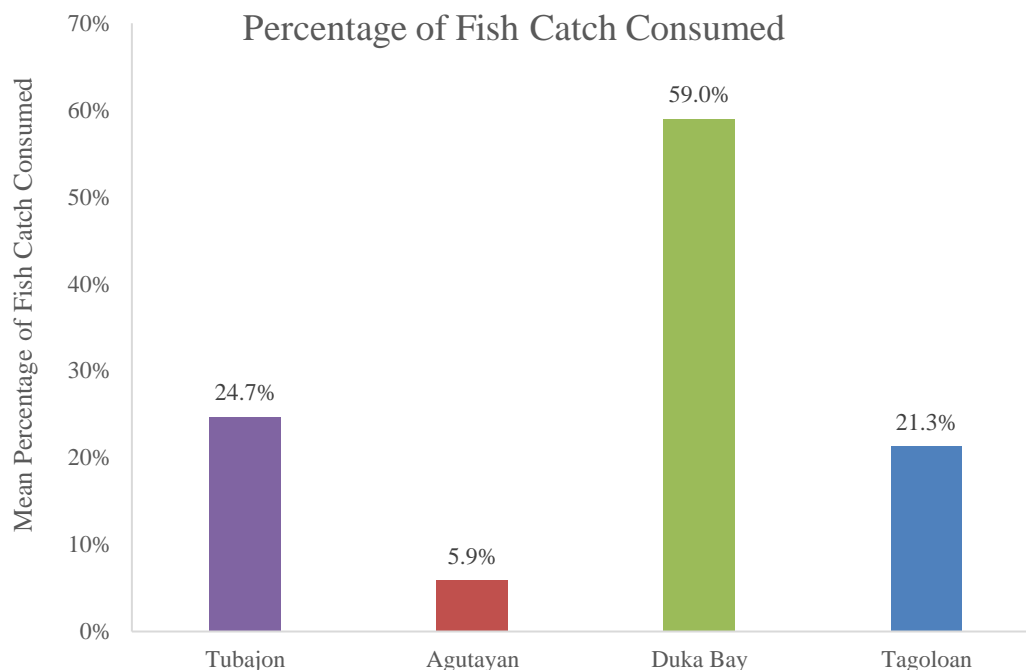


Figure 46. Percentage of fish catch consumed in the household in the four sites (n = 375)

Table 41. The results of the Mann-Whitney U Test pairwise comparisons between percentage of fish catch consumed by the household in the sites. Significant p-values adjusted with Bonferroni correction at the $\alpha = 0.0083$ level are indicated with an *.

	Percentage of fish caught and consumed by household			
	U-stat	z value	r value	p-value
Tubajon vs. Agutayan	2250	-7.89	0.5	<.0001*
Tubajon vs. Duka Bay	2296	-6.17	0.4	<.0001*
Tubajon vs. Tagoloan	3591	-0.874	0.1	0.382
Agutayan vs. Duka Bay	640	-10.45	0.7	<.0001*
Agutayan vs. Tagoloan	1075.5	-8.3	0.6	<.0001*
Duka Bay vs. Tagoloan	1387	-6.07	0.5	<.0001*

Perceptions regarding the marine resources

Respondents were asked how they perceived the condition of the marine resources five years ago. Specifically, what was the quantity of fish and the health of the

coral reefs five years ago. Overall respondents in the four sites felt that quantity of fish available was lower (70.8%) (a lot less = 24.0% and less = 46.8%) five years ago (Figure 47). Tubajon (52.1%, $n = 50$) and Tagoloan (51.5%, $n = 50$) respondents both had negative perceptions of the quantity of fish health five years ago with perceiving “less” fish. There was a significant difference found in household responses of the perception of fish quantity five years ago across the four sites (Tubajon, $n = 96$, Agutayan, $n = 112$, Duka Bay, $n = 120$, Tagoloan, $n = 97$; $\chi^2 (3, n = 435) = 94.81$, $p = <0.0001$). Pairwise comparisons found significant differences in perception of fish quantity five years ago in: Tubajon and Duka Bay, Tubajon and Tagoloan, Agutayan and Duka Bay, and Duka Bay and Tagoloan (Table 42). The greatest difference between sites in terms of fish quantity perception five years ago was Tubajon and Duka Bay and Agutayan and Duka Bay. Respondents from Duka Bay (private MPA) especially felt the quantity of fish was much lower five years ago with an average perception of (1.58) compared to Tubajon (bottom-up MPA) (2.67), Agutayan (top-down MPA) and Tagoloan (non-MPA site) (Table 43).

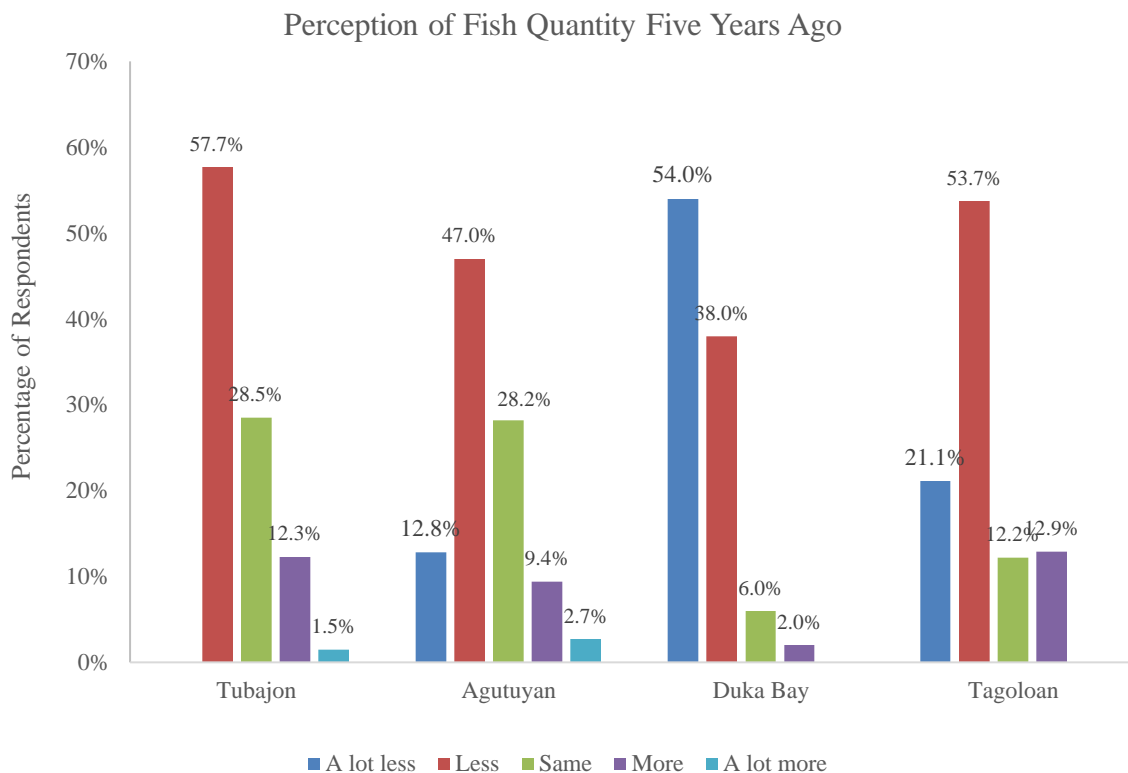


Figure 47. Percentage of responses to households in the four study sites, on the perception of the quantity of fish five years ago. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis (n = 435).

Table 42. The results of the Mann-Whitney U Test pairwise comparisons between responses regarding the perception of fish quantity five years ago across the sites. Significant p-values adjusted with Bonferroni correction at the $\alpha = 0.0083$ level are indicated with an *.

	Perception of fish quantity five years ago			
	U-stat	z value	r value	p-value
<i>Tubajon vs. Agutayan</i>	4489	-2.22	0.1	0.026
<i>Tubajon vs. Duka Bay</i>	1891	-9.04	0.7	<0.0001*
<i>Tubajon vs. Tagoloan</i>	3009	-4.61	0.3	<0.0001*
<i>Agutayan vs. Duka Bay</i>	3302	-7.14	0.6	<0.0001*
<i>Agutayan vs. Tagoloan</i>	4420.5	-2.49	0.0	0.013
<i>Duka Bay vs. Tagoloan</i>	3888.5	-4.57	0.4	<0.0001*

Table 43. Average perception to the question, "Compared to five years ago, what is the quantity of fish?" (1 = a lot less; 5 = a lot more).

MPA	Average Perception
Tubajon (<i>n</i> =96)	2.67
Agutayan (<i>n</i> =112)	2.38
Duka Bay (<i>n</i> =120)	1.58
Tagoloan (<i>n</i> = 97)	2.11

Respondents from the four communities had varying perception regarding the general health of their coral reef, when asked, is your coral reef healthy? Tubajon households did feel their coral reef was healthy with 94.7% (*n* = 142) answering “yes” (Figure 48). But in Tagoloan, respondents felt differently about the general health of their reef, with 62.6% (*n* = 92) stating they were not. There was a significant difference found in household responses of the perception of general coral health across the four sites (Tubajon, *n* = 150, Agutayan, *n* = 150, Duka Bay, *n* = 150, Tagoloan, *n* = 147; χ^2 (3, *n* = 597) = 108.96, *p* = <0.0001). Pairwise comparisons found significant differences in the perception of general coral health in: Tubajon and Agutayan, Tubajon and Duka Bay, Tubajon and Tagoloan, Agutayan and Tagoloan, and Duka Bay and Tagoloan. Specifically, the greatest difference being between Tubajon and Tagoloan where respondents in Tubajon had significantly lower perception of coral health when compared to Tagoloan (Table 44).

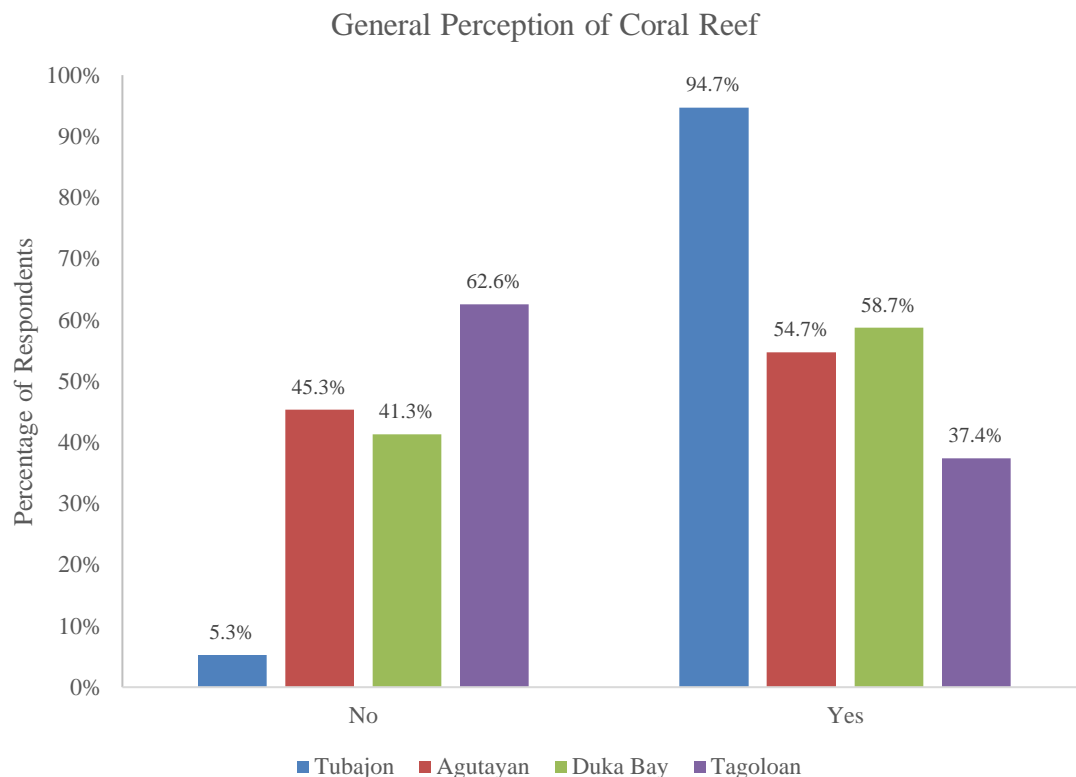


Figure 48. Overall perception from respondents when asked about the health of their coral reef in the four sites (n = 597).

Table 44. The results of the Mann-Whitney U Test pairwise comparisons between responses regarding the perception of general coral health across the sites. Significant adjusted with Bonferroni correction p-values at the $\alpha = 0.0083$ level are indicated with an *.

	Perception of coral health			
	U-stat	z value	r value	p-value
Tubajon vs. Agutayan	6750	-7.95	0.5	<0.0001*
Tubajon vs. Duka Bay	7200	-7.36	0.4	<0.0001*
Tubajon vs. Tagoloan	4713	-10.42	0.6	<0.0001*
Agutayan vs. Duka Bay	10800	-0.698	0.0	0.485
Agutayan vs. Tagoloan	9123	-2.98	0.2	0.003*
Duka Bay vs. Tagoloan	8692	-3.66	0.2	<0.0001*

Coral health perceptions in the past five years was varying across the four sites (Figure 49). In Tubajon coral reef health in the past five years was perceived as either “more” healthy (48.1%, $n = 51$) or the “same” (39.6%, $n = 42$). However, in Tagoloan, coral health was perceived to be improving with respondents 45.4% ($n = 44$) answering that reefs were “a lot less” healthy five years previously. There was a significant difference in household responses of the perception of coral five years ago across the four areas (Tubajon, $n = 106$, Agutayan, $n = 113$, Duka Bay, $n = 120$, Tagoloan, $n = 97$; $\chi^2 (3, n = 436) = 122.22, p = <0.0001$). Pairwise comparisons found a significant difference in perception of coral five years ago in: Tubajon and Agutayan, Tubajon and Duka Bay, Tubajon and Tagoloan, Agutayan and Duka, Agutayan and Tagoloan, and Duka Bay and Tagoloan. Tubajon and Tagoloan were found greatest difference in respondent’s perceptions of coral reef health (Table 45). Respondents from Tubajon (bottom-up MPA) had a significantly higher average perception regarding the health of their coral reefs five years ago (3.42), compared to Tagoloan (non-MPA site) (1.81) who had a negative view of their coral health five years ago (Table 46). Also, Duka Bay (private MPA) respondents perceived the health of the coral reef to be less five years ago, with the average perception of (2.42).

Perception of Coral Health Five Years Ago

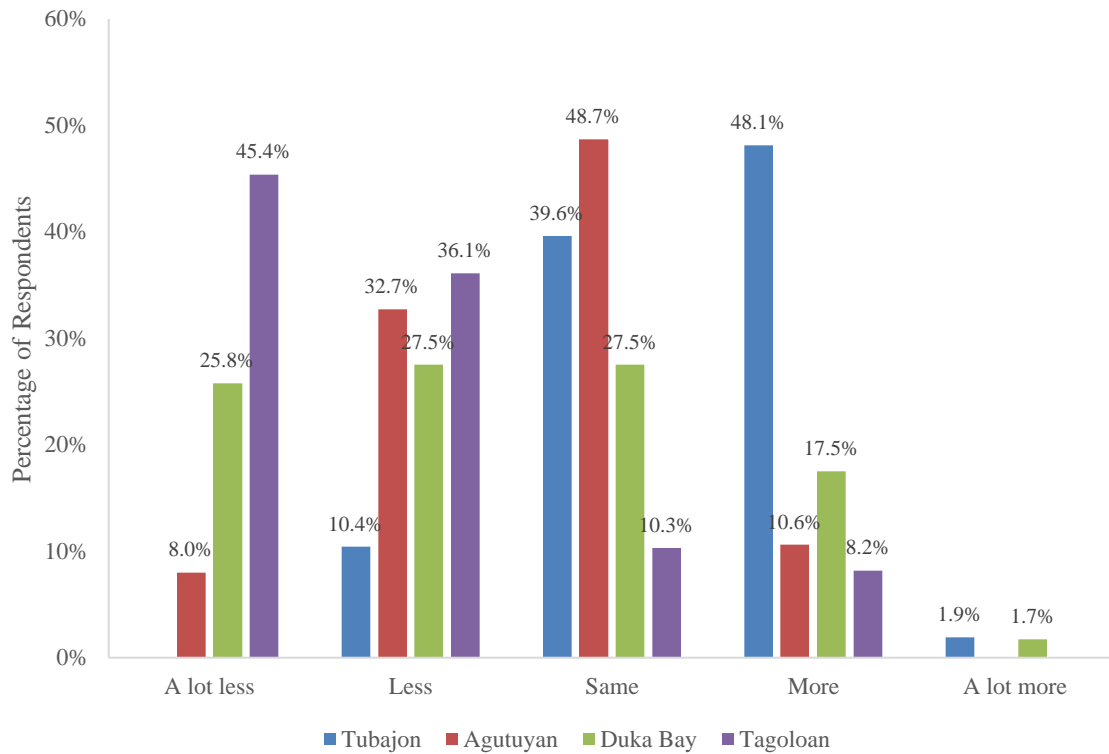


Figure 49. Respondents perception of the health of the coral reef five years ago. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis (n = 436).

Table 45. The results of the Mann-Whitney U Test pairwise comparisons between responses regarding the perception of coral health five years ago across the sites. Significant p-values adjusted with Bonferroni correction at the $\alpha = 0.0083$ level are indicated with an *.

	Perception of coral health				
	U-stat	z value	r value	p-value	
<i>Tubajon vs. Agutayan</i>	2905.5	-7.02	0.5	<0.0001*	
<i>Tubajon vs. Duka Bay</i>	3096	-6.93	0.5	<0.0001*	
<i>Tubajon vs. Tagoloan</i>	1140	-9.89	0.7	<0.0001*	
<i>Agutayan vs. Duka Bay</i>	5945.5	-1.7	0.0	0.89	
<i>Agutayan vs. Tagoloan</i>	2751.5	-6.51	0.2	<0.0001*	
<i>Duka Bay vs. Tagoloan</i>	4009.5	-4.11	0.2	<0.0001*	

Table 46. Average perception to the question, "Compared to five years ago, what is the health of coral reefs in your community?" (1=a lot less; 5= a lot more)

MPA	Average Perception
Tubajon (<i>n</i> =106)	3.42
Agutayan (<i>n</i> =113)	2.62
Duka Bay (<i>n</i> =120)	2.42
Tagoloan (<i>n</i> = 97)	1.81

Perceptions regarding MPA

Respondents in Tubajon felt that MPA was providing some biological improvements, with 52.0% (*n* = 66) “agreeing” with the statement that the quantity of fish has improved since the MPA (Figure 50). But in Agutayan and Duka Bay the respondents had “disagreed” with the statement regarding improved fish catch, in Duka Bay especially with 70.9% (*n* = 83) “disagreeing”. There was a significant difference in respondent’s perception of increased fish quantity since the MPA was established in the three sites (Tubajon, *n* = 127, Agutayan, *n* = 113, Duka Bay, *n* = 117), χ^2 (2, *n* = 357) = 51.30, *p* = <0.0001. All sites were found to be significantly different from one another with an adjusted alpha level *p* <0.0167), with Tubajon (bottom-up MPA) and Duka Bay (private MPA) having the greatest difference (Table 47). Respondents from Tubajon had a higher average perception regarding increased fish catch since the MPA (3.35, *n* = 127), compared to Agutayan (top-down MPA) and Duka Bay (Table 48). Alternatively, household’s from Duka Bay had a negative view of the improved fish catch since the MPA, with an average perception of (2.46, *n* = 117).

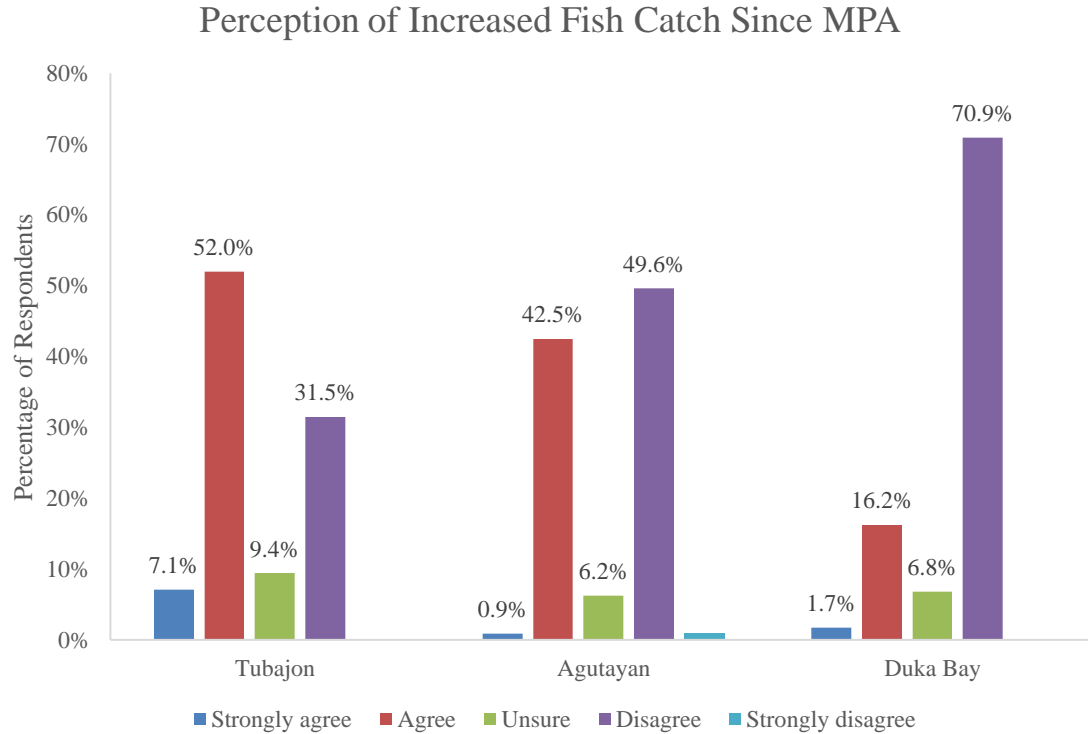


Figure 50. Perception of increased fish quantity after the MPA had been established in the three sites. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis (n = 357).

Table 47. The results of the Mann-Whitney U Test pairwise comparisons between responses regarding the perception of increased fish catch since MPA establishment across the sites. Significant p-values adjusted with Bonferroni correction at the $\alpha = 0.0167$ level are indicated with an *.

	Perception of increased fish catch			
	U-stat	z value	r value	p-value
Tubajon vs. Agutayan	5644.5	-3.13	0.2	0.002*
Tubajon vs. Duka Bay	3888	-7.06	0.5	<0.0001*
Agutayan vs. Duka Bay	4790.5	-4.15	0.3	<0.0001*

Table 48. Average perception to the question, " Since the MPA has been established the fish catch has increased in the community?" (1=a lot less; 5= a lot more).

MPA	Average perception of fish quantity since MPA
Tubajon (n=127)	3.35
Agutayan (n=113)	3.09
Duka Bay (n=117)	2.46

At all sites the majority “agreed” that the MPA was improving coral health in their community (Figure 51). In Tubajon 71.7% ($n = 91$) of respondents “agreed” that coral health was improving. However, in Agutayan 35.4% ($n = 40$) of the respondents “disagreed” that coral health was improving since the MPA was established. There was a significant difference in respondent’s perception of improved coral health since the MPA was established in the three sites (Tubajon, $n = 127$, Agutayan, $n = 113$, Duka Bay, $n = 117$; $\chi^2 (2, n = 357) = 13.58, p = 0.001$). Sites found to be significantly different from one another (Table 49), were Duka Bay versus Agutayan as well as Tubajon versus Agutayan, with the latter having the greatest difference when comparing z and r values. Respondents from Tubajon (bottom-up MPA) had a higher average perception regarding improved coral health since MPA inception (3.25, $n = 127$), compared to Agutayan (top down MPA) and Duka Bay (private MPA) (Table 50). Alternatively, household’s from Duka Bay had a neutral view of the coral’s health since the MPA was established, with an average perception of (3.60, $n = 117$).

Perception of Improved Coral Health Since MPA

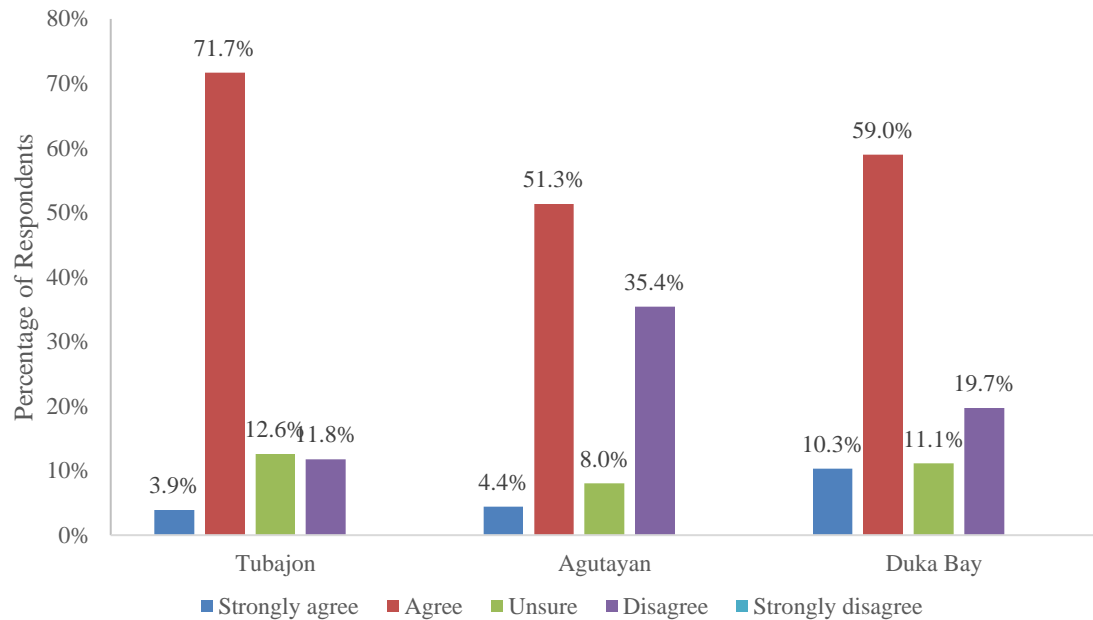


Figure 51. Respondents perception in three MPA communities on the health of the coral reefs since the MPA was established. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis (n = 357).

Table 49. The results of the Mann-Whitney U Test pairwise comparisons between responses regarding the perception of improved coral health since MPA establishment across the sites. Significant p-values adjusted with Bonferroni correction at the $\alpha = 0.0167$ level are indicated with an *.

	Perception of improved coral health			
	U-stat	z value	r value	p-value
Tubajon vs. Agutayan	5566.5	-3.47	0.2	0.001*
Tubajon vs. Duka Bay	7244	-0.40	0.0	0.690
Agutayan vs. Duka Bay	5369.5	-2.73	0.2	<0.0001*

Table 50. Average perception to the question, “Since the MPA has been established the quantity and quality of coral reefs has improved?” (1=a lot less; 5= a lot more)

MPA	Average perception of coral health since MPA
Tubajon (n=127)	3.68
Agutayan (n=113)	3.25
Duka Bay (n=117)	3.60

Social improvements were perceived by the respondents since the MPAs were established in all communities (Figure 52). When asked about increased tourists in their community, all sites “agreed” there were more tourists since the MPAs were established. In Duka Bay (the private, resort-managed MPA) respondents reported the highest increase in tourists, with 55.1% ($n = 81$) “strongly agreeing” and 44.2% ($n = 65$) “agreeing”. Respondents from Tubajon (bottom-up MPA) did not perceive as many tourists in their community since the MPA, with 11.3% ($n = 17$) “unsure” or 18.7% ($n = 28$) “disagreeing”. There was a significant difference in respondent’s perception of increased tourists in their community since the MPA was established in the three sites (Tubajon, $n = 127$, Agutayan, $n = 113$, Duka Bay, $n = 117$; $\chi^2 (2, n = 357) = 102.64$, $p = <0.0001$). Sites found to be significantly different from one another (Table 51), were Tubajon versus Agutayan and Tubajon versus Duka Bay, with the latter having the greatest difference when comparing z and r values. Respondents from Duka Bay (private MPA) had a significantly higher average perception regarding increased tourists in their community since the MPA was established (4.56, $n = 117$), compared to Agutayan (top-down MPA) and Duka Bay (Table 52). Alternatively, Tubajon (bottom-up MPA) respondents had a lower, and more negative, perception regarding tourist numbers since the MPA, with an average perception of (3.59, $n = 127$).

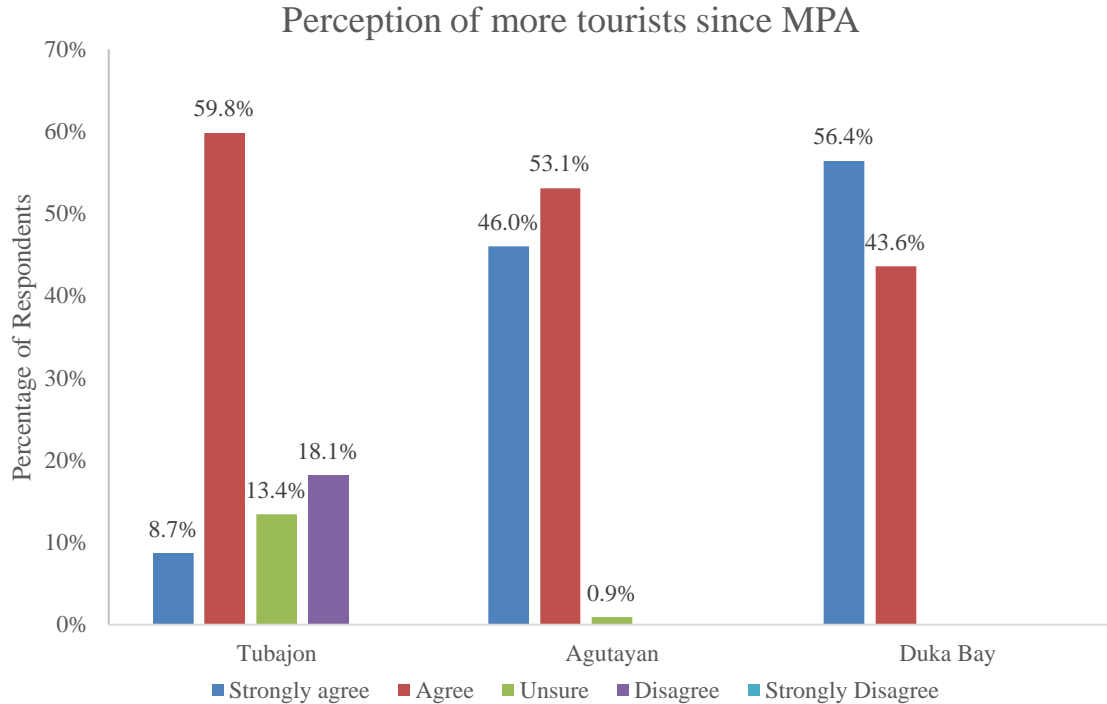


Figure 52. Respondents perception of an increase in tourists in the community after the MPA was established in the three sites. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis (n = 357).

Table 51. The results of the Mann-Whitney U Test pairwise comparisons between responses regarding the perception of increased number of tourists since MPA establishment across the sites. Significant p-values with adjusted Bonferroni correction at the $\alpha = 0.0167$ level are indicated with an *.

	Perception of increased number of tourists			
	U-stat	z value	r value	p-value
Tubajon vs. Agutayan	3321.5	-8.03	0.5	<0.0001*
Tubajon vs. Duka Bay	2862	-9.12	0.6	<0.0001*
Agutayan vs. Duka Bay	5898	-1.63	0.1	0.104

Table 52. Average perception to the question, “Since the MPA has been established are there more tourists visiting your community?” (1=a lot less; 5= a lot more)

MPA	Average Perception of increases in tourism
Tubajon (n=127)	3.59
Agutayan (n=113)	4.45
Duka Bay (n=117)	4.56

The MPAs in all sites were perceived as providing several biological benefits to the community (Figure 53). In Tubajon (bottom up MPA) “increased fish abundance” had the most responses (20.3%, n = 95), while in Agutayan (top down) “stopped habitat destruction” had the highest percentage of responses at (20.0%, n = 76). Duka Bay (private MPA) respondents were split between “increased fish abundance” (18.7%, n = 78) and “increased fish size” (19.9%, n = 83). Chi-Square tests of independence were conducted on each biological benefit to determine if there was significant difference between sites (Table 53). There were significant differences in sites for the following biological benefits: “increased fish abundance”; “increased fish size”; “brought species back” and also “no biological benefits”.

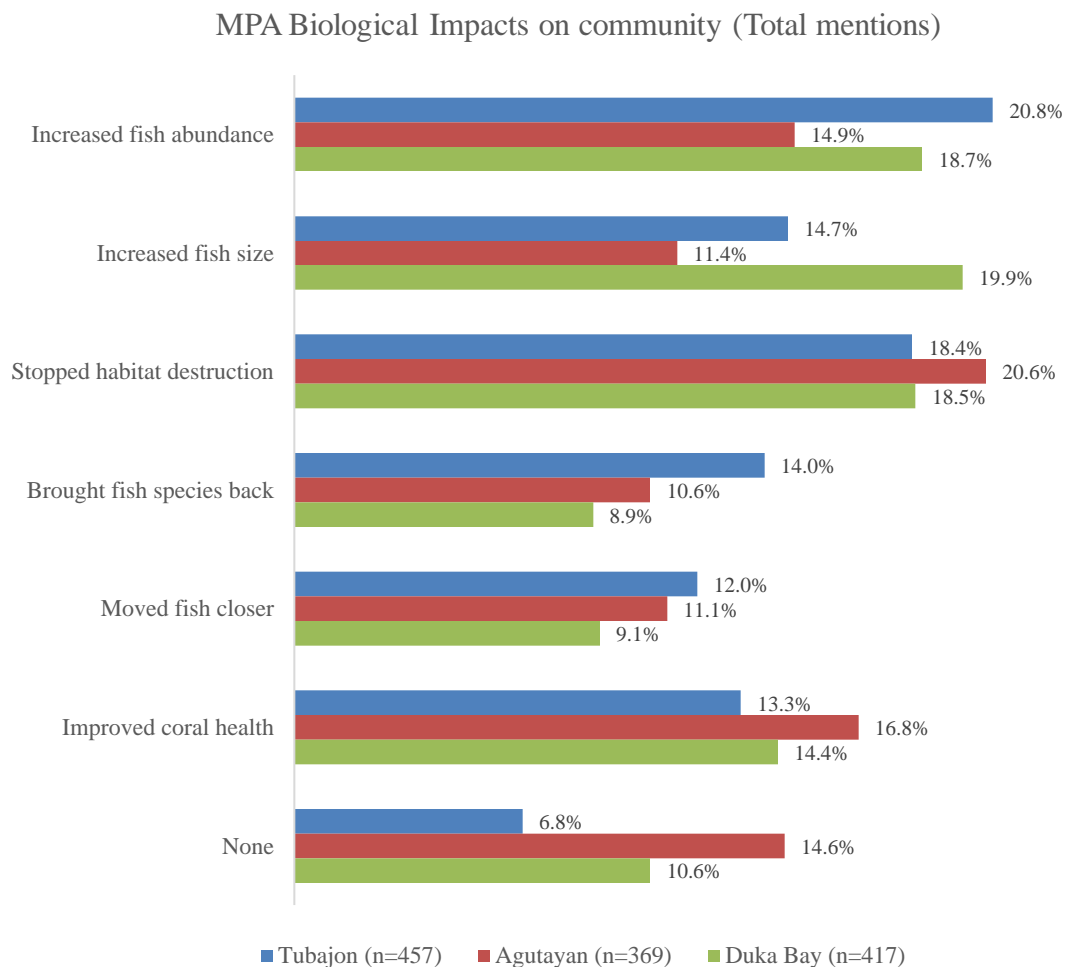


Figure 53. Perceived biological benefits of the MPA from the respondents in each of the three sites

Table 53. Chi-Square tests of independence results of the biological benefits perceived by the respondents in the Tubajon, Agutayan and Duka Bay. Significant *P*-values are shown in bold.

Biological Benefits	Pearson's Chi-Square	df	P-value	Phi
Increased fish abundance	21.71	2	<0.0001	0.22
Increased fish size	24.82	2	<0.0001	0.24
Stopped habitat destruction	0.89	2	0.65	0.05
Brought fish species back	13.54	2	0.00	0.17
Moved fish closer	4.89	2	0.09	0.11
Improved coral health	0.02	2	0.99	0.01
None	8.71	2	0.01	0.14

The main social benefits perceived by the respondents from the MPA were either “conserves resources for future generations” or “removes bad gear practices” (Figure 54). In Duka Bay 34.4% (n = 100) of respondents felt the greatest benefit of the MPA was “conserving resources for future generations” and the same was also reported in Agutayan 25.1% (n = 89). Removing bad gear or practices had the highest number of responses in Tubajon (22.4%, n = 69). Respondents in all sites did had very low response for “improves equity”, “educational opportunities” and “excludes outsiders”. A Chi-Square test of independence was conducted on each social benefit to determine if there was significant difference between sites (Table 54). There were significant differences in sites for the following social benefits: “improved fish catch”; “excludes outsiders”; “removed bad/gear practices”; “reduces conflicts”; “provides educational opportunities”; and “improves equity”.

MPA Social Benefits in community (Total mentions)

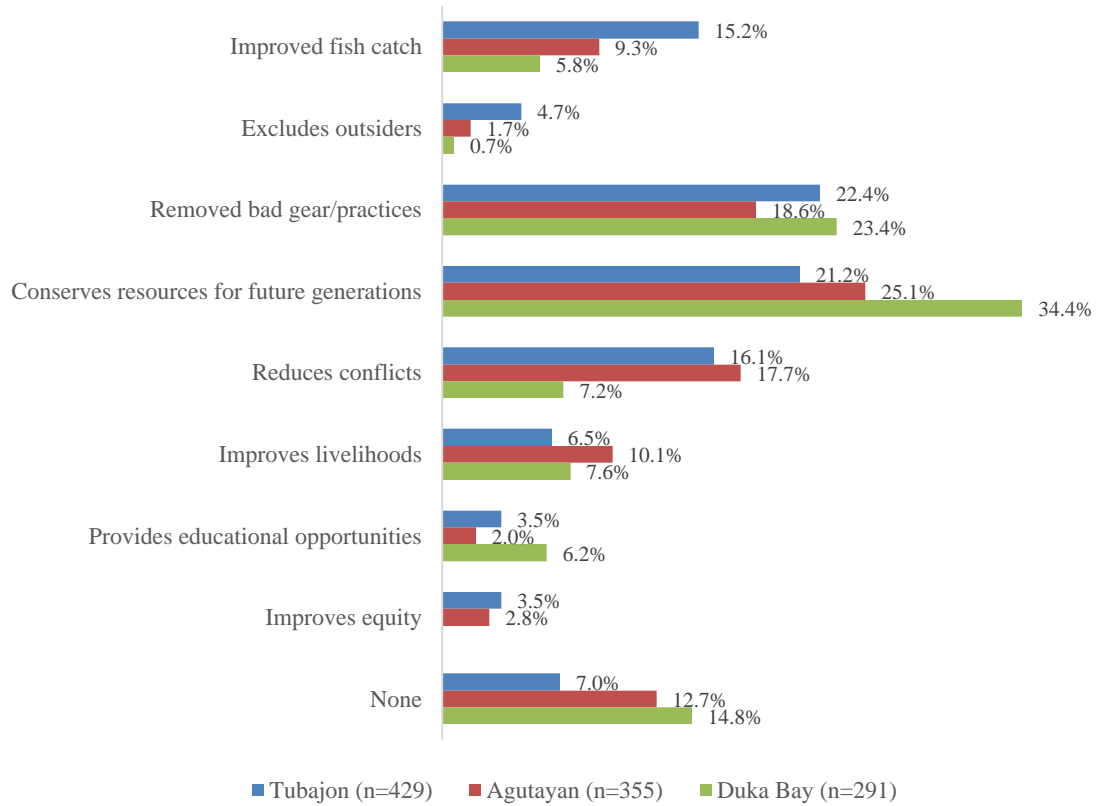


Figure 54. Perceived social benefits of the MPA from the respondents in each of the three sites.

Table 54. Chi-Square tests of independence results of the social benefits perceived by the respondents in the Tubajon, Agutayan and Duka Bay. Significant *P*-values are shown in bold.

Social Benefits	Pearson's Chi-Square	df	P-value	Phi
Improved fish catch	40.52	2	<0.0001	0.30
Excludes outsiders	20.10	2	<0.0001	0.21
Removed bad gear/practices	14.38	2	0.001	0.18
Conserves resources for future generations	2.77	2	0.25	0.08
Reduces conflicts	39.23	2	<0.0001	0.30
Improves livelihoods	3.95	2	0.139	0.09
Provides educational opportunities	5.54	2	0.063	0.11
Improves equity	14.55	2	0.001	0.18
None	4.78	2	0.092	0.10

Tubajon (bottom up MPA) was the community where respondents had the most overall positive perception of the MPA with 45.3% ($n = 68$) saying that it was “slightly good” and 21.3% ($n = 32$) answering it was “very good” for their community (Figure 55). Agutayan (top down MPA) respondents were somewhat in the middle of being positive to neutral in their perception of the MPA with (40.7%, $n = 61$) answering “slightly good” to 28.7% stating “neither” ($n = 43$). Duka Bay respondents overall had a positive perception with 45.6% ($n = 67$) of the households saying that it has been “slightly good”. However, there were more negative views of the MPA in Duka Bay (private) than in any of the other sites with 27.9% ($n = 41$) saying that the MPA has been “slightly bad” to 8.8% ($n = 13$) perceiving the MPA as “very bad”. There was a significant difference in respondent’s overall perception of the MPA in the three sites (Tubajon, $n = 150$, Agutayan, $n = 150$, Duka Bay, $n = 147$; $\chi^2 (2, n = 447) = 21.76$, $p = <0.0001$). Tubajon and Duka Bay were found to be significantly different from one another, as were Agutayan and Duka Bay, with Tubajon and Duka Bay having the greatest difference (Table 55). Respondents from Tubajon (bottom up MPA) had a significantly higher average perception regarding the overall impact of the MPA (3.61, $n = 149$), compared to Agutayan (top down MPA) and Duka Bay (private MPA) (Table 56). While Duka Bay had a more neutral view in regards to the overall impact of the MPA on the community, with an average perception score of 3.07 ($n = 146$).

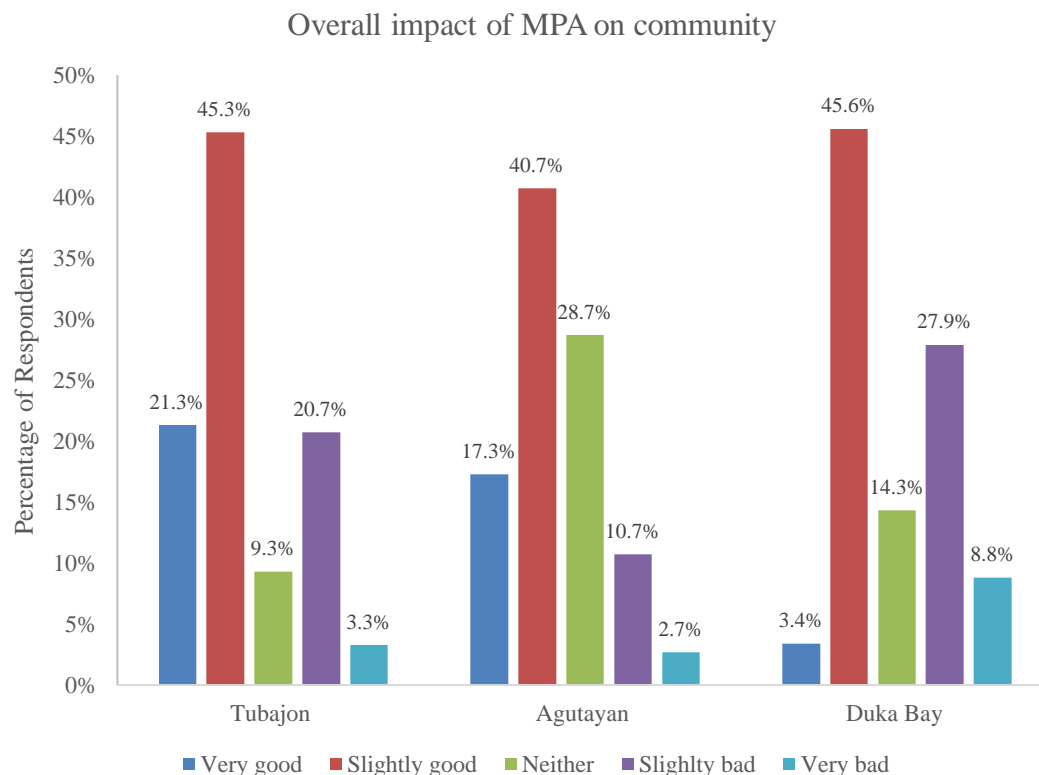


Figure 55. Overall perception of the MPA in the communities Tubajon, Agutayan, and Duka Bay (n = 447).

Table 55. The results of the Mann-Whitney U Test pairwise comparisons between responses regarding the overall perception of the MPA on the community across the three sites. Significant p-values adjusted with Bonferroni correction at the $\alpha = 0.0167$ level are indicated with an *.

	Overall perception of the MPA			
	U-stat	z value	r value	p-value
Tubajon vs. Agutayan	10795	-0.638	0.0	0.524
Tubajon vs. Duka Bay	8074	-4.23	0.2	<0.0001*
Agutayan vs. Duka Bay	8339	-3.82	0.2	<0.0001*

Table 56. Average perception to the question, “Overall, has the MPA been good or bad for the community?” (1=very good; 5= very bad)

MPA	Average Perception of MPA
Tubajon (n=149)	3.61
Agutayan (n=150)	3.59
Duka Bay (n=146)	3.07

MPA Community Participation

The majority of respondents from Tubajon (bottom up MPA) and Duka Bay (private MPA) were aware of community meetings regarding MPA establishment, Tubajon (66.7%, $n = 58$) and Duka Bay (60.5%, $n = 52$) (Figure 56). However, in the top down established MPA area Agutayan, 62.6% ($n = 46$) were not aware of any community meetings regarding MPA establishment. There was a significant difference in awareness of community meetings regarding MPA establishment in the three sites (Tubajon, $n = 87$, Agutayan, $n = 68$, Duka Bay, $n = 86$; $\chi^2 (2, n = 241) = 19.89$, $p = < 0.0001$, $\phi = .287$). Chi-square posteriori tests using residuals found Agutayan (top down MPA) was significantly lower than the other MPA communities on public awareness of meetings on MPA establishment (Table 57).

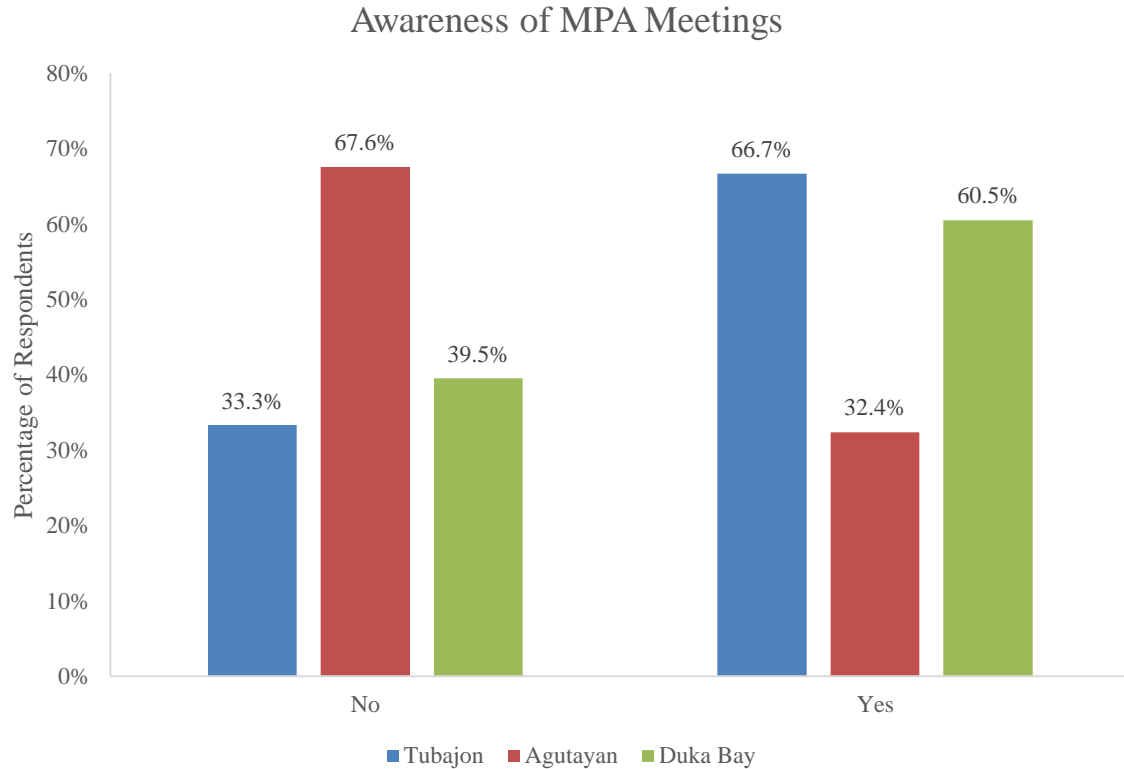


Figure 56. Respondents awareness of community meetings regarding MPA establishment in the three sites. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis (n = 241).

Table 57. Chi-square tests results of respondents who answered “yes” and “no”, regarding awareness of community meetings taking place in their community in the three MPA communities with residuals and calculated *p* values. Significant *p*-values adjusted with Bonferroni correction at the $\alpha = 0.0083$ level are indicated with an *

	Not Aware		Yes Aware	
	Residual	p-value	Residual	p-value
Tubajon	-1.6	0.1096	1.5	0.1336
Agutayan	2.7	0.0069*	-2.5	0.0124
Duka Bay	-0.8	0.4237	0.7	0.4839

Overall the majority of respondents in all communities with MPAs had wanted it established in their community (Figure 57). Duka Bay (private MPA) had the highest number of positive responses (80.9%, $n = 72$) while Agutayan (top down) had the lowest (73.0%, $n = 54$). However, there was no significant difference between communities in terms of respondents wanting the MPAs (Tubajon, $n = 88$, Agutayan, $n = 74$, Duka Bay, $n = 89$; $\chi^2(2, n = 251) = 1.89$, $p = .389$, $\phi = .087$).

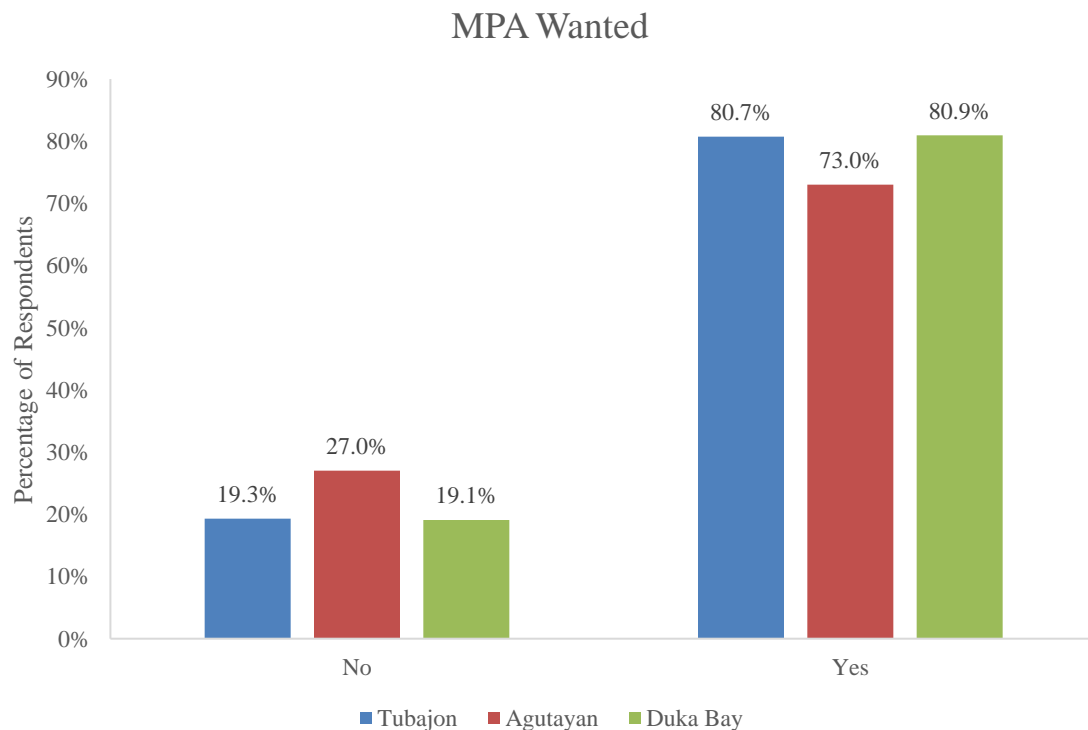


Figure 57. Percentage of respondents who desired to have the MPA established in their community in the three sites. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis ($n = 251$).

The government was perceived as being involved in MPA establishment in all three sites (Figure 58). In Agutayan (top down MPA), (100%, $n = 75$) stated, unsurprisingly, that the Government involved in the establishment of the MPA. Duka Bay (private MPA) had the most respondents saying the Government was not involved (22.2%, $n = 20$). There was a significant difference in the level of perceived Government involvement with the MPAs for the three sites (Tubajon, $n = 88$, Agutayan, $n = 75$, Duka Bay, $n = 90$; $\chi^2 (2, n = 253) = 34.46$, $p = <0.0001$, $\phi = .358$). Chi-square posteriori test using residuals revealed Duka Bay (private MPA) to have respondents to have a significantly lower perception of Government involvement than the other two MPAs (Table 58).

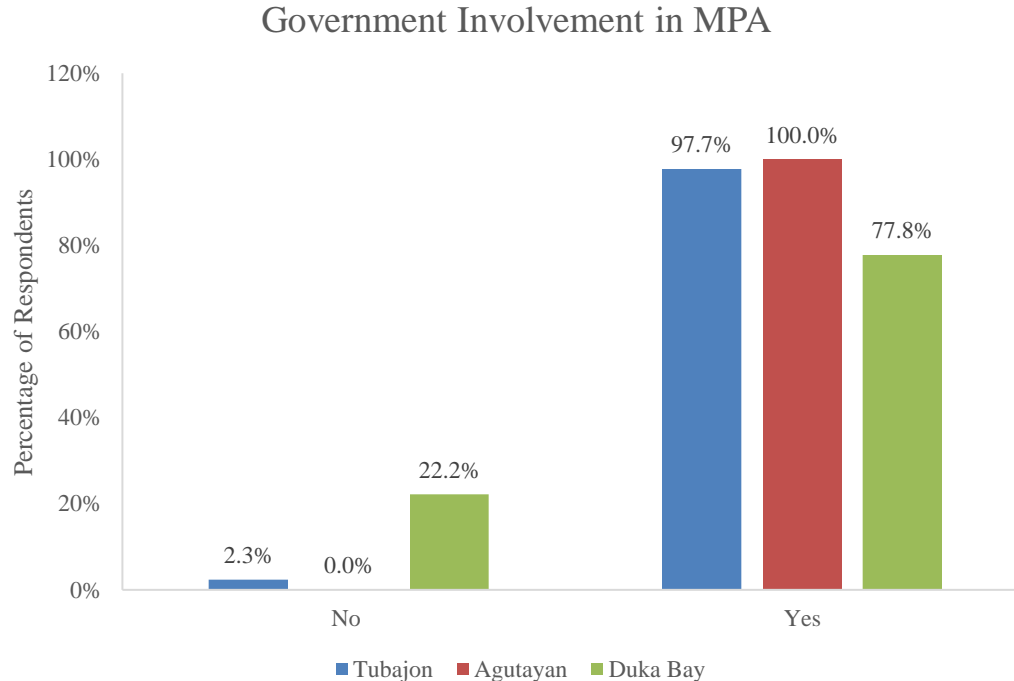


Figure 58. Percentage of respondents in each of the three sites who felt the government was involved in the establishment of the MPA in their community (n = 253).

Table 58. Chi-square tests results of respondents who answered “yes” and “no” regarding continued government involvement in their community in the three sites with residuals and calculated *p* values. Significant *p*-values adjusted with Bonferroni correction at the $\alpha = 0.00833$ level are indicated with an *.

	No		Yes	
	Residual	p-value	Residual	p-value
Tubajon	-2.0	0.0455	0.6	0.5485
Agutayan	-2.6	0.0093	0.8	0.4237
Duka Bay	4.4	<0.0001*	-1.3	0.1936

Households from each of the three communities were primarily split in their responses regarding whether they were involved in environmental education programs before the MPAs were established (Figure 59). For example, 55.7% Tubajon (bottom up MPA) respondents answered “yes” (n = 49) they were involved in environmental educational programs whereas in Agutayan (top down MPA) 53.3%, n = 49) said they

were not. There was no significant difference in environmental education program involvement between sites (Tubajon, $n = 88$, Agutayan, $n = 75$, Duka Bay, $n = 92$; $\chi^2 (2, n = 255) = 1.86$, $p = 0.395$, $\phi = .085$).

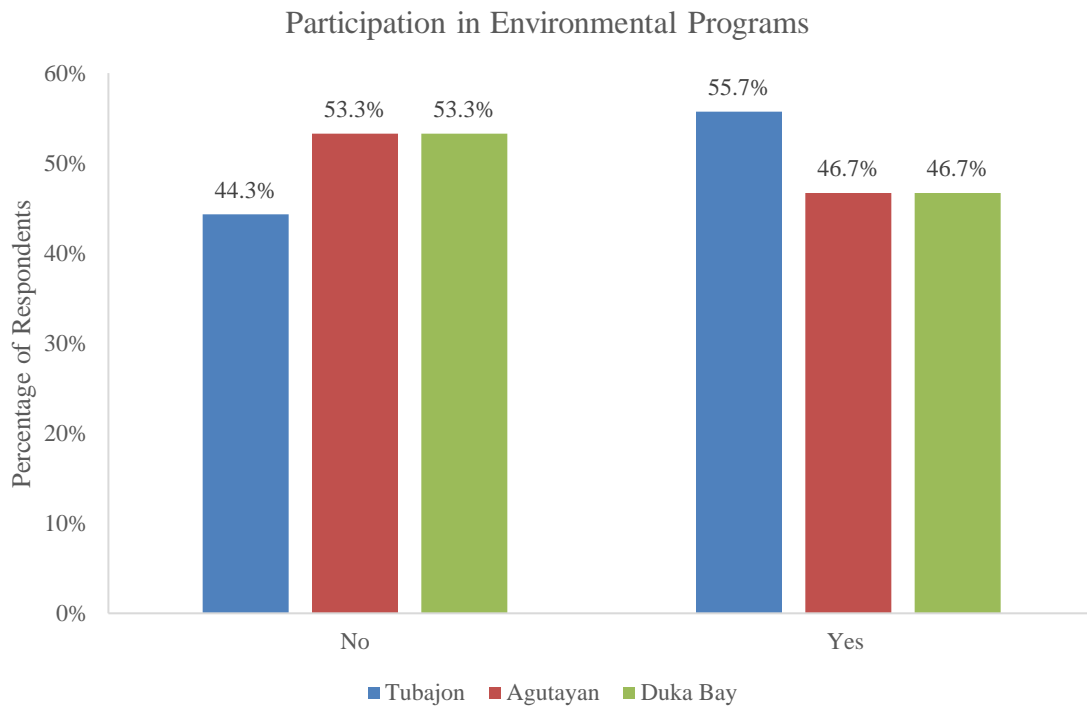


Figure 59. Percentage of respondents who were involved in environmental education programs before the MPA was established. Respondents that were not living in the community and respondents who were not 18 years of age when the MPA was established were removed from the analysis. ($n = 255$).

Enforcement and Conflicts

As for illegal fishing, in Agutayan (top down MPA) and Duka Bay (private MPA) there was a somewhat even split between respondents who felt that illegal fishing did, or did not, take place in their community (Figure 60). But a majority of the respondents in Tubajon (bottom up MPA) (79.3%, $n = 119$) did not feel illegal fishing took place. There

was significant difference between the three MPA communities regarding perceptions of illegal fishing (Tubajon, $n = 150$, Agutayan, $n = 150$, Duka Bay, $n = 150$; $\chi^2 (2, n = 450) = 37.66$, $p = < .0001$, $\phi = .289$). The difference in perceptions of illegal fishing was significantly different between Tubajon (bottom up MPA) with fewer residents believing illegal fishing occurred (Table 59). Illegal fishing as was mainly identified as either large scale fishing, or illegal fine mesh nets (Figure 61).

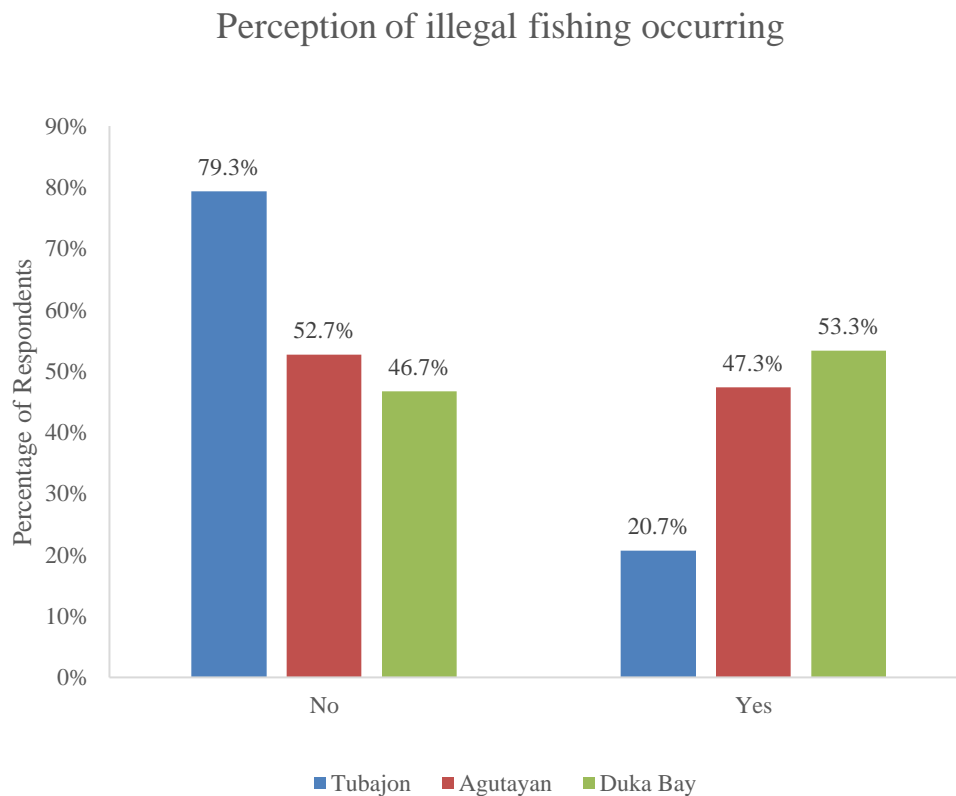


Figure 60. Percentage of responses regarding illegal fishing either taking place or not taking place in their community in the three sites ($n = 450$).

Table 59. Chi-square tests results of respondents who answered “yes” and “no” regarding illegal fishing taking place in their community in the three MPA communities with residuals and calculated *p* values. Significant *p*-values adjusted with Bonferroni correction at the $\alpha = 0.00833$ level are indicated with an *.

	No: Illegal Fishing		Yes: Illegal Fishing	
	Residual	p-value	Residual	p-value
Tubajon	3.1	0.0019*	-3.8	<0.0001*
Agutayan	-1.1	0.2713	1.3	0.1936
Duka Bay	-2.0	0.0455	2.5	0.0124

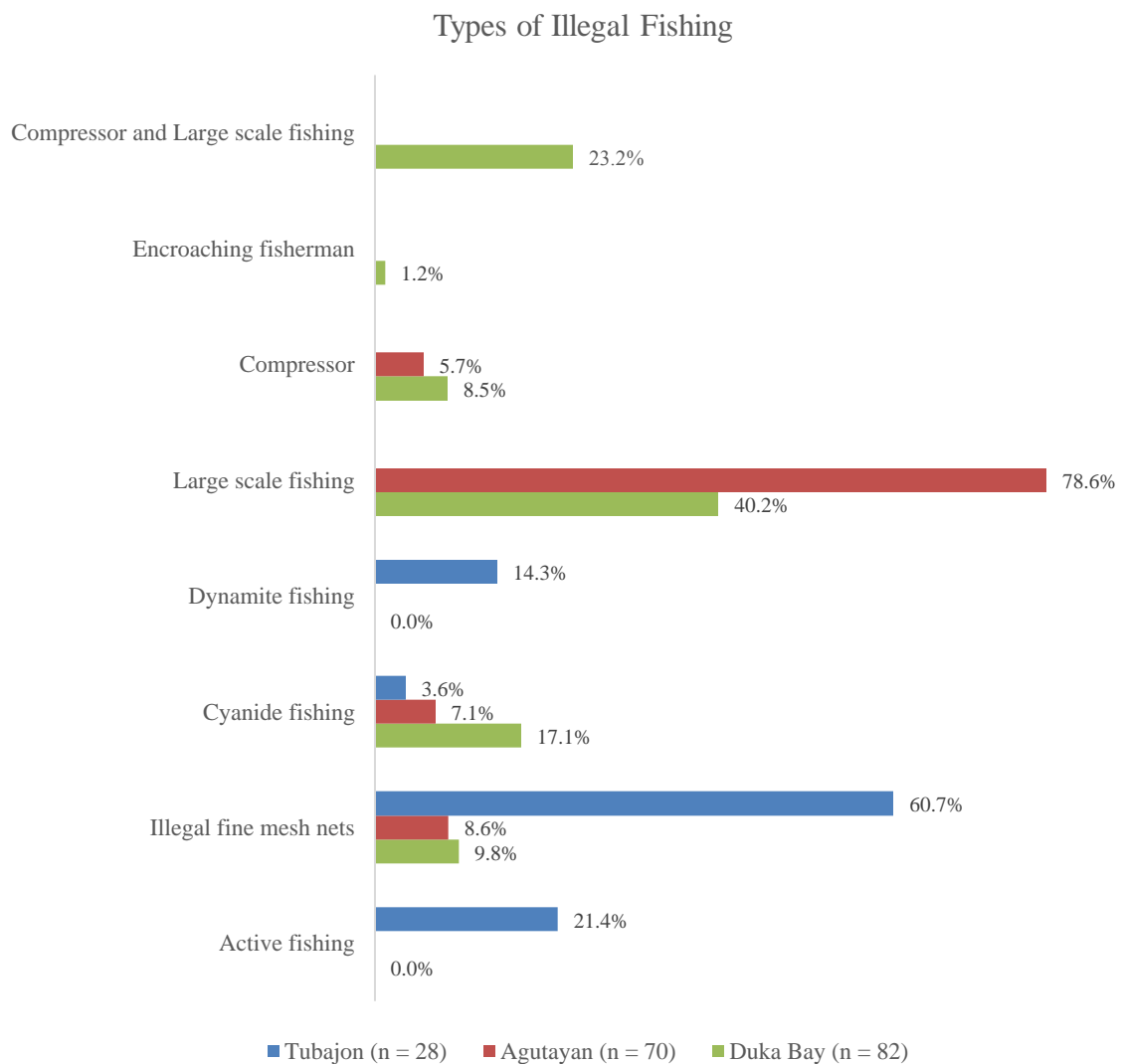


Figure 61. Percentages of the type of illegal fishing method respondents identified in their community (n = 180).

In terms of the government being actively involved in the MPAs, most households in all sites did feel that the government had a continued involvement in the MPA (Figure 62). A majority of Tubajon respondents (66.7%, $n = 100$) “agreed” that the government was actively involved as well as respondents from Agutayan. However, some respondents (19.7%, $n = 29$) in Duka Bay felt the government was not actively involved. There was a significant difference between the three sites for respondent’s perception of continued government involvement (Tubajon, $n = 150$, Agutayan, $n = 150$, Duka Bay, $n = 147$; $\chi^2 (2, n = 447) = 20.73$, $p = <0.0001$). Duka Bay (private MPA) had a significantly lower perception of continued Government involvement in the MPA than Tubajon (bottom up MPA) and, especially, Agutayan (top down MPA) (Table 60).

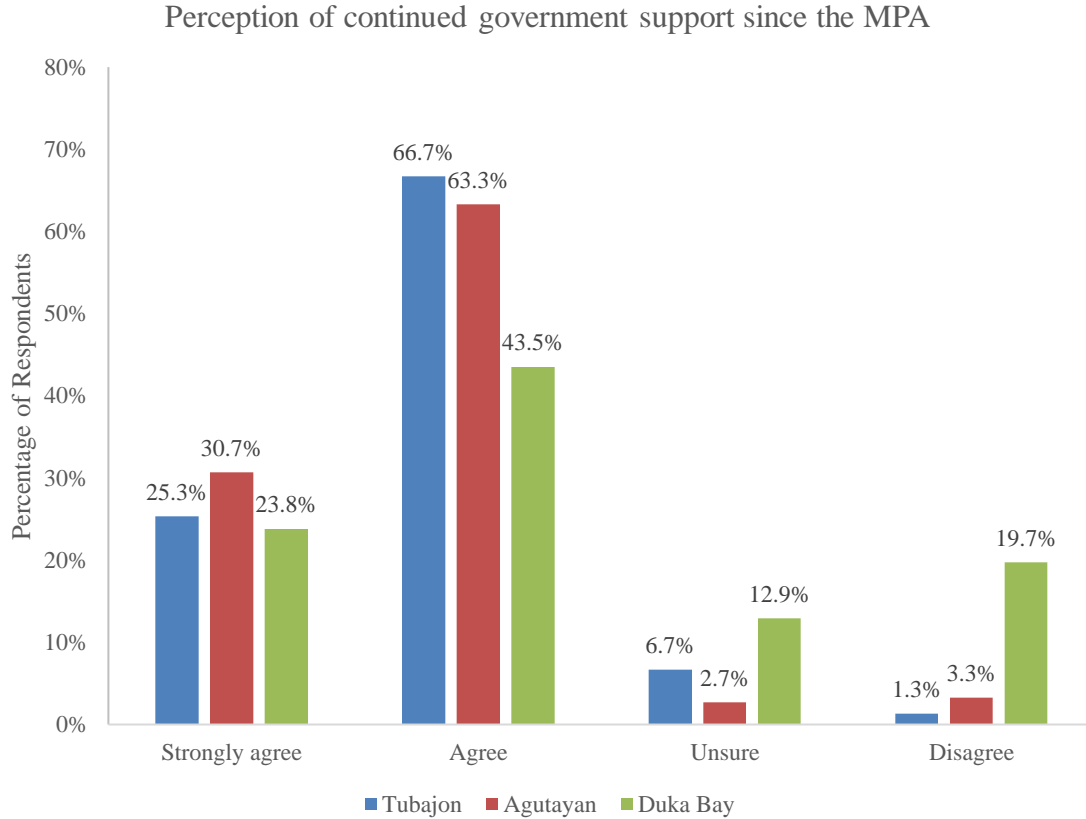


Figure 62. Perception of on the governments involvement in their MPA in the three sites (n = 447).

Table 60. The results of the Mann-Whitney U Test pairwise comparisons between responses regarding the perception of continued government involvement in the MPA across the three sites. Significant p-values adjusted with Bonferroni correction at the $\alpha = 0.0167$ level are indicated with an *.

	Perception of continued government involvement			
	U-stat	z value	r value	p-value
Tubajon vs. Agutayan	10551	-1.11	0.1	0.267
Tubajon vs. Duka Bay	8715	-3.46	0.2	0.001*
Agutayan vs. Duka Bay	8266.5	-4.11	0.2	<0.0001*

When asked about specific problems with their particular MPA, most respondents listed that it: “erodes traditional authority”; “causes conflicts” or that “regulations are not well enforced”; or there are “too many regulations” (Figure 66). In Duka Bay (private

MPA) the highest percentage of responses were for “erodes traditional authority” (28.7%, n = 72). In Tubajon (bottom up MPA) respondents often listed: “regulations not well enforced” (21.2%, n = 63)”, and “too many regulations” (21.2%, n = 63) as the main problems with the MPA. There were significant differences in sites for the following MPA problems (Table 61; Figure 63): “too many regulations”, “regulations not well enforced”, “causes conflicts”, “creates inequity”, as well as those that stated there were “no problems”.

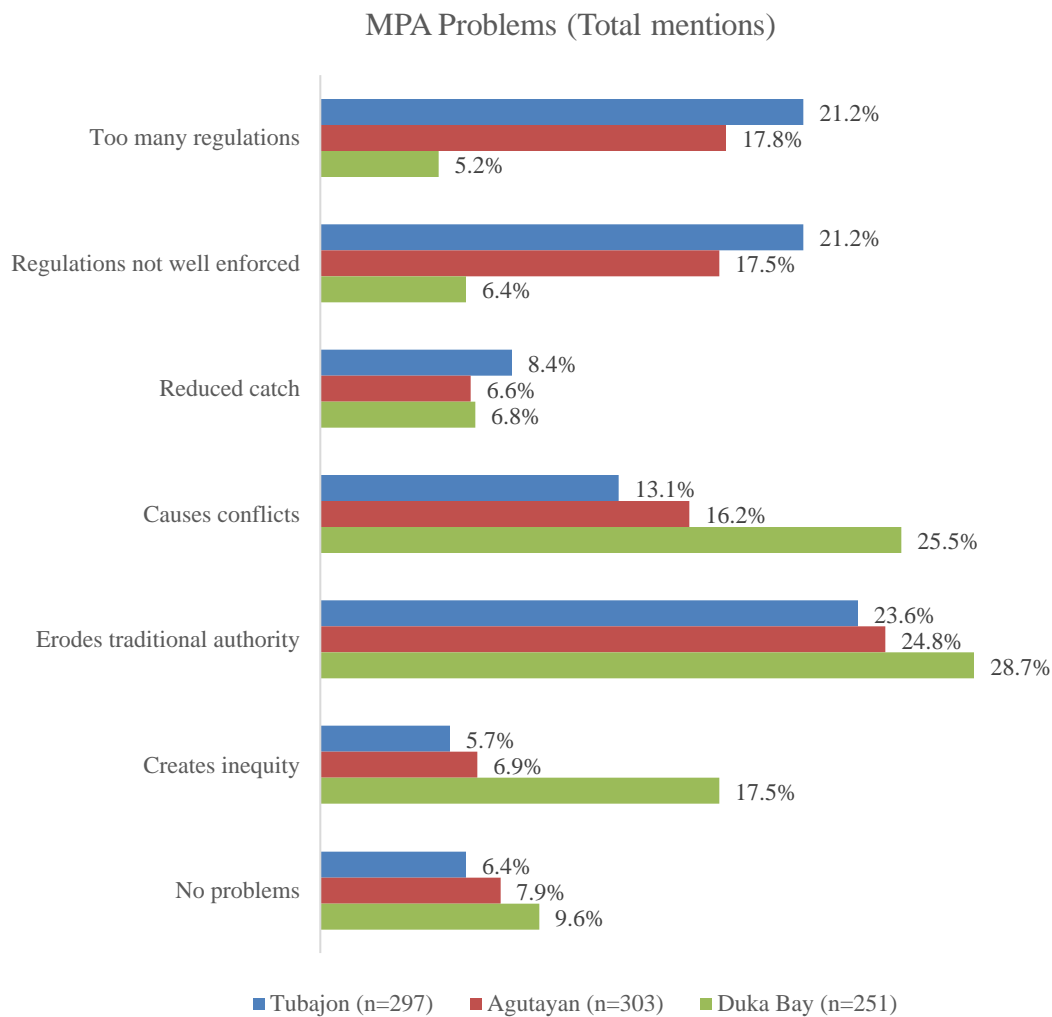


Figure 63. Percentage of responses to the problems of the MPA in each of the three sites.

Table 61. Chi-Square tests of independence results of the MPA problems perceived by the respondents in the Tubajon, Agutayan and Duka Bay. Significant *P*-values are shown in bold.

MPA Problems	Pearson's Chi-Square	df	P-value	Phi
Too many regulations	44.97	2	<0.0001	0.32
Regulations not well enforced	38.33	2	<0.0001	0.29
Reduced catch	1.65	2	0.44	0.06
Causes conflicts	10.31	2	0.01	0.15
Erodes traditional authority	0.412	2	0.81	0.03
Creates inequity	19.69	2	<0.0001	0.21
No problems	0.985	2	0.61	0.05

Empowerment

The respondents in all sites stated that they were not very involved in decision-making in their community (Figure 64). In Duka Bay (private MPA), almost all of the respondents answered that they weren't involved (99.3%, $n = 148$), and in both Agutayan and Tubajon only 19.3% ($n = 29$) said they were involved. In Tagoloan (non-MPA site) respondents were evenly split between saying they were involved or not involved in decision-making (50.0%, $n = 74$). The difference in involvement in decision making was significant between the four sites (Tubajon, $n = 150$, Agutayan, $n = 150$, Duka Bay, $n = 149$, Tagoloan, $n = 148$; $\chi^2 (3, n = 597) = 107.37$, $p = <0.0001$, $\phi = 0.424$). Tagoloan was found to have a significantly higher percentage of respondents involved in decision-making compared to the three other sites (Table 62). In regards to MPAs, Duka Bay (private MPA) was perceived as having less community involvement in decision-making compared to the two MPA sites.

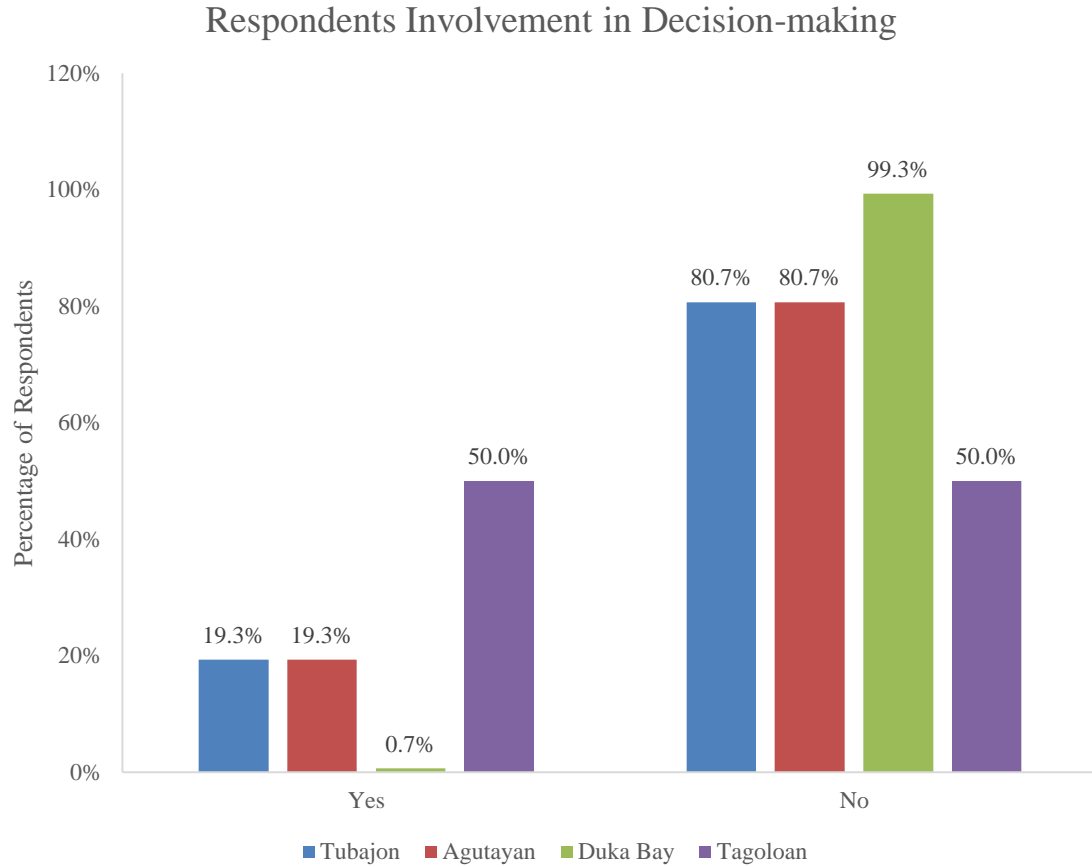


Figure 64. Percentage of respondents who are involved in decision making in their community across the three sites (n = 597).

Table 62. Chi-square tests results of respondents who answered “yes” and “no” regarding being involved in decisions in the four sites with residuals and calculated *p* values. Significant *p*-values adjusted with Bonferroni correction at the $\alpha = 0.00625$ level are indicated with an *.

	Involved in Decision-making		Not involved in Decision-making	
	Residual	p-value	Residual	p-value
Tubajon	-.8	0.4237	.4	0.6892
Agutayan	-.8	0.4237	.4	0.6892
Duka Bay	-5.6	<0.0001*	3.0	<0.0027*
Tagoloan	7.1	<0.0001*	-3.8	<0.0001*

A majority of the MPA households considered that they weren't involved in marine resource use decisions in their community either (Figure 65). In Duka Bay 77.7% of respondents ($n = 115$) stated that they were "not" involved in marine resource use decisions. Alternatively, in Tagoloan (non-MPA site) there was involvement in marine resource decisions with 53.4% ($n = 79$) of the respondents answering "yes" they were involved in marine resource decisions. There was a significant difference found between marine resource decision-making in four sites (Tubajon, $n = 150$, Agutayan, $n = 150$, Duka Bay, $n = 148$, Tagoloan, $n = 148$; $\chi^2(3, n = 596) = 29.12$, $p = <0.0000$, $\phi = .221$). Respondents in Tagoloan were significantly more likely to be involved in marine resource decisions in their community compared to the other three sites (Table 63).

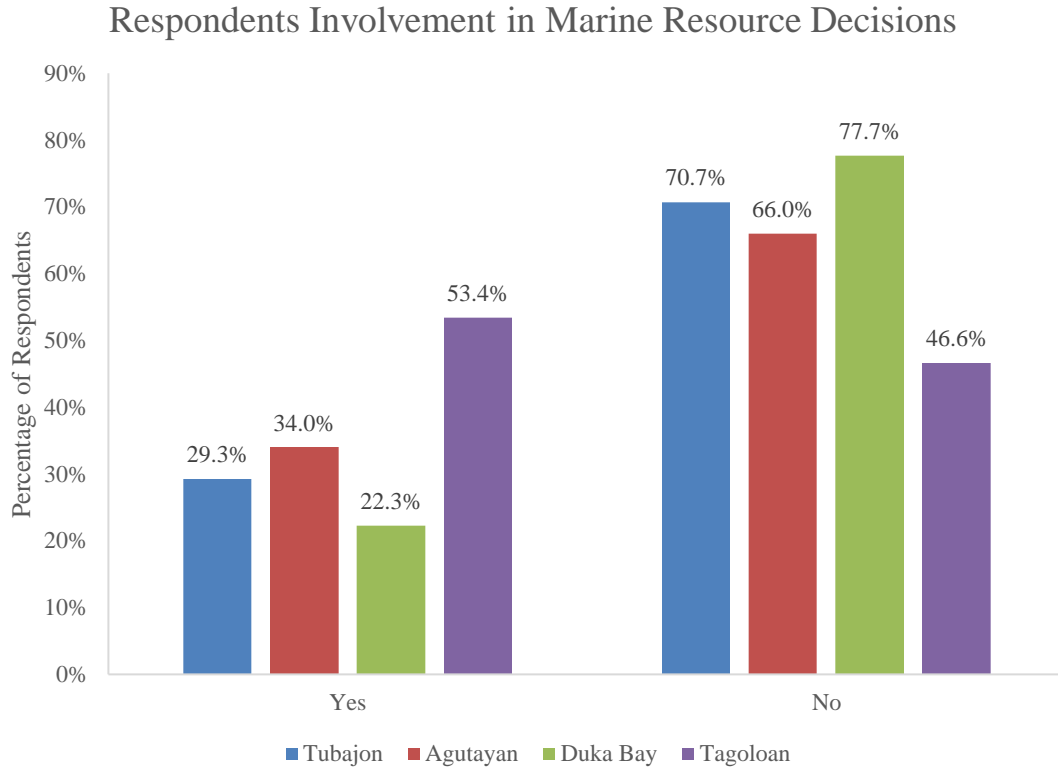


Figure 65. Percentage of respondents who were involved in marine resource decision making in their community in the three sites (n = 596).

Table 63. Chi-square tests results of respondents who answered “yes” and “no” regarding participation in marine decisions in the four sites with residuals and calculated *p* values. Significant *p*-values adjusted with Bonferroni correction at the $\alpha = 0.00625$ level are indicated with an *.

	Yes: Marine Decisions		No: Marine Decisions	
	Residual	p-value	Residual	p-value
Tubajon	-1.1	0.2713	.8	0.4237
Agutayan	-.2	0.8415	.1	0.9203
Duka Bay	-2.6	0.0093	-1.9	0.0574
Tagoloan	3.8	0.0014*	-2.9	0.0051*

Participation in people’s organization groups (POs) was limited in all sites. Only 27.5% (n = 164) of the respondents said they participated in a PO group (Figure 66). Tagoloan had the highest percentage of respondents (39.9%, n = 59) who said they

participated in the POs and Tubajon had the lowest percentage (16.0%, $n = 24$). There was a significant difference in group involvement between the four communities (Tubajon, $n = 150$, Agutayan, $n = 150$, Duka Bay, $n = 148$, Tagoloan, $n = 148$; $\chi^2 (3, n = 596) = 29.12$, $p = <0.0000$, $\phi = .221$). Respondents in Tagoloan were significantly more likely to be a members of a people's organization group (Table 64).

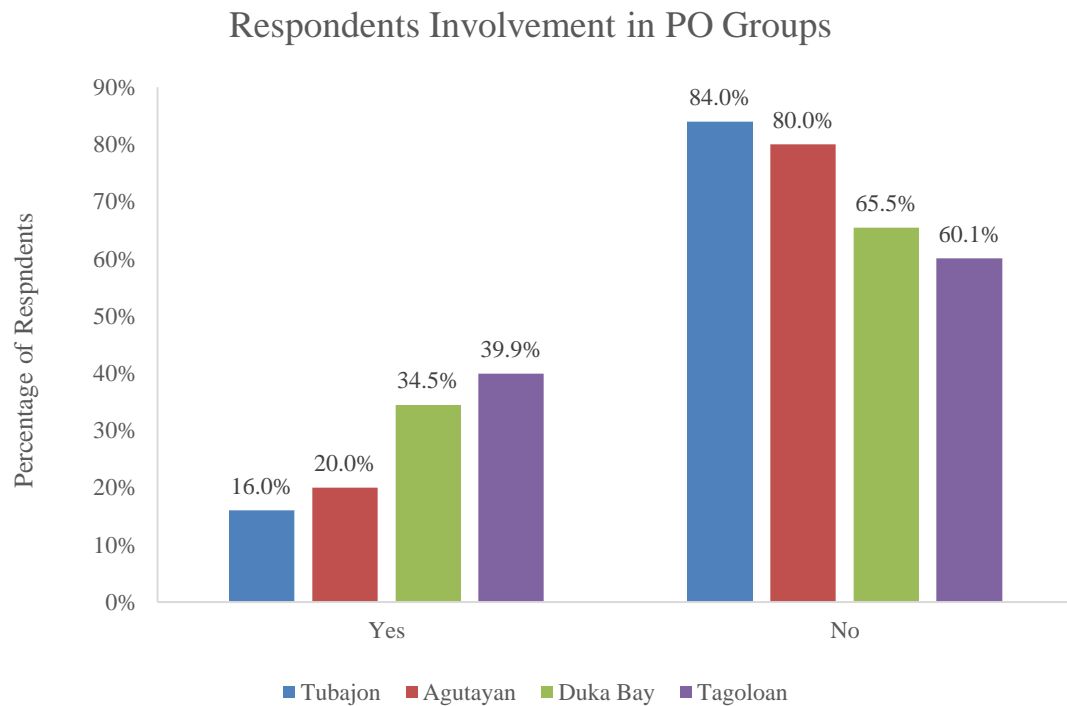


Figure 66. Percentage of respondents who participated in People Organization (PO) groups in the three sites ($n = 448$).

Table 64. Chi-square tests results of respondents who answered “yes” and “no” regarding participation in PO groups in the four sites with residuals and calculated *p* values. Significant *p*-values adjusted with Bonferroni correction at the $\alpha = 0.00625$ level are indicated with an *.

	Yes: PO Groups		No: PO Groups	
	Residual	p-value	Residual	p-value
Tubajon	-2.7	0.0069	1.7	0.0891
Agutayan	-1.8	0.0719	1.1	0.2713
Duka Bay	-1.6	0.1096	-1.0	0.3173
Tagoloan	2.9	0.0037*	-1.81	0.0719

At all four sites the majority of the groups people were members of, were fisherfolk associations. Tagoloan (non-MPA site) respondents reported attending “all” (71%, $n = 47$) of the meetings the most out of all other sites. In MPA communities Duka Bay respondents reported attending “all” (60.0%, $n = 29$) of the meetings, the most of MPA sites (Figure 67). There was a significant difference in respondent’s PO meeting attendance in the three sites (Tubajon, $n = 24$, Agutayan, $n = 30$, Duka Bay, $n = 46$, Tagoloan, $n = 64$; $\chi^2 (3, n = 164) = 49.82$, $p = <0.0001$). Tagoloan respondents attended significantly more meetings when compared to either of the other sites, but a particularly higher rate of attendance than Agutayan (Table 65).

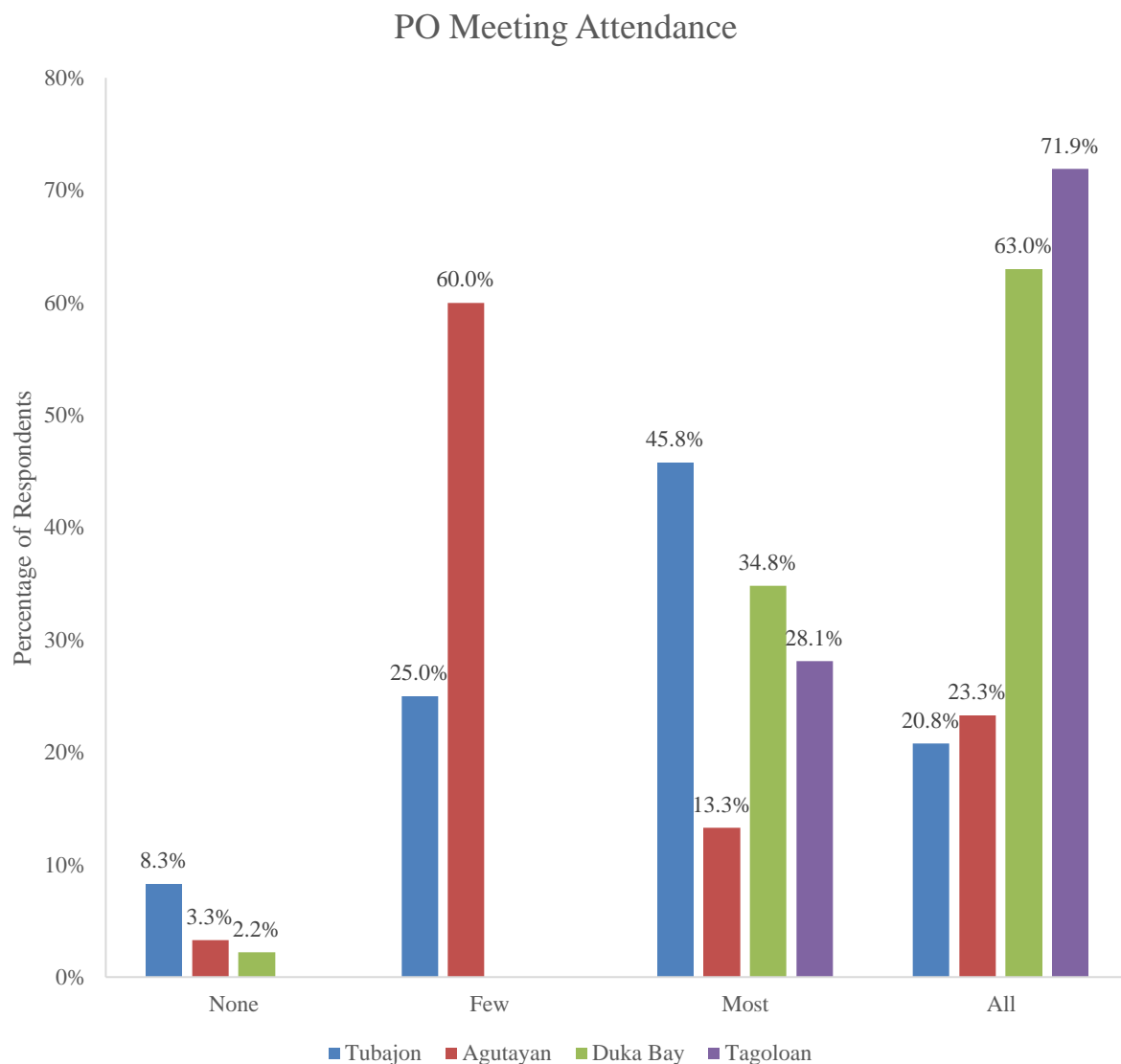


Figure 67. Number of people's organization group meetings the respondents from Duka Bay attended (n = 164).

Table 65. The results of the Mann-Whitney U Test pairwise comparisons between People Organization meeting attendance in the four sites. Significant p-values adjusted with Bonferroni correction at the $\alpha = 0.00833$ level are indicated with an *.

Meeting Attendance of PO Groups				
	U-stat	z value	r value	p-value
<i>Tubajon vs. Agutayan</i>	295.5	-1.2	0.2	0.231
<i>Tubajon vs. Duka Bay</i>	263.5	-3.92	0.5	<0.00001*
<i>Tubajon vs. Tagoloan</i>	304	-4.96	0.5	<0.00001*
<i>Agutayan vs. Duka Bay</i>	275	-4.75	0.5	<0.00001*
<i>Agutayan vs. Tagoloan</i>	323	-5.77	0.6	<0.00001*
<i>Duka Bay vs. Tagoloan</i>	133	-1.04	0.1	0.297

Perception: Fishers versus Non-Fishers

The responses to perception questions between fishers' vs non-fishers was similar for all questions and all sites except significant differences in perception were found in Tubajon for fisher's responses to how the MPA impacted their livelihood (Table 66). Tubajon fisherfolk had a more negative perception on how the MPA impacted their livelihood compared to non-fishers (Table 67). Significant differences were also found in Agutayan for perception questions related to coral health five years, coral health after the MPA, and how the MPA impacted their livelihood with fishers in Agutayan having more negative views than non-fishers. Non-fishers in Duka Bay had a more negative perception of fish catch since the MPA. Significant differences were also found with fishers believing that there were fewer tourists in their community than non-fishers after the MPA.

Table 66. The results of Mann-Whitney U Tests on fisher versus non-fisher responses to perception questions in each of the three MPA sites. Significant differences are note with a *.

Tubajon Perception Fishers vs Non-Fishers				
	U-stat	z value	n	p-value
Fish Quantity Five Years Ago	749.5	-1.52	113	0.129
Coral Health Five Years Ago	1603	-0.41	129	0.681
Government Involvement	1645	-0.7	129	0.484
Environmental Programs	1374	-1.84	150	0.066
Fish Catch After MPA	1915.5	-1.47	150	0.14
Coral Health After MPA	1995	-1.29	150	0.197
Tourists Number After MPA	2232	-0.01	150	0.992
MPA on Livelihood	1716	-2.21	149	0.027*
Agutayan Perception Fishers vs Non-Fishers				
	U-stat	z value	n	p-value
Fish Quantity Five Years Ago	1233.5	-0.43	113	0.67
Coral Health Five Years Ago	995.5	-2.08	113	0.038*
Government Involvement	1264	-0.89	113	0.372
Environmental Programs	1167.5	-0.95	113	0.343
Fish Catch After MPA	2138.5	-0.6	150	0.548
Coral Health After MPA	1820.5	-2.05	150	0.04*
Tourists Number After MPA	2079	-0.905	150	0.365
MPA on Livelihood	1342.5	-4.05	150	<0.00001*
Duka Bay Perception Fishers vs Non-Fishers				
	U-stat	z value	n	p-value
Fish Quantity Five Years Ago	1642	-0.84	123	0.4
Coral Health Five Years Ago	1586	-1.08	123	0.282
Government Involvement	1609.5	-0.71	120	0.48
Environmental Programs	1503	-1.25	120	0.212
Fish Catch After MPA	2149	-2.13	147	0.033*
Coral Health After MPA	2312	-1.29	147	0.199
Tourists Number After MPA	1817	-3.56	147	<0.00001*
MPA on Livelihood	2228.5	-1.35	147	0.178

Table 67. The mean ranks of significant Mann-Whitney U tests on fisher verses non-fisher responses to perception questions in each of the three MPA sites.

	Mean Rank	
	Fishers	Non-Fishers
Tubajon		
MPA on Livelihood	79.61	62.85
Agutayan		
Coral Health Five Years Ago	79.38	65.51
Coral Health After MPA	79.64	64.81
MPA on Livelihood	84.07	53.46
Duka Bay		
Fish Catch After MPA	68.92	81.58
Tourists Number After MPA	82.85	60.8

MPA Evaluation Scores

The results for the evaluation scores of the social factors examined did reveal a difference between each of the sites (Table 68). Tubajon (bottom-up) MPA had the highest score with a value of 16 while Duka Bay (private MPA) had the lowest score of 10.

Table 68. Results of MPA Evaluation Score for the three MPA sites (+) indicates the threshold was met and (-) indicates the threshold was not met. Evaluation MPA Scores: 0 is the lowest and 20 is the highest Score.

Factor Evaluated	Threshold	Tubajon (Bottom Up)	Agutayan (Top Down)	Duka Bay (Private)
Alternative livelihood				
	35%-Yes	(-)	(-)	(-)
Perception of the MPA				
MPA awareness	35%-Yes	(+)	(+)	(+)
Perceived trends in fish catch after MPA	35%- Slightly positive	(+)	(+)	(-)
Perceived trends in coral reef health after MPA	35%-Slightly positive	(+)	(+)	(+)
Tourism	35%- Slightly positive	(+)	(+)	(+)
Perception of MPA on livelihood	35%-Slightly positive	(+)		(-)
Perception of Government Involvement	35%-Slightly positive	(+)	(+)	(-)
Perception of MPA on community	35%-Slightly positive	(+)	(+)	(+)
MPA Community participation				
Meeting involvement	35%-Yes	(+)	(-)	(-)
MPA establishment	35%-Yes	(+)	(+)	(+)
Environmental education	35%-Yes	(+)	(+)	(+)
Enforcement and Conflicts				
Illegal Fishing	70%-No	(+)	(-)	(-)
Too Many Regulations	70%-No	(+)	(+)	(+)

Regulations Not Well Enforced	70%-No	(+)	(+)	(+)
Causes Conflict	70%-No	(+)	(+)	(-)
Erodes Traditional Authority	70%-No	(+)	(-)	(-)
Creates Inequity	70%	(+)	(+)	(+)
Empowerment				
Participation in general decision-making	35%	(-)	(-)	(-)
Participation in marine resource decision-making	35%	(-)	(-)	(-)
People organization participation	35%	(-)	(-)	(+)
Total		16	12	10

Discussion

Household characteristics socioeconomics

This research found that the general makeup up of the respondents in all four sites were individuals that were around 43 years of age and were either elementary or high school graduates. Similar findings were reported in Tietze's (2000) study of fishing communities in the Municipality of Iloilo, Philippines, where 96% of fisherfolk had some education. Respondents from Duka Bay had significantly higher percentage of individuals having at least some college education (16%), compared to the three other sites. Tietze (2000) found only 11% of the fisherfolk had a college education. Tubajon

respondents had a low proportion of individuals with higher education (7.3%) which might be expected from a fourth class Municipality (lower income Municipality⁷).

Household size was similar in all four sites with approximately three adults and two children living in the home with a majority of the adults being originally from the community. These results are also lower than D'Agnes' et al. (2005) study of Philippine coastal communities but are consistent with the national average of five members per household. Almost all of the respondents in the four sites owned their own home, again similar to the Tietze (2000) study where 95% of fishers owned their own home, and few rented.

Households in this study spent most of their income on rice and either beef, fish, or pork. In the three MPA communities the second highest expense item was fish but in the non-MPA site, Tagoloan it was pork. Tagoloan is a "first class Municipality" (highest income Municipality) that is closer to the urbanized city of Cagayan de Oro (26.9 km) than the other three sites. In being close to Cagayan de Oro this offers the community more possibilities in terms of availability and affordability of certain proteins, such as pork. The homes in all four sites had numerous technological items such as TVs and mobile phones. The main forms of transportation in Agutayan, Duka Bay and Tagoloan were "walking" but in Tubajon respondents mainly used motorcycles and *jeepneys*. This is expected since Tubajon is a remote village, which is not easily accessible, because of majority of the roads are unpaved.

⁷ Municipalities in the Philippines are divided into six main classes according to average annual income during the last four fiscal years. First class municipalities have the highest average annual income and sixth class municipalities have the lowest (Milne & Christie 2005).

The results of this study found that the homes in Tagoloan (non-MPA site) had a lower degree of modernization than the rest of the sites. Tagoloan homes were primarily made or constructed of thatch roofs, bamboo floors and wood walls. Fisherfolk houses in Tietze (2000) study were characteristic of the homes in Tagoloan, with wooden walls and thatch roofs. This result is unexpected given that Tagoloan is a “first class Municipality” and some of the other sites researched for this study were “fourth class Municipalities”.

In comparing the homes in the three MPA communities this current study, it was found that they had characteristic of farming homes in Tietze’s (2000) research, i.e., they had cement walls and floors and generally were more solidly built than fishers’ houses. Agutayan (top-down MPA) homes had a higher degree of modernization with metal roofs, wood and cement floors, and walls made of cement. This result might be expected because Agutayan was a “second class Municipality” whereas Tubajon and Duka Bay were both “fourth class Municipalities”.

Livelihood Options

Fishing was found to be the primary livelihood in all four sites researched (60%) and this would be expected in any coastal village in the Philippines (Tietze 2000). Therefore, fishery regulations and management tools such as MPAs could have a direct impact on people’s livelihoods. The research found that there was significant difference in the number of fishers and non-fishers in the sites, with Tubajon (bottom up MPA) having the highest percentage of fisherman (72.7%) and Duka Bay (private MPA) having the lowest (40.0%). Tubajon is a fairly remote coastal village that is situated next to the

coastline, so opportunities other than fishing would be expected to be low. However, Duka Bay is also a coastal village, but with paved roads and easier access to the city of Medina, which could provide the opportunity for other jobs besides fishing. This hypothesis was supported when Duka Bay was found to have the highest percentage of respondents engaged in other activities aside from fishing, being laborers or salaried workers in government offices of Medina.

Marine resource use patterns

The results found that years of fishing did not differ between all four sites. The mean fishing experience for all of the sites was around twenty-eight years. Most of the fishers at each site also had fathers who had fished. Although Duka Bay a significantly lower proportion (66.3%) compared to the other four sites (average 87.2%). When fishers in Tietze's (2000) study were asked if they would advise their children to also fish, only 30% said they would, indicating a negative outlook for the longevity of their profession. The results of this study could indicate that there is possibly shift in generational fishing in Duka Bay, with reduced number of respondents currently fishing (72%) when compared to their fathers (87.2%).

The most common fishing gear used in all sites was "net" and "hook and line" was the second most common gear type used. These results are consistent with FAO (2015) reports of the Philippines fishery profile, with "nets" and "hook and line" being the main fishing gears used, but the type of "nets" in the FAO report were categorized further into the type of "net" including, ringnets, bag nets, gillnets, etc. The fishing boats

reported as being mainly used in the municipal waters were double-outrigger crafts (with a two bamboo outriggers) called a *banca*, which are either motorized (three horse power or less) or non-motorized (FAO 2015). This study also found that the main fishing vessels were *bancas*. In this study, fishers in Agutayan and Duka Bay used motor boats while in Tubajon and Tagoloan they primarily used non-motor boats. Tagoloan had a significantly lower number of fisherman using motor boats than all of the other sites. This result was not be expected since Tagoloan is a “first class Municipality”, and would be expected to have more resources for motor boats than the other, lower classed, sites.

The current study also found that that the main fish targeted in each of the four sites were groupers (*Epinephelinae*), sardines (*Sardinella* spp.) and tuna (*Thunnus* spp.). These results are consistent with the FAO (2015) reports which lists the main pelagic fish targeted in the Philippines are: anchovies (*Stolephorus* spp.), sardines (*Sardinella* spp.), tuna (*Thunnus* spp.), and demersal fish including: spadefishes (*Ephippidae* spp.), groupers (*Epinephelinae*) and slipmouths (*Leiognathus* spp.). Small pelagic fish such as sardines are “considered the main source of inexpensive animal protein in lower-income groups in the Philippines” (Asian Development Bank 2104, p. 17). Groupers were mainly targeted in Tubajon and Tagoloan while in Agutayan and Duka Bay sardines were targeted.

The results revealed that the consumption of fish was significantly different in all sites, except Tubajon and Tagoloan. Few fishermen in Agutayan (5.89%) consumed the fish they caught while in Duka Bay more than half consumed them (59.03%). Whereas in Tubajon, and Tagoloan they didn’t at all. As expected, considering these results,

Agutayan also had the highest percentage (94.01%) of fish sold or bartered to a middleman, while Duka Bay had the lowest (40.97%). Considering the volume of fish that that was reported to be caught in Agutayan on a weekly basis, and taking into account the fishing gear and boat used, one could assume that fishing in Agutayan was a primarily commercial venture, rather than a subsistence activity, when compared to other sites in this study.

Alternative Livelihoods

This study found that respondents did have significantly different perceptions of how the MPA impacted their livelihood. In Agutayan (top-down MPA), most respondents (51.0%) thought the MPA had a “slightly positive” or “very positive” impact on their livelihoods. However, in Duka Bay (private MPA) (45.2%) felt the MPA had been “slightly negative” or “very negative” to their livelihood. In the creation of a protected area fishermen will lose fishing grounds and this could have a negative impact by reducing fish catches, which could, in turn, increase fishing effort in other areas, and potentially leading to further overexploitation (Jackson et al. 2001). One way to mitigate the loss of fishing grounds, resulting from MPA establishment, is the offering of alternative livelihoods. Alternative livelihood programs have proven beneficial from a financial perspective, and also as a way to foster concepts and ideas of environmental conservation to the surrounding MPA community (Pollnac et al. 2001). Examples of livelihoods directly related to MPA establishment include: dive guiding, selling of tourist products (t-shirts and other souvenir items), and sea warden positions. Additionally, in

the establishment of some MPAs, there is also a component involving the development of specific livelihood opportunities, such as basket weaving, seaweed farming, and livestock production. In all three sites, there was a very low percentage of alternative livelihoods made available to the communities once the MPA was established. Tubajon (bottom-up MPA) and Agutayan (top-down MPA) did have a few respondents report changes with alternative livelihoods becoming available, but this was mainly seaweed farming, selling of handicrafts or serving as a MPA guard. In Duka Bay, no respondents reported a change in livelihood opportunities after the MPA was established. The development of alternative livelihoods in all sites could be beneficial to the community, but studies such as Berget et al. (2004) concluded that to ensure success, it is important that such new livelihoods offered to the community should be ones that community members have the skills to utilize or there are established markets that can accept the products.

Perceptions regarding marine resources and MPA

The results revealed that respondents in all four sites believed that fish quantity was lower five years ago than they were today. Fishers from Tietze (2000) study also perceived fish catch decreasing as well as the variety and average size of fish. Respondents from the privately managed MPA (Duka Bay) had a significantly greater negative perception of the fish catch five years ago with more than half the respondents saying that it was “a lot less”. This study also found that coral health perception five years ago was more varied in the four sites, with respondents from Tagoloan having the most negative perception of their coral reef five years ago, with 45.4% of respondents

saying that it was a lot less healthy. Tubajon (bottom-up MPA) respondents had a more positive perception of the prior health of their coral reef, with (48.1%) saying that there was “more” coral health five years ago. When asked, generally if their coral reef was currently healthy, a large majority (94.7%) of the respondents in Tubajon (bottom up MPA) agreed it was, but the majority of Tagoloan respondents (62.6%) said that there coral wasn’t healthy. Tagoloan is the “non-MPA” site with no established MPA, which may explain why Tagoloan was significantly different in their view of the overall coral health when compared to the three MPA sites.

Overall biological improvements, in terms of increased fish catch, were primarily perceived by the respondents in Tubajon (bottom-up MPA), while majority (70.9%) of respondents in Duka Bay (private MPA) “disagreed”. Tubajon is a larger MPA, encompassing 22 hectares allowing theoretically for a larger fish population to recover from fishing. Alternatively, Duka Bay and Agutayan are relatively small MPAs: between 4.5 and 6 hectares. Although, small, and older, MPAs have shown significant increases in food security, these results are often localized (Mascia et al. 2010). This current study found that in all sites coral health was perceived as improving since the MPA, with a majority of respondents again from Tubajon (bottom up) “agreeing” that the quantity and quality of the coral reef has improved. However, there was a percentage (35.4%) of respondents in Agutayan (top-down MPA) that stated that coral health had not improved since the MPA was established. This does paint the “bottom” up MPA in a positive light compared to the other sites.

The major social improvements observed after the establishment of the MPA in all sites were an increase in tourists visiting their area. The study revealed that Duka Bay (private MPA) respondents reported a significantly higher percentage of tourists visiting their community when compared to the other two sites. Tubajon (bottom up) respondents reported the lowest percentage of tourists visiting their area. These results are expected since Duka Bay is in a major tourist areas of Misamis Oriental while Tubajon is in a remote coastal village with limited access. Also, the Duka Bay MPA was managed by a resort and the MPA was undoubtedly was used as a marketing tool to attract tourists to the region. Arias et al.'s (2016) study found that increased levels of tourism in MPA communities in Costa Rica had a positive relationship with perceived fisher's compliance with MPA strictures. Efforts should be made at all the MPA sites to focus on increasing tourism in their communities, because it can provide alternative livelihood opportunities - to fishing - in each MPA community.

This study found that other social benefits the MPA provided to the community in all three sites were either that the MPA "conserves for future generations" or that it "removed bad [fishing] gear practices". Very few respondents in each of the sites mentioned social benefits of "improves livelihood" (or "excludes outsiders" from fishing in their waters and competing with locals). White et al. (2006) determined that a perception of improving livelihoods, and the MPA is able to exclude outsiders, was important for maintaining MPA effectiveness in several MPAs in the Philippines (White et al. 2006).

Community participation

The current study found that respondents at all sites did appear to be generally involved in the MPA establishment process. A majority of the respondents were aware of community meetings regarding the MPA establishment in Tubajon (bottom up MPA) and Duka Bay (private MPA) but not in the top-down MPA, Agutayan (67.6% of the respondents were not aware of meetings). Community involvement in the beginning stages of the MPA planning process is known to be beneficial for community acceptance, but it can also lead to better compliance with MPA strictures (Himes 2007; Charles & Wilson 2009). If the community doesn't feel as though they have been involved in the decision-making process, it is difficult to obtain compliance, and support, for the MPA (Pomeroy et al. 2006).

The current study found that respondent's participation in environmental educational programs before the MPA was established was similar in all sites (around 50.0%). Educational programs have proven beneficial in helping the community understand the purposes and expectations of protecting an area from fishing. Such environmental programs can help reduce confusion and conflict which can later arise when dealing with poaching issues, encroaching fisherman, etc.

Perceptions of Government, NGO or Academic Involvement

In addition to resident community involvement, it is also important to have government, NGO or academic involvement in the MPA planning, establishment, and ongoing support of the MPA. This study found that a majority of the respondents in all

sites believed the government and NGOs were involved in the establishment of the MPA. However, in the privately-managed Duka Bay MPA, a significantly higher percentage (17.1%) of respondents felt that government had not been involved in MPA establishment when compared to Agutayan and Tubajon. Duka Bay is an MPA that was managed by a private resort initially, but continued government support is necessary to ensure violators accountable and punishable by law and to aid with potential conflict between stakeholders (discussed below). This study also found that when respondents were asked about continued Government involvement after the MPA was established, again in Duka Bay there was significant percentage (19.7%) of respondents stated that the Government wasn't actively involved in their MPA. Governmental and NGO support is critical, not only in terms of violations and conflicts, but also for absorbing the financial costs of maintaining, enforcing and conducting assessments of the MPA.

Enforcement

The results from this study indicated there was contradictory opinions on respondent's perception of illegal fishing taking place in their community. In Tubajon (bottom up MPA) most respondents (79.3%) did not feel that illegal fishing took place. But, in Duka Bay, 53.3% of the respondents believed illegal fishing was taking place in their community. The main type of illegal fishing identified in Duka Bay was "fine mesh nets" while in Agutayan and Tubajon it was "large-scale fishing". These illegal methods are common to all of the Philippines. It was documented in the Philippines Fisheries and Aquaculture Department's (2015) report that large-scale fishing continues to be problem

for a majority of the municipalities in the Philippines. Apprehending large-scale fishing vessels is very difficult for small villages such as Tubajon, given that most of the fishermen use non-motorized boats and have limited resources.

Results from the current research indicated that respondents in the three MPA sites had differing opinions about the specific problems with the MPA. In Duka Bay and Agutayan respondents felt the MPA “erodes traditional authority”. Developing countries, such as the Philippines, often have a long history of traditional authority and customary management of marine resources, in which members of the community may limit: fishing in specific areas; time frames; gear used; who is permitted to fish; or prevent certain species from being harvested (Cinner & Aswani 2007). It is important that customary management and traditional authority be integrated into the modern management of MPA, because it has been documented that when customary management has been eroded, there was decrease in marine productivity (Cinner & Aswani 2007). The eroding of traditional authority was not a primary problem for respondents in Tubajon, and this would be expected since it a “bottom-up” MPA. In Tubajon, the major problems listed by the respondents were the MPA was “not well enforced” and had “too many regulations”. Walmsley and White (2003) concluded that proper enforcement is the best indicator of MPA effectiveness in terms of biological success, such as increased fish abundance. But “good” enforcement requires the finances and support of 24 hour patrolling, something that is difficult in a rural coastal village such as Tubajon.

Empowerment

A key component in community-based coastal resource management is the empowerment of the local community (Beger et al. 2004). In Beger et al. (2004) study of marine reserves in the Philippines empowerment was found to begin with conservation education programs in which the community developed a willingness to protect to the marine resources and involvement in community conservation programs such as MPAs and eventually leading to empowerment. The goal of recent conservation program in Indonesia and the Philippines by a non-profit RARE is to “empower coastal communities to manage their fisheries more sustainable to reap the full benefits of marine protected areas” (RARE 2016, p. 3). In order to empower the communities, the program will involve outreach programs to build community awareness of conservation issues and training local fishers on more sustainable fishery management practices (RARE 2016). The current research revealed that out of 448 respondents from the MPA sites only 105 were involved in environmental education programs. People organization participation was highest in Tagoloan (non-MPA site) and highest in Duka Bay (private MPA). Most of the people organizations the respondents were involved in were fishing associations, which were established prior to MPA establishment. Therefore, the MPAs studied provided little conservation awareness programs or environmental education to the communities, which further limited potential community empowerment opportunities.

At all MPA sites there was limited community involvement in the decision-making process; with a significantly lower percentage in Duka Bay (private MPA). Agutayan and Tubajon were similar in the percentage of respondents who said they were

involved in decision-making process (19.3%). Although this was higher than Duka Bay, it is still a low percentage. When asked specifically about marine resource decision-making in their community, a majority of the respondents in all sites said they were not involved either. The lack of community involvement in decision-making could be detrimental to continued success of each MPA, because stakeholders need to feel they have a voice in the rules governing an MPA. Stakeholder policy preferences can vary significantly between individuals, and social groups, Therefore, each voice must be heard when making decisions that will impact the community. Involvement from all stakeholders is not only important in the establishment process of the MPA but it must be maintained throughout the management of the MPA. Hind et al.'s (2010) research highlighted how the stakeholders of the successful Apo Island reserve felt excluded from the decision-making process when Apo transitioned from the community MPA to a top-down managed MPA. Future efforts should be made at all sites to provide opportunities for continued stakeholder involvement, and have the community feel as though they involved in the MPA management processes.

Perceptions Fishers vs. Non-Fishers

Overall, perception of the marine resources and social factors did not vary much between fishers and non-fishers in each of the MPA sites. These sites are small coastal villages that are highly dependent on the marine resources. However, the perception questions that were significantly different were perception questions related to livelihood. In Tubajon and Agutayan fishermen had a more negative perception of how the MPA

impacted their livelihood than non-fishermen. This result would be expected in these sites because over 70% of the respondents were fishermen, compared to 40.0% in Duka Bay. Perceptions regarding coral reef health five years and after the MPA were found to be different in Agutayan (top down MPA) with non-fishers having a more positive view of the health of the coral reefs. Fisherfolk in Agutayan may possess better knowledge of the reef area because of their daily coral reef encounters compared to non-fishers. Fishers in Duka Bay did not perceive the increased tourists visiting their community that non-fishers did, and this could be attributed to non-fishers involvement in other occupations including salaried positions at tourists areas, including Duka Bay Resort.

Differences in the non-MPA Site

This results of this study did show that the non-MPA site (Tagoloan) was different from the other sites which had MPAs, for some of the factors. Respondents from Tagoloan did have a lower degree of modernization, with homes constructed of more primitive material than the other sites. Additionally, a majority of respondents in Tagoloan had more negative perceptions about the health of their reef. Without a MPA, Tagoloan does not have the incentive or laws of an MPA to prohibit destructive fishing practices that cause habitat degradation.

This study was not able to look at differences in income levels in all sites, which would have been beneficial in determining if there are socio-economic benefits to having an MPA. However, it is realized that income level is only one of many factors that would explain variability in socio-economics between the sites.

In terms of community participation respondents from Tagoloan were found to be more involved in decision-making than the other MPA sites. Also, Tagoloan respondents were found to more involved in marine resources decision-making and participated in in significantly more people organization groups compared to the other three sites. It would not be expected that the non-MPA site would have more community participation in marine resource decision-making than compared to Tubajon (bottom-up MPA), where the core of MPA establishment was developed by the community. Possible explanations for greater community participation in Tagoloan is there is an active fishing cooperation present in the area.

Differences in “top-down”, “bottom- up” and “privately managed” MPAs

As for overall differences and similarities between a bottom-up, top- down, and private MPA, Tubajon (bottom up MPA) had the highest MPA social evaluation score compared the other sites indicating that it was performing better than the other sites. Agutayan (to down MPA) had the second highest social MPA scores but received a lower score for lack of community participation and negative perceptions of how the MPA impacted their livelihood. Agutayan, being a top-down managed MPA, had more governmental support in terms of funding for the *bantay dagat*, (MPA guards) monitoring biological performance of the MPA, and enforcement if the rules of the MPA are violated. However, Tubajon is a bottom-up managed MPA with a community that was found to have significantly higher percentage of respondents who are dependent on the marine resources for their livelihood. Tubajon also had a significantly higher

percentage of respondents who perceived that fish catch increased after the MPA was established, which is important for a large fishing community. Perceptions of reef health were also positive for this MPA, thus it seems that the MPA is effective in its biological goals, at least in terms of public perception of reef and fish.

Duka Bay is a privately managed MPA, in which the government has minimal involvement and respondents had significantly more negative perceptions of their MPA performance when compared to the other sites. Also Duka Bay did have the lowest MPA evaluation score indicating that is not performing well. These negative perceptions could be attributed to the fact it is privately-managed, and the community may feel that the MPA is not benefiting them, but rather the Duka Bay resort.

Qualitative Differences among “top-down”, “bottom- up” and “privately managed” MPAs

The major themes of the qualitative data were related to before the MPA, after the MPA, and currently impacting the MPA. The informants in all sites provided a description of the reef fifty or more years ago that pristine and abundant with marine life. However, in the 1970s and 1980s the condition of the reef changed dramatically with the introduction of illegal fishing such as cyanide and dynamite fishing. During the late 1990s to early 2000 is when MPAs were established in these communities and informants in all sites reported a general lack of acceptance. In some sites, such as Duka Bay (private MPA) the community was significantly opposed to the idea of a MPA. Attempts were made in all sites to encourage community acceptance through meetings and holding

open forums, with some sites offering more opportunities than others such as in Tubajon (bottom-up MPA). As for issues, related to currently impacting the MPA many sites reported problems with patrolling, enforcement and apprehensions because of a lack of funds or lack of governmental supporting prosecuting those that violated the rules of the MPA. Tubajon MPA and Agutayan MPA informants spoke of the importance of having collaborations with academic institutions, NGOs and government departments such as the Department of Tourisms and Bureau of Fisheries and Aquatic Resources. Lastly, many informants spoke of the benefits they believed the MPA was providing such as increases in fish quantity, abundance and species as well as increases in coral cover. In all sites, the increases in the number of tourists visiting their community was discussed by several informants.

In all MPAs the research indicated that there were few or no alternative livelihoods offered to the communities and this is somewhat concerning given that there is high dependence on the natural resources by the community. For example, in Tubajon fishermen lost critical fishing grounds because of the 22 hectare no-take zone, and there is no mechanism in place, such as an alternative livelihood or a modified fishing strategy, such that the fishermen are able to cope with the changing conditions (Pomeroy et al. 2006). Fox et al. (2012) concluded that the government is important for MPA performance for: decision-making arrangements, resource, use rules, monitoring and enforcement systems, and conflict resolution mechanisms. The results of this current study found the community in Duka Bay perceive a lack of governmental support, because of their negative responses to perception questions regarding problems of the

MPA, involvement in decision-making, and direct questions about the level of Governmental support. There appears to be a disjoint between the private management of Duka Bay's MPA, the local Government unit (LGU) of Medina, and the community of Duka Bay. In the future, efforts should be made to involve the fisherfolk community in more decision-making in Duka Bay, and to improve the relationship between the community, Duka Bay Resort, and LGU of Medina.

All sites could benefit from more collaborate educational seminars and open forums regarding the MPAs, because these will provide a platform for the community to be heard by the LGU, other stakeholders, academic institutions, and NGOs.

Lastly, conclusions and recommendations from this research can be used as part of adaptive management strategies which involves planning, implementing, monitoring, evaluating and adapting conservation needs to improve MPA management outcomes (Bennett 2016). The final step of this project is for the results and recommendations of this study to be communicated to necessary MPA managers, and involved stakeholders, so solutions can be developed collectively, and put into action, to ensure long-term success of each MPA.

CHAPTER SEVEN: CONCLUSION AND FUTURE RESEARCH NEEDS

Overall, the findings from this current study highlight the importance of incorporating social scientific monitoring into MPA performance. Social science research of MPAs can offer managers an alternative picture from ecological research by providing insight into how the MPA may socially be impacting the community (whether negatively or positively) and how this may benefit, or lead to problems for, the MPA. Investigation of the effectiveness of MPAs has involved numerous biological studies that have analyzed the effects of protected areas on marine resource abundance and diversity within, and outside of the protected areas, spillover effects, changes in coral cover within and outside the protected areas but there are both biologic and social impacts to MPAs. Thus explaining the emergence of social science research of MPAs which involves "sociology, anthropology, psychology, history, political science, law economics, and others that deal with human and social dimensions" (Oracion 2016, p. 83). Guidebooks for social science research have been published to inform social scientists and managers how to assess the social aspects of MPA (Pomeroy et al. 2004; NOAA 2003). These guidebooks highlight the need for baseline information on of the attitude, perceptions, beliefs, behavior, identifying stakeholder conflict to improve MPA acceptance and address public concerns regarding the MPA.

This study has made three contributions to the social scientific investigation of MPAs. First, this study provided a detailed social scientific evaluation of three MPA using a mixed method approach. Second, it provided a statistical social comparative study across three MPAs and one non-MPA area. Finally, this study provided social scientific MPA research in a region of the Philippines, Mindanao, that has been underrepresented in both ecological and social MPA research (P. Christie, personal communication, Oct 13, 2011). In identifying and analyzing how social factors (household socioeconomics, living standards, livelihood options, marine resource use patterns, perceptions regarding marine resources, perceptions regarding the MPA, community participation; enforcement and conflicts, empowerment) are negatively or positively impacting the residents in each of the areas and sharing this knowledge and insight with the local and national government, the hope is to maintain longevity and success of Tubajon's MPA, Agutayan's MPA, and Duka Bay's MPA.

This current study used a mixed method approach for social scientific investigation using both quantitative data (household questionnaire surveys) and qualitative data (semi-structured interviews). Quantitative results from this study provided a broad scope of information on baseline demographics; household characteristics; marine resource use; perception and attitudes of changes in the marine environment (before and after MPA establishment); and social and biological impacts of the MPA. However, the quantitative information was not as detailed and complex as was revealed in the qualitative data. The semi-structured interviews provided a complete picture of why some of the perceptions and attitudes exist in the community, and in some

cases, qualitative data offered a different result from the quantitative data. For example, in Duka Bay household surveys indicated that the respondents perceived the coral reefs as not healthy but many interviews commented on the healthiness of coral reefs in Duka Bay MPA. Thus, highlighting the importance of incorporation of both methods into social science research. However, qualitative data analysis is time-consuming (for conducting, transcribing, and analyzing data), and there is a risk that because of this time lag, the results and recommendations from analyses may be offered too late. Also, there is a bias against the results of qualitative data in the marine conservation community, with marine conservation scientists (who typically have a natural science background) considering it to be “just anecdotal”, that “sample sizes are too small” and that such results are not “real science” (comments by marine conservation reviewers on qualitative/mixed method data - E.C.M. Parsons, personal communication, November 16, 2016)

Limitations

Potential for bias

One of the limitations of the current study was the potential of confirmation bias in the household survey. The respondents were only offered positive choices for Questions 35 and 36 and not a neutral response. Future, surveys should utilize a more neutral approach to prevent potential respondent influence.

Additionally, direct questioning bias cannot be ruled out from this study. Direct questioning, through face-to-face interviews, has many benefits especially in the collection of sensitive data but also in yielding higher response rates (Gavin et al. 2009). However, direct questioning has several potential biases. The respondents must trust the

interviewer because in this study questions asked were potentially sensitive and the possibility that respondents gave socially desirable answers cannot be ruled out. It should be noted that the respondents in this study were cooperative and openly expressed negative views of the MPAs (e.g. admitting to fishing illegally in the MPA), and willing to be audio-reordered. Direct bias could have affected the results of the study with underreporting of illegal activities. Also, with direct questioning, there is a possibility of recall bias in which respondents tend to remember rare events instead of common ones (Sudman & Schwartz 1989). In this study, informants were asked to recall destructive and illegal fishing techniques taking place in their community, and many recalled dynamite fishing and bombings of the reefs as being common, but in actuality, they could have been rare events. Future, surveys should utilize a variety of methods (e.g. randomize response technique and direct observation) for surveying the respondents especially regarding sensitive questions about illegal activity to help improve the accuracy of responses (Gavin et al. 2009).

Site Selection and Sample Size

The sites selected in this study were dependent on existing relationships between Xavier University-McKeough Marine Center, local government units (LGU), a private resort (Duka Bay Resort), and the Macajalar Bay Development Alliance. Additionally, sites were chosen to fill one of the three governance and management categories (top-down, bottom-up, and private MPA). Random selection of sites within Misamis Oriental's 22 MPAs would have been one optimal way to remove potential sampling bias

in this study. However, randomization is not always feasible when there are political, financial, or legal reasons why sites are selected; an alternative could be the use of quasi-experimental design (Ferraro 2009). Furthermore, all variables for site selection could not be controlled for such as, Municipal classification, the population size of the community, size of the MPA and age of the MPA.

Only one site was representative of each government and management category. Therefore, interpretation of the results comparing between top-down, bottom-up, and private MPA should proceed with caution. Future studies should aim to increase the sample size of each of the governance and management categories.

The non-MPA site selection was limited to coastal fishing areas that did not have a MPA or were not in the process of creating a MPA. There were few areas that met these criteria because of the large number of MPAs that have already been established in Misamis Oriental. All variables for the site selection could not be controlled for (e.g. Municipal classification, population size, reef size, and health) these results should be interpreted with caution.

Furthermore, the demographics (i.e. male/female) of the population were not verified with a statistical dataset. Therefore, the population sampled in this study may not have been representative of the population in each community.

Statistical Limitations

In this study Bonferroni corrections were applied to multiple comparison analysis to avoid Type I errors. However, Bonferroni corrections are quite conservative and

reduce the statistical power of the analysis. Therefore, in this study more significant comparisons could have been detected if Bonferroni corrections were not applied. Future studies could utilize alternatives to Bonferroni corrections such as Pearson's r and Cohen's d (Nakagawa 2004).

Socioeconomic Analysis

The collection of household socioeconomic data was not able to be analyzed because respondents gave their incomes as daily or weekly and did not specify what unit this uses. Additionally, household item data was not incorporated into a wealth index which did not allow for socioeconomic analysis between sites. Future studies should incorporate income analysis as well as wealth index status to determine if there difference in the socioeconomics between sites.

Time Frame

Another limitation of this study, specifically in the collection of interview data, was in the relatively short period used to collect data. The finances and time frame for this study did not permit collection to occur over a lengthy period. Qualitative data was not collected in the non-MPA site but interviews from community members regarding the condition of their reef decades ago to now, desires of establishing or not establishing an MPA in their community could have enhanced the comparative study analysis in this research. Additionally, the time frame affected informant selection in this study. The informants selected for the interviews utilized a snowballing technique where community

members, government officials suggested which individuals should be interviewed for this study. There is a possibility that important key informants were missed because of the study's time frame and reliance of snowballing techniques for informant selection. Ideally, future studies should utilize an ethnographic approach in which the researcher is immersed into the community. This approach can offer a more detailed picture of the social aspects that each community was encountering and identifying key informants that should be interviewed for the study.

Future research needs

Future studies in the Philippines could involve evaluating more MPA communities in Misamis, Oriental, Philippines using the same quantitative and qualitative techniques used in this study as well the MPA Management Effectiveness Assessment Tool (MEAT). MEAT utilizes a more simplified management tool to measure effectiveness in MPAs and would be valuable for evaluating a larger number of MPAs on a broader scale (Philippines CTI NCC 2011). In incorporating more sites into the analysis, the goal would be to have more sites that were second class or fourth class municipalities and more top-down, bottom-up, privately managed MPAs to understand better if these factors are influencing the data. Aside from expanding to more sites in Misamis, Oriental, future research could also expand to other regions of the Philippines. The expansion to other regions of the Philippines is of particular importance as the Philippines begins to establish MPA networks. Before, the scaling up MPAs into MPA networks occurs it is important that the social factors and perceptions of the small MPAs

are documented and understood and what implications a network would have the surrounding community, region, or country. The collection of MPA social baseline information should utilize a mixed method approach similar to what was performed in this study because of the need to collect information on sensitive issues such as illegal fishing or poaching of the protected areas. Additionally, mixed methods such as face-to-face interviews proved to be very effective in the Philippines regarding response rate. Face-to-face interviews have shown to yield higher response rates but do have a potential for biases discussed earlier. Therefore, utilizing a variety of survey techniques will ensure accuracy across data collection. Lastly, future research in the Philippines could incorporate the vast ecological data that exists on MPAs, to contrast biological with the perceptions and attitudes of the respondents within the communities, to see whether the biological data support or refuse the perceptions of the neighboring communities.

The future of MPA research globally needs to involve a collaboration between natural scientists, social scientists, and an open dialogue with policy makers. The involvement and collaboration between natural scientists and social scientists need to be in all phases of the MPA management and governance (planning, establishment, monitoring, and assessment). Involving social scientists in all aspects is necessary for example when potential resource conflicts between fishers and other stakeholders arise after MPA establishment. Social scientists can help in developing conflict resolution mechanisms to maintain MPA support or other issues that may develop. Furthermore, future MPA investigation may move from an adaptive management approach to impact evaluation. Adaptive management applied to MPAs requires MPA managers to have

detailed biological and social assessments at an almost "real time" to invoke change in MPA management decisions (Fox et al. 2012). An alternative to adaptive management in MPA research is impact evaluation. The application of impact evaluation to MPAs is still in its infancy but when applied it can offer important decisions about MPA placement, design, and implementation, that result in positive ecological outcomes (Ahmadia et al. 2015). Impact evaluation requires the analyst to estimate the counterfactual "what would have happened to a variable of interest in absence of the intervention" (Glew et al. 2012, p. 18). As more MPAs are established to meet the Aichi Target 11, MPA researchers should use an impact evaluation with a quasi-experimental approach. Utilizing impact evaluation will allow for more robust data gathering from quasi-experimental designs that incorporate inside and outside areas as well as offering monitoring information at a scale relevant for managers (Ahmadia et al. 2015). Lastly, no matter which method is used in evaluating MPAs effectiveness, it is important to include both biological and social assessments because there will always be both human and non-human elements to MPAs.

APPENDIX ONE: HOUSEHOLD SURVEY FOR MARINE PROTECTED AREA SITES

Household Survey

This survey is being conducted by Alexandra Shah at George Mason University to be used toward the completion of a Doctor of Philosophy. You may contact the George Mason University Office of Research Subject Protections at 703-993-4121 if you have questions or comments regarding your rights as a participant in the research. Your participation is completely voluntary. There are no direct benefits for participating. All responses are completely confidential and you may stop answering at any point.

Section A. Demographic Information

1. In what year were you born? _____
2. What is your gender? ☐ Male ☐ Female
3. What is your highest level of education?
4. Where are you originally from?
☐ This community ☐ This Region ☐ This country ☐ Other Country
5. How long have you lived in _____?
6. If, not originally from _____, why did you move to _____?
☐ Employment ☐ Fish ☐ Other work ☐ Family & Friends
☐ Health/spiritual ☐ Other: Specify _____
7. How many people live in your home?
____ Adult Male ____ Adult Female ____ Male children ____ Female children

Section B. Household Possessions and Amenities

8. Do you rent or own your home? ☐ Rent ☐ Own
9. Check each of the items you have in your home?
Household items and facilities

<input type="checkbox"/> Generator	<input type="checkbox"/> Water tank	<input type="checkbox"/> Refrigerator	<input type="checkbox"/> Air conditioner
<input type="checkbox"/> Electric fan	<input type="checkbox"/> Radio/cassette	<input type="checkbox"/> TV	<input type="checkbox"/> VCR/DV
<input type="checkbox"/> Satellite dish	<input type="checkbox"/> Landline	<input type="checkbox"/> Mobile phone	<input type="checkbox"/> Dining table
<input type="checkbox"/> Wall clock	<input type="checkbox"/> Electric iron	<input type="checkbox"/> Boat	<input type="checkbox"/> Motor (boat)

Lighting

- ☐ Electricity ☐ Air pressure ☐ Kerosene ☐ Candle
☐ Flashlight ☐ Nothing

Water

- ☐ Piped water in home ☐ Piped water (public faucet) ☐ Pump or artesian well
☐ Open well ☐ Private flush toilet ☐ Private closed pit ☐ Open pit

Transportation

- ☐ Nothing ☐ Bicycle ☐ Motorcycle ☐ Tricycle
☐ Vehicle ☐ Jeepney ☐ Other: Specify _____

Cooking

- ☐ Firewood ☐ Charcoal ☐ Kerosene ☐ Gas/electric

Roof material

- ☐ Thatch ☐ Metal (GI) ☐ Tile ☐ Other:
 Specify _____

Floor material

- ☐ Dirt ☐ Bamboo ☐ Plank wood ☐ Cement/Concrete
☐ Tile ☐ Other

Wall material

- ☐ Bamboo/thatch ☐ Wood ☐ Stone block ☐ Metal
☐ Cement/concrete ☐ Other: Specify _____

Section C. Socio-economic Information

10. What is your household's total monthly income? _____

11. What are your household expenses for the following items?

Expense	One Month
Rice	
Vians (pork)	
Vians (beef)	
Vians (fish)	
Grocery (soy, vinegar)	
Vegetables	
Children school allowance	
Medicine	
Clothing	
Electricity	
Cooking fuel	
Rent	

School expenses	
Other: Specify	

12. Which of the following jobs listed below do you and other people in your home do to bring in food or money? Check which one is your primary source of income and list income amount.

Activity	Check if respondent	Number of people involved	Check if primary source of income	How much per month is the income?
Fishing				
Laborer				
Carpentry				
Selling of goods				
Farming				
Small village store				
Marketing marine products				
Cash Crops				
Salaried Employment				
Tourism				
Sale of handicrafts				
Other: Specify				

If you fish answer questions 12 through 18. If you do not fish skip to question 19.

Section D. Fisheries Information

13. How long have you been a fisherman? _____

14. Was your father a fisherman? ☐ Yes ☐ No

15. When you go fishing, what equipment is involved?

Equipment/Gear	Type of boat used	Days per week	Type of fish targeted (Food or Aquarium)

16. How many times do you fish in a week during the following seasons?

Food Fishing			Aquarium Fishing		
<i>Good weather</i>	<i>Northeast Monsoon</i>	<i>Southwest Monsoon</i>	<i>Good weather</i>	<i>Northeast Monsoon</i>	<i>Southeast Monsoon</i>

17. What is your estimated volume of catch in kilos in a week during the following seasons?

Food Fishing			Aquarium Fishing		
<i>Good weather</i>	<i>Northeast Monsoon</i>	<i>Southwest Monsoon</i>	<i>Good weather</i>	<i>Northeast Monsoon</i>	<i>Southeast Monsoon</i>

18. What percentage of your catch is for your family's food consumption? _____

19. What percentage of your catch is for sale to the market or to a middleman? _____

Section E. Perception of Coastal Resources

20. Compared to five years ago, what is the quantity of available fish?

☐ A lot more ☐ More ☐ Same ☐ Less ☐ A lot less

21. Explain how you know this?

22. Are the coral reefs in your community healthy? ☐ Yes ☐ No

23. Compared to five years ago, what is the health of coral reefs in your community?

☐ A lot more ☐ More ☐ Same ☐ Less ☐ A lot less

24. Does illegal fishing take place in your community? ☐ Yes ☐ No

25. If yes, what type of illegal fishing occurs in your community? (Check all that apply)

☐ Dynamite fishing ☐ Cyanide fishing ☐ Muro-ami ☐ Illegal fine mesh nets
☐ Other: Specify _____

26. Are you aware of a marine protected area (MPA) or marine sanctuary in your community?

☐ Yes ☐ No

27. Before the MPA was established were there meetings in your community regarding its establishment? ☐ Yes ☐ No ☐ Don't know

28. Did you want the MPA established in your community? ☐ Yes ☐ No ☐ Don't know

29. Was the local/provincial/national government/or NGO involved in the MPA establishment in your community? ☐ Yes ☐ No ☐ Don't know

30. Before the MPA was established did you or your family members participate in any environmental education programs? ☐ Yes ☐ No
31. After the MPA was established did you or any of your family members engage in any of the following livelihoods?
☐ Seaweed farming ☐ Selling of handicrafts ☐ Dive guide ☐ Tour boat operator
☐ Livestock ☐ MPA guard ☐ None
32. Since the MPA has been established the fish catch has increased in the community?
☐ Strongly agree ☐ Agree ☐ Unsure ☐ Disagree ☐ Strongly disagree
33. Since the MPA has been established the quantity and quality of coral reefs has improved?
☐ Strongly agree ☐ Agree ☐ Unsure ☐ Disagree ☐ Strongly disagree
34. Since the MPA has been established are there more tourists visiting your community?
☐ Strongly agree ☐ Agree ☐ Unsure ☐ Disagree ☐ Strongly disagree
35. In your opinion, which of the following has the MPA had an impact on in your community? (Check all that apply)
☐ Increased fish abundance ☐ Increased fish size ☐ Stopped habitat destruction
☐ Brought fish species back ☐ Moved fish closer ☐ Improved coral health
☐ None
36. In your opinion, which of the following benefits has the MPA provided to your community?
☐ Improved fish catch ☐ Excludes outsiders ☐ Removed bad gear/practices
☐ Conserves resources for future generation ☐ Reduces conflicts
☐ Improves livelihoods ☐ Provides educational opportunities ☐ Improves equity
☐ None ☐ Other : Specify _____
37. The local/provincial/national government has been actively involved in your communities' MPA?
☐ Strongly agree ☐ Agree ☐ Unsure ☐ Disagree ☐ Strongly disagree
38. Overall, how has the MPA impacted your livelihood?
☐ Very positively ☐ Slightly positively ☐ Neither ☐ Slightly negatively ☐ Very negatively
39. Overall, has the MPA been good or bad for the community?
☐ Very good ☐ Slightly good ☐ Neither ☐ Slightly bad ☐ Very bad
40. In your opinion, what are some of the problems with the MPA? (Check all that apply)
☐ Too many regulations ☐ Regulations not well enforced ☐ Reduced catch
☐ Causes conflicts ☐ Erodes traditional authority ☐ Creates inequity
☐ No funding ☐ No problems

Section F. Community Participation

41. If there is a decision to be made in your community, are you involved in that decision?

☐ Yes ☐ No

42. If yes, how are you involved in the decision making process?

43. Are you involved in the decisions made about marine resource use (fishing, collecting) or management (MPA establishment) in your community? ☐ Yes ☐ No

44. Do you belong to any people organization groups? ☐ Yes ☐ No

Name of group	Type (Fishing Cooperative, Women's group, Environmental group)

45. How many group meetings have there been in the last six months? _____

46. How many of these meetings have you attended?

☐ None ☐ Few ☐ Most ☐ All

APPENDIX TWO: HOUSEHOLD SURVEY FOR NON-MPA SITE

Household Survey NON-MPA Site

This survey is being conducted by Alexandra Shah at George Mason University to be used toward the completion of a Doctor of Philosophy. You may contact the George Mason University Office of Research Subject Protections at 703-993-4121 if you have questions or comments regarding your rights as a participant in the research. Your participation is completely voluntary. There are no direct benefits for participating. All responses are completely confidential and you may stop answering at any point.

Section A. Demographic Information

1. In what year were you born? _____
2. What is your gender? ☐ Male ☐ Female
3. What is your highest level of education?
4. Where are you originally from?
☐ This community ☐ This Region ☐ This country ☐ Other Country
5. How long have you lived in _____?
6. If, not originally from _____, why did you move to _____?
☐ Employment ☐ Fish ☐ Other work ☐ Family & Friends
☐ Health/spiritual ☐ Other
7. How many people live in your home?
____ Adult Male ____ Adult Female ____ Male children ____ Female children

Section B. Household Possessions and Amenities

8. Do you rent or own your home? ☐ Rent ☐ Own
9. Check each of the items you have in your home?
Household items and facilities

<input type="checkbox"/> Generator	<input type="checkbox"/> Water tank	<input type="checkbox"/> Refrigerator	<input type="checkbox"/> Air conditioner
<input type="checkbox"/> Electric fan	<input type="checkbox"/> Radio/cassette	<input type="checkbox"/> TV	<input type="checkbox"/> VCR/DV
<input type="checkbox"/> Satellite dish	<input type="checkbox"/> Landline	<input type="checkbox"/> Mobile phone	<input type="checkbox"/> Dining table
<input type="checkbox"/> Wall clock	<input type="checkbox"/> Electric iron	<input type="checkbox"/> Boat	<input type="checkbox"/> Motor (boat)

Lighting

- ☐ Electricity ☐ Air pressure ☐ Kerosene ☐ Candle
☐ Flashlight ☐ Nothing

Water

- ☐ Piped water in home ☐ Piped water (public faucet) ☐ Pump or artesian well
☐ Open well ☐ Private flush toilet ☐ Private closed pit ☐ Open pit

Transportation

- ☐ Nothing ☐ Bicycle ☐ Motorcycle ☐ Tricycle
☐ Vehicle ☐ Other

Cooking

- ☐ Firewood ☐ Charcoal ☐ Kerosene ☐ Gas/electric

Roof material

- ☐ Thatch ☐ Metal ☐ Tile ☐ Other

Floor material

- ☐ Dirt ☐ Bamboo ☐ Plank wood ☐ Cement
☐ Other

Wall material

- ☐ Bamboo/thatch ☐ Wood ☐ Stone block ☐ Metal
☐ Cement ☐ Other

Section C. Socio-economic Information

10. What is your household's total monthly income? _____

11. What are your household expenses for the following items?

Expense	One Day	One Week	One Month
Rice			
Vians (pork)			
Vians (beef)			
Vians (fish)			
Grocery (soy, vinegar)			
Vegetables			
Children school allowance			
Medicine			
Clothing			
Electricity			
Cooking fuel			
School expenses			
Other			

12. Which of the following jobs listed below do you and other people in your home do to bring in food or money? Check which one is your primary source of income.

Activity	Check if respondent	Number of people involved	Check if primary source of income
Fishing			
Laborer			
Carpentry			
Selling of goods			
Farming			
Small village store			
Marketing marine products			
Cash Crops			
Salaried Employment			
Tourism			
Sale of handicrafts			
Other			

If you fish answer questions 12 through 18. If you do not fish skip to question 19.

Section D. Fisheries Information

13. How long have you been a fisherman? _____

14. Was your father a fisherman? ☐ Yes ☐ No

15. When you go fishing, what equipment is involved?

Equipment/Gear	Type of boat used	Days per week	Type of fish targeted (Food or Aquarium)

16. How many times do you fish in week during the following seasons?

Food Fishing			Aquarium Fishing		
<i>Good weather</i>	<i>Northeast Monsoon</i>	<i>Southwest Monsoon</i>	<i>Good weather</i>	<i>Northeast Monsoon</i>	<i>Southeast Monsoon</i>

17. What is your estimated volume of catch in kilos in a week during the following seasons?

Food Fishing			Aquarium Fishing		
<i>Good weather</i>	<i>Northeast Monsoon</i>	<i>Southwest Monsoon</i>	<i>Good weather</i>	<i>Northeast Monsoon</i>	<i>Southeast Monsoon</i>

18. What percentage of your catch is for your family's food consumption? _____

19. What percentage of your catch is for sale to the market or to a middleman? _____

Section E. Perception of Coastal Resources

20. Compared to five years ago, what is the quantity of available fish?

☐ A lot more ☐ More ☐ Same ☐ Less ☐ A lot less

21. Explain how you know this?

22. Are the coral reefs in your community healthy? ☐ Yes ☐ No

23. Compared to five years ago, what is the health of coral reefs in your community?

☐ A lot more ☐ More ☐ Same ☐ Less ☐ A lot less

Section D. Community Participation

24. If there is a decision to be made in your community, are you involved in that decision?

☐ Yes ☐ No

25. How are you involved in the decision making process?

26. Are you involved in the decisions made about marine resource use (fishing, collecting) or management (MPA establishment)? ☐ Yes ☐ No

27. Do you belong to any people organizations group? ☐ Yes ☐ No

Name of group	Type (Fishing Cooperative, Women's group, Environmental group)

28. How many group meetings have there been in the last six months? _____

29. How many of these meetings have you attended?

☐ None ☐ Few ☐ Most ☐ All

APPENDIX THREE: KEY INFORMANT INTERVIEW QUESTIONS

Key Informant Interview Questions

Initial Questions:

1. Job title:
2. Agency:
3. Where you elected or appointed to this position? ☐ Elected ☐ Appointed
4. What is your highest level of education?
5. How long have you been at your position?

Marine Resource Use:

6. Please tell me a little bit about the history of fishing and marine resource use in the area?
7. Please tell me a little bit about marine resource use problems in the area, such as destructive fishing, encroaching fisherman, reduced fish catch?

Marine Protected Area (MPA) Establishment:

8. Please tell me a little bit about your involvement with the MPA?
9. Was there any conflict within the village regarding the establishment of the MPA?
10. If yes, how was conflict resolved within the village?
11. Overall, did the village want the MPA established in their community?

Government Role:

12. What is the government's vision for the future of the MPA?
13. Does the government continue to have a direct involvement in the MPA? Please explain how.
14. Has the government conducted any evaluations of the MPA after its establishment?
15. Has the government provided any funding for the MPA and do they plan to continue to provide funding for the MPA?
16. Does the government plan to establish or aid in the establishment of any more MPAs in the area?

MPA General Questions:

17. Has tourism increased in the area since the MPA has been established?
18. Has fish catch and coral reef health improved since the MPA has been established?
19. Are there any problems with the MPA?
20. Overall, do you think the MPA has been beneficial for the community?

REFERENCES

- Ahmadia, G.N., Glew, L., Provost, M., Gill, D., Hidayat, N.I., Mangubhai, S., Purwanto, & Fox, H.E. (2015) Integrating impact evaluation in the design and implementation of monitoring marine protected areas. *Philosophical Transactions of the Royal Society of B*, 370, 20140275.
<http://dx.doi.org/10.1098/rstb.2014.0275>
- Alcala, A. C. (1981). Fish yield of coral reefs of Sumilon Island, central Philippines. *Nat. Resource Council. Philipp. Res. Bull*, 36(1), 1-7.
- Alcala, A. C. (1988). Effects of marine reserves on coral fish abundances and yields of Philippine coral reefs. *Ambio*, 194-199.
- Alcala, A. C. (1998). Community-based coastal resource management in the Philippines: a case study. *Ocean & Coastal Management*, 38(2), 179-186.
- Alcala, A.C. (2001) *Marine Reserves in the Philippines: Historical Development, Effects and Influence on Marine Conservation Policy*. Makati, Philippines, Bookmark, Inc.
- Alcala, A. C., & Russ, G. R. (1990). A direct test of the effects of protective management on abundance and yield of tropical marine resources. *ICES Journal of Marine Science*, 47(1), 40-47.
- Alcala, A. C., & Russ, G. R. (2006). No-take marine reserves and reef fisheries management in the Philippines: a new people power revolution. *AMBIO: A Journal of the Human Environment*, 35(5), 245-254.
- Alfeche, L. R. (2003). Coral reef restoration through coral transplantation: the case of Duka Bay, Medina, Misamis Oriental. *GROWTH*, 1(2), 3.
- Alfeche, L., & Rodriguez, R. (2010). Concrete Substrates for Accelerated Coral Restoration, Philippines. *World Architecture Review*, 1, 015.
- Allen, G. R. (2008). Conservation hotspots of biodiversity and endemism for Indo-Pacific coral reef fishes. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 18(5), 541-556.

- Allison, G. W., Lubchenco, J., & Carr, M. H. (1998). Marine reserves are necessary but not sufficient for marine conservation. *Ecological Applications*, 8(sp1), 79-92.
- Arceo, H.O., Campos, W.L., Fuentes, F., Aliño, P.M., (2004). In: Proceedings of the Workshops towards the Formulation of the Philippine Marine Sanctuary Strategy (PhilMarSaSt). The Marine Science Institute, University of the Philippines, Diliman, Quezon City, Philippines, p. 148.
- Arias, A., Pressey, R. L., Jones, R. E., Álvarez-Romero, J. G., & Cinner, J. E. (2016). Optimizing enforcement and compliance in offshore marine protected areas: a case study from Cocos Island, Costa Rica. *Oryx*, 50(01), 18-26.
- Asian Development Bank. (2014). *State of the Coral Triangle: Philippines*. © Asian Development Bank. <http://hdl.handle.net/11540/776>. License: CC BY 3.0 IGO.
- Aswani, S., & Furusawa, T. (2007). Do marine protected areas affect human nutrition and health? A comparison between villages in Roviana, Solomon Islands. *Coastal Management*, 35(5), 545-565.
- Badalamenti, F., Ramos, A. A., Voultsiadou, E., Lizaso, J. S., d'Anna, G., Pipitone, C., C., Mas, J., Fernandez, J.R., Whitmarsh, D., & Riggio, S. (2000). Cultural and socio-economic impacts of Mediterranean marine protected areas. *Environmental Conservation*, 27(02), 110-125.
- Bartlett, C. Y., Maltali, T., Petro, G., & Valentine, P. (2010). Policy implications of protected area discourse in the Pacific islands. *Marine Policy*, 34(1), 99-104.
- Bennett, N. J., & Dearden, P. (2014). Why local people do not support conservation: community perceptions of marine protected area livelihood impacts, governance and management in Thailand. *Marine Policy*, 44, 107-116.
- Bennett, N. J. (2016). Using perceptions as evidence to improve conservation and environmental management. *Conservation Biology*, 30: 582-592.
- Beger, M., Harborne, A. R., Dacles, T. P., Solandt, J. L., & Ledesma, G. L. (2004). A framework of lessons learned from community-based marine reserves and its effectiveness in guiding a new coastal management initiative in the Philippines. *Environmental Management*, 34(6), 786-801.
- Bureau of Fish and Aquatic Resources. (2009) 2008 Philippine profile. Manila, Philippines, Department of Agriculture. Retrieved from <http://www.bfar.da.gov.ph>

- Botsford, L. W., Castilla, J. C., & Peterson, C. H. (1997). The management of fisheries and marine ecosystems. *Science*, 277(5325), 509-515.
- Bromley, D. W. (1991). *Environment and economy: property rights and public policy*. Basil Blackwell Ltd.
- Cabral, R. B., Aliño, P. M., Balingit, A. C. M., Alis, C. M., Arceo, H. O., Nañola Jr, C. L., Geronimo, R.C & Partners, M. S. N. (2014). The Philippine marine protected area (MPA) database. *Philippine Science Letters*, 7(2), 300-308.
- Campos, W.L., Aliño, P.M. (2008). Recent advances in the management of marine protected areas in the Philippines. *Kuroshio Science*, 2, 29-34.
- Carpenter, K. E., & Springer, V. G. (2005). The center of the center of marine shore fish biodiversity: the Philippine Islands. *Environmental Biology of Fishes*, 72(4), 467-480.
- Charles, A., & Wilson, L. (2009). Human dimensions of marine protected areas. *ICES Journal of Marine Science*, 66(1), 6-15.
- Christie, P. (2004). Marine protected areas as biological successes and social failures in Southeast Asia. In *American Fisheries Society Symposium* (Vol. 42, pp. 155-164).
- Christie, P., McCay, B. J., Miller, M. L., Lowe, C., White, A. T., Stoffle, R., Fluharty, D.L., McManus, L.T., Chuenpagdee, R., Pomeroy, C. & Suman, D. O. (2003). Toward developing a complete understanding: A social science research agenda for marine protected areas. *Fisheries*, 28(12), 22-26.
- Christie, P., Pollnac, R. B., Oracion, E. G., Sabonsolin, A., Diaz, R., & Pietri, D. (2009). Back to basics: An empirical study demonstrating the importance of local-level dynamics for the success of tropical marine ecosystem-based management. *Coastal Management*, 37(3-4), 349-373.
- Christie, P., & White, A. T. (2007). Best practices for improved governance of coral reef marine protected areas. *Coral Reefs*, 26(4), 1047-1056.
- Cicin-Sain, B., Knecht, R. W., Jang, D., & Fisk, G. W. (1998). *Integrated coastal and ocean management: concepts and practices*. Island Press.
- Cinner, J. (2005). Socioeconomic factors influencing customary marine tenure in the Indo-Pacific. *Ecology and Society*, 10(1), 36-49.
- Cinner, J. E., & Aswani, S. (2007). Integrating customary management into marine conservation. *Biological Conservation*, 140(3), 201-216.

- Cinner, J. E., & Pollnac, R. B. (2004). Poverty, perceptions and planning: why socioeconomics matter in the management of Mexican reefs. *Ocean & Coastal Management*, 47(9), 479-493.
- Claudet, J., Garcia-Charton, J. A., & Lenfant, P. (2011). Combined effects of levels of protection and environmental variables at different spatial resolutions on fish assemblages in a marine protected area. *Conservation Biology*, 25(1), 105-114.
- Coastal Conservation Education Foundation (CCEF). (2008). Marine Protected Area Databases. Retrieved from <http://www.coast.ph/coastdb/>
- Creel, L. (2003). *Ripple effects: population and coastal regions* (pp. 1-7). Washington, DC: Population Reference Bureau.
- Dalby, J., & Sorensen, T. K. (2002). Coral reef resource management in the Philippines: With focus on marine protected areas as a management tool. *University of Copenhagen, Botanical Institute, Department of Physical Ecology*.
- D'Agnes, H., Castro, J., D'Agnes, L., & Montebon, R. (2005). Gender issues within the population-environment nexus in Philippine coastal areas. *Coastal Management*, 33(4), 447-458.
- Day J., Dudley N., Hockings M., Holmes G., Laffoley D., Stolton S. & Wells, S. (2012). *Guidelines for applying the IUCN Protected Area Management Categories to Marine Protected Areas*. Gland, Switzerland: IUCN. 36pp.
- Dayton, P. K., Thrush, S. F., Agardy, M. T., & Hofman, R. J. (1995). Environmental effects of marine fishing. *Aquatic Conservation: marine and freshwater ecosystems*, 5(3), 205-232.
- DeJus, D. (2016, February 3). Buluan Island Marine Sanctuary, Batangas MPA and Bantay Dagat Network- Top Performers in Marine Protection. Retrieved from <http://www.mpasupportnetwork.org>.
- Department of Agriculture. (1998). Implementing Rules and Regulations of the Philippine Fisheries Code of 1998 (Administrative Order No. 3 of 1998 of the Department of Agriculture). Retrieved from <http://www.fao.org>
- Department of Philippine Tourism. (2009). Philippine Sites: Misamis Oriental. Retrieved from <http://www.tourism.gov.ph>
- de Vaus, D. A. (1991). Surveys in social research. UCL, London, England.

- Dimech, M., Darmanin, M., Smith, I. P., Kaiser, M. J., & Schembri, P. J. (2009). Fishers' perception of a 35-year old exclusive Fisheries Management Zone. *Biological Conservation*, 142(11), 2691-2702.
- Everitt, B.S. (1992). *The Analysis of Contingency Tables*. Chapman & Hall/CRC, London.
- Eilperin, J. (2016, August 26). Obama creates the largest protected place on the planet, in Hawaii. *The Washington Post*. Retrieved from <http://www.washingtonpost.com>.
- Fabe, B. (2015, August 5). To protect environment, SPI partners with LGUs. *Mindanao Daily News*. Retrieved from <http://www.mindanaodailynews.com>
- Fargier, L., Hartmann, H. J., & Molina-Ureña, H. (2014). "Marine Areas of Responsible Fishing": A Path Toward Small-Scale Fisheries Co-Management in Costa Rica? Perspectives from Golfo Dulce. In *Fisheries Management of Mexican and Central American Estuaries*, Pp. 155-181. Springer Netherlands.
- Ferraro, P. J. (2009). Counterfactual thinking and impact evaluation in environmental policy. In M. Birnbaum & P. Mickwitz (Eds.), *Environmental program and policy evaluation. New Directions for Evaluation*, 122, 75–84.
- Fishery and Aquaculture Country Profiles. Philippines (FAO). (2014). Country Profile Fact Sheets. In: *FAO Fisheries and Aquaculture Department*, Retrieved from <http://www.fao.org/fishery/facp/PHL/en>
- Fox, H. E., Mascia, M. B., Basurto, X., Costa, A., Glew, L., Heinemann, D., Karrer, L.B., Lester, S.E., Lombana, A.V., Pomeroy, R.S., & Recchia, C. A. (2012). Reexamining the science of marine protected areas: linking knowledge to action. *Conservation Letters*, 5(1), 1-10.
- Gavin, M. C., Solomon, J. N., & Blank, S. G. (2010). Measuring and monitoring illegal use of natural resources. *Conservation Biology*, 24(1), 89-100.
- Gaymer, C. F., Stadel, A. V., Ban, N. C., Cárcamo, P., Ierna, J., & Lieberknecht, L. M. (2014). Merging top-down and bottom-up approaches in marine protected areas planning: experiences from around the globe. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 24(S2), 128-144.
- Gell, F. R., & Roberts, C. M. (2003). Benefits beyond boundaries: the fishery effects of marine reserves. *Trends in Ecology & Evolution*, 18(9), 448-455.

- Gjertsen, H. (2005). Can habitat protection lead to improvements in human well-being? Evidence from marine protected areas in the Philippines. *World Development*, 33(2), 199-217.
- Glew, L., Mascia, M. B., & Pakiding, F. (2012). Solving the mystery of MPA performance: Monitoring social impacts. Field Manual (version 1.0). *World Wildlife Fund and Universitas Negeri Papua, Washington DC and Manokwari, Indonesia*.
- Hamilton, M. (2012). Perceptions of fishermen towards marine protected areas in Cambodia and the Philippines. *Bioscience Horizons*, 5, 1-24.
- Henry, G. T. (1990). Practical sampling. Sage Publications, Newbury Park, California, USA.
- Himes, A. H. (2007). Performance indicator importance in MPA management using a multi-criteria approach. *Coastal Management*, 35(5), 601-618.
- Hind, E. J., Hiponia, M. C., & Gray, T. S. (2010). From community-based to centralized national management—A wrong turning for the governance of the marine protected area in Apo Island, Philippines? *Marine Policy*, 34(1), 54-62.
- Hoegh-Guldberg, O., Hoegh-Guldberg, H., Veron, J. E. N., Green, A., Gomez, E. D., Ambariyanto, A., & Hansen, L. (2009). The Coral Triangle and climate change: Ecosystems, People and Societies at risk. Brisbane, WWF. Pp 276.
- Hoegh-Guldberg, O., Mumby, P. J., Hooten, A. J., Steneck, R. S., Greenfield, P., Gomez, E., Harvell, C.D., Sale, P.F., Edwards, A.J., Caldeira, K., & Knowlton, N. (2007). Coral reefs under rapid climate change and ocean acidification. *Science*, 318(5857), 1737-1742.
- Horigue, V., Aliño, P. M., White, A. T., & Pressey, R. L. (2012). Marine protected area networks in the Philippines: Trends and challenges for establishment and governance. *Ocean & Coastal Management*, 64, 15-26.
- Hughes, T. P., Rodrigues, M. J., Bellwood, D. R., Ceccarelli, D., Hoegh-Guldberg, O., McCook, L., Moltschaniwskyj, N., Pratchett, M.S., Steneck, R.S. & Willis, B. (2007). Phase shifts, herbivory, and the resilience of coral reefs to climate change. *Current Biology*, 17(4), 360-365.
- Indab, J. D., & Suarez-Aspilla, P. B. (2004). Community-based marine protected areas in the Bohol (Mindanao) Sea, Philippines. *NAGA, WorldFish Center Quarterly*, 27(1-2), 4-8.

- IUCN World Commission on Protected Areas (IUCN-WCPA), 2008. Establishing Marine Protected Area Networks-Making It Happen. IUCN-WCPA, National Oceanic and Atmospheric Administration and The Nature Conservancy, Washington, D.C., 118 pp.
- Jackson, J. B., Kirby, M. X., Berger, W. H., Bjorndal, K. A., Botsford, L. W., Bourque, B. J., Bradbury, R.H., Cooke, R., Erlandson, J., Estes, J.A. & Hughes, T. P. (2001). Historical overfishing and the recent collapse of coastal ecosystems. *Science*, 293(5530), 629-637.
- La Viña, A. G.M., Kho, J. L. & M. J. Caleda, M. J. (2010). Legal Framework for Protected Areas: Philippines. IUCN-EPLP No. 81. 49 pp.
- Lester, S. E., Halpern, B. S., Grorud-Colvert, K., Lubchenco, J., Ruttenberg, B. I., Gaines, S. D., Airamé, S. & Warner, R. R. (2009). Biological effects within no-take marine reserves: a global synthesis. *Marine Ecology Progress Series*, 384, 33-46.
- Lowe, C. (2003). Sustainability and the question of “enforcement” in integrated coastal management: the case of Nain Island, Bunaken National Park. *Indonesian Journal of Coastal and Ocean Management* (special edition 1), 49-63.
- Lubchenco, J. (1995). The role of science in formulating a biodiversity strategy. *Bioscience-Washington*, 45, S-7.
- Lubchenco, J., Palumbi, S. R., Gaines, S. D., & Andelman, S. (2003). Plugging a hole in the ocean: the emerging science of marine reserves. *Ecological Applications*, 13(1), S3-S7.
- Lundquist, C.J. & Granek, E.F. (2005). Strategies for Successful Marine Conservation: Integrating Socioeconomic, Political, and Scientific Factors. *Conservation Biology*, 19, 1771-1778
- Mascia, M. B. (2003). The human dimension of coral reef marine protected areas: recent social science research and its policy implications. *Conservation Biology*, 17(2), 630-632.
- Mascia, M. B., Claus, C., & Naidoo, R. (2010). Impacts of marine protected areas on fishing communities. *Conservation Biology*, 24(5), 1424-1429.
- McClanahan, T. R., & Graham, N. A. J. (2005). Recovery trajectories of coral reef fish assemblages within Kenyan marine protected areas. *Marine Ecology Progress Series*, 294, 241-248.

- McClanahan, T. R., & Shafir, S. H. (1990). Causes and consequences of sea urchin abundance and diversity in Kenyan coral reef lagoons. *Oecologia*, 83(3), 362-370.
- Miclat, E., & Ingles, J. (2004). Standardized terms and definitions for use in marine protected area management in the Philippines. In *Proceedings of the Workshop Toward the Formulation of the Philippine Marine Sanctuary Strategy* (pp. 3-8). Quezon City: Marine Science Institute, University of the Philippines.
- Milne, N., & Christie, P. (2005). Financing integrated coastal management: experiences in Mabini and Tingloy, Batangas, Philippines. *Ocean & Coastal Management*, 48(3), 427-449.
- MPA Support Network. (2014). Philippine MPA Database. Retrieved from <http://www.mpa.msi.upd.edu.ph>
- Myers, R. A., & Worm, B. (2003). Rapid worldwide depletion of predatory fish communities. *Nature*, 423(6937), 280-283.
- Nakagawa, S. (2004). A farewell to Bonferroni: the problems of low statistical power and publication bias. *Behavioral Ecology*, 15(6), 1044-1045.
- National Research Council. (2001). Marine protected areas: tools for sustaining ocean ecosystems. National Academy Press, Washington DC.
- NOAA (National Oceanic and Atmospheric Administration). (2002). Marine protected areas social science workshop notes form breakout groups. NOAA National MPA Center, Santa Cruz, CA. Retrieved from <http://www.mpa.gov>
- NOAA (National Oceanic and Atmospheric Administration). (2003). Social Science Research Strategy for Marine Protected Areas. Coastal Service Center and the National Protected Areas. Retrieved from <http://www.csc.noaa.gov/mpass>
- Nowlis, J. S., & Friedlander, A. (2005). *Marine reserve function and design for fisheries management*. Island Press.
- Oracion, E. (2016). A Case Study of Politics Over Local Knowledge and Practices in Marine Protected Area Development and Management. Pp. 81-98. In, Xing, J., & Ng, P. Indigenous Culture, Education and Globalization: Critical Perspectives from Asia. Springer Press. New York.
- Padilla, J. E., & Rosales, R. M. (1997, December). Towards benefit-cost analysis of marine protected areas in the Philippines. In *Proceedings of the Workshop on*

Marine Protected Areas in the Philippines. Marine Science Institute, University of the Philippines (pp. 15-16).

- Pajaro, M., F. Olano, & San Juan, B. (1999). *Documentation and review of marine protected areas in the Philippines: A preliminary report*. Manila, Philippines: Haribon Foundation.
- Pauly, D., Christensen, V., Dalsgaard, J., Froese, R., & Torres, F. (1998). Fishing down marine food webs. *Science*, 279(5352), 860-863.
- Petrossian, G. A. (2015). Preventing illegal, unreported and unregulated (IUU) fishing: A situational approach. *Biological Conservation*, 189, 39-48.
- Philippines CTI NCC (2011). Toolkit: Marine Protected Area Management Effectiveness Assessment Tool. Retrieved from <http://coraltriangleinitiative.org>
- Philippine Statistics Authority. (2010). Censuses of Population and Housing. Retrieved from <http://www.psa.gov.ph>
- Pietri, D., Christie, P., Pollnac, R. B., Diaz, R., & Sabonsolin, A. (2009). Information diffusion in two marine protected area networks in the Central Visayas Region, Philippines. *Coastal Management*, 37(3-4), 331-348.
- Pinnegar, J. K., Polunin, N. V. C., Francour, P., Badalamenti, F., Chemello, R., Harmelin-Vivien, M. L., M.L., Hereu, B., Milazzo, M., Zabala, M., d'Anna, G. & Pipitone, C. (2000). Trophic cascades in benthic marine ecosystems: lessons for fisheries and protected-area management. *Environmental Conservation*, 27(02), 179-200.
- Pollnac, R. B., Christie, P., Cinner, J., Dalton, T., Daw, T., Forrester, G., Graham, N., & McClanahan, T. (2010). Marine reserves as linked social-ecological systems. *Proceedings of the National Academy of Sciences*, 107, 18262-18265.
- Pollnac, R. B., Crawford, B. R., & Gorospe, M. L. (2001). Discovering factors that influence the success of community-based marine protected areas in the Visayas, Philippines. *Ocean & Coastal Management*, 44(11), 683-710.
- Pollnac, R. B., Pomeroy, R. S., & Harkes, I. H. (2001). Fishery policy and job satisfaction in three southeast Asian fisheries. *Ocean & Coastal Management*, 44(7), 531-544.
- Pomeroy, R. S., & Carlos, M. B. (1997). Community-based coastal resource management in the Philippines: a review and evaluation of programs and projects, 1984–1994. *Marine Policy*, 21(5), 445-464.

- Pomeroy, R., Garces, L., Pido, M., & Silvestre, G. (2010). Ecosystem-based fisheries management in small-scale tropical marine fisheries: emerging models of governance arrangements in the Philippines. *Marine Policy*, 34(2), 298-308.
- Pomeroy, R. S., Mascia, M.B. & Pollnac, R.B. (2006). Marine protected areas: the social dimension,” in Report and Documentation of the Expert Workshop on Marine Protected Areas and Fisheries Management: Review of Issues and Considerations, Food and Agricultural Organization, Ed., pp. 149–181, Food and Agricultural Organization of the United Nations, Rome, Italy, 2006, FAO Fisheries Report no. 825 FIEP/R825.
- Pomeroy, R. S., Parks, J. E., & Watson, L. M. (2004). *How is your MPA doing?: a guidebook of natural and social indicators for evaluating marine protected area management effectiveness*. IUCN.
- Province of Misamis Oriental. (2016). The Province of Misamis Oriental. Retrieved from <http://www.misamisoriental.gov.ph>
- RARE. (2016). The rising tide of community level conservation: Strengthening local fisheries management in the coral triangle. Pp1-12. Retrieved from <http://www.rare.org>
- Roa-Quiaoit, H., Guzman, A., Villaluz, E., Dawang, D., Quimpo, F, Mabao, A., & Martinez, L. (2010). Ecological and fisheries profile of Macajalar Bay 2008. Xavier University Press, pp. 183.
- Roberts, C. M., Bohnsack, J. A., Gell, F., Hawkins, J. P., & Goodridge, R. (2001). Effects of marine reserves on adjacent fisheries. *Science*, 294(5548), 1920-1923.
- Roberts, C. M., Hawkins, J. P., & Gell, F. R. (2005). The role of marine reserves in achieving sustainable fisheries. *Philosophical Transactions of the Royal Society of London B: Biological Sciences*, 360(1453), 123-132.
- Roberts, C. M., McClean, C. J., Veron, J. E., Hawkins, J. P., Allen, G. R., McAllister, D. E., D.E., Mittermeier, C.G., Schueler, F.W., Spalding, M., Wells, F., & Vynne, C. (2002). Marine biodiversity hotspots and conservation priorities for tropical reefs. *Science*, 295(5558), 1280-1284.
- Russ, G. R., & Alcala, A. C. (1999). Management histories of Sumilon and Apo Marine Reserves, Philippines, and their influence on national marine resource policy. *Coral Reefs*, 18(4), 307-319.

- Russ, G. R., & Alcala, A. C. (2003). Marine reserves: rates and patterns of recovery and decline of predatory fish, 1983-2000. *Ecological Applications*, 13(6), 1553-1565.
- Russ, G. R., Alcala, A. C., & Maypa, A. P. (2003). Spillover from marine reserves: the case of *Naso vlamingii* at Apo Island, the Philippines. *Marine Ecology Progress Series*, 264, 15-20.
- Sala, E., Aburto-Oropeza, O., Paredes, G., Parra, I., Barrera, J. C., & Dayton, P. K. (2002). A general model for designing networks of marine reserves. *Science*, 298(5600), 1991-1993.
- Sanchirico, J. N., & Emerson, P. M. (2002). *Marine protected areas: economic and social implications* (p. 24). Washington, DC: Resources for the Future.
- Sobel, J., & Dahlgren, C. (2004). *Marine reserves: a guide to science, design, and use*. Island Press.
- Spalding, M., Ravilious, C., & Green, E. P. (2001). *World atlas of coral reefs*. University of California Press.
- Sudman, S., and N. Schwarz. 1989. Contributions of cognitive- psychology to advertising research. *Journal of Advertising Research*, 29, 43-53
- Suman, D., Shrivani, M., & Milon, J. W. (1999). Perceptions and attitudes regarding marine reserves: a comparison of stakeholder groups in the Florida Keys National Marine Sanctuary. *Ocean & Coastal Management*, 42(12), 1019-1040.
- Thomas, H. L., Macsharry, B., Morgan, L., Kingston, N., Moffitt, R., Stanwell-Smith, D., & Wood, L. (2014). Evaluating official marine protected area coverage for Aichi Target 11: appraising the data and methods that define our progress. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 24(S2), 8-23.
- Thomassin, A., White, C. S., Stead, S. S., & David, G. (2010). Social acceptability of a marine protected area: the case of Reunion Island. *Ocean & Coastal Management*, 53(4), 169-179.
- Tietze, U., Groenewold, G., & Marcoux, A. (2000). *Demographic change in coastal fishing communities and its implications for the coastal environment* (No. 403). Food & Agriculture Organization.
- Toropova, C., Meliane, I., Laffoley, D., Matthews, E., & Spalding, M. (2010). *Global ocean protection: present status and future possibilities*. IUCN.

- Vasconcelos, L., Pereira, M. J. R., Caser, U., Gonçalves, G., Silva, F., & Sá, R. (2013). MARGov—Setting the ground for the governance of marine protected areas. *Ocean & coastal management*, 72, 46-53.
- Veron, J. E. N., Devantier, L. M., Turak, E., Green, A. L., Kininmonth, S., Stafford-Smith, M., & Peterson, N. (2009). Delineating the coral triangle. *Galaxea, Journal of Coral Reef Studies*, 11(2), 91-100.
- Walmsley, S. F., & White, A. T. (2003). Influence of social, management and enforcement factors on the long-term ecological effects of marine sanctuaries. *Environmental Conservation*, 30(04), 388-407.
- Webb, E. L., Maliao, R. J., & Siar, S. V. (2004). Using local user perceptions to evaluate outcomes of protected area management in the Sagay Marine Reserve, Philippines. *Environmental Conservation*, 31(02), 138-148.
- Weber, M.L. (2008). Marine Wildlife Policy: Underlying Ideologies. Pp. 231-243. In, Rockwood, L.L., R.E. Stewart, and T. Dietz, Editors. *Foundations of Environmental Sustainability: The Coevolution of Science and Policy*. Oxford University Press. New York.
- Weeks, R., Russ, G. R., Alcala, A. C., & White, A. T. (2010). Effectiveness of marine protected areas in the Philippines for biodiversity conservation. *Conservation Biology*, 24(2), 531-540.
- White, A. T., Vogt, H. P., & Arin, T. (2000). Philippine coral reefs under threat: the economic losses caused by reef destruction. *Marine Pollution Bulletin*, 40(7), 598-605.
- White, A. T., Courtney, C. A., & Salamanca, A. (2002). Experience with marine protected area planning and management in the Philippines. *Coastal Management*, 30(1), 1-26.
- White, A. T., Aliño, P. M., & Meneses, A. B. T. (2006). *Creating and managing marine protected areas in the Philippines*. Fisheries Improved for Sustainable Harvest Project.
- Wilkinson, C. (2008). Status of Coral Reefs of the World: 2008 Global Coral Reef Monitoring Network and Reef and Rainforest Research Center. *Townsville, Australia*. 296pp.
- Wood, L. J. (2007). MPA global: a database of the world's marine protected areas. Sea Around Us Project, United Nations Environment Programme World Conservation Monitoring Centre & World Wildlife Fund, Vancouver, B.C.

Wood, L. J., Fish, L., Laughren, J., & Pauly, D. (2008). Assessing progress towards global marine protection targets: shortfalls in information and action. *Oryx*, 42(03), 340-351.

Yates, K.L. (2014). View from the wheelhouse: Perceptions on marine management from the fishing community and suggestions for improvement. *Marine Policy*, 48, 39-50.

BIOGRAPHY

Alexandra Shah (née Didoha) received her Bachelor of Science from Eckerd College in 1999. She served as a United States Peace Corps Volunteer in the Philippines for two years and received her Master of Arts in Marine Affairs and Policy from the University of Miami Rosenstiel School of Atmospheric and Marine Science in 2004. In 2016, she was awarded her doctorate in Environmental Science and Public Policy from George Mason University.