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BSc Marine Biology**

Perceptions of fishermen towards MPAs in Cambodia and the Philippines



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Contents

Abstract	3
1. Introduction	4 - 8
2. Materials & Methods	9 - 17
2.1. Study site	9 - 11
2.2. Questionnaire design	11 - 12
2.3. Survey technique	12
2.4. Data analysis	13 - 17
2.4.1. Data organisation	13
2.4.2. Descriptive statistics	13
2.4.3. Statistical tests	13 - 17
2.5. Limitations/sources of error	17
3. Results	18 - 26
3.1. Respondent characteristics	18 - 19
3.2. Opinions about MPAs	20 - 21
3.3. Opinions about state of resources	21 - 23
3.4. Opinions about management of MPAs	23 - 25
3.5. Acceptance of MPAs	25 - 26
4. Discussion	27 - 34
4.1. Comparison of findings at each study site	27 - 30
4.2. Effect of fisher characteristics on perception of MPAs	30 - 33
4.3. Conclusions	33 - 34
Acknowledgements	35
References	36 - 39
Appendices	40 - 49

Abstract

Marine protected areas (MPAs) can be used to conserve parts of marine ecosystems, including fish stocks exploited by fisheries. Social acceptance of MPAs must be achieved if they are to function as effective management tools. Artisanal fishers operating around tropical coral reef areas were questioned in an attempt to investigate their acceptance and perceptions of MPAs. Fishers from two areas were surveyed: Koh Rong Island, Cambodia, where MPAs are a new concept to fishers, and Southern Leyte, the Philippines, where MPAs have been used in management for over ten years. Fishers' opinions of MPAs from each study site were compared and variables affecting fishers' opinions of MPAs were also investigated at each site. Although small sample sizes of fishers were observed at each study site, results showed that the majority of fishers at each site accepted MPAs as a management tool. Cambodian fishers felt the state of marine resources had worsened in the past decade (with regards to the number of fish, the size of fish and the number of species present in their catch), whereas most Filipino fishers had noticed an opposite trend. Older Cambodian fishers had greater acceptance of MPAs; age did not affect Filipino fishers' acceptance, and did not affect any other opinions fishers had of MPAs at either site. Community-based management of MPAs was fishers' preference at both sites. The study shows evidence of MPA support in Cambodia, with mobile gear users being more willing to be involved in MPA management. Most Filipino fishers felt their MPA improved their catches, although there was evidence of conflict between fishers since the MPA was implemented.

Key words: marine protected areas, artisanal fishery management, tropical fisheries, perceptions, acceptance

Picture on title page: A Filipino fisher heading out to begin fishing at sunset.

1. Introduction

Marine protected areas (MPAs) are management tools where human activities in areas of the marine environment, such as fishing, are prohibited or monitored in certain areas (Moffitt *et al*, 2011; Sale *et al*, 2005). Implementation can be based on a variety of factors, including conservation of habitats or ecosystems and management of commercial fish stocks. MPAs have been seen to be successful in protecting species biodiversity and the ecosystem (Fletcher *et al*, 2011; Mouillot *et al*, 2011; Teh *et al*, 2008), making them an effective tool in conservation management. The size, number and location of MPAs, as well as the population dynamics of the species present, are factors that need to be carefully considered during the planning stages, for example creating a “MPA network” (Moffitt *et al*, 2011). MPA networks consist of several MPAs that are sufficiently close to one another, allowing processes such as larval and adult dispersal to occur (Roberts *et al*, 2001). Each MPA in the system can act as sources (supplying recruits to other areas) or sinks (receiving exports from elsewhere) for fish and larvae, complementing other MPAs (Christie *et al*, 2010; Williams *et al*, 2009). Russ *et al* (2008) report that the densities of fished species increased substantially within a large MPA network established on the Great Barrier Reef off the coast of north-eastern Australia compared to fished areas nearby, illustrating the positive effects that MPAs can deliver. In tropical systems such as the Great Barrier Reef, coral reefs are crucial for fish that feed on coral, which in turn maintain the dynamics of a healthy reef, providing other species with shelter (Cheal *et al*, 2008) therefore coral conservation and larvae dispersal are important in these areas to prevent declines in both coral cover and species dependent on coral. Many coral reef areas have already experienced a reduction in biodiversity (Graham *et al*, 2008). MPAs can also be designed to protect individual areas of high biodiversity, such as coral reefs, or habitats containing endemic species to maintain

species richness and genetic diversity in that area (Allen, 2008; Miller and Ayre, 2008).

Individual MPAs can be incorporated into MPA networks as management develops, providing benefits for relatively static species and also migratory species; this is a more appropriate strategy than one extensive MPA for the conservation of migratory species which would result in a substantial loss of fishing ground for fisheries in the area (Le Quesne and Codling, 2009).

A huge problem around coral reef systems, and many other parts of the world, is overfishing.

MPAs are a method of tackling the detrimental effects of overfishing on fish populations, such as reduced mean length as fishing pressure increases (Cinner and McClanahan, 2006). Fishing can also disrupt the whole ecosystem, for example when herbivorous fish or invertebrates are depleted, increased algal growth can have a negative effect on coral growth (Hoegh-Guldberg *et al*, 2007; Hughes, 2008), worsening the situation further for species dependent on coral.

Management plans such as gear restrictions can allow local fish stocks to recover providing an increase in resources available to fishers in the area (McClanahan *et al*, 2008). Although fishers lose fishing grounds, no-take MPAs provide better protection for exploited species than partially protected areas and increase fishers' yields in the long-term (Lester and Halpern, 2008), with the exception of fisheries for highly mobile species (Hilborn *et al*, 2004); Willis *et al* (2003) found that the density of a moderately mobile species was greater within no-take MPAs in New Zealand compared to the fished waters surrounding them. Fished species survive better within MPAs and adult individuals proceed to move to surrounding areas where fishing occurs; the export from MPAs increases fishers' yields and is known as the "spillover effect" (Alcala and Russ, 2006). Besides overfishing, coral reef communities face a range of issues such as climate change and ocean acidification (Hoegh-Guldberg *et al*, 2007; Munday *et al*, 2008). The resilience of coral reefs refers to their ability to withstand changes in the environment and how

well they can recover or adapt (West and Salm, 2003), therefore if fisheries are managed effectively, the result is healthier, more resilient ecosystems that have a better chance at coping with natural, stochastic changes (Hughes *et al*, 2005; Keller *et al*, 2009).

The success of MPAs as a means of management depends largely on participation from the people involved, including fishers. MPAs are more likely to succeed in their specific purposes if there is input and agreement from a range of stakeholders that impact or are impacted by a MPA, for example fishers and scientists (Klein *et al*, 2008). Gleason *et al* (2010) suggest that the public and stakeholders from multiple sectors should be involved, with each fully understanding their role in the process and also the roles the MPA is designed to fulfil. Alcala and Russ (2006) state that two MPAs in the Philippines have been very successful since management changed from a government top-down approach to co-management, involving locals and the government. The way MPAs are managed is important in gaining support of locals and fishers; Himes (2003) found that fishers who felt uninformed about MPA management did not trust managers, and suggests that managers should involve locals by asking their opinions and providing them with explanations at each management stage.

The aim of this study is to investigate fishers' opinions and acceptance of MPAs in two countries, Cambodia and the Philippines. The two areas that were visited in each country had different levels of marine resource protection. Fishers in Cambodia have little experience of MPAs as a very low number exist along the country's coast; the Ream MPA is one example (Depondt and Green, 2006), although MPA efforts in Cambodia are recent and conservation has been a low priority in the past (Braatz, 1992). A new MPA was implemented close to the study site in Cambodia during data collection of the present study [2011]. The Philippines have several MPAs in the area studied and 1169 throughout the country (in 2007; Aliño *et al*, 2011), including

some of the best known examples of MPA success (Alcala and Russ, 2006). Fishers with a better knowledge of MPAs may show different levels of acceptance and perceptions towards them than fishers who know little about them. Findings will be used to show similarities and differences expressed by fishers, within and between countries. This information will give an insight into the aspects of MPAs that fishers agree with and support, and what they would like to see in terms of marine resource management. The hypotheses investigated in this study concern fishers' acceptance and perceptions of MPAs based on: 1) responses received between different study sites and 2) fishers' characteristics that have an effect on their views of MPAs.

Fishers' opinions are not uniform and knowledge of the variability of fishers' opinions is likely to help increase MPA success (Dimech *et al*, 2009). Factors which influence fishers' opinions and acceptance of MPAs, based on findings from other peer-reviewed studies, were used to test the hypotheses. The age of fishers can influence their actions and perceptions, including their opinions towards the management of their fishery (Tzanatos *et al*, 2006). Abernethy *et al* (2007) suggest that older fishers may have better knowledge about reef dynamics and their natural resources than younger fishers. Fishers operating different gear types can have varying opinions towards MPAs and restricted areas, for example Blythe *et al* (2002) found that static gear operators felt they should have their own fishing zones that excluded mobile gear operators; however the mobile gear operators felt they should be allowed to share fishing zones with the static gear users. Pita *et al* (2010) found that there are also differences between static and mobile gear fishers' opinions regarding the management of MPAs, with most static fishers perceiving restrictions as beneficial whereas fishers that used mobile gear were less in favour of the restrictions and did not feel as involved in decision-making processes. If fishers are involved in a management scheme they agree with, such as MPAs, there is a greater chance that they will

support that management as they feel a sense of responsibility (Alcala and Russ, 2006). Fishers' acceptance of MPAs has been seen to be greater when they are involved in the management and also when the fishers perceive the benefits of MPAs (such as increases in their catch and providing nursery grounds for fish) from their own fishing experiences (Gelcich *et al* 2009; Leleu *et al*, 2012). These factors influencing fishers' acceptance and perceptions of MPAs will be investigated with fishers in Cambodia and the Philippines.

2. Materials & Methods

2.1. Study site

Data was collected on the island of Koh Rong, Cambodia, from July to August 2011 and in the barangay (village) of Napantao, Panoan Island, Southern Leyte, in the Philippines, from September to October 2011. Both sites were the location of Coral Cay Conservation (CCC) expedition bases, a not-for-profit conservation organisation dedicated to surveying coral reefs and working with local communities to promote sustainable management of marine resources. Figure 1 shows each study site where data was collected from fishers and other interviewees. MPAs were a new concept for fishers in Cambodia, and CCC had just begun work there with the aim to implement a MPA around the whole island of Koh Rong. In the Philippines, fishers were familiar with MPAs, as several had already been implemented in the Sogod Bay area, where the survey took place (management improved from 2002 when CCC began the Southern Leyte Coral Reef Conservation Project).

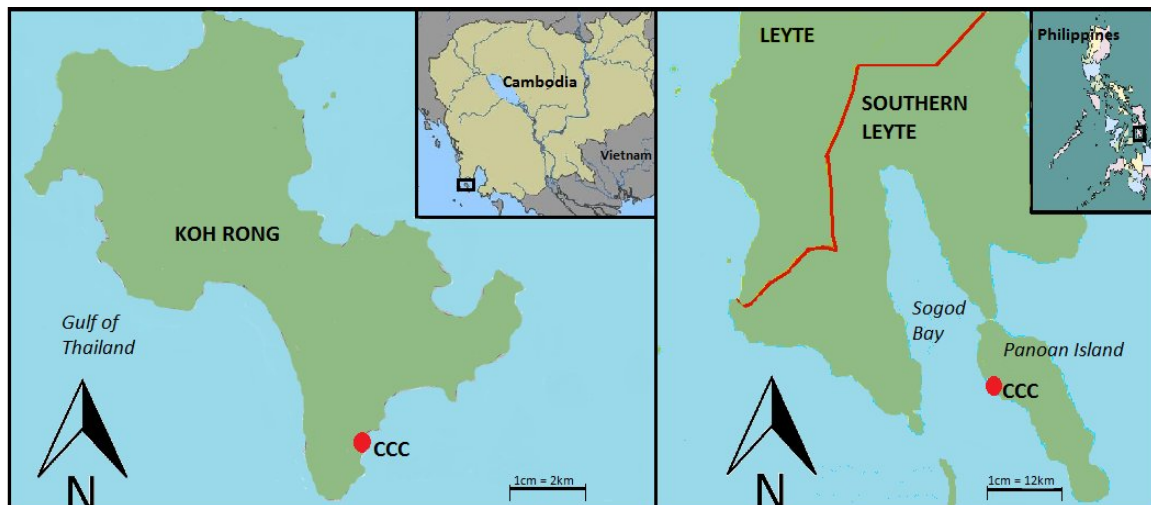


Figure 1: Study sites on Koh Rong island, Cambodia, and Napantao, Southern Leyte, the Philippines, showing the locations of Coral Cay Conservation expedition bases in the villages where the surveys took place (●).

Table 1 summarises the details of MPAs at each study site. Fishers from both countries fished in an artisanal manner, but differed in the type of gear they used (the gear most frequently used by Cambodian fishers was seine nets and by Filipino fishers hooks and lines). The MPA studied in the Philippines is much smaller than the one proposed around Koh Rong, resulting in far fewer fishers exploiting it. Figure 2 shows the location of the MPA where data was collected in the present study, as well as other surrounding MPAs, in the Sogod Bay area of the Philippines. The figure also shows details of how each MPA was managed in 2010 (from work done by CCC).

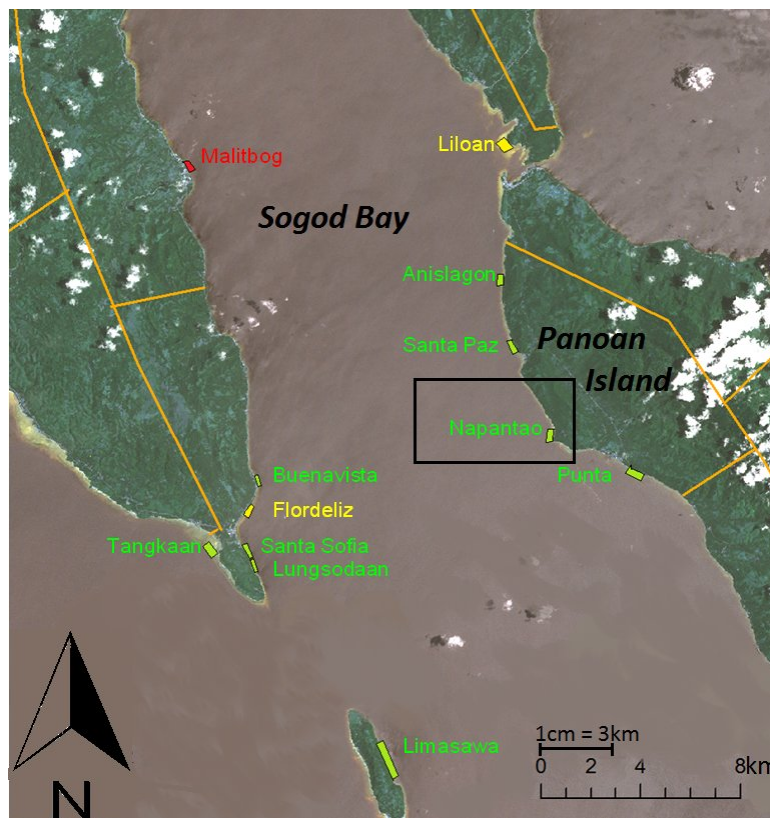


Figure 2: MPAs present in the Sogod Bay area, the Philippines, in 2010, including management status (green = well-managed, yellow = poorly-managed and red = no management) determined by CCC. The study site MPA (Napantao) is shown within the black box. [Map modified from CCC]

Table 1: Description of MPAs at each study site.

MPAs	Cambodia^a	Philippines
Name	-	Napantao
Year created	Not yet created	1996
Area (km ²)	~ 3.83	~ 0.1
Number of villages present	~ 4 (Tourist resorts expected in the future)	1
Prohibition	Multiple-use area	No-take
Gear used most frequently	Seine nets	Hook & line
Number of fishers using MPA	>100	~ 50
General description	Around entire coastline of Koh Rong; restriction ranging from no-take to minimal limitations.	One of several small MPAs in the area (see Figure 2).

Note: ^a Cambodia is still in the early planning stages of MPAs, with limited information available. 1 new, no-take MPA exists around the tourist resort islands of Song Saa, northeast Koh Rong (currently under construction [2011]).

2.2. Questionnaire design

Questionnaires were created to investigate the opinions of fishers towards various aspects of MPAs and assess their support for MPAs. The questionnaires included two sections: A) section with personal questions about the fisher (such as their age, fishing methods, species frequently caught, religion etc.) and B) section regarding fishers' opinions about the effects of MPAs and their willingness to be involved. For the latter section, many of the questions were constructed using a Likert-scale answering system (ranging from “Strongly Disagree” to “Strongly Agree”). Other questions had categorical answers, such as “Yes” or “No”. The questionnaires were designed to allow a comparison of a range of opinions (from Section B) to the types of fishers (from Section A) to see if the responses were caused by fishers' characteristics (explanatory

variables). Such connections could then be compared between the two countries. The wording of certain questions differed between Cambodia and the Philippines, as Cambodia has very few MPAs or methods of management in place, whereas the Philippines have had several MPAs implemented in the study area over the last decade. The questionnaires differed slightly so they were relevant for each area. Appendix 1 shows the questionnaires used in the present study.

2.3. Survey technique

Surveys were carried out by one interviewer (the author) and a translator. The questionnaire used in Cambodia was translated into Khmer (the most widely spoken language in Cambodia) and the questionnaire used in the Philippines was carried out in English (with the aid of a translator speaking Visayan, the regional language). Translators asked the questions to each fisher and translated the responses so the interviewer could mark the answers on each questionnaire. Fishers were found randomly in Cambodia along the beach and on piers where their boats were. In the Philippines the surveys were mostly conducted in fishers' houses (known by the translator) and also with fishers who were found randomly around Napantao. Most surveys took 15 – 20 minutes, depending on how much information the fishers gave and whether there were any issues caused by the language barrier. Sometimes fishers were approached as a group, where each question was asked to the fishers one by one and the responses were marked on each questionnaire corresponding to the correct fisher. A total of 29 fishers were surveyed in Cambodia and 20 in the Philippines.

Interviews were also carried out with key stakeholders in Cambodia only: with the village chief (with a translator) and the CCC expedition leader and project scientist. Responses were recorded in a log book during each interview.

2.4. Data analysis

2.4.1. Data organisation

Prior to analysis, all questionnaire data were entered into a database using Microsoft Excel. Data was copied into a statistical software package (IBM SPSS, version 19) where it was analysed against selected variables (Table 2).

2.4.2. Descriptive statistics

Responses from Section A of the questionnaires were tabulated to show the means and standard deviation of continuous data and the frequencies of occurrence of categorical data. Categorical and ordinal data from Section B of the questionnaires were also tabulated to show the percentage of responses to each question from each study area. Categorical responses were presented as “Yes”, “No” and “Maybe/DK”, where “Maybe” and “Don’t know” responses were combined. Ordinal responses were measured on a 5-point Likert-scale (ranging from “Strongly agree” to “Strongly disagree”) and then reduced to a 3-point Likert scale (due to the small sample sizes), containing only the responses “Agree”, “Neutral” (neither agree nor disagree) and “Disagree”. The Likert-scale responses were also presented as percentages of each response from fishers at each study site.

2.4.3. Statistical tests

H₀: There will be no difference between fishers’ acceptance and perceptions towards MPAs from responses received at each study site.

Firstly, the question “Are protected areas a good thing?” (Q7, Appendix 1), measured categorically (“Yes”, “No” and “Maybe/DK”), was used as a proxy for fishers’ acceptance of MPAs. Results were displayed as descriptive statistics. Secondly, fishers’ opinions relating to

MPAs (such as their impact on fishing activity and the local community) were investigated. Fishers' views towards MPAs were investigated at each study site (the Cambodia site where MPAs are a novel concept and the Philippines site where MPAs have been present for over a decade) using a 5-point Likert-scale (Q8, Appendix 1). The responses gathered were collapsed to a 3-point Likert-scale ("Agree", "Neutral" and "Disagree") and statistical tests were used to determine if fishers' responses between study areas differed significantly. The data was ordinal, so non-parametric Kruskal-Wallis tests were used. Results were displayed with descriptive statistics.

Fishers' management preferences were also investigated and compared between study sites. Fishers were asked which of four management options they would prefer for MPAs in the future (Q11d, Appendix 1): 1) "Management by the government", 2) "Management by both fishers and government", 3) "Local community-based management excluding women" and 4) "Local community-based management including women". A categorical variable was created by grouping responses 1 and 2 together and responses 3 and 4 together: co-management (= 0) and community-based management (= 1), respectively. Fishers who opted for the "Management by the government" option were included in the co-management category, as few fishers responded with that answer (3 in Cambodia; 2 in the Philippines). A chi-squared test was used to determine if management preference differed between countries, as both management and country data (Cambodia = 1, Philippines = 2) were categorical.

H₀: There will be no effect of fishers' characteristics on their perceptions or acceptance of MPAs.

Statistical tests were used to test differences in fishers' perceptions about MPAs. Responses to the question "Are protected areas a good thing?" were collapsed to a categorical variable of

“Yes” (= 1) and “Other” (= 0, including the responses “No”, “Maybe” and “Don’t know”). All but three fishers from the Philippines site fell into the “Yes” category, so statistics were only carried out with data from Cambodian fishers for this particular question. Several characteristics of Cambodian fishers (age, gear operated, species in catch and management preference) were tested against these responses to investigate their acceptance of MPAs, as shown in Table 2. Fishers were asked if they operated a range of fishing gear (Q3, Appendix 1) and responses were reduced to two categories: mobile gear (= 1) and static gear (= 0). Management preference (Q11d, Appendix 1) was also reduced to two categories: community-based management (= 1) and co-management (= 0). A range of other variables regarding fishers’ opinions of MPAs were tested to investigate their acceptance of MPAs; these responses were measured on a 5-point Likert-scale (Q8, Appendix 1) ranging from “Strongly agree” to “Strongly disagree” and reduced to a categorical variable of “Agree” (= 1, including the responses “Strongly agree” and “Agree”) and “Other” (= 0, including “Strongly disagree”, “Disagree” and “Neither agree nor disagree”) to test fisher’s acceptance of MPAs. Fishers’ perceptions of a change in the number of individuals present in their catch were tested against whether they caught squid or not for fishers at both sites, as squid was commonly caught at both sites (Lunn and Dearden, 2006, state that squid fishers do not feel their target species decrease over time compared to finfish fishers); categorical variables were used (increase in the number of most caught species = 1, other = 0; squid present in catch = 1, squid not present in catch = 0). Whether fishers caught squid (= 1) or not (= 0) was also tested against fishers’ acceptance of MPAs for Cambodian fishers only.

Table 2: Factors used to test fishers' opinions and acceptance of MPAs.

Variables	Impact on fishers' acceptance/perceptions of MPAs	Literature reference	Tested in this study
<i>Fishers' age</i>	Alter tactics or behaviour; may affect MPA acceptance.	Tzanatos <i>et al</i> , 2006	Age data were tested using 2 independent-sample t-tests (parametric tests as the age data were continuous and normally distributed using Shapiro-Wilks test for normality).
	Younger/more experienced fishers are more positive towards MPAs	Leleu <i>et al</i> , 2012	
<i>Type of fishing gear operated (mobile/static)</i>	Static gear users feel more involved in management; also more accepting of restrictions.	Pita <i>et al</i> , 2010	A categorical variable (Mobile gear = 1, Static gear = 0) was used to test data using non-parametric chi-squared (χ^2) tests (or Fisher's exact test when the data did not meet assumptions).
	Different gear operators have different opinions of MPAs.	Blythe <i>et al</i> , 2002	
<i>Species in catch</i>	Squid fishers are not severely affected by fishery development and do not notice declines in catches over time.	Lunn & Dearden, 2006	A categorical variable (fishers who catch squid = 1, fishers who do not catch squid = 0) was used to test data using non-parametric Fisher's exact test (as data did not meet chi-squared (χ^2) assumptions).
<i>Fishers' management preference</i>	More likely to obey rules and feel involved in the process when given a choice; more accepting.	Alcala & Russ, 2006	A categorical variable (co-management = 0, community-based management = 1) was used to test data using Fishers exact test (as data did not meet chi-squared (χ^2) assumptions).
<i>Fishers' experience of MPAs^a</i>	Fishers who have experience of MPAs perceive them as beneficial.	Leleu <i>et al</i> , 2012	Cambodia fishers had no experience of MPAs so no tests were done to test fishers' acceptance.
	Fishers who have seen benefits of MPAs are more likely to support and manage MPAs.	Gelcich <i>et al</i> , 2009; Russ <i>et al</i> , 2003	

Note: ^a This was the only variable that was not tested against responses to the question, "Are MPAs a good thing?", and was tested using only data from the Philippines study site.

As Filipino fishers were the only ones to have previous experience of MPAs, only data gathered in the Philippines were used to test if previous MPA experience affected fishers' perceptions of the effects of MPAs. Fishers' perceptions of how marine resources have changed over time (Q9, Appendix 1) were compared to underwater survey data (from within Napantao MPA, provided by CCC) to investigate whether fishers' perceptions of resources matched evidence directly from the reef. A line graph was created showing the change in the mean number of different size classes of fusilier fish (the only species appearing frequently in both reef survey data and questionnaire data) over time. Data was from the years 2008, 2010 and 2011, so fish numbers for 2009 were estimated for each size class by taking the means of fish numbers from 2008 and 2010. A categorical variable (positive change in resources over time = 1, other = 0) was tested against responses relating to fishers' involvement in MPA planning using Fisher's exact test (as data did not meet chi-squared (χ^2) test assumptions) to investigate whether fishers' willingness to be involved in management was influenced by their perception of the state of resources.

2.5. Limitations/sources of error

Small sample sizes from both study sites (Cambodia: $n = 29$, Philippines: $n = 20$) affected the statistical tests by increasing effects from any atypical data and making results less reliable. Fishers were occasionally questioned in a group, which may have caused their responses to be more similar than if they had been questioned alone, due to peer pressure. Using different translators at both locations could have had an effect on the data collected; each translator could have worded certain questions in their own way, affecting the responses given by each fisher. The translation of the questionnaire from English to Khmer could also have changed the meaning of some questions. Fish data from underwater visual census surveys were gathered by various CCC SCUBA divers, with estimations of fish numbers possibly differing between divers.

3. Results

3.1. Respondent characteristics

Table 3 shows a summary of responses to the questions used to gather fishers' background information. The mean age of fishers was greater at the Philippines site (39.1 years) compared to Cambodia (31.5 years), as was the mean years of experience (Philippines = 17.4, Cambodia = 12.7). The fishing gear operated by fishers at both sites varied, although seine nets were operated by fishers in both sites (Cambodia = 44.8% fishers, Philippines = 25.0% of fishers). There was more overlap between the species caught by fishers, as squid, jacks and fusiliers were caught at both study sites.

The majority of fishers (~ 90%) questioned in Cambodia did not have another source of income, whereas the opposite was true in the Philippines where only 10% of fishers' only source of income was from fishing. Almost all fishers in Cambodia (~ 97%) and all fishers in the Philippines had religious beliefs. Buddhism was the dominating religion for Cambodian fishers (100% of those who had religious beliefs) and most Filipino fishers were Roman Catholic (90%, the remaining fishers were part of the Philippine Benevolent Missionaries Association). Mean boat length was over three times greater in Cambodia than the Philippines (11.9m and 3.7m, respectively). Mean boat power was also much higher in Cambodia (23.2 HP, Philippines = 0.7 HP) as well as the mean distance travelled to reach fishing grounds (Cambodia = 90.9km, Philippines = 0.9km). The mean distance data from Cambodian fishers had a very large standard deviation value (SD = 122.2) due to fishers varying widely in the distance they travelled. With such large differences between study sites, the variable "country" can account for "another job", "religious beliefs", "boat length/power" and "distance from coast" data.

Table 3: Descriptive statistics for fishers in the survey.

	Cambodia (n = 29)		Philippines (n = 20)	
	Mean (Std. Dev.)	Frequencies of occurrence (%)	Mean (Std. Dev.)	Frequencies of occurrence (%)
<i>Socio-economic characteristics</i>				
Age (y)	31.45 (8.99)	-	39.05 (11.72)	-
Experience fishing (y)	12.70 (7.79)	-	17.40 (10.74)	-
Has another job not connected to fisheries	-	10.3	-	90.0
Religious beliefs	-	96.6	-	100.0
Main religions:				
Buddhism	-	100.0	-	0.0
Roman Catholic	-	0.0	-	90.0
<i>Fishing characteristics</i>				
Boat length (m)	11.88 (1.60)	-	3.71 (0.77)	-
Boat power (HP)	23.23 (2.87)	-	0.74 (2.09)	-
Fishing methods ^a :				
Crab nets	-	20.7	-	0.0
Seine nets	-	44.8	-	25.0
Spearfishing	-	0.0	-	30.0
Trawl (drag nets)	-	24.1	-	0.0
Longlines	-	0.0	-	5.0
Hook & line	-	0.0	-	85.0
Other	-	34.5	-	25.0
Species present in catch ^a :				
Squid	-	27.6	-	70.0
Jack/Trevally	-	51.7	-	15.0
Crab	-	24.1	-	0.0
Red Snapper	-	44.8	-	0.0
Shrimp	-	20.7	-	0.0
Fusilier	-	48.3	-	45.0
Mackerel	-	0.0	-	35.0
Fishing operation:				
Distance from coast (km)	90.85 (122.19)	-	0.88 (1.78)	-
Times per week	6.24 (0.99)	-	4.23 (2.37)	-

Note: ^a Totals sum to more than 100% due to some fishers using more than 1 fishing method or catching more than 1 species.

3.2. Opinions about MPAs

Table 4 shows a greater percentage of Filipino fishers (85.0%) answered positively to the question “Are protected areas a good thing?” compared to fishers in Cambodia (62.1%), with no Filipino fishers giving the answer of a definite “No”.

Table 4: Fishers’ opinions about marine protected areas

Question	% Responses					
	Cambodia (n = 29)			Philippines (n = 20)		
	Yes	No	Maybe/DK	Yes	No	Maybe/DK
<i>Marine Protected Areas (MPAs)</i>						
“Are protected areas a good thing?”	62.1	31.0	6.9	85.0	0	15.0

Table 5 shows there were no significant differences between fishers’ responses from each study site concerning increased fish numbers ($H=4.69$, $d.f.=2$, $p>0.05$) or increased number of species ($H=5.56$, $d.f.=2$, $p>0.05$) around MPAs; age, gear operated and management preference did not significantly affect responses either (Table 10, Appendix 2). There were significant differences between sites in perceptions towards reefs and seagrass, in terms of whether they were important for fishing ($H=18.73$, $d.f.=2$, $p<0.001$) and whether their only importance was to provide shelter for fish ($H=22.83$, $d.f.=2$, $p<0.001$). There was a significant difference in responses to MPAs impacting fishing activity between sites ($H=18.78$, $d.f.=2$, $p<0.001$) and the type of gear operated influenced Cambodian fishers’ responses (Fisher’s exact: $p<0.05$; Table 10, Appendix 2). There was a significant difference as to whether MPAs cause conflicts between fishers ($H=11.32$, $d.f.=2$, $p<0.05$) with only Filipino fishers (30%) perceiving MPAs to cause conflicts, however fishers between sites did not significantly differ in their opinions that a new MPA would cause conflict within communities ($H=4.48$, $d.f.=2$, $p>0.05$).

Table 5: Descriptive statistics on survey statements designed to quantify fishers' opinions about marine protected areas, showing Kruskal-Wallis test results. Significant *p*-values are shown in bold.

Statement	% Responses ^a						Kruskal-Wallis statistic, <i>p</i> -value
	Cambodia (n = 29)			Philippines (n = 20)			
	D	N	A	D	N	A	
“Fish sanctuaries increase the number of fish caught outside/around them”	0	27.6	72.4	10.0	10.0	80.0	4.69, <i>p</i> =0.096
“Fish sanctuaries increase the different types of fish in the area”	0	24.1	75.9	10.0	5.0	85.0	5.56, <i>p</i> =0.062
“Reefs and seagrass are important for fishing to be successful”	58.6	6.9	34.5	0	5.0	95.0	18.73, <i>p</i><0.001
“Coral reefs/seagrass beds are only important for fish to shelter”	65.5	3.5	31.0	0	0	100.0	22.83, <i>p</i><0.001
“Fish sanctuaries strongly impact fishing”	34.4	38.0	27.6	10.0	0	90.0	18.78, <i>p</i><0.001
“Fish sanctuaries increase conflicts between fishers”	75.9	24.1	0	65.0	5.0	30.0	11.32, <i>p</i>=0.003
“Fish sanctuaries only benefit neighbouring coastal waters/villages”	3.4	20.8	75.8	10.0	10.0	80.0	1.65, <i>p</i> =0.438
“Any new fish sanctuaries will result in conflicts in the community”	65.5	3.5	31.0	35.0	10.0	55.0	4.48, <i>p</i> =0.106

Note: ^a Statements were measured in a five-point Likert-scale and subsequently dropped to a three-point Likert-scale: Disagree (D), Neutral/Neither agree nor disagree (N) & Agree (A).

3.3. Opinions about state of resources

Most fishers from both study sites had noticed a difference in the state of marine resources in the past decade. Table 6 shows the most common response was "Yes" to a perceived change in the fish numbers of fishers' most targeted species present in their catch (69.0% in Cambodia, 50.0% in the Philippines), the sizes of the most targeted species (55.2% in Cambodia, 75.0% in the Philippines) and the number of different species caught (58.7% in Cambodia, 70.0% in the

Philippines). All Cambodian fishers who noticed a difference in the state of resources felt that resources were better ten years ago and had only noticed negative changes. Cambodian fishers' perception of a change in the number of their most caught species was not significantly affected by whether they caught squid or not ($p=0.209$), with fishers who caught squid being evenly split between perceiving an increase in the number of individuals in their catch ($n=4$) and thinking otherwise ($n=4$). The same was true of Filipino fishers ($p=1.000$), with an equal number of squid fishers perceiving an increase in individuals in their catch ($n=7$) and thinking otherwise ($n=7$).

Table 6: Fishers' opinions about the state of resources

Statement	% Responses					
	Cambodia (n = 29)			Philippines (n = 20)		
	Yes	No	Maybe/DK	Yes	No	Maybe/DK
<i>Perception state of resources</i>						
"In the last 3 years, compared to 10 years ago, I've noticed a difference in the...						
...number of [most fished species] in the catch"	69.0	24.1	6.9	50.0	20.0	30.0
...size of [most fished species] in the catch"	55.2	27.6	17.2	75.0	15.0	10.0
...number of different species present in the catch"	58.7	31.0	10.3	70.0	25.0	5.0

Figure 3 shows the change in the mean number of fusilier fish (Caesionidae) of three different size classes over time within Napantao MPA (survey site in the Philippines). 65% of Filipino fishers that noticed a difference in the number of their most caught species felt there had been an increase in the last decade. Figure 3 shows that the two smaller size classes of fusiliers decreased in recent years (1 – 10cm: slope = -1.33, 11 – 20cm: slope = -7.49), contradicting the fishers' views of numbers increasing (although fusiliers were one of the most caught species for only 30% of Filipino fishers). Of the fishers who noticed a difference in the size of their most fished species, 70% felt the size had increased over the last decade. Figure 3 shows the largest size class of fusiliers (21 – 30cm) was the only size

class to increase in number (slope = 1.66), which reflects fishers' perceptions of the increasing presence of larger fish in more recent years. 85.7% of fishers who perceived a change in the number of different species present in their catch felt there had been an increase.

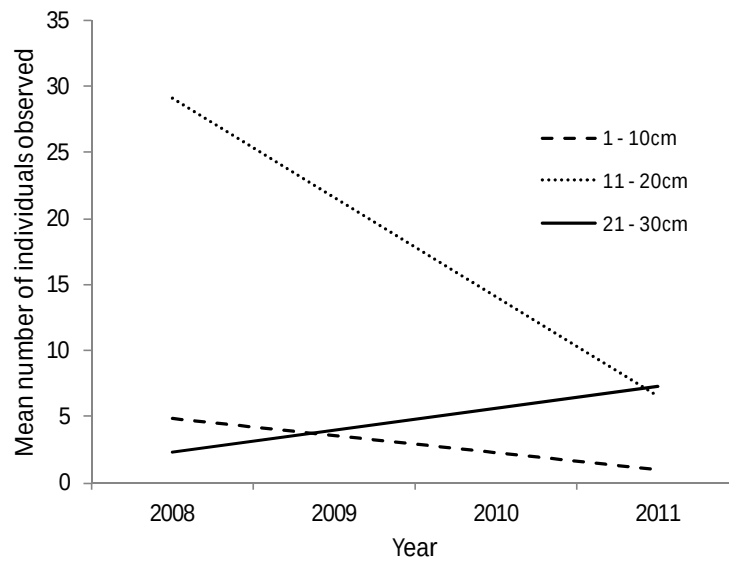


Figure 3: Graph showing the change in the mean number of fusilier fish individuals of different size classes observed during underwater surveys with time, over 4 years. Data was collected by underwater visual surveys within Napantao MPA. [Data provided by CCC]

3.4. Opinions about management of MPAs

Most fishers in Cambodia (89.7%) stated they had never been asked to change their fishing methods, which is also true for the Philippines although there was a more even split with 60.0% of fishers never being asked, as shown in Table 7. Most Cambodian fishers did not know of any MPA plans (41.4% claimed they did know), however approximately half (48.3%) said they would like to be involved in MPA planning procedures. Most fishers in the Philippines (65.0%)

said they had been involved in MPA planning at some stage (even if it was only attending informative meetings in the barangay) and 90.0% said they liked being (or would like to be) involved. There was no significant difference in management preference between the two study sites ($\chi^2=3.0$, d.f.=1, $p=0.084$); 83.3% of fishers who responded in Cambodia preferred community-based management compared to 60.0% of fishers in the Philippines.

Table 7: Fishers' opinions about MPA management

Statement	% Responses			
	Cambodia (n = 29)		Philippines (n = 20)	
	Yes	No	Yes	No
<i>Management</i>				
“Have you ever been asked to start/stop using any kind of fishing gear?”	10.3	89.7	40.0	60.0
<i>Involvement in planning of MPAs</i>				
“Do you know of ^a /Have you ever been involved in the development of ^b any sanctuary development plans”	41.4	58.6	65.0	35.0
“Would you like to be/Did you like being involved in the planning of sanctuaries”	48.3	51.7	90.0	10.0
Note:	^a Cambodia ^b Philippines			

Table 8 shows that Filipino fishers' perceptions of whether MPAs increase the number of fish, size of fish or number of species present in their catch were not significantly affected by any previous involvement in any MPA plans or any desire to be involved.

Table 8: Fishers' involvement in MPA management in the Philippines, tested against perceived benefits of Napantao MPA using Fisher's exact test (data did not meet chi-squared assumptions).

Fishers' opinions	Statistical test results
	Philippines (n = 20)
<i>Previously involved in MPA development</i>	
Increase in number of most fished species	$p = 0.587$
Increase in size of most fished species	$p = 0.270$
Increase in number of species present	$p = 0.613$
<i>Like to be involved in MPA planning</i>	
Increase in number of most fished species	$p = 0.368$
Increase in size of most fished species	$p = 0.284$
Increase in number of species present	$p = 0.447$

Cambodian fishers who stated they would like to be involved in MPA planning had a significantly greater mean age (35.9 years; $t=2.9$, d.f.=27, $p<0.05$) than those who stated they would not like to be involved (mean age = 27.3 years); the type of gear operated by Cambodian fishers also affected whether they would like to be involved in MPA planning or not ($\chi^2=10.2$, d.f.=1, $p<0.05$), with mobile gear operators being more willing to participate (11 out of 13 static gear users did not want to be involved and 12 out of 16 mobile gear users said they would like to be involved).

3.5. Acceptance of MPAs

Table 9 shows that fishers' accepting MPAs were significantly older (mean age = 34.8 years) than those who answered otherwise (mean age = 25.9 years) in Cambodia ($t=2.9$, d.f.=27, $p<0.05$). Age also influenced Cambodian fishers' responses regarding knowledge of any MPA development plans with fishers who did know of plans having a greater mean age (37.2 years) than those who did not (mean age = 27.4; $t=3.4$, d.f.=27, $p<0.05$) (Table 11, Appendix 2). The type of gear operated did not affect Cambodian fishers' acceptance of MPAs, however it did affect whether they felt MPAs would impact their fishing (static gear users' opinions were evenly split, however 15 out of 16 mobile gear users felt their fishing would not be affected,

$p < 0.05$) (Table 10, Appendix 2). Management preference, species targeted and all of the statements regarding fishers' perceptions of MPAs shown in Table 9 had no significant effect ($p > 0.05$) on Cambodian fishers' responses regarding their acceptance of MPAs.

Table 9: Fishers' MPA acceptance. Selected variables were tested against data from Cambodia using independent sample t-tests for interval normal data and Fisher's exact test (as data did not meet chi-squared assumptions) for categorical data. The appropriate statistical values were presented with p-values. Significant p-values are shown in bold.

Variables	Statistical test results Cambodia (n = 29)
<i>MPAs are a good thing</i>	
Age (y)	$t = 2.9, p = \mathbf{0.007}$
Mobile/static gear operated	$p = 0.702$
Species targeted ^a	$p = 0.671$
Management preference	$p = 1.000$
"Fish sanctuaries increase the number of fish caught outside/around them"	$p = 0.671$
"Fish sanctuaries increase the different types of fish in the area"	$p = 0.677$
"Reefs and seagrass are important for fishing to be successful"	$p = 0.432$
"Coral reefs/seagrass beds are only important for fish to shelter"	$p = 0.412$
"Fish sanctuaries strongly impact fishing"	$p = 0.197$
"Fish sanctuaries only benefit neighbouring coastal waters/barangays"	$p = 0.375$
"Any new fish sanctuaries will result in conflicts in the community"	$p = 0.096$

Note: ^a Data was tested based on whether fishers caught squid (= 1) or not (= 0).

4. Discussion

Participation from fishers is crucial for implementing management tools, such as MPAs, which is often difficult to gain due to fishers having different opinions towards management (Dimech *et al*, 2009). The planning, implementation and management of MPAs are all dependent on human aspects, as well as conservation considerations (Charles and Wilson, 2009). If social challenges of MPAs are not given adequate attention (such as gaining acceptance of those dependent on resources in that area), then MPAs that succeed in their biological aims may become ineffective if locals have low levels of support (Christie, 2004). Understanding the variability of fishers' perceptions is therefore of high priority for MPAs to have optimal results as management tools. There is a large degree of variance in the context of individual MPAs (biological, social and management implications) at different sites, making it difficult to generalise what is required for the success of MPAs (Villa *et al*, 2002). The aim of this study was to show the factors affecting fishers' perceptions and acceptance of MPAs from two separate locations: Cambodia, where MPAs were a novel idea at the study site, and the Philippines, where MPAs were well known in the study area and had been present for over a decade. Results show differences in fishers' attitudes towards MPAs and factors that did or did not influence their opinions. The small sample sizes of fishers at each study site (Cambodia: $n = 29$, Philippines: $n = 20$) are limitations to the findings of this study, possibly causing false-positive associations between variables or a lack of significance (Hackshaw, 2008), therefore results should not be treated with a great deal of confidence.

4.1. Comparison of findings at each study site

Differing socio-economic and fishing characteristics (including experience of MPAs) may be responsible for the differences observed in responses between Filipino and Cambodian

fishers. A higher proportion of Filipino fishers felt MPAs were “a good thing”, which is likely due to the fishers having already seen benefits of the MPA reflected in their catches since the MPA was implemented in Napantao; Russ *et al* (2003) show that another MPA in the Philippines has caused fishers to notice an increase in catch rates and predict that support of MPAs rises among locals because of this. None of the Filipino fishers answered “No” to the question “Are MPAs a good thing?” and three gave neutral answers to the question, which suggests they did not associate the MPA with having negative impacts on their fishing activity (Leleu *et al*, 2012). McClanahan *et al* (2005) state that acceptance of a management strategy increases the longer management has been in place. MPAs have been present for longer (over a decade) at the Philippines site compared to Cambodia (where only one MPA existed on the other side of the island, which few fishers knew about), which could explain why fishers in the Philippines were more accepting of MPAs than Cambodian fishers.

Fishing vessels in the Philippines travelled a much shorter distance from the coast during fishing trips (meaning their fishing grounds were adjacent to the MPA) than observed in Cambodia, which is probably linked to the fact that the boats were much smaller and less powerful (most were paddle boats). Cambodian vessels were larger and more powerful so fishing grounds further from the coast could be exploited, also because the fishers often had fishing trips lasting several days and had to live aboard their boats. Fishing close to a MPA may cause Filipino fishers to notice the spillover effects better, such as increases in the number and size of individuals in their yield (Stelzenmüller *et al*, 2008) as was noticed by fishers in this study. Several Filipino fishers said the MPA acted as a spawning and nursery ground for fish (also noticed by fishers in the study by Leleu *et al*, 2012) and allowed more fish to be caught by fishers in the village, indicating that they anticipated improved catches around the MPA. Other Filipino fishers felt that there were more fish within the MPA but

not outside or around it for them to catch; Tetreault and Ambrose (2007) report that target species of fish were more abundant and larger inside MPAs off the coast of California which may also be true for the MPA at the Philippines site in this study, which some fishers may have noticed. Few Cambodian fishers felt that reefs or seagrass were important to their fishing activity, possibly as their fishing grounds were so far from the inshore waters where these habitats occur, as many fishers stated they only fished over areas of sandy substrate. Filipino fishers' opinions about reefs and seagrass contradicted that of Cambodian fishers, as all but one Filipino fisher felt that reefs were important for fishing to be successful. Gelcich *et al* (2005) found that fishers in Chile had positive views towards conservation of the natural environment and acknowledged how important it was to their fishing; views that are similar to those expressed by Filipino fishers in this study.

MPAs are a novel concept in Cambodia, although the majority of Cambodian fishers accepted the idea of MPAs. Management of marine resources did exist in the surrounding areas of the Cambodia study site; “Steung Haav” was mentioned by seven fishers when they were asked if they knew of any development plans: this was an area on the coast of mainland Cambodia approximately 25km from the study site where larger boats were not allowed to operate. No Cambodian fishers knew about the newly implemented MPA at Song Saa (northeast of the island) which suggests they are ill-informed about MPA plans in their area (less than half of fishers knew of any MPA development plans). Marshall *et al* (2010) found that over three-fourths of fishers in Egypt did not know that the waters of their coastal village were part of a MPA; this, as well as Cambodian fishers' lack of knowledge, suggests that information regarding development plans in an area must be relayed to the fishers it may concern to avoid the ignorance of social aspects of MPAs and low compliance levels (Claudet and Guidetti, 2010). A lack of communication, as well as ineffective management enforcement by the government, seems to be a problem for many artisanal fisheries (Himes,

2003; Hauck *et al*, 2002). Perhaps Cambodian fishers were accepting of MPAs as they felt the need for a better management strategy. Community-based management was the option chosen by most fishers at each study site (over co-management with the government), however few Cambodian fishers were willing to be involved in MPA planning, suggesting that a community-based management plan in that area may require greater levels of support from the locals than observed in this study.

Few Cambodian fishers felt MPAs would impact their fishing, compared to Filipino fishers who mostly felt the MPA had already impacted their fishing by increasing the number and size of fish in their catch, showing they are aware of the benefits of their MPA (also found by Leleu *et al*, 2012). None of the Cambodian fishers felt a MPA would increase conflicts between fishers, however 30% of Filipino fishers felt conflicts had increased as a result of their MPA. The perceptions of increased conflict could be due to Filipino fishers already having experienced conflict concerning their MPA; McClanahan and Mangi (2000) report that conflicts increased between different MPA users and different gear users once a MPA was implemented in Kenya, until management steps were taken to reduce conflict. MPAs that succeed in biological terms may not be effective in social terms if they cause conflicts, which may eventually cause them to be unsuccessful as a form of management (Christie, 2004) therefore it is important that efforts to resolve conflicts are taken (as described by McClanahan and Mangi, 2000).

4.2. Effect of fisher characteristics on perception of MPAs

Older Cambodian fishers were more accepting of MPAs and also more willing to be involved in MPA management plans. Leleu *et al* (2012) found that older, more experienced artisanal fishers in the Mediterranean were less positive in their perceptions towards MPAs. Although older Cambodian fishers showed support towards the idea of MPAs, their

perceptions (and possibly younger fishers' also) may become more negative once implementation of a MPA occurs. Age did not influence Filipino fishers' perceptions of MPAs, although the small sample size means it cannot be said with confidence that age did not affect fishers' views towards MPAs.

Lowe (2010) suggests that static gear fishers are less likely to feel the need to be involved in planning procedures of a MPA designed for conservation purposes if they do not feel their gear has detrimental effects on the environment. Static gear users in Cambodia may have been less eager to be involved in MPA planning if they felt their gear did little or no damage to the marine environment. Blythe *et al* (2002) found that fishers (from both mobile and static gear sectors) viewed protected areas where only static gear users were allowed to operate as a way of reducing conflict between fishers. Areas like this may exist in the MPA proposed around Koh Rong, as it is likely to have different zones with varying levels of protection. It was mentioned by some Cambodian fishers that larger boats, often foreign, operated in shallow waters and it was they that caused conflict; perhaps this was the reason so many mobile gear users were willing to be involved in the planning and management of MPAs, as they were keen for measures that restricted larger fishing vessels from elsewhere.

Russ *et al* (2003) state that local fishers around a MPA in the Philippines associate it with improvements in their catch sizes, and Alcala and Russ (2006) show that the same MPA has been successful due to management input by the locals. Alcala and Russ (2006) argue that local fishing communities must participate in management for a MPA to be successful, maximising fishers' positive perceptions of the returns they gain from the MPA, however this study showed no correlation between fishers' involvement in management and their perceptions of changes in the state of resources (results may have been more clear with larger sample sizes). As found by Leleu *et al* (2012), Filipino fishers did not feel the MPA was a negative addition to the waters around Napantao, although the underwater visual

surveys suggested that individual numbers of smaller fusilier fish had declined in the last four years (Figure 3). The slight increase in large fusilier individuals matched Filipino fisher's perceptions of catching larger fish, although greater sample sizes of fishers (and underwater survey replicates) would give a clearer idea of how accurately fishers view the change in their resources (Neis *et al*, 1999, suggest fishers' perceptions of resources often reflect reality). At both study sites, fishers' perceptions of the state of resources were not influenced by whether they caught squid or not. Lunn and Dearden (2006) found that fishers who targeted invertebrates, such as squid, were not affected as much by declining stocks due to the life histories of many invertebrates allowing stocks to recover quicker than finfish; few fishers in this study only targeted squid so it is likely that their perceptions of resources were influenced by other species in their catch.

Most fishers at both study sites opted for a community-based management approach of MPAs. The village chief at the Cambodia site mentioned that villagers would like to be involved in MPA planning and maintenance, and that the local police would be willing to monitor a MPA using their boat and fuel. The CCC expedition leader and project scientist in Cambodia thought it might be effective to assign roles to locals within the village, for example the village chief being employed as a fisheries officer. As described by Alcala and Russ (2006), time and effort must be spent to educate locals in conservation and management if an effective community-based management plan is to be achieved, and locals must feel a sense of responsibility by being given the opportunity to be involved in MPA management (Gelcich *et al*, 2009). In the Philippines, some CCC staff members were locals from the village which allowed them to have an active part in the management and conservation of marine resources in the area. In Cambodia, the village chief stated that if a non-governmental organisation (NGO) implemented a MPA, the locals would happily be involved in its management; this meets the criteria for successful community-based

management suggested by Pollnac *et al* (2001), who recommend involvement of the local community and long-term communication with an organisation that implemented the MPA (CCC in this case). Regarding management, fishers' main concerns are often sustainable fisheries, whereas other stakeholders may be more concerned about conservation of ecosystems (Mangi and Austen, 2008), so it is important each view is carefully considered to minimise conflicts between stakeholders.

4.3. Conclusions

Similarities and differences were found between fishers' responses from each study site. The high levels of acceptance towards MPAs found in this study are encouraging at both study sites. In Cambodia, there was evidence of support for MPAs from fishers, even though the MPA around Koh Rong is still at an early planning stage. The positive opinions Filipino fishers had towards their village MPA continued to remain high as compared with findings by Chaigneau (2008) who conducted similar surveys with fishers in the same village. Although Filipino fishers had mixed views towards some aspects of their village MPA (such as causing conflict), the general impression was that fishers had accepted it and perceived the benefits they received from it, from past experience. Community-based management of MPAs was supported at each study site; effective management with local involvement is important in both countries, for optimal success and acceptance of MPAs. Agardy (2000) states that the implementation of a MPA is when data collection and management begin, therefore it is crucial that MPAs are appropriately monitored and management is adapted accordingly. As seen in this study, fishers' perceptions of MPAs change depending on their previous experiences, therefore work of this sort is an ongoing process. Future work could include studies with larger sample sizes, to investigate Cambodian fishers' opinions further, for example why some fishers feel MPAs will not affect them. Once a MPA is implemented around Koh Rong (if proposed plans go ahead), an investigation into Cambodian fishers'

opinions and acceptance of MPAs could be conducted to see if they have changed significantly since this study. Further work in the Philippines should be carried out to investigate possible reasons for the conflicts perceived in this study, and to generally monitor fishers' perceptions.

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Appendices

Appendix 1:

Questionnaire used in Cambodia 41 - 42

Questionnaire used in the Philippines 43 - 44

Appendix 2:

Extra data analysis 45 - 46

Appendix 3:

Plagiarism disclaimer 47

Appendix 4:

Risk Assessment 48 - 49

Word count: 7248

SURVEY:

FISHERS' PERCEPTIONS OF MPAS IN CAMBODIA AND THE PHILIPPINES

QUESTIONNAIRE #

All the information given will be used for statistical purposes only and will be treated in complete confidentiality. No individual questionnaire will ever be identified in any material published as a result of this survey nor will any of the data obtained be passed on to any other party. We would really appreciate your cooperation.

LOCATION OF THE SURVEY:

Date:

A. Background questions:

Q.1a) What is your age? years

Q.1b) How long have you been a fisherman? years

Q.1c) Do you have another job? Yes ☐ 1 → If yes, please specify.....
No ☐ 2

Q.2) Could you please give some detail about your boat:

Q.2a) Length? m / feet

Q.2b) Power? kW / HP (ask units)

Q.3) What fishing **methods** do you use?

a) crab nets ☐ d) trawl (drag nets) ☐ g) dynamite ☐
b) seine nets ☐ e) stingray hooks ☐ h) other (please specify) ☐
c) trawl (long lines) ☐ f) cyanide ☐

Q.4) Which type of fish do you catch? (Please note the proportion in the catch)

	% in catch	When (time of year – note units)
1 st :		
2 nd :		
3 rd :		
Others:		

Q.5a) How far from the coast do you usually fish?

Q.5b) How many times a week do you fish?

Q.6) Do you have any religious beliefs? Yes ☐ 1 → If yes, please specify
No ☐ 2

B. MPAs/Fish Sanctuaries – opinions

Q.7a) Are protected areas (fish sanctuaries) a good thing?

(MPAs/Areas where no fishing is allowed)

Yes ☐ 1 No ☐ 0 Maybe ☐ 2 Don't know ☐ 3

Q.7b) Why? Note any issues the fisher mentions

(e.g. objectives, benefits MPAs, enforcement issues, worries)

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Q.8) On a scale from **strongly disagree** to **strongly agree**, could you please give your opinion on the following statements:

	Strongly disagree		Disagree		Neither agree nor disagree		Agree		Strongly agree
1) "Fish sanctuaries will increase the number of fish caught outside/around them"	1	...	2	...	3	...	4	...	5
2) "Fish sanctuaries will increase the different types of fish in the area"	1	...	2	...	3	...	4	...	5
3) "Reefs and seagrass are important for fishing to be successful"	1	...	2	...	3	...	4	...	5
4) "Coral reefs/seagrass beds are only important for fish to shelter"	1	...	2	...	3	...	4	...	5
5) "Fish sanctuaries will strongly impact on my fishing"	1	...	2	...	3	...	4	...	5
6) In a positive or negative way? Positive 1 Negative 0									
7) "Fish sanctuaries will increase conflicts between local and foreign fishers"	1	...	2	...	3	...	4	...	5
8) "Fish sanctuaries will only benefit neighbouring coastal waters/villages"	1	...	2	...	3	...	4	...	5
9) "A new fish sanctuary will result in conflicts in the community"	1	...	2	...	3	...	4	...	5

Note any issues the fisher mentions

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Q.9) In the last 3 years, compared to 10 years ago, have you noticed a difference:

	Yes		No		Maybe		Don't know
Q.9a) in the number of [most fished species] you catch?	1	.....	0	.....	2	.....	3
Q.9b) in the size of [most fished species]?	1	.....	0	.....	2	.....	3
Q.9c) in the number of different species present. In your catch?	1		0		2		3

Note any issues the fisher mentions

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Q.10) Regarding fisheries management:

Q.10a) Have you ever been asked to start/stop using any kind of fishing gear? Yes No

Q.10b) How / doing what?

.....

.....

Q.11) Regarding involvement with planning fish sanctuaries:

Q.11a) Do you know of any sanctuary development plans? Yes No

Q.11b) Would you like to be involved in the planning of sanctuaries? Yes No

Q.11c) Why?

.....

.....

Q.11d) Regarding the future management of no-take sanctuaries, which of these four management approaches would you prefer?

Management by the government	1
Management by both fishers & government	2
Local community based management excluding women	3
Local community based management including women	4

SURVEY:

FISHERS' PERCEPTIONS OF MPAS IN CAMBODIA AND THE PHILIPPINES

QUESTIONNAIRE #

All the information given will be used for statistical purposes only and will be treated in complete confidentiality. No individual questionnaire will ever be identified in any material published as a result of this survey nor will any of the data obtained be passed on to any other party. We would really appreciate your cooperation.

LOCATION OF THE SURVEY:

Date:

A. Background questions:

Q.1a) What is your age? years

Q.1b) How long have you been a fisherman? years

Q.1c) Do you have another job? Yes ☐ 1 → If yes, please specify.....
No ☐ 2

Q.2) Could you please give some detail about your boat:

Q.2a) Length? m / feet

Q.2b) Power? kW / HP (ask units)

Q.3) What fishing **methods** do you use?

a) fish traps ☐ d) longlines ☐ g) dynamite ☐
b) seine nets ☐ e) hook & line ☐ h) other (please specify) ☐
c) spearfishing ☐ f) cyanide ☐

Q.4) Which type of fish do you catch? (Please note the proportion in the catch)

	% in catch	When (time of year – note units)
1 st :		
2 nd :		
3 rd :		
Others:		

Q.5a) How far from the coast do you usually fish?

Q.5b) How many times a week do you fish?

Q.6) Do you have any religious beliefs? Yes ☐ 1 → If yes, please specify
No ☐ 2

B. MPAs/Fish Sanctuaries – opinions

Q.7a) Are protected areas (fish sanctuaries) a good thing?

(MPAs/Areas where no fishing is allowed)

Yes ☐ 1 No ☐ 0 Maybe ☐ 2 Don't know ☐ 3

Q.7b) Why? Note any issues the fisher mentions

(e.g. objectives, benefits MPAs, enforcement issues, worries)

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Q.8) On a scale from **strongly disagree** to **strongly agree**, could you please give your opinion on the following statements:

	Strongly disagree		Disagree		Neither agree nor disagree		Agree		Strongly agree
1) "Fish sanctuaries have increased the number of fish caught outside/around them...."	1	...	2	...	3	...	4	...	5
2) "Fish sanctuaries have increased the different types of fish in the area"	1	...	2	...	3	...	4	...	5
3) "Reefs and seagrass are important for fishing to be successful"	1	...	2	...	3	...	4	...	5
4) "Coral reefs/seagrass beds are only important for fish to shelter"	1	...	2	...	3	...	4	...	5
5) "Fish sanctuaries have strongly impacted my fishing"	1	...	2	...	3	...	4	...	5
6) In a positive or negative way? Positive 1 Negative 0									
7) "Fish sanctuaries have increased conflicts between fishers"	1	...	2	...	3	...	4	...	5
8) "Fish sanctuaries have only benefitted neighbouring coastal waters/barangays"	1	...	2	...	3	...	4	...	5
9) "Any new fish sanctuaries will result in conflicts in the community"	1	...	2	...	3	...	4	...	5

Note any issues the fisher mentions

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Q.9) In the last 3 years, compared to 10 years ago, have you noticed a difference:

	Yes		No		Maybe		Don't know
Q.9a) in the number of [most fished species] you catch?	1	.....	0	.....	2	.....	3
Q.9b) in the size of [most fished species]?	1	.....	0	.....	2	.....	3
Q.9c) in the number of different species present. In your catch?	1		0		2		3

Note any issues the fisher mentions

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Q.10) Regarding fisheries management:

Q.10a) Have you ever been asked to start/stop using any kind of fishing gear? Yes 1 No 0

Q.10b) How / doing what?

.....

.....

Q.11) Regarding involvement with planning fish sanctuaries:

Q.11a) Have you ever been involved in any sanctuary development plans? Yes 1 No 0

Q.11b) Would you/did you like being involved in the planning of sanctuaries? Yes 1 No 0

Q.11c) Why?

.....

.....

Q.11d) Regarding the future management of no-take sanctuaries, which of these four management approaches would you prefer?

Management by the government	1
Management by both fishers & government	2
Local community based management excluding women	3
Local community based management including women	4

Extra data analysis

Table 10: Fishers’ opinions from responses gathered about MPAs^a. Significant differences between selected variables were tested for each country (independent sample t-tests for interval normal age data and Fisher’s exact test for categorical data) and the appropriate statistical values presented, with p-values. Significant p-values are shown in bold.

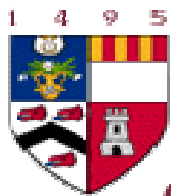
Statement	Statistical test results		
	Cambodia (n = 29)		Philippines (n = 20)
	Age (y)	Gear operated ^b	Age (y)
“Fish sanctuaries increase the number of fish caught outside/around them”	t=0.8, p=0.455	p=0.406	t=0.1, p=0.884
“Fish sanctuaries increase the different types of fish in the area”	t=1.3, p=0.194	p=0.667	t=0.4, p=0.713
“Reefs and seagrass are important for fishing to be successful”	t=0.7, p=0.510	p=0.008	t=-1.2, p=0.232
“Coral reefs/seagrass beds are only important for fish to shelter”	t=0.3, p=0.762	p=0.130	-
“Fish sanctuaries strongly impact fishing”	t=-1.6, p=0.111	p=0.010	t=0.3, p=0.802
“Fish sanctuaries increase conflicts between fishers”	-	-	t=1.5, p=0.141
“Fish sanctuaries only benefit neighbouring coastal waters/barangays”	t=0.3, p=0.793	p=0.026	t=1.0, p=0.325
“Any new fish sanctuaries will result in conflicts in the community”	t=0.1, p=0.932	p=1.000	t<0.1, p=0.987

Note: ^a Responses measured on a 5-point Likert-scale were reduced to a categorical variable of just “Agree” (= 1) and “Other” (= 0).

^b Categories were mobile (= 1) and static (= 0) for gear operated data. Fisher’s exact test was used as data did not meet the assumptions of the chi-squared test. “Gear operated” was not tested for data from the Philippines as all Filipino fishers used static gear.

Table 11: Fishers' opinions about MPA planning and management. Independent sample t-tests were used for interval normal age data and chi-squared tests for categorical data.

Variables	Statistical test results	
	Cambodia (n = 29)	Philippines (n = 20)
<i>Sanctuary development plans</i>		
Age (y)	t = 3.4, p = 0.002	t = 0.8, p = 0.454
Mobile/static gear operated	$\chi^2 = 0.1$, p = 0.774	-
<i>Like to be involved in MPA planning</i>		
Age (y)	t = 2.9, p = 0.007	t = -0.9, p = 0.391
Mobile/static gear operated	$\chi^2 = 10.2$, p = 0.001	-
<i>Type of management</i>		
Age (y)	t = 0.7, p = 0.491	t = -0.9, p = 0.393



UNIVERSITY
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te Received:

13/01/12

School Of Biological Sciences

CAS Mark Awarded

20

Front Cover Sheet

Please complete for every piece of work submitted

Name: <u>Mark Hamilton</u>								
ID	0	8	1	2	9	9	7	7
Course Code: Z04027								
Course Title: Honours practical project report								
Assignments set by: Dr. B. E. Scott								
Date due in: 13/01/2012								

Description of Assignment	
Practical Report	☐
Essay	☐
Data Analysis	☐
Other	☐
Title: Perceptions of fishermen towards MPAs in Cambodia and the Philippines	

This assignment is my own work derived from information collected during:

Individual study

☐

Groupwork

☐

Tick one.

Plagiarism is a form of cheating and is treated as a serious disciplinary offence by the University.

The University defines plagiarism as: "Plagiarism is the use, without adequate acknowledgment, of the intellectual work of another person in work submitted for assessment". In simple terms **plagiarism is copying other people's work** and you must avoid this completely.

I have read, and understand, the University regulations and advice on cheating, including plagiarism -

<http://www.abdn.ac.uk/writing/plag/page1.htm>

Signed: Mark Hamilton Date: 13/01/12

Honours Project Summary Risk Assessment

Notes for project supervisors

It is the supervisors responsibility to ensure that your honours students have been fully briefed on all risk associated with their project as identified in the official School lab/fieldwork risk assessment forms, have signed off on the relevant risk assessments and have completed the Summary Risk Assessment form attached. Please note the Summary Form now has a section in which the student must cross-reference the titles of all your formal lab/field risk assessments applicable. The Summary Risk Assessment form must be returned even if no risks are identified.

Once the Summary Risk Assessment is completed, you (and the student) should sign it, and a copy sent to the School Safety Adviser (Susan Blaney).

I would once again remind you that the Summary Risk Assessment must be returned before any work can commence. Failure to do so will lead to sanctions by the HoS.

Notes for Students on Risk Assessment

It is essential (and the University is required by the Health and Safety at Work Act) that all activities undertaken as part of your honours project be subject to a risk assessment. The purpose of this is to identify potential hazards, and to consider and implement control measures to reduce risk so far as is reasonably practicable. Before you begin your project work you must discuss safety with your supervisor and ensure that all your activities are described within formal risk assessments that he/she will have on file. It may be that your supervisor needs to create a new risk assessment to cover your work and in that case this should be done in discussion with you. You will be required to sign each risk assessment and keep copies readily to hand (normally bound in the front of your lab book).

In addition, you must fill out the “Summary Risk Assessment” form enclosed. The purpose of this is to ensure that you have given safety full consideration and to allow the School to keep a central record to this effect. On the Summary Risk Assessment, you will also cross-reference all the formal lab/field risk assessments relevant to your work. Both you and our supervisor must sign the Summary Risk Assessment and then a copy sent to the School Safety Adviser.

School of Biological Sciences

Honours Project Summary Risk Assessment Form

This form must be used to record the significant risks discussed with the project supervisor. When completed, the form must be countersigned by the project supervisor and a copy must be given to the School Safety Adviser BEFORE commencement of the project work.

Name of student: Mark Hamilton

Names of others who will be involved e.g. Post doc, technician:

Cristina Pita (Post doc), Jan van Bochove (Coral Cay Conservation), Toby Eastoe (Flora & Fauna International)

Description of Work

Questionnaires & Interviews with locals to investigate perceptions towards Marine Protected Areas.

Intended location(s) of fieldwork or laboratory number:

Koh Rong island, Cambodia and Southern Leyte, the Philippines

Intended start date: 29/06/11

Hazard identification	Control measures
Describe those aspects of the work that could create significant risks	List those to be used to reduce the risks to an acceptable level
Chemical	N/A

Biological Microbiological infection risks are increased for individuals who are immunosuppressed (for example as a result of various forms of chemotherapy) or immunocompromised (for example as a result of HIV and other chronic viral infections). If you fall into one of these categories, you should discuss this risk assessment with your medical practitioner.	Vaccinations before departure: Hepatitis A, Tetanus, Typhoid. Malaria tablets (Doxycycline) to be taken once daily for a week before departure, each day abroad, and 4 weeks after returning.
Sharps	N/A
Electrical	N/A
Radiation	N/A
Field	Accompanied by CCC staff member at all times, Interpreter present for surveys/interviews, Avoid areas as advised by the foreign office, Appropriate travel (between locations abroad and via flight), Appropriate use of sun screen and sensible time in the sun, Appropriate use of insect repellent, Sensible hygiene procedures due to tropical climate, Sensible footwear worn at all times, Sufficient food and water consumption,
Manual handling	N/A
Workstation	N/A
Animal House/Aquarium Access required Y/N	N

Prepared by Mark Hamilton Signature _____ Date _____

Approved by Supervisor _____ Signature _____ Date _____

Approved by Safety Adviser _____ Signature _____ Date _____

Others involved with the work with whom the assessment has been discussed.

Name Cristina Pita Signature _____ Date _____

Name Jan van Bochove Signature _____ Date _____

Name Toby Eastoe Signature _____ Date _____

List all lab/field risk assessments consulted in the preparation of this project risk assessment*

Title of Risk Assessment	Prepared by	Approved by	Approval Date
School of Biological Science Fieldwork Handbook	University of Aberdeen		

*Students working at external Institutes must return this form, enclosing copies of relevant risk assessment forms from their place of work.

Honours Summary Risk Assessment May 2006 JMS/SCB