Université de Montréal

Living and fishing in a marine protected area: balancing traditional fisheries with conservation in Karimunjawa National Park, Indonesia

par Gilles Maillet

Département de géographie
Faculté des arts et des sciences

Mémoire présentée à la Faculté des arts et des sciences en vue de l'obtention du grade de M. Sc. en géographie

Août, 2012

Université de Montréal

Faculté des études supérieures et postdoctorales

Ce mémoire intitulé :

Living and fishing in a marine protected area: balancing traditional fisheries with conservation in Karimunjawa National Park, Indonesia

présenté par :

Gilles Maillet

a été évalué par un jury composé des personnes suivantes :

Mme. Kathryn Furlong

présidente-rapporteuse

M. Rodolphe De Koninck

directeur de recherche

M. Bernard Bernier

membre du jury

Résumé

Cette recherche a porté sur quelques enjeux importants liés à la gestion des aires marines protégées (AMP) en Indonésie en examinant comment celles-ci sont en mesure d'adapter leurs politiques afin de mieux répondre à l'évolution des conditions socioéconomiques et écologiques, quels ont été les impacts socioéconomiques de ces aires, et quelles sont les préoccupations environnementales des acteurs locaux dont les moyens de subsistance dépendent des ressources règlementées. Le « *livelihoods framework* » a servi de guide pour notre analyse des changements socioéconomiques dans la région, tandis que la notion d'« environmentality » d'Agrawal a fourni les bases théoriques pour l'examen de la formation de sujets environnementaux au parc national de Karimunjawa. Cette étude a montré que les changements de politique apportés au plan de la gestion du parc sont un pas dans la bonne direction, mais que les objectifs importants liés sa cogestion n'ont jamais été entièrement réalisés dans la pratique. Les résultats montrent également que d'importants changements socioéconomiques surviennent dans le parc, de nombreux pêcheurs se tournent vers des moyens de subsistance alternatifs, afin de compenser la baisse des prises de poissons. Enfin, cette étude a révélé que d'importants changements positifs dans les préoccupations environnementales sont survenus depuis la modification du zonage du parc, mais que ceux-ci ne se sont pas entièrement traduits en conformité avec les règles et règlements de l'AMP.

Mots clès : aires marines protégées, gestion côtière, pêcheries artisanales, cogestion, moyens de subsistance dans les zones côtières, pêches destructives, Indonésie, parc national de Karimunjawa

Abstract

This research examined a few important issues related to marine protected area (MPA) management in Indonesia by looking at how MPAs are able to adapt their policies in order to better suit evolving socioeconomic and ecological conditions, what socioeconomic impacts have been felt as a result of MPA implementation, and what are the environmental subjectivities of local actors whose livelihoods are dependent on the resources that are being regulated. The livelihoods framework served as a guide when examining local socioeconomic changes in the region, while Agrawal's concept of environmentality provided the theoretical underpinnings when examining the formation of environmental subjects in Karimunjawa National Park. This study found that the policy changes brought about in KNP's reworked management plan are a step in the right direction, but that important goals related to park co-management were never fully realized in practice. The results also show that significant socioeconomic changes are occurring within the park, with many fishermen turning to alternative livelihoods in order to offset declining fish catches. Lastly, this study uncovered that significant positive shifts in environmental subjectivities have occurred since the re-zoning of the park, but that these have not fully translated into compliance towards the rules and regulations of the MPA.

Keywords: marine protected areas, coastal management, small-scale fisheries, co-management, coastal livelihoods, destructive fishing, Indonesia, Karimunjawa National Park

Table of Contents

Figures

Tables

List of Acronyms

ADB	Asian Development Bank
ASEAN	Association of Southeast Asian Nations
AusAid	Australian Agency for International Development
BTNK	*Balai Taman Nasional Karimunjawa* - Karimunjawa National Park Authority
BNP	Bunaken National Park
CBM	Community based management
COREMAP	Coral Reef Rehabilitation and Management Program
CRMP	Indonesian Coastal Resources Management Project
DFP	Destructive fishing practices
DGF	Directorate General of Fisheries
Dislautkan	*Dinas Kelautan Dan Perikanan* - Department of Marine Affairs and Fisheries
FAO	Food and Agriculture Organization of the United Nations
ICM	Integrated coastal management
IUCN	International Union for Conservation of Nature
KNP	Karimunjawa National Park
KSDA	*Balai Konservasi Sumber Daya Alam* – Natural Resources Conservation Office
LFTV	Live fish transport vessel
MPA	Marine protected area
MSY	Maximum sustainable yield
NGO	Non-governmental organization
NRM	Natural Resources Managements Program (USAID)
PA	Protected area
PHKA	*Direktorat Jenderal Perlindungan Hutan dan Konservasi Alam* – Directorate General of Forest Protection and Nature Conservation
SEA	Southeast Asia
USAID	United States Agency for International Development

WCS	Wildlife Conservation Society
WWF	World Wildlife Fund

Pour Mam et Pap

Acknowledgements

First and foremost I would like to express my deepest thanks to my research director, Prof. Rodolphe De Koninck, whose unwavering support and relentless passion for research have been the drivers behind this study.

I would also like to express my gratitude to the ChATSEA project for fieldwork funding and to the Canada Chair of Asian Research for providing the financial support that enabled me to work on this project until fruition.

I am very grateful for the constant support and encouragement of my colleagues and friends at the Canada Chair of Asian Research. These include Justin Veuthey, Chris Gibb, Bruno Thibert, Pham Thanh Hai, Monia Poirier, Simon L'Italien, and Jean-Philippe Leblond.

In Indonesia, my sincerest gratitude goes out to Prof. Pujo Semedi, Guntur Widiatmaka Harisena, and Ika Purwita Sari from the University of Gadjah Mada for providing invaluable help during my fieldwork. My sincerest thanks go out to these individuals not only for making my work in Indonesia possible, but also for providing such warm hospitality during my Indonesian sojourn.

I would equally like to express my thanks to WCS staff Tasrif Kartawijaya and Rian Prasetia, and BTNK staff Puji Prihatinningsih for providing valuable data for this research as well as other forms of support during my fieldwork in Karimunjawa National Park. I would also like to thank the head of BTNK, Mr. Nababan, for taking the time out of his busy schedule in order to answer my many questions about the park and its management.

Lastly, I will forever be grateful to Pak Carik and his family for welcoming me into their home and making me feel like part of the family during my time in Karimunjawa.

1 Introduction

1.1 Research Problem and Significance of the Study

Mounting evidence is pointing to the fact that many fisheries across the planet are being overexploited, and as a result the sustainability of many fish stocks is threatened (Pauly *et al.* 1998). This is happening to such a degree that some researchers have even predicted a total collapse of the world's fisheries in the coming few decades if current trends continue (Worm *et al.* 2006). This intense fishing pressure is not only caused by industrialized large-scale fisheries, but also by small-scale fisheries such as those found in coral reef marine ecosystems. The latest estimates by the FAO suggest that more than half of the world's marine and inland fish catch come from small-scale fisheries, which employ a staggering 90 percent of the world's 35 million capture fishermen and another 84 million within associated fields such as fish processing, distribution and marketing (FAO 2010).

Although global capture production has remained relatively stable during the past decade (FAO 2010), there is evidence pointing to how the condition of various marine ecosystems differ greatly, with some showing relative stability (e.g., eastern Bering Sea) while others show a collapse in biomass (e.g., eastern Canada) (Worm *et al.* 2009). Such scientific studies are very disconcerting when we consider that the livelihoods of approximately 540 million people depend on the primary and secondary sectors of fisheries and aquaculture (FAO 2010). In addition, these fish populations and coral reefs that are being rapidly depleted by anthropic activities provide both humanity and marine ecosystems with valuable goods and services such as food production, recreational value, regulation of sediment processes, regulation of food web dynamics and coastal protection among many others (Holmlund and Hammer 1999; Moberg and Folke 1999).

These trends of overexploitation have not gone unnoticed and efforts to maintain marine biodiversity and to secure sustainable fish and seafood supplies are being made by fisheries experts at an international scale. While the overall effectiveness of these management efforts are showing promise in some high-income countries, the majority of low-income countries, which are for the most part situated in the tropics, have on average

poor management effectiveness (Mora *et al.* 2009). Furthermore, it is in these developing tropical countries where the vast majority of small-scale fishermen are located and where lies the vast majority of our global marine biodiversity. For example, Southeast Asia's coral reefs are the most extensive and diverse on the planet, with 480 species of coral and 1,650 species of fish (Burke *et al.* 2011; Glaser *et al.* 2010).

Although most western countries have adopted fisheries and coastal management strategies that by and large best suit their needs, many other developing countries are late to the game in regards to proper fisheries management and marine conservation. The importance of these marine resources cannot be overstated as they provide valuable goods and services to human societies. In most Southeast Asian countries for example, seafood provides an important source of animal protein for local populations and is a staple food in many regions.

It is in this region of the world where we find heated debates between fisheries development and marine conservation. As stated above, Archipelagic SEA lies in what is the richest and most diverse marine ecosystem in the world. Once abundant in marine resources, its waters have become dangerously depleted due to dramatic increases in fishing pressure throughout the region. This increase in fishing pressure has been mainly brought about by the industrialization of SEA's fishing fleets and by fisheries management systems that focused for decades on the commercialization of small- and large-scale fisheries. The green revolution served as impetus for this rapid development in SEA's fisheries. Agricultural and industrial development associated with the green revolution provided investment opportunities in the fisheries sector thereby causing its growth (Pauly and Chua 1988).

Although many strategies have been brought forth by both decision makers and scientists to combat this trend of declining marine resources, one in particular has stood out. Marine protected areas (MPAs) have become a popular contender in the marine conservation and fisheries management discourse and is seen as a promising solution for the diverse issues facing both coastal and marine resources in not only tropical waters but in temperate settings as well (Lester *et al.* 2009). Although much is known on the ecological benefits of MPAs, their social impacts are less documented. This research will

attempt to shed light on the socio-economic impacts of MPAs on local fishing communities in Karimunjawa National Park, Indonesia.

1.2 Core Concepts and Literature Review

The literature pertaining to coastal resource management and marine conservation is extremely vast. The multiple discourses that exist within these fields are continually evolving as new studies shed light on lesser-known areas. In the following section, we will discuss a few of the main themes that emerge from these bodies of work. However before doing so, the topics of overfishing and destructive fishing practices will be addressed in order to set the groundwork for our discussion on coastal resource management strategies.

1.2.1 Overfishing

With the near complete industrialization of the world's fishing fleets, the problem of overfishing has gained increasing importance over the past few decades. A recent report shows that the problem of overfishing and/or destructive fishing threatens over 55 percent of the world's reefs, with Southeast Asia's coral reefs being the most threatened with 95 percent of them affected (Burke *et al.* 2011). In Indonesia, destructive fishing practices and overexploitation are common throughout the country and pose a threat not only to the marine environment but to the economy as well. Such economies suffer through losses of fisheries and tourism potential, by reason of declines in fish diversity and population sizes (Bellwood *et al.* 2004; Jentoft *et al.* 2007; Pet-Soede *et al.* 1999; Worm *et al.* 2009).

A popular theory often attributed to the general problem of overfishing is called the "tragedy of the commons" (Bohnsack and Ault 1996; Hardin 1968). This occurs when open access to fisheries (or to any natural resource for that matter) promotes intense competition amongst fishermen, thereby causing damage to the fishery as each tries to increase its share of the marine resource over the other. This situation inevitably leads to the overexploitation of the marine resource. Such an explanation of overfishing certainly holds a valid place in describing overfishing as a general problem. However much has been written on the subject of overfishing in recent decades and more detailed accounts of the social and ecological processes involved have been put forth. One prominent

author having written extensively on the subject of overfishing is Professor Daniel Pauly who was the first to introduce the concepts of *ecosystem overfishing* (Pauly 1979a; Pauly 1979b) and *Malthusian overfishing* (Pauly *et al.* 1989; Teh and Sumaila 2007). The theory of Malthusian overfishing has contributed enormously to the discourse of fisheries management, especially in areas where destructive fishing is present, and has helped introduce social sciences into a field that had traditionally been dominated by biological sciences (McManus 1997). However, before discussing this topic, we must first address the stricter ecological definitions of overfishing.

Growth overfishing is described as the capture of fish before they have had sufficient time to grow. This simply means that individual fish are caught before having the opportunity to attain the mature size of their respective species (Pauly *et al.* 1989). In a definition provided by Ward *et al.* (2001), they state '"Growth overfishing" occurs when the mean size of harvested individuals is less than the mean size that would theoretically result in the optimal yield based on balancing individual growth and mortality rates' (Ward *et al.* 2001: 6). They go on to say that this type of overfishing will cause the exploited population to become younger and therefore physically smaller. One common tactic that aims to prevent growth overfishing is the regulated implementation of appropriate mesh sizes for fishing gears, which would allow maximum sustainable yield (MSY)[1] for a given targeted species. Growth overfishing has been shown to be a common problem in Southeast Asia's multispecies fisheries, where the mesh sizes of net are often smaller than 2 cm. The optimum biological range for mesh sizes in this region is said to be between 3.5-5.0 cm, therefore the use of meshes below 2 cm in the region's trawl fisheries results in severe growth overfishing (Pauly 1988a; Pauly *et al.* 1989).

Recruitment overfishing is described as a reduction of the number of juvenile fish entering the fishing ground (McManus 1997; Pauly *et al.* 1989). This type of overfishing occurs when a given population of fish is unable to produce enough offspring (recruits) to maintain the current population numbers. This can either be caused directly by catching too many mature individuals capable of spawning, or indirectly by catching too many immature individuals not yet ready for spawning (Ward *et al.* 2001). In either case, the

[1] MSY, in a general sense, is defined as 'the maximum use that a renewable resource can sustain without impairing its renewability through natural growth or replenishment'. (Marnane *et al.* 2003).

spawning biomass is too scarce to sustain the population, which can lead to a population collapse of the fish stock. Pauly *et al.* (1989) also point out that recruitment overfishing can be brought on by coastal environmental degradation caused by fishing activities, which would in turn have a negative impact on the size and suitability of nursery areas.

Ecosystem overfishing is described as a process of intense fishing that can lead to an 'altered … balance of species on the fishing grounds, with some species increasing, but failing to replace the depleted ones' (Pauly *et al.* 1989: 316). This concept was introduced and first described by Pauly (Pauly 1979a; Pauly 1979b) where a study of demersal trawling[2] impacts in the Golf of Thailand found that increased amounts of ecological production after overfishing was favouring nonresource species such as benthic invertebrates and large zooplankton. Areas suffering from ecosystem overfishing are often marked by a reduction of predatory species, which can lead to major shifts in community and ecosystem structure. This shift in relative abundance of species causes populations of organisms economically valuable for fisherman to decrease, while causing populations of less valuable organisms (situated at lower trophic levels) to increase (McManus 1997). The negative impacts of these changes include reductions of diversity, physical complexity and productivity of the ecosystem, as well as a reduction in the reef system's ability to recover from natural perturbations such as hurricanes (Roberts 1995). Furthermore, as Jackson (2001) shows, the increased density of organisms situated in lower trophic levels increases the rate of disease transmission and therefore renders the population more susceptible to disease outbreaks.

Malthusian overfishing was originally described as 'what occurs when poor fishermen, faced with declining catches and lacking any other alternative, initiate wholesale resource destruction in their effort to maintain their incomes' (Pauly *et al.* 1989: 232). As McManus (1997) points out, the use of this terms acknowledges the fact that social sciences hold an equally valid place as does biological sciences in fisheries and resource ecology. The term Malthusian overfishing refers to the work of the Reverend I.R. Malthus (1766-1834) who argued that unchecked population growth would, in the long run, result in shortages of food supply. This argument is based on the assertion that populations grow exponentially, while food supplies can only grow

[2] See Appendix 2 for trawl diagram.

linearly. Therefore in the long term, food supplies would fail to meet the consumption requirements of an exponentially growing population (Pauly 1990; Pauly 1997). In his contextualization of Malthusian overfishing Pauly (1989) explains that the number of small-scale fishermen in Southeast Asia is continually growing due to internal recruitment (children of fishermen entering the industry) and increasing landlessness among farmers. He goes on to say that the majority of these fishermen are situated below the poverty line and often lack any other means of survival other than fishing. Therefore, traditional management measures that have attempted to mitigate overfishing such as mesh size regulations, closed areas and seasons, limits on gear size, etc, are often ineffective in these areas because of the financial inability of fishermen to implement or comply with any new regulations. Furthermore, due to the lack of alternative employment opportunities, these fishermen are forced to remain in the fisheries sector even as the state of coastal resources deteriorates (Pauly 1997).

As noted by Pauly and Chua (1988), migrant fishermen, i.e. new fishermen, are not held back in any particular coastal area by family and informal ties, nor do they possess small parcels of land, as do some long established fishermen, to depend on during periods of low catches. According to the authors, this makes them more susceptible to begin using techniques such as excessively small mesh sizes, dynamite, cyanide and bleach. In his original definition, Pauly says that Malthusian overfishing usually involves '(1) [the] use of gears and mesh sizes not sanctioned by government; (2) [the] use of gears not sanctioned within the fisherfolk communities and/or catching of fish "reserved" for a certain segment of the community; (3) [the] use of gears that destroy the resource base; and (4) [the] use of "gears" such as dynamite or sodium cyanide that do all of the above and even endanger fisherfolk themselves' (Pauly *et al.* 1989: 323). Such tactics have since then come to be referred to as "destructive fishing practices" and are inherent to Malthusian overfishing, a problem which has grown rapidly with the increasing number of people in coastal developing countries (McManus *et al.* 1997). Destructive fishing practices have left their mark on the coral reefs of Southeast Asia as well as on its peoples, and it is the subject to which we will focus our attention in the following section.

1.2.2 Destructive Fishing Practices and Their Resulting Socioeconomic Impacts

As demonstrated above, destructive fishing practices (DFPs) have been shown to exist in areas suffering from Malthusian overfishing (McManus *et al.* 1997; Pauly *et al.* 1989). Much attention has been given to DFPs these past couple of decades and as a result the term 'destructive practice' can be interpreted in a variety of ways. Some researchers have considered practices such as the live-finning of sharks destructive (Pet-Soede and Erdmann 1998), and while we do not refute this, a more precise definition would be better fitted for our purposes when looking at DFPs through a Malthusian overfishing perspective. Pet-Soede and Erdmann propose a simple definition of DFP which fits well within the context of this research: '…a destructive fishing practice (DFP) is one which results in direct damage to either the fished habitat or the primary habitat-structuring organisms in the fished habitat…' (1998: 29).

It goes without saying that this above-mentioned damage to either the fished habitat or the primary habitat-structuring organisms is incompatible with any hope of sustainability. As the literature cited below will demonstrate, it is not only the physical marine ecosystem that suffers from DFPs, but also the economic viability of fishing communities using such methods.

The severity of the problem is made very clear in a report by Burke *et al.* (2011), in which they claim that at least 60% of Southeast Asian reefs are threatened by destructive fishing. The most common forms of destructive fishing in the region include blast fishing, cyanide fishing, muro-ami and inshore trawling. The particularities for each of these practices will be explored in detailed in Chapter 3, however for the present time it is important to point out that among these four destructive fishing methods, blast fishing has been identified as the most destructive force (Pet-Soede and Erdmann 1998) and in 1988 was present in at least 40 countries globally (McManus 1997; citing Wells 1988).

In an original study, Pet-Soede *et al.* offer a detailed projection of the economic costs and benefits of blast fishing in Indonesia over a 20-year period. Taking into account three major costs of blast fishing, which include the loss of coastal protection functions due to the degradation of the coral reefs, negative impacts on tourism and negative impacts on non-destructive fisheries, the paper shows that 'the economic costs to society are four times higher than the total net private benefits from blast fishing in areas with high

potential value of tourism and coastal protection' (Pet-Soede *et al.* 1999: 83). They quantify this loss at US$306,800/km^2 of coral reef over a period of 20 years, while also stating that such an estimate is conservative because the costs derived from losses in coastal protection and tourism had not yet fully been felt. Fishermen who practice blast fishing often ignore these long-term impacts in favour for the immediate short-term gains. As Andersson (1995) makes clear in his study on Tanzanian fishermen, the incentives to engage in blast fishing are significant, since blast fishermen can catch in two days the equivalent of what other fishermen would catch in twenty.

The research cited above highlights the severity of the destructive fishing problem in Southeast Asia. In the following sections, we will discuss different management strategies that all have a firm footing in the literature on overfishing/destructive fishing mitigation and coastal resource management.

1.2.3 Evolving Coastal Management Strategies: From Centralized to Community Based

The literature on governance, particularly in the field of coastal management and marine protected areas, is very well developed and the following section will offer a typology of various coastal management strategies most discussed in the research. Governance is strongly influenced by the particular socio-political, historical, and socio-economic context of an area. As Christie and White (2007) points out, the problems associated with failed efforts to find panacea-like management models have served a valuable lesson in past research. The management strategies outlined in the following three sections can serve as valuable tools in coastal resource management and protection when properly fitted within the social and ecological goals of a particular area.

The concept of managing coastal resources is certainly nothing new. Traditional or pre-colonial management has existed for millennia and has proven sufficiently effective in 'maintaining marine resources for coastal communities for long periods of time prior to Western contact' (Christie and White 1997: 157). Traditional management systems have a long history in Southeast Asia. However only a few still exist in the region (Pomeroy 1995). What little is known about pre-colonial management systems comes from historical government reports and research on the ones that have survived. These

management systems based on traditional knowledge rely on taboos, social norms and sanctions to prevent the overexploitation of resources (Christie and White 1997; Christie and White 2007). Although traditional knowledge systems have suffered greatly due to colonialism and are still disappearing due to poverty, population growth and globalization (Christie and White 1997), some argue that these traditional systems may still be sustainable and effective in some modern contexts, i.e. the West Pacific Islands (Christie and White 2007). Although the representation of traditional communities living in perfect harmony with their environment is greatly simplified, such generalizations can serve an important role in affecting policy shifts and new program directions (Li 1996). As we will see below, this assertion has bearing in the field of coastal resource management as community based approaches gained favour in relation to centralized approaches due to their increased number of positive affects.

Pomeroy (1995) describes the transferral of governance of coastal areas from communities to local and national governments as one of colonialism's most important effects one coastal communities. For example, in British Malaya commercial colonial resource use and traditional resource use were clearly incompatible. Traditional forms of community based management were eventually replaced by 'commercially efficient and unsustainable centralized forms' (Christie and White 1997: 158). In many Southeast Asian countries, the trend for the four decades leading up to the mid-90s was the expansion of national government's place in coastal fisheries management (Pomeroy 1995). Centralized forms of coastal resource management are considered to be advantageous because they are efficient and well grounded in scientific research. However criticism surrounding centralized planning rests on the idea that such an approach can lead to a lack of consideration of localized socio-economic and demographic impacts of policy changes. Also, the response of stakeholder groups affected by policies for which they have no control can prove to be a serious limitation (Christie and White 2007).

In her analysis of the economic costs of blast fishing in Indonesia, Pet-Soede (1999) makes clear that the centralized and top-down approaches to coastal resource management were not successfully achieving sustainable exploitation. She adds that the pattern of continuous intensification of coastal resource exploitation had to change 'in

favour of goals of conservation and sustainable use' (Pet-Soede *et al.* 1999: 92). In the larger region of Southeast Asia, fisheries management had been derived from a Western model designed for temperate marine ecosystems, which needed a centralized administrative authority and consisted of calculating the MSY for a few target species. However, this model has proven to be incompatible with tropical, multi-species fisheries (Christie and White 1997; Pomeroy 1995). In fact, approaches to fisheries management based on equilibrium models such as MSY have repeatedly been shown to be lacking not only in tropical fisheries, but in temperate fisheries as well (Caddy and Gulland 1983; Larkin 1977; Walters and Maguire 1996; Wilson *et al.* 1994). One major flaw leading to the failure MSY approaches as described by Berkes *et al.* (2000), is the lack of adaptability and resilience of these resource management institutions in response to ecosystem changes. Furthermore, these centralized forms of management based on western models are usually designed around "higher fishing technology" found in industrialized countries, which often prove inappropriate for artisanal fisheries of low-income countries (Allison and Ellis 2001).

As Agrawal (1999: 631) describes, early research on communities and policy regarded "People" as 'an obstacle to efficient and "rational" organization of resource use' and carried the implication that if any successful resource management had existed in some "harmonious past", that past was long gone. However, he continues by saying that perceptions about community have since undergone a dramatic change and that various international agencies such as the World Bank, Conservation International, The Nature Conservancy and USAID, to name a few, had all "found" community. These perception shifts about community certainly hold true in Southeast Asian coastal resource policy as management strategies moved away from their previous centralized forms to community based forms.

The shortfalls of centralized coastal management programs caused a new wave of initiatives to establish redesigned management programs in Southeast Asia. These redesigned programs, which incorporated what became to be known as a community-based management, effectively changed coastal management from what had been a top-down philosophy, to one that was bottom-up. The Philippines led this movement with a number of influential early attempts in the 1980s and thanks to the positive initial results

of these first initiatives in environmental recovery and communal empowerment, other Southeast Asian countries later began integrating community-based approaches in their own coastal management programs (Christie and White 1997).

Community-based management (CBM) recognized that managers of coastal resources needed to widen their scope to include not only information pertaining to the physical coastal environment, but also socio-economic information (Christie and White 1997). Fisheries management experts had by now come to the agreement that the fundamental causes of fisheries over-exploitation often stemmed from social, economic, institutional and/or political origins (Pomeroy 1995). A community-based approach therefore recommends that interdisciplinary research be conducted in coastal areas in order to properly take into account all important factors during the planning of management projects (Christie and White 1997). Community-based management also takes advantage of valuable traditional knowledge of local resources that was otherwise ignored in centralized systems (Agrawal and Gibson 1999; Pomeroy 1995).

Early research on CBM has shown promising results in areas using this type of approach. These benefits include reduction of destructive fishing practices, establishment of marine sanctuaries, regulation of fishing gears, closed seasons and the reversal of declining fish catch trends (Alcala 1988; Christie and White 1994; Christie and White 1997). Though community based approaches show clear promise, it bears mentioning that the implementation of community based approaches may be slow in areas where communal decision making is absent (Christie and White 1997). Furthermore, the success of these systems depends on 'the development of new legal, administrative and institutional arrangements to complement contemporary political, economic, social and cultural structures' (Pomeroy 1995: 159). That being said, Southeast Asia's overall political climate shows good potential for the implementation of community based approaches (Christie and White 1997).

Pomeroy (1995) additionally draws attention to the idea that the reemergence of community-based fisheries management in Southeast Asia would come under the form of co-management, one of the themes we will focus on in the following section.

1.2.4 Co-management and Integrated Coastal Management

As we have seen in the above section, community-based and co-management approaches are increasingly being advanced as alternatives to centralized, top-down approaches to fisheries and coastal management. Co-management 'aims to achieve joint responsibility and authority for resource management through cooperation between the government and local resource users' (Pomeroy 1995: 150). This type of management is often the result of a community-based approach. Co-management has been described by Christie (1997; 2007) as a compromise between bottom-up and top-down management where local actors, who are actively engaged in coastal resource exploitation, and government officials engage on equal footing in a transparent planning process which is formally recognized and sanctioned. However, as Pomeroy (1995) points out, it is the government which ultimately retains the position of authority. Christie (1997: 163) reiterates this statement by adding that the primacy placed on the role of governments over local communities might even be interpreted as a reinforcement of 'the sovereign control of government agencies over the governance of coastal resources, a legacy of colonialism in the tropics'.

Integrated coastal management (ICM) adheres to a methodical process of assessment, planning, and management in which government often acts in collaboration with other institutions (Christie and White 1997). The process of ICM includes multiple levels of actors such as local and national governments as well as community groups, who work together simultaneously in the process of coastal management implementation. Essentially, ICM and co-management are nearly identical. They both recognize the government as having ultimate authority in creating the legal framework for management and they 'both recommend working in an integrated, multisectoral, interdisciplinary manner' (Christie and White 1997: 164). The main difference is that ICM works in a broader sense in an effort to manage multiple elements such as living resources, physical processes, and stakeholders within a designated area. On the other hand, co-management is more focused and will tend to devote its efforts towards the management of a specific resource, such as a fishery. This means that in practice, co-management approaches are commonly used within the broader scope of ICM programs. It has been shown that for ICM programs to be successful, the participation of stakeholders from the community is

essential (Christie and White 1997; Pollnac and Pomeroy 2005; White *et al.* 2005). Because most ICM projects in developing countries require external financial and technical support, there is a risk of unsustainability once funds and support staff are removed (Pollnac and Pomeroy 2005). For this reason, it is important for the community and local stakeholders to have strong favourable perceptions of the environmental and socio-economic benefits from ICM projects. This, in turn, leads to stronger community support and thereby reduces their dependence on external donors and favours long-term sustainability of the project. The establishment of alternative livelihoods and the improvement of village infrastructure, livelihoods and income are examples of such benefits. In addition, alternative livelihoods play an important role in reducing the pressure on coastal resources and in mitigating the negative impacts of new policies, such as closed areas, on the incomes of resource users (Christie and White 1997; White *et al.* 2005).

1.2.5 Marine Protected Areas

ICM projects take advantage of a variety of management tools in order to achieve their objectives and marine reserves, or Marine Protected Areas (MPAs), are one of these (Christie 2005; Christie and White 2007; Crawford 2009). In his analysis of the ecological impacts of marine reserves, Halpern (2003: 117) makes the noteworthy assertion that 'traditional management methods [i.e. western methods] such as maximum sustainable yield estimates are inadequate for addressing the multiple types of anthropogenic impacts on marine life such as over-fishing, certain fishing methods, pollution, coastal development, and other human derived impacts'. Therefore, MPAs are seen as a promising solution to mitigate illegal fishing practices and overexploitation while simultaneously addressing other issues such as conservation and human needs (Christie 2005; Halpern 2003). Others have indicated that generally, protected areas can reduce the amount of resource user conflicts and poverty in a given area through proper management (Jentoft and Chuenpagdee 2009; Pomeroy *et al.* 2007). However, the effects of MPAs on both the marine environment and on local populations need to be assessed in order to fully understand their efficiency (Pomeroy *et al.* 2005).

The way in which a MPA can be defined is quite broad due to the variability of goals set by each. Some MPAs, often referred to as no-take, are very tightly controlled and do not permit any form of extractive or non-extractive use. On the other hand, the most common type of MPA is based on a more flexible model and can allow certain kinds of extractive use (i.e. traditional fishing) in a few areas, while simultaneously banning all user access in other areas through complex zoning schemes (Crawford 2009). Despite this variability, MPAs all share a common goal of conservation and protection of the marine and coastal ecosystems (Jentoft *et al.* 2007). This project will focus on MPAs incorporating a zoned no-take design, meaning that fishing activities are regulated and often prohibited within some zones of the MPA, but allowed in others.

The most commonly accepted definition of MPAs found in the literature (Christie and White 2007; Crawford 2009; Mascia *et al.* 2010) is the one proposed by the International Union for the Conservation of Nature:

> "An 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." (IUCN 1988)

Southeast Asia is home to the largest and richest coral reef ecosystems on the planet and as such, most of the region's fisheries depend on the health of these coral reefs in order to maintain adequate catches. MPAs are currently considered the best tool for the management and protection of coral reefs and other marine systems (Hughes *et al.* 2003) and in Southeast Asia, there has been a growing number of MPAs implemented under ICM projects (White *et al.* 2005). In total, approximately 12% of the region's coral reefs and their associated fisheries are within an MPA, however this is insufficient to properly protect coral reefs and biodiversity, especially when considering that the effectiveness of the majority of these MPAs is considerably low. These discrepancies in MPA implementation also hold true at a global scale. Worldwide, MPAs cover approximately 18.7% of all coral reefs, however less than one percent (0.01%) of coral reefs are actually situated within low risk no-take zones where poaching is absent (Mora *et al.* 2006). Ecological modeling would suggest that this coverage is greatly insufficient in order to assure maximum sustainable yields and long-term protection of exploited reef fish. These

models indicate that the total coverage of the world's reefs by no-take areas should be at least 30 percent (Hughes *et al.* 2003).

Despite the lack of optimal no-take area implementation outlined above, MPAs are nonetheless considered to be the best management strategy in addressing overfishing and habitat degradation (Christie and White 2007). Recent studies have confirmed the theorized benefits of MPAs incorporating a no-take design by showing that they help promote increases in density, biomass, individual size and diversity of marine species located within its boundaries (Gell and Roberts 2003; Halpern 2003; Lester *et al.* 2009; Silvert and Moustakas 2011; Ward *et al.* 2001) and can help rebuild depleted fisheries stocks (Pauly *et al.* 2002; Roberts *et al.* 2001; Russ *et al.* 2004; Ward *et al.* 2001). Even smaller sized marine reserves show these same positive results to varying degrees (Halpern 2003; Lester *et al.* 2009).

1.2.6 Gaps in the literature on MPAs

The literature on MPAs is vast, however as Dalton (2005: 1393) explains, most of the research done thus far on the topic has been 'heavily weighted with perspectives grounded in ecological theory', and argues that research must also come from the social sciences camp in order to better inform marine policy decision making. In a rare study on the impacts of MPAs on fishing communities, Mascia *et al.* (2010: 1424) reiterate Dalton's statement by asserting that 'further research must better document and explain variation in the positive and negative social impacts of MPAs' in order to better inform policy making. Others agree that social impacts of MPAs are poorly understood and that insufficient research has been done on the subject (Christie *et al.* 2003; West *et al.* 2006).

Furthermore, it is widely recognized that, in order for MPAs to reach desired long term ecological and socioeconomic goals, a robust co-managerial framework between policy makers, local stakeholders and the community must be incorporated as a main component of its management plan (Christie and White 2007; Clifton 2003; Erdman *et al.* 2004; Pomeroy and Berkes 1997). This approach to MPA management is meant to ensure that the regulatory framework remains dynamic, meaning that MPAs can adapt and change over time as the environment (natural and political) around them transforms. It has recently been discussed that for managed coastal areas to meet current environmental

and anthropogenic challenges, a shift towards this kind of dynamic and adaptive marine resource management is needed (Agardy *et al.* 2003; Ferse *et al.* 2010; Game *et al.* 2009; Jentoft and Chuenpagdee 2009; Jentoft *et al.* 2007; Tompkins and Adger 2004). This flexibility is crucial, as scientific uncertainties in MPA design still remain, largely due to gaps in scientific knowledge on protected areas and to the irregularities of each area (Sale *et al.* 2005). However very little research has been done to verify if indeed MPAs adapt through time (Jentoft *et al.* 2007).

In the socioeconomic arena, gaps are present in our knowledge of the changes occurring at local scales in fishing villages that depend on the resources within these controlled no-take areas (Sale *et al.* 2005). Thus, better understanding is needed of the changes occurring in the fishing efforts and in the environmental subjectivities of local actors affected by MPA regulations. It is important to consider these changes in fishing communities situated within MPAs because local actors serve an important role in the co-management of marine resources on which they depend for their livelihoods. In order to properly assess the effectiveness of coastal resource management, there needs to be continuous feedback from the community level in order for the management of the area to remain dynamic to the needs of local actors (Agardy *et al.* 2003; Brechin *et al.* 2002). As we have seen in our review of the literature in the above section, the participation of these actors is crucial and can often determine the success or failure of the objectives set forth by coastal resource management (Christie and White 1997; Dimech *et al.* 2009; Ferse *et al.* 2010; Hilborn *et al.* 2004; Jentoft *et al.* 1998; Pollnac and Pomeroy 2005; Pomeroy *et al.* 2005; Richardson *et al.* 2005; Walpole and Goodwin 2001; White *et al.* 2005).

1.3 Research Objectives

The objective of this project is to examine at a local scale the environmental and social effects of MPA implementation in Karimunjawa National Park. Multiple social and environmental factors will be examined in order to better understand the processes interacting together within these contexts. However, the specific research questions of interest to this project will be: 1) has the MPA adapted and changed over time in order to better improve both the physical condition of the surrounding environment and the

socioeconomic condition of the local populations? 2) what are the perceptions of local fisherman about the need for regulation and the condition of the local fishery? 3) what socioeconomic changes have occurred in local fishing villages as a result of MPA implementation?

2 Research Design and Methodology

2.1 Theoretical Framework

The theoretical underpinnings of this study will primarily draw from the work of two authors, namely Agrawal on "environmentality" and Allison on "sustainable livelihoods". The following section will address each of these theoretical tools all the while demonstrating their usefulness in our analysis of the processes and outcomes of MPA implementation in Karimunjawa National Park.

2.1.1 Environmentality

The term environmentality, as defined in this dissertation, was first proposed by Arun Agrawal (2005) in his study of the formation of "environmental subjects" in rural India. These "environmental subjects" are simply defined as 'people who care about the environment' (Agrawal 2005: 162). In his very well developed analysis, Agrawal describes how certain local actors, who once opposed forest protection, underwent significant changes in perceptions over time and eventually came to support, or even actively be involved in, the protection of forested environments. In his study, he adeptly demonstrates that perceptions towards environmental protection followed, as opposed to preceded, state institutional change. In doing so, he highlights that 'beliefs and thoughts are formulated in response to experiences and outcomes over many of which any single agent has very little control' (Agrawal 2005: 163). In order for him to lay the theoretical groundwork for his analysis on subject formation, his examination draws inspiration from the conceptual writings of authors such as Benedict Anderson and Michel Foucault. He points out that although these authors have greatly contributed to the discourse on shifts in subjectivities, the specific processes by which these shifts occur are seldom discussed. Agrawal argues that the investigation of these processes is best done through the examination of social practices relevant to the formation of subjects. In his words, this approach 'creates the opportunity for learning more about how actions affect ways of thinking about the world and produce new subjects' (Agrawal 2005: 166). Furthermore, he notes that previous writings on subject formation, while conceptually sound, have not ventured outside the abstract. His aim is therefore to think about the formation of

environmental subjects concretely rather than abstractly. His stated objective is to discover 'when and for what reason do socially situated actors come to care about, act in relation to, and think about their actions in terms of something they identify as "the environment"?' (Agrawal 2005: 162). This framework will hopefully help us better examine the shifts in subjectivities of Karimunjawa fishermen after MPA implementation.

Agrawal (2005: 166) uses the term "environmentality" 'to denote a framework of understanding in which technologies of self and power are involved in the creation of new subjects concerned about the environment'. As mentioned above, Agrawal draws inspiration from the work of Foucault, more precisely from Foucault's writings on "governmentality" (Foucault 1988), in laying the theoretical groundwork for his discussion on the formation of environmental subjects, which he aptly names "environmentality". His above definition of environmentality is steeped in Foucauldian terminology such as "technologies of self" and "technologies of power". In his writings, Foucault describes two technologies that modify individuals: '(1) technologies of power, which determine the conduct of individuals and submit them to certain ends or domination, an objectivizing of the subject; [and] (2) technologies of the self, which permit individuals to effect by their own means or with the help of others a certain number of operations on their own bodies and souls, thoughts, conduct, and ways of being, so as to transform themselves' (Foucault 1988: 18). The contact between these two technologies, of power and of the self, is what Foucault calls governmentality. This concept of governmentality is what serves as the fundamental framework for Agrawal's writings on environmentality.

In Foucault's governmentality, he states that government can be understood as "le conduire des conduits" – the conduct of conducts (Foucault 1982: 220-221) – which can be interpreted as 'a generalized power that seeks to fashion and guide the bodily comportments and inward states of others and the self' (Crampton and Elden 2007: 187). In this sense, we can consider government as a form of power that attempts to construct subjects through subtle technologies of power, which causes these subjects to transform themselves in accordance to the desires of the government through technologies of the

self. It is important to note that 'subjects enter into their subjectivity freely, giving their consent and ultimately conducting themselves' (Birkenholtz 2009: 211).

By focusing his attention on the practices of rural Indians, Agrawal is able to form a bridge between the theoretical and actual processes of subject formation. He does this by offering a compelling explanation on how 'forest-dependent people in India willingly reshaped their environmental practices around the conservation goals of the state, and then internalised these goals as their own' (Birkenholtz 2009: 211). Thus, we can appreciate how Agrawal's environmentality framework, inspired by Foucault's concepts concerning governmentality, can serve as a valuable looking glass through which to analyze shifts in subjectivities in regards to environmental conservation and the formation of environmental subjects. This will prove useful in our analysis of the perceptions of Karimunjawa fishermen towards the regulation of their fishery as well as their perceptions towards the more general ideology of conservation emphasized by park managers.

2.1.2 Livelihoods Approach

An important characteristic of coastal communities is the diverse, multisectoral nature of livelihood activities within each given area. These occupational sectors can include fisheries, agriculture, and tourism among many others (Allison and Ellis 2001; Cinner and Bodin 2010; Pomeroy *et al.* 2006). Due to the inherently high dependence of coastal communities on natural resources, any fluctuation, caused either by a reduction in the amount of resources or lack of access, can lead to critical problems if other sources of livelihood are not found. As a way to mitigate this vulnerability, coastal communities often rely on diversified livelihood activities that span multiple sectors and that effectively augment households resilience against ecological or economic shocks (Allison and Ellis 2001). This is the case in Karimunjawa where people are active in several livelihood activities, with an average of 2.24 types of sources of livelihoods per household (Wibowo 2005), that span a few sectors including fishing, agriculture, seaweed farming, fish farming, tourism and perennial crops. As part of its MPA initiative, Karimunjawa National Park is actively promoting alternative, "sustainable", livelihood activities in an effort the reduce fishing pressure and to augment standards of

living. Furthermore, because KNP utilizes a no-take approach within several zones of the MPA, it is conceivable that this lack of access to certain fishing grounds may affect fishermen's livelihoods. In order to partially fulfill our stated objective of examining the socio-economic changes occurring in KNP after MPA implementation, we will draw inspiration from the livelihoods approach as described by Allison and Ellis (2001) to guide our analysis.

Scoones (1998) provides us with a fitting definition of "sustainable livelihoods" which goes: 'a livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets, while not undermining the natural resource base' (Scoones 1998: 5). While this definition is satisfactory for describing "sustainable livelihoods", Allison and Ellis (2001) go further by putting emphasis on the variability of access to these assets and activities with the following definition: 'a livelihood comprises the assets (natural, physical, human, financial and social capital), the activities, and the access to these (mediated by institutions and social relations) that together determine the living gained by the individual or household' (Allison and Ellis 2001: 379; citing Ellis 2000: 10). Both these definitions are appropriate for our analysis of livelihoods in Karimunjawa. The first definition addresses the notion of "sustainable livelihoods" which fits well with KNP management's goal of introducing alternative livelihoods to supplement, or even replace fishing. The second definition addresses the notion that access to assets and activities varies for different local actors and forewarns us to the reality that not all people have equal access to the same opportunities. This question of access to alternative livelihood opportunities will reemerge in our discussion pertaining to the distribution of benefits derived from tourism throughout several KNP communities.

In their paper, Allison and Ellis (2001: 379) describe the livelihoods approach as being 'typically set out in the form of a framework that brings together the principal components that are thought to comply with the livelihoods definition, as well as demonstrating the interactions between them' (see Table 1). We are shown that this approach, which had seldom been used on small-scale fisheries, can indeed be applied to them and 'can help bring a fuller understanding of fisherfolk's adaptive strategies into the

policy arena of small-scale fisheries management in low income countries' (Allison and Ellis 2001: 378). Although our project does not put as much emphasis on policy recommendations as do the authors cited, the livelihoods framework nevertheless serves as a valuable tool in examining socioeconomic changes and livelihood diversification occurring after MPA implementation in KNP. Furthermore, it enables research from a cross-sectoral perspective when examining rural people's income-generating and subsistence activities (Allison and Ellis 2001). As we have seen in the literature review in Chapter 1, such a multisectoral perspective is a key component in the analysis of both ICM and co-management projects.

In order to properly assess socioeconomic changes within Karimunjawa, we must take into account the heterogeneous nature of coastal communities. The "livelihoods framework" serves as a valuable tool in achieving this.

Table 1: Livelihoods framework

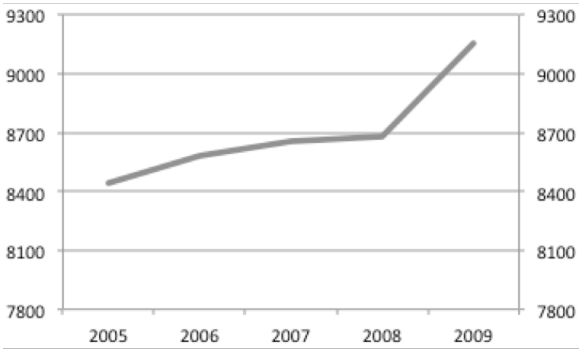
A	B	C	D	E	F
Livelihood platform	Access modified by	In context of	Resulting in	Composed of	With effects on
Assets: Natural capital Physical capital Human capital Financial capital Social capital	*Social relations*: Gender Class Age Ethnicity *Institutions*: Rules & customs Land and sea tenure Markets in practice *Organizations*: Associations NGOs Local admin State agencies	*Trends*: Population Migration Technological change Relative prices Macro policy National econ trends World econ trends *Shocks*: Storms Recruitment failures Diseases Civil war	Livelihood strategies	*NR based activities*: Fishing Cultivation (food) Cultivation (non-food) Livestock Nonfarm NR *Non-NR based*: Rural trade Other services Rural manufacture Remittances Other transfers	*Livelihood security*: Income level Income stability Seasonality Degrees of risk *Env. Sustainability*: Soils & land quality Water Fish stocks Forests Biodiversity

Source: Adapted from (Allison and Ellis 2001)

2.2 Study Site

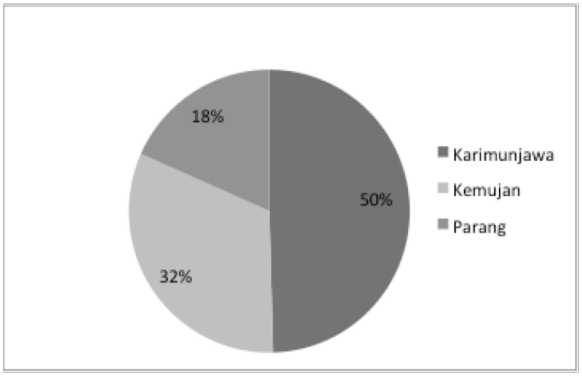
Situated in the Java sea, Karimunjawa National Park (KNP) encompasses 22 islands of the small 27-island archipelago of Karimunjawa, which lies approximately 75 km off central Java's northern coast (Marnane *et al.* 2003) (See Figure 3), with Semarang, the capital of Central Java province (*Provinsi Jawa Tengah*), being the closest large city. Administratively, Karimunjawa is a sub-district (*Kecamatan Karimunjawa)* under the Jepara regency (*Kabupaten Jepara*) situated in the province of Central Java. There are three villages within the Karimunjawa sub-district, namely Karimunjawa, Kemujan and Parang. Based on figures obtained from the Department of Population and Civil Registration in Jepara for 2009, the region has a population density of 129/km^2, which is significantly less when compared to the average population density of 794/km^2 for Central Java[3]. In fact, Karimunjawa is situated next to the most populous island of Indonesia, Java, that has an average population density of 1,033/km^2 (De Koninck 2009). As we will see later on, the enormous population pressure on neighbouring Java is felt within the waters of Karimunjawa as fishermen from Java's northern coast persistently try to fish within the protected waters of KNP. Five of Karimunjawa's islands are

Figure 1: Population growth in KNP (2005-2009)



Source: Department of Population and Civil Registration Jepara (2010)

Figure 2: Population distribution in KNP (2009)



Source: Department of Population and Civil Registration Jepara (2010)

[3] 2010 Population Census, Central Agency on Statistics (*Badan Pusat Statistik – BPS),* Jakarta.

inhabited (Karimunjawa, Kemujan, Parang, Nyamuk and Genting) (Mukminin *et al.* 2006; Widjatmoko and Putra 2003) with a total population of 9,157 people in 2009. Based on figures from 2005 to 2009, we observe that KNP's population has increased 8.5% during the past five years (Figure 1). As we can see from Figure 2, the majority of the population resides within the main village of Karimunjawa (50%), with Kemujan and Parang following at 32% and 18% respectively. The population of KNP is comprised of a Javanese majority (88.8%), as well as Bugis (6.7%), Madurese (1.5%), Bajo (0.7%) and Mandar (0.7%) minorities (Wibowo 2005). These various ethnic groups, which often inhabit shared spaces in the three villages of the archipelago, have a history of peaceful cohabitation and have developed distinct customs and traditions (ASEAN 2003). Each village in KNP is equipped with diesel power generation facilities that provide electricity to 73.9% of households, while another 18.7% have there own generators (Wibowo 2005). Since electricity is only available at night through the villages' generation facilities, from 17h00 to 7h00 in Karimunjawa or 17h00 to 24h00 in Kemujan, some wealthier households have generators in addition to being connected to the grid for when they need electricity during the daytime off-hours.

The archipelago of Karimunjawa is described as one of the few regions in western Indonesia where the coral reefs are categorized as being in good condition (Mukminin *et al.* 2006). These healthy reefs support relatively abundant and diverse populations of coral reef fish on which the livelihoods of local traditional fishing communities depend. Ecosystem surveys have identified up to 64 genera of coral and 353 species of reef fish in KNP waters (Marnane *et al.* 2004; Mukminin *et al.* 2006). Local reef fish communities have such high diversity that approximately 50% of the total number of reef fish species found in Indonesia are represented in KNP (Marnane *et al.* 2004). A total of sixteen rare marine species are present in the waters surrounding Karimunjawa islands, among which include a couple species of turtles and several species of clams[4] that are protected under natural resource and ecosystem conservation laws (ASEAN 2003). Furthermore, the archipelago's many islands support fairly high biodiversity among other ecosystems

[4] Some of these rare species include Green turtle (Chelonia mydas), Hawksbill turtle (Eretmochelys imbricata), Giant clam (Tridacna maxima), Sand Clam (Hipopus hipopus), Boring clam (Tridacna crocea), Skinny Clam (Tridacna squamosa), China Southern Clam (Tridacna derasa) and Nautilus (Nautilus pompilus), a rare mollusk (ASEAN 2003).

including lowland tropical forests, coastal forests, mangroves and seagrasses. Thanks to these rich ecosystems, archipelagic Karimunjawa was targeted as a priority area for marine conservation, and in 1999 was declared[5] a Marine National Park by the Indonesian Ministry of Forestry with a total area of 111,625 hectares. Subsequently, 98% of KNP's area (110,117 ha) was declared[6] a Marine Protected Area (MPA) in 2001[7] (ASEAN 2003; BTNK 2004c; Yulianto *et al.* 2007). Karimunjawa National Park's current land use is mainly comprised of agricultural (29.6%) and built (29.0%) land, while ecosystems such as wetlands (21.6%), tropical rain forests (18.1%) and mangroves (5.6%) cover the remaining areas (KK 2009). Figures for detailed land use are sparse and mostly incoherent, with some sources calculating KNP's total land area at 7,115 (BTNK 2008) and others at 7,120 Ha (BTNK 2004c). However, one list offered by BTNK in their 25-Year Management Plan (BTNK 2004c), divides KNP's land use as follows (Table 2), with ecological areas accounted for in the forested category.

Table 2: Types of land usage in Karimunjawa National Park

Type of land usage	Area (Ha)	Percentage
Built	2062	29.0
Agricultural	2211	31.1
Grassland	12	0.2
Swamp land	21	0.3
Fish ponds	28	0.4
Forest	2106	29.6
Other uses	680	9.6
Total	7120	100

Source: BTNK (2004c)

Given the archipelagic nature of Karimunjawa, it has a very long coastline along which a well-established practice of traditional fishing exists. It is therefore unsurprising that the principal livelihood activity in the area is fishing, with 55% of the working population identifying it as their primary livelihood activity in 2009, according to figures obtained from Karimunjawa sub-district offices (KK 2009). The people of the area are

[5] Minister of Forestry Decree No. 78/Kpts-II/1999 (BTNK 2004a).
[6] Minister of Forestry Decree No. 74/Kpts-II/2001 (BTNK 2004a).
[7] The history of KNP's legal framework will be further developed in Section 4.1.

therefore highly dependent on fishery resources and furthermore, the Karimunjawa archipelago is said to have one of the most important artisanal fisheries in the Java Sea (Mukminin *et al.* 2006), with most others, particularly those on the northern Javanese coast, having been industrialized throughout the past four decades (Semedi 2003). Another important means of livelihood is farming, with 37% of the working population identifying it as their primary occupation. Aside from the two principle means of livelihood of fishing and agriculture, professions such as labourer, merchant, civil servant and construction are also listed as other, less prominent, types of livelihoods. Yet another popular livelihood activity that is not well represented in most data is seaweed farming. Due to its very recent introduction and expansion in KNP, no official data is available on the number of people practicing seaweed farming either as a primary or secondary livelihood. However, interviews during our fieldwork clearly demonstrated that seaweed farming figured very importantly in the livelihood strategies of local communities. Karimunjawa households are often active in several livelihood activities either simultaneously or seasonally, with an average of 2.24 livelihood sources per household (Wibowo 2005).

Karimunjawa National Park provided an ideal site for our research for a few key reasons. Firstly, KNP has recently undertaken a drastic change in its approach to management with the implementation of the new zoning system in 2005[8] due to the fact that the old system no longer suited the socioeconomic culture and ecology (BTNK 2004b). This shows the park management's dedication towards adaptive management and their willingness to propose and effectuate major policy changes in response to evolving ecological and socioeconomic conditions. This fits well with our first research objective, which is to describe what changes the MPA has made to better ensure its long-term durability within evolving and complex social and ecological systems. Secondly, KNP is working to develop a sense of awareness amongst fishermen in regards to the importance of marine and coastal resource management. Furthermore, the park's new management plan highlights the need for participatory management by local communities. As we have seen in our literature review, these are very promising first steps, however the success of

[8] Director General of Forest Protection and Nature Conservation Decree No. 79/IV/Set-3/2005 (BTNK 2004a).

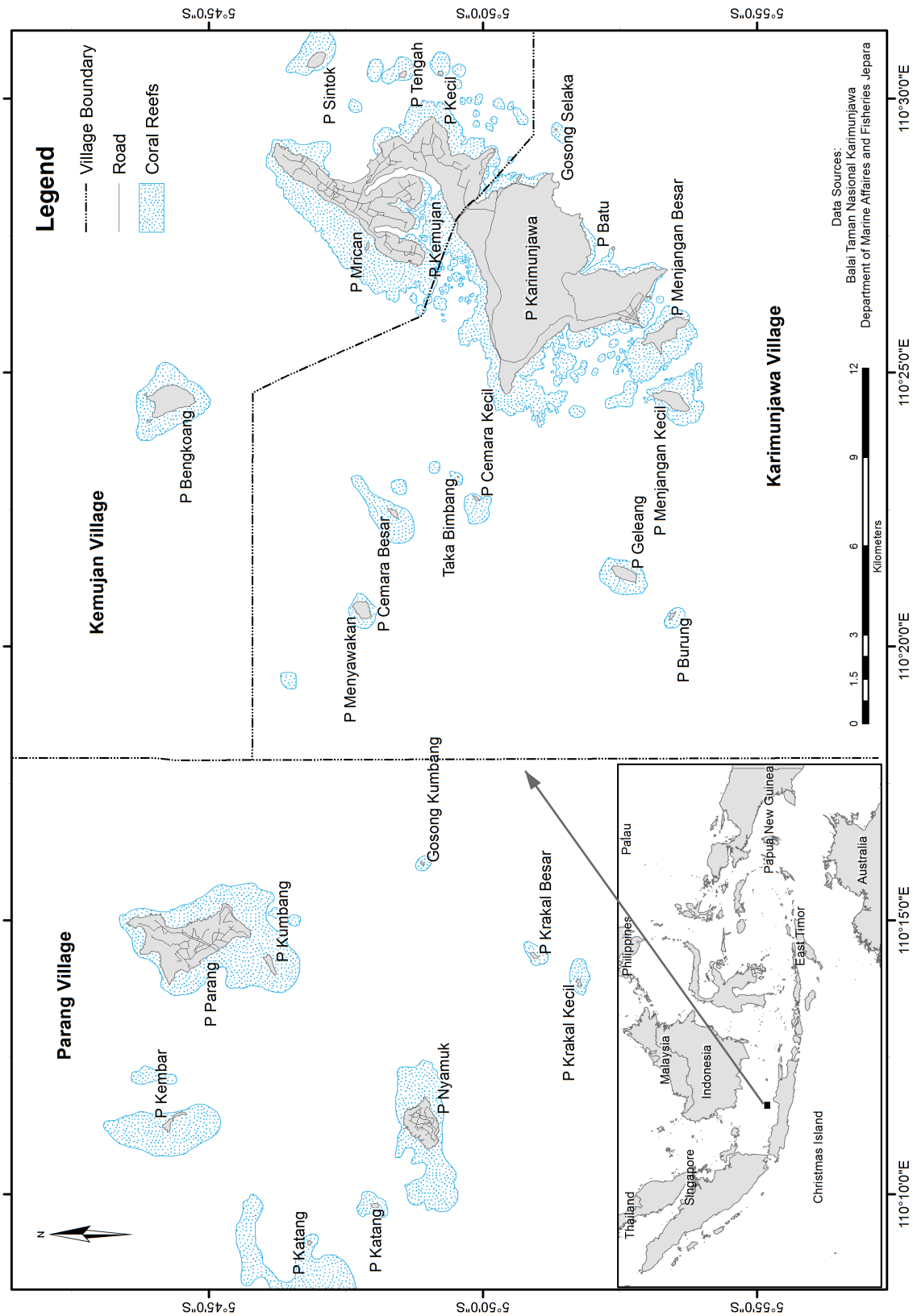
such initiatives depend on the perceptions of local people towards regulation and their subsequent willingness to participate in such co-managerial approaches. This fits well with our second research objective, which aims to reveal such subjectivities within KNP fishing communities. Lastly, in addition to having implemented a new zoning system in 2005, KNP is actively promoting tourism as an alternative means of livelihood for local fishermen (BTNK 2004a). It is highly possible that at least one of these actions will have direct effects on the socioeconomic dynamics of the region, which is precisely what we will attempt to uncover with our third research objective.

In addition to being well suited towards our research objectives, a few key factors facilitated our entry into Karimunjawa National Park and helped the feasibility of this research. One important Indonesian contact from Gadjah Mada University[9], Professor Pujo Semedi, facilitated our entry into KNP and provided crucial support to obtain the government permits required to conduct research in KNP. Furthermore, he helped us establish contact with a researcher familiar with local Karimunjawa communities. This enabled us to gain access to small traditional fishing communities and to form links with fishermen that would prove essential for our field interviews and participatory observations which included tagging along for overnight fishing trips among other things. The fact that the Balai Taman Nasional Karimunjawa (BTNK)[10], in collaboration with the non-governmental organization the Wildlife Conservation Society (WCS), had published several socioeconomic and ecological reports during the planning process and ongoing assessment of the new management plan was helpful in assuring access to relevant secondary data.

[9] Gadjah Mada University (*Universitas Gadjah Mada – UGM*) is Indonesia's largest and oldest university located in Yogyakarta, Daerah Istimewa Yogyakarta, Indonesia.

[10] BTNK being the Karimunjawa National Park Authority, a governmental branch under the Director General of Forest Protection and Nature Conservation (*Direktorat Jenderal Perlindungan Hutan dan Konservasi Alam – PHKA*), responsible for the management of KNP.

Figure 3: Map of the Karimunjawa archipelago



2.3 Research Methods

For this study we gathered data from a combination of primary and secondary sources that employ both qualitative and quantitative methods. Field interviews were conducted with local fishermen and non-fishermen as well as with other actors, such as local WCS and BTNK officials. The following section will outline these methods as well as offer descriptions of the different types of data sources from which our analysis will be drawn.

Our fieldwork was conducted between late May and late August 2010 during which time a total of two months were spent on the islands of Karimunjawa National Park and another month on the "mainland" part of the Central Java province. During this time, several trips were made between KNP and Java in order to collect data and arrange permits, visas and attend to various issues of a logistical nature.

In KNP, a series of semi-structured interviews were conducted with local fishermen from two villages – Karimunjawa and Kemujan. In addition, a questionnaire[11] was developed in order to assess various socioeconomic indicators such as age, livelihood activities, involvement in coastal resource policy creation, perceptions about MPA regulations, etc. A total of twenty-eight respondents answered the questionnaire during which time other questions were asked depending on the direction of conversational topics. This questionnaire was modified from a set of guidelines proposed by Bunce and Pomeroy (2003) which aim to promote socioeconomic monitoring for coastal managers and researchers in Southeast Asia. Our questionnaire was designed around a series of questions with yes/no responses and Likert-type scaled responses ranging from one to five. It permitted us to gauge the varying subjectivities of interviewed fishermen. The questionnaire and the accompanying semi-structured questions focused around a few themes related to our research objectives, which included demographic and livelihood information along with questions pertaining to attitudes and perceptions towards conservation, park management, coastal resource rules and regulations, enforcement, compliance, the state of the fishery and tourism. Some fishermen were more expansive than others thereby favouring the semi-structured part of the interview, while others were less so, possibly due to "research fatigue" from having already been interviewed several

[11] A copy of the questionnaire can be found in Appendix 1.

times during other research and monitoring campaigns conducted by either WCS, BTNK or outside researchers.

Several semi-structured interviews were also conducted with non-fishermen such as WCS, BTNK and Dinas Kelautan Dan Perikanan (Dislautkan)[12] officials, as well as with stakeholders in the tourism and seaweed industries. These interviews were valuable for gaining insight into the questions of coastal resource management and conservation from all important actors in BTN. Key respondents from the WCS field office included the Karimunjawa Program Coordinator and Conservation Officer. Other key respondents included several park officials from BTNK. Among these respondents were several members of the BTNK conservation staff that we were able to interview on several separate occasions and we also were able to sit down with the head of BTNK at the park's main office in Semarang near the end of our fieldwork. Relevant information about the state of the fishing industry was gathered though several discussions with government officials from the sub-district, regency and provincial Dislautkan offices situated in Karimunjawa, Jepara and Semarang respectively. The tourism industry was represented during informal interviews with guesthouse operators, tour operators and tour boat captains operating in KNP. Information relevant to park enforcement was gathered from an interview with a government official at the local Dinas Perhubungan[13] office. Several discussions also took place with a major seaweed dealer in Karimunjawa and several seaweed farmers throughout Karimunjawa and Kemujan in order to gain valuable data on the fast expanding seaweed industry of the region.

Other primary data originated from participatory observations throughout the Karimunjawa archipelago, but with heavy focus on the villages of Karimunjawa and Kemujan. The fact that we resided directly within KNP enabled us to gather pertinent data through impromptu casual interviews and discussions with fishermen and other local actors (park rangers, tour guides, etc.). Such encounters proved valuable in obtaining additional data that were not specifically addressed in our semi-structured interviews and questionnaire but that were relevant to our research. These casual encounters also proved

[12] Dislautkan being the Department of Marine Affaires and Fisheries.
[13] Dinas Perhubungan being the Department of Transportation.

useful in confirming certain data that had already been obtained through our formal interviews.

Our first week in KNP was spent in a small hamlet in central Kemujan. There we established a favourable relationship with a Bugis elder and were able to accompany him and his team of deckhands, which for the most part were comprised of members of his immediate family, on an overnight fishing trip near the island of Bengkoang. The remainder of our time was spent on the island of Karimunjawa near the main village where we were able to participate in smaller fishing outings nearer to shore. These trips gave us the opportunity to directly observe traditional fishing techniques and to gain insight into the varying challenges presenting themselves to modern day Karimunjawa fishermen. During our time in Karimunjawa we were housed by the Pak Carik[14] of the village, who also happened to be one of the largest *rumput laut* (seaweed) traders of the archipelago. This permitted direct observations of the burgeoning seaweed industry in KNP through the perspective of a large local trader. We directly observed the full process of trading *rumput laut* in KNP from buying, drying, to selling. This also permitted a number of discussions with Pak Carik on the topic, which helped provide us with a better understanding of the industry.

We also were able to participate in two separate outings to peripheral areas of the MPA with groups from both major governing bodies of the park, WCS and BTNK. The primary purpose for the WCS outing was to conduct a scheduled round of surveillance around the entire MPA for data relevant to fishermen compliance with marine rules and regulations. This provided an excellent opportunity to discuss several topics relating to park conservation and management with the conservation officers conducting the patrol and to directly observe several of the fishing techniques utilized by local fishermen. The primary purpose of the BTNK outing was to conduct ecological monitoring of several endangered giant clam species. This trip to coral reefs located in the far western region of the park provided a valuable opportunity to visually compare the conditions of reefs situated in different zones of the MPA and to gain a better understanding of the daily

[14] "Pak Carik" is the traditional term for the village secretary and has since come to be legally termed "sekretaris desa" (village secretary) with the arrival of the New Order. A Pak Carik 'is responsible for the daily operation of the village and is deputy headman. The … secretary is seen in the village office almost every day, writing letters of permission or recommendation, registering mail, and receiving visits from villagers with problems" (Antlöv and Cederroth 1994: 79).

operations of BTNK officials and researchers. Both these outings provided excellent opportunities to observe some of the data gathering methods of WSC and BTNK officials, two key authors of many of our secondary sources. Moreover, due to the large distances covered, such outings with fishermen as well as with WCS and BTNK officials provided excellent opportunities to directly observe the practice and extent of seaweed farming throughout KNP.

Near the end of our stay in Karimunjawa, we were able to attend a meeting between BTNK and community representatives from all three KNP villages. The meeting was lead by the head of BTNK and focused on raising awareness for a new initiative named PAM Partisipatif, which aims to have fishermen act as volunteer patrols of a sort while out fishing. This meeting helped us gain access to the head of BTNK, which ultimately enabled us to be able to secure an interview with him at the park's head office in Semarang. The meeting also proved fruitful in allowing us to assess the park management's relation with the community and to directly observe management approaches employed by BTNK. Furthermore, this gave us a representation of BTNK's awareness raising techniques aimed at community representatives in relation to conservation and other park objectives such as tourism development.

These qualitative research methods permitted us to obtain a better understanding of the attitudes and perceptions of interviewees towards the themes raised by the research questions and to gain an accurate perspective of the dynamics within KNP that would have remained unclear if only quantitative methods would have been used. The semi-structured approach was beneficial in providing respondents with a certain degree of flexibility in their answers and provided the opportunity to explore unforeseen yet pertinent lines of questioning that helped us meet our research objectives.

Secondary data was obtained through visits to several governmental offices in the sub-district of Karimunjawa, as well as in the city of Jepara, the capital of the Jepara regency, in Semarang, the provincial capital of Central Java, and in Jakarta, the national capitol of Indonesia. Demographic and socioeconomic data was gathered from the sub-district administrative office in Karimunjawa. The sub-district office of the Department of Transportation (*Dinas Perhubungan*) was visited for data relevant to local port traffic, as well as the sub-district, regency, provincial and national offices of the Department of

Marine Affaires and Fisheries (*Dinas Kelautan dan Perikanan – Dislautkan*) in Karimunjawa, Jepara, Semarang and Jakarta respectively. The Dislautkan offices provided profiles of local, regional and national fishing sectors, with data showing trends in the condition of the fishery at all levels. Other secondary data pertaining to tourism and population growth was gathered from the regency offices of the Department of Tourism (*Dinas Pariwisata*) and the Department of Population and Civil Registration (*Dinas Kependudukan Dan Pencatatan Sipil*) in Jepara. We also visited the Semarang offices of the Karimunjawa National Park Authority (*Balai Taman Nasional Karimunjawa – BTNK*) and of the Ministry of Forestry (*Kementerian Kehutanan*) for statistical data on KNP and were provided with park management reports. Additionally, the office of the Director General of Marine, Coast and Small Islands (*Direktorat Jenderal Kelautan, Pesisir dan Pulau Pulau Kecil*) [15] in Jakarta provided descriptive data on the Karimunjawa archipelago. The offices of the Wildlife Conservation Society (WCS), the NGO acting in collaboration with BTNK towards KNP planning and management, provided valuable ecological, socioeconomic and managerial reports as well as other data relevant to our research.

Both primary and secondary data were used in an attempt to cover the full range of information needed for us to meet our research objectives. Management plans from BTNK helped us assess the management approach of the park and, when combined with our direct observations, gain an accurate representation of how those plans are translated into reality. Secondary data from the WCS and BTNK reports provided a detailed picture of socioeconomic conditions before the revamped management plan of KNP took effect and served as a valuable point of reference when comparing to primary data obtained during our fieldwork. Included in some of these socioeconomic reports, was data pertaining to people's attitudes and perceptions about conservation, the fishery and park regulation. Such data help our analysis of the evolving environmental subjectivities of park residents when compared to our primary data.

[15] See Appendix 3 for a translated list of all Indonesian offices.

3 Marine Exploitation in Indonesia: National to Local Scales

> 'There has always existed a paradox and tension between the two arms of fisheries policy, increasing efficiency and regulating the catch' (Allison and Ellis 2001: 382).

Fisheries development in southern countries has had a rocky history. The goals set by fisheries development programs have been described as "antagonistic" and "paradoxical" due to the fact that historically there have been instances where goals brought forward in a single program have been mutually exclusive (Allison and Ellis 2001; Bailey and Jentoft 1990). For example, on the one hand, modernization programs have focused on improving fishing gear efficiency in the hopes of improving fishermen's catches and incomes. On the other hand, fishery policy has often tried to regulate fish catches due to the overexploitation of fish stocks incurred by highly efficient fishing fleets. Furthermore, this overexploitation can obviously have adverse effects on fishermen's livelihoods due to the fact that if the same number of fishermen exploit a given fish stock with increasingly efficient gears, the overexploitation of that fish stock will eventually reduce catch sizes for individual fishermen, thereby reducing their incomes (Allison and Ellis 2001). Another example of antagonistic goals often found in fisheries development programs is the attempt to modernize fishing equipment all the while increasing the levels of employment. This proves problematic because large-scale fishing units with increased technological power, such as trawlers, can harvest with a crew of five the equivalent of what a crew of 50 would harvest using small-scale gear (Bailey and Jentoft 1990). As we will see in this chapter, fisheries development in Indonesia has had its fair share of such antagonistic goals, which has led to several problems such as overfishing and increased hostility between large- and small-scale fishermen.

3.1 Fisheries Development in Indonesia

With the sea making up approximately two thirds of its total territory, Indonesia's fishery resource is extremely important and some would argue its most important, even taking primacy above both oil and gas (Bailey 1988). In an effort to take advantage of

this significant resource, Indonesia has implemented over the past few decades a series of policies that has aimed to develop its fisheries sector into a modern and capital-intensive industry (Bailey 1988). The importance of the fisheries sector towards national welfare, from an economic and a food security perspective, is often highlighted in the literature as justification for such policy decisions (Bailey 1988; Bailey *et al.* 1987; Bailey and Jentoft 1990; Crawford 2009). For example, according to recent figures, Indonesian fish and seafood exports in 2008 had an estimated value of over 2.5 billion USD[16] and fishing provided employment for over 2.5 million Indonesians[17]. Estimates from 1990 have valued coastal resources and activities at 24% of Indonesia's Gross Domestic Product, providing employment to approximately 14 million people (Crawford 2009 citing; Hotta and Dutton 1995). Furthermore, the FAO estimates that Indonesians derive approximately 52% of their total animal protein intake from fish and seafood products[18]. The expansion of Indonesia's fishing industry into its current state, which is for the most part industrialized, especially on Java's northern coast, can be attributed to various policy decisions during the past few decades that have enabled strong investment into the sector. During the 1950s and 1960s, fisheries development programs in Indonesia typically focused on 'gear and vessel improvements as the primary means of increasing marine landings and improving incomes' (Bailey *et al.* 1987: 89) among the large number of people employed in the fisheries sector. As we will see later on, this push towards modernization has often come at the expense of small-scale fishermen, not to mention the marine ecosystem (Bailey *et al.* 1987; Bailey and Jentoft 1990). However, before tackling those subjects, a brief history of the development of the fisheries sector will be drawn by highlighting a few key events.

3.1.1 The Push Towards Modernization

During the past few decades, the Directorate General of Fisheries (DGF) has launched a Blue Revolution in parallel to the Ministry's Green Revolution in which attention was given to introducing powerful new fishing technologies along with major

[16] FAO, 2011.

[17] Department of Marine Affairs and Fishery, Jakarta, 2010. - This total of 2.5 million solely takes into account the number of capture fishermen and does not include employment from associated fields such as fish processing, distribution and marketing.

[18] FAO, 2011.

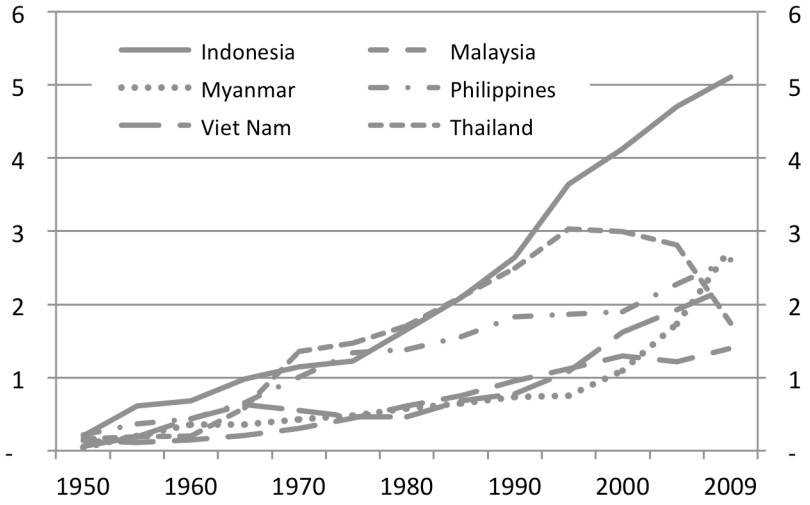
infrastructural improvements that would enable the development of a "modern" fisheries sector. Some of these improvements included the introduction of subsidized credit programs and port development projects as well as research on how to optimize both fishing vessel and gear designs (Bailey 1988). Along with these efforts, the DGF has put major emphasis towards developing an export-oriented fishing industry, which has favoured investments by external development assistance agencies. Two important laws that sparked these outside investments and began the industrialization of the Indonesian fishing industry were the Foreign Capital Investment Law of 1967 and the Domestic Capital Investment Law of 1968 that were enacted shortly after Suharto took power (Butcher 2004). The foreign capital investment law provided tax holidays to foreign companies and enabled duty-free importation of equipment. The domestic capital investment law provided similar privileges to Indonesian companies. Furthermore, in order to benefit from these laws, fishing companies had to agree to set up processing and storage facilities in addition to building and operating fishing boats within Indonesia. Shortly after in 1969, a stipulation was added to the foreign capital investment law that required foreign companies to enter into joint ventures with Indonesian companies in order to be able to fish within Indonesian waters, a requirement that had not previously existed (Butcher 2004; FAO 2006).

As a result of the various policy decisions mentioned above, the development of the Indonesian fisheries sector has seen an extremely rapid growth since the 1960s. Just as the policy makers intended, this growth was initially spurred by sources of capital and expertise from outside Southeast Asia (Pauly and Chua 1988). The earliest examples of capital-intensive investments in the Indonesian fisheries sector came between 1967 and 1971 when Japanese fishing companies, responding to high demand for shrimp in Japan (FAO 2006), funded about 10 joint ventures that began operating shrimp trawlers in the Straights of Malacca, in the waters off Kalimantan and in the Arafura Sea (Bailey *et al.* 1987; Butcher 2004; DGF 2001; FAO 2006). This rapid development of a large trawl industry marked a significant change in Indonesian fishing industry (FAO 2006). Up until then, although the number of motorized boats had increased by a factor of thirty between 1951 and 1967, these had remained relatively small in size and stayed close to shore when compared to larger commercial trawlers (Butcher 2004). By the end of 1976, a total

of US$46 million in foreign investments had been made in the shrimp fishery and 51 cold storage facilities had been built (FAO 2006). As for the tuna fishery, investments in the 1970s totalling US$59 million helped establish parastatal fishing enterprises that aimed to exploit this valuable catch. This initial capital was raised with the help of several outside lenders, which included the Asian Development Bank (ADB), the World Bank, and the Japanese government (Bailey and Jentoft 1990). Another significant investment included the establishment of a credit program by the World Bank aimed towards the construction of new trawlers in addition to the improvement of fishing ports, cold storage facilities, and other infrastructure important in supporting trawlers and purse seiners. Lastly, a school established by the FAO aimed at providing training for captains, mechanics, and gear specialists; positions that would need to be filled in order to support such a fast growing fishing industry. In total, US$207.3 million was invested in the Indonesian fisheries sector between 1974 and 1983, with nearly half provided by the ADB. Furthermore, a total of US$64.5 million of foreign investment, coming primarily from the Japanese, was spent on the establishment of joint venture corporations with Indonesian partners (Bailey 1988).

As we can see in Figure 4, the industrialization of Indonesia's fishing fleets drastically increased the yearly capture totals during the last 6 decades. Between 1950

Figure 4: Southeast Asian Total Capture Production for 1950 – 2008 (million tons)



Source data: FAO, 2011

and 2009 there has been a strong 25-fold increase in fish and seafood capture production based on data from the FAO. Indonesia is by far the leader in capture production among other Southeast Asian countries, with Myanmar and the Philippines coming in 2nd and 3rd respectively, and each producing only about half of Indonesia's total.

3.1.2 The Trouble with a "Modern" Fishery

At this point, it would be useful to reiterate that the broad goals of marine fisheries development programs in Indonesia were to increase fish catch production in a sustainable manner and to improve 'the incomes and standards of living of those employed in this sector, especially small-scale fishermen' (Bailey *et al.* 1987: 95). As we have seen in the above section, Indonesia's push to develop its fishery has certainly seen success from the point of view of increased marine landings, however, most would argue that this has been done in an unsustainable manner (a topic that we will return to this in the following section). Furthermore, the latter goal of increasing the welfare of the marine and fisheries community has not been so successful, with most small-scale fishermen, who represent the overwhelming majority of those employed in the fisheries sector, not having equal access to technical programs as opposed to their larger-scale counterparts (Bailey *et al.* 1987).

As Bailey (1988) poignantly brings to our attention, as with any period of rapid technological and structural change, the benefits of Indonesia's push towards a modernized fishery were not equally shared. He draws our attention to how this situation was partly analogous to Indonesia's Green Revolution, where some, such as smaller household farms, benefited very little from the increased productivity. As in the green revolution, the blue revolution suffered many setbacks that hindered goals of poverty reduction and increased inequalities between those with and those without. However, what Bailey fails to mention is that the reasons for the apparent exacerbation of inequalities between large- and small-scale producers differ between the green and blue revolutions. As De Koninck (1979) points out, the rapid introduction of new agricultural technologies during the green revolution in Malaysia and Indonesia, which were meant to help eradicate poverty, actually furthered the pauperization of peasant farmers more than it helped lift them out of poverty. These inequalities resulting from green revolution

policies were shown not to have been caused by the lack of access to advanced technologies by small-scale farmers, but rather unequal development between small- and large-scale farmers after the introduction of these new technological improvement packages. This differs from Indonesia's blue revolution in that one of the main factors that increased inequalities between large- and small-scale fishermen was access to funding through the various modernization programs of the late 1960s through the 1980s. In fact, small-scale fishers were essentially excluded from the development programs as a mere US$10 million from international agencies was devoted towards the small-scale subsector out of the hundreds of millions invested in the Indonesian fisheries sector (Bailey 1988). Despite this key difference, parallels could also be drawn between the negative environmental impacts of both the Green and Blue revolutions when we consider the massive deforestation resulting from the former due to agricultural expansion[19] (De Koninck 2003) and the widespread depletion of marine resources resulting from the latter due to overfishing.

The unequal funding between the large- and small-scale fisheries subsectors had a profound impact on the day-to-day fishing activities of small-scale fishermen. The emerging inequalities between these two groups helped create what Bailey (1988) named a "dualistic industry structure" within the Indonesian marine capture fisheries, in which small-scale producers were progressively marginalized by large-scale fishing units such as trawlers and purse seiners. Although small-scale fishermen had begun taking advantage of new technologies such as outboard motors and nylon netting since the 1960s, these improvements were not sufficient in increasing catches among this group mainly due to the increased pressure on fish stocks caused by the industrialized fishing fleets (Bailey 1988). The overexploitation of marine resources by trawlers and other large-scale producers led to decreased landings and in turn reduced the incomes and standards of living of small-scale fishermen who possessed relatively limited fishing power (Bailey *et al.* 1987; Bailey and Jentoft 1990; Pauly 1988a). What further aggravated this problem were the fundamental differences in motivation between the two

[19] Although logging is also responsible for deforestation, both industrial logging and agricultural expansion often act in tandem, with the latter often accompanying or following the former. In the late 1990s, massive agricultural expansion seemed to be the main cause of deforestation in some areas of Indonesia. For more on this issue, see Antlöv and Cederroth (1994) and De Koninck (2003).

classes of fishermen. Small-scale fishermen who operated primarily within coastal waters that constituted their traditional fishing grounds mainly caught fish for subsistence or for sale in local markets. However, large-scale producers, who are described as profit seeking, commercially oriented entrepreneurs, have the sole motivation of capital gain, and therefore their main focus is to increase productivity in order to sell to international markets. As the large-scale fishing fleets inevitably encroached within the traditional fishing grounds of the small-scale fishermen, this led to a situation that strongly resembled Hardin's classic notion of the "Tragedy of the Commons" (Bailey 1988).

The direct, and safe to say unfair, competition between small- and large-scale fishers, led to increased tensions between both groups and often escalated into direct conflicts. Along the north and south coasts of Java and in the Malacca Straits, outbreaks of violence were occasionally sparked by the frequent destruction of small-scale gear by trawlers (Bailey *et al.* 1987). The conflicts that emerged as a result of the inequalities between these two segments of the industry is well documented in the literature pertaining to fisheries development in Indonesia (Bailey 1988; Bailey *et al.* 1987; Bailey and Jentoft 1990; FAO 2006; Pauly 1988a; Semedi 2003). Between 1964 and 1976, clashes between trawlers and small-scale inshore fishermen resulted in a total of 62 vessels sunk and 34 fishermen killed according to official records (FAO 2006). Unfortunately, these conflicts are not restricted to the past as conflicts resulting in violence can still be found in modern Southeast Asian fisheries. Recent conflicts aren't solely confined to small-scale fishermen pitted against large-scale operations. Another factor responsible for causing conflict is the general depletion of resources that cause many fishermen, no matter their size, to enter in intense competition with one another over dwindling fish stocks. That being said, the monopolization of marine resources by modern fishing fleets is still a key factor in modern conflicts (Pomeroy *et al.* 2007).

In addition to small-scale fishermen receiving a disproportionally small share of fishery resources as the result of unequal competition with large-scale operations, the livelihood strategies of small-scale fishermen were also negatively affected by the modernization of the fishing industry. Seasonal or part time fishermen that depended on various sources of income in the context of a diversified livelihood strategy, were forced to engage in fishing full time, thereby cutting off other potential sources of income during

off seasons. Modernization policies essentially forced part-time or seasonal fishermen into becoming full-time operators in order to repay loans and to earn an adequate return on investments (Allison and Ellis 2001).

The increased efficiency of fishing gears brought about by the industrialization of Indonesia's fishing fleets along with the increased number of fishermen over the past few decades has had a major impact on the condition of marine resources throughout the archipelago. The situation was further exacerbated in certain areas where demersal fish species suffered critical declines in abundance due to the common practice of dumping bycatch[20] by trawlers (FAO 2006).

3.2 Overfishing & Destructive Fishing in Indonesia

Overfishing and destructive fishing practices (DFPs) are major threats to the sustainable management of Indonesian fisheries and the costs of improper management can be significant. Attempts to quantify the combined costs to the Indonesian economy due to both overfishing and DFPs have put forth eye-opening numbers. Losses to the Indonesian fishery sector have been estimated at US$410,000/km^2 in an economic model proposed by Cesar (1996) for a period of 25 years. Assuming that this economic model is valid as well as representative of the entire archipelago, Edinger *et al.* (1998) has calculated that with its 75,000km^2 of coral reef area, Indonesia's economy would suffer a loss of US$30 billion over a period of 25 years due to coral reef degradation and overfishing.

3.2.1 Emptying the Reefs: Overfishing in Indonesia

Discussion in regards to the overexploitation of marine resources in Southeast Asia is nothing new. Pauly and Chua (1988) describe a few of the key factors that led to overfishing in the gulf of Thailand during the 1980s. Increases in the number of trawl fishing boats, both large and relatively small "baby trawlers", are pointed to as one of the main causes of marine resource depletion in the area. However, they also point to another

[20] FAO offer the following general definition for the term bycatch: "the accidental capture of any species, of any size or sex that is not specifically aimed at during fishing activity. Fishermen may aim at a mix of species. Bycatch, as a choice of the fisher, may be retained or discarded, and is mostly dead when discarded" (Valdemarsen 2012).

factor, which was the underlying cause of the overexploitation of marine resources. This factor being the attitude amongst Southeast Asian leaders of the period in which fish resources were believed to be infinite. Therefore, the general idea was that the best way to increase catches for both domestic consumption and export was to increase the number of trawlers and to turn non-motorized boats into motorized ones. This had a drastic impact on marine resources (particularly on shrimp stocks) in the Gulf of Thailand, where a six-fold reduction in catch rates (in kg per trawling hour) occurred between 1961 and the early 1980s (Pauly and Chua 1988) due to ecosystem overfishing (Pauly 1988b). It would seem that Indonesian policy makers also aligned themselves with this way of thinking. As Bailey (1988) explains, the policies concerning fisheries development, as described in the previous section, which promoted modernization and maximized exploitation of fishery resources, lead to problems of over-exploitation and to the concentration of fishing power into the hands of a relatively few people. This overfishing was in large part due to the overly ambitious goals set by the DGF. In its effort to attain a developed fishery, the DGF based its policy decisions on inaccurate assessments of the maximum sustainable yield (MSY) of Indonesia's fisheries. The problem of overexploitation caused by the DGF's inaccurate estimates of resource potential were further exacerbated by the fact that Indonesia's marine fisheries were being unevenly exploited, with some areas such as the Malacca Straight, the north coast of Java and the waters off South Sulawesi Province being exploited particularly heavily due to their location near major population centers (Bailey 1988). Recent estimates have estimated that the coral reef ecosystems of Indonesia, with over 2000 species of coral fish, have a maximum sustainable yield of 145,000 tons/year, of which 156,000 tons of fish are exploited annually (Djamali and Mubarak 1998 cited by; Mukminin *et al.* 2006). Based on these numbers, it can be said that 108% of the MSY for coral reef ecosystems are already being exploited. These figure only represent coral reef ecosystems, but the importance of these estimates become apparent when we consider that the vast majority of small-scale fishermen operate exclusively within these areas.

The depletion of marine resources in Indonesian waters is not exclusively attributed to the extensive scale of fishing power introduced during Indonesia's modernization push. As we have seen in the literature review, overfishing, in its many forms, is a

complex process that isn't solely determined by the total amount of fish being removed from a certain fishery, but also by the manner in which fish are caught and by what gears are used. Ward *et al.* (2001: 60-61), citing Auster *et al.* (1996); Collie *et al.* (1997); Dayton *et al.* (1995); Goñi (1998); Hutchings (1990); and Jones (1992) describe how trawling can negatively impacts benthic environments by 'crushing organisms, dislodging and scattering sessile organisms from their substrates (especially erect foliose and reef-building species), damaging their hard structures, damaging burrows or other refuges, exposing organisms to predators, resuspending sediments, and disturbing the fluxes of nutrients and other chemicals between the sediment and water column'. The extent of disturbance by trawling will vary among different species, but its impacts can easily cause mortality and injuries, not to mention stress and energetic costs that can decrease the longevity of affected organisms (Ward *et al.* 2001). The negative impacts of trawling certainly affected Indonesian fisheries as many areas where trawlers operated suffered declines in demersal fish abundance. One area strongly affected was the Arafura Sea, where the problem was worsened by the habit of dumping non-targeted (dead) fish back into the sea (FAO 2006). As Bailey (1988) explains, Indonesia's shallow coastal waters suffered important declines in fish stocks due to trawling. These shallow waters serve as nursery grounds for many commercially valuable fish species. As such, trawlers operating in these areas would catch large amounts of juvenile, sexually immature, fish, thereby altering the reproductive cycle of fish within that particular habitat (Bailey 1988). This form of overfishing, termed growth overfishing, is primarily caused by inappropriately small mesh sizes on nets used in a multispecies fishery and is a common problem in Southeast Asian coastal trawl fisheries (Pauly *et al.* 1989).

3.2.2 Scarring the Reefs: Destructive Fishing Practices in Indonesia

In what is far too common in overexploited coral reef fisheries, small-scale fishermen in Indonesia began using alternative, and destructive, fishing techniques in an effort to offset declining levels of income due to increasingly depleted fish stocks. This process, termed Malthusian overfishing (Pauly *et al.* 1989), spread rapidly throughout Indonesia as increasing numbers of fishermen became aware of the effectiveness of DFPs in producing large catches. The most common forms of DFPs in Indonesia are blast fishing,

cyanide fishing, *bubu* trap fishing, muro-ami and inshore trawling (Pet-Soede and Erdmann 1998), all of which have been practiced in Karimunjawa National Park at one point or another. Some DFPs, such as blast fishing, do indeed have very high catch rates when compared to traditional methods and in some studies blast fishermen have been shown to be able to catch in two days the equivalent of what normal fishermen would catch in twenty (Andersson and Ngazi 1995). With such strong incentives, it is not surprising that blast fishing has spread significantly within certain segments of the Indonesian fisheries sector and is still considered a major threat to the coral reefs of the archipelago despite strong efforts by NGOs in raising awareness about its negative effects on the long term health of coral reef fisheries. As we have seen, blast fishing is generally considered as the most destructive of all other DFPs, and unfortunately for Indonesian coral reefs ecosystems, is widely practiced throughout the archipelago despite being illegal (Pet-Soede and Erdmann 1998). Although blast fishing counts as one of the major threats to Indonesian coastal ecosystems as far as DFPs are concerned, in Karimunjawa it is much less of an issue. It has been abandoned during the 1990s even before MPA implementation through a consensus about its detrimental effects. However, all other DFPs mentioned in the following sections have continued to be used throughout the park until very recently.

3.2.2.1 Blast Fishing

Blast fishing was first introduced in Indonesia by the Dutch army in the first half of the 20th century during the colonial era, however its use remained very limited due to strict rules enforced by the colonial authority (Chozin 2008). During WWII, its use was greatly extended during the Japanese occupation, as the Japanese military resorted to fishing with hand grenades and other munitions in order to feed its soldiers (Cesar 1996; Chozin 2008; Pet-Soede and Erdmann 1998). The Japanese are therefore usually given credit, if you can call it that, for having introduced blast fishing to many regions throughout the Indonesian archipelago. From then on, blast fishing became increasingly popular amongst fishermen throughout Indonesia as dwindling resources forced them to look for methods that would improve their catches.

Initially, fishermen used explosive materials originating from leftover WWII munitions in order to build their bombs. Other sources for explosives included dynamite from international developmental civil engineering projects, however recently most bombs are fabricated with chemical fertilizers, namely ammonium or potassium nitrate (Cesar 1996; Pet-Soede and Erdmann 1998). Various methods of fabrication are used, but most methods include filling empty glass bottles with ammonium/potassium nitrate and kerosene (Fox and Erdmann 2000; McManus *et al.* 1997; Pet-Soede *et al.* 1999). The costs for making bombs are negligible when compared to the value of the catch.

The practice involves throwing a bomb into the water where it will reach the coral reef at the bottom and explode. After the explosion, fishermen enter the water, by either free-diving or with the help of a hookah compressor[21], to collect the killed or stunned fish. Blast fishing quickly became one of the biggest threats to Indonesian coral reefs, with several different types of blast fishing groups operating at different scales: small, medium and large (Pet-Soede *et al.* 1999; Pet-Soede and Erdmann 1998). The common thread between these groups is that they all resort to using homemade bombs in order to capture fish, however differences in vessel size, length of trips, distance traveled, number of crew and amount of fish caught differentiate these groups from one an other. Small-scale operations use simple 4 m long wooden canoes, typically outfitted with small outboard engines. Their reach is limited to sites close to their home islands and to sites no deeper than 10-12 m because they must free dive with a mask or goggles in order to retrieve the fish. They mostly operate within the same small area during extended periods of time, meaning that the coral reefs near the villages of small-scale blast fishermen are highly damaged (Pet-Soede *et al.* 1999). Medium-scale operations typically use small boats of 8-10 m in length and have a maximum of five crewmembers. These boats travel further than their small-scale counterparts on daylong trips in order to find reefs not yet heavily damaged and use hookah compressors to collect fish up to depths of 40 m. Large-scale operations also use hookah compressors to collect fish but travel much greater distances in order to find reefs near uninhabited islands with higher yields when compared to the heavily damaged reefs near their homes. Able to travel several hundred

[21] A hookah compressor is an air compressor commonly used for surface-supplied diving in Southeast Asia. The hookah compressor is run from a boat and supplies air to one or several divers via hose.

kilometers from their origin during weeklong trips, large-scale blast fishing operations use boats that are 10-15 m in length with a crew of 15-20 men. The fish are stored on ice until sold. Average small-scale operations detonate 1-3 bombs per day, while large-scale fishermen who are out to sea for long periods will detonate an average of 50 bombs over the course of a week (Pet-Soede *et al.* 1999). Most of the information concerning blast-fishing practices dates from the 1990s with very few in-depth studies on the subject having been done since. During one of our interviews with a BTNK official, they mentioned that the operations of blast fishermen had been severely affected by stricter regulations concerning the purchase of bomb making material (i.e. underwater fuses) since the Bali bombings of 2002. However, to this day blast fishing remains a significant threat to the coral reefs of the region (Burke *et al.* 2011).

Blast fishermen typically target species of schooling reef fish such as fusiliers, surgeonfish, rabbitfish, and snappers. Other target species can include small pelagic fish such as jackfish and sardines (Pet-Soede and Erdmann 1998). The average catch per day varies greatly between small-, medium-, and large-scale operations, with each hauling approximately 8 kg, 75 kg and 200 kg per day respectively (Pet-Soede *et al.* 1999). Other studies have documented catches of up to 75.3kg per blast (Fox and Erdmann 2000). As we have already alluded to, blast fishing can be very profitable when compared to other professions. Crewmembers and boat owners of medium- and large-scale blast fishing operations can earn US$197 and US$1100 respectively per week; much more than other non-blast fishermen and more than most government officials (Pet-Soede *et al.* 1999; Pet-Soede and Erdmann 1998). In fact, contemporary blast fishermen in Indonesia are considered to be mostly driven by greed rather by need (Pet-Soede and Erdmann 1998), with most of them stating that they do it “to earn money the easy way” (Pet-Soede *et al.* 1999). Since the majority of blast fishermen operate at sites distant from their areas of origin, they do not have to deal with the repercussions of their actions.

The effects of blast fishing on marine and coral reef ecosystems are dramatic. This practice not only kills targeted fish species, but all fish within a blast radius of 1-2 m. The resulting shock wave can be lethal up to a distance of 20 m for fish that are more

vulnerable[22] to abrupt changes in pressure (Saila *et al.* 1993). An explosion from a typical bomb creates a crater with a diameter of 1-2 m (McManus *et al.* 1997; Saila *et al.* 1993), in which all coral structures are shattered and turned to rubble. This in turn creates areas of unstable coral rubble where the survival rates of coral recruits are greatly reduced (Fox and Caldwell 2006; Fox *et al.* 2003). Anthropogenic mechanical damage to the coral reef, such as damage caused by blast fishing, has been shown to produce a 50% reduction of coral diversity in affected areas when compared to other reefs in the same region (Edinger *et al.* 1998). Furthermore, several studies have confirmed that live coral cover and habitat complexity is strongly correlated with fish diversity and abundance (Edinger *et al.* 1998). Since coral reef fisheries are so highly dependent on the quality and abundance of coral reefs, this type of destruction has a direct effect on fishermen operating in these areas and produces uncertainty for the future of affected fisheries. The economic effects on coral reef fisheries due to habitat destruction caused by blast fishing has been estimated to cost US$306,800/km^2 of coral cover over a period of 20 years in high potential areas (Pet-Soede *et al.* 1999).

What makes things worse is that very long periods of time are required in order for these affected areas to recover (Saila *et al.* 1993), ranging between 5-10 years for single blasts isolated within a reef matrix to several decades, or even centuries, in areas where repeated blasting has occurred (Fox and Caldwell 2006). Recovery is made even more difficult due to the fact that coral reefs, after being blasted, will be less resilient against environmental perturbations such as storms and global warming (Fox and Caldwell 2006; McManus *et al.* 1997). Rehabilitation techniques are possible for reefs damaged by blast fishing, but restoration methods tend to be very expensive, ranging from US$13,000 to more than US$100 million/ha (Spurgeon and Lindahl 2000).

3.2.2.2 Cyanide fishing

Another destructive fishing method that is widely practiced throughout Indonesia is cyanide fishing. This practice involves the use of poisons that shock coral reef organisms

[22] There are three categories in which fish fall under when comparing their vulnerability to shock waves from subsurface explosions: non-swim bladder fish, physostomous fish with open swim bladders connected to the alimentary canal, and physoclistous fish with closed swim bladder. Physoclistous fish are the most vulnerable because their closed swim bladders are more susceptible to rupturing from the negative pressure caused by a subsurface explosion, while non-swim bladder fish are the most resistant (Saila *et al.* 1993).

for live capture. Fish caught by this method are usually destined for the live fish trade, which includes markets for ornamental fish, live reef food fish[23] and rock lobsters. The majority of organisms caught by cyanide fishing in Indonesia are transported by Live Fish Transport Vessel (LFTV) to export markets in Hong Kong. The live fish food trade is the fishery most responsible for the prevalence of cyanide fishing in Indonesia (Pet-Soede and Erdmann 1998). This DFP was very present in Karimunjawa National Park, however its use has been greatly reduced according to MPA officials.

There are no clear accounts of when and how cyanide fishing was first introduced in Indonesia, but we do know that as early as 1962, fishermen in some areas of the Philippines were using sodium cyanide to capture ornamental fish (McAllister *et al.* 1999). Afterwards, the practice spread from there to Indonesia, where it remained little talked about until a campaign spearheaded by The Nature Conservancy began raising awareness about the extent of the live reef fish trade problem in the mid-1990s (McAllister *et al.* 1999). Total export volumes of wild-caught living fish from Indonesia in 1995 are estimated to range from 1003 metric tons (official figures) to 6000-9000 metric tons (estimated figures) (Erdman and Pet-Soede 1996; Pet-Soede and Erdmann 1998). These figures are admittedly very "elusive" (Erdman and Pet-Soede 1996) and precise estimates are complicated by "rampant under-reporting of volumes for tax purposes and by potentially large volumes of fish that are caught and exported illegally by foreign LFTV's" (Pet-Soede and Erdmann 1998: 30). However, these estimates help give us a general idea of the extent of cyanide fishing during that period.

Cyanide fishing involves diving down to the coral reef, often with the assistance of a hookah compressor, and using squirt bottles to apply poison to a target fish or its dwelling among the corals (McManus 1997; Pet-Soede and Erdmann 1998). After the fish has been anaesthetized by the cyanide solution, it is removed from its refuge in the reef framework, often by breaking the surrounding coral (Pet-Soede and Erdmann 1998).

[23] The most common live reef food fish are groupers and Napoleon wrasses (Saila *et al.* 1993). The live reef food fish trade is fuelled by very high demand from foreign markets, most notably from the urban centers of Hong Kong, Singapore and Taiwan. Clients are able to choose their fish from restaurant aquariums just moments before eating. The high prices associated with these fish are derived not only from their freshness and taste, but also from their alleged virility-enhancing and health-promoting qualities (Pet-Soede and Erdmann 1998).

It has been suggested that plant poisons were used for fishing in the Philippines before the introduction of cyanide-based solutions (Galvez *et al.* 1989; McAllister *et al.* 1999). McManus *et al.* (1997) also point out that fishermen in the Philippines have been known to use poisons from a variety of leaves, roots and berries, as well as bleach and insecticides. Cyanide based solutions however, have become the most widely used poison, which is why, not surprisingly, the practice is most commonly referred to as cyanide fishing. The two distinct cyanide chemicals used are sodium cyanide (NaCN) and potassium cyanide (KCN) (McAllister *et al.* 1999; McManus *et al.* 1997). Of the two, sodium cyanide is most commonly used for fishing in Indonesia (Pet-Soede and Erdmann 1998).

Similar to blast fishing, cyanide fishermen operate at different scales. Large-scale operations have up to 20 crewmembers and can remain at sea for up to one month while working in mostly remote and pristine areas. Medium-scale operations, of up to five crew on three-day trips, and small-scale, single manned operations tend to work near their areas of origin, more often than not near densely populated areas with highly exploited reefs (Pet and Pet-Soede 1999). As with most other DFPs, cyanide fishing can prove to be very profitable for those involved and can be extremely lucrative when certain species are caught. For example, (Erdman and Pet-Soede 1996) report that some high value species, such as the Napoleon wrasse, can sell for over US$5,000 and that the lips alone can be worth up to US$245. Obviously, such prestigious fish are not the only targets of cyanide fishermen. Other commonly caught species include 'rock cod and groupers (Epinephelus spp.), coral trout (primarily *Plectropomus* spp., but also *Cephalopholis* and *Variola* spp.), barramundi cod *(Cromileptes altivelis)* and the Napoleon wrasse *(Cheilinus undulatus)*. Non-reef species such as the sea bass *(Lates calcarifer)* are also part of this trade' (Erdman and Pet-Soede 1996: 41). Large-scale operations are able to catch on average 2500 kg per trip, while medium- and small-scale operations catch on average 20 kg and 1 kg respectively. Net profits for those employed in the cyanide fishery can range from US$ 100, US$ 413 and US$ 35,000 for small-, medium- and large-scale boat owners, to US$ 100, US$ 252, US$ 400 for small-, medium- and large-scale crewmembers (Pet and Pet-Soede 1999).

The harmful effects caused by cyanide fishing are twofold. First of all, the coral reef itself can sustain heavy damage due to the breaking of coral that takes place when fishermen collect anaesthetized fish. It is possible for an area of coral measuring one square meter to be destroyed in order to remove a single grouper from hiding (Pet and Pet-Soede 1999). Also, the cyanide solution applied near and on the reef has been shown to be lethal for hard corals (Pet-Soede and Erdmann 1998) and can prevent new coral recruits from successfully settling if continued poisonings occur (Pet and Pet-Soede 1999). Secondly, ecosystem dynamics can be severely modified through the eradication of keystone species such as the grouper and Napoleon wrasse. A common tactic employed by cyanide fishermen is to seek out specific spawning aggregation sites, where groupers and Napoleon wrasse migrate from many miles to reproduce. When a single aggregation site is wiped out, the resulting consequence will be the elimination of top predators for several square miles of reef (Pet and Pet-Soede 1999). Furthermore, many small fish and mobile reef invertebrates with no market value fall victim to the crossfire when cyanide is used to capture large reef fish (Pet-Soede and Erdmann 1998).

3.2.2.3 Trap Fishing (*Bubu*)

Trap fishing is a traditional fishing technique that is widely practiced throughout Indonesia (Pet-Soede and Erdmann 1998) as well as in Karimunjawa. *Bubu* traps were already being used well before the modernization of Indonesian fisheries, and as opposed to the other DFPs mentioned here, are based on traditional technologies. Although *bubu* fishing differs somewhat from our typical conception of DFPs that use modern technologies (chemicals, gears, etc.), it can nonetheless be categorized as a DFP, albeit a less important one in most regions of the country, for reasons that we shall see.

There are several variations of *bubu* traps, yet most of them are built from bamboo and they are all based on the same design concept[24] that enables fish to easily swim into the trap, but not out. By themselves, *bubu* traps are not considered destructive, however the process off setting the traps into place on or next to the reef can easily break branching and foliose corals (Pet-Soede and Erdmann 1998). This destruction happens as the traps are lowered from the boat for installation and lifted back into the boat after some

[24] Examples of bubu traps can be found in Appendix 2.

time to collect the catch. Of these two steps, the most destructive to coral reefs is when the traps are pulled back up from the bottom as they often shift with the currents and can easily become entangled with the coral reef structure. When this happens, fishermen will typically pull on the rope until the coral breaks to let loose the entangled trap or rope. Some fishermen have been known to use hookah compressors to set and retrieve traps. This generally causes less damage as the traps can be installed more precisely in order to avoid damaging the corals. However, using hookah diving for *bubu* fishing, while better for the reefs, can have severe health consequences for the divers[25] and is strongly discouraged by MPA management. Some fishermen use cyanide-tainted bait, which anaesthetizes the fish and prevents self-inflicted damage. This method is common for fish destined for the live fish trade (Pet-Soede and Erdmann 1998).

3.2.2.4 Muro-Ami

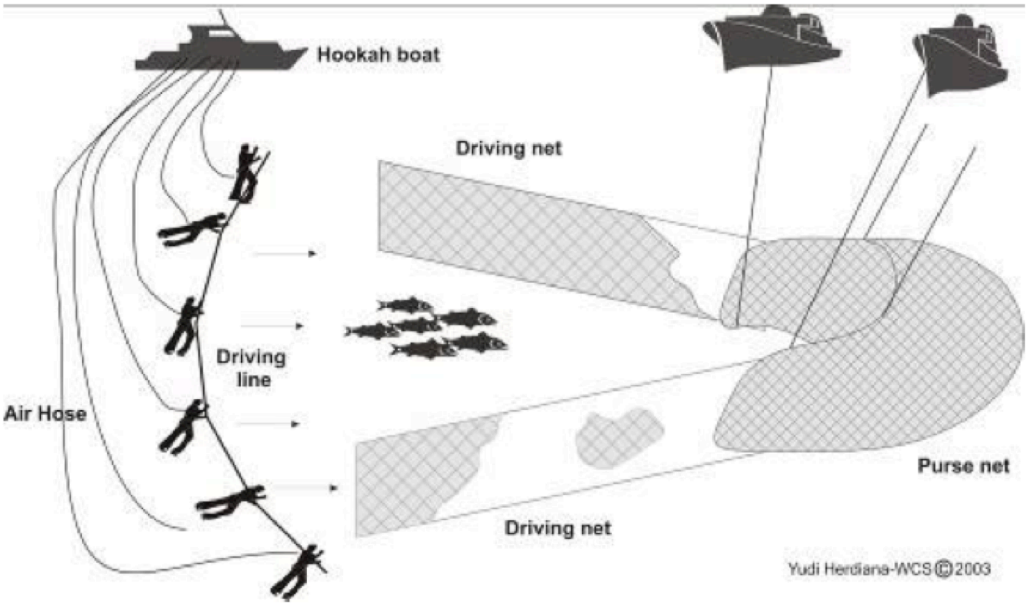
Muro-ami, while only observed in a few areas of Indonesia (Pet-Soede and Erdmann 1998), was a common destructive fishing practice in Karimunjawa and was one of the main focuses for park management early after the MPA introduced new zoning guidelines. First developed in Japan, muro-ami was first introduced to the Philippines in the 1930s (Marnane *et al.* 2003). It isn't clear when the practice transferred into Indonesia, however we do know that it made its first appearance in Karimunjawa in the early 1990s (Marnane *et al.* 2004).

Muro-ami (Figure 5) is categorized as a drive-in net fishing method, in which hookah divers form a "scare line" on the reef bottom and advance towards a large stationary purse seine in order to drive fish into it (Campbell and Pardede 2006; Marnane *et al.* 2003; Pet-Soede and Erdmann 1998). To form an effective scare line, fishermen will often stretch out a rope between them that has pieces of plastic tied at regular intervals and will rhythmically lift and drop the rope into the reef framework in order to scare the fish ahead (Pet-Soede and Erdmann 1998). In addition to the scare line, the fish are also forced forward by the wall of exhaled bubbles emanating from the hookah divers (Pet-

[25] Proper diving procedures are rarely followed and/or rarely known by small-scale fishermen using hookah compressors. As a result, divers commonly suffer from decompression sickness, which is generally caused by ascending too fast from depths and not waiting long enough between dives. Most commonly this will cause pain in the joints, but in severe cases can cause neurological damage and even death.

Soede and Erdmann 1998). Some operations also bang on the reef with hollow metal pipes (Pet-Soede and Erdmann 1998) or use metal rings (Marnane *et al.* 2003) in order to frighten the fish into the net.

Figure 5: Muro-ami fishing operation in Karimunjawa



Source: Dirhamsyah (2006)

The main target family of muro-ami fishing is caesionidae, more specifically, in Karimunjawa, the species of yellow fusilier (Marnane *et al.* 2003; Pet-Soede and Erdmann 1998). Muro-ami is characterized by having very large catch rates per unit effort, however a large amount of capital is required to mount a muro-ami fishing operation (Marnane *et al.* 2003).

Muro-ami incurs direct damage to the coral reef in several ways. Firstly, as the fishermen dive down to the bottom of the reef to setup the net, drive the fish, and haul the net, they not only swim, but also walk. As they walk during these processes, their footsteps on the reef cause damage to coral. Secondly, the rope used for the scare lines often becomes entangled with the reef and causes damage as the fishermen pull on the rope to untangle it. Thirdly, the hollow metal pipes and metal rings that are banged on the reef in order to frighten the fish often cause damage to coral. Finally, the net itself can cause damage to the coral as it becomes entangled into the reef (Marnane *et al.* 2003).

During the drive-in net process, a single diver will break an average of 11.4 cm^2 of coral for every 1 m^2. With 1 – 5 divers in a single muro-ami operation, the damage to the reef can be quite severe (Marnane *et al.* 2003).

3.3 Overfishing and Destructive Fishing in Karimunjawa

Being situated next to Indonesia's most populated island, Java, Karimunjawa's fishing grounds have for a long time been subject to strong fishing pressure not only from local small-scale fishermen, but also from non-local fishermen from the north coast of Java. Outside fishermen are attracted to Karimunjawa due the relatively healthy state of its coral reef fisheries when compared to the rest of the Java Sea. Although non-local fishermen and non-traditional fishing gears are technically prohibited within the waters of Karimunjawa National Park[26], they nonetheless manage to operate within park boundaries due to difficulties in enforcement. The exploitation of Karimunjawa's fishery resources, by both local and non-local fishermen, has had severe effects on its various fish stocks and has left its waters in a state of overexploitation. Furthermore, some destructive fishing practices have been adopted by certain segments of the Karimunjawa fishing community, further exacerbating the problem.

Karimunjawa fishermen use a variety of fishing gears. Table 3 shows some of the most common types of gears used along with their associated target fish.

Table 3: Common types of fishing gears used in Karimunjawa and associated target species

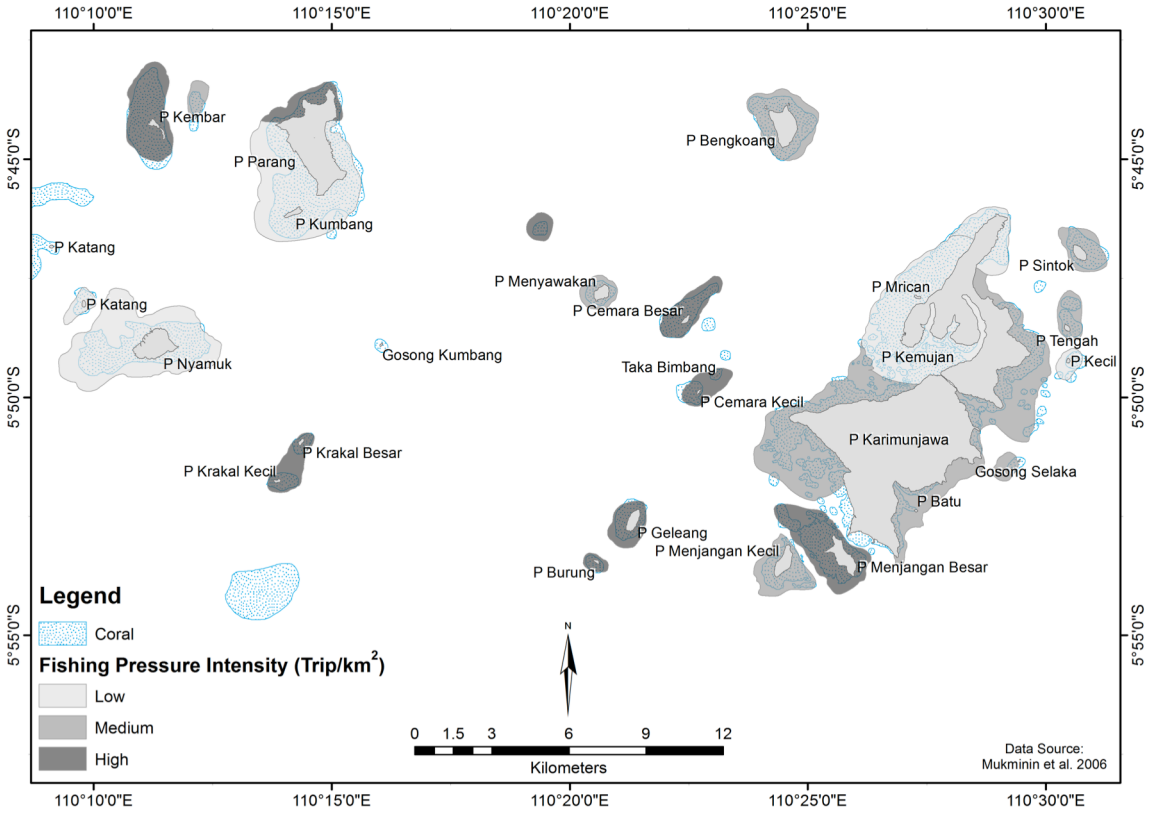
Gear type	Handspear	Muro-ami	Speargun	Lift net	Gillnet	Trap
Reef fish families	Scaridae	Caesionidae	Scaridae	Scaridae	Scaridae	Serranidae
	Mullidae	Scaridae	Haemulidae	Signidae	Lethrinidae	Caesionidae
	Serraniade	Lutjanidae	Mullidae	Lehtrinidae	Lutjanidae	Scaridae
	Acanthuridae	Acanthuridae	Lutjanidae	Mullidae	Serranidae	Haemulidae
	Lethrinidae	Lethrinidae	Lethrinidae	Caesionidae	Caesionidae	Lethrinidae
	Signidae	Signidae	Acanthuridae	Acanthruridae	Mullidae	Balistidae
Number of fishermen	1	18	1	5	3	3

Source: Adapted from Campbell and Pardede (2006)

[26] The topic of rules and regulations in Karimunjawa will be discussed in further detail in Chapter 4.

In a study by Campbell and Pardede (2006) examining the impacts of artisanal fishing gears on reef fish biomass in Karimunjawa, a negative correlation was found between fishing gears and most of their target species. Strong negative relationships were found between fishing pressure from all gears on Caesionidae (fusiliers) and Mullidae (goatfish) in particular. The map in Figure 6 shows fishing pressure in various locations throughout KNP between 2003-2005.

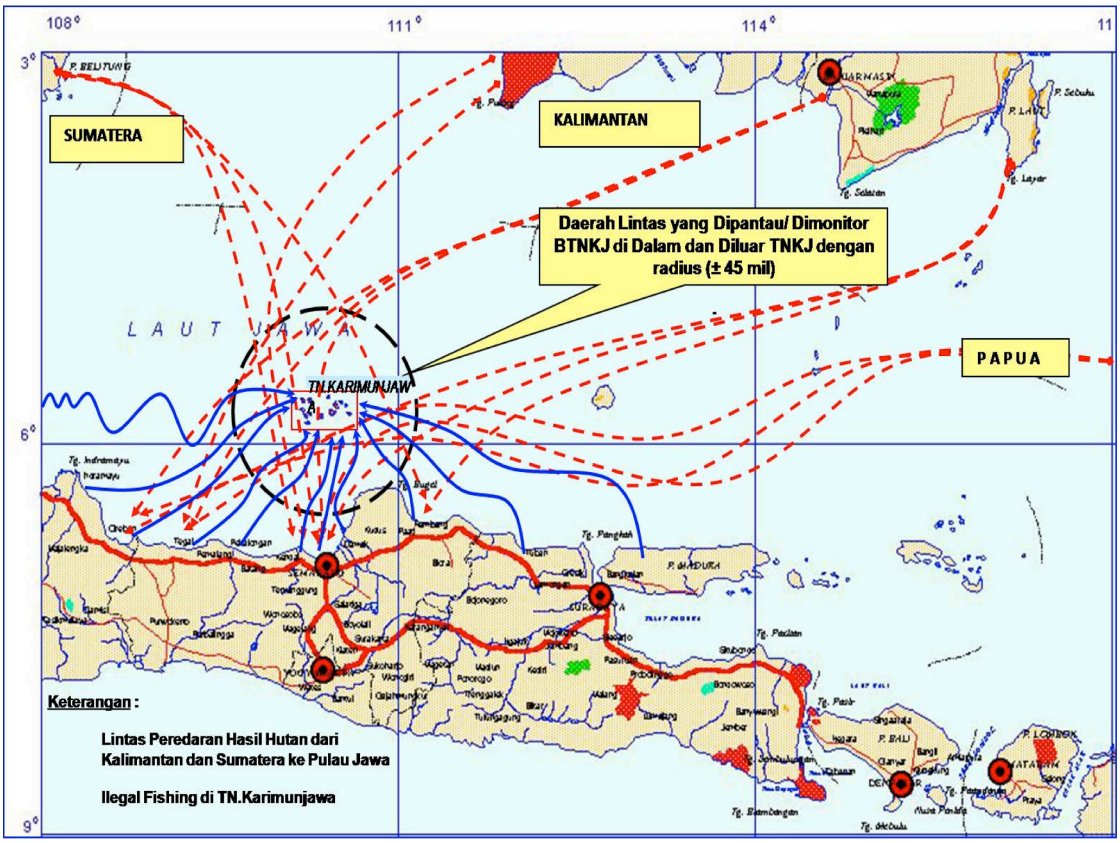
Figure 6: Map of fishing pressure for 2003-2005



Non-local fishermen, using non-traditional, large-scale fishing gears, are another reason for the depletion of fish stocks in Karimunjawa. In our interviews with local fishermen, non-local fishermen operating in and around KNP were often cited as one of the major threats to marine resources. Although the real impact of non-local fishermen is difficult to quantify due to a lack of data, KNP managers and officials agree that the presence of non-local fishing boats in Karimunjawa has severe detrimental effects on the

local fishery. It is precisely for this reason that BTNK, along with various other government bodies, continually carry out patrols in the attempt to keep non-local fishing boats out of KNP waters. The map below (Figure 7) illustrates well the extent of this problem. The solid lines in the map indicate the various areas from which non-local fishermen operating in Karimunjawa originate. Local Karimunjawa fishing fleets have remained strictly small-scale, using traditional fishing gears. However, non-local fishing boats mostly originate from areas on the northern coast of Java that have already seen their fishing fleets modernized. As a result, these non-local fishing boats possess significantly more fishing power when compared to local fishing boats and the resulting unequal competition between these two groups has been known to cause conflicts.

Figure 7: Fishing pressure from illegal non-local fishing boats



Source: BTNK, 2010

In a report by the Wildlife Conservation Society summarizing the ecological state of Karimunjawa's coral reefs, the authors state that the low number of predatory fish is a strong indication of overfishing in that region (Marnane *et al.* 2004). Furthermore, it is noted that the negative impacts to the fish population resources of Karimunjawa are chiefly due to fishing pressure (Marnane *et al.* 2004). The same report also suggests that the low densities of both clam and sea cucumber observed throughout the park 'indicate direct over-harvesting of these species' (Marnane *et al.* 2004: 36). A decline in the number of reef fish has also been observed in Karimunjawa by Widjatmoko and Putra (2003) and in their report mention that muro-ami has contributed to this decline. Mukminin *et al.* (2006) have also highlighted the role of muro-ami in decreasing the number of reef fish in Karimunjawa. In their report they mention that although muro-ami provides hundreds of jobs to fishermen who do not own boats, the benefits are relatively short term because muro-ami causes stocks of reef fish to decline very quickly (especially the redbelly yellowtail fusilier).

Muro-ami was first introduced to Karimunjawa in the early 1990s (Marnane *et al.* 2003) and eventually became so widespread in the region that between 2003 and 2005 it accounted for 55.8% of all fish caught in Karimunjawa (Mukminin *et al.* 2006). However, between 1996 and 2001 muro-ami was not present in Karimunjawa due to a ban imposed by local fishermen who rejected the practice due to its disturbance of local traditional fishing (Marnane *et al.* 2003). Nevertheless, in 2002 a regulation[27] issued by the district government allowed for muro-ami fishing in Karimunjawa with the condition that the fishery be 'operated mostly by local fishermen, using local boats; and the net mesh size must be a minimum of 2 inches' (Marnane *et al.* 2003). Shortly after the introduction of this new regulation, the number of muro-ami fishing operations grew very rapidly from 3 groups in September 2002 to 26 groups in January 2003 (Marnane *et al.* 2003).

Another form of destructive fishing found in the waters of Karimunjawa is cyanide fishing. According to local fishermen, this fishing technique was first introduced to the region during the late 1970s or early 1980s and became more prevalent after the introduction of the hookah compressor (Mukminin *et al.* 2006). Initially, Karimunjawa's

[27] District Government Act No. 534/2813 of 2002.

cyanide fishery primarily targeted Napoleon wrasse along with various species of grouper, but as the number of large Napoleon wrasses diminished in the mid-1990s, cyanide fishermen shifted their focus towards the live grouper trade. Fishermen in Karimunjawa have also been known to lace *bubu* trap bait with cyanide (Mukminin *et al.* 2006). At present, large Napoleon wrasse are very rare in Karimunjawa due to the region's history of cyanide fishing. In fact, the Napoleon wrasse is one of the primary examples used by park management in order to illustrate the negative effects of DFPs to local fishermen. As in other areas of Indonesia, the live fish trade in Karimunjawa is very profitable for local fishermen. Although groupers only account for 2.5% of the total catch in Karimunjawa, they account for 11% of the total revenue from the local fishery (Mukminin *et al.* 2006). In 2004 there were eight live reef fish traders operating in KNP at various scales ranging from 400 kg to 1 ton per quarter (Mukminin *et al.* 2006).

Coral mining, the removal of pieces of coral from the reef, is yet another threat to the coral reefs of Karimunjawa. These pieces are often used locally as bricks for building houses. Although this practice seems to be in decline, houses built from coral were frequently seen in Karimunjawa during our fieldwork.

4 Marine Management and Conservation: National to Local Scales

As we have seen in the previous chapter, the management of marine resources in Indonesia during the past few decades has mostly focused on their development rather than on their sustainable exploitation. In fact, during REPELITA IV[28], which lasted between 1984 and 1989, the Directorate General of Fisheries (DGF) allocated two-thirds of its budget (approximately US$490 million) towards capture fisheries and aquaculture development, while spending less than 3% on fisheries resource management and environmental protection (Bailey *et al.* 1987). This clearly shows that from the perspective of DGF staff, 'the primary business of the DGF [was] the administration of development activities aimed at increasing production' (Bailey 1988: 30). Management of the marine sector was further complicated by a certain number of institutional constraints such as the lack of qualified workers and the lack of coordination between various branches of government (Crawford 2009). As a result, Indonesia's rich marine resources and coral reef ecosystems have suffered in recent decades due to various anthropogenic activities such as destructive fishing practices, overfishing and industrial pollution (Crawford 2009).

Beyond providing valuable food and economic security to a large segment of the population, Indonesia's coral reefs are also extremely important in the context of global biodiversity. It is estimated that 18% of the world's coral reefs are situated in Indonesia and are home to the highest marine biodiversity in the world, with 480 species of coral and 1,650 species of fish (Burke *et al.* 2002; Glaser *et al.* 2010). However, as a consequence of the various anthropogenic activities described already (Chapter 3), the state of Indonesia's coral reefs has become increasingly urgent, with 85% of the nations coral reefs estimated to be under threat (Burke *et al.* 2002).

[28] REPELITA or Five-Year Development Plan (*Rencana Pembangunan Lima Tahun - REPELITA*) was a series of 5 five-year development plans that were started by Suharto's New Order in 1969.

4.1 Marine Resource Management: The Long Road Decentralization

In an effort to address the multiple threats to marine resources, the Indonesian government began implementing a series of state policies and development plans during the 1980s that aimed to promote better management of marine resources (Crawford 2009). The first of such policy decisions was the introduction of a ban on industrialized trawling in 1980. Initially, the governmental decree[29] banned industrialized trawling only in the waters surrounding Java and Bali, but in 1981 the ban[30] was extended to include the waters surrounding Sumatra (DGF 2001; FAO 2006). In 1983, the ban was extended yet again to include nearly all Indonesian waters, with the exception of the Arafura Sea in far eastern Indonesia where trawling continued under certain requirements pertaining to bycatch reduction (Butcher 2004; FAO 2006). Therefore, after 1983 virtually all forms of demersal trawling were prohibited from operating in Indonesia's territorial waters (FAO 2006; Pauly and Chua 1988). The impetus for the establishment of the trawling ban essentially originated from the realization amongst policy maker of the severe inequalities between large-scale trawlers and small-scale fishermen. The escalating conflicts amongst these two groups played an important role in forcing policy makers realize the extent of the problem and to introduce the trawling ban (Bailey 1988; FAO 2006). One of the most important effects of the ban was that it helped transfer inshore demersal fishery resources from large-scale trawl operators back to small-scale fishermen (Butcher 2004). However, although the establishment of the trawling ban marked a significant step in Indonesian fisheries and coastal resource management, its implementation under the centralized government proved difficult. As with other regulations, such as those controlling mesh sizes, the trawling ban never proved fully effective and during the early 1990s there was a resurgence of trawlers operating in Indonesian waters. The trawlers responsible for this resurgence either operated illegally or were "licensed" by local authorities despite the nation-wide ban (FAO 2006).

The Indonesian legislative framework has also incorporated several laws forbidding DFPs[31], in which stiff penalties for violators are included. However, due to the vagueness

[29] Ministry of Agriculture Decree No. 503/Kpts/Um of 1980.
[30] Ministry of Agriculture Decree No. 542/Kpts/Um/6 of 1981.
[31] Fisheries Law No. 9 of 1985 prohibits 'the use of destructive fishing techniques such as explosives, poison and electrical techniques' (Erdman and Pet-Soede 1996); Fisheries Act No. 31 of 2004 'which

of these laws and the resulting conflicts within them, the most severe penalties (up to six years of imprisonment and fines of US$133,000 in the case of blast fishing) are rarely given (Dirhamsyah 2006). Enforcement issues also stemmed from the fact that many DFPs were conducted in very remote areas of Indonesia and that many 'local law enforcers often lack the means and will to patrol and make arrests at sea' (Pet-Soede *et al.* 1999: 84). Problems of corruption also hindered the enforcement of certain DFPs, as government officials with low salaries would accept large bribes from destructive fishing operations (McAllister *et al.* 1999). It is well known that similar types of corruption were rampant during Suharto's centralized government.

The problems with fisheries and coastal management under the centralized government of the period were not only limited to the enforcement of regulations. Between 1987-1998 several international development bank loan programs were put in place in an effort to improve the development of marine policy and resource management capacity. However, of the US$400 million spent during that period in non-participatory and top-down marine resource management projects, there is little evidence that those investments contributed to any significant change on the ground (Crawford 2009). In order to improve fisheries management as a whole in Indonesia, some studies have recommended the need for the decentralization of fisheries policy (Satria and Matsida 2004). Although a significant transferral of power from the centralized government to the provinces has occurred since the fall of Suharto (*reformasi*) through the Autonomy Law[32] (Dirhamsyah 2006), for much of the following decade the central government was still formally responsible for formulating natural resource and conservation policies (Clifton 2003; Dirhamsyah 2006). However, a relatively new piece of legislation named the Coastal Zone and Small Island Management Act of 2007[33] has marked a significant step in furthering the decentralization of marine resource management. The most significant clauses of this act enable 'provinces and districts to grant long term and transferable coastal resource use rights to individuals, traditional community groups and Indonesian legal entities … [and] … provinces and districts to establish local conservation areas'

prohibits activities that will result in the destruction of fish habitats (Articles 8–10)' (Pet-Soede *et al.* 1999).

[32] Government Act No. 22 of 1999.

[33] Government Act No. 27 of 2007.

(Crawford 2009: 10). Other key features of the act include an accreditation program for local coastal management programs and a formalized program that promotes collaborative research, training and education between the government, universities and other private interests (Crawford 2009). These recent reforms of coastal resource management demonstrate a belief amongst Indonesian policy makers that a democratized and decentralized governance framework will help promote improved and more sustainable forms of development (Crawford 2009).

4.2 Marine Protected Area Implementation in Indonesia

In 1984, the first plans for Indonesian MPAs were drawn up for the Directorate General of Forest Protection and Nature Conservation (PHKA)[34]. These first plans, financed by the IUCN[35] and WWF, established Indonesia's MPA strategy for the following decades, in which the goal of establishing and effectively managing 10 million hectares of MPAs was set (Cheung *et al.* 2002; Pet-Soede 2006). At that time, Indonesia had eight small and poorly managed MPAs (Pet-Soede 2006), but as of 2012 that number had grown to 243[36] and covered an area of over 10 million hectares (Glaser *et al.* 2010). The government has since updated its goal to achieving 20 million hectares of marine protected areas by 2020 (Glaser *et al.* 2010; Pet-Soede 2006). In terms of percentage of area covered, in 1990 MPAs covered 0.5 percent of Indonesia's territorial waters, while in 2010 this number increased to 2 percent[37]. Among these hundreds of MPAs, there are six marine national parks, including Karimunjawa National Park, that are classified as Category II nature conservation areas by the IUCN (Cheung *et al.* 2002) and are therefore relatively well managed according to their respective 25 year management plans. Although the 1984 IUCN/WWF plan provided the guidelines and policy recommendations for the establishment of MPAs in Indonesia, it wasn't until 1990 that the first law for the designation and the management of MPAs was included into the

[34] The Directorate General of Forest Protection and Nature Conservation is the English translation of *Direktorat Jenderal Perlindungan Hutan dan Konservasi Alam* (PHKA).

[35] International Union for Conservation of Nature (IUCN).

[36] This total of 243 comes from the World Database on Protected Areas (WDPA), however it would be prudent to note that most of these MPAs are without IUCN classification and have either no management or very little (Cheung *et al.* 2002).

[37] United Nations, Millennium Development Goals Indicators, 2011.

nation's legislative framework (Cheung *et al.* 2002; Pet-Soede 2006). This law[38] provides the legal basis not only for MPAs, but also for the wider reaching 'management, conservation, and use of biological resources, natural habitats and protected areas' (Dirhamsyah 2006: 74-75). Furthermore, article 32 of the 1990 law states that national parks are to be managed by a zoning system consisting of core zones, protected zones, and other zones as may be required for each particular park (BTNK 2004c).

The establishment of MPAs in Indonesia was often done under the umbrella of larger programs that commonly used integrated coastal management (ICM) approaches and that were financed either entirely or in part by foreign donors. As MPAs are common tools employed in ICM programs, the increasing use of ICM projects in Indonesia consequently increased the number of MPAs nationwide. Two examples of ICM programs that used MPAs as part of their overall strategies were the Indonesian Coastal Resources Management Project (CRMP) (1997-2003) funded by the USAID and the Coral Reef Rehabilitation and Management Program (COREMAP) (1998-2013), which is currently the largest program in Indonesia promoting the development of MPAs and is funded by the World Bank, ADB[39] and AusAid (Chozin 2008; Glaser *et al.* 2010; White *et al.* 2005). The broad goals of both these programs focused on the improvement of coastal resource policies through decentralization, leading to the introduction of participatory and community-based management projects throughout the country (Chozin 2008; White *et al.* 2005). These were cross-sectoral projects whose actors originated from national and regional governments, non-governmental organizations and the private sector (Chozin 2008; White *et al.* 2005).

Although these developments were significant and helped bring about an increase in the number of MPAs and the total area they covered, there were still several factors at national and provincial levels that restricted the successful management of Indonesian MPAs, especially from a co-managerial perspective (Clifton 2003). First of all, the *Balai Konservasi Sumber Daya Alam* (KSDA)[40], a sub-department of the Ministry of Forestry's PHKA responsible for the management of protected areas (PAs) at the provincial level, requires each PA to provide lengthy and detailed management plans. Due to lack of

[38] Government Act No. 5 of 1990 (BTNK 2004c; Dirhamsyah 2006).
[39] Asian Development Bank.
[40] *Balai Konservasi Sumber Daya Alam* translates to the Natural Resources Conservation Office.

resources and/or expertise, this legal requirement often led PA management teams to seek help from foreign-based NGOs. Such was the case for Karimunjawa (BTNK 2004a), Komodo (Pet and Yeager 2000), Bunaken (MacAndrews 1998) and Taka Bone Rate (Alder *et al.* 1994) national parks. The important role these agencies played in the management of protected areas was said to not be favourable for local involvement. Secondly, all monetary profit collected in PAs went directly to the Ministry of Forestry's national offices, thereby making long term financial planning very difficult for the provincial KSDA. Lastly, the park rangers working in the parks were primarily trained on arrest procedures and self-defence, after which they were cycled through Indonesia's network of PAs in periods of 1 to 3 years. As a result, KSDA staff might not have been fully aware of the array of local stakeholders and conflicts all interacting within the PA. These problems arose primarily due to the remnants of the centralized pre-*reformasi* era, which are manifested in the legislative framework for coastal and marine resource management.

However, Indonesia's recent efforts towards the decentralization of governance from the central government to the provinces and regencies, along with the establishment of the Coastal Zone and Small Island Management Act of 2007, are helping to promote better management of MPAs through decentralized and co-managerial processes. Furthermore, in 2009 an institutional reorganization transferred the responsibility of MPA management from the Departments of Forestry and of Agriculture to the Ministry of Marine Affaires and Fisheries. This change aims to provide further support to the government's objective of MPA development in Indonesia (Glaser *et al.* 2010).

4.3 MPA Management in Karimunjawa National Park

4.3.1 Karimunjawa as an MPA

As made clear in the previous chapter, the use of DFPs, especially muro-ami and cyanide fishing, were becoming increasingly prevalent in Karimunjawa National Park up until the early 2000s. These practices were having severe negative effects on the region's coral reef ecosystems and therefore on the local fishery. Also contributing to the deteriorating state of the Karimunjawa fishery were non-local large-scale fishing boats

operating within KNP whose exploitation activities reduced the amount of fish available for local traditional fishermen. Furthermore, the park regulations at that time did not sufficiently protect local fishing communities as profits from these large-scale operations went to interests outside Karimunjawa (Marnane *et al.* 2003). A study conducted by WCS during the planning stage of the park's new management plan reported that the majority of people in Karimunjawa coastal communities felt that natural resource degradation was happening despite the presence of protected area regulations (Wibowo 2005). As problems of overfishing and destructive fishing by both local and non-local fishing operations increased, which led to problems with the condition of coastal resources and livelihood stability, managers became aware that the current regulations did not accurately reflect the current socioeconomic culture and ecological state of the region (BTNK 2004b). Furthermore, conservation was found to not be an important issue for Karimunjawa residents during the early to mid-2000s (Mukminin *et al.* 2006).

In an effort to revamp the old and ineffective management system, Karimunjawa National Park Authority (BTNK) proposed a new 25-Year Management Plan in 2002 (BTNK 2004b) centered around a new zoning system for the MPA (ASEAN 2003). This new management plan, drawn up during Indonesia's push for decentralization, was designed around an integrated coastal management (ICM) model that is meant to favour community-based management approaches (BTNK 2004a). This major restructuring of KNP's management system, which took effect in 2005, is a strong indication of the park management's readiness towards adaptive management and their recognition that policy needs to change in response to evolving ecological and socioeconomic conditions (BTNK 2004a).

Leading up to the implementation of a new 25-Year Management Plan, the archipelago of Karimunjawa had already undergone several changes in its legal framework. The first support for the idea of turning the Karimunjawa archipelago into a conservation area is found in a 1982 letter by the Governor of Central Java, in which he approves the creation of a marine national park as well as the promotion of marine tourism development in Karimunjawa[41]. After this first initiative, KNP's history has been the following:

[41] Letter of Central Java Governor No. 556/21378 dated October 26, 1982.

- 1986: Karimunjawa archipelago is designated as a marine nature reserve by the Minister of Forestry[42]
- 1988: Karimunjawa archipelago is declared a marine national park encompassing 22 islands and covering 111,625 ha of land and sea.[43]
- 1999: The Ministry of Forestry changes Karimunjawa's designation from a marine nature reserve and marine national park to a National Park with the name Karimunjawa National Park (*Taman Nasional Karimunjawa*)[44].
- 2001: An area of 110,117.30 ha (the total marine area of KNP) is declared a marine protected area[45] and a zoning system is implemented as the basis for park management (BTNK 2008).
- 2002: Formalization of organizational structure and working procedures of BTNK[46].
- 2005: A new zoning system is put in place[47] as a substitute for the old one after extensive community consultations (Wibowo and Kartawijaya 2004).

As we can see, the development of KNP's legal status and framework has spanned nearly two decades during which time at least two important changes have occurred. First of all, after its designation as a marine nature reserve and marine national park, in 1986 and 1988 respectively, the park was transformed into a national park in 1999. Secondly, in 2005 the zoning system that had existed since 2001 was totally rebuilt after the realization that the old zoning system no longer suited the socioeconomic and ecological state of that time (BTNK 2004b). This new zoning system is a central component of the 25-Year Management Plan that was developed in 2004 by BTNK in collaboration with the Wildlife Conservation Society (WCS) and serves as the foundation for park management (BTNK 2004b; BTNK 2004c; Wibowo and Kartawijaya 2004).

[42] Minister of Forestry Decree No. 123/Kpts-II/1986 (BTNK 2004b; BTNK 2004c; Yulianto *et al.* 2007).
[43] Minister of Forestry Decree No. 161/Menhut-II/1988 (BTNK 2004c).
[44] Minister of Forestry Decree No. 78/Kpts-II/1999 (BTNK 2004b; BTNK 2004c; Yulianto *et al.* 2007).
[45] Minister of Forestry Decree No. 74/Kpts-II/2001(BTNK 2004b; BTNK 2004c; Yulianto *et al.* 2007).
[46] Minister of Forestry Decree No. 6136/Kpts-II/2002 (BTNK 2004c).
[47] Director General of Forest Protection and Nature Conservation Decree No. 79/IV/Set-3/2005 (BTNK 2004a; Wibowo 2005).

The zoning system established in the new 25-Year Management Plan was the result of extensive community consultation through workshops between BTNK, Wildlife Conservation Society (WCS), local stakeholders and community members[48]. These workshops focused on establishing a series of criteria for each protected zone and subsequently determining their placement in high value ecological areas throughout the park (BTNK 2004a; Wibowo and Kartawijaya 2004). Recommendations about the zoning plan were also given by WCS (Wibowo and Kartawijaya 2004), who since January 2003, has been working along side BTNK in redesigning the park's management plan and conducting research activities (Marnane *et al.* 2004) .

4.3.1.1 MPA Zones

The zone planning process resulted in the establishment of seven types of zones: Core Zone, Protected/Wilderness Zone, Fishery Utilization Zone, Tourism Utilization Zone, Mariculture Utilization Zone, Rehabilitation Zone and Buffer Zone. Each zone has its unique set of rules and regulations describing what activities allowed or prohibited. Potential sites for each type of zone are identified and selected according to various ecological, social and economic criteria. Below are descriptions of the rules and regulations for each zone along with some examples of the criteria used in determining their placement when available. This information is adapted from the zoning plan reports obtained from BTNK (2004a) and Wibowo and Kartawijaya (2004).

1. Core Zone

Core zones are highly protected areas within which all resource exploitation is prohibited and where visitors are not allowed to enter except with express permission from BTNK. All forms of extraction, by fishing or other means, of reef fish, coral, molluscs, marine mammals, turtles, migratory birds and other marine biota, dead or alive are strictly prohibited. Any activities with the potential to perturb the marine ecosystem, such as mariculture, fish farming, coral or sand mining, etc., are equally prohibited. Core zones are meant to be sheltered from nearly all forms of human intervention, with

[48] Details of these workshops are described in two zoning plan progress reports written by BTNK and WCS (BTNK 2004a; Wibowo and Kartawijaya 2004).

activities such as ecosystem rehabilitation, habitat reconstruction, and marine biota reintroduction also being prohibited. The only activities allowed within these zones are those related to research, education, monitoring and protection. The BTNK head office allocates permits for access to core zones through a research proposal process. Sites for core zones were chosen according to the following criteria:

- An area possessing spawning grounds for fish and other marine biota
- An area possessing coral reefs in relatively good condition (50% or higher coral cover) with a relatively high abundance and diversity of fish and other biota compared to nearby areas
- Not required to be an island, however needs to possess a distinct ecosystem/s
- An area with strong potential for the expansion of fish and marine biota.

2. Protected/Wilderness Zone

Similar to core zones, protected zones are meant to provide protection for important species of fish, coral, invertebrates, seagrasses, mangroves and their habitats while offering more flexibility in regards to ecosystem rehabilitation efforts. All activities prohibited in core zones are also prohibited in protected zones with the exception of activities related to the rehabilitation of marine habitats and marine biota populations. All activities permitted in core zones are likewise allowed within protected zones. Also allowed are limited tours of educational nature that are conducted in prearranged locations during certain periods of the year through special permits. Protected zone sites were chosen according to the following criteria:

- An area that can overlay and protect the core zone
- An area that can support rehabilitation and conservation efforts of wildlife
- An area with a minimum distance of 1.5 miles from residential areas
- An area with enough nutriment for fish populations
- An area with an intact and uncontaminated ecosystem
- An area with limited tourism use

3. Utilization Zones

Fishery utilization zones are designed around the principle of common property, in which fishermen do not own the fishery resource but instead own the rights of use. Fishery utilization zones allow the exploitation of the fishery resource with the use of traditional fishing gears, such as handlines and gill nets[49], that have been used locally for generations. Local communities are also able to practice a specific form of floating mariculture in these zones where the cultivation equipment doesn't touch the seabed except for the anchors that hold it in position. Furthermore, the construction of facilities and other types of infrastructure are permitted with special permission.

Prohibited activities include the use of fishing gears that are not considered environmentally friendly, such as muro-ami, cyanide, cantrang nets[50] and other nets that are destructive to the marine habitat. Additionally, the introduction of marine biota is not allowed within fishery utilization zones.

*Tourism utilization zone*s are areas designated specifically for ecotourism. The selection of appropriate areas for tourism utilization zones was made based on the assessment that an area's environmental conditions would be able to support tourism and outdoor recreation development. Low impact tourism is therefore permitted within these zones as well as the development of environmentally sound tourism facilities and infrastructure through special licenses. Aside from these allowances, all activities prohibited in core zones are also prohibited within tourism utilization zones.

Mariculture utilization zones are areas that have been allocated for fishing activities as well as for various types of mariculture such as grouper farming and seaweed farming. Locals are permitted to install mariculture equipment as long as they do not intentionally or unintentionally take, disturb or displace the marine biota.

4. Rehabilitation Zones

These zones are placed in heavily damaged areas with less than 25% coral cover where habitat rehabilitation activities can take place. The goal of this rehabilitation is to restore the original function of the area's ecosystem. All regulations applicable to core

[49] See Appendix 2 for gill net diagram.
[50] See Appendix 2 for diagrams of cantrang nets.

zones are also applicable to rehabilitation zones with the exception of regulations pertaining to ecosystem rehabilitation and habitat development activities.

5. Buffer Zone

All areas surrounding KNP boundaries are classified as buffer zones. These zones are described by BTNK (2004a: 53) as areas where 'development activities and alternative economic efforts' take place through optimized utilization in order to reduce pressure on KNP resources.

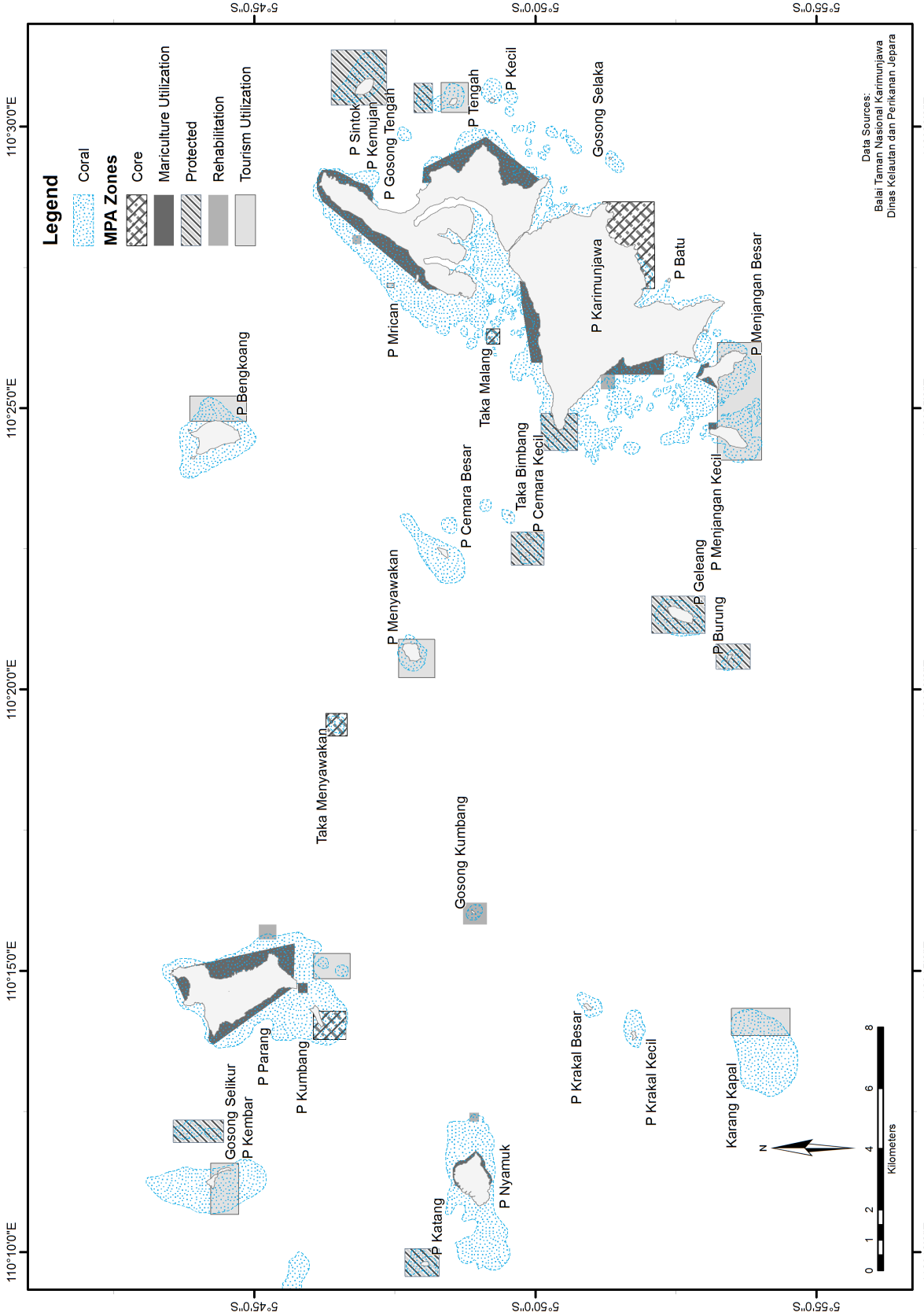
Table 4: Location and size of Karimunjawa National Park zones

Zone	Surface Area	Location
Core Zone	444,629	Mostly marine including P.[51] Kumbang, Taka Menyawakan, Taka Malang, and Tanjung Bomang
Protected Zone	2,587,711	Terrestrial low-lying tropical rainforest of P. Karimunjawa and mangrove forests of P. Kumujan
		Waters off P. Geleang, P. Burung, Tanjung Gelam, P. Sintok, P. Cemara Kecil, P. Katang, Gosong Selikur, Gosong Tengah
Fishery Utilization Zone	103,883,862	All waters outside predetermined zones inside Karimunjawa National Park
Tourism Utilization Zone	1,226,565	Waters off P. Menjangan Besar, P. Menjangan Kecil, P. Menyawakan, P. Kembar, P. Tengah, sebelah Timur P. Kumbang, P. Bengkoang, Indonor, Karang Kapal
Mariculture Utilization Zone	788,213	Waters off P. Karimunjawa, P. Kemujan, P. Menjangan Besar, P. Parang dan P. Nyamuk
Rehabilitation Zone	122,514	Waters east of P. Parang, P. Mosquitoes and waters west of P. Kemujan and P. Karimunjawa
Residential Zone	2,571,546	P. Karimunjawa, P. Kemujan, P. Parang dan P. Nyamuk
Buffer Zone	n/a	Outside Park Boundaries
Total	**111,625,040**	

Source: Adapted from BTNK statistics reports (BTNK 2008; BTNK 2009)

[51] P. is the abbreviation of *pulau*, the Indonesian word for "island".

Figure 8: Map of Karimunjawa National Park MPA Zones



4.3.2 Karimunjawa National Park Objectives

Encouraged by the enactment of the autonomy law of 1999[52], Karimunjawa National Park began designing a new management plan focused on 'collaborative management' (BTNK 2004a: 27), in which the following three overarching management objectives were defined (BTNK 2004c: 89):

1. To realize the full potential of biological and ecosystem resources by restoring them to their intact states.
2. To optimize the function of Karimunjawa National Park in order to promote community welfare.
3. To ensure sustainable development in Karimunjawa National Park.

These overarching management objective are further defined in the management plan (BTNK 2004c) under KNP's function, vision and mission statements, which all focus on the common themes of environmental protection, sustainable use of natural resources and raising awareness about conservation in local communities. A more detailed account of KNP's objectives for sustainable development can be found in their zoning plan process report (BTNK 2004a: 9):

1. Improve community welfare through the expansion of employment and business opportunities.
2. Develop programs and activities that lead to an increase in optimal and sustainable utilization of resources in coastal and marine areas.
3. Improve the participation of coastal communities in environmental conservation.
4. Improve education, training, research and development in coastal and marine areas.

As for the specific objectives pertaining to the development of the new zoning plan, they are described by Wibowo and Kartawijaya (2004: 1) as the following:

[52] Government Act No. 22 of 1999.

1. To build communication and coordination between stakeholders to set the direction of the Karimunjawa National Park management policy.
2. To gain the commitment from stakeholders in conducting a joint process starting from planning to monitoring and evaluation.
3. To increase cooperation for the management implementation.

One common theme found throughout BTNK's management plan as well as in various other reports authored by WCS is the importance of developing alternative livelihoods in Karimunjawa National Park. This stems from the park management's recognition that the implementation of the zoning system will probably have both direct and indirect consequences for the local community. For example, prohibiting fishermen's access to certain zones was predicted to directly affect the utilization patterns of fishermen by forcing them to conduct fishing activities in other areas, which would in turn have negative effects on their incomes (BTNK 2004a). Efforts to promote alternative livelihoods in KNP will be discussed further in Chapter 5.

4.3.3 Community Participation

As BTNK realized that the old management system no longer suited local community dynamics or the condition of natural resources in Karimunjawa National Park, they began working on a new management plan, as described above, that would be developed through a participatory process involving public consultation (BTNK 2004a). Park managers identified that prior to the new zoning plan, local communities were not active in management activities because of a few key reasons, among which included a (1) lack of awareness raising in local communities about KNP managements programs, (2) lack of public awareness raising on the importance of environmental protection, and (3) lack of two-way communication between BTNK and local communities that would have better communicated that conservation actually means prohibiting certain activities in specific areas (BTNK 2004a).

4.3.3.1 Documented Co-management

Therefore, in an effort to improve the involvement of local communities in KNP's policymaking process, a series of workshops were held with various local actors during the development process for the new zoning plan. This participatory approach was documented in BTNK's report detailing the zoning plan process, in which we find the executive summaries for six workshops that took place between June of 2003 and October of 2004 (BTNK 2004a). Participants included representatives from BTNK, the district government, universities, the private sector, government institutions, NGO's, and the community. In these workshops, relevant stakeholders debated the details of the zoning plan until specific locations for each type of zone were finally agreed upon.

These reports show evidence for co-management between BTNK and members of local communities during the zoning plan process. For example, BTNK and WCS recommended six locations for designation as core zones, of which only one ended up being included in the final four core zone locations agreed upon by workshops participants. We can see in the zoning plan process report (Wibowo and Kartawijaya 2004) that compromises were made by BTNK after members of the community expressed disagreement about the initial recommended locations for core zones. The community's disagreement stemmed from the fact that one of the recommended locations (Tanjung Kemujan) was already being used by community members for seaweed farming and that another (Tanjung Gelam) was thought to have strong potential for tourism. As a result, a compromise was found where Tanjung Kemujan was lowered to a utilization zone and Tanjung Gelam to a protected zone. However, community members present at the workshops, who we can assume consisted of local fishermen for the most part, weren't solely trying to block proposed no-take areas. The report describes a seemingly collaborative process where community members also gave suggestions as to other locations not thought of by BTNK that should be designated as core zones. One such suggestion is Taka Menyawakan that was pinpointed by the community as a possible spawning ground and was subsequently designated as a core zone in BTNK's finalized zoning plan.

Other management issues, aside from the zoning plan itself, were addressed during this series of workshops. Issues such as gear restrictions for certain types of destructive

fishing practices were discussed in order to avoid future negative impacts to local coral reef fishing grounds. Also tackled were questions of awareness raising about Karimunjawa National Park regulations as well as concerns about the role of various stakeholders in the promotion and development of alternative livelihoods.

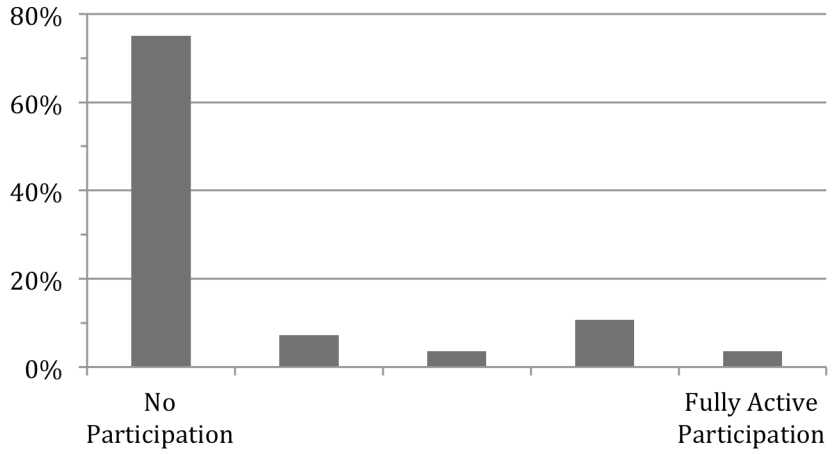
4.3.3.2 Observed Co-management

Although we find evidence for co-management in the documentation provided by BTNK, specifically in the reports detailing the planning process for the zones of the MPA (BTNK 2004a; Wibowo and Kartawijaya 2004), during our field interviews such evidence for the co-management of KNP was harder to ascertain. In fact, although community members were able to participate in some of the zoning plan workshops, only a relatively small number of individuals were actually present when compared to the total population of the park. Furthermore, of the six workshops held during the zone planning process, community members attended only two. The first of these was attended by 61 community members representing all three KNP villages, while the second was attended by 67 people from various groups (district government, institutions, universities, NGOs, etc) and from the community. When we consider that only a very small portion of the community actually participated in the zoning workshops hosted by BTNK, it seems reasonable to assume that identifying individuals during our field interviews that have participated in these workshops would be difficult. This indeed turned out to be the case. However, what we also found was that a very high percentage of interviewed individuals had not only never attended the zoning plan workshops, but had also never participated in any other sort of coastal management decision-making process.

Figure 9 shows the results from our questionnaire, in which the vast majority of respondents (75%) stated that they had never participated in any form of coastal management decision-making. A small proportion (7%) stated that they had had next to no participation, while 11% and 4% stated that they had participated to some degree or had fully participated in coastal management decision-making, respectively. If we were only discussing levels of participation in the zoning plan workshops, these responses should not come as any surprise and might even be higher than expected. However, it is important to keep in mind that the responses shown in Figure 9 represent not only the

percentage of respondents having participated in the zoning plan workshops during two instances in 2004, but represent the percentage of respondents having participated in any kind of coastal management decision making process between the beginning of the planning process for the new management plan in 2003 to when we conducted our fieldwork in 2010. From that perspective, 15% of respondents stating some level of participation seems rather low when compared to 82% of respondents stating no participation.

Figure 9: Level of Participation in Coastal Management Decision Making



Source: Questionnaire data (see Appendix I)

These low levels of participation in coastal management decision-making could be due to a variety of reasons; luckily our data can help us pinpoint a few possible causes for this situation. First of all, although mentions of co-management are found throughout BTNK's twenty-five year management plan (BTNK 2004b; BTNK 2004c) and zoning plan process reports (BTNK 2004a; Wibowo and Kartawijaya 2004), no formal channels for communication between park management and the community were setup in the years following the implementation of the new management plan. In our field interviews, the WCS Karimunjawa Program Director confirmed that the co-management of KNP is based on an informal system. He explained that in practice KNP had chosen to follow an informal system after discovering that complications had arisen within the management body of another park, Bunaken National Park (BNP), after the departure of USAID's Natural Resources Managements Program (NRM). The NRM Program was a

collaborative program between the government of Indonesia and several groups, consisting mostly of international NGO's, in BNP and acted in a role similar to the one of WCS in KNP by helping the park's governing body develop a twenty-five year national park management plan (Erdman *et al.* 2004). NRM played an important role in the creation of a formalized co-management board in BNP that was comprised of several stakeholders representing the local community, NGO's and the government (Erdman *et al.* 2004). After learning about the complications that had arisen in BNP after the departure of the NRM Program, KNP opted for an informal approach to co-management where twice a year a meeting is held between BTNK and various stakeholders of the park, in which informal agreements about park management can be made.

As we can see, in practice BTNK has chosen to deviate from its original intentions to build a formalized collaborative management framework such as described in its twenty-five year management plan and zoning process report (BTNK 2004a; BTNK 2004b; BTNK 2004c; Wibowo and Kartawijaya 2004). Furthermore, the park's objective to 'increase the capacity of local institutions to increase community awareness […] [in order] to increase active participation of the community in the national park management' (Wibowo and Kartawijaya 2004: 17) seems to also have been largely put aside. Other management issues such as marine ecosystem protection and rehabilitation appear to have been given precedence over efforts to improve local institutional capacities for building community awareness about conservation and park management. As a result, we have found during our field interviews that local fishermen and non-fishermen alike seemed to have a general sense of alienation from the KNP policymaking process. We believe this is a direct result of BTNK's choice not to build a formal and transparent system for communication between local actors about management issues. During our field interviews, respondents commonly spoke in terms of "them" and "us" when referring to park management and themselves, which indicates a sharp divide between the two groups. Furthermore, locals commonly expressed during interviews that they felt as though they had nothing to do with the decisions that BTNK made concerning natural resource management. This sentiment is particularly strong on Pulau Kemujan, the second most populated island in KNP located just off the northern coast of Pulau Karimunjawa. This disconnect between park management and the community is well

illustrated in one of our interviews where a fishermen/seaweed farmer affirmed that he would not know how to discuss a hypothetical problem with BTNK if one were ever to arise.

It bears mentioning that the goal of raising community awareness and increasing community participation in management was never completely removed from BTNK's agenda in the years between the implementation of the new management plan and the period during our fieldwork. What instead seems to have happened is that BTNK chose to focus on other management issues that could have been perceived as being more important for the immediate future of the park. By looking at WCS reports in which the research and management activities of BTNK and WCS are documented for the period spanning between 2005 and 2010, we observe that most of the park's activities focused primarily on technical issues such as carrying out ecological surveys of the marine environment (Ardiwijaya, Baird*, et al.* 2008; Ardiwijaya, Kartawijaya*, et al.* 2008; Ardiwijaya, Pardede*, et al.* 2006; Ardiwijaya, Wibowo*, et al.* 2006; Sabarini 2006; Yulianto *et al.* 2007), monitoring fisheries utilization (Mukminin *et al.* 2006) and monitoring fishermen's compliance to regulations (Prasetia *et al.* 2010; Yulianto and Herdiana 2006). During the same period we also find a couple reports detailing socioeconomic research which focused to a large extent on the community's knowledge and perceptions about MPA regulations as well as their perception about the condition of marine resources (Wibowo 2005; Yulianto *et al.* 2009). Of all these reports co-written by WCS and BTNK since the implementation of the new management system, there is only one that deals directly with questions pertaining to the co-management of Karimunjawa National Park (Kartawijaya *et al.* 2008). It is clear that the issue of co-management figured but a small part in KNP's agenda during the period between the introduction of the park's new management plan in 2005 and 2010.

That being said, improving on the co-management of KNP seems to currently be one of the primary concerns of BTNK for the upcoming years. This was made clear during a meeting we were able to attend in KNP between BTNK officials and several community representatives. This meeting, lead by the head of BTNK, outlined the details of a new project being introduced in KNP which will attempt to get fishermen actively involved in patrolling park waters for illegal fishing activities. One thing both BTNK and fishermen

can agree on is the threat that non-local fishing boats operating illegally within park boundaries pose to the durability of the local fishery. Hoping to take advantage of this mutual concern about non-local fishermen intruding in KNP waters, BTNK mounted the PAM Partisipatif program in 2010. In this program local fishermen are asked to report to BTNK all incidences of illegal fishing by non-local and/or large scale fishing boats in KNP waters. Because of BTNK's limited resources for patrolling, this program has the potential to greatly improve the monitoring of park waters. Furthermore, unlike BTNK patrols that operate with predictable schedules, it is much more difficult to predict when fishermen will go out to sea. Therefore, it is possible that fishermen will have more success in spotting illegal fishing activity, not to mention that illegal fishermen will be less apprehensive about another fishing boat as compared to a patrol boat. Although this program obviously focuses on participatory enforcement of park policy rather than on participatory creation or modification of policy, it is nonetheless a promising step towards improved collaboration between park management and the community. Furthermore, in a short discussion with the head of BTNK after the conclusion of the meeting, he asserted that he would like for community involvement to progress to the point where the community would be able to create regulations "for themselves and by themselves" and to also be able to handle the punishment of offenders.

5 Socioeconomic Transformations in Karimunjawa National Park

5.1 Changes in the Fishery

In a recent study showing the effects of MPAs on fishermen's catches, it was demonstrated that in all cases there was an 'initial decline in fish landings followed after several years by recovery to previous levels and higher' (Silvert and Moustakas 2011: 316). This report finds that permanent fishery closures within an MPA will undoubtedly have immediate negative effects on fish landings, however in the long run, chances for the full recovery of both the fishery and the fish stocks are high. During the planning stage of the new MPA zones for KNP, BTNK predicted these negative impacts of no-take zones on the local fishery, and as we will see further in this chapter, has planned to mitigate them with the promotion of alternative livelihoods (Wibowo and Kartawijaya 2004). However, before tackling that topic, let us attempt to describe the changes in the local Karimunjawa fishery that have occurred since the implementation of the new MPA zones in 2005.

Two indicators that can help us identify changes occurring in the local Karimunjawa fishery after MPA implementation are fish landings as well as the number of fishing trips per year. Determining fish landings for periods prior to, as well as after the implementation of no take zones can help determine the direct effect of the modification of fishing grounds access on fishermen's catches and derived livelihoods. The second indicator, the number of trips per year, can help us identify changes in fishing pressure for the period following no-take zone implementation. A downward trend here would suggest that fishermen are fishing less often and might suggest that other sources of livelihood have been found.

Unfortunately, catch data for the specific Karimunjawa sub-district is very fragmented and inconsistent. This is undoubtedly due to both the complexity of the task of collecting such data and to the limited resources of the local Dislautkan offices charged with the task. The Dislautkan office responsible for the sub-district of Karimunjawa sends their data to the regional Jepara office, where the latter aggregates all the data from all sub-districts within the region in order to form a representation for the

entire district. However, as we can see in Table 5, the same data points are inconsistent between the Karimunjawa and Jepara Dislautkan offices. These discrepancies are sometime quite large. For example, Dislautkan Karimunjawa calculates the total fish landings for 2007 at 385,636 kg, while Dislautkan Jepara calculates it at 793,920 kg; a significant difference of over 400,000 kg. Furthermore, the availability of Karimunjawa fishery data on sufficiently large temporal scales proved to be an issue during our fieldwork. It would seem that the large part of historical fishery data in both local and regional Dislautkan offices were either misplaced or lost after being transferred to respective offices higher up the bureaucratic hierarchy within the Ministry of Marine Affairs and Fisheries. Other reasons given for the lack of data for large time frames (10-15 years) was of a more technical nature such as hard drive failures.

Table 5: Statistics on the Karimunjawa Fishery

	2004	2005	2006	2007	2008	2009
Total Capture (kg)[1]	73,429	363,000	445,249	385,636	372,205	-
Total Capture (kg)[2]	-	-	-	793,920	543,904	527,360
Trips[1]	4,000	5,395	4,245	5,852	2,528	946
Number of Boats[1]	632	666	666	690	690	-

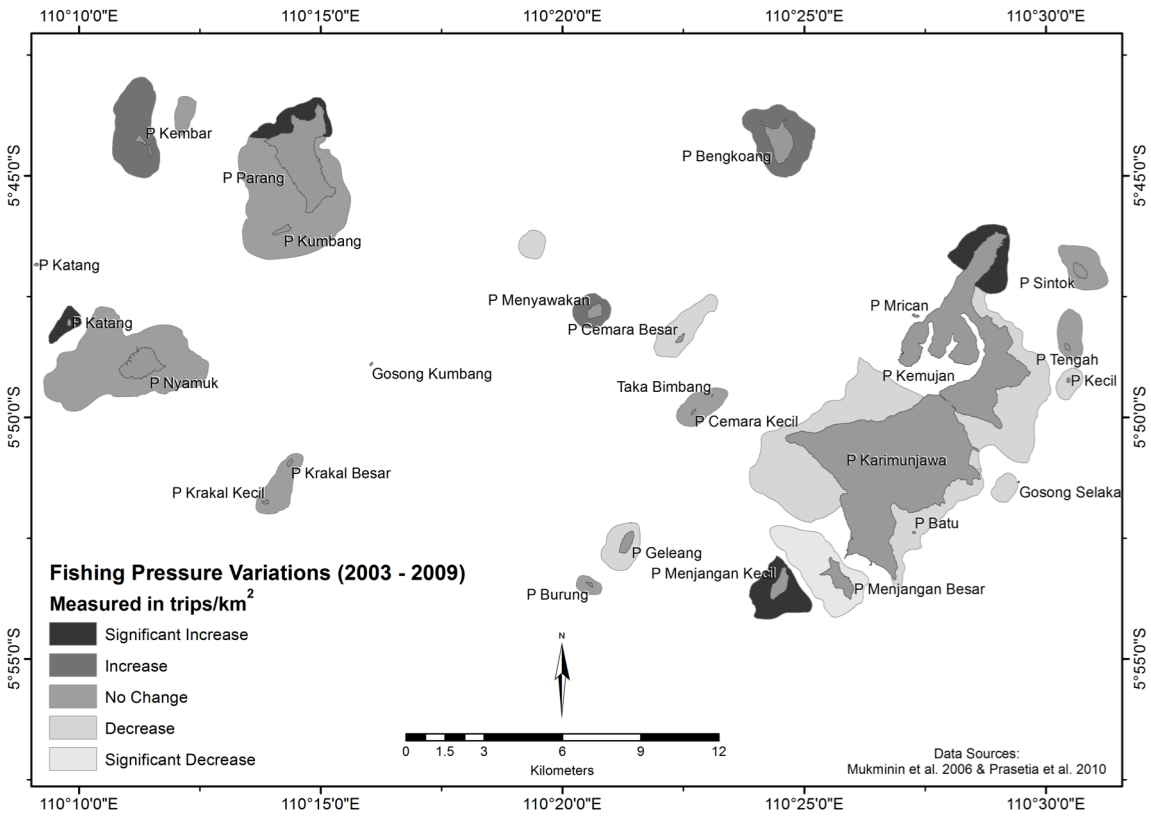
Source: [1]Dinas Kelautan dan Perikanan Karimunjawa, 2010
[2]Dinas Kelautan dan Perikanan Jepara, 2010

While keeping these above-mentioned caveats in mind, a couple trends can nonetheless be observed. First of all, although sources for Karimunjawa fishery data are inconsistent, they both share one common feature. By looking at the data from Dislautkan Karimunjawa, we can see a downward trend in total capture beginning in 2006, which directly follows the implantation of the new MPA zoning system in 2005. The data from Dislautkan Jepara also indicates a downward trend in fish landings between 2007-2009. These results would seem to coincide with the findings of Silvert and Moustakas (2011) where fish landings were shown to drop during the period immediately following the establishment of no-take zones over existing fishing grounds. Silvert and Moustakas (2011) go on to explain that the chances for a full recovery of the fishing industry several

years after the establishment of no-take zones through an MPA are very good and that 'both the fishery and the fish stocks will benefit in the long run' (Silvert and Moustakas 2011: 312). Due to the relatively short timescale of our study period, we aren't able to observe the rebound of either the fishery or fish stocks, however there is no reason to think that this won't occur in the years to come as long as proper management and enforcement can be practiced within KNP. Since our data only covers a few years following the implementation of new no-take zones within the Karimunjawa MPA, it would be safe to assume that the declining catches can also be partly explained by the lingering effects of overfishing and destructive fishing that had been very common in KNP up until the implementation of the new management plan in 2005. Secondly, we can also observe a downward trend in the number of fishing trips between 2007 and 2009. This decrease is quite significant. The number of fishing trips has dropped by a factor of 619 percent over a period of three years following the implementation of the new MPA zones. Although correlation evidently doesn't imply causation, we can nonetheless discern from the data an important change in both the fish landings and the practices of fishermen within the local Karimunjawa fishery. The significant decrease in fishing trips could possibly have been brought on by fishing ground closures, however other reasons such as the rapid adoption of seaweed farming by local fishermen, which we will cover further in this chapter, should also be explored.

In addition to changes in the frequency of fishing trips in KNP, we can also observe spatial shifts in fishing pressure throughout the park between two periods; the first between the years 2003-2005 and the second for the year 2009 (see Figure 10). When comparing these two periods we notice that the fishing grounds in the areas surrounding P. Menjangan Besar, P. Gelean, P. Cemara Besar, P. Kembar, Taka Menyawakan, Gosong Seloka, Northern Parang, Western Karimunjawa, Eastern Karimunjawa and Eastern Kemujan, have seen a decrease in fishing pressure, with P. Menjangan Besar having seen the greatest decline. On the other hand, the areas surrounding P. Menjangan Kecil, P. Katang, P. Bengkoang, P. Menyawakan, P. Kecil and the northern tip of Kemujan have underwent increases in fishing pressure between the 2003-2005 period and 2009, with P. Menjangan Kecil, P. Katang and the northern parts of P. Kemujan and P. Parang having been subjected to the greatest increases.

Figure 10: Temporal variations in fishing pressure (2003 – 2009)



Looking beyond the quantitative data, we can add to our picture of the Karimunjawa fishery's post MPA transformation by consulting the qualitative data obtained from our multiple interviews with local fishermen. A total of 85% of the respondents claimed a reduction in catches over the past 5 years, with an average estimated decline of 55%. The majority of interviewed fishermen made it clear that catches were not as they were, with many recounting stories of *dulu* (the past) when fish were abundant when compared to todays' scarcity. One example of such recollections is the commonly shared story of anchovy fishermen who maintain that both species of anchovies traditionally caught in Karimunjawa are much less abundant than in the past. Whereas one boat and crew could catch between one to several tons per trip several years ago, that number has now been greatly reduced to around 100kg per trip.

As for what directly concerns fishing as a means of livelihood, two surveys covering separate time periods have found that the number of working individuals that identify

fishing as a primary livelihood has decreased from 61% in 2005 (Wibowo 2005) to 55% in 2009 (KK 2009), which constitutes a decrease of six percent over the four years following the implementation of the new zones.

5.2 Alternative Livelihoods in KNP

Although it has been stated in a report from 2003 coauthored by WCS and BTNK that 'fisheries production in Karimunjawa is a social and economic imperative that has no obvious alternative' (Marnane *et al.* 2003), KNP managers are nonetheless focusing much of their efforts on developing alternative livelihoods in hopes of reducing fishing pressure on coral reef resources. In addition, finding and developing alternative livelihoods in KNP is considered by BTNK to be a strategy that would help mitigate the negative impacts of the zoning implementation in the short term, all the while providing long term opportunities for the local community (Wibowo and Kartawijaya 2004). BTNK identifies tourism as the most important opportunity for alternative employment in the region, with other options such as mariculture also showing promise but being less emphasized by BTNK. Moreover, alternative livelihoods are expected to provide new sources of income for fishermen during off seasons (BTNK 2004a), and as we will see later on, seaweed farming, as opposed to tourism, seems to currently be the most important livelihood activity for fishermen during off seasons. In their zoning plan (BTNK 2004a), BTNK acknowledges several constraints that need to be overcome in order to permit the development of alternative livelihoods in KNP. These constraints are related to '(1) access to venture capital, (2) skills in the use of other resources available in the area, (3) motivation in seeking an alternative business ventures, (4) technical assistance in regards to training, (5) processing operations, and (6) marketing efforts' (BTNK 2004a: 25).

In the reports outlining the development process of the zoning plan, BTNK states that the responsibility of developing and promoting alternative livelihood strategies belongs not only to the protected area managers from the national park, but also to academia and other relevant agencies and institutions (BTNK 2004a). More specifically, the district government's role, according to the zone planning report, is to (Wibowo and Kartawijaya 2004: 28):

- Assist local communities in developing alternative livelihoods
- Provide human resource training and capacity building for tourism
- Promote tourism and provide the infrastructure to support tourism
- Assist the community with the marketing of alternative livelihood products that are and will be produced

The degree to which the regional government and other institutions provide support for the promotion of alternative livelihoods will undoubtedly have a strong effect on the successfulness of the various alternative livelihood initiatives being introduced in Karimunjawa National Park. The importance of this outside support is highlighted in a study by Salafsky and Wollenberg (2000), in which alternative livelihood activities such as tourism are shown to be strongly linked to conservation, however they are also shown to be more difficult for local communities to successfully implement on their own due to the complex nature of these types of enterprises.

5.3 Tourism

5.3.1 Tourism as an Alternative Livelihood

Currently in Karimunjawa National Park, BTNK officials are actively promoting tourism as an industry that has the potential to greatly improve the local economy and standards of living, all the while reducing pressure on fish stocks by offering a promising alternative livelihood for local fishermen. BTNK states that any development in Karimunjawa should accommodate social welfare in addition to environmental sustainability. Park officials therefore pinpoint ecotourism as an industry that, if well managed, fits well within these criteria (BTNK 2004a). Whether or not this strategy of tourism promotion in KNP will convince many fishermen to give up their nets in order to refit their boats for the comfort of tourists still remains to be seen.

An important factor in further developing tourism in Karimunjawa is the degree to which local communities will be keen to go along with, and participate in this new industry. BTNK confirms this requirement for community participation and further acknowledges the possibility that an influx of various foreign cultures through tourism could have an effect on, or could simply be incompatible with, local cultures (BTNK

2004a). In order to incentivize local village leaders into accepting the idea of tourism in order that they might promote it in their respective villages, BTNK has already organized a trip where a few village leaders were sent to Bali, Indonesia's tourism mecca[53], in order for them to witness first hand the economic potential of tourism. In an interview with BTNK's head, Mr. Nababan, he confirmed that another trip was being planned for the near future, in which a larger number of about twenty community leaders would be sent to Bali. Mr. Nababan mentions that the organisation of these trips is in response to low community interest in tourism throughout KNP, that according to him stems from the fact that local villagers don't seem to grasp the "big picture" and therefore aren't able to recognize the full potential that this industry can bring to the local economy. BTNK hopes that these trips will help encourage local community members to become more involved in the burgeoning tourism industry of Karimunjawa.

Despite these above-mentioned difficulties of getting people actively involved in tourism, our data shows very strong support for tourism in the two villages of Karimunjawa and Kemujan where our interviews were conducted. When the respondents were asked if they desired more tourists to come to Karimunjawa National Park, a staggering 95 percent declared that they were in favour of more tourists visiting the islands, while a very small portion (5 percent) claimed that they did not desire more tourists to visit KNP. With such strong support for increased tourism, we can assert that locals do indeed grasp the potential benefits of tourism, at least to a certain extent, and that the problem of low community participation in tourism, such as described above by Mr. Nababan, might find its roots elsewhere.

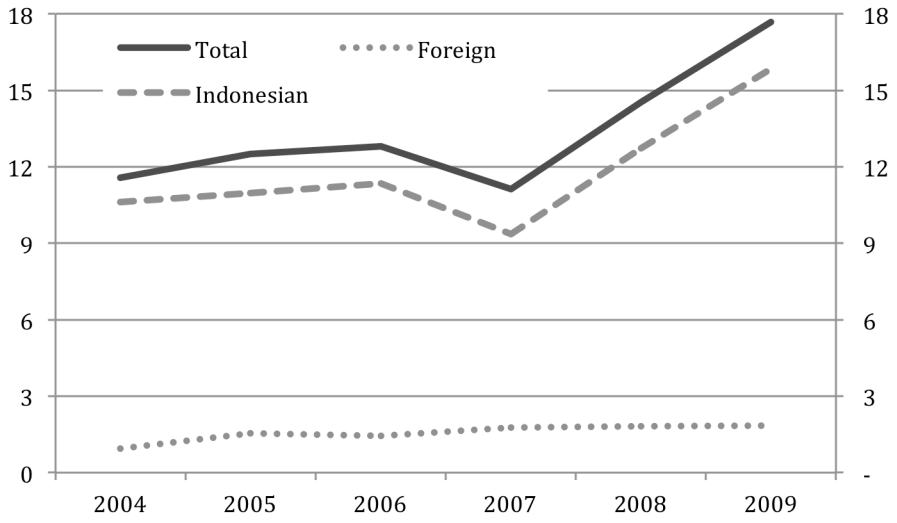
5.3.2 A Burgeoning Industry

As Figure 11 shows, visitors to Karimunjawa National Park between the years of 2004 and 2009 have increased overall by 53 percent. We can also see that the great majority of visitors were Indonesian, while foreign visitors only accounted for a fraction of the total. New hotels and guesthouses have been built during this period in order to accommodate the growing number of tourists visiting the islands. In 2004 there were nineteen homestays and hotels in KNP and in 2009 that number had increased to twenty-

[53] For the year 2011 alone, a total of 2,826,709 tourists visited Bali.

seven (BTNK 2004a; KK 2009). Our interviews revealed that only a minority of fishermen actually derived income from tourism, with 37.5 percent of respondents stating that they received money from tourism and another 62.5 percent stating that they did not.

Figure 11: Number of visitors to KNP from 2004 to 2009 (thousands)



Source: Ministry of Tourism's Jepara Office

Karimunjawa is becoming a well-known and popular vacation destination for Indonesians and especially for people from Java. Groups of students from various Javanese universities often visit the islands during their school breaks or even as part of their university programs to do social work. Although there are strong increases in Indonesian tourists, it is an entirely different story for foreign tourists. Karimunjawa still remains in the shadow of much better known destinations such as Bali, and as a result there is only a very slight increase in foreign visitors between the years 2004 and 2009, as Figure 11 clearly shows. If KNP's tourism industry is to reach the economic goals set out by its managers, it must find a way to attract more foreign tourists.

One possible explanation for such low numbers of foreign tourists is the relative difficulty for people unfamiliar with the region and language to reach the islands. Two ferries, one from Jepara and the other from Semarang, are the only options for reaching the park aside from a small airport on Kemujan that is mainly used by Kura Kura Resort, one of the most upscale resorts of the park, that uses its own plane exclusively for their

guests. Although the ferries each make trips between KNP and their respective ports a few times a week, it is rather difficult for foreign tourist to obtain information on the exact schedule of the ferries. The head of BTNK raised the issue concerning tourist's access to KNP during our interview in Semarang. He also pointed out that the safety standards for one of the ferries, KM Muria, was a cause for concern not only for BTNK, but for the local Karimunjawa office of the Department of Transportation as well. Built in 1994, the 33m long ship has a maximum allowable capacity of 263 passengers, but according to a source at the Department of Transportation, the KM Muria is often overloaded with as many as 500 passengers. Safety concerns about the ferry are further exacerbated by the poor condition of the ship and its peculiar tendency to arrive at port with a slight list caused by the emptying of one of the fuel tanks on either side of the ship. The issues concerning access to Karimunjawa highlights the importance for the cooperation between BTNK and the local government in developing alternative livelihoods.

5.3.3 Equal opportunities?

Although tourism is undoubtedly growing in the small archipelago, questions still remain about whether there is equal access to tourism opportunities, or whether the benefits from tourism are being equally shared between various stakeholders and villages. By looking at the data from our questionnaire, we find that our sample group was split down the middle on this topic. When asked if only a few people benefited from tourism in KNP, one half of the respondents answered "yes", while the other half answered "no".

KNP's tourism industry is for the most part comprised of three different stakeholder groups, namely tour guides, lodging providers (guesthouses and hotels) and boat owners. Tour guides, many of whom are from Java, act like middlemen between the tourists and the boat and lodging operators. Most visitors to KNP organize their trips through these tour guides who offer various packages that usually include lodging and activities such as hiking, camping, snorkelling and scuba diving. Tour guides organize marine activities by making arrangements with local boat owners for daylong outings to the surroundings islands, beaches and coral reefs. The role that tour guides play in bridging the gap

between tourists and locals employed in tourism is, as we will see, not without its problems.

Tour guides, in return for sending tourist to a specific hotel or boat, usually receive a percentage of the profits made from those transactions. A similar relationship exists between lodging providers and boats owners, in which a certain guesthouse for example will recommend one or two boat owners to their guests. These kickbacks shared between various stakeholders have helped create what is essentially a small network of people in the local tourism industry, centered in and around Karimunjawa village, that send business to one another while excluding aspiring tourism workers and preventing them from gaining a foothold in the industry. Many interviewed boat owners have criticised these relationships between established members of these three stakeholder groups. Some have indicated that these ties between tour guides, lodging providers and boat owners have made it very difficult for them personally when they first attempted to enter the tourism industry.

However, some boat owners who aspire to earn supplemental income from tourism, but that are excluded form the tight-knit network of tourism stakeholders, are beginning to take things into their own hands by offering their services directly to tourists. By cutting the middlemen out, boat owners can gain footing in the burgeoning tourism industry, not to mention keep the entirety of the profits. However, since very few, if any, boat owners speak English, their client base is for the most part limited to Indonesian tourist. For the moment this is not a problem as the great majority of visitors are Indonesian, however if KNP is to attract more foreign tourist as BTNK hopes, the issue of a language barrier could definitely become more of a problem. In a similar vein, some guesthouses are also choosing to operate outside the tight-knit network of tourism stakeholders by running and operating their own tour boats.

Other issues with the current state of tourism in KNP arise from the unequal distribution of benefits from tourism between villages. The village of Karimunjawa, located on the south shore of Karimunjawa island, is the biggest village of the archipelago where most businesses and government offices are located, as well as the only restaurants of the region. Also, the main port used to ferry people to and from Java is located in the north-eastern part of the village. Thanks to these factors most

guesthouses and resort are located in and around Karimunjawa village, with the exception a few luxurious resorts that occupy their own small islands. A few respondents have brought to our attention that nearly all benefits from tourism remain either in Karimunjawa village or with those who operate from there. One such respondent from a Bugis village on the island of Kemujan expressed his grievances over this by stating, "the tourists come to our village and take pictures of us like if we were animals in a zoo and don't spend any money in the village". He described how both Indonesian and foreign tourists often come to the village to see traditional Bugis houses, but they simply pass through without contributing to the local village economy.

5.4 An Unexpected Boom Industry: Seaweed Farming

In a short few years, seaweed farming has become a very important source of supplemental income for local households. Many fishermen have gotten into the industry thanks to its low barrier to entry and furthermore, many are able to simultaneously fish while maintaining their seaweed crops. Being a much more accessible livelihood than tourism for most fishermen, seaweed farming has become a very important component of a diversified livelihood strategy in a relatively short period of time. Thirty-nine percent of fishermen we interviewed stated that they are active in seaweed farming to various degrees.

The type of seaweed farming practiced in Karimunjawa National Park is relatively straightforward. Empty bottles are attached to a long monofilament line at intervals of about a few meters along its length in order to make the line float near the surface of the water. Both ends of the line are anchored to the sea floor so that it remains in place. Seedlings are then attached to the length of the line at intervals of a few dozen centimeters and are left in the water for 2 – 3 months in order to reach an appropriate size for harvest. Once harvested, the seaweed is spread-out and left to dry under the sun, after which it is ready for sale to regional, national and international markets. The most commonly harvested type of seaweed in KNP is eucheuma cottonii, from which a hydrocolloid compound called carrageenan is extracted. Carrageenan compounds are important ingredients in many products in today's modern food and dairy industry (Sievanen *et al.* 2005).

Figure 12: Photos of seaweed farming in KNP

a) Eucheuma cottonii

b) Seaweed cultivation lines

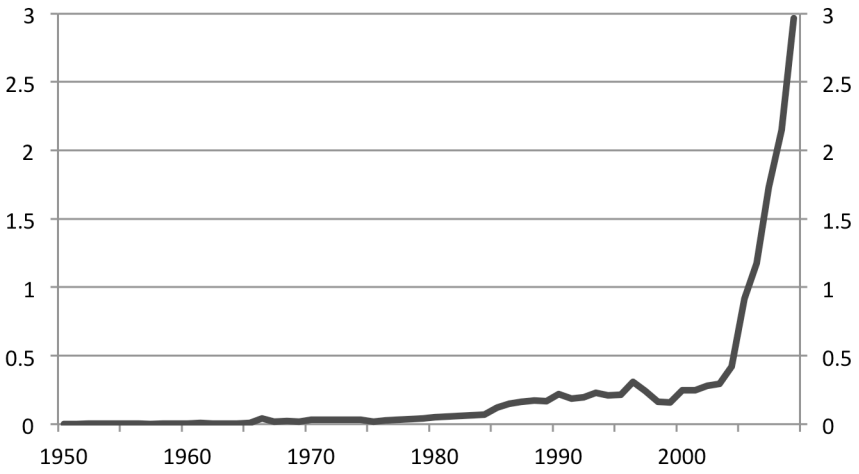
c) Seaweed drying tables

d) Juices and jellies with carrageenan as an ingredient

Sources: Gilles Maillet (c) & Dislautkan Jepara (a, b & d)

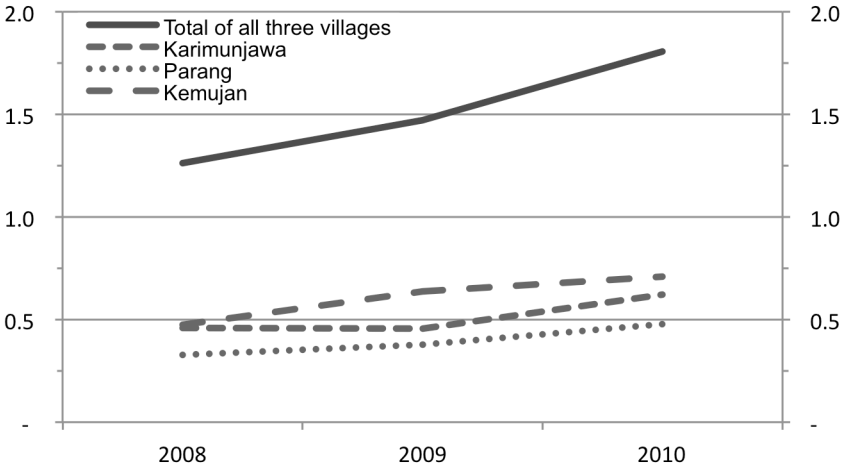
Seaweed farming's increasing prevalence as an alternative livelihood in KNP was somewhat unexpected for KNP managers. Having mostly focused on the promotion of tourism and grouper farming as an alternative means for locals to earn a living, the expansion of seaweed farming in the region occurred naturally in response to demand from regional and international markets. As we can see in Figure 13, this trend is not only present in the sub-district of Karimunjawa, but the whole of Indonesia, as seaweed production has exploded nationwide during the past few years. In a remarkable increase of productivity, Indonesia's seaweed production jumped from just under 0.25 million tons in 2000 to approximately 3 million tons in 2009. As for Karimunjawa, data for seaweed production only started being collected a few years ago, however from this

Figure 13: Total Seaweed Production in Indonesia (million tons)



Source: FAOStat, 2012

Figure 14: Seaweed Production in KNP (million kilograms)



Source: Department of Marine Affairs and Fisheries Karimunjawa

limited time frame we can already see a strong increase in production between the years 2008 and 2010. Figure 14 indicates that seaweed production for the villages of Karimunjawa, Kemujan and Parang combined figured at around 1.3 million kilograms in 2008 and increased to about 1.8 million kilograms in 2010 for the period between January and June. Considering that the data only shows production for half of 2010, it's safe to say that the finally figure for that year ended up being much higher.

Although the practice of seaweed farming necessitates a rather large coastal area, the cultivation of seaweed itself has been shown to be environmentally benign when compared to other mariculture practices. In fact, it has been shown to even have the potential to provide benefits to coastal environments by dissolving oxygen into the water and by providing shelter for fish. Furthermore, in the Philippines, fish production in and around severely degraded reefs has been improved thanks to seaweed farming, and as a result has provided economic benefits for nearby residents (De Silva 1998). However, seaweed farming is not without its caveats. Concerns have arisen about the possible negative effects of placing seaweed farming near or directly above coral reefs due to the shading of corals that might occur (Crawford 2002). Other possible negative environmental impacts include changes in patterns of sedimentation, water movements and erosion due to physical changes in habitat incurred by the introduction of seaweed farming (De Silva 1998). Other concerns about the depletion of nearby mangroves have been raised in cases where wood from mangroves is used as poles to secure seaweed farming lines (Crawford 2002). Despite these concerns, it's safe to say that the adverse effects of seaweed farming on the marine environment can be negligible as long as there exists proper management of the practice.

During the first few years of development of seaweed farming in KNP, BTNK did not directly sponsor the alternative livelihood in any way. However, in 2009 as the economic potential of seaweed farming and its benign nature became clearer, BTNK began offering assistance to locals wanting to enter the thriving industry. Falling under the larger *Bantuan Usaha Ekonomi* (Economic Effort Assistance) program put in place by BTNK, this support came under the form of equipment handouts and training to groups of ten seaweed farmers per year. Equipment handouts consisted of the rope and bottles that a seaweed farmers need in order to begin production. Because seaweed cultivation lines for individual farmers can sometimes span several kilometers, the simple fact of obtaining ropes at no charge enormously helps beginner farmers who often have very limited, or even no capital. The training program involved teaching locals how to process seaweed into end products such as drinks or edible jelly. The latter program encountered some issues however and was abandoned due to the difficulty associated in

receiving approval from the Indonesian Agency of Food and Drug Control, which is necessary to put those types of products to market.

Another option available for aspiring seaweed farmers, who aren't able to take advantage of BTNK's limited support programs, is to borrow seaweed farming equipment from some of the bigger seaweed traders of the region. In return for receiving sufficient equipment to setup a seaweed farming operation, the farmers is required to sell exclusively to the seaweed dealer who loaned the equipment at a discounted price. Once the debt is considered settled, the farmer is then able to sell to the dealer of his choosing at the going price.

5.5 Alternative Livelihoods: A Silver Bullet?

Historically, fishermen have often been described as the "poorest of the poor" who have only entered the fishing industry after being forced out of traditional occupations such as farming (Allison and Ellis 2001; Pauly 1997; Pollnac *et al.* 2001). This has given rise to the belief that fisheries are an 'occupation of last resort' (Pauly 1997: 3) that is only entered into by people who have no other opportunities for alternative employment. These two assumptions, among with others that characterize fishing as a dirty, hard and undesirable profession that poor people enter into because they are indifferent to what type of job they have as long as it provides enough sustenance for them and their families, have in turn lead fishery researchers and policy makers to automatically assume that fishermen would switch to an alternative livelihood if only given the opportunity (Pollnac *et al.* 2001). However, a study by Pollnac *et al.* (2001) has shown that this is not always the case and that such above mentioned assumptions are rarely in line with the reality of Southeast Asian fisheries. This research demonstrates that only a minority of fishermen from the populations sampled in Vietnam, Indonesia and the Philippines would actually switch to an alternative occupation if given the chance, with job satisfaction and income cited as reasons for sticking with the profession. The results of this study indicate that 'there is no support for the assumption that the majority of fishers would leave fishing if an alternative were available' (Pollnac *et al.* 2001: 542).

The results from Pollnac *et al.* (2001) go to show that although alternative livelihoods can indeed provide an important strategy within a well developed management plan, they

certainly do not provide a "silver bullet" for the protection of marine resources as so many make them out to be. The reality that many fishermen will choose to remain in the fishery for a variety of reasons which may include, tradition, love for the sea, no boss, etc, needs to be taken into account. This, in part, is why marine protected areas should avoid putting all their eggs in the alternative livelihoods basket and need to establish a strong co-managerial framework with the local community in order to ensure the robust management of their natural resources. Pollnac *et al.* (2001) also bring up the important point that in order for the alternative livelihoods model to work, the proposed alternative occupations should offer some of the same characteristics as those deemed to be desirable in fishing in order to be attractive to fishermen. This might help us explain the recent success of seaweed farming as an alternative livelihood in Karimunjawa National Park. Seaweed farming shares several characteristics with fishing such as a low barrier to entry, no boss and being out on the sea, all of which having been mentioned by fishermen interviewed in the study as desirable or pleasurable aspects of fishing.

With regards to seaweed farming specifically, thanks to the fact that it has been shown to be environmentally benign (Crawford 2002; De Silva 1998), an increasing number of MPA managers, including those at KNP, are looking to it as a promising alternative livelihood that might wean enough locals from the fishery as to produce a significant reduction in fishing pressure. This however might prove to be wishful thinking. A study examining how seaweed farming, promoted as an alternative livelihood within ICM projects, would affect fishing pressure showed that at a national scale seaweed farming had no impact on fishing efforts, while at local scales, seaweed farming had mixed results, with some case studies showing a reduction in fishing efforts and others showing none (Sievanen *et al.* 2005). The reasons for the apparent negligible impact of seaweed farming on fishing pressure in some areas were diverse, ranging from fluctuations in the seaweed market to the fact that women and children are often able to farm seaweed while the father is out to sea or that seaweed farming and fishing can be carried out at different times of the day. Furthermore, thanks to the diversified livelihood strategies of most coastal fishing communities in Indonesia, if a seaweed crop were to fail, it is very easy for people to revert back to fishing in order to maintain a stable income. Sievanen *et al.* (2005) go on to emphasize that alternative livelihoods alone can't

ensure the proper protection of natural resources, but that it can provide a valuable component to a diversified livelihood strategy when coupled with other resource management tools. Karimunjawa National Park managers seem to be conscious of these facts as they are continuing to devote efforts towards better implementing the objectives laid out in their management plan which, on top of promoting alternative livelihoods, will also focus on promoting the sustainable use of resources, the improvement of community participation in conservation, education and training.

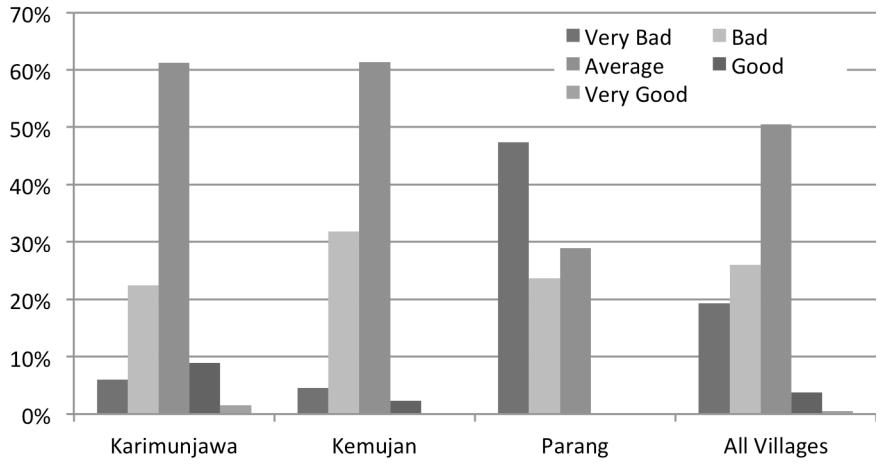
6 Attitudes and Perceptions in Karimunjawa

6.1 Perceptions about the Condition of Local Fisheries and Coastal Resources

This section will outline some of the perceptions found in all three Karimunjawa National Park villages in regards to the condition of the local fishery and coastal resources. The data presented has been drawn from both secondary sources obtained during our fieldwork and from the questionnaire data obtained during our interviews with local fishermen.

In a socioeconomic monitoring study conducted in 2009 (Figure 15), WCS and BTNK researchers found that only a small minority of the respondents in all three KNP villages perceived the condition of fish catches as being in good condition, with zero percent describing catches as very good and another 4 percent describing them as good. The most popular response was the one of "average" at 51 percent, followed by "bad" at 26 percent and "very bad" at 19 percent. These results clearly show that that most community members who participated in the 2009 study perceived fish catches as being in average condition, with another significant portion believing them to be in either bad or very bad shape.

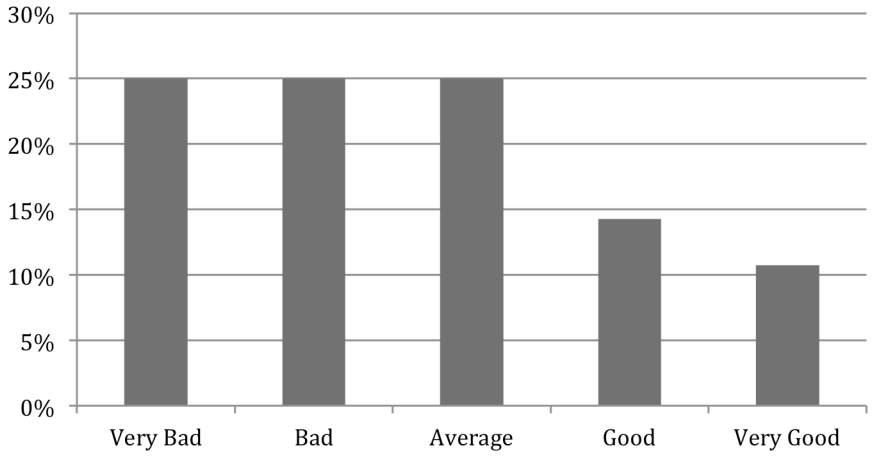
Figure 15: Community perceptions towards the condition of fish catches (2009)



Source: Yulianto *et al.* (2009)

These results are mirrored in the data from our own interviews. As we can see in Figure 16, it would seem that perceptions about the condition of the local fishery have become even more critical since 2009, at least on the islands of Karimunjawa and Kemujan where the interviews during our fieldwork took place. For example, we can easily notice that a much larger percentage of respondents, 25 percent, qualified their responses as "very bad" in our 2010 interviews (Figure 16) as compared to the relatively few, 6 and 5 percent for Karimunjawa and Kemujan respectively, who chose "very bad" in 2009 (Figure 15).

Figure 16: Perceived condition of local fishery



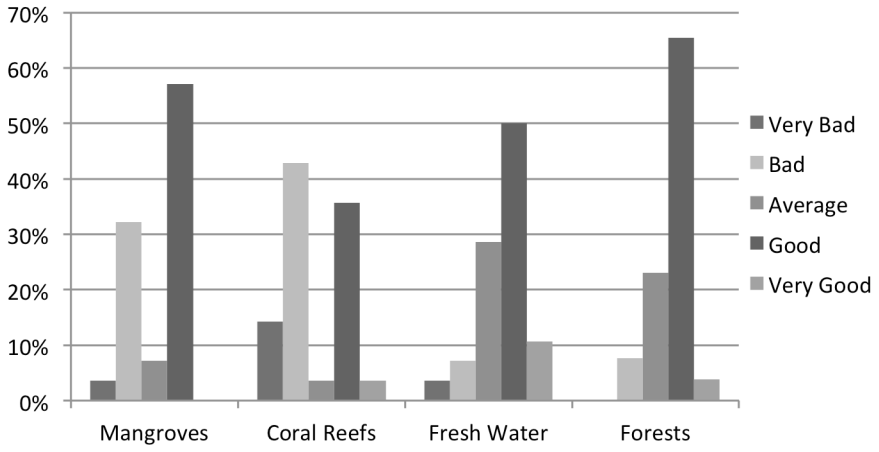
Source: Questionnaire data

Furthermore, eighty-five percent of the respondents from our 2010 interviews stated that their catches had decreased over the past five years, with an average estimated decrease of 55 percent. These results are the same as those of a 2005 study conducted by WCS and BTNK (Wibowo 2005) that showed that an average of 85 percent of fishermen in all three KNP villages (Karimunjawa 76%, Parang 95%, Kemujan 85%) felt that their catches had decreased over the past five to ten years. By comparing the data from the 2005 report (Wibowo 2005) and our own data from 2010, we can observe that there haven't been any changes in regards to perceived catch levels since the re-zoning of the MPA in 2005. The large majority of fishermen still feel that their catches are declining

even five years after the implementation of new regulations that aimed to improve fish stocks within the park.

More generally, as for what concerns the condition of natural resources, the 2005 study co-written by WCS and BTNK (Wibowo 2005) found that 70% of respondents from all 3 villages within KNP felt that the condition of the coral reefs has declined during the last 5-10 years. Our own questionnaire data (Figure 17) revealed the following perceptions in regards to the condition of a few important types of natural resources in KNP. The majority of respondents agreed that mangroves, fresh water and forests were in "good" condition, with 57, 50 and 65 percent of respondents stating so, respectively. Coral reefs were considered as being in the worst condition than all other natural resources, with 57 percent of respondents describing them as being in either bad (43%) or very bad (14%) condition. It is worth noting however that another 36 percent of respondents stated that they felt the coral reefs surrounding KNP were in "good" condition.

Figure 17: Perceived condition of natural resources in KNP

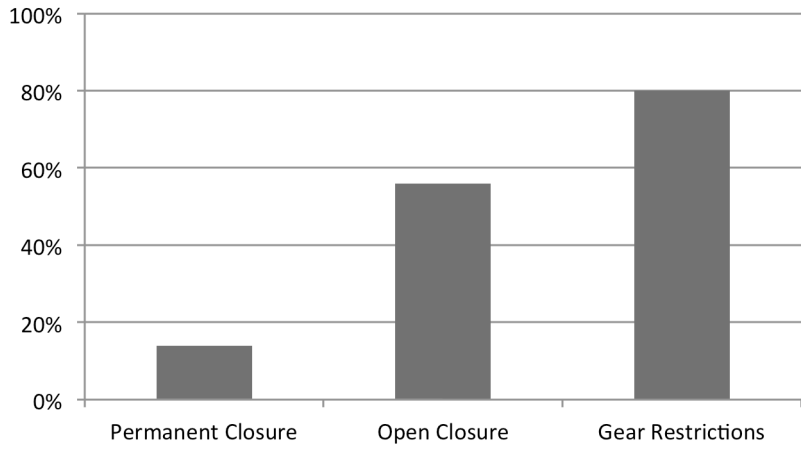


Source: Questionnaire data

6.2 Attitudes Towards Natural Resource Protection and Increased Regulation

As we have seen in the above section, the majority of the fishermen who were interviewed for our study and for BTNK's and WCS's studies possess either neutral or negative subjectivities in regards to the condition of the local fishery and fish catches. This is the general state of things four and five years after the introduction of the new zoning plan that occurred in 2005. In this section we will observe if these negative attitudes have carried over to the issues of natural resource protection and increased regulation within the park, all the while attempting to see if the community's subjectivities in regard to these issues have changed since the re-zoning.

Figure 18: Community perceptions on fisheries management in 2003

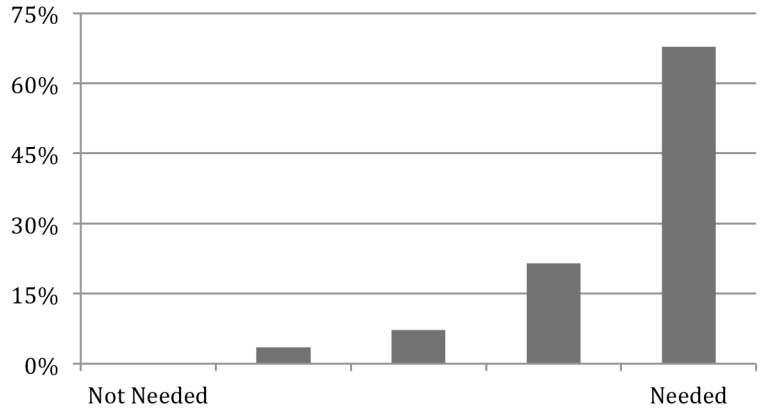


Source: Marnane *et al.* (2003)

In the chart above (Figure 18) we observe that a mere 14 percent of people were in favour of permanent closures of fishing grounds in 2003, while the majority were open towards gear restrictions. This hesitation amongst fishermen about permanent closures was attributed to general belief that permanent no-take areas would negatively affect fish catches as well as livelihoods of fishermen due to the reduced number of fishing grounds that would result from their implementation (Marnane *et al.* 2003). However, during our field interviews in 2010, these attitudes appeared to have significantly changed, with the large majority of interviewed fishermen (89 percent combined) showing positive attitudes towards the importance of coastal management rules and regulations (Figure 19).

Considering that the current rules and regulations are centered around a zoning system with multiple no-take areas permanently closed to fishermen (core zones, protected zones, tourism utilization zones, etc), we can conclude that fishermen's attitudes towards permanently closed areas have undergone a significant shift in the years between 2003

Figure 19: Perceived Importance of Coastal Management Rules and Regulations (2010)

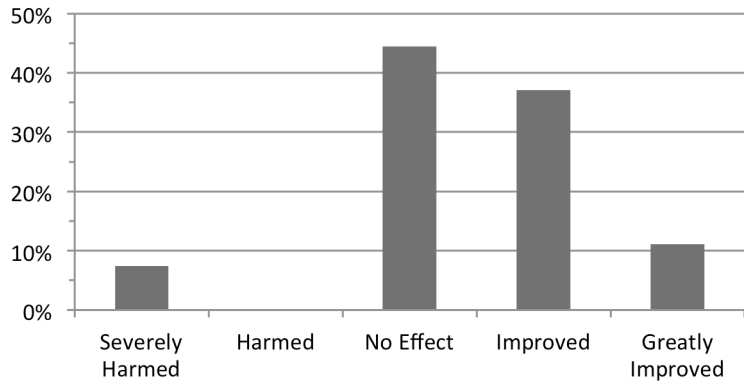


Source: Questionnaire data (see Appendix I)

and 2010. Furthermore, a recent report published by WCS corroborates these findings by revealing that 51.43 percent of fishermen were against the idea of zoning in 2005, while in 2009 that number had decreased to 20.13 percent (Yulianto *et al.* 2009). Yet again, this shows a positive shift in the subjectivities of fishermen in regards to the 2005 MPA re-zoning.

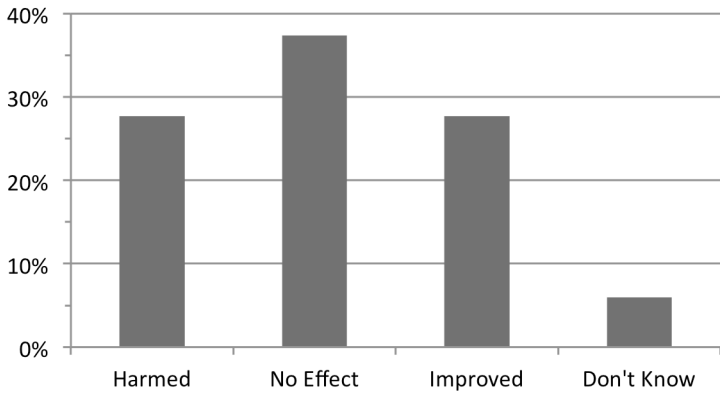
In fact, our interviews with local Karimunjawa fishermen in 2010 showed that a majority of fishermen actually perceived the new zoning system as having a positive effect on local fishermen's livelihoods. Figure 20 shows that a total of 48 percent of respondents stated that coastal regulations had either improved (37%) or greatly improved (11%) local livelihoods, while only 7 percent stated that livelihoods had been greatly harmed. This again demonstrates a positive shift in fishermen's subjectivities in regards to zoning. In 2005 only 28 percent of respondents claimed that MPA zoning had benefited local livelihoods, while another 28 percent claimed that it had harmed livelihoods (Figure 21). Some Karimunjawa fishermen who were of the opinion that MPA zoning improved peoples lives justified their belief by explaining that future

Figure 20: Perceived effects of coastal regulations on livelihoods (2010)



Source: Questionnaire data

Figure 21: Perceived effects of zoning on livelihoods (2005)



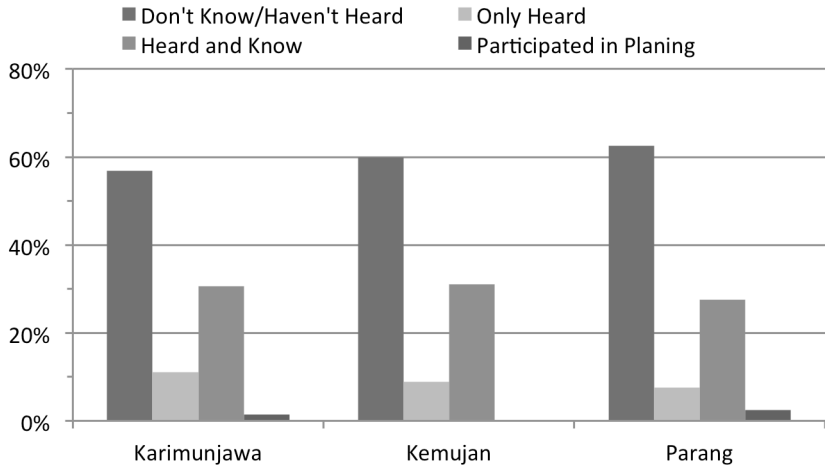
Source: Wibowo (2005)

generations would be able to benefit from coastal resources thanks to the protection provided by zoning. On the other hand, fishermen who believed that zoning had negative impacts on livelihoods explained that the establishment of no-take areas had reduced the number of available fishing grounds and thereby forced fishermen to spend more on fuel in order to reach viable fish grounds (Yulianto *et al.* 2009). This last point was reiterated several times during our interviews by respondents who felt that BTNK was making fishing in KNP more difficult by forcing fishermen to go further in order to catch fish.

6.3 Knowledge of MPA Regulations and Zones

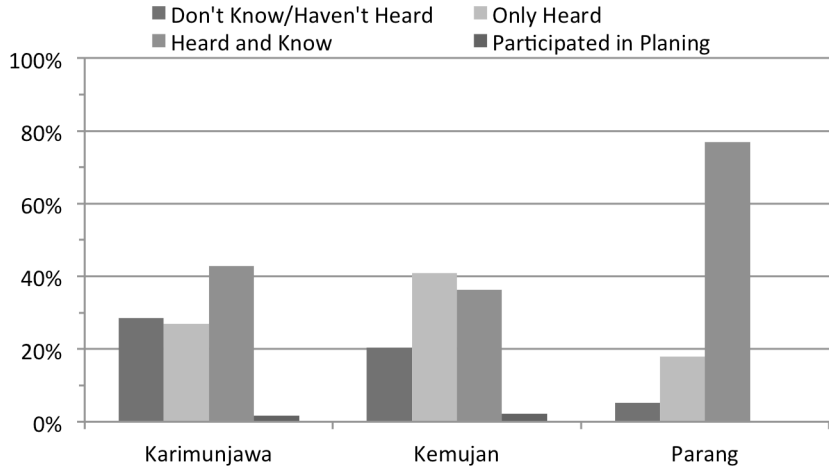
As for what concerns the community's awareness about zoning, we find that there has also been significant progress on this front. In a recent report from WCS (Yulianto *et al.* 2009), we find data comparing community knowledge of zoning between the years 2005 and 2009. In Figures 22 and 23, we find that the percentage of people who didn't know or hadn't heard of the MPA zoning had decreased significantly in all three villages

Figure 22: Community knowledge about zoning (2005)



Source: Yulianto *et al.* (2009)

Figure 23: Community knowledge about zoning (2009)



Source: Yulianto *et al.* (2009)

between the years 2005 and 2009. For example, the percentage of people unaware of zoning had decreased from 57 percent to 29 percent in Karimunjawa, from 60 percent to 20 percent in Kemujan and from 63 percent to 5 percent in Parang. As for the amount of people who had heard about the zoning, but who did not necessarily know where the different zones are, their numbers had increased from 11 percent to 27 percent in Karimunjawa, from 9 percent to 41 percent in Kemujan and from 8 percent to 18 percent in Parang. And finally, the amount of people who had heard and who knew about the zoning had increased from 31 percent to 43 percent in Karimunjawa, from 31 percent to 36 percent in Kemujan and from 28 percent to 77 percent in Parang. These numbers are a strong indication that the awareness raising efforts of the National Park have had positive results in educating the local community about zoning and coastal rules and regulations, with the most important changes having occurred in the village of Parang. However, the data from Figures 22 and 23 also show that a relatively large portion of respondents, especially in Karimunjawa and Parang, only claim to have heard of the zoning and do not know anything else about it such as the location of the different zones throughout the park, what is permitted or prohibited in each zone, etc. This would indicate that although the awareness raising efforts of BTNK have undoubtedly brought zoning to the attention of many, these efforts have been less successful in properly educating the community about the geographic and regulatory details of the zoning.

This last point is well demonstrated in the data from our fieldwork questionnaire. In an attempt to gain insight into just how knowledgeable our respondents were about the location and the rules and regulations for various zones, the fishermen were asked to name the zone in which a certain geographical area was located as well as answer “true” or “false” for various statements relating to the rules and regulations of a few zones. This goes beyond simply putting forth questions such as: “Do you know the location of each zone in the park?” or “Do you know the rules and regulations for each zone?”. By actually testing the knowledge of respondents in regards to zoning, we gain a more accurate picture about the state of zoning awareness in the park. The questions asked to the respondents were the following (Question 8 from Appendix I):

1) What zone do the following areas fall under (Core Zone, Protected Zone, Usage Zone)?

a. Taka Malang _____

b. Pulau Gelean _____

c. Pulau Katang _____

2) Answer true or false to the following statements:

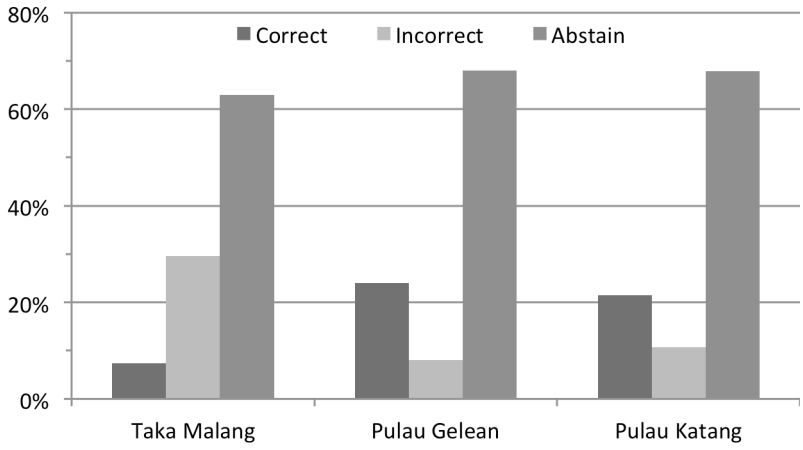
a. No fishing is allowed in the *Zona Pemanfaatan Wisata* (Tourism Utilization Zone) _____

b. Only traditional fishing is allowed in the *Zona Inti* (Core Zone) _____

c. *Tembak* (spearfishing) is not allowed in the *Zona Perlindungan* (Protected Zone) _____

In Figure 24 below, the results from the first question, in which respondents were asked to identify the proper zone for each location, have been compiled to show the percentage of respondents who answered either correctly or incorrectly, or who abstained from answering. As we can see, the large majority (63 percent for Taka Malang, 68

Figure 24: Results for question number 1



Source: Questionnaire data

percent for Pulau Gelean and 68 percent for Pulau Katang) were unsure of which zone to assign to which location and therefore abstained from answering. When looking at incorrect responses, we observe that 30 percent answered incorrectly for Taka Malang,

while 8 and 11 percent answered incorrectly for Pulau Gelean and Pulau Katang respectively. As for correct responses, we find that only 7 percent answered correctly for Taka Malang, while 24 and 21 percent answered correctly for Pulau Gelean and Pulau Katang respectively. These results indicate that although many are aware of zoning in KNP, very few are actually familiar with the location of the various zones throughout the park.

The results for the second question, in which respondents answered "true" or "false" to a variety of statements pertaining to the rules and regulations of several zones, were somewhat better than the results of the first question, but remain far from ideal. First of all, to the statement "No fishing is allowed in the Tourism Utilization Zone", for which the correct answer is "true", the majority of respondents (61 percent) answered correctly while another large portion (32 percent) abstained from answering. A small minority of 7 percent gave incorrect responses. Secondly, to the statement "Only traditional fishing is allowed in the Core Zone", for which the correct answer is "false", the results were much more evenly distributed. A relative majority of 39 percent answered incorrectly, while another 36 and 25 percent answered correctly or abstained from answering, respectively. Finally, to the statement "Spearfishing is not allowed in the Protected Zone", we find that the majority (71 percent) of respondents answered correctly, while another 21 percent gave incorrect responses. For this last question, only 7 percent of respondents chose to abstain from answering. These results suggest that our sample group was much more familiar with some regulations as opposed to others. For example, the large majority of respondents gave correct answers for both the first and last statements, while a slight relative majority gave incorrect responses for the second statement.

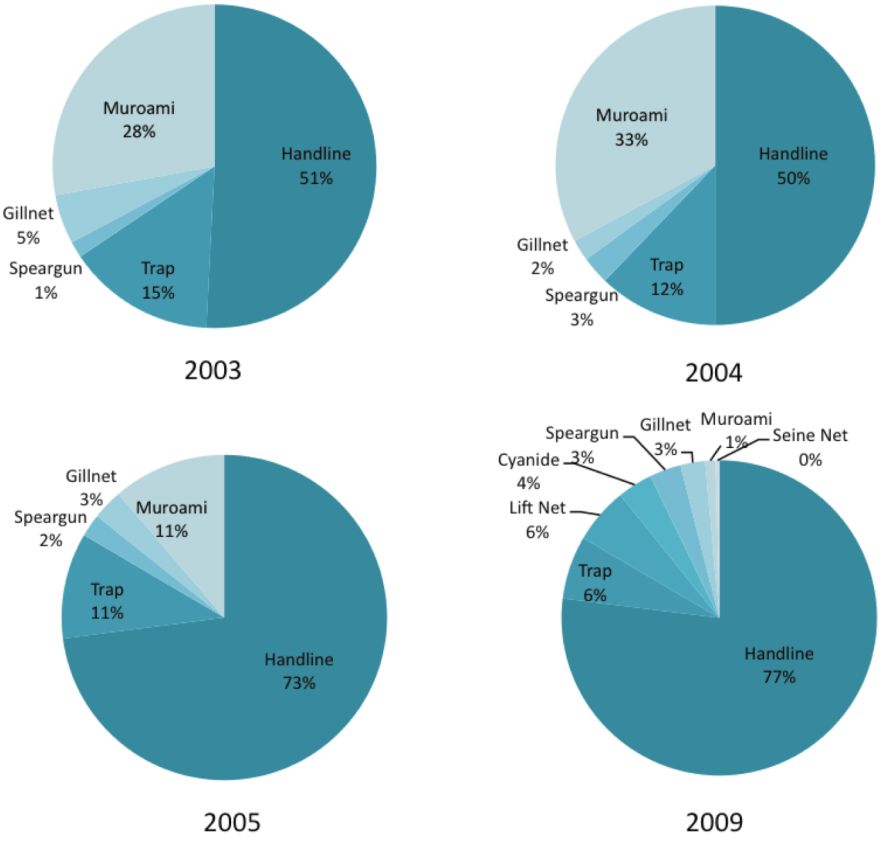
Furthermore, several respondents expressed concerns about the low level of knowledge about MPA zoning amongst their peers. One respondent from Kemujan stated that fishermen from his village know of the existence of zones, but know nothing about their placement or about the rules and regulations associated to each zone. Another interviewee from Karimunjawa mentioned that he had participated in a workshop held by BTNK where zone locations were discussed, but not the rules and regulations for the zones.

6.4 Compliances to MPA Regulations

In terms of compliance to the MPA regulations imposed by Karimunjawa National Park, there has been significant progress during the past few years. As we saw in our description of KNP destructive fishing practices (DFPs) in Chapter 3, some DFPs such as muro-ami became so widespread throughout the region that 55.8% of all fish landed in Karimunjawa between 2003-2005 actually came from muro-ami (Mukminin *et al.* 2006). However, since then muro-ami has been virtually eradicated from KNP waters. While the data is inconsistent about the exact number of muro-ami outfits operating in Karimunjawa waters at various points in time, the downward trend is indisputable. One WCS report states that 27 muro-ami groups were active in 2003, while five were active in 2004 and only one in 2005 (Ardiwijaya, Wibowo*, et al.* 2006). A separate report co-written by WCS and BTNK states that three muro-ami outfits were present in KNP in 2004 (Yulianto *et al.* 2007). While both Ardiwijaya, Wibowo*, et al.* (2006) and Yulianto *et al.* (2007) each present different numbers for muro-ami operations present in Karimunjawa in the year 2004, five and three respectively, we can nonetheless assert that a drastic reduction in muro-ami operations has occurred since the implementation of the new management plan. Figure 25 represents yet another source showing the downward trend in muro-ami fishing operations in KNP's core and protected zones. We observe that at its highest point in 2004 muro-ami was responsible for 33% of fish landings, while in 2009 was responsible for a meagre 1% (Prasetia *et al.* 2010).

Another destructive fishing gear that has successfully been eradicated from KNP waters is the seine net. In an interview with the WCS Karimunjawa Program Coordinator, he mentioned that locals have stopped using seine nets in the past few years, going from 20 -25 active users to zero. In fact, all infractions related to seine nets in 2009 were perpetrated by fishermen from outside Karimunjawa (Prasetia *et al.* 2010). One destructive fishing practice that is still present, although to a lesser degree than before, is cyanide fishing. In the pie chart for 2009 in Figure 25, we can see that cyanide fishing accounted for 4 percent of all fishing gears in core and protected zones. Fishermen who use cyanide in KNP are said to be able to avoid getting caught by park authorities because they are familiar with the locations and schedule of BTNK patrols.

Figure 25: Changes in fishing gear composition in core and protected zones between 2003-2009



Source: Prasetia *et al.* (2010)

Despite the lingering problem of cyanide fishing, it is clear that good progress has been made in KNP towards the reduction of destructive fishing operations. However, compliance is still an issue in KNP, especially in regards to MPA zoning compliance. Fishing in no-take zones, like the core zone, protected zone, tourism utilization zone, etc., is still relatively common throughout the marine protected area.

The map in Figure 26 shows us the fishing pressure for 2009 throughout Karimunjawa National Park. We can plainly see that some areas that are designated as no-take zones are still being exploited to various degrees. For example, we find medium and high fishing pressure around the islands of Menjangan Besar and Menjangan Kecil respectively, even though both these islands fall within a designated no-take tourism

utilization zone. Several other examples can be found in the map where not only tourism utilization zones are being subjected to heavy fishing pressure, but protected and core

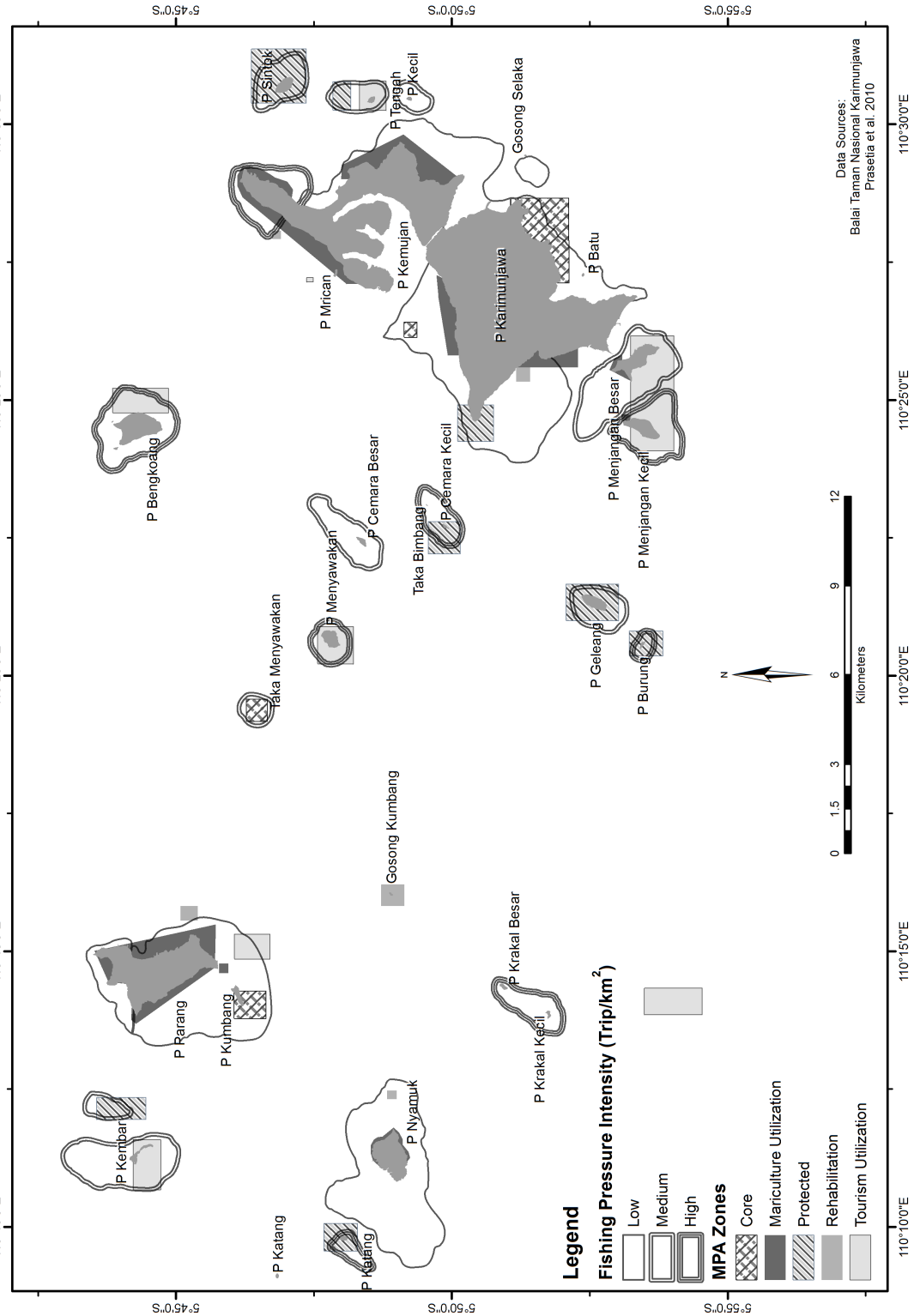


Figure 26: Map of fishing pressure in Karimunjawa National Park MPA zones (2009)

zones as well. Of the four core zones, Taka Menyawakan is where we find the heaviest fishing pressure in 2009, rated at medium intensity, while all other core zones are shown to receive low intensities of fishing pressure. As for protected zones, four of the eight zones have received medium intensity fishing pressure during 2009, while three of the eight zones have received high intensity fishing pressure. The average level of compliance in the core zone is higher than in the protected zone, however considering that all these zones are designated as strict no-take areas, the fact that any fishing pressure can be found within them would suggest a relatively severe lack of compliance amongst fishermen in regards to zone boundaries. In fact, compliance monitoring conducted by WCS in 2009 uncovered that a total of 839 fishing vessels had been found operating in the MPA's no-take zones, of which 53 vessels breached the core zone and another 225 vessels the protected zone (Prasetia *et al.* 2010).

By far, the most commonly used fishing gear in no-take zones is the hook and line, which accounted for 79 percent of cases in 2009. In Figure 25 shown earlier, we can observe an upward trend in the number of infractions committed by hook and line fishermen in the core and protected zones combined. For these two zones, hook and line (also known as handline) account for 51 percent of all infractions in 2003 and by 2009 had risen to account for 77 percent of all infractions. When considering again the infractions for all no-take zones combined in 2009, the composition of fishing gears was as follows: *bubu* trap (6%), gillnet (4%), lift net (4%), seine net (3%), cyanide (2%), muro-ami (1%) and Speargun (1%) (Prasetia *et al.* 2010).

What is interesting from this data is that knowledge about zoning is not positively correlated with levels of compliance in regards to zoning. Although much progress has been made in KNP in regards to the use of various destructive fishing practices such as blast fishing, cyanide fishing and muro-ami, zoning compliance is still an issue despite the fact that WCS studies have stated an increased awareness of zoning amongst fishermen. However, we find this unsurprising because as we mentioned in section 6.3 above, although many more fishermen are presently aware of the existence of zones throughout the park, relatively few are actually knowledgeable as to the location of the zones throughout the park. One program that might help mitigate this problem is BTNK's PAM Partisipatif program that encourages fishermen to become more involved in park

enforcement. As fishermen become more involved in park management, it would be fair to assume that they will become more knowledgeable as to the location of the MPA zones.

Although KNP fishermen have not shown the highest levels of compliance, the situation is still worse when talking about fishermen from outside the park. Many fishermen from the northern coast of Java operate in or around KNP. While more research is needed to gain a picture of the levels of awareness of park zoning for this group, the Wildlife Conservation Society's compliance report shows that outside fishing boats are an important source of fishing pressure in KNP's no-take zones. Of the 839 fishing boats observed operating in no-take zones, only 3.81 percent were boats from outside the park. However, the fishing pressure caused by this small group is exponentially larger due to the non-traditional nature of their fishing gears. WCS estimates that fishing boats from outside the park are responsible for approximately 38.4 percent of fishing pressure when adjusted for the impact of these boats' modernized fishing gears (Prasetia *et al.* 2010).

The presence of these outside fishermen is not only negatively affecting the state of local fish stocks, but also the relations between local and non-local fishermen. Conflicts between these two groups have already escalated to the point where boats have rammed one another in the past. Several of our interviews with local fishermen revealed deep frustrations in regards to the activities of outside fishermen within Karimunjawa National Park boundaries. Several respondents talked about how outside fishermen do not follow the rules and regulations of the park and as a result deplete the fish stocks within traditional fishing grounds. KNP managers are very aware of this issue and have begun prosecuting intruders more heavily by actually having adapted park policy in order to focus more on the apprehension and prosecution of outside fishing vessels operating illegally within KNP as opposed to local fishing boats who infringe on park rules and regulations. However, this is somewhat challenging simply because of the difficult task of properly being able to patrol KNP waters. Yet again, this is an area where park managers hope that the new PAM Partisipatif program might be able to contribute. BTNK plans to begin awareness-raising campaigns about the MPA's various zones in fishing villages located outside KNP in the hopes of reducing illegal fishing by outside

fishermen. When this is accomplished, BTNK's plan is to shift their focus again towards apprehending local fishermen who violate park rules.

7 Conclusion

This study aimed to shed light on a few key socioeconomic aspects related to MPA implementation in Karimunjawa National Park, Indonesia. First of all, we set out to determine how the MPA had adapted and changed over time in order to better improve both the physical condition of the surrounding environment and the socioeconomic condition of the local populations. Another main component of this research was to determine what were the perceptions of local fishermen in regards to the need for coastal regulation and the condition of the local fishery. Finally, our last objective in this study was to examine what socioeconomic changes that had occurred in local fishing villages as a result of MPA implementation. These three objectives were examined through a theoretical framework using both environmentality and the livelihoods approach at its foundation.

In Chapter 3 we laid the contextual groundwork for destructive fishing practices and overfishing in Indonesia in order to gain a better understanding of the seriousness and ubiquitousness of these problems. The push to modernize the country's fishing fleets to develop the fisheries sector made it so that the management of Indonesia's marine resources focused more on their commercial development than on their sustainable exploitation. Like most other areas in Indonesia, Karimunjawa was severely affected by these destructive fishing practices as blast fishing, muro-ami and cyanide fishing wreaked havoc on its coral reefs. As we saw in Chapter 4, the Indonesian government began implementing in the 1980s a series of policies in an attempt to address the problems associated with the fisheries sector. Although progress was relatively slow, these new policies enabled the development of a rather large, although mismanaged, MPA network throughout the country. The decentralization of marine resource management helped improve the management of MPAs throughout the country and this is when we can observe a significant change in the management approach used in KNP. Chapter 4 provides evidence that KNP managers are very open to adaptive management in order for park policy to better fit the evolving ecological and socioeconomic conditions within the park. BTNK's new 25 Year Management Plan adopted in 2005 includes several important management strategies that are currently recognized as the most promising for proper MPA management in modern coastal management literature. These strategies,

revolving around co-managerial and interdisciplinary approaches, aim to get more locals actively involved in the management of resources on which they depend for their livelihoods. However, although KNP has indeed adapted its 25 Year Management Plan to include co-management, they have not fully introduced mechanisms conducive to co-management in practice. We find that BTNK's objective of increasing community participation in coastal resource management was never fully realized, thanks in part to the failure of increasing local institutional capacity that would have helped raise community awareness about BTNK's activities. BTNK has spent much of its efforts in the five years following the 2005 re-zoning on issues such as marine ecosystem research, protection and rehabilitation. Although such work on the physical environment is unquestionably very important for the management and conservation of marine resources, other work of a more social dimension, such as awareness raising and the establishment of formalized forums of communication between community members and BTNK staff, would most definitely have helped BTNK come closer to achieving its goal of co-management. Furthermore, this lack of proper communication has not improved relations between BTNK and the local community. As our analysis reveals in Chapter 4, there is a definite rift between those doing the governing and those governed. Our interviews with local fishermen revealed that many in the community feel as though they have nothing to do with the decisions BTNK make about the management of marine resources and that they wouldn't even know how to go about discussing a hypothetical problem with BTNK if one were ever to arise. With co-management being widely regarded in the literature as the most successful approach in MPA management, one can't help wonder if BTNK's decision not to build a formal co-managerial framework won't cause difficulties in the future.

This research has equally shown shifts in the fishing community's subjectivities in regards to fisheries regulations, especially in regards to the utilization of no-take zones throughout the MPA. Such as described in Agrawal's notion of environmentality, we observe that the attitudes of KNP fishermen have become aligned with policies set by the governing body. Our analysis in Chapter 6 reveals these shifts in subjectivities by demonstrating that many more people have become open to the idea of implementing no-take zones around fishing grounds as opposed to the past. These shifts in subjectivities

are quite significant when we consider that in 2003 only 14 percent of the sample group were in favour of permanently closed no-take zones while in 2010 a total of 89 percent of respondents showed positive attitudes towards the current rules and regulations in KNP that are based on a series of no-take zones. Furthermore, we can also observe how environmental subjects were formed in KNP by taking a look at the environmental practices of local fishermen. The significant reduction of muro-ami and cyanide fishing in the few years following the implementation of the new 25 Year Management Plan indicates how Karimunjawa fishermen have willingly modified their fishing practices around the conservation goals of BTNK. Furthermore, our analysis also demonstrated that the subjectivities of respondents in regards to the impacts of park zoning on local livelihoods had also undergone significant change. We observed that the number of people of the opinion that zoning had improved local livelihoods had gone up from 28 percent in 2005 to 48 percent in 2010 and that people of the opinion that zoning had harmed livelihoods had decreased from 28 percent in 2005 to 7 percent in 2010. These results plainly show a positive shift in the subjectivities of local actors about BTNK's coastal management policies and provide strong evidence for the formation environmental subjects such as described by Agrawal's environmentality.

However, although certain fishing practices have changed in order to better fit with the conservation and management policies of BTNK, we find that there is still much progress to be done in regards to where fishermen choose to operate. Although we have found strong support for fisheries management and conservation in our analysis in Chapter 6, these positive subjectivities have not translated into full compliance of MPA zones. In 2009, varying degrees of fishing pressure could still be found in all of the no-take zones in KNP. For example, of the eight protected zones in KNP, three received high levels of fishing pressure and another four received medium levels of fishing pressure. What we found is that knowledge and even support of zoning is not positively correlated with levels of compliance in regards to zoning. This means that although fishermen are aware and even supportive of the presence of no-take zones in the park, they are not necessarily knowledgeable as to the location of the various types of zones or about what is or is not allowed within each zone. On this front, we find that there is still much work

to be done in order to properly raise the local community's awareness about the location of zones and their associated rules and regulations.

This study likewise illustrated the socioeconomic shifts that had occurred in KNP since the re-zoning of the MPA in 2005. Our analysis in Chapter 5 revealed a correlation between the implementation of no-take zones throughout KNP and the reductions in fishing activity and fish catches in the following years. Although causation cannot always be drawn from correlation, these results coincide with other research done on this topic. We can therefore assert that the reduction of fishing grounds due to the implementation of no-take zones in KNP has undoubtedly had a negative impact on local livelihoods derived from fishing. However, these negative impacts on fish catches are expected to be temporary because of the high probability for the replenishment of fish stocks within an MPA using no-take zones. Additionally, we saw how the majority of households utilize a diversified livelihood strategy in order to cope with modified access to natural resources and/or reduced availability of natural resources. The livelihoods approach provided us with a valuable tool when examining how local households were able to engage in alternative livelihoods, such as seaweed farming and tourism, in the face of diminishing fish catches.

In spite of BTNK's attempt to make tourism KNP's principle alternative livelihood, seaweed farming has proven to be much more successful as a main component of a diversified livelihood strategy in KNP. Having arisen naturally through market forces, seaweed farming has proven to be a more accessible endeavour than tourism for the great majority of fishermen in KNP. Although there has been an increase of 53 percent in visitors to KNP between 2003 and 2009, many boat owners have expressed frustrations about not being able to enter the burgeoning tourism industry because of the tightknit network of lodging providers, tour guides and boat owners that keep business between themselves through kickback based arrangements. Furthermore, the benefits drawn from tourism were perceived by many respondents as being unequally distributed in KNP, with the lion's share said to end up in the village of Karimunjawa. Due to these reasons, seaweed farming, with its low barrier to entry, has become a much more attractive venture compared to tourism for local fishermen hoping to curb diminishing incomes due to dwindling fish catches.

Furthermore, we have shown in Chapter 5 that BTNK's desire to reduce fishing pressure by promoting alternative livelihoods, be it tourism or otherwise, might prove to be problematic due to the common oversimplification of this problem. The assumption that fishing is an "occupation of last resort" only entered into by individuals with no other opportunities has been shown to be baseless in a study conducted by prominent coastal management researchers. What they have found instead is that the majority of fishermen in SEA would actually stay in fisheries even when given the opportunity to do something else. Furthermore, we have illustrated how the growth of seaweed farming in a certain area does not automatically guarantee a reduction in fishing pressure as so many assume. This is because seaweed farming can be practiced at different periods than fishing and that women and children are able to do most of the work associated with seaweed farming while the father is out to sea. Therefore, we recognize in this research that in addition to promoting alternative livelihoods, BTNK managers also need to continue working on their efforts to better improve the level of community participation in conservation and natural resource management.

The results of this research indicate that MPA management in KNP is indeed adaptive to ecological and socioeconomic changes within its borders. Furthermore, the local community have demonstrated positive shifts in subjectivities in regards to the new rules and regulations imposed by BTNK during the restructuring of the park's management plan. Although these regulatory changes have negatively affected the local fishing industry in the short term, alternative livelihoods have begun to take root in order to offset some of the diminished incomes from fishing. However, the feeling of marginalization from the policy making process is common in KNP; a fact that risks to either stall community support for coastal management or even reverse what progress has been made in creating environmental subjects within KNP. A better co-managerial framework where community members could take an active part in the policy making process and management of natural resources on which they depend for their livelihoods would help ensure that this doesn't happen.

Bibliography

AGARDY, T., BRIDGEWATER P., CROSBY M.P., DAY J., DAYTON P.K., KENCHINGTON R., LAFFOLEY D., MCCONNEY P., MURRAY P.A., PARKS J.E. and PEAU L. (2003), Dangerous targets? Unresolved issues and ideological clashes around marine protected areas. *Aquatic Conservation-Marine and Freshwater Ecosystems,* 13(4)**,** 353-367.

AGRAWAL, A. (2005), Environmentality - Community, intimate government, and the making of environmental subjects in Kumaon, India. *Current Anthropology,* 46(2)**,** 161-190.

AGRAWAL, A. and GIBSON C.C. (1999), Enchantment and disenchantment: The role of community in natural resource conservation. *World Development,* 27(4)**,** 629-649.

ALCALA, A.C. (1988), Effects of Marine Reserves on Coral Fish Abundances And Yields of Philippine Coral Reefs. *Ambio,* 17(3)**,** 194-199.

ALDER, J., RAYMAKERS C., LAUDE S. and PURBASSI I. (1994), Taka Bone Rate National Park, Indonesia—progressing towards community based management. *Coastal Management in Tropical Asia,* 8(8)**,** 8-11.

ALLISON, E.H. and ELLIS F. (2001), The livelihoods approach and management of small-scale fisheries. *Marine Policy,* 25(5)**,** 377-388.

ANDERSSON, J.E.C. and NGAZI Z. (1995), Marine resource use and the establishment of a marine park: Mafia Island, Tanzania. *Ambio,* 24(7-8)**,** 475-481.

ANTLÖV, H. and CEDERROTH S. (1994). *Leadership on Java: gentle hints, authoritarian rule.* Curzon Press,

ARDIWIJAYA, R.L., BAIRD A.H., KARTAWIJAYA T. and CAMPBELL S.J. 2008. Changes in reef fish biomass in Karimunjawa National Park: a test of the effectiveness of government gazetted marine parks in Indonesia. In *11th International Coral Reef Symposium*. Ft. Lauderdale, Florida:

ARDIWIJAYA, R.L., KARTAWIJAYA T., SETIAWAN F. and HERDIANA Y. (2008). *Laporan Teknis - Monitoring Ekologi Taman Nasional Karimunjawa 2007, Monitoring Fase 3*. Wildlife Conservation Society - Marine Program Indonesia. Bogor, Indonesia.

ARDIWIJAYA, R.L., PARDEDE S.T., KARTAWIJAYA T. and HERDIANA Y. (2006). *Laporan Teknis – Program monitoring tahun 2005 di Taman Nasional Karimunjawa Laporan Monitoring Fase 1, 2005*. Wildlife Conservation Society - Marine Program Indonesia. Bogor, Indonesia.

ARDIWIJAYA, R.L., WIBOWO J.T., KARTAWIJAYA T., MUKMININ A. and HERDIANA Y. (2006). *Monitoring Report, Resource Map of Karimunjawa National Park - Report of monitoring survey phase 1, 2005*. Wildlife Conservation Society – Marine Program Indonesia. Bogor, Indonesia.

ASEAN. 2003. The Oasis of Java. Karimunjawa Marine National Park Profile. In *ASEAN Biodiversity. Marine/Coastal and Wetland Management* Laguna, Philippines: Association of Southeast Asian Nations (ASEAN)

AUSTER, P.J., MALATESTA R.J., LANGTON R.W., WATTING L., VALENTINE P.C., DONALDSON C.L.S., LANGTON E.W., SHEPARD A.N. and BABB W.G. (1996), The impacts of mobile fishing gear on seafloor habitats in the gulf of Maine (Northwest Atlantic): Implications for conservation of fish populations. *Reviews in Fisheries Science,* 4(2)**,** 185-202.

BAILEY, C. (1988), The Political Economy of Marine Fisheries Development in Indonesia. *Indonesia,* (46)**,** 25-38.

BAILEY, C., DWIPONGGO A. and MARAHUDIN F. (1987). *Indonesian marine capture fisheries*. International Center for Living Aquatic Resources Management,

BAILEY, C. and JENTOFT S. (1990), Hard choices in fisheries development. *Marine Policy,* 14(4)**,** 333-344.

BELLWOOD, D.R., HUGHES T.P., FOLKE C. and NYSTROM M. (2004), Confronting the coral reef crisis. *Nature,* 429(6994)**,** 827-833.

BERKES, F., FOLKE C. and COLDING J. (2000). *Linking social and ecological systems: management practices and social mechanisms for building resilience.* Cambridge University Press,

BIRKENHOLTZ, T. (2009), Groundwater governmentality: hegemony and technologies of resistance in Rajasthan's (India) groundwater governance. *Geographical Journal,* 175**,** 208-220.

BOHNSACK, J.A. and AULT J.S. (1996), Management Strategies to Conserve Marine Biodiversity. *Oceanography,* 9(1)**,** 73-82.

BRECHIN, S.R., WILSHUSEN P.R., FORTWANGLER C.L. and WEST P.C. 2002. Beyond the square wheel: Toward a more comprehensive understanding of biodiversity conservation as social and political process. 41-64. Taylor & Francis Inc

BTNK. (2004a). *Penataan Zonasi Taman Nasional Karimunjawa, Kabupaten Jepara, Provins Jawa Tengah*. Balai Taman Nasional Karimunjawa. Semarang, Indonesia.

BTNK. (2004b). *Rencana Pengelolaan Taman Nasional Karimunjawa Periode Tahun 2005 - 2024: Buku I Rencana Pengelolaan*. Balai Taman Nasional Karimunjawa. Semarang, Indonesia.

BTNK. (2004c). *Rencana Pengelolaan Taman Nasional Karimunjawa Periode Tahun 2005 - 2024: Buku II Data dan Analisis* Balai Taman Nasional Karimunjawa. Semarang, Indonesia.

BTNK. (2008). *Statistik Balai Taman Nasional Karimunjawa Tahun 2008*. Balai Taman Nasional Karimunjawa. Semarang, Indonesia.

BTNK. (2009). *Statistik Balai Taman Nasional Karimunjawa Tahun 2009*. Balai Taman Nasional Karimunjawa. Semarang, Indonesia.

BUNCE, L. and POMEROY R.S. (2003). *Socioeconomic Monitoring Guidelines for Coastal Managers in Southeast Asia (SocMon SEA).* World Commission on Protected Areas and Global Coral Reef Monitoring Network/Australian Institute of Marine Science, Townsville, Australia.

BURKE, L., SELIG E. and SPALDING M. (2002). *Reefs at Risk in Southeast Asia*. World Resources Institute. Washington, D.C. http://pdf.wri.org/rrseasia_full.pdf (March 30, 2011)

BURKE, L., SPALDING M., REYTAR K. and PERRY A. (2011). *Reefs at Risk Revisited*. World Resources Institute. Washington, D.C. http://pdf.wri.org/reefs_at_risk_revisited.pdf (March 30, 2011)

BUTCHER, J.G. (2004). *The closing of the frontier: a history of the marine fisheries of Southeast Asia, c.1850-2000.* Institute of Southeast Asian Studies,

CADDY, J.F. and GULLAND J.A. (1983), Historical Patterns of Fish Stocks. *Marine Policy,* 7(4)**,** 267-278.

CAMPBELL, S.J. and PARDEDE S.T. (2006), Reef fish structure and cascading effects in response to artisanal fishing pressure. *Fisheries Research,* 79(1-2)**,** 75-83.

CESAR, H. (1996). *Economic analysis of Indonesian coral reefs.* Environment Departement, World Bank, Washington, D.C.

CHEUNG, C.P.S., ALIÑO P.M., UYCHIAOCO A.J. and ARCEO H.O. (2002). *Marine Protected Areas in Southeast Asia*. ASEAN Regional Centre for Biodiversity Conservation, Department of Environment and Natural Resources. Los Baños, Philippines.

CHOZIN, M. 2008. Illegal but Common: Life of Blast Fishermen in the Spermonde Archipelago, South Sulawesi, Indonesia. In *Southeast Asian Studies*, 144. Ohio: Ohio University

CHRISTIE, P. (2005), Observed and perceived environmental impacts of marine protected areas in two Southeast Asia sites. *Ocean & Coastal Management,* 48(3-6)**,** 252-270.

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., BLOUNT B.G., HUPPERT D., EISMA R.L.V., ORACION E., LOWRY K. and POLLNAC R.B. (2003), Toward developing a complete understanding: A social science research agenda for marine protected areas. *Fisheries,* 28(12)**,** 22-26.

CHRISTIE, P. and WHITE A.T. (1994), Reef Fish Yield and Reef Condition for San Salvador Island, Luzon, Philippines. *Asian Fisheries Science,* 7**,** 135-148.

CHRISTIE, P. and WHITE A.T. (1997), Trends in development of coastal area management in tropical countries: From central to community orientation. *Coastal Management,* 25(2)**,** 155-181.

CHRISTIE, P. and WHITE A.T. (2007), Best practices for improved governance of coral reef marine protected areas. *Coral Reefs,* 26(4)**,** 1047-1056.

CINNER, J.E. and BODIN O. (2010), Livelihood Diversification in Tropical Coastal Communities: A Network-Based Approach to Analyzing 'Livelihood Landscapes'. *Plos One,* 5(8)**,** 13.

CLIFTON, J. (2003), Prospects for co-management in Indonesia's marine protected areas. *Marine Policy,* 27(5)**,** 389-395.

COLLIE, J., ESCANERO G.A. and VALENTINE P.C. (1997), Effects of bottom fishing on the benthic megafauna of Georges Bank. *Marine Ecology Progress Series,* 155(1)**,** 159-172.

CRAMPTON, J.W. and ELDEN S. (2007). *Space Knowledge and Power. Foucault and Geography.* Ashgate Publishing Limited, Aldershot.

CRAWFORD, B. (2002). *Seaweed Farming: An Alternative Livelihood for Small-Scale Fishers*. Coastal Resource Center.

CRAWFORD, B.R. 2009. Factors Influencing the Success of Community-Based Marine Protected Areas in North Sulawesi Indonesia. In *Marine Affairs*. University of Rhode Island

DALTON, T.M. (2005), Beyond biogeography: a framework for involving the public in planning of US marine protected areas. *Conservation Biology,* 19(5)**,** 1392-1401.

DAYTON, P.K., THRUSH S.F., AGARDY M.T. and HOFMAN R.J. (1995), Environmental effects of marine fishing. *Aquatic Conservation: Marine and Freshwater Ecosystems,* 5(3)**,** 205-232.

DE KONINCK, R. (1979), The Integration of the Peasantry: Examples From Malaysia and Indonesia. *Pacific Affairs,* 52(2)**,** 265-293.

DE KONINCK, R. 2003. Southeast Asian Agriculture Post-1960: Economic and Territorial Expansion, in *Southeast Asia Transformed: a Geography of Change,* ed. CHIA, L. S. Singapore: Institute of Southeast Asian Studies, p.191-230.

DE KONINCK, R. (2009). *L'Asie du Sud-Est.* A. Colin,

DE SILVA, S.S. (1998). *Tropical Mariculture.* Academic Press, London.

DGF. 2001. Reducing The Impact Of Tropical Shrimp Trawling Fisheries On Living Marine Resources Through The Adoption Of Environmentally Friendly Techniques And Practices In The Arafura Sea, Indonesia, in *Tropical shrimp fisheries and their impact on living resources. Shrimp fisheries in Asia: Bangladesh, Indonesia and the Philippines; in the Near East: Bahrain and Iran; in Africa: Cameroon, Nigeria and the United Republic of Tanzania; in Latin America: Colombia, Costa Rica, Cuba, Trinidad and Tobago, and Venezuela,* ed. FAO. Rome: FAO.

DIMECH, M., DARMANIN M., SMITH I.P., KAISER M.J. and SCHEMBRI P.J. (2009), Fishers' perception of a 35-year old exclusive Fisheries Management Zone. *Biological Conservation,* 142(11)**,** 2691-2702.

DIRHAMSYAH, D. (2006), Indonesian legislative framework for coastal resources management: A critical review and recommendation. *Ocean & Coastal Management,* 49(1-2)**,** 68-92.

DJAMALI, A. and MUBARAK H. (1998). *Sumberdaya Ikan Konsumsi Perairan Karang in Potensi dan Penyebaran SDI Laut di Perairan Indonesia*. Komisi Nasional Pengkajian Stok SDI Laut, LIPI. Jakarta.

EDINGER, E.N., JOMPA J., LIMMON G.V., WIDJATMOKO W. and RISK M.J. (1998), Reef degradation and coral biodiversity in Indonesia: Effects of land-based pollution, destructive fishing practices and changes over time. *Marine Pollution Bulletin,* 36(8)**,** 617-630.

ELLIS, F. (2000). *Rural livelihoods and diversity in developing countries.* Oxford University Press,

ERDMAN, M., MERRILL P., MONGDONG M., ARSYAD I., HARAHAP Z., PANGALILA R., ELVERAWATI R. and BAWORO P. (2004). *Building Effective Co-Management Systems for Decentralized Protected Areas Management in Indonesia: Bunaken National Park Case Study*. Natural Resources Management Program. (April 2009)

ERDMAN, M.V. and PET-SOEDE L. 1996. How fresh is too fresh?: the live reef food fish trade in eastern Indonesia, in *SPC Live reef fish information bulletin #3*. Secretariat of the Pacific Community, p.41-45.

FAO. (2006). *The history of industrial marine fisheries in Southeast Asia*. Food And Agriculture Organization Of The United Nations. Regional Office For Asia And The Pacific. Bangkok.

FAO. (2010). *The State of World Fisheries and Aquaculture*. FAO Fisheries and Aquaculture Departement. Rome.

FERSE, S.C.A., COSTA M.M., MANEZ K.S., ADHURI D.S. and GLASER M. (2010), Allies, not aliens: increasing the role of local communities in marine protected area implementation. *Environmental Conservation,* 37(1)**,** 23-34.

FOUCAULT, M. 1982. The Subject and Power, Afterword, in *Michel Foucault: Beyond Structuralism and Hermeneutics,* eds. DREYFUS, H. & RABINOW P. London: Harvester Wheatshaft.

FOUCAULT, M. 1988. Technologies of the self, in *Technologies of the self: a seminar with Michel Foucault,* eds. MARTIN, L. H., GUTMAN H. & HUTTON P. H. Amherst: University of Massachusetts Press.

FOX, H.E. and CALDWELL R.L. (2006), Recovery from blast fishing on coral reefs: a tale of two scales. *Ecological Applications,* 16(5)**,** 1631–1635.

FOX, H.E. and ERDMANN M.V. (2000), Fish yields from blast fishing in Indonesia. *Coral Reefs,* 19(2)**,** 114-114.

FOX, H.E., PET J.S., DAHURI R. and CALDWELL R.L. (2003), Recovery in rubble fields: long-term impacts of blast fishing. *Marine Pollution Bulletin,* 46(8)**,** 1024-1031.

GALVEZ, R., THERESE G.H., BAUTISTA C. and TUNGPALAN M.T. 1989. Sociocultural dynamics of blast fishing and sodium cyanide fishing in two fishing villages in the Lingayen Gulf area, in *Towards sustainable development of the coastal resources of Lingayen Gulf, Philippines: proceedings of an ASEAN/US Coastal Resources Management Project Workshop, Bauang, La Union, Philippines, 25-27 May,* eds. SILVESTRE, G., MICLAT E. & CHUA T. E.: Philippine Council for Aquatic and Marine Research and Development, p.43-62.

GAME, E.T., BODE M., MCDONALD-MADDEN E., GRANTHAM H.S. and POSSINGHAM H.P. (2009), Dynamic marine protected areas can improve the resilience of coral reef systems. *Ecology Letters,* 12(12)**,** 1336-1346.

GELL, F.R. and ROBERTS C.M. (2003), Benefits beyond boundaries: the fishery effects of marine reserves. *Trends in Ecology & Evolution,* 18(9)**,** 448-455.

GLASER, M., BAITONINGSIH W., FERSE S.C.A., NEIL M. and DESWANDI R. (2010), Whose sustainability? Top-down participation and emergent rules in marine protected area management in Indonesia. *Marine Policy,* 34(6)**,** 1215-1225.

GOÑI, R. (1998), Ecosystem effects of marine fisheries: an overview. *Ocean & Coastal Management,* 40(1)**,** 37-64.

HALPERN, B.S. (2003), The impact of marine reserves: Do reserves work and does reserve size matter? *Ecological Applications,* 13(1)**,** S117-S137.

HARDIN, G. (1968), The tragedy of the commons. The population problem has no technical solution; it requires a fundamental extension in morality. *Science (New York, N.Y.),* 162(3859)**,** 1243-8.

HILBORN, R., STOKES K., MAGUIRE J.J., SMITH T., BOTSFORD L.W., MANGEL M., ORENSANZ J., PARMA A., RICE J., BELL J., COCHRANE K.L., GARCIA S., HALL S.J., KIRKWOOD G.P., SAINSBURY K., STEFANSSON G. and WALTERS C. (2004), When can marine reserves improve fisheries management? *Ocean & Coastal Management,* 47(3-4)**,** 197-205.

HOLMLUND, C.M. and HAMMER M. (1999), Ecosystem services generated by fish populations. *Ecological Economics,* 29(2)**,** 253-268.

HOTTA, K. and DUTTON I.M. (1995). *Coastal management in the Asia-Pacific region: issues and approaches.* Japan International Marine Science and Technology Federation, Tokyo.

HUGHES, T.P., BAIRD A.H., BELLWOOD D.R., CARD M., CONNOLLY S.R., FOLKE C., GROSBERG R., HOEGH-GULDBERG O., JACKSON J.B.C., KLEYPAS J., LOUGH J.M., MARSHALL P., NYSTROM M., PALUMBI S.R., PANDOLFI J.M., ROSEN B. and ROUGHGARDEN J. (2003), Climate change, human impacts, and the resilience of coral reefs. *Science,* 301(5635)**,** 929-933.

HUTCHINGS, P. (1990), Review of the effects of trawling on Macrobenthic Epifaunal communities. *Marine and Freshwater Research,* 41(1)**,** 111-120.

IUCN. 1988. 17th session of the General Assembley of the IUCN and the 17th technical meeting. ed. IUCN. Gland, Switzerland:

JACKSON, J. (2001), Historical overfishing and the recent collapse of coastal ecosystems. *Science,* 293(5530)**,** 629-638.

JENTOFT, S. and CHUENPAGDEE R. (2009), Fisheries and coastal governance as a wicked problem. *Marine Policy,* 33(4)**,** 553-560.

JENTOFT, S., MCCAY B.J. and WILSON D.C. (1998), Social theory and fisheries co-management. *Marine Policy,* 22(4-5)**,** 423-436.

JENTOFT, S., VAN SON T.C. and BJORKAN M. (2007), Marine protected areas: A governance system analysis. *Human Ecology,* 35(5)**,** 611-622.

JONES, J.B. (1992), Environmental impact of trawling on the seabed: A review. *New Zealand Journal of Marine and Freshwater Research,* 26(1)**,** 59-67.

KARTAWIJAYA, T., YULIANTO I. and RIPANTO. (2008). *Laporan Pelatihan. Laporan Pelatihan. Pelatihan Pembuatan Rencana Strategis Desa Secara Partisipatif Dalam Rangka Mendukung Pengelolaan Taman Nasional Karimunjawa*. Wildlife Conservation Society - Indonesia Marine Program. Bogor, Indonesia.

KK. (2009). *Karimunjawa Dalam Angka*. Kecamatan Karimunjawa.

LARKIN, P. (1977), An epitaph for the concept of maximum sustained yield. *Transactions of the American Fisheries Society,* 106(1)**,** 1-11.

LESTER, S.E., HALPERN B.S., GRORUD-COLVERT K., LUBCHENCO J., RUTTENBERG B.I., GAINES S.D., AIRAME S. and WARNER R.R. (2009), Biological effects within no-take marine reserves: a global synthesis. *Marine Ecology-Progress Series,* 384**,** 33-46.

LI, T.M. 1996. Images of community: Discourse and strategy in property relations. 501-527. Blackwell Publ Ltd

MACANDREWS, C. (1998), Improving the management of Indonesia's national parks: Lessons from two case studies. *Bulletin of Indonesian Economic Studies,* 34(1)**,** 121-137.

MARNANE, M.J., ARDIWIJAYA R.L., PARDEDE S.T., MUKMININ A. and HERDIANA Y. (2004). *Rebuilding of Management Effectiveness by Research and Capacity Building in Karimunjawa National Park, Ecological Summary*. Wildlife Conservation Society - Marine Program Indonesia. Bogor, Indonesia.

MARNANE, M.J., ARDIWIJAYA R.L., WIBOWO J.T., PARDEDE S.T., MUKMININ A. and HERDIANA Y. (2003). *The Study of Fisheries Activities - Muro-ami Net in Karimunjawa Islands, September 2003*. Wildlife Conservation Society - Marine Program Indonesia. Bogor, Indonesia.

MASCIA, M.B., CLAUS C.A. and NAIDOO R. (2010), Impacts of Marine Protected Areas on Fishing Communities. *Conservation Biology,* 24(5)**,** 1424-1429.

MCALLISTER, D.E., CAHO N.L. and SHIH C.-T. 1999. Cyanide fisheries: Where did they start? , in *SPC Live Reef Fish Information Bulletin #5*. Secretariat of the Pacific Community, p.18-21.

MCMANUS, J.W. (1997), Tropical marine fisheries and the future of coral reefs: a brief review with emphasis on Southeast Asia. *Coral Reefs***,** S121-S127.

MCMANUS, J.W., REYES R.B. and NANOLA C.L. (1997), Effects of some destructive fishing methods on coral cover and potential rates of recovery. *Environmental Management,* 21(1)**,** 69-78.

MOBERG, F. and FOLKE C. (1999), Ecological goods and services of coral reef ecosystems. *Ecological Economics,* 29(2)**,** 215-233.

MORA, C., ANDREFOUET S., COSTELLO M.J., KRANENBURG C., ROLLO A., VERON J., GASTON K.J. and MYERS R.A. (2006), Coral reefs and the global network of marine protected areas. *Science,* 312(5781)**,** 1750-1751.

MORA, C., MYERS R.A., COLL M., LIBRALATO S., PITCHER T.J., SUMAILA R.U., ZELLER D., WATSON R., GASTON K.J. and WORM B. (2009), Management Effectiveness of the World's Marine Fisheries. *Plos Biology,* 7(6).

MUKMININ, A., KARTAWIJAYA T., HERDIANA Y. and YULIANTO I. (2006). *Laporan Monitoring, Kajian Pola Pemanfaatan Perikanan di Karimunjawa (2003-2005)*. Wildlife Conservation Society - Marine Program Indonesia. Bogor, Indonesia.

PAULY, D. (1979a), Biological Overfishing of Tropical Stocks. *ICLARM Newsletter,* 2(3).

PAULY, D. (1979b). *Theory and Management of Tropical, Multispecies Stocks: A review, with emphasis on the Southeast Asian demersal fisheries*. International Centre for Living Aquatic Resources Management. Manila.

PAULY, D. 1988a. Fisheries research and the demersal fisheries of Southeast Asia, in *Fish Population Dynamics,* ed. GULLAND, J. A. New York: Wiley Interscience.

PAULY, D. (1988b), Some Definitions of Overfishing Relevant to Coastal Zone Management in Southeast Asia. *Tropical coastal Area Management,* 3(1)**,** 14-15.

PAULY, D. 1990. On Malthusian Overfishing. In *Naga, the ICLARM Quarterly*.

PAULY, D. 1997. Small-Scale Fisheries in the Tropics: Marginality, Marginalization, and Some Implications for Fisheries Management, in *Global Trends: Fisheries Management,* eds. PIKITCH, E. K., HUPPERT D. D. & SISSENWINE M. P. Bethesda, Maryland: American Fisheries Society Symposium 20.

PAULY, D., CHRISTENSEN V., DALSGAARD J., FROESE R. and TORRES F. (1998), Fishing down marine food webs. *Science,* 279(5352)**,** 860-863.

PAULY, D., CHRISTENSEN V., GUENETTE S., PITCHER T.J., SUMAILA U.R., WALTERS C.J., WATSON R. and ZELLER D. (2002), Towards sustainability in world fisheries. *Nature,* 418(6898)**,** 689-695.

PAULY, D. and CHUA T.E. (1988), The Overfishing Of Marine Resources - Socioeconomic Background In Southeast-Asia. *Ambio,* 17(3)**,** 200-206.

PAULY, D., SILVESTRE G. and SMITH I.R. (1989), On development, fisheries and dynamite, a brief review of tropical fisheries management. *Natural Resource Modeling,* 3(3)**,** 307-329.

PET, J.S. and PET-SOEDE L. 1999. A note on cyanide fishing in Indonesia, in *SPC Live Reef Fish Information Bulletin #5*. Secretariat of the Pacific Community, p.21-22.

PET, J.S. and YEAGER C. (2000). *25 Year Master Plan for Management Komodo National Park*. The Nature Conservancy and Conservation, Ministry of Forestry. Jakarta. http://www.putrinagakomodo.com/downloads/Management Plan Book 1.pdf (October 23, 2009)

PET-SOEDE, L. (2006), MPAs in Indonesia: What Progress Has Been Made Since 1984? *MPA News,* 8(1)**,** 3.

PET-SOEDE, L., CESAR H.S.J. and PET J.S. (1999), An economic analysis of blast fishing on Indonesian coral reefs. *Environmental Conservation,* 26(2)**,** 83-93.

PET-SOEDE, L. and ERDMANN M.V. 1998. An overview and comparison of destructive fishing practices in Indonesia, in *SPC Live reef fish information bulletin #4*. Secretariat of the Pacific Community, p.28-36.

POLLNAC, R.B. and POMEROY R.S. (2005), Factors influencing the sustainability of integrated coastal management projects in the Philippines and Indonesia. *Ocean & Coastal Management,* 48(3-6)**,** 233-251.

POLLNAC, R.B., POMEROY R.S. and HARKES I.H.T. (2001), Fishery policy and job satisfaction in three southeast Asian fisheries. *Ocean & Coastal Management,* 44(7-8)**,** 531-544.

POMEROY, R.S. (1995), Community-based and co-management institutions for sustainable coastal fisheries management in Southeast Asia. *Ocean & Coastal Management,* 27(3)**,** 143-162.

POMEROY, R.S. and BERKES F. (1997), Two to tango: The role of government in fisheries co-management. *Marine Policy,* 21(5)**,** 465-480.

POMEROY, R.S., PARKS J., POLLNAC R., CAMPSON T., GENIO E., MARLESSY C., HOLLE E., PIDO M., NISSAPA A., BOROMTHANARAT S. and HUE N.T. (2007), Fish wars: Conflict and collaboration in fisheries management in Southeast Asia. *Marine Policy,* 31(6)**,** 645-656.

POMEROY, R.S., RATNER B.D., HALL S.J. and PIMOLJINDA J. (2006), Coping with disaster: Rehabilitating coastal livelihoods and communities. *Marine Policy,* 30(6)**,** 786-793.

POMEROY, R.S., WATSON L.M., PARKS J.E. and CID G.A. (2005), How is your MPA doing? A methodology for evaluating the management effectiveness of marine protected areas. *Ocean & Coastal Management,* 48(7-8)**,** 485-502.

PRASETIA, R., KARTAWIJAYA T., RIPANTO and YULIANTO I. (2010). *Laporan Monitoring, Kajian Tingkat Kepatuhan (Compliance) Nelayan Terhadap Zonasi di Taman Nasional Karimunjawa 2009*. Wildlife Conservation Society - Indonesia Marine Program. Bogor, Indonesia.

RICHARDSON, E.A., KAISER M.J. and EDWARDS-JONES G. (2005), Variation in fishers' attitudes within an inshore fishery: implications for management. *Environmental Conservation,* 32(3)**,** 213-225.

ROBERTS, C.M. (1995), Effects of Fishing on the Ecosystem Structure of Coral-Reefs. *Conservation Biology,* 9(5)**,** 988-995.

ROBERTS, C.M., BOHNSACK J.A., GELL F., HAWKINS J.P. and GOODRIDGE R. (2001), Effects of marine reserves on adjacent fisheries. *Science,* 294(5548)**,** 1920-1923.

RUSS, G.R., ALCALA A.C., MAYPA A.P., CALUMPONG H.P. and WHITE A.T. (2004), Marine reserve benefits local fisheries. *Ecological Applications,* 14(2)**,** 597-606.

SABARINI, E.K. (2006). *Nursery Functional Role of Seagrass for Reef fish in Marine Protected Area of the Karimunjawa National Park, Indonesia. Project report to VLIR - Research Backpack Project*. Wildlife Conservation Society - Marine Program Indonesia. Bogor, Indonesia.

SAILA, S.B., KOCIC V.L. and MCMANUS J.W. (1993), Modeling the effects of destructive fishing practices on tropical coral reefs. *Marine Ecology-Progress Series,* 94(1)**,** 51-60.

SALAFSKY, N. and WOLLENBERG E. (2000), Linking livelihoods and conservation: A conceptual framework and scale for assessing the integration of human needs and biodiversity. *World Development,* 28(8)**,** 1421-1438.

SALE, P.F., COWEN R.K., DANILOWICZ B.S., JONES G.P., KRITZER J.P., LINDEMAN K.C., PLANES S., POLUNIN N.V.C., RUSS G.R., SADOVY Y.J. and STENECK R.S. (2005), Critical science gaps impede use of no-take fishery reserves. *Trends in Ecology & Evolution,* 20(2)**,** 74-80.

SATRIA, A. and MATSIDA Y. (2004), Decentralization Policy: An Opportunity for Strengthening Fisheries Management System? *The Journal of Environment Development,* 13(2)**,** 179-196.

SCOONES, I. (1998). Sustainable rural livelihoods: a framework for analysis. *Working Paper, No. 72*, Institute of Development Studies, Sussex, UK

SEMEDI, P. (2003). *Close to the Stone, Far From the Throne, The Story of a Javanese Fishing Community. 1820s-1990s.* Benang Merah, Yogyakarta.

SIEVANEN, L., CRAWFORD B., POLLNAC R. and LOWE C. (2005), Weeding through assumptions of livelihood approaches in ICM: Seaweed farming in the Philippines and Indonesia. *Ocean & Coastal Management,* 48(3-6)**,** 297-313.

SILVERT, W. and MOUSTAKAS A. (2011), The impacts over time of marine protected areas: A null model. *Ocean & Coastal Management,* 54(4)**,** 312-317.

SPURGEON, J.P.G. and LINDAHL U. 2000. Economics of coral reef restoration, in *Collected Essays on the Economics of Coral Reefs,* ed. CESAR, H. S. J. Kalmar, Sweden: CORDIO, p.125–136.

TEH, L. and SUMAILA U.R. (2007), Malthusian overfishing in Pulau Banggi? *Marine Policy,* 31(4)**,** 451-457.

TOMPKINS, E.L. and ADGER W.N. (2004), Does adaptive management of natural resources enhance resilience to climate change? *Ecology and Society,* 9(2)**,** 14.

FAO (2012) World inventory of fisheries. Selectivity of gear. Issues Fact Sheets, FAO Fisheries and Aquaculture Department, Text by: VALDEMARSEN, J.W., Date Accessed: 14 August 2012. http://www.fao.org/fishery/topic/12282/en

WALPOLE, M.J. and GOODWIN H.J. (2001), Local attitudes towards conservation and tourism around Komodo National Park, Indonesia. *Environmental Conservation,* 28(2)**,** 160-166.

WALTERS, C. and MAGUIRE J.J. (1996), Lessons for stock assessment from the northern cod collapse. *Reviews in Fish Biology and Fisheries,* 6(2)**,** 125-137.

WARD, T.J., HEINEMANN D. and EVANS N. (2001). *The Role of Marine Reserves as Fisheries Management Tools: a review of concepts, eividence and international experience*. Bureau of Rural Science. Canberra, Australia.

WELLS, S. (1988). *Coral Reefs of the World*. United Nations Enrironment Programme and International Union for the Conservation of Nature and Natural Resources. Cambridge, UK.

WEST, P., IGOE J. and BROCKINGTON D. (2006), Parks and peoples: The social impact of protected areas. *Annual Review of Anthropology,* 35**,** 251-277.

WHITE, A.T., CHRISTIE P., D'AGNES H., LOWRY K. and MILNE N. (2005), Designing ICM projects for sustainability: lessons from the Philippines and Indonesia. *Ocean & Coastal Management,* 48(3-6)**,** 271-296.

WIBOWO, J.T. (2005). *Laporan Monitoring, Aspek Sosial Ekonomi Dalam Pengelolaan Taman Nasional Karimunjawa, 2005*. Wildlife Conservation Society - Marine Program Indonesia. Bogor, Indonesia.

WIBOWO, J.T. and KARTAWIJAYA T. (2004). *Karimunjawa Nation Park Zoning Plan: The Process*. Wildlife Conservation Society. Semarang.

WIDJATMOKO, W. and PUTRA K.S. (2003). *Coral Reef Monitoring and Coral Campaign*. REEFCHECK.

WILSON, J.A., ACHESON J.M., METCALFE M. and KLEBAN P. (1994), Chaos, complexity and community management of fisheries. *Marine Policy,* 18(4)**,** 291-305.

WORM, B., BARBIER E.B., BEAUMONT N., DUFFY J.E., FOLKE C., HALPERN B.S., JACKSON J.B.C., LOTZE H.K., MICHELI F., PALUMBI S.R., SALA E., SELKOE K.A., STACHOWICZ J.J. and WATSON R. (2006), Impacts of biodiversity loss on ocean ecosystem services. *Science,* 314(5800)**,** 787-790.

WORM, B., HILBORN R., BAUM J.K., BRANCH T.A., COLLIE J.S., COSTELLO C., FOGARTY M.J., FULTON E.A., HUTCHINGS J.A., JENNINGS S., JENSEN O.P., LOTZE H.K., MACE P.M., MCCLANAHAN T.R., MINTO C., PALUMBI S.R., PARMA A.M., RICARD D., ROSENBERG A.A., WATSON R. and ZELLER D. (2009), Rebuilding Global Fisheries. *Science,* 325(5940)**,** 578-585.

YULIANTO, I., ANGGRAENI R., LISTIANINGSIH W., KARTAWIJAYA T., PRASETIA R. and RIPANTO. (2009). *Laporan Monitoring. Aspek Sosial Ekonomi Dalam Pengelolaan Taman Nasional Karimunjawa, 2009*. Wildlife Conservation Society – Indonesia Marine Program. Bogor, Indonesia.

YULIANTO, I. and HERDIANA Y. (2006). *Laporan Monitoring: kajian tingkat kepatuhan (compliance) di Taman Nasional Karimunjawa 2003-2005*. Wildlife Conservation Society - Marine Program Indonesia. Bogor, Indonesia.

YULIANTO, I., KARTAWIJAYA T., SULISYATI R., MULYADI and SYAIFUDIN Y. (2007). *Status Ekosistem Di Taman Nasional Karimunjawa*. Balai Taman Nasional Karimunjawa and Wildlife Conservation Society. Bogor, Indonesia.

Appendix 1

Survey Questionnaire

Translated from Original Indonesian Version

_____ Location : _____ GPS : _____ Picture : _____ Date : _____

HOUSEHOLD DEMOGRAPHICS

1) Age, Gender, Ethnicity, Education, Religion, Language, Occupation, Household Size:

Household Members	Age	Gender	Education Level	Ethnicity	Language	Primary Occupation	Secondary Occupation

2) Household Income:

d. What is your household's most important source of income?
_____

e. What is your household's second most important source of income?
_____

f. Has your household's most important source of income ever changed (yes/no)?

Explain:

g. If yes to the above question, has the presence of the park regulations/policies influenced this change (yes/no)? _____

COASTAL AND MARINE ACTIVITIES

3) Household Activities, Household Goods and Services, Types of Household Uses, Household Market Orientation, Household Uses:

Coastal and Marine Activities	Coastal and Marine Goods and Services	Types of Household Uses	Household Market Orientation	Household Uses
1.				
2.				
3.				

ATTITUDES AND PERCEPTIONS

4) Non-market and Non-use Values:

Indicate degree of agreement with the following statements using the scale: agree strongly (5); agree (4); neither agree nor disagree (3); disagree (2); disagree strongly (1).

_____ a) The reefs are important for protecting land from storm waves.

_____ b) In the long-run fishing would be better if we cleared the coral.

_____ c) Unless mangroves are protected we will not have any fish to catch.

_____ d) Coral reefs are only important if you fish or dive.

_____ e) I want future generations to enjoy the mangroves and coral reefs.

_____ f) Fishing should be restricted in certain areas even if no one ever fishes in those areas just to allow the fish and coral to grow

_____ g) We should restrict development in some coastal areas so that future generations will be able to have natural environments.

5) Perceptions of Fishery Conditions:

a. How would you describe current condition of the marine fishery on a scale from very good (5), good (4), not good not bad (3), bad (2) to very bad (1): _____

b. Would you say that the coastal management rules and regulations have greatly improved (5), improved (4), had no effect (3), harmed (2) or severely harmed (1) the marine fishery? _____

c. Has your catch decreased (1) or increased (2) during the past 5 years? _____

d. By approximately how much? _____

6) Perceptions of Resource Conditions:

How would you describe current coastal resource conditions on a scale from very good (5), good (4), not good not bad (3), bad (2) to very bad (1):

Mangroves _____; Coral reefs _____; Fresh water _____; Upland forests _____

7) Perceived Threats: What are the top 5 major threats to the health of coastal resources?

1._____; 2._____; 3._____;
4._____; 5._____

8) Awareness of Rules and Regulations:

What zone do the following areas fall under (Core Zone, Protected Zone, Usage Zone)?

a. Taka Malang _____

b. Pulau Gelean _____

c. Pulau Katang _____

Answer true or false to the following statements:

d. No fishing is allowed in the Zona Pemanfaatan Wisata (Tourism Utilization Zone) _____

e. Only traditional fishing is allowed in the Zona Inti (Core Zone) _____

f. Tembak (spearfishing) is not allowed in the Zona Perlindungan (Protected Zone) _____

9) Perceptions of the Need for Regulations in the Park / Natural Resource Conservation

a. On a scale from 1 to 5 (1=not needed, 5=needed), how important are coastal management rules and regulations? _____

b. On a scale from 1 to 5 (1=not needed, 5=needed), how important is natural resource conservation? _____

10) Compliance:

On a scale of 1 to 5 (1=no compliance, 5=full compliance), to what extent do people comply with coastal management rules and regulations? _____

11) Enforcement:

On a scale of 1 to 5 (1=no enforcement, 5=full enforcement), to what extent are the rules and regulations enforced? _____

12) Participation in Workshops

Have you ever participated in workshops about coastal managment regulations or natural resource conservation? Yes / No

If yes, which workshop? _____

13) Participation in Decision-making:

On a scale of 1 to 5 (1=no participation, 5=fully active participation), to what extent do you participate in coastal management decision-making? _____

14) Adaptive Management

a. Apakah Taman Nasional pernah membuat perubahan dalam menanggapi masukan masyarakat? Ya / Tidak

b. Jika ya, sebutkan dua perubahan yang paling penting:

1. _____

2._____

15) Membership in Stakeholder Organizations:

Is someone from your household a member of a stakeholder organization? Yes / No

If yes, which organization? _____

16) Positif / Negative Impacts on Livelihoods

Have the coastal managment rules and regulations greatly helped (5), helped (4), had no effect (3), harmed (2), or severely harmed (1) you livelihood? _____

17) Tourism

a. Tourism greatly helps (5), helps (4), has no effect (3), harms (2), or severely harms (1) the community. _____

b. Do you receive income from tourism? Yes / No

c. Do you want more tourists to come to Karimunjawa? Yes / No

d. Tourism only benefits some people. Yes / No

MATERIAL STYLE OF LIFE

18) Income:

What is your monthly income? _____

19) Material Style of Life:

type of roof: tile _____tin_____wood_____thatch_____

type of outside structural walls: tiled _____ brick/concrete_____ wood_____ thatch/bamboo _____

windows: glass_____ wooden_____ open_____ none _____

floors: tile_____ wooden _____ cement _____ thatch/bamboo_____ dirt_____

OPEN ENDED QUESTIONS

1) Positive / Negative Impacts on Livelihoods

a. What are the two major ways the National Park has helped local community livelihoods?

b. What are the two major ways the National Park has harmed local community livelihoods?

2) Perceived Coastal Management Problems and Solutions:

a. Aside from threats, what do you see as the two major problems facing coastal management in the community?

b. What do you see as solutions to these problems?

3) Successes and Challenges in Coastal Management:

a. What two things do you think have worked well for coastal management in the community?

b. What two things do you think have not worked well for coastal management in the community?

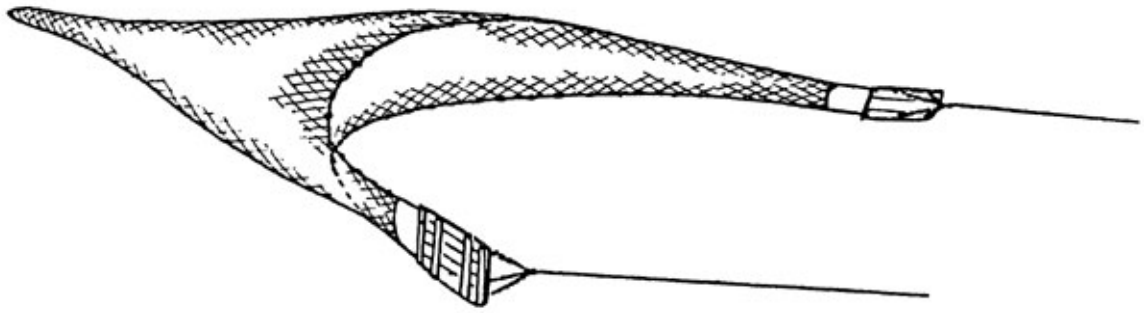
4) Perceived Community Problems:

What are the two major problems facing the community?

Appendix 2

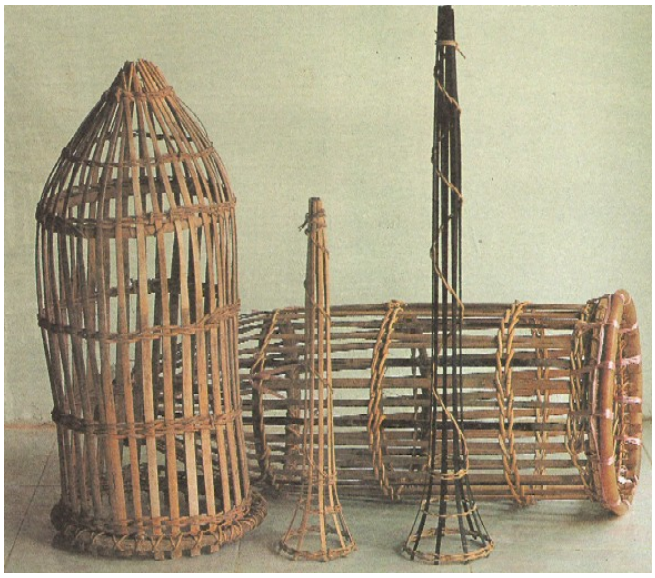
Diagrams and photos of various types of fishing gears used in Indonesia and Karimunjawa.

Trawl:



Source: fao.org

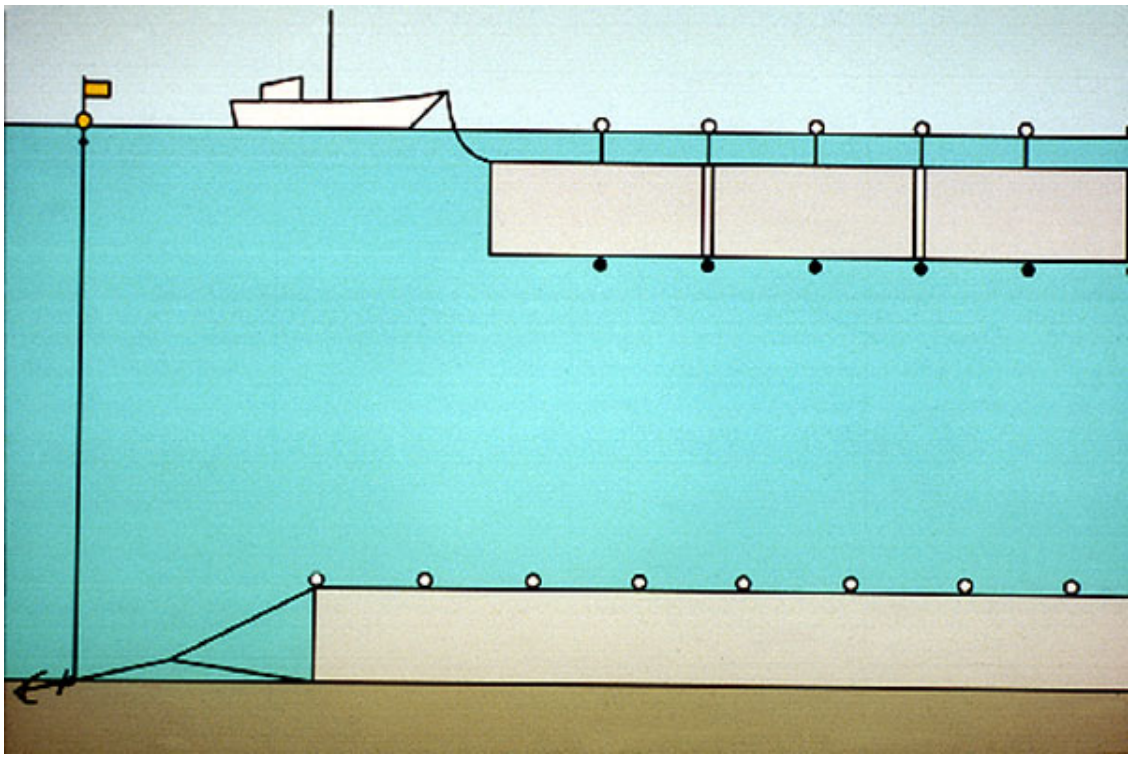
***Bubu* traps**:



Source: aseankorea.org

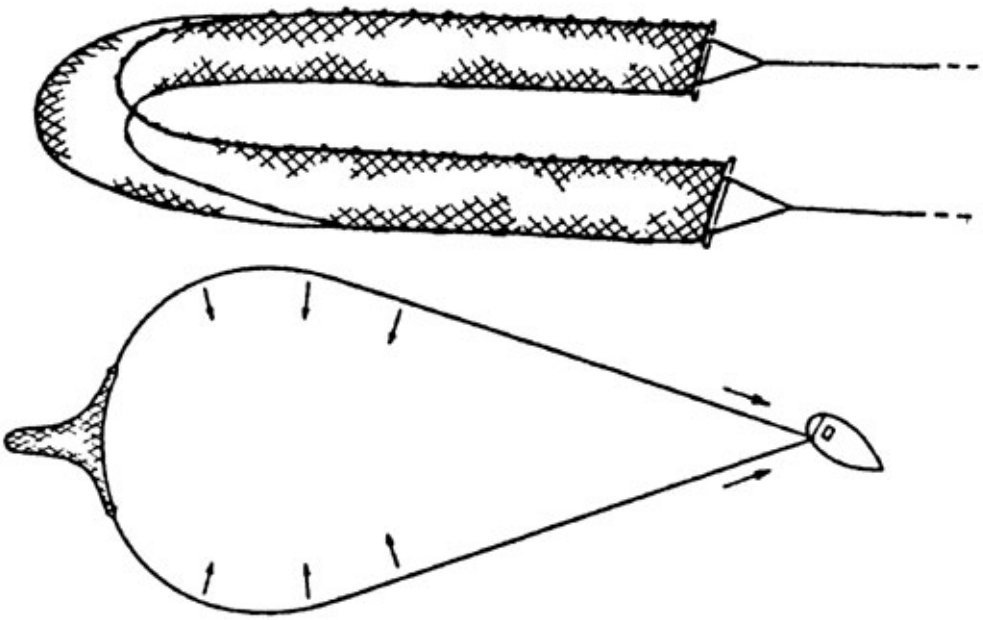
Source: borneoartifact.com

Gill net:



Source: fao.org

***Cantrang* nets**:



Source: fao.org

Appendix 3

List of Indonesian Offices:

- *Balai Konservasi Sumber Daya Alam* - Natural Resources Conservation Office
- *Balai Taman Nasional Karimunjawa (BTNK)* - Karimunjawa National Park Authority
- *Dinas Kelautan dan Perikanan (Dislautkan)* - Department of Marine Affaires and Fisheries
- *Dinas Kependudukan Dan Pencatatan Sipil* - Department of Population and Civil Registration
- *Dinas Pariwisata* - Department of Tourism
- *Dinas Perhubungan* - Department of Transportation
- *Direktorat Jenderal Kelautan, Pesisir dan Pulau Pulau Kecil* - Director General of Marine, Coast and Small Islands
- *Kementerian Kehutanan* - Ministry of Forestry

Appendix 4

Fieldwork Description

The fieldwork for this research project provided an extremely enriching experience, both academically and personally, during which I gained invaluable experience in the preparation and execution of graduate level international field research. My Indonesian field season took place between May 15th and Aug 22nd 2010. The below section will outline some of the preparation that was required in order to successfully execute my fieldwork as well as offer a description of experiences gained during my time in the field.

One key aspect in the preparation of the fieldwork for this research project was the learning of the Indonesian language of *Bahasa Indonesia*. Since the methodology for this research project weighted so heavily upon participatory observations and interviews with local small-scale fishermen, a good understanding of the local language was essential for its undertaking. During the summer of 2009, I completed *Bahasa Indonesia* courses at the Southeast Asian Studies Summer Institute (SEASSI). This eight-week intensive language training program held at the University of Wisconsin–Madison taught me the basic grammar, vocabulary and structure of *Bahasa Indonesia*. Furthermore, after arriving in Indonesia in the late spring of 2010, I followed private *Bahasa Indonesia* classes at Wisma Bahasa, a language school located in the university city of Yogyakarta. The curriculum for these classes focused on the practical fundamentals of *Bahasa Indonesia* as well as on the specific vocabulary and terminology associated with coastal living, fishing, conservation, and protected areas. Gaining a working proficiency of the language proved crucial during my time on the islands of Karimunjawa National Park, enabling me to communicate directly with local villagers, fishermen and park officials without always having to rely on a translator. Furthermore, general knowledge of *Bahasa Indonesia* along with a good knowledge of fisheries related terminology helped me enormously on solo data mining trips to various government offices throughout the province of Central Java, in which very few, if any, employees spoke English.

Aside from language courses, my time in Yogyakarta was devoted to securing contacts in the field and other logistics. Professor Pujo Semedi, through Gadjah Mada

University, provided the sponsorship required in order for me to obtain research permits from local, regional, and provincial governments. Guntur Widiatmaka Harisena, a student of Prof. Semedi, was instrumental in helping me acquire these permits required for my fieldwork. Thanks to his resoluteness and patience, I was able to weave my way through the bureaucratic maze of the permit application process in each level of government quickly and unscathed. I spent a total of one month in the city of Yogyakarta and various other locations throughout Central Java finalizing preparations for my fieldwork before continuing to my research site, Karimunjawa National Park.

Upon first arriving at Karimunjawa National Park in late June, Guntur and I spent one week in a small hamlet on the island of Kemujan, which is situated just north of the main island of Karimunjawa. Guntur, who was conducting his own research for his bachelor's degree in KNP, provided me with invaluable help during my fieldwork and often acted as my research assistant. During our time on Kemujan, we were able to spend time with a Bugis elder and his family, with whom I accompanied on an overnight fishing trip. We also conducted several semi-structured interviews while in Kemujan before I had to depart for Yogyakarta in early July to get my visa renewed. The process of extending my visa was greatly facilitated with the help of Ika Purwita Sari and Prof. Pujo Semedi who helped me obtain the documents required by the immigration office. During this visa run, I took the opportunity to visit several government offices in cities of Jepara and Semarang in Central Java in order to collect data relevant to my research.

New visa in hand, I returned to KNP and established myself on the island of Karimunjawa where Pak Carik, the village secretary, kindly offered to accommodate Guntur and myself for the remainder of our field season. Although our stint in the Kemujan hamlet turned out to be productive, it also proved an unfavorable location from which to conduct research due to its remote inland location and to the fact that we did not have regular access to a motorcycle for transportation. Being much closer to Karimunjawa, the park's largest village, and with regular access to the household motorcycles, Pak Carik's house offered a much more promising location from which to continue my fieldwork. Shortly after arriving at Pak Carik's, I began conducting interviews on a daily basis with fishermen and locals throughout the islands of Karimunjawa and Kemujan. I also began interviewing officials from WCS and BTNK at

their respective offices in the nearby village of Karimunjawa. Data pertaining to the local fishery and tourism industry was also collected from various local government offices.

Near the end of my month and a half at Pak Carik's, I was able to accompany both WCS and BTNK on two separate boat outings in the park. Both these excursions offered very valuable insight into the day-to-day activities of both of the park's governing bodies during which I was able to directly observe the data gathering methodologies of the two primary authoring bodies of my secondary sources. In mid august I concluded my research activities in KNP and headed to BTNK's head office in Semarang in order to conduct a final interview with the head of the park. Afterwards, I went on a final data mining trip to the nation's capital, Jakarta, in order to collect data pertaining to the national fishery and KNP from the federal offices of the Department of Marine Affaires and Fisheries, and the Director General of Marine, Coast and Small Islands.