

Case study 3: Bunaken National Marine Park (Indonesia)

The Role of Marine Protected Areas in Contributing to Poverty Reduction

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As ever, all errors, omissions or opinions remain the responsibility of the authors.

1. Introduction

1.1 Background of the study

This report is part of a larger study looking at how marine protected areas have contributed to poverty reduction at four different sites in four countries. Between November 2006 and May 2007, the study team conducted almost 1,000 household interviews and many group discussions in Fiji, the Solomon Islands, Indonesia and the Philippines. The data and information collected were focused on determining if the marine protected area had contributed to poverty reduction, and if so, why.

The study contributes to a growing stance in the literature that conservation practices “should at least do no harm” recognizing that many of the residents and neighbours of protected areas are poor and highly dependent on the environmental resources and services provided by protected areas to meet their daily survival needs. The study provides information to understand and support the recommendation adopted at the World Parks Congress on “Poverty and Protected Areas” (IUCN 2003) specifically that:

- 1) Protected areas should strive to contribute to poverty reduction at the local level (either directly or indirectly), and at the very minimum not create, contribute to, or exacerbate poverty;
- 2) In order to achieve their potential both to conserve biodiversity and to assist in reducing poverty, protected areas should be integrated within a broad sustainable development system; and
- 3) Knowledge about the linkage between protected areas and poverty needs to be improved.¹

Site selection for this study was limited to the Asia-Pacific region because this is the geographic area of interest for two study sponsors. Within Asia-Pacific, sites were selected based on three factors. First, experts who knew a site had to agree that the marine protected area (MPA) was likely to have contributed to poverty reduction. Second, the MPA had to be in an area poorer than the national average. Third, the MPAs themselves had to be as different as possible one from the other in order to give a wider basis for determining common elements of success in contributing to poverty reduction. The four sites selected were:

- *Fiji*. Yavusa Navakavu Locally Managed Marine Area on Fiji’s main island of Viti Levu.
- *Solomon Islands*. The Arnavon Community Marine Conservation Area between the large islands of Choiseul and Santa Isabel.
- *Indonesia*. Bunaken National Park at the northern tip of Sulawesi Island in central Indonesia.
- *Philippines*. Apo Island near Negros Island in the central region of the Philippines.

This portfolio of sites is roughly representative of small, one-community local MPAs (Fiji), medium-sized, multi-community local MPAs (Solomons), big collaboratively managed national

¹ This section above borrows from previous writing at: Scherl, LM. 2005 “Protected Areas and Local and Indigenous Communities”. In McNeely, J.A. (ed.). *Friends for Life: New Partnerships in Support of Protected Areas*, pp. 101-112, IUCN, Gland, Switzerland; and Scherl, L.M. Wilson, A., Wild, R., Blockhus, J., Franks, P., McNeely, J., and McShane, T. (2004,) *Can Protected Areas Contribute to Poverty Reduction? Opportunities and Limitations*. IUCN, Cambridge and Gland (Translated Portuguese version, 2006).

MPAs with lots of people (Indonesia), and small, co-managed national MPAs with few people (Philippines).

This report addresses the study conducted in Indonesia at Bunaken National Marine Park.²

1.2 Site description



Figure 1.1 Location of Study Villages and Bunaken National Marine Park (Indonesia)

Bunaken National Marine Park is located in the northern end of Sulawesi Island near the centre of Indonesia. Manado international airport is 30 minutes away. The park was established in 1991 by a decree of the national government. Approximately 30,000 people live in the 22 villages inside the national park. Fishing and farming are the traditional livelihoods in the area, but tourism has recently become a driving force in the local economy. The park is home to some of the best coral reef diving in the world and more than 38,000 people visited the park in 2004. The MPA is split into two sections. The southern part is mostly mangroves and the northern part contains five islands and a number of coral reefs.

Bunaken is collaboratively managed by the national government and an advisory board. The advisory board is made up of the key stakeholders and has 19 members representing national, provincial and city governments, local communities, private-sector tourism operators, and academics. To ensure local people benefit from the park, thirty percent of the park entrance fees are earmarked for community development activities, and tourism operators in the area have committed to hiring at least 80 percent of their staff from the local community.

Poverty in Bunaken varies considerably from sub-district to sub-district. Several of the islands in Bunaken and the sub-districts adjacent to the park have poverty rates of greater than 30 percent

² Country reports have been written for each site as well as a synthesis report for all countries. A film related to this study has also been produced.

based on the national poverty line (2004 data). The sub-districts in nearby Manado city, however, had poverty rates of less than 10 percent in 2004. Nationally, about 17.8 percent of Indonesians were below the government poverty line in 2006.³

1.3 Background literature

There have been a number of detailed studies about the benefits and costs of Bunaken National Park for local communities. This body of work helps to provide a cross-check for the current study and gives a longer-term perspective. Several of the key points from relevant works are summarized here.

Perhaps the most germane study is Tyler Blake Davis's May 2005 one titled *Local and Semi-Local Economic Impacts of Dive Tourism in Bunaken National Park, North Sulawesi, Indonesia*. After five months of fieldwork, Davis quantified, *inter alia*, the initial tourism investments by private-sector dive tourism operators, their annual running costs, and the number of tourism jobs created by the MPA. Davis found that the 38 dive operators operating in the park had invested the equivalent of US\$10,236,631 (2005 dollars) in start-up costs (mostly in the period 1999 to 2004), and the running costs for the dive operators were the equivalent of US\$4,486,628 (2005 dollars) per year. When the tourism multiplier effect and the secondary jobs and benefits are added, the total benefit to the local economy from dive tourism at Bunaken National Park was estimated to be the equivalent of US\$220,000,000 from 1998 to early 2005. The study also counted 1,063 "identifiable jobs" that were created by the dive tourism operators since 1998. The Davis study clearly illustrates that Bunaken tourism has generated significant economic activities for the poorer-than-average province of North Sulawesi where Bunaken is located.

The visitor numbers to Bunaken National Park have been tracked since 2001. From 2001 to 2004, visitor numbers increased 152% (15,066 to 38,003). About one third of the visitors are international in the average year.

A 1999 study titled *Valuing Resources Fisheries, Tourism and Preservation Values Bunaken National Marine Park* (Chris LaFranchi/NRM Program) found approximately 20,000 people made a living from park resources in the late 1990s and about 75 percent were fishers, farmers or both. The economic value of the fisheries alone was estimated at US\$3.8 million per year for full-time fishers and at least US\$330,000 per year for part-time fishers. The fisheries valuation methodology used surveys and village meetings to determine direct income data based on the level of catch, market value of the product, and production costs. A separate economic valuation of tourism gave the total benefits at US\$4.2 million per year, based on a willingness-to-pay survey of 45 local tourists and 185 non-local tourists between late 1995 and early 1996. This study also notes tourist arrivals in North Sulawesi fell sharply between 1997 and 1998 due to turmoil after the Suharto regime ended, highlighting the fact that Bunaken tourism benefits have had sharp drops in the past.

Visitors come to Bunaken National Park because it is home to a huge diversity of marine life and some of the rarest marine creatures in the world. It was in the waters near Bunaken that the coelacanth was rediscovered in 1998. *Building Effective Co-management Systems for Decentralized Protected Areas Management in Indonesia: Bunaken National Park Case Study* (Erdmann et al., 2004) details how the discovery of this "living fossil" fish helped the communities and governments around the park coalesce into a group with a shared interest in

³ <http://www.indonesiamatters.com/946/world-bank-on-poverty/>

conserving the park. This document details the birth of the North Sulawesi Watersports Association, the Bunaken National Park Management Advisory Board, the Community Forum, the entrance fee system, and notes many of the challenges faced by the park from 1997 to 2003. The document also highlights the pro-active and catalytic role internationally funded projects have played in bringing Bunaken's diverse stakeholder interests together.

2. Qualitative assessment

This country report, and the study overall, uses the World Bank's definition of "poverty". This is a multi-dimensional definition of poverty comprising three elements: opportunity, empowerment and security. The research and the results were organized around these three elements.

The main methodological processes and tools used to ascertain information on the social, cultural, governance and some aspects of livelihoods were: focus group discussions, key informant interviews (primarily qualitative data) and specific questions inserted into the household surveys (primarily quantitative data). The qualitative data are discussed in the section immediately below, and the quantitative data are discussed in the following section. The full descriptions of the methodologies used for the qualitative and quantitative information collection are in appendices to this report.

The core of the qualitative assessment is based on fieldwork conducted in February and March 2007 in Bunaken National Park. The information comes from focus group discussions and key informant interviews conducted in three island communities (Manado Tua, Siladen and Bunaken and one mainland community (Tiwoho) within the park. There were a total of three focus group discussions conducted at the community level with a mixed composition of community members. These meetings lasted around 2½ hours and had on average 10 participants. In addition, two focus group discussions took place in Manado City with members of the secretariat of the Citizen's Forum that represent all the communities within the MPA (4 hours in total). Key informant interviews were conducted with women who participated in training for alternative income-generating activities like coconut charcoal and clay stoves, women selling souvenirs, school staff, religious leaders, village chiefs, village-level representatives to the Citizens Forum, village administrators, fishers, youth representatives, patrol officers, resort managers and owners, heads of tourism associations, and heads of a number of NGOs working within the park. The key informant interviews lasted from 20 minutes to 1½ hours.

2.1 General perceptions of the MPA

Overall, there seems to be a great sense of pride on the part of the communities that Bunaken National Park (BNP) exists because it is known worldwide, but at the same time there is a lack of understanding of the "meaning" of the park for a range of people. Support for the park's regulations, like the zonation, and its rules on access are clearly ambivalent. Some are aware of it and others are not. *"There is law reinforcement from BNP, the patrol can arrest the people that break the regulation of the national park. There's a big sign in front of the mangroves from BNP: Do not take mangroves and corals, do not catch turtles and dugong."* There was some mention of zonation as beneficial, but for others it is unnecessary because the village follows its traditional methods of zonation/resource use anyway. Protecting the sea has been part of their life and their tradition for a long time, especially near the islands. *"The marine park breaks the customs of traditional way of catching fish". "Community people here understand how to protect their coral and in fact, the 'zonation area' has been long known and the coral around the island is still in good condition."*

People in some villages refer to the core zone (or no-take zone) as a "bank", functioning to save fish for the next generation; they only take the interest that accrues so that there will be fish for their children. They call this *"Tabungan"* (deposit), which is essentially a concept of conservation. In other communities, they simply do not accept or obey the zonation and

continue to fish where they have traditionally. Ineffectual patrolling to enforce zonation and control illegal harvesting (see below) allows this to continue, but there is also a lack of information within some groups regarding how to implement the zonation system. It seems understanding of zonation is more widespread in certain communities or certain groups within the communities (with higher levels of education equating to more understanding compared to lower levels of education).⁴

Introduction of the zoning system has not been without its problems, as in 2003 for example, there was a protest by villagers in Bunaken in which they declared that there was no longer any zonation. External fishers heard and came in large numbers to fish in the area, catching large numbers of fish, shark, etc.; people in Bunaken then became scared and realized the importance of the park and patrol. There is, however, a more generalized perception that since zonation there has been an increase in fish abundance and size.⁵ Moreover, people noticed that there are fewer people catching fish with cyanide and explosives, catching small fish with *wori* leaves, and fewer people taking corals from the ocean especially in front of the village. *“The zonation area has changed the way of catching fish, and the area of fish (which is now protected). In the former time our traditional way of catching in the fringing area was by potassium and a special local plant which has poison and is locally called ‘Daun Wori’”.*

People are now more aware of the lack of proper patrolling and enforcing mechanisms. *“The limitation of gasoline provided by the board which was normally 200 litre but is now 100 litre/month is causing less patrol”.* Some community members say that the water police (called POLAIR) must also patrol their area and so far this has not happened. Moreover, people perceive that because there is an increase in fish stock due to the park, more and larger boats from other areas in North Sulawesi and overseas are coming to fish around their area, and sometimes these boats follow them because of their local knowledge of the best spots to fish. Community members say that they have told this to the Management Advisory Board patrol people but so far nothing has happened.

The Bunaken National Park is also known within these communities because of the benefits they have derived from entrance fees, which have gone to the improvement of public facilities in the communities.⁶ People understand, for instance, that the board constructed new paths, installed a pier and water supply tank and renovated a school building with the money. These infrastructure development projects come from the distribution of 30% of the entrance fees to the 30 communities in and around the park equally. Each community submits a proposal to the advisory

⁴ At the request of most communities in the park, the rezonation was proposed six years ago through the Ministry of Forestry in Jakarta but has not yet been formally recognized. However, after six years of revised zonation, WWF staff mentioned that in general people are now more aware of the national park.

⁵ There have also been many comments from repeat guests to the park saying that they noticed an increased abundance of fish. “Am I seeing double when I go diving now?” In Manado Tua, an artificial reef called Ecoreef was built and was soon settled by fish. There was also a coral growth survey conducted in 2004 that showed increases in levels of coral cover of 16%.

⁶ In 2001, the NRM project (funded by USAID) offered guidance on how to establish a park user fee system. For the first two years of this system being operational, there was a shortfall from the fees, which was picked up by the NRM project. This was considered part of the evolutionary stage towards becoming financially self-sustaining.

board for the use of this money.⁷ While this system has worked very well and no doubt contributed greatly to awareness and support for the Bunaken National Park, signs of its erosion were noticed. The second allocation of this community share of the entrance fees for specific proposals (which vary across the communities) was due October 2006 but communities still had not received it as of February 2007. They understand that it has now been promised by March 2007.⁸ Some even claimed that “*We need our own ‘village regulation’ regarding the entrance fee in order to control the diving activities*”. The expectations of receiving the allocation and its subsequent delay is no doubt eroding credibility of the Management Advisory Board amongst community members (see below) as well as their support for the park (particularly in communities that do not benefit from tourism).

2.2 Assets and opportunities

Impact on livelihoods

There is a positive perception of the impact of Bunaken National Park on livelihoods and diversification of opportunities in some communities, while others say that there has been very limited or no impact. Perceptions of negative impact on livelihoods are negligible. There is, in general, a perception that there are plenty of fish to catch for subsistence and for sale, particularly to the tourist resort, with creation of the NP only curbing harvesting in some places (particularly where there are well-defined tourism zones for diving and snorkelling). Given that within the zonation system there is also a zone close to the communities where harvesting is permitted, people are noticing an increase in fish supply there due to the spillover effect of the no-take zones. However, some of this is still due to the fact that in certain communities, zonation has not been respected and fish abundance is still quite good to sustain “free” harvesting. But in such situations, community members feel that if zonation is implemented fully then there would be a detrimental impact on their livelihoods due to more difficult access to fishing areas.

There have also been some changes in the fishing methods. Whereas traditionally community members fished around the coral area (which is now prohibited), now a new way of fishing (trolling) is practiced. They never had such fishing tools before, and some fishers have been trained and were given these tools at the inception of the national park. The dependence on marine harvesting is related to level of education; there is more dependence amongst those less educated community members. Many villagers practice farming and this has not changed in intensity or type because of the BNP. There are also seasonality effects on the livelihoods of the communities whereby many people may work as farmers during the dry season and fish during the rainy season, which have not changed because of the national park.

⁷ There is also the perception that some Heads of Villages take advantage of the user fee allocation, but in other cases there is a genuine community-based planning process for use of the money.

⁸ Further discussions with WWF personnel, members of the Citizens' Forum and others reveal that park entrance revenues (though not visitor numbers) have been declining for some time due to September 11, the Bali bombings, SARS, etc. Moreover, all the stages of the Natural Resource Management Project (funded by USAID over a period of 10 years) and also the Coastal Zone Management Project which directly or indirectly supported the park has now been finalized. The 30% contribution to the community needs to be self-sustaining with regard to the entrance fees, but this is proving difficult to achieve.

Diversification of livelihood opportunities

Alternative livelihood opportunities and training have been provided through the Natural Resources Management (NRM) Projects that supported the establishment and implementation of the park. Community members associate many of these opportunities with the creation of the park (like clay stoves and production of charcoal from coconuts to reduce the use of mangroves and timber for fuel). They recognize that the park helped with opportunities for income diversification and at the same time protection of mangroves; many of these affected women directly and their potential to earn income (see below). However, the sustainability of such enterprises varies across the park, as many have abandoned this for a number of reasons.⁹ There is also the additional factor that once there is a demand for a greater volume of the products coming from these activities (e.g., making handicrafts from dried fish scales, paper recycling, weaving of baskets and other products using tree bark or palm leaves, and salted fish) there is insufficient production capacity at the community level to attend to the demands. So the concept and training for alternative livelihoods seems to be sustainable, but they are context specific, and depending on the level of organization within each community, outcomes vary across the park. Moreover, even with examples like charcoal from coconuts, although not as economically viable now as before, it is still something they say they learned how to do and can pick up production again if conditions become more favourable.

The tourist industry is certainly the largest contributor to the diversification of opportunities for community members. In the communities directly impacted by the tourist industry, there seems also to be quite strong support for the industry and good relationships between communities and tourist resort operations. Significant employment generation flows from this industry, which has grown because of the creation of the park, and this is particularly noticeable in places like Bunaken and Siladen.^{10,11} This has created jealousy among communities, with some not

⁹ For instance, one of the materials required to make the clay stove is difficult to find in the Manado Tua Island (rice husk) and is only sold in Manado City. The cost to get to Manado by boat and buying the necessary rice husks is more than they could get from selling clay stoves. The selling price for a clay stove on the island and other islands around Manado Tua is Rp. 25.000 (US\$ 2.50). To make one clay stove one needs: 3 kg rice husks, 2 medium buckets of clay, ½ medium bucket of ashes and water. It takes 2-3 hours to make one clay stove and one week to dry it. The reason some women are not producing charcoal from coconut shells now is because most of the coconuts are being sold in Manado still green and this is more economically advantageous. To make one sack of coconut charcoal requires more time because one has to wait for the coconut fruit to be ready to be picked up from the tree. Then one has to take the coconut meat out of the shell one by one (after it had already been separated), and then they will start making the charcoal. The time people have to wait for the coconut fruit to be ready to be picked from the trees is 4 months. To make a big drum of charcoal one needs 5 big sacks of coconut shells.

¹⁰ A study by Tyler Blake Davis (2005) showed, for instance, that the resorts or tourism sector employs in general more than 30% of the villagers in Bunaken. Other statistics compiled by the tourism organizations (see below) shows that 75% of people arriving on flights in Manado are foreigners, most of whom arrive for the purposes of marine tourism. Tourism in North Sulawesi is now continuing to grow and is becoming more sustainable.

¹¹ A woman interviewed in Siladen mentioned, for instance, that some of her family works in one of the resorts. Her mother is a landscaper/grounds keeper, two of her sisters are waitresses and one of her brothers works in a dive shop in the same resort. They receive salary and bonus service tips. The bonus is dependent on how many guests stay in the resort or go diving. Sometimes they can get nearly USD60 - USD70 a month during the peak tourism season in North Sulawesi (from July to October).

benefiting from tourism (like Manado Tua) and resenting the fact that tourists come to dive in front of their village but they never get any benefits from those visits.¹² *“From an economic perspective, the ‘Coffee Cape’ dive spot on the last tip of the village doesn’t give any benefit to the community”.* *“We see divers there all the time and they never come here.”* In Bunaken and Siladen, direct employment at the resorts affect a very substantial number of households as well as income generation through the sales of produce and products (such as fish, fruits and vegetables, embroidery handkerchiefs, shell lamps used in the resorts, and bamboo furniture¹³). *“Local fishers and farmers can sell their products to the resort at a good price.”*¹⁴

Helping to ensure that this situation is maintained is a set of rules agreed to by the members of the North Sulawesi Watersports Association (NSWA) (see more below) to the effect that members of this association (hotel owners, dive operators, etc.) commit to the employment of 80% of their staff from the local population; this includes work in hotels, diving operations, etc. and to always purchase fish, coconuts, and other products from the local villagers. In addition, resorts also provide other substantive benefits to the communities, as in Siladen, for instance, where the resort generator supplies energy to the whole village every day for four hours (previously there was no electricity on the island), provides garbage bins, and constructed a jetty that is also used by community members. However, there was some dissatisfaction voiced that *“the contribution of 5% from the tags fee is never received”* (the fee is collected at Siladen resort). There is also another benefit derived from the park entrance fee: the allocation of soft loans to villagers to run their small business. Other job opportunities created by the park are related to the running of the advisory board, e.g., staff who work as fee collectors and others who run the board.

From the perspective of some members of the tourism industry came the following observations. *“Bunaken National Park may be considered the ‘prima donna’ of marine parks– it is referred to metaphorically by some circles as the “locomotive” that operates at the provincial level that is followed by other cars or components of the tourism sector (cars represent hotels, air lines, diving operations, etc.) – each car must determine how it must learn to tag along to the locomotive or take advantage of the benefits that flow from the BNP”.* *“Tourists come for world-class diving and the local economy and tourism sector directly benefits (everything from money changers, dive operators, hotel owners, to farmers etc.); local farmers and fishers directly benefit because hotels and restaurants purchase much of their food from farmers and fishers (fish and other marine products, vegetables, coconuts, rice). Tourism has a multiplier effect on the local*

¹² In the beginning, Manado Tua residents refused to have tourists around their village because of tourist behaviour (walking half-naked, etc), but now they realize it is part of the tourist customs. Others we held discussions with perceive the situation with Manado Tua as one where community members now seem to want ecotourism. (Though they were not very amenable towards this proposition before.) This potential must be studied carefully, as it is unique with its mountain and forests. Moreover, development of tourism in Manado Tua would be more cumbersome because there are no sandy beaches and its rocky coasts make it difficult to land boats.

¹³ The mangrove rehabilitation projects, which have included initiatives to promote building homes and furniture with treated bamboo, seem to have had a significant impact in Tiwoho village, for instance, and also with the presence of the NGO Kelola. This project has been supported by the Seacology organization with funding channelled through Kelola.

¹⁴ There is a well set-up area in front of the visitors’ centre in Bunaken Island where a number of women sell handicrafts, t-shirts and some local food and drinks for visitors, and there seems to be a lot of collaboration amongst the women who discuss prices, etc. Also national tourism visitation, in particular, supports the local shops.

economy – mainly as the result of the money that tourists spend in the local areas. Ecotourism has been growing at 10-15% per year.”¹⁵

Education

The standard curriculum education has not been greatly affected by the National Park with the exception of the fact that local environmental lessons have been added more recently in some places. The NSWA scholarship program has been quite successful in the communities and some people interviewed attribute this scholarship to the Bunaken Management Advisory Board (NSWA is a member of the Board) and the existence of the national park. The funds are distributed through the Forum *Masyarakat* (see below for more information on this forum). Members of the Forum choose five students per village for the scholarship program (the NSWA serves as the “*foster parent*” of a total of 150 children from the local communities/villages within BNP) and selected students are given the necessary materials and funds to attend school, including uniforms, shoes, books, bags, and sometimes monthly sums when it is needed for tuition expenses. This program has also included two to four college-age students who study in the fisheries or marine biology departments. The scholarship program for school-age students has since been replaced by government funding for education that now allows everyone to attend school and currently most of the NSWA funds are used for environmental education programs. This scholarship fund is an example of a well-known and tangible benefit arising from the park.

Environmental awareness

The extracurricular environmental awareness and education program, however, has benefited greatly from the national park. Lestari, an NGO with environmental education in its mandate, runs a number of environmental education programs. Another small NGO, called *Bintang Laut*, also has programs for environmental education in the communities. The NSWA is also involved in environmental education and, for instance, conducts an annual activity called “Dive into Earth Day” on Earth Day each year, with the primary purpose of educating school-age to college-age students on the importance of conservation in general and more specific themes such as recycling. After last years’ event, several teachers approached the NSWA expressing a desire to participate in subsequent events as well, so now the NSWA must decide on how to best cater for these groups. Moreover, NSWA members have adopted a set of good practices, including environmental policies such as the restriction of anchoring on coral reefs, the non use of gloves, and the “swim not stand” campaign, which serve to make people more aware of how to care for the environment.

In Tiwoho, as another example, Kelola, an NGO working on environmental awareness, has activities planting new mangrove trees around their beach. “*People now have more understanding about the importance of mangrove trees in their area, so there will be no beach erosion, more protection for the fish eggs and little fish*”. “*Due to the re-growing of mangrove, the beach is now well covered with new mangrove. Before the national park was established, locals often used the mangrove for making fences, bridges, etc.*” Other smaller activities related to environmental awareness include a marine environment painting competition for elementary students conducted

¹⁵ In May 2009 there will be a high-profile event (The World Ocean Summit) hosted in Manado; many believe that this represents a fantastic opportunity to increase the visibility of BNP and to highlight the tourist potential of the North Sulawesi region in general.

by the management advisory board. The advisory board has also organized some classes on the marine environment with a guest teacher for the elementary school. Moreover, church groups and spiritual leaders play an important role at the community level to enhance awareness of environmental issues. One such leader who was interviewed told us that “*Almost every week, his speech in the church or in other church meetings mentions how to take care of and maintain the national park*”.

New skills

In terms of the acquisition of new skills, there is no doubt that the tourism industry has trained many local community members in several aspects of this service industry. However, there is still a pronounced skilled human resources deficit in the region, representing a significant challenge to the further development of the tourism sector. Moreover, as mentioned above, some of the alternative income generation activities (e.g., charcoal, stove and furniture making) were introduced with considerable training in new skills, particularly affecting women.

2.3 Empowerment and governance

Governance

The most significant and major achievements with respect to governance of the Bunaken National Park have been the creation of the Bunaken National Park Management Advisory Board (BNPMAB) and the Forum *Masyarakat* (Citizen's Forum). The BNPMAB is a multi-stakeholder board with members from the government, tourism industry, academia and the communities. Its existence and constitution has also been entrenched in legislation.¹⁶ It has been very successful, from the perspective of all parties interviewed, in creating a forum for discussing issues, for achieving consensus on decisions, and for instilling a democratic process for the running of the park. The advisory board is a very important decision-making mechanism. While it has decision-making power on some issues, many others must be referred to relevant government institutions for ultimate decision-making (e.g., the pending enactment into legislation of the revised zoning plan). The formation of the Board started with the Natural Resources Management Project in 2000, from which it received its initial support. The idea is that the running of this Board should be self-sustaining with funding from the entrance fees (the establishment of the mechanism for collecting fees was also supported by the Natural Resources Management Project). Through the Board, the park and its accompanying processes of decision-making have received government acceptance at the national and provincial levels, and the tourism sector has been able to influence government priorities with respect to management of the park.

In the beginning, local communities felt there were no benefits to them from the Park, and this is why in the year 2000 they established a special forum to help people to determine the use of the national park for their own benefit – the Forum *Masyarakat* (Citizen's Forum). The forum was developed through USAID funding (primarily through the phases of the Natural Resources

¹⁶ The BNPMAB consists of representatives of: the local communities (Forum *Masyarakat*), the tourism sector (represented by NSWA and HPWLB-the local business owners of Bunaken Island), the Water Police, local government departments, (from 3 different regions of the North Sulawesi province including the municipality of Manado), and a representative of the local university. It represents a considerable effort in establishing a democratic process for the running of the park, considering that it came immediately after the Suharto regime, as many interviewed mentioned.

Management Project). Forum members (which are selected by each village in the park) have a six-year term and must be originally from the villages represented. Of these, six persons now (before there were only five) represent the forum in the BNPMAB. There is great variation in community governance among the villages in the park. In some villages, the Head of Village is not elected, so there is no democratic process, while in others participation is greater and the Head of Village is elected. As a result, there are varying levels of participation, types of relationships, and systems of governance among the 30 villages participating.

Participation in meetings at the community level is still a problem because of the difficulty in gathering entire villages. In this regard, the Bunaken National Park Management Advisory Board is highly successful at the broader multi-stakeholder level, but some community representation within the board still lacks accountability and transparency back to the community level. This is an issue that, when holding discussions with the forum representative on the BNPMAB, they recognize should be addressed more thoroughly. Also, because of the current shortfall in revenues from entrance fees (and the end of the major donor-funded projects) it has been difficult to convene a meeting of the whole forum – the last one took place in 2005. This reflects people's perceptions that the Forum has not been very active for a while now. Before 2005 there were meetings (formal and informal) conducted regularly (at least once every month).

Besides the BNPMAB and the Citizen's forum, the North Sulawesi Watersports Association (NSWA), which was also strengthened because of the park, plays an important role in bringing the business sectors together and contributing to managing, raising awareness and, more generally, enhancing support for the park (see previous sections). Another tourism organization, NSTO, also began in 1998.¹⁷

Role of women and men and the lives of children

Opportunities for women have changed slightly with some of the alternative income generating activities they received training for attributed directly to the park (see above). They say their husbands are happy with that because the little bit of money they earn helps cover some expenses for the household needs. Moreover, employment in the resorts is also for men and women, opening opportunities not there before. The potential for earning more income because of these activities has afforded some women more respect and power in their households. However, there is still low production capacity in some of these income generating activities because women are responsible for household chores (women normally control the household money in these communities anyway). Women and men have equal opportunities and voices in determining/making decisions during the meetings in the citizen's forum or within the board (although there are few women members of the board – and only one represented in the citizen's forum amongst the six representatives there).

One noticeable benefit related to activities associated with the park is that women are more willing to participate in the decision-making process and their participation has increased. There is a perception that women in the park communities have an equal role; however, there are also few women in the Forum *Masyarakat* as a whole. Moreover, when it comes to equal

¹⁷ It started as a satellite chapter of PATA, but the North Sulawesi chapter was later closed. However, there was still a need for organizing efforts so it was resurrected as the NSTO (North Sulawesi Tourism Organization). They do a couple of trade shows each year. They have representation from hotels, diving operations, etc.– in total 23 members now.

participation in leadership positions, such as in the advisory board, it seems that many women do not feel comfortable or do not have time to participate.

Access and rights

Zonation, where implemented properly, limits access to resources. Some communities perceive that they have bad luck because the fish spawning aggregation areas are right in front of the village and these areas are now closed from fishing.

2.4 Security

Health

There has been no benefit to the delivery of health services because of the national park. But some health and sanitation benefits have been identified which directly relate to the national park. Clay stoves and charcoal from coconuts, for instance, are considered highly effective for cooking and more beneficial to one's health, resulting in less production of smoke and inhalation of fumes and thus less respiratory illness. It also takes less time/effort to cook and collect fuel wood and less money is spent on energy. In some villages there are beach cleaning programs and provision of garbage bins that is also attributed to greater environmental awareness due to the national park. People in the village realized that they could get sick by eating the fish that they catch using *wori* leaves or cyanide, so they stopped fishing with these methods. Community projects funded by the Board included the construction of a water supply tank and public toilets and washing places. Moreover, people perceive that the new mangrove trees growing in some areas shield the coastal village from the strong west wind that can cause illness.

Social Cohesion

Both the BNPMAB and the Citizen's forum have contributed greatly to enhance social cohesion amongst different stakeholders and between some of the communities. Increased capacity and skills amongst local people to deal with a variety of functions in the management of the park has also increased cooperation amongst people who participate in conservation-related programs.¹⁸ However, the positive social cohesion effect due to the national park is counter-balanced by feelings of envy between villages (mentioned above). For instance, people at Manado Tua said they would like to have the park renamed as Manado Tua because this was the place where they found the renowned *Coelacanth*, which was considered to be an extinct fish and has since made Bunaken National Park even more famous. Moreover, much illegal harvesting still takes place inside the park (mentioned above when addressing the need for patrols), which undermines social cohesion. *"Net fishing activities are still conducted by locals in the protected area, particularly in the evening when the control by the water police is less. Boat crews who work at the dive centres also do fishing."*

Supply of natural resources

Due to the new mangrove plantings, people feel secure in some places because their beaches now are protected from erosion, westerly monsoon impact and other disasters caused by strong

¹⁸ Traditionally there is the practice of *Arisan* - a mutually beneficial assistance system between 2 or more people in which group members will assist one member when they need it, so social cooperation that enhances cohesion is part of their cultural traditions.

westerly winds. They surely feel safer with the existence of the national park in terms of maintaining stocks in case of emergencies.

2.5 Qualitative summary

This section positions the information above by addressing the linkages between conservation initiatives in the Bunaken National Park and the multi-dimensional aspects of poverty reduction. Several conclusions emerged from the qualitative analysis.

1. There is a mixed relationship with the dimension of poverty that relates to assets and opportunities.

For the communities adjacent to tourism resorts, affected by this industry, the relationship is a positive one (i.e., employment opportunities have increased and there is more income for the households). Moreover, for the many others not directly employed in the industry there are also a lot of opportunities to sell local produce for consumption at the resorts or directly to the tourists (e.g., souvenirs). The tourism associations' principle of employing a majority of local people and buying produce locally has also contributed to this. Moreover, other benefits, such as electricity in one community, improved the quality of life. For the communities not directly affected by the tourist industry, assets and opportunities have not been altered greatly. The few alternative income generating activities that were promoted after the establishment of the National Park (e.g., clay stoves and charcoal from coconut) for the communities we visited have yielded unsatisfactory results. Many of these activities have now been abandoned.

The widening of opportunities for employment also brought a mixed relationship with the dimension of capacity building and acquisition of skills and learning that again affects mostly those villagers adjacent to the tourism industry. Noteworthy here, however, is the fact that a lot of capacity-building programs or exchange of knowledge has taken place because of the National Park and the USAID-funded programs that supported its establishment and implementation for many years (e.g., for producing clay stove and charcoal from coconuts, fish scale jewellery, bamboo furniture) and different methods of fishing away from the reef areas. The acquisition of such skills has been quite important and widespread in the communities and is retained there to date. Moreover, representation in the Bunaken National Park Management Advisory Board and in the Forum *Masyarakat* also enhanced skills for participation, collaborative management and management more generally. Programs for environmental awareness and education have been widespread in the region with many different NGOs having these as part of their objectives. Spiritual leaders also do their share of work to raise such issues within their constituency of followers. People seem to be very aware about the existence of the National Park (not always, however, supporting the zoning or abiding by it).

2. Conservation, empowerment and good governance go hand in hand

There is also a positive linkage between the empowerment and governance dimension of poverty and the conservation measures that affect quite a number of people because of the creation of both the Bunaken National Park Management Advisory Board and the Forum *Masyarakat*. The Board has without doubt been a forum where a multi-stakeholder group can voice concerns, discuss issues, and plan actions. It has, in particular, brought community, government representatives and the tourist industry into more direct dialogue. The community representatives on the Board feel empowered and able to contribute to discussions and decisions meaningfully. All of this is an incredible achievement in the exercise of democracy after what many interviewed refer to as "the Suharto era in Indonesia". The accountability to the community of what takes

place in the board and the secretariat of the Forum *Masyarakat*'s meetings, and indeed the canvassing of issues in a more open way prior to those, has varied greatly. The latter depends on the way villages run their decision-making processes (whether democratically or not) and also availability of funds to hold meetings with all members of the forum. By and large, the voice of women is still lacking in these forums although there is not a perception that they can't participate equally if they wish to (traditional roles in the household seem to curb availability of time to do so and perhaps further encouragement is also needed). After the cycle of donor-funded programs finished, maintaining the governance system established for Bunaken National Park has proven to be a great challenge with sustainability quite questionable at the time of this study.

3. Conservation measures have a mixture of impacts on security

By and large there are also a number of other ramifications for the community from the conservation measures that demonstrate a decrease in vulnerability. For *social cohesion* there is a mixture of outcomes, with it being enhanced (amongst communities but also across different stakeholders) because of the creation of the Board and the Forum. On the other hand, however, *social cohesion* has decreased because of envy from perceived opportunities to earn income available in some communities but not in others. *Health* delivery has not benefited directly but greater environmental awareness has brought many benefits to sanitation, fishing practices, and foreshore protection by mangroves, positively affecting health. Moreover, local community infrastructure projects funded by park entrance revenues has contributed to health with better water supplies, better pathways, etc.. Proximity to resorts in some islands has also done its share to alert communities to sanitation issues. By and large, people feel safer by having the National Park with its replenishment of stocks and proud that it is known around the world. This sense of identity (of being part of Bunaken National Park) is a psychological benefit important to the general wellbeing.

Overall, based on this analysis, one can say that there is quite a positive association between the conservation initiative of Bunaken National Park and poverty reduction. This positive relationship is, however, not widespread amongst all communities in the park (i.e., it is patchy) and aspects of sustainability in this relationship are seriously being questioned at the present time. The strong support through years of donor-funded programs and the considerable tourism industry no doubt played a major role here.

3. Quantitative assessment

3.1 Introduction

During the months of January, February and March 2007, 299 interviews were conducted in and around Bunaken National Park.¹⁹ To determine a desirable sample size for the study, several assumptions were made. First, the acceptable margin of error in estimating welfare characteristics was set at around $\pm 5\%$ with a confidence level²⁰ at 95%. The level of 95% is usually selected when one wants to be reasonably confident of the outcome. Second, based on a population of Bunaken National Park of 30,000 and an average household size of 4.2 persons, the total number of households was estimated to be 7,143. Finally, the confidence interval was calculated given the selected confidence level and household population ($\pm 5.5\%$).²¹ Although this slightly exceeds the desirable margin of error of $\pm 5\%$, the team decided that a sample of 300 households would generate high enough confidence level to be considered representative for the population.

Next, villages were selected which sufficiently represented the populations of Bunaken National Park. Similarly, the selected control villages were isolated from any impact of MPA, but which maintained similar characteristics as the MPA villages in terms of population sizes (i.e., villages), economic activities (i.e., fisheries, tourism), absence of major development projects in the local area excluding the MPA, location and market access (i.e., coastline, proximity from urban centres), and ethnic and religious background (e.g., Christian, Muslim). The control site villages were selected by consulting a range of experts with in-depth local knowledge.

The distribution of the survey sample is shown in Table 3.1 and Table 3.2. The sample was subdivided on the basis of two criteria:

- Whether the household was within the MPA or not (i.e., MPA versus non-MPA);
- Whether the prime source of income of the household was dependent on fisheries or the tourist industry (i.e., fisheries versus tourism).

The reason for specifically addressing these sub-categories is that, on the one hand, possible differences may arise between poverty levels within MPA and non-MPA areas, while on the other hand, the creation of an MPA may create additional opportunities for the tourist industry and affect the welfare of fishing livelihoods. Fishing is also the traditional source of cash income in the park and remains the dominant livelihood strategy in the area. Tourism is number two—hence the comparison between the two alternatives of fishing and tourism.

¹⁹ The average duration of an interview was 29 minutes.

²⁰ The confidence level shows the likelihood that the selected sample is large enough so that the statistical results concerning welfare characteristics fall within the specified margin of error, which is 5% in this case. Choosing the 95% confidence level, for example, means that if one were to select a sample of a certain size, this sample will possess the desired attribute, within a specified margin of error (the confidence interval), 95% of the time.

²¹ Confidence interval = $1.96\sqrt{((\text{population size} - \text{sample size}) / (4 * \text{population size} * \text{sample size}))}$

Table 3.1 Sample distribution categorised by MPA/non-MPA and by economic activity

Subgroups	Tourism	Fishers	Total
Non-MPA	55	46	101
MPA	109	89	198
Total	164	135	299

Table 3.2 Sample distribution across different locations

Villages (MPA)	Sample	Villages (non-MPA)	Sample
Tongkaina	33	Tandu Rusa	45
Siladen	29	Pintu Kota	42
Tiwoho	25	Makawidey	10
Manado Tua I	23	Papusungan	2
Molas	20	Mawali	2
Arakan	19		
Poopoh	18		
Bunaken	17		
Manado Tua II	15		
Total MPA sub-sample	199	Total Non-MPA sub-sample	101

The average household interviewed consisted of 4.3 members. This includes an average number of 1.4 children (with an equal division of boys and girls). Respondents' gender was 96% male and 4% female.²² The average age of the respondent was 42 years with a range of 20 to 77 years. For education, 91% of the respondents had an education level of primary school or higher compared with the national average of 94% (2002 data).

3.2 Assets and opportunities

Various indicators were included in the questionnaire to derive more information about the level of wealth of households in Bunaken National Park. Besides income, specific information was retrieved on the characteristics of housing and luxury items present in the household. The subjectivity and uncertainty involved in combining income, housing and luxury items into one composite welfare indicator, led to an analysis of the three welfare variables separately.

Income

The most common welfare indicator is income. The survey explicitly addressed income through fisheries, tourism, and other economic activities. The sum of these cash generating activities is used in this sub-section. The first comparison is the average monthly income of MPA (Rp 758,634 or US\$84) and non-MPA households (Rp 734,117 or US\$81).²³ The differences in the

²² This heavy male bias was due to insufficient emphasis with the local survey staff on the need for a rough gender balance. The gender imbalance, however, does not appear to have skewed the results because as the reader will see, there is a strong correlation between the qualitative findings that did have gender balance and the quantitative findings that did not.

²³ The official exchange rate in February 2007 of Rp 9,058 is used throughout.

average monthly income of MPA and non-MPA households are not statistically significant.²⁴ The box-plot²⁵ in Figure 3.1, illustrates the distribution of income for MPA and non-MPA areas.

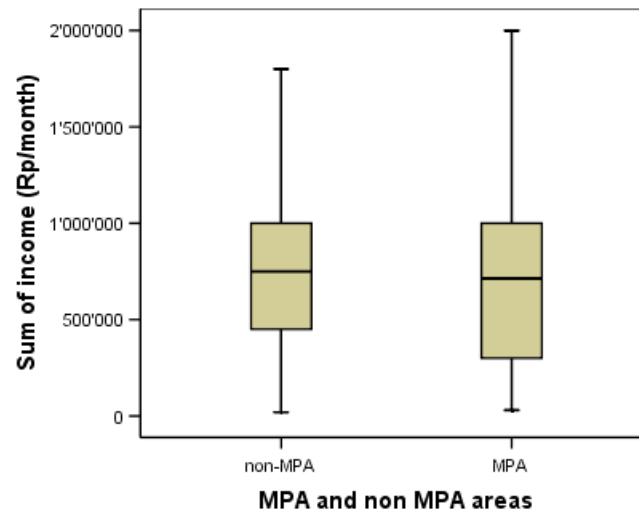


Figure 3.1 Box-plot of monthly income categorised by non-MPA and MPA

The second comparison is the monthly household income of fishers (Rp 400,534 or US\$44) and households that depend on the tourist industry (Rp 1,036,925 or US\$114). As shown in the box-plot in Figure 3.2, the differences between these two groups is much more pronounced. There are statistically highly significant differences²⁶ in the mean values of income between fishers and people who are involved in tourism activities ($p < 0.001$). Though tourism households are probably more dependent on cash for subsistence than fisher households because fishers generally get some of their food from their catch.

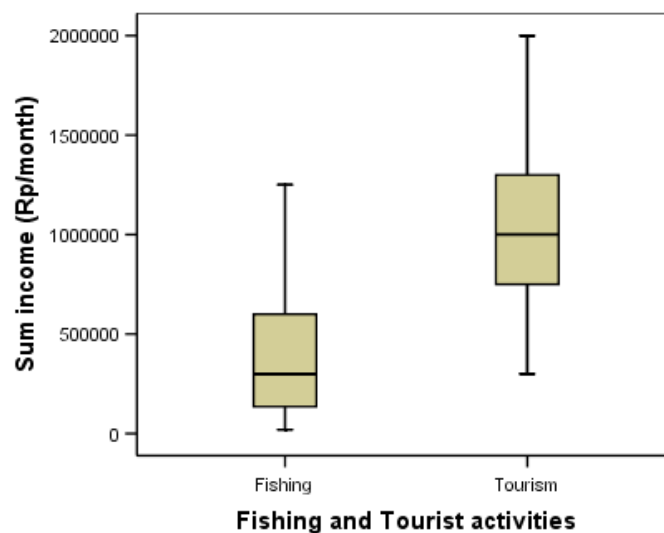


Figure 3.2 Box-plot of monthly income categorised by economic activity

²⁴ The t-test indicates no statistical differences between the mean values of income for MPA and non-MPA areas. The test includes 285 households (191 MPA-households and 94 non-MPA households).

²⁵ Box-plots show the median, interquartile range, outliers, and extreme cases of individual variables.

²⁶ The t-test indicates significant differences ($p < 0.001$) between the mean values of income for fishers and people involved in tourism industry. The test includes 258 cases (119 fishery-dependent households and 139 tourism-dependent households).

Table 3.3 confirms that both tourism and fishery dependent households are better off in the MPA compared to the non-MPA areas. Given that Bunaken tourist arrivals grew from 15,000 in 2001 to 38,000 in 2004 (an average of 25% annual increase), the data suggests that if the tourism industry continues to grow as it has in the recent past, and the sector continues to recruit its employees from local communities, households in the MPA will benefit substantially.

Table 3.3 Average cash income by activity and location (in Rp/month)

	Non-MPA		MPA	
	Income	Sample	Income	Sample
Tourism	949,074	54	1,036,691	108
Fisheries	528,070	43	534,483	88

To test the main determinants of monthly income, a multiple regression was conducted. The dependent variable being the monthly income and independent variables consisting of: MPA/non-MPA; fishing activities; tourism activities; age of the respondent; respondent's education; and the average age of children. The model presented in Table 3.4 explains almost 28% of the variance in income ($R^2 = 27.6$). Being active in tourism is strongly related with higher income. Fishers have lower incomes, given the negative sign of the variable. However, the negative relationship between being fishers and income is not statistically significant. All other variables did not appear to be significant either.

Table 3.4 Model estimation of income

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	540,711	206,938		2.613	.010
	MPA and non MPA areas	67,956	66,799	.058	1.017	.310
	Fishing activities	-166,037	121,605	-.152	-1.365	.174
	Tourism activities	440,568	122,348	.406	3.601	.000
	Age of the respondent	712	3,110	.014	.229	.819
	Respondent's education	12,362	33,424	.023	.370	.712
	Average age of children	1,103	7,192	.009	.153	.878

a Dependent Variable: sum_income_2

Housing

The interviewers recorded two characteristics of the premises of the households: the material used for the wall (e.g., bamboo, wood, corrugated iron, or brick/concrete) and the materials used for the roofing (e.g., thatch/leaves, tiles, corrugated iron, or concrete). Attaching weights to the above materials varying from one to four created a housing indicator. The minimum score is two, representing a house with bamboo walls and a thatch leaves roof. The maximum score is eight, representing a house with brick or concrete walls with a concrete roof. By following the procedure of weighted summation, three groups were created:

- Group 1. *Low-cost housing*: encompasses the cases with values 2 and 3 (walls are from bamboo or wood; roof is from thatch/leaves or tile);
- Group 2. *Medium-cost housing*: housing which is neither poor nor wealthy, encompassing the cases with a value 4 to 6 (walls are from wood or corrugated iron; roof is from tile or corrugated iron);

- Group 3. *High-cost housing*: encompasses the cases with values 7 and 8 (walls are from corrugated iron or brick/cement; roof is from corrugated iron or concrete).

Figure 3.3 demonstrates how the three categories are distributed between MPA and non-MPA sub-samples. The chi-square test indicates that there are statistical differences ($p < 0.05$) in wealth (measured by housing) between the MPA and non-MPA areas.²⁷ However, high-cost housing is the most common form of housing in both MPA and non-MPA areas.

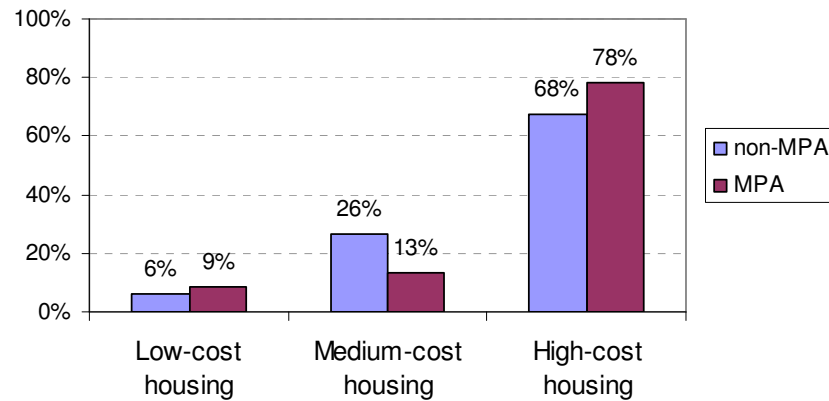


Figure 3.3 Distribution of housing classes categorised by MPA and non-MPA

Figure 3.4 show the distribution of the three housing categories on the basis of the main economic activity of the household. The chi-square test confirms that there are significant statistical differences ($p < 0.01$) in wealth (measured by housing) between persons who are involved in fishing and those involved in tourism.²⁸

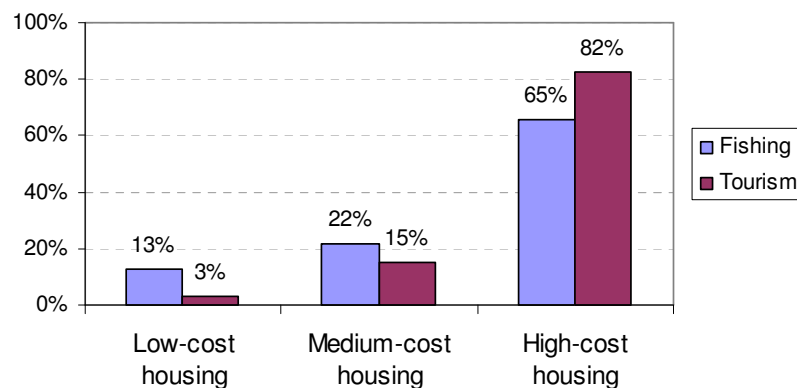


Figure 3.4 Distribution of housing classes categorised by activity

An additional housing indicator that can potentially be used as a proxy for wealth is whether the household is connected to the electrical grid. Table 3.5 presents the allocation of electricity availability between MPA and non-MPA households. The great majority of the respondents have electricity available in their houses. However, despite apparent small differences between MPA and non-MPA households, the statistical test shows that, for the whole sample, there is no statistically significant difference between the non-MPA and MPA areas in the availability of the electricity.²⁹ Also, the chi-square test indicates that the differences in availability of the electricity

²⁷ The chi-square test includes 297 households (198 MPA-households and 99 non-MPA-households).

²⁸ The chi-square test includes 275 households (133 fishery-based and 142 tourism-based households).

²⁹ The test includes 300 households (199 MPA-households and 101 non-MPA-households).

for fishers in MPA and non-MPA areas are not statistically significant.³⁰ It is impossible to do a similar test for tourist-based households, due to the small number of cases without electricity. However, the data show that nearly all people (92% in non-MPA and 98% in MPA areas) who earn their income with tourism have electricity in their homes.

Table 3.5 Availability of electricity

MPA/non-MPA	Non-MPA	MPA
No electricity	14%	7%
Electricity	86%	93%

The same analysis can also be conducted for the availability of running water in the premises of the respondent. The chi-square test indicates that there are highly significant differences in the availability of running water in the households between the non-MPA and MPA areas ($p < 0.001$).³¹ The chi-square test also shows that there are significant differences between MPA and non-MPA areas in availability of running water inside fisher's houses ($p < 0.01$)³² and for people involved in tourism activities ($p < 0.001$).³³ However, this difference may be explained by location (i.e., mainland versus island-based villages) rather than by the level of welfare.

Table 3.6 Availability of running water inside the house

MPA/non-MPA	Non-MPA	MPA
No running water	25%	64%
Running water inside the house	75%	36%

Luxury goods

Another alternative welfare indicator is the type and number of “luxury” items available in the household. The interviewers registered the presence of nine items. Next, the items were aggregated by weighted summation. Three weight categories are used (see Table 3.7): a weight of one for radio, watch/clock, canoe, and bicycle; a weight of two for a television and a motorised boat; and a weight of three for satellite dish, motorcycle and car/truck. The weighted summation was normalised to a scale of one to ten, where ten represents the maximum score.

Table 3.7 Weights applied for aggregation of indicator items

Weights:	Weight: 1	Weight: 2	Weight: 3
	Radio	TV	Satellite dish
	Watch/clock	Motorised boat	Motorcycle
	Canoe		Car/truck
	Bicycle		

Figure 3.5 shows the presence of the nine items in the household. The most popular items are watches and televisions, which are owned by almost 75% of the population. Satellite dishes and

³⁰ The test includes 134 fishery-based households (88 from MPA area and 46 from non-MPA area).

³¹ The test includes 297 households (199 MPA-households and 98 non-MPA-households). The number of households included in each test varies because not all the households answered every question and because for the T-tests the extreme values were removed from the test.

³² The test includes 132 fishery-based households (88 from MPA area and 44 from non-MPA area).

³³ The test includes 142 households (91 MPA-households and 51 non-MPA-households).

cars are truly luxury items owned only by a small minority of the interviewed households. Some differences can be observed between the MPA and non-MPA sub-samples. For most items, the MPA households seem to possess more of these items than the non-MPA households. However, to confirm structural differences, statistical testing was conducted.

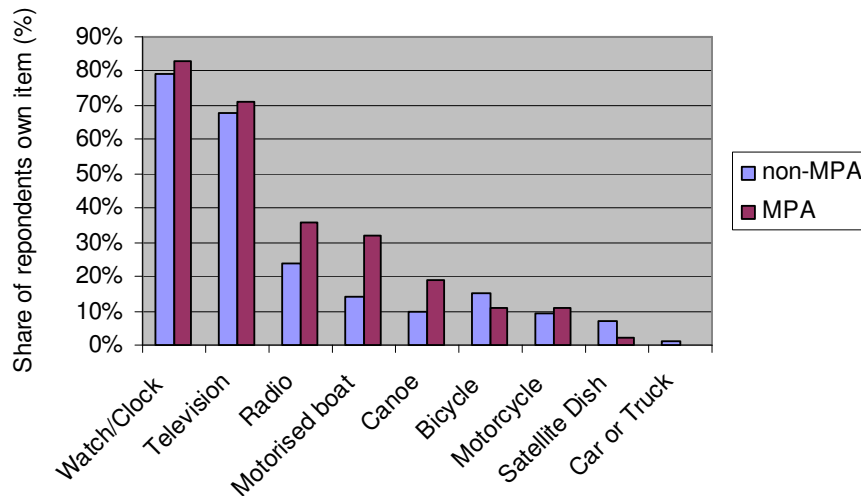


Figure 3.5 Share of respondents owning luxury items categorised by MPA/non-MPA

Figure 3.6 shows box-plots for the presence of luxury goods categorised by MPA/non-MPA (on a scale from 0 to 10). For reasons of clarity, the outliers have been removed from the graph. The mean and median score, on a scale of zero to ten, for MPA households is 2.31 and 2.35, respectively. For non-MPA households, the mean and median scores are 2.01 and 1.76, respectively. However, the t-test for independent samples indicates that the mean values of luxury goods are not significantly different between MPA and non-MPA areas.³⁴

³⁴ The test includes 300 households (199 MPA-households and 101 non-MPA-households). Since the Levene's Test for Equality of Variance is significant and, therefore, the equal variances are not assumed, the result from the calculation with the lower degree of freedom is reported.

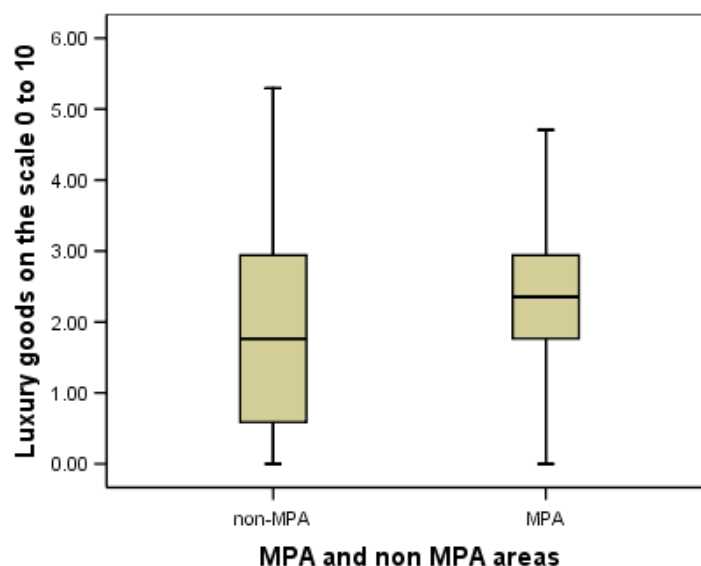


Figure 3.6 Box-plot of presence of luxury goods categorised by MPA/non-MPA (on a scale from 0 to 10)

Similar to the housing, we also test for differences in presence of luxury items between fishery households and households that work in the tourism industry. Figure 3.7 shows the share of respondents owning the nine luxury items categorised by economic activity. The ranking of the items is the same as shown in Figure 3.5, but the differences between the two sub-samples is significantly higher. Only for motorised boats and canoes, fishers' family score significantly higher. This can be explained by the professional dependence on these goods. For all of the other items, however, tourism-related families score better.

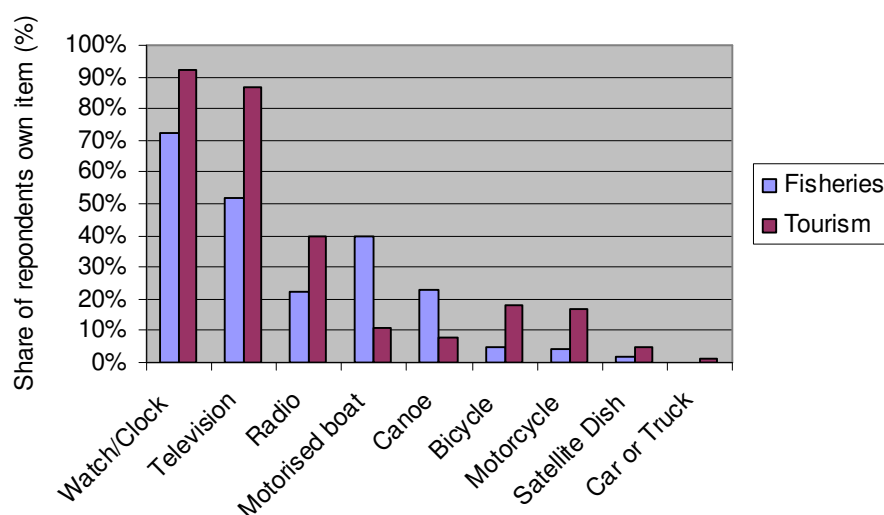


Figure 3.7 Share of respondents owning luxury items categorised by economic activity

Figure 3.8 shows box-plots for the presence of luxury goods categorised by economic activity (on a scale from 0 to 10). Again, outliers have been removed from graph. The mean and median score, on a scale of zero to ten, for tourism households is 2.48 and 2.35, respectively. For fishery households, the mean and median scores are 1.90 and 1.76, respectively. The t-test indicates that

the differences in the mean values of luxury goods between fishers and people that depend on the tourist industry are statistically significant ($p < 0.001$).³⁵

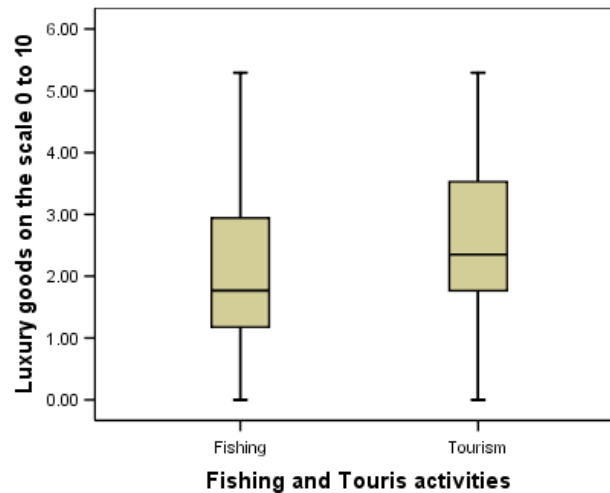


Figure 3.8 Box-plot of presence of luxury goods categorised by activity (on a scale from 0 to 10)

To test the main determinants of luxury goods, a multiple regression was conducted. The dependent variable being the monthly income and independent variables consisting of: MPA/non-MPA; fishing activities; tourism activities; age of the respondent; respondent's education; and the average age of children. The model presented in Table 3.8 explains almost 12% of the variance in income ($R^2 = 11.7$). Both being part of the MPA and having higher age are strongly related with a higher score of luxury items. Fishers have lower incomes, given the negative sign of the variable. However, the negative relationship between being fishers and luxury items is not statistically significant. The remaining variables did not appear to be significant either.

Table 3.8 Model estimation of luxury goods

Model		Unstandardized Co-efficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.743	.492		1.511	.132
	MPA and non MPA areas	.318	.158	.128	2.009	.046
	Fishing activities	-.400	.290	-.171	-1.382	.168
	Tourism activities	.341	.292	.146	1.169	.244
	Age of the respondent	.021	.007	.201	2.902	.004
	Respondent's education	.118	.080	.102	1.479	.141
	Average age of children	-.001	.017	-.002	-.035	.972

a Dependent Variable: Luxury goods on the scale 0 to 10

Fishing activities

The main criticism about MPAs is the potential negative impact of MPAs on fishing activities. Fishers are generally no longer allowed in certain areas, which implies that they lose part of their fishing grounds. This may mean that the fishers have to go to other, more remote areas or areas with more competition. As a result, their catch may be reduced and travel costs increased. To verify the impact of the MPA on fishers in and around Bunaken National Park, 143 fishers were

³⁵ The test includes 277 households (134 fishery-based and 143 tourism-based households).

interviewed about their fishing activities. As shown in Table 3.1, two third of this sample is from the MPA area and one third of the sample is living outside the MPA area.

Figure 3.9 and Figure 3.10 show the importance of certain type of fish catch and fisheries techniques of the MPA and non-MPA fishers, respectively. Due to limited time and resources, the level of importance is not measured through absolute measurement of fish caught. Instead, the respondent was asked to indicate the first most and second most important technique used and fish type. This can show if MPA fishers have switched to different techniques or are catching different kinds of fish than those outside the MPA. A difference in fishing techniques has time and catch implications for fishers. A difference in fish types caught has income implications for fishers.

By attaching weights to the first and second most important options selected, a weighted score was created which reflects the relative importance of each technique and fish type. Note that the first most important technique and fish type weighs twice as much as the second most important technique or fish type.

Figure 3.9 shows the composition of fish catch by MPA and non-MPA fishers. The composition is not significantly different between the two, except for a somewhat larger share of pelagic fish (i.e., tuna), reef fish and bottom fish for the MPA fishers. The fishers were also asked whether the composition of their fish catch has changed compared to five years ago, when the MPA was not as effective as it is today. The statistical analysis could not detect significant differences over time.

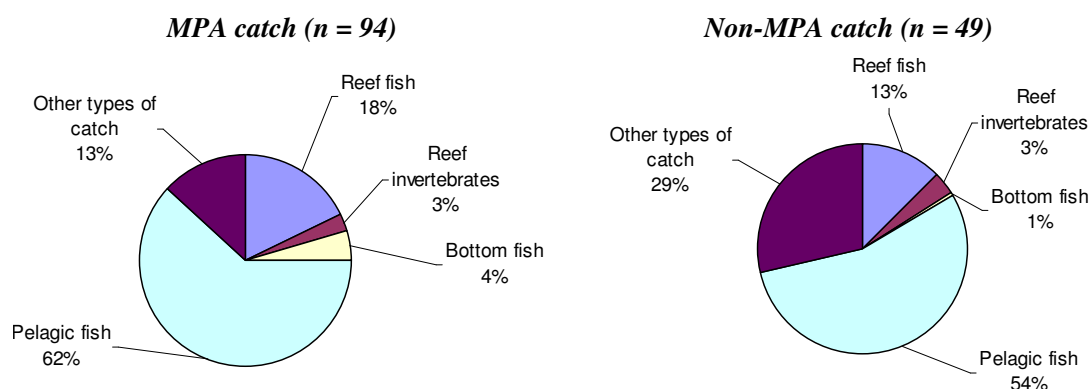


Figure 3.9 Composition of fish catch by MPA and non-MPA fishers

Figure 3.10 shows the range of fishing techniques used by MPA and non-MPA fishers, respectively. As opposed to the fish types, the composition of techniques used is significantly different between the two sub-samples. The main difference between the groups is the use of destructive techniques, such as drag and surround nets, that are hardly used by MPA fishers. The fishers were also asked whether the techniques used have changed over time. Similar to the fish types, no notable differences have been found compared the composition of techniques five years ago.

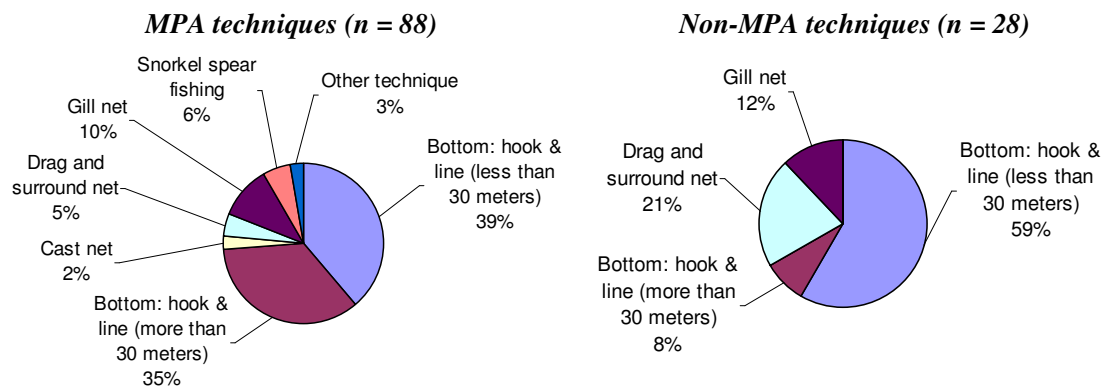


Figure 3.10 Fishing techniques applied by MPA and non-MPA fishers

Figure 3.11 shows the response of the fishers, when asked about their perception on the changes in the fishery industry in the last five years. The majority (around 80%) of the fishers experienced more difficult conditions. The fishers in the MPA appeared to be somewhat less pessimistic, but the difference with the fishers from non-MPA areas is not statistically significant. The more difficult fishing conditions are probably related to the fact that park zonation has not been fully implemented, and enforcement of the zones that are agreed has not been entirely effective. Fish need the space and time to grow larger and more plentiful. The biological effects of the park on growing fish biomass are not expected to be very significant until the zonation has been fully implemented for several years.

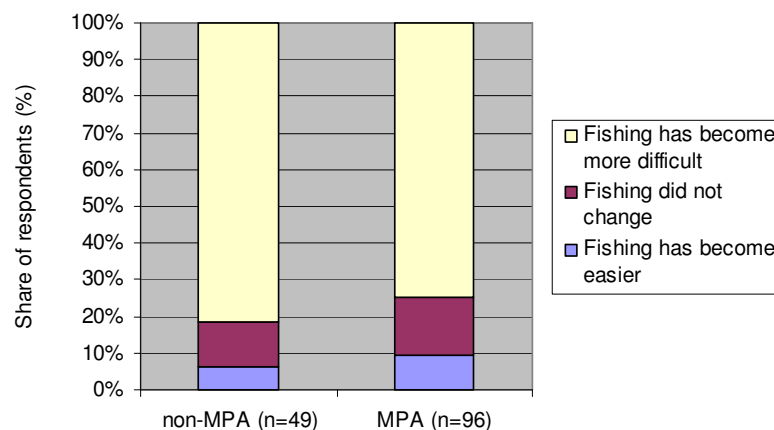


Figure 3.11 Perceived changes in the last five years in the fishery industry according to interviewed fishers

When asked about the reason for the decline in catch per unit effort, the main reason indicated by the fishers was the increased competition among fishers (see Figure 3.12). The second reason was a diverse set of responses of which the most important reason provided was the weather. Apparently weather has made fishing more difficult for many fishers in the area. The third most important reason was the perceived decline in fish stock, which is related to the increased competition. When analysing the differences in perception between MPA and non-MPA fishers, competition is less of an issue for MPA fishers, possibly because some fishers in their communities changed jobs into the tourist industry or possibly because of the growing awareness of the need to cooperate and respect the MPA. Also, MPA fishers seem more aware of the decline in fish stock. Again, this may be the result of awareness raising in the context of campaigns by the national park.

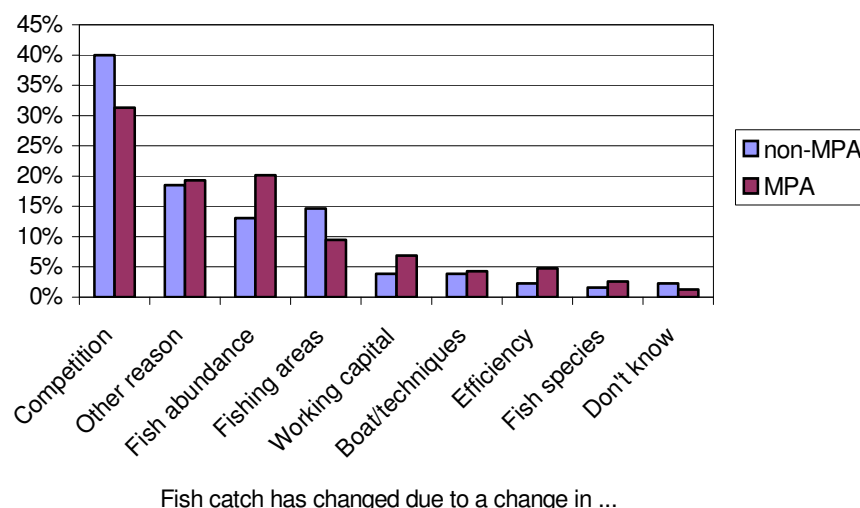


Figure 3.12 Reasons for change in fish catch compared to five years ago

Thus, the study finds that for fishing, there is no statistically significant difference between MPA and non-MPA fishing techniques, fish type, or perception of changes in fishing. Fishers in the MPA do, however, use less destructive fishing techniques, and this will have longer-term implications for the differences between the MPA and non-MPA areas.

To learn more about the possible impact of the MPA on the fishing efficiency of the fishers, two tests were conducted. First, the respondent was asked about the duration and frequency of their fishing trips. On average, MPA and non-MPA fishers spend 7.5 hours and 9.5 hours respectively on a fishing trip. The mean values in fishing time between MPA and non-MPA are significantly different ($p < 0.05$).³⁶ Possible explanations could be that the catch per unit of effort (CPUE) of non-MPA fishers is lower and therefore they need to spend more time fishing. This explanation also holds for Figure 3.13, which shows that non-MPA fishers go fishing more frequently: 71% of fishers from the non-MPA area go fishing every day. In the MPA area, only half of the fishers go fishing every day. The differences in fishing frequency between the two groups are statistically significant.³⁷

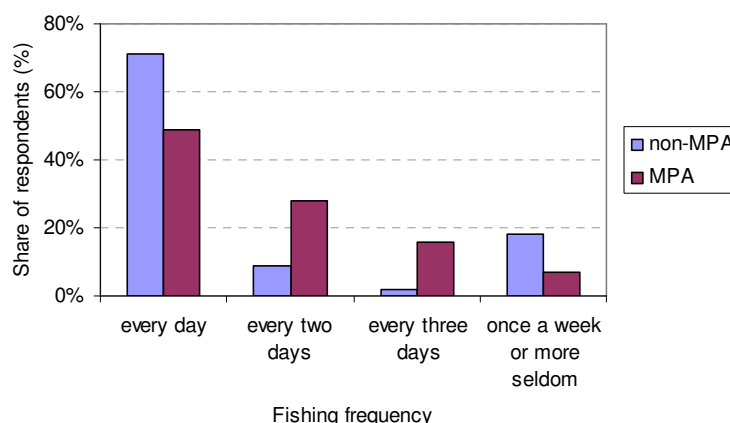


Figure 3.13 Fishing frequency

³⁶ The comparison of the mean values by using t-test is based on 135 cases including 89 fishers from MPA area and 46 fishers from non-MPA area.

³⁷ The test was performed for 134 cases including 89 fishers from MPA area and 45 fishers from non-MPA area.

By combining the fishing frequency and the fishing time, the total fishing time per year was calculated for both MPA fishers ($n=89$) and non-MPA fishers ($n=45$). The comparison of the mean values indicates that there are significant differences between MPA and non-MPA fishing time ($p<0.01$). As shown in Figure 3.14, the calculation reveals that non-MPA fishers, with 2,855 hours per year, spend almost 50% more time for fishing than their colleagues from the MPA area, who fish in average only 1,936 hours per year. One possible explanation for the difference in fishing time is a lower CPUE for the non-MPA fishers.

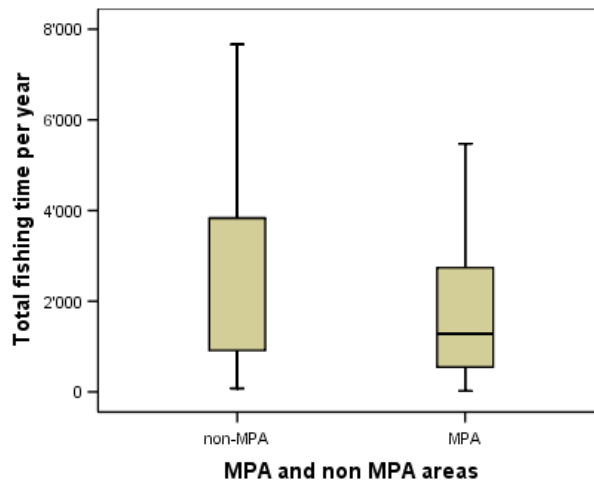


Figure 3.14 Box-plot for total fishing time per year for MPA and non-MPA fishers

Second, the respondents were requested to report their travel time to the primary fishing ground now and five years ago. The average travel time now and 5 years ago is not significantly different if calculated for MPA and non-MPA areas separately. However, significant differences in travel time can be observed between the MPA and non-MPA areas. The t-tests for both variables (travel time now and travel time 5 years ago) indicate that there are significant differences in mean values between MPA and non-MPA areas ($p<0.05$). Fishers from MPA need in average more time to travel to their primary fishing ground compared with fishers from non-MPA. The difference between MPA and non-MPA in mean value of travel time is now about 35 minutes and has slightly increased in the last 5 years.

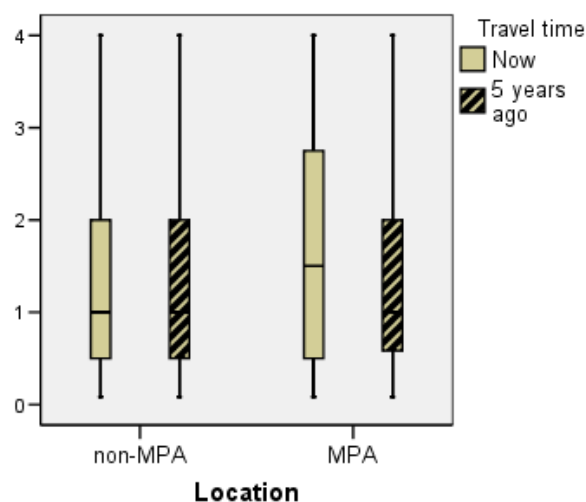


Figure 3.15 Box-plot for travel time

Alternative livelihood

The survey also analysed whether the MPA provided opportunities for an alternative livelihood in tourism. Figure 3.16 provides an insight into the previous occupation of the tourism-dependent respondent as well as the main reason for the respondent to change jobs. Figure 3.16 shows that 16% of the respondents who moved into tourism used to work as fishers. More than a quarter was unemployed before. The largest category of previous occupations is “other activities”, which contain a range of jobs such as working in the tuna factory and working as sailors in sea transport. The main reason given for the switch was that the original income was insufficient.

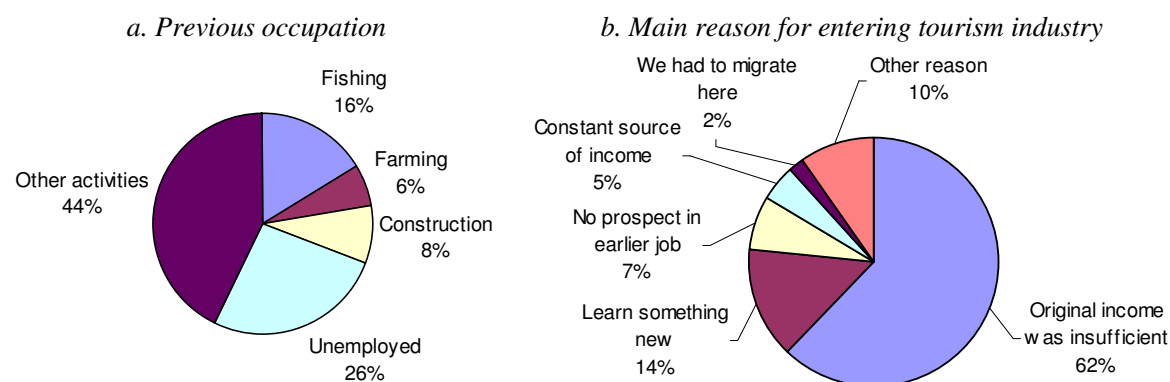


Figure 3.16 Previous occupation before working in the tourist industry, and main reason for changing jobs

The tourism-related households were also explicitly asked about whether their family's welfare has changed since the household members moved into the tourism industry. As shown in Figure 3.17, the majority of the respondents experienced a moderate or substantial increase in welfare (81%). But a bit less than 5% did lose compared to their previous occupation.

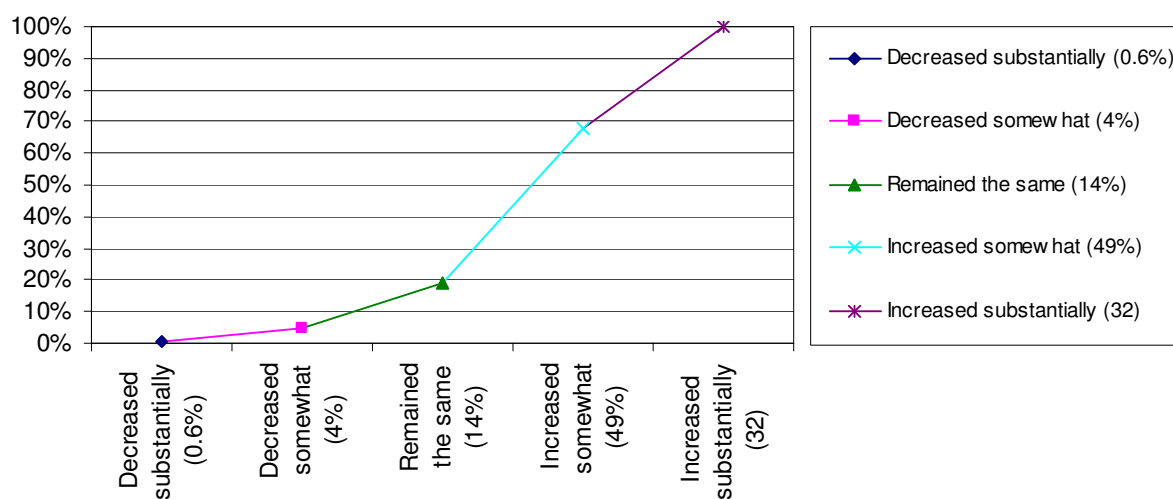


Figure 3.17 Change in family's welfare of tourism-based households compared to previous occupation (n=147)

Education

Education is an important indicator representing the opportunities of the local communities. As shown in Table 3.9, around 60% of the children between 6 and 15 years of age attend school. Although there are differences between the categories MPA/non-MPA and fishery/tourism, these differences are too small to be considered statistically significant. When asked about the highest level of education within the household, a similar pattern emerges. As shown in Table 3.10, the differences are not substantial between the various categories.

Table 3.9 School attendance of children between 6 and 15 years of age categorised by MPA/non-MPA and economic activity

	Non-MPA	MPA	Fisheries	Tourism
Attend school	60%	58%	57%	61%
Do not attend school	40%	42%	43%	39%

Table 3.10 Highest level of education recorded within the interviewed household categorised by MPA/non-MPA and economic activity

	non-MPA	MPA	Fisheries	Tourism
No schooling	2%	1%	1%	2%
Primary	9%	20%	13%	19%
Secondary	20%	24%	17%	30%
Tertiary	52%	47%	57%	40%
Other	17%	8%	12%	9%

Respondents were also requested to respond to various statements about education (see Figure 3.18 and Figure 3.19). The responses were ranked on a scale from –1 (fully disagree) to +1 (fully agree). On two statements, the respondents unanimously were in agreement: “It is important that my children attend school” and “The chances for going to school are the same for boys and girls”. The only significant difference between perceived changed by fishery families and tourist-dependent households are the ease with which children can attend school and the ease in paying school fees. On both aspects, the tourist-dependent household are more in agreement.

Another interesting observation is that neither fishers nor tourist workers learned new skills to earn a living. This could be a point of attention for the management of Bunaken National Park. This would be particularly important if a greater number of fishers from local communities were encouraged to embrace tourist-related employment opportunities rather than fostering the need for an increase in migration from the mainland to the islands by people with higher base skills and levels of education.

Statistically, there are no significant differences between MPA and non-MPA households for income, electricity, water supply, fishing techniques, types of fish caught, perceptions of changes in fishing compared with 5 years ago, education or health, and only a small pro-MPA difference statistically in housing. The big difference is in fishing time. Non-MPA fishers spend almost 50% more time per year fishing than fishers in the MPA, yet their income is roughly equal. So the MPA fishers are better off because of the MPA. Add this to the more than 1,000 tourism jobs created by the park and it is clear that Bunaken National Park has increased assets and opportunities.

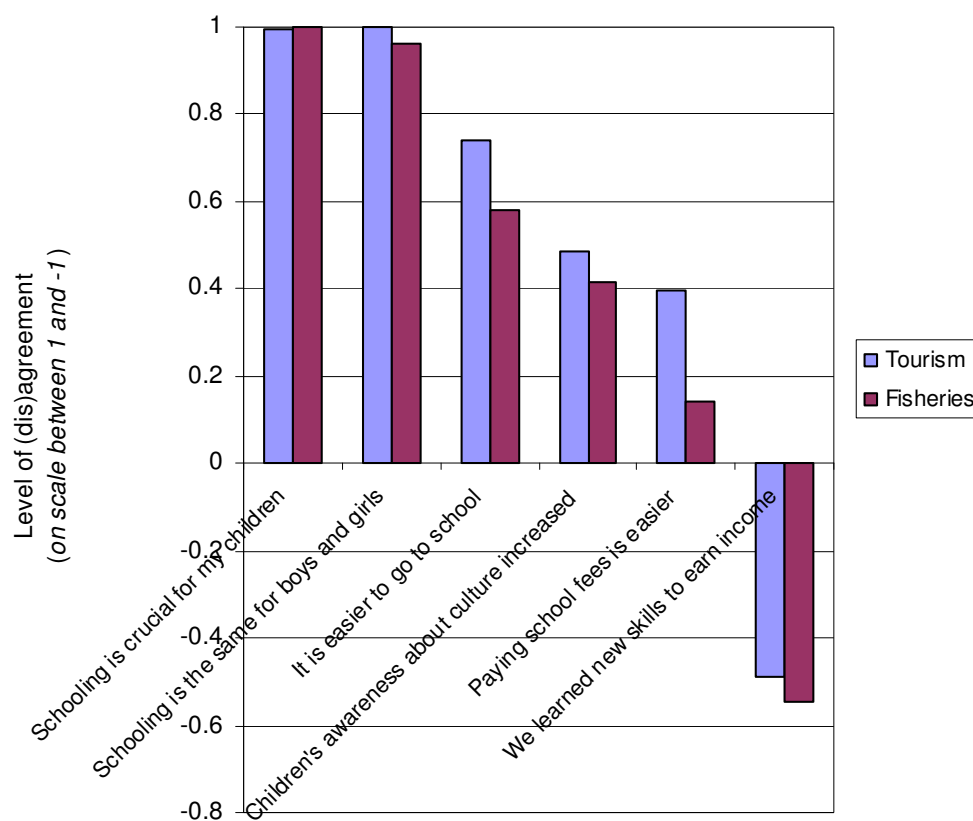


Figure 3.18 Changes in education compared to five years ago categorised by activity

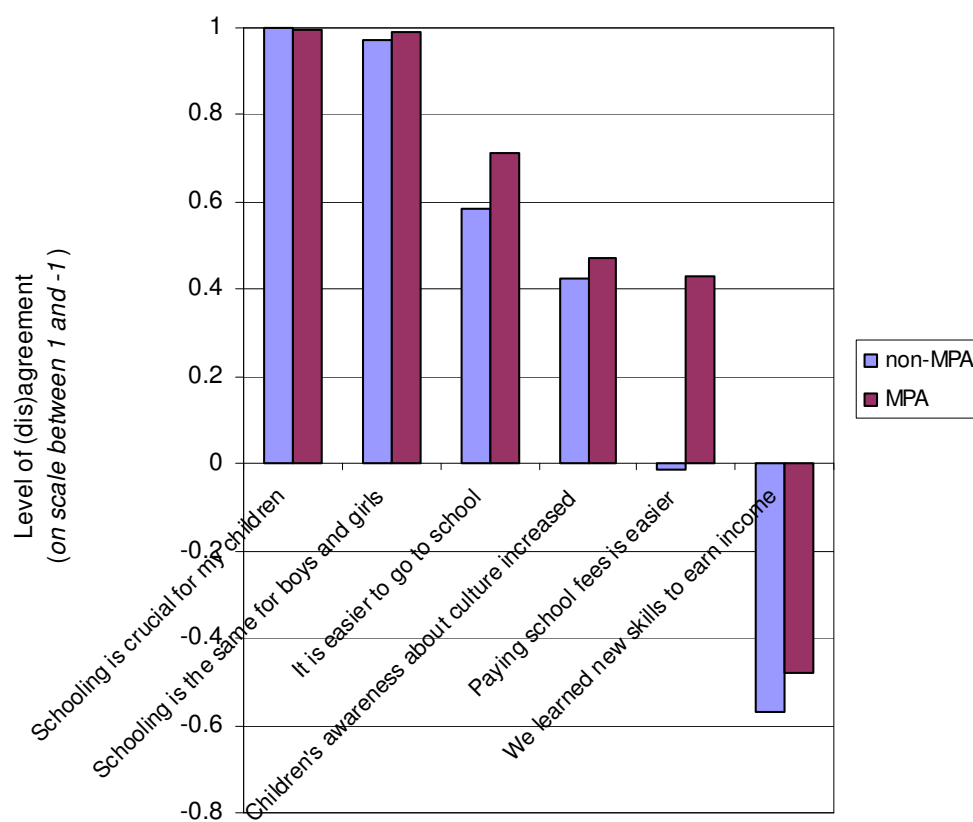


Figure 3.19 Changes in education compared to five years ago categorised by location

3.3 Empowerment and governance

Community engagement

The level of community engagement was tested in two ways. First, the respondent was asked whether anyone in his or her household was a member of some sort of committee. Being part of a committee implies that the respondents can potentially have a stronger voice in policies and management issue in the region, thereby representing a higher degree of empowerment.

Table 3.11 shows the presence of committee members, categorised by MPA/non-MPA and by economic activity. There is no statistical difference between the extent to which fishers and tourist workers participate in local committees, but this difference is notable between MPA households (8% participation) and non-MPA households (no participation observed). The most plausible explanation for this difference is the formation of the Bunaken National Park Management Advisory Board, the Citizen's Forum, and committees that may have been established to facilitate some of the alternative income activities (such as production of clay stoves, coconut charcoal, and mangrove derived products) as well as the committees working on the awareness programs related to the MPA.

Table 3.11 Participation rate of households categorised by MPA/non-MPA and by economic activity

	Non-MPA	MPA	Tourism	Fisheries
No committee members	100%	92%	94%	95%
Committee members	0%	8%	6%	5%

Next, various statements were presented to the respondent about how community engagement has changed since the implementation of the MPA five years ago (see Figure 3.20). Similar to the previous statements, responses are ranked on a scale from –1 (fully disagree) to +1 (fully agree). The majority of the respondents agreed that conflicts with neighbouring communities have been reduced compared with five years ago. Similarly, the community seemed to be more united than before. Thus, the MPA seems to help conflict resolution, and to minimize conflicts internally and externally. Tourism-based households and fishers differ in the extent to which they experience support from governmental and non-governmental organisation. Fishers are much more pessimistic about this aspect than tourism-related households.

When analysed to distinguish between MPA and non-MPA households, a similar patterns emerges. The main difference between these two groups is the way in which the support of NGOs is perceived. Clearly, households from the outside the MPA area, are negative about the support received from NGOs. This also results in the pessimistic perceptions about the opportunities for the youth by the non-MPA respondents.

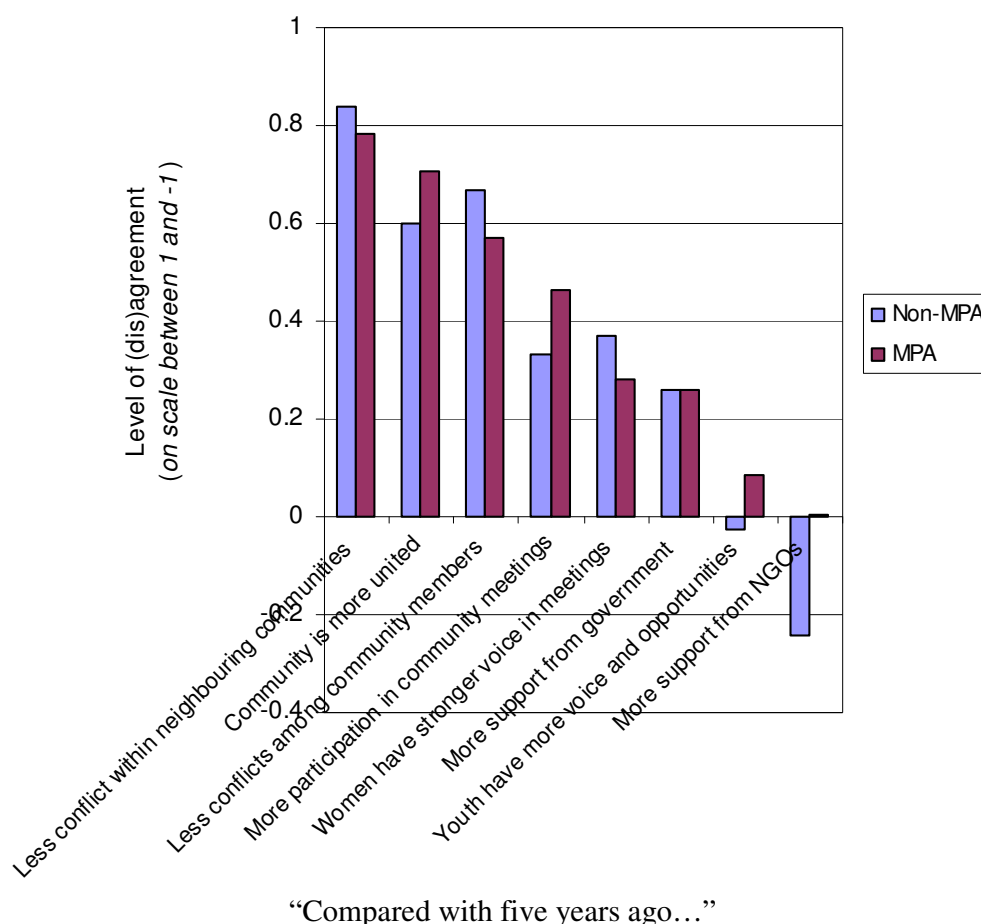


Figure 3.20 Statements about community engagement categorised by location

3.4 Security

Health

As a health proxy, the researchers investigated the impact of the MPA on the fish diet. First, information about the frequency in which fish was consumed in the household was collected. On average, households consume fish 321 days in a year, with a lower limit of 316 days per year (some MPA residents) and an upper limit of 330 days per year (some non-MPA residents).

The households also indicated whether they had changed their fish consumption compared to five years ago. The majority of the respondents indicated they consume the same or less fish compared to five years ago (see Table 3.12). Even fishers themselves consume less fish than they use to do. When asked about the reason, the most frequent reasons include reduced availability of specific species and a reduction in fishery activities partly caused by changed weather conditions. Additionally, the price for fish has increased, and culturally the wealthier a family becomes, the more they consume chicken and red meat.

Table 3.12 Changes in fish diet compared to five years ago

	Non-MPA	MPA	Tourism	Fisheries
Eat less fish	42%	39%	34%	47%
No change	42%	44%	45%	40%
Eat more fish	17%	18%	21%	13%

Various statements were presented to the respondent about health issues (see Figure 3.21 and Figure 3.22). Similar to the previous statements, responses are ranked on a scale from –1 (fully disagree) to +1 (fully agree). Most importantly, respondents noted improved market access, which makes it easier for them to buy medicine. Similarly, sanitary conditions and medical facilities have improved, compared to five years ago. Tourism-dependent household overall are more optimistic about their health conditions, except for the availability of traditional medicine for which fishers score better. Despite the improved market access, both groups experience a reduced availability of food and fish. This may be one of the explanations why fish consumption reduced compared to five years ago.

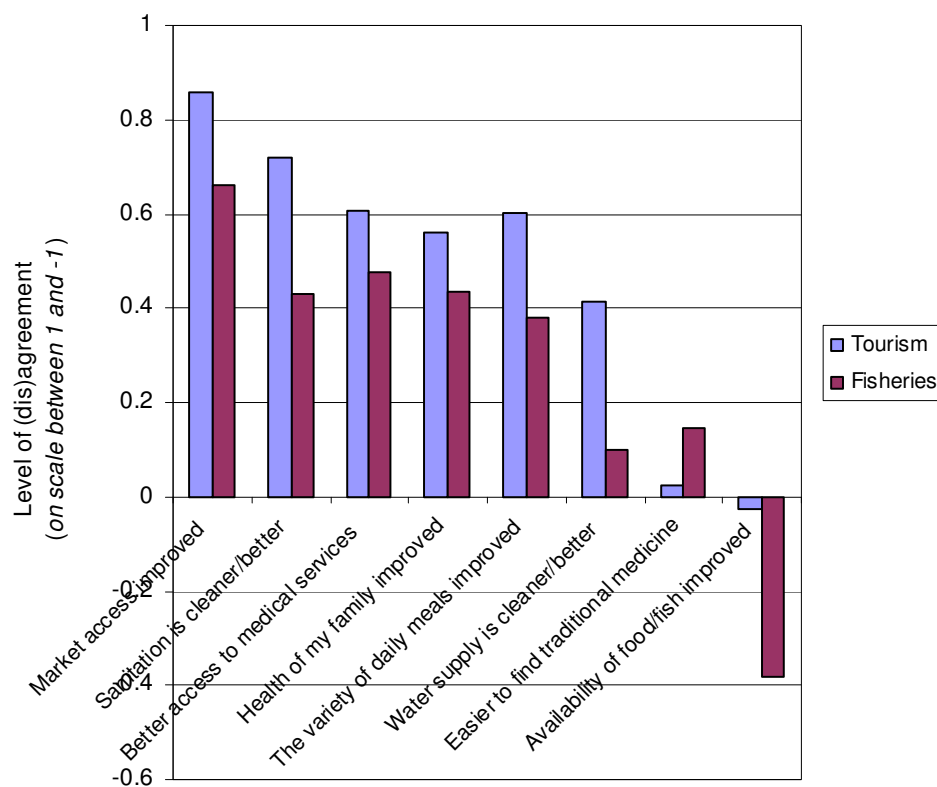


Figure 3.21 Health related changes compared to five years ago categorised by activity

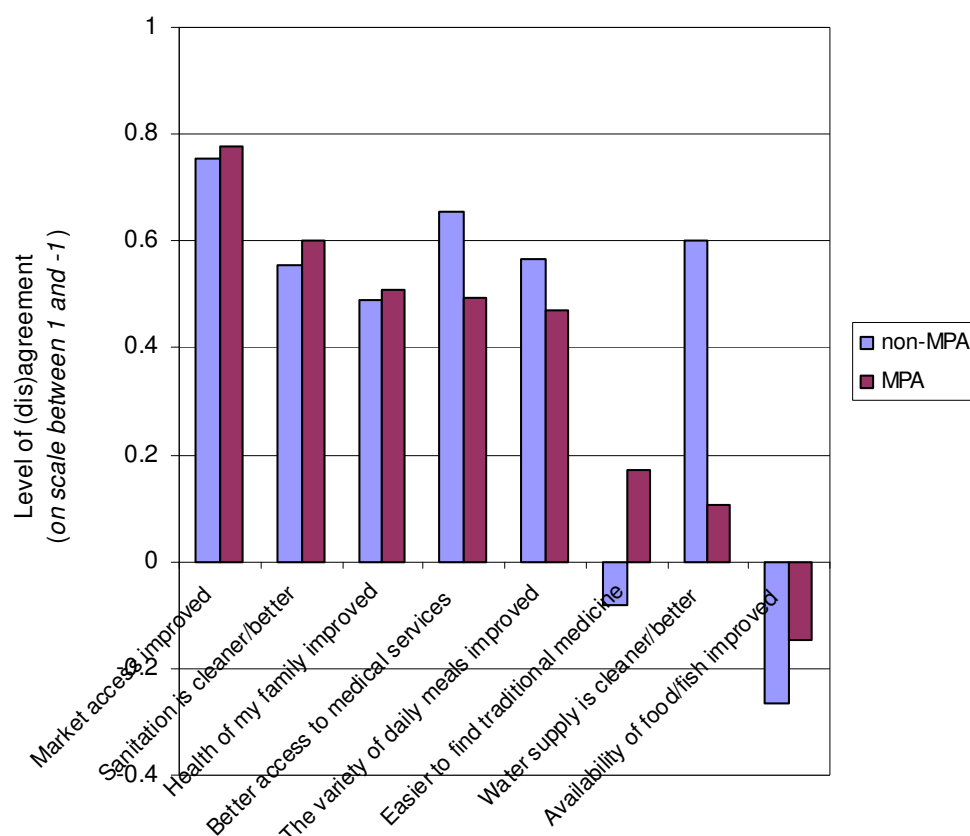


Figure 3.22 Health related changes compared to five years ago categorised by location

Social cohesion

MPAs generally require a social system in which decisions concerning the management of the MPA are made. As a result, a common interest is created which generally has a positive impact on the social cohesion in the area. The social cohesion was tested by asking the respondent how often they encountered people using illegal fishing practices (for example, dynamite, cyanide, fishing in a no-take zone) or found evidence that people have recently used illegal practices in their area.

The results (Table 3.13) suggest illegal practices are rare overall, but this may reflect respondents' hesitance to answer candidly rather than the actual situation. Illegal practices are more often observed by MPA household, partly because they are more aware of what is legal and what is illegal, and partly because the rules and regulations in Bunaken National Park are more stringent and can therefore more easily be violated. It is also not surprising that fishers witness most offences, since they spend more time offshore. When asked about the type of violators, the respondents indicated that 70% of the violators came from their own communities while only 30% came from outside.

Table 3.13 Witnessed illegal practices in the last year categorised by MPA/non-MPA and by economic activity

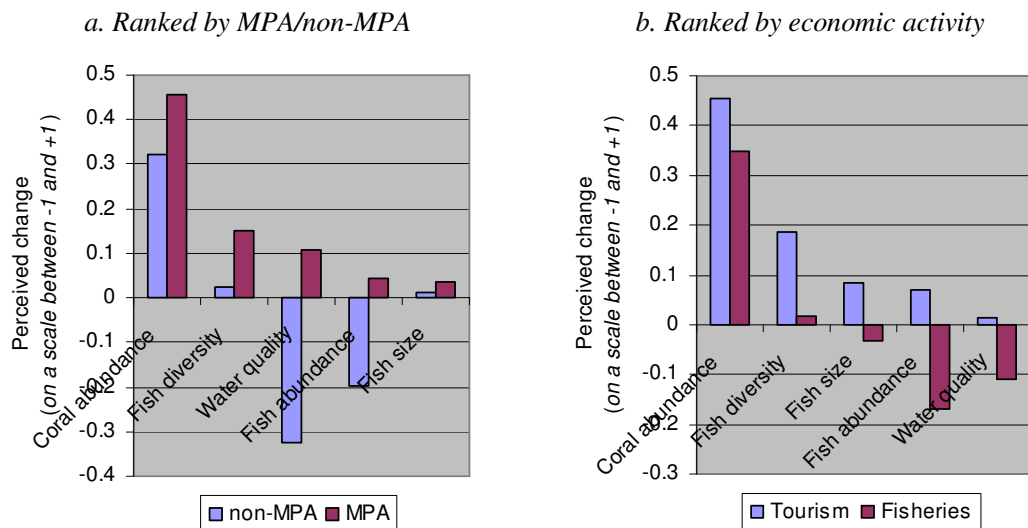
	Non-MPA	MPA	Tourism	Fisheries
Did encounter illegal practises	2%	5%	1%	6%
Did not encounter illegal practises	98%	96%	99%	94%

The key points here are that the majority of the respondents feel that it is their task to safeguard the MPA for the future and not necessarily the task of the government. Local communities have a positive view of the management of the MPA, both in terms of communication and in helping to maintain the local culture and traditions in the area.

3.5 General perception of the marine environment and the MPA

Environmental awareness

Perceived changes in the state of the general marine environment were tested by asking the respondents about the quality of a range of environmental indicators (i.e., coral and abundance, fish size and diversity, and water quality). The responses are normalised to a scale between -1 (lowest quality) and $+1$ (highest quality). Coral abundance seemed to have improved the most, while water quality and fish abundance have degraded most in eyes of the respondents. Differences can be observed between fishers and tourist workers, as well as between MPA/non-MPA households. Generally, fishers and non-MPA respondents are more pessimistic about the changes in the marine environment.



“Compared to five years ago, the environment has changed ...”

Figure 3.23 Perceived changes in the environment categorised by MPA and non-MPA and economic activities (on a scale between -1 and $+1$)

Relationship with the MPA

Finally, respondents who live inside Bunaken National Park were interviewed about their perception of the MPA. Two sets of statements were presented to the respondent on the MPA and its effect on the community. Similar to the previous statements, responses are ranked on a scale from -1 (fully disagree) to $+1$ (fully agree).

The first set concentrated more on the perceived impact of the MPA on the income of the community in general. As shown in Figure 3.24, the statement that received most support was that “The MPA is good for my families' future”. Practically everybody, both tourism-based workers and fishers agreed to this statement. The two groups were also united in confirming that the MPA helped to improve infrastructure and services. Importantly, only tourism-based households were convinced about the positive impact of the MPA on their income. Fishers were

less optimistic in this regard. Logically, the divide is even larger between the two groups with regard to the claim that the MPA made the respondent less dependent on fishing only. Most fishers disagree to this statement. Both groups are pessimistic about the positive impact of the MPA on fish catch.

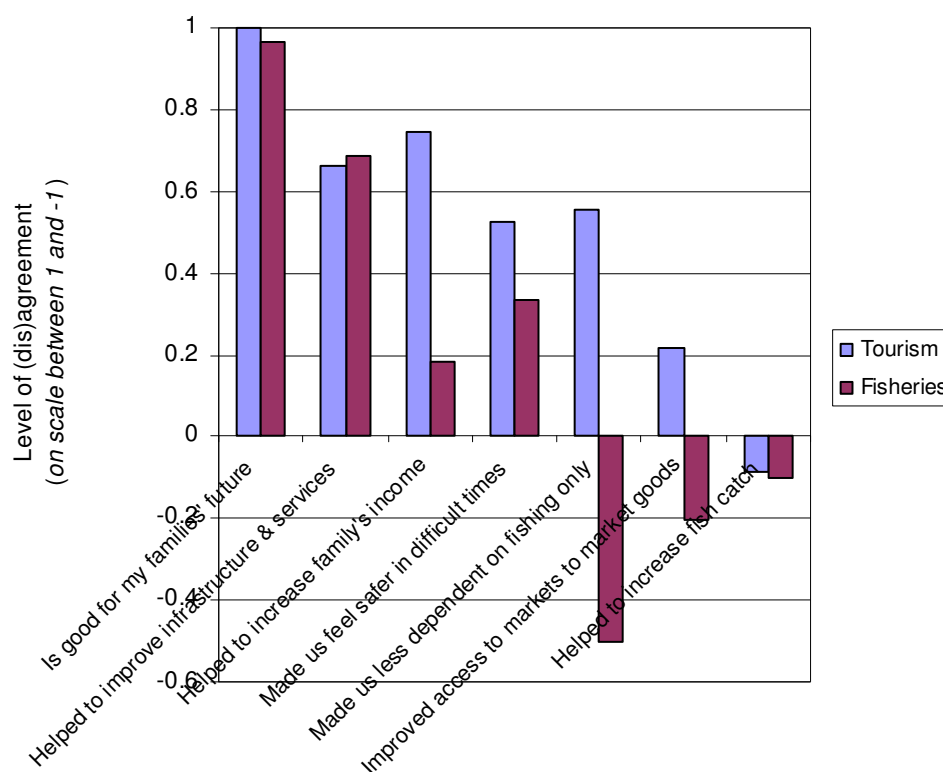


Figure 3.24 Perceptions on the MPA and its impact on the income of community

The second set of statements concentrated more on the public support of the MPA, the impact it has had on women and on culture and tradition, and the perceived quality management of the MPA. Figure 3.25 shows that all 299 respondents agree that destroying the MPA now will cause significant problems in the future. Note that it is rare that everybody in a survey agrees to statements. The respondents also feel that it is their task to safeguard the MPA for the future. The larger majority of the households agreed to the statement that “Villagers are responsible to protect MPA”. The two groups are also in agreement with the statement that “MPA management communicates well” and that the “MPA helped to maintain the local culture and traditions in the region”. The MPA has also had a positive impact on the position of women according to tourism-industry workers. This can be explained by the fact that fisheries is a predominantly male occupation, while the tourist sector provide opportunities for women to find employment. Fishers are much more pessimistic about their ability to influence decisions about MPA. Both tourist-based households and fishers somewhat deny that the MPA has improved access to natural resources. This can be explained by the fact that many areas have been closed for fishing and other extractive activities.

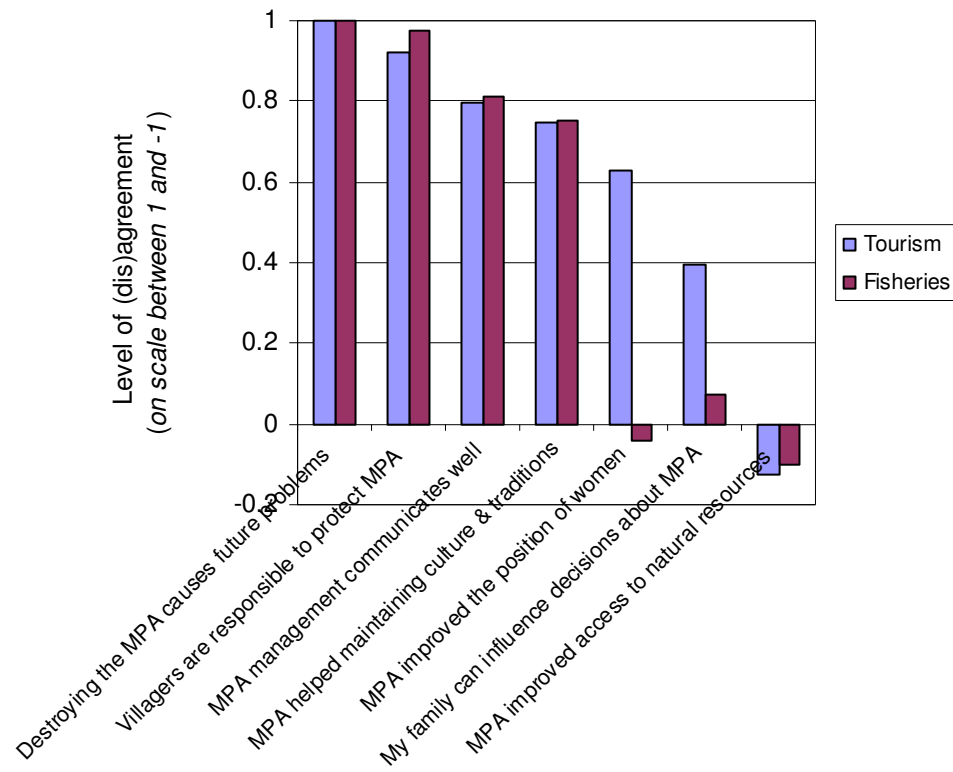


Figure 3.25 Statements about MPA management and community categorised by activity

4. Conclusions and synthesis

Bunaken National Marine Park is the most complex of the four case studies included in this international research project. The implementation of the MPA, benefited the local economy from increased tourism, while mixed effects are observed in the fishery sector. This ambiguity of the impact of the MPA has been found in both the qualitative and the quantitative assessments. This section aims to combine the findings of both research methods into a set of conclusions.

4.1 Assets and opportunities

The focus group discussions and the key informant interviews showed that, overall, there is quite a positive association between the conservation initiative of Bunaken National Marine Park and poverty reduction. This positive relationship is, however, not widespread amongst all communities in the park (i.e., it is patchy). *“Tourists come for world-class diving, and the local economy and tourism sector directly benefit (everything from money changers, dive operators, hotel owners, to farmers); local farmers and fishers directly benefit since hotels and restaurants purchase much of their food from farmers and fishers.”*

Bunaken National Marine Park had increased local incomes. Much of the increase has come from greater opportunities for employment in the tourism sector and from farmers and fishers selling their harvests to the tourism sector. In Bunaken and Siladen, direct employment at the resorts and income generation through the sales of produce and products to tourists benefits a substantial number of households. *“Local fishers and farmers can sell their products to the resort at a good price.”*

A study by Tyler Blake Davis (2005) shows that the tourism sector employs more than 30% of the villagers in Bunaken Island for instance. Members of the North Sulawesi Watersports Association (resort owners and dive operators) have committed to hiring 80% of their staff from the local population. Blake's study also counted 1,063 “identifiable jobs” created in tourism due to the park.

The national park sets aside 30% of its entrance fees, which is divided equally among the 30 communities in and near the park to help them with infrastructure development projects. (In practice, however, the flow of entrance fees to community projects has not been consistent, and there have been significant delays in making the funds available.) Another benefit derived from the park entrance fee is the allocation of soft loans to villagers for small businesses.

The quantitative assessment verified and measured the above effects. MPA and non-MPA fisher income is comparable, and there is no statically significant difference in income, electricity, water supply, fishing techniques, types of fish caught, perceptions of changes in fishing compared with 5 years ago, education or health, and only a small pro-MPA difference statistically in housing.

Yet MPA fishers spend less time per fishing trip and go less frequently compared to non-MPA fishers even though their travel time to the fishing areas has increased. In fact, non-MPA fishers spend almost 50% more time per year fishing than fishers in the MPA, yet their income is roughly equal. So the MPA fishers are better off because of the MPA. Add this to the more than 1,000 tourism jobs created by the park and it is clear that Bunaken National Park has increased assets and opportunities.

Tourism has clearly made local people better off (81% have increased incomes compared to their previous job), and 16% of the respondents now in tourism switched from fishing. (Tourism and fishing are the two primary livelihood strategies in the park area.) If Bunaken's number of visitors continues to grow as expected, this will create additional jobs in the tourism sector and an increasing number of fishers could potentially switch careers to tourism (given training and education) and thereby increase their household income.

Yet income is only one of many welfare indicators. Other relevant proxy's for welfare are the quality of housing and the number of luxury items available in the household. Alternatively, the changes in welfare of fishers can be measured directly by observing changes in the fish catch. Finally, welfare can also be estimated by directly asking respondents about their perception of changes in his or her family's welfare. A summary of these combined indicators is provided in Figure 4.1.

The left side of Figure 4.1 shows the radar chart categorised by location (i.e., MPA/non-MPA households). Because both the MPA and non-MPA sub-samples contain fishers, fish catch is used as the fourth welfare indicator. More specifically, fish catch shows the share of respondents that experienced an improvement in fishery conditions. Note that the four welfare indicators are normalised on a scale from 0 to 1. The highest score for each welfare indicator is automatically presented as the maximum score, being "1" in this graph. The radar chart by location (Figure 4.1a) shows that the MPA group generates the highest score for each indicator, although difference are not very large or statistically significant.

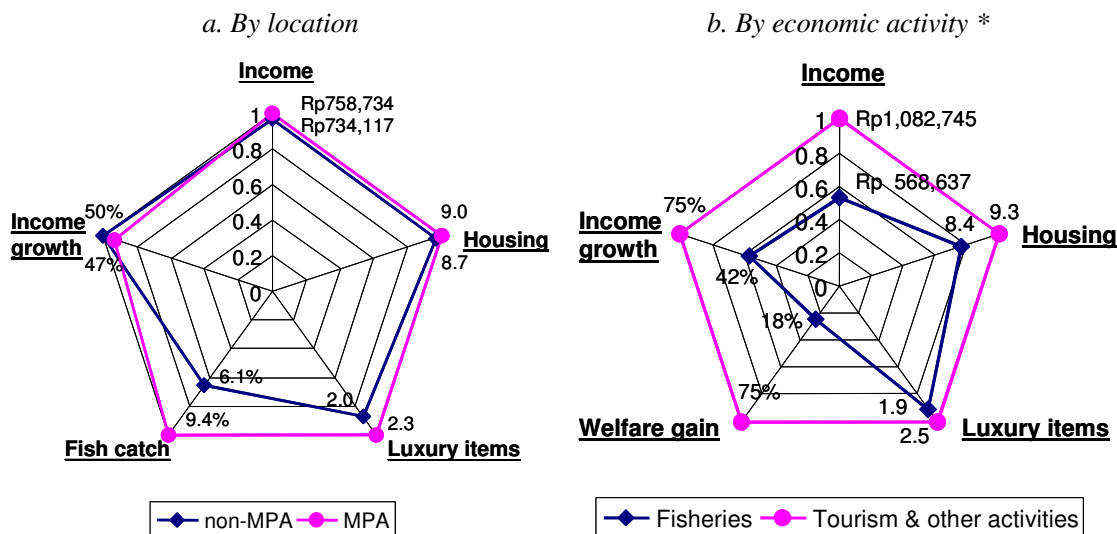


Figure 4.1 Summary of Bunaken welfare indicators

- Note that the axis "Fish Catch" has been replaced by "Family Welfare" in the second graph, which represents the share of the respondents that perceived their family's welfare has improved compared to five years ago.

The right side of Figure 4.1 shows the radar chart categorised by economic activity (i.e., fisheries versus tourism-based households). Because only the former group answered the fish catch question, an alternative indicator is used: family welfare. This indicator represents the perceived changes of the respondent's family welfare in the last five years. Compared to the categorisation by location, the differences shown in Figure 4.1b are significantly larger. As was already seen in Table 3.3, fishers earn substantially less than people working in the tourist sector. Therefore, the

four welfare indicators of tourism-workers widely outweigh those of fishers. Especially striking is the difference in changes in family welfare: 75% of the tourist-worker experienced an increase in their families' welfare, while this was only 18% among fishers.

4.2 Empowerment and governance

Bunaken has improved local empowerment. The park's Management Advisory Board has members from government, the tourism industry, academia, and local communities. Its existence and constitution are supported by a legal framework. The Management Advisory Board has been very successful in creating a forum for discussing issues, for achieving consensus on decisions, and for instilling a democratic process for the running of the park. Forum members (which are selected by each village in the park) have a six-year term and must be originally from the villages they represent. Participation in the Bunaken National Park Management Advisory Board and in the Citizens' Forum (Forum *Masyarakat*) enhanced skills for participation, collaborative management, and management more generally.

Employment in the resorts has afforded some women more respect and power in their households.

The quantitative assessment confirms the above conclusions from the qualitative assessment. There is a pro-MPA difference statistically for community engagement compared to non-MPA households. Due to the presence of the MPA and the community engagement in its management, people experience a more stable social environment with fewer conflicts than before. It should be noted, however, that fishers still feel largely deprived from support from governmental and non-governmental organisation. Tourism-related households seem to receive much larger backing from these organisations than fishers do.

The survey also proved that local residents consider the MPA as a crucial element for themselves and future generations. All respondents agreed that destroying the MPA now will cause significant problems in the future. Moreover, the majority of the respondents felt that it was their task to safeguard the MPA for the future and not necessarily the task of the government. Local communities have a positive view of the management of the MPA, both in terms of communication and in helping to maintain the local culture and traditions in the area.

4.3 Security

The qualitative assessment confirmed that both the park's Management Advisory Board and the Citizens' Forum have contributed greatly to enhance social cohesion among different stakeholders and between some of the communities. This has helped to increase security and decrease vulnerability.

Church groups and spiritual leaders have played an important role at the community level to enhance awareness of environmental issues. One such leader told us: *"Almost every week, during my speech in the church or in other church meetings I mention how to take care of and maintain the national park"*.

In some villages, there are beach cleaning programs and provision of garbage bins that is also attributed to greater environmental awareness due to the national park. People in the village realized that they could get sick by eating the fish caught using *wori* leaves and cyanide, so they stopped fishing with these methods. Community projects funded by the Management Advisory Board included the construction of a water-supply tank and public toilets and washing places.

Moreover, people perceive that the new mangrove trees growing in some areas shield the coastal villages from the strong west wind that is believed to cause illness.

Due to the new mangrove plantings, people feel secure in some places because their beaches now are protected from erosion, westerly monsoon impact, and other disasters caused by strong westerly winds. The park also has supplies that help the communities to feel more secure in case of emergencies. There is also a very strong sense of pride among communities within the MPA that “their” park is known around the world. This sense of identity (of being part of Bunaken National Park) is a psychological benefit important to general wellbeing.

The majority of the residents in the survey confirmed that the MPA has had a positive impact on reducing conflicts between neighbouring villages. Moreover, by learning about the marine ecosystem, local communities are more aware about the illegality of certain fishing methods, and therefore more often encounter violations than non-MPA respondents, who simply do not register it as being illegal. The household survey also showed that fishers and non-MPA respondents are more pessimistic about the changes in the marine environment.

There were two interesting points that do not quite fit into one of the above sections. The first is that people in some villages refer to the no-take zone as a “bank”, functioning to save fish for the next generation; they only take the interest that accrues so that there will be fish for their children – they call this “*Tabungan*” (deposit). The second is that the dependence on marine harvesting is related to level of education; there is more dependence amongst poorer community members.

Appendix I. Protocol for qualitative assessment

As a methodological component of this general study, the objective of the Focus Group Discussions (FGD) and Key Informant Interviews (KII) were to provide a qualitative base of information to complement quantitative information provided by socio-economic analysis through household surveys. The idea was to understand the perceptions of community members with respect to the impact of a marine protected area on the many dimensions of their daily lives and on the management of the natural resources. The focus of the discussions were on the linkages between a given conservation initiative and poverty eradication at a particular community level in the three countries. This methodology aimed to address, predominantly, social, cultural and governance dimensions of community life whilst also attempting to canvass information related to livelihoods that would complement the Household Survey. It also helped, in some instances, to understand the dynamics of community life and how to best implement the Household Survey in each community. Focus group discussions and key informant interviews were conducted only at the communities affected by a conservation regime.

Content

Environmental conservation through Marine Protected Areas, in general, aims at the provision of better environmental services, species protection, maintenance of cultural and spiritual sites and values and better infrastructure and mechanisms for management of the natural resources. Poverty is a multi-faceted condition including several usually interconnected economic, social and cultural dimensions (lack of assets and income; lack of opportunities; lack of voice and empowerment; vulnerability and lack of capacity).

The focus of these discussions was to understand some of these linkages between what a marine protected area means to the local people as it affects livelihoods and poverty reduction in their communities. The intention of the Focus Group Discussions and Key Informant Interviews were to address the following specific areas:

1. General perceptions of what people feel about the marine protected area
2. General perceptions of the effect of the marine protected area on the livelihoods of households in the community
3. Some aspects of education
4. Some aspects of health
5. The role of women and men and opportunities for the youth
6. Governance and Social Cohesion
7. Access and use of resources and rights
8. Vulnerability (including maintenance of cultural and spiritual values)
9. Some aspects of livelihoods and opportunities

Information on areas 3-9 above was sought by aiming, primarily, at understanding whether there has been any noticeable impact that can be attributed to the marine protected areas on these dimensions.

Mechanism for Conducting Focus Group Discussions

These were conducted in small groups of people (between 6-12 individuals), with national team counterparts and/or national institutional partners notifying the communities and organizing the meetings in advance. Each meeting took on average between 2 - 2 ½ hours. The composition of

the groups (and whether they were homogeneous or heterogonous) depended on what was most appropriate for each community and for each locality of a MPA. This was discussed and agreed in advance with national team counterparts and/or national institutional partners. There were two facilitators for each meeting (the social scientist and a national counterpart/translator). There was also one bi-lingual recorder of information at each group discussion.

The steps and questions for reference that were used during the group discussions are presented below. The philosophy of the Focus Group Discussions was to commence more in-depth discussion on issues that participants mentioned at the start and then move on to other issues that may not be as salient to that particular group, but also relevant to the study. The idea was to maintain as much as possible a natural flow of discussion, where talking about one particular content area led to another. Thus, reference questions did not assume a logical order for guiding the discussion. Some areas were more appropriate for particular group discussions than for others (i.e., not all the questions were addressed at every group discussion). Particular attention was given to ensure a full spectrum of participation by all group members. All meetings were conducted in the local language with translation for the social scientist and the information was recorded in English (by the bi-lingual recorder). Data recorded was entered into the computer soon after the conclusion of the meetings (and also of the key informant interviews below).

Key informant interviews

The objective of the key informant interviews was to provide more in-depth specific qualitative information on targeted areas described in points 1-9 above. Thus, for instance, at each community individual interviews were held with staff from the health clinic, from the school and from a youth group to ascertain more detailed information on whether the MPAs has had any impact on health, education and the lives of young people.

Appendix *E* contains the list of Focus Group Discussions and Key Informant Interviews conducted at each site.

Steps for FGD and KII

1. Explain the purpose of the study and of the Focus Group discussion
2. Individual Introduction of participants
3. Ask participants a general question of what the marine protected area has done for themselves for their lives and for the community live – can be either positive or negative (ask each participant to write 3-4 major things that are most important to him/her in a card with a mixture of things related to the lives of their own household but also the community live)
4. Give people time to think and write in the cards
5. People individually present their points and place them in a board/wall
6. Two participants and the facilitator then make logical grouping of those
7. If there is any omission of general areas important for discussion than the facilitators may also include some cards
8. Start addressing some of those groupings of things mentioned by the community baring in mind the questions below as references for stimulating discussions on a number of different dimensions
9. Start discussing the groupings that are more relevant for the areas 1-8 mentioned above

Reference Questions for FGD and KII

Education/new skills

- Has the marine protected area had any effect in the availability of education for children at this community?
- Has the marine protected area had any effect on people being able to afford to pay school fees?
- Has the marine protected area contributed to members of this community being able to learn new skills?
- Has the marine protected area contributed to teach children in this community about any cultural or traditional values?

Health

- Has the marine protected area helped or hindered access to the practice of traditional health? In what ways?
- Has the marine protected area contributed or not to having more health care available in this community? In what ways?
- Has the marine protected area contributed or not to health in general in this community? In what ways?
- Does you think everyone has sufficient to eat everyday and a mixture or a limited amount of things?
- Does the marine protected area contributed or not to the food supply in your household?
- Have there been any improvements to sanitation in this community since the declaration of the marine protected area?

Governance and social cohesion

- Have there been other committees or community groups established since the declaration of the marine protected area?
- Is anyone in this group a member of any committee related to the management of the marine protected area? Which one?
- Is anyone in this group involved in any other activity related to the management of the marine protected area? In what ways?
- Do members of this group feel that in general they can influence decisions related to the management of the marine protected area? Are there mechanisms for more general participation in decisions?
- Do members of this group feel that in general there is transparency in the way decisions are made related to the management of the marine protected area?
- Do members of this group feel that in general they are properly informed about decisions related to the management of the marine protected area?
- How often are there meetings related to the management of the protected area? What are the things addressed in those meetings?
- Has the formation of committees and groups related to the management of the marine protected area helped this community in any ways?
- From your perception has the marine protected area helped the community to be more united?
- From your perception has the marine protected area created more conflict amongst community members?
- From your perception has the marine protected area created more conflict between neighbouring communities?

Role of Woman and Man and the lives of children

- Has the marine protected area changed what a woman does in her daily activities in this community?
- Has the marine protected area changed what a man does in his daily activities in this community?
- Has the marine protected area changed anything about how children can grow up in this community?

Access and use of resources, rights and ownership

- Has the marine protected area had an effect on access to natural resources by members of this community (e.g., fisheries, water, and timber?)
- Has the marine protected area had an effect on the ownership of, and rights to, natural resources by members of this community?

Vulnerability

- Do you feel that the marine protected area helped this community to have a better natural environment with more plants, animals and environmental resources like cleaner water?
- Does the marine protected area help your family to feel a sense of more or less security when you go through difficult times or when there is an environmental disaster?
- Has this community received more or less support from the government or from other organizations because you live in or near a marine protected area?
- Has the marine protected area helped or not this community to maintain traditional and spiritual customs?

Livelihoods and opportunities

A range of specific questions tailored to the economic and subsistence activities and opportunities of the community that will be mentioned during the cards exercise (see above). In particular understanding will be sought on the social-cultural impacts of alternative or new activities attributed to the conservation initiative.

Appendix II. Questionnaire for household survey

Household survey Bunaken (Indonesia)

I. Name Interviewer:		V. Duration of the interview	
II. Date of interview:		VI. Name data enterer:	
III. Location of interview:		VII. Date of data entry:	
IV. Coordinates (lat / long)		VIII. ID number:	

Section 1: Household, education & housing

0. Interviewer: Record the main material of the walls and roof of the house without asking

- | | |
|---|--|
| a. Walls
1 Bamboo
2 Wood
3 Corrugated iron
4 Brick/cement
5 Other, please specify | b. Roof
1 Thatch / leaves
2 Tile
3 Corrugated iron
4 Concrete
5 Other, please specify..... |
|---|--|

I would like to make a complete list of all the people who normally live and eat their meals together in this house beginning with your immediate family and then the extended family.

[Start filling with the respondent]

	1. NAME	2. SEX	4. AGE	5. SCHOOL	6. LEVEL	7. FEE
ID CODE		Male. 1 Female. 2	How old is [NAME]?	Is [NAME] attending school now? Yes. 1 No. 2 <if "2", continue to next member>	What is the highest level of education by [NAME]? See box below	What is currently the yearly school fee for [NAME]? (IDR/year)
	NAME	SEX	YEARS	SCHOOL	LEVEL	SCHOOL FEE

1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						

Box for codes: Q.6: Highest schooling

- | | | |
|-----------------|--------------|--------------------|
| 1. NO SCHOOLING | 3. SECONDARY | 5. OTHER (SPECIFY) |
| 2. PRIMARY | 4. TERTIARY | |

8. Do all the children between the age of 6 and 15 in your household attend school?
And, if not, why not?

- 0 Yes, they all go to school
1 No, because we cannot afford the school fees
2 No, because we need the children to help out at home / at work
3 No, because the school is too remote
4 No, other reason (specify)

Statements on Education:		0 Don't know	1 Disagree	2 Neutral	3 Agree
Now I would like to read a list of statements on education. Can you indicate to what extent you agree or disagree with each of these statements? Compared to 5 years ago ... (Tick one option for each statement)					
9.	It has become easier for our children to go to school				
10.	We are now better able to afford the school fees				
11.	My family has learned new and practical skills to earn an income				
12.	It is important for my children to attend school				
13.	My children have become more aware about our culture and traditions				
14.	The chances for going to school is the same for boys and girls				

15. Were you born here? [0 = no, 1 = yes]

16. If not born here, where were you born? (please fill)

17. If not born here, when did you arrive here? (Please fill)

Could you indicate whether your household has the following items [a], and if yes, when you obtained these [b], and whether it involve a replacement of an old item or whether it was the first time the item was present in the house [c]?

	a. Present in household [0 = No 1 = Yes]	b. How long ago purchased [Years]	c. Replacement or first time present [0 = replaced, 1 = new]
18. Running water inside house			
19. Electricity			
20. A radio			
21. A TV set			
22. Satellite Dish			
23. A Watch or Clock			
24. A canoe			
25. A bicycle			
26. A boat without motor			
27. A motorised boat			
28. A motorcycle			
29. A car or a truck			

30. Please indicate your family's monthly expenses on non-fishing items.

Cost category	a. Amount (Indonesian Rupiah)	b. Unit [0=per week, 1=per month, 2=per year]
1. Food		
2. Fuel/kerosine		
3. Housing		
4. School fees		
5. Transport		
6. Electricity		
7. Cigarettes/beetle nuts/lime		
8. Drinks		
9. Donations		
10. Other, please specify		

Section 2: Health & Diet

31. How often does your family eat fish/seafood? We eat fish/seafood... [Circle one]

- | | | | |
|---|------------------|---|-----------------|
| 1 | Every Day | 5 | Every two weeks |
| 2 | Every two days | 6 | Once a month |
| 3 | Every three days | 7 | Never |
| 4 | Once a week | | |

32. Did your family's fish/seafood diet change over the last 5 years?

- 1 Eat less fish
- 2 No change (skip following question)
- 3 Eat more fish
- 4 Don't know

33. What is the most important reason that your family's diet of fish/seafood had changed? And what is the second most important reason?

	a. 1 st most important	b. 2 nd most important
1. We fish less/more		
2. We fish the same amount of time but catch less/more		
3. There is less/more sharing of fish between family, friends, etc.		
4. Change to other food (e.g. spam)		
5. The price of fish has decreased/increased		
6. Availability of certain local species changed		
7. Preference for fish has changed (don't like fish as much)		
8. There is more easy access to markets than a few years ago		
9. Other, specify ...		
10. Don't know		

	Statements on health: Now I would like to read a list of statements on health. Can you indicate if you agree or disagree with each of these statements? Compared to 5 years ago ... [Tick one option for each statement]	0 Don't know	1 Disagree	2 Neutral/same	3 Agree
34.	It has become easier to find traditional medicine				
35.	The availability of food/fish has improved				
36.	My family has better access to medical services				
37.	The health of my family has improved				
38.	The variety of our daily meals have improved				
39.	Water supply is cleaner and better				
40.	There is more easy access to markets than a few years ago				
41.	Sanitation (toilets, etc.) is cleaner and better				

Section 3: Fishing

42. Please indicate in which activities your family participates? Also specify if this is mainly for own consumption or for cash and how this compares to five years ago.

	[0=no, 1=yes]		c. Cash income Generated [in IDR / month]	d. Compared to 5 years ago [0 = less, 1 = more, 2 = no change]
	a. Own con- sumption	b. Cash		
1. Fin fish fishing				
2. Sea food collection (e.g. shells / mud crab / oysters)				
3. Seaweed cultivation				
4. Fish / aqua / mariculture				
5. Trade of sea food / fish				
6. Reef fishing				

! *Note for interviewer: if the respondent expressed to be active in fishing [option 1 to 4], continue to question 43. Otherwise skip questions 43 to 52.* **!**

43. What is the 1st most important and 2nd most important fishing technique you use now? And what were they 5 years ago?

	Now		5 years ago	
	a. 1 st	b. 2 nd	c. 1 st	d. 2 nd
1. Bottom: hook & line (less than 100ft / 30 meters)				
2. Bottom: hook & line (more than 100ft / 30 meters)				
3. Trolling				
4. Cast net				
5. Drag and surround net				
6. Gill net				
7. Snorkel spear fishing				
8. Scuba spear fishing				
9. Foraging the reef (shell, crabs, etc)				
10. Trapping (octopus, crabs, etc.)				
11. Hand spear				
12. Other techniques, specify ...				

44. How often do you fish or collect seafood? [Circle one answer]

- | | | | |
|---|------------------|---|-----------------|
| 1 | Every Day | 5 | Every two weeks |
| 2 | Every two days | 6 | Once a month |
| 3 | Every three days | 7 | Never |
| 4 | Once a week | | |

45. On average, how much time is spent actively fishing per day? [Circle one answer]

- | | | | |
|---|-----------|---|-------------|
| 1 | 0-3 hours | 4 | 9-12 hours |
| 2 | 3-6 hours | 5 | 12-18 hours |
| 3 | 6-9 hours | 6 | >18 hour |

46. How much time do you spend to travel to your primary fishing ground?

<input type="text"/>	Hours and	<input type="text"/>	Minutes	(or can't recall [tick "0"]):	<input type="text"/>
----------------------	-----------	----------------------	---------	-------------------------------	----------------------

47. How much time did you spend traveling to your primary fishing ground 5 years ago?

<input type="text"/>	Hours and	<input type="text"/>	Minutes	(or can't recall [tick "0"]):	<input type="text"/>
----------------------	-----------	----------------------	---------	-------------------------------	----------------------

48. Can you indicate 1st most and 2nd most important reasons why you go fishing?

	a. 1 st most important	b. 2 nd most important
1. I really enjoy fishing		
2. I really need the fish to feed my family		
3. Giving catch to others strengthens bonds; sharing is part of our culture		
4. I really need the money from the fish I sell		
5. Tradition: My family has always fished. Fishing is my life!		
6. Fishing strengthens the bond with my children/family		
7. Fishing strengthens the bond with my fellow fishermen		
8. I go fishing to catch fish for fiestas/parties		
9. Other, specify ...		
10. Don't know		

49. What is the 1st most important and 2nd most important fish/seafood that you catch/collect now and five years ago?

Type of catch	Now		5 years ago	
	a. 1 st	b. 2 nd	c. 1 st	d. 2 nd
1. Reef fish				
2. Reef invertebrates (octopus, shellfish, crab, etc)				
3. Bottom fish				
4. Pelagic fish				
5. Other, specify....				

50. Has fishing or seafood collection become easier or more difficult since the last five years, or has there been no change?

- 1 Fishing has become easier
- 2 No change
- 3 Fishing has become more difficult

51. What do you think is the main reason for this change? Please indicate the 1st most and 2nd most important reasons.

	a. 1 st most important	b. 2 nd most important
1. Because I am more/less efficient		
2. Because fish availability has changed (quantity and size)		
3. Because fish species have changed		
4. Because competition has changed		
5. Because fishing areas have changed significantly		
6. Because I use better/worse boats or techniques		
7. Because I can/can't afford to buy more fishing equipment		
8. Other, specify ...		
9. Don't know		

52. Please indicate your average yearly expenses on fishing related items.

Cost category	a. Amount (Indonesian Rupiah)	b. Unit [0=per week, 1=per month, 2=per year]
1. Fuel & oil		
2. Fishing Equipment (e.g. nets, lures, lines, and hooks)		
3. Boat rent		
4. Scuba tanks		
5. Licenses		
6. Other, specify ...		
7. Don't know		

Section 4: Other activities

53. Please indicate in which activities your family participates? Also specify since when you are involved in this activity and how this compares to five years ago.

	a. Involved [0=no, 1=yes]	b. Since when? [year]	c. Average cash income generated [in IDR / month]	d. Compared to 5 years ago [0 = less, 1= more, 2 = no change]
1. Tourist boat operations				
2. Tourist boat building				
3. Handicraft manufacturing				
4. Souvenir selling				
5. Dive/snorkel/marine operations				
6. Service (hotel, restaurants)				
7. Farming Staple Foods				
8. Farming Vegetables/coconut				
9. Other income from non-fish sources, specify				

! *Note for interviewer: if the respondent expressed to be active in tourism [option 1 to 6], continue to question 54. Otherwise skip questions 54 to 56.* **!**

54. What was the main source of income for your household before you entered these types of activities?

- | | | | |
|---|--------------|---|---------------------|
| 1 | Fishing | 4 | Civil service |
| 2 | Farming | 5 | Others, specify ... |
| 3 | Construction | 6 | Unemployed |

55. What was the main reason for your household to enter these types of activities?

- | | | | |
|---|------------------------------------|---|---------------------------|
| 1 | Original income was insufficient | 4 | Constant source of income |
| 2 | No prospect in original occupation | 5 | Learn something new |
| 3 | We had to migrate here | 6 | Other, specify |

56. Has your family's welfare increased since you entered these types of activities?

- | | | | |
|---|-------------------------|---|-------------------------|
| 1 | Decreased substantially | 4 | Increased somewhat |
| 2 | Decreased somewhat | 5 | Increased substantially |
| 3 | Remained the same | 6 | Do not know |

Section 5: Marine Environment and Community**57. How often do you encounter people using illegal fishing practices (for example, dynamite, chlorine, acid, fishing in marine reserves, etc.) or find evidence that people have recently used illegal practices in an area? ... [Circle only one]**

- | | | | |
|---|--------------|---|---------------------------------|
| 1 | Regularly | 3 | Rarely |
| 2 | Occasionally | 4 | Never [skip following question] |

57a. How does illegal fishing compare to the situation 5 years ago? [Circle only one]

- | | | | |
|---|-------------------------|---|-------------------------|
| 1 | Decreased substantially | 4 | Increased somewhat |
| 2 | Decreased somewhat | 5 | Increased substantially |
| 3 | Remained the same | 6 | Don't know |

58. If you do witness these practices, who are the violators?

- | | |
|---|--|
| 1 | People from the community |
| 2 | People from outside the community, specify from which village/community: |
| 3 | Don't know |

In your opinion, how has the quality of the following components of the marine environment in your area changed during the last 5 years?

		1. Increased	2. Remained stable	3. Decreased	4. Don't know
59.	Live coral abundance				
60.	Fish abundance				
61.	Fish size				
62.	Fish species diversity				
63.	Water quality				

64. Are you or any of your family members involved in a committee on the management of the marine protected area?

- | | |
|---|------------------------------------|
| 0 | No |
| 1 | Yes, namely [Name Committee] |

	Statements on the Community Now I would like to read a list of statements on the community. Can you indicate to what extent you agree or disagree with each of these statements? Compared to 5 years ago..... [Tick one option for each statement]	0 Don't know	1 Disagree	2 Neutral	3 Agree
65.	Members of my family are more often taking part in community meetings				
66.	Women are more often involved in community meetings				
67.	The youth has more voice and opportunities in our communities				
68.	The community has become more united				
69.	There are more conflicts amongst community members				
70.	There are more conflict between neighbouring communities				
71.	Support from the government has improved				
72.	Support from other organizations has improved				

NOTE TO INTERVIEWER: If you are interviewing reference communities who are not affected or influenced by a marine protected area, do skip question 73 to question 88.

	Statements on the Marine Protected Area Could you indicate to what extent you agree with the following statements on the Marine Protected Area or Reserve and its effect on the community? [Tick one option for each statement]	0 Don't know	1 Disagree	2 Neutral	3 Agree
73.	Destroying the reserve now will cause problems in the future				
74.	The protected area has helped to increase my family's income				
75.	Since the start of the reserve we are less dependent on fishing only				
76.	The reserve helped to improve the position of women in our community				
77.	Fish catch has increased because of the protected area				
78.	My family can influence decisions about the protected area				
79.	Decisions by the management of the reserve are well communicated				
80.	Access to natural resources has worsened since creation of the reserve				
81.	Villagers are responsible to protect the reserve				
82.	The reserve has helped us to maintain our culture & traditions				
83.	Due to the reserve we feel safer in difficult times (disasters, bad weather)				
84.	The reserve has helped to improve infrastructure and services for us				
85.	The reserve has led to better access to markets to sell/buy our products				
86.	It is good for the future of my family that there is a protected area				

Thank you for your cooperation!

87. Any other response by the respondent can be filled here (optional)

88. Any relevant observation by the interviewer can be filled here (optional)

Appendix III. Statistical tests

The following statistical tests have been applied in the quantitative analysis.

Nonparametric test: Chi-square analysis of two samples of nominal data

For the computation of chi-square one utilizes observed and expected frequencies (and never proportions or percentages). The test is used to find out whether there is a relationship between the two variables, which we test.

If chi-square is significant we reject H_0 (H_0 assumes that there is no relationship between the tested variables) and conclude that the proportions in the population we sampled are not the same with both variables.

Parametric test: The two sample t-test

The two sample t-test assumes that both samples come at random from normal populations with equal variances. Numerous studies have shown that the t-test is robust enough to stand considerable departures from its theoretical assumptions, especially if the sample sizes are equal or nearly equal, and especially when two-tailed hypotheses are considered. However, if the underlying populations are markedly skewed, then one should be wary of one-tailed testing, and if there is considerable non-normality in the populations, then very small significance levels (say, $p < 0.01$) should not be depended on.

If H_0 is not rejected, then both samples are concluded to have come from populations having identical means.

Some authors have recommended that the two variances should be compared and concluded to be similar, prior to employing the t-test. However, considering that the t-test is so robust, and that the variance-comparison test performs so poorly when the distributions are non-normal, the routine test of variance is not recommended.

Statistical errors in hypothesis testing

One needs an objective criterion for rejecting or not rejecting the null hypothesis (H_0) for a statistical test. The probability used as the criterion for rejection is called the *significance level*. A probability of $p < 0.05$ ($p < 0.01$; $p < 0.001$) means that the probability of error by rejecting H_0 is lower than 5% (1%; 0.1%).