Resource dependence and social resilience in North Ari Atoll, Maldives

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Executive Summary

This study aimed at understanding resource use and dependence, perception of marine conservation policies, and adaptive capacity of communities of North Ari atoll, Maldives. The study provides information on the social resilience (defined as the ability of human communities to withstand external shocks to their social infrastructure, such as environmental variability or social, economic and political instability) of 8 local community islands in North Ari atoll, and identifies differences in gender role, in resource use and perception of environmental issues. Hence, the study is key in understanding the value of ecosystem services in one atoll in the Maldives.

Approximately 25% of the adult resident populations in North Ari atoll took part in the social surveys carried out between August and December 2014 in all 8 local community islands in North Ari atoll. Based on their main occupations, the respondents were categorized into three groups of resource users; 1) direct resource users (e.g. fishermen, dive guides, farmers), 2) indirect resource users (e.g. people employed by resorts or tourism companies), and 3) non-users of natural resources (e.g. teachers, administrators, unemployed people).

The main findings suggest that social resilience in North Ari is potentially high at individual level (i.e. individuals are willing to learn new skills and change their current life style, and they are willing to comply with new regulations that government would put in place). However, a major obstacle at community/island scale is the lack of alternative occupations: tourism and fishery are the most common options.

Men and women have different roles in the society, which is reflected in the way they interact and understand natural resources. Women did not relate with natural resources, except for recreational use (i.e. picnics) and did not swim, snorkel or dive, however they expressed an increasing interest in learning new skills to become more independent financially. Finally, most women felt they 'did not know' enough about natural resources to express an opinion and tended to let men take decisions on all matters related to management of natural resources.
Approximately 25% of the adult resident populations in North Ari atoll took part to the social surveys carried out between August and December 2014 in all 8 local community islands in North Ari atoll. Based on their main occupations, the respondents were categorized into three groups of resource users; 1) direct resource users (e.g. fishermen, dive guides, farmers), 2) indirect resource users (e.g. people employed by resorts or tourism companies), and 3) non-users of natural resources (e.g. teachers, administrators, unemployed people).

Finally, based on the results obtained in this study, the following recommendations are suggested:

- Consider the differences among islands when trying to implement new conservation measures;
- Demographic traits like age, sex, education level and salary have an important effect on individual resilience and should be taken into account when proposing adaptation measures;
- Variety is a key aspect of strong resilience and new measures should look investing in job creation and capacity building according to people's aspirations and culture;
- Low environmental consciousness is a major obstacle when trying to implement conservation measures. The connection between healthy reefs and healthy people did not seem so obvious and new communication strategies should be investigated to address specifically the adult sector of the population.
- Measures taken to protect resources should show clear benefits for all community members and should not favor one group (e.g. resort owners) over another (e.g. fishermen) and should be communicated broadly.

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Acronyms

EPA	Environmental Protection Agency
GoM	Government of Maldives
IUCN	International Union for Conservation of Nature
MoFA	Ministry of Fisheries and Agriculture
MEE	Ministry of Environment and Energy
MOFA	Ministry of Foreign Affairs
MoTAC	Ministry of Tourism, Arts and Culture
MPA	Marine Protected Are
MRC	Marine Research Centre
RBM	Resilience Based Management
USAID	United States Agency for International Development

1. Introduction

1.1 The context of Maldives

Located 700 km west of Sri Lanka and 500 km south of India, the Republic of Maldives is a chain of approx. 1,192 coral reef islands spread over an area of more than 150,000 km2 (Naseer, 2003). Out of 1,192 islands, 203 are inhabited and 110 host luxury resorts (MoTAC, 2014a). Coral reefs in the Maldives are characterized by a great variety of formations, which is reflected by the richness of words used locally to describe different structures (e.g. faru, thila, giri, haa and gaa) based on their size and depth (Mohamed, 2007). More than 180 species of corals can be found in the Maldives, hosting 1,100 species of reef fish and charismatic animals including sharks, manta rays, marine mammals and marine turtles (CBD, 2015).

The Maldives relies heavily on reef resources (Ghina, 2003; Spalding et al., 2001), directly (e.g. fishery, tourism and coral sand mining) and indirectly (e.g. land formation and shoreline protection) (Mohamed, 2007). Tourism, the most important economic activity in the Maldives in terms of employment and generation of GDP (27% of the total GDP; MoTAC, 2014a), and fishery depends directly on the maintenance of the local biodiversity (Emerton et al., 2009):

- During a survey conducted in 2014 by the Ministry of Tourism, tourist opinion surveys revealed that 19% of the tourists were visiting the Maldives mainly for snorkeling and diving, and 58% of the respondents chose the Maldives as their final destination because of the beach, the underwater life, the weather and the fact that the Maldives are a small island state (MoTAC, 2014b).

- While tuna is not directly a reef resource, baitfish that is used to catch tuna is closely dependent on healthy coral reefs (Mohamed, 2007).

Reef ecosystems also provide essential services like shoreline protection and land formation, which not only make it possible to live on the islands but are also essential to conduct economic activities (Mohamed, 2007; Emerton et al., 2009).

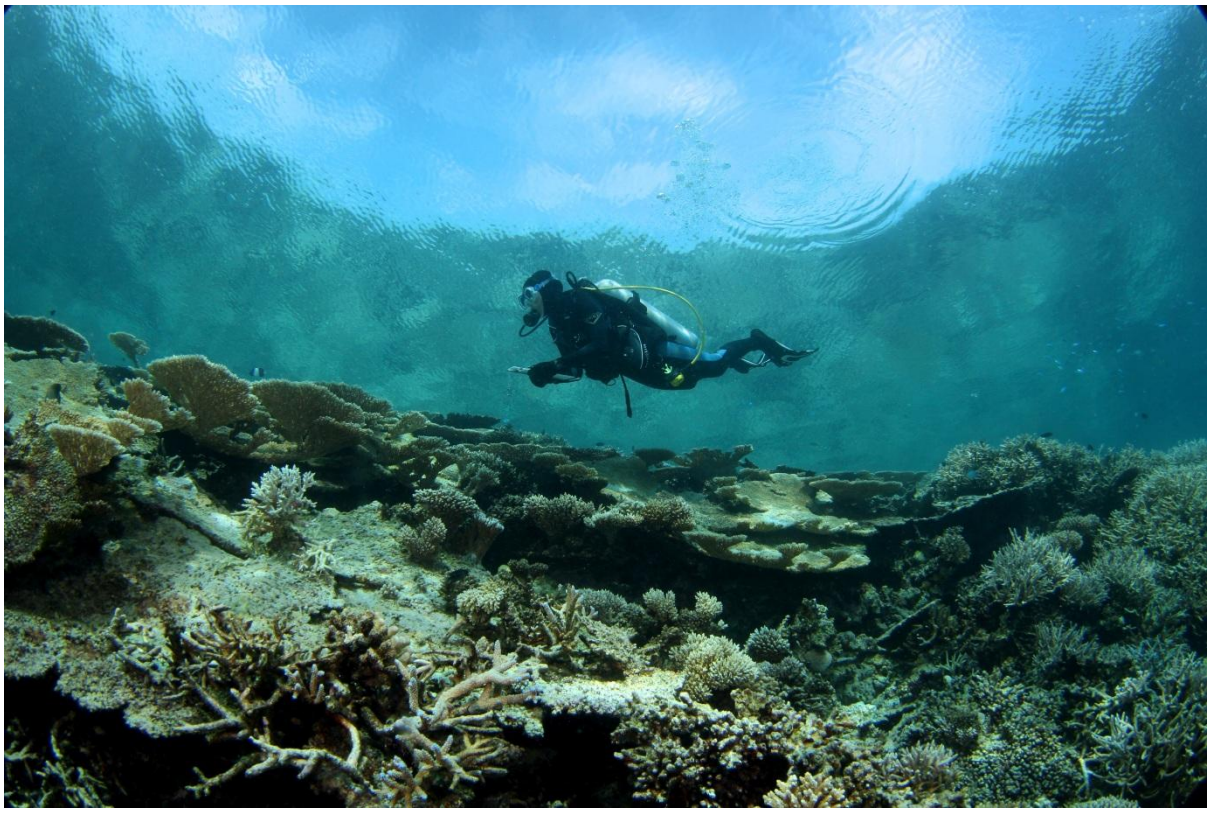
A recent study showed, however, that the Maldives natural resources are at risk due to the predicted effects of climate change, including: increased sea level and high waves, increased sea temperature, changes in currents and wind speeds and directions, increased air temperatures during dry seasons (that will be longer), and more extreme rain events during wet seasons (that will be shorter) (Hays, 2006). While the impacts of climate change will vary according to the atolls, some effects are to be expected in most places (Hays, 2006; Becken et al., 2011). Table 1 summarizes the main consequences of climate change effects on tourism and fishery, the 2 major economic drivers of the Maldives.

Table 1. Predicted effects of climate change to fishery and tourism in the Maldives.

	Fishery	Tourism
Increased sea level and waves		Coastal erosion, land loss, flooding, inundation
Increased sea surface temperature	Coral bleaching, algal bloom, fish mortality or changes in fish population	Loss of corals, algal bloom, fish mortality or change in fish population
Increased air temperature		Heat stress for humans and animals, increased diseases

Changes in currents and winds	Changes in feeding and migration patterns of fish species, change of spawning aggregation areas	Changes in swimming conditions, changes in surfing conditions
Changed frequency of rainy events	Floods and droughts	More days of bad weather, droughts

In recent years, in an attempt to reduce impacts on coral reef ecosystems, the Government of Maldives has designated protected areas at 42 sites (EPA, 2014). MPAs are an important tool for conservation of natural resources, however if management does not take into account the needs of resident local communities and stakeholders, their efficacy is strongly diminished (Marshall, 2007). In the Maldives, all but one MPA lack a management plan, de facto converting most protected areas into 'paper parks' (i.e. parks declared and existing on maps but with no conservation/management regulation in place) (Mohamed, 2007). This lack of management was attributed to a lack of understanding of the true value of reef resources (UNDP, 2004). Only very few studies are currently available for the Maldives that quantify the economic value of natural resources and most of them refer to the value of charismatic species (like reef sharks, whale sharks and manta rays) for tourism (UNDP, 2004; Anderson et al., 2011; Cagua et al., 2014). A better understanding of the value of reef resources would enable the Government of Maldives to implement and enforce more adequate conservation policies; however conservation goals can be achieved only if the needs and aspirations of the people using those resources are also considered and understood.



Healthy coral reefs are crucial for the socio-economic stability of Maldives. © Brian Zgliczynski

1.2 Resilience-based management framework

Social resilience is defined as *'the ability of human communities to withstand external shocks to their social infrastructure, such as environmental variability or social, economic and political instability'* (Adger, 2000). A Resilience-Based Management (RBM) framework is defined as one that 1) helps develop conservation strategies that minimize negative social consequences, and 2) improves long-term viability

and utility of conservation measures by integrating human dimension into resource management (Marshall et al., 2009). A RBM framework is thought to increase the adaptive capacity of a socio-ecological system to respond to sudden changes (Berkes et al., 2003); however, adaptability can only increase if all variables and processes on which the ecosystem relies to function are actively managed (Adger, 2000).

In order to establish such a framework, Marshall et al. (2009) suggests evaluating three major characteristics: resource dependence, institutional perception, and adaptive capacity, which will determine the social resilience of an individual or a community.

Resource dependence refers to the nature and strength that individuals, families, and communities have with natural resources that surround them (Force et al., 1993; Bailey and Pomeroy, 1996; Jacob et al., 2001). The stronger the resource dependence, the lower social resilience will be, however any potential impacts associated with being resource dependent can be moderated by adaptive capacity (Marshall et al., 2013). In the framework of this project, we determined economic and social resource dependence based on the following questions:

1) Are resources producing an income (i.e. the income is dependent on the status of the resources)?

2) How are resources being used (i.e. resources can be used for work or for recreational/traditional purposes)?

3) How often are resources being used?

We did not include in this study the importance of natural resources in land formation and shoreline protection.

Institutional perception describes how individuals and communities perceive conservation and management practices implemented by governmental institutions (e.g. designation of a marine protected area). It is fundamental that local communities and individuals utilizing natural resources in a defined area are involved in the decision-making process and are actively participating in the management of natural resources (Marshall, 2007). Negative institutional perceptions have proven to undermine conservation efforts (Carpenter and Brock, 2004; Trosper, 2004; Janssen et al., 2006).

Adaptive capacity refers to the ability of people to respond to challenges by using existing human, social financial and natural capitals in new ways so that to be able to manage risks and impacts (Brooks and Adger, 2004; Folke et al., 2005; Smit and Wandel, 2006). A key point of adaptive capacity is the willingness of people to experiment and adopt new approaches (Olsson and Folke, 2001; Berkes and Seixas, 2005).

A RBM framework takes into account resource dependence of local communities and evaluates their adaptability (i.e. the capacity of adapting to changes in the ecosystem; Walker et al., 2004), but it should also provide clear information on how the ecosystems work and how change can affect them (ecological vulnerability and exposure). Finally, a RBM framework should include a series of steps that will help local communities managing and dealing with changes in the short, medium and long term (Berkes et al., 2003).

1.3 Project Regenerate

Started in October 2013, Project Regenerate is a joint initiative of IUCN Maldives Marine Projects (IUCN-MMP), the Ministry of Energy and Environment (MEE), the Ministry of Fishery and Agriculture (MoFA), the

Marine Research Center (MRC) and Environmental Protection Agency (EPA); and is supported by USAID. This project aims at developing a RBM framework to improve the ability of policy-makers, conservation practitioners, and stakeholders in the Maldives to understand the risks from global, regional, and local-scale pressures on their environment. The outcomes of this project are meant to 1) contribute to identifying the steps necessary to enhance understanding of resilience, and 2) provide tools that will increase capacity of local community islands to manage coral reef resources. Finally, through the support of governmental institutions, project Regenerate aims at providing guidelines for marine governance that will allow for adaptive management of coral reef ecosystems.

2. Scope of this report

Although this project addresses national priorities, field intervention was applied to North Ari atoll, which was selected by the project coordination committee[1] as demonstration site to show the utility of the activities run under Project Regenerate and successfully address any challenges that may be faced during the implementation phase. This report summarizes findings from a study aimed to measure social resilience of local communities in North Ari by understanding their use and dependence on marine resources, perceptions and attitudes towards management policies and regulations, and adaptive capacity.

This report also addresses differences in gender role in resource use and perception of environmental issues. In conjunction with an ecosystem service valuation to be conducted during year 2 of Project Regenerate, this study sets the base for a comprehensive understanding of the value of ecosystem services in one atoll in the Maldives.

[1] Project Regenerate coordination committee is composed by representatives from: MEE, MoFA, MRC, EPA, IUCN, USAID.

3. Study area

Located at a latitude between 4° 27' N and 3° 55' N and a longitude of 72° 49' E, North Ari Atoll (also known as Alifu Alifu) is the northern part of Ari Atoll, one of the largest atolls in the Maldives, 89 km long and 31 km wide. Declared as administrative division of Maldives in 1984, North Ari is composed of 8 inhabited community islands, 13 resort islands and a number of uninhabited islands. Four declared MPAs (Mushimasmigili Thila, Orimas Thila, Mayaa Thila, Karibeyru Thila) and 8 sensitive areas including a green turtle-nesting site in Maalhos can be found within the North Ari administrative borders (Figure 1). In 2014, North Ari atoll was selected as the demonstration site under project REGENERATE because its community islands represented well the variety that can be found in the Maldives; resort islands, islands open to local tourism (Mathiveri, Maalhos, Rasdhoo), islands that do not directly host tourists (Himandhoo), islands with strong community involvement (Ukulhas), islands hosting mostly fishers (Feridhoo), and islands that are involved in agriculture as a primary source of income (Thoddoo). It also has a good representation of the fishery related activities (tuna fishery, reef fishery, fish processing factory, etc) and a fair representation of the most common ecosystems and charismatic species in the Maldives (whale sharks, manta rays, sharks, turtles etc). In addition, North Ari Atoll also hosts globally endangered species such as green and hawksbill turtles (endangered and critically endangered respectively, according to the IUCN Red List) as well as Manta alfredi and whale sharks (vulnerable under IUCN Red List) (Marshall et al,, 2011).

Officially, 6,054 people inhabit North Ari islands (Department of National Planning, 2014); however, according to unpublished data obtained from the Atoll Council, the actual resident population is higher (Ali Sameer, pers. comm.) (Table 2).

Table 2. Number of inhabitants in the 8 local community islands of North Ari Atoll where social surveys were conducted.

Island	Population (unpublished data obtained from atoll council)	Population (National Bureau of Statistics, 2014)	Above 18 (unpublished data obtained from atoll council)
Bodufoludhoo	820	607	600
Feridhoo	760	437	534
Himandhoo	766	703	448
Maalhos	691	426	330
Mathiveri	863	578	450
Rasdhoo	1116	1065	600
Thoddhoo	1817	1320	1150
Ukulhas	981	615	510

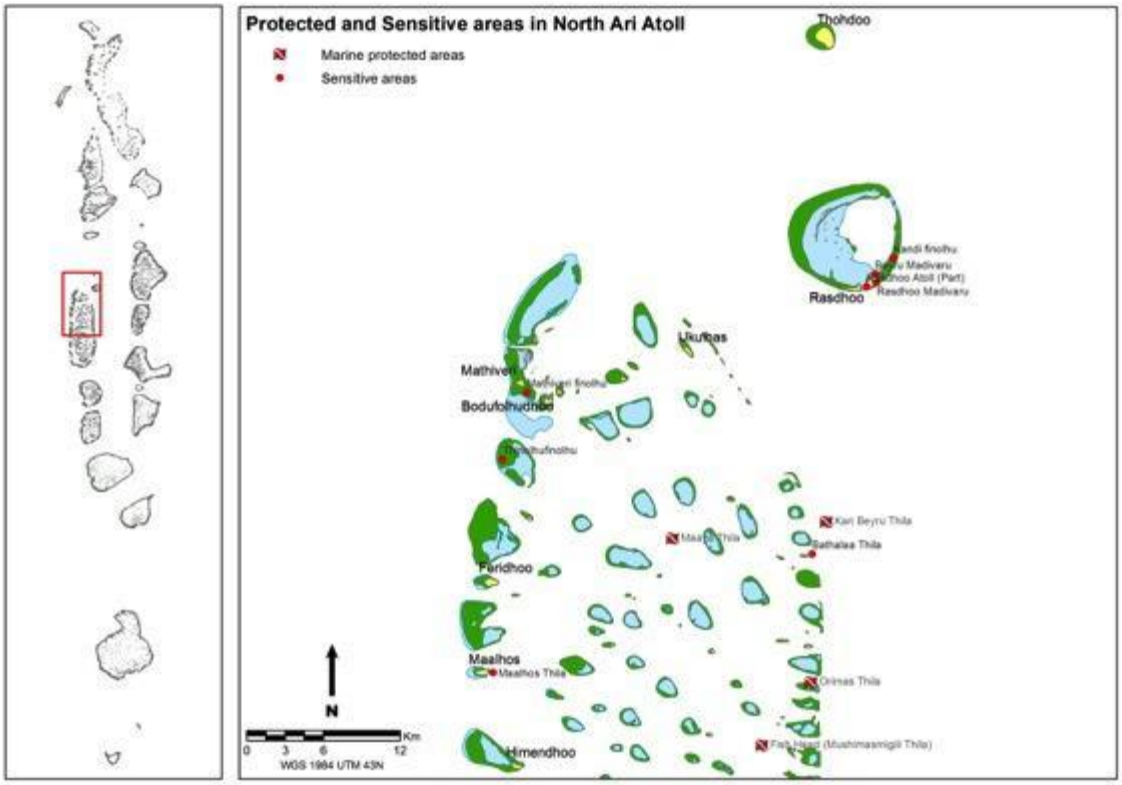


Figure 1. North Ari Atoll: map of the study area.

4. Methodology

4.1 Survey design

Semi-structured surveys were conducted at all local community islands in North Ari Atoll in August (Mathiveri, Maalhos, Ukulhas and Rasdhoo) and December 2014 (Thoddho, Bodufolhudhoo, Feridhoo and Himandhoo).

The questionnaire was modified after the first round of surveys to make the proposed answers more precise. However, the questions remained mostly the same, hence data from both the rounds were combined in the analysis. The questionnaire included different types of questions (open ended, multiple choice, single choice, agreement to statements) to capture as much information as possible. For agreement to statements, we used a 5-point Likert scale (1=Strongly disagree, 2=Disagree, 3=No opinion, 4=Agree, 5=Strongly agree), where values greater than 3.0 indicate agreement with the statement.

The survey questionnaire, developed based on the one used by Marshall et al. (2009), included 51 questions, grouped into 5 sections:

- Section A – Resource use and dependence: This section was aimed at understanding how respondents are using the marine resources in North Ari, and how they perceive the actual status of natural resources. Specific questions were asked to enquire about reef fish and baitfish status and the trends in both reef and tuna fishery (see Annex 1, questions 1 to 28).

- Section B – Perceptions towards marine conservation policies and legislation: The aim of this section was to understand how respondents felt about marine conservation policies, but it was also aimed at understanding what respondents thought their and government roles were in marine conservation (see Annex 1, questions 29 to 41).

- Section C – Adaptive capacity: This section was aimed at understanding how local residents of North Ari Atoll communities would cope with drastic environmental challenges (see Annex 1, questions 42 to 43).

- Section D – Demographics: This section aimed at obtaining information on the demographic and economical variables of the respondents (see Annex 1, questions 44 to 49).

- Section E – Resource use maps: this section aimed at obtaining spatial data on resource distribution and use within North Ari atoll (see Annex 1, questions 50 to 51).

Respondents were divided into three groups based on their main occupation:

- Direct users of natural resources: this group included all those respondents that were using natural resources as part of their main occupation in an extractive or non-extractive way (including fishermen, farmers, people using natural resources for construction purposes, people working in the diving/snorkeling industry).

- Indirect users: this group included all those respondents which main occupation depended indirectly from natural resources (including shop owners selling souvenirs to tourists and all other kinds of activities related to the tourism industry, people employed in fish processing plants, etc.).

- No use: this group included all those respondents whose main occupation was not related to natural resources (including administrative/government jobs, teaching, work in hospitals, unemployed, retired, students, etc.).

4.2 Data analysis

Data were analyzed using predominantly descriptive statistics. When possible, non-parametric tests were used to compare response rates and perceptions among groups (e.g. Men vs. Women, differences among types of use of resource users, differences among islands, etc.). All analyses were carried out using SAS JMP® software.

A matrix for social resilience (SR) was created to rank the islands of North Ari. Social resilience was defined as the sum of four parameters (1):

- Resource dependence (RD)
- Institutional perception (IP)
- Adaptive capacity (AC)
- Demographic traits (Dem)

$$SR = RD + IP + AC + Dem \quad \ldots\ldots\ldots\ldots (1)$$

Each parameter was attributed a value from 1 to 100, based on results of the surveys, 100 indicating most resilient respondents and 1 indicating least resilient respondents. Average scores were attributed to each island. Only complete interviews were used for the matrix (i.e. the respondents answered all questions used in the score calculation).

Resource dependence was calculated based on type of use of resources (use for income, use for recreational activities, no use), number of uses (fishery, diving or snorkeling, picnics, etc.), and frequency of use of natural resources.

Institutional perception was calculated based on the perception of individual, community and government roles in nature conservation and the level of compliance to future possible regulations.

Adaptive capacity was calculated based on presence of a second job and job alternatives, and the willingness of respondents to adapt and change.

Finally, **demographic traits** (age, level of income, level of education, attachment to the place) were also included as they have an impact on the resilience of a community island (e.g. elders will have more difficulties to learn a new job and adapt therefore their resilience will be lower, people with a higher level of education will be able to adapt and change occupation more easily than those with lower levels of education, etc.).

Given the non-normality of data, we used generalized linear models (GLMs) with a Gaussian link function to assess the effect of social factors on these response variables (McDonald, 2009). The explanatory variables, i.e. social factors, considered in this analysis were “island”, “age”, “sex”, “education level”, “salary level”, “use”, “sub-category of use”, in equation 1. For each variable the following levels were used:

- Island: Bodufolhodhoo, Feridhoo, Himandhoo, Maalhos, Mathiveri, Rasdhoo, Thoddho, Ukulhas;
- Education level: Basic, primary, secondary, high, university;
- Salary: no salary, low (<5,000 MVR), medium (5,000 – 10,000 MVR), high (10,000 – 20,000 MVR), very high (> 20,000 MVR).

- Type of use: direct (sub-categories: agriculture, fishery, construction with local materials, diving/snorkeling), indirect (related to tourism, business, selling resources), no use (admin/government, education, health, unemployed/retired).

The response variables, i.e., resource dependence, institutional perception, adaptive capacity and social resilience, Y_i, were modeled as a function of the explanatory variables as following:

$$Y_i = \beta_0 + \beta_1 x_{1i} + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{3i} + \beta_4 x_{4i} + \varepsilon_i \quad \ldots\ldots\ldots (2)$$

Where the observations i=1,...,n are independent; $\beta_1, \beta_2, \beta_3, \beta_4$ are the coefficient of variation corresponding to the explanatory variables, x_1, x_2, x_3, x_4 , ε_i i.e., ε_i are the normally distributed errors.

The AIC was used to determine models representing the best fit to the data (lowest AIC). Models with $\Delta\text{AIC} \leq 2$ were considered of equal value (Burnham and Anderson 2002).

We used the R package 'glmulti' to run model selection and identify the best explanatory variables.

4.3 Resource use mapping

Respondents were asked to identify on a map the areas they were using and to indicate, for each area, the type of use according to the following categories (see Annex 1, question 50):

- Fishing (commercial): areas used by fishermen to catch species for trade.
- Fishing (recreational): areas used by non-professionals (i.e. non commercial fishermen) to fish.
- Fishing (subsistence): areas used by non-professionals to provide for family needs.
- Recreational (Snorkeling and diving, picnic): areas used for recreational snorkeling and diving trips, and areas used by local community members to spend time with family and friends.

Finally, respondents normally involved in direct use of natural resources were asked to indicate (see Annex 1, question 51):

- Reef fish aggregation areas: areas where large number of fish are gathered
- Turtles nesting grounds;
- Bait fishing areas;
- Seagrass meadows/patches.

All hand-drawn maps from respondents were digitized by creating polygons in ArcGIS v10.2 Software ® by ESRI. Separate map layers for each 'Type of use' category was created and polygons were drawn with identifying survey numbers allocated to them. A union of each map layer was performed and individual XY coordinates were obtained for the unions. Each union layer was then dissolved based on their coordinates field with count to obtain sum of layers at unique XY coordinates. Each dissolved layer was converted from polygon to raster based on the percentage of respondents for each category. Zonal Statistics (Spatial Analyst) of 2 x 2 kilometer cells for each raster category was performed using Variety to obtain the number of unique percentages of respondents in each 2 x 2 kilometer cell.

4.4 Survey administration

The surveys were designed for resident adult (over 18 years old) Maldivian citizens and were administered in Dhivehi by a team of 7 people. Interviewees were approached randomly at houses as well as on the streets during day time, and were given a little briefing about the survey before being asked if they wanted to take part to the study. Each survey lasted from of 0.5 to 1 hour.

Table 3. Survey response rate on each island in North Ari Atoll, Maldives

Island	Resident adult population	% of resident population surveyed	No. of positive responses	% response rate
Bodufoludhoo	600	26	158	82
Feridhoo	534	25	135	79
Himandhoo	448	25	112	73
Maalhos	330	25	82	98
Mathiveri	450	27	122	81
Rasdhoo	600	22	132	83
Thoddhoo	1150	19	217	60
Ukulhas	510	26	131	80
	4622	24	1089	76

In total, 1,089 people agreed to participate in the social surveys (out of 1438 that were approached, response rate: 76%) on 8 local community islands in North Ari. This represents approx. 24% of the total adult resident population in the atoll (Table 3). As the respondents were given the choice to skip questions, only 541 questionnaires were actually complete (i.e. all questions were answered).

5. Results

5.1 Demographics

52% of the respondents were males (n=564), while 31% were females (n=343), for 17% of the respondents sex was not recorded (n=181). Respondents were on average 38.2 ± 15.4 years old (range: 18 – 86, n=903). About 31% of the respondents received basic education (n=279), 26% finished grade 7 (n=234), 32% finished grade 10 (n=292), and only 11% had higher education (up to university degree) (n=101).

The large majority of the respondents were born on the island (89%, n=804) or North Ari Atoll (2%, n=21). Only 9% considered themselves as 'immigrants' (i.e. being born in a different atoll) (n=82). Most respondents either lived all their life on the island they were interviewed (80%, n=727) or had been working there for more than 10 years (6%, n=53); only 11% of the respondents had spent less than 10 years (n=96) or were not residents on the island (3%, n=30).

Salary information was available for 803 respondents only: most respondents indicated receiving a monthly salary in the range of 5,000-10,000 MVR (approx. 325-650 USD) (40%, n=324), 20% indicated a monthly salary of less than 5,000 MVR (n=157) and 18% received a monthly salary between 10,000-20,000 MVR (approx. 650-1300 USD) (n=69). Only 5% of the respondents received a salary of 20,000 MVR (approx.1850 USD) or more per month (n=42). 17% of the respondents declared not receiving any salary (n=138). The Pearson's chi-square test for associations indicated a significant difference between monthly revenue for men and women ($N=803$, $df=5$, Chi-square=189.038, $p<0.0001$), with men earning usually 5,000 to 10,000 MVR (approx. 325-650 USD) (47% of all men), and women being usually unemployed/having no revenue (38% of all women).

The fishing industry is the second largest contributor to the Maldives economy. © Adam Abdulla

5.2 Resource use and dependence

Out of 1,089 respondents, 27% were classified as direct users of natural resources (n=289), 13% were classified as indirect users of natural resources (n=149), and 60% were classified as not using resources for their occupations/income (n=651) (Table 4). Fishermen (i.e. those that indicated tuna, reef fish, or baitfish fishery as their main occupation) represented only 14% (n=156) of respondents (Table 4).

Direct users were on average 40.4±1.0 years old (n=223, CI 95%: 38.5 – 42.3), had basic education (40%, n=91), had lived all of their life on the island were they were born (88%, n=196) and usually earned between 5,000 and 10,000 MVR per month (48%, n=106).

Indirect users were on average younger (33.0±1.1 years old; n=126, CI 95%: 30.7 – 35.2), had studied until grade 10 (44%, n=56) (with 16% of the indirect users having finished high school or university, n=17), had lived all of their life on the island were they were born (77%, n=98) and usually earned between 5,000 and 10,000 MVR (45%, n=56), or more than 10,000 MVR per month (33%, n=41).

Those respondents classified as non-users of resources were on average 38.5±0.7 years old (n=554, CI 95%: 37.2 – 39.9), had basic education (30%, n=165) or had studied until grade 7 (22%, n=124) and 10 (34%, n=186), had lived all of their life on the island were they were born (78%, n=433) and usually had no salary (29%, n=134) or earned between 5,000 and 10,000 MVR (36%, n=162).

The occupation (and therefore the type of use of resources: direct, indirect or no use) was significantly different according to the island (Pearson's Chi Square test; n=1089, df=14, Chi-sq=115.036, p<0.0001), the sex of respondents (Pearson's Chi Square test; n=907, df=2, Chi-sq=165.357, p<0.0001), and the education level (Pearson's Chi Square test; n=906, df=8, Chi-sq=77.442, p<0.0001).

The most frequently cited uses of marine resources were: fishing (commercial, recreational and subsistence fishery) (44% of 1,647 answers, n=728), indirect use for recreational activities like snorkeling and picnics (35% of total answers, n=569) and tourism for professional reasons (12% of total answers, n=193). Only 2% of total answers indicated other uses of natural resources (n=33). 8% of the respondents (n=124) declared that they did not use natural resources. Most men indicated fishery as their main way to use resources, while women seemed to associate the use of natural resources predominantly with recreational activities (picnics and snorkeling) (Figure 2).

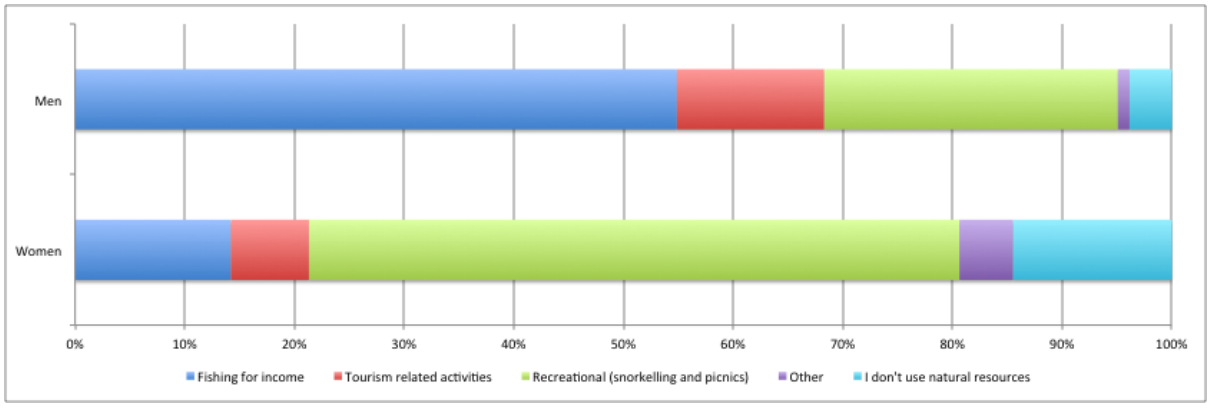


Figure 2. Difference in use of natural resources among men and women in 8 local community islands in North Ari atoll.

Table 4. Classification of user in 8 local community islands in North Ari atoll based on their use of natural resources in the framework of their occupations (B: Bodufolhudhoo; F: Feridhoo, H: Himandhoo, MS: Maalhos, MV: Mathiveri, R: Rasdhoo, T: Thoddho, U:Ukulhas).

	B	F	H	MS	MV	R	T	U	Total
Direct use	**26 (17%)**	**17 (13%)**	**32 (29%)**	**10 (12%)**	**33 (27%)**	**17 (13%)**	**92 (42%)**	**62 (48%)**	**289 (27%)**
Agriculture			1 (9%)				87 (40%)		88 (8%)
Traditional construction	9 (6%)	13 (10%)	14 (13%)						36 (3%)
Diving/Snorkeling		1 (1%)	1 (1%)						2 (<1%)
Fishery	16 (10%)	3 (2%)	12 (11%)	10 (12%)	33 (27%)	17 (13%)	3 (1%)	62 (47%)	156 (14%)
Selling resources	1 (1%)		4 (4%)				2 (1%)		7 (1%)
Indirect use	**21 (13%)**	**23 (17%)**	**18 (16%)**	**6 (7%)**	**24 (20%)**	**27 (21%)**	**19 (9%)**	**11 (8%)**	149 (13%)
Construction	5 (3%)	6 (4%)	2 (2%)	5 (6%)	1 (9%)	2 (2%)	6 (3%)	1 (1%)	38 (4%)
Health							1 (>1%)		1 (>1%)
Related to tourism	16 (10%)	17 (13%)	16 (14%)	1 (1%)	13 (11%)	25 (19%)	12 (6%)	10 (8%)	110 (10%)
No use	**111 (70%)**	**95 (70%)**	**62 (55%)**	**66 (81%)**	**65 (53%)**	**88 (66%)**	**106 (49%)**	**58 (44%)**	651 (60%)
Health	2 (1%)	6 (4%)	1 (1%)	2 (2%)	4 (3%)	2 (2%)	3 (1%)		20 (2%)
Unemployed/ret.	68 (43%)	55 (41%)	39 (35%)	25 (31%)	33 (27%)	26 (20%)	53 (24%)	21 (16%)	320 (29%)
Education	8 (5%)	8 (6%)	4 (4%)	2 (2%)	3 (3%)	3 (2%)	9 (4%)	2 (2%)	39 (4%)
Admin/Government	24 (15%)	16 (12%)	14 (13%)	13 (16%)	14 (12%)	26 (20%)	28 (13%)	14 (11%)	149 (14%)
Business	4 (3%)	5 (4%)	2 (2%)	8 (10%)	4 (3%)	14 (11%)	7 (3%)	10 (8%)	54 (5%)
Other	5 (3%)	5 (4%)	2 (2%)	16 (20%)	7 (6%)	17 (13%)	6 (3%)	11 (8%)	69 (6%)
Total	**158**	**135**	**112**	**82**	**122**	**132**	**217**	**131**	1089

The use of natural resources for fishing was frequent (once or twice per week) in most cases (33%, n=125) or occasional (once or twice per month) (24%, n=92). Only 18% of the respondents declared to be fishing daily (n=67) while 24% declared rarely or never going fishing (n=93).

Snorkeling and/or diving trips were frequent (33%, n=62) and occasional (32%, n=60). Only 10% of the respondents declared going snorkeling/diving daily (n=19) while 25% of the respondent said to rarely or never go in the water (n=46).

36% of the respondents said that they rarely or never went for picnics (n=76), while 34% was going occasionally (n=70) or frequently (26%, n=54). Only 4% declared to go for picnics daily (n=9).

5.2.1 Use of specific resources

Reef fishery

Reef fish was commonly caught using hooks and lines (76% of the answers, n=420). Spear fishing (10%), gillnets (6%), jigging (5%) and cast nets (1%) were also used but less frequently (Figure 3).

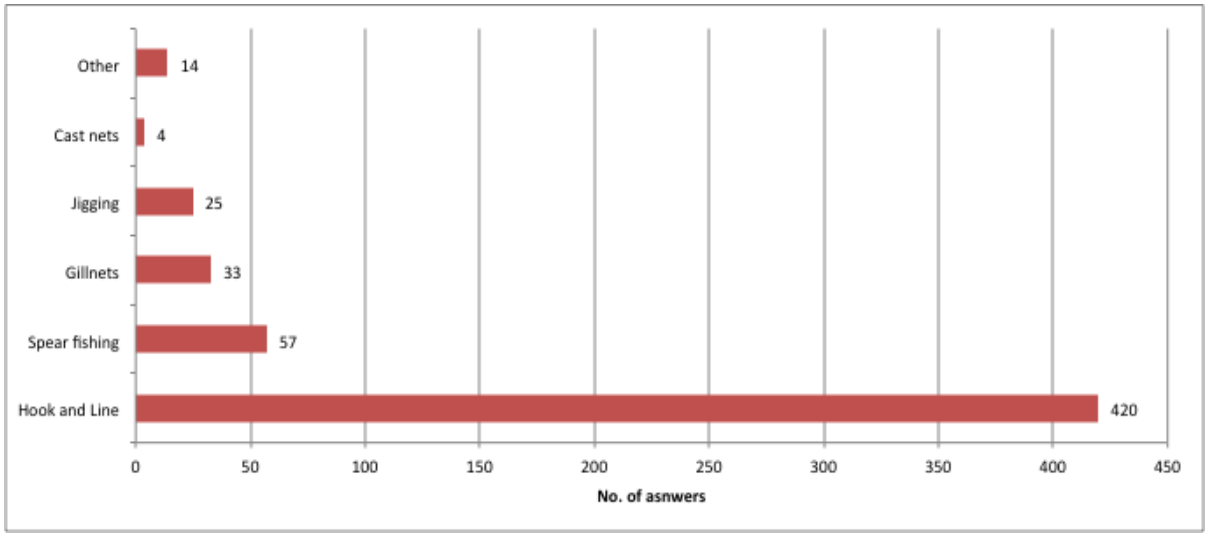


Figure 3. Most commonly used fishing gears as reported during the surveys at 8 local community islands in North Ari atoll (n=553).

Most commonly caught reef fish species were (in order of importance): Snappers (30% of total answers), various species of carangidae (including: trevally and rainbow fish) (18%), greenjob fish (Aprion virescens) (10%), and Emperor fish (Lethrinus spp.) (9%).

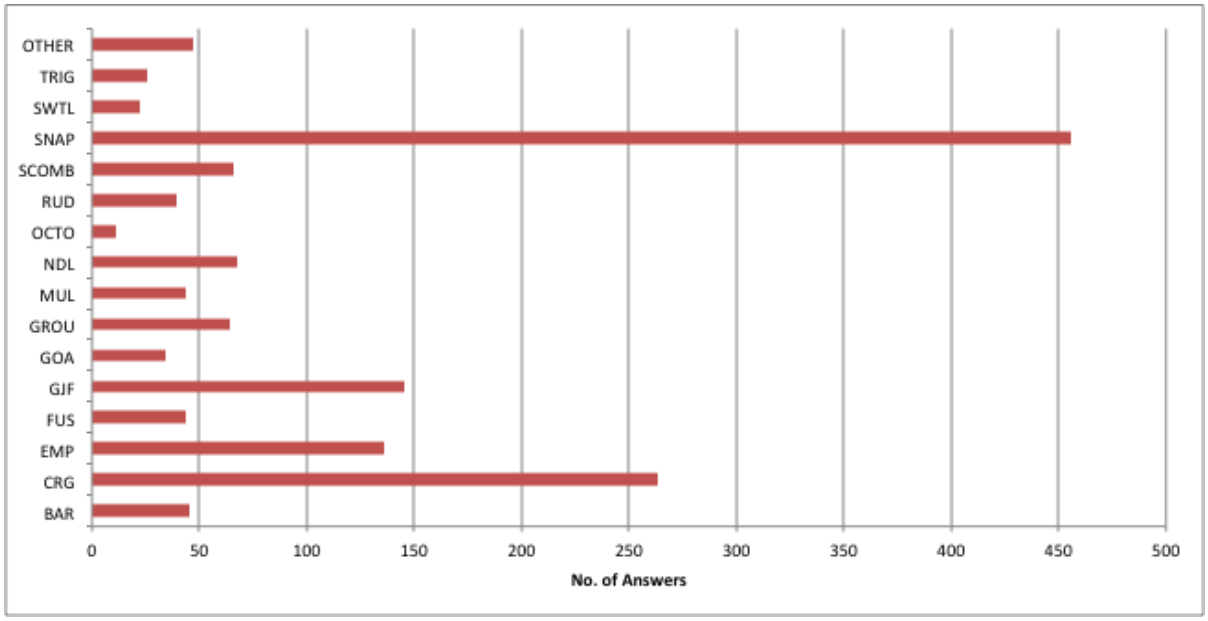


Figure 4. Most commonly caught types of reef fish in North Ari Atoll as reported during the surveys at 8 local community islands in North Ari atoll (n=1506).

Most commonly eaten reef fish species were similar to those commonly fished with Snappers (37% of total answers), and various species of carangidae (including: trevally and rainbow fish) (23%) being the favorite ones (Figure 5).

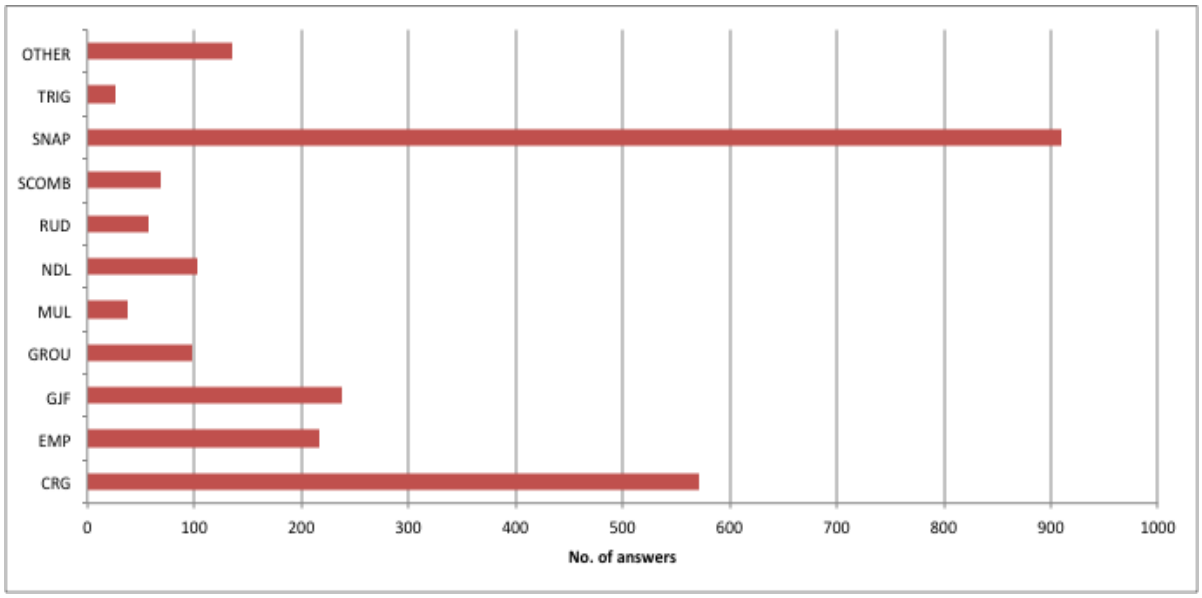


Figure 5. Most commonly eaten types of reef fish in North Ari Atoll as reported during the surveys at 8 local community islands in North Ari atoll (n=2462).

Reef fish was used mostly for consumption (85%, n=422), and consumption was generally found to be frequent (once or twice per week) (33% out of 935 respondents, n=307) or occasional (once or twice per year) (29% of the respondents, n=274). Only 16% of the respondents declared eating reef fish daily (n=153), while 21% consumed it rarely (once or twice per year) (n=169) or never (n=32).

The consumption of reef fish was driven by its taste (49% out of 1,396 responses), with respondents mentioning eating reef fish because they like it (n=674), while 21% reported to eat it with friends as

leisure (n=289). 14% of the respondents used reef fish as an alternative when tuna was not available (n=185). Only 12% of respondents used reef fish to provide food for their family (n=168), while for 6% reef fish was a source of income (n=80) (Figure 6).

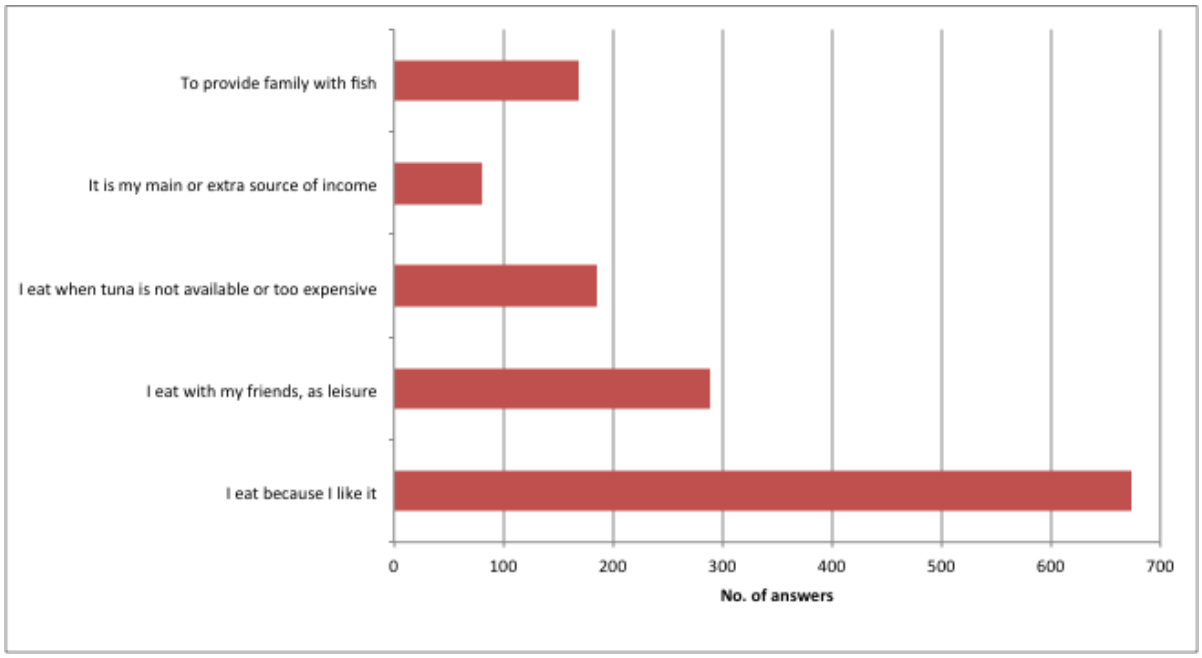


Figure 6. Most common reasons to eat reef fish as reported during the surveys at 8 local community islands in North Ari atoll (n=1369).

A group of fishers share their concerns with a facilitator. © Abdulla Fisam

Bait fishery

Out of 1,089 respondents, 45% declared doing some bait-fishery (n=489), the number of people was very different according to the island where the interviews took place: in Ukulhas, Rasdhoo, Mathiveri and Maalhos, almost all respondents were involved in bait-fishery. In Bodufolhudhoo, Feridhoo, Himandhoo and Thoddhoo, almost none of the respondents were doing any bait-fishery (Figure 7).

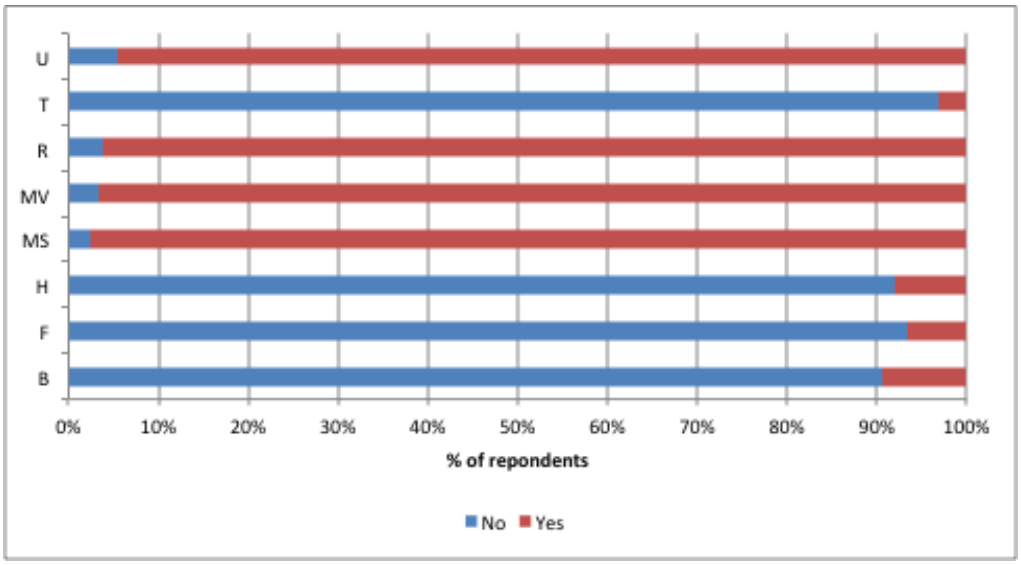


Figure 7. Percentage of respondents doing some kind of bait-fishery in 8 community islands in North Ari atoll. (B: Bodufolhudhoo; F: Feridhoo, H: Himandhoo, MS: Maalhos, MV: Mathiveri, R: Rasdhoo, T: Thoddho, U: Ukulhas).

When asked about the current situation with baitfish fishery, most fishermen answered that during the past 10 years the fishery had been decreasing (63% of all respondents, n=309), only 9% saw no change (n=42), while 9% thought it was increasing (n=35) and 21% had no knowledge (n=103). The perception of bait-fishery decreasing was found in all three groups of users, however there was a significant difference among groups (Pearson's Chi Square test; n=489, df=6, Chi-sq=58.495, p<0.0001), direct users being more aware of the decreasing.

The use of lights to catch baitfish was perceived as highly (45%, n=221) or somewhat destructive (13%, n=66), however significant differences were found among group of users (Pearson's Chi Square test; n=495, df=8, Chi-sq=60.315, p<0.0001) (Table 5). Diving to catch baitfish was considered generally highly (52%, n=256) or somewhat destructive by all respondents (7%, n=34), however significant differences were found in the perception of impact of this activity among different group users (Pearson's Chi Square test; n=490, df=8, Chi-sq=50.956, p<0.0001)(Table 4). Bait-fishery was perceived as highly detrimental to corals by all respondents (85%, n=422), however significant differences were found in the perception of impact of this activity among different group users (Pearson's Chi Square test; n=495, df=8, Chi-sq=25.556, p=0.0004) with direct users being more aware of impacts (Table 5).

Table 5. Perceptions of the impacts of two fishing techniques for baitfish on coral reef ecosystems and marine life.

	Direct use	Indirect use	No use
The use of lights to catch baitfish is			
Highly destructive	62% (n=87)	34% (n=25)	39% (n=109)
Somewhat destructive	16% (n=23)	19% (n=14)	10% (n=29)
Not very destructive	7% (n=10)	7% (n=5)	7% (n=19)

Not at all destructive	12% (n=17)	18% (n=13)	10% (n=28)
No answer/don't know	3% (n=4)	22% (n=16)	34% (n=96)
Diving to catch baitfish is:			
Highly destructive	66% (n=93)	59% (n=42)	44% (n=121)
Somewhat destructive	11% (n=15)	7% (n=5)	5% (n=14)
Not very destructive	9% (n=13)	4% (n=3)	6% (n=17)
Not at all destructive	6% (n=8)	8% (n=6)	6% (n=17)
No answer/don't know	8% (n=11)	22% (n=16)	39% (n=109)
The impacts of bait-fishery on corals are:			
Highly destructive	91% (n=130)	92% (n=66)	81% (n=226)
Somewhat destructive	2% (n=3)	1% (n=1)	1% (n=3)
Not very destructive	2% (n=3)	1% (n=1)	3% (n=8)
Not at all destructive	3% (n=4)	3% (n=2)	>1% (n=1)
No answer/don't know	2% (n=3)	3% (n=2)	15% (n=42)

5.2.2 Perceptions of resource status and impact on income

When fishermen were asked about the status of the reef fish stocks, 51% of the respondents said that they felt fish stocks had decreased over the past 10 years (n=300), 20% did not see any change (n=120), while 12% thought fish stocks had increased (69). 17% of the respondents could not answer the question (n=103). The perception of changes in reef fish stocks over the past 10 years was different among groups of users (Pearson's Chi Square test; n=592, df=6, Chi-sq=21.505, p=0.0015) (Table 6). On the other hand, reef fish price seemed to have increased over the past 10 years (72% of respondents, n=423), a perception that was common to all groups of users (Table 6).

Respondents agreed that the fish populations had been decreasing over the past 10 years (n=587, mean response value = 3.99±0.06, CI 95%: 3.87 – 4.11, values greater than 3 indicate strong agreement with the statement). All groups of users shared the same opinion, however direct users seemed to more strongly agree with the statement (n=178, mean response value = 4.2±0.1; ANOVA, n=587, df=2, F=3.1794, p=0.0423). When asked about main threats to fish populations in the region, 51% of the respondents (n=294) mentioned fishery (either overfishing or use of destructive techniques) as main causes for reduced fish abundance. Changes in monsoons related to climate change and lack of a proper waste disposal system counted respectively for 16% and 13% of the responses (n=90 and n=73 respectively) (Figure 8).

Table 6. Perceptions of changes in reef fish stocks and reef fish prices over the past 10 years.

	Direct use	Indirect use	No use
Over the past 10 years, reef fish stock have:			
Increased	10% (n=18)	14% (n=15)	12% (n=36)
No change	20% (n=37)	18% (n=18)	21% (n=65)
Decreased	60% (n=110)	54% (n=56)	44% (n=134)
Don't know	10% (n=17)	14% (n=15)	23% (n=71)
Over the past 10 years, reef fish price has:			
Increased	76% (n=139)	79% (n=83)	66% (n=201)
No change	7% (n=5)	5% (n=5)	7% (n=22)
Decreased	6% (n=11)	3% (n=3)	4% (n=12)
Don't know	11% (n=20)	13% (n=14)	23% (n=69)

35% of respondents that declared to earn revenue from direct or indirect use of natural resources said that their income did not change over the past 10 years (n=122), 34% said it increased (n=118), while 26% said it decreased (n=89). Direct and indirect users had different perceptions of the evolution of their income over the past 10 years (Pearson's Chi Square test; n=346, df=6, Chi-sq=12.043, p=0.0072), with a higher proportion of those directly depending on natural resources declaring that their income decreased (30% versus 14% of indirect users).

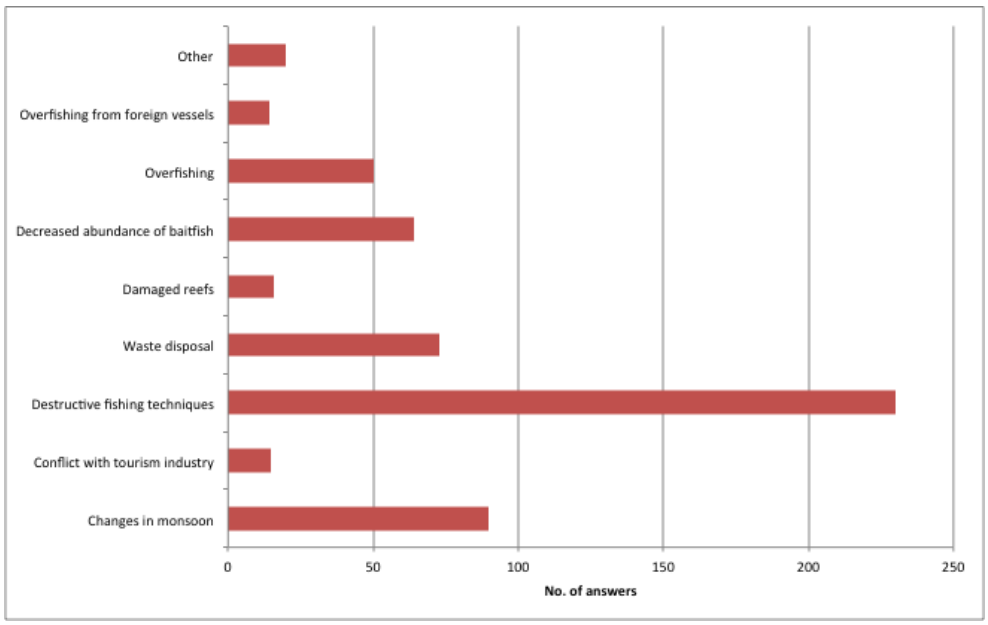


Figure 8. Main threats to reef fish populations identified during the social surveys at 8 local community islands in North Ari atoll (n=572).

Most frequently cited reasons for increased or decreased income are summarized in Table 7: personal reasons (like ageing, health conditions, retirement) and decreased fish catches were considered as the most important causes for decreased income (55% out of 78 respondents). On the other hand, better job conditions and increased demand for fish were considered the most important reasons behind increased incomes (66% out of 133 respondents).

Table 7. Most frequently cited reasons for decreased or increased income as reported by respondents in North Ari atoll.

Reasons for decreased income	1) Personal reasons (age, health, etc.) (32%, n=25) 2) Decreased fish catches (23%, n=18) 3) Increased competition (19%, n=15) 4) New government policies (14%, n=11) 5) Increased costs of living (10%, n=8) 6) Changes in monsoon (1%, n=1)
Reasons for increased income	1) Better job conditions (38%, n=50) 2) Increased demand and increased prices (28%, n=37) 3) Diversified sources of income (17%, n=23) 4) Increased tourism activities (7%, n=9) 5) Increased fishing effort (3%, n=4) 6) Increased support from other family members (3%, n=4) 7) Other (4%, n=6)

Respondents generally showed no (68%, n=500) or few concerns (6%, n=46) about the future. Only 17% of the respondents (n=129) seemed to have strong or some (9%, n=63) concerns. Direct users usually felt more concerned about the future compared to other users groups (Pearson's Chi Square test; n=738, df=6, Chi-sq=28.150, p<0.0001). Main reasons for concerns were: 1) few to no job opportunities (22%, n=34), 2) depletion of natural resources using destructive fishing methods (18%, n=28), 3) increased inflation and political instability/change in government policies (15%, n=24). Other reasons for concern were summarized in Table 8.

Table 8. Most frequently cited reasons for concerns towards the future as reported by respondents in North Ari atoll.

Reasons for concern	No. of answers (%)
Few to no job opportunities	34 (22%)
Depletion of natural resources using destructive fishing methods	28 (18%)
Increased inflation and political instability/change in government policies	24 (15%)
Low or no market for local products and reduced prices	7 (5%)
Low salary rates	7 (5%)
Increasing conflicts with resorts/tourism industry	6 (4%)
Decreased demand for tourism due to reef being damaged	6 (4%)
Waste disposal at sea that may affect marine life	5 (3%)
Increased number of sharks affect fishery	3 (2%)
Health	3 (2%)
Land degradation and erosion	3 (2%)
Salt water contaminating freshwater	3 (2%)
Difference between generations, different views among people.	2 (1%)
Prices of goods increased	2 (1%)
Other	23 (14%)

5.3 Perception towards marine conservation policy

Most people did not recall any historical measure taken to reduce pressure on natural resources (81%, n=796), however those few that remembered some measures being taken in the past (19%, n=184) mentioned that they were very effective (54% of responses, n=92), or somewhat effective (27% of responses, n=46). Construction of groins, seawalls and/or small jetties (45%, n=61), restriction/regulation of sand and coral mining (25%, n=61) and tree plantation and protection of shoreline vegetation (13%, n=18) were the most frequently cited measures.

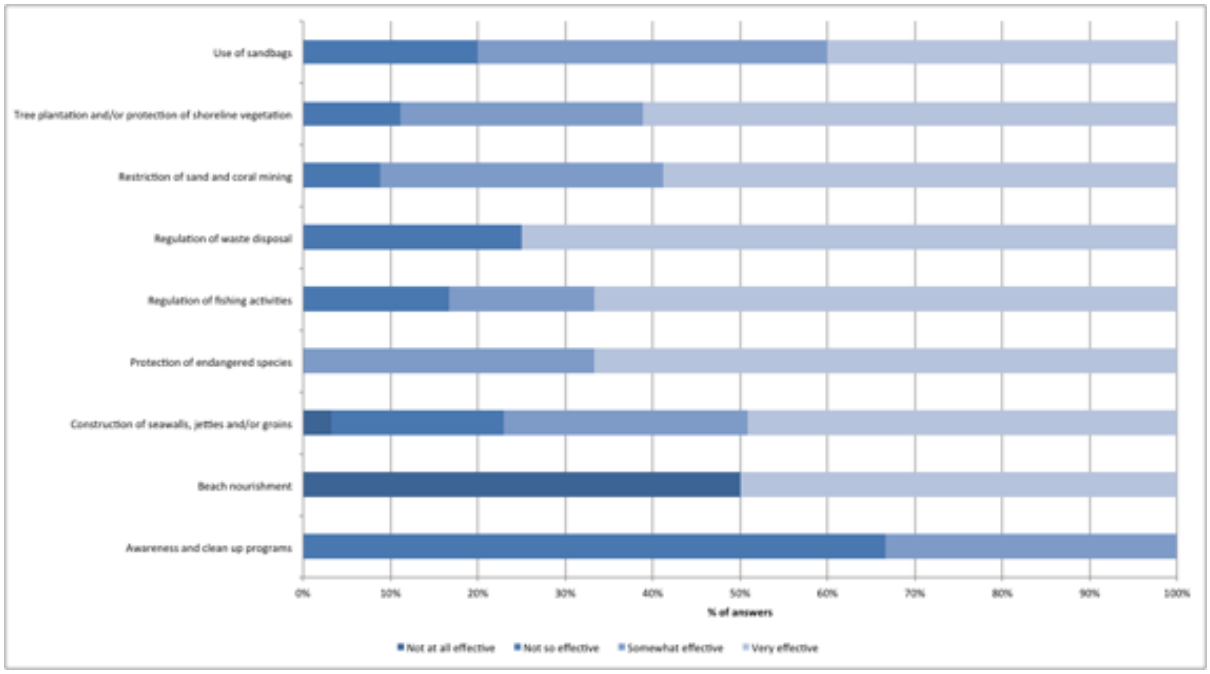


Figure 9. Main historical measures taken to protect community islands and their effectiveness (n=136)

5.3.1 Perception of individual role in marine conservation

When asked about the role of local communities in marine conservation, 80% of the respondents declared that local communities did not usually take initiatives to protect the fish stocks or coral reefs (n=783). The remaining 20% of respondents said that local communities had few to several measures in place (n=91), the most frequently mentioned being: 1) Awareness and clean up programs (41%, n=37), 2) Waste management plans (22%, n=20), 3) Enforced sand mining regulations (20%, n=18), 4) Tree plantation to protect the shoreline (8%, n=7), 5) Construction of defense systems (6%, n=6), and 6) Enforcing fishery regulations (3%, n=3).

Most respondents were not at all involved in activities organized by NGOs and local associations (31%, n=301), however there was a significant difference 1) among islands (Pearson's chi-square test, n=981, df=21,Chi-square=397.481, p<0.0001) (Figure 10) with respondents in Maalhos, Mathiveri, Rasdhoo and Ukulhas generally being more active; and 2) between men and women (Pearson's chi-square test, n=981, df=3,Chi-square=75.550, p<0.0001), with women usually feeling less involved/being less active than men (Figure 11).

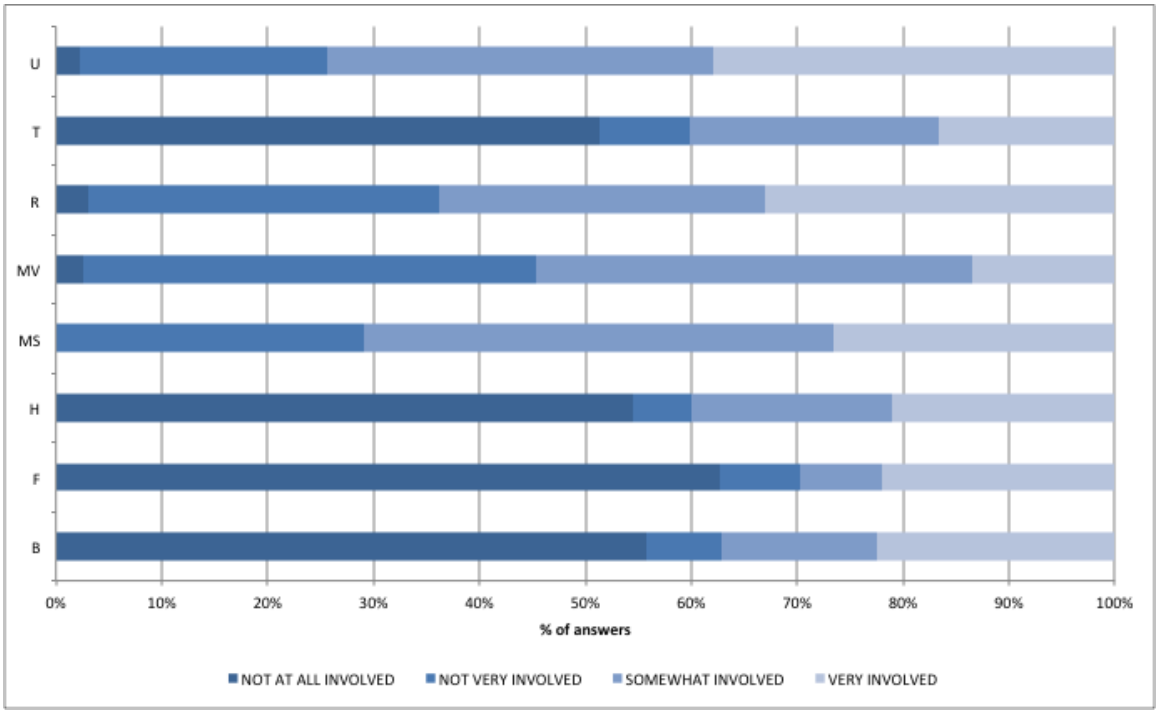


Figure 10. Involvement of individuals in local community meetings and activities (n=981). (B: Bodufolhudhoo; F: Feridhoo, H: Himandhoo, MS: Maalhos, MV: Mathiveri, R: Rasdhoo, T: Thoddho, U: Ukulhas).

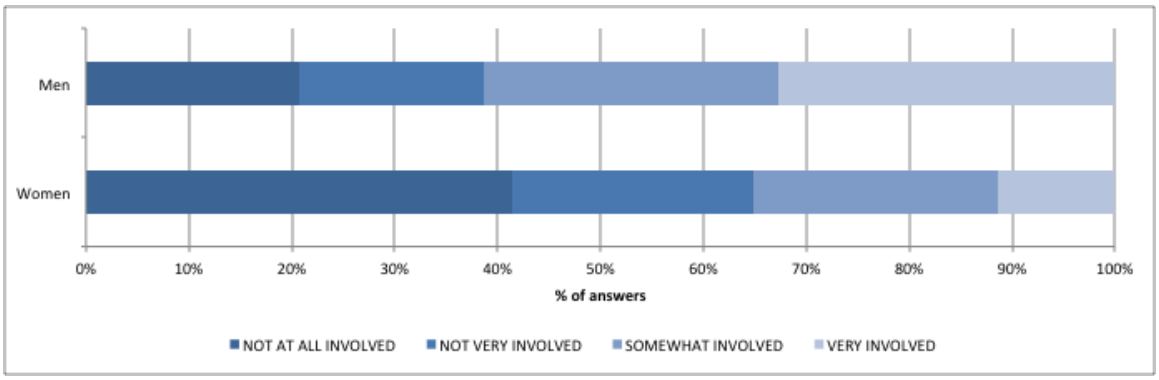


Figure 11. Difference in involvement of men and women in local community meetings and activities (n=897).

Only 24% of the respondents declared to always attend meetings for public consultations (n=235) and 44% never or rarely attended those meetings (n=430). 7% also felt uninvited (n=69). However participation was different according to islands (Pearson's chi-square test, n=970, df=35, Chi-square=157.266, p<0.0001) (Figure 12), and sex of respondents (Pearson's chi-square test, n=902, df=5, Chi-square=47.367, p<0.0001) (Figure 13). At these meetings, most respondents never spoke up (49%, n=461).

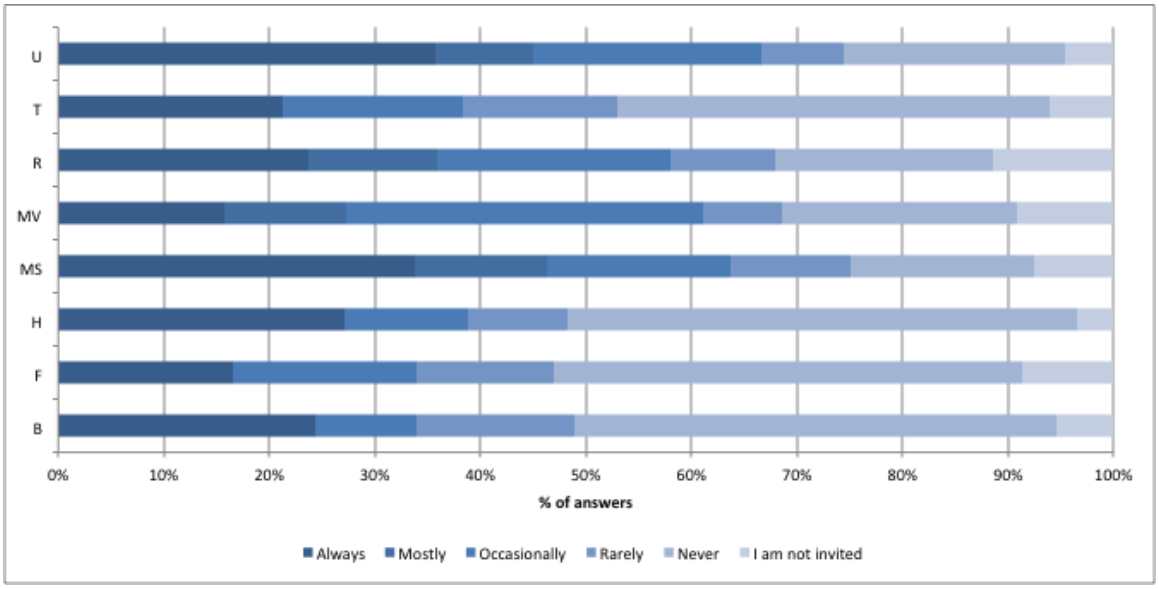


Figure 12. Participation to meetings for public consultations in 8 local community islands in North Ari atoll (B: Bodufolhudhoo; F: Feridhoo, H: Himandhoo, MS: Maalhos, MV: Mathiveri, R: Rasdhoo, T: Thoddho, U: Ukulhas) (n=970).

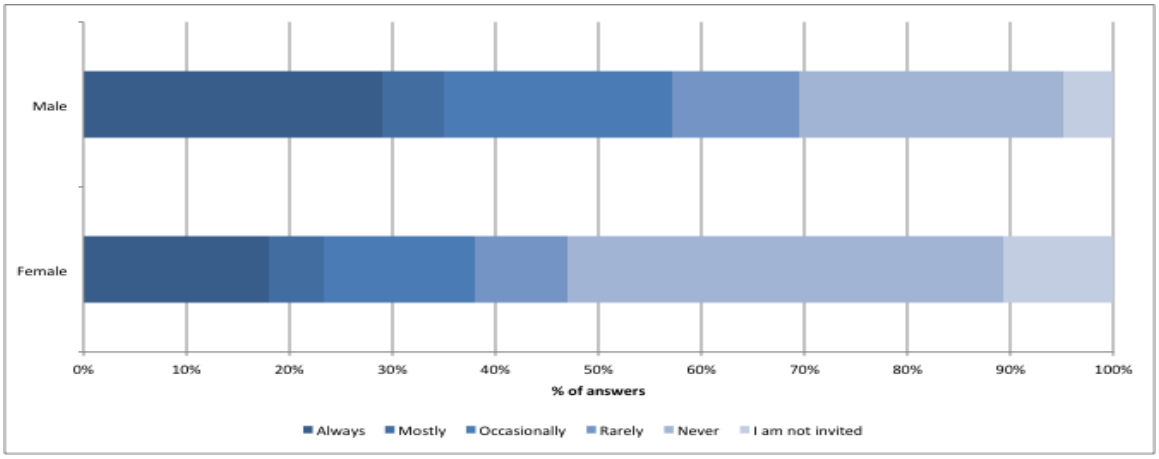


Figure 13. Participation of men and women to meetings for public consultations in 8 local community islands in North Ari atoll (n=902).

5.3.2 Perception of government role in marine conservation

When asked about conservation measures taken by government to protect the marine environment, a large majority of respondents declared to be very little (42%, n=405) or not at all aware (37%, n=306) of those measures; nevertheless, 87% of the respondents thought that those measures were very important (n=657). Furthermore, 87% of the respondents mentioned that it was very important to have a strategy in place to regulate all activities related to natural resource use (n=829). The reasons mentioned for the need of such a strategy were grouped into broader categories and the most quoted were: 1) To act as guidelines on how to improve use, monitoring and management of natural resources (29%, n=239), 2) To better protect and conserve natural resources (28%, n=229), and 3) For a better share of benefits from natural resources to all community members (12%, n=103) (Table 9).

Table 9. Main reasons suggested by respondents as to why a strategy to conserve natural resources would be important (n=829)

	Direct Use	Indirect Use	No Use	Total
A strategy is important if coming from government but needs to be enforced	4 (2%)	3 (3%)	11 (2%)	18 (2%)
For a better share of benefits from natural resources to all community members	23 (11%)	15 (13%)	65 (13%)	103 (12%)
To act as guidelines on how to improve use, monitoring and management of natural resources	65 (32%)	33 (29%)	141 (28%)	239 (29%)
To benefit tourism	2 (1%)	1 (1%)	11 (2%)	14 (2%)
To better protect and conserve natural resources (habitats, species and ecosystems)	61 (30%)	29 (25%)	139 (27%)	229 (28%)
To increase awareness of people	2 (1%)	3 (3%)	3 (1%)	8 (1%)
To insure that natural resources are maintained and/or increased for present and future generations	18 (9%)	14 (12%)	45 (9%)	77 (9%)
To prevent destructive activities that could damage the reefs and other natural resources	12 (6%)	5 (4%)	41 (8%)	58 (7%)
To reduce conflicts among resource users and determine a zoning plan	14 (7%)	9 (8%)	32 (6%)	55 (7%)
It would be difficult for fishermen to follow rules	4 (2%)	1 (1%)	3 (1%)	8 (1%)
Other	1 (>1%)	2 (2%)	17 (3%)	20 (2%)
Total	**206**	**115**	**508**	829

5.3.3 Attitudes towards regulations and policies

Most respondents strongly agreed on 1) establishing no-take areas to protect coral reefs and fish stocks (mean=4.38±0.03, n=936), 2) on establishing a proper waste management center (mean=4.85±0.02, n=925), 3) on demarking zones around the islands for specific activities (mean=4.58±0.03, n=921). Finally, most respondents strongly agreed with supporting management strategies (mean=4.81±0.02, n=902) and mentioned that they would comply with regulations if there were any in place (mean=8.98±0.07, n=967; values greater than 8 indicate very strong compliance). While general perceptions and attitudes were similar, some statistically significant differences were found among different groups of users, with direct users generally being less convinced by management measures (Table 10).

Table 10. Attitudes and perceptions of marine conservation policies of three groups of resource users in 8 local community islands in North Ari atoll (p>ChiSq refers to the results of Pearson's Chi Square test for association). * indicates a significant difference among users groups.

	Direct Use	Indirect Use	No Use	p >ChiSq
Establishing no-take zones to protect coral reef and fish stocks	4.11±0.07 (n=243)	4.20±0.10 (n=131)	4.53±0.05 (n=562)	0.0002*
Establishing a proper management center first	4.76±0.03 (n=240)	4.83±0.05 (n=128)	4.89±0.03 (n=557)	0.4811
Demarking zones around the island for specific activities	4.29±0.07 (n=238)	4.52±0.09 (n=128)	4.72±0.04 (n=555)	0.0012*
Support management strategies aimed at protecting the marine resources around the area	4.73±0.04 (n=237)	4.85±0.06 (n=125)	4.84±0.03 (n=540)	0.3994
Rate your compliance if there were restrictions and regulations around the area that you use now	8.48±0.14 (n=248)	9.23±0.20 (n=131)	9.13±0.09 (n=588)	0.0107*

In addition to complex marine ecosystems, Maldives also has diverse terrestrial ecosystems. © Farah Ahmad

5.4 Adaptive capacity

Among people being employed at the time of the survey, only19% of the respondents had a second occupation (n=210), and 38% did not know about any possible alternative job (n=207). However the remaining 62% of respondents (n=293) cited jobs related to tourism (17%, n=94) or fishery (15%, n=81) as possible alternative occupations (Table 11). Women cited most frequently: starting own business (tailoring, sewing, preparing food) (25%, n=15), administrative job/government (11%, n=7), traditional activity (thatching) (11%, n=7) and they said to be willing to take any kind of job. Men cited most frequently: jobs related to tourism (32%, n=94), jobs related to fishery (27%, 81) or agriculture/farming (12%, n=34).

Table 11. Main alternative occupations cited by respondents during social surveys in North Ari atoll (n=55)

	No. of answers (%)
Admin/Government	16 (3%)
Agriculture/Farming	39 (7%)
Carpentry/Engineering/Construction	30 (5%)
Related to exploitation of terrestrial natural resources (coconut leaves)	8 (1%)
Related to fishing	81 (15%)
Related to tourism	94 (17%)
Start own business	36 (6%)
Teaching/Education	10 (2%)
Will accept to do anything	14 (3%)
Other	15 (3%)
No job/Doesn't know	207 (38%)
Total	550

Table 12. Main alternative occupations cited by fishers during social surveys in North Ari atoll (n=32)

	No. of answers (%)
Agriculture and thatching	1 (3%)
Carpentry/Engineering/Construction	9 (28%)
Related to fishing	6 (19%)
Related to tourism	8 (25%)
Other	8 (25%)

When asked about the importance of being around the sea, respondents somewhat disagreed with the statement (mean=2.92±0.06, n=820). Respondents were generally confident that they could be able to find a job elsewhere if needed (mean=4.26±0.04, n=751) and they felt they were more likely to adapt to financial changes than most of their friends (mean=4.19±0.04, n=749).

Most respondents disagreed with the statement that they wouldn't be able to find any other job (mean=2.38±0.06, n=736), and they seemed to be very keen in learning new skills in a different field (mean=4.36±0.04, n=803). There were statistically significant differences on adaptive capacity skills among different groups of users (Table 13) and between men and women (Table 14).

Table 13. Adaptive capacity of three groups of resource users in 8 local community island in North Ari atoll (p>ChiSq refers to the results of Pearson's Chi Square test for association). * indicates a significant difference among users groups.

	Direct Use	Indirect Use	No Use	p >ChiSq
Financially it is important for me to be around the sea	3.20±0.12 (n=228)	3.18±0.16 (n=126)	2.70±0.07 (n=466)	0.0004*
I am confident that I will be able to get work elsewhere if I needed to	4.26±0.09 (n=226)	4.67±0.07 (n=126)	4.14±0.06 (n=399)	>0.0001*
I am more likely to adapt to financial change then my friends	4.33±0.08 (n=221)	4.48±0.09 (n=126)	4.03±0.06 (402)	>0.0001*
This is the only job I know, I won't be able to find anything easier than this	2.66±0.12 (n=223)	2.02±0.14 (n=126)	2.33±0.08 (387)	0.0003*
I am willing to learn new skills outside my industry	4.36±0.09 (n=225)	4.50±0.11 (n=126)	4.33±0.06 (452)	0.0278*

Table 14. Adaptive capacity of men and women in 8 local community island in North Ari atoll (p>ChiSq refers to the results of Pearson's Chi Square test for association). * indicates a significant difference among users groups.

	Women	Men	p >ChiSq
Financially it is important for me to be around the sea	2.41±0.09 (n=281)	3.19±0.08 (n=528)	0.0004*
I am confident that I will be able to get work elsewhere if I needed to	3.93±0.08 (n=230)	4.41±0.05 (n=513)	>0.0001*
I am more likely to adapt to financial change then my friends	3.79±0.08 (n=231)	4.48±0.09 (n=511)	>0.0001*
This is the only job I know, I won't be able to find anything easier than this	2.53±0.10 (n=222)	2.29±0.07 (n=507)	0.0064*
I am willing to learn new skills outside my industry	4.26±0.07 (n=225)	4.41±0.06 (n=526)	0.0003*

5.5 Adaptive capacity

When assigned scores for resource dependence, institutional perception, adaptive capacity and finally social resilience, Maalhos, Mathiveri and Thodhoo appeared to be the most resilient islands, while Bodufoludhoo, Himadhoo and Ukulas appeared to be the least resilient ones. However all the islands scored more than 200 over 400 points, indicating that social resilience in North Ari atoll is generally high (Table 15) (see annex 2 for a short summary of results per island).

Table 15. Summary of values of social resilience and related parameters (resource dependence, institutional perception, adaptive capacity, demographics) at 8 local community islands in North Ari.

Community islands (B: Bodufolhudhoo; F: Feridhoo, H: Himandhoo, MS: Maalhos, MV: Mathiveri, R: Rasdhoo, T: Thoddho, U: Ukulhas) have been ranked from the most resilient (1) to the least resilient (8).

Island	N	Resource dependence ± SD	Institutional perception ± SD	Adaptive capacity ± SD	Demographic ± SD	Resilience ± SD	Rank
B	57	70.1±13.6	79.9±12.9	74.6±12.8	53.8±13.5	278.3±34.0	6
F	64	70.2±12.6	80.2±8.7	74.5±11.3	54.4±15.6	279.3±30.4	5
H	46	60.2±14.5	81.3±11.2	73.8±11.1	55.8±14.4	271.1±29.4	7
MS	42	69.4±14.2	86.3±10.6	82.3±11.3	52.6±14.9	290.7±29.3	1
MV	66	62.3±15.2	83.5±9.7	80.7±10.0	58.1±10.4	284.5±22.5	2
R	86	59.5±15.1	85.8±9.4	75.5±10.3	61.7±13.8	282.5±26.1	4
T	95	65.0±15.1	82.8±9.2	80.5±11.5	55.8±13.2	284.2±26.6	3
U	85	51.8±16.6	82.1±15.1	72.5±13.1	57.5±14.4	264.0±38.9	8
Total	541	62.8±15.9	82.8±11.2	76.7±11.9	56.7±13.9	279.0±30.9	550

Using general linear models, it was found that the island, the sex of respondents and the type of use had an effect on the resource dependence (Table 16). Rasdhoo, Ukulhas and Himandhoo were the most resource dependent islands. Men appeared to be more dependent on natural resources than women, while those using natural resources for their income were obviously more dependent than those not using resources for income.

Table 16. Results of the general linear model testing the combined effects of demographics variables (age, sex, level of education, salary), islands, type of use (direct, indirect and no use) and related sub-categories on resource dependence score. Only significant variables have been included in the final model (***p<0.001, **p<0.01, *p<0.05).

Factor	Categories	Estimate	Std. Error	t-value	Pr (>|t|)	Significance
	(Intercept)	54.22	1.42	38.27	<.0001	***
Islands	Feridhoo	0.37	1.47	0.25	0.7997	
	Himandhoo	-3.40	1.61	-2.11	0.0355	*
	Maalhos	-1.25	1.64	-0.76	0.4489	
	Mathiveri	0.57	1.49	0.39	0.7000	
	Rasdhoo	-6.68	1.40	-4.77	<.0001	***
	Thoddhoo	4.00	1.38	2.90	0.0039	**
	Ukulhas	-5.71	1.44	-3.95	0.0001	***
Sex	Male	-7.72	0.89	-8.67	<.0001	***
Use	Indirect	13.41	1.04	12.92	<.0001	***
	None	27.04	0.87	30.93	<.0001	***

The salary level had a negative effect on the institutional perception: people with lower or no salary had a lower institutional perception (i.e. they seemed less willing to comply with regulations) (Table 17). Similarly, the type of use had an effect on institutional perception, with people not using resources showing higher level of compliance with regulations (or willingness to comply) (Table 17).

Table 17. Results of the general linear model testing the combined effects of demographics variables (age, sex, level of education, salary), islands, type of use (direct, indirect and no use) and related sub-categories on institutional perception score. Only significant variables have been included in the final model (***p<0.001, **p<0.01, *p<0.05).

Factor	Categories	Estimate	Std. Error	t-value	Pr (>|t|)	Significance
	(Intercept)	81.49	1.21	67.07	<.0001	***
Salary	No salary	-10.66	1.86	-5.73	<.0001	***
	Low	-4.31	1.42	-3.04	0.0025	**
	Medium	-1.04	1.20	-0.87	0.3876	
	Very high	0.03	2.07	0.02	0.9874	
Use	Indirect	1.72	1.30	1.32	0.1866	
	None	6.61	1.09	6.07	<.0001	***

Adaptive capacity differed significantly according to the island, sex, job and age of the respondents (Table 18): Maalhos island had a significantly higher adaptive capacity, while men seemed generally better equipped to adapt to changes. Older people or people with a low or no salary seemed less able to cope with change. Fishermen seemed also to be the group least able to adapt.

Finally, differences in resilience were best explained by the island, the type of job and demographics characteristics like salary, level of education and age (Table 19): Himandhoo, Rasdhoo and Ukulhas resulted to be the least resilient islands. Older people, or people with lower education level and lower salary rates seemed to be the most vulnerable (i.e. least resilient) groups. Fishermen and those working in the diving industry appeared to be the least resilient groups. Sex of respondents had no significant effect on resilience.

Table 18. Results of the general linear model testing the combined effects of demographics variables (age, sex, level of education, salary), islands, type of use (direct, indirect and no use) and related sub-categories on adaptive capacity score. Only significant variables have been included in the final model (***p<0.001, **p<0.01, *p<0.05).

Factor	Categories	Estimate	Std. Error	t-value	Pr (>|t|)	Significance
	(Intercept)	87.18	2.27	38.33	<.0001	***
Islands	Feridhoo	-0.67	1.86	-0.36	0.7199	
	Himandhoo	-2.35	2.06	-1.14	0.2539	
	Maalhos	5.29	2.17	2.44	0.0149	*
	Mathiveri	1.83	1.93	0.95	0.3454	
	Rasdhoo	-2.39	1.86	-1.29	0.1988	
	Thoddhoo	2.59	1.97	1.31	0.1900	
	Ukulhas	-3.20	1.92	-1.66	0.0969	
Sex	Male	3.30	1.18	2.81	0.0052	**
Salary	No salary	-9.49	3.33	-2.85	0.0045	**
	Low	-0.09	1.43	-0.06	0.9504	
	Medium	-1.20	1.18	-1.02	0.3097	
	Very high	-1.45	2.03	-0.72	0.4737	
Type of job	Fishery	-6.52	1.54	-4.25	<.0001	***
	Agriculture	-0.36	2.26	-0.16	0.8752	
	Diving/Snorkeling	-0.38	10.33	-0.04	0.9707	

Factor	Categories	Estimate	Std. Error	t-value	Pr (>|t|)	Significance
	Selling resources	-8.10	4.78	-1.69	0.0908	
	Construction	1.31	1.97	0.67	0.5063	
	Tourism	-3.85	1.54	-2.50	0.0127	*
	Business	-4.76	2.13	-2.23	0.0260	*
	Education	3.99	2.43	1.64	0.1009	
	Health	4.05	2.89	1.40	0.1620	
	Other	-5.24	1.86	-2.81	0.0051	**
	Unemployed/Retired	-6.11	3.18	-1.92	0.0549	
Age		-0.23	0.03	-6.93	<.0001	***

Table 19. Results of the general linear model testing the combined effects of demographics variables (age, sex, level of education, salary), islands, type of use (direct, indirect and no use) and related sub-categories on social resilience score. Only significant variables have been included in the final model (***p<0.001, **p<0.01, *p<0.05).

Factor	Categories	Estimate	Std. Error	t-value	Pr (>|t|)	Significance
	(Intercept)	313.60	6.28	49.94	<.0001	***
Islands	Feridhoo	0.45	3.19	0.14	0.8878	
	Himandhoo	-4.28	3.54	-1.21	0.2264	
	Maalhos	10.10	3.74	2.70	0.0071	**
	Mathiveri	9.30	3.34	2.78	0.0056	**
	Rasdhoo	-1.88	3.17	-0.59	0.5543	
	Thoddhoo	7.16	3.39	2.11	0.0353	*
	Ukulhas	-3.25	3.29	-0.99	0.3241	
Education	Primary	7.86	2.70	2.91	0.0037	**
	Secondary	14.57	3.17	4.60	<.0001	***
	University	21.85	3.90	5.60	<.0001	***
	High	21.90	6.05	3.62	0.0003	***
Salary	No salary	-26.10	5.68	-4.60	<.0001	***
	Low	-13.70	2.46	-5.58	<.0001	***
	Medium	-8.45	2.03	-4.17	<.0001	***
	Very high	3.80	3.50	1.09	0.2778	
Type of job	Fishery	-45.04	2.69	-16.72	<.0001	***
	Agriculture	-28.87	3.96	-7.29	0.0000	***
	Diving/Snorkeling	-26.32	17.68	-1.49	0.1371	
	Selling resources	-33.81	8.20	-4.12	<.0001	***
	Construction	-23.44	3.40	-6.90	<.0001	***
	Tourism	-24.31	2.62	-9.27	<.0001	***
	Business	-9.95	3.69	-2.70	0.0072	**
	Education	5.44	4.30	1.27	0.2061	
	Health	6.61	4.95	1.33	0.1828	
	Other	-5.46	3.18	-1.71	0.0873	
	Unemployed/Retired	-13.46	5.45	-2.47	0.0138	*
Age	Age	-0.54	0.09	-6.08	<.0001	***

5.6 Resource use maps

Fishing activities (commercial, recreational and for subsistence) were assigned a wide area and covered most inhabited and uninhabited islands of North Ari atoll. There was a strong overlap among the areas used for the three types of fishery, artisanal fishery occurring over the largest area (Figure 14, 15 and 16). No fishery hotspot (i.e. indicated by more than 50% of the respondents) was identified. Some potential conflict areas were identified where artisanal fishery seemed to occur close to resort islands. Important fish spawning aggregation sites were found around Mathiveri and Ukulhas (Figure 17). Areas used for fishing overlapped with spawning sites, with highest density fishing areas being very close or overlapping spawning sites. Finally, bait-fishery occurred at low densities mostly in shallow waters or lagoons (Figure 18) and overlapped with fishing areas indicated by commercial and recreational fishermen. A significant spot for bait-fishery was identified in the northern part of the atoll (Figure 18).

The areas used for recreational activities were usually restricted to or very close to the main islands and their lagoons, with highest densities in the area between Mathiveri and Bodufolhudhoo, and around Rasdhoo (Figure 19). Environmentally sensitive areas and protected areas did not seem to be used much, except around Rasdhoo Atoll (Figure 19).

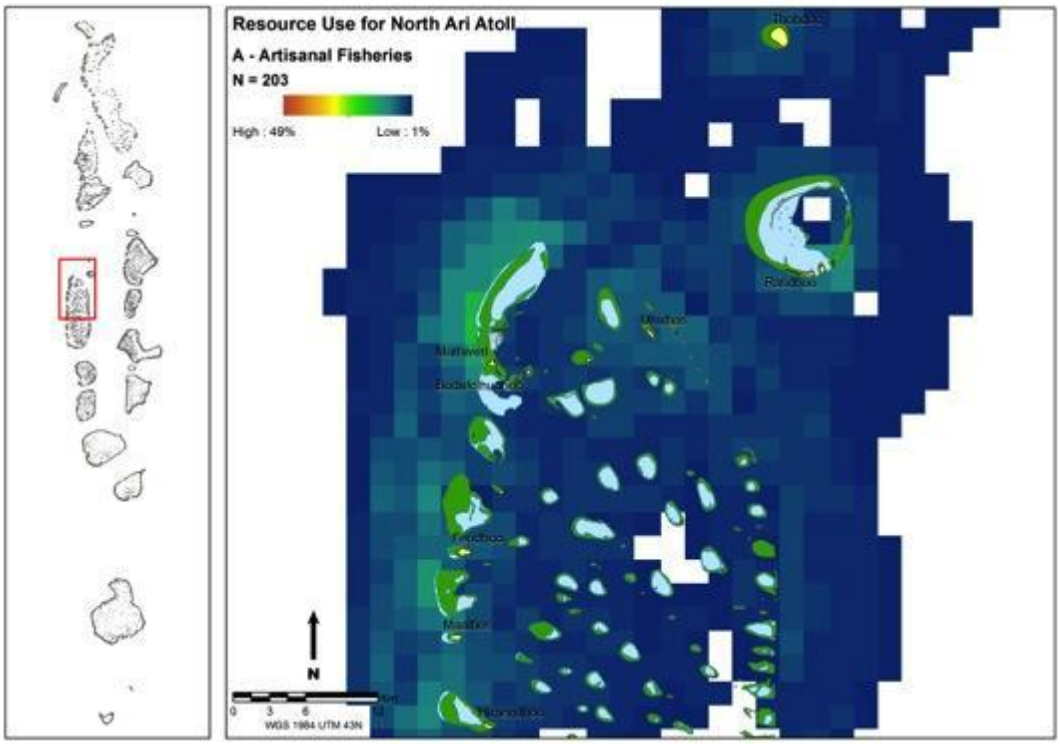


Figure 14. Areas used for commercial (artisanal) fishery in North Ari.

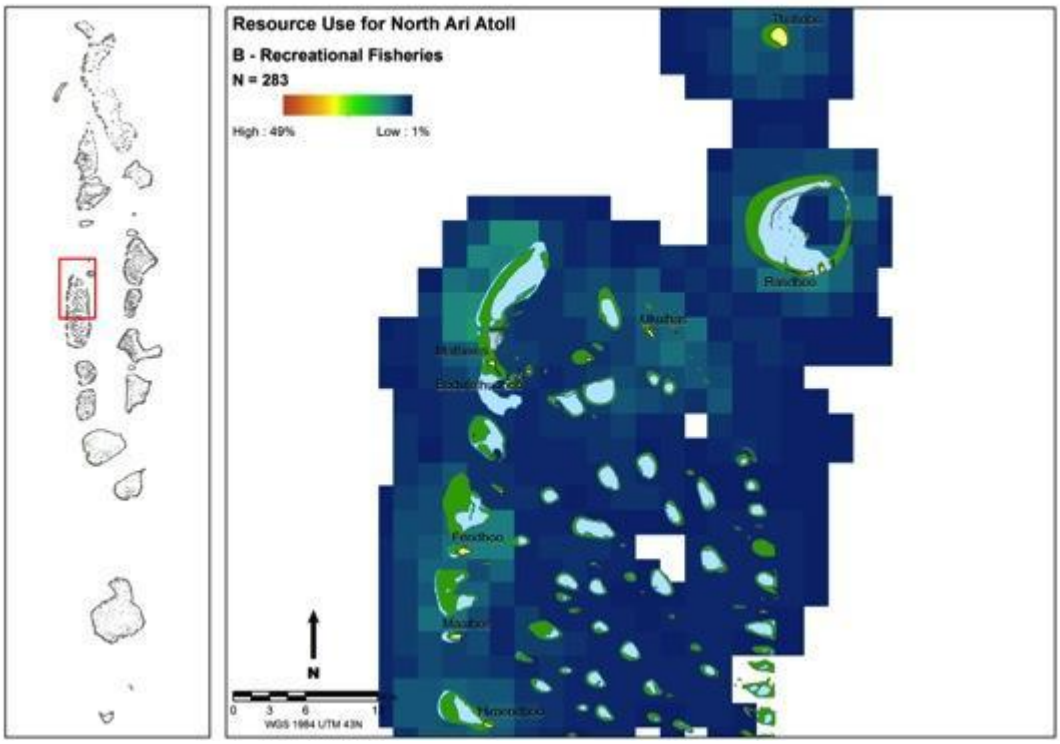


Figure 15. Areas used for recreational fishery in North Ari.

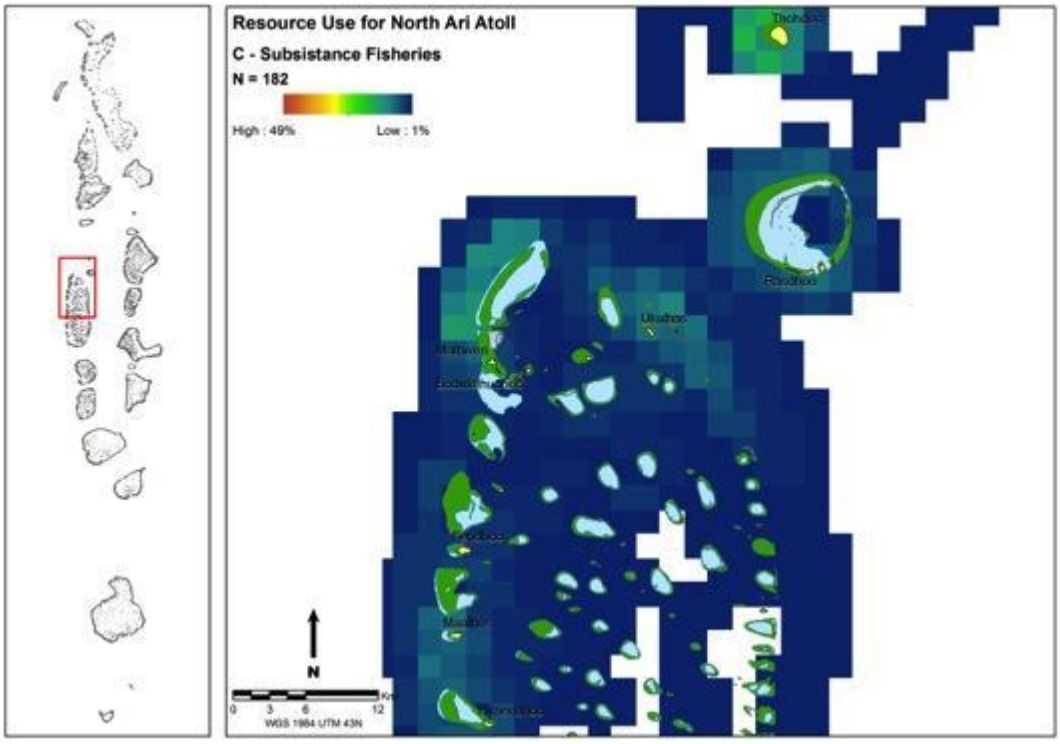


Figure 16. Areas used for subsistence fishery in North Ari.

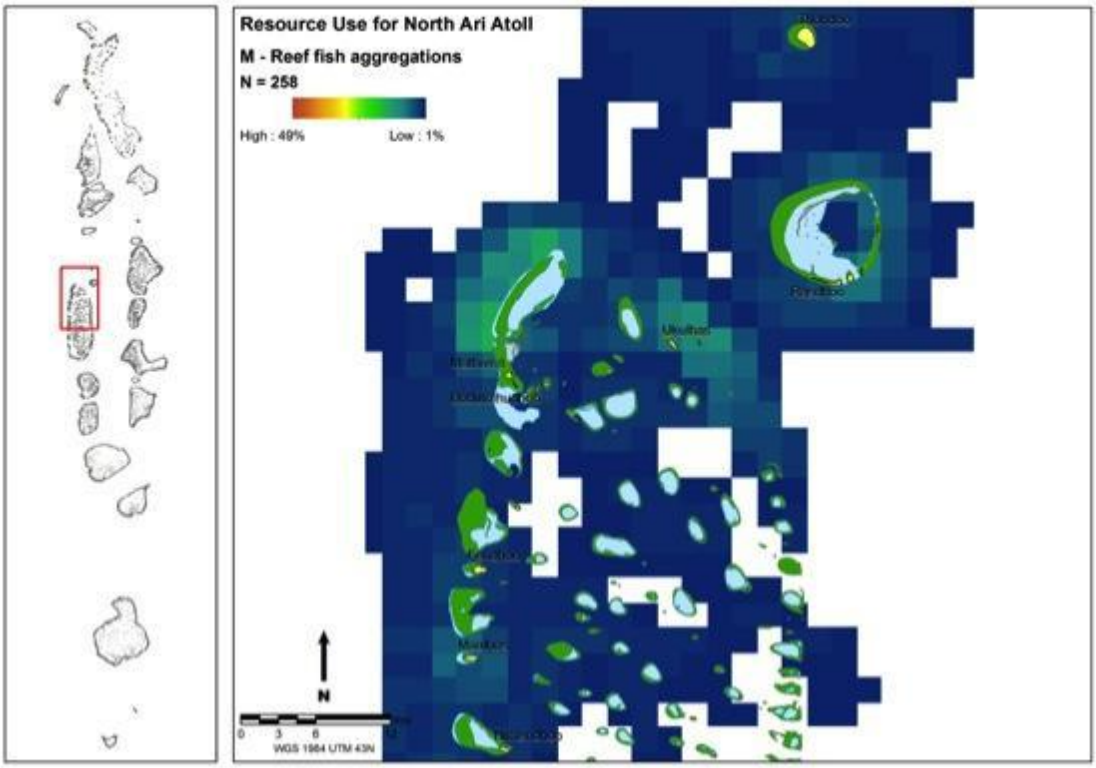


Figure 17. Fish spawning aggregation sites in North Ari.

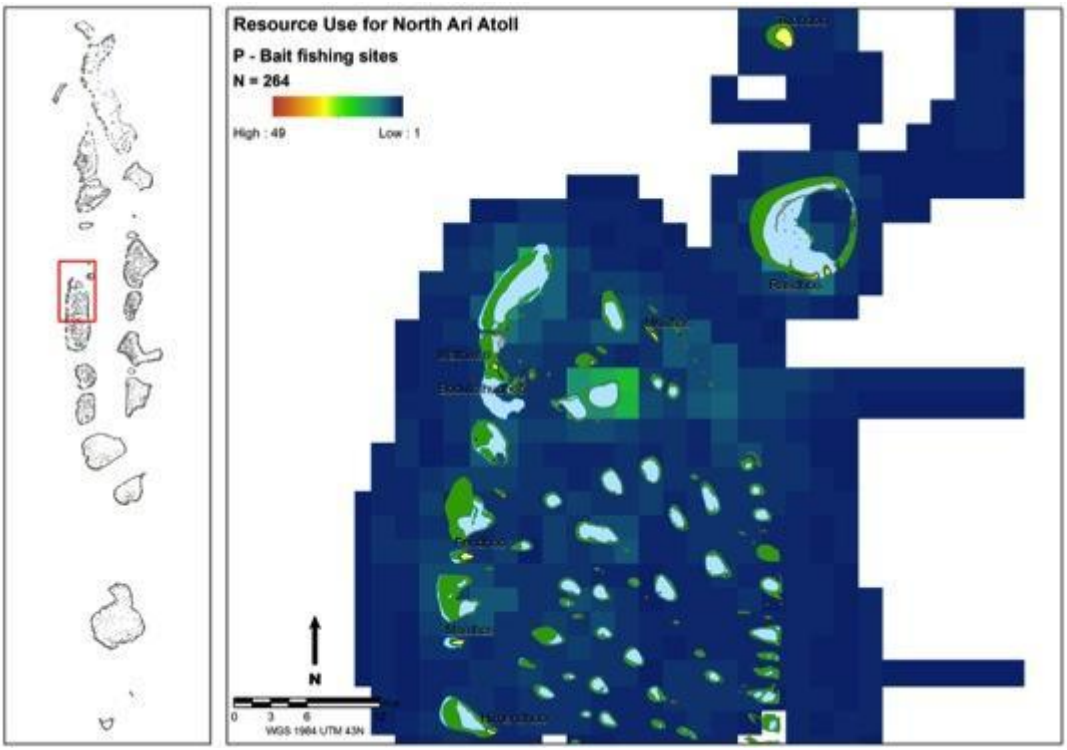


Figure 18. Areas used for bait-fishery in North Ari.

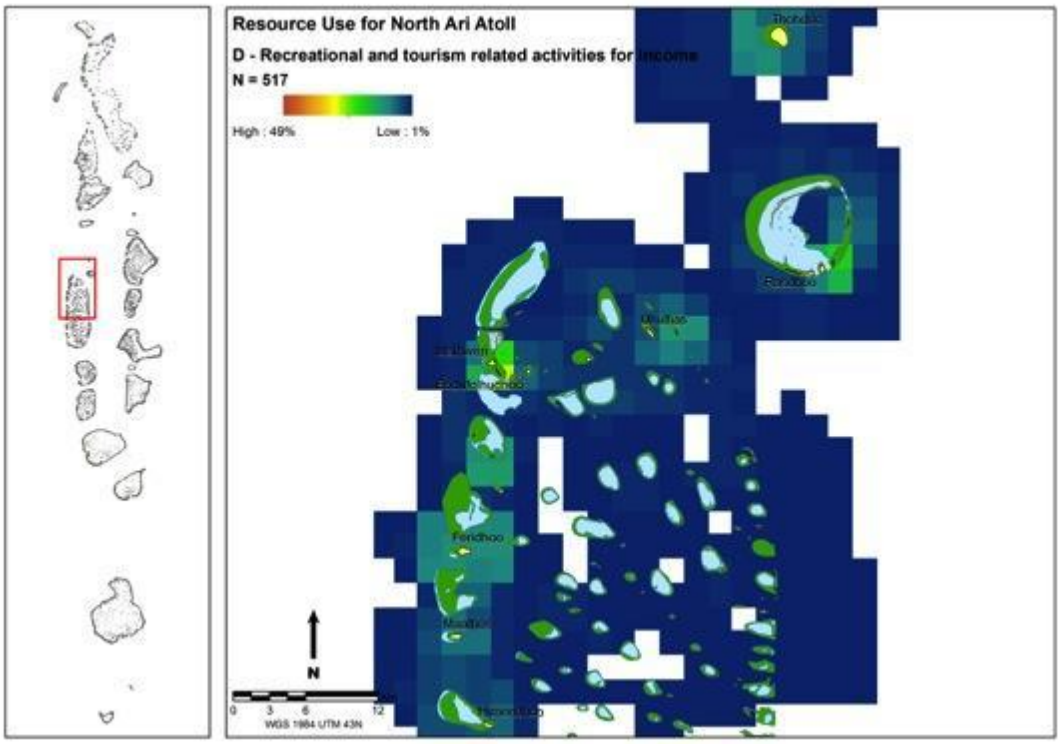


Figure 19. Areas used for recreational activities in North Ari.

6. Discussion

6.1 Social resilience

A RBM framework takes into consideration how resources are used, the level of dependence of users and then proposes actions that will increase socio-ecological resilience of the system through a series of adaptive measures. If governmental institutions develop such a management framework, it is fundamental that the local perception of policies and legislation is positive, otherwise all proposed changes would not be effective (Marshall et al., 2009). In this study, we focused on 8 local community islands in North Ari and we attempted to understand what a RBM framework should include to increase their resilience to change. Our sample size of approx. 25% of the resident population should be representative of different stakeholder groups on each island and included both men and women living normally on their islands.

6.1.1 Resource use and dependence

This study showed a relatively low dependence on marine resources for income with approx. 25% of the respondents directly or indirectly depending on the sea (Table 3); however dependence for food and other traditional uses was high (Figure 2).

Most Maldivians rely on fish as their main source of proteins (Jameel, 2007); while consumption of reef fish was generally thought to be low in comparison with tuna (Anderson & Hafiz, 1995; Spalding et al., 2001), this study revealed that reef fish consumption is more frequent than expected. Reef fish is eaten because of its taste and is considered leisure. While the dependence on fish as main source of protein cannot be overstated, diverse species can be consumed and there is a certain flexibility in the fish species that are consumed. The use of marine resources is also high, with about 92% of respondents that declared to use marine resources for subsistence, recreational or professional purposes, with fishing, snorkeling and diving being practiced frequently and/or occasionally.

Extractive activities like reef fish and baitfish fisheries are seen as destructive and there is a general consensus that as a consequence of those activities, fish populations are decreasing. By admitting that certain fishing methods and the increased consumption of certain species might affect fish stocks and coral reef ecosystems in general, most fishermen recognized having an active role in the protection or destruction of natural resources, and this has a direct effect on their income, which has been decreasing over the past 10 years. Fishermen and other direct resource users were more concerned about the future, in particular over depletion of natural resources and changes in monsoon and currents (which directly affect resource distribution and abundance).

Resource dependence varied among islands in North Ari, predominantly due to the number of direct users: islands like Rasdhoo, Himandhoo, and Ukulhas had higher proportions of fishermen, while in Thoddhoo we found a great number of farmers. Although this report does not focus on terrestrial resources, results showed that agriculture/farming and the use of coconut leaves are important in North Ari atoll, specifically on certain islands like Thoddhoo. More focused surveys should be carried out to better understand the importance of such resources for the local economy, but also to understand the impact of salt water infiltration on farming.

6.1.2 Perception of marine conservation policies

This study showed that people with a higher salary and lower dependence on natural resources have a better perception of conservation policies. Historical measures have been taken on most islands to protect the environment, the most visible ones being the construction of solid waste centers and seawalls to reduce coastline erosion. Nevertheless, only 1/5 of the respondents were aware of those

measures. Similarly very few people were aware of initiatives taken by local community councils to preserve natural resources. Awareness seems to be generally weak: not only people feel like they do not know about ongoing activities, but even when awareness activities are run, these do not seem to be very effective on the long term. It is suggested to look more in detail into past awareness events organized in North Ari to better understand which approaches could or could not work on the long term.

The general understanding that marine resources are being depleted probably induced a positive attitude towards the implementation of a strategy to conserve marine resources. However, conservation initiatives shall be taken at government level: generally, individuals and communities feel like they do not have the will or the power to implement rules. Regulations that are coming from governmental institutions are considered fundamental (i.e. people will abide to regulations and laws coming from the Government of Maldives); however, to insure successful application of new rules and compliance, 1) all initiatives need to be communicated clearly to local communities that lamented a lack of knowledge (Marshall, 2007); and 2) a system to enforce those regulations should also exist.

6.1.3 Adaptive capacity

At individual level, adaptive capacity was found to be generally high: the residents of local community islands in North Ari are on average young (on average below 40 years old) and have usually an income that is higher than the minimum wage in Maldives (2,600.00 MVR for government employees[2]); however adaptive capacity was correlated with salary levels and the type of job of respondents, with people with lower or no salary being less able to cope with change. While only 21% already had a second (or even third occupation), most respondents showed a strong interest in learning new professional skills and were positive about being able to find a different occupation if needed. Some had already thought about possible alternative occupations, mostly in the tourism or fishing industry. Furthermore, the lack of attachment to the sea, particularly from those not using resources for income, can be seen as positive in terms of adaptability because it implies that people will be willing to move to another place to find better opportunities (Green, 1999; Hidalgo and Hernandez, 2001; Twigger-Ross and Uzzell, 1996). However, such a lack of connection with the environment also means that people will not be willing to take action to reduce threats to resources they do not feel ownership for (Bolton, 1992; Flora, 1998; Gustafson, 2001; Stedman, 1999). Even fishermen, a notoriously sensitive group to climate change, seem to have a discrete adaptive capacity when compared to other countries where fishermen are highly specialized on one type of fishery or one resource (e.g. in the Andavoaka community, Madagascar, octopus fishery is practiced by 85% of the households; Marshall et al., 2009). In North Ari, a variety of target species are caught for commercial, recreational and subsistence purposes and the most commonly used fishing method is hooks and lines, which is a low impact fishing technique that allows for species specific catches.

At community level however, adaptive capacity might be much lower mainly due to the fact that there is a lack of diversity of income sources: approx. 29% of our respondents were either retired or had no occupation, so likely depending on other family members to provide an income for the household. Furthermore, on small islands, like most local community islands in the Maldives where the population is less than 1000 inhabitants (67% of all islands in Maldives; MPND, 2006), job opportunities are usually related to: fishery, tourism, and to a much lesser extent education/teaching and administration. Tourism and fishery are also the two most frequently cited alternatives in case of need to find a different job. The lack of job alternatives is typical of small island nations where the economy is generally limited to a few specialized activities (fishery and tourism in this case), and can only be resolved with the creation of new job opportunities (Briguglio, 2003).

[2] http://www.anyworkanywhere.com/jcf_mv.html

6.2 The role of women

The effects of climate change are perceived differently by men and women, according to the roles they play in the society (Denton, 2002). This study confirmed this theory, and revealed that women and men in North Ari play different roles in the society that is reflected in the way they interact and understand natural resources. Women that took part to this survey were mostly housewives with little or no income that did not relate with natural resources, except for recreational use (i.e. picnics) and did not swim, snorkel or dive (activities reserved usually to tourists). Even fishing for subsistence was not common among them (only one woman stated she was a fisher). In this study, women were found less dependent on resources but also less able to adapt to change, mostly because of lack of knowledge or skills (Table 16). However, women in North Ari expressed an increasing interest in learning new skills to become more independent financially. Previous studies showed that in cases of extreme events, women would be able of changing their role easier than most men (Arora-Jonasson, 2011). Finally, most women expressed that they took part to meetings at community level, but did not usually speak up because they felt they 'did not know' enough about natural resources to express an opinion (all women gave at least one 'I don't know' answer). While this can be simply a social norm, it can also be the consequence of a different access to education that is common in rural areas in other countries (Arora-Jonsson, 2011). Focused group discussions targeting women would provide a better understanding of how women interact with natural resources and how they would cope with change in resource access or availability.

Women in North Ari Atoll are highly involved in handicraft production. © Adam Abdulla

6.3 Limits of this study

When interpreting results of our study, we need to highlight some methodological limitations. Surveys were carried out during daytime approx. from 8 am to 8 pm. Some island residents are known to work in resorts and they commute daily (leaving early in the morning and coming back in the evening); similarly, tuna fishermen usually leave for 4-5 days and only come back to their resident islands on Thursday evening to leave again on Friday evening. Therefore the likelihood of meeting these 2 sectors of the population was lower compared to other sectors that spend most of their time on the island. This could have had an impact on the number of people involved in direct or indirect use of resources. While some surveys were run at 'unusual' times (i.e. in the evening and on Fridays), it is suggested to conduct further studies at times and days were all possible stakeholder groups could be equally met. Furthermore, while all the interviewers underwent the same training on how to approach people and how to ask questions, misinterpretation of questions is always a possibility. To reduce this risk, we added some control questions (the same question was asked in different ways at different moments of the survey); however in certain cases, inconsistencies in control questions were found and therefore the answers were eliminated. Finally, as the survey was carried out with governmental approval, people could have felt the need to give answers that would please government (e.g. the compliance rate to possible future regulations was very high) or would send a clear message on what steps to or not to take (e.g. 'If there are restricted areas, the situation would be very difficult for the fishermen'). In order to make people feel more confident, previous to each interview, the interviewers explained clearly the purpose of the study and the role and work of IUCN in the Maldives.

7. Conclusion and recommendations

The Maldives relies heavily on marine ecosystem goods and services, directly (e.g. provision of food, source of income) and indirectly (e.g. shoreline protection, storm buffering) (Emerton et al., 2009).

Coral reefs around North Ari were found to be highly vulnerable to increased water temperatures, and natural hazards like cyclonic winds and floods resulting from natural disasters like tsunamis (UNEP, 2005; UNDP, 2006). Therefore, the exposure (i.e. the changes likely to affect social-ecological systems; Marshall et al., 2009b) of the atoll to the effects of climate change is moderately high. However this study showed that as a result of positive attitude towards marine conservation policies, and high adaptive capacity, the overall social resilience in North Ari could potentially be high (Table 13).

Implementing a new governance method can be challenging, especially if it includes measures to reduce or limit traditional use of natural resources (Costanza et al., 2000; Lambin, 2005). Therefore, it is important that the new system considers the adaptability of local community residents (Dietz et al., 2003; Folke et al., 2005) but also their aspirations (Marshall and Marshall, 2007). Residents of North Ari atoll seem to be able to adapt to new situations, and are willing to accept new regulations, however communication and direct participation will be fundamental for compliance.

In order to operationalize a RBM framework in North Ari, it is essential to incorporate into decision-making and managing process those factors that have been found to increase or decrease social resilience (Adger, 2000; Brunckhorst, 2002). Based on results from this study, the following recommendations are suggested:

1. While a general RBM framework can be discussed for North Ari atoll, a successful implementation will need to take into account the differences among the 8 community islands. North Ari islands differ significantly in terms of employment, job opportunities and demographics, as well as communities' perception on the use of natural resources, therefore adapted conservation measures and communication strategies will need to be developed.

2. When trying to establish a governance framework aimed at increasing ecological sustainability, while minimizing impacts on people, it is important to understand who is going to be affected by new policies and regulations. Resilience is strictly related to demographic traits like age, level of education and salary: older people or people with lower education or salary will have less flexibility to learn, cope and adapt to change (Sutton and Robin, 2012).

3. Resource dependence is stronger in islands with less variety in terms of job alternatives. Some islands were found to be 'less dependent' than others because they offered a greater variety of opportunities: for instance, in islands like Maalhos or Mathiveri, people are involved in different types of jobs and are more prone to change as they have already experienced positive effects on their livelihoods (i.e. higher salaries).

4. Participatory marine spatial planning meetings should be organized in collaboration with multiple stakeholders to reduce conflict generated from multiple uses of the same area.

5. Measures to protect marine resources should be communicated widely to community members, possibly using methods different from those used in the past, to make sure that the awareness is effective. Decision makers should meet with community members before implementing new regulations or new protected areas. Perspectives and concerns of community members should be incorporated in the decision-making processes to minimize conflicts. Outputs of consultations should be included in future plans. Conflicts among resource users should be minimized ensuring that all sectors will share benefits from an improved management of natural

resources. Particularly sensitive groups like fishermen have a general feeling that most regulations will target their activities and decrease their income. There is a need to communicate conservation strategies in a positive way (i.e. restricted areas created to increase fish productivity versus strictly no use areas).

6. Adaptive capacity is a key factor in increasing resilience: people showing interest and will to learn new skills and adapt to change will be less likely at risk of suffering from impacts from climate change. For instance this study showed that men are better equipped to learn, cope and adapt to change than women; however women showed a strong interest in learning new skills and become more independent financially, therefore there is a great opportunity in North Ari to create alternative jobs for women specifically in the sewing and thatching business. In islands like Ukulhas, where the community is significantly more active than in other islands, such programs could be successful and increase the resilience of the island.

7. Creating new jobs and opportunities on the islands, and providing capacity building, will be a key aspect of a RBM framework and would help diversify the sources of income and insure a better use of resources. However, the new opportunities need to meet with people aspirations and culture. For instance an island like Himandhoo will be less prone to local tourism development, however the good relationship between the island and the nearby resort could be the ground to build new business opportunities for men and women on the island (e.g. cooperative of fishermen selling fish to the resort for a fair price, women groups running a sewing or handy-craft company, etc.).

8. The connection between healthy reefs and healthy people should be communicated more broadly, not only to children through the new science curriculum textbooks but also to adults through focused discussion groups.

9. Discussions should include women as well as men, because they are the primary consumers of natural resources like fish (although they do not feel so). It is important that the environment is seen wholly, not just as a 'men' issue, women should be encouraged to take part in meetings and express their opinion, particularly in health and sanitary matters (e.g. management of waste, healthy food). In this study, women have expressed an interest in attending meetings and learning new things, so capacity building efforts should focus on helping women explore and explain their connections with the environment, not necessarily confined to the formal economy. A focus group discussion with women is recommended as a means to understand how women connect the marine environment and then to identify activities they can be involved in in order to become more economically independent.

While this study provides a general overview of social resilience in North Ari, more information is necessary at island level to better understand island specific problems and aspirations. For this reason, focused discussion groups were conducted at 4 local community islands in North Ari in May 2015 under project Regenerate and results will be used to delineate island-specific conservation strategies.

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Annex 1 - Questionnaire

Surveyor
Date
Survey Form Number
Island

Section A. Resource use and dependence

1. What is your main line of occupation? CHOOSE ONLY ONE ANSWER
2. Do you have a second job?
   ☐Yes ☐No
3. What is your second occupation?
4. What was your occupation 5 years ago? Choose only ONE answer.
5. If current occupation is different from occupation 5 years ago, why did you change your occupation?
6. How do you mainly use natural resources?
7. Did you reply 'I don't use resources'?
8. On average in a year, how would you describe the frequency of use of natural resources?
   General
   Fishing for income
   Recreational fishing
   Fishing for subsistence
   Snorkelling/Diving
   Tourism related activities
   Picnic

Sub-Section A.1: Reef fish Use

9. Do you do any kind of fishery?
   ☐Yes ☐No
10. What are the main types of gears used for reef fishing?
11. If you select 'other gears', please specify:
12. What are the most common reef fish species that you catch?
13. How do you mainly use reef fish?
    ☐For income
    ☐For consumption
14. What are the most common types of reef fish species that you eat?
15. Please describe how frequently you eat reef fish:
    ☐Never
    ☐Rarely
    ☐Occasionally
    ☐Frequently
    ☐Daily
16. Which of the following statements best describe your use of reef fish? Choose as many as apply
    ☐I eat because I like it
    ☐I eat with my friends, as leisure
    ☐I eat when tuna is not available or too expensive
    ☐It is my main or extra source of income
    ☐To provide family with fish

Sub-Section A.2: Baitfish

17. Do you do any bait fishery?
18. In your opinion, in the last 10 years bait fishery has:
19. Please give your opinion concerning the following statements:
    Using lights to catch baitfish is:
    Diving to catch baitfish is:
    The impacts on corals done by bait fishery are:

Sub-Section A.3: Perception of resource status and impact on income

20. How would you describe the reef fish abundance in the last 10 years?
21. How would you describe the reef fish price in the last 10 years?
22. Please rate the following statement:
    The number of fish in the region has decreased since i started fishing
23. What are your concerns?
24. What would you list as main threats to fish populations/fisheries in the region? Choose as many threats as you can identify.
25. If you choose other threats, please specify:
26. Over the past 5 years, how would you describe the income generated from your job?
27. Please give reasons, in your opinion, that brought to a change in the income generated from your job
28. Do you have any concern about the future of your income from this area?

Section B. Perceptions of marine conservation policies

29. Do you know of any measure that was taken historically to protect natural resources?
30. What were those measures?
31. Please rate the effectiveness of the measures you mentioned: - the measures were

Sub-Section B.1: Perception of individual role

32. Are there measures that are already taken by the locals as a community to protect fish stocks and coral reefs?
33. Please list the measures you know of
34. How involved are you in any organisation (NGO) on the island?
35. Please rate the following statements:
    Do you attend meetings that call for public consultation?
    Do you speak up at these meetings?

Sub-Section B.2: Perception of government role

36. Are you aware of any protection measure adopted by the government on natural resources?
37. Do you think these protection measures are important?
38. Do you think it is important to have a strategy to regulate activities in this area?
39. Please provide reasons for your answer

Sub-Section B.3: Attitude towards conservation measures

40. How would you rate your compliance if there were restrictions and regulations around the area that you use now? (1=no compliance, 10=full compliance)
41. In your opinion, what is the best way to manage marine resources in this area?
    Establishing no-take zones to protect coral reef and fish stocks

Establishing a proper management center first
Demarking zones around the island for specific activities
Support management strategies aimed at protecting the marine resources around the area

Section C. Adaptive capacity

42. What are the alternatives that you have thought of to secure your income in case you are not able to do what you are doing now?
43. Can you tell me how much you agree or disagree with the following statements?
    Financially it is important for me to be around the sea
    I am confident that i will be able to get work elsewhere if I needed to
    I am more likely to adapt to financial change then my friends
    This is the only job I know, I won't be able to find anything easier than this
    I am willing to learn new skills outside my industry

Section D. Demographics

44. Age
45. What is your gender?
46. Years of formal education
47. What is your birth island? People born in different atolls will be classified as 'immigrants'
48. How long have you lived on this island?
49. How much do you earn in a month?

Section E. Resource use maps

50. Where around the islands do you use? (Please show it on the map. Areas identified with corresponding Alphabet from the list below)
    ☐ A. Fishing for income
    ☐ B. Recreational fishing
    ☐ C. Fishing for subsistence
    ☐ D. Swimming Snorkeling and diving for locals
    ☐ D. Swimming Snorkeling and diving for tourists
    ☐ E. Tourism related activities for income
    ☐ F. For picnic for locals
    ☐ F. For picnic for tourists
    ☐ G.I don’t use it
    ☐ H. Others
51. Please use the map to identify:
    ☐M. Areas where large number of large reef fish aggregate
    ☐N. Turtle nesting grounds
    ☐O. Seagrass patches
    ☐P. Bait fishing sites

Annex 2 - Synopsis per island

Bodufolhudhoo

A. Demographic data

Resident Adult Population:	600
Survey participants:	158
Response rate:	82%
Percentage of resident population:	26%

Average age (±SD):	37.9±15.3 (n=107, range: 18-78)
Percentage of women:	56% (n=107)
Percentage of people from the island:	92.5% (n=107)
Level of education:	Grade 10 (30.8%, n=107)
Salary range:	No salary (47.7%, n=107)

B. Resource use and dependence

- Types of jobs

	No. of respondents	Percentage
Direct use	**26**	**16%**
Construction	9	6%
Fishery	16	10%
Selling resources	1	1%
Indirect Use	**21**	**13%**
Construction	5	3%
Related to tourism	16	10%
No use	**111**	**70%**
Admin/Government	24	15%
Business	4	3%
Education	8	5%
Health	2	1%
Other	5	3%
Unemployed/retired	68	43%
Total	**158**	**100%**

- Main uses of natural resources

	No. of respondents	Percentage
Fishing for income	24	11%
Fishing for subsistence	28	12%
Recreational fishing	38	17%
Tourism related activities	5	2%
Recreational (snorkeling and picnics)	99	44%
Other	0	0%
I don't use natural resources	31	14%
Total	**225**	**100%**

- Frequency of use of resources

	Daily	Frequently	Occasionally	Rarely	Never
Fishing for income	10	8	2	2	5
Recreational fishing	3	13	12	10	1
Fishing for subsistence	6	8	8	2	1
Tourism related activities	5	20	12	12	2
Recreational	2	16	30	14	0
Total	26	65	64	40	9
Percentage per frequency	12.7%	31.9%	31.4%	19.6%	4.4%

- Perception of impacts and risks

	Most frequent answer
Income:	No change (51.8%, n=85)
Fish Price:	Increased (90.6%, n=32)
Fish abundance:	Decreased (60.6%, n=33)
Concerns about the future:	No concerns (80.1%, n=137)

C. Institutional perception

	Most frequent answer
Personal involvement:	Not at all/not very involved (62.8%, n=129)
Participation in public meetings:	Rarely/Never (60.7%, n=127)
Voicing opinion:	Rarely/Never (78.4%, n=125)
Importance of a strategy:	Very important (89.3%, n=122)

Reasons given for the need for a strategy to protect natural resources:

To better protect and conserve natural resources (habitats, species and ecosystems)	(34.9%, n=109)

	Average (±SD, n)
Level of compliance	9.1±2.2 (n=125)
Establishing no-take zones to protect coral reef and fish stocks	4.4±1.0 (n=125)
Establishing a proper management center first	4.7±0.7 (n=119)
Demarking zones around the island for specific activities	4.4±1.1 (n=119)
Support management strategies aimed at protecting the marine resources around the area	4.8±0.6 (n=119)

D. Adaptive capacity

Percentage of people with a second activity	13.9% (n=158)

	No. of respondents	Percentage
Direct Use	4	18.2%
Agriculture and tatching (DU)	2	9.1%
Fishing (DU)	2	9.1%
Indirect use	2	9.1%
Tourism related (IU)	2	9.1%
No use	16	72.7%
Carpentry/Engineering/Construction (NU)	6	27.3%
Admin/Government (NU)	0	0.0%
Other (NU)	10	45.5%

Learning new skills and adapting:

	Average (±SD, n)
Financially it is important for me to be around the sea	2.81±1.3 (n=119)
I am confident that I will be able to get work elsewhere if I needed to	4.0±0.9 (n=109)
I am more likely to adapt to financial change then my friends	3.7±1.1 (n=109)
This is the only job I know, I won't be able to find anything easier than this	2.2±1.2 (n=109)
I am willing to learn new skills outside my industry	4.6±0.9 (n=109)

- Possible alternatives

Percentage of people that have alternative jobs in mind	29.1% (n=158)

	No. of respondents	Percentage
Direct use	**10**	**22%**
Related to fishing	7	15%
Agriculture/Farming	2	4%
Related to exploitation of terrestrial natural resources (coconut leaves)	1	2%
Indirect use	**12**	**26%**
Related to tourism	12	26%
No use	**21**	**46%**
Start own business	9	20%
Sewing/Tailoring/At-home jobs	2	4%
Admin/Government	6	13%
Teaching/Education	2	4%
Carpentry/Engineering/Construction	2	4%
Other	2	4%
All	**1**	**2%**
Will accept to do anything	1	2%
Total	**46**	**100%**

Feridhoo

A. Demographic data

Resident Adult Population:	534
Survey participants:	135
Response rate:	79%
Percentage of resident population:	25%

Average age (±SD):	38.9±16.8 (n=104, range: 18-86)
Percentage of women:	53% (n=104)
Percentage of people from the island:	91.3% (n=104)
Level of education:	Grade 10 (35.6%, n=104)
Salary range:	No salary (37.5%, n=104)

B. Resource use and dependence

- Types of jobs

	No. of respondents	Percentage
Direct use	**17**	**13%**
Construction	13	10%
Diving/Snorkeling	1	1%
Fishery	3	2%
Indirect Use	**23**	**17%**
Construction	6	4%
Related to tourism	17	13%
No use	**95**	**70%**
Admin/Government	16	12%
Business	5	4%
Education	8	6%
Health	6	4%
Other	5	4%
Unemployed/retired	55	41%
Total	**135**	**100%**

- Main uses of natural resources

	No. of respondents	Percentage
Fishing for income	11	6%
Fishing for subsistence	21	11%
Recreational fishing	43	22%
Tourism related activities	5	3%
Recreational (snorkeling and picnics)	92	47%
Other	0	0%
I don't use natural resources	25	13%
Total	**197**	**100%**

- Frequency of use of resources

	Daily	Frequently	Occasionally	Rarely	Never
Fishing for income	0	4	3	2	1
Recreational fishing	3	14	13	10	0
Fishing for subsistence	3	8	5	2	0
Tourism related activities	11	16	11	13	1
Recreational	3	14	12	17	0
Total	20	56	44	44	2
Percentage per frequency	12.0%	33.7%	26.5%	26.5%	1.2%

- Perception of impacts and risks

	Most frequent answer
Income:	No change (45.5%, n=66)
Fish Price:	Increased (87.1%, n=31)
Fish abundance:	Decreased (91.2%, n=34)
Concerns about the future:	No concerns (66.1%, n=121)

C. Institutional perception

	Most frequent answer
Personal involvement:	Not at all/not very involved (70.3%, n=118)
Participation in public meetings:	Rarely/Never (57.3%, n=115)
Voicing opinion:	Rarely/Never (68.5%, n=111)
Importance of a strategy:	Very important (90.1%, n=111)

Reasons given for the need for a strategy to protect natural resources:

To act as guidelines on how to improve use, monitoring and management of natural resources	(30.5%, n=105)

	Average (±SD, n)
Level of compliance	9.3±1.9 (n=111)
Establishing no-take zones to protect coral reef and fish stocks	4.4±1.0 (n=111)
Establishing a proper management center first	4.7±0.7 (n=108)
Demarking zones around the island for specific activities	4.8±0.6 (n=108)
Support management strategies aimed at protecting the marine resources around the area	4.8±0.6 (n=108)

D. Adaptive capacity

Percentage of people with a second activity	20.0% (n=135)

	No. of respondents	Percentage
Direct Use	15	55.5%
Agriculture and tatching (DU)	10	37.0%
Fishing (DU)	5	18.5%
Indirect use	1	3.8%
Tourism related (IU)	1	3.8%
No use	11	40.7%
Carpentry/Engineering/Construction (NU)	4	14.8%
Admin/Government (NU)	0	0.0%
Other (NU)	7	25.9%

Learning new skills and adapting:

	Average (±SD, n)
Financially it is important for me to be around the sea	3.0±1.4 (n=108)
I am confident that I will be able to get work elsewhere if I needed to	3.9±1.1 (n=106)
I am more likely to adapt to financial change then my friends	4.0±1.1 (n=106)
This is the only job I know, I won't be able to find anything easier than this	2.2±1.3 (n=106)
I am willing to learn new skills outside my industry	4.3±1.4 (n=106)

- Possible alternatives

Percentage of people that have alternative jobs in mind	31.1% (n=135)

	No. of respondents	Percentage
Direct use	**16**	**38%**
Related to fishing	10	24%
Agriculture/Farming	1	2%
Related to exploitation of terrestrial natural resources (coconut leaves)	5	12%
Indirect use	**6**	**14%**
Related to tourism	6	14%
No use	**21**	**41%**
Start own business	5	12%
Sewing/Tailoring/At-home jobs	3	7%
Admin/Government	2	5%
Teaching/Education	1	2%
Carpentry/Engineering/Construction	4	10%
Other	2	5%
All	**3**	**7%**
Will accept to do anything	3	7%
Total	**46**	**100%**

Himandhoo

A. Demographic data

Resident Adult Population	448
Survey participants	112
Response rate	73%
Percentage of resident population	25%

Average age (±SD):	38.9±16.9 (n=71, range: 18-78)
Percentage of women:	38% (n=104)
Percentage of people from the island:	91.5% (n=71)
Level of education:	Basic literacy (33.8%, n=71)
Salary range:	No salary (29.6%, n=71)

B. Resource use and dependence

- Types of jobs

	No. of respondents	Percentage
Direct use	**14**	**13%**
Agriculture	1	1%
Diving/Snorkeling	1	1%
Fishery	12	11%
Indirect Use	**36**	**32%**
Construction	16	14%
Related to tourism	16	14%
Selling resources	4	4%
No use	**62**	**55%**
Admin/Government	14	13%
Business	2	2%
Education	4	4%
Health	1	1%
Other	2	2%
Unemployed/retired	39	35%
Total	**112**	**100%**

- Main uses of natural resources

	No. of respondents	Percentage
Fishing for income	24	13%
Fishing for subsistence	26	14%
Recreational fishing	36	19%
Tourism related activities	5	3%
Recreational (snorkeling and picnics)	75	40%
Other	0	0%
I don't use natural resources	23	12%
Total	**189**	**100%**

- Frequency of use of resources

	Daily	Frequently	Occasionally	Rarely	Never
Fishing for income	9	11	3	0	0
Recreational fishing	6	17	9	3	0
Fishing for subsistence	7	10	6	1	0
Tourism related activities	8	10	13	9	0
Recreational	4	9	10	13	2
Total	34	57	41	26	2
Percentage per frequency	21.3%	35.6%	25.6%	16.3%	1.3%

- Perception of impacts and risks

	Most frequent answer
Income:	No change (48.3%, n=60)
Fish Price:	Increased (81.8%, n=33)
Fish abundance:	Decreased (66.7%, n=33)
Concerns about the future	No concerns (83.0%, n=78)

C. Institutional perception

	Most frequent answer
Personal involvement:	Not at all/not very involved (60.0%, n=90)
Participation in public meetings:	Rarely/Never (57.6%, n=85)
Voicing opinion:	Rarely/Never (69.5%, n=82)
Importance of a strategy:	Very important (86.7%, n=83)

Reasons given for the need for a strategy to protect natural resources:

To better protect and conserve natural resources (habitats, species and ecosystems)	(40.0%, n=75)

	Average (±SD, n)
Level of compliance	9.2±1.7 (n=83)
Establishing no-take zones to protect coral reef and fish stocks	4.4±1.1 (n=83)
Establishing a proper management center first	4.8±0.4 (n=78)
Demarking zones around the island for specific activities	4.7±0.8 (n=78)
Support management strategies aimed at protecting the marine resources around the area	4.8±0.6 (n=78)

D. Adaptive capacity

Percentage of people with a second activity	17.9% (n=112)

	No. of respondents	Percentage
Direct Use	**4**	**20%**
Agriculture and tatching (DU)	1	5%
Fishing (DU)	3	15%
Indirect use	**4**	**20%**
Tourism related (IU)	4	20%
No use	**12**	**60%**
Carpentry/Engineering/Construction (NU)	4	20%
Admin/Government (NU)	0	0%
Other (NU)	8	40%

Learning new skills and adapting:

	Average (±SD, n)
Financially it is important for me to be around the sea	3.4±1.5 (n=78)
I am confident that I will be able to get work elsewhere if I needed to	3.9±1.2 (n=71)
I am more likely to adapt to financial change then my friends	4.0±1.0 (n=71)
This is the only job I know, I won't be able to find anything easier than this	2.5±1.3 (n=71)
I am willing to learn new skills outside my industry	4.6±1.1 (n=71)

- Possible alternatives

Percentage of people that have alternative jobs in mind	32.1% (n=112)

	No. of respondents	Percentage
Direct use	**17**	**48%**
Related to fishing	15	42%
Agriculture/Farming	2	6%
Related to exploitation of terrestrial natural resources (coconut leaves)	0	0%
Indirect use	**8**	**22%**
Related to tourism	8	22%
No use	**9**	**26%**
Start own business	6	17%
Sewing/Tailoring/At-home jobs	1	3%
Admin/Government	0	0%
Teaching/Education	1	3%
Carpentry/Engineering/Construction	1	3%
Other	0	0%
All	**2**	**6%**
Will accept to do anything	2	6%
Total	**36**	**100%**

Maalhos

A. Demographic data

Resident Adult Population	330
Survey participants	82
Response rate	98%
Percentage of resident population	25%

Average age (±SD):	43.3±17.5 (n=82, range: 18-84)
Percentage of women:	46% (n=82)
Percentage of people from the island:	96.3% (n=81)
Level of education:	Basic literacy (49.4%, n=81)
Salary range:	5,000-10,000 MVR (52.5%, n=59)

B. Resource use and dependence

- Types of jobs

	No. of respondents	Percentage
Direct use	**10**	**12%**
Agriculture	0	0%
Diving/Snorkeling	0	0%
Fishery	10	12%
Indirect Use	**36**	**7%**
Construction	5	6%
Related to tourism	1	1%
Selling resources	0	0%
No use	**62**	**80%**
Admin/Government	13	16%
Business	8	10%
Education	2	2%
Health	2	2%
Other	16	20%
Unemployed/retired	25	30%
Total	**82**	**100%**

- Main uses of natural resources

	No. of respondents	Percentage
Fishing for income	19	12.5%
Fishing for subsistence	22	14.5%
Recreational fishing	29	19.1%
Tourism related activities	26	17.1%
Recreational (snorkeling and picnics)	45	29.6%
Other	10	6.6%
I don't use natural resources	1	0.7%
Total	**152**	**100%**

- Frequency of use of resources

	Daily	Frequently	Occasionally	Rarely	Never
Total	7	19	23	19	0
Percentage per frequency	10%	28%	34%	28%	0%

- Perception of impacts and risks

	Most frequent answer
Income:	No change (47.1%, n=17)
Fish Price:	Increased (85.2%, n=61)
Fish abundance:	Decreased (51.5%, n=68)
Concerns about the future	No concerns (75.0%, n=16)

C. Institutional perception

	Most frequent answer
Personal involvement:	Somewhat/very involved (70.9%, n=79)
Participation in public meetings:	Mostly/Always (46.3%, n=80)
Voicing opinion:	Rarely/Never (42.3%, n=76)
Importance of a strategy:	Very important (83.8%, n=80)

Reasons given for the need for a strategy to protect natural resources:

To better protect and conserve natural resources (habitats, species and ecosystems)	(36.5%, n=63)

	Average (±SD, n)
Level of compliance	8.8±2.7 (n=82)
Establishing no-take zones to protect coral reef and fish stocks	4.5±1.2 (n=80)
Establishing a proper management center first	4.9±0.8 (n=81)
Demarking zones around the island for specific activities	4.6±1.0 (n=81)
Support management strategies aimed at protecting the marine resources around the area	4.9±0.4 (n=77)

D. Adaptive capacity

Percentage of people with a second activity	28.0% (n=82)

	No. of respondents	Percentage
Direct Use	12	52.2%
Agriculture and tatching (DU)	6	26.1%
Fishing (DU)	6	26.1%

Indirect use	**4**	**17.4%**
Tourism related (IU)	4	17.4%
No use	**7**	**30.4%**
Carpentry/Engineering/Construction (NU)	4	17.4%
Admin/Government (NU)		0.0%
Other (NU)	3	13.0%

Learning new skills and adapting:

	Average (±SD, n)
Financially it is important for me to be around the sea	2.7±1.9 (n=66)
I am confident that I will be able to get work elsewhere if I needed to	4.7±1.0 (n=59)
I am more likely to adapt to financial change then my friends	4.4±1.3 (n=59)
This is the only job I know, I won't be able to find anything easier than this	2.6±1.9 (n=55)
I am willing to learn new skills outside my industry	4.6±1.1 (n=62)

- Possible alternatives

Percentage of people that have alternative jobs in mind	28.0% (n=82)

	No. of respondents	Percentage
Direct use	**9**	**39.1%**
Related to fishing	7	30.4%
Agriculture/Farming	2	8.7%
Related to exploitation of terrestrial natural resources (coconut leaves)		0.0%
Indirect use	**5**	**21.7%**
Related to tourism	5	21.7%
No use	**6**	**26.1%**
Start own business	1	4.3%
Sewing/Tailoring/At-home jobs		0.0%
Admin/Government		0.0%
Teaching/Education	1	4.3%
Carpentry/Engineering/Construction	3	13.0%
Other	1	4.3%
All	**3**	**13.0%**
Will accept to do anything	3	13.0%
Total	**23**	**100.0%**

Mathiveri

A. Demographic data

Resident Adult Population	450
Survey participants	122
Response rate	81%
Percentage of resident population	27%

Average age (±SD):	34.2±13.4 (n=121, range: 18-75)
Percentage of women:	36% (n=121)
Percentage of people from the island:	84.3% (n=121)
Level of education:	Grade 10 (39.7%, n=121)
Salary range:	5,000-10,000 MVR (54.5%, n=88)

B. Resource use and dependence

- Types of jobs

	No. of respondents	Percentage
Direct use	**33**	**27%**
Agriculture	0	0%
Diving/Snorkeling	0	0%
Fishery	33	27%
Indirect Use	**24**	**20%**
Construction	11	9%
Related to tourism	13	11%
Selling resources	0	0%
No use	**65**	**53%**
Admin/Government	14	11%
Business	4	3%
Education	3	2%
Health	4	3%
Other	7	6%
Unemployed/retired	33	27%
Total	**122**	**100%**

- Main uses of natural resources

	No. of respondents	Percentage
Fishing for income	31	15.3%
Fishing for subsistence	30	14.8%
Recreational fishing	37	18.2%
Tourism related activities	28	13.8%
Recreational (snorkeling and picnics)	69	34.0%
Other	8	3.9%
I don't use natural resources		0.0%
Total	**203**	**100.0%**

- Frequency of use of resources

	Daily	Frequently	Occasionally	Rarely	Never
Total	10	25	47	20	0
Percentage per frequency	10%	25%	45%	20%	0%

- Perception of impacts and risks

	Most frequent answer
Income:	Decreased (40.5%, n=42)
Fish Price:	Increased (86.2%, n=87)
Fish abundance:	Decreased (69.0%, n=84)
Concerns about the future	No concerns (60.0%, n=50)

C. Institutional perception

	Most frequent answer
Personal involvement:	Somewhat/very involved (54.6%, n=119)
Participation in public meetings:	Occasionally (33.9%, n=121)
Voicing opinion:	Rarely/Never (44.3%, n=118)
Importance of a strategy:	Very important (86.6%, n=119)

Reasons given for the need for a strategy to protect natural resources:

To act as guidelines on how to improve use, monitoring and management of natural resources	(30.6%, n=98)

	Average (±SD, n)
Level of compliance	8.7±2.4 (n=122)
Establishing no-take zones to protect coral reef and fish stocks	4.5±1.0 (n=117)
Establishing a proper management center first	4.8±0.7 (n=118)
Demarking zones around the island for specific activities	4.5±1.1 (n=118)
Support management strategies aimed at protecting the marine resources around the area	4.8±0.5 (n=115)

D. Adaptive capacity

Percentage of people with a second activity	11.5% (n=122)

	No. of respondents	Percentage
Direct Use	6	42.9%
Agriculture and tatching (DU)	5	35.7%
Fishing (DU)	1	7.1%
Indirect use	3	21.4%
Tourism related (IU)	3	21.4%

No use	**5**	**35.7%**
Carpentry/Engineering/Construction (NU)	2	14.3%
Admin/Government (NU)		0.0%
Other (NU)	3	21.4%

Learning new skills and adapting:

	Average (±SD, n)
Financially it is important for me to be around the sea	2.3±1.7 (n=108)
I am confident that I will be able to get work elsewhere if I needed to	4.6±1.0 (n=90)
I am more likely to adapt to financial change then my friends	4.4±1.0 (n=93)
This is the only job I know, I won't be able to find anything easier than this	2.2±1.8 (n=91)
I am willing to learn new skills outside my industry	4.6±1.0 (n=102)

- Possible alternatives

Percentage of people that have alternative jobs in mind	39.3% (n=122)

	No. of respondents	Percentage
Direct use	**17**	**35.4%**
Related to fishing	11	22.9%
Agriculture/Farming	3	6.3%
Related to exploitation of terrestrial natural resources (coconut leaves)	3	6.3%
Indirect use	**17**	**35.4%**
Related to tourism	17	35.4%
No use	**13**	**27.1%**
Start own business	2	4.2%
Sewing/Tailoring/At-home jobs		0.0%
Admin/Government	4	8.3%
Teaching/Education	1	2.1%
Carpentry/Engineering/Construction	5	10.4%
Other	1	2.1%
All	**1**	**2.1%**
Will accept to do anything	1	2.1%
Total	**48**	**100%**

Rasdhoo

A. Demographic data

Resident Adult Population	600
Survey participants	132
Response rate	83%
Percentage of resident population	22%

Average age (±SD):	35.8±13.8 (n=130, range: 18-80)
Percentage of women:	29% (n=131)
Percentage of people from the island:	75.6% (n=131)
Level of education:	Grade 10 (40.5%, n=131)
Salary range:	5,000-10,000 MVR (53.7%, n=108)

B. Resource use and dependence

- Types of jobs

	No. of respondents	Percentage
Direct use	**17**	**13%**
Agriculture	0	0%
Diving/Snorkeling	0	0%
Fishery	17	13%
Indirect Use	**27**	**20%**
Construction	2	2%
Related to tourism	25	19%
Selling resources	0	0%
No use	**88**	**67%**
Admin/Government	26	20%
Business	14	11%
Education	3	2%
Health	2	2%
Other	17	13%
Unemployed/retired	26	20%
Total	**132**	**100%**

- Main uses of natural resources

	No. of respondents	Percentage
Fishing for income	36	11.8%
Fishing for subsistence	36	11.8%
Recreational fishing	54	17.7%
Tourism related activities	65	21.3%
Recreational (snorkeling and picnics)	105	34.4%
Other	9	3.0%
I don't use natural resources		0.0%
Total	**305**	**100.0%**

- Frequency of use of resources

	Daily	Frequently	Occasionally	Rarely	Never
Total	29	41	29	21	0
Percentage per frequency	24%	34%	24%	18%	0%

- Perception of impacts and risks

	Most frequent answer
Income:	No change (38.0%, n=50)
Fish Price:	Increased (85.2%, n=88)
Fish abundance:	Decreased (46.2%, n=78)
Concerns about the future	Strong concerns (46.0%, n=50)

C. Institutional perception

	Most frequent answer
Personal involvement:	Somewhat/very involved (63.9%, n=130)
Participation in public meetings:	Mostly/Always (35.9%, n=131)
Voicing opinion:	Rarely/Never (53.2%, n=124)
Importance of a strategy:	Very important (90.8%, n=118)

Reasons given for the need for a strategy to protect natural resources:

To act as guidelines on how to improve use, monitoring and management of natural resources	(39.8%, n=113)

	Average (±SD, n)
Level of compliance	8.9±2.5 (n=132)
Establishing no-take zones to protect coral reef and fish stocks	4.3±1.2 (n=130)
Establishing a proper management center first	4.9±0.4 (n=131)
Demarking zones around the island for specific activities	4.7±0.9 (n=131)
Support management strategies aimed at protecting the marine resources around the area	4.9±0.6 (n=122)

D. Adaptive capacity

Percentage of people with a second activity	16.7% (n=132)

	No. of respondents	Percentage
Direct Use	5	22.7%
Agriculture and tatching (DU)	1	4.5%
Fishing (DU)	4	18.2%
Indirect use	8	36.4%
Tourism related (IU)	8	36.4%

No use	**9**	**40.9%**
Carpentry/Engineering/Construction (NU)	1	4.5%
Admin/Government (NU)		0.0%
Other (NU)	8	36.4%

Learning new skills and adapting:

	Average (±SD, n)
Financially it is important for me to be around the sea	3.2±1.9 (n=124)
I am confident that I will be able to get work elsewhere if I needed to	4.4±1.2 (n=114)
I am more likely to adapt to financial change then my friends	4.2±1.5 (n=111)
This is the only job I know, I won't be able to find anything easier than this	2.4±1.9 (n=110)
I am willing to learn new skills outside my industry	4.4±1.4 (n=122)

- Possible alternatives

Percentage of people that have alternative jobs in mind	36.4% (n=132)

	No. of respondents	Percentage
Direct use	**22**	**45.8%**
Related to fishing	12	25.0%
Agriculture/Farming	10	20.8%
Related to exploitation of terrestrial natural resources (coconut leaves)		0.0%
Indirect use	**16**	**33.3%**
Related to tourism	16	33.3%
No use	**10**	**20.8%**
Start own business	1	2.1%
Sewing/Tailoring/At-home jobs		0.0%
Admin/Government	1	2.1%
Teaching/Education		0.0%
Carpentry/Engineering/Construction	5	10.4%
Other	3	6.3%
All	**0**	**0.0%**
Will accept to do anything		0.0%
Total	**48**	**100.0%**

Thoddhoo

A. Demographic data

Resident Adult Population	1150
Survey participants	217
Response rate	60%
Percentage of resident population	19%

Average age (±SD):	41.2±15.9 (n=163, range: 18-78)
Percentage of women:	34% (n=163)
Percentage of people from the island:	95.1% (n=163)
Level of education:	Basic literacy (35.0%, n=163)
Salary range:	5,000-10,000 MVR (38.5%, n=161)

B. Resource use and dependence

- Types of jobs

	No. of respondents	Percentage
Direct use	**90**	**41%**
Agriculture	87	40%
Diving/Snorkeling	0	0%
Fishery	3	1%
Indirect Use	**20**	**10%**
Construction	6	3%
Related to tourism	12	6%
Selling resources	2	1%
No use	**107**	**49%**
Admin/Government	28	13%
Business	7	3%
Education	9	4%
Health	4	1%
Other	6	3%
Unemployed/retired	53	24%
Total	**217**	**100%**

- Main uses of natural resources

	No. of respondents	Percentage
Fishing for income	16	5.8%
Fishing for subsistence	50	18.2%
Recreational fishing	39	14.2%
Tourism related activities	8	2.9%
Recreational (snorkeling and picnics)	101	36.7%
Other	0	0.0%
I don't use natural resources	61	22.2%
Total	**275**	**100.0**

- Frequency of use of resources

	Daily	Frequently	Occasionally	Rarely	Never
Fishing for income	8	4	4	1	15
Recreational fishing	1	11	17	9	10
Fishing for subsistence	11	17	10	5	13
Tourism related activities	4	22	26	12	15
Recreational	0	15	18	28	2
Total	24	69	75	55	55
Percentage per frequency	8.6%	24.8%	27.0%	19.8%	19.8%

- Perception of impacts and risks

	Most frequent answer
Income:	No change (44.1%, n=152)
Fish Price:	Increased (73.8%, n=42)
Fish abundance:	Decreased (64.2%, n=53)
Concerns about the future	No concerns (70.4%, n=196)

C. Institutional perception

	Most frequent answer
Personal involvement:	Not at all/not very involved (59.6%, n=188)
Participation in public meetings:	Rarely/Never (55.8%, n=183)
Voicing opinion:	Rarely/Never (69.7%, n=183)
Importance of a strategy:	Very important (91.7%, n=181)

Reasons given for the need for a strategy to protect natural resources:

To better protect and conserve natural resources (habitats, species and ecosystems)	(32.4%, n=173)

	Average (±SD, n)
Level of compliance	9.6±1.2 (n=182)
Establishing no-take zones to protect coral reef and fish stocks	4.6±1.0 (n=172)
Establishing a proper management center first	4.9±0.6 (n=172)
Demarking zones around the island for specific activities	4.7±0.8 (n=172)
Support management strategies aimed at protecting the marine resources around the area	4.9±0.4 (n=172)

D. Adaptive capacity

Percentage of people with a second activity	24.9% (n=217)

	No. of respondents	Percentage
Direct Use	25	46.3%
Agriculture and tatching (DU)	21	38.9
Fishing (DU)	4	7.4%
Indirect use	2	3.7%
Tourism related (IU)	2	3.7%
No use	27	50.0%
Carpentry/Engineering/Construction (NU)	6	11.1%
Admin/Government (NU)	7	13.0%
Other (NU)	14	25.9%

Learning new skills and adapting:

	Average (±SD, n)
Financially it is important for me to be around the sea	2.7±1.6 (n=172)
I am confident that I will be able to get work elsewhere if I needed to	4.2±1.2 (n=166)
I am more likely to adapt to financial change then my friends	4.4±1.0 (n=166)
This is the only job I know, I won't be able to find anything easier than this	2.6±1.7 (n=166)
I am willing to learn new skills outside my industry	4.6±1.1 (n=166)

- Possible alternatives

Percentage of people that have alternative jobs in mind	51.6% (n=112)

	No. of respondents	Percentage
Direct use	**34**	**30.4**
Related to fishing	14	12.5
Agriculture/Farming	19	17.0
Related to exploitation of terrestrial natural resources (coconut leaves)	1	0.9
Indirect use	**34**	**30.4**
Related to tourism	34	30.4
No use	**40**	**35.7**
Start own business	11	9.8
Sewing/Tailoring/At-home jobs	3	2.7
Admin/Government	4	3.6
Teaching/Education	8	7.1
Carpentry/Engineering/Construction	9	8.0
Other	5	4.5
All	**4**	**3.6**
Will accept to do anything	4	3.6
Total	**112**	**100.0**

Ukulhas

A. Demographic data

Resident Adult Population	510
Survey participants	131
Response rate	80%
Percentage of resident population	26%

Average age (±SD):	36.3±13.0 (n=163, range: 18-75)
Percentage of women:	20% (n=129)
Percentage of people from the island:	86.8% (n=129)
Level of education:	Grade 7 (33.3%, n=129)
Salary range:	5,000-10,000 MVR (50.9%, n=106)

B. Resource use and dependence

- Types of jobs

	No. of respondents	Percentage
Direct use	**62**	**47%**
Agriculture	0	0%
Diving/Snorkeling	0	0%
Fishery	62	47%
Indirect Use	**11**	**8%**
Construction	1	1%
Related to tourism	10	8%
Selling resources	0	0%
No use	**58**	**44%**
Admin/Government	14	11%
Business	10	8%
Education	2	2%
Health	0	0%
Other	11	8%
Unemployed/retired	21	16%
Total	**131**	**100%**

- Main uses of natural resources

	No. of respondents	Percentage
Fishing for income	66	19.3%
Fishing for subsistence	57	16.7%
Recreational fishing	65	19.0%
Tourism related activities	61	17.8%
Recreational (snorkeling and picnics)	86	25.1%
Other	6	1.8%
I don't use natural resources	1	0.3%
Total	342	100.0%

- Frequency of use of resources

	Daily	Frequently	Occasionally	Rarely	Never
Total	26	54	31	13	0
Percentage per frequency	21%	44%	25%	10%	0%

- Perception of impacts and risks

	Most frequent answer
Income:	Decreased or Increased (41.2%, n=68)
Fish Price:	Increased (93.0%, n=115)
Fish abundance:	Decreased (60.7%, n=107)
Concerns about the future	No concerns (44.0%, n=75)

C. Institutional perception

	Most frequent answer
Personal involvement:	Somewhat/Very involved (74.4%, n=129)
Participation in public meetings:	Mostly/Always (45.0%, n=129)
Voicing opinion:	Rarely/Never (37.3%, n=129)
Importance of a strategy:	Very important (74.0%, n=127)

Reasons given for the need for a strategy to protect natural resources:

To act as guidelines on how to improve use, monitoring and management of natural resources	(35.5%, n=93)

	Average (±SD, n)
Level of compliance	8.0±3.0 (n=1131)
Establishing no-take zones to protect coral reef and fish stocks	3.9±1.6 (n=128)
Establishing a proper management center first	4.9±0.6 (n=128)
Demarking zones around the island for specific activities	4.2±1.5 (n=126)
Support management strategies aimed at protecting the marine resources around the area	4.6±1.2 (n=122)

D. Adaptive capacity

Percentage of people with a second activity	21.4% (n=131)

	No. of respondents	Percentage
Direct Use	7	25.0%
Agriculture and tatching (DU)	3	10.7%
Fishing (DU)	4	14.3%
Indirect use	8	28.6%
Tourism related (IU)	8	28.6%

No use	**13**	**46.4%**
Carpentry/Engineering/Construction (NU)	9	32.1%
Admin/Government (NU)		0.0%
Other (NU)	4	14.3%

Learning new skills and adapting:

	Average (±SD, n)
Financially it is important for me to be around the sea	3.3±1.8 (n=121)
I am confident that I will be able to get work elsewhere if I needed to	4.3±1.4 (n=112)
I am more likely to adapt to financial change then my friends	4.4±1.2 (n=112)
This is the only job I know, I won't be able to find anything easier than this	2.4±1.8 (n=109)
I am willing to learn new skills outside my industry	4.1±1.6 (n=119)

- Possible alternatives

Percentage of people that have alternative jobs in mind	23.7% (n=131)

	No. of respondents	Percentage
Direct use	**14**	**45.2%**
Related to fishing	11	35.5%
Agriculture/Farming	3	9.7%
Related to exploitation of terrestrial natural resources (coconut leaves)		0.0%
Indirect use	**8**	**25.8%**
Related to tourism	8	25.8%
No use	**7**	**22.6%**
Start own business	2	6.5%
Sewing/Tailoring/At-home jobs		0.0%
Admin/Government	1	3.2%
Teaching/Education	1	3.2%
Carpentry/Engineering/Construction	2	6.5%
Other	1	3.2%
All	**2**	**6.5%**
Will accept to do anything	2	6.5%
Total	**31**	**100.0%**

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