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Exploring Social-Ecological Resilience in Small-Scale Fisheries: Fish Abundance and Diversity, Local Management and Tourism Dynamics in Jambiani, Zanzibar

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Abstract

Small-scale fisheries are dependent on their local seascapes for food and income. The increasing threats of habitat degradation, fishing pressures, tourism and climate variability inform the importance of effective management practices to mitigate vulnerabilities within fishing communities and strengthen social-ecological resilience. This study investigates local management initiatives of small-scale fisheries in Jambiani, Zanzibar in relation to fish abundance and diversity, and tourism. Utilizing frameworks of social-ecological resilience and vulnerabilities, the study explores how local managers adapt their practices to foster positive outcome for both the local seascape and for the community.

An overview of Jambiani's seascape was conducted through a combination of ecological surveys, remote sensing, and ground-truthing to gain insights into marine habitats, fish diversity and abundance. Furthermore, in-depth interviews of local fishers were conducted to investigate fishing techniques, management perspectives, and decision-making processes. Additional interviews of hotel managers were conducted to investigate fish consumption of tourists and hotel's fish purchasing choices.

The seascape of Jambiani consists of various biotypes, in which highest fish abundance and diversity was found within coral reefs. Coral reefs act as important fishing grounds and are therefore focused upon for conservation by local initiatives. Local management was aimed to increase yields and preserve fishing grounds for future generations and to increase community welfare. The local-level establishment of conservation zones had been met with high positivity from local fishers due to its social and ecological benefits. In contrast, a national-level ban of small-sized nets was met with negativity by fishers impacted by the regulations, as it imposed too much change for their livelihood. Furthermore, tourism was found to contribute little to increased income for fishers, as fish markets for hotels were located in other areas of Zanzibar. Despite increasing pressures on marine resources, local management strategies in Jambiani demonstrated resilience by prioritizing long-term ecosystem health and community well-being. Fishers shows adaptive behaviors through learning from past management mistakes, integrating different knowledge in decision-making, fostering diversity, and creating new opportunities in changing circumstances. While increasing tourism in Jambiani had limited benefits for fisheries, opportunities did exist for enhancements through for instance vessels improvements.

In conclusion, local management approaches in Jambiani responded to changes through policies that balanced marine conservation objectives with community well-being.

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List of Acronyms

SSF: Small-scale fisheries

TEK: Traditional ecological knowledge

1. Introduction

The coastal area of tropical shallow zones usually consists of multiple habitats which are interlinked through biophysical and ecological processes (Berkström et al., 2012). The interlinked coastal systems are often referred to as the tropical seascape which can consist of for instance corals, mangroves and seagrasses (Ogden, 1988 as cited in Berkström et al., 2012). Zanzibar has highly biodiverse ecosystems, where the different marine environments, such as seagrass meadows and coral reefs, interact with each other to support the diverse marine life (Francis & Bryceson, 2001). Seagrass beds create habitats for various fish species by providing refuge or shelter (Duarte et al., 2018), and provide food availability through the production of associated flora and fauna (Campbell et al., 2011). Moreover, seagrasses support surrounding habitats through nutrient cycling, enhanced organic matter, and by trapping sediments and preventing them from accumulating on coral reefs (Heck et al., 2008). Tropical coral reefs are one of the most productive ecosystems in the world where they act as an important provider of habitat and refuge for a variety of species through different life stages, supporting an approximate total of 830 000 multi-cellular species worldwide (Fisher et al., 2015; Graham & Nash, 2013). Furthermore, certain fish species are seen to be directly dependent on corals for settlement, habitat, and food (Salinas-de-Léon et al., 2008).

However, the coastal seascapes are under increased pressures from human activities, which are contributing to degradation of marine ecosystems (Bindoff et al., 2019; He & Silliman, 2019; Paukert et al., 2017). Major threats include increased pressure of urbanization, higher exploitation of marine resources, and the complex impacts of climate change (Crain et al., 2009). Increased urbanization and use of marine resources exerts persistent pressures on fisheries, representing chronic disturbances, while some stressors associated with climate change, such as increased temperatures during El Niño events, present acute disturbances through more abrupt impacts. Marine degradation causes impacts of ecosystem structures and creates alterations in the habitats (Barbier, 2015; Duarte et al., 2020). For example, coral reef degradation leads to decreased coral cover and loss of coral species (Beldade et al., 2015), with further implication for fish assemblages due to their direct dependency of these habitats (Jones et al., 2004; Graham et al., 2006). It has for instance been shown that there is less species richness when coral cover is decreased to 20% or less (Beldade et al., 2015).

Impacts of acute disturbances could be reduced by lowering chronic pressures from unsustainable practices. Chronic pressures degrade systems slowly over a long period of time, thus compromising resilience (Graham et al., 2013). To reduce chronic pressures, it is crucial for local managers to identify pressures and disturbances in their systems and manage activities thereafter to limit degradation (Pratchett et al., 2021). Human interventions may either hinder or allow marine systems to maintain and build higher biodiversity and abundance, in which the latter is crucial for systems to build resilience and to resist or recover from unexpected events (McClanahan, Polunin & Done, 2002).

1.1 Small-Scale Fisheries

The global fishing industry consists mostly of fishers and fish workers employed in small-scale fisheries (SSF) (Funge-Smith et al., 2023). Small-scale fisheries are often defined based on the size of the fishing units in which SSFs' boats, fishing trips, energy consumption, and capital usage are small (Cochrane, 2002; Rehren et al, 2022). Resultingly, SSF are predominately operating fishing in inshore areas and rely on a variety of labor-intensive gears (Salas et al., 2007). The high biodiversity of the tropical seascape combined with variations indifferent fishing techniques contributes to yield catches of high biodiversity compared to conventional fisheries, in which SSF's catches consists of a variety of pelagic, demersal, and reef fish, as well as multiple invertebrate species (Francis & Bryceson, 2001; Jiddawi & Ohman, 2002).

Fisheries in Zanzibar are dominated by small-scale fisheries (SSF) where 95% of total catch is derived from SSFs, which sustain the island's population's primary source of animal protein (Jiddawi & Ohman, 2002). Furthermore, SSFs act as an important provider for livelihoods in which Zanzibar had in 2016 nearly 50,000 active fishers (Department of Fisheries Development, 2016). This makes SSFs one of the largest sectors in Zanzibar (Lange & Jiddawi, 2009). In addition to being one of the largest economic sectors, SSF is a traditional way of life encompassing knowledge, culture, traditions and practices that has been passed down through generations (Westlund et al., 2023). Local traditions need to be recognized in management strategies as it underlines the importance of having locally adapted management policies.

1.2 Local Management

Local management refers to the involvement of local stakeholders in governance and decision-making of their natural resources. Local fishers often have deep understandings of marine ecology, such as habitat use, feeding habits, or connectivity of fishes (e.g., Bärkström et al., 2019; Gaspare, Bryceson & Kulindwa, 2015). These understandings, often called traditional ecological knowledge (TEK), provides additional information to the knowledge obtained through science. Incorporating TEK into management practices can be beneficial as it contributes to new information and incorporates traditional management approaches (Gaspare, Bryceson & Kulindwa, 2015). The threats marine ecosystems are facing need to be addressed at multiple institutional levels, in which resource use is a main concern for local people (Berkes, 2007).

No-take marine reserves are considered seen as a promising way to safeguard marine resources. Evidence shows that marine reserves have positive effects on various biological measures such as fish abundance, density, biomass, and size (e.g., Boaden & Kingsford, 2015; Gell & Roberts, 2003; Lester et al., 2009; McCook et al., 2010). Improving such biological measures can result in multiple benefits for fisheries. Increased abundance and density can create high competition between fish which can cause fish to move, thus increasing fishing yield (Gell & Roberts, 2003). Furthermore, increased fish size leads to higher production size through increased egg production, resulting in more export and settlement of juveniles both inside and outside of reserves (Gell & Roberts, 2003). However, because SSFs are indispensable to coastal communities by being the primary provider of income and animal protein, the communities are highly vulnerable to restrictive management measure such as no-take reserves (Rehren et al., 2020).

Small-scale fisheries are complex and relate to both social and ecological systems. Management approaches need to have multiple objectives which are aligned with the objectives of the local communities. With multiple objectives, one can address multiple ecosystem services as well as human well-beings (Berkes, 2007). Local management can initiate community-based conservation, in which the goal is to sustainably utilise and conserve natural resources and biodiversity by, for and with the local community (Western &

Wright, 1994, as cited in Berkes, 2007). This would put the focus of management on the coexistence of people and nature (Western & Wright, 1994, as cited in Berkes, 2007). When management is grounded locally, the community can adapt practices to function within their system through strengthening their underlying resilience and capacity for adaptation.

However, that management at a local scale may not be sufficient to deal with all problems since small-scale communities also are affected by external drivers (Berkes, 2006), such as a change in market driven by tourism. Local communities need integrated responses with assistance from the government or other institutions, as their systems are impacted by changes outside of their own activities (Berkes, 2007). However, this thesis is mainly focusing on the importance of local responses in management.

1.3 Tourism

There was little tourism in Zanzibar 40 years ago and the local communities received all the benefits from their coastal ecosystems. Since then, tourism in Zanzibar has increased immensely, where total visitors in 2023 reached 638.498 (Owere, 2024). This makes tourism the largest contributor to Zanzibar's economy (Lange, 2015). Tourism can create potential for diversifying livelihoods of fishers, where the high capital of the developed world could provide trickle-down effects for local communities and contribute to development (Gössling, 2002). For example, the coast entertains many activities for tourists, such as snorkeling, fishing, kiting and sailing, which offer job opportunities to fishers which could utilize already owned equipment, such as their traditional sailboats or snorkeling equipment, to accommodate tourists. Additionally, it creates a new market to cover the high demand for seafood from the of hotels (Benansio et al., 2016), which creates opportunities to expand fisheries. However, the over-all impact of increased tourism on the livelihoods of Zanzibaris is not clear (Lange, 2015).

Local fishers could experience incentives to shift fishing strategy to accommodate the increasing tourism since fish are sold at a higher price to hotels than to local markets (Thyresson et al., 2013). However, fishers are seen generally selling their catches to fish traders instead of directly to hotels (Ali, Bilame & Ngusa, 2023), in which the benefits of

increased prices are going to the retailers instead of to the local fishers (O'Neill et al., 2018). Moreover, the increased activities in fishers' local seascape have led to conflicts, as fast passing boats and kites over fishing grounds have been disturbing fishing and, in some cases, led to gear destruction (Benansio et al., 2016). Lastly, the increased pressure on fisheries resources, the coral reefs, and the seascape in general can cause further degradation, putting the SSF further at risk.

Tourism is undoubtedly providing some opportunities. However, households are remaining poor with little changes after a long time with tourism present in Zanzibar (Benansio et al., 2016). Tourism needs to be managed correctly to bring positive impacts for the local community and for the benefits to be distributed equally.

1.4 Theoretical framework

To understand the complex challenges within SSF management, the concepts of social-ecological resilience and vulnerability will be utilized. Resilience and vulnerability share commonalities, as both analyses responses to shocks and stresses, as well as adaptive capacity to change (Agder, 2006). Vulnerability can be impacted by the erosion of resilience within social-ecological systems (Agder, 2006), in which unexpected events can expose underlying vulnerabilities and possibly reduce resilience (Agder et al., 2005). Understanding the interplay between vulnerabilities and resilience can provide valuable insights into management strategies and enhance adaptive capacity.

1.4.1 Social-ecological resilience

The well-being of an ecological system is closely linked to the well-being of a social system (Berkes & Folke, 1998), because different components of these systems interact and thus make them highly complex and interconnected (Berkes, 2015). However, the well-being of social systems could also create negative implications for ecological systems where for example anthropogenic factors have increased impacts and stressors on ecosystems leading to overexploitation and loss of ecological resilience (Folke, Colding, Berkes, 2003). Social-ecological resilience theory can be used to understand and explore the relations between such systems. Strong links between social and ecological resilience are common in communities that are dependent on natural resources for their livelihoods (Agder, 2000). The components

of both social and ecological systems must therefore be understood together for relevant information in respect to resilience, adaptation and transformative capacity (Berkes, 2015).

There are two main definitions of resilience, in which one can understand how systems absorb and withstand disturbances or shift over to another state. Holling et al., (1995) describes resilience through an ecosystem renewal cycle of four stages: exploitation, conservation, release, and reorganization, where resilience is the capacity of a system to absorb the changes and still persist (Holling, 1973). Berkes and Folke (1998) describe resilience as how much disturbance a system can absorb, and in which conditions, before it leads to structural changes and shifts into a new equilibrium state. A resilient system can still be pushed over its threshold, as thresholds for change are dynamic and uncertain (Berkes, 2015). However, resilience gives opportunities for the system to revive and thrive even after thresholds have been crossed.

Building resilience within a social-ecological system contributes to prepare the social system to react to change and accept uncertainty, and to prepare the ecosystem to be able to adapt after disturbances (Folke, Colding & Berkes, 2003). Folke et al. (2003) suggests that in order to build resilience there is a need of four main factors: 1) learning to live with uncertainty, 2) nurturing diversity, 3) combining knowledge, and 4) having opportunities for self-organization.

To learn to live with uncertainty is important to maintain social-ecological resilience by creating possibilities to adapt and respond to the unfamiliar changes (Berkes, 2015). To learn how to respond it is important to have a social and ecological memory of past events as this can give answers to future problems. Creating such memory must be done with deliberation for the community to learn valuable insights needed to create directions of what to do during unexpected events (Berkes & Folke, 2002). Deliberated institutional learning can be done through conversation of community members and stakeholders with the intent to exchange views, debate evidence and negotiate (Stern, 2005).

Management measures that enhance diversity within social-ecological systems fosters resilience by facilitating reorganization and renewal through provision of new opportunities for adaptation and innovation (Berkes, 2015). The diversity is not only encompassing biodiversity, which is essential for resources and ecosystem services, but it includes social diversity such as the variety of cultures and knowledge systems within a community (Berkes et al., 2000). Nurturing both ecological and social diversity is important as it offers multiple options to cope with change and thus increase the capacity to withstand disturbances. Moreover, creating economic diversity through new opportunities is important to increase the livelihood options available, particularly in the event of disturbance and setbacks of fisheries. The diversification of economic activities provides communities with alternative sources of income and livelihoods and reduces the dependence on fisheries (Berkes, 2015)

Combining different kinds of knowledge is important for resilience as it opens up for a variety of insights which can contribute to new solutions. To understand the complexity of social-ecological systems and its challenges, one should borrow and integrate concepts, skills, and knowledge from natural science, social science and humanities (Berkes, 2015). Furthermore, knowledge sharing should go across knowledge systems to coproduce new insights and understanding, by learning from traditional environmental knowledge alongside western scientific knowledge (Berkes, 2015). Learning from and utilizing different forms of knowledge can further enhance adaptive capacity and create solutions for emerging challenges.

Lastly, to create opportunities for self-organization is central to build resilience within social-ecological systems. Communities has the capacity to self-organize and establish institutions that enables collective decision-making and resource management (Berkes, 2015). Community-based management allows for adaptive responses within the community. Furthermore, communities often respond best to change through their own institutions because it fosters local ownership of management strategies (Berkes, 2015). However, support from government agencies is needed when dealing with drivers originating from outside (Berkes, 2015).

These factors contribute to enhancing the adaptive capacity, which is the social and ecological ability to respond to unexpected changes and events (Berkes, 2015). The flexibility, diversity, learning, and self-organizations contributes to systems being able to navigate uncertainties and transform in response to the new circumstances. By having the capacity to adapt, the system is able to modify its vulnerabilities by recovering and learning from losses and exploiting new opportunities (Agder & Vincent, 2005).

Through a social-ecological lens, one can learn what state the ecosystem is in, and how people manage the system, react to change, and transform new pathways for livelihoods (Folke, 2016). Additionally, management decisions can further be understood when analyzing whose needs are being prioritized and met (Beymer-Farris, Basset, & Bryceson, 2012).

1.4.2 Vulnerabilities

Vulnerability refers to the susceptibility of individuals and communities to be harmed by various stressors (Agder, 2006; Berkes, 2015). It encompasses the degree of how a system is exposed to risk, its sensitivity to those risks, and the capacity of adapting (Agder, 2006). Exposure refers to the degree of contact people have to stressors, such as physical proximity or dependency (Agder, 2006). For example, coastal communities reliant on coastal ecosystems are highly exposed to marine degradation and decreased fish abundance due to the direct impact on their livelihoods and SSF. Sensitivity, on the other hand, involves how people are affected by hazards, including factors such as access to resources (Agder, 2006). Communities with limited resources are often more sensitive to risks as they may lack the resources to respond to disturbances and adverse impacts. Adaptive capacity, as discussed under social-ecological resilience, is the ability of the community to cope with, respond to, and adapt to stressors (Agder, 2006; Berkes, 2015), thus being important for both enhancing resilience and reducing vulnerability.

Small-scale fisheries play a crucial role in providing food and livelihoods, yet they are fraught with multiple risks and vulnerabilities (Platteau & Nugent, 1992). Fishing is viewed as a high-risk occupation due to large fluctuations in stock size, fishing location, and price

due to seasonal and cyclical variations (Allison & Ellis, 2001). Small-scale fishers are particularly susceptible to these challenges by having smaller boats limited to inshore fishing (Platteau & Nugent, 1992). In addition, marine degradation can result in further exacerbation of these fluctuations.

Due to many of these risks being unavoidable, the livelihood of fishers is viewed as having high exposure and sensitivity to risks in comparison to livelihoods of non-fishers in coastal areas (Schwarz et al., 2011; Berkes, 2015). Furthermore, impacts of acute disturbances in marine ecosystems can cause unexpected changes in fish stocks. Management strategies should therefore address vulnerabilities with the concerned SSF by decreasing the sensitivity to disturbance and increase adaptive capacity (Cinner et al., 2012). Communities at high risks could also lower exposure, by for example moving to a lower risk area (Cinner et al., 2012), however, such interventions are not relevant to understand resilience within management of SSF and will not be further discussed. Rather, SSF should adapt management strategies which focus on building social-ecological resilience to better cope to the risks they are exposed to in their everyday life.

Analysing underlying vulnerabilities in a community contribute to the understanding of how different factors increases susceptibility to risks or rather contributes to build resilience when faced with stressors. By addressing underlying drivers of vulnerability, one can manage systems to improve and build resilience towards stressors through informing management practices with context-specific approaches.

1.5 Research Motivation

The marine ecosystems of Zanzibar are facing multiple pressures, including habitat degradation, increased fishing pressure, and increasing impacts of tourism. These pressures are causing challenges for the SSF, thus threatening the backbone of local livelihoods. Effective involvement of local management is necessary to address the complex relations between human activities and the marine ecosystems.

With focus on the local fishers of Jambiani, a small village on the east-coast of the Unguja Island in Zanzibar, this study is investigating small-scale fisheries and their relationship to local management practices, fish diversity and abundance, and fish demand from tourism dynamics. By using the social-ecological resilience framework, this study aims to assess the resilience of Jambiani's community and ecosystem to external pressures, identify vulnerabilities within existing management systems, and explore the opportunities and capacity for adaptation.

1.5.1 Objectives and Research Questions:

In this study, I aim to map local fisheries management in Jambiani, Zanzibar, examining key aspects of ecological and social factors contributing to a resilient system. Specifically, this study aims to answer following questions:

- How are selected fisher's management practices related to fish diversity and abundance in various parts of the seascape of Jambiani, Zanzibar?
- How does local SSF management foster social-ecological resilience for sustainable coastal livelihoods in Jambiani, Zanzibar?
- How does tourists' demand for seafood in Jambiani impact the local SSF?

To answer these questions, this study aims to:

- (1) assess the abundance and diversity of fish communities in the local seascape,
- (2) investigate the preferred fishing methods of selected fishers in Jambiani and its relation to fishing area and yield,
- (3) investigate management responses of local fishers in relation to fish diversity and abundance, and to tourism.

2. Methods

This study aims to understand how local fishers are managing their fisheries in relation to fish diversity and abundance, and how fishers adapt to increasing tourism and fishing pressure. To gain an insight into fisheries practices and management choices, as well as having a perspective of the ecological status of their seascape, the study was designed to have an interdisciplinary approach of both social and natural science. Therefore, the methods were

split in two main categories. One part consisted of interviewing local fishers, to gain insights into their fishing practices, attitudes towards fishery management and the potential effect of increasing tourism. Additionally, some hotels were interviewed for further information on hotels and tourists' consumption of fish. The second part consisted of seascape surveying which had two main goals. First, to identify the dominant habitat types and their locations within the seascape. Secondly, to investigate species diversity and abundance associated with the three main habitat types: seagrass meadows, sandy bottom, and coral reefs. Additionally, the surveys provided insights of local fishing areas and conservation zones.

2.1 Study area

The study was conducted in Jambiani, a small village located on the southeast coast between Paje and Makunduchi on Unguja island, Zanzibar, Tanzania [-6.3149146, 29.5469383] (Figure 1). Jambiani is long stretched with approximately 5 km of shoreline. The people of Jambiani are dependent on this shoreline for a large part of their livelihood, as it gives access to fishing and seaweed farming in addition to providing for tourist attractions such as snorkeling- and fishing tours.

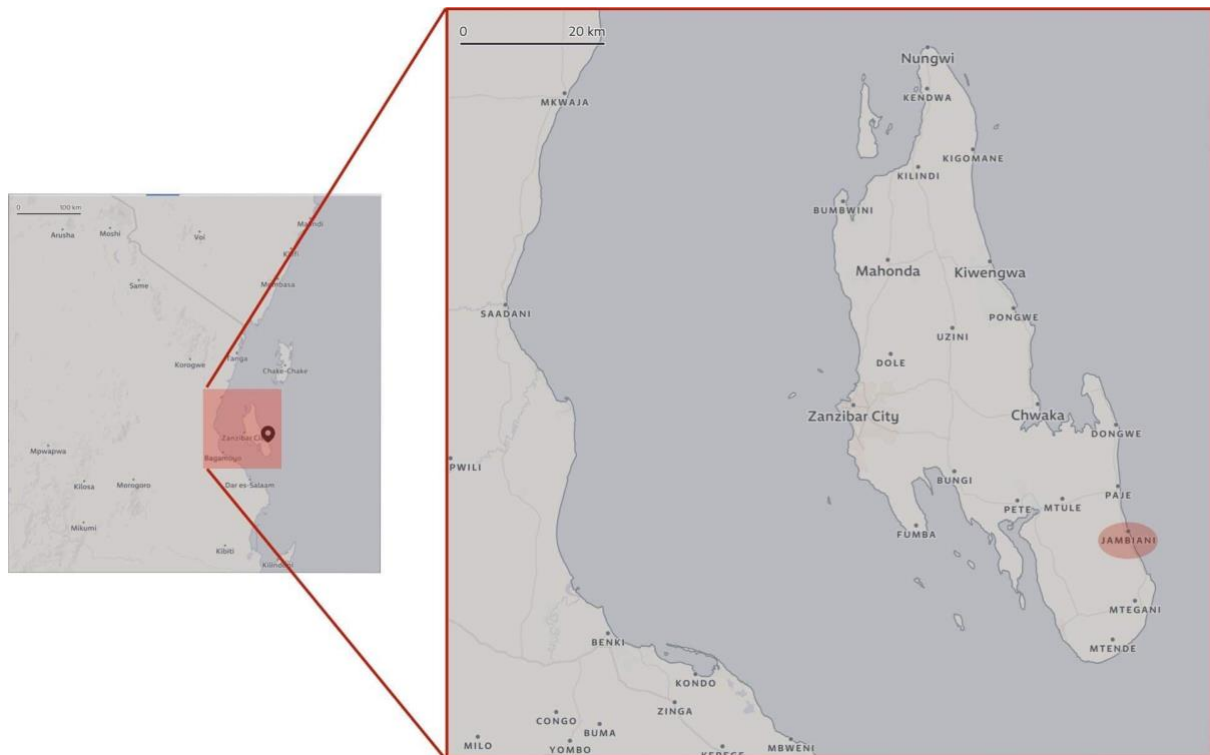


Figure 1: Map of Unguja island, Zanzibar, highlighting the location of Jambiani (Yr, n.d.). The location of Zanzibar is further highlighted at the east coast of Tanzania.

Jambiani was chosen as a representative small-medium sized village with local focus on fishery management. The local fishers have been organizing their own way of management which aims to 1) enhance marine habitats, sustain good yields, and secure food for villagers, and 2) enhance social welfare through infrastructure improvements. and to take care of their villagers. Furthermore, the seascape of Jambiani is heterogeneous and consists of coral reefs, seagrass meadows, sandy and rocky areas, and deeper waters deep sea. Jambiani is characterized by a fringing reef that stretches out parallel to the shore, creating a border to the open ocean (Eggertsen et al., 2021). The fringing reef creates a shallow lagoon (< 5m) in which one can find coral reefs, seagrass bed, and sandy and rocky areas. Furthermore, the fringing reef creates a border to the open ocean, which makes it difficult for many fishers to access resources outside of the lagoon.

2.2 Data collection

2.2.1 Interviews

This study relied on qualitative interviews as one of two main approaches of data collection, as a central part of the study was to gather information about fishers' thoughts and attitudes towards fisheries management and increasing tourism. Qualitative interviews act as a functional tool to bring out and understand thoughts and meanings of people (Clark et al., 2021, p. 350), as it gives the opportunity for respondents to respond in long answers. Furthermore, to understand their different views, the interviews were used to obtain information on individual yield and gear usage.

In addition to interviewing local fishers, hotel managers in Jambiani were also interviewed. These interviews were intended to triangulate some of the information from the fishers' interviews, and to gain greater insights into hotels' fish purchase practices and tourists' fish consumption.

2.2.1.1 *Local fishers*

The main data collection consisted of multiple semi-structured interviews of local fishers, both individually and in groups. The fishers who participated in the interviews were chosen

sampled through purposive sampling as the participants needed relevant background and diversity. Therefore, two criteria were set for the purposive sampling to obtain necessary data. The primary criteria were different fishing techniques, where at least two fishers should represent each technique. Secondly, fishing experience was a criteria, with variations between low, medium and high fishing experience. Only fishers of medium and high experience were interviewed, which could lead to having interviewed more people that are aware of fishing regulations and management than what beginners could be. However, many fishers start very young and could already have 10 years of experience in their twenties. This made it difficult to differ between low and medium experience, as well as finding participants of low experience to interview.

The interviews were structured around a questionnaire with a set of questions within categories of personal fishing information, management practices, and tourism (Appendix). The questions within personal fishing information were more straightforward as they were set to gather background information of the participants, such as “what are your main fishing technique(s)?”. Within the two other categories, the questions were open ended. This opened up for new insights and allowed for further inputs of the participants’ personal meanings, attitudes and perceptions of management practices and tourism. Additionally, the semi-structuredness allowed for follow-up questions for further elaboration on new information.

Furthermore, the semi-structured interviews were beneficial during group interviews as they opened up for discussion between participants. The majority of the interviews were in groups of 2 – 4 participants. Group interviews allowed for discussion of opinions that not necessarily everyone would have thought to mention individually. This allowed for the other participants to comment on statements and increased insights on even more subjects.

Although it was valuable to have multiple insights during interviews, the groups were kept small to not intimidate respondents to speak. The group composition was also important to allow for free expression, where for instance women and net-fishers were in groups by themselves. Women were interviewed alone to not feel intimidated or oppressed by other men, and the net-fishers were interviewed alone as some of the other fishers were known to

look down on net-fishing. Additionally, due to time limit of participants, smaller groups allowed for enough time for each participant to answer in depth.

The interviews were conducted with a translator because I did not speak Swahili and most fishers did not feel confident speaking English. The translator was a local woman with pre-knowledge of the fishing community in Jambiani. Possible power imbalances between me, the translator and the fishers were hopefully limited by having a female translator.

Furthermore, as the translator was a local person, some of the fishers felt safer to share their thoughts. However, by being dependent on having a translator, some of the information could have been misunderstood, either by the questions asked being translated differently or by answers not being translated to its entirety. To minimize misunderstandings, some questions were rephrased for the translator and some additional questions were asked for clarifications.

2.2.1.2 Hotels

To gain more information on hotel's practices on fish consumption, managers of hotels along the beach of Jambiani were interviewed. The hotels were selected at random, with the criteria of being located on the beach. Multiple hotels were asked to participate in the interviews along the entire coastline of Jambiani, however, only a few accepted. Some hotel managers were too busy, and others were not interested in participating. So, although the selection was at random, the acceptance of being interviewed could be biased towards friendlier hotels. In the interviews, the hotels were asked about their fish consumption and purchases practices. Hotels that were open to be interviewed might be the hotels that are also cooperating well with local fishers, which was important to take into consideration when interviewing and analyzing the answers.

The interviews were constructed as semi-structured to allow for open conversations and to ask additional questions if needed. However, most questions were quite straightforward and did not require much discussion. The interviews were conducted individually, with only me and one owner or manager present. Individual interviews were chosen to get honest reviews of fish consumption and purchasing practices without the pressure of other hotel managers being present.

2.2.2 Seascape surveys

Jambiani has a heterogenous seascape with different types of habitats. To get a better overview of the seascape inside the lagoon, the study had two approaches: (1); to identify and map the different habitats, and (2); to observe fish diversity and abundance within the three main habitats: coral reefs, seagrass meadows and sandy bottom.

2.2.2.1 Seascape mapping

Data collection to create a map of the seascape was constructed to be simple and efficient through collecting *in situ* data for remote sensing data interpretation (Barrett & Curtis, 1976). With a boat, the seascape was surveyed at random., with a goal to sample minimum twenty geographical points within each habitat. The geographical points were found using the built-in GPS of Google Maps. The points were then used for ground truth analysis, which involves validation of in-field data with satellite photos. Validated points could then be used as a representation of observations from smaller areas and quantified to larger areas. To quantify results, the online mapping platform “Remap” was utilized. Remap uses Google Earth engine, which gives direct access to satellite data and remote sensing methods (Murray et al., 2018). The Remap system uses the truth grounded points to identify the habitats and uses this to predict across the rest of the seascape (Murray et al., 2018). However, since some of the coral reefs were smaller than the pixels, some of the reefs could appear larger. Additionally, in one area, the habitats were too mixed in with each other to recognize habitats in the satellite photos, which lead to merging the habitats in that area.

2.2.2.2 Fish abundance and diversity

Within each main habitat (coral reefs, seagrass meadows, and sandy bottom), three quadrats of 10x10 meters were surveyed for fish species, along with species of corals and seagrasses, substrate cover, structural complexity and depth. A quadrat was created at each site through securing the measuring tape at every 10 meters, as well as turning 90° degrees at each 10-meter stop, until a square was created. The quadrats were placed randomly within the habitat, with the exception of one smaller reef. The reef was smaller than the quadrat, so to include the entire reef, the reef had to be placed in the middle of the quadrat. All surveys were conducted during daytime, between 08:00 and 15:00.

The main objective was to identify all fish to species level (or to family level if species level was not possible), and their individual length which was measured from their snout to their last vertebrae. The surveys followed the visual census method of reef fish by the Australian Institute of Marine Science (Emslie & Cheal, 2018), to ensure to collect as accurate data of the fish assemblages as possible. First, the most mobile species was recorded to decrease risks of them moving out of the quadrat before being detected. Secondly, slow-moving and sedentary species, for instance hawk fish, were recorded. Lastly, fish species that hide or other species that were merely blocked from view during the first recording were recorded.

To further improve the surveys, some preparations were done beforehand. Prior to surveying quadrats, I went out to a reef to identify species and to take pictures of species I did not recognize. The species then identified in field and the species identified from the pictures were written down on a dive slate, with extra space for new species. Species identified in-field could then be noted down right into the sheet. Species that was not easily identifiable were taken a picture of, recorded as the number of pictures of that day, e.g., “Picture01”, and identified at a later point with the use of Coral Reef Fishes (Lieske & Myers, 2001) and FishBase (fishbase.se).

Moreover, corals were identified in field, where each new coral family within the quadrat was written down. The seagrass was identified by taking two samples of each seagrass, one being a picture and the other being a physical sample, to identify species at a later point. The substrate cover was an estimate calculated from how much of the quadrat was covered in each substrate. By having an overview of the quadrat, one can visually estimate the cover to the nearest 5% (Figure ?). Structural complexity was also visually measured, on a scale of 0-5, where 0 = no vertical relief, 3 = moderately complex, and 5 = exceptionally complex with caves or overhangs (Polunin & Roberts, 1993; Wilson et al., 2007). Depth was recorded by lowering the measuring tape from the surface until it touched the sand.

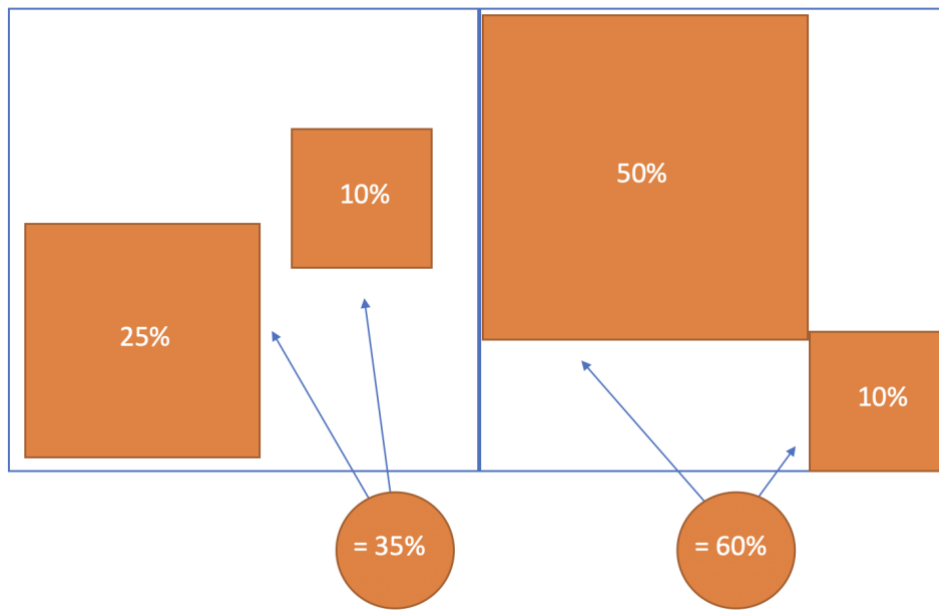


Figure 2: Illustration of how to visually estimate total percentage of substrate cover.

Furthermore, the quadrat was surveyed in a straight line from one corner to the next corner. When reaching the corner of the quadrat, a new straight line parallel from the first line was surveyed until the whole quadrat was surveyed (Figure 2). The space between each line dependent on two criteria. First, the visibility was an important role in the spacing. With high visibility, the ability to have larger spacing was possible as the vision to each side of the line was greater. Lower visibility resulted in smaller spacing. Secondly, the number of fish in the area was important to consider. With high number of fish, the spacing needed to be smaller, even in conditions of high visibility, because if not it would be too many fish to survey at the same time.

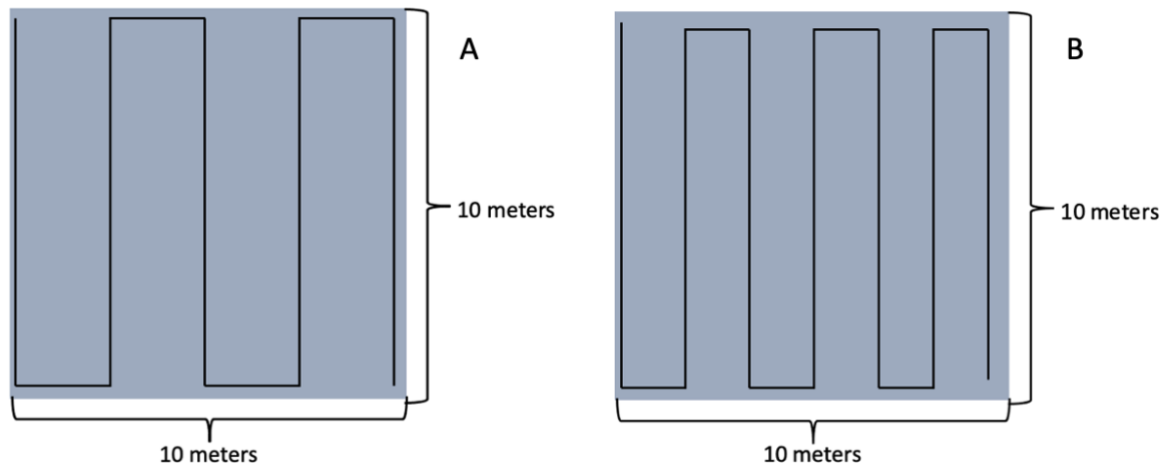


Figure 3: Quadrat surveying. The quadrat was 10x10 meters. The surveying was done in parallel lines, with differentiating spacing depending on the conditions. The space could be larger (A) or smaller (B).

2.2.3 Observational data

Observational data allows for studying interactions within the community. As the study involves a complex system, observational data of community and fishing techniques contributed to a better insights and understandings of other research findings. Furthermore, observation was used to understand phenomenon who is not easily understood when explained. For example, gaining insights into how fishers used the different fishing equipment, how fishers work together to fish, and which fishing ground they preferred to go is not easy to understand only through words. By accompanying fishers on their fishing trips, all this was rather experienced first handed which led to contextual and grounded insights.

2.3 Data analysis

2.3.1 Interviews

The interviews were recorded for a precise transcribe of the interviews. Transcribes can provide the opportunity for in depth analysis as the researcher can go through the interviews repeatedly for examinations and analysis (Clark et al., 2021, p. 441). Additionally, transcribes provide the opportunity for other researchers to search for applicability to their own studies (Clark et al., 2021, p. 42). The transcribes were analyzed by categorizing the answers into the main themes that were studied. Furthermore, the answers within the categories were grouped into the different fishing practices and fishing experience. Within the main themes, the major

points were written down to see if answers correlated within and/or between groups. Additionally, some quotes were chosen to represent certain statements.

2.3.2 Seascape surveys

The information from the dive slate (fish and habitat data) was transferred and systematized in excel the day of surveying. Excel was further used to create tables and figures. Abundance was measured as the number of fish per 100 m². For one of the analyses, the data was sorted to compare the observational data of fish length with targeted species within the fishery. Targeted species was defined by fishers' statements in the interviews and was separated into targeted species of net-fishers and of basket-trap fishers.

2.4 Research ethics

In this study, I met a lot of people that were willing to spare some extra time to talk to me and share a lot from their life and daily practices. In return, it is important to meet the participants with respect and gratitude (Stake, 2000, p. 447). Participants were thanked before and after interviews for their time and contribution. The villagers got a monetary compensation for lost worktime as a further sign of gratitude. Furthermore, the different views of local fishers and hotel managers were appreciated and not in any way looked down upon or rejected.

Additionally, it is important to create safety for the participants, in which they understand their contribution to the study and how their information will be used. The research was explained to participants prior to interviews, along with information of where and to whom the study would be shared. Before and after interviews, I opened up for questions to clear up any doubts related to the research or the interviews. A few of the locals were a bit hesitant at first as they had bad experience of sharing information with other foreigners as it was used against them at a later point. However, after being explained the study, the fishers gained a greater trust and built a stronger relation.

Furthermore, the participants were explained their rights to stop the interview at any time, to not answer certain questions or to get statements retracted. Since the interviews were recorded for later analysis, the participants were also asked for consent of recording.

Recordings was not started until consent was stated. To ensure their privacy, the audio-recordings will be deleted after completed research. Additionally, in accordance with the Norwegian Center for Research Data (NSD), no direct or indirect personal information was recorded.

In the ecological surveys, there were less people involved. However, there are still ethical concerns. First of all, the livelihood of the locals is dependent on their coast. Therefore, it is important to be respectful of their practices while being out on the sea, by for instance not disturbing ongoing fishing by setting up quadrats in that area. Additionally, to take care of their nature, no trace was left behind as all equipment and wastage was brought back to land, and the areas of study were disturbed minimally.

2.5 Limitations

There are certain limitations in the study, even though the research followed procedures to ensure high trustworthiness. Firstly, the language and cultural differences could lead to misunderstandings of information and observations, in which certain practices or concepts can be difficult to translate into other cultural contexts, which could be a limiting factor of validity. To mitigate some of the cultural issues, I spent some time in Zanzibar before commencing the study. I got time to familiarize myself with Jambiani, its villagers and culture, as well as to seek input from a local fisher. Secondly, the time possible to spend with field work was constrained. Short time in Jambiani limited both the sample size and the research design. More time would allow for more interviews and seascape surveys, which could increase the representativeness of the study. A more comprehensive research design could also allow for greater insights of the research questions. The goals for the field work were set appropriately to the time available to ensure that time was used wisely. Lastly, there are limited previous research available from Jambiani, which reduce the possibility to compare these finding with previous findings.

3. Results

3.1 Overview of Jambiani's Seascape

The seascape of Jambiani consisted of a diverse range of habitats, including coral reef, seagrass beds, sandy and rocky area, algae reefs, the beach with intertidal flats, and the open ocean (Figure 2). The open ocean is being separated from the main biotypes as there is a fringing reef parallel to the shore. The fringing reef creates a barrier between the open ocean and the inshore lagoon area. The lagoon is shallow (<5 m) which makes it easy for boats to fish inside the lagoon. However, the barrier over to the open ocean can be difficult since this is the area where the waves accumulate and can be difficult to cross in small traditional sail boats. The study is focused in the lagoon area because this is the area which is under conservation measures.

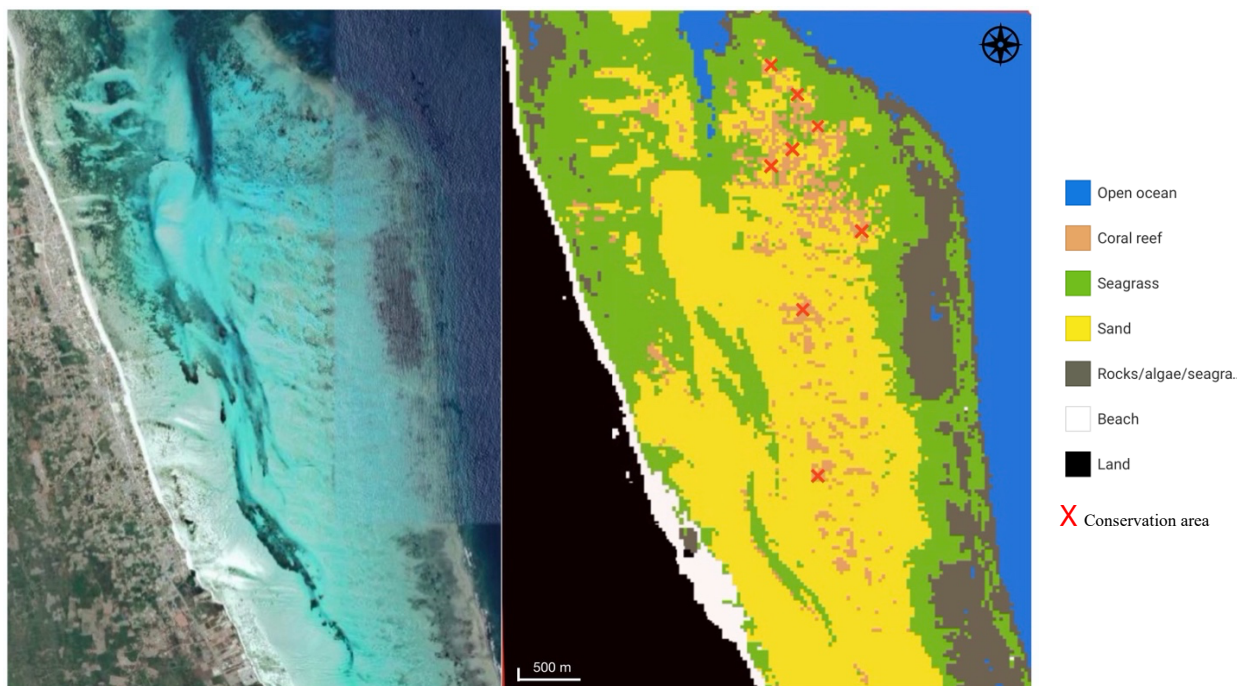


Figure 4: Overview map of the costal lagoon in Jambiani, Zanzibar. The colours signify different biotypes as labelled, while the red X shows locations of conservation areas.

While sandy areas dominated the area, there were also large stretches of seagrass present. The seagrass areas were both made up of wild seagrasses, mostly *Cymodocea serrulata*, while other areas were cultivated for seaweed, mostly *Eucheuma denticulatum*. The coral reefs were distributed in patches and were relatively small in size. However, many reefs were in

close proximity to each other, which allows fish to utilize multiple reef areas for habitat, feeding, breeding, nursery etc. The surveyed reefs had a mean coral cover of 65%, with the highest cover of 80% and the lowest of 50%. The reef with lowest coral cover was a small reef (approximately 50m²) surrounded by seagrass, rubble, and sand. The reef was relatively small, had a structural complexity of 1, and low coral diversity as only the families of Porities and Pocillopora was found. This reef also had the lowest fish diversity and abundance. The reef with highest coral cover was a larger reef (approximately 400m²), with a structural complexity of 4, and a higher coral diversity (Porities, Pocillopora, Acropora, Platgyra, Lobophyllia) with some presence of seagrass and sand. This reef also had highest fish diversity and abundance.

The conservation areas were marked with buoys, where the coral reefs in close proximity to the buoys were considered protected. The buoys situated between two reefs included both reefs in protection. Of the 8 zones, 3 had been in place for a longer period of time, while 5 were added this year and is under testing. If the new zones do not receive positive response by the community, they might be removed. Additionally, there were other areas which were limited for net-fishing. However, as these areas lacked official marking they are not depicted on the map.

3.2 Total Species

A total of 46 species was found across the three habitats, most of which were located in the coral reefs (Table). Specifically, it was recorded 42 species in coral reefs, 10 species within seagrass habitats, and 3 species was identified in the sandy areas. These findings encompass a diversity of 20 taxonomic families.

Table 1: Overview of species found in the three main biotypes: coral reefs, seagrass beds, and sandy areas. The overview includes family names and every species identified within the family.

CORAL						
Acanthuridae	Apogonidae	Aulostomidae	Blenniidae	Chaetodontidae	Cirrhitidae	Gobiidae
<i>Acanthurus nigrofasciatus</i> <i>Acanthurus triostegus</i> <i>Zebrafish</i>	<i>Cheilodipterus</i> <i>quinquelineatus</i>	<i>Aulostomus Chinensis</i>	<i>Plagiotremus</i> <i>rhinorhynchus</i>	<i>Forcipiger flavissimus</i> <i>Heniochus acuminatus</i>	<i>Paracirrhites forsteri</i>	<i>Gnatholepis cauerensis</i>
Holocentridae	Labridae	Lethrinidae	Lutjanidae	Mullidae	Ophichthidae	Pempheridae
<i>Myripristis murdjan</i> <i>Sargocentron diadema</i> <i>Neoniphon argenteus</i>	<i>Gomphosus caeruleus</i> <i>Halichoeres cosmetus</i> <i>Halichoeres scapularis</i> <i>Labroides dimidiatus</i> <i>Thalassoma hardwicke</i>	<i>Lethrinus harak</i>	<i>Lutjanus fulviflamma</i>	<i>Parupeneus barberinus</i>	<i>Myrichthys maculosus</i>	<i>Pempheris vanicolensis</i>
Pomacentridae			Scaridae	Soleidae	Syngnathidae	Tetraodontidae
<i>Abudefduf sexfasciatus</i> ; <i>Abudefduf vaigiensis</i> ; <i>Amphiprion akallopsis</i> ; <i>Chromis fieldi</i> ; <i>Chromis viridis</i> ; <i>Chrysiptera unimaculata</i> ; <i>Dascyllus aruanus</i> ; <i>Dascyllus trimaculatus</i> ; <i>Plectroglyphidodon dickii</i> ; <i>Plectroglyphidodon lacrymatus</i> ; <i>Pomacentrus sulfureus</i>			<i>Chlorurus sordidus</i> <i>Scarus ghobban</i>	<i>Paradachirus marmoratus</i>	unkown species	<i>Arothron hispidus</i> <i>Canthigaster bennetti</i> <i>Canthigaster valentini</i>
SEAGRASS						
Holocentridae	Labridae	Lethrinidae	Mullidae	Pempheridae	Scaridae	Sphyraenidae
<i>Myripristis murdjan</i>	<i>Halichoeres scapularis</i> <i>Pteragogus flagellifer</i> <i>Thalassoma hardwicke</i>	<i>Lethrinus harak</i>	<i>Parupeneus barberinus</i> <i>Parupeneus pleurostigma</i>	<i>Pempheris vanicolensis</i>	<i>Chlorurus sordidus</i>	<i>Sphyraena flavicauda</i>
SAND						
Gobiidae	Lethrinidae	Soleidae				
<i>Gnatholepis cauerensis</i>	<i>Lethrinus harak</i>	<i>Paradachirus marmoratus</i>				

3.3 Fishing techniques

Of the interviewed fishers, the main fishing techniques was basket trap fishing and net fishing (Table 2). Other techniques, such as handline fishing or stick and spear fishing was often used as an additional method. The only one having spear fishing as his main method was an octopus fisher. Spear fishing is one of the most common methods used for octopus, along with catching them by hand.

Table 2: Ratio of fishing techniques of interviewed fishers. Primary method being the method they used the most, secondary methods being the methods they used additionally. The secondary methods exceed 100% as some fishers utilised multiple additional methods.

FISHING TECHNIQUE	PRIMARY METHOD	SECONDARY METHOD
BASKET-TRAP	64%	0%
NET-FISHING	27%	0%
SPEAR/STICK	9%	45%
HAND-LINE	0%	64%

On of the main fishing techniques is basket traps. Basket traps is a tool made out of sticks, often bamboo, used by certain fishers to trap fish by luring the fish inside a tunnel to the basket. The baskets are filled with seaweeds to act as a lure for the fish and are placed on the sea bottom for at least one day. Some fishers use smaller baskets which are placed inside and around the coral reefs in shallower areas, while other fishers use larger baskets which is brought out to the open ocean. In the shallows, fishers use various boats, however, to fish in the open ocean a fibre boat is needed to cross the boundary made by the fringing reef. Fishers going to the open ocean are more likely to catch larger fish, however, the sea is often rough, and it can be difficult to access the traps when conditions are poor. Consequently, the deep reefs fishers are left vulnerable as their traps can be destroyed during the rough conditions or because they are not able to provide enough income during these periods. One basket-trap fisher stated: “As a trap fisher, I went out with my trap when the conditions were nice, but when the sea was rough, I couldn’t go fish, which led me to have many days without fishing.” (Fisher 3, transcript 2). However, to decrease some of the vulnerability, most of the basket-trap fishers were also handline fishers, fishing in shallow reefs during rough weather conditions.

The other main fishing technique is net-fishing. Net fishers go out to fish in larger groups, around 8 – 14 people, usually in one or two fibre boats. Some of the fishers goes in the water with snorkelling equipment to search for the certain species and alert the crew when found. This way, the net fishers have more possibility to target certain species. The crew in the boat releases a net in a U-shape around the fish to enclose them in a contained area, where the snorkelling fishers adjust the net as needed. A smaller net is then put inside the U-shaped net

which is dragged by the snorkellers to push the fish towards one corner and pushed inside the net, which is then pulled onboard. Net-dragging can cause coral breakage, however, to reduce damage, multiple fishers dived down to lift the net over the corals instead. Some of the snorkellers also bring a stick or spear underwater, that they use to catch mainly octopus, which they do while they search for fish species to target with their nets.

The spears and sticks are used to target individual fish or octopus. The wooden sticks are sharpened at the end, while the spears have a pointy steel attachment at the end of the stick, making them sturdier. The fishers look for fish or octopus while free diving and uses the stick/spear to catch the prey. Stick and spear fishers can access their fishing areas by boat or by walking or swimming from the shore.

A handline is a hand-held line with one or multiple hooks attached. This method can target most species, but catch can depend on the hook size, bait, and fishing ground. Handline fishing can be used from any kind of boat.



Figure 5: The two main fishing techniques used in Jambiani: net-fishing (left) and basket-trap fishing (right).

3.4 Targeted species and their abundance

Basket trap fishers had preferences of which families of fish they preferred and often hoped for. However, due to the nature of trap fishing, it can be difficult to target species. The basket attract fish with the seagrass inside, or potentially already trapped fish, and is placed in areas where they have been successful with fishing before. The larger traps can target bigger fish due to its size and is therefore placed outside of the lagoon. The smaller traps are placed inside the lagoon within or close to coral reefs. Net fishers had also preferences towards what kind of fish they wanted, and were able to target these more specifically, as they were able to visually scope the fishing ground for the species they were targeting. If the species were not found, they moved to another fishing ground. Both fishing techniques is acquiring multiple species, in which none can be viewed as by-catch as they bring home all species for food.

It was a difference in balance between preferred species and what was caught while fishing between basket-trap fishers and net-fishers (Table 3). In observation of fishing, basket-fishers inspected a total of 10 traps, compromised of 7 large traps located outside of the lagoon and 3 small traps located inside the lagoon. Of the fish species previously documented in ecological surveys (see Table 1), species in 13 out of the 20 families were captured, many of which were of low preference by the fishers. On the other hand, the net-fishers fished in five different locations within the lagoon, with the primary objective of catching yellowtail barracuda (*Syphraena flavicauda*). Across all five fishing grounds the yellowtail barracuda constituted the majority of the catch, with the occasional occurrence of parrotfish and rabbitfish. Although not quantifiable, this observation suggest that net fishers may possess a greater proficiency in targeting specific fish species.

Table 3: Overview of preferred species to target by basket-trap fishers and net-fishers.

Preferences is based on information from interviews: low-medium-high signify the frequency of mentions in interviews. “In field” refers to observational data of what fishers caught during one fishing trip of each method. The families included in the table is based on the diversity found in ecological surveys, with the exception of Siganidae which was included due to the high frequency of preference among fishers.

Latin	English	Trap: preference (high/medium/low)	Trap: in field	Net: preference (high/medium/low)	Net: in field
Acanthuridae	Surgeonfish	High	Yes	Low	No
Apogonidae	Cardinalfish	Low	No	Low	No
Aulostomidae	Trumpetfish	Low	Yes	Low	No
Blenniidae	Blennies	Low	No	Low	No
Chaetodontidae	Butterflyfish	Low	Yes	Low	No
Cirrhitidae	Hawkfish	Low	No	Low	No
Gobiidae	Gobies	Low	No	Low	No
Holocentridae	Squirrelfish	Medium	Yes	Low	No
Labridae	Wrasse	Medium	Yes	Low	No
Lethrinidae	Emperor	High	Yes	High	No
Lutjanidae	Snappers	High	Yes	Medium	No
Mullidae	Goatfish	High	Yes	High	Yes
Ophichtidae	Snake eel	Low	Yes	Low	No
Pempheridae	Sweeper	Low	No	Low	No
Pomacentridae	Damselfish	Low	Yes	Low	No
Scaridae	Parrotfish	Medium	Yes	Medium	Yes
Soleidae	Flounder	Low	Yes	Low	No
Sphyraenidae	Barracuda	Low	No	High	Yes
Syngnathidae	Pipefish	Low	No	Low	No
Tetraodontidae	Pufferfish	Low	Yes	Low	No
Siganidae	Rabbitfish	Low	Yes	High	Yes

The majority of observed preferred species was identified within coral reefs, although characterized by relatively low abundance and size, generally compromising fewer than 10 individuals per species and measuring under 30 cm in length (Figure 5). In contrast, there was a lower species diversity observed within seagrass beds, however, those species exhibited the highest abundance. Sandy areas were both low in diversity and abundance.

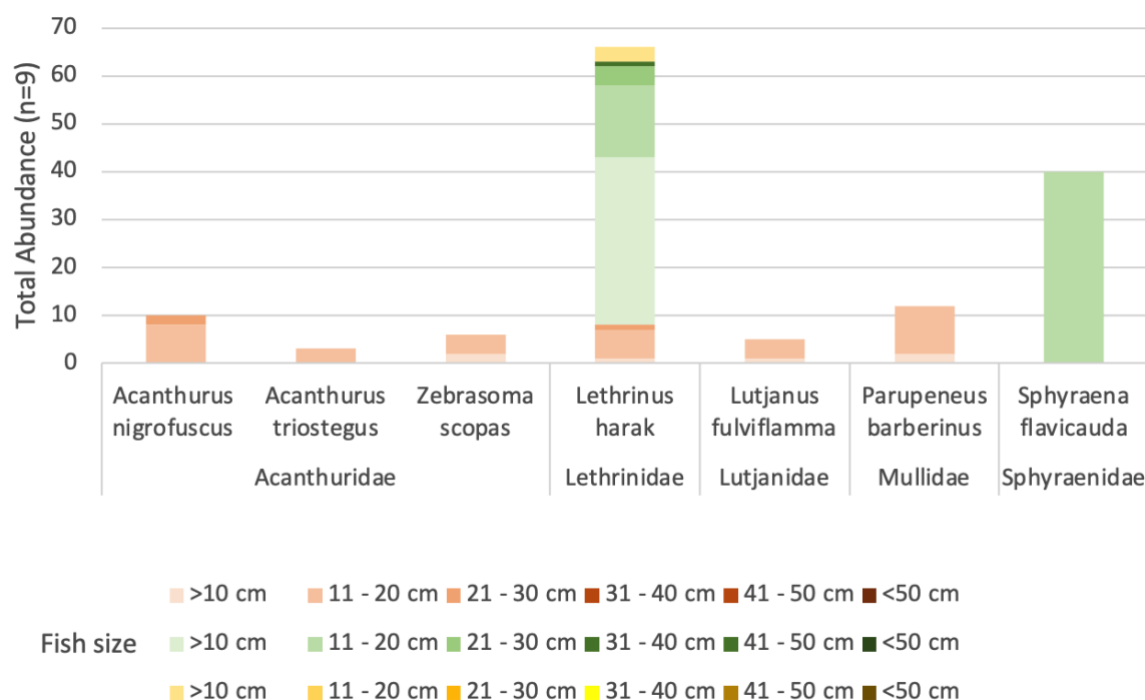


Figure 6: Total abundance of observed targeted species across coral reefs, seagrass beds and sandy areas. The colors of fish size differentiate the biotypes: orange (coral reefs), green (seagrass beds), and yellow (sandy areas).

3.5 General differences and similarities between fishers

All basket-trap fishers had other activities to do for their livelihood in addition to fishing, while only some net-fishers did other activities (Table 4). The octopus fisher earned a lot from his fishing when he caught octopus, as he could sell to hotels. However, due to uncertainties in octopus yield, the fishing was accompanied with other work as well. Many of the fishers saw the value of using their boats to bring tourists out on snorkeling tours, however, not all the fishers were confident enough in their English to do so. When asked about income contributions to livelihood, one basket trap fisher answered: “It depends, around 70% on fishing, and around 30% farming. I don’t take tourists out because I don’t speak English”.

All fishers were primarily fishing for their own household and to the community. More net-fishers stated that there were sometime large enough yields to bring fish to the market in Stone Town to earn more. The octopus fisher had possibilities to sell directly to hotels in Jambiani when catching enough octopus. When asked why not more fish was sold to the

hotels, the answers were that the fish often was too small for hotels due to being limited to inshore fishing. For example, a net fisher stated that they wanted to have opportunities within the hotels' markets but that: "we don't have the equipment to do this. With the nglawala (traditional sailboat) we are not able to go to the deep sea, and we don't have space on the boat to catch many big fish".

Table 4: Overview of fishing techniques.

	Basket trap and hand-line fishing	Net fishing	Stick/spear fishing
Gender	Men	Men	Men and women (only interviews of men)
Targeted species	Generally, not targeting any species. Differences in catch from small and big traps.	If possible, targeted certain species (emperor, kingfish, rabbitfish, barracuda). If not, any kind of fish was fished for.	Octopus and fish.
Fishing contribution to livelihood	Medium contribution. Not enough to only fish, all reported that they relied on other work as well. Most had a combination of both farming and fishing for food, and snorkelling guides or working smaller irregular jobs for extra income.	High contribution. For some, net fishing provided enough income to be the only income in the household. Others had seasonal work during low fishing periods, for instance at hotels.	Medium contribution. During periods where fishers caught a lot of octopus, the income was enough to be the only income. During low periods, the fishers had other jobs, for example as taxi driver or working at hotels.
Market	Mostly to their own family and other villagers. If there was extra, it could be sold to hotels or other markets.	Low yields: mostly to their own family and other villagers. High yields: transported to the fish market in Stone Town.	Octopus: sold to both villagers and local hotels. Fish: household and community.

3.6 Management practices

The local management of conservation zones was met with positivity from all interviewed fishers (Table 5). The fishers liked the conservation zones because they saw benefits of increased yields, thus increase in income, as well as the positive outcomes for their

community. Improvements of infrastructure, health-services, education, and recreational activities has been achieved through fees which is paid by fishers during reopening for fishing within conservation zones, and by guides who brings tourists out to snorkel within the zone:

“It is good to keep this place, because if we keep this place for many years and then open it up to fish later it is possible that there will be so much more fish there. With more fish, we will get more money when we sell it, and then we can put this money towards fixing problems in the community and strengthen other things that we come across.” (Net fisher).

“I feel more comfortable and happier because this contribution for the village is for our own good, not for someone else. So, I feel happy and proud that we do this on our own and for our own village.” (Basket-trap fisher).

The success of the conservation zones has been so high that the fishers are wanting to create even more zones for conservation: “We started with only one place and now we have three places. So, I am thinking that it would be good with even more places like this to conserve” (Basket-trap fisher). This was achieved in the same month, in which the fishers with the support of governmental officials created a cluster of 5 new conservation zones, resulting in a total of 8 conservation zones. To further safeguard resources, the fishers come together to discuss decisions concerning their seascape to ensure that the decision made is benefitting their community and marine resources. For example:

“We have cooperation with the management and the people. If we want to decide about something, the decision can’t be done alone. For example, if someone finds a new area with more fish that they want to fish, they have to come to the people and talk about this area and then together we will make a decision if we could fish this area to benefit from it now or if it is better to leave it if it is not good to go there, maybe save for later.” (Basket-trap fisher).

Although most reactions were positive to local management policies, one net-fisher stated dissatisfaction to the areas that were only restricted to net fishing:

Yes, there are some areas, it is not really conservation zones, but it is areas where it is net-fishing is banned. I find this very unfair because we are left with little

areas to fish. I think it is good to have the conservation areas, but would like to be able to come and fish in the net-banned areas. (Net fisher).

The two other net-fishers, however, thought that this regulation was fine as there was still enough areas for them to fish in. There was a larger agreement of dissatisfaction towards the governmental ban of fishing with net with small-sized mesh. The government restricted fishing with these nets due to the high pressure it creates towards juvenile fish populations. However, net-fishers found the restriction to be very limiting for their fishing. One net-fisher expressed:

As a fisher, our income depends on the fishing, and of course, we don't have the modern equipment, so we are quite dependent on fishing for it to cover our needs, as we are not rich. Sometime the government do not think about this, they don't think about us people that are poor and depend on the ocean. So, for us, it is important to be able to say what works and that this can be respected. The government comes here and tell us that small size of fishing net is not wanted to be used, but they are not coming with solution. For instance, they are not saying, instead of using this you can use this. They just come here with the rule: don't use this! And that's it! But, for us, this is the kind of net where a lot of our income depends on. You, see? (Net fisher).

To ease the transitions and to not lose a lot of income, the fishers expressed a wish to the government to assist them with knowledge, to learn what to do instead, and with new equipment to use instead. Here again, the net-fisher expressed negativity to the help they received:

The education is good for nothing. They already come here and give education but we don't have the equipment needed for this. So how can we use what we learn? They come with education, but we can't use it. (Net fisher).

I'm a bit concerned, because the government are not investing a lot to look after the fishers in this villages. They are not supporting us with new equipment or other kind of boats. This gives little hopes for the future. We need some strategies where we can build the fisheries stronger for the new challenges coming. Sometimes they say they will help, but it is not working. (...) I don't see that there is good enough collaborating between us and them. (Net fisher).

Despite the negative reception of the implementation of this ban, other management collaborations with the government have had positive outcomes because the local fishers were able to provide inputs on the regulations. However, when it came to the small, meshed net-fishing ban, the feedback from the fishers did not result in change. A fisher explains:

What the government do, is only to come here and present rules to the villages or to the place where they want to place the rules for fishing. So then, the villagers are the ones that will sit with the rule, we will test it out to see how it works and then bring back feedback. This is fine, because if it is something we are not comfortable with we can bring this information back to the government. (...) Sometimes they respect it, and sometimes they respond with force for the rule to stay.” (Net fisher).

The responses shows that the fishers have high willingness and desire to create management initiatives that prepare the fishery for future challenges and tries to create space for community improvements.

Table 5: Summary of local and national management practices and following challenges and attitudes.

	Basket trap and hand-line fishing	Net fishing	Stick/spear fishing
Local management			
Regulations	Conservation zones with no fishing. Opens for fishing when fish abundance and size has increased. This fishing is subjected to a fee.	Conservation zones with no fishing. Opens for fishing when fish abundance and size has increased. This fishing is subjected to a fee. Additional zones where there are no net-fishing. Open for other fishers.	Conservation zones with no fishing. Opens for fishing when fish abundance and size has increased. This fishing is subjected to a fee. Local rules of not catching juvenile octopus.
Attitudes	Positive. Recognize the ecological benefits of increasing coral cover and fish abundance/size. Recognize the social benefit, as income derived	Positive. Recognize the ecological benefits of increasing coral cover and fish abundance/size. Recognize the social benefit, as income derived	Positive. Recognize the ecological benefits of increasing coral cover and fish abundance/size. Recognize the social benefit, as income derived

	from conservation zones goes back to the community.	from conservation zones goes back to the community. Both positive and negative reactions to areas of no net-fishing.	from conservation zones goes back to the community.
Challenges	Some hand line fishers that still fish in conservation areas. However, not viewed as a true challenge as their impact is small.	Net fishers still fishing in conservation zones and in no-net fishing zones. Problematic as the net can break corals. Some net fishers lift the net over corals but stated that they might not see all the corals. With both types of restriction zones, net-fishers feels there are little space left to fish in.	Not many challenges, tend to fish outside of the conservation zones.
National management			
Regulations	Conservation zones (although made locally, government helps with support and legal documents) Payment fee for fishing license and license for the boat. Different license for different size of fish.	Conservation zones (although made locally, government helps with support and legal documents) Payment fee for fishing license and license for the boat. Different license for different size of fish. Net-size regulations. Not allowed to use nets with small loops.	Conservation zones (although made locally, government helps with support and legal documents) Payment fee for fishing license and license for the boat. Different license for different size of fish.

Attitudes	<p>Neutral.</p> <p>Positive to have help with conservation zones but does not see any positive changes in fishing or fish abundance that can be attributed to the governmental regulations.</p>	<p>Neutral – negative.</p> <p>Positive to have help with conservation zones.</p> <p>Negative to rules of net-sizes as it is restricting their livelihood.</p> <p>Disappointed as the government does not help the fishers to adjust to the rules.</p>	<p>Neutral.</p> <p>Positive to have help with conservation zones.</p>
Challenges	<p>Do not feel the government help enough with the other concerns the locals' fishers has expressed.</p>	<p>Do not feel the government help enough with the other concerns the locals' fishers has expressed.</p> <p>Fishers using the small nets as they do not know what else to do.</p> <p>Fishing during night to not get caught by government officials.</p>	

3.7 Fish consumption and purchase patterns of hotels

The hotels were mainly serving large, pelagic species. Hotels primary fish purchase was tuna, where all hotels purchased or acquired tuna weekly (Table 6). The hotels had different size preferences, depending on the size of the hotel. The larger hotels stated they wanted tuna of 28 kilos while smaller hotels wanted 6 kilos. Reason being that the hotels want as fresh fish as possible and do not want to purchase more fish than what guests would eat within 2-3 days. The secondary fish purchase was of mahi mahi, which was used in fish curries, fish cakes and fish soups. The hotels did not serve smaller reef fish. One hotel stood out, as they generally did not purchase fish as they had weekly guided fishing tours to fish big-game species which was enough to sustain the hotel's fish demand.

Tuna and other fish was generally not bought in Jambiani due to low supply of tuna and other big fish. The hotel who fished their own fish stated that they sometimes bought smaller reef fish from a fisher-friend in Jambiani, although this was rare and only done when having portion-fish demands from guests. Seafood products, such as octopus, squid, and lobster, were purchased both in and outside of Jambiani. Two of the hotels had contact with one fisher based in Jambiani who regularly supplied octopus, while the two other hotels purchased their seafood at the same market they purchased their fish from, due to convenience.

Qualities looked for in the fish was freshness and size. All hotels preferred freshly caught fish, although frozen tuna was acceptable during low tuna season. Size preference varied between small and large hotels, with lowest size of 6kg and highest of 23kg. The smaller hotels preferred the smaller fish, and the bigger hotels wanted fish of bigger size. Not wanting to purchase juvenile fish and octopus was also a factor, especially for octopus in which one hotel had a following statement printed on the menus to warn guest of octopus shortages: “As soon as there is a shortage of fully grown octopus, we won’t be able to serve the octopus dishes, for as long as it takes.” (Menu, hotel 2).

Table 6: Summary of purchases and consumption of fish at hotels

	Hotel 1	Hotel 2	Hotel 3	Hotel 4
Menu	Fish of the day, crusted fish, roasted fish (always tuna) Squid/prawns /octopus Seafood salad, fish soup	Catch of the day (always tuna), tuna salad, tuna sandwich Squid/prawns /octopus/lobster	Catch of the day, tuna salad Squid/prawns /octopus/lobster	Tuna salad, fish curry (mahi mahi), fish cakes Squid/prawns /octopus/lobster
Fish qualities	Species: Tuna Size: 6-9 kg	Species: Tuna Size: 13-23 kg Quality: fresh and grown-up adults (no juveniles of both fish and octopus)	Species: tuna, mahi mahi, king mackerel	Species: mainly tuna, and some mahi mahi. Size: 10-13 kg Qualities: fresh and grown-up adults (no juvenile octopus)

Fish marked and frequency	<p>Tuna: mostly from Kizimkazi. Sometimes in Paje, or fish market in Stone Town.</p> <p>Seafood: mostly from Kizimkazi. Sometimes octopus is bought from local fisher from Jambiani who comes to their doorstep.</p>	<p>Tuna: Kizimkazi and Bwejuu.</p> <p>Seafood: Kizimkazi and Bwejuu.</p>	<p>Fish: is not purchased, but fished by themselves and tourists during guided fishing tours, which the hotel arrange themselves. Fishing usually occurs outside of Kizimkazi. Seafood: bought from Jambiani and Kizimkazi.</p>	<p>Tuna: Kizimkazi or fish market in Stone Town</p> <p>Seafood: mainly Kizimkazi</p>
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4. Discussion

4.1 Fishery Regulations

Among the regulations that fishers in Jambiani must follow, two stood out in interviews. One was a local initiative proposed by the fishers themselves, while the other was regulated by the government. Locally, the fishers proposed the establishment of conservation zones. These areas prohibit all fishing activities but with periodic reopenings. Fishing during reopening's were put under a local fee. They are only reopened for short periods of time and are then closed to facilitate further recovery of fish diversity and abundance. Moreover, these zones were also utilized for snorkeling tours for tourists, which were similarly subjected to fees. Additionally, the fishers agreed to restrict other vulnerable areas, such as shallow (less than 3 meters of depth) coral reefs, from net-fishing as well to limit coral breakage. On the other hand, the government introduced measures that banned the use of nets with small mesh size due to concerns about their impact on fish populations. Small mesh nets are known to capture a higher number of juvenile fish, which could result in a higher decline in overall fish populations.

In comparison, the conservation zones imposed broad restrictions on all fishers, with additional limitations on net-fishing, while the governmental net-regulation were only restricting a specific type of net-fishing. However, the conservation areas were generally viewed positively by the fishers, while the net-ban was met with negative response, as fishers found it difficult to adapt to this regulation.

In contrast to many top-down management approaches by governmental institutions or private actors, the local management of conservation zones address multiple objectives. Integrating multiple objectives in management makes it possible to address multiple ecosystem services, as well as well-being within a community, at the same time (Berkes, 2007). The local regulations contribute to marine conservation, as well as strengthening the community through the tax put on fishing and snorkeling tours to the areas. This is important, as it includes both ecological and social objectives into management practices. The following section will look into how the local management practices foster social-ecological resilience, and challenges that follows.

4.2 Social-Ecological Resilience

4.2.1 Learning to live with uncertainty

Regular meetings between stakeholders to discuss views on challenges can create new ideas in how to cope with challenges coming in the future (Berkers, 2015; Stern, 2005). There are regularly held meetings where all fishers in Jambiani are invited to share concerns, complaints, observed changes, or positive observations. These meetings are arranged by fishers which has been elected to leaders within the governance structure of Jambiani. Fishers using different fishing methods might have different opinions where for instance net-fishers are more heavily impacted by regulations than the other fishers. The inclusion of all opinions is therefore important as it can contribute to new information.

The idea of creating conservation zones came from the local meetings between fishers in Jambiani. Fishers were concerned for the future of fishing, as many reported declining yields. Fishers' expressed concerns for their children, being afraid of too low yield to sustain food and income for the next generation. Furthermore, the community saw a need to create positivity within the community by engaging youth in recreational activities and offering education, as well as taking care of the community by building health-care facilities. To react to these uncertainties, the fishers created taxed conservation zones, with later subsequent collaborative support from the government. They started with one zone, and later ended up with creating multiple zones as feedback from fishers were highly positive, both within the ecological and the social system.

The positive results from the creation of conservation zones have led to further eager to create other initiatives to foster ecological and social well-being. Fishers, other members of the community, and the government comes with suggestions of other measures that could function. These are tested out for a while, and local fishers respond with their thoughts in meetings. Through this process, the fishers are using deliberated learning (Stern, 2005) to learn new ways to cope with their vulnerabilities through testing policy measures, discussing evidence of how measure works, exchanges different views of fishers as measures can impact fishers differently, and then negotiating what to do with the new information. In many cases, the tested policies are not working, and the fishers tries to come up with new possibilities,

starting the learning cycle again. Fostering the reciprocal and feedback learning within local institution is essential to enable adaptive management.

4.2.2 Nurturing diversity

4.2.2.1 Ecological diversity

The conservations zones were initiated with the aim of restoring coral habitats to provide more areas for settlement, spawning and nursery for multiple species. Limiting fishing has two main effects: minimizing coral breakage and reducing pressure on fish stocks. This contributes to better reef health by promoting increased coral cover and coral diversity. Furthermore, it contributes to increased fish abundance since the reduced pressure will safeguard larger populations to reproduce. Lastly, untargeted fish can get the opportunity to grow bigger, and thus also provide higher reproduction rates, ultimately increasing biomass.

Of the preferred fish families to target, few species were observed in field. Furthermore, the species observed were generally smaller in size. The conservation zones can create less pressure on some of the most targeted species and create possibility to rebuild populations. Which in turn will provide benefits for fisheries when increased abundance will generate spill-over to surrounding habitats. Furthermore, the most species and abundance were found in the coral reef with highest complexity. Limiting coral breakage contribute to coral growth, which can over a longer period of time contribute to increase the structural complexity of reefs. Additionally, higher coral diversity creates potential to buffer unexpected disturbances as there will be a greater variety of species fulfilling similar roles which reduces risks.

Most of the ecological diversity that is protected is within coral reefs. However, many reef species within tropical seascapes are settling in surrounding habitats where for instance seagrass meadows and seaweeds beds acts as important nursery habitats (Bärkström et al., 2020; Tano et al., 2017). Fishing within seagrasses is often preferred by net-fishers because their nets do not as easily tear by corals or rocks. There could be an increased pressure within seagrasses as net-fishers must adapt to decreasing fishing grounds within coral reefs due to local regulations. Moreover, one of the highest preferred fish species of net-fishers was found only in seagrass areas, which could act as an additional motivation. Juveniles could therefore be subjected to high pressures as fishers continue to use small mesh-sized nets. This

highlights the importance of understanding connectivity between habitats and fish movements for management (Berkström et al., 2013). Including a higher diversity of biotypes into the conservation zones in Jambiani could further increase fish abundance and diversity.

4.2.2.2 Social diversity

Although management practices are in place to create higher abundance and diversity of fish, which in turn will contribute to higher yield, there are still risks concerning seasonal variations. The seasonal variations can cause times with low catch rates or times where the sea is too rough for fishing. Diversification is an important tool as it spreads the risks of vulnerability within a family or community (Turner et al., 2003). There are multiple ways to diversify activities. By utilizing different approaches to diversify one will obtain different possible responses to changes which will create higher resilience towards unexpected changes. The fishers in Jambiani have diversified their livelihoods in two main ways: various fishing methods and multiple income streams.

Basket-trap fishers with larger traps need to cross the fringing reef to go over to the open ocean. However, the waves are often too big to cross this border and could lead to many consecutive days without being able to fish. Adapting to having more than one fishing method contributes to have more possibilities. Most of the basket-trap fishers were also handline fishers and/or spear fishers. Fishing by handline or spear is done in the reefs close to shore where it is quite shallow. The waves are buffered by the reef which allows for fishing even when conditions outside of the reefs are rough. By adapting to having more methods, the fishers are therefore less vulnerable towards weather changes and climate changes and are able to switch methods as necessary. Basket-trap fishers further diversified their livelihoods by having other sources of income.

Risk can further be distributed on multiple income streams, which will further reduce the risks of livelihood failures in fishing communities (Allison & Ellis, 2001). Diversification in livelihood will give option of other income streams when fishing is completely unavailable, either due to extreme weather preventing fishing in inshore reefs or due to low fish stocks in the area. One of the main additional activities for fishers in Jambiani was farming. For

fishers, farming is used as an additional part of their livelihood to supply their family and neighbors with more food during low fishing seasons. It is not necessarily providing extra monetary income but act as an extra source for food. Additionally, some fishers generated extra income through jobs connected to tourism, such as working in construction or in a hotel, or by bringing tourists on guided snorkeling- or fishing tours. However, low season of fishing often goes hand in hands with low season of tourism due to the bad weather, meaning that work revolving around the tourism-business is very low. It is therefore important for fishers to save the extra income to have as support in addition to farming during low fishing season, to sustain their livelihood.

Net fishers, however, are mainly fishing with nets as the total income from net fishing is enough to sustain livelihoods all-year round, which makes the incentive to find other jobs low. Being dependent on net fishing as both the only technique and means of income results in higher vulnerability for unexpected changes for net fishers. As already discussed, the implemented ban of small mesh nets was poorly received since many fishers did not know how to adapt to this ban as it caused high impacts on their income.

4.2.3 Combining knowledge

Combining diverse knowledge contributes to a multitude of insights which can provide new solutions to complex problems (Berkes, 2015). The conservation zones integrate natural and social sciences, addressing both ecological vulnerabilities by protecting marine resources and habitats, and social vulnerabilities through fostering social learning, diversification and infrastructure improvements. This combination is not only enhancing social-ecological resilience but also underpins the effectiveness of the conservation zones, as minimal effort is put on enforcements due to the high communal benefits derived from conservation efforts.

The conservation zones are primarily based on local knowledge. For instance, conservation zones were based on fishers' observations of declining yields in areas which previously had been known as highly productive fishing grounds. While local knowledge is crucial for building effective and well-functioning management system, as fishers has built up relevant knowledge and understandings of ecosystem dynamics (Olsson, Folke & Berkes, 2004), input

from other knowledge systems can be useful to coproduce new understandings (Berkes, 2015).

The perception of decreases in yield by fishers in Zanzibar has contradicted other sources of information (Rehren et al., 2022). Local fishers have identified poor resource status across whole areas in local seascapes, ecological surveys highlight poor resource status only in specific areas, while official catch statistics pointed towards good resource statuses (Rehren et al., 2022). Integrating local knowledge of fish abundance, yield and natural fluctuations, along with ecological surveys and fisheries assessments could create nuanced insights into the most appropriate and effective locations for conservation efforts. Implementing more factors into the placement of conservation zones, such as connectivity with other habitats, can contribute to increased benefits for ecological resilience and the fishery.

Furthermore, existing knowledge sharing between different knowledge systems has been largely one-sided. Local fishers have tested out different management policies and provided feedback to the government, which is a great tool to strengthen local management. However, an unbalance is created when local feedback is overlooked. For example, the ban of small mesh nets was met with skepticism by fishers, but it was implemented regardless. Net-fishers asked for education and support to adapt to new regulations, however, the government did not provide any education other than information on which nets that were being banned.

Arguably, the fishers could adapt to fish with larger nets, but such a shift could result in lower yield due to limited time to invest in learning new methods and low capital to invest in new types of gear. Consequently, net fishers could be left with little income and food to bring home. Resultingly, some fishers resort to illegal fishing practices and hide it by fishing at night. This poses risks towards fishers and could lead to further environmental degradation since the reefs are more difficult to spot during night and passing over them could cause coral breakage. Knowledge must be shared across systems to enable full potential in their adaptive capacity.

4.2.4 Self-organization and adaptive capacity

The local stakeholders in Jambiani have demonstrated a strong commitment to advocate for conservation measures which contributed to positive change. Communities respond better to change created through their own institutions (Berkes, 2015), and the well-organized local fishers has facilitated possibilities to organize quickly after disturbance and adapt accordingly. Decision-making and management initiatives at a local level is important for the success of conservation efforts, as they actively engage resource users in the protection of their own livelihood. The establishment of conservation zones in Jambiani is a good example in itself of self-organization in response to observed declines in yield.

Adaptation in the SSF as a whole is accepted with low level of enforcements as main focuses are to increase benefits for the whole community and create open space for learning and knowledge sharing. This contributes to all stakeholders being included in decision-making and contributes to ownership of policies. The enhanced learning opportunities, expanded possibilities for livelihood diversification, improved access to education and healthcare, and the implementation of safety measures is all contributing to the collective capacity to adapt to future challenges. Moreover, the resilience fostered in ecosystem through conservation enhances the systems capability to cope with external stressors, such as coral bleaching.

The local management empowers stakeholders to participate in resource management and create space for fishers' knowledge to enhance policies for the collective well-being of the community. The fisheries in Jambiani shows large ability to adapt to local changes, however, external disturbances might be more difficult to adapt to due to lower connectedness with other institutions and stakeholders. Increasing tourism can cause unexpected changes outside of fishers' capabilities.

4.5 Tourism

Changes in the local fisheries could be expected as a response to the increasing tourism. Evidence suggest that fish sold to town markets compared to hotels in Zanzibar has a significantly lower price (Thyrresson et al., 2013), although, this price difference could be reflected in size differences. However, in Jambiani, none of the fishers, with the exception of the octopus fisher, sold directly to the hotels. Furthermore, none of the hotels purchased fish

directly from the fishers in Jambiani either. Instead, most of the harvest was consumed locally, with some exceptions of large harvests where the fish was transported to the fish market in Stone Town.

Reasons for this kind of transaction not being present in Jambiani are multiple. First, fish caught could be too small for hotels seeing that the size of the fish is an important determining factor in deciding where the fish goes (Crona et al., 2010). Local consumers and small-scale traders are open for fish of all maturity stages, while hotels primarily seek adult fish and has no purchase of juveniles at all (Thyrresson et al., 2013). In Jambiani, most hotels were seeking adult fish, and one hotel were actively taking distance from juvenile-fish purchases due to environmental concerns. Secondly, there is not a stable amount of large harvests for hotels to trust a secured weekly transaction, as many of the hotels purchased fish several times a week. Even with stable large harvests, it could be logistically difficult to get to know which fishers to purchase from as there is no official landing site in Jambiani. Lastly, hotels in Zanzibar have a large demand of high quality pelagic- and reef associated species of higher trophic levels such as tuna, kingfish, red snappers, and jacks (Crona et al., 2010), where interviewed hotels in Jambiani was almost entirely seeking tuna. Tuna is however a pelagic fish who only seasonally come close to the shore (Nikolic et al., 2017), and as many fishers in Jambiani are restricted to inshore fishing, it is not caught enough tuna to sustain the hotels' demand.

Tourism is said to increase benefits for locals, through for instance job creation. However, the fishers were not experiencing any benefits within their fishery. Fisheries benefitting from the increased tourism is rather located in areas with direct access to deep sea fishing, such as in the neighboring village Kizimkazi, where multiple of the hotels in Jambiani bought their fish from. The fisheries in Kizimkazi are largely dominated by large species such as tuna and kingfish (Ali, Bilame & Ngusa, 2023), and is therefore able to cover hotel's demands. Arguably, the lack of tuna in Jambiani's fishery could be the main reason for little to no transactions being present between hotels and fishers in Jambiani. Hotels were very skeptical to include other species in their menus as the tourists generally opted for tuna, and other species would then go to waste. Opportunities to offer other fish through for instance

“Today’s Catch” could provide opportunities for local fishers, however the hotels with such offers were still only serving tuna as their daily catch.

Interestingly, the high demand of tuna in Jambiani seems to contradict consumption trends of tourists in other islands states. For example, in the Maldives, tuna adds up to 17% of tourists’ consumption, while the remaining 87% consists of reef species and lobster (Hemmings, Harper & Zeller, 2023). Although the Maldives traditionally fish for tunas and has been for the past 1000 years (Adam, Anderson & Hafiz, 2003), the hotels are primarily demanding reef species and has created a new market for reef-fisheries (Sattar et al., 2014). Why tourists in Jambiani are refusing to eat other fish species is a mystery in its own.

However, pushing hotels to sell more local reef-fish to support local fishers might not be ecologically wise. In Palau, the tourist's consumption of reef fish is one of the highest drivers of reef degradation. Here, one of the main management strategies is to change fish consumptions of tourists over to pelagic species, such as tuna, by increasing pelagic fish resources through improving fishing vessels of local fishermen (Wabnitz et al, 2018). A similar approach for Jambiani to include fishers in the benefits of tourism could be possible as the demand for pelagic fish in Jambiani is already highly present. Many fishers expressed a wish to pursue hotel’s demands but were unable due to small boats or too simple equipment.

5. Conclusion

The coastal resources are of key importance to Zanzibar and provide a high protein supply and job possibilities. Small-scale fisheries have long traditions within communities and their local seascape is important for their sense through shaping people's identity, cultural heritage, and ecological knowledge. This connection and dependency of the seascape is further important for the community's well-being. However, the coastal habitats of Zanzibar are facing multiple challenges through high fishing pressure, increasing tourism, and the uncertainties that follows climate change. Climate change pose immediate threats to fisheries, as unexpected events, such as bleaching due to heatwaves, can cause significant impacts on habitats and on diversity and abundance of fishery resources. The complex social-ecological interactions between small-scale fisheries, tourism, coastal habitats, and its resources underscores the importance of proper management to diminish vulnerabilities of SSF through fostering social-ecological resilience.

The fishers in Jambiani are navigating these complex challenges to safeguard both the marine environment and the well-being of their community. Their traditional ecological knowledge is at the centre of management strategies, where conservation zones are placed in valuable habitats with regards to vulnerable reefs, juvenile habitats, and connectivity. However, increased access to other knowledge systems could contribute to other understandings and create new skills. The local management is especially important as it enables fishers to work together to sustain fishing yields and promote long-term ecosystem health by developing management strategies, knowledge and diversity to increase their adaptive capacity.

The rapid expansion of tourism exacerbates existing vulnerabilities by increased pressure and introduces new challenges to coastal communities and marine ecosystems through disturbing fishing activities. Although tourism does present some economic opportunities, the local fishers of Jambiani are experiencing few. External challenges such as tourism can be difficult to tackle solely at a local level, which underscores the need for improved collaborative efforts. One possibility to include local fishers in the opportunities could be governmental support to expand fisheries.

By employing interdisciplinary methodologies, this research has contributed to an understanding of the challenges inherent in coastal resource management and the importance of local management and its opportunities for adaptive management approaches have been

explored. Moving forward, policies that prioritize the integration of conservation objectives with community welfare will be essential for ensuring the long-term viability of small-scale fisheries and marine ecosystems. Essentially, these policies need to be adapted to the local context which should be done through local management and community initiatives.

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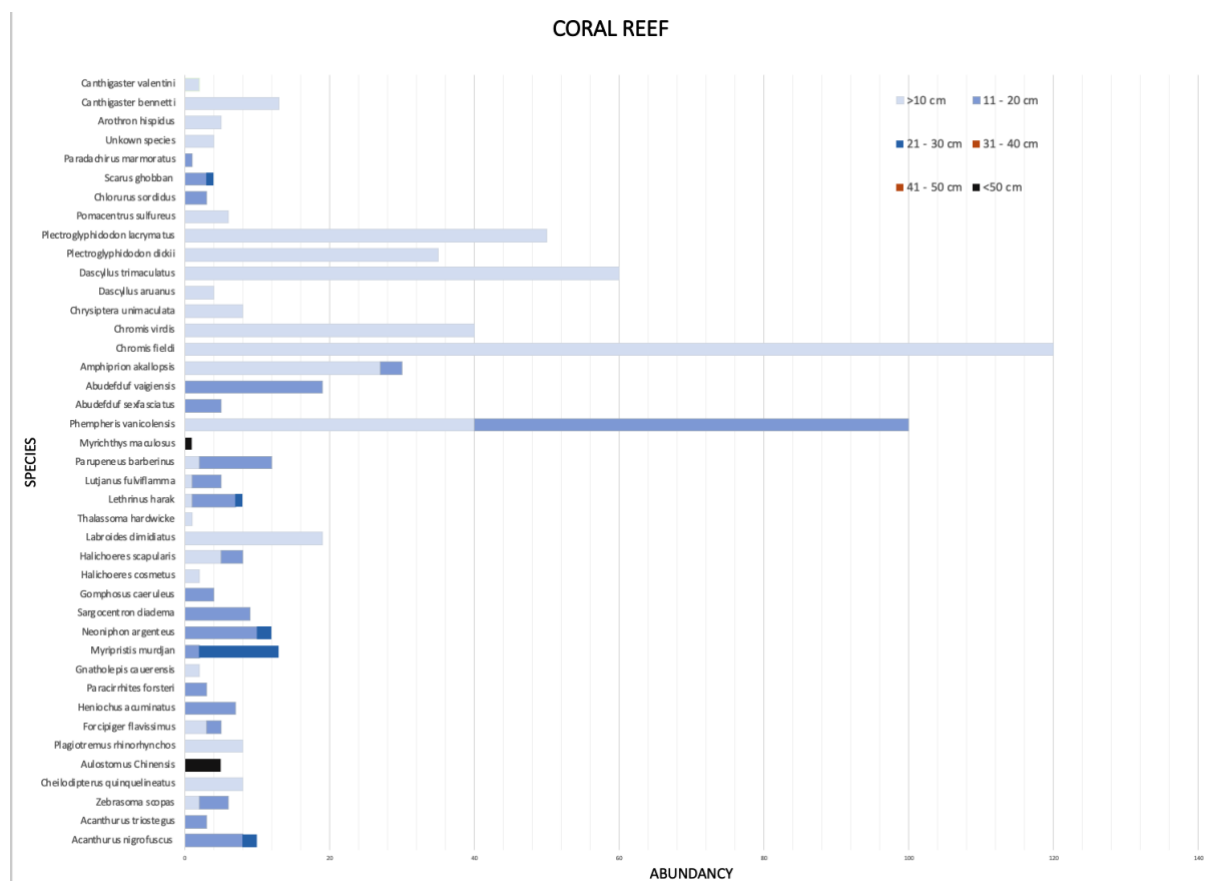
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7. Appendices

Appendix 1: Extra table

Total overview of the abundance of all species identified with its lengths marked by different colours.



Appendix 2: Questionnaires

Fishers Questionnaire

General:

How long have you been a fisher?

What fishing techniques and gear do you mostly use?

Which areas do you prefer to fish? How do you decide on where you go?

Do you target any specific kind of fish? Why/why not? (e.g., species, size, trophic level)

Have you observed any changes in the fishing industry / fish population / ecosystem?

Management

Are there any regulations you must follow as a fisher? What is the difference between local and national regulations? How well are these regulations enforced?

How effective do you feel the fisheries are managed?

Do you feel involved in the decision-making processes?

What is the role of the local community to regulate fishing?

What is the role of the government?

- What support from the government could be most helpful?

Are there any community-based initiatives?

How is the relationship between fishers in Jambiani?

How is the relationship between fisheries in neighboring villages?

- Do fishers share information?

What do you feel could strengthen the level of awareness / management practices to sustain a productive but also a conserving fishery?

- Educational programs?

Livelihood

To what extent is your livelihood dependent on fishing?

How do changes in tide/weather affect your fishing? What do you do when yield is low?

(If perceived changes in fish populations) How are declining fish populations affecting your work + livelihood?

Do you have other sources of income?

Market

What kind of fish do you fish for?

Is there different economical gain to fish certain species?

How has tourism affected your fishery?

- Do you see tourism as a negative or positive force, and why?
- Could the benefits of tourism be better distributed to and within the community?

Concluding

What challenges do you see coming in the future

What hopes/goals do you have for the future for the local fisheries in Jambiani?

Hotel Questionnaire

How many hotels in Zanzibar/Jambiani do you own?

For how long have you been a hotel owner?

Who do you buy your fish from? How often?

Can you describe the relationship between the hotel and the local fishers?

What qualities are you looking for in the fish you buy? (Size, certain species, freshness)

Does your hotel prefer specific fish or have fish you actively promote on your menu?

- What do you do if the local fishers do not catch the fish you are looking for?

How do you think your hotel's choices impact local fishers and the local community?

Appendix 3: Transcribes

Transcribes: interviews of local fishers in Jambiani

Prior to interview, the fishers were explained what the research was about and how the interviews would be used in my master thesis. I further explained that they would stay anonymous, and that the only personal information shared would be that they are fishers from Jambiani, alongside with their preferred fishing methods. Furthermore, they were informed about their rights to not answer certain questions, to end the interview, or to be removed from the research. Before the interview started, I asked if they were comfortable with being recorded and that the recording would only be used for me to transcribe their sayings more accurate.

Interview 1: one fisher (Basket)

09.02.2024

Interviewer: We will start with some general questions. How long have you been a fisher for?

Participant: From when?

Interviewer: Yes, from when.

Participant: I have been a fisher since 1995.

Interviewer: What are your preferred fishing techniques or methods?

Participant: Fishing line or local basket traps.

Interviewer: Where do you go when you fish?

Participant: I usually go outside of the reef, in the deep area or to the coral reef.

Interviewer: Do you then use (fishing) line in the coral reef and the traps outside of the reefs?

Participant: Yes.

Interviewer: Do you target any specific kind of fish?

Participant: What?

Interviewer: For instance, is there any specific species you fish for, or fish of certain size, small or big?

Participant: I fish for all kind of fish. Some people like small, other people like big, so I fish for a bit of everything. I don't fish that are too small. Also, not a lot of fish that are very big because to go where the big fish are I would need proper equipment with special line and

boat. With smaller equipment it is difficult. I would need more modern equipment, which is expensive, like motorboat, and if not, it is quite difficult.

Interviewer: Okay. Are there any regulations you must follow as a fisher in Jambiani?

Participant: I fish according to the water, like the low and high tide. I have a schedule, like I go today and tomorrow not. Sometimes I must wait two days or more, the water cannot be too rough to go out with the fishing box. I must wait until the fish get in the trap also.

Interviewer: Aha, I understand. I was more wondering about if there are any regulations you must follow. For instance, does the government have rules for you to follow.

Participant: I must have my license for fishing and for the nglawala and the boat I have. And they categorize these licenses for low level, medium and for the big fish. So, it is not the same for each fisher.

Interviewer: What kind of license do you have?

Participant: I have for the small, medium, and bigger.

Interviewer: Is there other regulations you must follow that are set by the locals?

Participant: There is the rule, here locally, we decided by ourselves that some areas are not for fishing. We make a period of time where for instance after two months or three months we can fish this place again, and after that we have to wait again. We want to give time for the fish to relax and grow bigger, so by the time we want to fish we hope we catch bigger fish.

Interviewer: How do you decide which areas to choose as no-fishing zone? And who decides this?

Participant: We have a committee, where a person who checks who go there and tries to say to who fish that place to say, "ah there are someone that are out fishing there now", so we take a boat and go there to make sure to control these people to not fish there. We make ban,

only for the net. The line you can do, it is allowed. But the net, sometimes it grabs and destroy the coral, so the net is banned.

Interviewer: What do you do to the fishers that you catch fishing illegally?

Participant: We tell them to go away and then they go. If they already got some fish, they know that they do wrong, so then we take the fish away.

Interviewer: And who decides what areas to protect? Do all the local fishers come together to decide or is it a selected few? Like who decides?

Participant: It is decided by telling each other, where we see that this is not a good way of fishing. We get support from some ??? who came with this idea, where we should keep this area to keep fish to grow bigger and maybe reproduction. To let the fish make their, hm what you say, to reproduce a lot there and maybe the fish outside of Jambiani maybe also would come to these protected areas as it is more calm. When we want to fish them it might be a lot fish for the one or two time it is allowed to fish again. Because this is a place where they can do reproduction, and also because there is not so much movement there, they can go a bit of distance. So maybe people who are fishing can get from this benefit, as the fish can move to other places. So, it is also helping areas where it is not protected. So, help both. It is a project which has helped us, as when we go to fish there we get a lot a lot of fish which help us get money, which go back to the community. Like building school, building some kind of football ground, some form of local ceremony, or maybe to build a hospital.

Interviewer: Is it then the fisher's money from fishing in these areas that goes back to the community?

Participant: Yes.

Interviewer: How much goes to the community?

Participant: It depends, maybe sometime a million points to 2 million, something like that.

Interviewer: For the whole year?

Participant: Hm, no. Let's say for the whole year you maybe go fish there 4 or 5 times only. If they get 1 million, they then get 6 or 7 or something like that. Sometimes, a new fish from somewhere comes here for their destination, if someone goes there to fish there, they tell each

other and then we go there and fish this. This fish might stay but sometimes they don't stay. When they (fish) come like this, we can't wait, we have to go there and fish them. Because, if we wait, all will go and just remain to what we have to eat.

Interviewer: Okay, and how does it work when you want to open for fishing again in the no-fishing zone?

Participant: We go two boats, something like this.

Interviewer: Is all fishers allowed to go?

Participant: Depends, sometimes we don't have the right net to fish. So, for example, we might ask the next part of Jambiani, different section, and we call them to come. Also, to add, before it was difficult to say, "here you can't fish" and people answer "ah we need fish and we need money", so it was difficult. But so, time came and people realise that this was the best way because then we can have a lot of fish that reproduce and after that we can fish so many. Sometimes we do committee, to say that we put another place for the whole of Jambiani. Like her in Kibijiga, this is only for us, but after this people woke up and see that this is a good way, so they decided to take places for the whole of Jambiani as they saw the benefits of this.

Interviewer: Aha, so there are some no-fishing areas which are only for this section of Jambiani, and then other sections are for the whole of Jambiani?

Participant: Yes!

Interviewer: Do the locals respect this ban of fishing?

Participant: Yes! Of course, you might meet some people that are a bit crazy that sneak there, but people look and if they see you, they will go there and take away their fish. Also, it is

forbidden so sometimes they will charge you an amount to pay back, like a penalty. They can also take away the fish trap as a penalty.

Interviewer: Is it mostly fishers from Jambiani who breaks these regulations, or does it come fishers from other villages also?

Participant: Yes, there are some thieves, if I can say thief, that come from Bojojue (?) and Paje. From Jambiani it is rare because most of them understand the rules.

Interviewer: Okay, interesting. Which type of management do you feel has been the most effective here?

Participant: Like the most benefit?

Interviewer: Yes.

Participant: I find our ban on fishing to be better, more effective, than the government. To be honest, the government looks for this tax, because every year we have to pay for the license for the boat and to fish, where the money goes back to the central government and don't come back to the village. It is more for themselves. Also, this government, as you know the government has these people, like where you have management and this sub-, this sometimes come on their own boat with the net, which is not allowed, and they could be the one who

destroys the environment. Because we cannot do anything to them, it is not possible to say to go up to them and say “what are you doing” because they are management.

Interviewer: Have you seen them coming here and fish?

Participant: Three months ago, I saw them. Big problem with people from government. We can't do anything.

Interviewer: So, while you try to improve the conditions, you feel like the government come and don't respect your rules?

Participant: Yes, we just try to take care of ourselves but when they come, they don't care. It happened one time, long time ago, that they take the rule on their hands, where they grab the nets and just cut them and they were about to be in jail because of this.

Interviewer: Aha, interesting. (Some pause). Do you as a fisherman feel involved in the decision-making progress in Jambiani?

Participant: I feel involved, and also because I see so many benefits. Because now we have nursing school, which comes from this committee where they collect the money and decided to make a school, and also, they made the football ground which comes from money from fishing. Also, it is good because also we show a lesson to our children, to show something that is good, like keeping the environment and seaside. When we are getting old, the children will know how to take care of their own property, and their ocean and how to protect it from the many harmful. Since I was a kid, I saw the benefits from using equipment, from using box and line, and not using line, there was a lot of fish, like full of boat, where you cannot even drive it because it was so full of fish, it was so nice at that time. The time where they found out about this net, ahhh, everything is mess. Because then the fish, you know,

sometimes they use very small, tiny ones, where they also kill the coral reefs, which they need to do reproduction a lot. So, the net drags like, rrrrrrr, and you kill the coral.

Interviewer: Okay, so you feel like the fish has decreased?

Participant: Yes, I think because of this net they have destroyed a lot of fish, many kinds, and many species as we don't see them anymore.

Interviewer: Do you have any restrictions on nets, and if so, which?

Participant: There are some kind of net, which are not killing the coral. The small nett with small eyes are not allowed. Some sizes we say is allowed. Also, not to go beneath the coral, only over.

Interviewer: Do you feel like the fishery management in Jambiani is good as it is or would you like more help from the government?

Participant: The ban gets more benefits than the government help.

Interviewer: Okay. Moving a bit away from management, I will ask you some questions of tourism. Have you noticed any changes in fishing with the increase in tourism?

Participant: Like for the guest in the hotels?

Interviewer: Yes

Participant: Yes, on this, we get some benefits and also some changes because when we bring big fish to them, we get more money than when we sell to each other.

Interviewer: Okay, and is it certain species you would then sell to the hotels?

Participant: Yes, like kingfish, tuna, they go there (hotels). So when we get this fish, some days we sell to the tourists and sometimes to our own community.

Interviewer: As you are saying that you would earn more money selling these kind of fish to the hotels, does that make you want to target these fish specifically?

Participant: Most of time, I sell first to my own community for food, but after I look for fish to hotel. So first, I focus on local people and then to make money. If the locals have enough to eat, then I can go to the hotels.

Interviewer: Do you then see tourism to affect your daily fishing practice?

Participant: Some effect, because there are so many hotels, if you look at the beach area of Jambiani, it is so many hotels. It affects because they would need a lot of fish. So even if I fish to feed myself, other fishers think they want to fish for money. A lot of fish would have to go to the hotels, which could decrease the fish. In addition of this, other big effect, as you know they have these swimming pools, which from time to time they have clean and change the water, which they put to the sea, which have some chemicals. Sometimes we have problems with the sea, and we think it might be true that it is from the poison from the swimming pools, as they put this water after changing straight to the sea. You know these big fish you see in the deeper sea, long time ago, you could also see them in the shallow water, because there were so many and so big. Now, we don't see them. Also, before the government had this rule where the hotel had to leave 40 meters from the beach. This distance might help the people to move across there. Also, for the turtles to come up and produce eggs on the beach. When the wall is so close to the beach, this becomes more difficult.

Interviewer: So, the government used to have this rule, but not anymore?

Participant: Now, nobody cares. It could be because we change president with new rules or ideas, so maybe at that time it worked because the president was okay with that, but with time changing, this also changed. Also, some island around here would be good to keep but they keep renting it. The government rent the island to other people, where they build hotels. They think they earn money, but they destroy the islands. (Showing video of Quale island). This island, we sometimes go there to sleep for 3 days, one week, 2 weeks or a month to fish a lot of fish, and then come back. Now we can't do, because the owners of the hotels make rules that you can't go and step there. After that, you could come back with some money and a lot of fish. Before I was going there, but now it is difficult, also because of family.

Interviewer: So, you feel like there are some positive changes with tourism, as the possibility to earn some more money, but also you see some negative sides, as the decrease of the fish

and the hotels of the beach. How do you feel the benefits of tourism are distributed to the community and the locals?

Participant: In this part of Jambiani, we sometime, after Ramadan, the eid, people, the tourists, go there and have to pay. Sometimes we can also go to the hotels and bring tourists out on boats. Also, some more jobs. Also, in Jambiani we have these caves with freshwater, where the tourist must pay the community to go visit.

Interviewer: But as a fisher, do you feel some benefits even though there are these challenges that you mentioned?

Participant: We can't control the hotels anymore, and a matter of time, the life is like this. We can't say that they have to sell all the hotels and go home.

Interviewer: What do you do to take care of the fishing when you feel these challenges?

Participant: We adapt this box (trap) and line. We are looking for keeping the environment, so for us we are happy to use this fish box and this line, but not with net. Although we can get a lot of fish with net, we want to keep the environment quite safe.

Interviewer: To what extent is your livelihood dependent on fishing?

Participant: Hm?

Interviewer: Your livelihood, like your income.

Participant: It is balanced, half from tourist and half of fishing. In times with low tourism, I have to look more to fish, while in times with a lot of tourism you sometime go fishing and sometime excursion with tourists. There is a time when you cant fish, with the water having

so much current and the water is dangerous, maybe like a week or so. If you only rely on fishing you don't earn money. Sometimes, the fishers also go to do farming.

Interviewer: Do you do farming?

Participant: Yes!

Interviewer: aha, what kind of farming?

Participant: Cassava, also like lime trees, coconut trees, mango trees.

Interviewer: Do you sell this or for yourselves?

Participant: This is difficult. This one (points to lime tree) we have had for long time so now we can do the limes. But the others are not so long time, we try to produce, but is too few. More to eat ourselves. But when they grow up, in 3 or 4 year it will be good to sell.

Interviewer: In the future, what challenges do you see? And do you have any hopes?

Participant: Maybe later on, it will be less fish, even more than now. That's why I take my time now to do farming, so if something happens so that there are few fish, not like now, or maybe there will be more currents or more people destroying the sea. Concerning with this, it is important to put more effort towards farming. Later on, I can get more benefit on farming and have something to rely on other than fishing. In 10 or 20 years, I don't know how the sea

will be. Like last year, we survive on the farm as we produce the cassava, as well as all these kinds of fruits. Because the fishing was not good, and the tourism was not good.

Interviewer: Aha, so you are a bit scared of fish declines?

Participant: Yes, afraid of it being more worse than now. On how it looks, there are many challenges on this.

Interviewer: Okay! But we have talked for an hour now, so I think we could wrap it up. Is there anything else you would like to add before that?

Participant: I just want to say how happy I have been with this community, and how we have been able to get money to invest in the school and football and so on. People become more eager to learn and do thing by looking at this initiative, like people are waking up now. In addition, on this, when we sat down to figure out what to do for out village, like building this school, the government came look at the school and wanted to take care of it, while it was us in the village who came with the idea and build it. We found good teacher to teach the children.

Interviewer: Who participated in these meeting that came up with these ideas?

Participant: It came from, one day, from my and other parents, they had a meal and went on the beach and went racing, and peoples' mind woke up, wondering why they don't start having their own things like nglawala race or their own marathon or something like that. At this point, thing came on their mind on how to do things like that. They decided to be together and collect the thinking of everyone, asking them what they think and what they

could do. They started with the older people, and to other to see critical thinking to come up with things that could be good for the community.

Interviewer: ah okay! Was this the whole community or mostly fisher coming together?

Participant: The whole community.

Interviewer: But for the initiative that pays for the new schools and football fields, does that come from other sectors than fishing?

Participant: When they get the tourist to go snorkelling, they have to pay to the community, every boat that goes snorkelling have to pay around two or three thousand. In addition to the money from fishing. Sometimes, we go to house to house, for households also to contribute.

Interviewer: What contributes the most money to this?

Participant: Fishing the most, tourism and then house to house. But also, we come across a challenge. Most of the hotels do their own tours for snorkelling, so sometime if you are a beach boy or some others don't pay. The hotels have their own tours, where they convince their guests to their own tours, so the villagers got these challenges because it takes away work and don't contribute to the community. If I could ask for one thing to take care, it would be to deal with the hotel, that some of these things must go to the community and the

villagers. What they are doing is to have their own tour and take all the money. The government are the ones that could decide this or make a rule on this.

Interviewer: Great! I think that was a good end on this.

Participant: Yes, I think to end here is a good time.

Interviewer: I want to thank you for taking time to talk with me and share your experiences, thoughts and feeling.

Participant: Thank you!

Interview 2: group interview of four local fishers
13.02.2024

Interviewer: First, I will start by asking some general questions and then I would like everyone to answer one by one. Then, after we will start having some more discussion.

Participant 1: okey.

Interviewer: How long have you been a fisher?

Participant 1: 40 years

Participant 2: 30 years

Participant 3: 35 years

Participant 4: 30 years

Interviewer: Which fishing techniques do you prefer to use?

Participant 2: local traps, handline, and sometimes going with mask with a stick or a spear.

Participant 4: I do the same.

Participant 1: Me too

Participant 3: Me too

Interviewer: Which do you think you use the most?

Participant 2: It depends, as some time, according to the sea, I see what fits best.

Interviewer: Where do you prefer to fish?

Participant 1, 2, 3, 4: Out of the reef.

Participant 2: But also, it depends, we have to see how the sea is and the situation. Sometimes there is a lot of current and the water does not allow you to go there, like out of the reef. So sometimes here, but I like more going out to the deep.

Interviewer: Aha, so if the weather allows it, you would go out to the deeper reefs?

Participant 2: Yes

Interviewer: When you go out to fish, is there certain fish, such as species or size, that you want to specifically target?

Participant 2: When I want one specific fish, such as a red snapper, I would target it. But sometimes it is not working, so I have no choice.

Interviewer: Which fish would you target when you do target?

Participant 2: Tassi. (Rabbitfish).

Participant 1,3,4: (all agreeing)

Participant 4: But I don't target tassi (rabbitfish) all the time, I often change my schedule, where I for example also go stick-fishing after pwesa (octopus). It depends on the sea and the current.

Interviewer: How much of your livelihood, your income, depends on fishing?

Participant 2: It depends, around 70% on fishing, and around 30% farming. I don't take tourists out because I don't speak English.

Participant 4: I also have around the same, mostly fishing and some farming.

Participant 1,3: (agreeing)

Interviewer: We will move over to a more of a conversation, so feel free to talk back and forth between each other, or disagreeing with each other, every opinion is valuable to hear.

Participant 1: Mhm.

Interviewer: How well do you feel that the fisheries are managed, both with the local rules and the national rules. Do you think it is working well?

Participant 2: We work together with the rules from the government and also create our own rules. But try to work together with the government.

Interviewer: But how do you feel like it works?

Participant 2: I have no problems with it.

Participant 1,3,4: (agreeing).

Interviewer: Do you feel involved in the management and decision-making?

Participant 4: I am fine with the government rule because sometime there are some people from the community that end up thinking about the rule, and end up, because we have these

ambassadors and representatives, so sometimes I sit with them to get some ideas, so when they go to the government, they can bring these ideas with them there.

Interviewer: So, you have conversations with people who bring ideas to the government?

Participant 4: Yes, so sometimes the rule can start from here, and then go there. Then the government think about it, and if they think it is nice then they put it here.

Interviewer: Are everyone of you participating in these conversations?

Participant 2: yes

Participant 1,3: mhm

Interviewer: Also, I've heard about the local arrangements to bring in money from fishing in certain areas, along with money from snorkelling, to support the building of schools, hospitals and other important things for the community. How do you feel about this?

Participant 2: I feel more comfortable and happy because this contribution for the village is for our own good, not for someone else. So I feel happy and proud that we do this on our own and for our own village.

Interviewer: And how do you feel about the fishing bans in certain areas that also have followed this initiative?

Participant 2: I feel like it is good to have this area because it is good for the fish' reproduction and it is good because after time we can get more fish. I see the benefits we can get from this.

Participant 4: I feel the same, it is good.

Interviewer: How do you feel when other fishers break the no-fishing rules?

Participant 4: I am not happy when I see people coming fishing with net in these areas. If it is only line, it is maybe okay, but not with net.

Interviewer: what do you do if you see this happening?

Participant 4: I would go there and kick them out by telling them go away.

Participant 2: Me too, sometimes I can fool them with stories of calling enforcement, but they leave before anyways.

Interviewer: How would you say that the relationship between the fishers in Jambiani is?

Participant 2: We have good tone. We sometimes go fishing together with other fishers, because if I can go one place to fish other fishers can do the same. Except, when someone say "leave here" because someone is there to do robbery of fish in the areas where it is not

allowed. But the fishers realize that they are not supposed to fish there when we say “go away, you can’t fish here”.

Interviewer: Do you help each other to understand the benefits that you feel the no-fishing zones has, or is it just saying, “go away” and then hope they understand?

Participant 2: Often I take time to explain how to take care and how to conserve the area, and the benefits and everything, and after this they usually get better and understand why.

Interviewer: After starting this, do you feel that more fishers has learnt more about conserving?

Participant 2: Yes, it works. When we started, we were fewer people, but now people follow and now they do the same in other parts of Jambiani also, which is very good.

Interviewer: What more would you like to do, to further improve this?

Participant 4: We started with only one place and now we have three places (that are conserved). So, I am thinking that it would be good with even more places like this to conserve.

Interviewer: How would you go ahead and choose the new areas to conserve?

Participant 4: As a fisher, most of the time I am out on the sea anyways, so I do some research to look at the areas and see if I find areas with a lot of corals or fish. When finding these areas, I think it is good to conserve. If after, we see that this work, we could put bigger or more areas to make even more homes for the fish and build more coral. So first, we test it a

bit out, and if we see that it works and that the fishermen are comfortable, then we could do more.

Interviewer: A lot of the beachfront in Jambiani is hotels, which brings a lot of tourists. Do you feel like the tourists have affected your fishing in any kind of way?

Participant 2: There are some effects, but not big. But I also see some benefits as well, because if I get a lot of fish I can sell to them, and also it brings money from snorkelling.

Participant 4: It is good, as we can sell them fish. But in general, for the village, I see quite few benefits. It is more depending on other things, not on tourism.

Interviewer: Do you see any challenges coming in the future?

Participant 2: We see challenges in the future, as tourism bring this kiting which can affect the fishing, and maybe also affect the sea and disturb the fish. Sometimes, we need a place to

fish but the kites are there. Fishing also depends on the sea, but with this disturbance also it can be difficult.

Interviewer: Do you already feel this happening to you?

Participant 1,2,3,4: yes, we feel this! (at the same time).

Participant 4: we see this with the kiting, and the motorbike also.

Interviewer: the motorbike?

Participant 4: Yes! They ride it on the beach. They are not allowed but they ride it here, and make “kuuh” (noise of accelerating a bike) on the beach which disturbs.

Participant 1: Also, they put dogs in the hotels.

Participant 3: And they put pool-water in the sea.

Interviewer: What do the dogs do?

Participant 1: sometimes they could go bite you, they are harmful.

Participant 2: It stated with two hotels having dogs, now maybe 15 hotels have them, and I fear that maybe later even more would have.

Interviewer: How do you fear that this will affect the fishing?

Participant 2: With the motorbike and with the kiting, the fish are afraid and run away. And also, pool, because it is poisoned and could kill fish and decrease the amount of fish. Maybe the fish would go elsewhere.

Participant 4: We see that areas where before it used to be all corals is now only sand and seagrass.

Participant 2: I also see that the fish is already decreasing, and in the future, I think this would only be even more worse.

Interviewer: what do you feel is needed to improve your fishing conditions?

Participant 2: All these problems mentioned we notice and share between fishers. We put it (the concerns) to the central government and the central government will do analysis and research on this, and then they will come back to us, maybe with solutions or new rules hopefully for the hotels.

Interviewer: Has the government followed up on the concerns that you have raised?

Participant 2: They have given feedback about the illegal fishing, with the net. But, with the kitesurfing, motorbike, pool and other things we have not gotten feedback yet. Maybe in the future.

Interviewer: What was the feedback on the illegal fishing?

Participant 2: They come with rule, and they also put some guards. They can follow who is fishing illegal or not.

Interviewer: Do you have any hopes for the future?

Participant 4: I look forward to getting more benefits, because this is the reasons why we chose to put these areas to conserve the fish. Because then we could go fishing there and get more fish there than now.

Participant 1: yes, I also think this will be good in future.

Participant 2: Now, we do fishing, but since long time ago we have used these box and fishing line, but I am feeling that now life is changing, and we might need more new or modern fishing equipment to be able to go further out to fish. Maybe if the government or others could help support this, we could change our ways to fish. It would make it easier for us to go out and fish and help us get more benefits. Because there is a lot of bigger fish out

here, but we are not able to take it with our equipment. If we get help with better equipment, we could also go and fish for these bigger fish which we can find outside of the deeper reef.

Interviewer: Do any of you others want to add anything to that?

Participant 1, 3: no.

Interviewer: Alright then. Thank you so much for your time to come here and talk with me. Asante sana. It was very nice to listen to all of you, so thank you again.

Participant 2: Thank you too, it is nice to be able to share a bit of what is happening here.

Participant 1,3,4: Thank you.

Interview 3: group of 3 fishers

22.02.2024

Interviewer: alright, so first I will start with some general questions to get an idea of who you are as a fisher, and then I would like everyone to answer one by one. After the general

questions we will start having more of a conversation around the fishery management here in Jambiani. Does that sound good?

Participant 2: Yes!

Participant 1,3: nodding

Interviewer: How long have you been a fisher for?

Participant 1: for 18 years

Participant 2: I fished for 10 years, but I don't fish anymore because I earnt too little.

Participant 3: I have fished for 30 years.

Interviewer: Which fishing method, or technique, do you use the most?

Participant 2: Fish box (trap) and fish line

Participant 1: I go after the octopus, then I use this stick with an attachment on (spear).

Participant 3: I also use the fishing box (trap) and fish line, but long time ago I also used the fishing net, but not anymore.

Interviewer: In which area do you usually go fishing?

Participant 2: When the sea is calm, I go outside of the reef to fish, but when the sea is not good, I stay in the shallow area.

Participant 1: I don't go fishing when the sea is rough, so I wait at home until the sea is good again to go hunting for octopus.

Interviewer: And when the sea is good, in which area would you then go?

Participant 1: I go to the coral reefs.

Interviewer: When you used to fish, where did you usually go?

Participant 2: I also went outside of the reef to the deep reef.

Interviewer: Do you target any specific fish when you go fishing?

Participant 3: I don't fish for any specific fish, I go with my trap and take any kind of fish.

Participant 2: (agreeing)

Participant 1: Octopus.

Interviewer: How much of your livelihood depends on fishing?

Participant 2: When I used to fish, I could get a lot of money for the fish. I could get 30.000 (tzs) or even 50.000 (tzs) which could last me for a week or two without a problem. But after some time, I did not feel like I earned enough on fishing, so I stopped. Now, I have a farm and I do some different small work around, which I think is easier way of getting money every day.

Participant 1: Fishing and I am also a driver in a Taxi.

Interviewer: How is your time and income roughly divided between those jobs?

Participant 1: Sometimes I earn a lot of money from octopus, as I get 9000 (tzs) for one kilo of octopus and then I don't need to drive as much. But when I find little octopus, I drive more.

Participant 3: I don't earn a lot of money on fishing, so I also do other work such as farming and some daily work where I help with building homes and so. I don't have all fishing

equipment needed so I need other fishers to bring me along, so it is important for me to have other work as well.

Interviewer: Great, thank you. We will then move on to the questions concerning your thoughts around management, tourism, and the future. So first, how do you feel the arrangement with both national and local rules work here in Jambiani?

Participant 2: All the management from the central government and the rules we have from the village, such as the local bans, is good, but sometimes some other fishers are breaking the law which I don't like. Some of the fishers doesn't agree with the local bans and are just breaking them. For example, we have this area where we conserve, where the whole village benefits, but some people want to go directly to this place where we conserve. It is not really illegal, but as a village we have decided that we want to keep it conserved for the fish to grow and for them to reproduce. So sometimes there are some disagreements between the fishers here which can be difficult and make problems.

Participant 3: It is working well with these areas because the fishing from the areas we conserve helps with money to the community, with building the schools. Also, sometimes the money can help families with little money to pay for funeral. But I also find it difficult when other fishers come fishing when they are not supposed to.

Participant 2: Sometimes there are accidents in the sea, where the sail or the boat sink in the water, we can use the boat with the motor to help the people, where the money from conservation areas have already paid for the gas. It makes it safe as we then are always prepared if a disaster happens.

Participant 1: This place (the conservation area) is also a safe place for the fish, where the fish can be attracted to stay and a place to call home, where they can stay and reproduce. Maybe fish from another place also come to live here because it is a more comfortable place to stay. This helps to get more fish here, and it is good for the times when we open for fishing

because we get so many fish when we go there. Also, this place often is a nice place to bring guests (tourists) to go there to look which also brings in some money.

Interviewer: As an octopus fisher, are you affected by these conservation areas?

Participant 1: I don't go in the conservation areas, not when it is open either. I find my octopus in other areas.

Interviewer: Are there any other rules for octopus fishing?

Participant 1: I don't know. You are not supposed to take the small ones.

Interviewer: Aha. (To all) Do you feel included in the decision making of these conservation areas?

Participant 2: We have cooperation with the management and the people. If we want to decide about something, the decision can't be done alone. For example, if someone finds a new area with more fish that they want to fish, they have to come to the people and talk about this area and then together we will make a decision if we could fish this area to benefit from it now or if it is better to leave it if it is not good to go there, maybe save for later.

Interviewer: Who is included in these meetings?

Participant 2: We have appointed a management group with a leader. They are all local leaders. All other fishers are also invited to these meetings, and if someone don't have time to go to the meeting, they will just tell what to say to someone else so that their view is still shared in the meeting.

(Participant 1 had to leave)

Interviewer: How do you feel that the government contribute to the fisheries management?

Participant 3: The government helped maybe for the first time when we first were thinking about making the conservation areas. They gave us a certificate to show that we were allowed

to keep the areas for conservation. But really, I don't see much help, because the most times when we ask for help the government do not show up.

Participant 2: Yes, when we first went and asked for help with the conservation areas, the government accepted this and came and helped with the permits and to assist by coming and putting up the buoys with us and were very positive. But now, the government are not helping us anymore. But maybe, that's because we don't ask for help, maybe we should go and ask for more help. But the government don't ask us if we need anything either.

Interviewer: How are the relationship between the fishers?

Participant 2: It is a good relationship; we all collaborate in a way. People from here collaborate, but we also collaborate with people of other parts of Jambiani. We can invite them up here to help with fish and we can go to them.

Participant 3: I think it is good because sometimes I get more benefits by collaborating with the other fishers.

Interviewer: How about the relationship with fishers from the neighbouring villages?

Participant 2: There are a good relationship with the other villages as well. We allow neighbouring villages, such as Paje, to come here to fish but only with line as this is not destroying the reef. We are also allowed to go to other areas to fish as well.

Interviewer: What do you feel is needed to improve here to build a better fishery? Where maybe you (Participant 2) would like to return to fishing?

Participant 2: As a trap fisher, I went out with my trap when the conditions was nice, but when the sea was rough, I couldn't go fish, which led me to have many days without fishing. However, you see these fishers that have motorboat are able to go fishing in difficult conditions. Also, if there are news that there are a lot of rabbitfish in Bojou they could easily go there with their boat, which makes it easier to fish more fish. But for me, who did not have

this good equipment or a boat with motor, you don't get these opportunities. With the nglawala it is very limited.

Interviewer: Ah yes, I understand.

Participant 2: Yes, it was very frustrating.

Interviewer: How about the increasing tourism? Do you feel like this has impacted your fishing?

Participant 2: No.

Participant 3: No.

Participant 2: For the people with motorboat, they can take the guests out on their fishing trips to Mkende or to Kizimkazi and get paid to bring them out to fish bigger species.

Participant 3: Sometimes I also bring guests out with our boat to come see fishing, but not very often, it depends. However, I do see some issues with all the kite surfing. Sometimes the kiter comes very close to the fishing boat, or to some of the reefs, and I am a bit concerned that it scares away the fish. Some respect the area, but many are crazy and goes very fast and very close to us.

Interviewer: Are the benefits from tourism distributed good to the rest of the community?

Participant 2: Yes, it is good, because a lot of the locals are only working with tourists, either by bringing them out snorkelling or in hotels.

Interviewer: Do you see any challenges as a fisher in the future?

Participant 2: Right now, most people fish with the nglawaw or the smaller fibre boats with motor, however you never know how it will be in the future. Tourism can increase a lot, where our small nglawala or fibre boats might be too small to bring all the tourists out, so

maybe there will be bigger boats to bring out big groups of tourists, and this could cause problems for us.

Participant 3: Life is changing, long time ago you could buy more fish for less money than now. The money you get for the fish now is not enough to cover the new prices. For the

future, this might be a even bigger problem, where we get smaller or fewer fish and for a lower price.

Interview: Do you have any hopes for fishing in the future?

Participant 3: Hopefully, we could get paid more for the fish we get.

Interviewer: Okay, that was really all my questions, is it anything else you would like to share?

Participant 2: No, not really.

Participant 3: No.

Interviewer: Alright. Thank you so much for taking time to talk to me. I really appreciate it.

Interview 4: seaweed farmers, 2 participants

29.02.2023

Interviewer: To start, we will have some general questions to understand of your field as a seaweed farmer, and then I would like you both to answer all questions. After these general questions we will start with more discussions.

Participant 1: We bring the sticks from the bush, cutting them and making them ready to bring them out in the ocean. We use this line between the stick to fasten the seaweed. There are great benefits to seaweed, where it's easy access to the sea as well as it is good for health. However, there are some challenges working with seaweed as well. There is a great difference between high tide and low tide, and we are out working in low tide, when the high tide comes, we have to wait and then we go out again with the next low tide, which can make very long workdays and we have to take some days rest sometimes. Also, the sea is

sometimes not okay also, a bit too rough as the water can take away all the seaweed we have put out, where we then could have great loss of seaweed.

Interviewer: Ahh, I see, that's very interesting. And we will talk more about this in a little bit. But first, how long have you been doing seaweed farming for?

Participant 1: I have been doing this for 30 years.

Participant 2: 15 years.

Interviewer: Do you have other work as well?

Participant 1: Some of the seaweed farmers here are also hunting octopus, but for us (the two participants), we are only doing the seaweed farming. Sometimes we go and look for snails and shells in the sand for food or to sell it to get some extra income.

Interviewer: As you are then mainly doing seaweed farming, is the income enough to support your household?

Participant 1: Before, it was a lot of benefits of doing seaweed farming, where we could base around half of our household on the seaweed income. But now, it has gotten worse, because the price of seaweed is reduced. Before, it was 1000 schillings per kg, but now they drop the price to 700 for 1 kg. So now we do a lot of work but get much less money.

Participant 2: Yes, this is a very big challenge for us. Now, everything depends on us. We have to buy our own sticks, our own rope, our own "tai tai", something we use to tie on the equipment. We have to spend our own money on all of this, and because the price is reduced

to 700 on the seaweed, we see that with all the money we spend on expenses we end up with nothing.

Participant 1: The expenses can even be much more than what we now earn from the seaweed.

Interviewer: Do you know why the price has decreased?

Participant 1: I don't know.

Participant 2: I think, maybe, that the tax to bring the product overseas has increased and this is why the government, or the companies, has decreased what they pay us.

Interviewer: Do you need other work as well due to this change?

Participant 2: Yes, we try to make small jobs as well. Some small businesses. I sometime make mandazi, buns, and some juice to sell. Other farmers are also good at making seaweed soaps. But there are also some challenges for this with the bad electricity here, because the juice goes bad without power for instance.

Interviewer: Yes, this is a bit difficult for you then.

Could you explain to me a bit of how you do your seaweed farming?

Participant 1: Yes, we use two sticks to put in the sand and then we put a rope between the sticks. We take this (shows a small part of a seaweed) and tie it to the rope like this (shows that they tie small part of seaweed across the entire length of the rope). We then bring this out to the sea. We can bring maybe two hundreds of this and put up in the sea. When the seaweed has grown, we harvest them and bring them up here and put them out to dry, put in baskets and then ready to sell. The seaweed is quite heavy when it is wet, and gets much lighter when it is dry, which is the weight we get paid for.

Interviewer: How much time does all of this take?

Participant 2: The process from going to the bush to take the sticks, to tie the seaweed, to put it in the ocean and wait for it to grow, and then harvest and dry it, it takes around 2 months.

Also, it takes many days to place all of this sticks, as it is not possible to do all 200 in one day. We might do around 20-40 in a day.

Interviewer: Is there any rules for where you can put out your seaweed?

Participant 1: It depends on the area. We can go with the sand, but some areas have more stones where we need a hammer to put down the sticks. But the shallow parts here are open for us to farm on.

Interviewer: What do you think is needed to do to make seaweed farming more viable for you?

Participant 2: We are losing our hopes for the future, because for this price it is no point, and we could rather just give up. If we I get the offer for another job, I would take it. Because now, we cannot depend anything on seaweed and we don't have hope for it to change either.

Participant 1: I would also just take another job.

Interviewer: When you started seaweed farming 30 years ago, was it then a good job to have?

Participant 1: For that time, it was much better, also because the life was much simpler then. Things are changing, if you compare prices now and then, it has increased a lot. So, the prices of seaweed has gone down and we earn less, but the price of living has gone up.

Interviewer: How are you adapting to these changes?

Participant 1: I am just looking for other work, either to be able to sell more of the things I make or maybe I could get a job at a hotel or something like this. For the seaweed, there is no point. I do seaweed now only because I don't have any other work to do.

Participant 2: Yes, really seaweed farming is like nothing for me anymore.

Interviewer: Do you think tourism has affected your seaweed farming in any way?

Participant 2: No.

Participant 1: No. Some of the other farmers have some few disturbances of kitesurfing, but in our area, there are no kiting, so we don't get disturbed.

Participant 2: It is rather the fault of the company or the government, I think. There might be some issues with the pools, where the hotels put the water into the sea, so maybe the pool

water destroys the seaweed a bit, or just make the seaweed not to grow so much or going bad. Sometimes it gets full of harmful stuff where the colour even changes or are almost dying.

Interviewer: What would you need to continue seaweed farming?

Participant 2: Higher prices. But honestly, we don't have much hope for the future.

Interviewer: Who are 'we'? You two?

Participant 2: No, all of the seaweed farmers in Jambiani. We are a team, and we collaborate, and we talk, and all are saying the same. We are not happy, and we don't know how we can continue.

Interviewer: Who are the companies you sell to?

Participant 2: Sometimes we sell to companies, like Zanea, or sometimes we sell to people who pass us and ask to buy for better price than the companies.

Interviewer: Alright, thank you. That is really all I needed, so thank you very much for your time and for meeting with me.

Participant 1: Thank you, it was nice talking to you.

Participant 2: Thank you, and you are welcome.

Interview 5: net fishers, 2 participants

29.02.2024

Interviewer: How long have you been a fisher for?

Participant 1: I started to fish when I was 10 years old, now I'm 50 so it's been 40 years with fishing.

Participant 2: 10 years.

Participant 3: 20 years maybe.

Interviewer: What have been your main fishing technique?

Participant 1: I fish with net, but I also go sometimes after octopus with a stick.

Participant 2: Also, net fishing.

Participant 3: Net fishing.

Interviewer: When you go net fishing, in which area do you go to fish?

Participant 1: We go many different places, sometimes in the seagrass, sometimes in coral reefs, and sometimes we go outside of the reef and fish in the deep waters. It depends on the ocean.

Participant 2: Yes, it is the same for me.

Participant 3: Yes, here in Jambiani it is usually in the shallow area, but sometimes we go to other areas outside of Jambiani.

Interviewer: How many are you when you go net fishing?

Participant 1: We are 15 – 20 people in one or two boats.

Interviewer: Do you target any specific kind of fish?

Participant 1: Sometimes we target specific species, but sometimes we take any kind.

Interviewer: When you target species, which species are you looking for?

Participant 1: Emperor, kole-kole, rabbit fish, toa. Both big and small fish.

Participant 2: I like toa, but we target the same kind of fish as him (Participant 1).

Participant 3: Toa is my favorite too. It is easy to catch, and we often get many. Other could be rabbit fish, emperor, parrotfish. We can get other fish in our net even when we are targeting the toa.

Interviewer: What size of net do you use?

Participant 1: We use bigger nets for big fish and smaller for small fish.

Interviewer: And how much of your livelihood is dependent on fishing?

Participant 1: My only activity is fishing, so 100% of income is fishing. But I do some farming for vegetables and fruits for my family.

Participant 2: I also get all income from fishing.

Participant 3: Most of my income is from fishing, but I also work at a hotel in Paje sometimes, if I need more money.

Interviewer: And the fish you catch, where do you sell it?

Participant 1: It depends. Today, we caught a lot of fish, so we sell first to the villagers, and it is all okay and everyone has gotten the fish that they need, and it is still much fish left, then we take them to Stonetown to sell.

Participant 2: Yes, we also take fish to Stonetown, to the fish market there to sell if we have a lot. Sometimes we might meet a buyer to buy fish to hotel, but not often.

Participant 3: Yes, the same. Some for me, some for the others fisher, to the village, and then if it is a lot more, we can sell it.

Participant 1: But generally, the fish goes to the villagers.

Interviewer: Is it a reason for not selling more to the hotel?

Participant 1: The hotels are looking for very specific kind of fish, it has to be tuna, white snapper, red snapper and so on, and also, they have to be big. We don't catch this kind of fish a lot.

Interviewer: Does this make you want to rather target the big fish?

Participant 1: Yes, but we don't have the equipment to do this. With the nglawala, we are not able to go to the deep sea, and we don't have space on the boat to catch many big fish.

Interviewer: Alright, and then I also wanted to discuss a bit around the fishery management. How do you feel the local management of conservation zones are working? How effective is this kind of management?

Participant 1: All of us fishers know each other and then we come together to agree on areas that would be good to conserve.

Interviewer: Yes, and do you think this is a good system? To create conservation zones?

Participant 1: Yes

Participant 3: Very good!

Interviewer: Which benefits do you see coming from this?

Participant 1: It is good to keep this place, because if we keep this place for many years and then open it up to fish later it is possible that there will be so much more fish there. With more fish, we will get more money when we sell it, and then we can put this money towards fixing problems in the community and strengthen other things that we come across.

Participant 2: Some is good, and some is not good. Some of the rules that are put on us that uses net, are very difficult to follow because it is very strict for us. But, it is still okay, because there are some areas that are still left for us net-fishers to fish.

Participant 3: I see a lot of benefits. We experience less fish in our catch and this conservation can help us bring it back. It is also good for the community.

Interviewer: Do you feel involved in the management of the fisheries? In the decision making?

Participant 1: There is meetings where all the fishers are called in, where we can come and present our challenges or benefits that we have seen.

Participant 3: Yes, all are invited to these meetings. We can go if we want to.

Interviewer: The government has some rules, and the locals have other rules. What do you feel works well and what is difficult for you as a fisher?

Participant 1: What the government do, is only to come here and present rules to the villages or to the place where they want to place the rules for fishing. So then, the villagers are the ones that will sit with the rule, we will test it out to see how it works and then bring back

feedback. This is fine, because if it is something we are not comfortable with we can bring this information back to the government.

Interviewer: Do the government respect the feedback?

Participant 1: Sometimes they respect it, and sometimes they respond with force for the rule to stay.

Interviewer: What are the rules right now that you must follow?

Participant 1: As a fisher, our income depends on the fishing, and of course, we don't have the modern equipment, so we are quite dependent on fishing for it to cover our needs, as we are not rich. Sometime the government do not think about this, they don't think about us people that are poor and depend on the ocean. So, for us, it is important to be able to say what works and that this can be respected. The government comes here and tell us that small size of fishing net is not wanted to be used, but they are not coming with solution. For instance, they are not saying, instead of using this you can use this. They just come here with the rule:

don't use this! And that's it! But, for us, this is the kind of net where a lot of our income depends on. You see?

Interviewer: Yes, I understand.

Participant 1: And this is where some of the conflicts are coming from, and it creates a bit of frustration from us towards the government.

Interviewer: Do you wish there was a better educational offer for you fishers from the government? Where they for instance could teach about other methods?

Participant 1: The education is good for nothing. They already come here and give education, but we don't have the equipment needed for this. So how can we use what we learn? They come with education, but we can't use it.

Participant 3: I feel the same. It is not easy to know what to do when they come here and say "hey don't do this".

Interviewer: I see. Do you then feel like the community-based management is working better here?

Participant 1: Yes, because from the community we get more benefits than from the government. We conserve these areas to protect the corals, and create place for the fish to reproduce, and also, we bring guests to these areas to snorkel. So, these areas provide income to the community, to the fishermen, to people bringing out guest, going out sailing, and more!

So, we get more benefits from this, than what we see coming from the rules from the government.

Interviewer: How is the relationship between the fishers in Jambiani? Is it good communication between fishers?

Participant 1: Yes, there is good relationship and communication between all the people in Jambiani who are fishing here. If there is a problem, we can talk about it. There is not really any conflict.

Participant 2: It is very easy, relaxed.

Interviewer: That's good. I've heard that sometimes there are people not agreeing with the conservation zones and are still fishing there. Have you noticed this?

Participant 1: Yes, this has happened. But it hasn't created big conflicts, we talk to the fishers who break the rule, and talk about where we conserve and why, for them to learn more. It is of course difficult, because as human beings we are not the same, some people do understand and appreciate it, while other people do not understand why. So of course, this happened, but we try our best.

Interviewer: How do you feel like the conservation zones works for you as a net-fishers? As there are some zones where the basket-fishers and the handline-fishers are allowed to go, but the net-fishers aren't allowed.

Participant 1:

26:44

Participant 2: Yes, there are some areas, it is not really conservation zones, but it is areas where it is net-fishing is banned. I find this very unfair because we are left with little areas to

fish. I think it is good to have the conservation areas, but would like to be able to come and fish in the net-banned areas.

Interviewer: How do you think would be a good way to continue net-fishing in these areas and at the same time take care of the coral?

Participant 2: Of course, we know that our net can harm the coral, so we would just have to be more careful in the vulnerable areas.

Interviewer: Okay. I also wanted to talk a bit about the tourism here. Have you felt that the tourism has impacted your fishing?

Participant 1: No.

Participant 2: No.

Participant 3: Sometimes the kite can come a bit in the way.

Interviewer: Do you see it as something positive or negative then?

Participant 2: I think it is positive.

Participant 1: Me too.

Participant 3: I think it is good, I get to work at the hotel for example.

Interviewer: Do you see any challenges coming in the future?

Participant 1: I'm a bit concerned, because the government are not investing a lot to look after the fishers in this villages. They are not supporting us with new equipment or other kind of boats. This gives little hopes for the future. We need some strategies where we can build the fisheries stronger for the new challenges coming. Sometimes they say they will help, but it is not working. The government send big boats with freezers to go to the deep sea, but not for the villagers. However, it should be the local villagers that got the opportunity to go fish

there to build the income in the local communities. They do this to build the economy for the government itself, but not to build the economy within their local communities.

Interviewer: Ah, I see. Do you see any hopes for the future, then?

Participant 1: It has to come through them, the government. You know, we are poor people who are doing only fishing, and they know that we don't have modern equipment. So, it is up to the government to think about this and think about their people. If they don't care, and

only bring big boats to themselves and not to the villagers, is not good for the development. I don't see that there is good enough collaborating between us and them.

Interviewer: Yes, I can understand that this is difficult.

Participant 1: Yes, very frustrating! We are just looking for some extra help.

Interviewer: Thank you a lot for your time. This has been a very nice talk, and I really appreciate that you have taken time to talk to me. Asante sana.

Participant 1: Asante sana! (Thank you).

Participant 3: Asante sana! (Thank you).

Hotel Interviews

Interview 1:

25.02.2024

Interviewer: Is this the only hotel in Jambiani you have?

Participant: This is the only hotel we have but we have some apartments, no – villas also.

Interviewer: Is this the only one with food then?

Participant: Yes, only food here. But we are closing in March.

Interviewer: Oh, why?

Participant: We are closing in March and opening in June to do some remodelling. To make everything in here like new.

Interviewer: Okay, for how long have you been a hotel owner here in Jambiani?

Participant: I have been owner here since September, but I came here in December.

Interviewer: Ah, so quite new then?

Participant: Yeah.

Interviewer: Where are you from?

Participant: Poland.

Interviewer: Do you serve fish here at the restaurant?

Participant: Uhm yes, but we serve only tuna. Because we like fresh fish you know? So they bring us tuna. But after remodelling, it might be different because we are going to change the menu, because we don't like this menu. It is too big. (Shows menu). Here you can see, our

menu is very big, so we are going to change the fish, the meat and everything. So not only tuna.

Interviewer: Where do you buy your tuna from?

Participant: Uhm, from the people, you know? From the fishing people, you know? Or from the store, in Paje.

Interviewer: In Paje?

Participant: Yes, because sometimes they don't have... Because now, there is no tuna. This is not the time for the tuna. But sometimes we buy frozen, yeah.

Interviewer: When you buy frozen tuna, where do you go then?

Participant: In Paje.

Interviewer: From the store in Paje?

Participant: Yes.

Interviewer: And when you buy fresh tuna, where do you go then?

Participant: It is fresh, it is only one day or something like this. They bring it from Kizimkazi and they put in the freezer. But it's one day fish. It is not like three or four days, you know.

Interviewer: But if you buy from the fishers, how do you do it then?

Participant: No no, we have a guy that brings us, you know, and he gives us receipts and everything. It is not like fishermen coming and sell, you know. It is a company owner.

Interviewer: So, you have one person that brings you all fish?

Participant: Yes.

Interviewer: How often does he deliver fish to you?

Participant: It is like two or three days a week, it depends.

Interviewer: Where do you prefer buying your fish from?

Participant: From the fishermen, because it is fresh, and not frozen so it is easier for our chefs to cut, and to do tartar, and they can do everything, you know. But frozen, you have to unfreeze, yeah.

Interviewer: Is it a certain size of tuna that you are after?

Participant: We like 6, 7 and 9 kilo tuna, because we want it fresh. So we don't buy bigger because if it is bigger, the people will not eat, too much fish.

Interviewer: You said you were planning to change your menu. Do you already know what other fish you would like to put on the menu?

Participant: Red fish, white fish, we want the grilled fish, you know like the whole fish to grill. But you know, we have to see the prices and everything before we change the menu,

and then I will know. Because there is many people that don't like to spend a lot of money, you know, so we don't want to go over the budget.

Interviewer: Do you have other seafood on your menu?

Participant: Octopus, yes we have calamari, we have lobster, we have something looking like lobster, we have prawns, we have king prawns, yes.

Interviewer: Do you get this seafood from the same guy you use to buy you tuna?

Participant: Yes.

Interviewer: From Paje also?

Participant: You know what, no. From Paje, I only but when I don't have it here. The guy brings usually from Kizimkazi, fresh. So, I'm buying from him because it is better price. Because in Paje you pay more. And also! Sometimes, it comes local fisher right here (points to the gate towards the beach) and brings octopus straight from the sea. This is great, because

I get super fresh octopus for a good price, and also all the tourists at my hotel likes it, they go there and take pictures, and it is very nice.

Interviewer: Ah that's great! Do octopus fishers come here often?

Participant: Not very often, sometimes. It is always the same person that comes, and I tell him he is welcome here.

Interviewer: Yes, that is good.

Participant: Yes!

Interviewer: What do you do when you don't find tuna?

Participant: I always find.

Interviewer: You always find?

Participant: I always find. No problem for me. I might have to drive to Stonetown, but I will find. And when my guy see that is not enough, he will tell me, so I have time to buy elsewhere. They don't tell me like, now it is finish, they tell me when it is almost finish, so I

have more time. Because not everybody eat fish, some people eat pasta, so I don't need a lot of fish all the time.

Interviewer: How do you think your hotel's choices impact the local fishers?

Participant: Good.

Interviewer: Do you also have snorkelling tours or any activities for your guests?

Participant: No, but we are going to do it after the closing. Now we give all our clients to my friend who is doing the tours, but after we are going to be together. Because now we are changing everything.

Interviewer: Who do you think will do the tours when you reopen then?

Participant: The guy, who I'm giving my clients to now. They go to the islands, to the safari blue, to everything you know.

Interviewer: Is he a local?

Participant: Yes.

Interviewer: Alright. But that really everything I needed, so thank you very much.

Participant: Thank you!

Interview 2:

27.02.2024

Interviewer: Where are you from?

Participant: I'm from the Netherlands.

Interviewer: And how many hotels in Jambiani do you have?

Participant: We have to locations. But only this one with food.

Interviewer: And for how long have you been a hotel owner here?

Participant: We started this place 9 and half year ago.

Interviewer: And for your hotel, where do you get your fish from?

Participant: We catch it ourselves. 90% of the fish, we catch ourselves. And then sometimes, when we have small fish, like portion fish, we buy from the local fishermen.

Interviewer: Because what you catch yourselves is more big fish species?

Participant: Yeah, more big game.

Interviewer: What species do you usually target then?

Participant: We target a lot of yellowfin tuna, but also, we catch mahi mahi, wawo, king mackerel.

Interviewer: And then you bring your catch back to the hotel to sell?

Participant: Exactly, exactly.

Interviewer: Are these you most popular fish that people buy off the menu as well?

Participant: Yeah, tuna is very popular of course. And white fish also, very popular.

Interviewer: And how about the smaller fish,

Participant: I'm sorry, I'm not feeling well, can we take a break.

Interviewer: Of course.

---- had to change Participant to the other hotel owner, because the Participant was not feeling well ----

Interviewer: So, where I was at with your colleague wat that we talked about for how long you've had this hotel for, that you fish most of your fish yourselves, but also that sometimes you but smaller fish from local fishers.

Participant: We have occasionally that also to support the locals, that we catch white snapper from them, which is a smaller fish and that they catch deep. We don't catch deep-water fish ourselves. We fish mostly pelagic fish on the surface.

Interviewer: Where do you go when you go on your fishing trips?

Participant: Kizimkazi.

Interviewer: And how would you say that the relationship between your hotel and the local fishers are?

Participant: Good actually. So, what we basically do, between the hotel and the local fishermen is fishermen for calamari, squid, we deal with them. We have a captain from Jambiani who fish for octopus. So, we have a long-term relationship with him as well, we buy octopus from him. And some people from the village comes here sometimes with white

snapper or lobster and then we buy that from them. So, the relationship with them is pretty good.

Interviewer: Okay, yeah. And you buy octopus always from the same guy?

Participant: Same guy, yes. And actually, squid also, from the same one or two guys.

Interviewer: Ah yes, squid also. And for your fishing trips, is that just you two owners that fish, or with tourist, or do you bring locals? How do that work?

Participant: I mean, there is also a local captain with on the boat. And the one who organize the trips is also local. Me and (other owner) just go with as a kind of guide. Fishing guide, yes.

Interviewer: How often do you go on these trips?

Participant: It depends on the season, low season it is not so much, on high season it is maybe twice a week.

Interviewer: And that's enough to sustain enough food for your hotel?

Participant: Yes, we are not a big hotel, so it is okay. If you are a good fisherman, you catch enough.

Interviewer: no that is good.

Participant: yeah, yeah. Occasionally, during low season we don't have enough fish and then we have to buy more.

Interviewer: And a bit off topic from fishing, but do you also organize snorkelling trips and those kind of activities for your guests?

Participant: That is actually a local guy, it is the same guy who gives us octopus. He is organizing this trip, and it is his boat, and he takes the guests out snorkelling.

Interviewer: Great! But that is really all my questions, so unless you have something you would like to add, I think we can call it done.

Participant: No, I'm alright

Interviewer: Okay. Thank you for your time, I really appreciate it.

Participant: No problem!

Interview 3:

27.02.2024

Interviewer: Alright, the start is just to get an overview of this hotel business in Jambiani. You are the manager here, right?

Participant: Yes.

Interviewer: Do you know how many other hotels the owner has here in Jambiani?

Participant: There is this one, and then there is one with a very different setup, which has private bungalows, there is no kitchen or no bars there, it is more of family homes. This one here is the main branch, while the other one is the second branch.

Interviewer: Where is the owner from?

Participant: Germany.

Interviewer: How long has this hotel been here?

Participant: The way that you see it now, it has been here since 2018. There was other managers and directors here, but the owner now got it in 2017 and then renovated it to how you see it now.

Interviewer: Alright. Where do you buy your fish from?

Participant: From local fishermen. We have two that we call regularly. One of them is located in Fibou and the other one is located in Kizimkazi.

Interviewer: And how often do you buy from them?

Participant: It really depends on the season. It is difficult to say, and it also depends on the season of seafood. Sometimes we buy tuna of 28kg, then we don't really need more that week. Sometimes we buy tuna of 13 kg, and that last of maybe two days. So, it really depends on what we get, and the season of seafood. But we buy fish at least once a week, and sometimes more.

Interviewer: How would you say that the relationship between the hotels and the local fishers are?

Participant: I mean, I can only speak for us, and for us it is really good. We have never had, I mean they are very honest as well, and we make sure that we buy fresh, so whenever we call them, they know that they can't show up with food that has been there for 4 days. I would say that there is a mutual respect.

Interviewer: What qualities are you looking for in the fish that you buy? Preferences in size, species, freshness etc.

Participant: Definitely freshness. I mean, we really only take fresh, we don't take anything that has been in the freezer, cause then we don't know how long it has been there. Then, what we also have written on our menu is that, in our last pages, is that seafood, as well as vegetables and fruits, is very seasonal, so whenever there are too much wind and people were not able to get enough octopus, and we don't buy the babies, we definitely look for a certain size, and grown-up adults, so anything small we will just leave. I mean, if they show up here with it because they didn't understand over the phone and try to push it out because they want to sell, we will not take it.

Interviewer: Is there any species that you also primarily want?

Participant: I mean, compared to other hotels, we don't really have lobster. We only have it sometimes when the guests want something special. But the clients here are different from other hotels. What we buy is calamari, octopus, and tuna. So, these three we buy on a regular

basis, and those three are what are fixed on our menu. And then, whenever we can buy king prawns, or lobster, it is really only when it is special days.

Interviewer: I also saw on your menu that you have the fish of the day.

Participant: Yes, for a very long time it was only tuna, and it is still most of the time. We are trying to change, but it is mostly due to costs calculations. Because tuna has quite a lot of wastage, so if you buy 28 kg of tuna, you will only be able to make fillet of around 13 kg. The rest is only head, and everything that has to be thrown away or given to our cats, which we are grateful for. But, to have tuna as the fish of the day is quite expensive so we are trying to shift. But we are not there yet.

Interviewer: Why is tuna fillets the catch of the day, instead of ...

Participant: Tuna is very easy for us, people like it, and it is also quite versatile in terms of being convenient, and for us to be able to offer tataki, and it is also fresh so, it is really one fish that we are able to sell and pull profit out of it. We can make tuna sandwiches, tuna spread, and so on. We are definitely trying to change but yeah. At one-point fishermen came her offering marlin and kingfish, because that was what they had. So, we are just trying to calculate ways, in terms of costs calculations.

Interviewer: So then if you are going to change in the future, then it would also be this other big species?

Participant: Most probably yeah. We sometimes, it really depends, we don't have a fixed menu, so sometimes we take portion fish, the smaller ones, but it is really dependent on the

guest, because they often don't like it. People from Nordic countries who grew up with fish are okay with it, but not every tourist.

Interviewer: How do you think your choices affect the local community?

Participant: I think it is good, honestly! We support local produce in Zanzibar and I don't know what we could do differently.

Interviewer: Okay, thank you for your time!

Participant: Thank you!

Interview 4:

01.03.2024

Interviewer: Where are you from?

Participant: South-Africa.

Interviewer: How many hotels in Jambiani do you own?

Participant: I only have this one. We've had it for 2 years now.

Interviewer: Who do you buy your fish from? And how often do you purchase fish?

Participant: I buy fish 2 times a week usually, but sometimes more often if I have too. I buy all my fish from Stone Town. I have a guy who buys it for me and brings it here. I get my

seafood from the same place. It is very convenient. I tell my guy what I need, and he comes to my doorstep.

Interviewer: What species do you serve here?

Participant: It is mostly tuna. It is what the people want. I also buy one white fish, often mahi mahi, which we use for soups, fish cakes, and so on. But for fish I serve, it is the tuna.

Interviewer: I see that you have “today's catch” on your menu? Does that change?

Participant: no, it is always tuna.

Interviewer: Ah okay. What qualities are you looking for in the fish you buy?

Participant: I want them big enough, maybe 10-12 kilos. I prefer to buy fresh also, but sometimes they don't have so then I buy frozen. As long as it has not been frozen for a very long time of course. Also, we don't buy juvenile octopus.

Interviewer: How do you think your hotel's choices impact local fishers and the local community?

Participant: I don't know.

Interviewer: Okay, is there anything else you would like to add?

Participant: No, I'm good.

Interviewer: okay, thank you for your time.



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