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Innovative Protection and Conservation of Coral Reefs in Madagascar

Meghan Parker
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Innovative Protection and Conservation of Coral Reefs in Madagascar

Meghan Parker

Academic Director: Andolalao Rakotoarison

Project Advisor: Rindrahatsarana Ramanankirahina

Colby College | Waterville, ME, USA

Environmental Policy and French Studies

Antananarivo, Madagascar

Biodiversity and Natural Resource Management

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Abstract

Madagascar is home to approximately 3,450 kilometers of coral reefs, including some of the most biodiverse and valuable marine ecosystems in the Indian Ocean (Webster 2002). This online research project investigates the status of Madagascar's coral reefs separated by region, threats that are facing the reefs and community-based solutions to protect and conserve the reefs. Conclusions of this online research suggest that most coral reefs in Madagascar are in relatively good health, although looming threats exist from overfishing, increased coastal populations, tourism, and warming waters. Community-based solutions are abundant and have proven effective, and can be implemented nation-wide, personalized to each community.

À l'île de Madagascar il y a environ 3,450 kilomètres de récif de corail, parmi quelques des écosystèmes marines les plus biodiverse et valable à l'Océan Indien (Webster 2002). Ce projet de recherche sur ligne enquête l'état des récifs corallien de Madagascar par région, les menaces au récifs et les solutions basées dans les communautés pour protéger et conserver les récifs coralliens. Les conclusions de cette recherche suggèrent que le plupart des récifs corail à Madagascar sont en généralement bonne santé, bien qu'il y ait des menaces de la surpêche, la monte de population sur la côte, le tourisme, et le réchauffement des eaux. Les solutions basées dans la communauté sont abondant et absolument efficace, et elles peuvent être mettre en pratique dans tous la nation si c'est personnalisé par communauté.

Introduction

Coral reefs in Madagascar are found largely in three regions of the country: the northeast, the northwest, and the southwest. Collectively, these regions account for about 3,750 kilometers of coral reefs on the Madagascan coast (Webster 2002). There are several efforts in place to monitor the biodiversity and health status of the reefs, one example being the Indian Ocean Commission (IOC) and its Regional Environmental Programme (Bigot 2000). Such reef monitoring programs condense their data into regular status reports for the region, which are then used in developing conservation policy.

Scleractinian corals, also known as hard corals, are the building blocks of coral reefs. The species diversity and abundance of hard corals is a good indicator for the overall health and biodiversity status of the reef (Obura 2011). Therefore, an assessment of the number of hard coral species in a region is important to any reef survey. Existing marine surveys have found an estimated 380 species of hard coral which make up Madagascar's coral reefs (Obura 2011).

There are several major threats to the survival and health of coral reefs. In Madagascar, the most relevant threats include pollution and sedimentation, overfishing and illegal fishing, harvesting live corals, and warming ocean waters. Threats from pollution are often due to industry, one example being the sugar refinery and hotel industry on Nosy Be. Illegal fishing techniques include walking on the coral reefs themselves to gather catch, which damages the reef. Live corals are often harvested for building materials or to sell to tourists. Warming ocean waters increase the instances of coral bleaching and poses a significant danger to coral reefs globally. (Bigot 2000)

There are two parts to the research conducted to complete this project. The first research question asks for the relative status of reefs in each region of Madagascar (the northeast, the

northwest, and the southwest). The second research question asks if there are community-based efforts to protect and conserve the coral reefs of Madagascar, and if so then what are these approaches. The objectives of this study begin with the first research question, using biodiversity measures and reported threats to assess the status of each region of coral reefs. Following this step, the final objective is to research innovative, community-based protection of the reefs.

Methodology

Research was conducted entirely online, and consisted of published and peer reviewed scholarly articles, as well as reports of community-based projects published on the Reef Resilience Network. Each source was reviewed and relevant data is used in the results and analysis of this report.

Status of Coral Reefs

To address the first research question and objective in determining the status of reefs in each region of Madagascar and any existing threats to those reefs, four scientific publications were used to gather data.

First, Bigot et al.'s 2000 "Status of Coral Reefs in the Southern Indian Ocean" provides a review of the threats to coral reefs and regional monitoring programs in place. This study includes data specific to the Nosy Be region of Madagascar.

Next, an excerpt from an international status report of coral reefs in the Indian Ocean provides a survey of the corals in northwest Madagascar. This excerpt, titled "An Assessment of Coral Reefs in Northwest Madagascar" and published by Webster and McMahon, is used to establish the biodiversity status and threats to the northwestern reefs. Data from this report includes the impact of the 1998 bleaching event as shown by percentage of dead coral cover, as well as a summary of the threats affecting northwest reefs.

Third, a 2007 survey of the corals in the southwest of Madagascar, titled "The Status of Coral Reefs in the Remote Region of Andavadoaka, Southwest Madagascar", and published by Nadon et al., is used to establish the biodiversity status of the reefs in this region. This survey discusses threats, relative health, and bleaching of southwestern reefs.

Finally, David Obura's 2011 study "Corals of Northeast Madagascar" gives a review of the biodiversity status of northeastern reefs based on coral reef surveys. This survey includes data for the species diversity of hard coral in the northeastern and northwestern regions of Madagascar.

Community Based Protection of Reefs

The second research question and objective involving research into existing community led projects for coral reef protection is supported by one scientific publication and three case studies published on the Reef Resilience Network.

Cinner's 2007 publication entitled "The Role of Taboos in Conserving Coastal Resources of Madagascar" is a survey of communities which interact with national marine parks. Data collected on local governance such as taboos is used in this report to determine the extent to which such regulations protect coral reefs.

The Reef Resilience Network published a 2014 project based in the southwest of Madagascar: "Social Marketing Campaign Engages Madagascar Fishing Villages in Sustainable Practices". The case study is used in this report as an example of community action regarding locally managed marine area (LMMA) laws.

A second project published by the Reef Resilience Network in 2014, "Boosting Marine Conservation Efforts Through Voluntary Family Planning", is a case study which is used in this report as an example of lowering pressure on reefs by providing resources for family planning.

Finally, the 2020 publication by Vincent and Razafimamonjiraibe on the Reef Resilience Network's project "Farmers of the Sea - Sea Cucumber Farming as an Alternative to Fishing" is

another case study based in the southwest of Madagascar. This study is used as an example of alternative income to reduce fishing pressure on reefs for this report.

Results

Status of Coral Reefs

Surveys have found that the coral reefs found in the northeastern region of Madagascar have an observed 281 species of hard coral and an estimated 313 total species of hard coral (Obura 2011). Obura also mentions in his 2011 publication that the northeastern reefs were largely not impacted by the 1998 bleaching event, likely because they were protected by the upwelling of cooler water.

In the northwestern regions of Madagascar, 323 species of hard coral and 453 reef fish species are observed (Obura 2011). Webster and McMahon reported less than 10% dead coral cover on northwestern reefs in their 2002 assessment. Threats to reefs in the northwest include sugar refinery waste, sedimentation, artisanal and commercial fishing, and tourism (Webster and McMahon 2002).

	Northeast Madagascar	Northwest Madagascar
Hard Coral Species Diversity	281 Species	323 Species

Table 1: Biodiversity measure of species diversity in hard coral in the northeastern and northwestern regions of Madagascar.

The southwestern coral reefs are found to be healthier when they are located farther from Toliara and river outlets (Nadon 2007). Nadon also found there to be a low impact of coral bleaching on patch reefs located in deeper waters. Threats to coral reefs in Madagascar's southwestern region includes overfishing due to population growth (Nadon 2007).

Governance

Governance and protection of coral reefs in Madagascar does not rest solely within the national and local governments. A 2014 case study published on the Reef Resilience Network discusses Velondriake, which is a Locally Managed Marine Area (LMMA) located in the southwest of Madagascar. In this region, there are *Dina*, or customary laws, which forbid destructive fishing practices and delineate protected areas (Vincent 2014).

Fady, which is a taboo against a certain activity in a specific location, sometimes have the effect of contributing towards reef conservation (Cinner 2007). For example, in the southwest there are sacred places such as an Andavadoaka rock and the Andavadoaka mangroves. In these places, there are *fady* which prohibit people from swimming, fishing, and cutting mangroves (Cinner 2007). In other places around Madagascar, *fady* make eating octopus, guitarfish, or sea turtles taboo which can have positive effects on coral reefs (Cinner 2007).

Community Protection of Reefs

The 2014 Sustainable Fishing Campaign published on the Reef Resilience Network had a goal of increasing the compliance and enforcing the rules of the locally managed marine area. Illegal fishing practices in the Velondriake area threatened reefs, fisheries, and the local way of life. A campaign was designed to target the local fishing community and raise awareness about the ban on illegal fishing with the hope of increasing compliance. This campaign resulted in increased knowledge and enforcement of fishing laws after one year. (Communication 2014)

A second 2014 project on the Reef Resilience Network to boost marine conservation efforts through voluntary family planning had a goal of enabling the 90% of women in the Velondriake area who wish to plan pregnancies to do so. This project uses the Population-

Health-Environment model to recognize the link between each of these entities, and that improving food security will boost local conservation efforts. There was a high demand for counselling and contraceptive options, and local women were trained to distribute contraceptives. The project resulted in an increased contraceptive use from 10% to 55% and a 40% decrease in fertility. As a result, women could plan their families, choose the number of children they wished to have, and therefore be better able to plan and execute income generating projects and work. This project also worked to reach broader audiences, for example engaging men in the need for family planning by relating it to issues of food security. (Vincent 2014)

Finally, the sea cucumber farming project published by Vincent and Razafimamonjiraibe on the Reef Resilience Network in 2020 had goals to reduce fishing pressure on coral reefs and provide alternate income for fishers to increase their food security. The program piloted in 2007, and grew to a total of 81 farms in 2018. Each farm usually was run by two farmers, meaning the project employed more than 170 individuals and more than half the team leaders and members were women. (Vincent and Razafimamonjiraibe 2020)

The governance system used involved community-developed guidelines for the aquaculture with Blue Ventures, which were then ratified by the community elders and traditional authorities. A Zanga Management Committee was formed to be responsible for the development, monitoring, and enforcement of the sea cucumber farms. An Advisory Board included the President and an aquaculture representative of the Velondriake Association which manages the LMMA, and a technical expert from Blue Ventures. All decisions are legitimized by traditional village leaders including the president of the Fokontany. (Vincent and Razafimamonjiraibe 2020)

The results of the project are successful: farmers are able to pay all their bills, are not in debt, and are able to contribute to a community fund with their net monthly income of US\$42. The

project is regularly assessed and improved, with a new model in place since 2017 to implement new standards for the farm sizes and strict carrying capacities to avoid disease. (Vincent and Razafimamonjiraibe 2020)

Discussion

Status of Reefs

The reefs in the northeastern and northwestern regions of Madagascar have similar hard coral diversity, as is seen in the biodiversity measures used to answer the first research question and objective (Table 1, Obura 2011). Comparatively, there are high levels of tourism around the northwestern reefs due to Nosy Be, a small island located off the northwest coast of Madagascar and one of the top tourist destinations. This has complex consequences for the health of the reefs. For example, the reefs around Nosy Tanikely (located very near Nosy Be) are generally healthier due to the protection of tourist organizations (Bigot 2000). In contrast, there are also higher levels of pollution in the waters surrounding Nosy Be and higher numbers of live corals harvested to sell to tourists (Bigot 2000).

The southwestern reefs near Toliara and river outlets are overfished and harmed by sedimentation (Nadon 2007). However, reefs near Andavadoaka, which is 150 kilometers north of Toliara, are in good health and not currently suffering from overfishing (Nadon 2007). The sources used in research for this paper do not make comparisons between the status of the three regions of coral reefs in Madagascar. However, it should be noted that all three of the community-based projects working towards conservation of coral reefs are located in the southwest of Madagascar. Further research could explore if there is actually a higher presence of community-based conservation projects in the southwest than the northeast and northwest, as well as what the results of that research then means for the comparative statuses of coral reefs in Madagascar.

Finally, the 1998 bleaching event is reported in the sources used for this research paper to have had a low overall impact on all regions of reefs in Madagascar (Obura 2011, Webster 2002, Nadon 2007).

Threats and Solutions

Major threats to coral reefs in Madagascar include overfishing, pollution, sedimentation, and warming waters, as seen in the review of the status of coral reefs (Webster 2002, Nadon 2007). These threats finish answering the first research question of status and threats of the reefs. The conservation projects highlighted in this report offer effective solutions which have been put into practice to combat these threats.

Solutions include investing in alternative income and food sources (Vincent and Razafimamonjiraibe 2020). This reduces the pressure on coral reefs from overfishing. Community-based projects that are managed within local governance systems and aided by NGOs also work well (Cinner 2007, Communication 2014, Vincent and Razafimamonjiraibe 2020). These projects helped to raise awareness and compliance of sustainable fishing practices, which also reduces overfishing and illegal fishing on reefs. Other projects to protect reefs work with interrelated issues like family planning and food security to help communities as much as coral reefs (Vincent 2014). These solutions and more are most effective when there is collaboration and leadership within communities who live nearby and interact with coral reefs. These solutions answer the second research question and final objective about community-based protection of coral reefs.

Limitations

The research completed and conclusions drawn from this study were extremely limited due to the restriction of working online due to the pandemic COVID-19. This meant that no original data was used, no in person interviews were completed, and creative methods of sharing this project to increase its impact were not an option. Therefore, this project had to be greatly altered from the previous, in-country and in-person proposal. Future studies will be more effective if completed in person in Madagascar.

Recommendations

After researching the statuses, threats and solutions of coral reefs in Madagascar, it is clear that there are projects in place working effectively toward protecting the reefs. The aquaculture project published on Reef Resilience Network by Vincent and Razafimamonjiraibe in 2020 recommends that similar projects should highlight collaboration and new governance systems in local communities. They also recommend sharing aquaculture projects that are successful in other regions of the country so that such projects can become more widespread (Vincent and Razafimamonjiraibe 2020).

Recommendations from the campaign run by Blue Ventures in Velondriake include choosing one key audience, incorporating government officials and engaging community members for a greater impact (Communication 2014).

Some other recommendations for methods to reduce overfishing on coral reefs include using Fish Aggregating Devices to focus catch on pelagic fish, and using fishing methods with a low impact on the reefs such as gill nets and hook and line among others (Bigot 2000). These recommendations are imperfect, and there are issues around using FADs such as leading to probable overfishing of pelagic fish (Bigot 2000). This highlights the importance of using a variety of solutions to protect and conserve coral reefs, and carefully monitoring any unintentional effects of implemented projects.

Conclusion

Coral reefs in Madagascar are generally in good health, although they are threatened by overfishing and increasing populations.

Effective protections of reefs are generally based in the community and build on local governance. It is essential to work to harmonize the needs of the community with the needs of the coral reefs.

References

Obura D. 2011. Corals of Northeast Madagascar. A Rapid Marine Biodiversity Assessment of the Coral Reefs of Northeast Madagascar. Pp. 17-24. <https://doi.org/10.1896/054.061.0102>

Bigot L, Charpy L, Maharavo J, Abdou Rabi F, Paupiah N, Aumeeruddy R, Villedieu C and Lieutaud A. 2000. Status of Coral Reefs of the Southern Indian Ocean: The Indian Ocean Commission Node for Comoros, Madagascar, Mauritius, Reunion and Seychelles. *Status of Coral Reefs of the World*. Pp. 77-93.

Nadon M-O, Griffiths D, Doherty E and Harris A. 2007. The Status of Coral Reefs in the Remote Region of Andavadoaka, Southwest Madagascar. *Western Indian Ocean J. Mar. Sci.* Vol. 6, No. 2, pp. 207-218.

Webster FJ and McMahon K. 2002. An Assessment of Coral Reefs in Northwest Madagascar. Coral Reef Degradation in the Indian Ocean. *CORDIO*. Pp. 190-201. ISBN 91-973959-2-7.

Cinner J. 2007. The Role of Taboos in Conserving Coastal Resources in Madagascar. SPC Traditional Marine Resource Management and Knowledge Information Bulletin #22. Pp. 15-23.

Vincent I and Razafimamonjiraibe H. 2020. Madagascar – Sustainable Livelihoods. Reef Resilience Network Case Studies.

Vincent I. 2014. Madagascar – Social Resilience. Reef Resilience Network Case Studies.

2014. Madagascar – Communication. Reef Resilience Network Case Studies.