

STATEMENT OF GRANT PURPOSE

Sophie Wulff, Indonesia, Fisheries

The effects of mangrove restoration on marine biodiversity Tanakeke Island, Indonesia

Mangroves provide a key service to the surrounding environment such as flood and tsunami protection, carbon sequestration, and fostering biodiversity in their habitats. They are also essential to fisheries as they act as a refuge for many species of juvenile fish due to abundance of feeding resources and reduced predation. About 55% of total fish catch biomass in Indonesia is made up of species dependent on mangrove habitats. However, coastal communities in the country have experienced mangrove degradation due to anthropogenic activity at an alarming rate. To address this issue, the Indonesian government has committed to restoring 600,000 hectares of mangroves in the country by 2024, the most ambitious mangrove rehabilitation program in the world. Since these efforts began, communities where this restoration has occurred have seen the economic benefits of flood prevention and ecotourism. However, very little research has been done to assess the improvements in marine biodiversity that have resulted from this restoration project. In this study, I propose to work on Tanakeke Island in the Takalar Regency, South Sulawesi. There, mangrove restoration has been continuously occurring since 2015 and has been organized and conducted by the local community. I aim to understand how mangrove restoration is affecting the local marine biodiversity, namely in increasing populations of emperor breams, snappers, groupers, and milkfish, all of which are commercially fished species that have experienced stock declines in recent years due to overfishing but may also be benefitting from this mangrove conservation effort. I will conduct this work with Dr. Rohani Ambo-Rappe from the Universitas Hasanuddin in Makassar and will disseminate this research in the form of peer-reviewed scientific articles as well as to local communities to help them make informed decisions about the benefits of mangrove restoration both ecologically and economically.

I plan to conduct my research in Tompotana village on Tanakeke Island, where mangrove forests were largely depleted due to shrimp aquaculture and charcoal production. Proving to be unsustainable, most shrimp farms were abandoned in the 1990s. As a response, the local community, particularly a women-led collective called Womangrove, have been restoring their mangrove forests and changing community dialogues around the value of mangroves ever since. As a result, there have been reports of higher harvest yield in mangrove crab and shellfish, however no formal study has been conducted on the role of mangrove restoration on increased catch on the other commercial species reliant on mangrove habitats. Mangrove restoration can be challenging as charcoal extraction is still practiced today. However, this enterprise produces small financial return for the amount of environmental destruction it brings, and I hope to compare the financial benefits of increased fishing to that of charcoal extraction to have a better understanding of the vast benefits of mangrove forests. I will collect data through Baited Remote Underwater Videos (BRUVs), a non-invasive, cheap camera contraption. I will deploy these BRUVs in Tompotana and will select sites that were restored in the early 2010s, recently restored sites, and sites that still have not been recovered from mangrove loss. From there, I will analyze these videos to assess what species are living in each area, create a local food web of these species, and calculate the biodiversity index of the sites, a key metric in assessing ecological health. Then, with the help of Dr. Ambo-Rappe, I will share my findings with the

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local community, both conservationists and fishers alike, to help inform how effective this mangrove conservation is and if commercially fished stocks are benefitting from these restoration efforts. I intend for this project to help understanding of the benefits of mangrove forests and for local groups in charge of these restoration projects to be able to use my findings when convincing locals of the benefits of mangroves.

My timeline for the project: September – November 2023: Focus on Bahasa Indonesia language learning in Java (contingent upon receiving the CLEA award). December 2023 – May 2024: Data collection on Tanakeke Island. This will involve moving to South Sulawesi and beginning to work with local people in the area. I will deploy a BRUV at three different sites in Tompotana village. Every day I will then analyze these videos and note the species found, how long they remained detected by the BRUV, and time of day they were spotted. June 2024: Data analysis, model food web creation and biodiversity assessment. July – August 2024: I will discuss results with Dr. Ambo Rappe, write up our findings, and begin developing conclusions on the benefits of mangrove restoration to present to Womangrove and other community leaders in mangrove restoration. This will come in the form of a report with the goal of providing information to these groups and allow community members to choose the best course of action given the findings of the project.

Dr. Rohani Ambo-Rappe is a seagrass ecologist that has worked extensively in the areas surrounding South Sulawesi with both fisheries researchers and the local community in the region. She can provide expertise in the area, connect me with local fishers, and provide key advice for conducting science in tropical marine areas. Dr. Ambo-Rappe has also helped me identify ways I can help support the local community. In order to engage with the students at Makassar, I plan on teaching weekly workshops in the statistical programming language R, a common analysis tool in ecology in order to aid university students in their research and experience in conducting scientific analysis. I have run similar workshops during my master's program and am familiar with the challenges new students face when learning to code. I would gain so much from a Fulbright Grant in Indonesia, and I hope to use this course to foster a mutual exchange of experience and knowledge.

I have conducted fisheries research both in the field and through data analysis. In 2017, I interned for the National Oceanic and Atmospheric Administration where I aided in a research project updating population models of Pacific fishes. Further, I participated in their bottom trawl survey, learning how to identify species in the Eastern Pacific and how fisheries are managed and regulated. I am familiar with coastal restoration research through my time at Louisiana Universities Marine Consortium, where I worked in a lab studying coastal erosion in Louisiana's marshland. Currently, I am getting my master's degree at University of New Hampshire's Department of Biological Sciences where I study mathematical applications in biology. My

thesis is in studying small-scale fisheries in Madagascar and I hope to continue this type of research during my Fulbright year.

Having lived abroad before, I understand not only the challenges of becoming fluent in a new language but also how essential it is to connecting to the people around you. To understand small-scale fisheries in Indonesia, the ability to speak with stakeholders is key which is why I will also be applying for the CLEA in order to be able to communicate effectively with my peers and colleagues. Before leaving for the country, I also plan on mastering the basics of Bahasa Indonesia through independent study using resources such as Duolingo. On top of that, I am already pursuing a formal Bahasa Indonesia course through the language course website Babel. Further, I have connected with members of a group in my area called Indonesia Community Connect that focuses on connecting Indonesian culture with the region and promotes Indonesian heritage in New Hampshire. Through this, and an online exchange program, I will meet weekly with a native speaker willing to have a language exchange where we can have conversations to practice speaking and understanding.

After Fulbright, I plan to apply for jobs at an NGO or government agency to better understand and quantify the status of our world's small-scale fisheries. This project will aid me in that goal as it will help me gain a better understanding of the complex relationship between culture and conservation and how the best way to protect the environment is to also understand people's relationship with it. Despite the growing threats ocean environments face, Indonesia is still home to precious marine resources that require better understanding in order to protect them.