

Final Evaluation Report

Your Details	
Full Name	Anargha Setiadi
Project Title	Sea turtles in Haji Buang: a baseline work towards the restoration of an Indonesian jellyfish lake
Application ID	27034-1
Grant Amount	3,827 GBP
Email Address	teuthomagna@gmail.com
Date of this Report	29 May 2020

1. Indicate the level of achievement of the project’s original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
Obtain baseline data on the lake’s chemistry and planktonic biota				At least four jellyfish species were discovered instead of three and data showed high disparity in size and abundance between species. Lake showed declining dissolved oxygen, temperature, salinity and pH with depth. Additional data on benthic composition and fauna were obtained from the lake’s perimeter.
Estimate the population of resident sea turtles				Footage was not captured due to disturbances caused by the drone and difficulties in operating the drone at quieter distances. However, at least nine separate sightings of sea turtles were recorded by team members, including one feeding observation. Another introduced species (a large triggerfish) was caught on camera.
Train local assistants and raise stakeholder awareness				Seven local guides were trained in hands-on 2-day field workshop. As the trip concluded we discussed our findings and concerns with a diverse audience of at least 17 local stakeholders. Attendees responded positively to the suggested protection and recovery strategies for the lake.

2. Please explain any unforeseen difficulties that arose during the project and how these were tackled.

1. Drone sessions failed to capture sea turtle images, thus preventing accurate estimation of their abundance in the lake. Technical difficulties such as signal loss, interferences and strong winds above the lake prevented us from safely flying the drone at higher altitudes. The noise disturbances produced by the drone and its relative proximity to lake surface might have provoked avoidance in resident turtles. We sought to mitigate this loss by recording the incidental sightings by our team members and by interviewing local people responsible for their release, which further confirm the presence of the turtles in the lake. Additionally, the drone captured footages of a single triggerfish (Fig. 1), which is believed to be introduced.

2. The COVID-19 pandemic and quarantine orders prevented further analysis of the zooplankton/phytoplankton samples, which are currently stored at the University of Indonesia. The pandemic also prevented us from reattempting sea turtle population counts and dissemination of educational posters, which was initially planned in March/April 2020. We hope to continue the work once the campus reopens and if it has become safer to travel and work in close quarters.
3. A fraud was attempted by one of the vendors (an equipment specialist from HACH Company) during the repair of our Quanta Hydrolab instrument by forwarding us a fraudulent bank information. However, a quick communication with the company's financial manager and the subsequent closure of the account prevented the wire transfer from being completed, thereby allowing the return of our payment. New payment was reinstated after the issue was clarified and secured by the financial manager.



Figure 1. Drone photograph of a large triggerfish (Family Balistidae). The fish appeared disoriented and suspected to be an introduction by local people.

3. Briefly describe the three most important outcomes of your project

1. Critical understanding on native biodiversity, benthic composition of lake shoreline and water quality profile, which will inform recommendations and educational materials for the public and local government. We discovered four species of jellyfish, with different abundances (Fig. 2) and size classes that possibly reflect differences in predation pressures. The dataset has helped us identify highly vulnerable regions in the lake due to their abundance of fragile sponge communities. Although the data were collected after disturbance occurred, they serve as an important baseline for future recovery programmes. Furthermore, future management plans will be designed on the basis of this knowledge.

2. Raised awareness among 17 local stakeholders and improved skills and knowledge in seven local guides who participated in the training. Pre- and post-training test comparisons showed that there was an average of 76% increase in their understanding of marine lake research and conservation (ecology, methodology, and threats). A presentation with local stakeholders revealed their enthusiasm to protect the lake in parallel to the nearby Kakaban Lake, which is a healthy marine lake and ecotourism site. The discussion session showed that many were previously unaware of Haji Buang's biodiversity and ecological values. A discussion with Green Nirvana's (a tourist resort) owner hinted at possible future partnership in designing environmentally responsible lake management schemes. These activities are an important groundwork for continued future collaborations and conservation projects on Berau marine lakes.

3. New discoveries on a unique, endemic species. A new species of sea star, *Limnasterias oinops*, was described and published after fieldwork (Fig. 4) and is believed to be endemic to the lake, likely representing a species highly vulnerable to extinction. The fieldwork allowed us to gauge its suitability as indicator species, due to its moderate abundance and relative sensitivity to environmental stresses. During the trip, we also discovered that some individuals are cannibalistic upon smaller cohorts. Moreover, a few other organisms (an algae and a mollusc) are being considered as possible new taxa candidates, currently awaiting further investigation. These highlight the lake's conservation value as a fragile ecosystem with highly unique biodiversity.

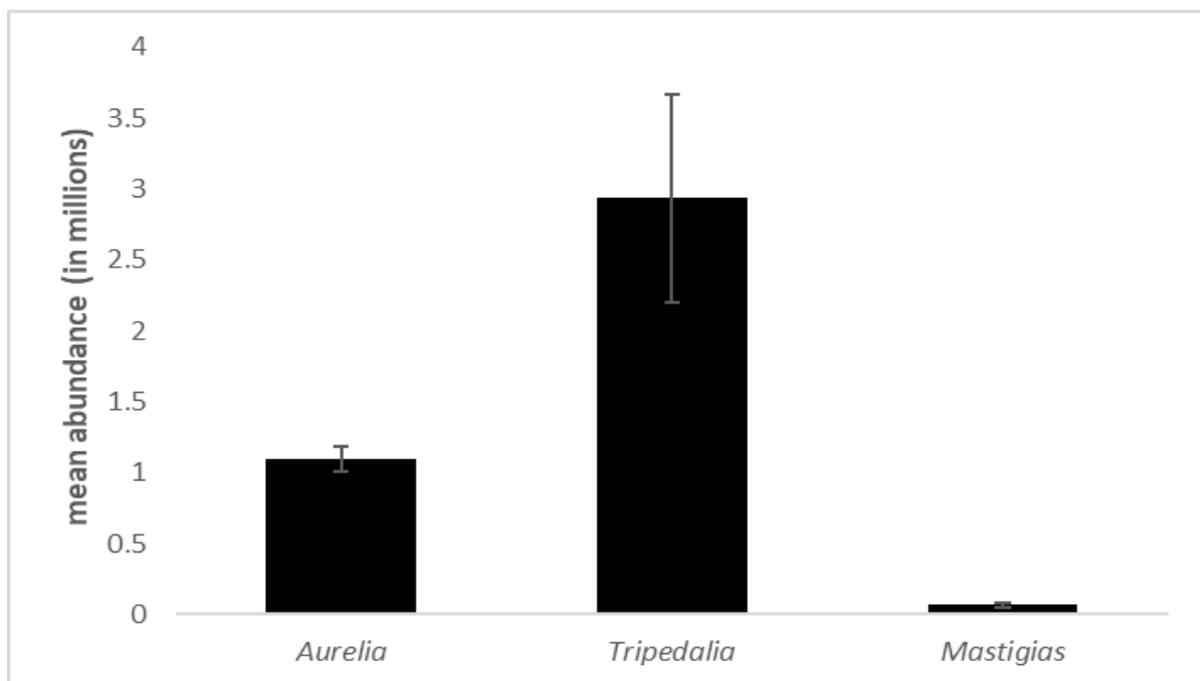


Figure 2. Mean abundances of lake jellyfish. *Cassiopea* not included it was present near lake entrance but was not observed in transects or net runs.

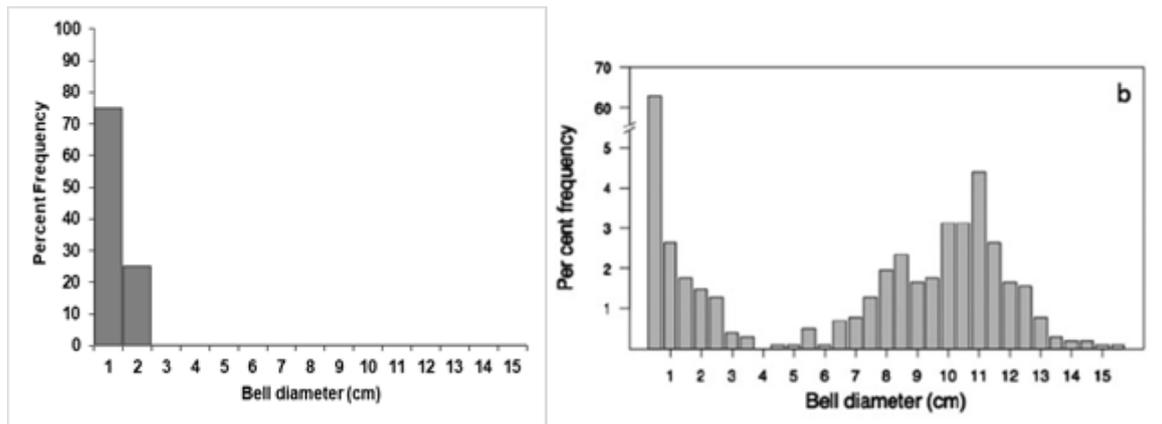


Figure 3. Comparison of size frequencies of *Mastigias papua* bell diameter from Haji Buang Lake in 2019 (left) and Palau in 2011 (right; directly copied from Cimino et al. 2018). This shows the absence of sexually mature *Mastigias* medusae in Haji Buang, likely due to the presence of predatory turtles. URL for Cimino et al. 2018: https://www.researchgate.net/publication/323152379_Jellyfish_distribution_and_abundance_in_relation_to_the_physical_habitat_of_Jellyfish_Lake_Palau

4. Briefly describe the involvement of local communities and how they have benefitted from the project.

We hired two local guides from Tanjung Harapan village, who assisted our work and navigation at the field and in local communities. They are paid their daily rates, ensuring their income during the fieldwork. The guides received training workshops along with five other local guides (one from Tanjung Harapan, two each from Payung-Payung and Bohe Bukut villages, respectively), which provided them skills and knowledge on marine lake ecology and conservation. This will enrich their guided tours in any of Berau's marine lakes and their skills will be valuable for visiting institutions, such as local universities.

Our project's final presentation involved 17 local stakeholders, comprising of landowners, local figures, government staff and tourism operators. The presentation would not be possible without valuable help from local guides, from key stakeholder invitations to venue preparations. During the discussion, we raised awareness about the lake's unique biodiversity and ecology and suggested for its protection as an ecotourism site.

Moreover, we received a request from the head of Payung-Payung village to produce guidance on lake management and *Peraturan Kampung* (Village Regulations). These are encouraging signs of increasing recognition of the lake's potential in ecotourism and conservation, in addition to marking their enthusiasm for future partnerships.

Our stay in Maratua relied on home-owned businesses, by staying in a local homestay, hiring a local catering and a driver for our meals and transport to the study site. The project directly supported their livelihoods by using their services throughout the fieldwork.

5. Are there any plans to continue this work?

Yes, we intend to continue this work by relocating the introduced animals (sea turtles) in the near future, thus allowing the recovery of native fauna. We also intend to initiate an active restoration of the golden jelly (*Mastigias*) using protective net enclosures. Ideally, this includes a long-term monitoring project by partnering with local institutions. However, the start of its execution depends on the feasibility of post-pandemic fieldwork.

6. How do you plan to share the results of your work with others?

Popular articles will be published to viable conservation and popular media outlets. Targets include Mongabay.com and the Jakarta Post. We will also collaborate with Tambora Muda as media partner to share the results on social media. This dissemination channel will be prioritised in reaching wider audience comprising of educators and college students, extending the reach beyond local stakeholders and researchers.

Collected data are currently being analysed for a future publication, which will discuss the post-disturbance ecological state of the lake. We hope to submit this article to suitable journals, including *Raffles Bulletin of Zoology* or *Biodiversity*.

The project has contributed significantly to the description of a sea star thought to be endemic to Haji Buang, which was published in *Zootaxa* in 2019 (Fig. 4).

Educational materials such as bilingual posters have been designed, targeting the local people of Maratua, Berau, and visiting domestic or international tourists. The posters showcase the issues of introduced species and interconnectivity between lakes (Fig. 5). We are still waiting for a safer period after the pandemic for their dissemination.

A recommendations document and an ecotourism zonation plan (in Bahasa Indonesia) are currently being developed with inputs from the local branch of The Nature Conservancy. This will be provided to local NGOs and governmental institutions, particularly Berau's Fisheries and Maritime Affairs Office and Tourism Office.

A new genus and two new species of sea stars (Family Asterinidae) from Indonesian marine lakes, with notes on habitat and feeding ecology

ANARGHA SETIADI

Research Center for Climate Change, University of Indonesia (RCCC UI), Laboratorium Multidisiplin FMIPA 7th Fl., Kampus UI Depok 16424 Indonesia. E-mail: teuthomagna@gmail.com

Abstract

A new genus of asterinid asteroid, *Limmasterias* gen. nov. and two new species, *Limmasterias oinops* sp. nov. and *L. estradivariae* sp. nov. are described from two East Kalimantan marine lakes, Indonesia. *Limmasterias* is differentiated from other asterinid genera by a combination of features: high aspect body with thick tissue covering; extensive papulate area; numerous single papulae in up to five rows at ray sides; boot-shaped inferomarginal plates; appressed superactinal plates and absence of superambulacral plates. The ecology and conservation of these species and their unique habitat are discussed.

Key words: Asteroidea, *Limmasterias*, anchialine, Borneo

Figure 4. Screenshot of the Zootaxa article by Setiadi, 2019. Of the two species, only *Limmasterias oinops* is native to Haji Buang Lake.

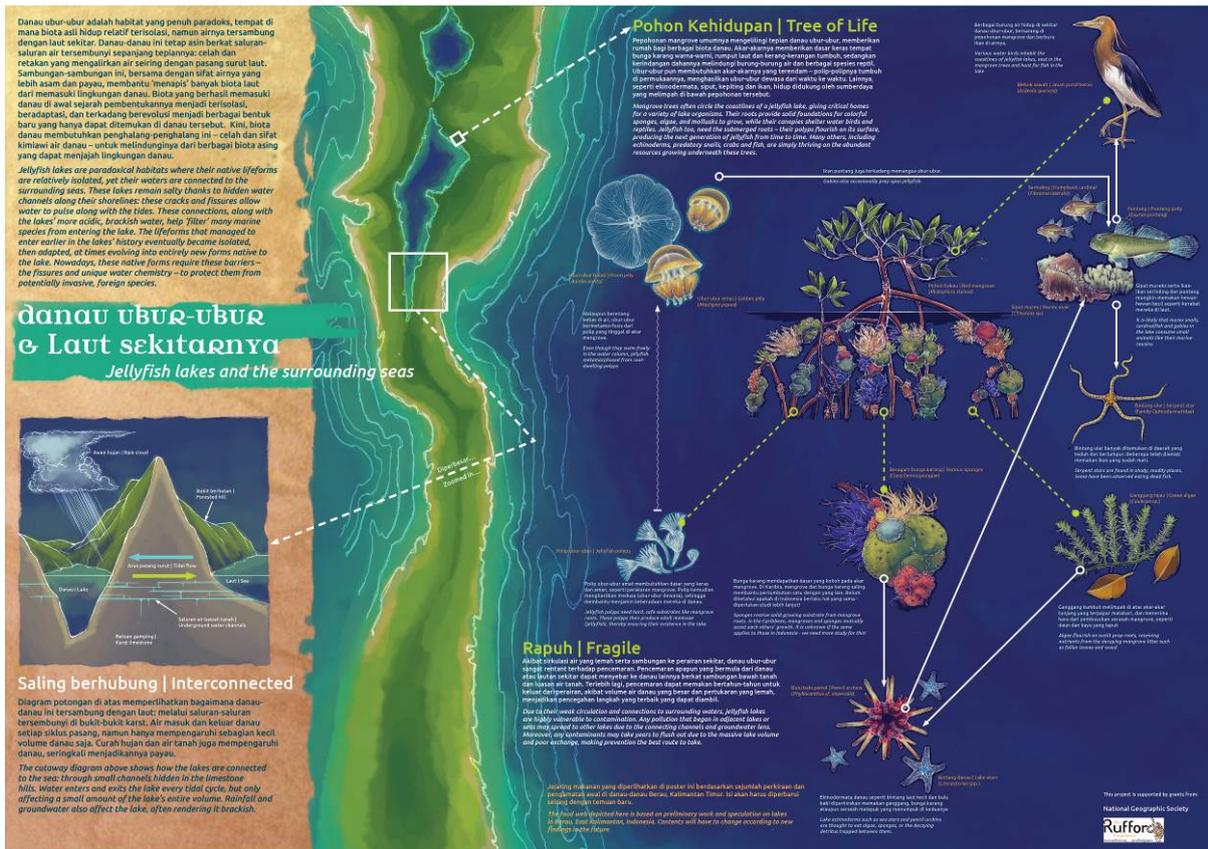


Figure 5. Bilingual poster titled 'Jellyfish lakes and the surrounding seas', focusing on hydrological connectivity and the role of mangrove trees to native biota. Illustrated by Anargha Setiadi and reviewed by Gerda Ucharm/CRRF Palau

7. Timescale: Over what period was the grant used? How does this compare to the anticipated or actual length of the project?

All of expenses for the fieldwork were made during April – July 2019 period. It covered all of the fieldwork essential for the post-disturbance baseline study. The length fits our expectation for the baseline phase. The fourth quarter of 2019 was spent to describe and publish the endemic starfish *Limnasterias oinops*, in addition to designing educational materials. These did not incur further costs from the initial budget.

There are planned successive phases (relocation and monitoring) that was initially anticipated for March or April 2020, partnering with Dr Nicolas Pilcher (Save Our Seas Foundation). These phases are to be funded by a new source. However, these, along with the distribution educational materials at study site, are currently being halted due to the ongoing COVID-19 pandemic.

8. Budget: Provide a breakdown of budgeted versus actual expenditure and the reasons for any differences. All figures should be in £ sterling, indicating the local exchange rate used. It is important that you retain the management accounts and all paid invoices relating to the project for at least 2 years as these may be required for inspection at our discretion.

Item	Budgeted Amount	Actual Amount	Difference	Comments
Flight, Roundtrip (Koror – Taipei – Jakarta – Taipei – Koror); China Airlines	846	1026	+180	Gerda requested transits in Taipei instead of Manila for safety, airline changed; USD to IDR exchange rate fluctuations
Hach Hydrolab Quanta - Multiparameter, portable + 30 ft cable	856	977	+121	AUD to IDR exchange rate fluctuations
Mavic Air Battery s/n OK4AF3JA350A42 + freight charges	61	68	+7	slight differences between Amazon reference and local vendor prices
Mavic Air Battery s/n OK4XF3694305CG + freight charges	61	67	+6	slight differences between Amazon reference and local vendor prices
Jellyfish net (material) - US Military Mosquito Net (S/N 141661116775)	73	11	-62	Net material only. frame and net assembly were outsourced to local craftsmen, incurring expense way over the predicted budget and was paid using alternate source.
Jellyfish net (material) - shipping charges	83	34	-49	See above
Hotel stay, 1 night	49	41	-8	Found cheaper hotel than

(Berau) + 10% Tax				expected
Lodging, Maratua (Losmen Ananda)	906	893	-13	Frequency less than budgeted; GBP to IDR exchange rate fluctuations
Meals - 2 members (June)	264	298	+34	GBP to IDR exchange rate fluctuations
Meals - 2 members (July)	168	149	-19	Frequency less than budgeted
Meals - 2 members (July) - Breakfast only	22	12	-10	Frequency less than budgeted
Local guide - Dedi Kusuma (June)	170	186	+16	GBP to IDR exchange rate fluctuations
Local guide - Dedi Kusuma (July)	170	93	-77	Frequency less than budgeted
Posters	98		-98	Not printed & distributed due to COVID-19 pandemic; will use other funding
Guide Certificate - Ivory cream A3 card + cover, print colour A3 & cover		3	+3	Was not budgeted
TOTAL	3827	3858	+31	Exchange rate: 1 GBP = 16,125.40 IDR

9. Looking ahead, what do you feel are the important next steps?

Once it is safe to perform fieldwork post-pandemic and further funds are secured, we hope to perform the following:

1. Reattempt sea turtle population estimation followed by their relocation to the sea. This stage will employ a more appropriate method or instrument (more robust drone, or alternatives such as Baited Remote Underwater Videography). Relocation stage will require significant brainstorming to ensure the turtles' safety. To achieve a better outcome, we hope to partner with Dr Nicolas Pilcher (Save Our Seas Foundation), who provided us with initial drone footage methodology, and other sea turtle experts.
2. Augment native jellyfish population by creating protective net enclosure inside the lake. A number of the surviving *Mastigias* and *Cassiopea* medusae will be introduced into the structure and allowed to grow into sexual maturity, thus producing viable polyps which will then produce more medusae. Its design will be consulted with collaborating marine lake and jellyfish experts (Palau's Coral Reef Research Foundation, Prof. Mike Dawson, Wyatt Patry from Monterey Bay Aquarium), accounting their ideal husbandry. This step is intended to help jumpstart recovery before the sea turtles' relocation is fully completed.
3. Begin a monitoring programme in collaboration with local universities, a local NGO branch (The Nature Conservancy) in Berau, and local volunteers in

Maratua. Their involvement will be critical as most of our team members do not reside in Berau. This programme could be recommended as part of the local university's research or academic activities, while simultaneously allowing the measurement of recovery or changes in the lake ecosystem.

4. Proposing management plans and actions to local policy makers. This is intended to avoid harmful proposals such as mass tourism, mineral extraction or deforestation for residential development. It is critical for the government to recognise the uniqueness and vulnerability of the site. As with the Kakaban Lake, Haji Buang lake can be safely managed as an ecotourism site, thereby allowing the use of their biodiversity without any extraction or excessive disturbances. Any recommendation documents will be supplied to the relevant government offices. Key stakeholders to be involved include local departments of DKP (Marine Affairs and Fisheries Office), local government (Maratua Subdistrict and Villages), NGO branches (The Nature Conservancy) and holiday resorts.

10. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did the Foundation receive any publicity during the course of your work?

Yes, we are using the logo for educational posters (Fig. 5) and training certificates (Fig. 6) we have designed. Our future publications will refer to the Foundation as one of the funders of our project.



Figure 6. Sample certificate for trainee local guides.

11. Please provide a full list of all the members of your team and briefly what was their role in the project.

Anargha Setiadi (University of Indonesia) – principal investigator, benthic invertebrate specialist, data analyst

Akbar Reza (Gadjah Mada University) – videographer, photographer, data analyst, sponge specialist. A member of Tambora Muda Indonesia (tamboramuda.org).

Asri Pratitis (Ministry of Fisheries and Maritime Affairs) – water quality and community outreach specialist

Jane Sarah Giat (Blue Marlin Dive) – field safety officer, data collection assistant

Gerda Ucharm (Coral Reef Research Foundation, Palau) – marine lake specialist, lake research methodology consultant

Ahmad Sahlan – field safety officer (active after Jane had to leave earlier)

Dedy Kusuma – local guide, logistics and transportation provider, associated with Maratua Guesthouse

Suhadi – local guide, logistics and transportation provider, associated with Maratua Guesthouse

12. Any other comments?

The lake is located on Maratua Island, which is under the regulation of National Strategic Area Plans (2018 – 2037). The Spatial Planning Policy aims to create environmentally responsible areas via supporting sustainable fisheries and tourism industries. General management plan for the lake has been mentioned on the regulation but a more specific management needs to be developed. Our work provides baseline data on the current state of the lake, which will be indispensable for future management. Regulation documents can be accessed here:

<http://www.fao.org/faolex/results/details/en/c/LEX-FAOC175931/>

We are grateful to the Rufford Foundation for their funding, which has been requisite for the completion of our work.