



Tara Bandu in Timor-Leste

Elodie Sandford Explorer Award 2019
Scientific Exploration Society
Final Report
Catherine Kim

Cover photo: Be'hau, Timor-Leste.
All photos taken by Catherine Kim
unless otherwise stated.

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Summary *Rezumu*

Outreach

Talks were given to the Ministry of Agriculture and Fisheries, the second cohort of marine science students at Universidade Nacional Timor-Leste (the national university), the UmaAmerika English Center for students, and SCUBA dive operators and local non-governmental organizations. At these events, 360-degree viewers were also provided to share immersive underwater imagery and video captured in Timor-Leste.



Estensaun Públiku

Iha apresentasaun ne'ebé hato'o ba Ministériu Agrikultura no Peskas, koorte daruak hosi estudante siénsia tasi nian iha Universidade Nasionál Timor-Leste, Uma América Sentru Inglés ba estudante sira, no operadór luku-tasi SCUBA sira no organizaun naun-governmental lokal sira. Iha eventu hirak-ne'e, vizualizadór 360-grau sira mós fornese atu fahe imajen no video tasi-okos imersivu ne'ebé kaptura tiha iha Timor-Leste.

Exploring Tara Bandu

Four villages were visited on the island of Ataúro to explore Tara Bandu: Adara, Beloi, Biqueli, and Villa. I was shocked to see some of the Tara Bandu marine protected areas were very barren with little coral. The intertidal reef flats were also generally stripped down as gleaning, or collecting of organisms, is an important means of subsistence. These village stays also afforded a glimpse into life in the village. Some communities all fish together in the morning. Beloi is the biggest village on the island with the most 'diversified' economy including a network of homestays of eight households providing accommodation for guests.

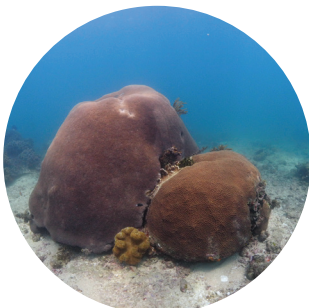


Buka-hatene kona-ba Tara Bandu

Halo vizita ba suku haat iha Rai-Kotun Ataúro atu buka-hatene tan kona-ba Tara Bandu: Adara, Beloi, Biqueli, no Villa. Ha'u laran xoke bainhira haree área tasi protejidu Tara Bandu kiuk liu ho ahu-ruin uitoan de'it moris hela. Área meti-aut entre tasi jeralmente hamolik tanba populasau loron-loron hili xipu, budu-tasi no organizmu sira-seluk nu'udar rekursu importante ba sira-nia hahán subsisténsia. Vizita atu hela iha suku hirak-ne'e mós fó biban atu observa moris iha suku no aldeia sira-nia laran. Comunidade balu peska hamutuk loron-loron. Beloi nu'udar suku boot liu nian iha rai-kotun Ataúro ho ekonomia 'diversifikadu' liu inklui rede umakain hanesan hela-fatin ba bainaka turista sira.

Reef Research

Four sites, Dili Rock, Cristorei, Beloi, and Be'hau, were re-surveyed, that had also been surveyed in 2015 and 2017. Since 2017, the development of a coastal road has been in process in addition to dredging for a new port just west of Dili. Beloi has been the best site consistently with the highest coral cover that has been comparable these last three surveys. Unfortunately, the remaining sites seem to have decreased in the amount of live coral cover from a variety of impacts.



Investigasaun ba Ekosistema Ahu-Ruin Meti-Aut

Iha investigasaun tasi-laran ne'ebé repete iha fatin haat, Dili Rock, Cristo Rei, Beloi, no Be'hau, ne'ebé uluk estuda iha tinan 2015 no 2017. Hori tinan 2017, dezvoltamentu estrada tuir tasi-sorin la'o hela hamutuk ho servisu ke'e tasi-kidun ba portu foun iha Tibar. Beloi nu'udar fatin konsistentemente di'ak liu ho kobertura ahu-ruin komparavelmente barak liu durante investigasaun tolu foin kotuk bá nia laran. Infelizmente, fatin sira-seluk hatudu redusaun ba kuantidade kobertura hosi ahu-ruin moris tanba impaktu oioin ne'ebé halo mate tiha.

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Boys in Adara enjoying a breakfast fish after the morning fishing.

Acknowledgements



Many thanks to the friends and family of Elodie Sandford for supporting this work in Timor-Leste. To the old and new friends this trip, I could not have done it without you! Support provided by Conservation International, Worldfish, Roman Luan, Compass Diving, and Tony Crean. Research permit provided by the Ministry of Agriculture and Fisheries. Translation by Hector Hill.

Personal

Pioneer with a Purpose

It seems too easy to forget how challenging field work can be. There were definitely ups and downs during this trip. The low points included losing my phone bouncing down an unpaved road in a tuktuk in Ataúro Island, contracting a bad case of diarrhea, and spraining my foot stepping off the curb. The foot sprain was the most stressful because I had just spent two weeks getting permission from the Ministry of Agriculture and Fisheries to re-survey four coral reefs I had surveyed in 2015 and 2017. I was concerned I would not be able to finish the 24 required SCUBA dives with a hurt foot. After staying off of it as much as possible for a good week, I was able to dive again and finish all the dive surveys.

The difficulties, however, were outweighed by the positives. I gave talks to the Ministry of Agriculture and Fisheries, the second cohort of marine science students at the national university, UmaAmerika English Center, and SCUBA divers and non-governmental organizations (NGOs). It was reassuring to see my work was well-received and inspiring to students and other stakeholders.

I also met and engaged with young Timorese working at NGOs and government who had completed their bachelors education abroad in the U.S., New Zealand etc. Timor-Leste as a country faces many challenges from improving basic sanitary conditions to natural resource management. I was inspired to see the young Timorese involved in tackling these issues.

It was also special to be able to stay in some of these communities and experience a small part of village life. Understanding the day-to-day life of the communities is an important aspect of how people interact with their natural resources which I never had the opportunity to explore previously.

Fall of 2019 also was the 20th anniversary of the United Nations Referendum for independence. It was a special time to be in the country.

I hope to continue to work in Timor-Leste in the future. Although I initially and still mostly care about the coral reefs, it is a social-ecological system where people and the coral reefs are interacting on a daily basis. Tara Bandu itself is a complex. Although many of the villages have implemented Tara Bandu marine protected areas, there is no clear system in place to pay the fee as a visitor or tourism operator. Sustainable tourism is an industry that a lot of effort and aid is going into to build-up and creating alternative livelihoods looks to be a key way to minimize impacts to reefs. This country will continue to be ripe with research opportunities and stories to tell.



Expedition Information


Timor-Leste is the newest country in Southeast Asia having recently become independent in 2002. It is also one of six member states of the Coral Triangle, the epicenter of global marine biodiversity. My PhD thesis was focused on the coral reef ecology of the north coast. I first came to Timor-Leste in 2014 as a part of the XL Catlin Seaview Survey expedition photographically surveying shallow coral reefs. I came back in 2015 and 2017 for my own field project surveying four reefs: Dili Rock, Beloi, Cristorei, and Manatuto.

It was on the 2017 field trip where I first learned of Tara Bandu. During the second survey of Beloi that year, I was informed that the reef was now a protected area and I would need to pay a \$2 USD fee to dive there. My focus at the time was solely the coral ecology, but I was inspired to learn more about Tara Bandu and its role in marine conservation in Timor-Leste.

Ataúro Island is the hub of this recent Tara Bandu activity. The first Tara Bandu marine protected area was created in the village of Adara on the west side of the island in 2015. The Beloi community protected their reef in 2017 and since then almost all the communities have implemented a similar system. To this end and for logistical reasons, the geographic focus of the expedition was Ataúro Island. The coral surveys were also redone as I realized there was still a need for this data upon arriving.



Map of the Dili area of Timor-Leste, the focus area of the trip. The area in the greater Indo-Pacific context can be seen on the next page.

A satellite map showing the region of Timor-Leste and surrounding areas. The map includes parts of Indonesia to the west and south, Australia to the south, and Papua New Guinea to the east. The Timor Sea is visible between Australia and Timor-Leste. A red square on the eastern coast of Timor-Leste marks the location of Beloi. Three white lines radiate from this red square, extending towards the bottom left of the frame.

Logistics in Timor-Leste is challenging and expensive which is largely the reason for focusing on a small geographic area. There is a water taxi available from Dili to Beloi on Ataúro Island for \$45 USD one-way and a local ferry that runs Thursdays and Saturdays for \$4-5 USD which enables easy access to the island from Dili.

Beloi is the biggest village and, although the island is relatively small, transportation around the island can be difficult. There are few cars on the island and roads connect Vila through Biqueli on the east coast with a variety of “public transport” options for a few dollars. There is a hike over the mountain connecting the east and west coasts which locals on the west side travel regularly to access Beloi where the high school and large weekend market takes place. There is also private water taxi to Adara depending on the boating schedule.

SCUBA diving and a dive buddy for the surveys was provided through Compass Boating and Diving, also the operator of the private water taxi. The 24 survey dives were accomplished through both shore and boat-based diving. Boat-support is required for Beloi as it is a barrier reef and the three remaining sites are shore accessible with a fair amount of swimming.

Itinerary

Arrival in Timor-Leste: July 19, 2019

July 26th - Transport to Adara

July 29th - Transport to Dili

Aug 5 - 7th - Beloi

Aug 8th - 2nd Timor-Leste National Aquaculture Forum

Aug 9th - Marine Tourism Association Launch sponsored by
the United States Administration for
International Development

Aug 15th - Transport to Vila

Aug 17th - Transport to Dili

Aug 19th - Transport to Beloi

Aug 23th - Wedding in Biqueli

Aug 26th - Transport back to Dili

Aug 30th - Referendum 20 Year Anniversary

Sept 11th - Seminar at Ministry of Agriculture and Fisheries

Sept 18th - Dili Rock Surveys

Sept 19th - Lecture at for marine science students at
Universidade Nacional Timór Lorosa'e

Sept 20th - 20th Anniversary of International Force East Timor
(arrival of United Nations forces)

Sept 21st - Transport to Villa

Sept 23rd - to Beloi

Sept 27th - Transport to Dili

Oct 3rd - Dili Rock surveys

Oct 5 - 6th - Day trip to Be'hau for surveys

Oct 7th - Finish Dili Rock surveys

Oct 10th - Talk at Uma Amerika

Oct 8th - Finish Be'hau surveys

Arrival back to Brisbane, Australia: October 14th, 2019

Return to the United States: November 29th, 2019

Team



Although this was a solo expedition there were many people who contributed to the success of the field trip.

Trudiann Dale and Anselmo Amaral at Conservation International were helpful in navigating the Ministry of Agriculture and Fisheries and lent me essential field gear. Dr. David Mills, Mario Pereira, and Inácia Teme at WorldFish provided office support and assistance with obtaining the research permit. José Silva and Zeck for assistance organizing lectures.

Conversations with the National Director of Tourism José Quintas, Avelino Fernandes at Roman Luan, Peter Semone of USAID Tourism for All, the Blue Ventures team, Kim Hunnam, Hector Hill, and the Timor-Leste research community.

Survey divers Syakib Haron and Ben McCarthy provided by Compass Diving. Housing in Dili was generously provided by Tony Creaan.



Top: Presentation at Uma Amerika English Center.

Bottom: "Super" Mario and his son "super" Enrique at their home in Adara.

Research

Aims, Objectives, & Methods

1

Share stories about the role of Tara Bandu as a mechanism for marine conservation.

The objective was to visit communities on Ataúro Island and understand Tara Bandu and life in the communities. Four communities on Ataúro Island were visited: Adara, Beloi, Biqueli, and Vila.

2

Outreach to communities and students with 360 degree virtual experiences of marine ecosystems.

The objective was to present my marine science research and work on Tara Bandu to relevant parties in Timor-Leste including the Ministry of Agriculture and Fisheries, students, SCUBA dive operators, and local organizations.



Beloi barrier reef.

3

Continuation of surveys at four coral reef sites established during my PhD research.

The objective was to quantify any changes in coral reef composition (i.e., changes in percent live hard coral) and assess coral health as development in the country continues. Since 2017 coastal road works have continued and dredging for a new port west of Dili has commenced.



C.Kim performing a coral survey.
Photo by: Syakib Haron.

Reef Survey Methods

Each site was surveyed at two depths: 5 and 10 m. Three 15 m transects were conducted at each depth per site for a total of 24 transects across each site.

A 15 by 2 m area was surveyed for coral health and the composition of the benthos was quantified down the 15 m transect in 5 cm increments.

The GPS coordinates of each transect were resurveyed to the greatest accuracy possible.



Results

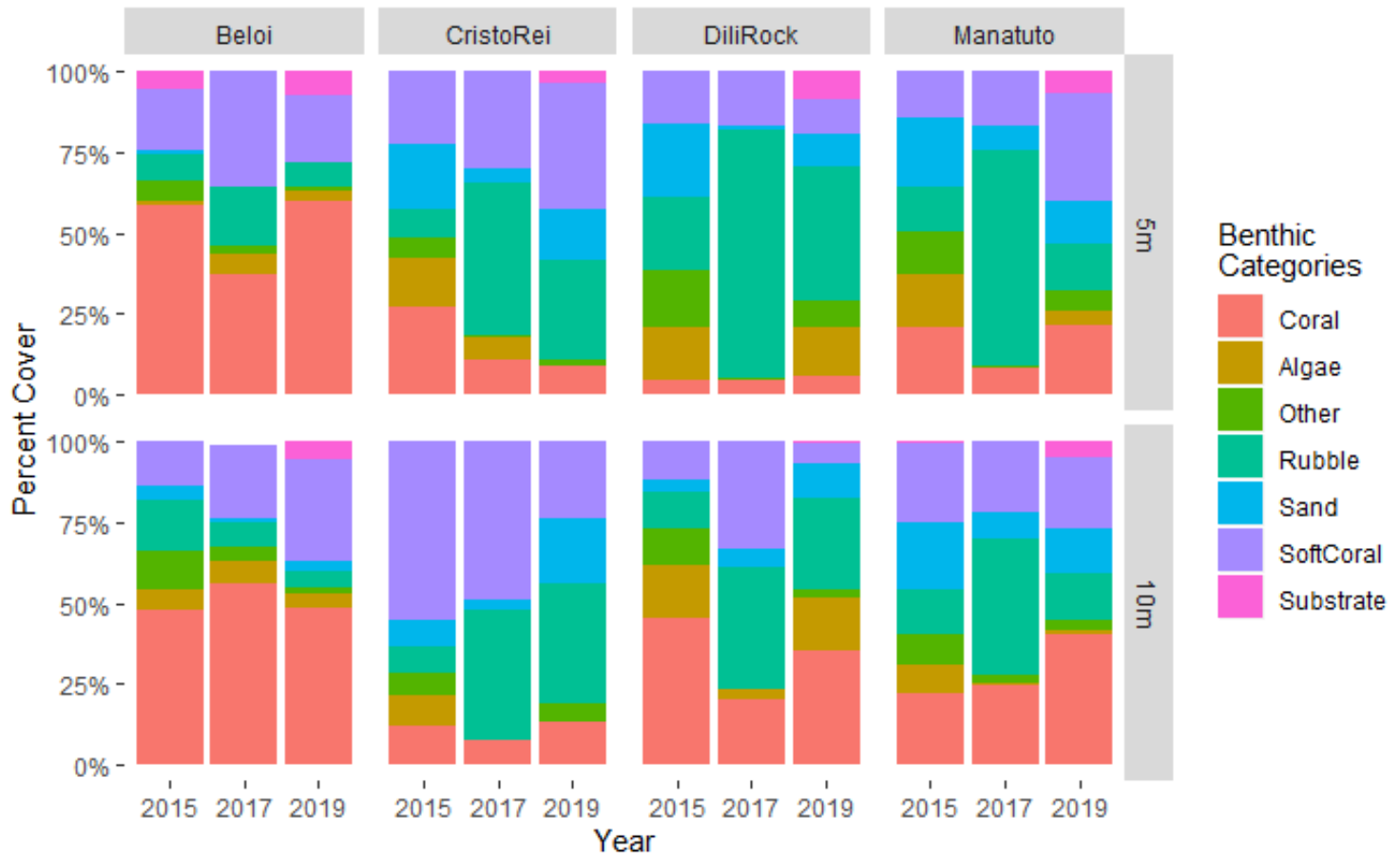
Tara Bandu is a complex socio-ecological topic. The country is emphasizing tourism as a means of diversifying its economy. The effort is supported by foreign aid such as the Marine Tourism Association Launch and Tourism for All project administered by the USAID.

Tara Bandu is an important part of tourism as the marine protected areas (MPA) are also zones where visitors pay a small fee for recreational use for visitors and businesses. Almost all of the 13 communities on Ataúro Island have established a Tara Bandu MPA with the intention of increasing coral reef fish stocks and as a means of income through the fee system. However, the ease of access to most of the communities on the island is difficult which currently is a barrier to travelers. Additionally, the Tara Bandu fee systems are not well established which is a problem for tourists and tourism operators alike.

Upon visiting some of the Tara Bandu sites, it was surprising to see how little live coral some of them contained. Adara, on the west side of the island, had very little coral in the Tara Bandu MPA right in front of the village which is likely due to nearest access for fishing and gleaning and boating activity.



Morning fishers in Dili harbor.

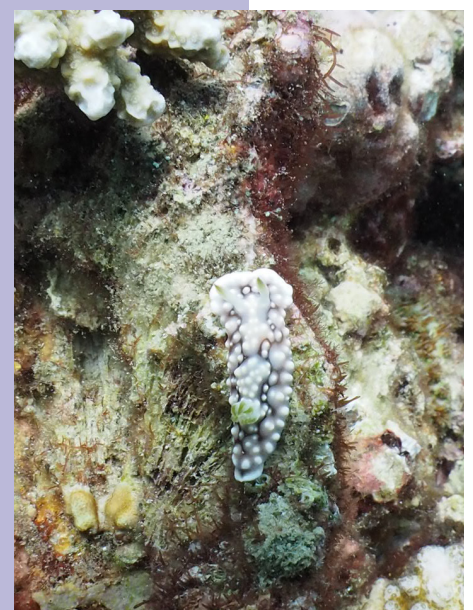


Benthic composition of coral reefs at four sites in Timor-Leste across three years: 2015, 2017, and 2019.

Although great efforts were made to survey the same reef areas, the patchiness of reefs can mean that being a few meters off from previous surveys can have a significant effect on the benthic composition recorded. As such, some of the variation across years is due to the lack of true permanent transects, but now with several years of data some trends can be established.

The coral surveys indicate that the coral reef composition has remained consistent through the three survey years at some sites, namely Beloi. Beloi remains the site with the highest coral cover and diversity.

The remaining sites have either shown signs of decreasing live coral cover (i.e. Christorei at 5 m depth, above graph) or remained consistently low (i.e. Dili Rock at 5 m).



Nudibranch in CristoRei.

Discussion

Tara Bandu & Tourism

The development of tourism promoting the marine biodiversity of Timorese coral reefs is an opportunity for sustainable development and increased economic activity for the country with a focus on Ataúro Island. These goals are also affected by the larger barriers to tourism development, such as the limited number of flights into the country. The elimination of one of the three international flights in 2019 saw an increase in flight prices overall which was a deterrent to potential tourists especially with nearby Bali as a popular and inexpensive tourism destination. The overall tourism economy suffered as a result with most businesses from SCUBA dive operators to homestays reporting decreased activity. The overall economic development of the country, such as airport infrastructure and utilities, have downstream effects on community-level tourism.

Although many Tara Bandu MPAs have been established, the financial benefit to communities via visitor fees have been limited to the original MPA zones in Adara and Beloi. Ataúro Island is small, however, it is a crowded space with several NGOs working in marine conservation. This has led the Tara Bandu MPAs to increase from two in 2017 to twelve in 2019. The surge is likely due to the success of the first two; however, the factors that contributed to those successes are not easily replicated in all communities.

The factors that appear to contribute to success are ease of access, reliable communications, and environmental setting. It is very difficult for travellers to access the remote villages on the island with no road access. Additionally, the remoteness makes it very difficult to plan accommodation etc. in advance as there is very little information online about these communities. Adventurous travelers on the island must arrange a local boat and use the island network to arrange accommodation. Save for one hotel, the amenities are very basic, no running water and shared bathrooms, which does not cater toward a large sector of tourists. Additionally, there is no clear system for which tourists and tourism operators can easily pay the Tara Bandu fees currently.

The remote communities are toward the northern and southern ends of the island which are also subjected to dangerous marine conditions (i.e. strong currents) seasonally which makes it difficult for dive operators to frequent those sites and thus contribute to the community through Tara Bandu fees. Similar to the country as a whole, the existing logistical conditions of the island provides challenges to the development of tourism and income generation through the Tara Bandu MPAs for many communities.

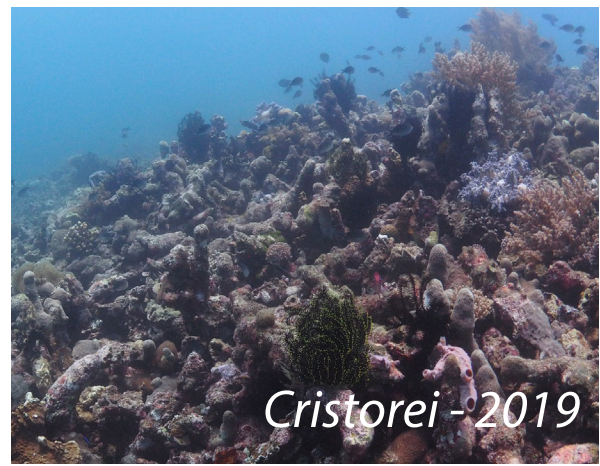
Most communities are in the early stages of Tara Bandu and, although the process in every community is different, Tara Bandu generally includes a process of evaluating whether or not to continue with the Tara Bandu as stipulated. Another aspect of the Tara Bandu MPAs is no fishing within the zone to allow for recovery of fish stocks. These zone are generally right in front of the communities where the reef was easiest to access. The decreased ability to fish combined with the lack of regular income from the MPAs has put additional pressures on remote communities.

Unfortunately, the benefits and efficacy of Tara Bandu for tourism is not equal across communities on Ataúro Island. Establishment of a Tara Bandu MPA does not automatically equal income generation for any given community. Ecologically, it is difficult to say whether the MPAs and restrictions on fishing are producing results as in increased fish biomass at this early stage. Many of the Tara Bandu MPAs have been impacted through subsistence level fishing and gleaning. Quantifying ecological metrics such as coral cover and fish biomass in these Tara Bandu MPAs are the next logical steps in determining any ecological impacts.

Coral Reef Health

The health of Timorese reefs are very context dependent. Timor-Leste is a developing country and there were many changes since the last survey of Dili Rock, Cristorei, Be'hau, and Beloi. Most notably, the road works on the coastal road from Dili out east toward Be'hau which was underway in 2017 was completed. The bay near Be'hau where the surveys were done had undergone a massive change. The road had been elevated 2-3 meters to allow for several large culverts and other pipes to be added under the road to allow for drainage. The area of reef closest to shore was almost entirely rubble, which could be attributed to the increase in water drainage to the bay with the addition of the culverts and decreased watershed health from decades of logging. However, moving further off-shore the condition was much like previous surveys. The reefs in Timor-Leste are very steep and subject to constant water movement. These factors are likely minimize the impact of terrestrial run-off further offshore; but, these initial impacts could worsen as the road has only been recently completed.

Dili Rock remains the most impacted site with consistent, low coral cover at 5 m across the three survey years. Although the surveys at 10 m have had consistently 30-40% coral over the last five years the diversity of corals present is much less than the other three sites. There were also a significant increase in abundance of small brown flat worms in certain areas of the reef. It is not clear whether these worms are harmful to corals directly. Dredging has commenced just west of Dili Rock for a new port, which could be influencing conditions at Dili Rock and the increase of flat worms.



Cristorei is on the east edge of Dili, popular recreational area, and part of a little known terrestrial and marine protected area. Coral cover has decreased at 5 m and remained stable at low levels at 10 m. There were large fishing traps present this year and in previous trips which may be a cause of reef damage. These bobur traps are hand made by communities on Ataúro Island. The fishermen come to Dili to fish because of the Tara Bandu no fishing restrictions and they can easily sell the fish caught here at the markets in Dili. The traps are tethered to a rock in the shallows and then tossed overboard on the reef. Potential damage from fishing traps can be seen above.

Beloi has remained the site with highest coral cover and diversity. White Syndrome, a coral disease, is also present and is at consistently low levels with about 1% prevalence on par with previous survey years.

Tara Bandu MPAs have the potential to decrease fishing impacts on coral reefs. However, if fishing restrictions are not enforced and factors such as poor watershed health are not addressed reef conditions could decline despite protection status.

Outreach



360-degree virtual diving.

Formal seminars were given at the Ministry of Agriculture and Fisheries, the Universidade Nacional Timor-Leste (UNTL), UmaAmerika English Center at UNTL, and a meeting with local organizations including environmental NGOs, the USAID Tourism for All office, and SCUBA dive operators.

All of these events included 360-degree “virtual diving” experiences showcasing Timorese reef environments. Underwater 360 imagery was also informally shared with homestay family, other guests etc.

Communication



Marine science students at UNTL.

Social media was an important method of sharing images and insights in to field work in Timor-lesste. A total of 41 Instagram posts, 4 Facebook posts, and 48 Tweets of Timor-Leste content during the field expedition.

A few blog posts on my personal website were posted and more are planned including more indepth discussion of the four survey sites and how they have changed.

A story centering on Tara Bandu and marine conservation in Timor-Leste will also be pitched to conservation minded magazines such as Seven Seas or Hakai magazine.

The coral survey data will also be incorporated into a peer-reviewed scientific papers.

Adversities & Challenges

Timor-Leste is a challenging place to work. Navigating government bureaucracy, whether it is extending your visa or obtaining a permit, is particularly difficult as procedures are not readily transparent and can change.

Language is another challenge as many locals, such as the marine science students at UNTL, do not speak English. Portuguese is an official language in addition to Tetun, the local language. Most Timorese also speak Bahasa Indonesia due to its recent history. Although, I did put time and effort into learning Tetun, certain idiosyncrasies such as continuing the use of Bahasa numbers for money were surprising.



A woman in Vila weaving.

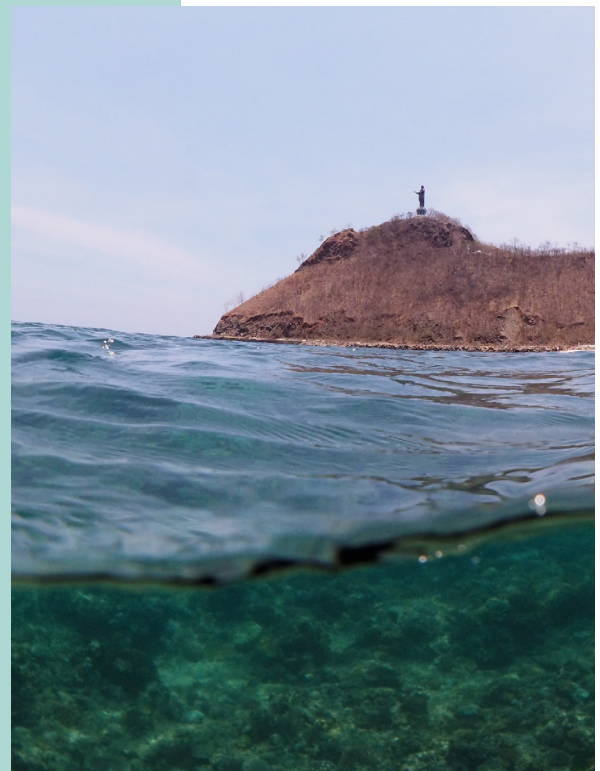
Risk Management

Both travel insurance and SCUBA diving insurance was purchased before the trip. To minimize safety concerns when in-country

Personal safety and theft is still a concern in-country. Therefore, efforts were focused on Ataúro Island where I was comfortable traveling back and forth alone with camera gear. After dark in Dili, transport was limited to cabs or rides from trusted individuals.

Two incidents occurred. In mid-September, my midfoot was sprained stepping off the curb which resulted in bruising and swelling. The injury was assessed by a doctor to confirm the foot was not broken. The injury was immobilized as much as possible for a week for recovery.

A gastrointestinal bug was also contracted in the last month. Normal activities were resumed after a few days of rest and a modified diet.



The Cristorei statue.

Budget & Final Report

Summary of expenses is presented below. Currency in Timor-Leste is USD. Please see the full financial report for further details.

	Amount USD	Item
Travel	\$ 665.50	Munich - Brisbane one-way flight
	\$ 749.57	Brisbane - Dili roundtrip flight
	\$ 84.18	Qantas flight change fee
	\$ 961.65	Brisbane - Washington DC one-way flight
	\$ 170.00	excess baggage fee
	\$ 84.35	local travel - microlets, taxis etc.
Diving	\$ 2,558.95	Compassing Diving
Insurance	\$ 225.00	DAN diving insurance
	\$ 160.00	Dan travel insurance
Accommodation	\$ 120.00	Adara
	\$ 80.00	Vila
	\$ 220.00	Beloi
Food	\$ 751.04	
Telecommunications	\$ 103.50	Three months of cellphone service and data
Camera	\$ 353.60	Lensrental
	\$ 416.03	Cameracorp
Miscellaneous	\$ 100.00	Visa and visa extension fee
	\$ 46.10	ATM fees
	\$ 179.97	Adobe Suite
	\$ 25.00	Tara Bandu fees
	\$ 225.00	Tetun lessons
	\$ 52.00	medical
	\$ 157.60	miscellaneous
Total	\$ 8,489.04	

The final report will be shared with SES, family and friends of Elodie Sandford, the Ministry of Agriculture and Fisheries in Timor-Leste, and in-country supporters such as Conservation International, WorldFish, and Roman Luan. It will also be publicized through social media and my personal website.



A seastar and algae farming in a seagrass bed off of Beloi.



The ferry coming into Beloi on Ataúro Island.