



Xiaoliuqiu, Sea Turtles, and Us

A high schooler exploring Taiwan's most precious species

Aiden Lo - Taipei Fuhsing Private School
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Brimming with excitement, I wildly signaled my sister towards the creature below us. Beyond my scuba mask, a Jurassic marine reptile glided in the distance like a bird in the sky – a green sea turtle. As I moved closer, I saw that its right flipper was tightly entangled by a fishing line, cutting deep into its flesh. My heart sunk with sadness and confusion: sadness from witnessing an innocent creature in pain; and confusion from the realization that we humans were the culprits. Despite knowing little about marine biology or environmental science, I spent the rest of my vacation on Xiaoliuqiu island conferring with scuba coaches and seeking hints of conservation... that's when my journey started!

From January 2021 onward, I began immersing myself in sea turtle conservation, beginning with my biology podcast, and

slowly connecting with experts on the field. This Story Map is the cumulation of my experiences and observations spiced with knowledge from experts I met along the way. I hope you enjoy!

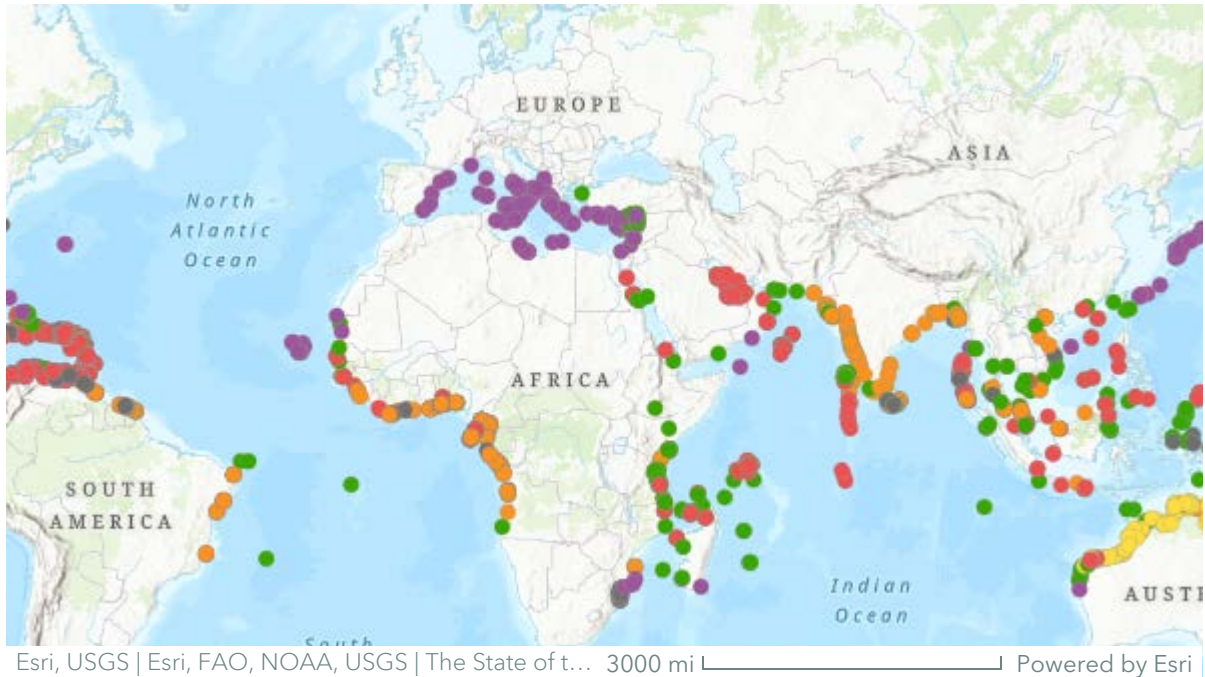
What are sea turtles? ... A talk with Mr. Sea

Seven different species of sea turtles grace our ocean waters. From the shallow seagrass beds of the Indian Ocean to the colorful reefs of the Coral Triangle and the sandy beaches of the Eastern Pacific, sea turtles can be found in all oceans except the polar regions. In fact, these huge marine reptiles undertake multiyear, epic migrations at sea. Every few years, they return to the exact spot where they were born to mate and lay their own eggs.



Scuba diving with family (Jan 3, 2021)

For more than 100 million years, sea turtles are vital in maintaining the health of the world's oceans. As “keystone species”, sea turtles prevent jellyfish, seagrass, and sponges from overpopulating the ocean and challenging the health of the coral. On the not-so-pleasant end, sea turtle eggs and hatchlings on the beaches provide valuable nutrients to coastal vegetation, as well as birds, raccoons, and fish.



Worldwide sea turtle distributions by species via SWOT database

Long Path Home

My first mentor in my journey to learn more about these creatures was Mr. Sea, our tour guide and the leading conservationist in Xiaoliuqiu. He began by explaining to me the behavior of sea turtles.



"Sea turtles will migrate away from their birthplaces to a new habitat, like Xiaoliuqiu, where they spend most of their life. Once they are ready to reproduce, however, they use the magnetic field to migrate back to the same beach they were hatched, just like salmon do. These yearly journeys back home, sometimes thousands of kilometers apart, are very dangerous for sea turtles and scientists still don't understand why they do it. Of course, the popular theory is that a sea turtle's birthplace is already a proven success for reproduction, so naturally, it's the safest bet to return."

Back at home, I browsed through the gallery of my GoPro, now filled with interview audio clips and NGO QR codes from the info center. I began deciphering my compiled clips, scouring online forms – searching for answers. What significance do the sea turtles bring other than tourism? How woeful should we be of marine degradation? How can we make sure humans and sea turtles coexist? The crystallization of my inquires became the first episodes of my podcast, which will appear later on.

In each of the following sections, I combined my Xiaoliuqiu experiences with my fellow sea turtle peers to paint a comprehensive picture of sea turtles in Xiaoliuqiu and Taiwan.

Sea turtles in Taiwan Culture

While sea turtles are imperative to biodiversity, I was staggered to discover their deep history in Taiwanese culture.

Listed below are a few notable examples of sea turtles' impact in local cultures.



1 Penghu



During the early days of agriculture and poverty, temples occasionally host new year events and create pastry from stored rice, embellished with turtle shell patterns. People on the island would return turtle pastry as gratitude for the gods. Over the years, the turtle patterns became a symbol of luck and prosperity. In the present day, “turtle begging” is still an annual tradition.

2

Kaoshiung



“Turtle begging” is also an annual tradition in mainland Kaohsiung. The ‘Guan Di’ temple is most famous for the 20-ton ‘King Turtle’ flower carts that go around the neighborhood to spread wealth and longevity.

3

Yilan



The grandest "turtle begging" event is hosted by the Sei Tian Temple. The tradition is to dye the turtle cakes red to symbolize prosperity. Yilan goes way beyond with the turtle model materials, which includes rice cakes and oranges.

4

Xiaoliuqiu



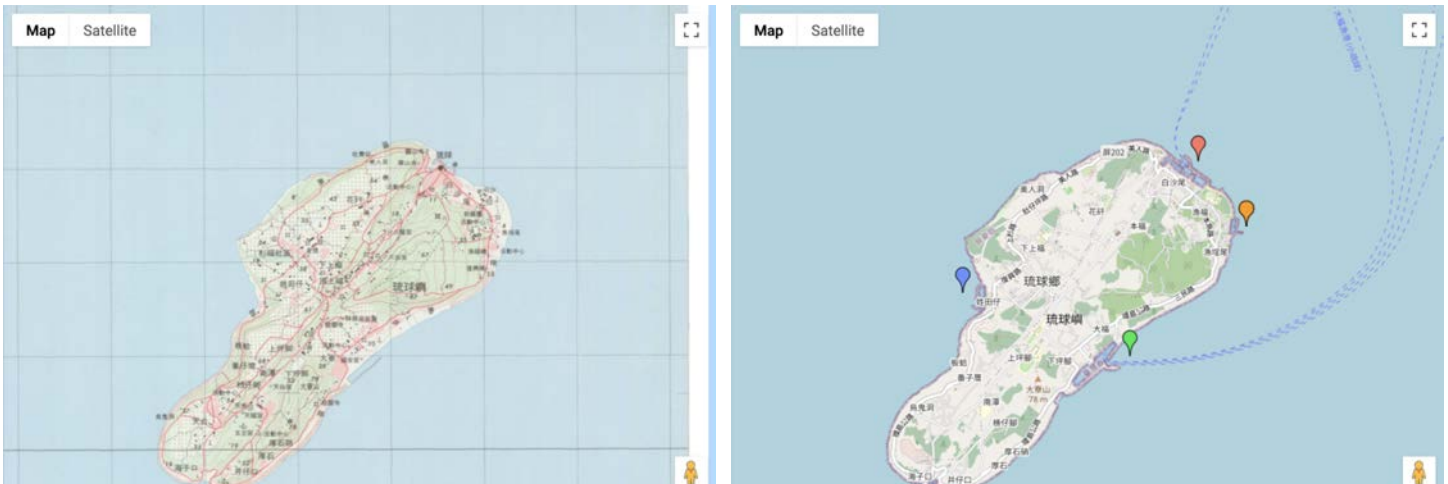
This island off the west of Pingtung is a bit different than the rest. Nicknamed 'Sea Turtle Paradise', thousands of actual sea turtles travel here annually to enjoy the plentiful moss and fair weather.

Xiaoliuqiu doesn't have a century-old turtle culture. Instead, its focus on tourism is immediately apparent with the prominence of sea turtle merchandise and branding – from turtle-shaped snakes to turtle plushies. But with commercialization comes an equal amount of conservation sentiment in the region. Murals and posters constantly remind people to stay at an optimal distance between sea turtles, while marine violations are heavily enforced.

'One Town One Harbor'

So how did Xiaoliuqiu become a 'Sea Turtle Paradise' tourist conglomerate?

In the 1980s, the Taiwanese government promoted the “One town one harbor” policy to stimulate the fishing industry, which turned out to be a complete failure. The plan proved to be too costly for cities to build and maintain, while the harbors themselves were mostly too shallow during the low tides for ships to dock. Islands such as Penghu and Xiaoliuqiu saw their sea turtle beaches destroyed for futile results. It is why Taiwan’s coasts still are littered with breakwaters and abandoned harbors.



Xiaoliuqiu topographic map from 1985 vs 2020 via *Center for GIS, Academia Sinica*

Due to this policy, in Xiaoliuqiu, both the Baishawei Harbor [red] and Yufu Harbor [orange] replaced a large area of the beautiful Zhonggao beach. (See if you can notice the shrinkage of the coast!)

Other ports built after 1985 include the Dafu Ferryboat Wharf [green] for shipment, and Shanfu Harbor [blue] for fishing.

These harbors are still in use, but have largely decreased in importance. For example, the Shanfu Harbor is now chiefly known as a scuba diving hotspot.



Baishawei Harbor (top left), Yufu Harbor (top right),
Dafu Wharf (bottom left), Shanfu Harbor (bottom right)
[credit: 熊本一家]

Fishing continued to dominate the island's economy up until a decade ago. It was only until recently that fishing restrictions and protected areas were established to protect marine creatures. Meanwhile, the island is slowly transitioning to

tourism after locals realized the diverse marine habitat residing in the ocean. With tourism comes hotels, people, and the rise of underwater activities, specifically snorkeling and scuba diving.

Environmental challenges

According to many coaches and inlanders I've interviewed, the scuba industry really gained steam in the past 4 to 5 years. As a result, tourist numbers continue rising. It hit its peak for both the summers of 2020 and 2021 as a result of “**revenge tourism**”. Revenge tourism is a phrase that originated in the 1980s when China saw an explosion in consumer spending after lifting travel restrictions for a long period of time. Now, it is used to describe the amplified domestic travels resulting from the Covid lockdown.

In Taiwan's instance, the restrictions on travel have prompted citizens to travel south and most notably, the outer islands like Xiaoliuqi. Just last summer, the total tourist population was roughly 57,000 people, which was five times the residential population in Xiaoliuqi.

The result of overpopulating the island is, of course, marine pollution. Traces of littering and pollution from hotels can be seen from the beaches, which could drive away turtles from living and hatching in Xiaoliuqi.

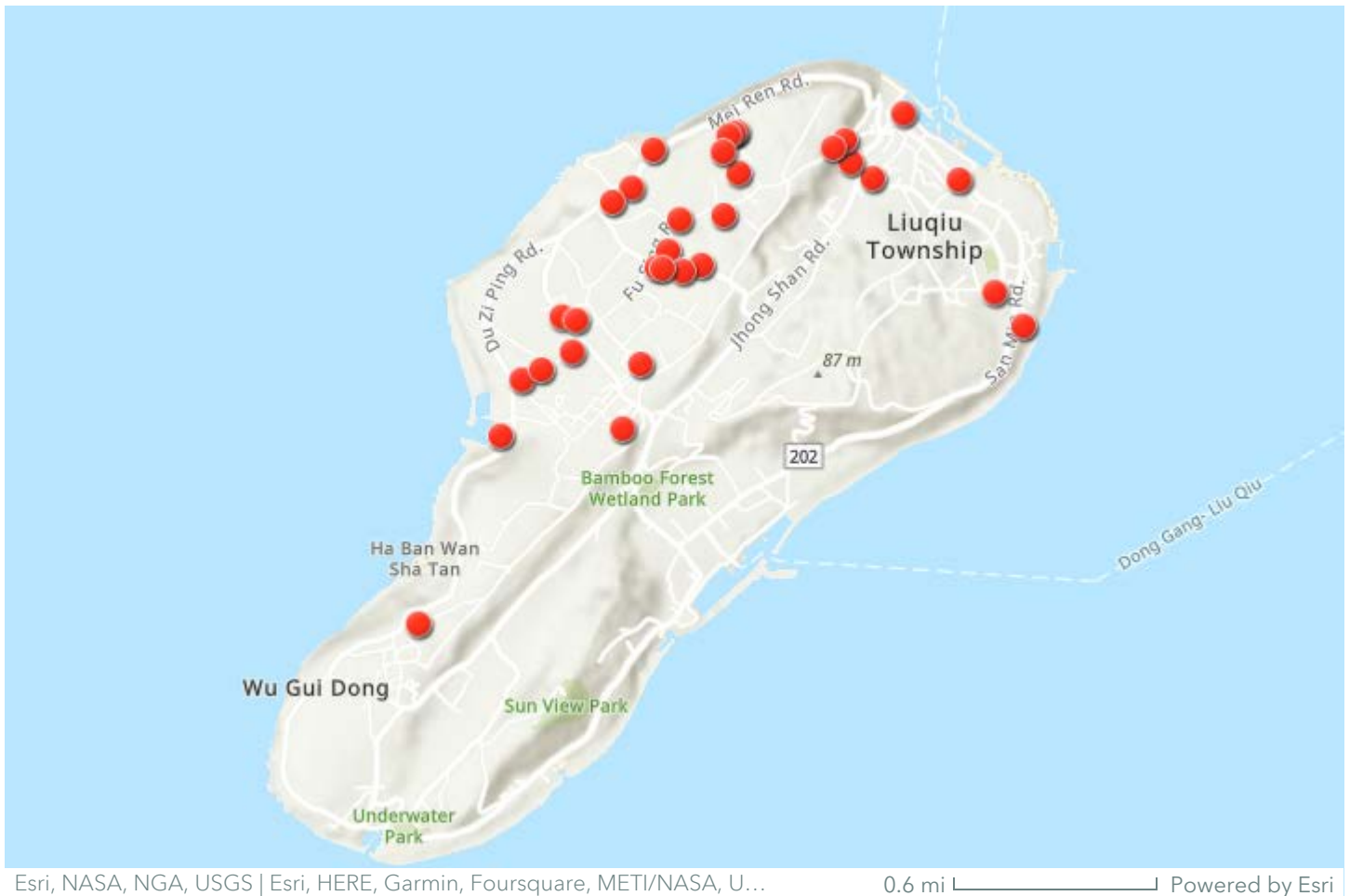


"When I first came to Xiaoliuqi [9 years ago], there are only 3 to 4 scuba stores. The last 2 years are when thousands of people from outside Xiaoliuqi came to open their own scuba stores, freelance, or establish their own personal workshops as I did." -

Coach 毛怪



Xiaoliuqi's trash production reaches an all-time high in 2019 [credit: Liuqi Township Office & 魏永源]

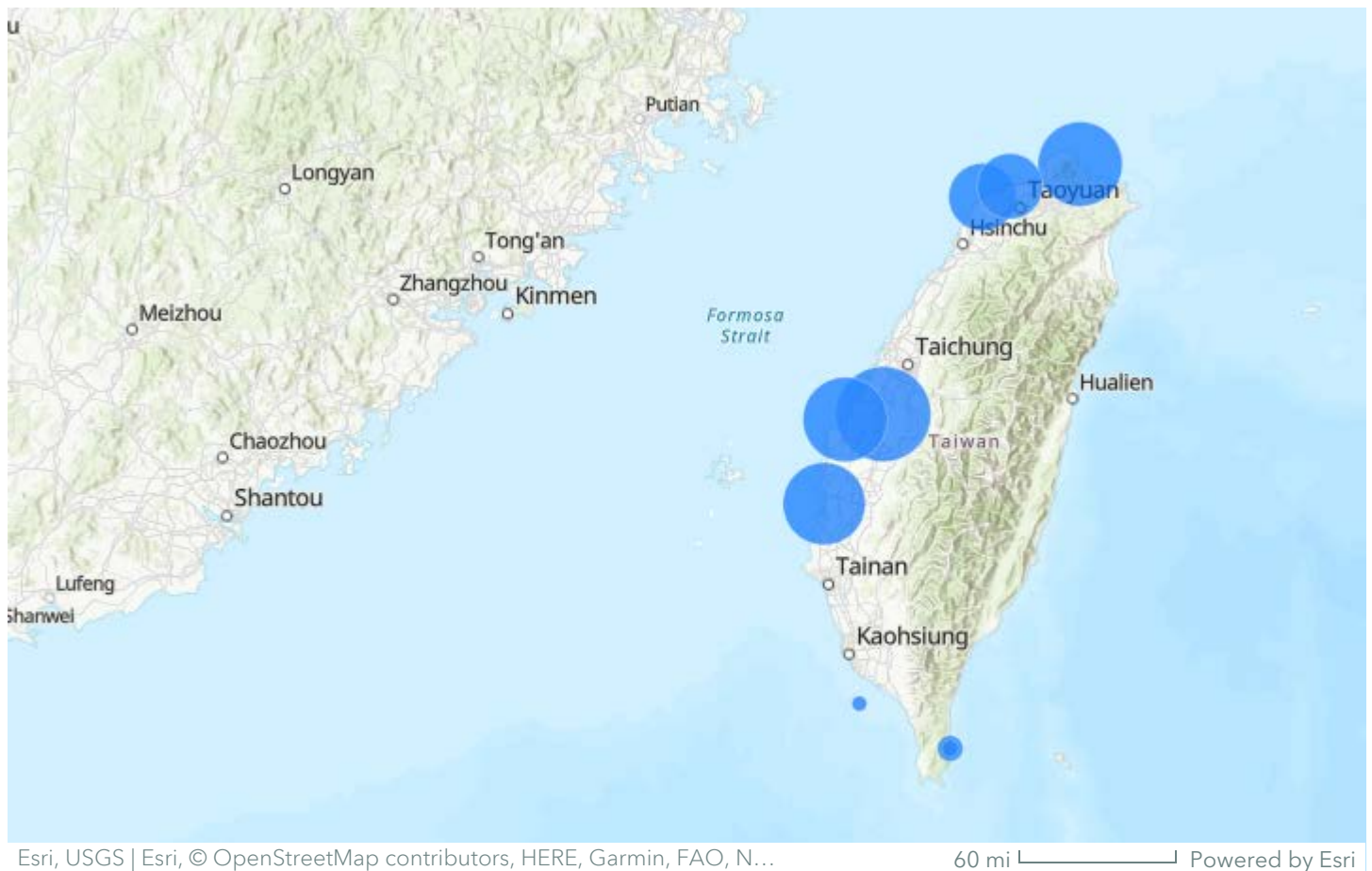


Illegal Hotels

Despite the value of sea turtles, people still continue to endanger them and the marine environment by illegally exploiting the island. **Amongst the 400+ hotels on the island, 70% of them are illegally built.** The sheer number of infrastructure also leads to water pollution in the oceans.

This map shows 32 illegal hotels listed by the Pingtung county government. Speculation suggests that these hotels are non-licensed because they don't want to be subject to environmental restrictions. Most of these hotels are either in close proximity to the main harbor to be built as fast as possible, or near the Shanfu Harbor (scuba diving spot) to attract divers.

(clicking on the dots shows their name and address)



Marine trash

According to multiple sea waste screenings from Green Peace and the Society of Wilderness, **Xiaoliuqiu island ranks top 13 of the most polluted coasts in Taiwan.** The most common trash types are plastic bottles (16%), fishing nets (20%), and styrofoam containers (48%). Sadly, these three types of wastes are particularly lethal for sea turtles. Plastic could be mistaken for jellyfish and, once ingested, may **rupture internal organs**. Fishing nets entangle turtle necks and limbs, causing **suffocation and disabled movement**. Lastly, styrofoam debris has been demonstrated to reduce fertility and **cause cancer** in invertebrates.



Marine activities

My first snorkel experience while in Xiaoliuqiu is still imprinted deep in my mind. The shore was crowded to the point where I occasionally bumped into the other tourist teams – everyone was trying to make room for themselves. Meanwhile, the sea turtles were right below us, seemingly used to the claustrophobia we've brought upon them.

As much as I'd like to think of scuba diving as an innocent spectating activity, it is most definitely not. Every time I dive, there's a possibility of my flipper shoes scraping the coral, my hands touching precious rock formations, or even – as much as I'd like to not think about it – my presence harassing the turtles. Now amplify the damage one person can cause to the 50,000 tourists Xiaoliuqiu receives every holiday, and you have a big problem. Even though I try to be ultra-

aware when diving, this is quintessential dilemma I've faced throughout this journey.



“All of these diving boots we wear will impair the growth of coral. Marine destruction is something to be aware about... but it’s not all bad either. Scuba diving brings people closer to sea turtles and spreads the environmentalist mindset around – people will understand that these creatures have to be protected.”



Oil Spills

Since the island is in close proximity to Kaohsiung Port, large oil tankers and cargo ships in Kaohsiung Port have docked intermittently – a looming environmental threat that materialized in June 2021. According to reports, an oil spill occurred off the Dalin refinery in Kaohsiung of PetroChina. Fuelled by wind and ocean currents, the oil spilled into the waters of Xiaoliuqiu, causing the coastline of Xiaoliuqiu to turn black. The map on the left shows the extent of the oil spill (315km).

Oil spills can affect the entire ecosystem in one turn. Because oil stains adhere to the surface, relatively small intertidal creatures, like crabs in caves, can die due to lack of air. Dolphins and whales may inhale oil and damage their lungs. In Xiaoliuqiu's case, not only did everything mentioned above happen, **because of the toxic water and polluted algae, sea turtles disappeared for two months.**

Despite the quick response from the government and NGOs to clean the oceans and beaches, there's no telling when similar events would happen again.



Local workers help soak up oil [credit: 陳宏發]



Dafu Wharf blackened by oil spill
[credit: Su Huai]

Although I now have a more in-depth understanding of the problem's surrounding Xiaoliuqiu, seeing the damage of tourism in particular has caused me to reflect on my status as a tourist. It's inevitable that I'll pollute the environment every time I travel to Xiaoliuqiu or scuba dive – the waste water of hotels, the trash I create, the disturbance of entering the marine habitat etc. – which raises the question: am I contributing to the problem despite my good intentions? Are there actually any solutions to these issues? Thankfully, the next step in my journey showed me a direction I can take: conservation.



Uncovering Xiaoliuqiu: Sea T...

Mar 2021 · 20-Minute Bio with Aiden Lo

PREVIEW

Deeper dive on scuba ethics, tourist anthropomorphism, and my own resolution available in my podcast!

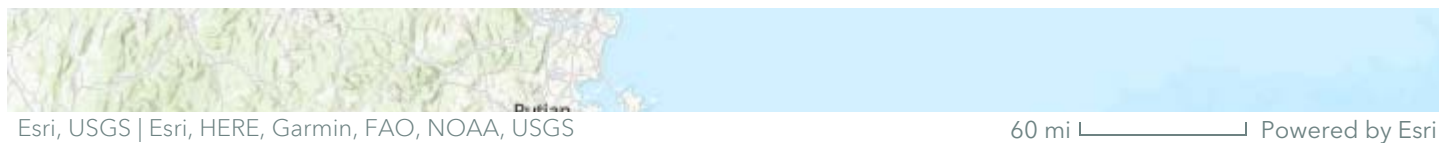
Conservation Efforts

Fresh off my scuba trip and research, I attended a lecture by the 'TurtleSpot club' I saw on social media. Thinking it was merely a workshop on sea turtle education, I was shocked to discover that the lecture gave me so much more...

TurtleSpot

The TurtleSpot club was initiated in June 2017 by researchers and enthusiasts who love sea turtles. It calls on divers to report back images of sea turtles to identify different individuals of sea turtles and establish a ID for each, in hopes of **establishing Taiwan's first "Sea Turtle Household Register"**. Since every sea turtle has a different face scale pattern, they can be differentiated by A.I. facial recognition software.

Thanks to the efforts of the scuba community, 380 Xiaoliuqiu turtles (and 442 in Taiwan) have been identified and named. **TurtleSpot completely flipped around my idea that scuba diving was a self-indulgent activity. In fact, it can have a real impact for the marine environment.**



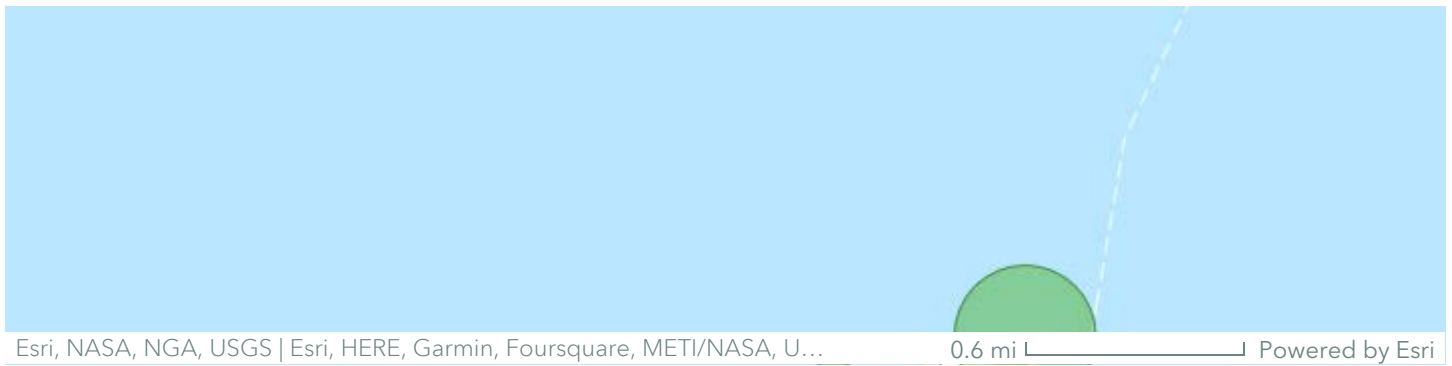
Taiwan's Sea Turtle Distribution

TurtleSpot's 2000+ sightings since June 2017 are compiled on this map on the left. Since Taiwan is surrounded by the Pacific Ocean, sea turtles can be found near any coast. Some of the sea turtle hotspots are located in Yilan, Penghu, and Green Island. However, it is not hard to see that **Xiaoliuqiu is the epicenter for sea turtles** for Taiwan, making up 1511 of the sightings.

This is because of the island's shallow waters and the tropical climate. The shallow waters allow for algae to grow near the coast, which means plenty of food. In the winter, the island is also warmer due to its proximity to the equator and the fact that the main island shields Xiaoliuqiu from northern winds.

Besides registering sea turtles, the data collected could also help stimulate sea turtle research. One of the attributes I've found particularly fascinating while surfing through the data* was the sea turtle injury cases.

Compiled below are injury reports from Xiaoliuqiu in the year 2021 so far...



Shell Injuries

Among the 44 reported injury cases this year, the most common type was shell injuries with 15. The classic case is the sea turtle "Little Hole" (小破洞), who was named after her missing shell chunk of her left rear. Since there are few sharks in Taiwanese waters that can generate this amount of damage, experts concluded that Little Hole and most other shell injury cases were caused by boat propellers or turbines, which could explain the injuries' prevalence near ports. Many conservationists agree that setting a standardized protective mechanism over boat propellers is needed to reduce these injuries.



"Little Hole" swimming unaffectedly in the ocean
[credit: Su Huai (2017) via National Geographic]



Standard yacht propeller issue
[credit: Grandpropeller Co.]



Sea turtles might be injured by turbines whilst trying to resurface in a heavy-traffic area
[self-drawn]



Fishline entwinement

Apart from the fishing industry, recreational fishing is a popular activity amongst locals. Since fishing lines are a one time usage product, some of them end up in the ocean, and entwined themselves on sea turtles' mouths and flippers.



Fishing line hooked on mouth and extends to the rear [credit: Marc Xue]



Fishing hook on turtle mouth [credit: William Lin]

Damaged Flippers

Damaged flippers may be the result of entangled fishing lines. In some worst case scenarios I've seen, the turtle's body will be tilted constantly to one side as the other flipper has fallen off and they only have one flipper to support their body.

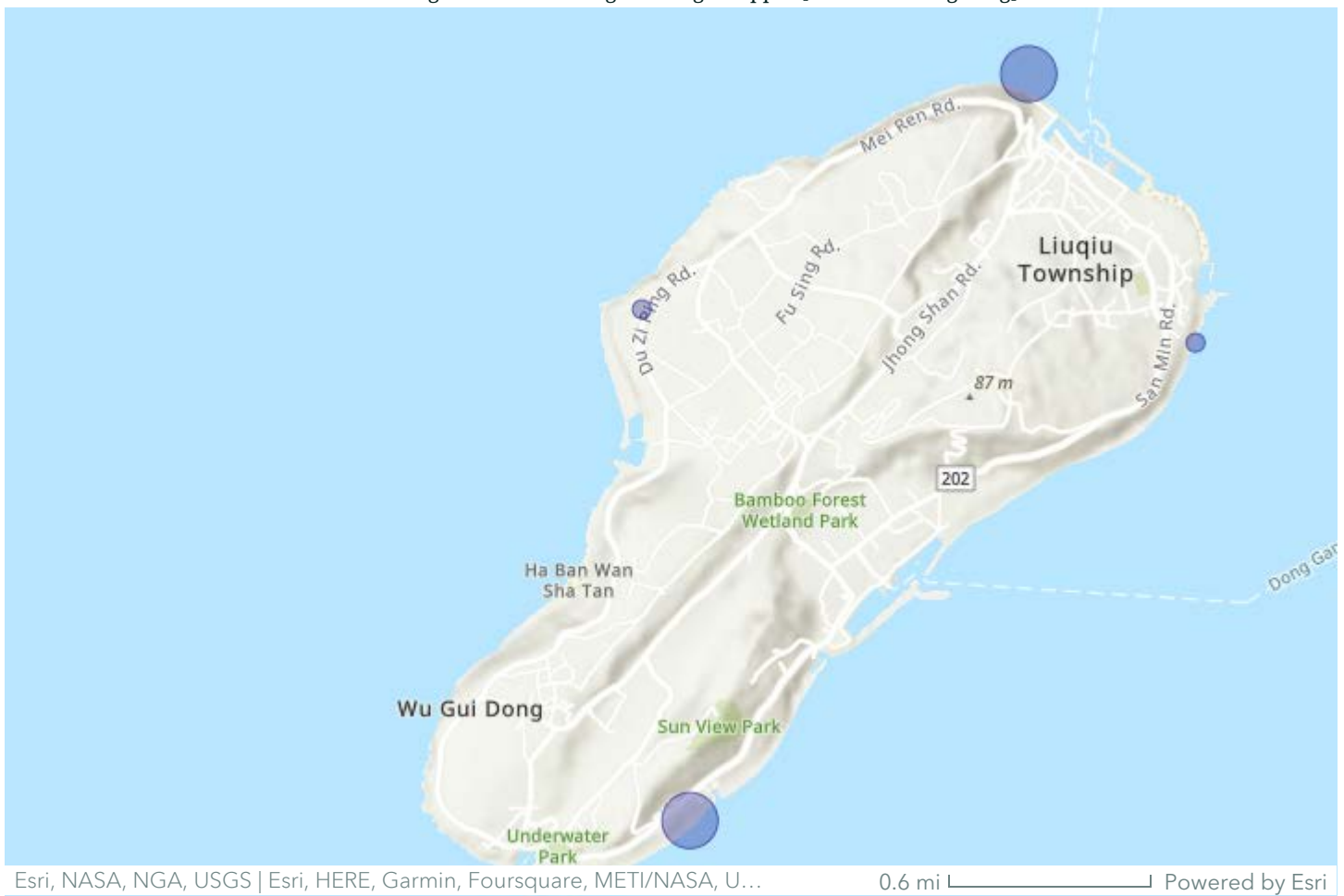
Damaged flippers can also be caused by tumors, which is natural and not a result of human influence.



Resting sea turtle missing rear right flipper
[credit: Jane Tsai]



Resurfacing sea turtle missing front right flipper [credit: Chialing Fong]



Other Injuries

Other injuries include cases of tumors, impaired features (ex. one eye), or corpses. While the last two could be caused by humans, the exact causes of death are always uncertain.

However, TurtleSpot members often offer interesting speculations in the comments.



Sea turtle with infected left eye [credit: Chen Tzu Chien]



Sea turtle corpse deeply entangled in fishing net [credit: 吳祖狀]

While I was engaged in TurtleSpot, I didn't forget the NGO QR codes I've gathered from the New Year trip. Turns out, the NGO was Loo-Koo Yu Organization (社團法人台灣啫咕嶼協會). Loo-Koo Yu is the chief proponent of conservation on Xiaoliuqiu. In the past four years, the NGO has launched numerous events, speeches, and services with the aim of reducing plastic in Xiaoliuqiu. Its two most major services are the Liuqiu Cup (琉行杯) and Gugu Coins (咕咕幣) programs, one is a free recyclable cup lending system, the other is a coin-exchange system for recyclable bowls. In 2018, 5,000 of their cups were lent and returned during the summer months. Meanwhile, about 100 recyclable bowls are in circulation around the island constantly.

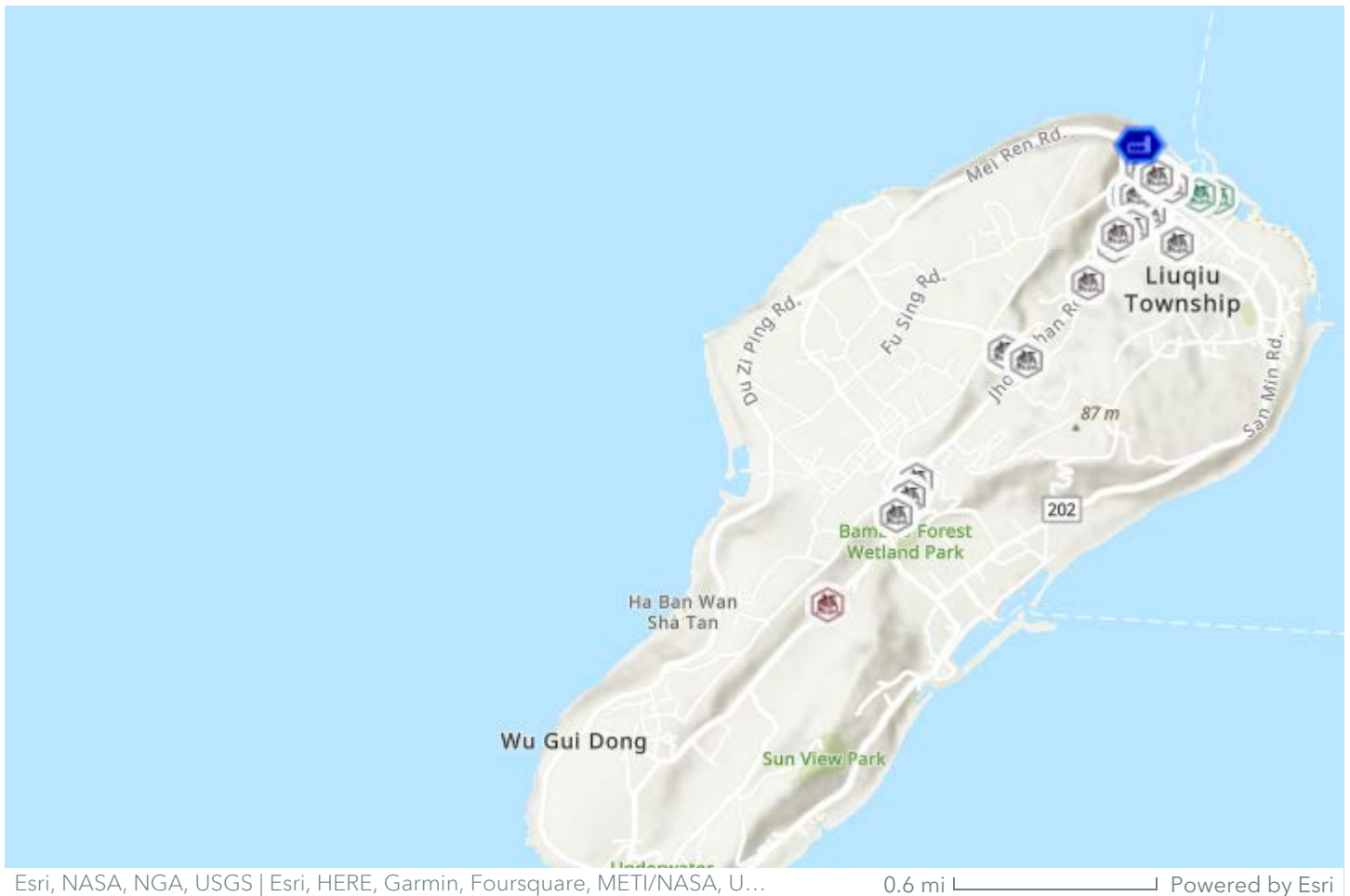


Ms. Zhang (top left) and her NGO organizes local artists to decorate coins and hosts events in Liuqiu schools to educate the kids.
[self-made podcast promotional image]

In March, I got into contact with and successfully interviewed one of its founders, Ms. Zhang. We discussed her motivation to save the ocean, where the NGO's creativity originates, and the NGO's future aspirations. In particular, she told me how seeing her restaurant's takeout container on the beach became her motivation to create change. Her passion and creativity showed me that, in the future, I could contribute to marine conservation in unconventional ways.



[Listen to the full interview here!](#)



Liuqiu Cup

The Liuqiu Cup was introduced by the community service organizations Su-Ga-Lu-A (塑嘎漏啊) and Loo-Koo Yu in 2019. They partnered with a number of stores and restaurants that will lend reusable insulated cups to tourists. The ideology is that every time someone uses the cup, one less plastic cup is used and thrown away.

The map of the left is their current network of 30+ collaborating stores on the island.



Liuqiu insulated cup promotion image

The Gugu Coins are similar in goal and execution. A person buys the coin via Gacha machines, spread across the island, for 150 NT and can use said coin to borrow reusable lunch boxes from specific stores for unlimited times. The coin is made from recycled styrofoam cleaned from the island shores and repainted by volunteers. It provides an easy, non-electrical way to borrow lunch boxes and become environmentally sustainable!



Colorful Gugu coins and reusable bowls

Closing Thoughts

Although it is in our interest to conserve and protect the environment, it's impossible to learn to live with every bird, insect, plant, spider, fish, etc. I believe in starting small. For me, that meant simply respecting and spreading awareness of the first "star species" that is closest to me and has the most impact in my region: sea turtles. I believe the key to conservation is through these "star species" because these are the animals we can empathize with. Once we achieve that, we can slowly but surely move towards a world where we protect more than our "star species" and try to coincide with other life. Ultimately, my belief is that we are all merely lifeforms who decided to spend our evolution points on different attribute trees, which means that we are all equals on this planet. I yearn to live in a world where humans and animals can coexist.

While writing this reflection, I slowly realized that this journey not only integrated fields from geography, but also

environmental science, wildlife conservation, communication, and data science. And through the mixture of all this, I feel like I am one step closer to reducing environmental degradation. I've been told many times in my journey that I'm too young to grasp the issue at hand, but this journey has taught me there are always ways to make a difference, and that there is so much yet to learn and think about. I relish the once-in-a-lifetime relationships I would've never gained had I not pursued them. I enjoyed considering the nuances of composing professional emails and pitching my ideas. I learned the value of doing something because I truly wanted my actions to create change – a future where that sea turtle I met in January can safely spread its wings and fly again.

I'd like to thank you every one of my mentors for accompanying me through this period of discovery. My gratitude extends to Amber Fong and Daphne Hoh from TurtleSpot for gifting me their valuable data, photos from their platform, and always giving me suggestions for this Story Map. I am incredibly thankful for the NGO founders, such as Ms. Zhang from Loo-Koo Yu, my first guide Mr. Sea, and dozens of scuba coaches who shared with me their stories, tips, and wisdom during interviews. And lastly, I'd like to thank my family for giving me the opportunity to let me do cool things in life. Cheers!



A sea turtle and I staring off into the distance coolly

Citations

*Taiwan sea turtle distribution data, injury data, and sighting pictures were all provided by TurtleSpot Taiwan independently

Sea turtle world map

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