CICI & TCI Ltd
2023 – 2024
Nesting Season
Final Report

Conflict Islands Conservation Initiative & The Coral Islands Ltd

2023 – 2024 Turtle Nesting Season

End of Season Report

Report Contents

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About the Conflict Islands

The Conflict Islands Atoll, in the heart of the Coral triangle and part of the Coral Sea in Milne Bay, Papua New Guinea is a bridge between the Solomon Islands, Australia and other interconnected waters of the greater Pacific Ocean.

Within Papua New Guinea, The Conflict Islands are held under a free hold land title, with 100% ownership to Mr. Ian Gowrie-Smith and his business The Coral Islands Ltd, and therefore decisions about how the Conflict Islands can be sustainably used and managed falls under the Papua New Guinea *Land Act 1996* and can be made by the owner. Adjacent communities are consulted and are involved in decision making and awareness and education programs are held with active communities.

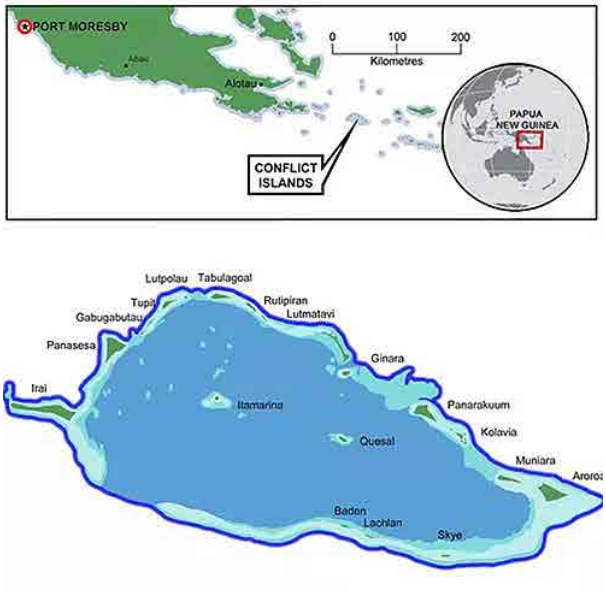

Figure 1: The Conflict Island Atoll is located in the Milne Bay Province of PNG, and within the coral triangle.

The Conflict Islands Atoll has very diverse coral fauna. A total of 418 Scleractinia corals clearly places it within the area of the highest coral diversity in the world ("Coral Triangle") along with the Philippines and Indonesia. The highest average number of species of reef fish (220) was recorded for the Conflict Group. The number of species in the below families is totaled to obtain the Coral Fish Diversity Index (CFDI). The total CFDI for Milne Bay Province is 337 with the following components: Labridae (108), Pomacentridae (100), Chaetodontidae (42), Acanthuridae (34), Scaridae (28) and Pomacanthidae (25). This is the highest total for a restricted location thus far recorded in the Indo-Pacific, surpassing the previous figure of 333 for the Maumere Bay region of Flores, Indonesia. Significant numbers of maori wrasse (*Cheilinus undulatus*), giant clams, white teat and black teat sea cucumber, all IUCN Red Listed as endangered species, also inhabit the reefs of the Conflict Group. Along with amazing richness of the coral reef and fish biodiversity rivalling that of Indonesia, the Conflict Group has recorded such important mega fauna as whale sharks, reef manta ray (*Mobula alfredi*) giant manta ray (*Mobula birostris*), bowmouth guitar shark (*Rhina ancylostoma*), endemic epaulette shark (*Hemiscyllium michaeli*), bigeye thresher *(Alopias superciliosus*) and marine mammals, such as risso dolphin (*Grampus griseus*), dugongs (*Dugong dugon*), false killer whales

(*Pseudorca crassidens*), bottlenose dolphins (*Tursiops sp.*) and reported sightings of orca (*Orcinus orca*) and sperm whales (*Physeter macrocephalus).*

The Conflict Island Group has globally and regionally significant nesting populations of sea turtle, many of which have migrated to the islands from other countries (e.g., Australia) to court and nest. There is also foraging populations that reside in the lagoons of the Conflict Island Atoll.

The critically endangered hawksbill turtle (*Eretmochelys imbricata*) and the endangered green turtle (*Chelonia mydas*) (IUCN Red List) are the two species known to use the islands to nest, breed and feed, however, there have been multiple sightings of the olive ridley turtle (*Lepidochelys olivacea*) foraging in these waters. There are also images of reported nesting and harvest of olive ridley turtles on surrounding islands which indicates a gap of understanding about this vulnerable species to also be utilizing the area of, around and beyond the atoll.

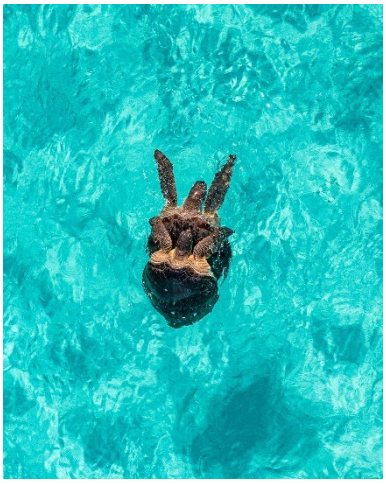

Figure 2: Aerial image of mating green turtles inside the Conflict Islands Atoll lagoon area. (© Migration Media Underwater Imaging, 2022)

The Coral Islands Ltd (TCIL) in partnership with Conflict Islands Conservation Initiative (CICI) has been running a Turtle Conservation Program on 21 of the Conflict Islands since the 2016-17 nesting season.

The program was built around a voluntourism model that relied on income from overseas volunteers, but also assisted the attendance of local Papua New Guinea university students and graduates to attend the program to gain experience and knowledge in the field of turtle conservation and husbandry. Financially supplemented by the island's owner Mr. Ian Gowrie-Smith where required and small grants and fundraising efforts received, limited conservation work was able to be conducted during the 2020-21 nesting season due to the impacts of COVID-19 and 100% loss of funding from volunteers' attendance and travel restrictions. These issues continue to impact the conservation work into 2024 as tourism confidence, numbers and costs of competitors in the same space for voluntourism continues to rise.

Our turtle conservation program has only been able to continue running through the support of our varied and generous sponsors and donors, of which we are forever grateful to for their support in these challenging times. Also enabling the continuation of the program is the visiting Carnival cruise ships and their guests all of which pay for a Turtle Tour, which 100% of the funds are used for running the Turtle Program.

Turtle Life Cycle

Turtles take roughly 20 to 30 years to reach sexual maturity in the wild. After hatching out of the sand as 2-3 cm long hatchlings, they head out into oceanic currents for their lost years those years where they are difficult to track. After a period of around 5-15 years, those which survive the lost years at sea, they settle to reside in a coastal reef area where they spend years feeding to reach breeding maturity. Once they are sexually mature, they migrate from their foraging grounds to a courtship area and then the females continue to a nearby location close to where they hatched to lay their own eggs.

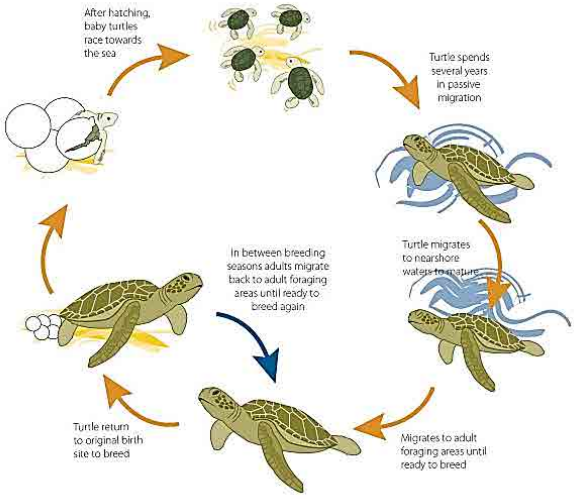

Figure 3: Turtle Life Cycle (courtesy of kingfisherbayresort.blogspot.com)

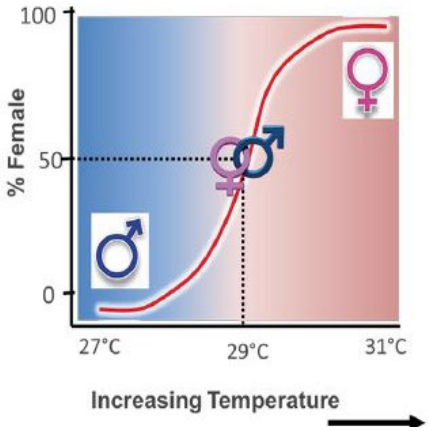

Figure 4: Marine turtle sex-ratio temperature dependence chart (adapted from Morreale et al. 1982).

CICI monitors both green and hawksbill turtle nesting in The Conflict Island Atoll. Researchers from WWF-Coral Triangle Programme and one of our directors Ms Christine Madden Hof, has been satellite tracking some hawksbill turtles that nested on the islands in 2017 and 2018. This data showed that most nesting hawksbills are migrating across the Coral Sea, to and from the Great Barrier reef in Australia to feed. Data collected from foraging turtles tagged in the Howick Island Group in the northern Great Barrier Reef also showed that green turtles have long migrations to the Conflicts to return to their nesting grounds. Female turtles do not make this migration annually, but every 5 – 8 years, returning to the nesting grounds to lay between 3 – 5 clutches of eggs. Whilst male turtles are likely to return to breed 2 – 3 times more frequently than their female counterparts.

The nesting season here starts in October, and the last of the hatchlings usually emerging by the end of April. There is no parental care for turtles. After the female deposits her eggs in her nest, she returns to the sea, with no further interaction with the nest or her hatchlings. Nest depth can vary between 30 – 60 cm deep for the different species, as does the number of eggs laid in each clutch. Some females may lay only 50 eggs toward the end of the season, but the total clutch count (number of eggs) can be as exceeding 220 eggs.

The sex of the hatchlings is not determined at fertilization (i.e., by sex chromosomes). Instead, sex is determined by the nest temperature during the middle third of embryonic development. Nest temperatures over ~29°C produce more females, and temperatures below this range produce more male hatchlings. With the warming global temperatures, some sea turtle populations are producing close to 100% female hatchling, such as the northern Great Barrier Reef green turtle population on Raine Island, the largest green turtle nesting site in the world. The consequences of this could be dire for the future of turtle species. Similarly, nest temperatures above 32°C are lethal for developing sea turtle embryos and have huge consequences to the overall health of the hatchling. Along with the low survival rate to maturity, which is less than one in every 1000 hatchlings, the future for the species without expert management and intervention is looking dire.

Threats to Turtles Globally and Locally

Figure 5: Turtle threats of by-catch from long liner (www.seaturtlestatus.org); passive fishing by discarded fishing nest at sea part of the plastic pollution problem (www.dhimurru.com.au); and boat strike victim (Ian Bell, Sea Turtle Foundation); coastal erosion exposing vulnerable turtle eggs due to sea level rise (champagnewhisky.com).

The global trend for many turtle populations is **declining** due to the many factors that affect them in every stage of their

life cycles, from global to local scales. Global threats include increasing sand temperatures ('feminization' and lethal incubation temperatures), sea level rise and erosion (nesting habitat loss), pollution (heavy metals, chemicals, toxins and plastics), fishing (either intentional or as by-catch), marine debris (including discarded (ghost net) fishing gear), over-harvest of meat and eggs, and the illegal wildlife trade.

For turtles in the Conflict Islands, key threats are poaching of turtles for meat and eggs, the illegal wildlife trade for "tortoise shell" (hawksbill turtles), erosion caused by sea level rise leading to a loss of available nesting beach, plastic debris, and marine debris including trees blocking access to the nesting habitats. The carapace of hawksbill turtles (*Eretmochelys imbricata)* is highly sought-after used in the fashion, medicinal and ornamental industry contributing to the illegal wildlife trade.

PNG's human population growth has increased around ~2% each year since 1950 (http://www.worldometers.info) and since the last census in 2011 Milne Bay shows a 170% increase in population growth rates. In combination with the global increase in the cost of living, further pressure has been put on turtle populations as there is an increased demand for their meat and eggs to substitute income for villages. When sold for cash, these products can be sold for ~350 kina ($130 AUD) at local markets. Traditional trade of turtles and the products is legal and widely used across the rural and maritime regions of the country. The turtle nesting season coincides with Christmas and New Year, and every year where the demand for cash increases and puts extra pressure on communities to provide for these western celebrations introduced with Christianity to Papua New Guinea.

Our team of Rangers are without exception, reformed turtle poachers, who openly admit to poaching and harvesting of turtles and was the most common use for the turtles that they harvested. As stated by our rangers, they money they got from selling turtles was often used to buy alcohol, betel nut, and Christmas supplies. Enforcement and effective management have always been an issue in PNG, even though high-level political members condone the sale of turtles.

Turtle Monitoring and Protection Program Overview

Figure 6: New dingy and outboard generously sponsored by Sea Shepherd and named by rangers as "Baby Blue."

CICI's ongoing Turtle Conservation Program is designed to monitor and protect nesting turtles and their eggs of the Conflict Island Atoll. Over the years we have also been creating a baseline data set that CICI and others will be able to use to determine if the management strategies put in place are successfully contributing to the conservation of green and hawksbill turtles. Supported my nesting population survey monitoring, some of the species management strategies used are poaching deterrence, egg protection, translocation, nest cooling, environment clean ups and community education and awareness. The program is continually evolving and adapting the methods and techniques to keep up with worlds best practice and to ensure laws, ethics and regulations are adhered to. This also involves partnering with government, students, PhD candidates, universities, scientific advisors, and other conservation organizations, ensuring data sharing and collaborations where possible.

The project area consists of the atoll's 21 islands with the furthest being Auroroa Island, ~ 22 kms away from the base and hatchery at Panasesa Island. This makes the logistics and costs to effectively monitor all the islands difficult and expensive to run.

CICI's Turtle Conservation Project aims to monitor the marine turtle populations at the Conflict Islands Atoll via a long-term tagging program to allow population trends and trajectories to be calculated (i.e., is the population increasing, stable or declining). Beach patrols occur at night when the female turtles come up to lay. At this time, the rangers are able to tag green and hawksbill turtles, take genetic samples where necessary, collect facial ID photos, and other morphological data collection such as carapace length (CCL) and nest depth. These patrols also protect the turtles and their eggs from poaching and enables education and awareness to be conducted when poachers are encountered. This project conducts emergence and hatchling success studies by collecting eggs and translocating them to the Conflict Islands Turtle Hatchery. The nests are incubated, and temperature regulated using shade and irrigation to produce healthy hatchlings and not all females. Some hatchlings are raised in the on-site nursery until they are healthy and strong enough (3 – 12 months) to be released into the wild as part of our 'head-start' program.

Figure 7: Titanium flipper tag on juvenile green turtle (©Migration Media Underwater Imaging, 2018)

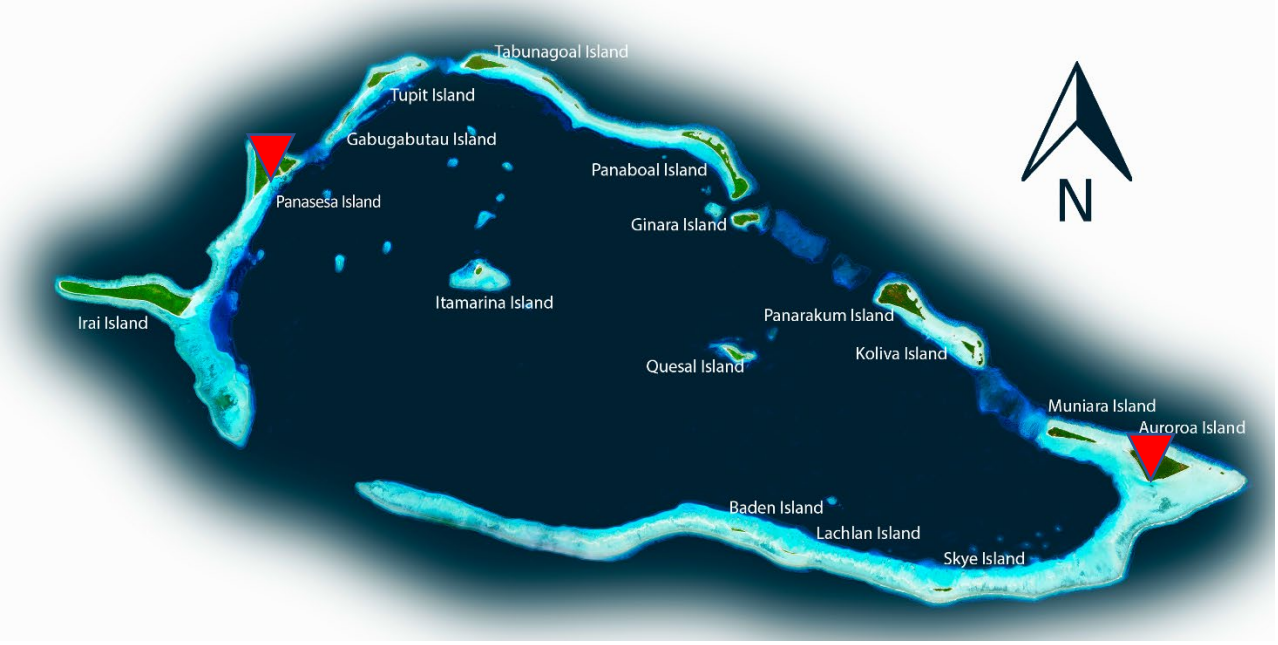

Figure 8: Conflict Island Map with Island names and locations of ranger deployments.

With fewer Rangers this season we were limited for the number of patrol base stations. This season we had one established at Auroroa Island and one at Panasesa where the main resort is based. This gave good coverage of the atoll most nights unless weather became an impediment. This was a much quitter season of nesting which allows for the rangers to spread the monitoring and patrol across the highest frequency nesting beaches for a greater result of relocations.

Our primary rangers of the team this season consisted of Steven Amos as Project Manager Patrick Lemeki as Head Rangers, and Toby Losane as our Community Liaison Officer. Promoted in their roles from last season were trainee rangers Banian Leonard and Clinton Luke, to take on more responsibilities in their roles respectively being responsible for data entry and equipment inventories. Badi Seko, Michael Moten, Rodney Taliya, and Norman Poate remained as trainee rangers as they have room to improve their skills and knowledge from their performances from last year.

Community Based Turtle Monitoring and Protection Program Overview

After Henry John piloted a new project in his home community at Tewatewa island to our east sponsored by Steamships community grant program, last season which was highly successful, and we gained the funding again to continue this program this season, with the addition of another community from the Deboyne Side of called Kimuta. This project is run by Female staff member Nina Ellice Wadilei, who started Epokom Community Conservation Project and approached CICI, as many other groups do to help empower them to learn how to protect and monitor turtles at their site.

Figure 9: Kimuta Island part of the Louisaide Group of island past Misima to the East of the Conflict Islands group

Youth and female engagement and enabling is a priority as we aim to meaningfully employ, educate, teach new skills and conservation principles to the trainees regardless of past opportunities, education or experience levels. All the trainees in the past had either eaten, harvested, or killed turtles and their eggs. After spending the last six months at home in their villages all of the rangers reported changes in their communities' attitudes towards turtles and even their own positions in the community. They also reported they had carried out awareness about the work they were doing and the effects it has had on the community. We endures a %0:50 male to female ration was interested by the program to be more inclusive for females who are interested in participating in the field work. **Results Reported Separately.**

METHODS

Tagging and Patrols

The tagging method was adapted from standard SPREP tagging instructions (Geermans, 1993) sections 2 (2.2) and 3 (3.1, 3.2 and 3.3). Female turtles were tagged on nightly patrols during the months of November 2023 – February 2024 across the entire atoll. The patrols started at nightfall through to the lowest point of the tide every night. The turtles were tagged with standard self-locking titanium tags. The tags belong to the Conflict Islands Conservation Initiative; tag series IGS0001-IGS3000.

Recorded data included when a turtle is encountered includes:

- Species
- Tag ID number
- Carapace length and width (CCL and CCW)
- Injuries, diseases or scars on the nesting female
- 2x facial identification photos (left and right)
- Date and time of laying event
- Nesting island
- GPS location of nest
- Nest Habitat (e.g., bare sand, grass)
- Number of eggs laid (total clutch count, TCC)
- Number of nests building attempts
- Reasons for nest failures (e.g., tree roots, erosion)
- Nest Relocation information

Figure 10: Facial Identification photo being taken by a CICI Conservation Ranger (©Migration Media Under Water Imaging, 2022)

Figure 11: Turtle Eggs and mucous being captured during oviposition. (©Migration Media Underwater Imaging 2022)

So as not to disrupt her during the egg laying phase, the female turtle is not handled/touched until she is near completion of laying. She is then flipper tagged on the trailing edge of her front left or right flipper on pad L3 (closest to the body), otherwise subsequent pads, L2 or L1 will be tagged. The turtle is only tagged after laying is finished and only once on the left flipper (a primary tag), and then on the right flipper on the second time the turtle is encountered (recapture). The tag number will be recorded as well as any injuries or previous tags. Where possible we also record a facial identification photograph, that is later uploaded to an online database (www.wildme.org) where facial mapping occurs through artificial intelligence (AI) software. Turtles have a unique scale print on their faces that in the future we hope will be able to be used effectively to identify individual, and to replace the flipper tags.

Egg Collection & Relocation

Eggs are only relocated if they are at high-risk of mortality. This may include poachers, predators or if the female has dug her egg-chamber below the high-tide line as they are at risk to drowning and erosion. Unfortunately, most clutches of eggs laid have to be relocated to a hatchery due to the high levels of threats. As the female starts laying her eggs into her egg-chamber, she is no longer susceptible to disturbance. This allows our Conservation Rangers to easily place a ziplock bag under her cloaca to catch the eggs and the mucous she excretes whilst laying (Figure 10). Once laying has finished, the air is removed from the ziplock bag minimize exposure to oxygen during relocation, which pauses the development of the pin head-sized embryos until they are placed into their new nest site (Williamson et al 2017, Kam 1993, Kennett et al 1993). The eggs are then carefully transported back to the hatchery on Panasesa Island via boat. This process is done as quickly as possible from the time of collection, to minimize the risk of mortality caused by rotations of the egg.

Figure 12: Ranger catching eggs from a laying green turtle. (© Migration Media Underwater Imaging, 2022)

A replicate nest is dug in the hatchery, to the same depth and width as the natural nest and is covered with the same sand the was removed to excavate the nest. The species, number of eggs and estimated hatching date, female's tag number and hatchery position are all recorded on the data sheet. We also collect data on the maximum and minimum diameter and weight of each egg from a random sample (n=10) pre clutch laid. The nest is then covered by a nest protector to exclude any crabs or other predators. The eggs are then left for approximately 60 days to develop and allow the hatchlings to emerge naturally.

Hatchlings

The nests are observed approximately a week prior to the estimated hatch date for the first signs of emergence of the hatchlings. The clutch is allowed to emerge naturally with some or very little assistance from the rangers. Hatchlings with no morphological mutations are released the same evening they hatch. The release location depends a lot on weather and conditions, and we try to release the hatchlings from high up on the originating beach where the eggs were originally collected from which may be important for their natal returning imprinting. If we cannot take them back to their natal beach, they are released at the closest beach to the nursery under the cover of darkness to reduce the number of predators. Other hatchlings that show distinct genetic deformities or weakness are brought to the nursery onsite for further husbandry and observation. The nest is then excavated to determine the hatchling and emergence success, and to identify if any eggs that did not develop, at what stage their development ceased. This entails opening any unhatched eggs to look for different stages of development. This helps us to improve our relocation and incubation techniques. If there are any unhatched eggs that look healthy, we use a candling technique to check if the embryo is still viable inside the shell. If it is, these are what we have termed 'live eggs' and we take these back to the nursery to our sand incubation tanks where they are left to emerge naturally. Once emerged they will be released with another clutch of hatchlings the same night if they are healthy.

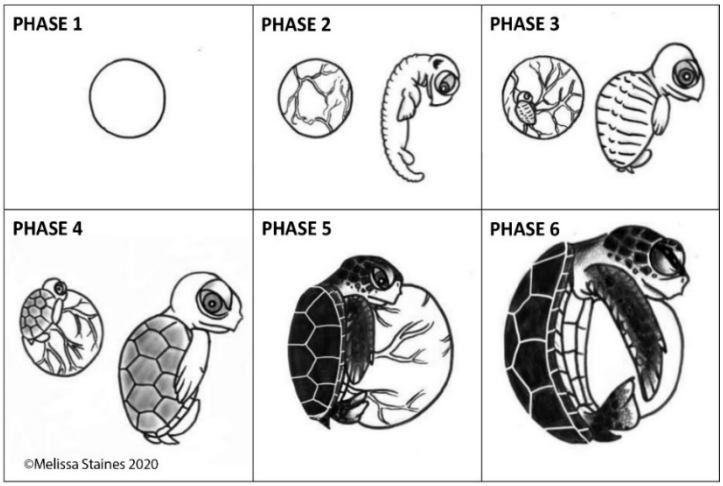

Figure 13: Embryonic development stages used in the field for assessing development stage at death (©Melissa Staines).

Hatchery Construction

To create our hatchery, we excavated an area 15m x 8m to a depth of 80 cm and lined the perimeter with builder's plastic (20 cm down in the sand) to stop root invasion and aid in predator exclusion, leaving the base open for natural water drainage. Roots alone can cause severe dehydration and death of the developing embryos.

Encompassed by a 60cm tall fence, this area is then refilled with beach sand from the ideal location for natural nesting. A roof to provide shade is then constructed over the top of the whole area, made from bush materials such as natural wood and woven coconut leaves for the roofing. A bird exclusion net is then placed to cover the gap between the roof and the top of the fence to ensure no predation (by animals alone, not humans), of emerged hatchlings by any of the birds.

Figure 14: Shaded Turtle Hatchery. (©Migration Media Underwater Imaging, 2018)

Nursery

We have limited use for the nursery and do not keep many hatchlings in there for extended periods. We utilize the facilities for any clearly deformed or week hatchlings and the incubation of any live eggs that require extended incubation after the rest of their clutch has emerged. We feed the hatchlings on a gelatin mix with calcium fresh fish pellets and ibika a local spinach whilst we keep them if for extended periods. We do not feed them if we release them within 72 hours of hatching.

RESULTS

1. Nesting Population Surveys

Table 1: Number of individual turtles tagged an observed within the Conflict Islands Atoll, during the survey period of nesting females from late September 2023 to the end of February 2024.

Species	New Individuals	Re-migrant Individuals	Total Individuals	In-season Recaptures	One-off Captures
Green Turtle	310	15	325	305	60
Hawksbill Turtle	29	4	33	21	24
Total	**339**	**19**	**358**	**326**	**84**

Table 2: Number of Green turtles observed within the Conflict Islands Atoll, during the survey period from 2017 when the program commenced until the end of 2024 nesting season.

GREENS					
	New Turtles	Re-migrant Turtles	SPREP Tags	QLD Tags	Total
2017-18	234	0	5	1	240
2018-19	52	0	2	0	54
2019-20	342	0	1	0	343
2020-21	78	5	0	0	83
2021-22	655	10	3	0	669
2022-23	98	7	0	1	106
2023-24	310	15	0	1	325
Total	**1769**	**37**	**11**	**3**	**1820**

Table 3: Number of hawksbill turtles observed within the Conflict Islands Atoll, during the survey period from 2017 when the program commenced until the end of 2024 nesting season.

HAWKSBILL					
	New Turtles	Re-migrant Turtles	SPREP Tags	QLD Tags	Total
2017-18	30	0	2	0	32
2018-19	40	0	2	1	43
2019-20	25	0	0	0	25
2020-21	35	0	0	1	36
2021-22	35	1	1	0	37
2022-23	25	2	0	0	27
2023-24	29	4	1	0	34
Total	**194**	**7**	**6**	**2**	**209**

Table 4: Number of green and hawksbill turtles tagged and observed within the Conflict Islands Atoll during the survey period from 2017 when the program commenced until the end of 2024 nesting season.

	COMBINED GREEN & HAWKSBILL DATA				
	New Turtles	Re-migrant Turtles	SPREP Tags	QLD Tags	Total
2017-18	264	0	7	1	272
2018-19	92	0	4	1	97
2019-20	367	0	1	0	368
2020-21	114	5	0	1	119
2021-22	690	11	4	0	706
2022-23	123	9	0	1	133
2023-24	339	19	1	1	360
Total	1989	44	17	5	**2055**

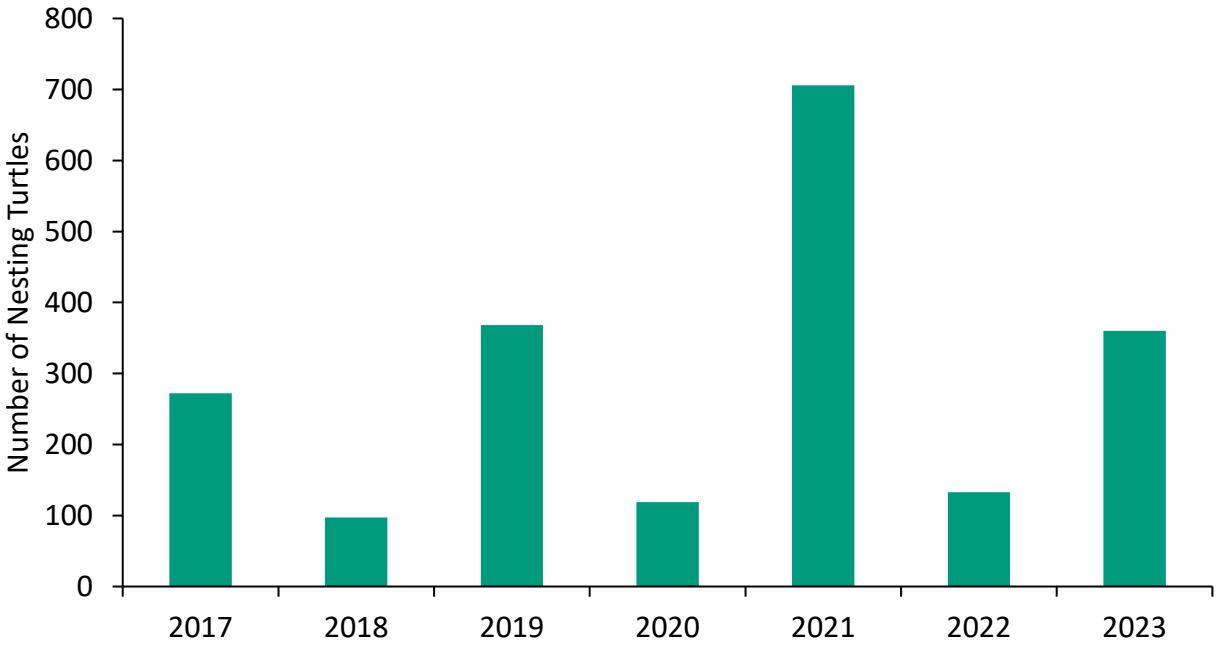

Figure 15. Combined tagged turtle interaction from 2017 through to 2023 nesting seasons.

2. Nesting Success

Table 5. Number of nesting events throughout 2023 – 2024 nesting season.

Species	Successful Nests	Failed Nest Attempts	Success Rate %
Green Turtle	477	377	55.9
Hawksbill Turtle	47	19	71.2
Totals	**524**	**396**	**56.9**

Table 6. Number of clutches Translocated and Protected in 2023 – 2024 season.

Species	Total Number of clutches Translocated	Total Number of eggs Translocated
Green Turtle	416	43429
Hawksbill Turtle	33	4584
Totals	**449**	**48013**

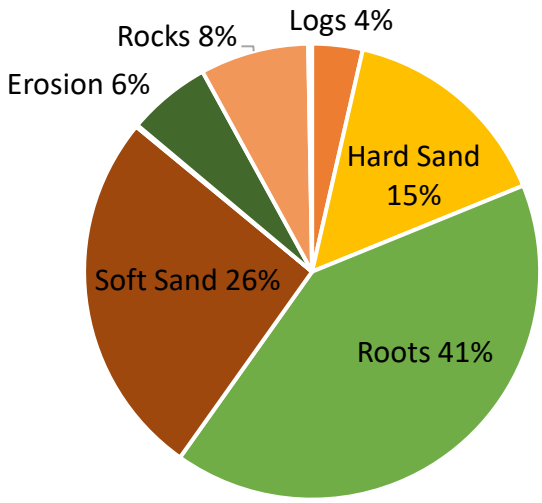

Figure 16. Reasons for failed nesting attempts of green and hawksbill turtles during the 2023-2024 nesting season.

Table 7. Number of nesting attempts categorized by survey island in the Conflict Island Atoll for the 2023 – 2024 Turtle Nesting Season, including missed turtles and tagged turtle nesting events for both Green and Hawksbill turtles.

Island	Green	Hawksbill	Total events (n)
Auroroa	88	10	98
Panasesa	59	19	78
Tabunagoal	64	5	69
Lachlan	27	3	30
Skye	59	2	61
Irai	376	8	384
Baden	21	2	23
Panarakum	48	5	53
Muniara	27	7	34
Tupit	64	4	68
Kolavia	4	1	5
Ginara	7	0	7
Itamarina	8	0	0
Panaboal	0	0	0
Quesal	0	0	0
Total	852	66	910

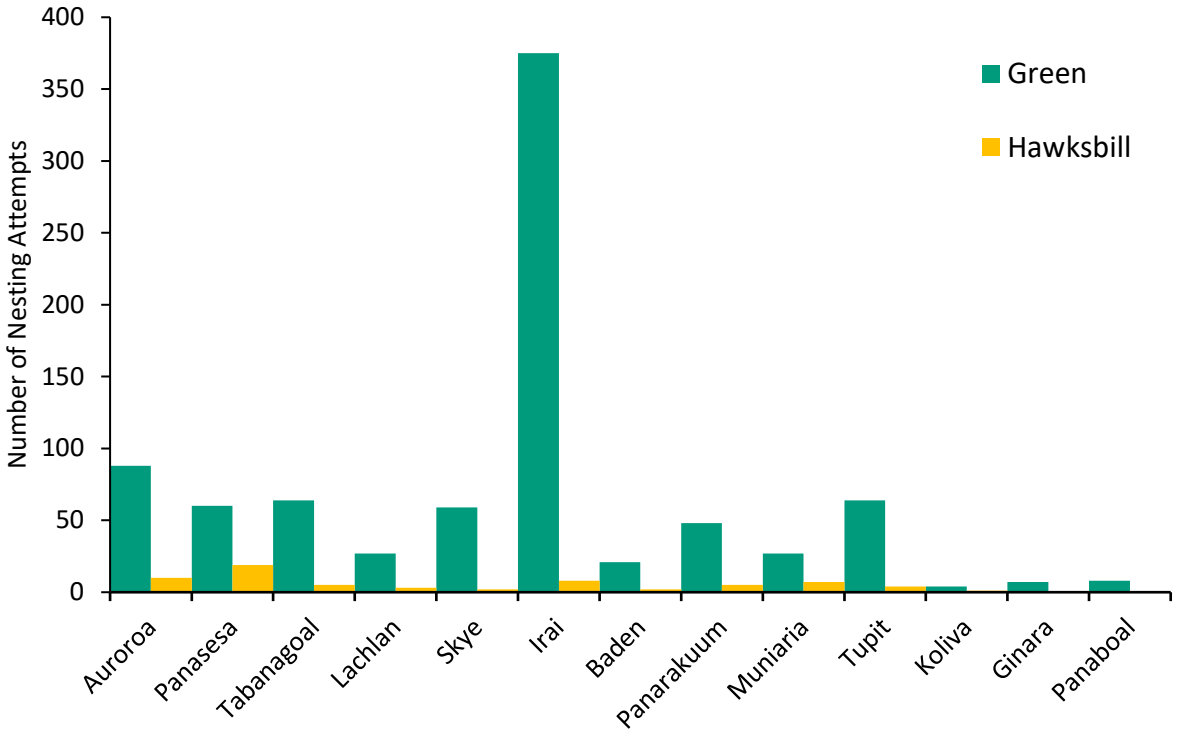

Figure 17. Number of nests events for green (dark) and hawksbill (light) turtles across the islands of the Atoll in 2023-2024 season.

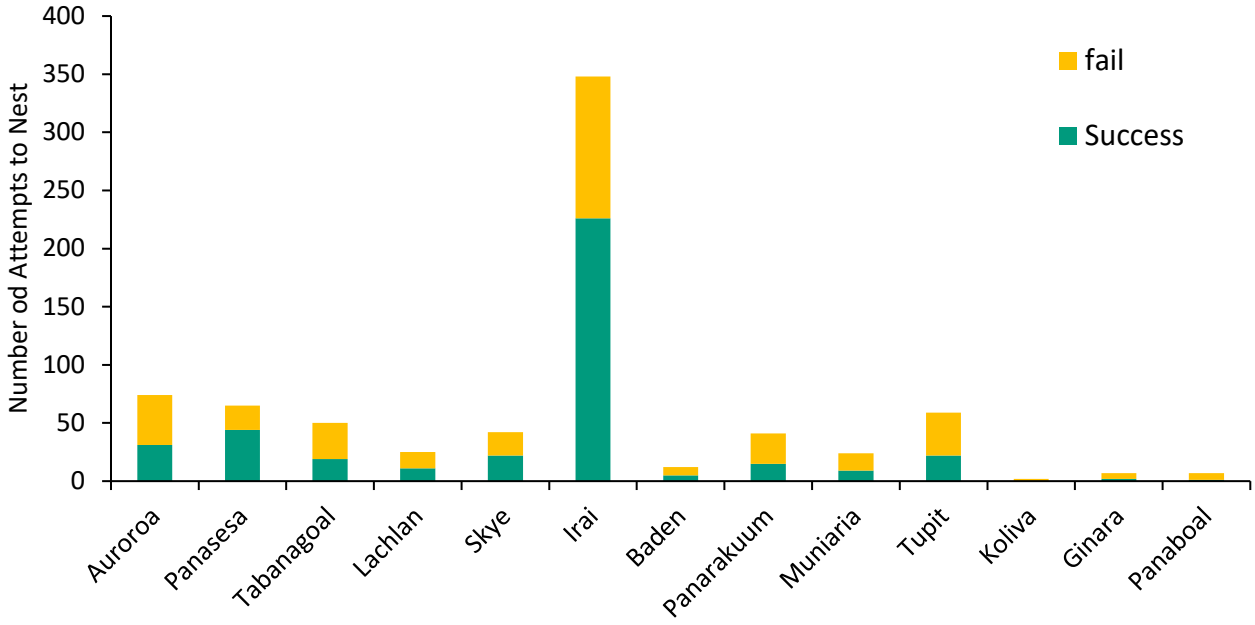

Figure 18. Total number of failed (dark) and successful (light) nesting attempts for each island by both turtle species throughout 2022 – 2024 season.

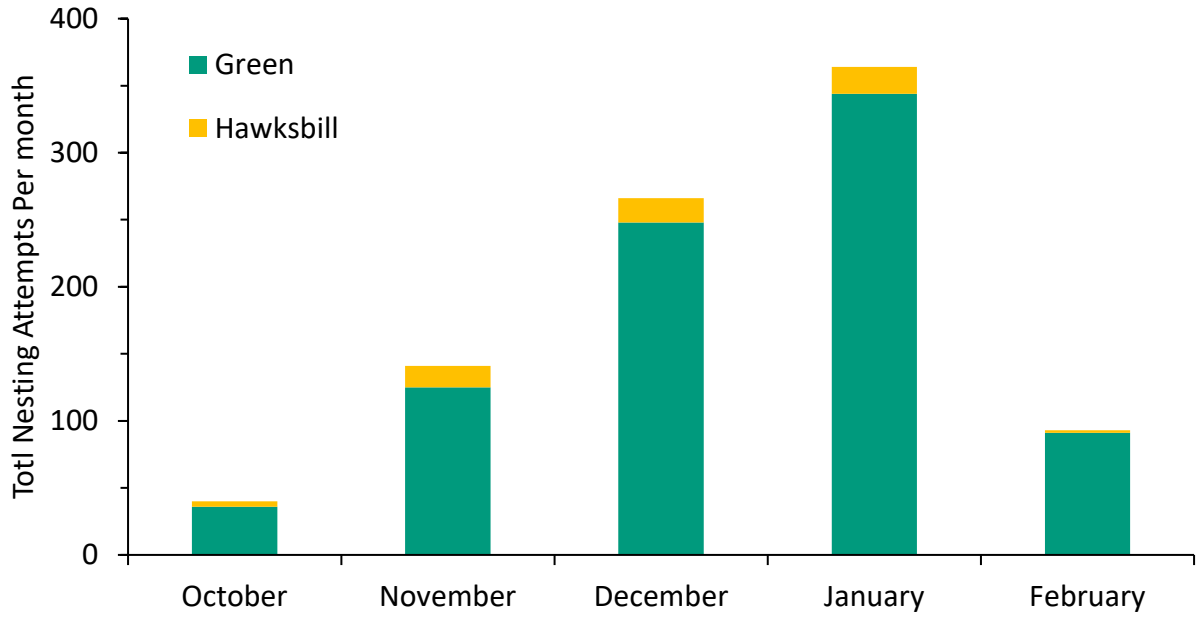

Figure 19. Total number of nesting attempts for each month for green and hawksbill turtles throughout 2023 – 2024 season.

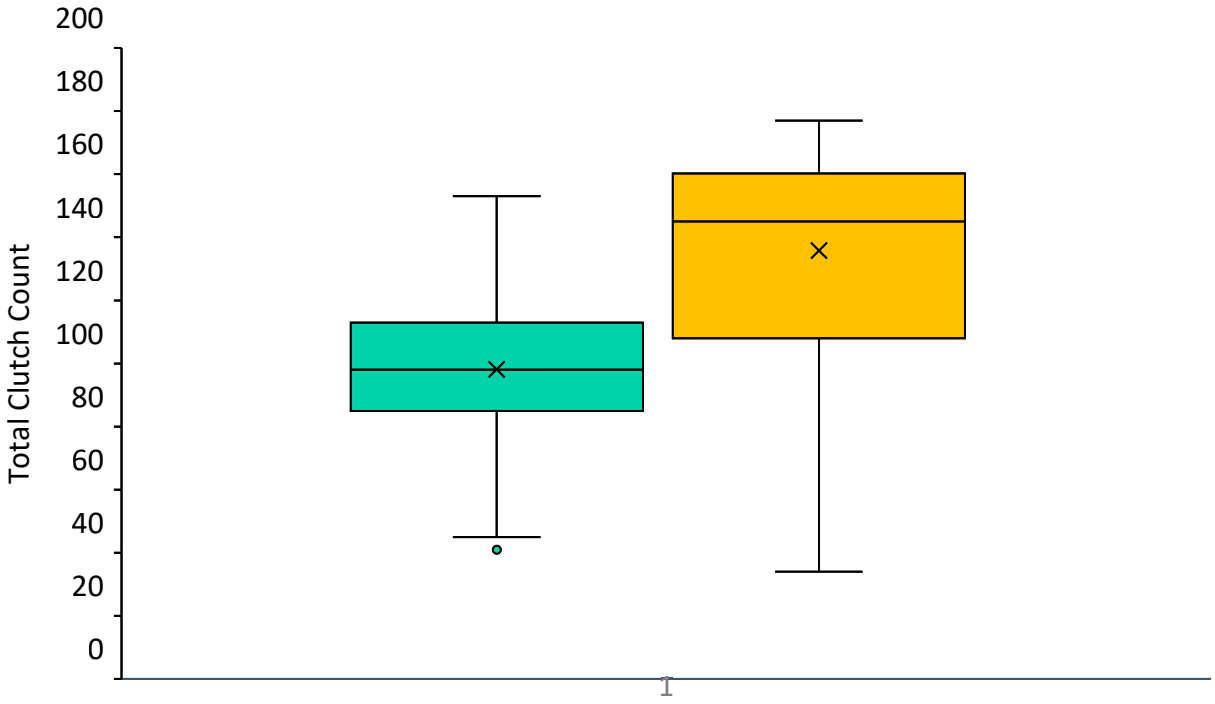

Figure 20. Box and whisker plot showing the variation in the number of eggs (clutch size) laid per nest in the 2023 -2024 nesting season by both green (green) and hawksbill turtles (orange).

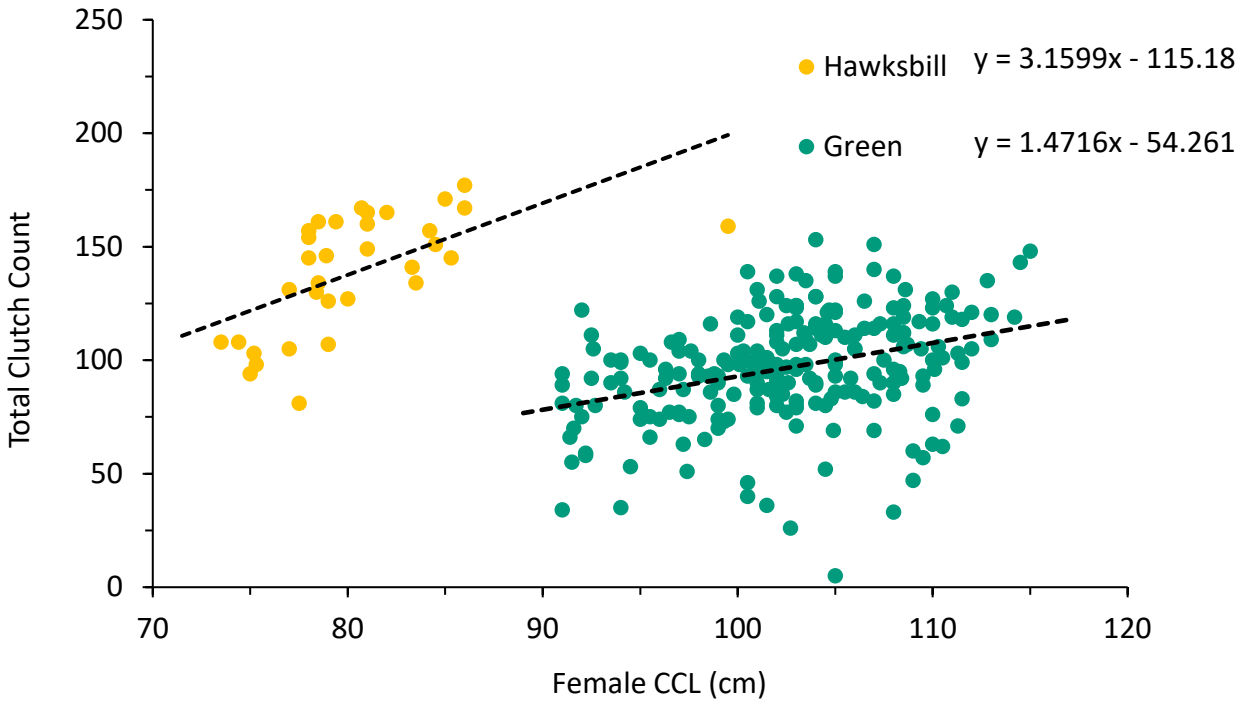

Figure 21. Relationship between female curved carapace length (CCL) and the number of eggs per clutch (total clutch count).

3. Hatchery Success

Table 8. Number of hatchlings released from translocated nests in hatchery during the 2023 – 2024 season to date.

Species	Nests Relocated	Number of Eggs	Number of Hatchings
Green	413	39394	35167
Hawksbill	33	4511	4198
Total	**446**	**43905**	**39365**

Table 9. Number of clutches relocated to the hatchery for the 2023 – 2024 Turtle Nesting Season, and corresponding hatchling production. (Excluding incomplete clutches of <30 eggs laid, 5 green turtles' samples)

Species	Hatchling Success (%)	Emergence Success (%)	Sample Size (clutches)
Green Turtle	89	89	413
Hawksbill Turtle	94	93	33
Both Species	**91.5**	**91**	**446**

4. Hatchling and Egg Morphometrics

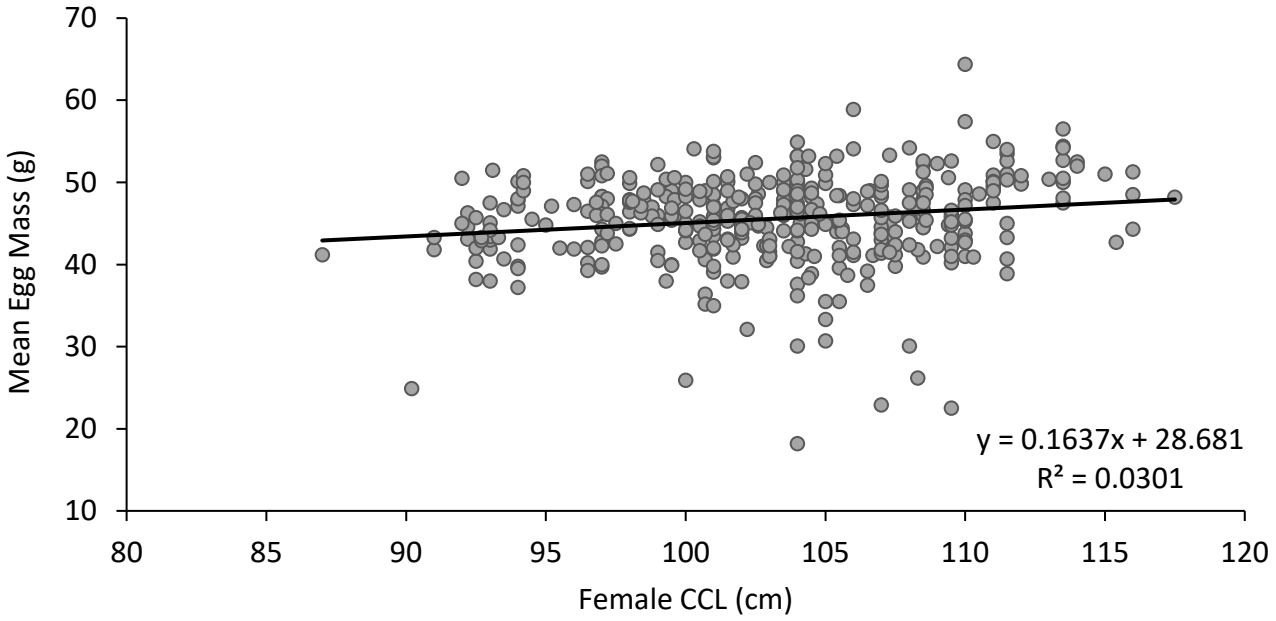

Figure 22. Scatter plot showing the relationship between the Green turtle female size (CCL) and the average egg mass for green turtle clutches.

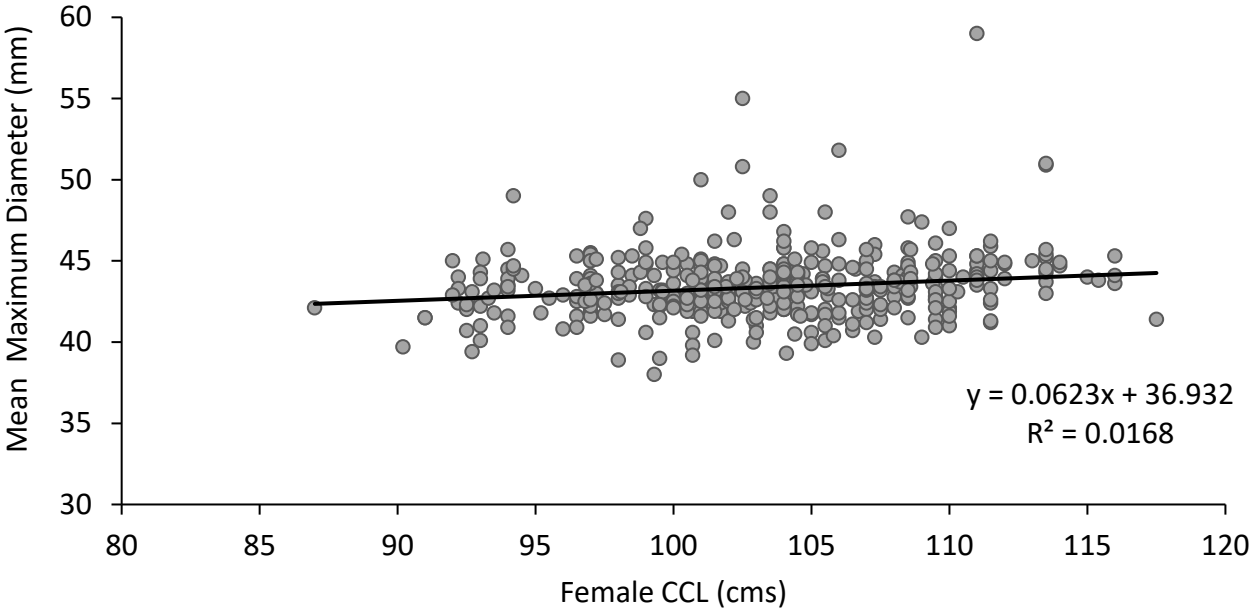

Figure 23. Scatter plot showing the relationship between the female size (CCL) and the average maximum egg diameter for green turtle clutches.

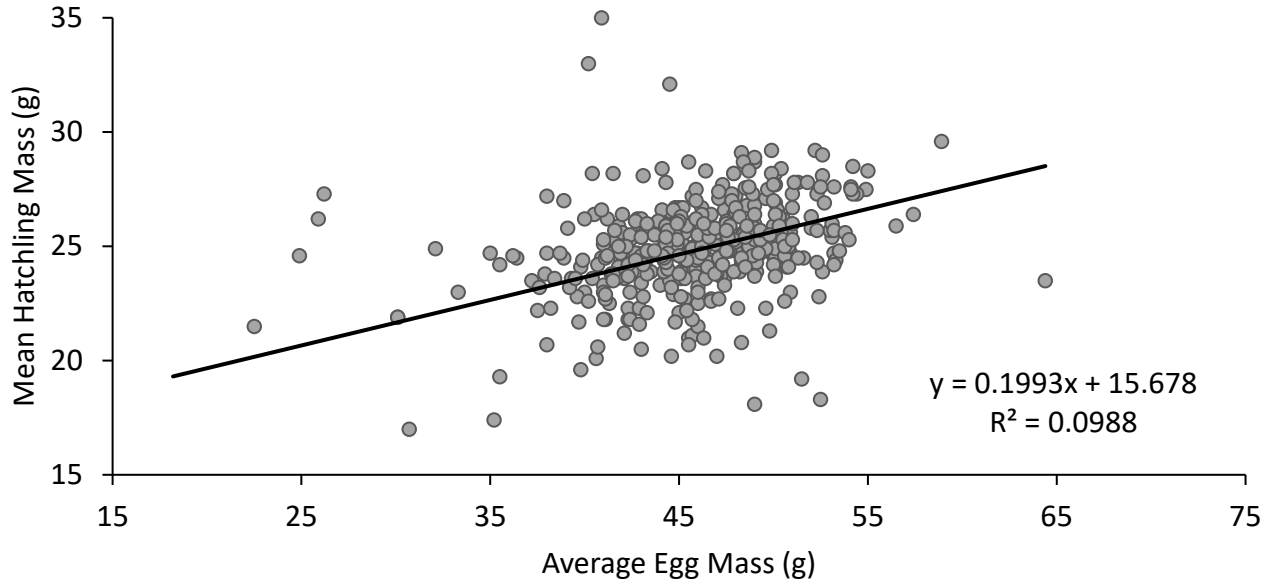

Figure 24. Scatter plot showing the relationship between the mean egg mass and the mean hatchling mass for green turtles.

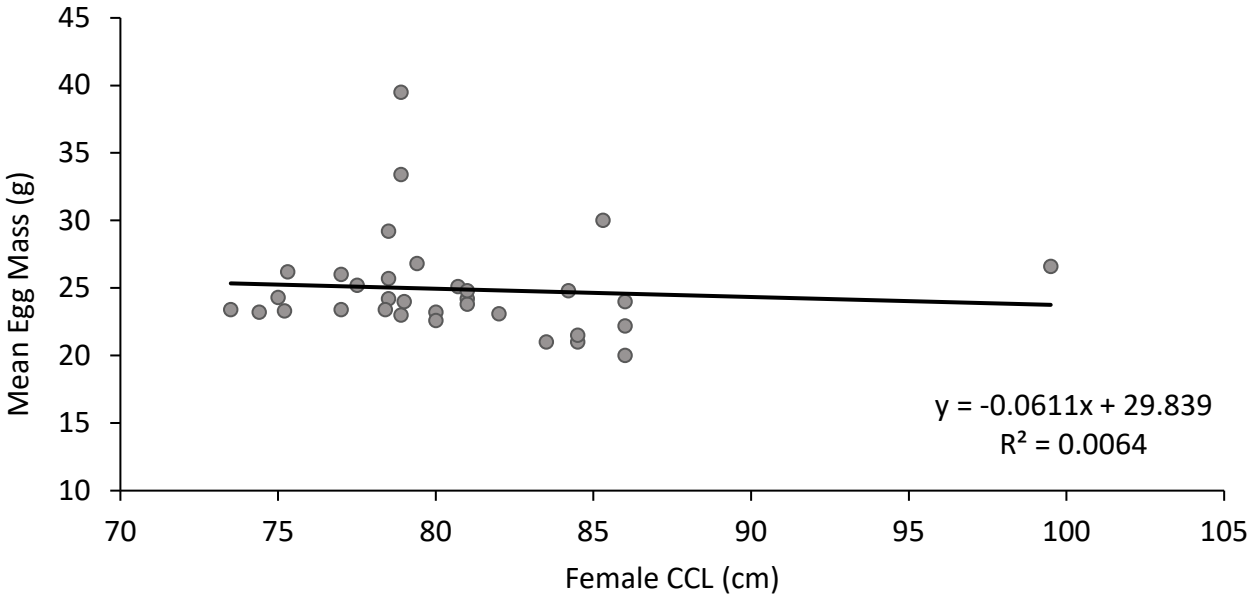

Figure 25. Scatter plot showing the relationship between the female size (CCL) and the average egg mass for hawksbill turtle clutches.

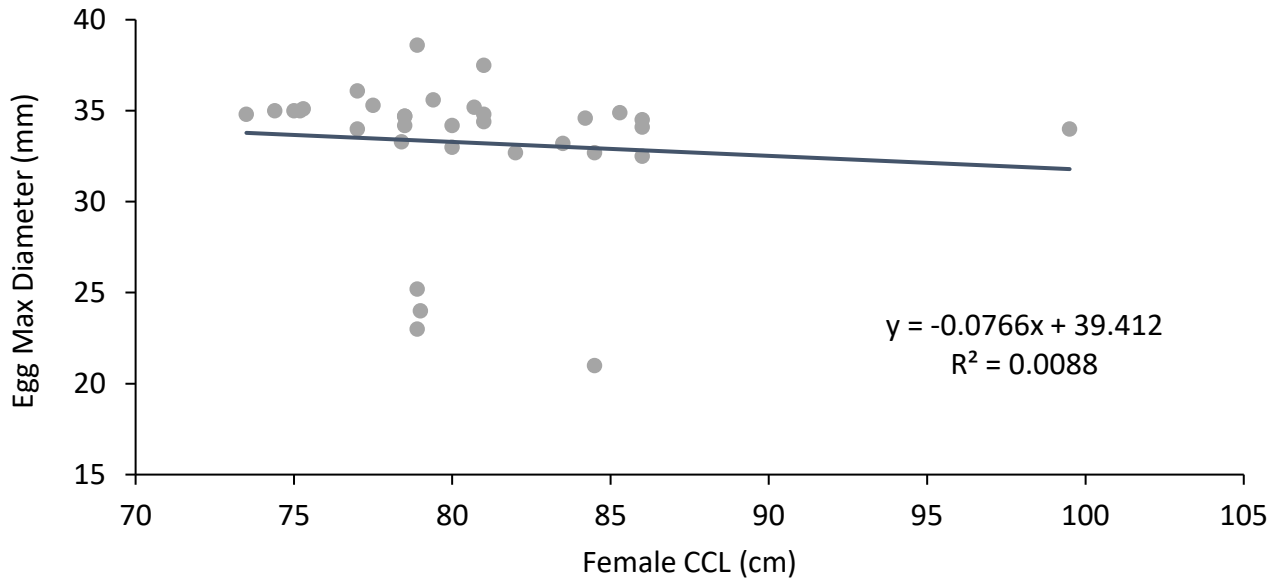

Figure 26. Scatter plot showing the relationship between the female size (CCL) and the average maximum egg diameter for hawksbill turtle clutches.

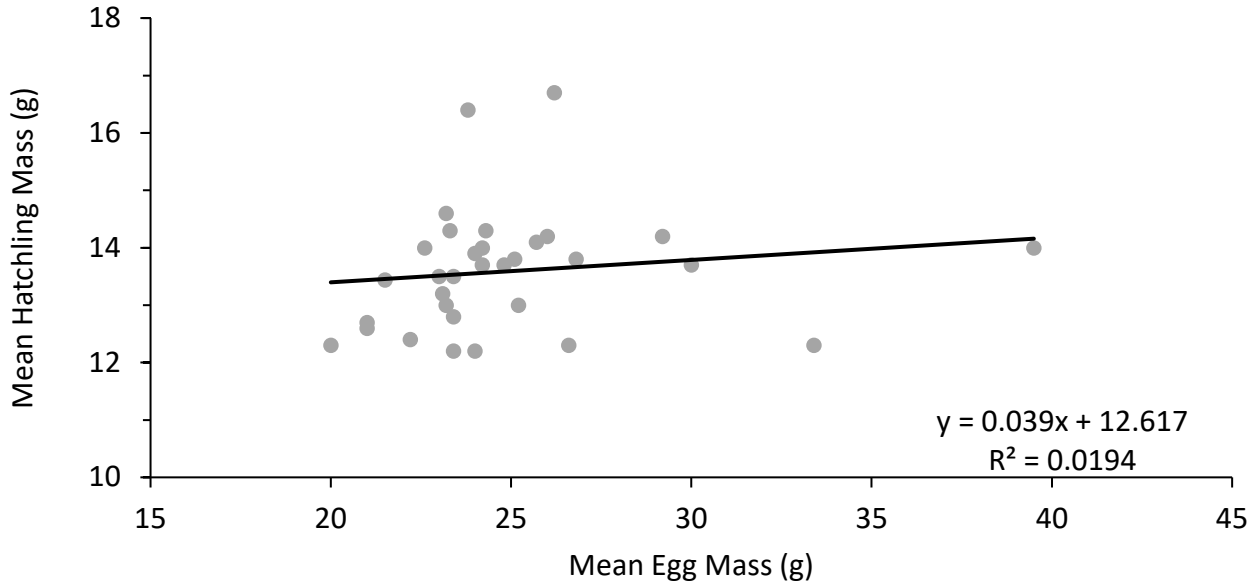

Figure 27: Scatter plot showing the relationship between the mean egg mass and the mean hatchling mass for hawksbill turtles.

5. Natural Nests

Figure 28. Reasons for unsuccessful 'natural nests' (in-situ nests) observed on the islands.

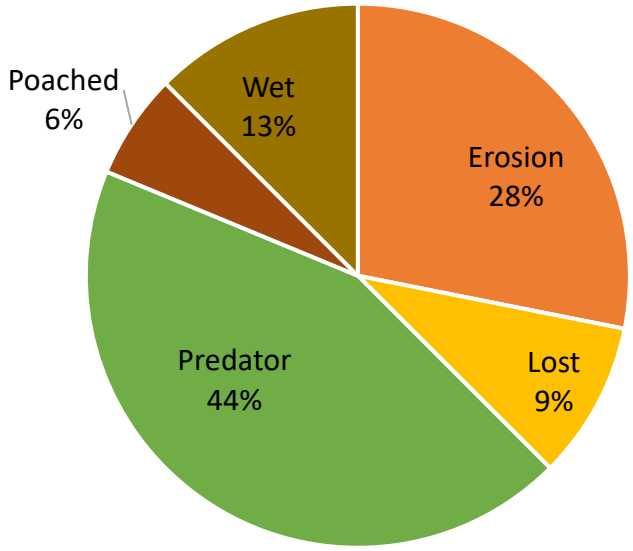

Table 10. Number of natural nests laid successful hatching and lost nests in the 2023 – 2024 season.

Species	Number of Natural Nests	Protection Placed	Successful	Impacted/ Lost	% Lost
Green Turtle	65	50	33	32	49
Hawksbill Turtle	12	11	10	2	16
Total	**77**	**61**	**43**	**34**	**44**

Table 11. Number of natural nests where successful hatchings occurred, and nest excavations were possible as most of these nests had been protected from predators with a mesh nest protector by the Rangers.

Species	Natural Nests found with successful hatching	No. of Eggs	Hatchlings emerged successfully from Natural Nests
Green Turtle	33	3162	2051
Hawksbill Turtle	10	1456	1163
Total	**43**	**4618**	**3214**

Table 12. Average Success of natural nests, most of these nests had been protected from predators with a mesh nest protector.

Species	Hatchling Success (%)	Emergence Success (%)	Sample Size (clutches)
Green Turtle	72	69	33
Hawksbill Turtle	81	79	10
Average	**77**	**73**	**43**

Table 13. Average Success of all natural nests

Species	Hatchling Success (%)	Emergence Success (%)	Sample Size (clutches)
Green Turtle	37	35	65
Hawksbill Turtle	74	72	11
Average	**55**	**53**	**43**

Table 14. Total number of hatchlings released from during the 2023 – 2024 season to date.

Species	Number of Hatchings Released
Green	37218
Hawksbill	5361
Total	**42579**

6. Turtle Poaching

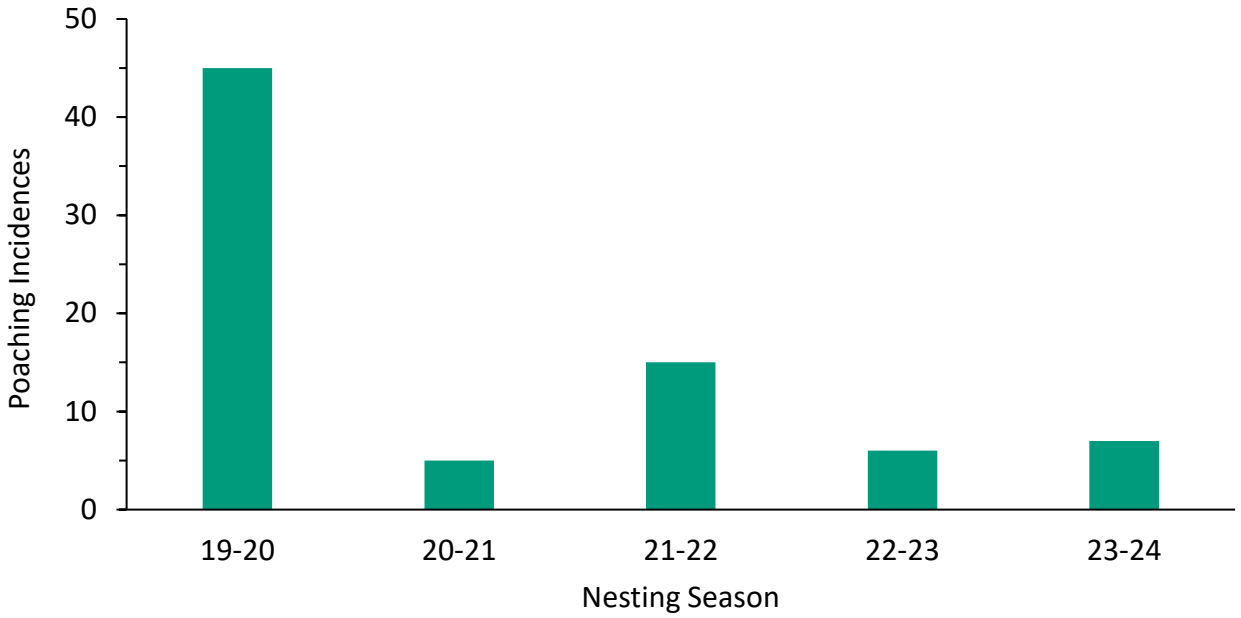

Figure 29. Number of poaching events that occurred within the Conflict Island Atoll over the past 5 nesting seasons or eggs and turtles.

7. Leucistic Hatchlings from Clutches

Table 15. Number of clutches, and hatchlings presenting with Leucistic trait

Species	Tag Number	Number of Leucistic Hatchlings	Clutch Size	Percentage of Clutch (%)
Green	IGS3295	27	103	26
Green	IGS3295	25	86	25
Green	IGS3250	18	91	19
Green	IGS3032	1	-	-
Green	IGS2979	1	-	-
Total	**4 females**	**72**	**-**	**25 (mean)**

Figure 30: Set of random Leucistic hatchlings from various clutches

8. Monitoring Logistics

Table 16. Number of turtles tagged and recorded by each ranger for the 2023 – 2024 Nesting Season.

Ranger	Recorded	Tagged
Badi	40	27
Banian	89	48
Clinton	115	34
Eddie	60	25
Kerryanne	53	9
Martha	2	0
Michael	82	23
Norman	116	41
Patrick	87	30
Rodney	91	27
Roselyn	36	19
Steven	35	20
Toby	82	36

Table 17. Number of tags used in the 2023 – 2024 nesting season and cost.

Species	Tags Applied	Cost
Green Turtle	310	$1860.00
Hawksbill Turtle	58	$348.00
Damaged or lost tags	16	$96.00
Total	**384**	**$2304.00**

Table 18. Number of hours spent training new recruits (n = 12) for 2023 – 2024 Nesting Season.

Position	Training Hours
Marine biologist	360
Project Manager	1390
Head Ranger	1570

9. Marine Debris Surveys

Table 19. Results of Marine Debris and Plastic Removal for 2023 – 2024 Nesting Season

Kilograms of waste removed	477 kgs
Number of pieces of waste removed	8360 pcs
Number of people who participated	53
Number of islands cleaned	15
Hours Spent collecting	49 hrs
Hours Spent Sorting	120 hrs

PROJECT OUTCOMES 2023 – 2024

Nesting Population Surveys

During the survey period from late September 2023 to the end of February 2024, the Conflict Islands Atoll saw a significant number of turtle interactions. A total of 325 individual Green Turtles were observed, consisting of 310 new individuals and 15 re-migrants. Among these, 305 were recaptured within the season, while 60 were one-off captures. Hawksbill Turtles were also surveyed, with 33 individuals observed, including 29 new and 4 re-migrants. Of these, 21 were in-season recaptures and 24 were one-off captures. Overall, the combined total for both species during this period was 358 individual turtles, with 339 new individuals and 19 re-migrants, resulting in 326 in-season recaptures and 84 one-off captures.

Long-term Trends (2017-2024)

Since the inception of the program in 2017, the number of Green Turtles observed has shown bi-annual variability. The 2021-2022 nesting season marked the peak with 655 new individuals. Over the years, the program recorded a total of 1,769 new Green Turtles and 37 re-migrant individuals. Tagging data revealed that 11 turtles were tagged by the Secretariat of the Pacific Regional Environment Programme (SPREP) and 3 by Queensland Government tagging programs (QLD). The total count of observed Green Turtles from 2017 to 2024 stands at 1,820.

For Hawksbill Turtles, the program observed a total of 209 individuals from 2017 to 2024, including 194 new and 7 re-migrants. The highest number of new Hawksbill Turtles, 40 individuals, was recorded in the 2018-2019 season. Tagging efforts identified 6 SPREP-tagged and 2 QLD-tagged individuals over the years.

Combining the data for both species, a total of 2,055 turtles were observed from 2017 to 2024. This includes 1,989 new individuals and 44 re-migrants. The program's tagging efforts resulted in 17 SPREP-tagged and 5 QLD-tagged turtles. The highest combined total for a single season was in 2021-2022, with 706 individuals observed. These results highlight the dynamic nature of turtle populations in the Conflict Islands Atoll and underscore the importance of continued conservation efforts.

Nesting Events

This season had a considerable number of nesting events. Green Turtles had 477 successful nests and 377 failed nesting attempts. In contrast, Hawksbill Turtles had 47 successful nests and 19 failed attempts. Overall, there were 524 successful nests and 396 failed nesting attempts across both species, indicating a relatively high nesting success rate.

Clutches Translocated and Protected

Efforts to protect turtle nests involved translocating a significant number of clutches. For Green Turtles, a total of 416 clutches were translocated, encompassing 43,429 eggs. Hawksbill Turtles saw the translocation of 33 clutches, totalling 4,584 eggs. In total, 449 clutches containing 48,013 eggs were translocated and protected during the season. This proactive measure likely contributed to the high rate of successful nests.

Distribution of Nesting Attempts Across Islands

Nesting attempts were distributed across various islands within the Conflict Islands Atoll. Irai Island had the highest number of nesting events with 376 for Green Turtles and 8 for Hawksbill Turtles, totalling 384 events. Other islands such as Auroroa, Panasesa, and Tabunagoal also saw significant nesting activity, with totals of 98, 78, and 69 events respectively. Smaller islands like Kolavia and Ginara had minimal nesting activity, with only 5 and 7 events respectively. In total, there were 852 nesting events for Green Turtles and 66 for Hawksbill Turtles across the Atoll, making a combined total of 910 nesting events.

Monthly and Species-Specific Nesting Data

Throughout the season, the number of nesting attempts varied by month, reflecting the seasonal nature of turtle nesting

behaviours. Green Turtles and Hawksbill Turtles exhibited distinct nesting patterns, which were closely monitored. The annual peak of nesting occurred in December and January with January being the highest number of events in a single month.

The variation in clutch size was also significant, with Green Turtles generally laying fewer eggs per nest compared to Hawksbill Turtles. Analysis of female curved carapace length (CCL) revealed a relationship with the number of eggs per clutch showed a positive correlation meaning the larger the female for booth hawksbills and Green species the larger the clutch size and number of eggs, providing insights into reproductive strategies and health of the nesting females.

Hatchery Success

During the 2023-2024 season, a significant number of hatchlings were released from translocated nests in the hatchery. For Green Turtles, 413 nests were relocated, containing 39,394 eggs, from which 35,167 hatchlings emerged. Hawksbill Turtles had 33 nests relocated, encompassing 4,511 eggs, resulting in 4,198 hatchlings. In total, 446 nests were relocated, with 43,905 eggs producing 39,365 hatchlings. These numbers reflect a robust hatchery program aimed at increasing the survival rates of turtle hatchlings.

Hatchling and Emergence Success

The hatchling success rate and emergence success rate were high for both species in the hatchery setting. Green Turtles exhibited an 89% success rate for both hatchling and emergence. Hawksbill Turtles had even higher rates, with a 94% hatchling success and 93% emergence success. Overall, the combined success rates for both species were 91.5% for hatchling success and 91% for emergence success, based on a sample size of 446 clutches. This indicates that the relocation, hatchery conditions and management practices were highly effective in ensuring the successful development and emergence of hatchlings then released to the wild populations.

Hatchling and Egg Morphometrics

The relationship between various morphometric parameters of eggs and hatchlings was analysed using scatter plots. For Green Turtles, a scatter plot showed a correlation between female curved carapace length (CCL) and average egg mass, indicating that larger females tend to lay heavier eggs. Another scatter plot revealed a relationship between female size (CCL) and the average maximum egg diameter. Additionally, the mean egg mass was found to be correlated with the mean hatchling mass, suggesting that larger eggs generally produce larger hatchlings.

Similarly, for Hawksbill Turtles, scatter plots indicated a relationship between female CCL and average egg mass, as well as between female CCL and average maximum egg diameter. The mean egg mass and mean hatchling mass were also positively correlated, reflecting similar trends observed in Green Turtles. These morphometric analyses provide valuable insights into the reproductive biology and hatchling development of both turtle species, contributing to the understanding of factors influencing hatchling success. Overall, demonstrating high effectiveness in producing healthy hatchlings from translocated nests, supporting the ongoing conservation efforts in the Conflict Islands Atoll.

Natural Nests

During the 2023-2024 nesting season, the Conflict Islands Atoll saw a mix of successful and unsuccessful natural (in-situ) turtle nests. Green Turtles laid 65 natural nests, with 50 of these nests receiving protection measures. Out of the protected nests, 33 were successful, while 32 were impacted or lost, resulting in a 49% loss rate. In comparison, Hawksbill Turtles laid 12 natural nests, with 11 being protected. Ten of these protected nests were successful, and 2 were lost, corresponding to a 16% loss rate. Overall, there were 77 natural nests with 61 receiving protection, 43 resulting in successful hatching, and 34 impacted or lost.

Successful Hatchings and Egg Data

Detailed monitoring of the successful natural nests provided insights into hatchling emergence. For Green Turtles, 33 natural nests resulted in successful hatchings, involving a total of 3,162 eggs, from which 2,051 hatchlings emerged

successfully. Hawksbill Turtles had 10 successful natural nests, with 1,456 eggs producing 1,163 hatchlings. Combined, the total number of eggs from successful natural nests was 4,618, leading to the emergence of 3,214 hatchlings. The use of mesh nest protectors by Rangers played a crucial role in safeguarding these nests from predators.

Success Rates of Protected Natural Nests

The average success rates of protected natural nests were notably high. For Green Turtles, the hatchling success rate was 72%, with an emergence success rate of 69%, based on 33 clutches. Hawksbill Turtles had higher success rates, with an 81% hatchling success and a 79% emergence success, based on 10 clutches. Overall, the combined average success rates for protected natural nests were 77% for hatchling success and 73% for emergence success, reflecting the effectiveness of protection measures.

Overall Success Rates of Natural Nests

When considering all natural nests, the success rates varied significantly. Green Turtles had a hatchling success rate of 37% and an emergence success rate of 35% across 65 clutches. Hawksbill Turtles exhibited higher success rates, with a 74% hatchling success and a 72% emergence success across 11 clutches. The combined average success rates for all natural nests were 55% for hatchling success and 53% for emergence success. These figures underscore the importance of protective measures, as protected nests showed markedly higher success rates compared to unprotected ones.

Challenges and Reasons for Unsuccessful Nests

Several factors contributed to the unsuccessful natural nests observed on the islands. Key challenges included predation, environmental conditions, and human disturbances. Understanding these factors is essential for enhancing the protection and management strategies for natural turtle nests. The natural nests in the Conflict Islands Atoll during the 2023-2024 season demonstrated variable success rates, heavily influenced by the presence of protective measures. The data highlights the critical role of nest protection in improving hatchling emergence and overall nest success.

Poaching Events

Over the past five nesting seasons, including 2023-2024, poaching has had a detrimental impact on turtle conservation within the Conflict Islands Atoll. The data on poaching events, involving both eggs and turtles, highlights the ongoing challenge of protecting these endangered species from illegal harvesting. The analysis of poaching trends reveals a positive pattern and change. Each season, poaching incidents have been recorded but are decreasing in frequency.

Efforts to combat poaching have been an integral part of the conservation strategy. Measures such as increased patrolling, community awareness programs, and the implementation of community endorsed regulations have been put in place. However, despite these efforts, poaching continues to pose a significant risk to the turtle nests and the overall success of the conservation initiatives.

The data on poaching events over the past five nesting seasons indicates a critical need for continued and enhanced conservation efforts. Addressing poaching requires a multifaceted approach, involving enforcement, community engagement, and ongoing monitoring. By strengthening these efforts, the goal is to reduce poaching incidents and ensure the protection and recovery of turtle populations in the Conflict Islands Atoll.

Leucistic Hatchling Turtle Results

During the 2023-2024 turtle nesting season in the Conflict Islands Atoll, a notable observation was made regarding the occurrence of leucistic hatchlings among Green Turtle clutches. Leucism is a rare genetic condition that results in reduced pigmentation, manifesting in turtle hatchlings as lighter or white coloration. This season, four female Green Turtles produced a significant number of leucistic hatchlings.

The first turtle, tagged IGS3295, had two clutches with a high percentage of leucistic hatchlings. The first clutch produced 27 leucistic hatchlings out of 103 total hatchlings, constituting 26% of the clutch. The second clutch from this turtle had 25 leucistic hatchlings out of 86, making up 25% of the clutch. Another turtle, tagged IGS3250, had 18 leucistic hatchlings

out of 91, which accounted for 19% of the clutch. Additionally, two other turtles, tagged IGS3032 and IGS2979, each had one leucistic hatchling, though the total clutch sizes for these were not recorded.

In total, these four female Green Turtles produced 72 leucistic hatchlings out of 280 hatchlings, resulting in an average percentage of 25% leucistic hatchlings per clutch. This relatively high occurrence of leucism within the observed population is noteworthy.

The presence of leucistic hatchlings is significant for several reasons. While leucism itself does not necessarily impact the health of the hatchlings, it can affect their camouflage and, consequently, their survival rates. Hatchlings with reduced pigmentation may be more visible to predators, potentially lowering their chances of reaching adulthood. Therefore, monitoring and studying these hatchlings is crucial to understand the genetic diversity and potential impacts on turtle populations in the Conflict Islands Atoll.

In conclusion, the 2023-2024 nesting season has revealed a substantial proportion of leucistic hatchlings among the Green Turtle population. This finding highlights the need for further research and monitoring to understand the implications of this genetic trait on the conservation efforts and overall survival of these turtles.

Marine Debris

During the 2023-2024 nesting season, significant efforts were made to address marine debris in the Conflict Islands Atoll. A total of 477 kilograms of waste, comprising 8,360 pieces, was removed from 15 islands. This extensive cleanup involved 53 participants who collectively spent 49 hours collecting and 120 hours sorting the debris. These efforts are crucial in maintaining healthy nesting habitats and reducing the impact of plastic and other waste on marine life, highlighting the importance of ongoing community involvement and environmental stewardship.

Season Conclusion

The 2023-2024 turtle nesting season in the Conflict Islands Atoll has been a pivotal period for both Green and Hawksbill

Turtle conservation efforts. The comprehensive data collected highlights the successes and challenges faced in various aspects of turtle conservation, from nesting and hatchery success to the impacts of natural nests and the persistent threat of poaching. A remarkable total of 42,579 hatchlings were released during the 2023-2024 season, with 37,218 Green Turtle hatchlings and 5,361 Hawksbill Turtle hatchlings. This achievement highlights the effectiveness of the conservation programs in place and underscores the potential for continued success in future seasons.

The 2023-2024 nesting season has demonstrated both the strengths and areas for improvement in the Conflict Islands Atoll turtle conservation efforts. The high number of hatchlings released is a testament to the dedication and effectiveness of the conservation strategies employed. Moving forward, addressing the challenges of poaching and ensuring the protection of natural nests will be crucial in maintaining and enhancing these successes. The continued commitment to these efforts promises a brighter future for the Green and Hawksbill Turtle populations in the Conflict Islands Atoll.

RECOMMENDATIONS FOR THE 2024 – 2025 SEASON

Enhanced Anti-Poaching Measures

- **Increase Patrolling**: Expand and intensify patrolling efforts across the Conflict Islands Atoll to deter poachers and protect nesting sites. Collaborate with local communities and authorities to improve surveillance and response.
- **Community Engagement**: Strengthen community outreach programs to raise awareness about the impacts of poaching and encourage local involvement in conservation efforts. Provide education and incentives for communities to support anti-poaching initiatives.

Strengthen Nest Protection

- **Expand Nest Protection**: Increase the number of nests protected with mesh nest protectors to reduce predation and environmental threats. Prioritize nests on islands with higher predation rates and where past protection efforts have proven effective.
- **Improve Nest Translocation**: Continue and optimize the practice of translocating nests to hatcheries. Ensure that the criteria for nest relocation are rigorously followed and that the conditions in the hatchery remain optimal for hatchling development.

Monitor and Enhance Hatchery Success

- **Optimize Hatchery Conditions**: Regularly review and adjust hatchery conditions to ensure they support the highest possible hatchling success rates. Implement best practices for temperature control, humidity, and nest management.
- **Expand Hatchery Capacity**: If feasible, increase hatchery capacity to accommodate a higher number of relocated nests, ensuring that resources are adequate to handle the volume of eggs and hatchlings.

Increase Data Collection and Analysis

- **Enhance Data Monitoring**: Implement more comprehensive data collection on nesting patterns, hatchling success rates, and poaching incidents. Utilize this data to identify trends and make informed decisions about conservation strategies.
- **Conduct Research**: Support research initiatives that investigate factors affecting nesting success, hatchling survival, and the impacts of environmental changes on turtle populations. Use research findings to refine conservation practices.

Address Environmental and Climate Impacts

- **Monitor Climate Effects**: Track and assess the impact of climate change on nesting sites and hatchling survival. Develop adaptive strategies to mitigate the effects of rising temperatures, sea-level rise, and other climate-related challenges.
- **Enhance Habitat Restoration**: Continue and expand efforts to restore and protect critical nesting habitats. Engage in habitat management practices that address erosion, pollution, and other environmental threats.

Strengthen Collaboration and Partnerships

- **Build Partnerships**: Strengthen partnerships with local and international conservation organizations, research institutions, and government agencies. Collaborate on joint initiatives, share resources, and leverage expertise to enhance conservation outcomes.
- **Foster Local Involvement**: Engage local communities in conservation activities, including monitoring, education, and habitat management. Provide training and resources to local stakeholders to support their involvement in turtle conservation.

Increase Public Awareness and Advocacy

- **Launch Awareness Campaigns**: Develop and implement public awareness campaigns to highlight the importance of turtle conservation and the challenges faced by turtle populations. Use social media, community events, and educational programs to reach a broader audience.
- **Promote Advocacy**: Advocate for stronger conservation policies and regulations at the local, national, and international levels. Work with policymakers and stakeholders to promote legislative changes that benefit turtle conservation efforts.

By implementing these recommendations, the Conflict Islands Atoll can build on the successes of the 2023-2024 season and address the ongoing challenges to ensure a positive outcome for the 2024-2025 turtle nesting season. These efforts will contribute to the long-term sustainability and recovery of Green and Hawksbill Turtle populations in the Atoll.

ACKNOWLEDGEMENTS

On behalf of the management Hayley Versace and Edward Cardwell, we would like to express our sincere gratitude, to you the communities of the Deboyne and Engineer Groups for your co-operation and fulfilment of the restrictions of island stays during the 2023 – 2024 Turtle Nesting Season at the Conflict Islands and no-take of turtles as we work

together now and into the future to protect your turtle populations for generations to come.

We would also like to express a sincere gratitude to the hard work of our Conversation Rangers who work tirelessly, almost seven days a week for 7 months of the year nonstop to protect the turtles, collect this valuable data and promote a positive conservation message to their communities. Thank you, Steven Amos, Patrick Lemeki, Toby Losane, Henry John, Banian Leonard, Clinton Luke, Badi Seko, Roselyn Elijah, Martha Eimba, Michael Moten, Rodney Taliya and Norman Poate.

We would like to acknowledge the rest of the staff from the Coral Islands Limited, who work to support the Conservation Rangers and help the islands running so we can achieve the conservation work. Thank you for stepping in driving dinghies, doing the maintenance and caretaking of the island's infrastructure.

We would also like to acknowledge and thank all those who privately contributed to the program with financial and in-kind donations. This season would not have been possible without your help.

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PROJECT IMAGES----

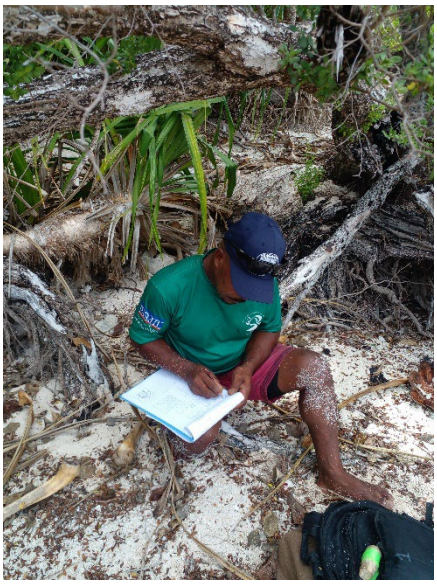

Image 1: Conservation Ranger Toby recording data.

Image 2: Project Manager Ranger Steven collecting green turtle eggs to relocate to hatchery

Image 3: Green turtle with new IGS flipper tag

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