

## BERMUDA TURTLE PROJECT

Annual Report for 2022

Dan Evans, Jennifer Gray, Rick Herren, Anne Meylan, Peter Meylan, and Gaëlle Roth



The Bermuda Turtle Project (BTP) is committed to the goal of promoting the conservation of marine turtles in Bermuda through research and education. BTP is a joint project of the Bermuda Zoological Society (BZS) and the Sea Turtle Conservancy (STC). Project activities during 2022 included field and laboratory research, and outreach via the media and the Bermuda Turtle Project website. The BTP was able to conduct its annual sampling and health assessment of the Bermuda green turtle aggregation in August 2022.



The annual sampling of the Bermuda green turtle aggregation was carried out for 10 days, August 8–19, 2022, with the entrapment net. The team consisted of Dr. Dan Evans, Rick Herren, Jennifer Gray, Dr. Gaëlle Roth, and Barbara Outerbridge. The BZS research vessel, *RV Endurance*, served as the main vessel and was captained by Nigel Pollard. Niall Waring was the first mate. The catch boat, *Chevron*, was captained by Jennifer Gray, with Emily Andrew as first mate. Snorkeling assistance was provided by volunteer Ruskin Cave and 9 students participating in the BTP In-Water Course.

During the August sampling, a total of 53 green turtles were captured during 21 sets of the net at 17 sites around the island. Animals ranged in size from 24.2 to 54.2 cm SCL (see sampling log below). Compared to 2021, when 46 turtles were caught in 22 sets at 17 sites, the total number of turtles caught was similar. All turtles captured in the entrapment net in 2022 were judged to be immature based on previously established shell and tail size criteria. They were tagged, biometric data and blood or tissue samples were collected, and the turtles were released at or near their capture site. Blood samples or skin biopsies were obtained for genetic analysis to study nesting beach origins of Bermuda green turtles, for hormone analyses to establish sex, and for stable isotope analysis.

As part of a health assessment, the research team measured blood values in a sample of 30 captured



*Sebastian Lee and Laura Gurrieri signaling they captured a turtle.*



*Dr. Gaëlle Roth analyzing blood sample in the lab.*

green turtles in August 2022, in order to establish a baseline and detect any changes in the Bermuda green turtle aggregation, including those potentially due to the continued loss of seagrass. Captured turtles were brought on board for a standard work up and small amounts of their blood and plasma were passed through handheld and desktop blood analyzers to document standard blood compounds and blood gas values. Results were generally within the expected ranges for green turtles. We manually measured the percentage of red blood cells in the whole blood (manual hematocrit) as well as the total protein in the plasma.

Most turtles had a manual hematocrit and total protein that were within the expected range for juvenile green turtles. Lactate was measured for the first time this year and values varied widely among the green turtles. A large portion had increased lactate values, but this could be due to a change in metabolism post-capture. The morphometrics measured on each turtle were used to calculate the body condition index per turtle. No turtles captured in 2022 exhibited signs of the disease fibropapillomatosis.

BTP researchers flushed the esophagus of captured green turtles during the 2022 sampling session. This is one of the most common ways to determine sea turtle diet and recently ingested items. BTP implemented it this year to determine the primary food source in the wake of widespread loss of turtle grass (*Thalassia testudinum*). The procedure uses a veterinary stomach tube and double-action pump to flush the contents of the mouth and esophagus with fresh sea water. We successfully collected the esophageal contents of 29 green turtles. While these samples will undergo a detailed lab analysis, a preliminary examination revealed that almost all of them contained a mix of manatee grass (*Syringodium filiforme*) and shoal grass (*Halodule wrightii*). Not surprisingly, this type of seagrass is common in inshore bays and wind-protected areas and this is where we captured the majority of green turtles in 2022.

### Sampling Log for Annual Bermuda Turtle Project 2022

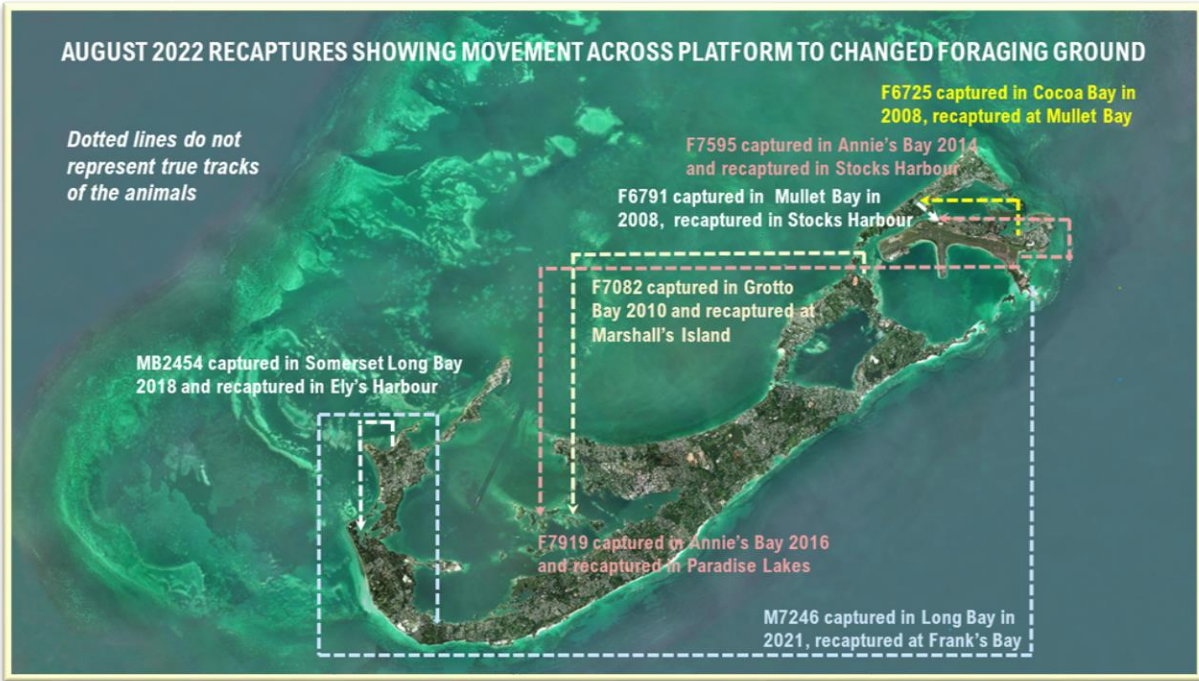
Date	Location	Set No.	Latitude	Longitude	Bottom Temp (° C)	No. of Turtles	Depth (ft.)
8/8/2022	Bailey's Bay	1	32.36777	-64.66287	29.5	1	6.0
8/8/2022	Stock's Harbour	2	32.37035	-64.68953	30.0	13	3.0
8/9/2022	North Rock	1	32.47295	-64.75065	29.0	0	18.5
8/9/2022	North Rock	Snorkel	32.47460	-64.77023	28.0	0	9.6
8/9/2022	North Rock	Snorkel	32.47339	-64.75129		0	
8/10/2022	Vixen	1	32.30749	-64.88684	30.0	0	10.1
8/10/2022	Cowground	2	32.31506	-64.86893	30.0	0	6.7
8/10/2022	Rockfish Shoals	3	32.32825	-64.88616	30.0	0	7.9
8/10/2022	Crescent East	4	32.38795	-64.82783	30.0	0	14.7
8/11/2022	Marshall Island N	1	32.28491	-64.81023	30.5	8	10.0
8/11/2022	Marshall Island S	2	32.28411	-64.81152	32.0	0	4.9
8/12/2022	Ely's Harbour	1	32.28584	-64.87852	30.0	0	4.8
8/12/2022	Ely's Harbour	2	32.28526	-64.87539	30.0	1	7.1
8/12/2022	Ely's Harbour	3	32.28016	-64.88196	30.0	2	7.9
8/15/2022	Mullet Bay	1	32.37499	-64.69040	30.0	9	11.3
8/16/2022	Paradise Lakes	1	32.28509	-64.82064	29.0	6	10.7
8/16/2022	Paradise Lakes	2	32.28466	-64.82144	29.5	2	13.3
8/17/2022	Dolly's Bay West	1	32.36605	-64.66434	29.0	1	10.5
8/17/2022	Fort St Catherine	2	32.38618	-64.66925	30.0	0	13.3
8/18/2022	Riddell's Bay	1	32.26357	-64.83099	29.5	2	5.6
8/18/2022	Frank's Bay	2	32.25430	-64.85594	30.5	7	12.6
8/19/2022	Walsingham Bay	1	32.34472	-64.70731	30.0	0	5.1
8/19/2022	Grotto Bay	2	32.35395	-64.70979	30.0	1	7.4

Total # of captures for 2022      53

Total # of Captures since 1992   5,238



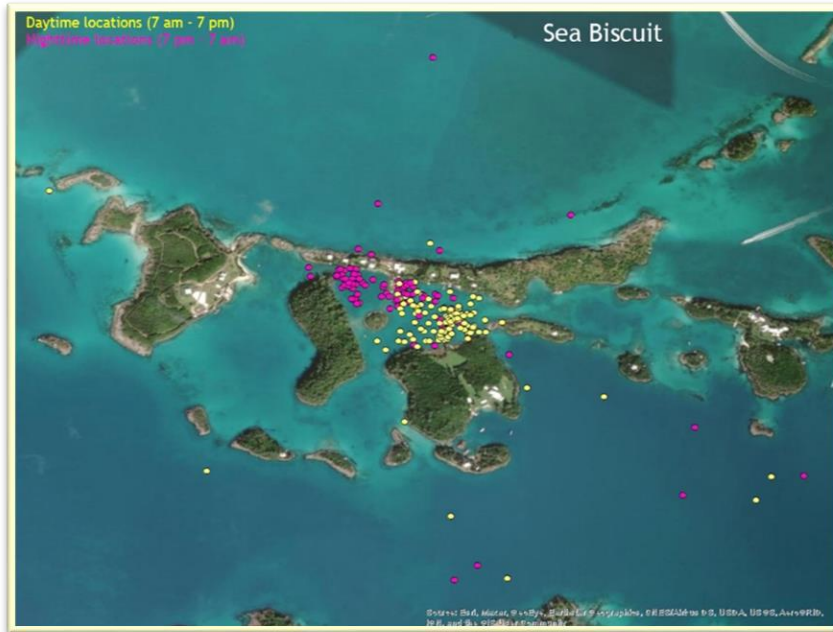
Of the 53 green turtle net captures made in August, 12 (23%) were recaptures of previously tagged animals. This compares with 22% in 2021, 34% in 2019 and 37% in 2018. While similar to 2021, the recapture rate is lower than years before the dramatic decline in captures and may suggest a higher mortality, greater mobility of turtles between sites, and/or earlier emigration off of the Bermuda Platform.



Five recaptures were made at the same site where the turtle was last captured. The seven others had moved to an alternate foraging area. Our work has shown two periods of reduced site fidelity, including one that started around 2010 and continues currently. The recent occurrence of lower site fidelity suggests that as seagrass has disappeared, green turtles are moving more often in search of food.

Two satellite transmitters were deployed during 2022. The first was deployed on a green turtle captured with the net at Stock's Harbour on 8 August 2022. The transmitter (PTT 232794) was attached to a 54.4 cm SCL turtle nicknamed "Lizzy". Since satellite attachment in August, this individual spent the majority of time moving around in Stock's Harbour, Bermuda. This transmitter is still sending signals as of January 31, 2023.





The second transmitter was deployed on a green turtle captured with the net at Paradise Lakes on 16 August, 2022. The transmitter (PTT 232795) was attached to a 52.4 cm SCL turtle nicknamed “Sea Biscuit”. Since satellite attachment in August, this individual spent its time moving among the islands of Paradise Lakes, Bermuda. This transmitter is still sending signals as of January 31, 2023.

During 2022, genetics classes at Eckerd College analyzed Bermuda sea turtle genetics samples during both spring and fall semester. Students attempted to generate long control region sequences for 60 turtles, 27 hawksbills and 33 green turtles. They were able to generate complete sequences for 21 hawksbills and 25 of the green turtles. The hawksbill sequences were assigned to 10 different haplotypes, four of which are apparently previously unknown. The 25 green turtle samples represent seven different haplotypes, plus one that appears to be new.

Analyses of sex ratios of the Bermuda green turtle foraging aggregation over time continued with help from Jeff Schwenter, South Carolina Department of Natural Resources, Dr. David Owens, emeritus faculty of the College of Charleston, and Dr. Brett Tornwall, a statistician formerly with the Florida Fish and Wildlife Conservation Commission. A manuscript describing results of sex ratio analyses from 1990 to 2018 was submitted for publication in December 2022 and is currently under review. A manuscript summarizing results of satellite telemetry work with Bermuda green turtles conducted from 2011-2018 was completed in late 2022 and will be submitted for publication in early 2023. Collaborations continued in 2022 on green turtle diet with Dr. Karen Bjorndal and Alexandra Gulick, UF, and with Dr. Larisa Avens, NOAA, on age and growth of Bermuda green turtles.

Nine international tag returns of green turtles originally tagged in Bermuda were received during 2022. Five turtles were recaptured in Nicaragua, three in Cuba, and one in Venezuela. Most of the turtles were recaptured by fishermen and we can infer that the turtles were presumably killed. Four of the turtles captured in Nicaragua had been tagged in Bermuda in the 1990s. Most of the tag returns received in 2022 lacked specific details about the recapture circumstances (date, capture method, turtle size, etc.). Some tags had been retained by the fishermen for several years due to COVID 19. Despite the paucity of recapture details, the tag returns help identify the countries that are visited by Bermuda turtles after they depart from the Bermuda Platform, and in some cases, the fates. The coordination of tag returns is handled by the Archie Carr Center for Sea Turtle Research at the University of Florida.

In support of our collaboration with Thomas Frankovich (Institute of Water and Environment, Florida International University) to identify diatoms in images of skin and carapace smears from green turtles, we collected epibiont films from the carapace and skin of green turtles.

BTP continues to work closely with the Bermuda Aquarium Museum and Zoo Wildlife Rehabilitation Centre (WRC) providing support, equipment, and tags, and helping with response to the Sea Turtle Stranding Hotline and strandings. A total of 16 sea turtles were brought to the WRC in 2022 (compared to 48 sea turtles in 2021). Fifteen were green turtles and 1 was a small loggerhead turtle. The loggerhead turtle was dead on arrival. Eleven green turtles were brought in dead, 4 green turtles were brought in alive but 2 died during rehabilitation due to their severely debilitated state. One green turtle was euthanized due to a severe laceration. One green turtle was released. No hawksbill turtles were brought in. This is a significant contrast compared to previous years, when strandings reached a maximum of 114 turtles in 2020. With a smaller turtle aggregation in Bermuda, we expect the percentage of strandings to decrease.

Necropsies are used to observe abnormalities and to attempt to determine the cause of death of stranded turtles. During 2022, a total of 11 green turtles were necropsied, 36% were female and 64% were male, and 82% had macroscopically visible parasites. Three had been tagged by BTP in Bermuda. Samples collected during necropsies performed by Dr. Gaëlle Roth throughout the year are being used by collaborators for multiple purposes, including genetic identification, diet and feeding biology, determination of age-at-recruitment and identification of threats to sea turtles in Bermuda.

We have made substantial progress on the publication of manuscripts involving the work of BTP. A paper describing changes in the green turtle aggregation over 50 years was published in *Marine Biology* in May 2022. The paper, by Peter Meylan, Robert Hardy, Jennifer Gray and Anne Meylan, is titled: “A half-century of demographic changes in a green turtle (*Chelonia mydas*) foraging aggregation during an era of seagrass decline” (<https://link.springer.com/article/10.1007/s00227-022-04056-5>).

The publication shows that the role of Bermuda in the life cycle of green turtles in the Atlantic has changed significantly and also provides evidence that the loss of seagrasses in Bermuda is not due to sea turtles alone, but rather to “synergistic stressors”. Jennifer Gray, Peter Meylan and Anne Meylan prepared a chapter on the sea turtles of Bermuda for the Regional Report of the IUCN Marine Turtle Specialists Group.



*Ines Morao and Joshel Wilson collecting skin and carapace samples.*



The Bermuda Turtle Project offered its 25<sup>th</sup> In-Water Course on the Biology and Conservation of Sea Turtles to international and Bermudian students from 8-19 August 2022. The course is offered each year by the Bermuda Zoological Society and the Sea Turtle Conservancy and is provided free-of-charge thanks to donor support. The two-week course consists of lectures, class discussions of assigned readings, a necropsy session, and ten days of field work aboard the *RV Endurance*.



*Student studies on board RV Endurance.*

The students learned to capture immature green turtles using the entrapment net. They also gained extensive practical experience in collecting data from the turtles once they were captured and brought on board the research vessel. The course was taught by Dr. Dan Evans and Rick Herren from STC, and Jennifer Gray and Dr. Gaelle Roth from Bermuda. This year students came from Anguilla, Antigua, Aruba, Bahamas/UK, Bermuda, Grenada, Portugal and USA.

During the necropsy session, students conducted necropsies of 11 green turtles that had been collected by the Bermuda Sea Turtle Stranding and Salvage Network (BAMZ). Veterinarian, Dr. Gaëlle Roth, performed a detailed demonstration necropsy at the beginning of the session, and then assisted students as they conducted necropsies themselves. In addition to providing an opportunity to learn basic anatomy of sea turtles and an introduction to necropsy techniques, this session enables participants to learn first-hand about some of the mortality factors for sea turtles, such as entanglement in monofilament line, ingestion of hooks used in various fisheries, disease, malnutrition and watercraft collisions.

Environmental education goals of the project were furthered by several presentations in 2022. In February The Bermuda College and the Bermuda Environmental Sustainable Taskforce (BEST) hosted a public presentation where Jennifer Gray shared insights into the changes in local sea turtle aggregations over time and touched on the impacts of human behaviour and the interaction between sea turtles and habitats.

In July Peter Meylan presented “A Half-Century of Demographic Changes in Bermuda’s Green Turtle Foraging Aggregation During an Era of Seagrass Decline” at the Bermuda Zoological Society AGM.

In May, BTP collaborator, Dr Alexandra Gulick gave a virtual lecture for the Bermuda Zoological Society titled AN Underwater Serengeti: Green Turtle Grazing dynamics in Caribbean Seagrass Ecosystems”

Environmental education happens spontaneously when BTP is conducting field work and interacting with members of the community. During the course, Gaelle Roth gave an online presentation “The Health Assessment of Juvenile Green Turtles in Bermuda” to the students, BZS members and WIDECAST members.



As a part of the genetics work done by Eckerd students, Peter Meylan gave a lecture to the genetics classes that highlights BTP and how its work and conservation genetics elucidate the role of Bermuda in the green turtle life cycle.

In October, Gaelle Roth gave a presentation at the Explorer's club in NYC, organized by the Atlantic Conservation Partnership, focusing on the conservation efforts of BTP and the recent changes that have been seen in the local aggregation. A news article was published in the Royal Gazette following this presentation. Later in October, Gaelle discussed BTP and the declining sea turtle aggregation on two live talk shows which aired on Bermuda radio stations.

Students participating in the annual course assisted the team in collecting valuable data and our work would not be possible without their involvement. In 2022, students (9) volunteered about 783 hours over 2 weeks, this includes the safety briefing, the sampling, the necropsy session and the online presentation.

Special thanks are offered to our volunteers and host families who provided accommodations and transportation to international participants.

Information about the Bermuda Turtle Project is available at <https://bermudaturtleproject.org> which is maintained by the Sea Turtle Conservancy. For 2022, the BTP website received nearly 2,014 unique visitors who accounted for over 4,900 page views. In addition, there were over 9,500 page visits of Bermuda satellite-tracked turtles in 2022. BTP continues to increase its social media presence through Facebook at <https://www.facebook.com/Bermudaseaturtles/>.

The work of the Bermuda Turtle Project in 2022 was made possible by generous support from the Atlantic Conservation Partnership, the Bermuda Zoological Society, the Helen Clay Frick Foundation, and the Sea Turtle Conservancy; in-kind support was received from Eckerd College and the Florida Fish and Wildlife Conservation Commission.



*BTP 2022  
team*