BANYAN TREE MALDIVIAN SEA TURTLE CONSERVATION PROJECT

END OF PROJECT REPORT

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SUMMARY

IThis project incorporated awareness, nest protection, headstarting and research to support green sea turtle conservation in the Maldives

The project started in **2001** and ran until **2016**

Released **246** tagged turtles

First satellite tracked turtles in the Maldives in **2002**

The longest operational turtle headstart programme in the Maldives

Protected **48** nests and released **2460** hatchlings

Increased survival rate in the first 2 years by **23,800%**

Released turtles averaged:

15.3 months
Old

30.2 cm
Curved Carapace Length

4.47 kg
Weight

INTRODUCTION

Marine turtle populations are threatened with extinction globally, having been heavily exploited by man-kind throughout the ages.

Six of the seven species of marine turtles are currently listed as vulnerable, endangered or critically endangered on the IUCN Red List of Threatened Species.

Turtles have been of great importance to residents of the Indian Ocean, nutritionally, economically and culturally for hundreds of years. Turtles provided sustenance for fishermen and villagers and the turtle products such as the meat, eggs and fat were used to feed families. However villages quickly became aware of the economic value associated with the by-products of turtles. The export market grew to a point where the turtle populations were becoming threatened.

Contemporary sea turtle populations are highly threatened by anthropogenic activities of marine (unsustainable extraction, fishing gear mortality, marine debris) and terrestrial origin (loss of nesting habitat, beach armouring, artificial lighting, egg harvesting). Within the Maldives, commercial fishing nets discarded by fishermen within the Indian Ocean become ‘Ghost Nets’ and are prominently responsible for entangling and trapping turtles.

Reported global declines in marine turtles led to the creation of new laws, legislation and turtle conservation programmes around the world. In a bid to sustain turtle populations, the Maldivian Ministry of Fisheries and Agriculture banned the catching or killing of marine turtle species in 1995, including import and sale of turtles and their products.

There is now a country-wide ban on keeping sea turtles and eggs without the correct permit from the Environmental Protection Agency (EPA).

WHAT IS BEING DONE TO PROTECT MARINE SEA TURTLES?

Sea turtle conservation programmes range in their approaches. One popular tactic known as headstarting, involves the captive rearing of hatchlings to help them avoid high mortality normally experienced by turtles at the start of their lives.

Headstart programmes have been used as a conservation and management tool with the goal of producing turtles of equivalent or superior biological fitness that join the wild population, returning to beaches to nest producing viable offspring.

Programmes like this have been employed by conservationists to increase survivorship of juvenile turtles for over 50 years.

Headstart programmes have been controversial in the past, and the programmes should always complement other conservation efforts, and the success may take decades to detect in adult populations in areas where by-catch is low, such as the western Indian Ocean.

TURTLE CONSERVATION PROGRAMME

Banyan Tree Vabbinfaru Marine Lab established a Marine Turtle Conservation Programme in 2001 which ran until 2016 operated at Banyan Tree Vabbinfaru (North Male' Atoll). The educational aspect of the project included Angsana Ihuru (North Male' Atoll), Angsana Velavaru (Dhaalu Atoll), multiple local communities and school groups.

PROJECT AIMS :

1) Safeguard nests and increase understanding of the importance of the Maldives to Indian Ocean green sea turtles by contributing to national databases;

2) Increase natural survival and growth of hatchling turtles through a headstart programme to benefit adult populations;

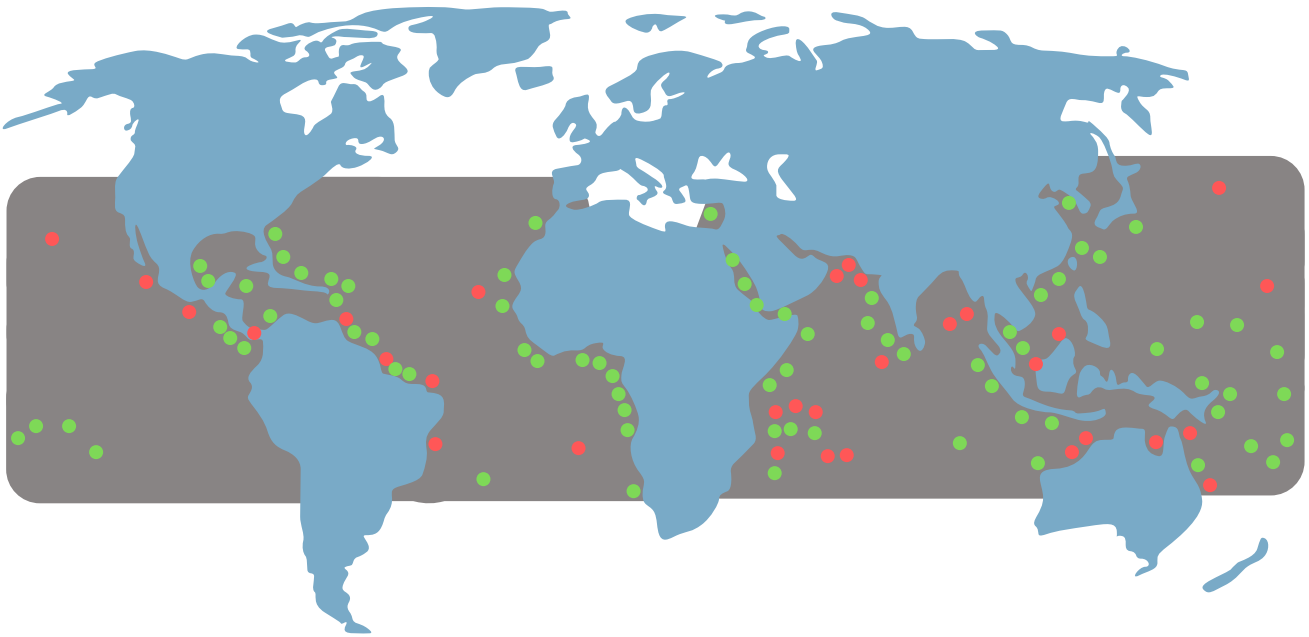
3) Raise awareness of the need to protect the species through local and regional education and awareness programmes.

GREEN SEA TURTLES

The green turtle ***(Chelonia mydas)***, has been classified as an endangered species on the IUCN Red List since 1986 and their slow growth and late maturity make them particularly susceptible to chronic disturbance and over-exploitation.

Green turtles are distributed throughout the tropics and sub-tropics. They primarily utilise the Maldives and other sites in the central Indian Ocean as breeding areas and nesting grounds, making long distance migrations to foraging grounds in the Seychelles and western Africa.

Survival to adults may be as low as 2.5 per thousand hatchlings, thus headstart programmes have the potential to help increase survival of juveniles, increasing adult populations.



BANYAN TREE MARINE TURTLE OPERATIONS

PROTECTION
of green sea turtles from mortality during early life stages.

CONSERVATION
of an endangered species helping to increase survival of juveniles

EDUCATION
and awareness for local communities, associates and guests.

RESEARCH
collected valuable data on the biology and movement of sea turtles.

NEST SAFEGUARDING

AIM:

Safeguard nests and increase understanding of the importance of the Maldives to Indian Ocean green sea turtles by contributing to national databases;

The nesting phase of sea turtles is crucial to their survival. Eggs are influenced by environmental conditions such as temperature. During this phase of their lives the eggs and small turtles are also extremely vulnerable to predation from crows and ghost crabs in the Maldives.

An important part of the conservation project was to safeguard nests laid by any turtle on the beaches at Angsana Ihuru, Banyan Tree Vabbinfaru and Angsana Velavaru.

Adult turtles nested on these islands between February and May. Breeding activity on Vabbinfaru and Angsana was intermittent and some years no turtles laid nests on the islands.

Human impact and disturbance were mitigated by reducing artificial lighting and noise on the resort islands during nesting seasons, with regular patrols to safeguard turtle nesting behaviour. During nesting seasons tracks were looked for and reported every morning. A member of the Marine Lab team was on call 24 hours during nesting season to ensure adherence to best practice, support successful nesting, and collection of vital data.

An estimate of the egg count was taken whilst laying. Turtles were checked for injuries and after nesting was complete, measured and tagged on the front flipper using a titanium iconel identification tag (see tagging section on page 20).

Turtle tracks and nest locations were recorded with a WAAS enabled GPS, along with time of digging, distance from high tide and to back of beach, along with any other important information.

if the nest was in a location with risk of tidal flooding or predation, then it was relocated following the procedures of Lutz et al. (2003 – The Biology of Sea Turtles) and the Florida Fish and Wildlife Conservation Commission (USA; FFWCC) to avoid any damage to the embryos. Following these guidelines it was imperative that nests were relocated within the first 12 hours after being laid.

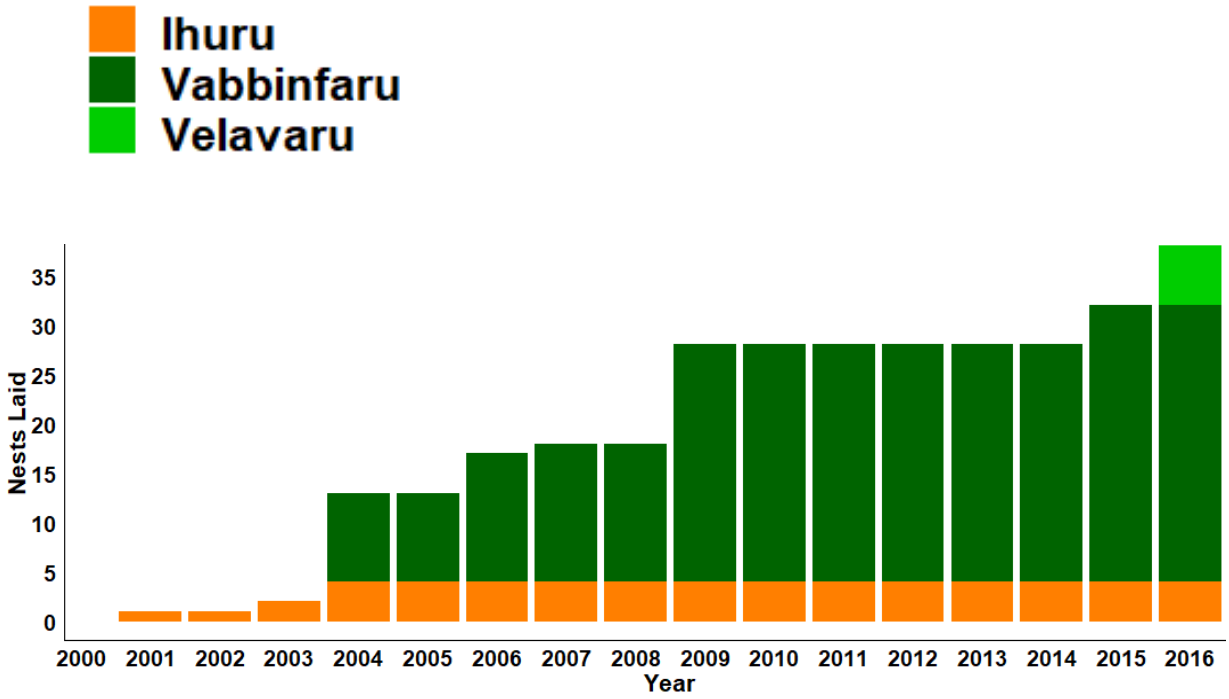
Nests were marked and cordoned off to prevent disturbance; a sign was displayed to inform guests and staff. Throughout the incubation period, nests were checked daily for signs of disturbance or predation. The suspected incubation and hatch period was calculated based on local experience and scientific knowledge. Hatchlings were usually observed emerging from the nest 48-70 days after incubation. Therefore, nests were checked daily after 48 days for increasing temperatures and looseness of sand.

Hatchlings emerged at night, sometimes over a period of up to 5 days. Number of hatchlings and unhatched eggs were both recorded.

Upon completion of nest emergence nest excavations were performed to free any hatchlings stuck in the sand, and to assess the success, emergence and development rates of the nests. Excavations of unhatched nests provided information which can assist in developing conservation management plans.

Hatchlings were collected and released within 24 hours in small groups 2 meters from the tide line, with an unobstructed path to the ocean. It was important for the turtles to make this initial journey across the beach as the location was imprinted into their biology and they will return to a similar location to lay their eggs when they are sexually mature.

TURTLE NESTS



Nest frequency on Ihuru, Vabbinfaru and Velavaru.

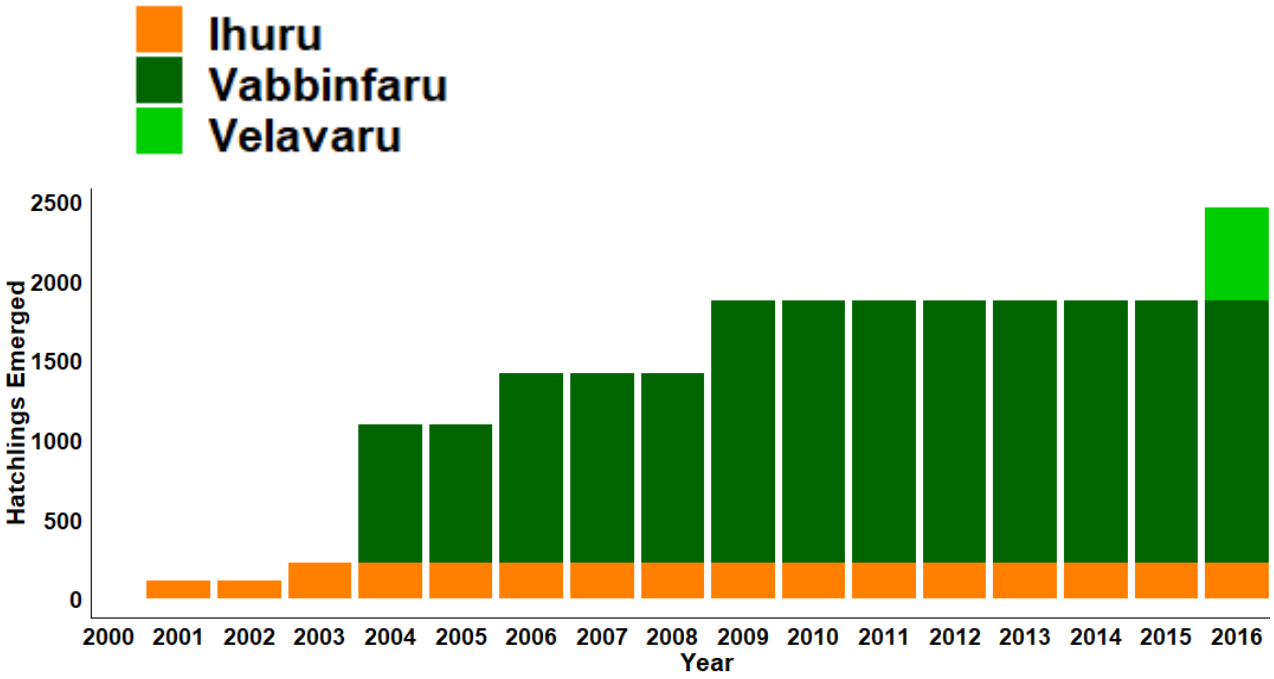
A total of 38 nests were laid by 30 Green Sea Turtles and 1 Hawksbill Turtle during the project.

There is no data for nests in Velavaru prior to 2016, however when speaking with former employees, turtles regularly laid nests on this island, but data was not recorded.

The most nests were laid in 2004, which were the first nests reported on Vabbinfaru since 1987.

Re-locations were conducted for a total of six nests and at least two of the nests would not have successfully hatched without relocation.

HATCHLINGS



Hatchling frequency on Ihuru, Vabbinfaru and Velavaru.

2460 hatchlings were recorded from the successful nests, the most recorded in 2004,

Each nest produced an average of 87 hatchlings.

Although four nests were laid in 2015, all of the nests failed to hatch. No excavations were performed so the reasons are not known

During the course of the project, from the data that we have access to, we know that no hatchlings emerged from 13 of the 38 nests, at a success rate of 65.8%

HEADSTART PROGRAM

AIM:

Increase survival rate and number of adult turtles at breeding age in the wild by nursing them through the first, most vulnerable years of their life.

As per permit guidance, up to 10% of nest hatchlings were retained for the programme,

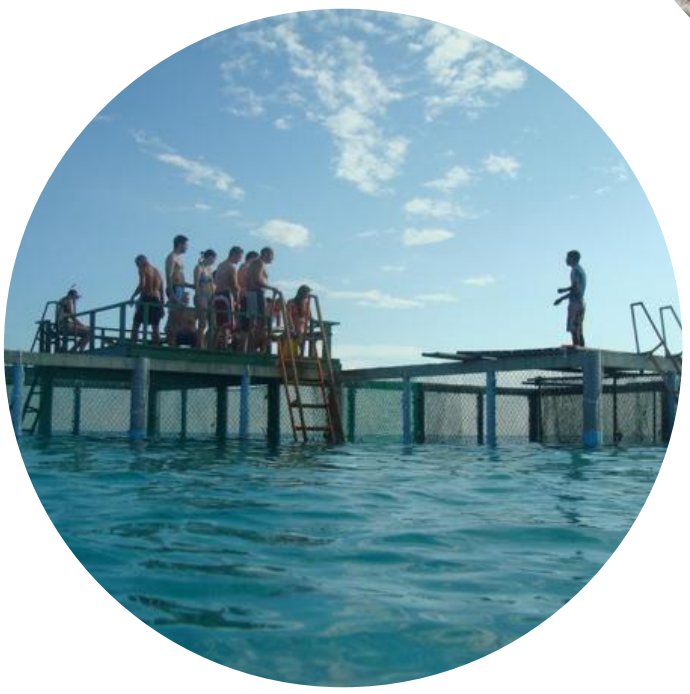
In a semi-natural, captive environment, with plentiful access to food, the growth rate of the turtles was accelerated. Once the turtles grew and formed a large carapace (shell), they were better protected from predators.

During the captive period, the aim was for the turtles to grow as quickly as possible. they reached sub-adult size (approximately 30-50 cm length).

ENCLOSURE

A primary concern of this project was to provide turtle hatchlings with a habitat that closely resembled their natural environment. The turtles were provided with two distinct enclosures after hatching in which to develop through their early life stages.

Hatchlings were initially reared on land in a tank which had a throughflow filtration system and inflow system that brought fresh sea water from the lagoon.



Once the hatchlings reached average carapace length of 10 cm they were transferred to a semi-natural enclosure within the lagoon. This enclosure was 7m x 10m and 3m high, it was set over a predominately sandy substrate encompassing several coral formations.

TURTLE CARE

The turtles were fed with an assortment of raw fish, squid, tuna, seagrass, jellyfish and leafy vegetables.

Turtles were fed three times daily until satiation, and care was always taken to ensure all turtles were feeding. To ensure the turtles were healthy and growing normally, turtles were checked daily for signs of disease or stress.

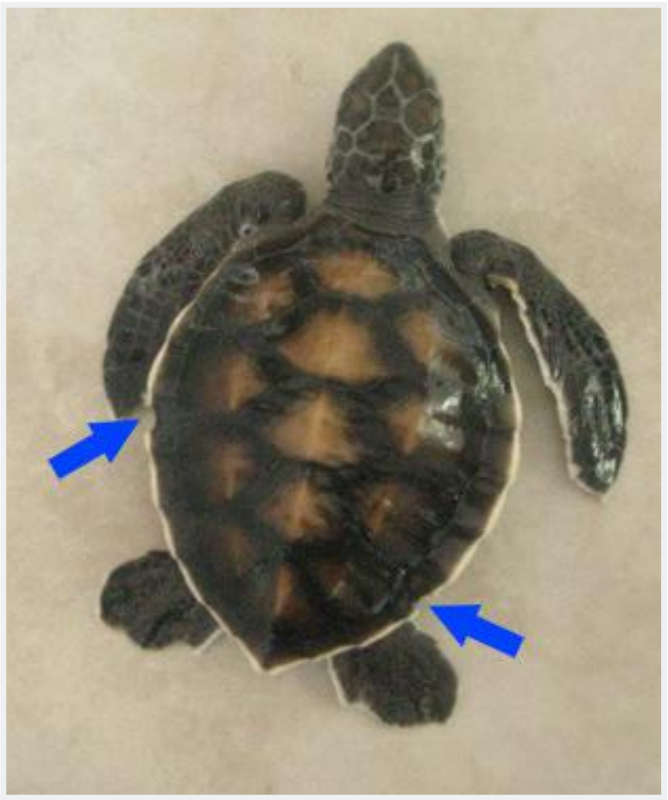
In case of injury or infection turtles were isolated and treated accordingly. The land based tank enclosure was filtered with fresh sea water four times daily.

GROWTH

Growth rate data was recorded for each turtle as soon as individual identification was possible,

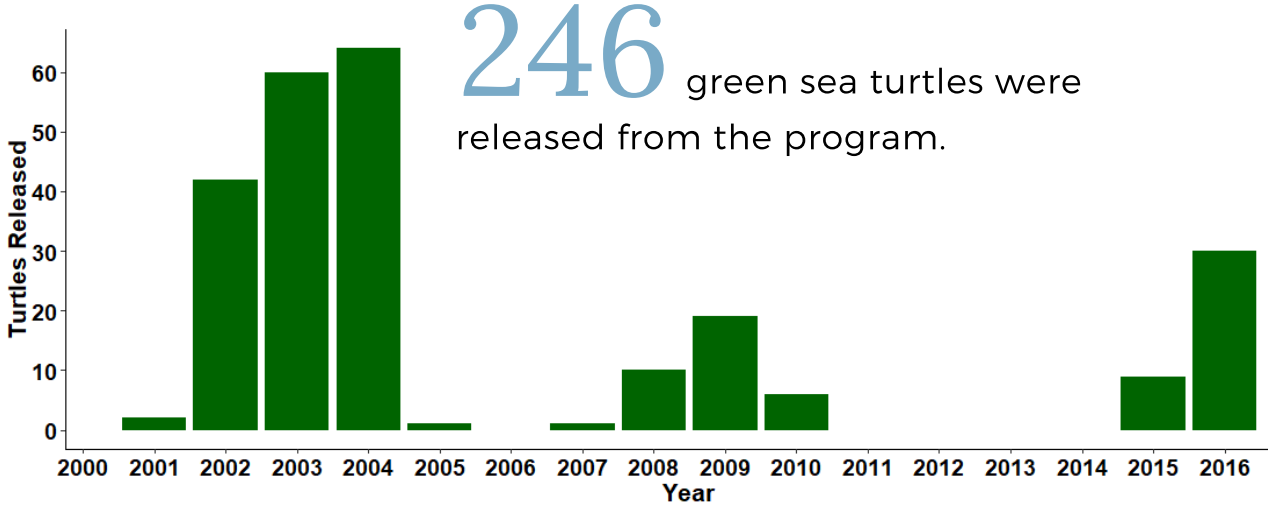
Turtles were identified by a sequence of notches placed on the outer scutes of the carapace at around three months.

Each month curved carapace length (centimeters) (CCL), straight carapace length (centimeters) (SCL) and weight (grams) were recorded for each turtle. These measurements were taken following established scientific protocols.



HEADSTART PROGRAM RESULTS

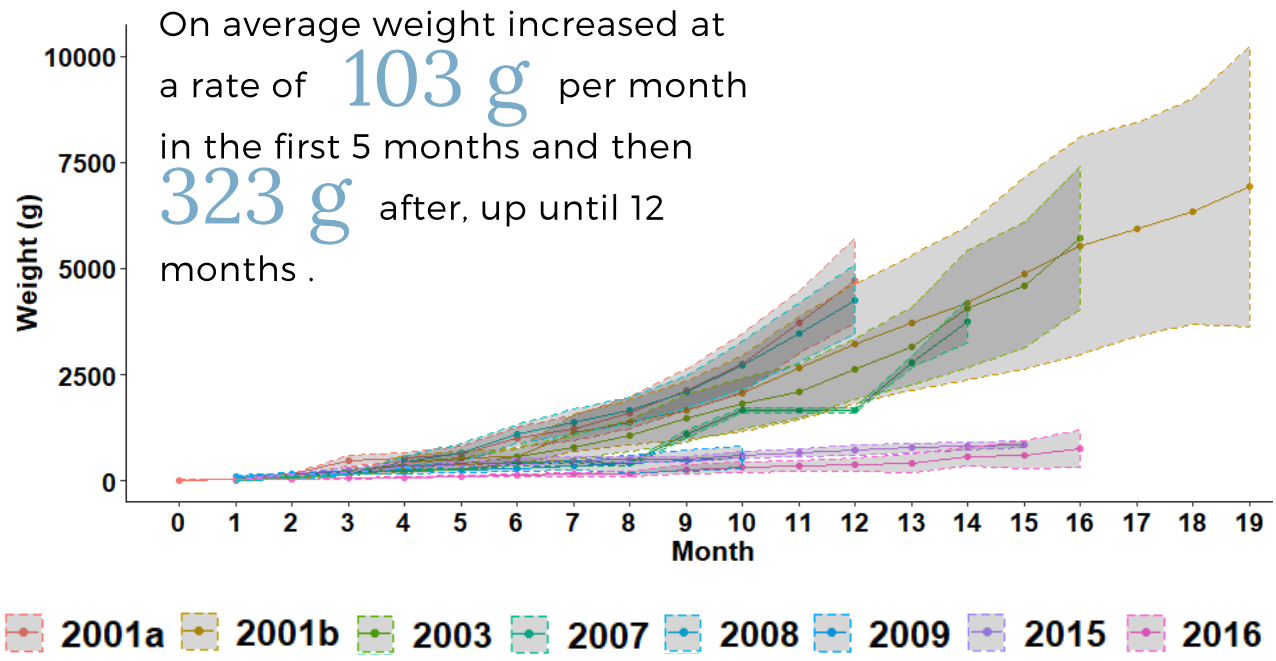
246 green sea turtles were released from the program.



Number of turtles released from the Banyan Tree HeadStart program between 2001 to 2016.

GROWTH (WEIGHT)

ALL BATCHES



Average turtle body weight by batch.

Weight ranged from 378 g to 4718 g after 12 months in the program.

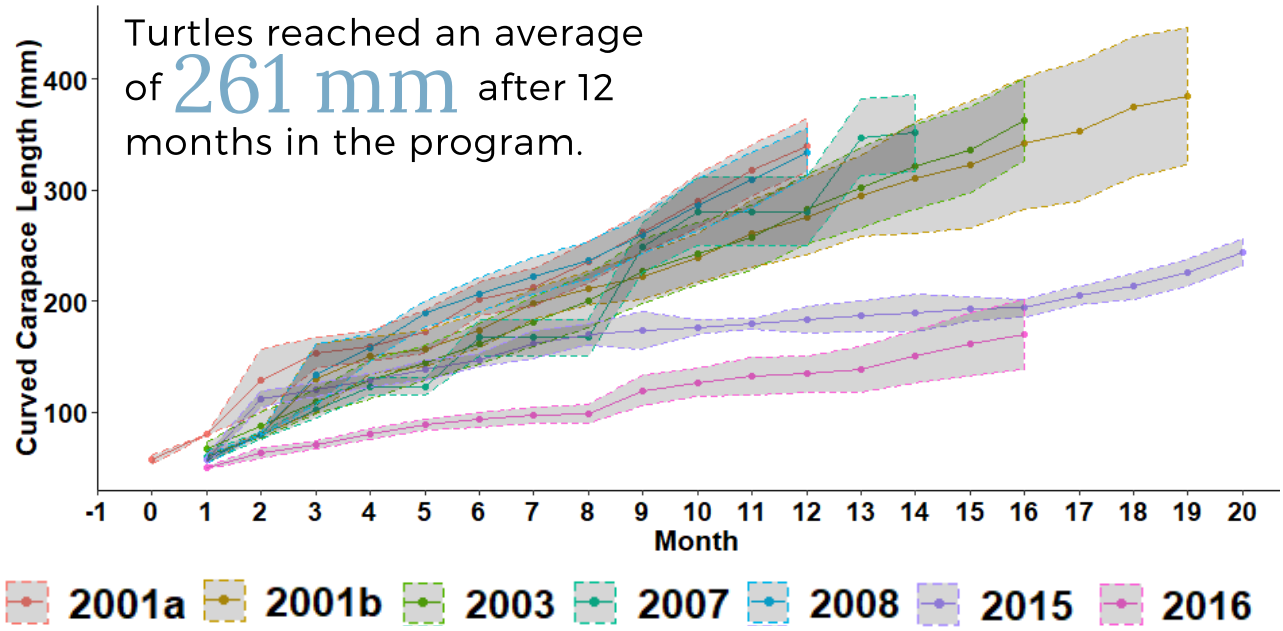
Generally growth was slow between 1-4 months, maybe due to a change in habitat and food foraging behaviour, from the tank to the in-ocean enclosure.

Differences in the size of individual turtles was attributed to natural variability and food quantity, the larger turtles often out-competing the smaller for food in the pen.

The results for 2015 and 2016 show a lower average that previous years due to dietary conditioning. The larger turtles also escaped the pen, decreasing the average.

GROWTH (LENGTH)

ALL BATCHES



Average turtle Curved Carapace Length (CCL) by batch.

Average increase in curved carapace length was **16.7 mm** per month.

For most of the batches the largest increase in length was between months 1 and 2, during which length more than doubled for batch 2001b and 2015.

Individual turtles showed little variation in carapace length up until 9 months when the difference became apparent, especially true for turtles in batches 2001a and 2001b.

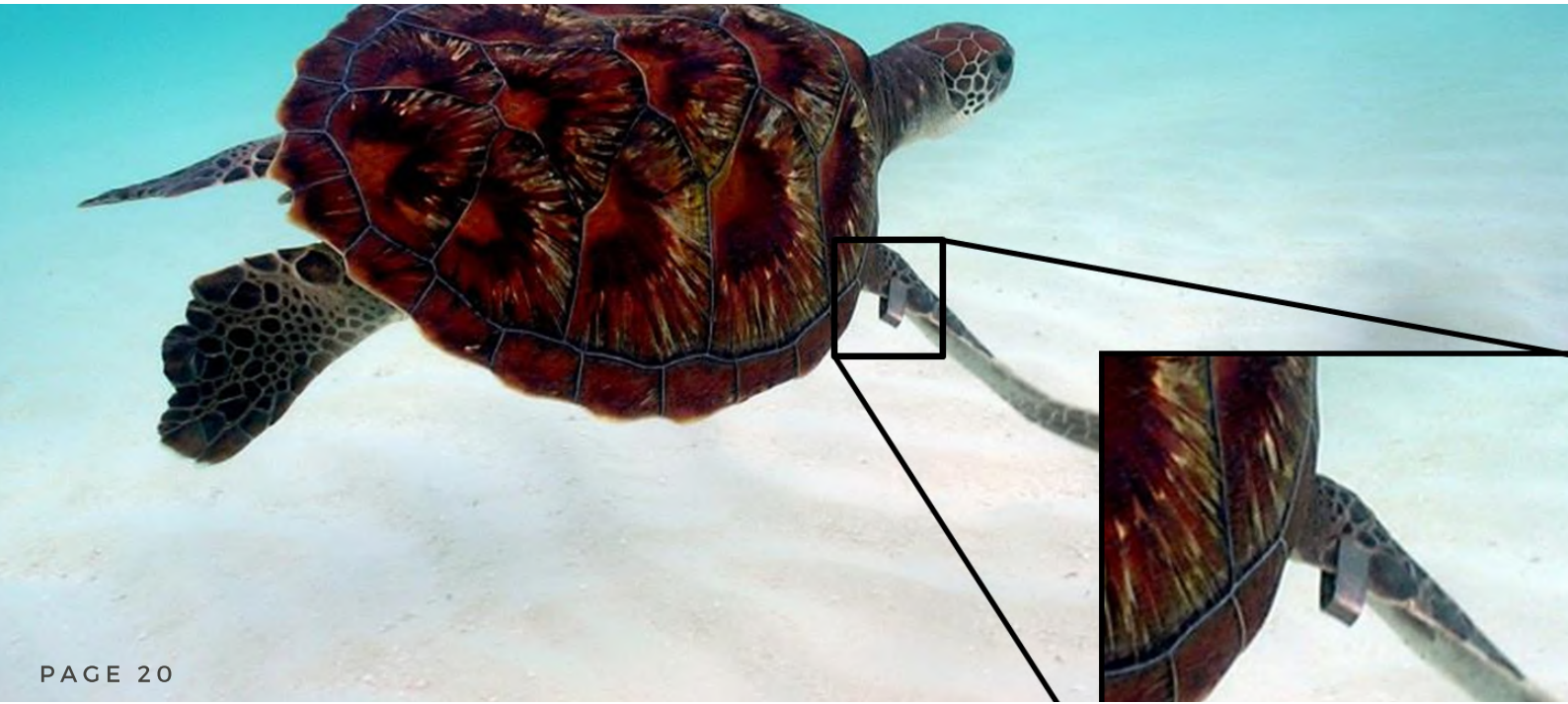
Turtles in batch 2016 displayed slow growth from the beginning, herefore the growth remained slow until their release.

TAGGING AND TRACKING

Prior to release turtles were tagged with inconel titanium flipper tags.

These tags are highly resistant to corrosion with a long lifespan (over a decade) required to assess returns of turtles from the program to nest within the Maldives.

Turtles were tagged adjacent to the thickened scale on the trailing edge of each front flippers, close to the axilla to reduce tag shedding. To minimise impact of tag loss, all turtles were double tagged on both front flippers. Although not permanent, if tagged correctly their operational life can be considerable.



The tags carried a return address, which allowed anyone who encountered the turtle to contact our project and allowed us to know where the turtle was re-sighted and the tagging of nesting females allows their identity to be verified upon return visits.

As yet no reports of tagged turtles have been received, or sightings of turtles returning to the beach to nest.

Example:
Banyan Tree Maldives BT 001
MR C Maldives
Tel: (960) (number)

However, the juveniles that were released will not yet be of an age to return to the beach, but in the coming years hopefully plenty of information will be gathered through sightings reports of these turtles as they start to reach sexual maturity.

SATELLITE TAGGING

Satellite tracking, while being a costly practice, offers an incredible opportunity to 'remotely' follow an animal, learning about its movements, life history and ecology, information that is critical to the conservation of the species.

During the program from 2001-2017, 6 turtles were satellite tagged.

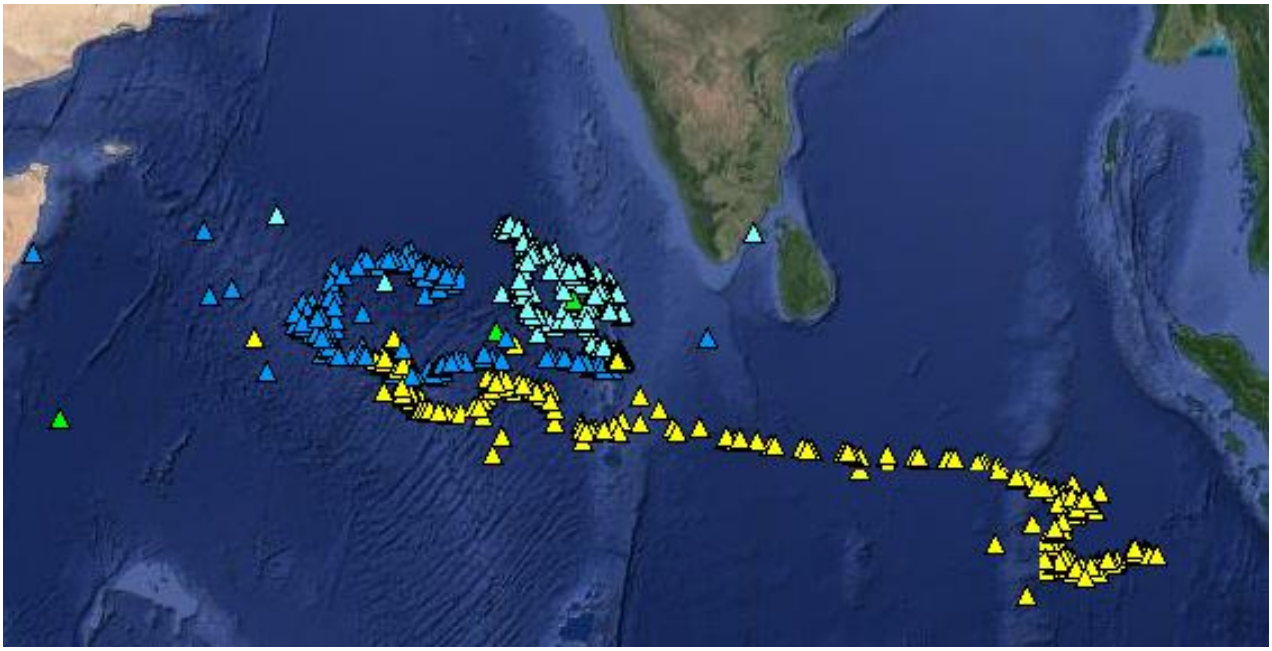
Satellite tagging was conducted in collaboration with Dr Nicholas J Pilcher, Marine Research Foundation, Sabah, Malaysia.

Findings from the satellite transmitters revealed no negative impact on turtle behavior or migration.

TRACKING RESULTS

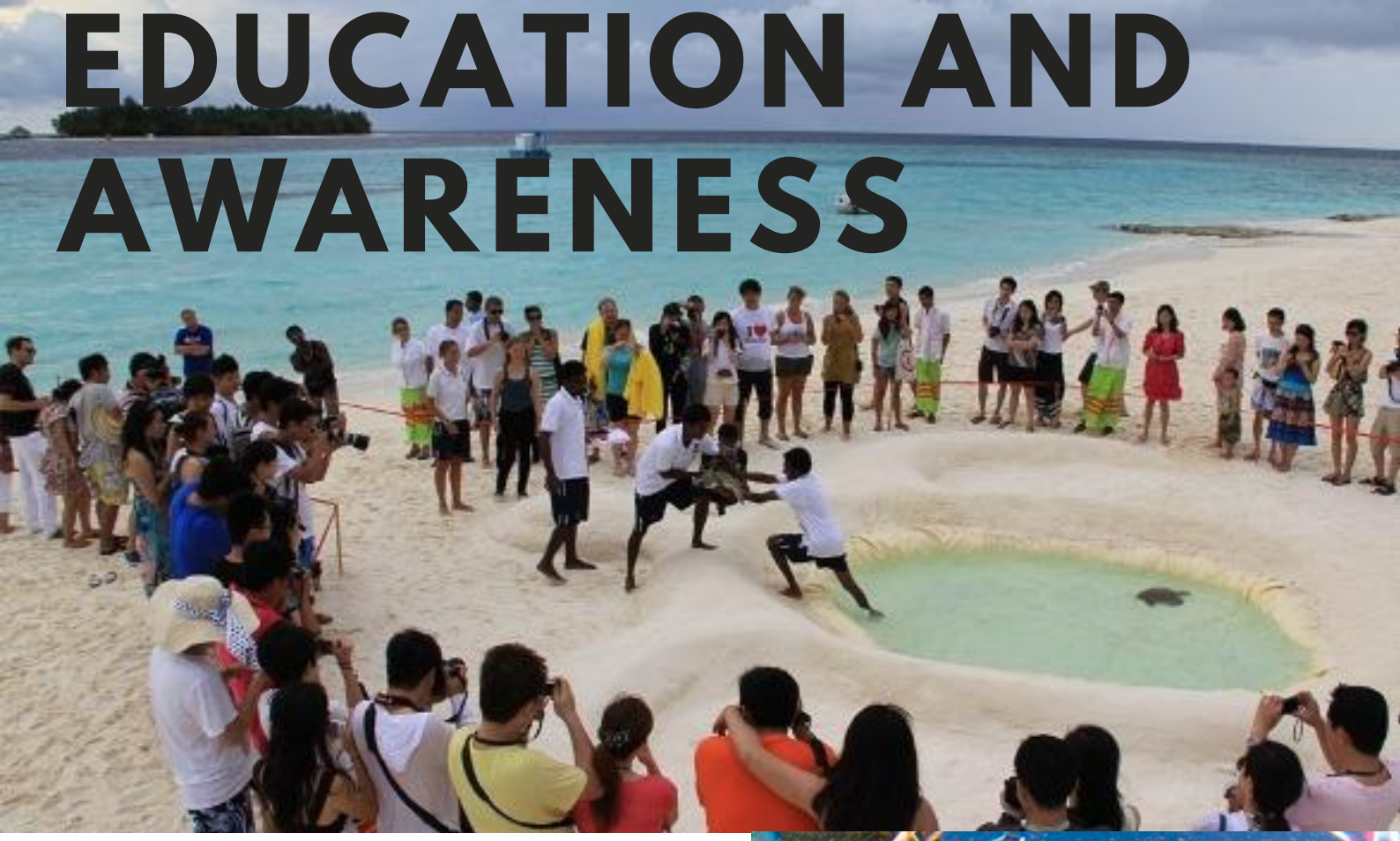
In 2004, four turtles were released with SirTrack satellite transmitters. The turtles initially traveled in a westerly direction and moved between inshore and offshore waters of the western side of the Maldives. These results supported the notion that turtles kept in captivity still left the area and continued a normal life.
At five weeks contact was lost with the transmitter on turtle 2 (green symbols).

Turtle 3 (blue symbols) was tracked for three months before the signal was lost. Turtle 4 (light blue symbols) for four months. Turtle 1 (yellow symbols) followed the same pattern before continuing in an easterly direction to the west coast of Sumatra, it was successfully followed moving between inshore and offshore waters in this area before the signal was lost after six months.



Satellite tracking map from 2004/2005 data, colours indicate the path of individual turtles (taken from SeaMap).

EDUCATION AND AWARENESS



Education and awareness was a critical component of this project. In addition to its biological benefits Banyan Tree headstart program had many social benefits in terms of education and outreach.

Guests at Banyan Tree Vabbinfaru and Angsana Ihuru were invited to daily turtle feeding activities where trained staff educated them about the importance of protecting these iconic and endangered species.

On average 5000 people engaged with the programme per year to learn more about turtles.

A turtle conservation booklet and guide in Dhivehi was distributed to 26 islands in 26 atolls across Maldives in 2002.

The resort hosted visits from multiple school groups each year as well as international marine biology interns.

Providing guests and local communities with information and a unique experience with sea turtles not only increased awareness of the vulnerabilities they face but increased stewardship for the marine environment.

FINAL REMARKS

The turtle conservation program at Banyan Tree successfully reared green sea turtles from infancy to sub-adult size, and reduced the high mortality rates that impact most turtle species in their initial life stages. In 2017 the Maldivian Government further improved their protection of sea turtles by implementing a nationwide ban on captive rearing of sea turtles. There is however still the need to protect turtles on a large scale by protecting nests and to create awareness.

Headstarting may have had its place in conservation, however it was often controversial. This report outlines that the implementation at Banyan Tree had an impact.

The benefit was seen through the 23,800% increase in survival rate, calculated from by comparing natural survival with survival in the project.This was also shown from the tracking results of a small number of turtles after release, which supported the notion that the turtles survived release after being in captivity and were able to still continue a normal life. The project produced large healthy turtles in the first year or two of their life, which in all probability will have had a better chance of survival. Over the 15 years, engagement with guests and associates averaged 5000 per year, equating to a total of 75,000 people in total.

By engaging with and encouraging people to think about the importance of turtles and the marine environment it creates awareness and hopefully the change necessary for the future protection of these animals.

Looking towards the future, it is anticipated that turtles that were released from the project will eventually return to the beach to lay eggs of their own, however the protection of highly migratory species is challenged by differing levels of exploitation across the range of an animal. There is a risk that released animals may be exploited in other locations, for example East Africa.

Banyan Tree Marine Labs will continue to protect turtle nests and create awareness, incorporating new non-invasive techniques such as photo ID, which can also engage citizen scientists. While turtles are now fully protected in the Maldives, there is always more that could be done on larger scales, such as protection across international boundaries.