

# MANAGING THE WORLD'S LARGEST GREEN TURTLE ROOKERY

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On the remote outer edge of Australia's northern Great Barrier Reef (GBR) lies Raine Island, a 27-hectare (67-acre) vegetated coral cay that hosts what is arguably the world's largest green turtle nesting population. Up to 20,000 densely packed females have been recorded coming ashore nightly. Declining reproductive success has been reported there for decades, signaling the possibility of impending rookery collapse. To stem this loss, the Raine Island Recovery Project (RIRP) was launched in 2015. The RIRP is a five-year collaboration between the Queensland government, BHP (a global resources company), the GBR Marine Park Authority, the GBR Foundation, and the Wuthathi and Meriam Nation (Ugar, Mer, and Erub) Traditional Owners. Over thousands of years, the Traditional Owners have held enduring links to Raine Island. They use its resources and hold cultural connections to the land and sea through song lines, stories, and voyages to the island.

The RIRP studied three key issues as possible contributors to rookery loss at Raine Island: (1) tidal inundation of the nesting beach, (2) mortality of nesting females (from multiple causes), and (3) influences of nest density (e.g., either nests being so close to one another that they adversely affect embryonic development, or the destruction of older nests by later nesting females). The RIRP developed innovative monitoring and adaptive management for each of those issues through research about nests, island geomorphology, turtle migration, and inter-nesting behavior.

## REDUCING NESTING TURTLE MORTALITY

One of the first management actions of the RIRP was to complete the installation of 1.75 kilometers (1.08 miles) of cliff-top fencing around parts of Raine Island's raised central phosphate cliff to block access and thereby reduce cliff-fall turtle mortalities and entrapments under the cliff line. Earlier studies had shown that such factors caused roughly one-third of Raine Island's nesting turtle mortality. Because of this intervention, turtle mortalities from cliff falls over the life of the project were reduced from 30 percent to 5 percent.

Nesting turtles that remain on the nesting beach after sunrise because of exhaustion or disorientation may perish from heat stress. A rescue program was instigated to ensure that as many turtles as possible were returned to the water before sunrise by a team equipped to free animals from virtually any form of entrapment and to transport them safely by vehicle to the water's edge. The lives of nearly 700 female greens were saved in this fashion.

## IMPROVING NEST SUCCESS

The most significant intervention at Raine Island thus far has been beach reprofiling to raise the level of the nesting environment so that the beach and natural clutch depth are both above the peak tidal water table. Heavy equipment was used to move sand in 2014, 2017, and 2019. All told, the effort shifted roughly 40,000 cubic meters (43,744 cubic yards) of material on 35,000 square meters (38,276 square yards) of beach, effectively doubling the island's viable nesting habitat (about 21 percent of the nesting habitat remains at risk of inundation). Each of the alterations has been associated with increased incubation success and hatchling emergence when compared with

control sectors. An estimated 4.6 million more hatchlings will be produced on Raine Island over the next 10 years because of this important beach reprofiling effort.

These management actions were informed by a series of innovative research projects that sought to increase RIRP's understanding of this remarkable cay. These projects studied the following:

- The composition, accretion, and future projections of the cay's sandy nesting habitat through fine-scale geomorphology and sea-current modeling
- The nesting, inter-nesting and migratory behaviors of nesting turtles by using satellite telemetry
- The use of drone technology to monitor the population
- The characteristics of nesting environments that may contribute to reduced hatchling emergence and nesting success

## ONGOING AND FUTURE CHALLENGES

Despite the partial successes of such intervention efforts, new and enduring issues continue to threaten the nesting turtles of Raine Island, and much work remains to be done to improve the long-term prospects for the island's green turtles. Recent research on temperature-dependent sex determination estimates that more than 90 percent of all hatchlings emerging on Raine Island are female. Given that it is the largest nesting aggregation of the 60 or so nesting beaches for the northern GBR turtle genetic stock, it is believed this population of green turtles may be heading toward a potentially dangerous feminization. Moreover, although RIRP observed increases in hatching and nesting success on Raine Island's reprofiled habitats, those seasonal figures remain highly variable and frequently fall below the average of other rookeries in the stock. The fluctuations indicate that there may be other factors contributing to the decline in the reproductive success of this rookery; such factors warrant continued investigation.

Finally, and most pressing as Earth's global climate changes, low-lying turtle rookeries such as the one on Raine Island fall under greater than average threat from rising sea levels and more frequent extreme weather events. Turtle preservation efforts must now consider whether those islands or their turtle populations have the capacity to adapt to the changes, which are likely to occur within one or two marine turtle generations. If not, what new interventions or strategies will be needed to safeguard the islands and their nesting populations against an uncertain future? •

AT LEFT: Hundreds of green turtles can still be seen nesting into the early morning on Raine Island. © Queensland Government