

# Post-Nesting Migrations of Hawksbill Turtles, *Eretmochelys imbricata*, From Moso Island, Republic of Vanuatu



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## Introduction

Hawksbill turtles (*Eretmochelys imbricata*) are considered critically endangered by the International Union for Conservation of Nature throughout most of the southwest Pacific Ocean. The Republic of Vanuatu has a resident population and a migratory nesting population of hawksbill turtles. Overall, Vanuatu is estimated to have approximately 300 female hawksbills nesting annually. Nesting females in Vanuatu have been shown to come from forage grounds as far away as northeastern Australia. In an effort to better understand the home forage grounds of hawksbill turtles that nest on Moso Island, in central Vanuatu, ARGOS satellite tags were attached to three post-nesting hawksbill turtles in early January, 2018.



**Figure 1.** Adult hawksbill returning to the ocean following a successful nesting event and attachment of a TAM 2460 satellite tag.

## Methods

Nesting beaches on the northwest coast of Moso Island in the Republic of Vanuatu were monitored during the night between January 10-13, 2018, to locate nesting hawksbill turtles. When a turtle was found, it was harmlessly restrained post-nesting. Measurements of the carapace were taken and two titanium flipper tags were applied if the turtle was not previously tagged. An ARGOS satellite-linked transmitter, TAM 2460 (Telonics, inc.), was attached to the turtle's second or third central scute. All transmitters were programmed with a duty cycle of 6 hours on and 24 hours off to economize battery life.

Turtle locations reported by ARGOS had varying location classes with a high frequency of LC A and LC B, which both have no assigned value for accuracy. These locations were used in the track calculations unless they (1) showed the animal on land, (2) gave a speed of travel over 5 km/h, or (3) the position demonstrated a turn of greater than 90 degrees from the previous direction over a 24-hour period.

Movebank (Movebank.org) and ZoaTrack (ZoaTrack.org) were used to identify travel paths using Douglas Argos filter and ARGOS Kalman filter respectively. The average rate of travel (km/h) was estimated using the straight travel distance and the total time of travel. Home range was calculated for one of the three turtles, "Ethana", using ZoaTrack's Spatial Analysis tool. Two of the satellite tags ended transmissions before there were enough positions to establish a home range.



**Figure 2.** The Vanuatu research team (l to r): Sara Thiel, Evan David, Nolan Kalmelu, Holly Hoffbauer, Tess Savage, Marama Hickey, Francis Hickey, and Marc Rice

## Results

Turtle 164949, "Teslaba," (Fig. 3) traveled approximately 2259 km in 50 days, at an average speed of 1.9 km/hr. Her last recorded position on March 29, 2018, was 226 km east of Cape Melville National Park, Australia (14.42191° S, 147.37191° E). This tag transmitted for 78 days.

The second turtle, 164957, "Lucy," (Fig. 4) traveled 2073 km at an average rate of 1.6 km/hr. in a west-southwest direction, skirting around the northern tip of New Caledonia before continuing across the Coral Sea to Australia's Great Barrier Reef. After 55 days, her final position was received on March 21, 2018, 7 km from Collins Island in the Broad Sounds Islands National Park of Australia (22.17660° S, 150.31535° E). This tag transmitted for 71 days.

The third turtle, 164948, "Ethana," (Fig. 5) departed Moso Island on January 26, 2018, and traveled a total distance of 536 km in 13 days to the northern tip of New Caledonia at an average speed of 1.7 km/h. Ethana then moved along the coastline to Nehou Bay (20.33996° S, 164.12625° E) where she appeared to take up residence. As of November 20, 2018, Ethana's tag was still transmitting with a total of 315 days of data. Its estimated home range area using the 95% kernel utilization distribution is 28.3 km<sup>2</sup> and 5.6 km<sup>2</sup> using the 50% kernel utilization distribution (Fig. 6).

ARGOS Number and Turtle Name	Curved Carapace Length (cm)	Total Distance Traveled (km)	Number of Days Migrating	Average Travel Speed (km/h)
164949 "Teslaba"	89.0	2250	50	1.9
164957 "Lucy"	88.0	2073	55	1.6
164948 "Ethana"	87.5	643	22	1.7

**Table 1.** Summary of tracking data for three post-nesting hawksbill turtles migrating from Moso Island, Republic of Vanuatu.



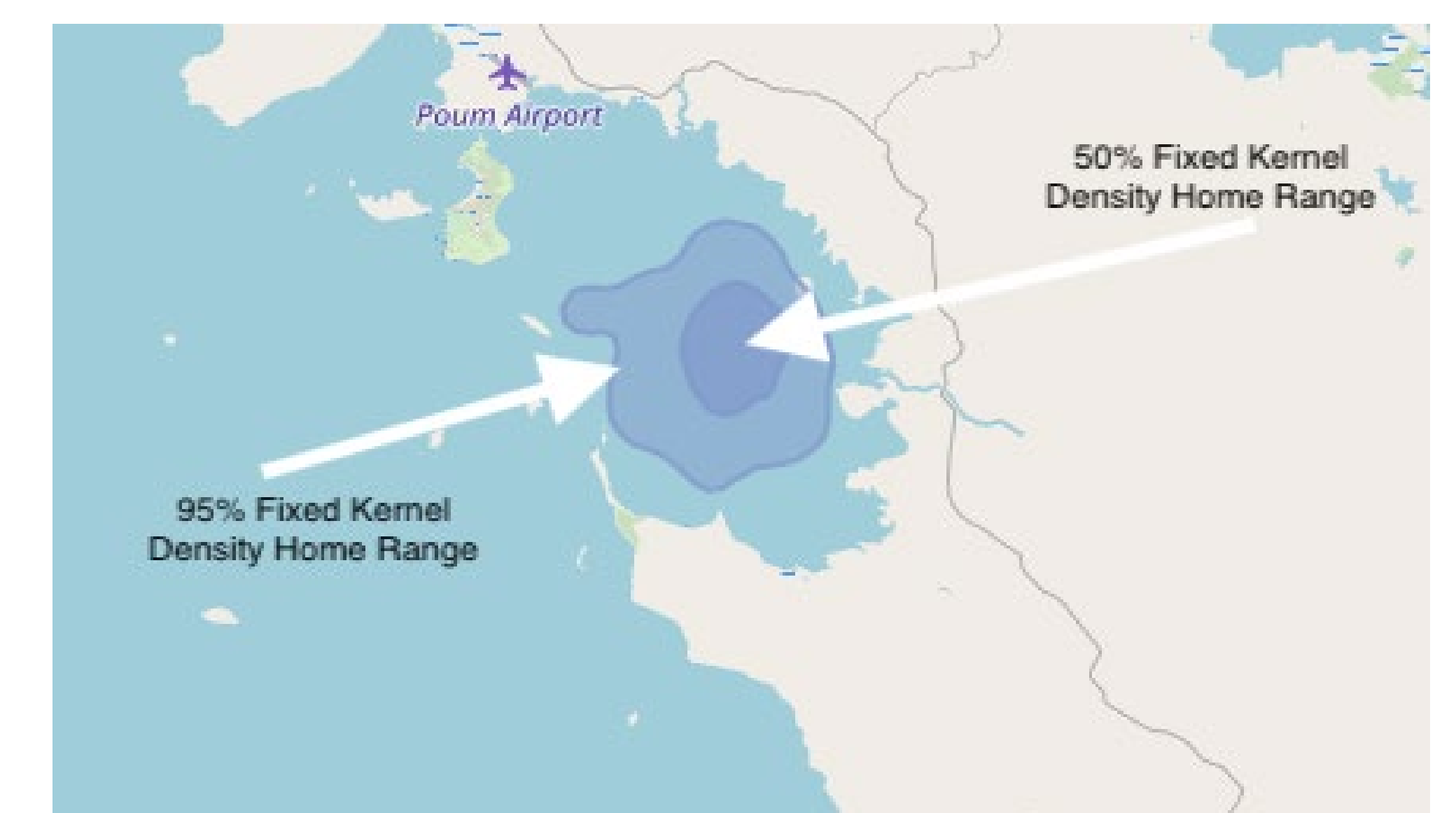
**Figure 3.** Post-nesting migration of turtle 164949, "Teslaba," from Moso Island, Vanuatu towards the northern Great Barrier Reef, Australia between February 9, 2018 and March 29, 2018.



**Figure 4.** Post-nesting migration of turtle 164957, "Lucy," from Moso Island, Vanuatu to the northern Great Barrier Reef, Australia between January 26, 2018 and March 22, 2018.



**Figure 5.** Post-nesting migration of turtle 164948, "Ethana," from Moso Island, Vanuatu to Nehou Bay, northwestern New Caledonia between January 26, 2018 and February 17, 2018.



**Figure 6.** Estimated home range for turtle 164948, "Ethana," in Nehou Bay, New Caledonia, showing the 95% and 50% kernel utilization distribution from 2/17/2018 until 8/26/2018.

## Conclusion

The ARGOS satellite data demonstrated that hawksbill turtles nesting on Moso Island, in central Vanuatu, travel long distances across vast open expanses of ocean. The tracks showed that two of the hawksbills (164949 and 164957) traveled across the Coral Sea to the vicinity of the Great Barrier Reef and one turtle (164948) traveled a shorter distance to northern New Caledonia. While the number of tracks is small, they support the notion that there is a Moso Island nesting site connection with turtles residing in Australia's Great Barrier Reef and in New Caledonia.

Knowledge about post-nesting hawksbills' migration and foraging grounds will enable traditional leaders, governmental agencies, and non-governmental organizations across political boundaries to develop a shared conservation plan to ensure appropriate and effective management of the species.

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