# Results from state-space model

## Table of contents



## 1 Background

Since the tags on air-breathing marine megafauna often transmit positions at irregular time intervals, usually with relatively high location errors, the first major step was to account for this location error in the green turtle (*Chelonia mydas*) tracks. This was performed using the continuous-time correlated walk (CTCRW) version of a state-space model (SSM) as implemented by the `crawl` package in R (Johnson et al. 2008). After initial model fitting, predictions were made at a 2 hr time interval, which is close to the median time interval across all tracked individuals. Another method of accounting for location error is to go one step beyond estimating the most likely track by estimating a number of potential realized paths the animal may have taken between the known observations. This method is called process (or multiple) imputation (Scharf, Hooten, and Johnson 2017), and is a subset of a full posterior distribution of a Bayesian model. A set of 20 imputed tracks were generated for each of the tracked turtles to account for these movements between the predicted observations at the 2 hr time interval. This resulted in 1986385 observations for the Gulf of Mexico, 1456651 for Brazil, and 135824 for Qatar.

## 2 Visualizations

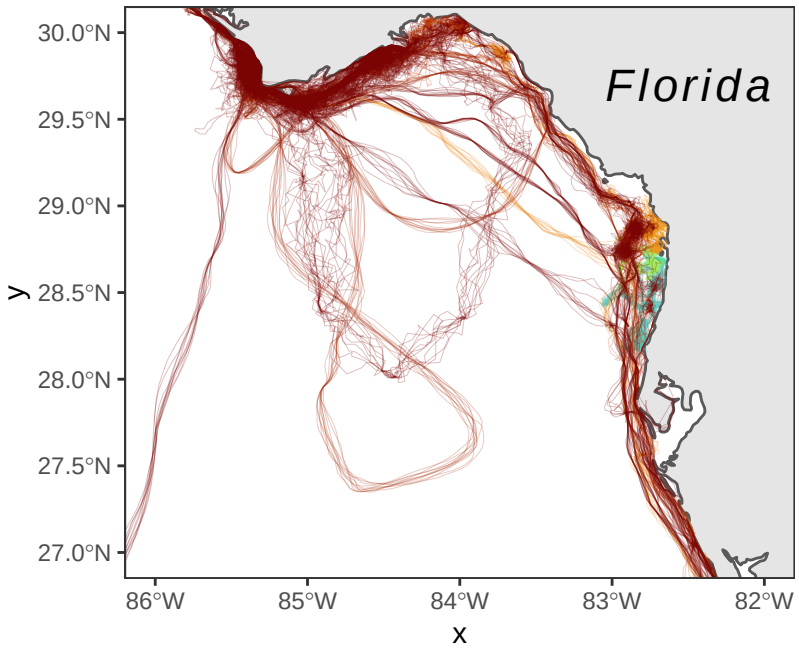


Figure 1: A subset of imputed tracks for green turtles in the Gulf of Mexico region. Colors indicate different individuals. Different tracks of the same color indicate the different realizations of the track of a given indivudal as a result of the process imputation procedure.

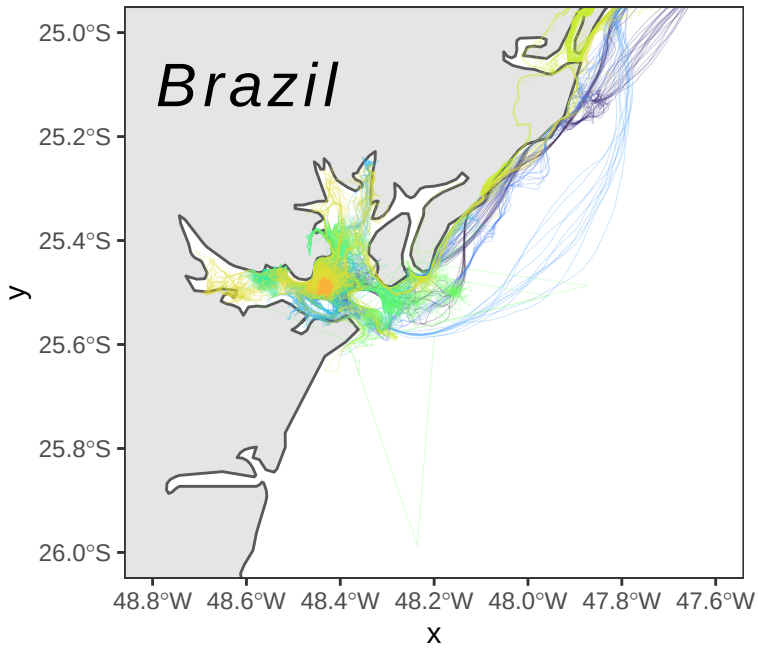


Figure 2: A subset of imputed tracks of green turtles along the coast of Brazil. Colors indicate different individuals. Different tracks of the same color indicate the different realizations of the track of a given indivudal as a result of the process imputation procedure.

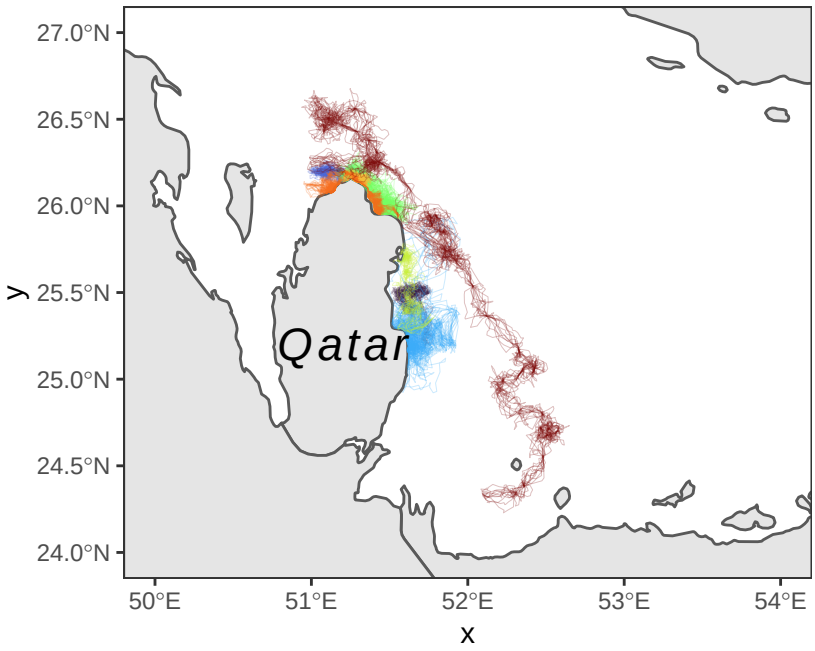


Figure 3: A subset of imputed tracks of green turtles along the coast of Qatar. Colors indicate different individuals. Different tracks of the same color indicate the different realizations of the track of a given indivudal as a result of the process imputation procedure.

## 3 References

Johnson, Devin S., Joshua M. London, Mary-Anne Lea, and John W. Durban. 2008. "CONTINUOUS-TIME CORRELATED RANDOM WALK MODEL FOR ANIMAL TELEMETRY DATA." *Ecology* 89 (5): 1208–15. https://doi.org/10.1890/07-1032.1.

Scharf, Henry, Mevin B. Hooten, and Devin S. Johnson. 2017. "Imputation Approaches for Animal Movement Modeling." *Journal of Agricultural, Biological and Environmental Statistics* 22 (3): 335–52. https://doi.org/10.1007/s13253-017-0294-5.