Hawaiian SFPW movement analysis

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April 18, 2017

Introduction

This workshop is an introduction to the use of the crawl package to predict individual movement paths from the posterior distributin of a correlated random walk model. Using the model fits, we can calculate utilization distributions for comparison with environmental variables.

Data included

Tag data from 2 short-finned pilot whales tagged near Maui. The data set includes latitude, longitude, location quality and datetime. The last column was modified from date and time columns to be understood in the R environment.

Data plot

Using leaflet, an interactive plot of the data for two individuals.

Crawl model fit

For each individual, fit a correlated random walk model to the data and estimate parameters a and P.

```
##
## ------------------------------------------------------------------
##         term          estimate   std.error   conf.low   conf.high
## -------------------- ---------- ----------- ---------- -----------
##     ln tau lc943       4.755       0.186       4.39       5.121
##
##     ln tau lc942       6.275       0.126      6.028       6.523
##
##     ln tau lc941       6.666       0.134      6.403       6.929
##
##     ln tau lc940        7.68       0.158      7.371       7.99
##
##     ln tau lc94A       8.071       0.184       7.71       8.431
##
##     ln tau lc94B       7.672       0.212      7.257       8.087
##
## ln sigma (Intercept)   4.262       0.052       4.16       4.364
##
## ln beta (Intercept)    -8.37       0.246      -8.851     -7.889
##
##        logLik          -4376        NA          NA         NA
##
##         AIC             8768        NA          NA         NA
## ------------------------------------------------------------------
##
```

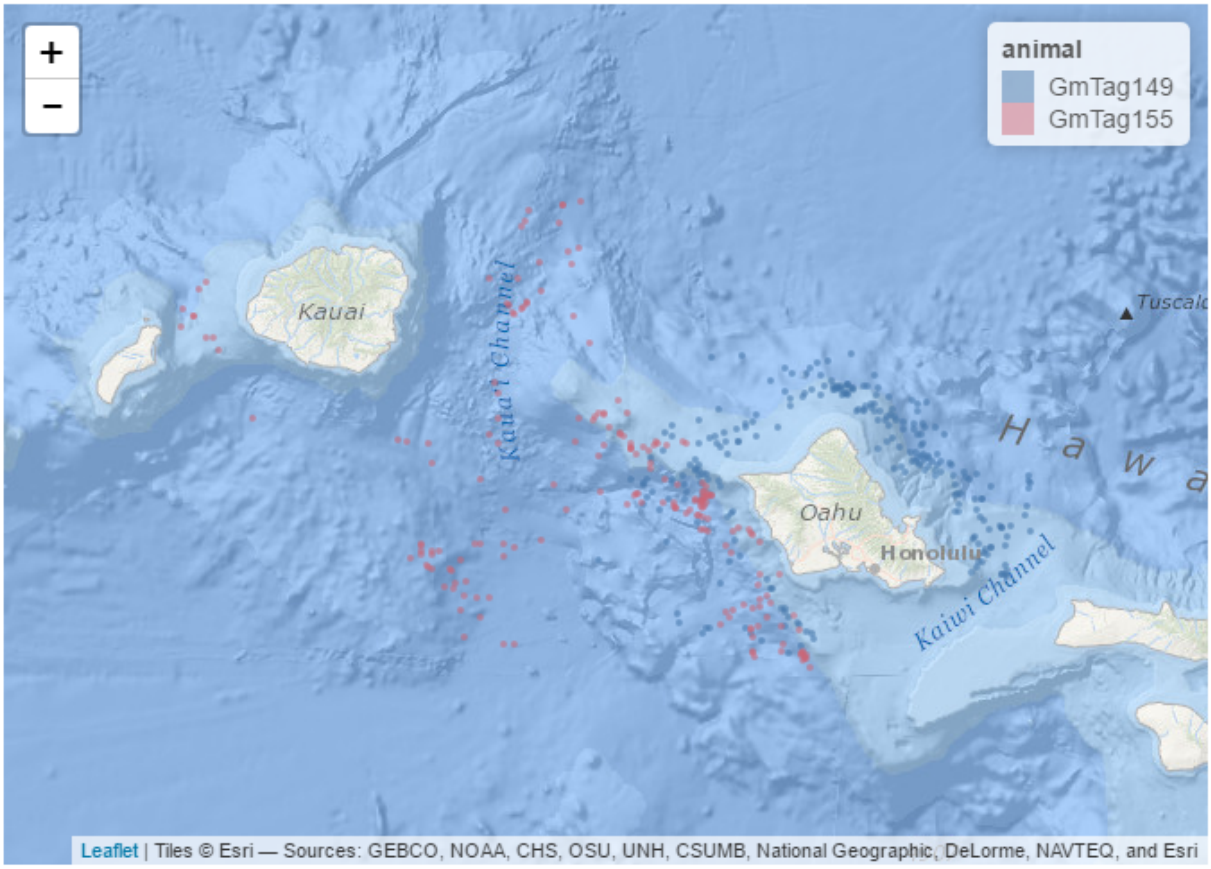
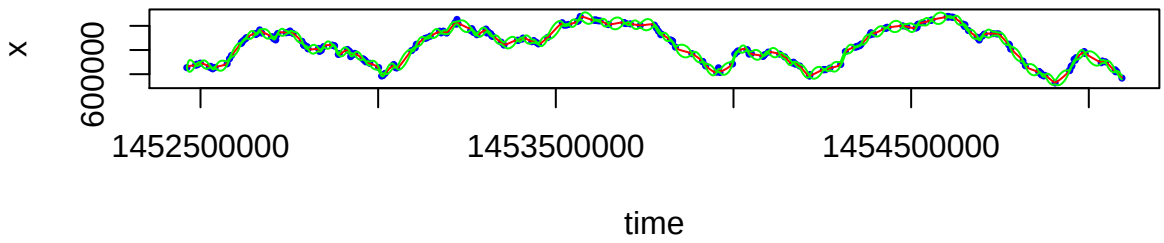

animal
GmTag149
GmTag155
Kauai
Kaua'i Channel
Oahu
Honolulu
Kaiwi Channel
H a w a
Leaflet | Tiles © Esri — Sources: GEBCO, NOAA, CHS, OSU, UNH, CSUMB, National Geographic, DeLorme, NAVTEQ, and Esri

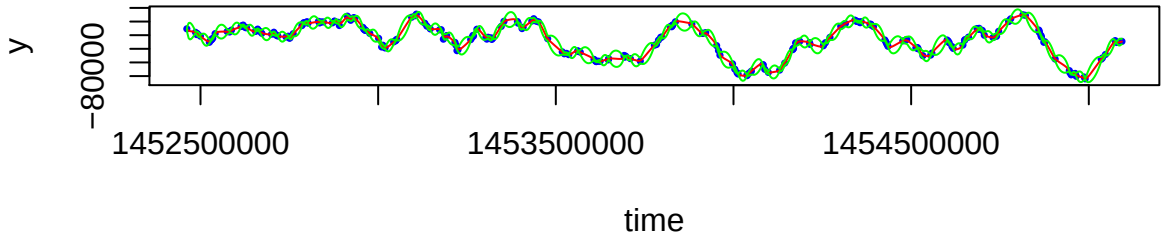
Figure 1:

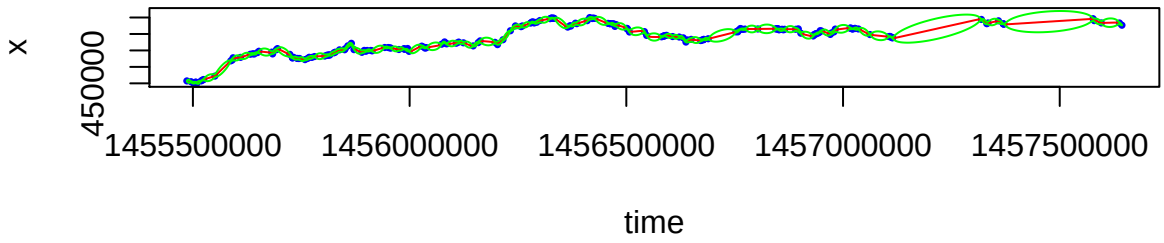
```
## Table: crwMLE fit parameters
##
##
## ------------------------------------------------------------------
##         term          estimate   std.error   conf.low   conf.high
## -------------------- ---------- ----------- ---------- -----------
##     ln tau lc943       5.609       0.189      5.238       5.98
##
##     ln tau lc942       6.119       0.157       5.81       6.427
##
##     ln tau lc941       7.214       0.137      6.944       7.483
##
##     ln tau lc940       7.841       0.163      7.521       8.161
##
##     ln tau lc94A       7.879       0.246      7.396       8.362
##
##     ln tau lc94B       8.103       0.177      7.756       8.45
##
## ln sigma (Intercept)   4.273       0.059      4.158       4.388
##
## ln beta (Intercept)    -7.979      0.244      -8.457     -7.501
##
##        logLik          -3500        NA          NA          NA
##
##         AIC             7015        NA          NA          NA
## ------------------------------------------------------------------
##
## Table: crwMLE fit parameters
```

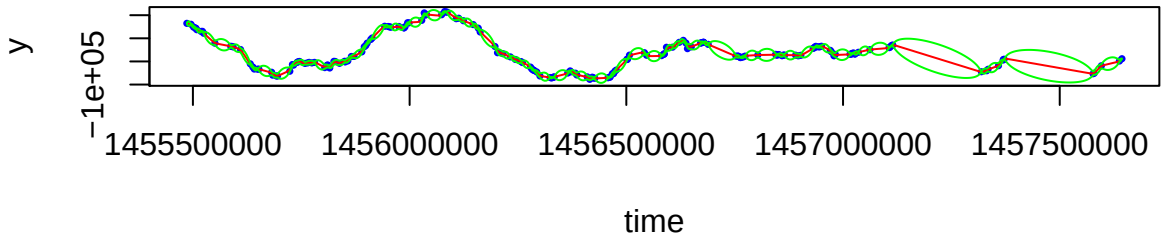
Predicted paths

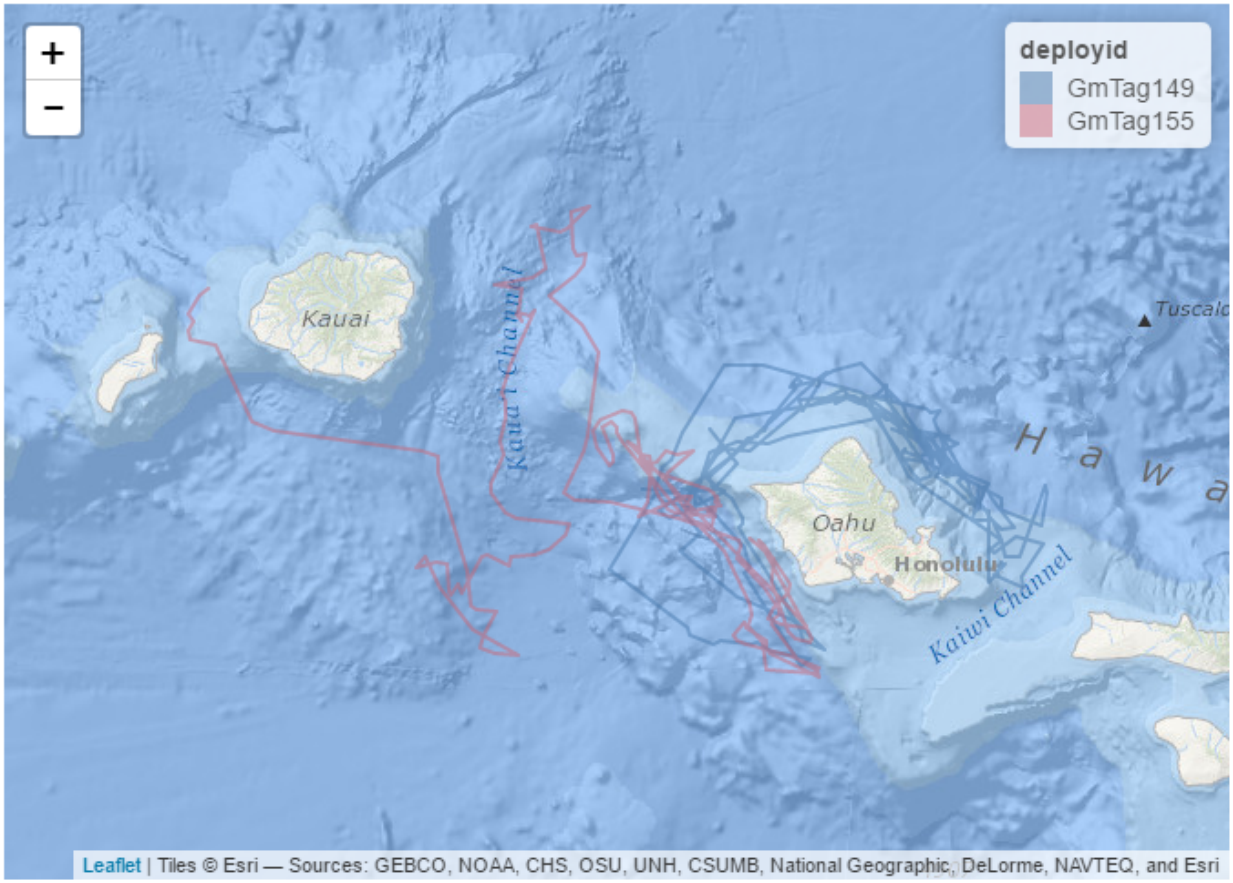
Using the fit parameters, predict the most likely paths for two animals. The below graphs show the estimated x and y track for each individual, and then a final map pulling all the data together.


x
600000
1452500000
1453500000
1454500000
time


y
−80000
1452500000
1453500000
1454500000
time


x
450000
1455500000
1456000000
1456500000
1457000000
1457500000
time


y
−1e+05
1455500000
1456000000
1456500000
1457000000
1457500000
time



Simulate error in track prediction

Use the posterior distributin of the model to generate N simulated tracksCreate and map simulated tracks from posterior distribution using crawlr.

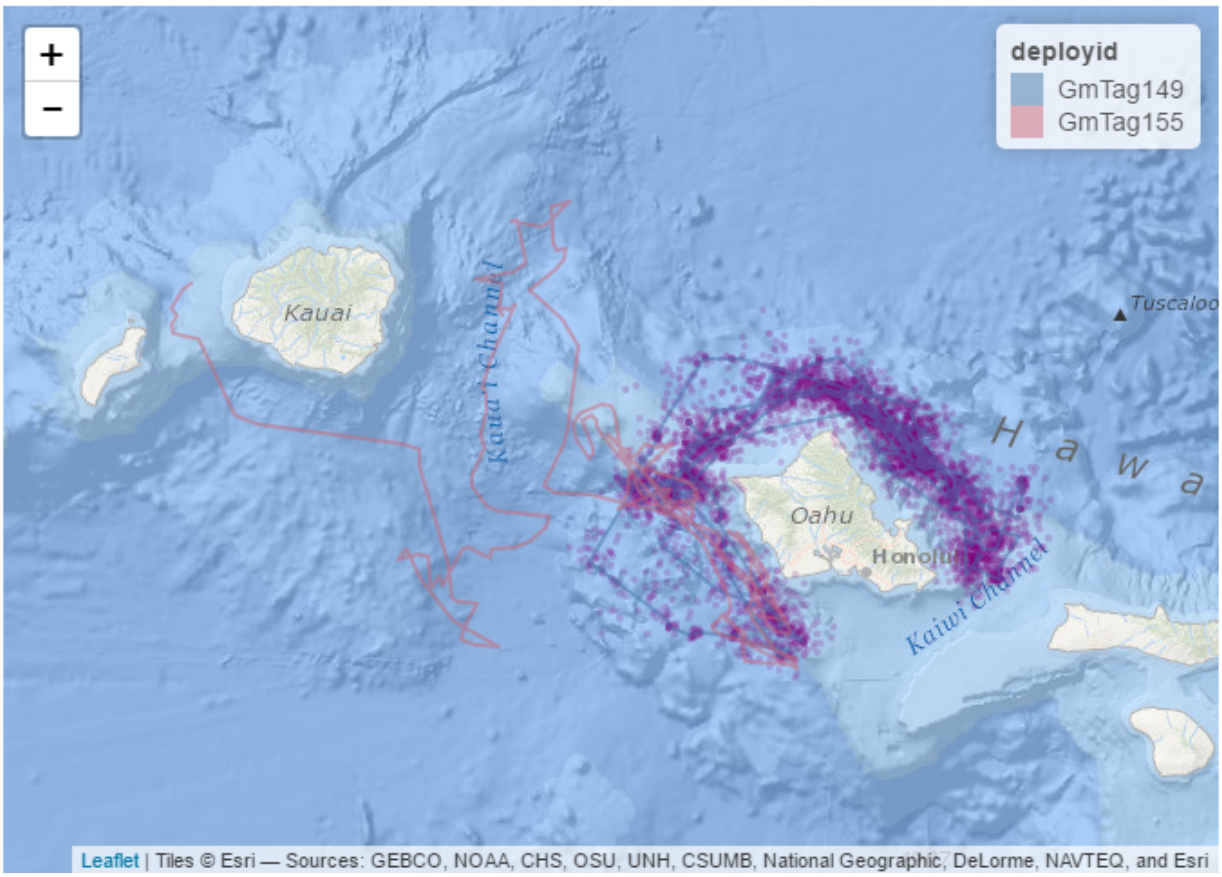

deployid
GmTag149
GmTag155
Kauai
Kaua'i Channel
Oahu
Honolulu
Kaiwi Channel
H a w a
Tuscaloo
Leaflet | Tiles © Esri — Sources: GEBCO, NOAA, CHS, OSU, UNH, CSUMB, National Geographic, DeLorme, NAVTEQ, and Esri

Figure 2: