

Migration Interest Group: Research Applied Toward Education

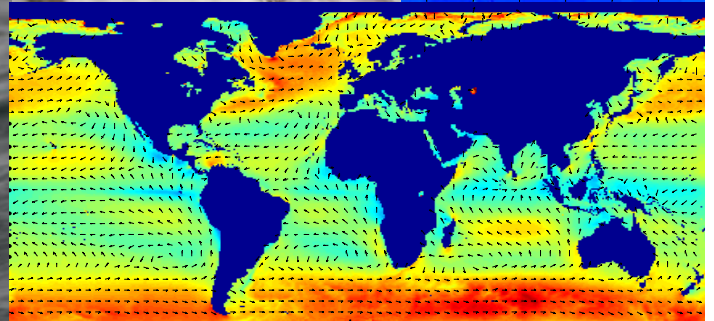
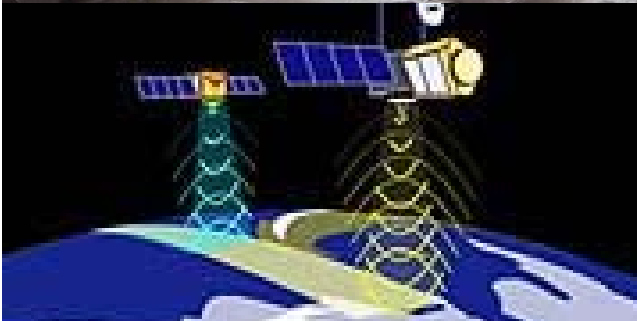
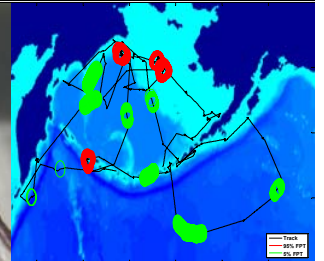
MIGRATE



National Science Foundation Research Coordination Network in Biological Sciences

Case Study: Seabirds

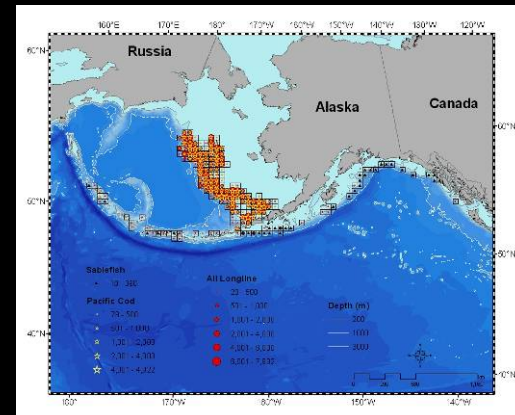
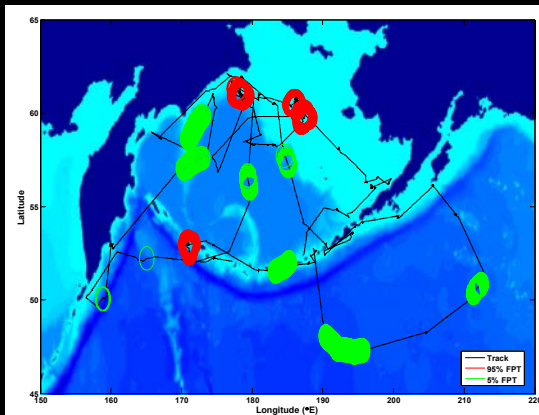
Argos, GPS, GLS



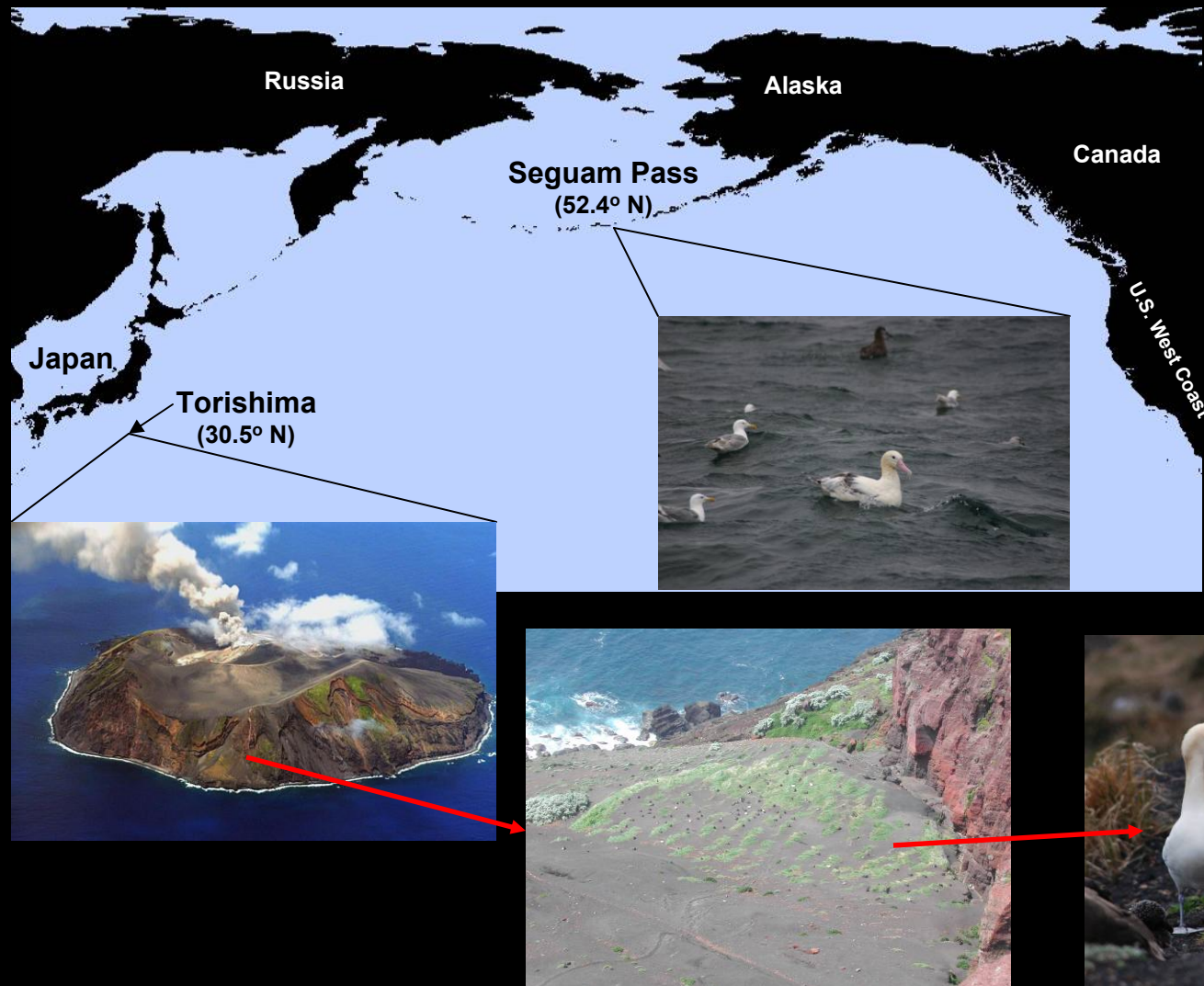
Short-tailed Albatross Objectives

1. Determine breeding and post-breeding season migration routes
2. Identify important habitat features used by short-tailed albatrosses.
3. Construct a mathematical model of habitat use.

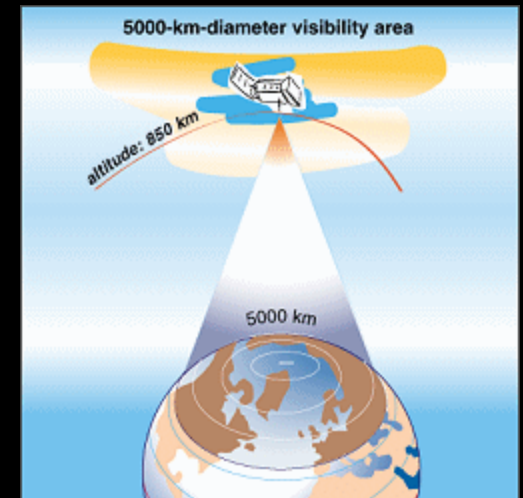
Ultimately to understand the ecology of this species to aid recovery efforts and to identify spatial and temporal overlap with domestic and international fisheries of Pacific Rim countries



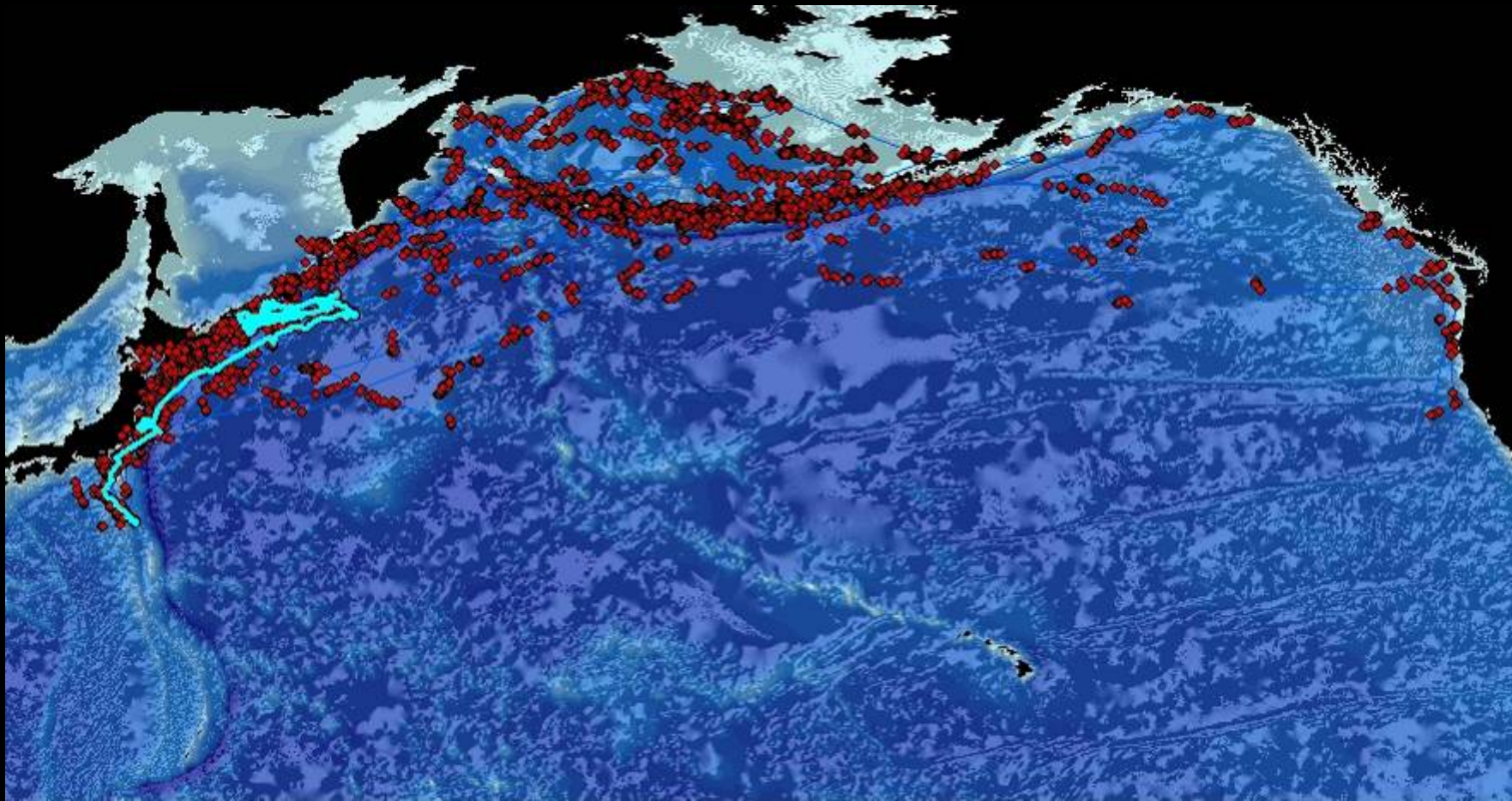
Short-tailed Albatross



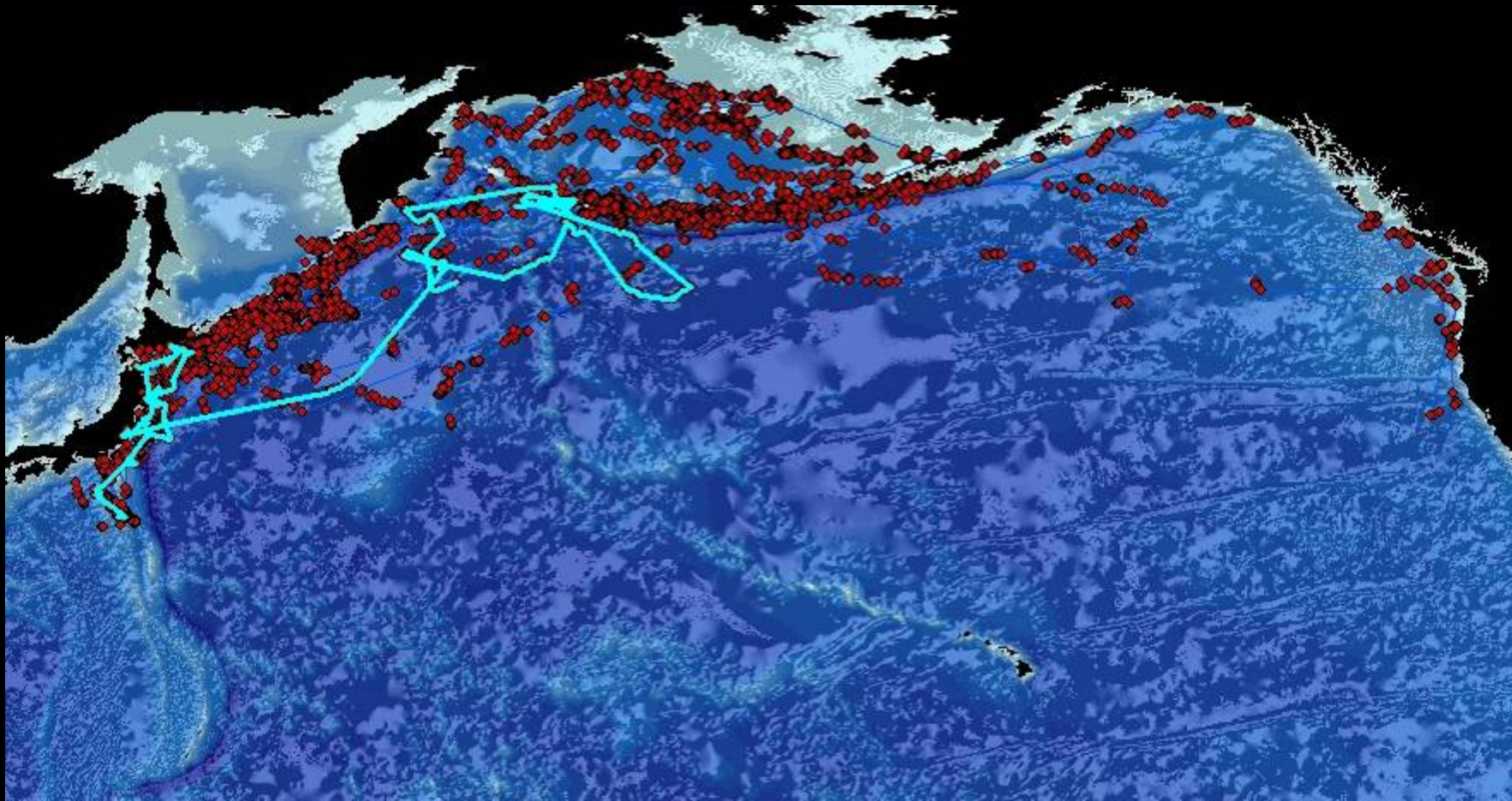
Satellite Tracking



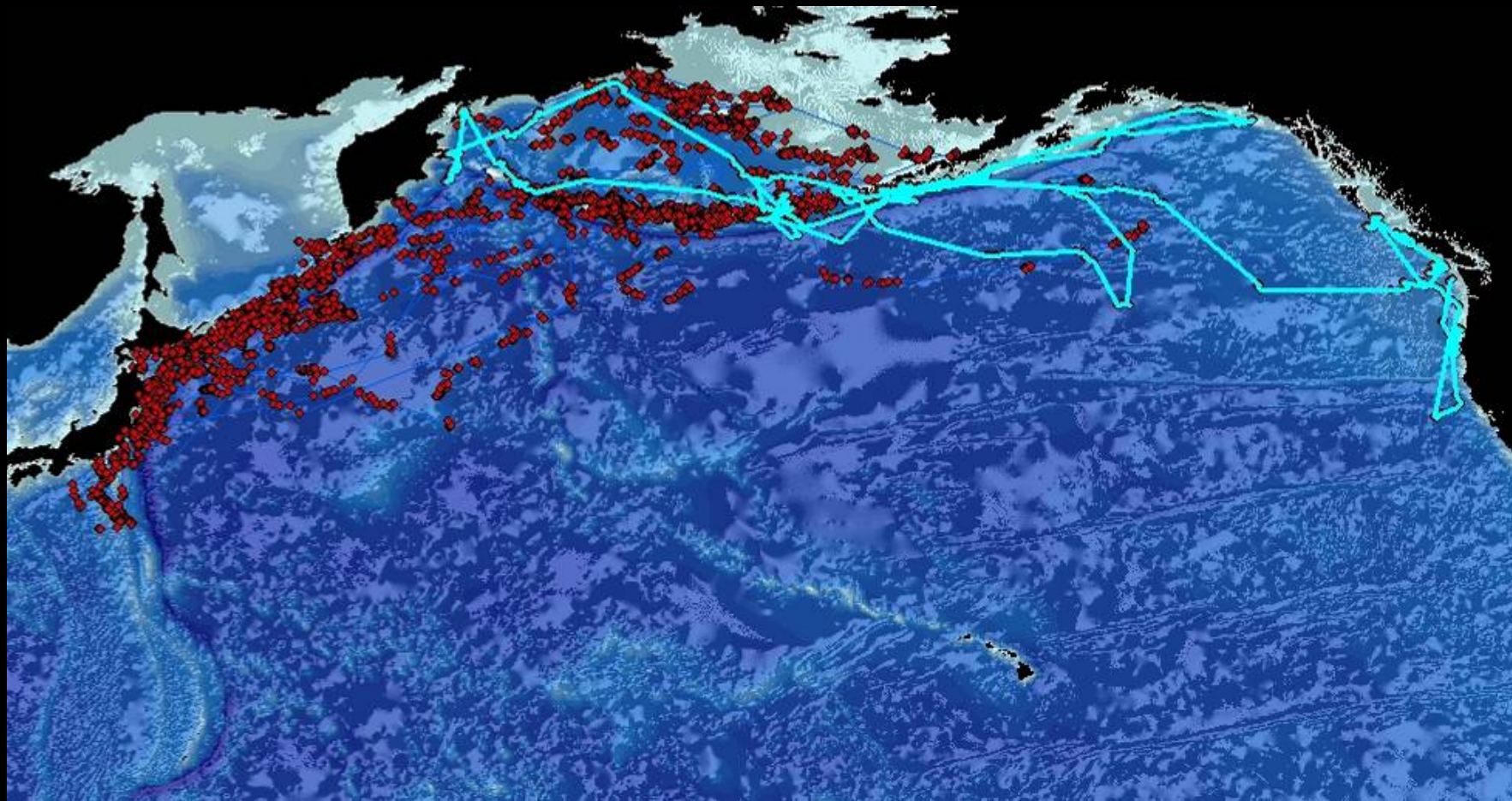
Short-tailed Albatross Tracks



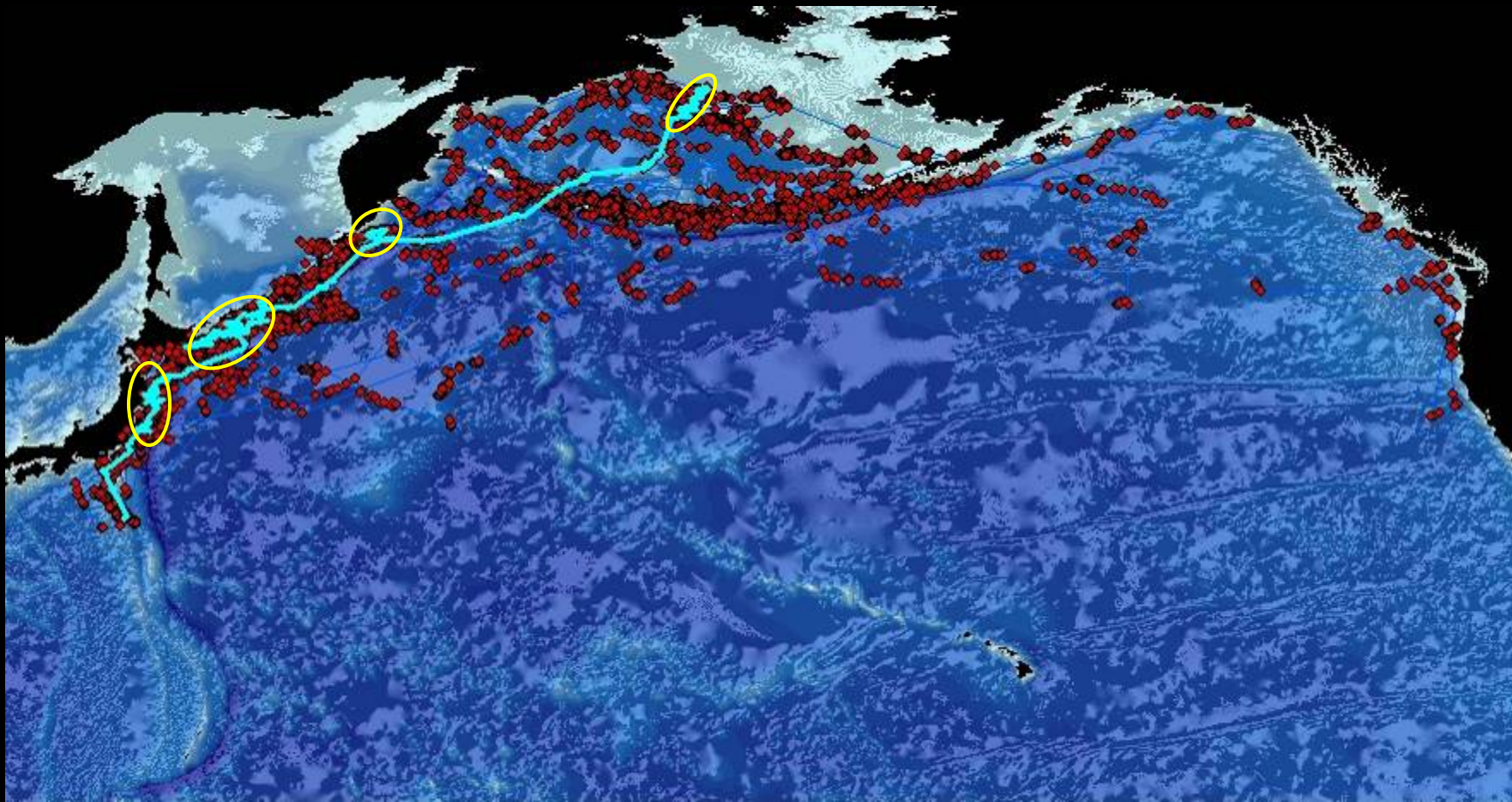
Short-tailed Albatross Tracks



Short-tailed Albatross Tracks

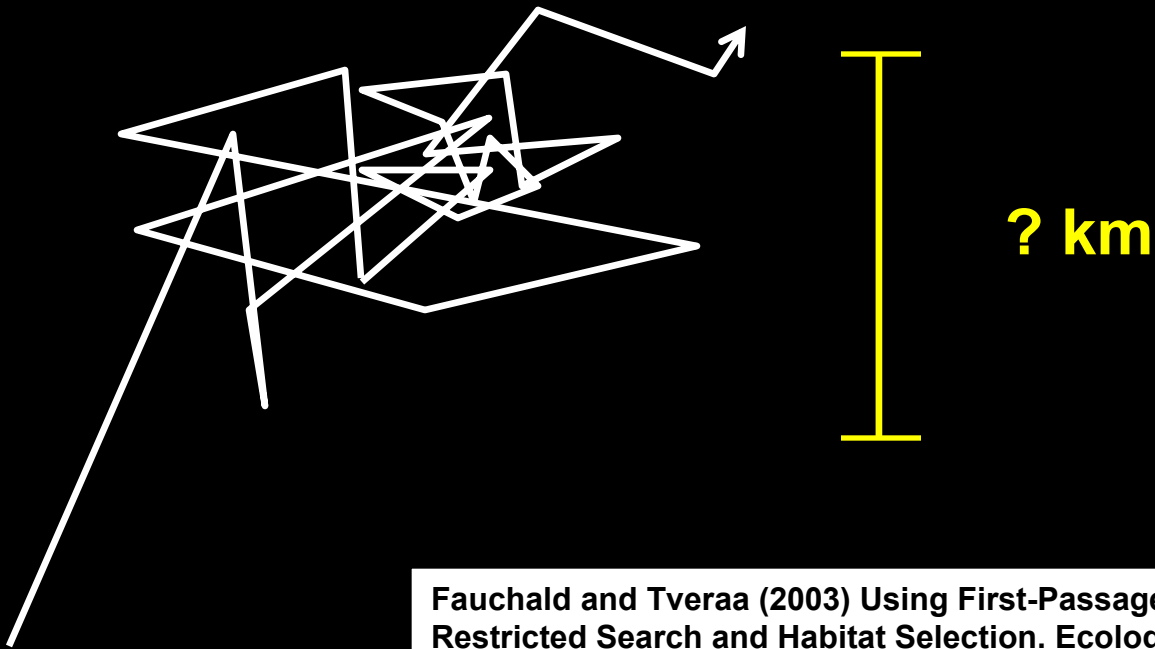


Short-tailed Albatross Tracks



First-Passage Time

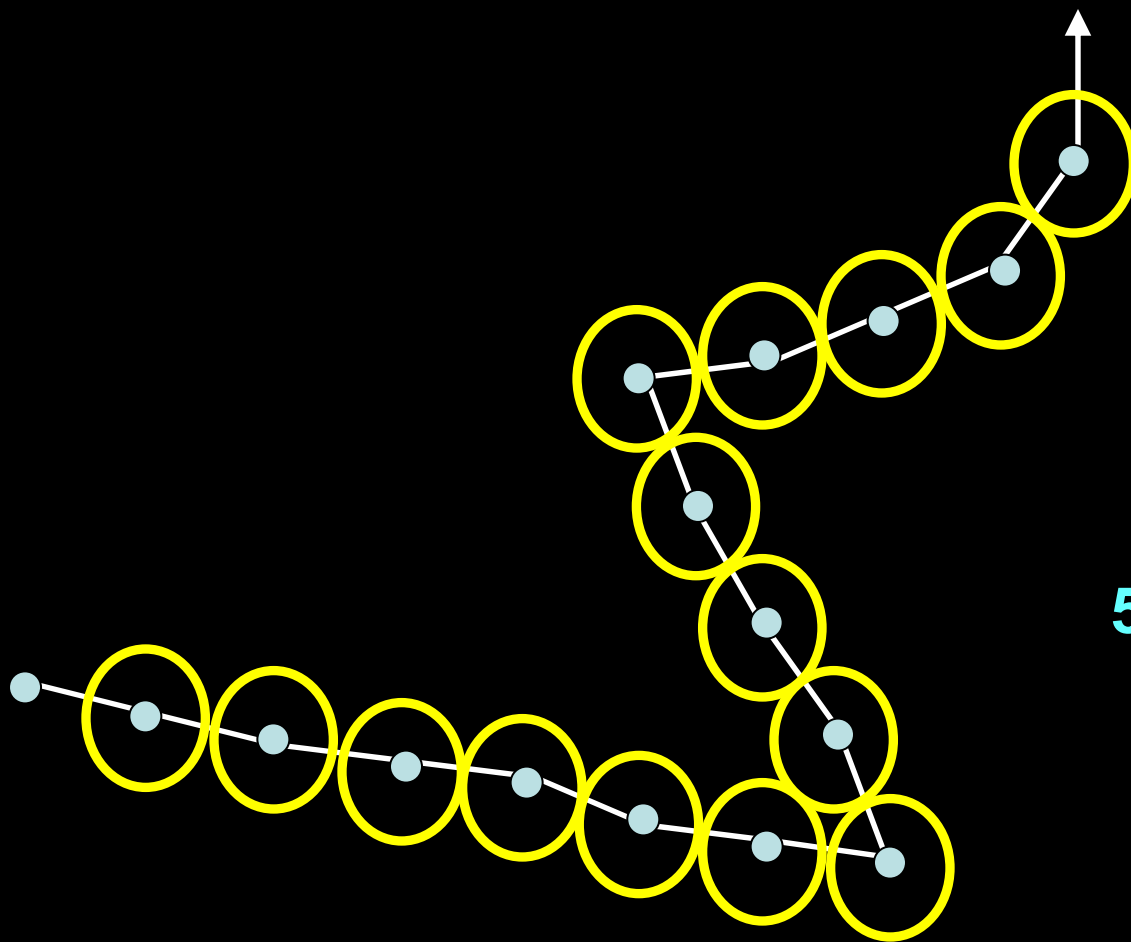
Locate and Determine Scale of Area Restricted Search Patterns



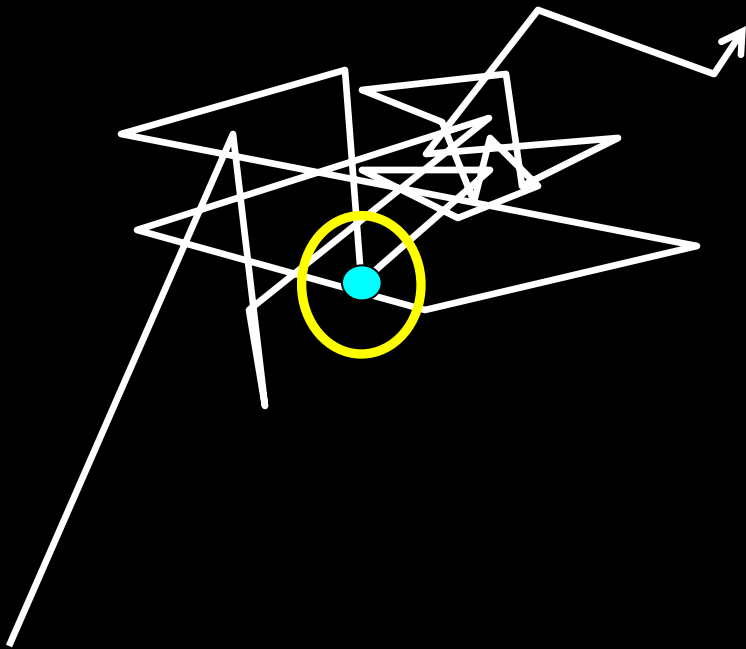
Fauchald and Tveraa (2003) Using First-Passage Time Analysis of Area-Restricted Search and Habitat Selection. Ecology 84:282-288

Johnson et al. (1992) Diffusion in a Fractal Landscape..... Ecology 84:282-288

First-Passage Time

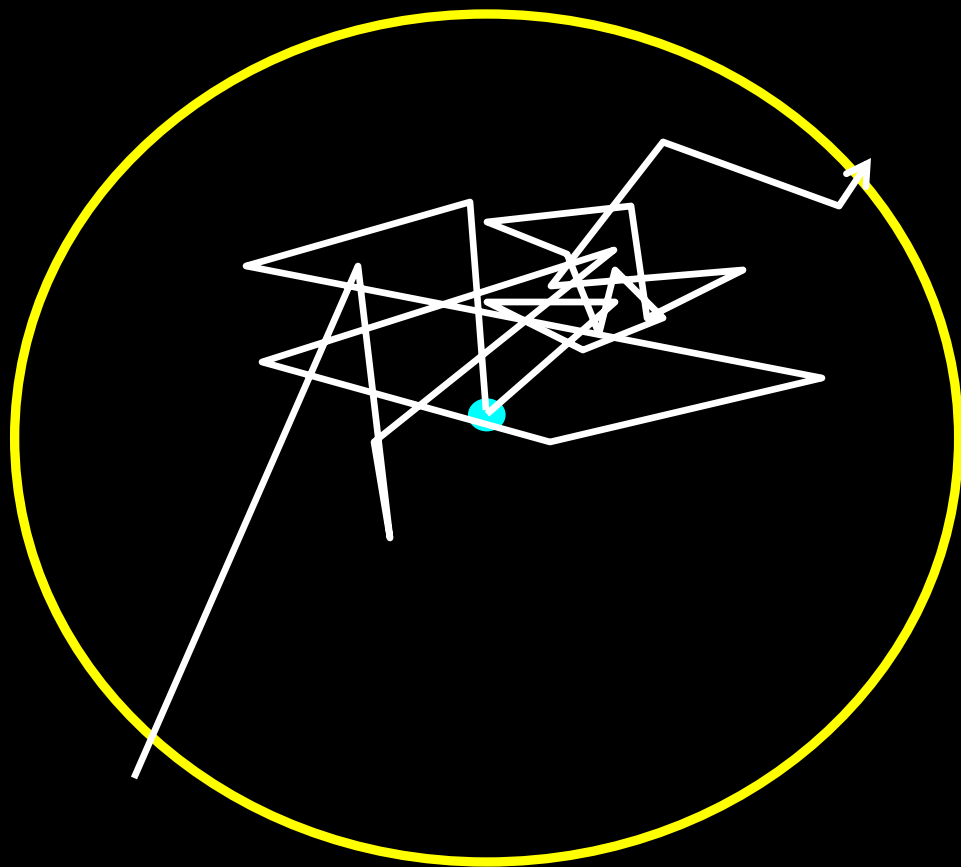


First-Passage Time



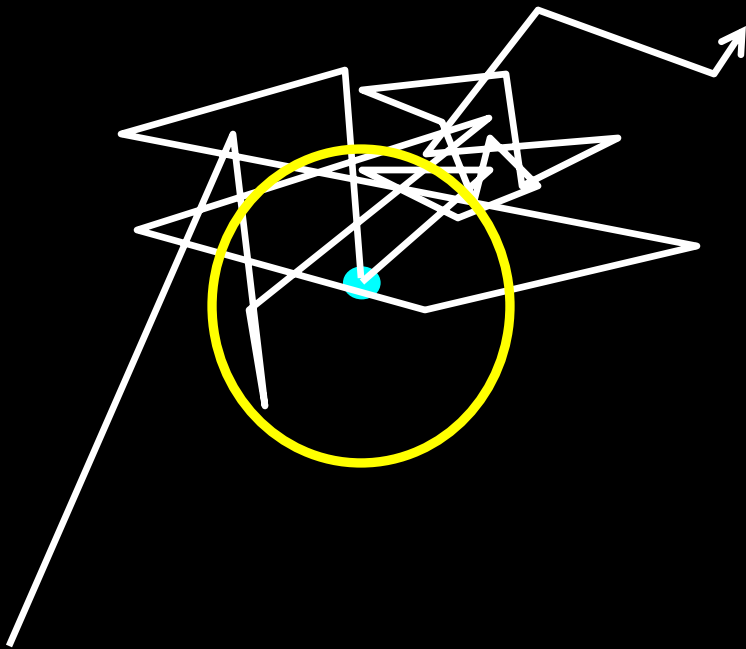
10 km FPT Radius

First-Passage Time



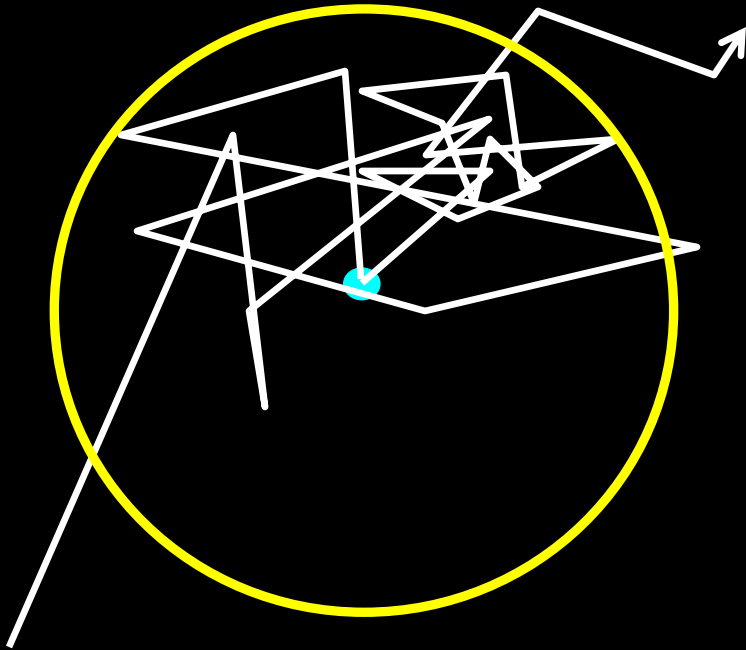
100 km FPT Radius

First-Passage Time



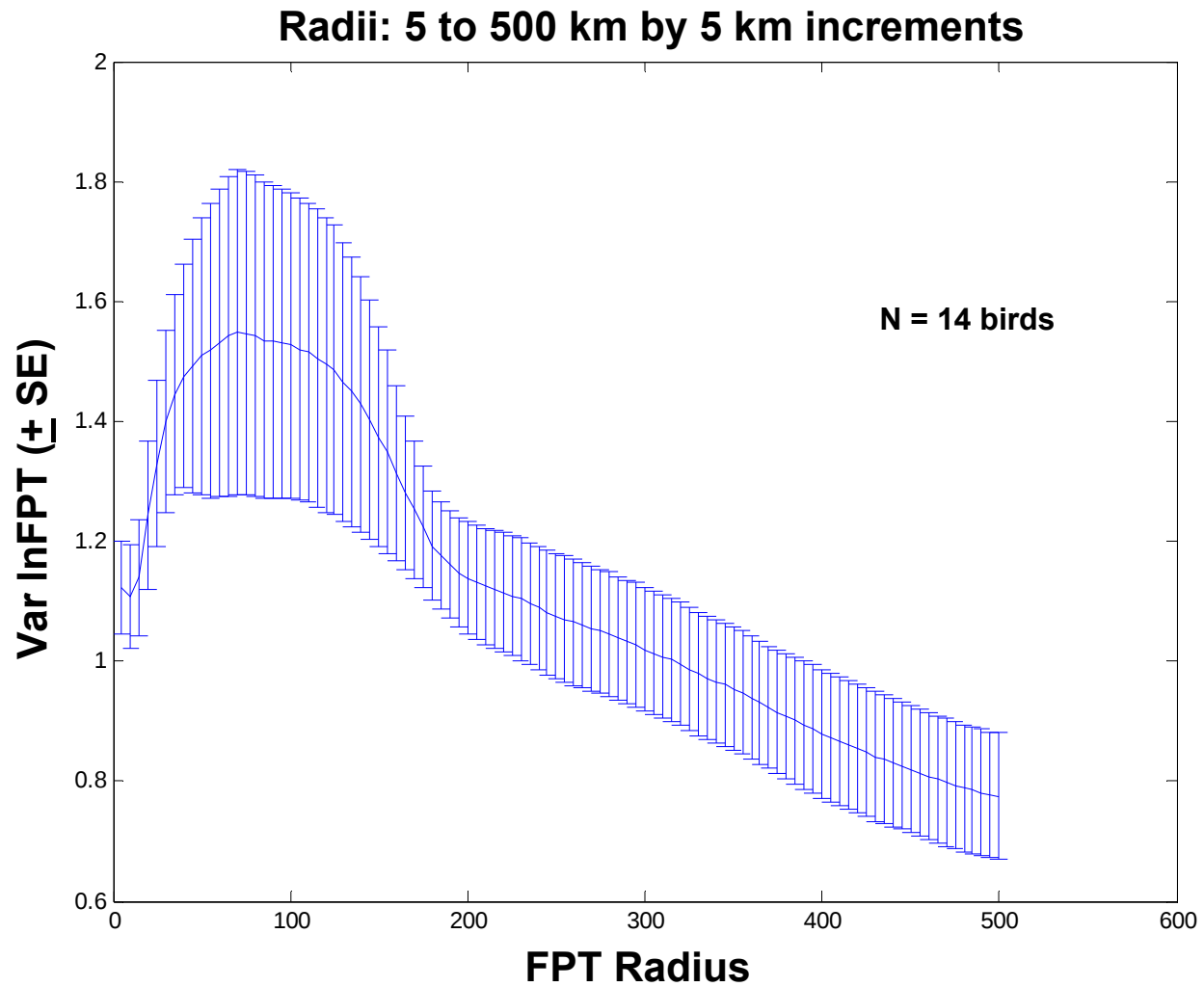
30 km FPT Radius

First-Passage Time

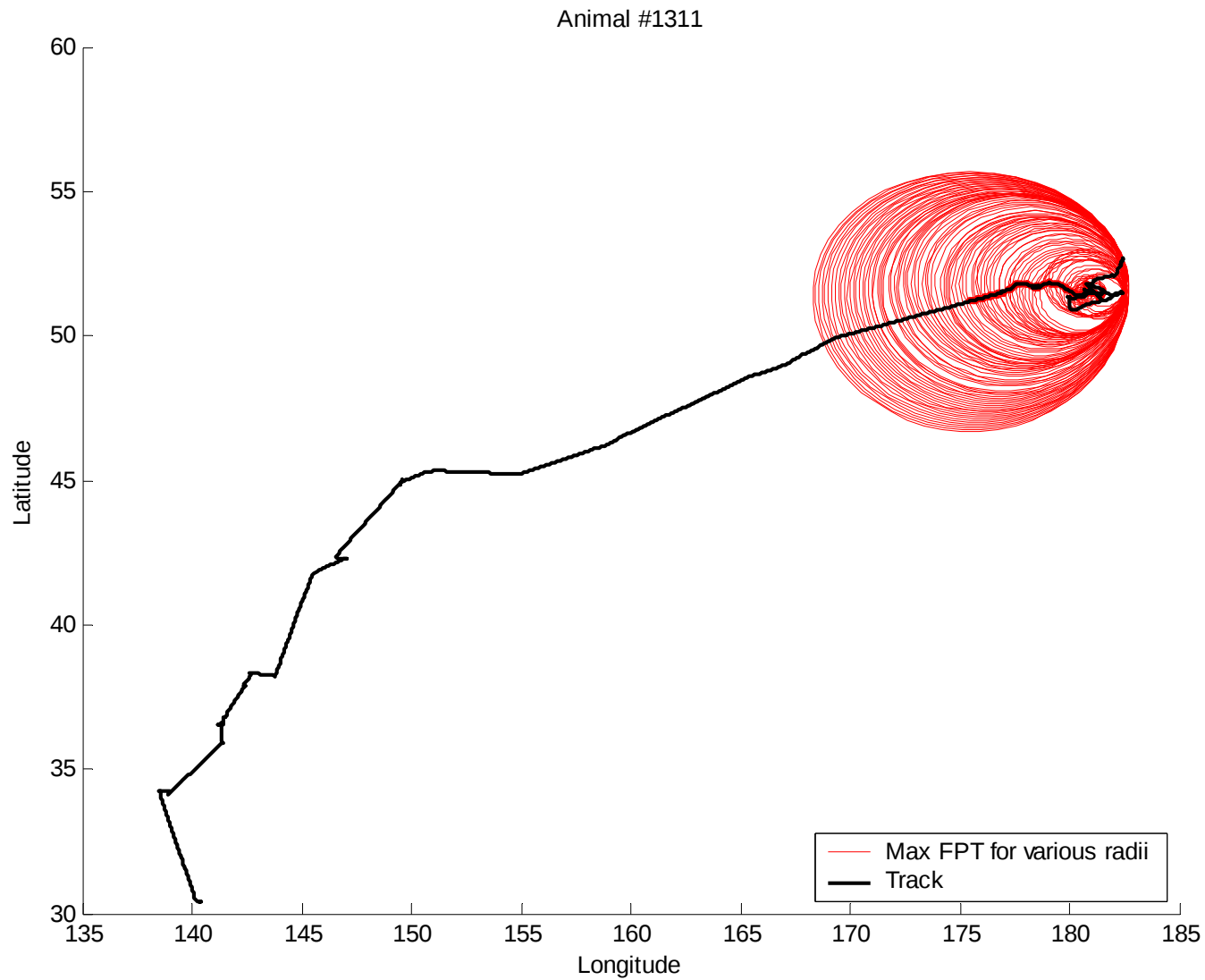


70 km FPT Radius

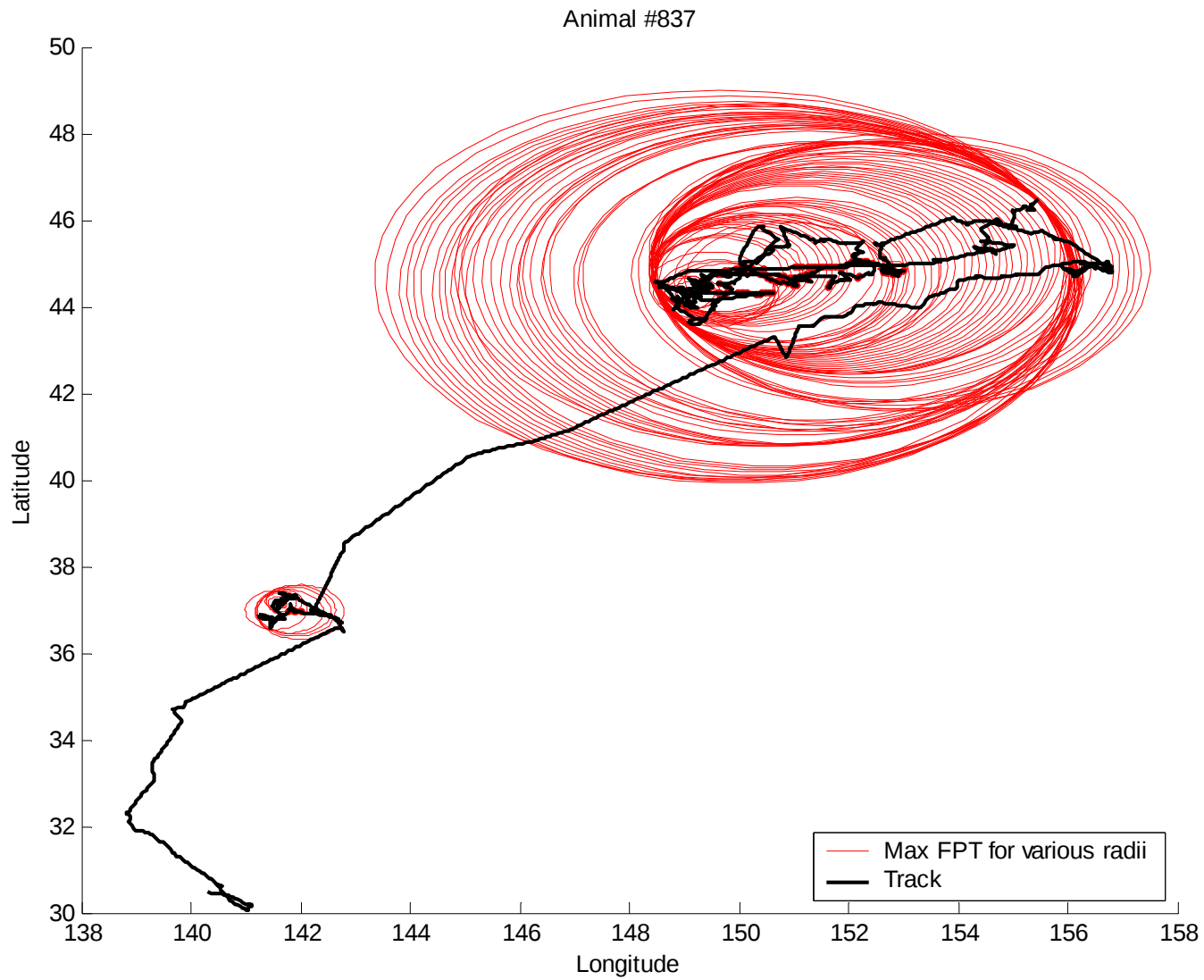
FPT Results



FPT Results

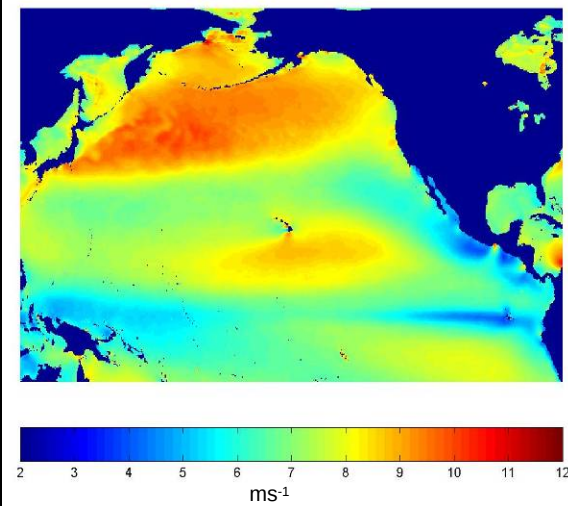


FPT Results

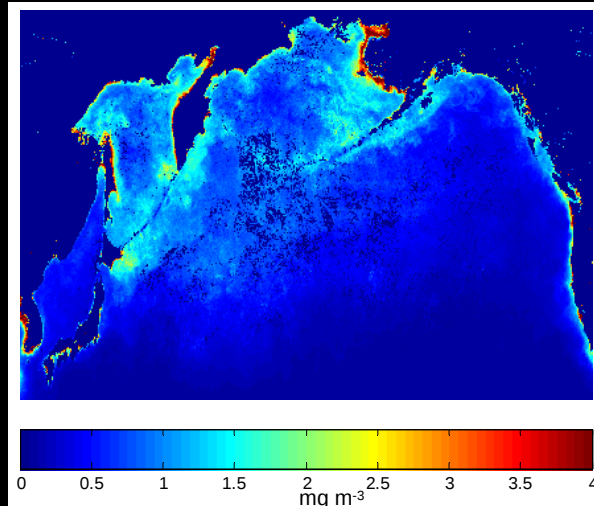


Habitat Variables

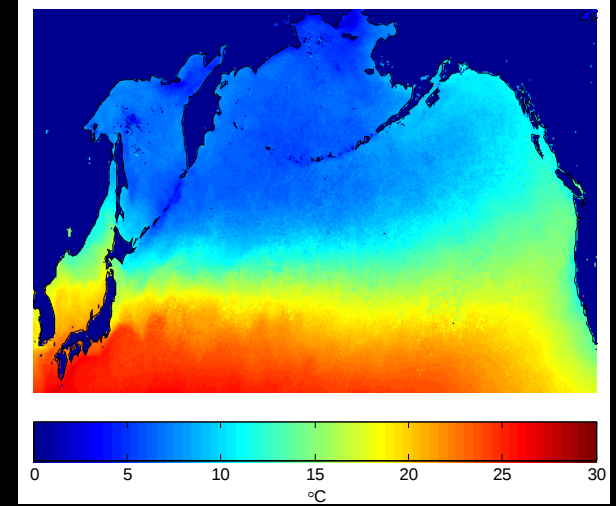
Wind Speed
~23km grid; 3-day



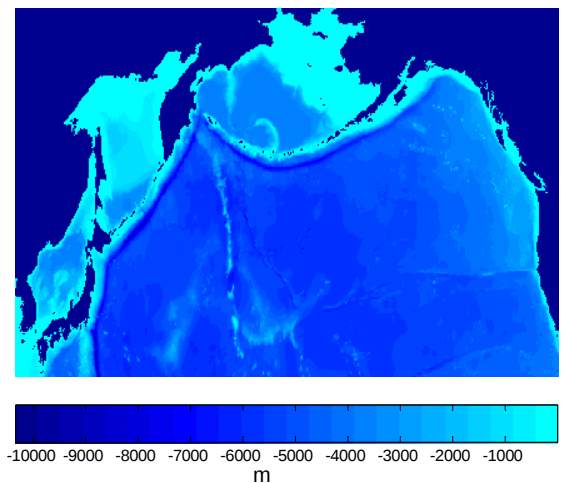
Chl a
~4km grid; 1-mo



SST
~4km grid; 1-wk



Depth
~8km grid



Gradients of Chl a, SST, Depth
Sobel Gradient Operator (3X3 pixel)

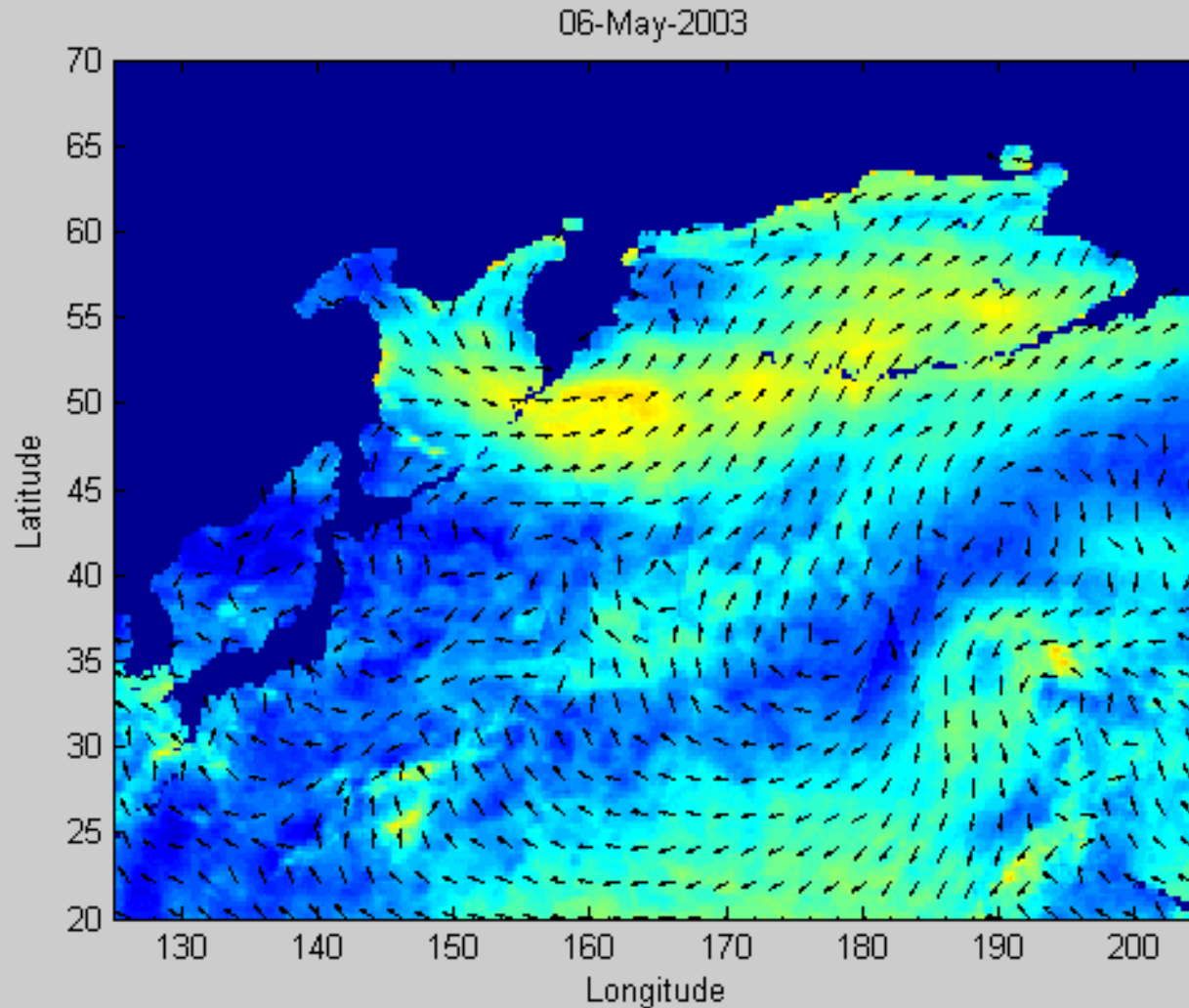
Mixed Effects Linear Model Results

Residence time (FPT) = Response Variable
Individual Bird = Random Effect
Habitat Variables = Fixed Effects

70 km First Passage-Time radii

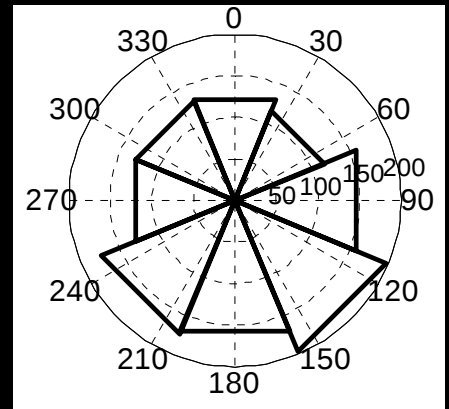
Variables	R ²	ΔAIC
wspd, depth, depthgrad, wspd*depth, chlgrad	0.40	0
wspd, depth, depthgrad, wspd*depth, chl	0.38	2.0

Wind Speed and STAL Migration

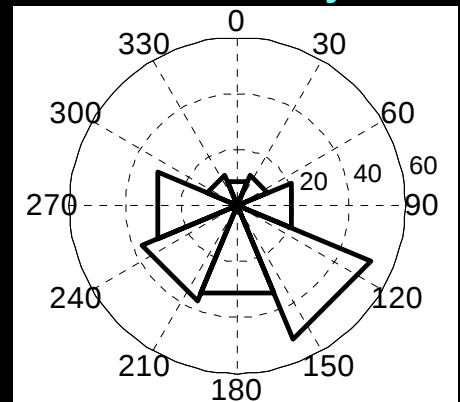


Wind direction relative
to albatross heading –
when traveling:

< 100 km/day

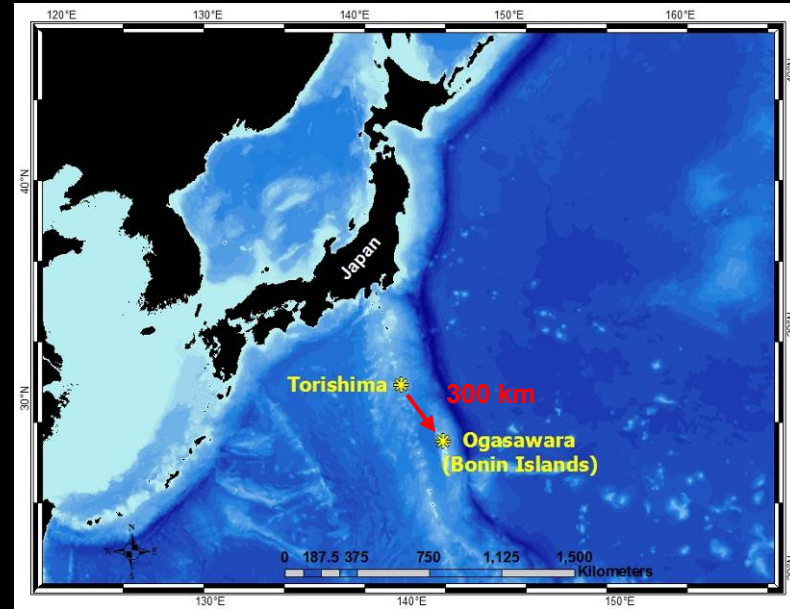


> 100 km/day



New Colony Establishment:

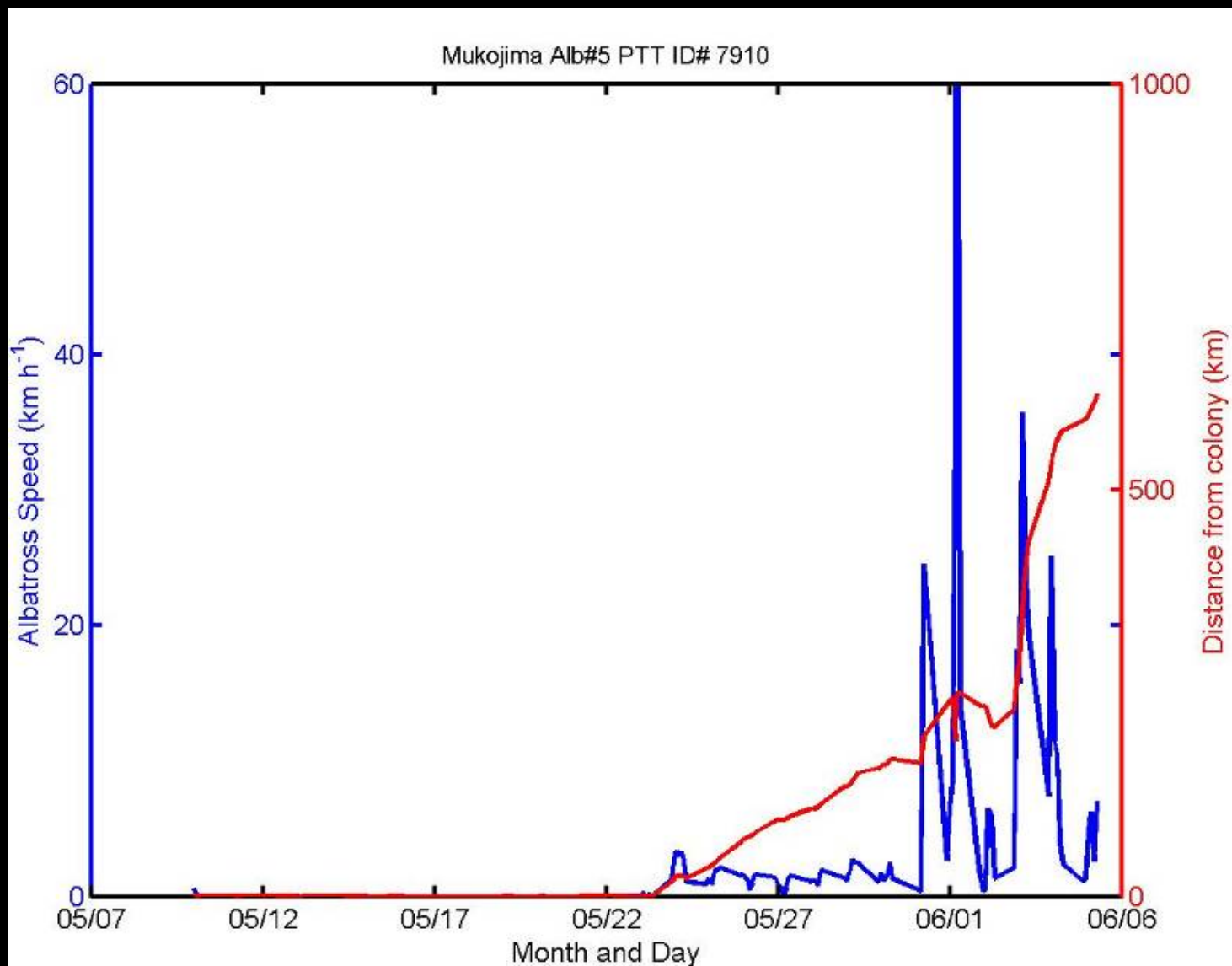
- Chick translocation
- Hand-rearing
- Post-fledging tracking



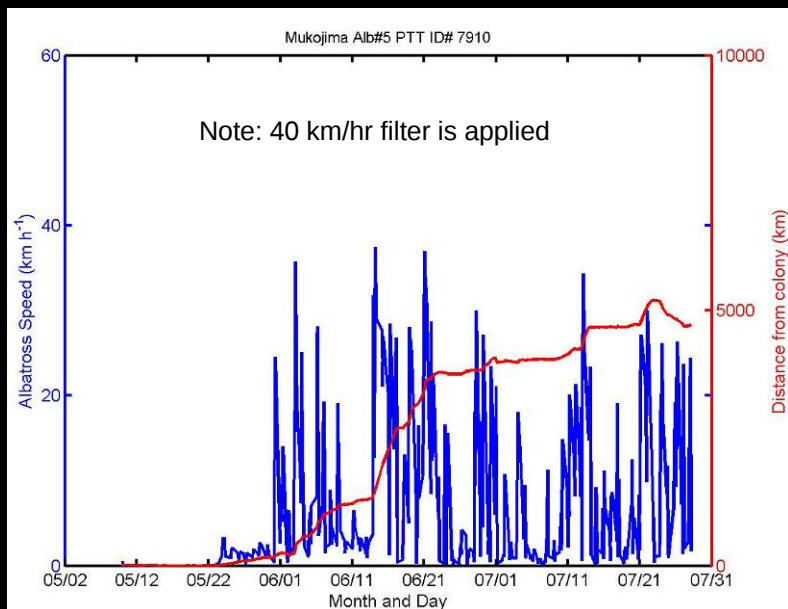
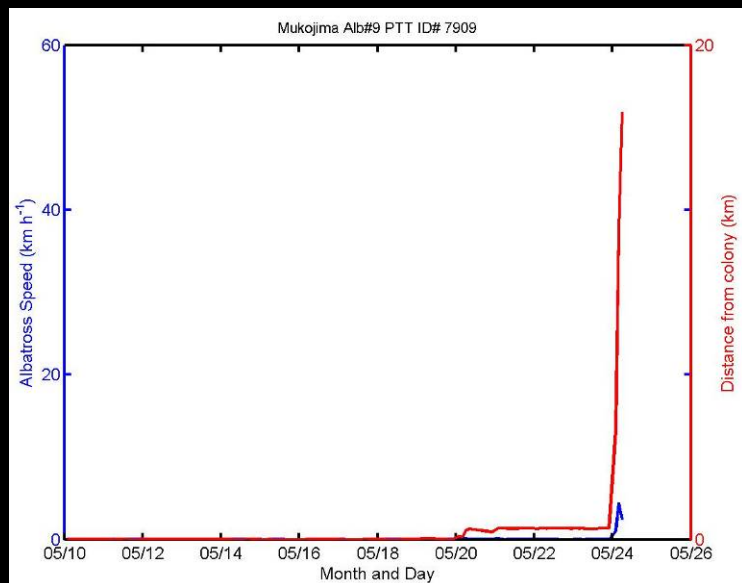
Post-fledging Tracking – GPS/PTT



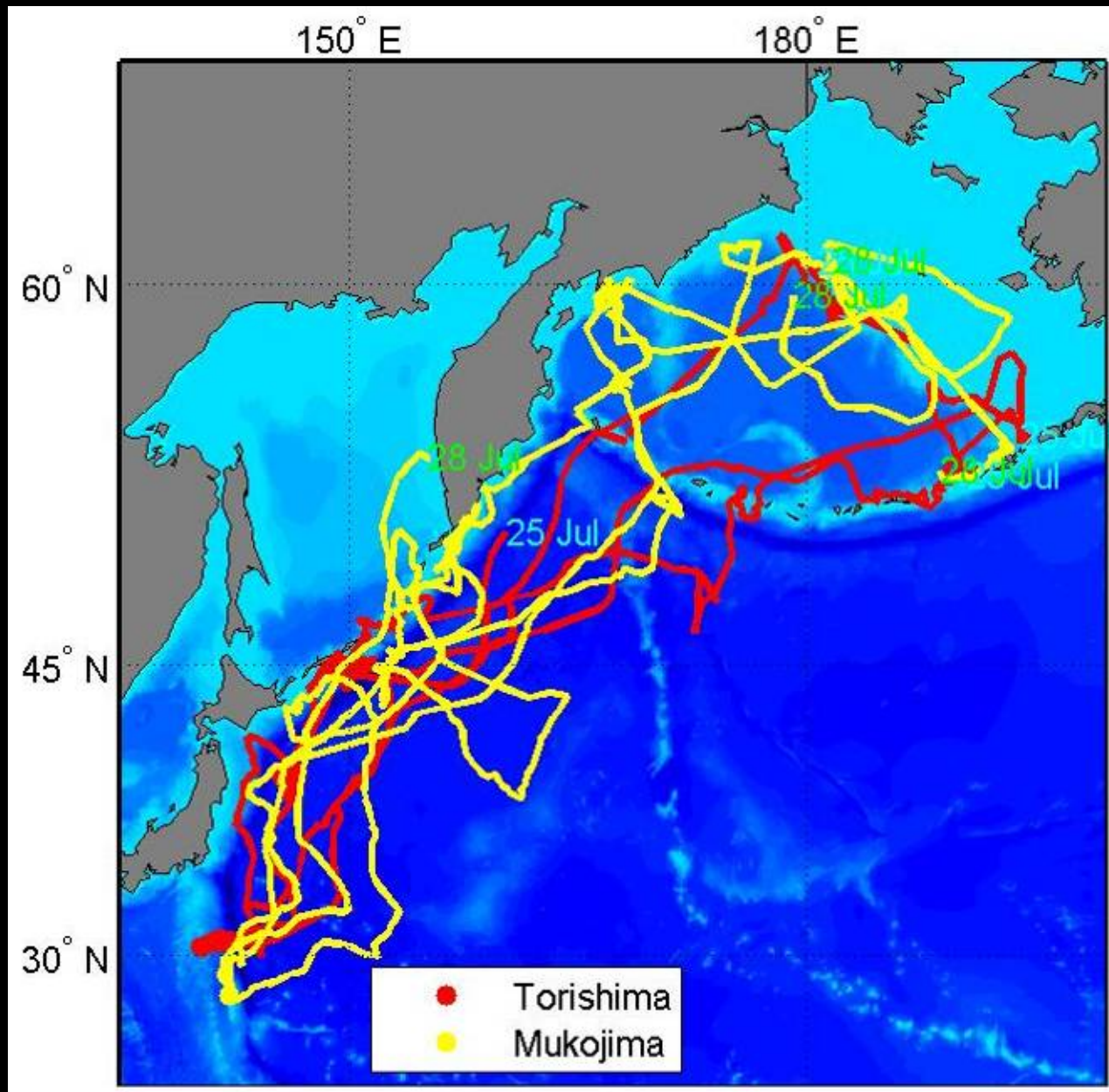
Post-fledging Tracking – Survival Estimates



Post-fledging Tracking – Survival Estimates



Post-fledging Migration & Habitat Use



Geolocation (GLS) Tracking



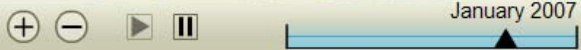
Tagging Of Pacific Predators



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TOPP PREDATORS TAGGING MAP





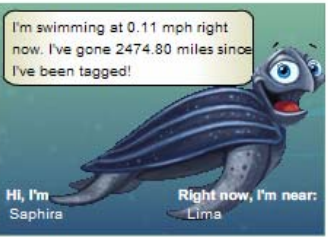
[Animal Key](#) | [Instructions](#)

PHOTO OF THE DAY



GET A WIDGET!

I'm swimming at 0.11 mph right now. I've gone 2474.80 miles since I've been tagged!



Hi, I'm Saphira

Right now, I'm near: Lima



ON TOPP OF THE WORLD BLOG

July 28th, 2008

>> **Last Day**
We were able to get the final 15 archival tags out on small bluefin tuna on Saturday morning, and we topped off the live wells so that 15 fish were aboard swimming in circles below deck.

>> **Tagging Pacific Bluefin**
Epic- Remarkable- Inspiring- Those are words to describe today, Friday, July 11th aboard the F/V Shogun.

>> **Tagging Sharks in the Southern California Bight**
The NMFS team just completed its annual juvenile shark survey in the Southern California Bight

[more](#)

Elephant Seal Homecoming

Elephant Seal Homecoming Days:

Geolocation (GLS) Tracking

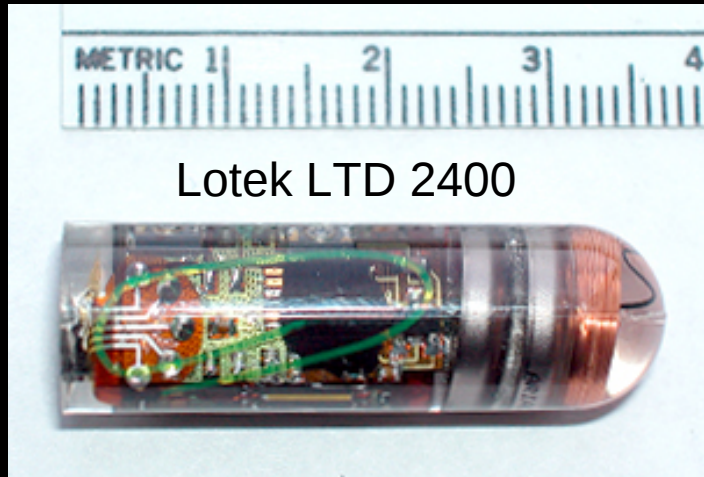
Laysan Albatross



Sooty Shearwater



Archival Data Loggers



Small and light weight

Factors affecting Light-based geolocation

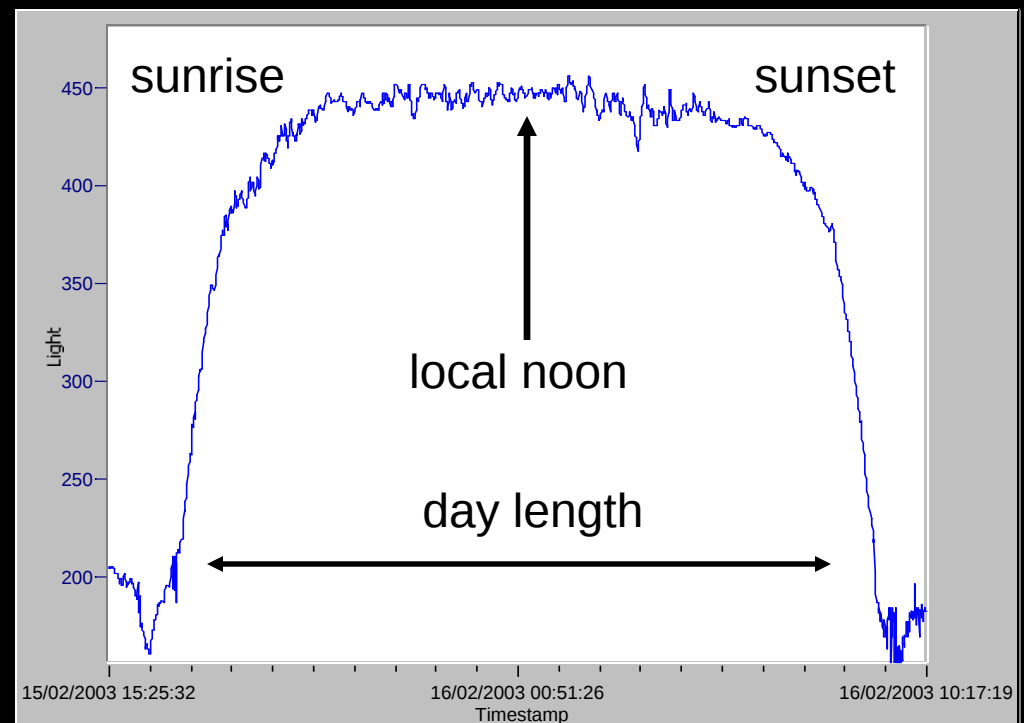
- Weather
- Animal behavior
- Latitudinal errors

1) Day length

2) Season

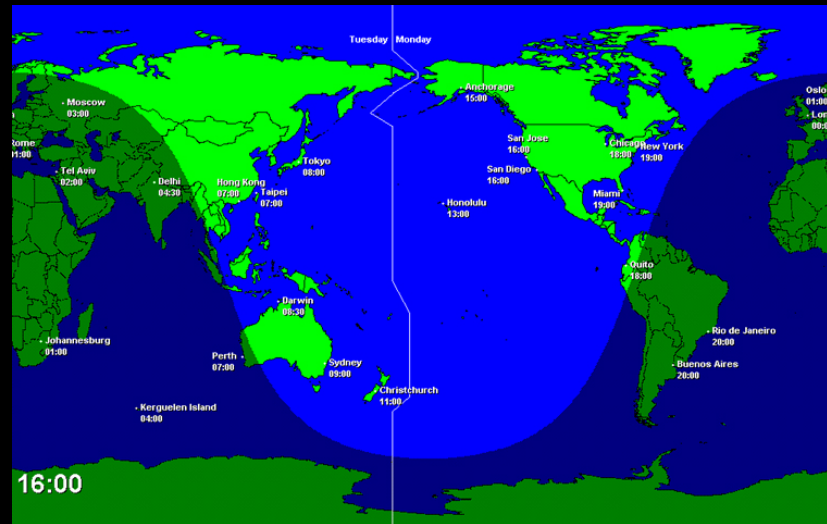
Light-based geolocation

- Longitude - compare local noon or midnight to GMT
- Latitude calculated based on length of day

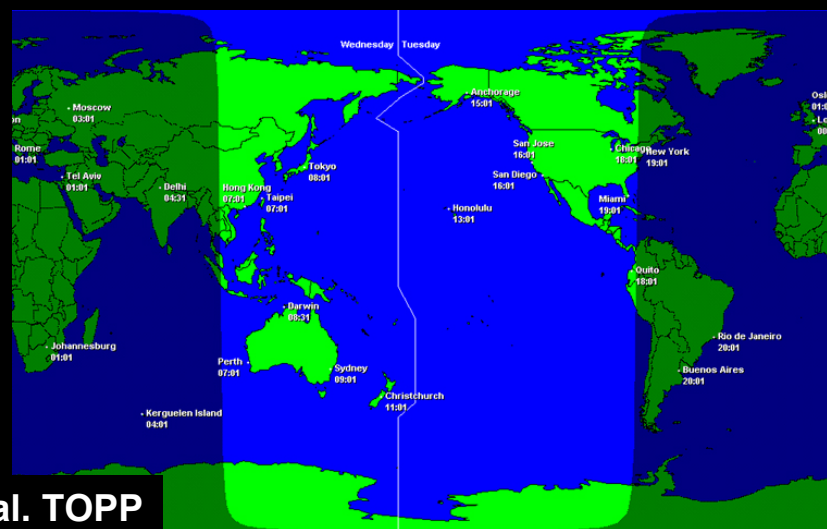


Courtesy of Scott Shaffer et al. TOPP

Day Length Varies With Latitude

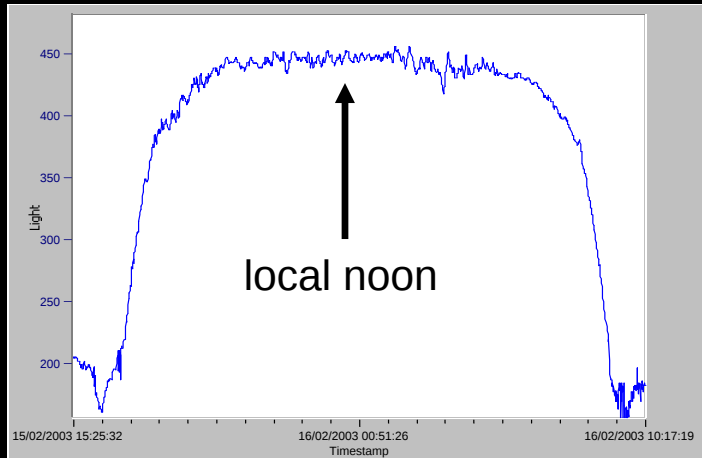


Autumnal & Vernal Equinox



Courtesy of Scott Shaffer et al. TOPP

Light & Sea Surface Temperature (SST) to Geolocate

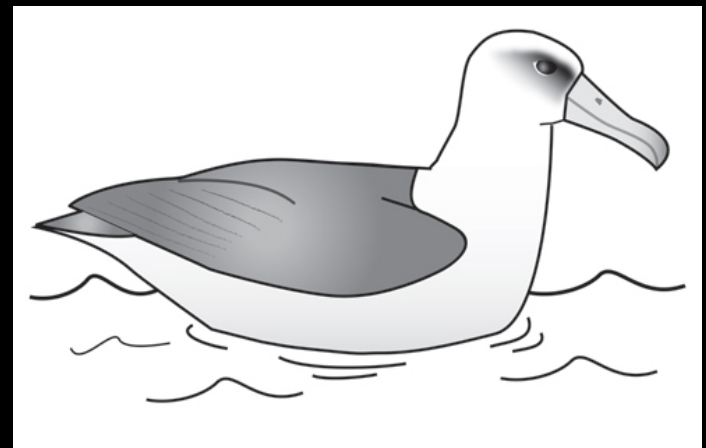
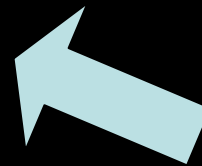
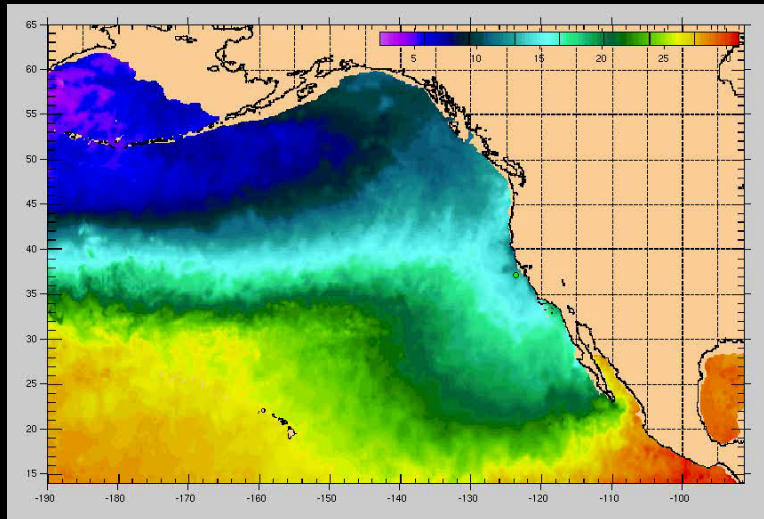


Use Light to estimate
Longitude



Use SST measured by the
tag on a bird to estimate
Latitude

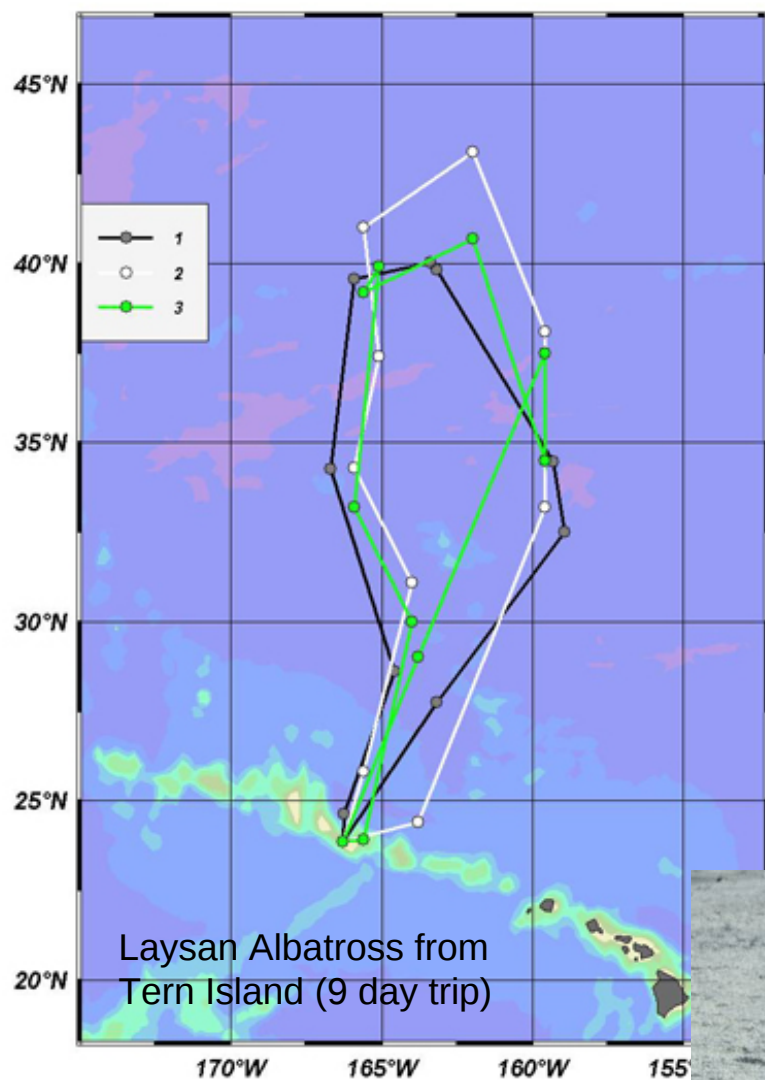
Remotely sensed SST



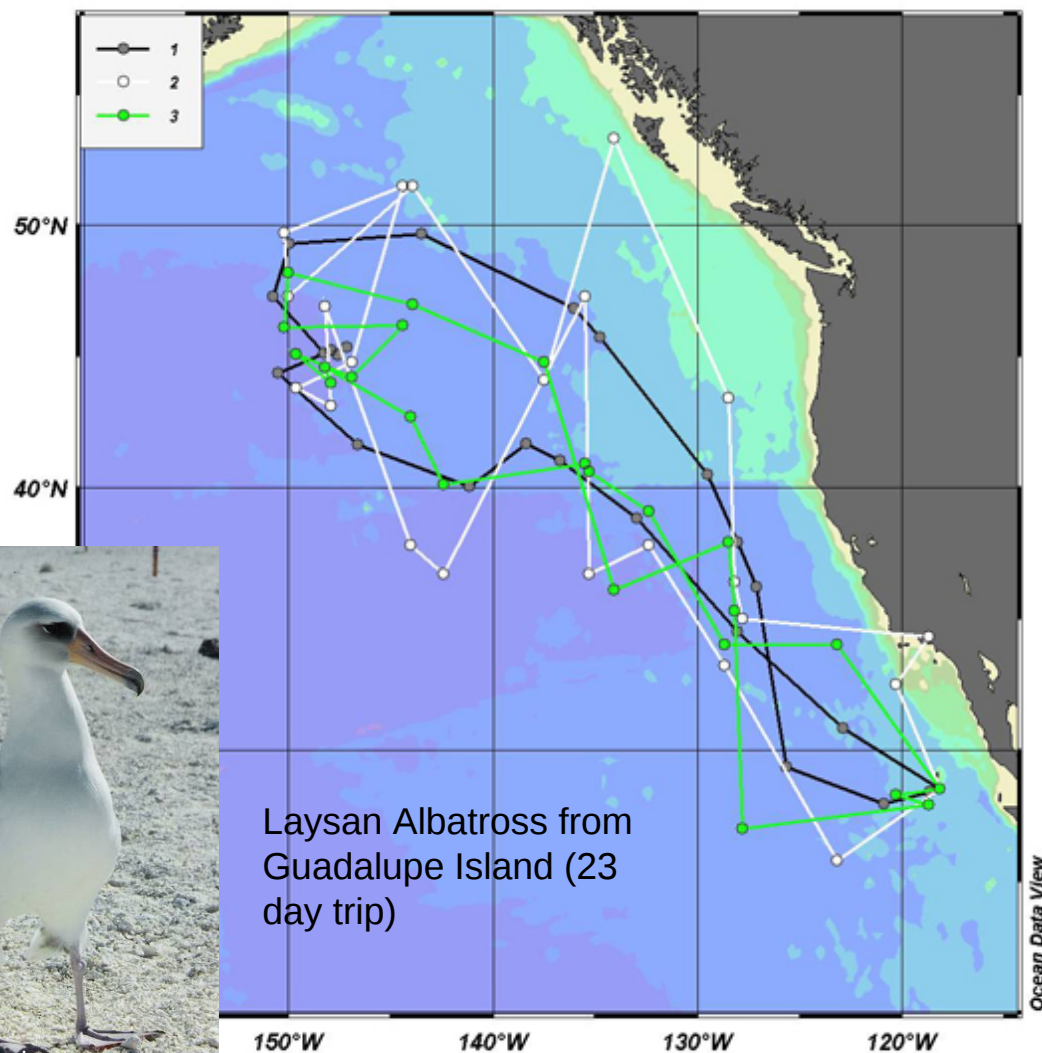
(Beck *et al.* 2002, Teo *et al.* 2004, Shaffer *et al.* 2005)
Courtesy of Scott Shaffer *et al.* TOPP

Comparison of Tracks

- 1) Argos Data
- 2) Light-based Geolocation
- 3) Light- & SST-based Geolocation



Laysan Albatross from
Tern Island (9 day trip)



Laysan Albatross from
Guadalupe Island (23
day trip)



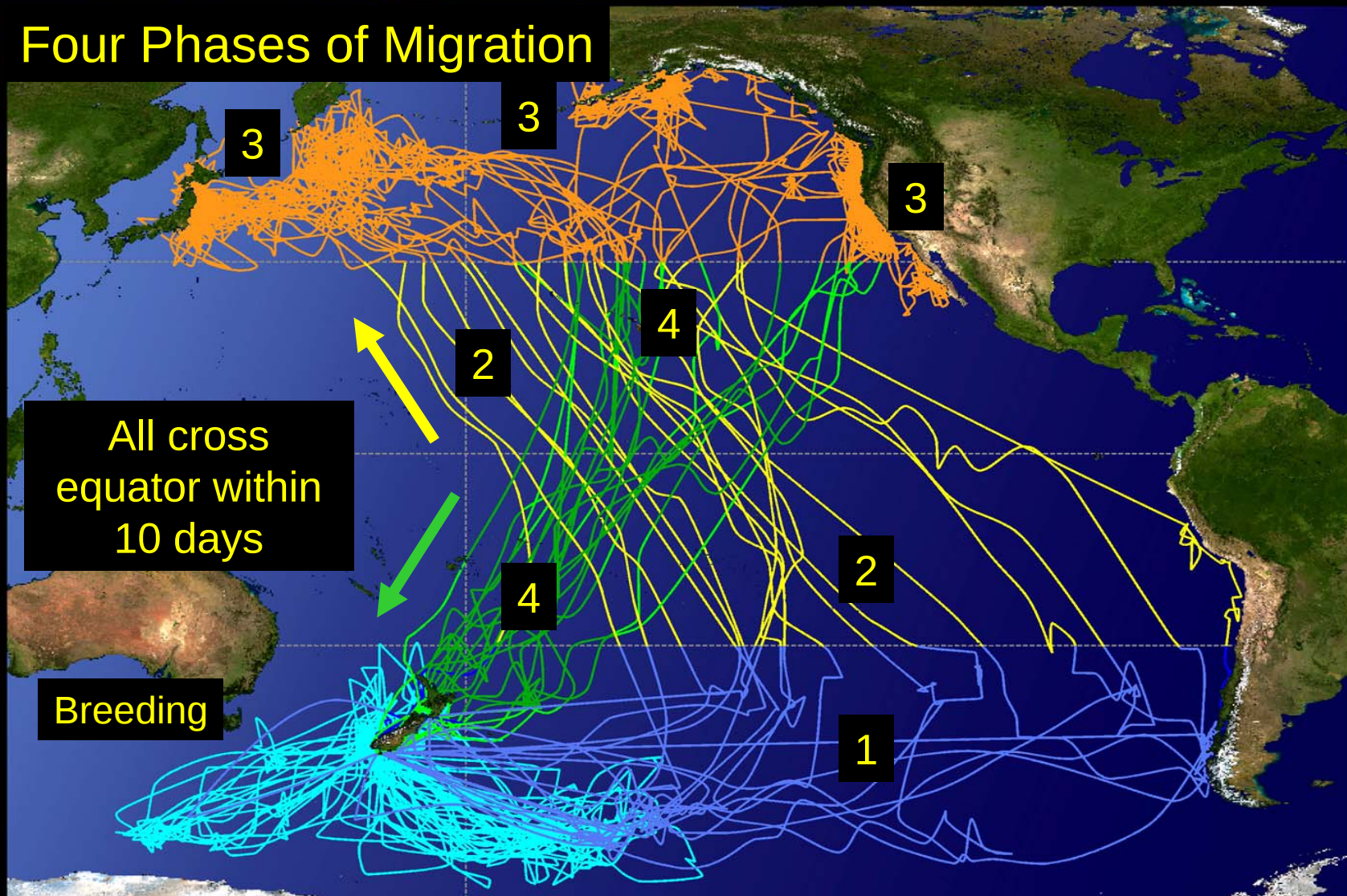
Karen Fischer

Courtesy of Scott Shaffer et al. TOPP

Tracking of Complete Sooty Shearwater Migration

Shaffer et al. 2006. Proc Natl. Acad. Sci. 1.3(34):12799–12802

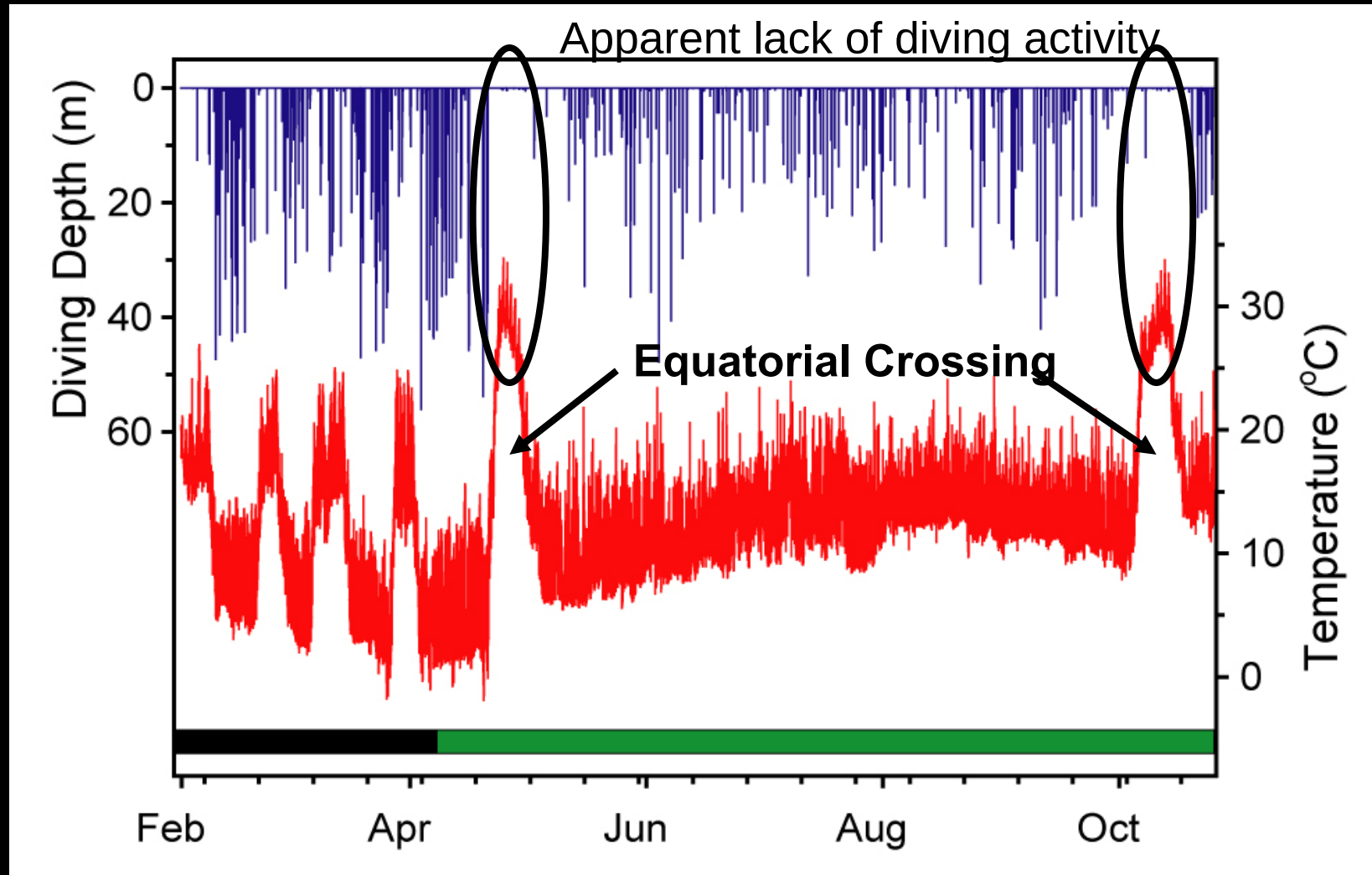
Four Phases of Migration



Courtesy of Scott Shaffer et al. TOPP

Example Time Series Profile

Shaffer et al. 2006. Proc Natl. Acad. Sci. 1.3(34):12799–12802



Courtesy of Scott Shaffer et al. TOPP