Geolocators Reveal Migratory Patterns of Arctic Terns Nesting in Maine

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Arctic Terns in the Gulf of Maine

- In 2015, 2,500 pairs of Arctic Terns nested at 8 colonies in the Gulf of Maine

- Four islands within Maine Coastal Islands NWR support 98% of Arctic Terns breeding in the lower 48 states

- Clutch size, chick growth rates, and productivity rates have all declined in the past 10 yrs (despite constant management actions)

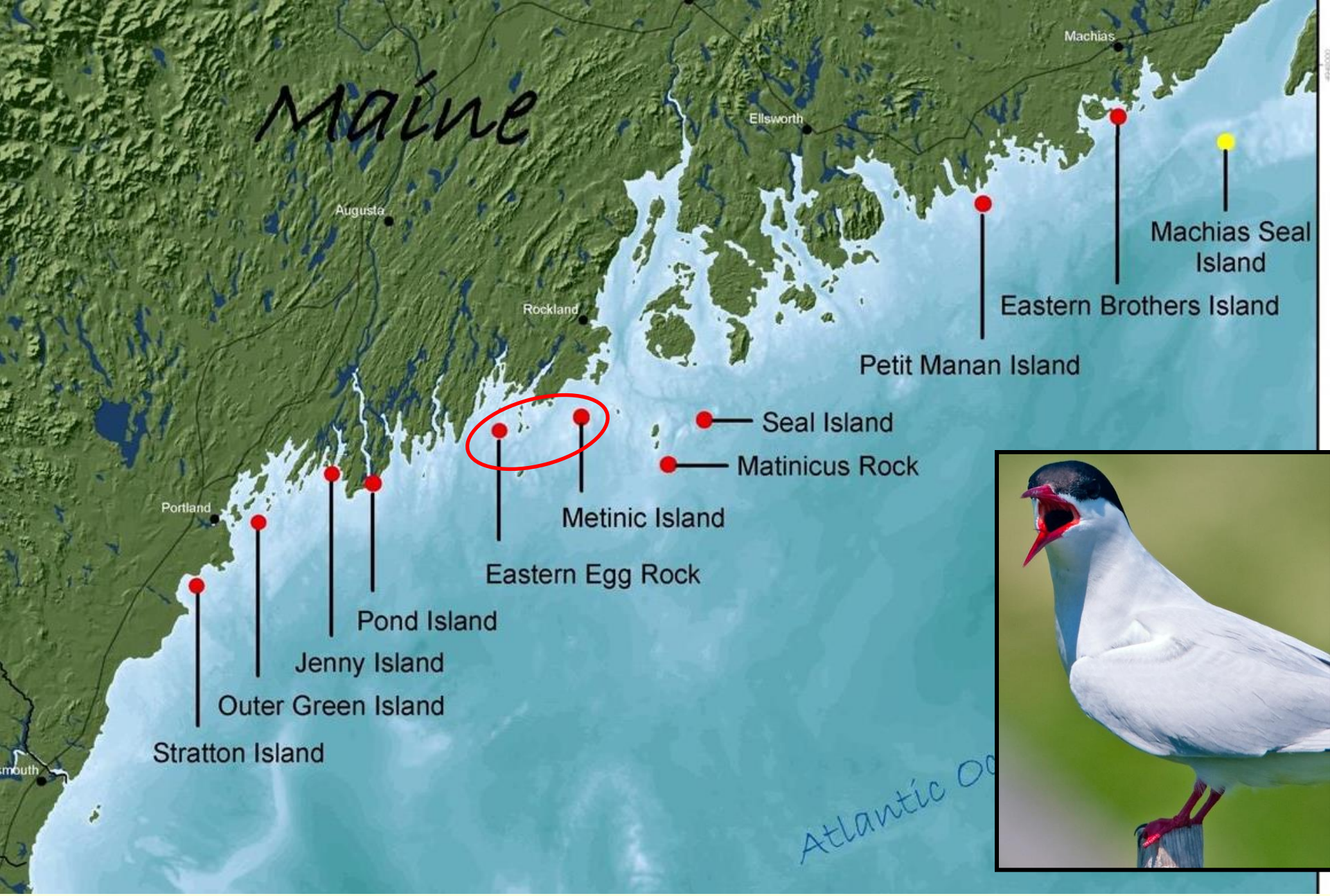
- Gulf of Maine Arctic Tern population has declined 51% and 50% of colonies have been lost in the past 10 years

Project Objectives

Document migration routes, stopover habitat, and wintering areas for Arctic terns breeding in Maine

Geolocators

- Small light sensing units attached to leg bands
  - 1.6 gram units – allows for tracking smaller seabirds
- Estimate location based on hours of daylight and time of sunrise / sunset
- Error of +/- 180km (not suitable for determining foraging habitat)
  - Error increases near equator or equinox
- Cost $160/unit (plus $70 for processing)
- <u>Must recover device to obtain data!</u>


Maine
Machias
Ellsworth
Augusta
Rockland
Portland
Machias Seal Island
Eastern Brothers Island
Petit Manan Island
Seal Island
Matinicus Rock
Metinic Island
Eastern Egg Rock
Pond Island
Jenny Island
Outer Green Island
Stratton Island

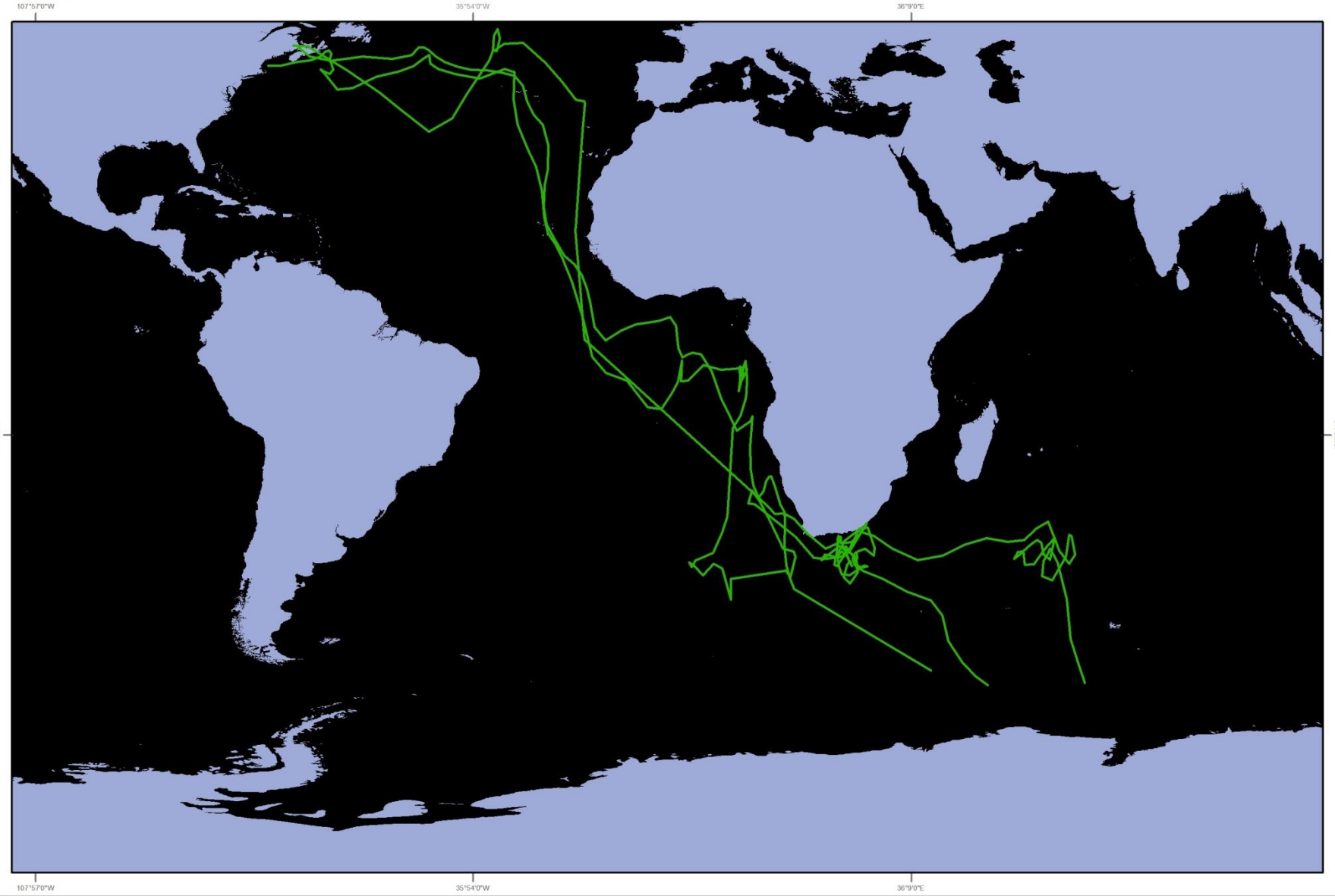

30 geolocators deployed on nesting ARTE on Metinic and Eastern Egg Rock in June 2010

Tag Recovery

- In 2011 incubating ARTE were re-trapped at the 2 breeding colonies
- 8/15 (53%) returned to each island
- 11/16 units recovered (69%)
- 9/11 (81%) had complete migration tracks
- In 2012, two ARTE from Metinic were retrapped on Matinicus Rock. Units had two full years of data!
- In 2014, one ARTE was recaptured on Metinic with 2.5 years of data.
- Overall: 14/30 units recovered (47%)

Arctic Tern *Sterna paradisaea* — *Geolocators*

U.S. Fish & Wildlife Service — Audubon

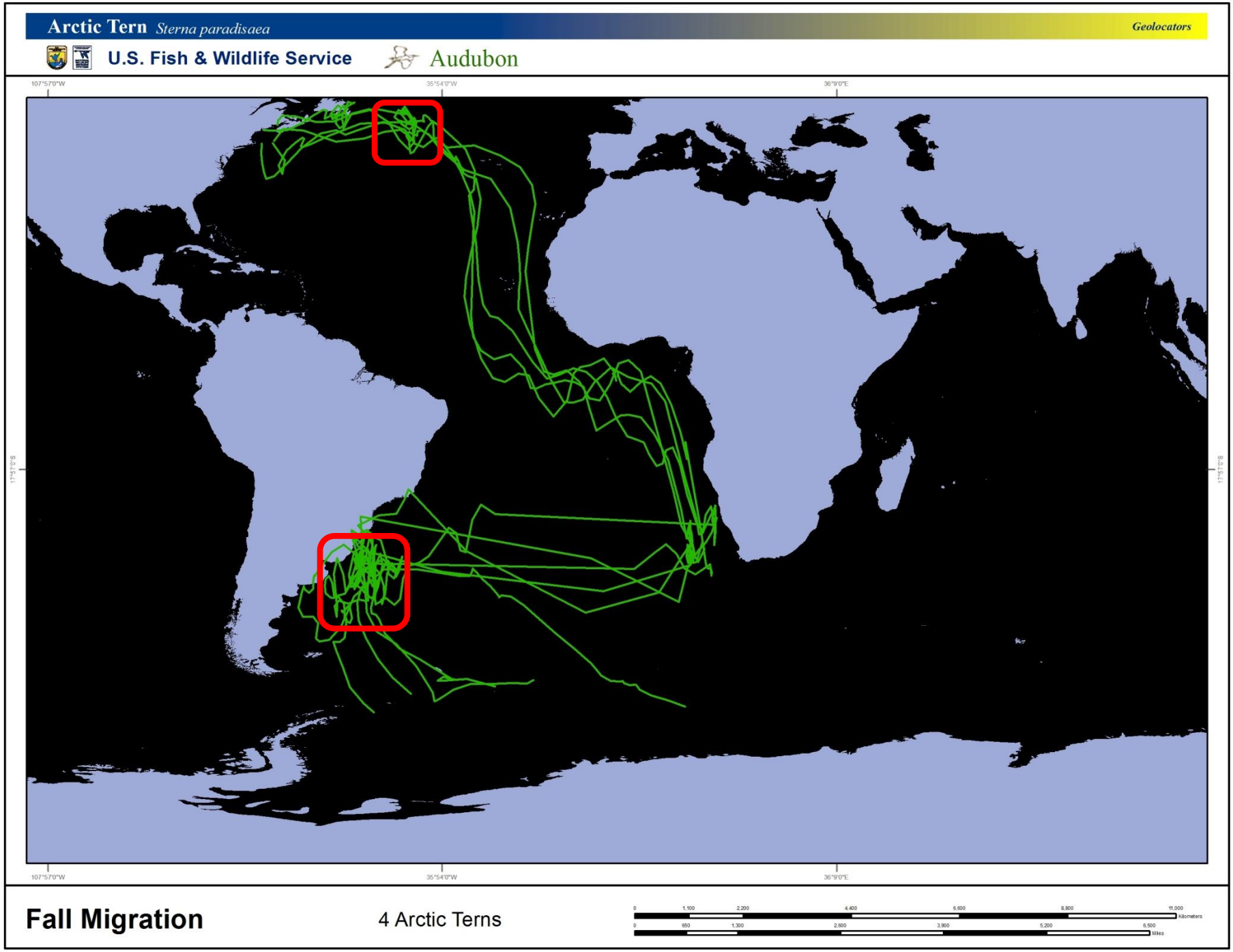


Fall Migration

3 Arctic Terns

0 1,100 2,200 4,400 6,600 8,800 11,000 Kilometers

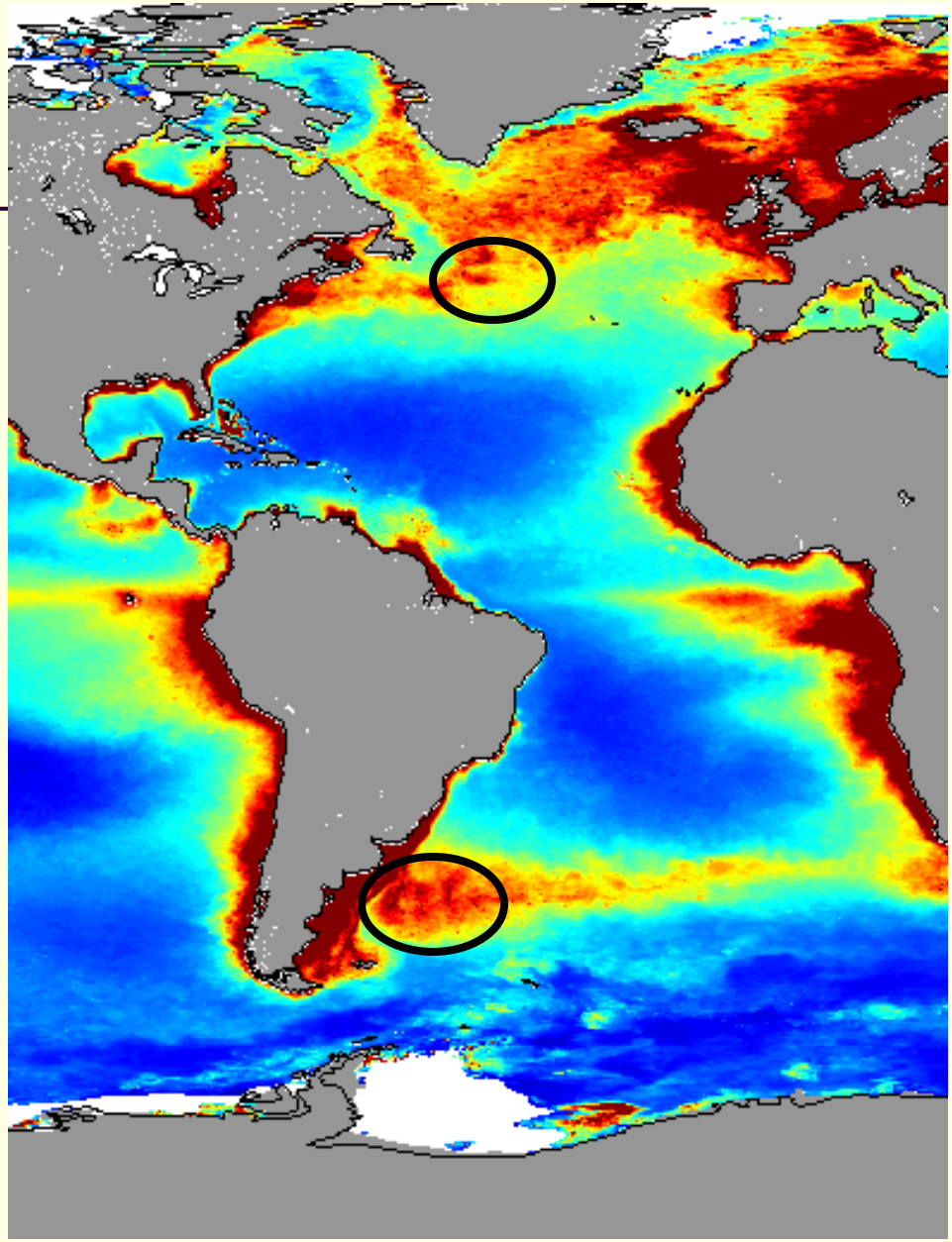
0 650 1,300 2,600 3,900 5,200 6,500 Miles

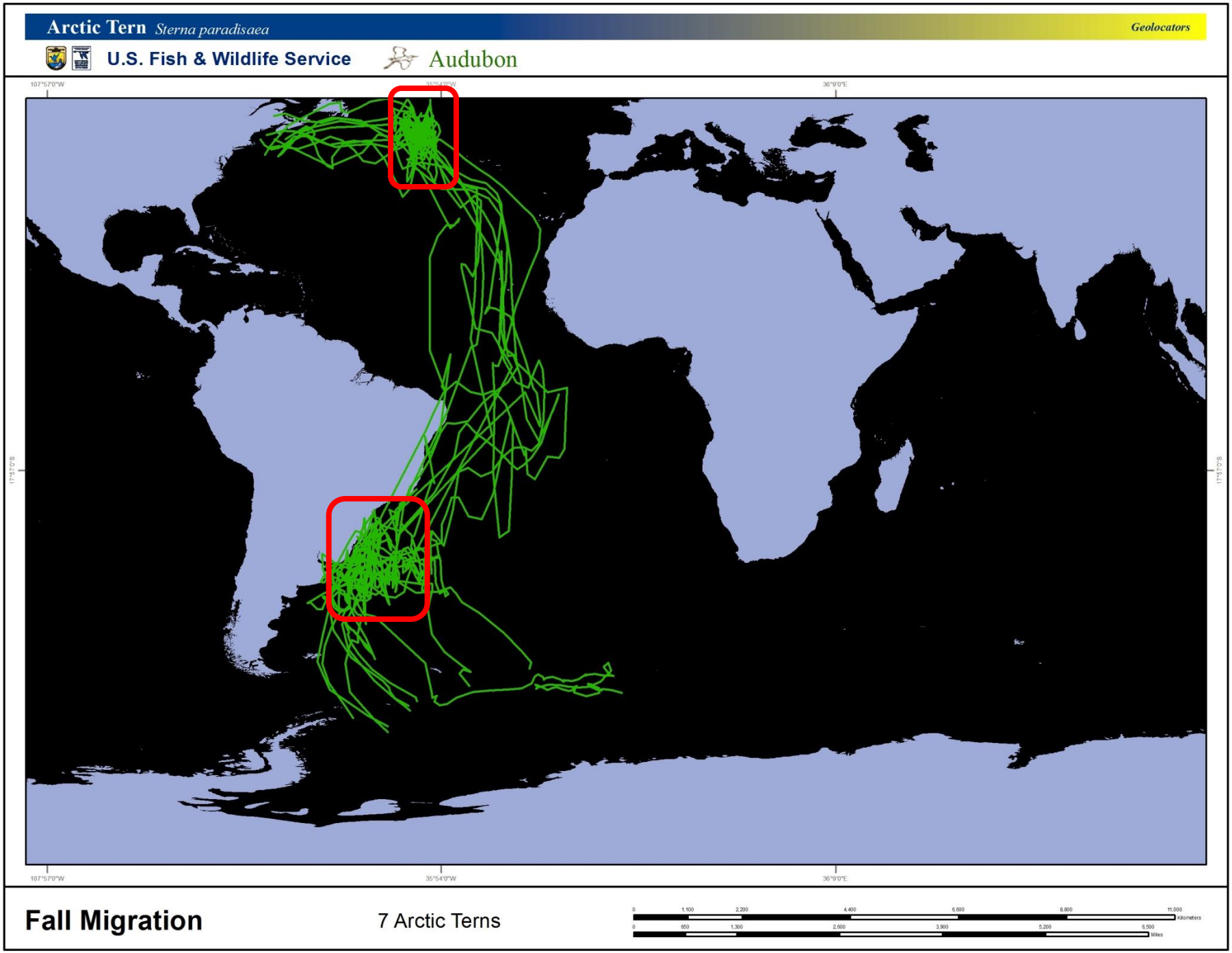

Arctic Tern Sterna paradisaea
Geolocators
U.S. Fish & Wildlife Service
Audubon
107°57'0"W
35°54'0"W
36°9'0"E
17°57'0"S
Fall Migration
4 Arctic Terns
0 1,100 2,200 4,400 6,600 8,800 11,000 Kilometers
0 650 1,300 2,600 3,900 5,200 6,500 Miles

Mid-Atlantic Ridge –

series of faults and volcanic islands creating upwellings

Confluence of two major currents creates region of high productivity off of Brazil and Argentina

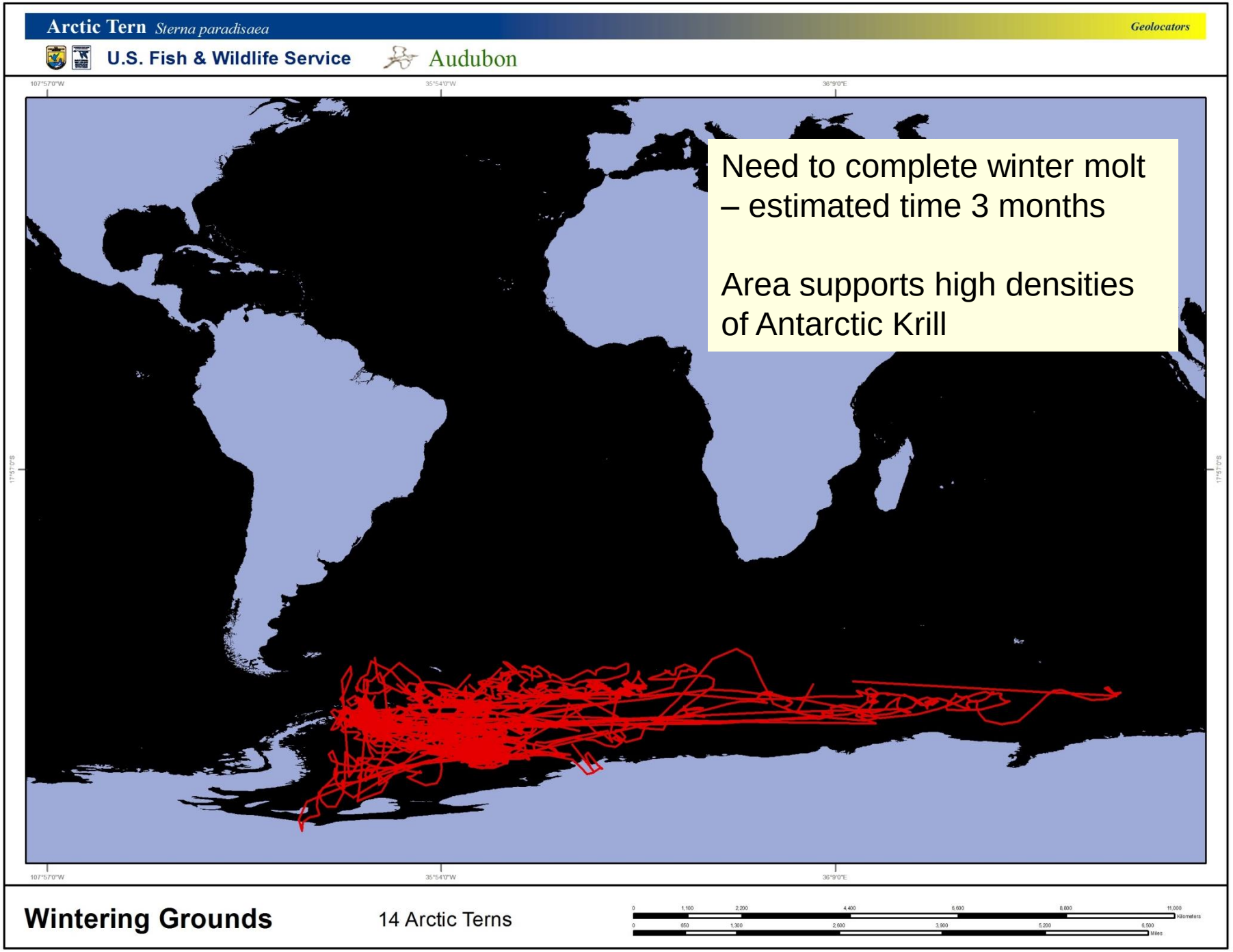



Arctic Tern Sterna paradisaea
Geolocators
U.S. Fish & Wildlife Service
Audubon
107°57'0"W
35°54'0"W
36°9'0"E
17°57'0"S
Fall Migration
7 Arctic Terns
0 1,100 2,200 4,400 6,600 8,800 11,000 Kilometers
0 650 1,300 2,600 3,900 5,200 6,500 Miles

Fall Migration

Activity	Result	Range
Average Departure from the Gulf of Maine:	August 5th	July 18 – Sept 2
Average length of time to reach wintering grounds:	93 days	33-126 days
Average distance traveled / day:	339 km	233 - 582 km
Average Speed:	18.5 km /hr	13.6 – 23.05 km /hr
Average distance traveled	30,246 km	19,219 - 39,826 km

- Use of new stopover location off coast of Argentina


Arctic Tern Sterna paradisaea
Geolocators
U.S. Fish & Wildlife Service
Audubon
Need to complete winter molt – estimated time 3 months
Area supports high densities of Antarctic Krill
Wintering Grounds
14 Arctic Terns

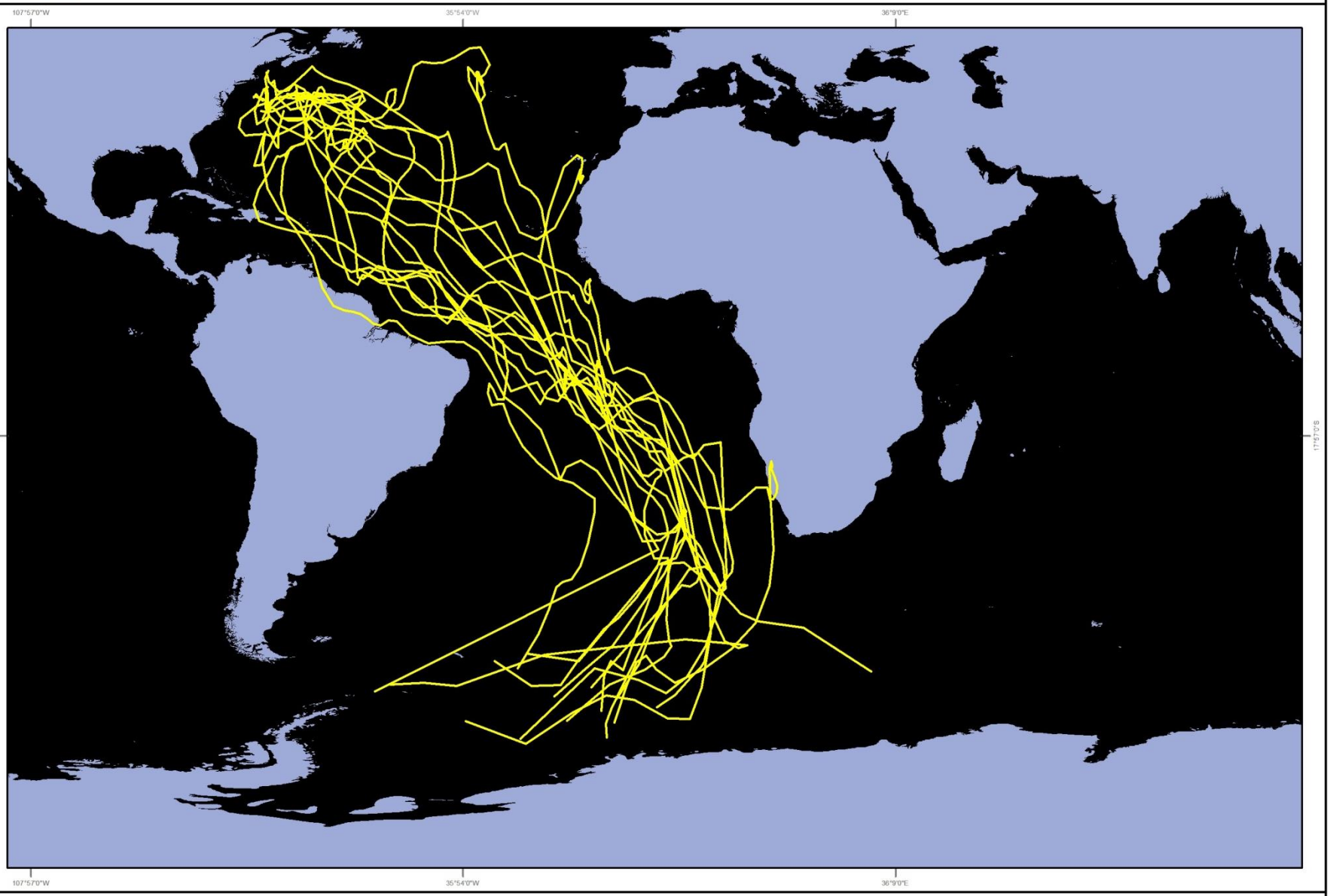
Wintering Grounds

Activity	Result	Range
Average arrival date:	Nov 5th	Sept 5*-Nov 26
Average length of stay:	153 days	114-218
Average distance traveled / day:	108 km	64-234 km
Average distance traveled	16,614 km	9,834 -33,046 km

*next earliest arrival was 10/27

Arctic Tern *Sterna paradisaea* — *Geolocators*

U.S. Fish & Wildlife Service — Audubon



Spring Migration

13 Arctic Terns

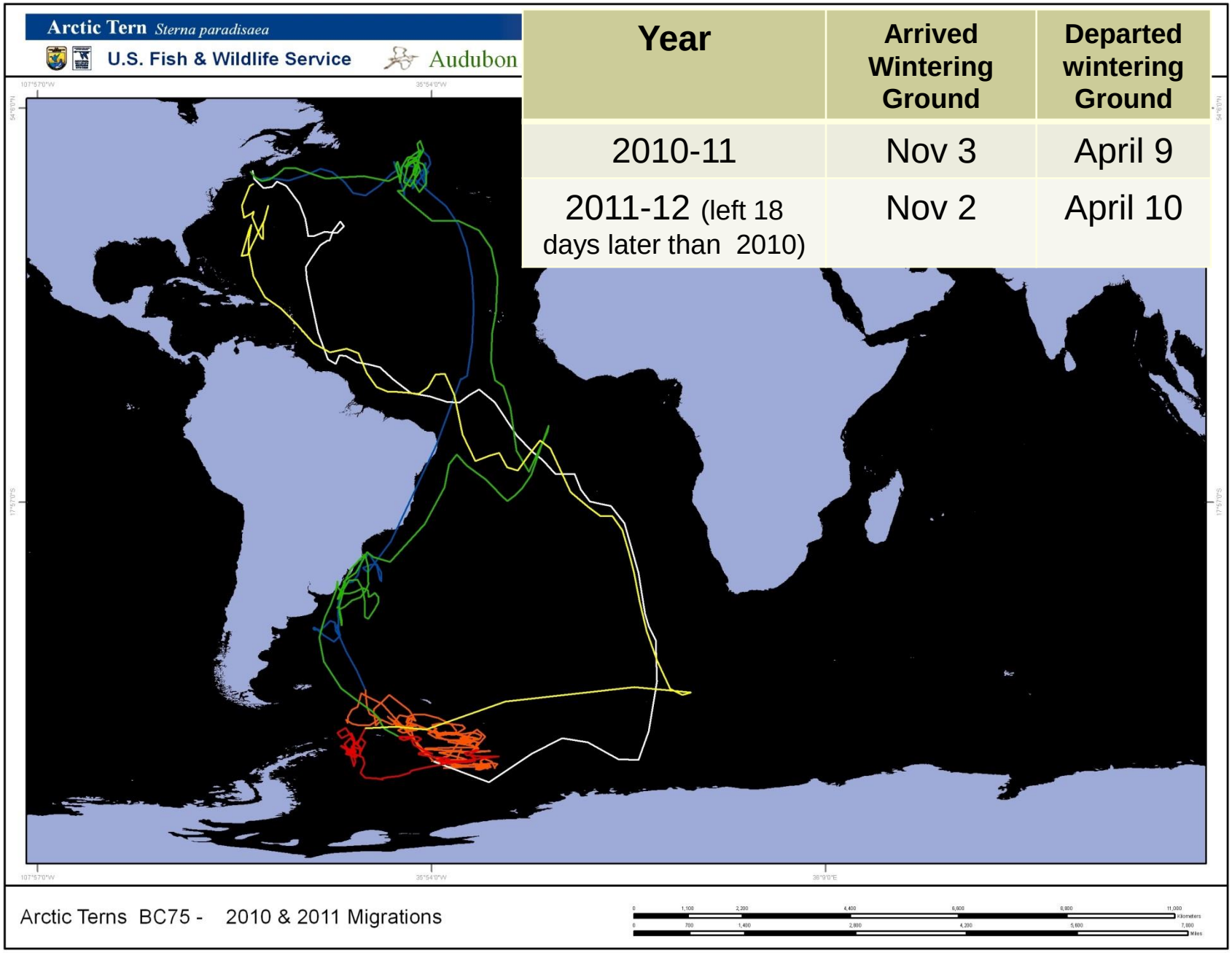
0 1,100 2,200 4,400 6,600 8,800 11,000 Kilometers

0 650 1,300 2,600 3,900 5,200 6,500 Miles

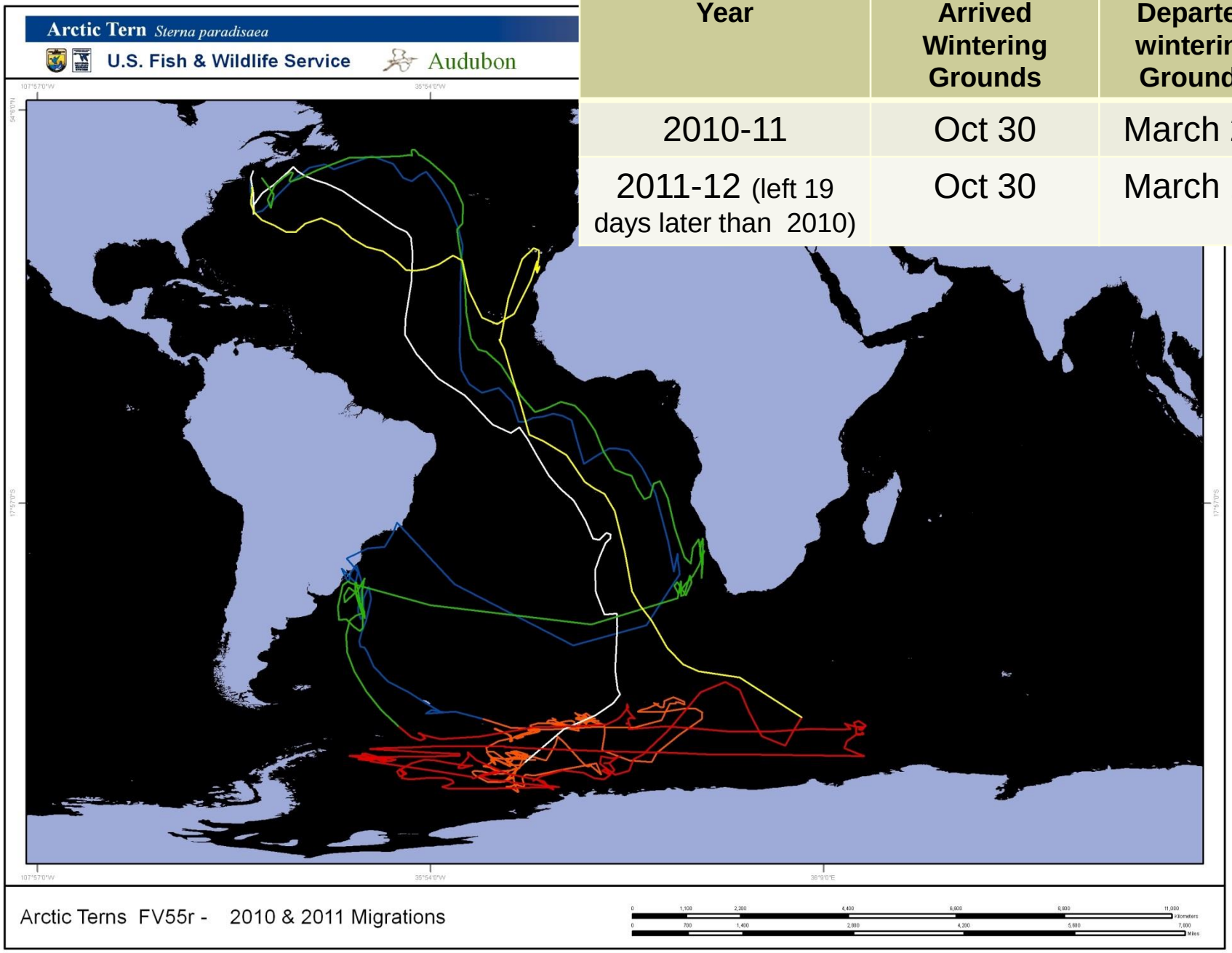
Spring Migration

Activity	Result	Range
Average departure from wintering grounds:	April 7th	March 30- April16
Average length of travel:	30 days	24-39 days
Average distance traveled / day:	760 km	592-883 km
Average Speed:	25.28 km / hr	17.25 -28.83 km /hr
Average distance traveled	22,512 km	19,515 -26,689 km

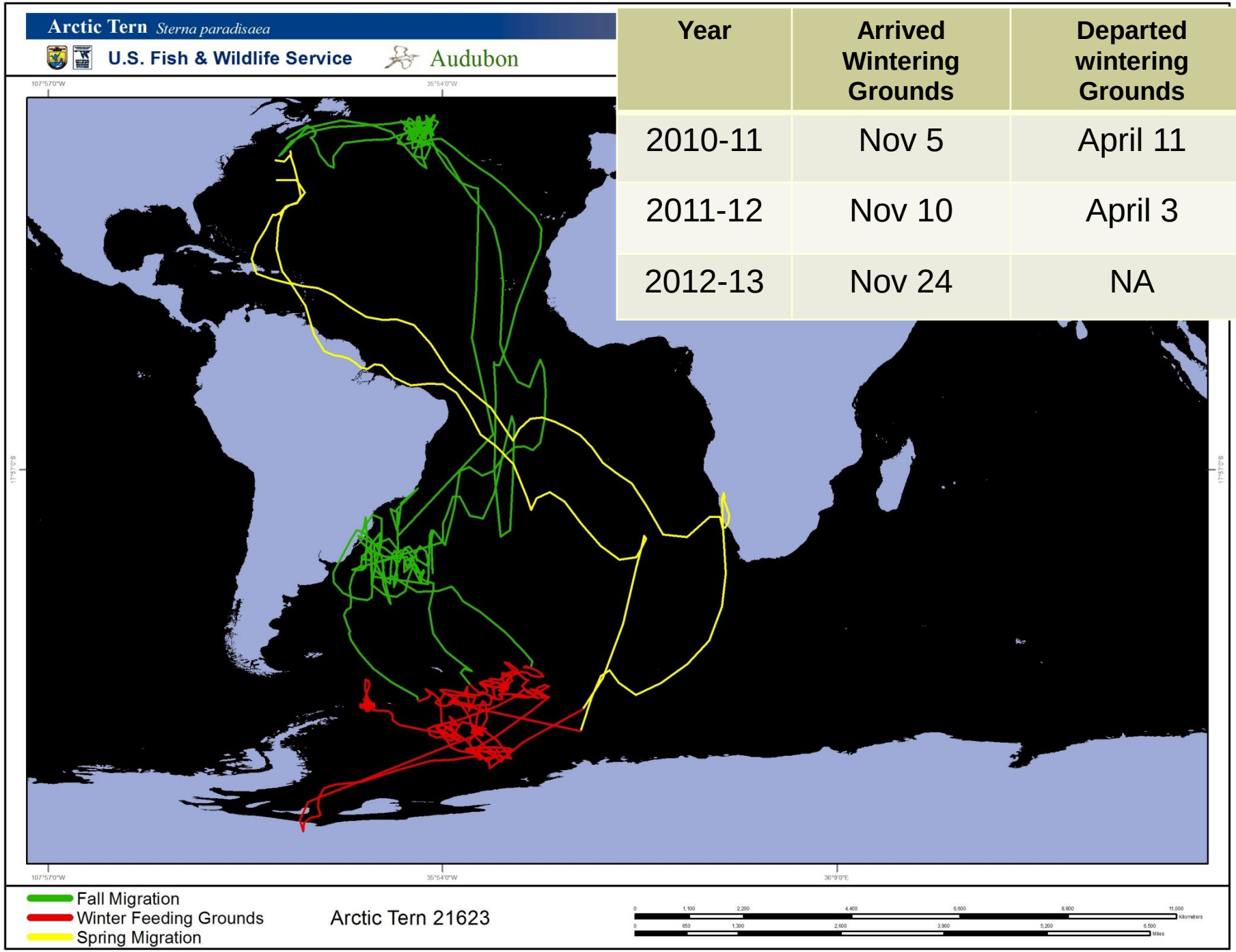
First Recovery of Arctic Tern Geolocators with multi-year data !



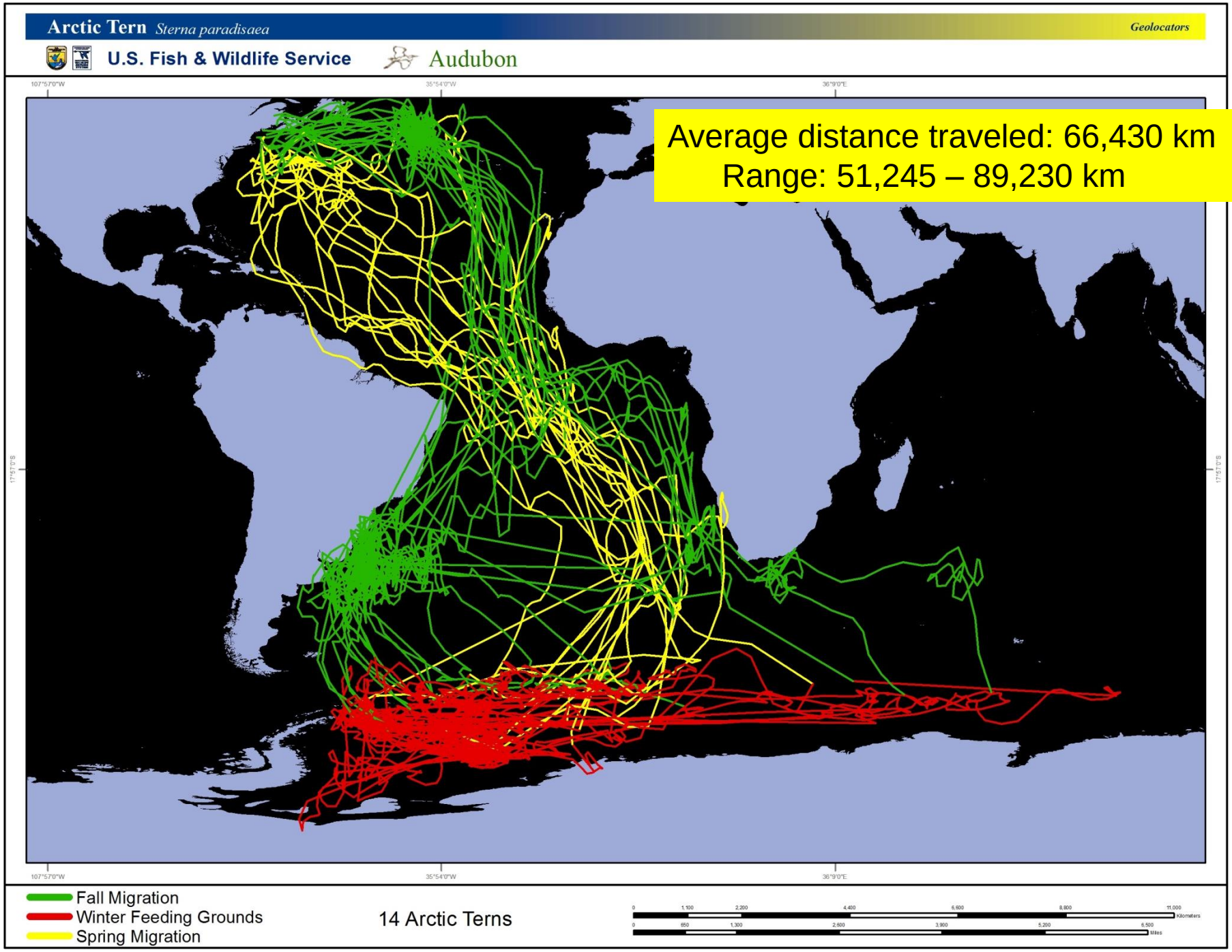
Year	Arrived Wintering Ground	Departed wintering Ground
2010-11	Nov 3	April 9
2011-12 (left 18 days later than 2010)	Nov 2	April 10



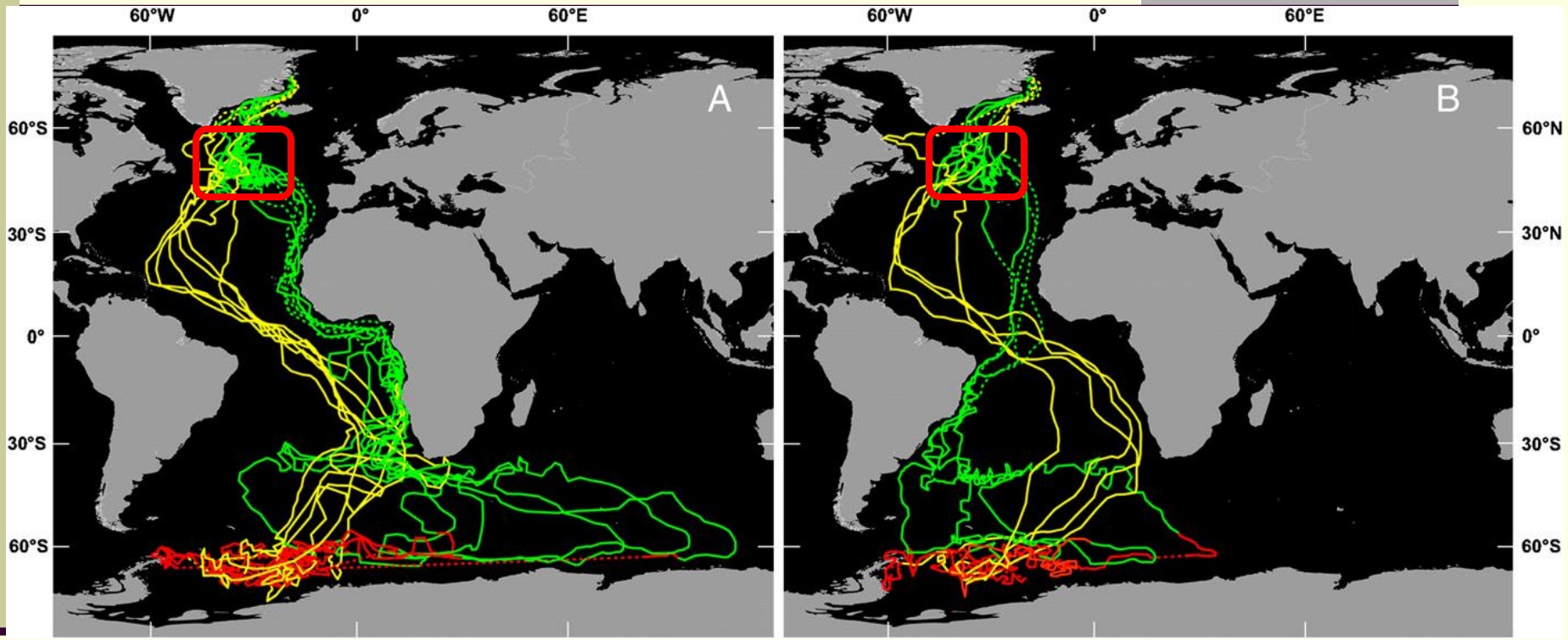
Year	Arrived Wintering Grounds	Departed wintering Grounds
2010-11	Oct 30	March 20
2011-12 (left 19 days later than 2010)	Oct 30	March 19



Year	Arrived Wintering Grounds	Departed wintering Grounds
2010-11	Nov 5	April 11
2011-12	Nov 10	April 3
2012-13	Nov 24	NA


Arctic Tern Sterna paradisaea
Geolocators
U.S. Fish & Wildlife Service
Audubon
107°57'0"W
35°54'0"W
36°9'0"E
17°57'0"S
Average distance traveled: 66,430 km
Range: 51,245 – 89,230 km
Fall Migration
Winter Feeding Grounds
Spring Migration
14 Arctic Terns
0 1,100 2,200 4,400 6,600 8,800 11,000 Kilometers
0 650 1,300 2,600 3,900 5,200 6,500 Miles

Arctic Terns Tagged in Greenland and Iceland

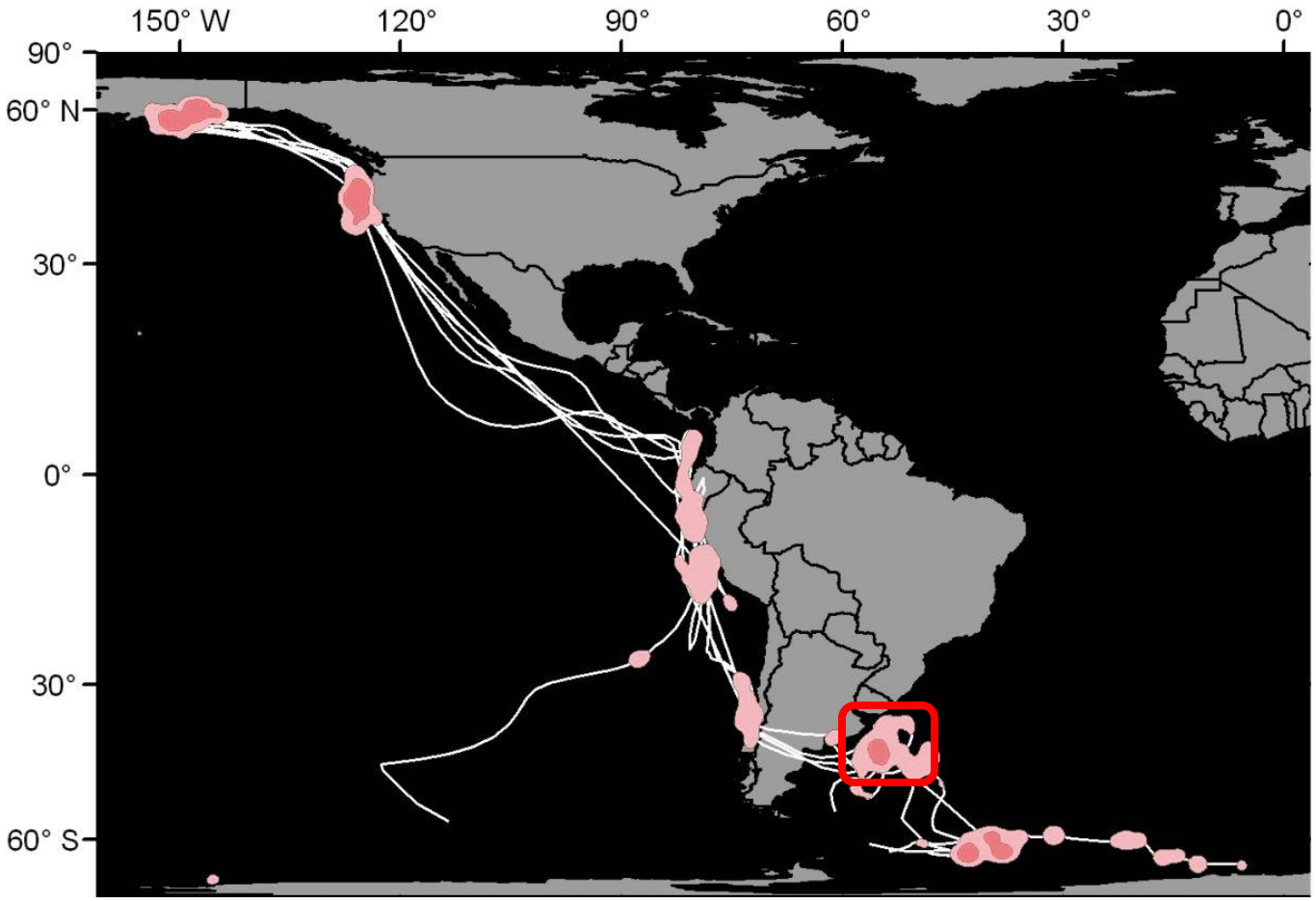


Total Distance Traveled: 70,900 km (59,500-81,600km)

(n=11)

(Egevang et al 2009)

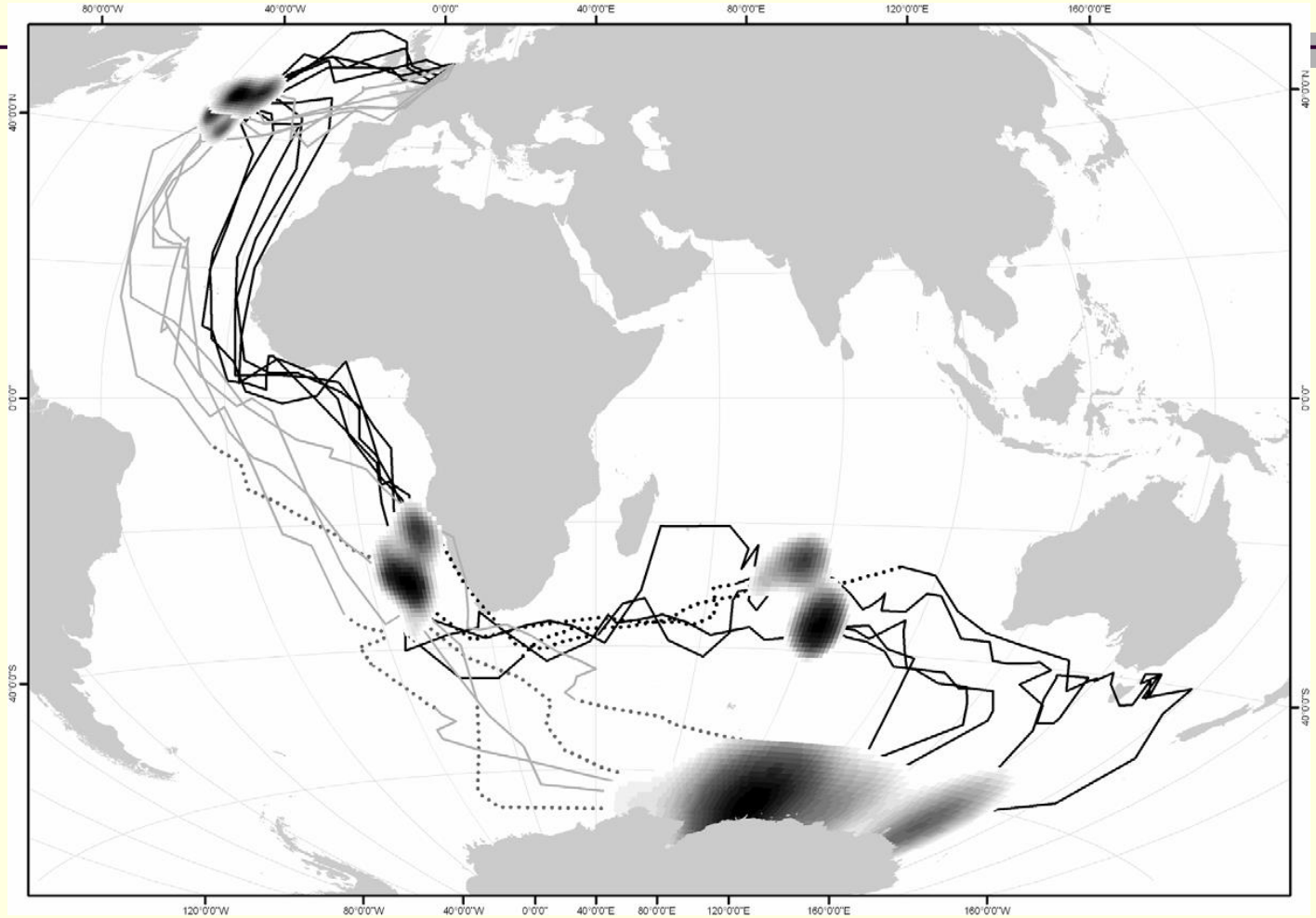
Arctic Terns Tagged in Alaska with Geolocators / Saltwater Immersion Tags



(n=6)

McKnight et al 2013

Arctic Terns Tagged in the Netherlands



(n=5)

Fijn et al. 2013

Conclusions

- Confirmed longest known migration
  - 35 years of migration = 2.3 million km !!
- Terns utilized three southward migration routes – including 2 staging areas
- Arctic terns face significant time constraints throughout migration
  - time stopovers to match periods of high productivity (McKnight et al 2013)
  - must complete 3 month molt on wintering grounds
- Breeding and wintering areas are located in regions projected to experience significant declines in productivity
- Changes in prey species abundance or availability along migratory pathway could significantly disrupt ability to complete migration