PTT and Geolocator Case Studies

Long-billed Curlew

Purple Martins and Wood Thrushes

Numeniini

- Curlews and Godwits (13 spp. worldwide)
- Decurved (curlews) and recurved (godwits) bills
- Among the largest, most charismatic shorebirds
- Wide range of body sizes
  - *N. minutus*: 220g
  - *N. madagascarensis*: 1400g
- Diverse, wide-ranging migration strategies
- 85% of species designated as species of concern or graver




Cooperative Effort

Principal Investigators

- Nils Warnock, UC Davis
- Robert Gill, USGS

For more information visit:

http://alaska.usgs.gov/science/biology/shorebirds/index.html

or

http://www.prbo.org/cms/424




Objectives

- Investigate migration strategies of 4 Pacific Basin Numeniini species
  - Bar-tailed Godwit (*Limosa lapponica*)
  - Hudsonian Godwit (*Limosa haemastica*)
  - Long-billed Curlew (*Numenius americanus*)
  - Bristle-thighed Curlew (*Numenius tahitiensis*)
- Determine migratory routes
- Identify key stopover areas
- Estimate length of stay at stopover areas
- Compare and contrast migration strategies among species




Bar-tailed Godwit

Limosa lapponica Gill et al. 2009, Proc. R. Soc. B 276: 447-457

- Northward migration (Two-phased)
  - New Zealand to Yellow Sea
  - Five-week layover
  - Yellow Sea to Alaska
- Total migration distance: 29,000 km

Anchorage Daily News 3/31/2008

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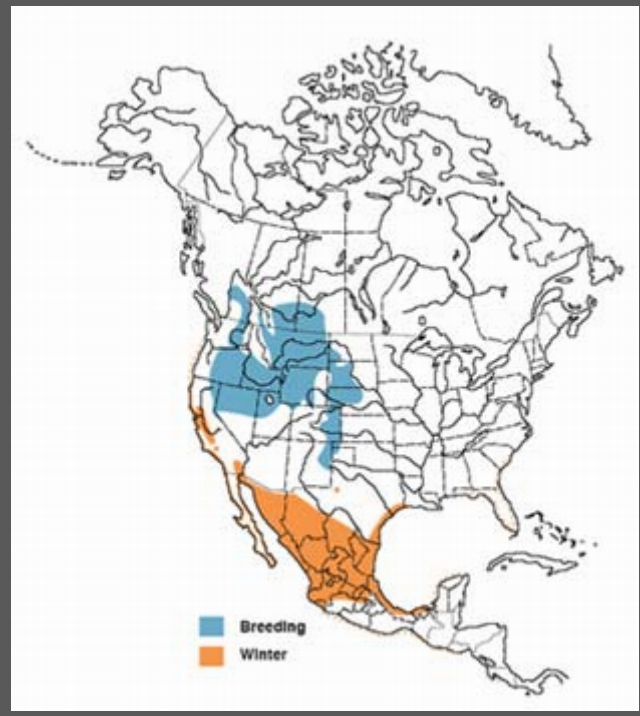
Long-billed Curlew

Numenius americanus

- Mass
  - Males: 500 – 650g
  - Females: 650 – 900g
- Largest NA shorebird
- Breed in open grasslands (Great Basin, prairies)
- Winter at coastal and inland sites (CA, MEX)
- Short-distance migrant
- Little to no pre-migratory fattening
- Highly Imperiled Species



Long-billed Curlew: Methods

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- 2006 – 2008
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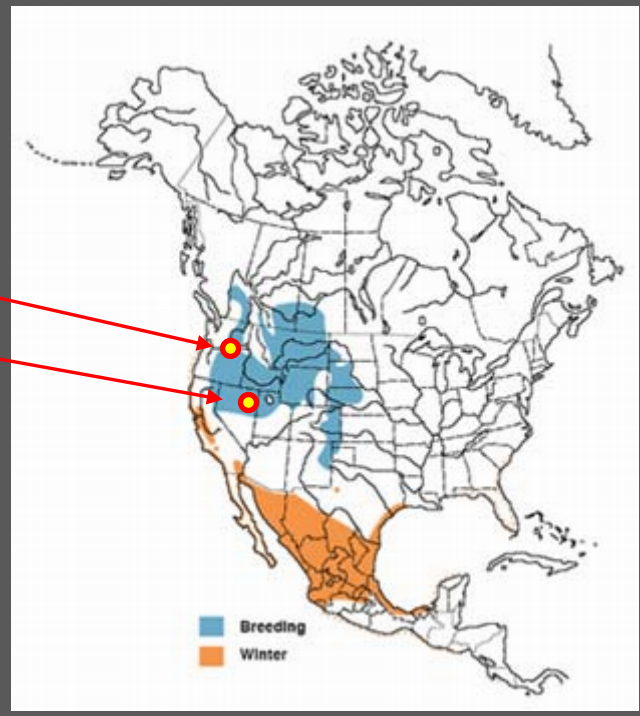

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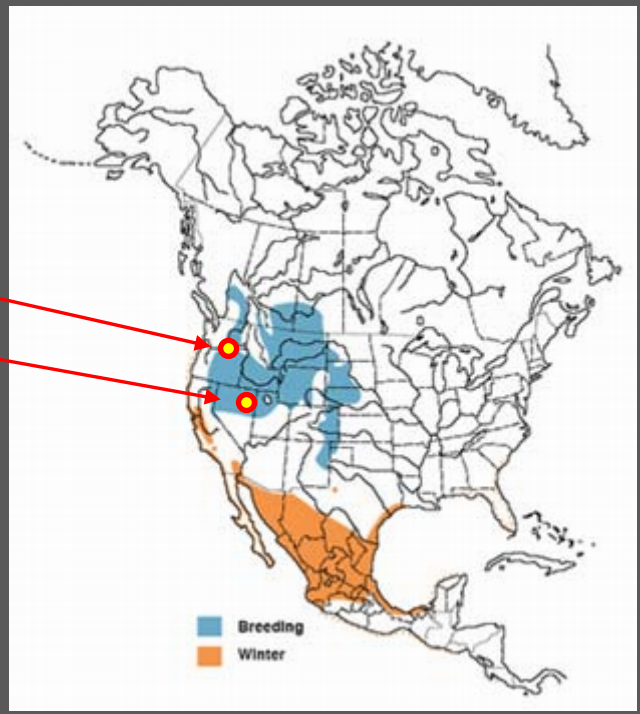

Mist net

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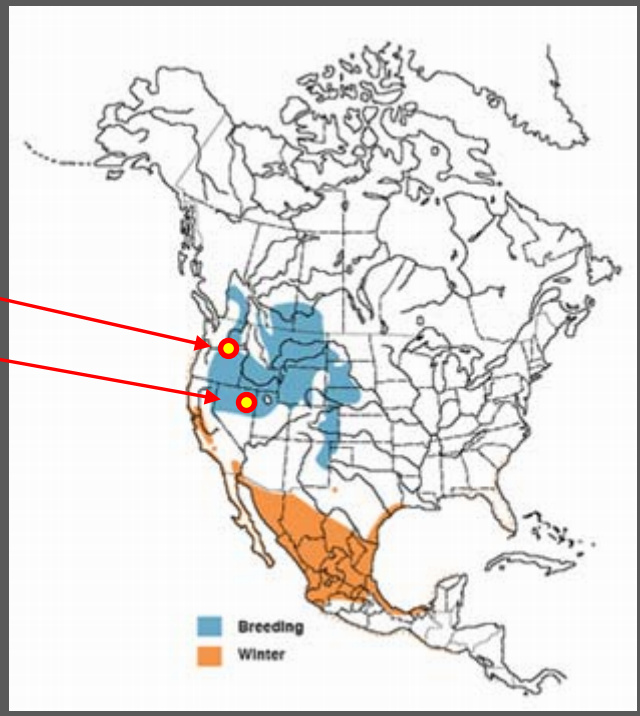

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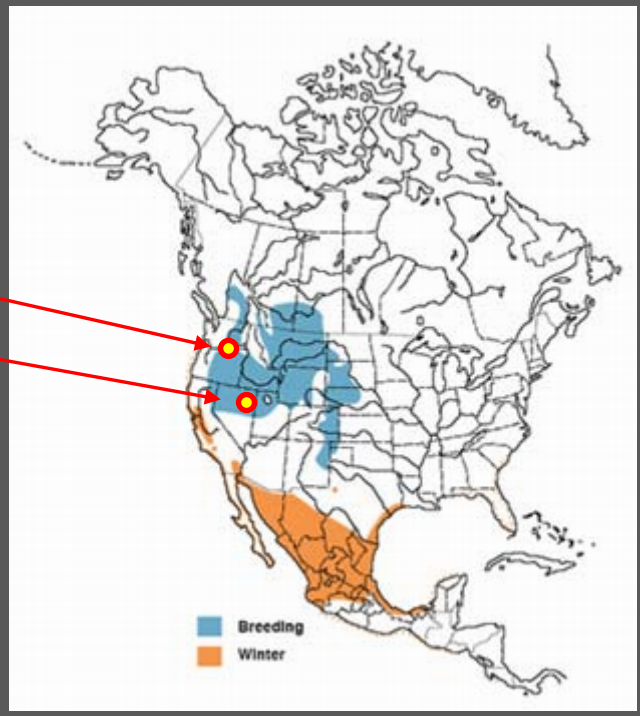

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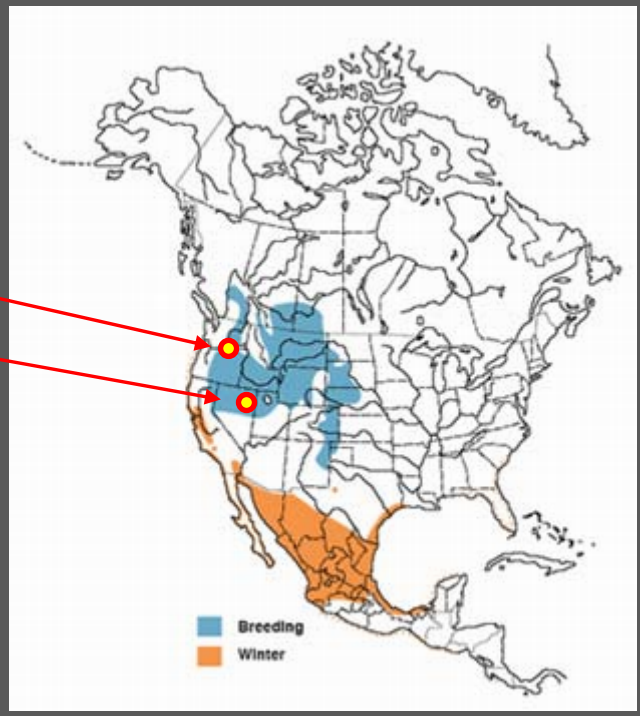

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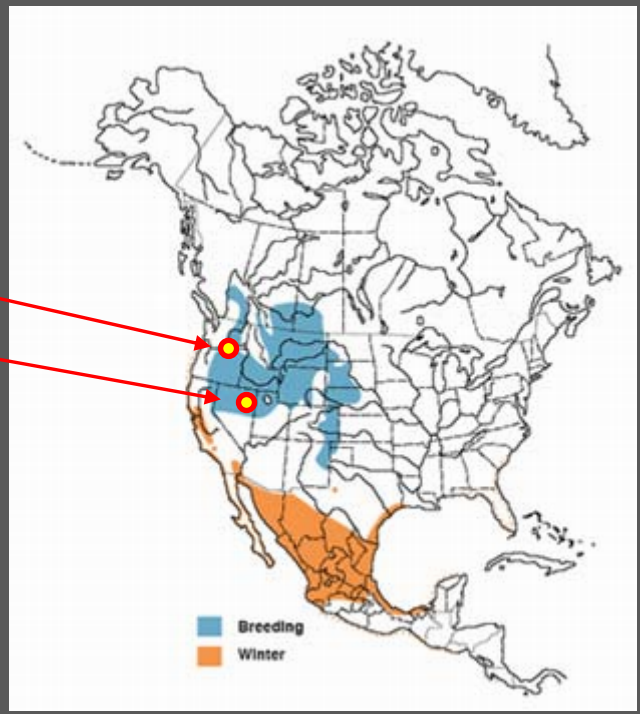
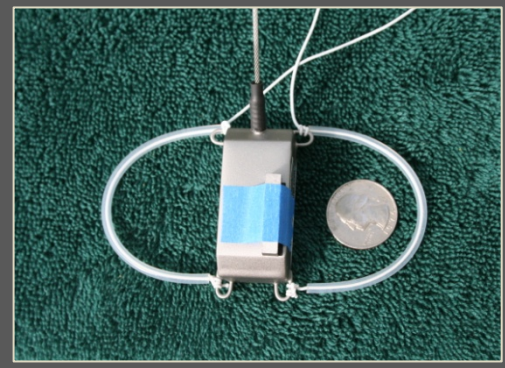


Long-billed Curlew: Methods

Numenius americanus

- Two types of PTTs used
  - 4, 20g battery-powered (Nevada, 2006)
  - 15, 18g solar-powered (Oregon & Nevada, 2007/2008)
- Leg-loop harness
  - Elastic cord
  - Teflon ribbon



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	2006	2007	2008	Total
Oregon				
Males		2	4	6
Females			4	4
Nevada				
Males	2	2		4
Females	2	3		5

Long-billed Curlew: Methods

Numenius americanus

Duty Cycles

- Battery-powered PTTs
  - 500 hr battery life
  - Variable Duty Cycles

DC	Hours On	Hours Off	# of Cycles	Hours	Months
1	6	168	4	24	15May – 15June
2	6	24	24	168	15June – 15July
3	8	48	14	280	15July – 15Aug
4	8	72	8	344	15Aug – 15Sept
5	8	168	6	392	15 Sept – 31Oct
6	8	18	2	408	
7	10	240	4	448	1Nov – 7Dec
8	8	18	2	464	
9	10	240	4	504	9Dec – 20Jan

Long-billed Curlew: Methods

Numenius americanus

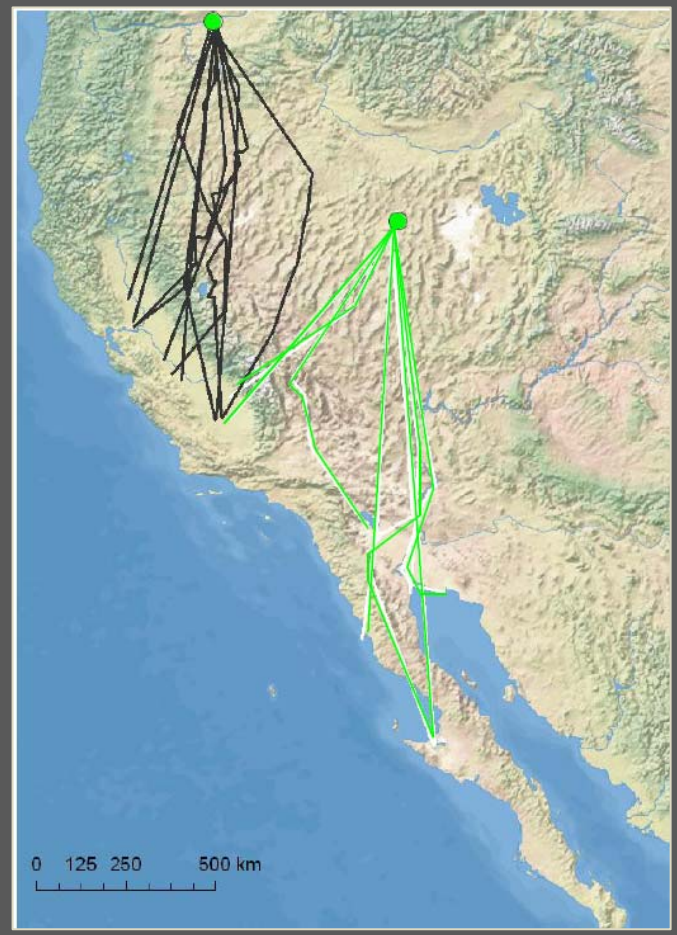
Duty Cycles

- Battery-powered PTTs
  - 500 hr battery life
  - Variable Duty Cycles
- Solar-powered PTTs
  - Single duty cycle
  - 10h on/24h off

Long-billed Curlew: Results

Numenius americanus

- 900 – 1,400 km migration
- Apparent winter segregation between Oregon and Nevada populations
  - Little overlap in winter ranges
- Oregon curlews winter exclusively inland
- Nevada curlews winter primarily coastal



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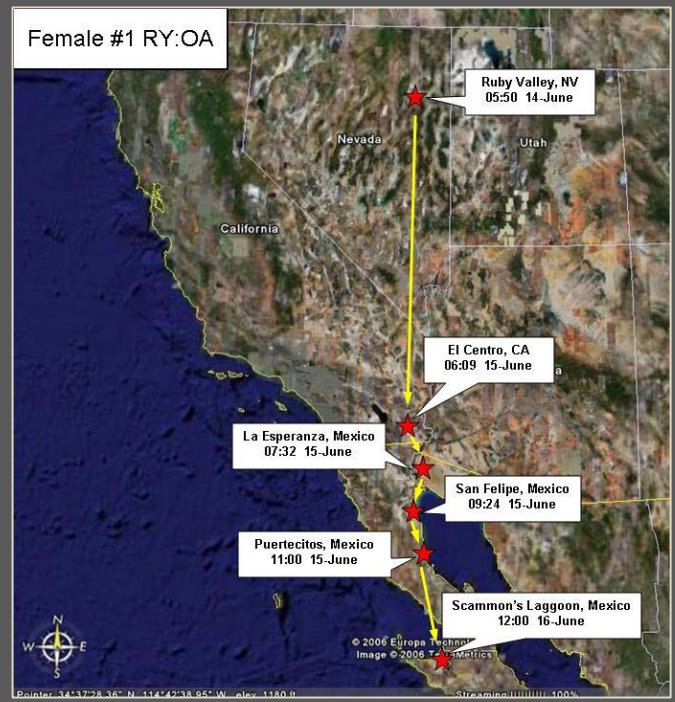
- Max. speed: 45 – 75 km/hr



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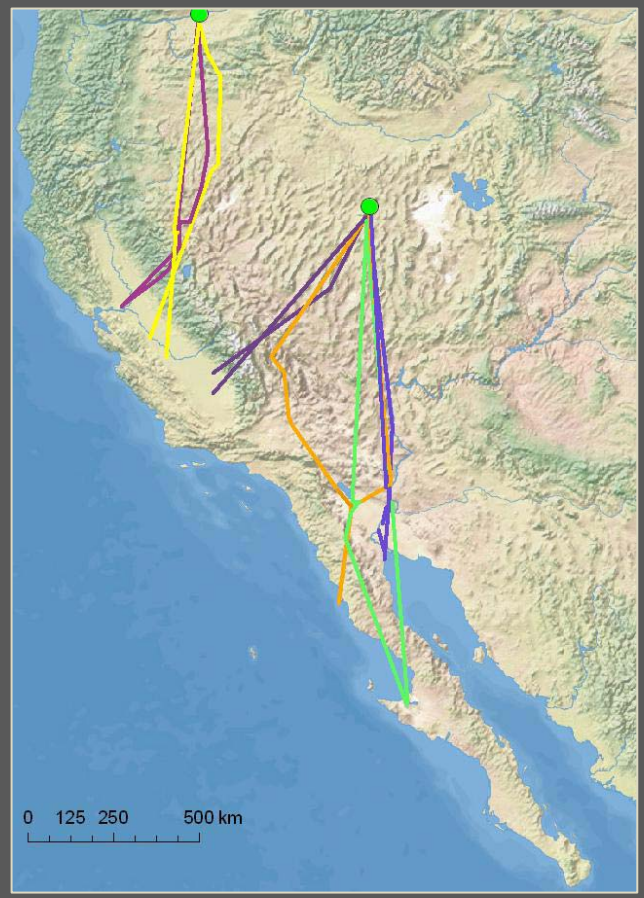

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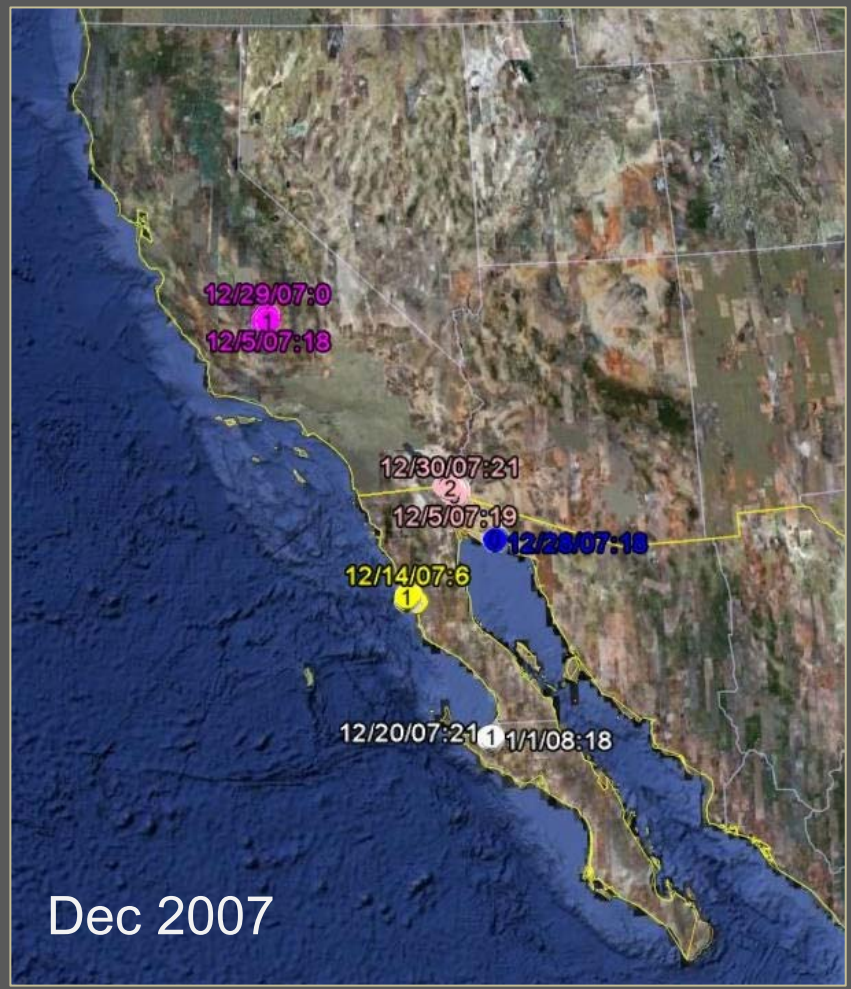
- Faithful to winter sites

Long-billed Curlew: Results

Numenius americanus

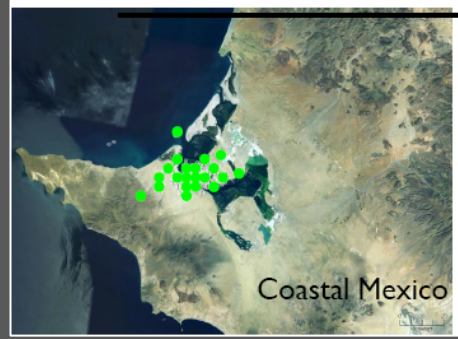


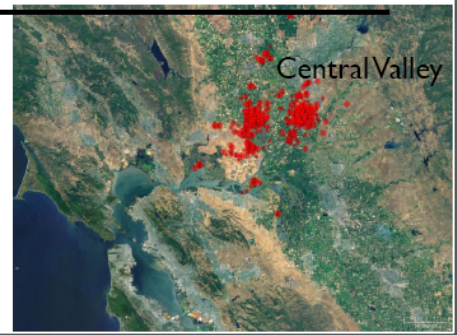
Long-billed Curlew: Summary

Numenius americanus

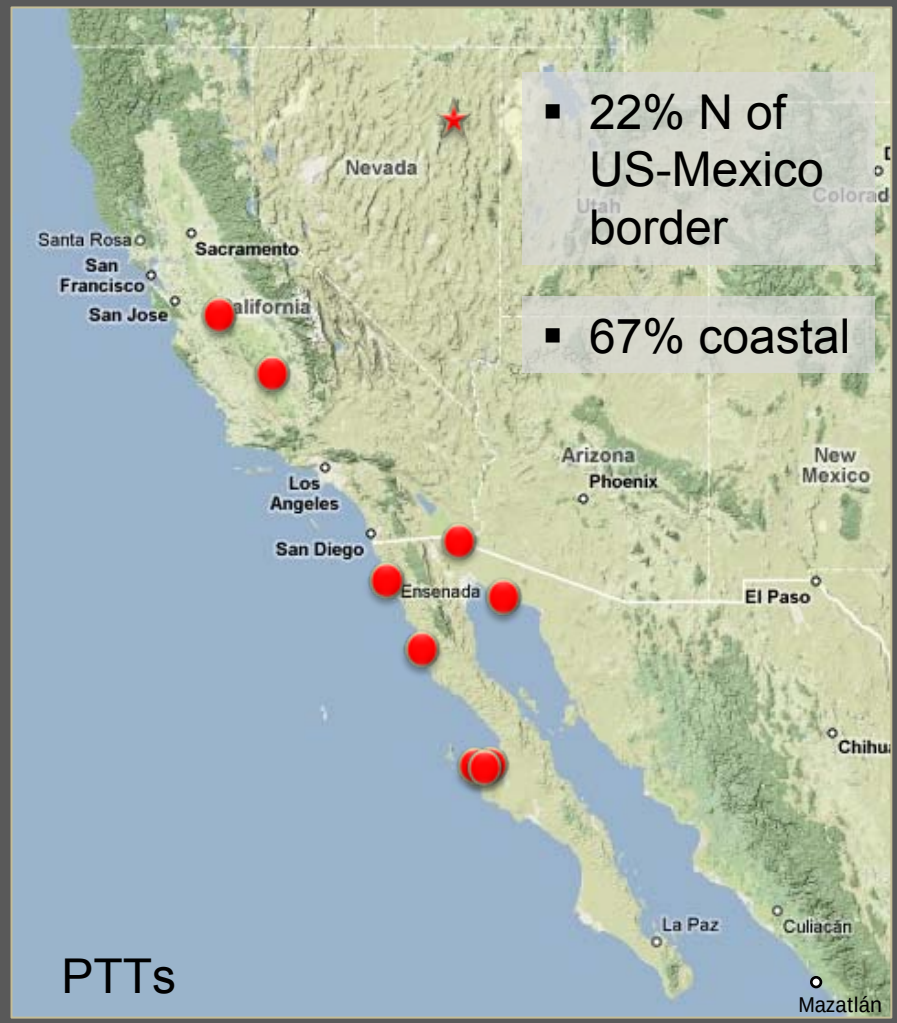
- Migration route and distance
- Migration speed and behavior
- Overwintering locations
- Site fidelity
- Home range size
- Core use areas
- Habitat associations

Non-breeding coastal	≤	Breeding	<	Non-breeding interior
4,760 ha		5,159 ha		12,820 ha
n = 4		*n* = 7		*n* = 6





Band reports vs. PTTs



Geolocators

- Small, light weight data loggers measuring light intensity
  - 1.0+ grams
- Have been used on many waterbirds
  - Albatross
  - Shearwaters
  - Geese
  - Penguins
  - Gannets
  - Cormorants
  - Loons
  - Petrels
  - Skuas

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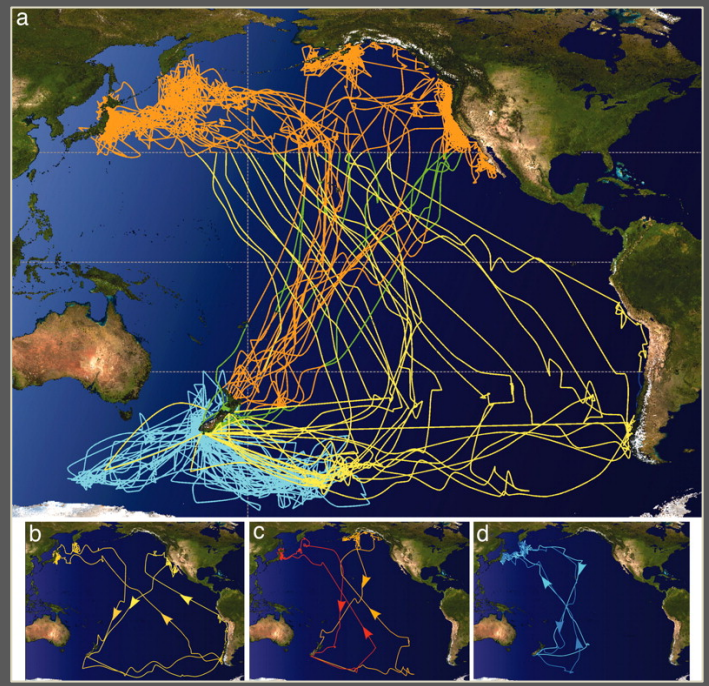
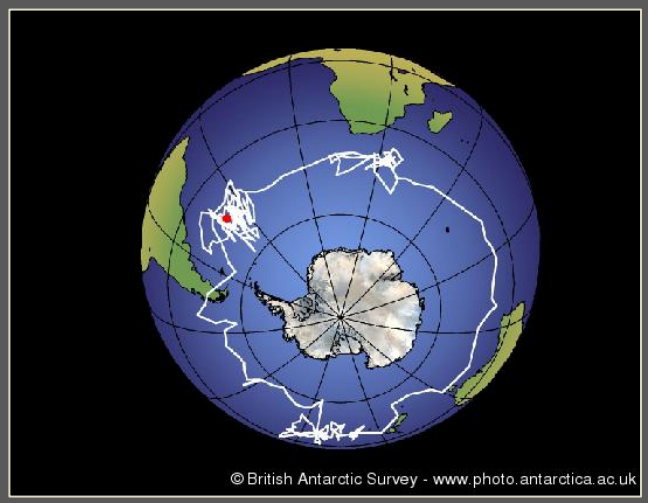
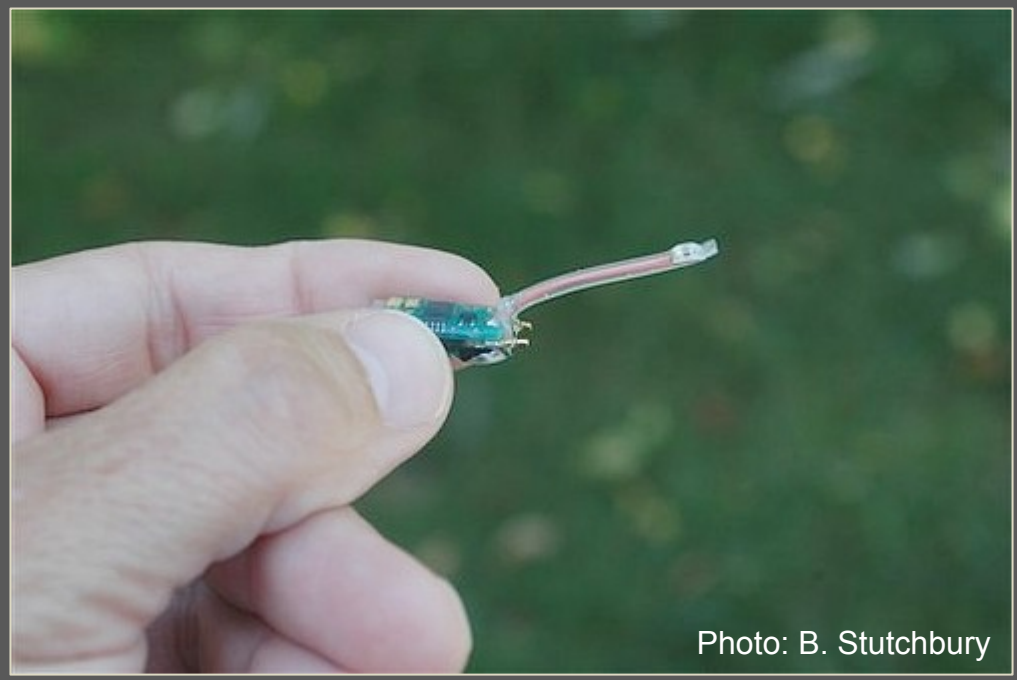


Shaffer S. A. et.al. PNAS 2006;103:12799-12802



Geolocators

Stutchbury et al. 2009, Science 323: 896



Geolocators: Methods

Stutchbury et al. 2009, Science 323: 896

- Purple Martin (*Progne subis*)
  - Neotropical migrant
  - Diurnal migrant
  - Breeds around human settlements in prairies and eastern U.S. & Canada
  - Winters in South America (rainforest, ag. areas)
  - Mass: 48 – 54 g
  - Captured at breeding site: Edinboro, Pennsylvania
  - 20 given 1.5g geolocator using leg-loop harness

	Tagged 2007	Returned 2008
Males	11	0
Females	9	2

Geolocators: Methods

Stutchbury et al. 2009, Science 323: 896

- Wood Thrush (*Hylocichla mustelina*)
  - Neotropical migrant
  - Nocturnal migrant
  - Breeds in deciduous and mixed forests of eastern U.S. and Canada
  - Winters in tropical forests of Central America
  - Mass: 44 – 54 g
  - Captured at breeding site: Crawford County, Pennsylvania
  - 14 given 1.5g geolocator using leg-loop harness

	Tagged 2007	Returned 2008
Males	7	4
Females	7	1

Geolocators: Results

Stutchbury et al. 2009, Science 323: 896

- Purple Martin
  - Flew 2500 km to Yucatan Peninsula in 5 days (500km/day)
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  - Overwintered in Amazon Basin

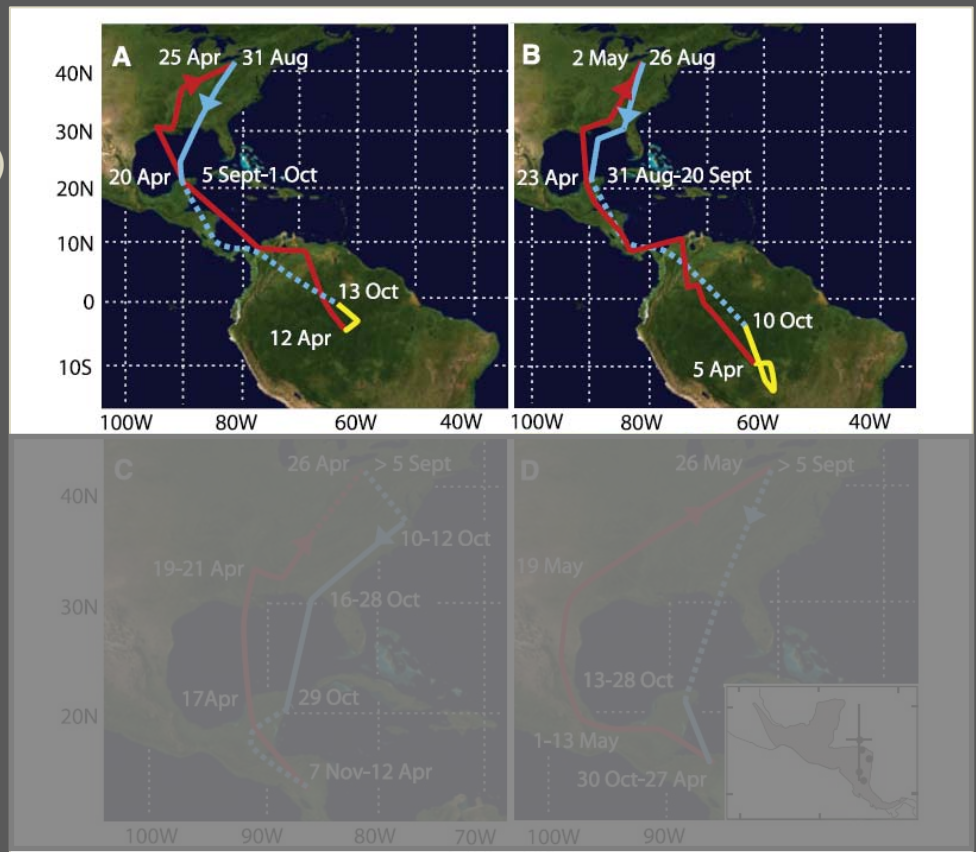

Fig. 1. Interpolated geolocation tracks of individual purple martins (**A** and **B**) and wood thrushes (**C** and **D**) that bred in northern Pennsylvania, USA (42°N, 80°W). Blue, fall migration; yellow, winter range movements; and red, spring migration. Dotted lines link locations when latitude could not be determined. Inset shows winter territory locations of wood thrush and species winter range (shaded); the standard deviation for one individual is shown.

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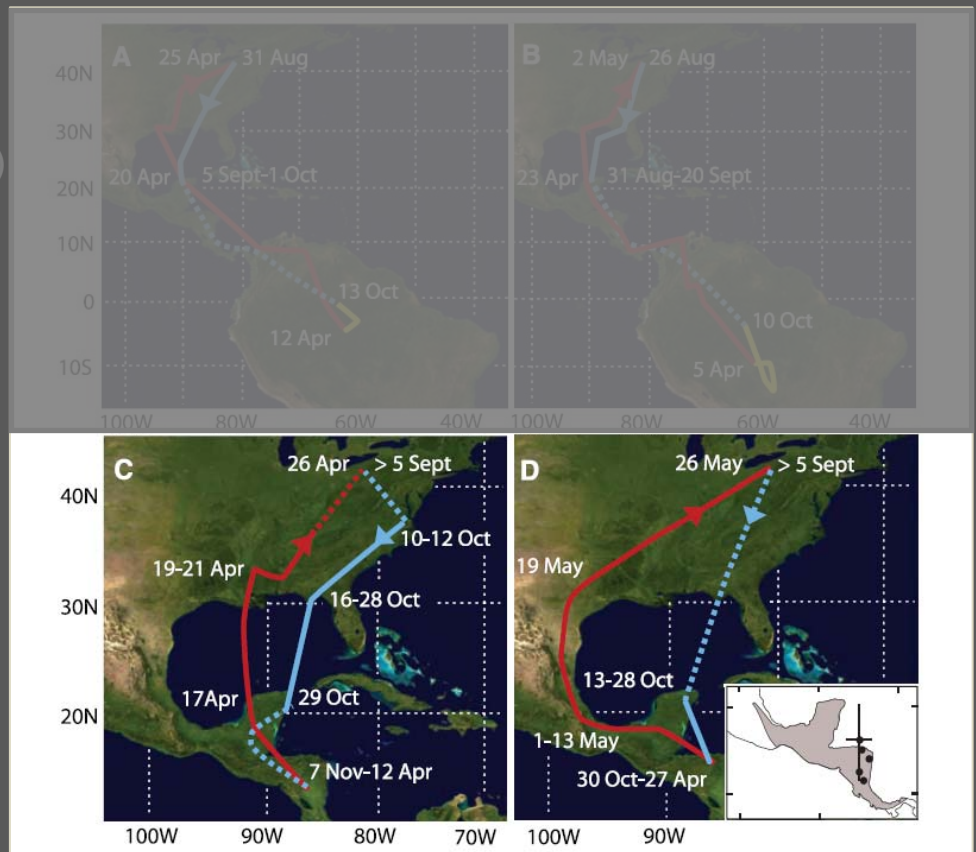

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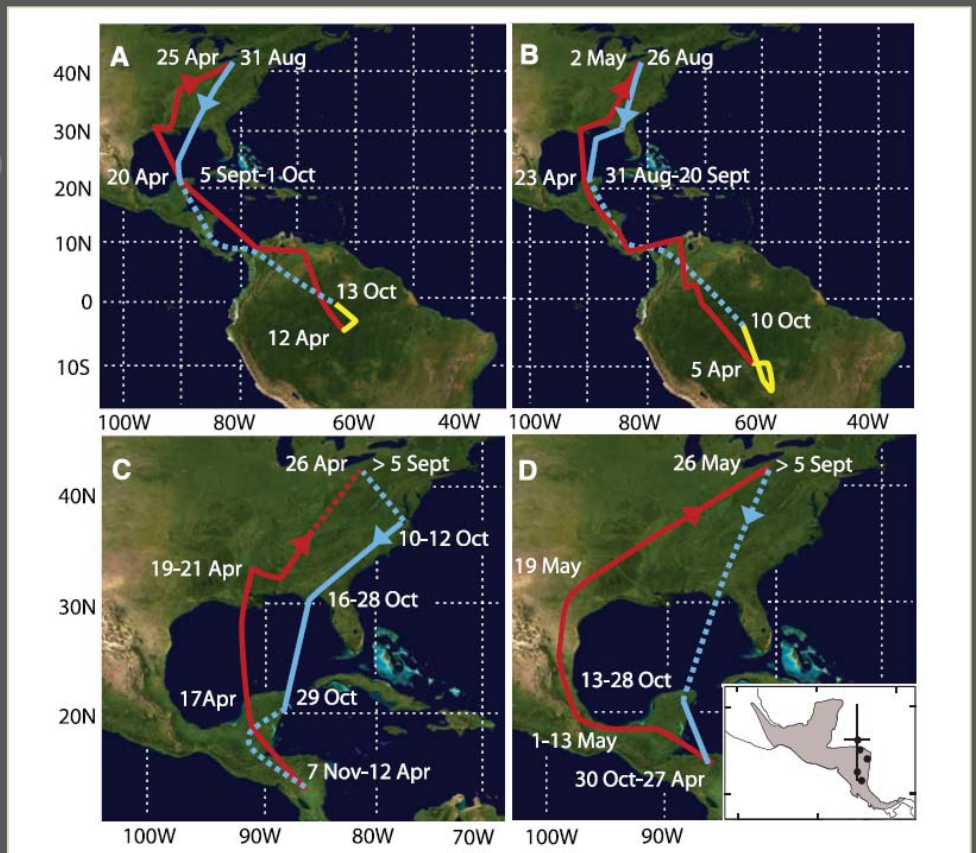

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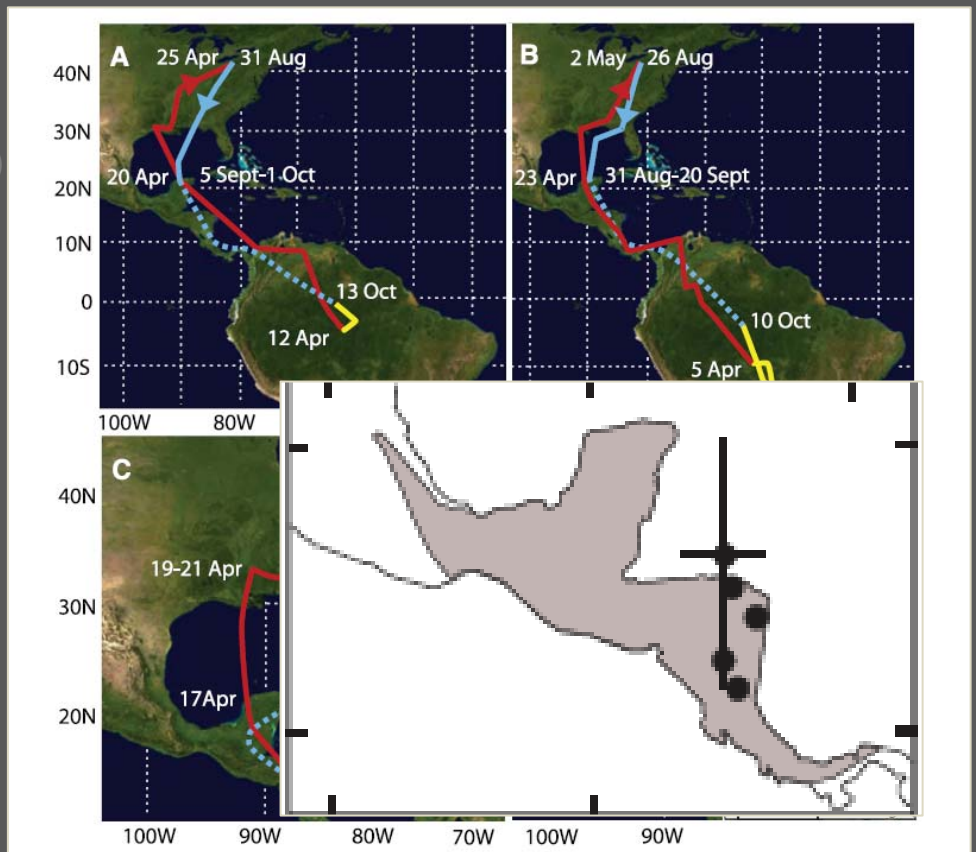

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Geolocators: Summary

Stutchbury et al. 2009, Science 323: 896

- First detailed description of migration for individual songbirds
- Major breakthrough in the study of migration
- Purple Martins and Wood Thrush migrate much faster than previously estimated
  - Previous estimates: 90 – 150 km/day
  - Now: 233 – 577 km/day
  - Similar to much larger birds such as plovers

Photo: T. Morton