

Tracking Marine Turtles Throughout the Seascape Reveals Connections Among U.S. Parks and Protected Areas



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U.S. Geological Survey*



SWOT: <http://seaturtlestatus.org/learn/lifecycle>



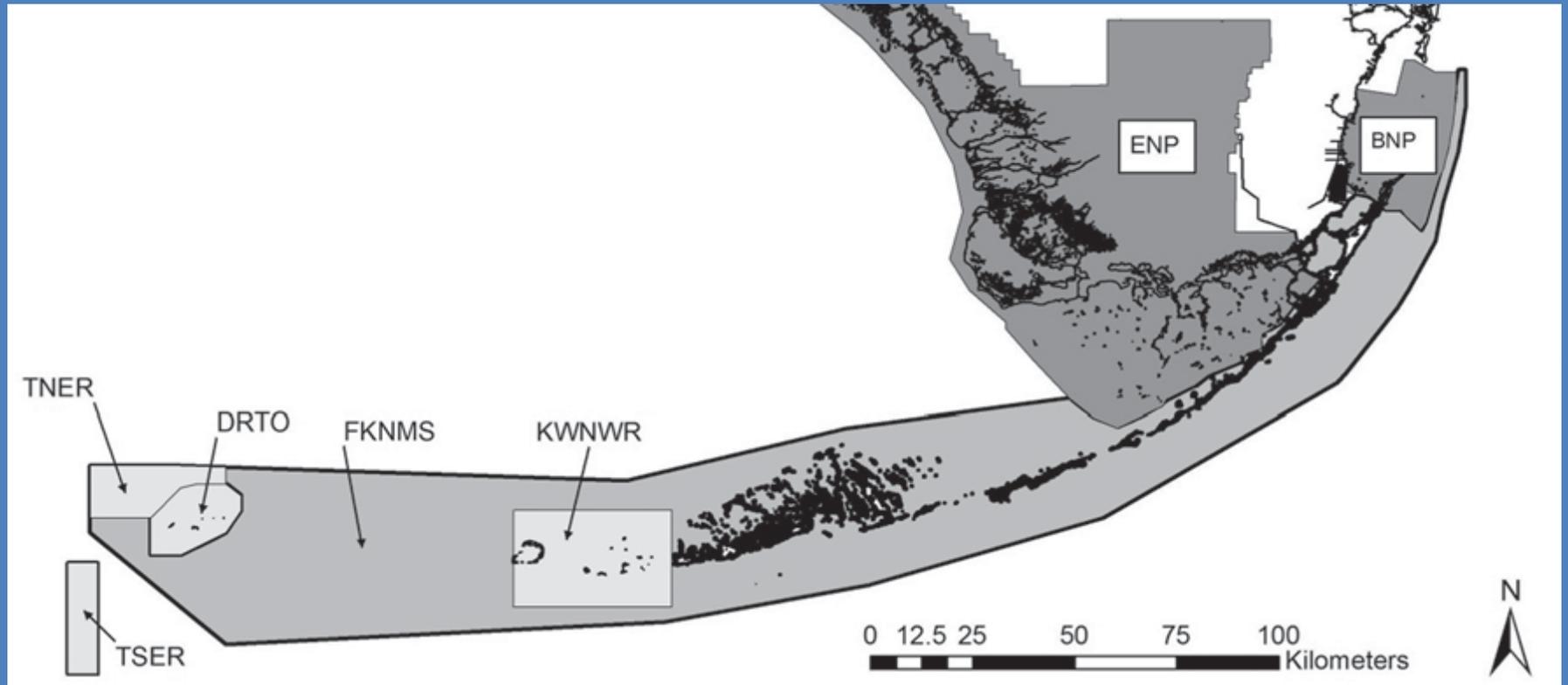
Imagery Date: 4/9/2013

lat 25.000372° lon -81.682424° elev -14 m

Eye alt 294.82 km



South Florida MPAs



Dry Tortugas National Park, South Florida, USA



Satellite Telemetry

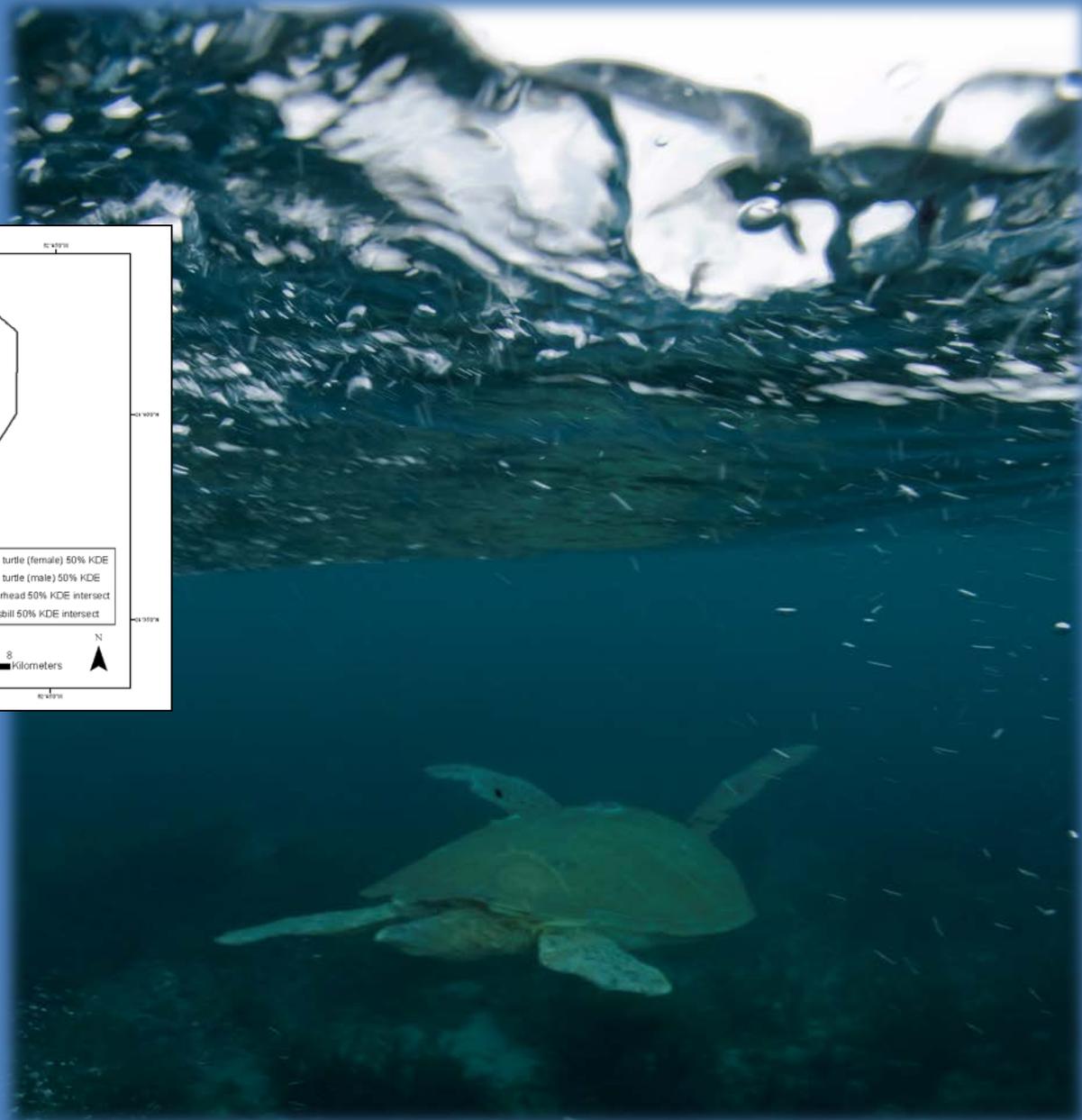
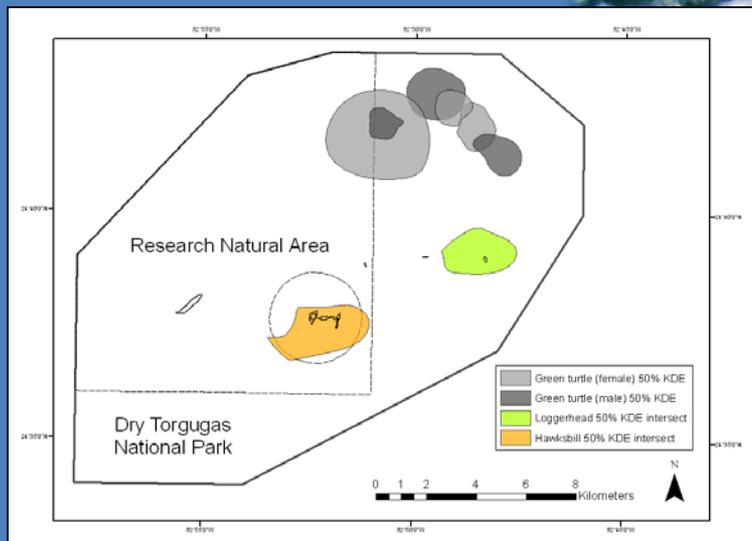
Analysis Methods

- Switching state-space modeling (SSM; Jonsen et al., Breed et al.)
- Home range estimation: Kernel density estimates (KDE), minimum convex polygons (MCP)
- Site-fidelity tests
- Overlap indices
- Centroids, environmental characteristics at centroid locations
- Grids to depict “hotspots”









- Initiated satellite tracking project in 2008 to track movements of marine turtles tagged in Dry Tortugas National Park (DRTN), 2014 in Everglades (ENP)
- Loggerheads, green turtles, and hawksbills spent disproportionate numbers of tracking days within US protected areas, the closest of which is the Florida Keys National Marine Sanctuary
- Many loggerheads and hawksbills, in particular, traveled into international waters, away from protected zones





Satellite Telemetry (N=96 turtles, several tracked twice)

- 58 loggerheads, 33 green turtles, 4 hawksbills, 1 Ei/Cc hybrid

Publications:

- Hart et al. (2010) Aquatic Biology (loggerhead females)
- Hart et al. (2012) Biological Conservation (loggerhead females)
- Hart et al. (2012) Marine Ecology Progress Series (in-water hawksbills)
- Hart et al. (2013) Biological Conservation (green turtle females)
- Hart et al. (2014) Oryx (loggerhead females)
- Hart et al. (2015) Animal Biotelemetry (loggerhead females)
- Fujisaki et al. (2016) Aquatic Biology (in-water green turtles)



Satellite Tracking of DRTO Turtles, 2008-2015 (N=118 tags)



>33,947 turtle-tracking days (range 40-1531 days)

www.seaturtle.org/tracking/?project_id=402

8/8/2012
2012 2016



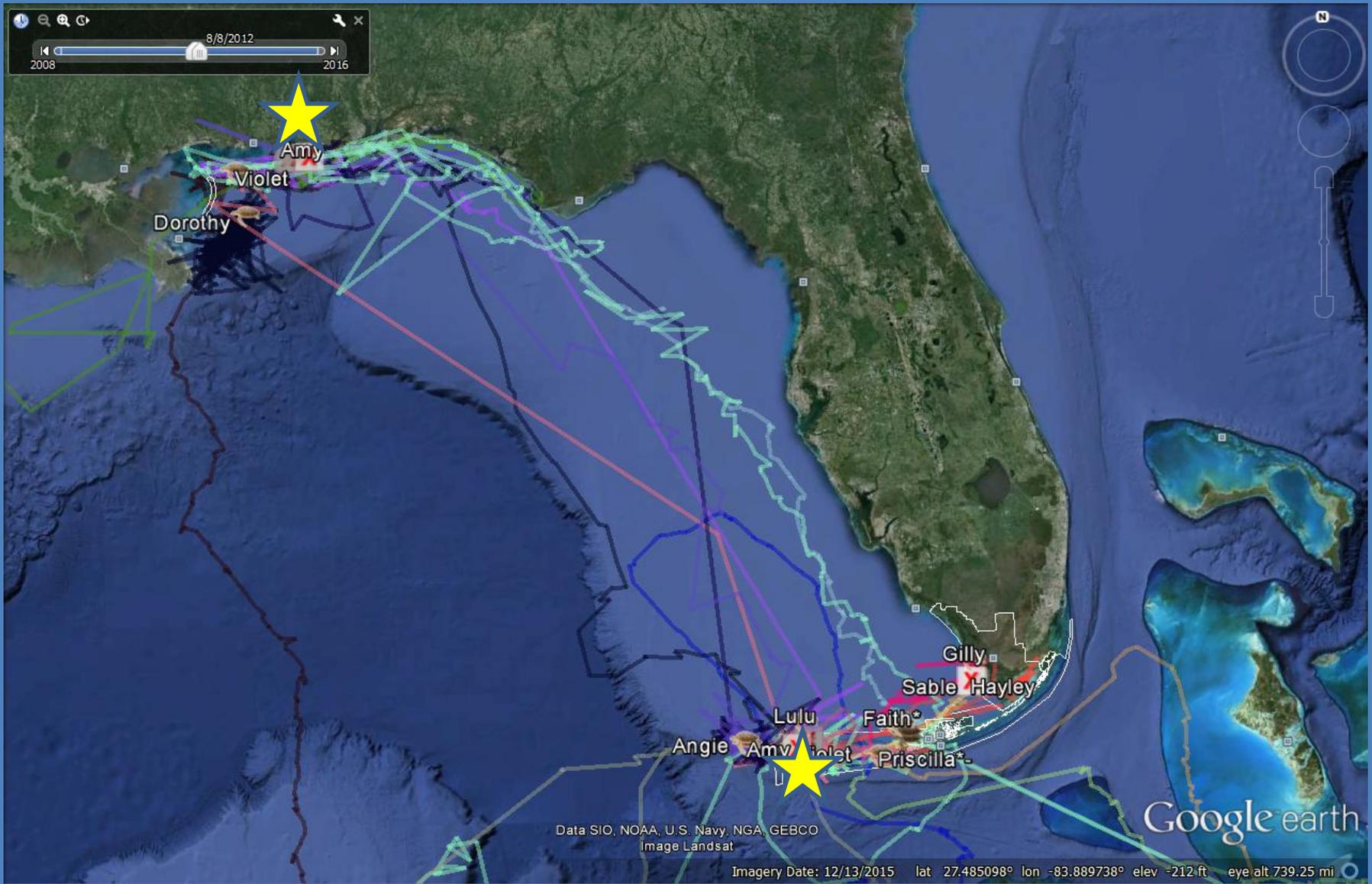
Data LDEO-Columbia, NSF, NOAA

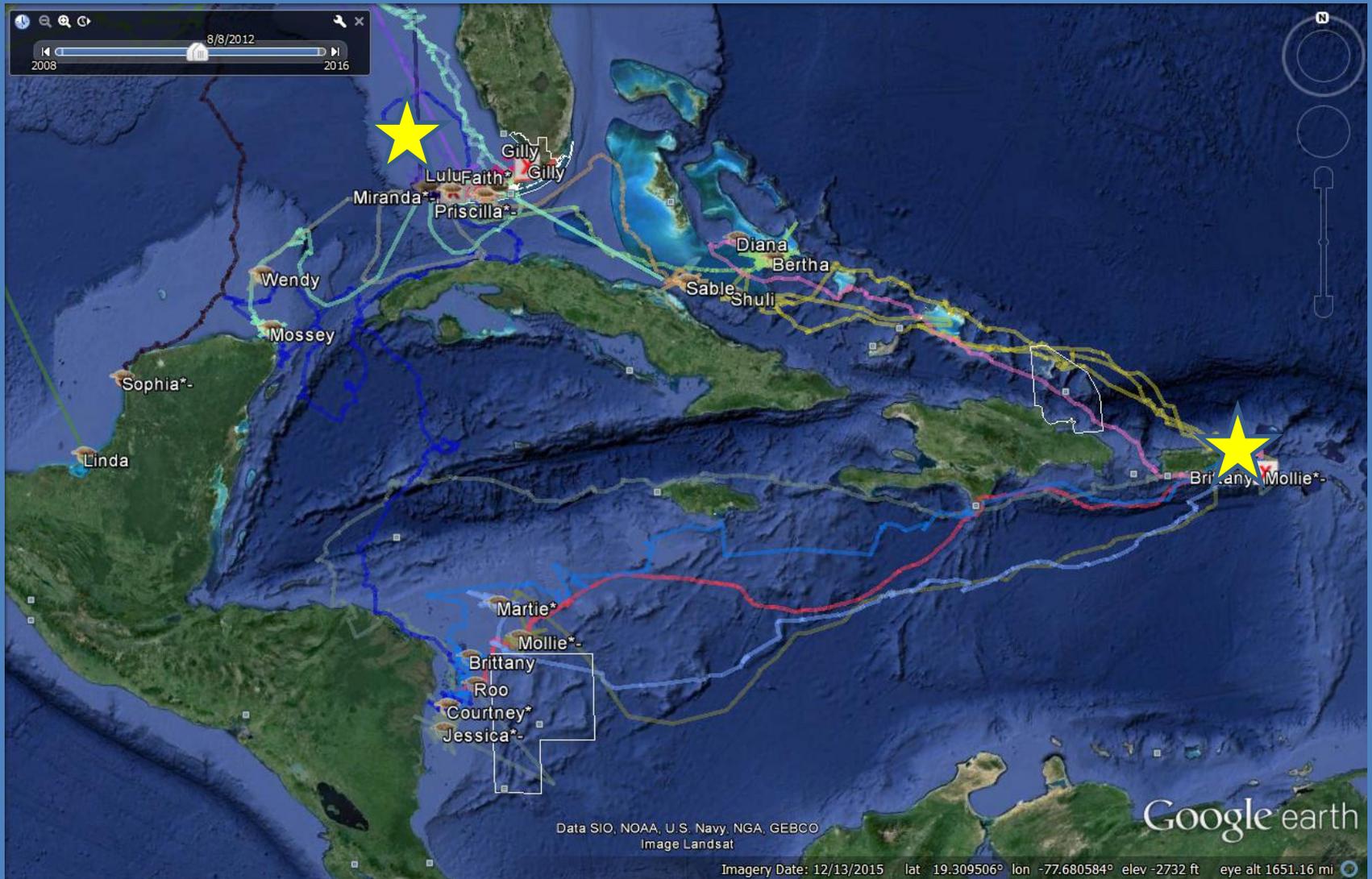
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat

Google earth



Imagery Date: 12/13/2015 lat 24.826245° lon -81.577483° elev -29 ft eye alt 192.41 mi





www.seaturtle.org/tracking/?project_id=402

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Dry Tortugas Sea Turtles

A project of **USGS Greater Everglades Sea Turtles** in conjunction with the partners and sponsors detailed below.

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Name	Species	Life Stage	Release Date	Last Location	Days Transmitted
Adrienne	Loggerhead	Adult	2012-05-13	2013-08-22	466
Andrea	Loggerhead	Adult	2012-07-04	2013-10-27	480
Barbara	Green Turtle	Adult	2012-07-06	2012-11-10	127
Reddy	Loggerhead	Sub-Adult	2010-06-06	2011-03-24	291



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Contents lists available at SciVerse ScienceDirect

Biological Conservation

journal homepage: www.elsevier.com/locate/biocon



Common coastal foraging areas for loggerheads in the Gulf of Mexico: Opportunities for marine conservation

Kristen M. Hart^{a,*}, Margaret M. Lamont^b, Ikuko Fujisaki^c, Anton D. Tucker^d, Raymond R. Carthy^e

^aUS Geological Survey, Southeast Ecological Science Center, 3205 College Avenue, Davie, FL 33314, USA

^bUniversity of Florida, Gainesville, FL, USA

^cUniversity of Florida, Research and Education Center, Davie, FL, USA

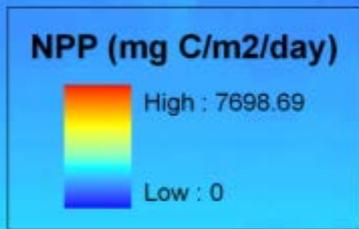
^dMote Marine Laboratory, Sarasota, FL, USA

^eUS Geological Survey, Florida Cooperative Fish and Wildlife Research Unit, University of Florida, Gainesville, FL, USA

- Use of SSM to identify key, common foraging areas used by loggerheads from 3 genetically distinct nesting subpopulations

Loggerhead Foraging-Site Characteristics:

- Relatively shallow water (<50 m)
- Mean 58.5 km from shore (range: 4.9 to 122.0; SD: 36.3)
- Net primary productivity ranged from 253.3 to 1180 mg C/m²/day
- Mean SST = 26.6 to 30.0 ° C

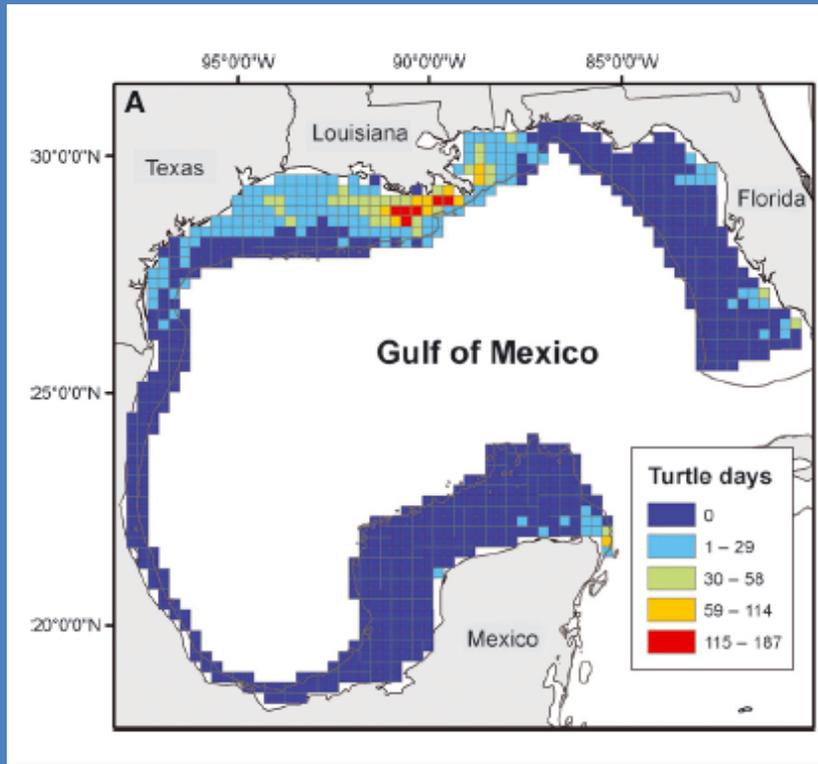


*Identification of foraging sites for Kemp's ridleys (*Lepidochelys kempii*) in the Gulf of Mexico over a 13-year time span*



Photo credit: NPS

- N=31 turtles from 2 sites (Padre Island National Seashore, TX, USA and Rancho Nuevo, MX)
- 6009+ tracking days
- “Hotspots” identified where turtles concentrated foraging activities
- Specific environmental characteristics (depth, SST, NPP) as predictors of foraging sites



Kemp's ridley Foraging-Site Characteristics:

- Relatively shallow water (<20 m)
- Average 33.0 km from shore

Ecology and Evolution

Open Access

Foraging area fidelity for Kemp's ridleys in the Gulf of Mexico

Donna J. Shaver¹, Kristen M. Hart², Ikuko Fujisaki³, Cynthia Rubio¹, Autumn R. Sartain⁴, Jaime Peña⁵, Patrick M. Burchfield⁵, Daniel Gomez Gamez⁵ & Jaime Ortiz⁵

¹National Park Service, Padre Island National Seashore, Corpus Christi, TX 78480-1300

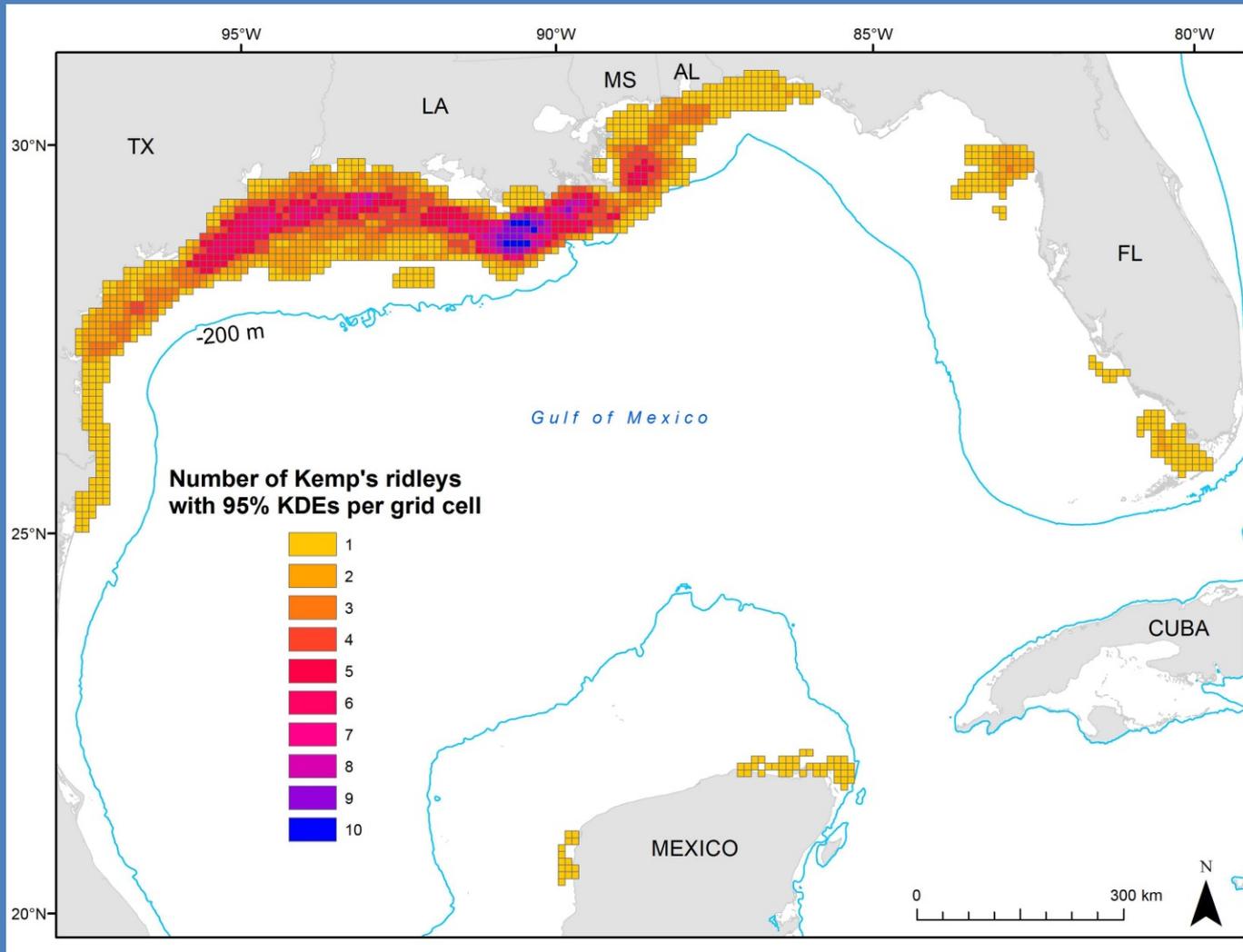
²U.S. Geological Survey, Southeast Ecological Science Center, Davie, FL 33314

³University of Florida, Ft. Lauderdale Research and Education Center, Davie, FL 33314

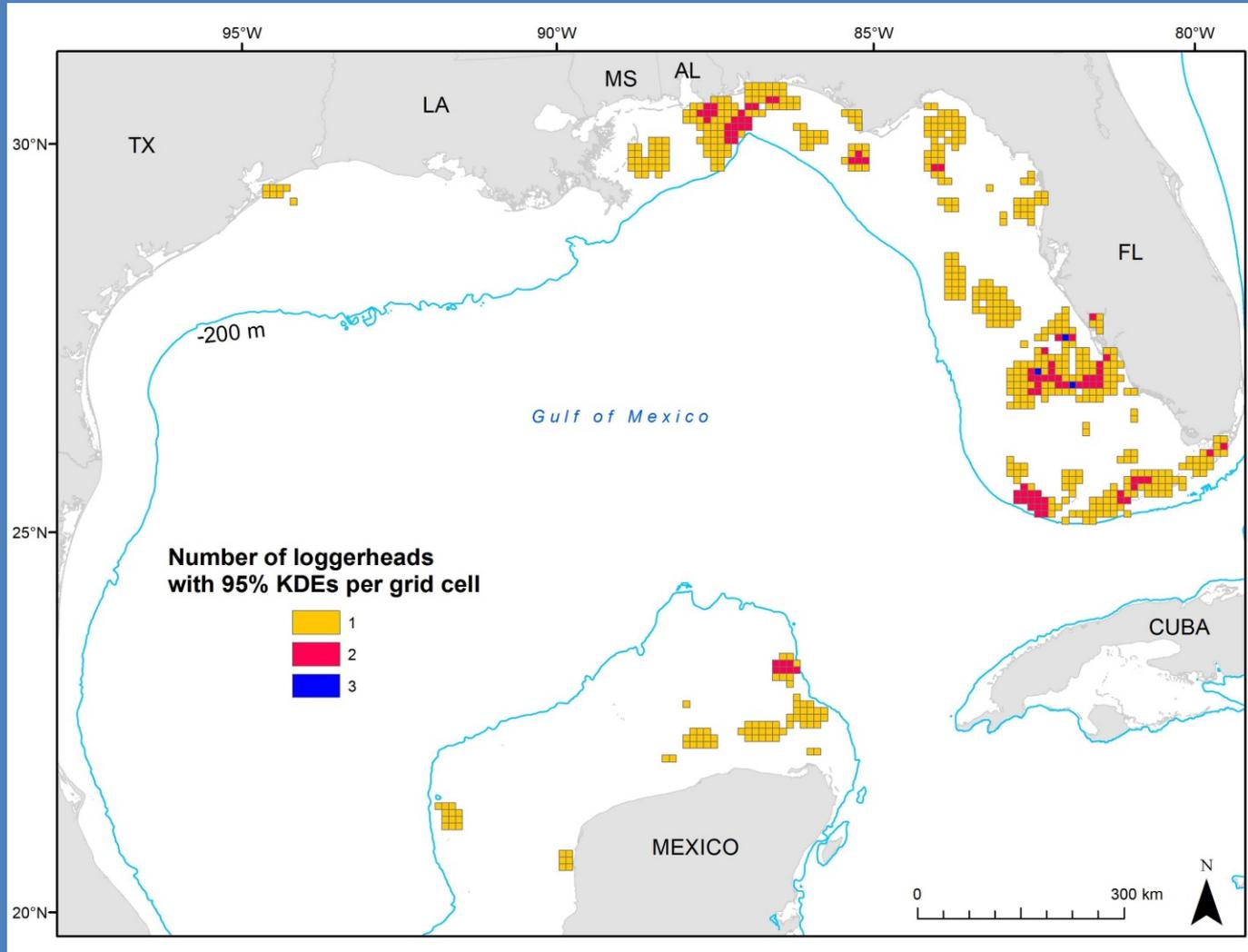
⁴Cherokee Nation Technology Solutions, contracted to U.S. Geological Survey, Southeast Ecological Science Center, Davie, FL 33314

⁵Gladys Porter Zoo, Brownsville, TX 78520

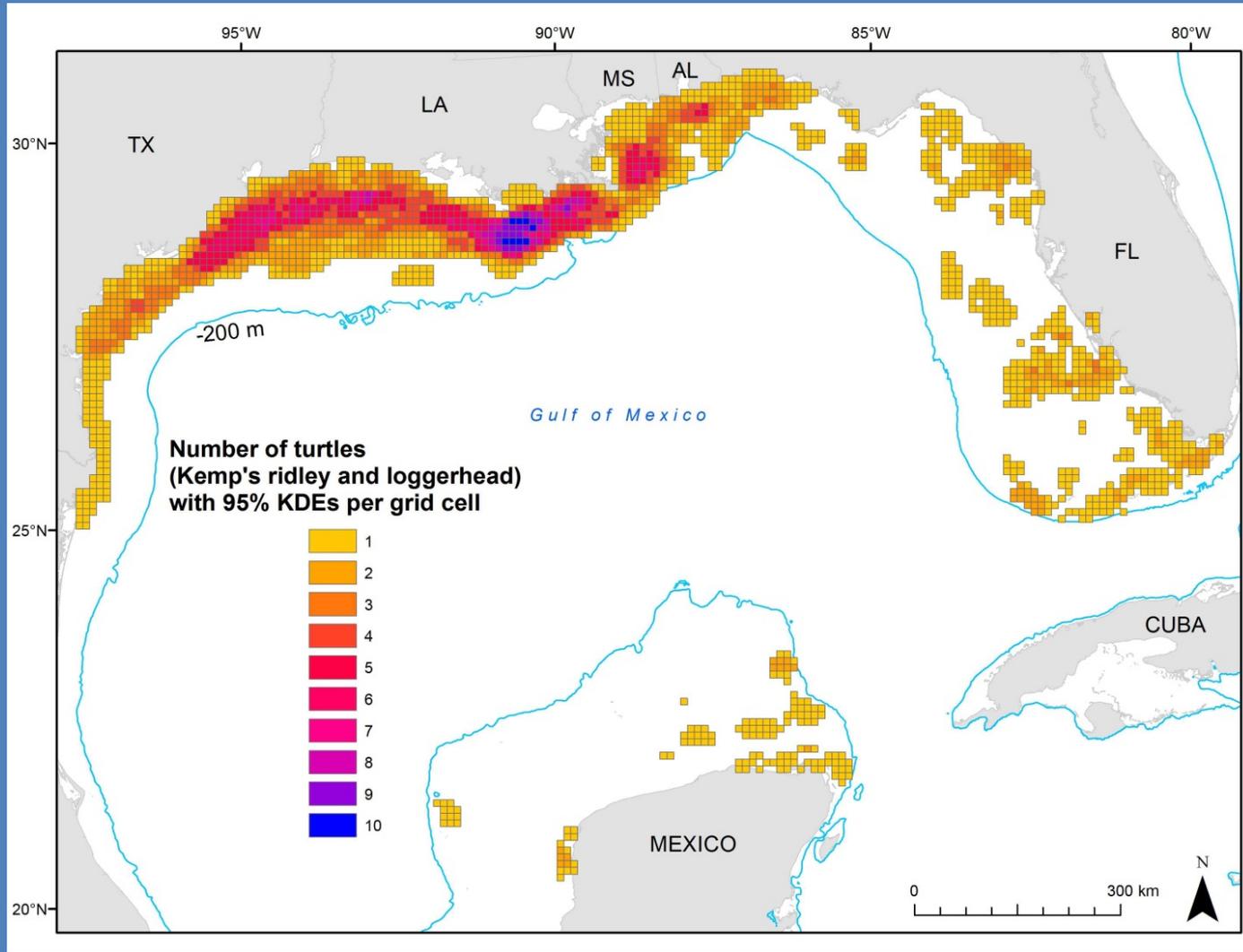
Kemp's ridley foraging areas



Loggerhead foraging areas



Loggerhead and Kemp's ridley foraging areas





Contents lists available at ScienceDirect

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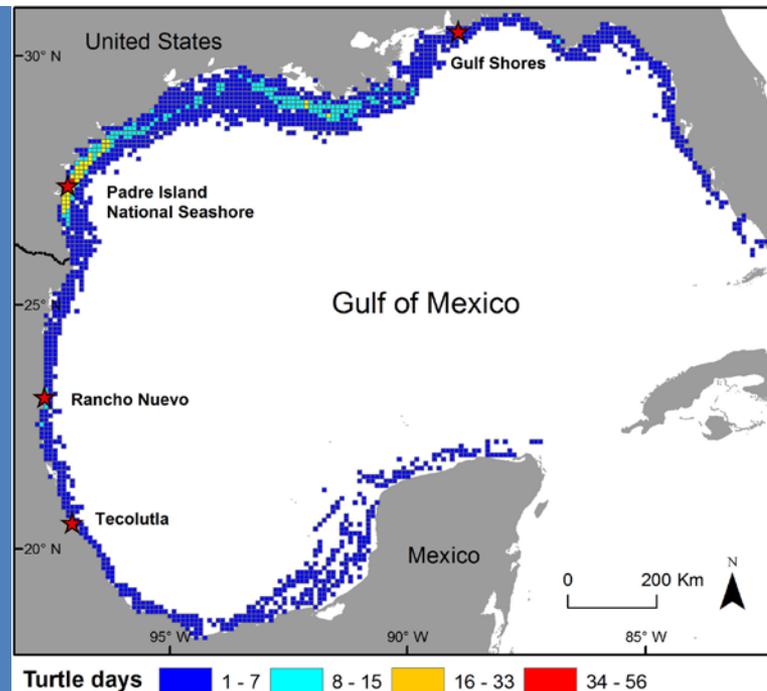
journal homepage: www.elsevier.com/locate/bioco



Migratory corridors of adult female Kemp's ridley turtles in the Gulf of Mexico



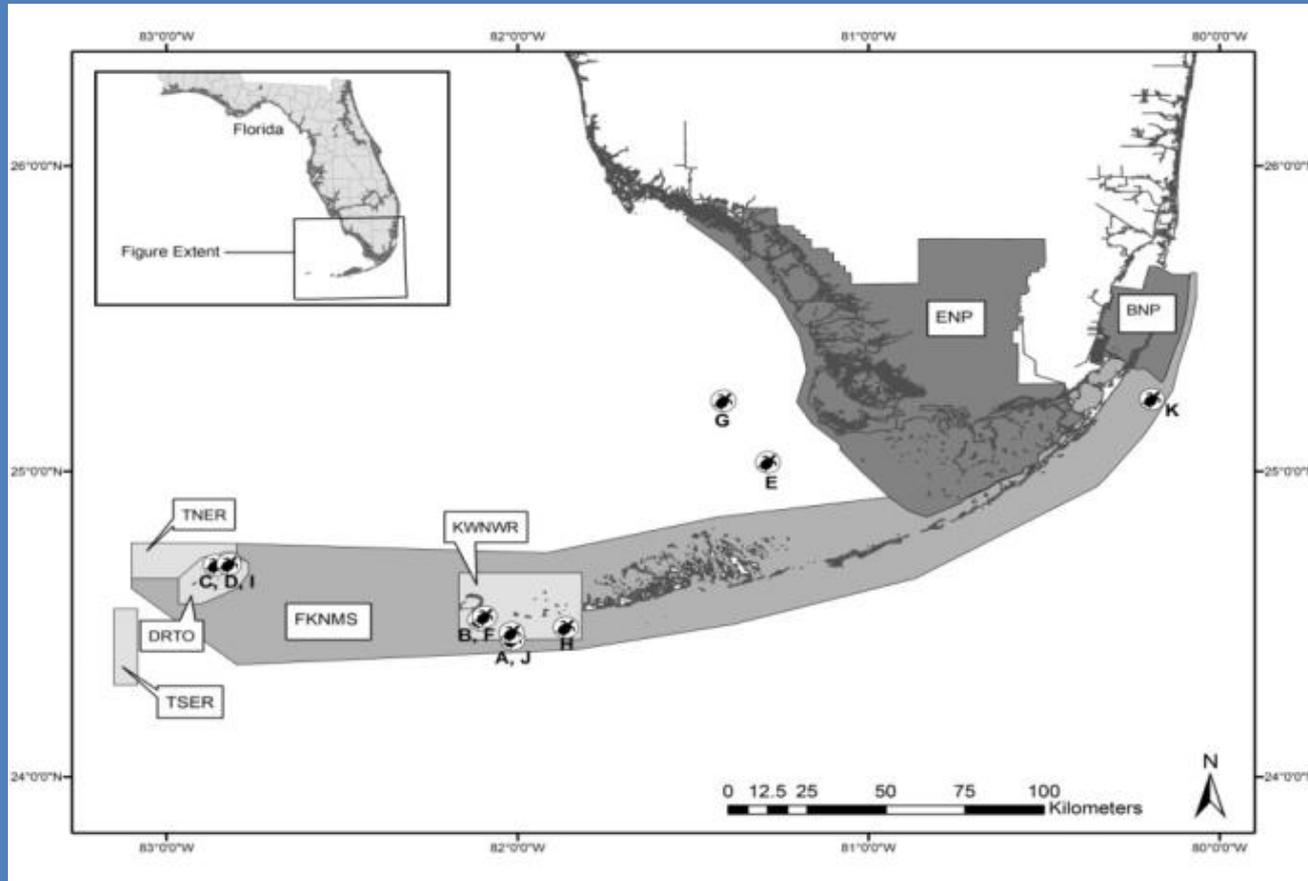
Donna J. Shaver^{a,*}, Kristen M. Hart^b, Ikuko Fujisaki^c, Cynthia Rubio^a, Autumn R. Sartain-Iverson^d, Jaime Peña^e, Daniel Gomez Gamez^e, Raul de Jesus Gonzales Diaz Miron^f, Patrick M. Burchfield^e, Hector J. Martinez^e, Jaime Ortiz^e



Satellite Telemetry

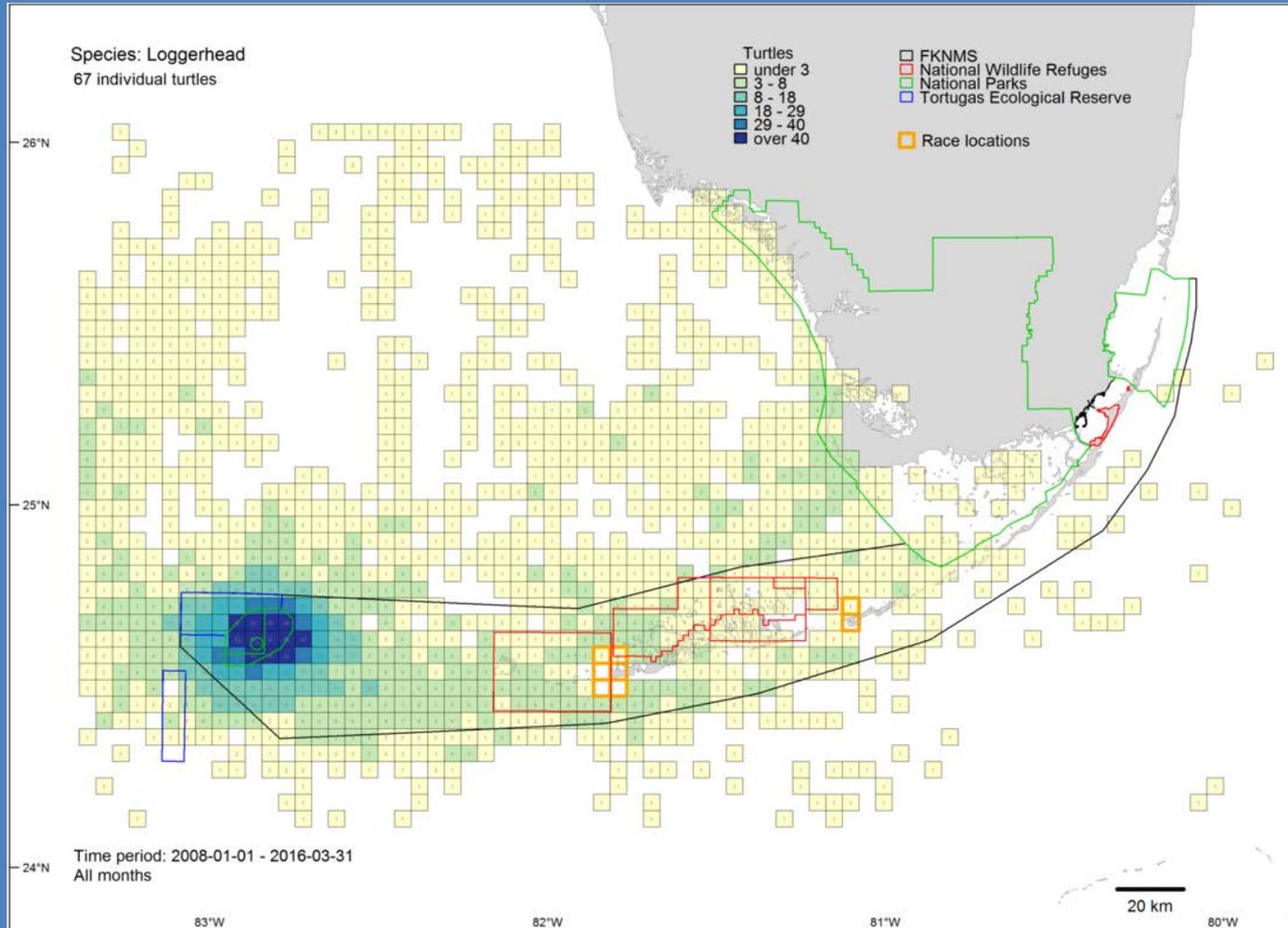
DRTO Green turtles:

- 9/11 (82%) adult females remained in protected areas post-nesting

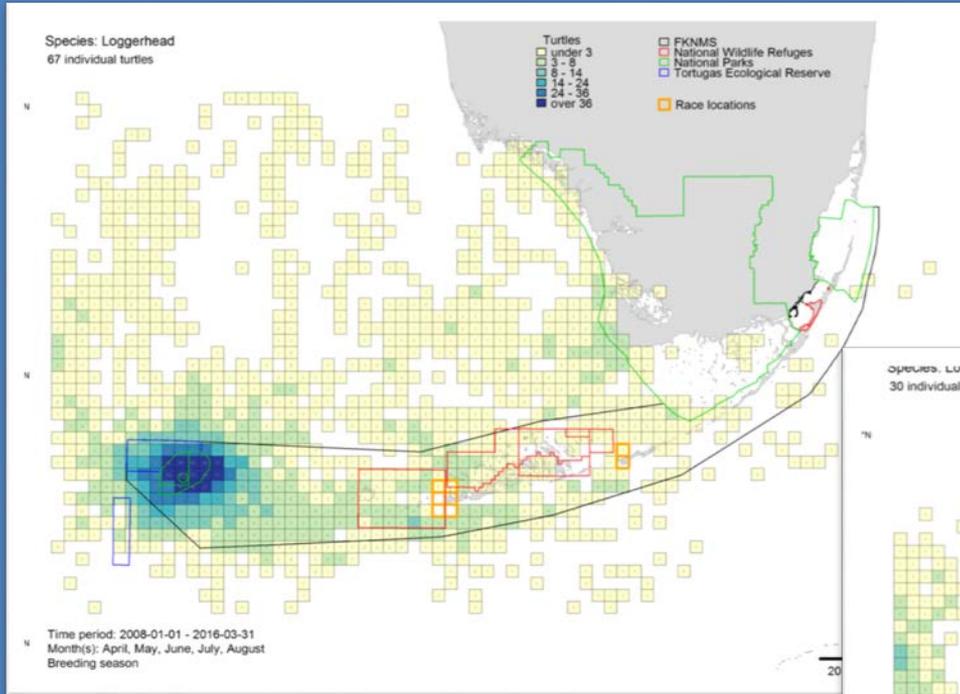


Hart et al. (2013) *Biol Cons* 161:142-154

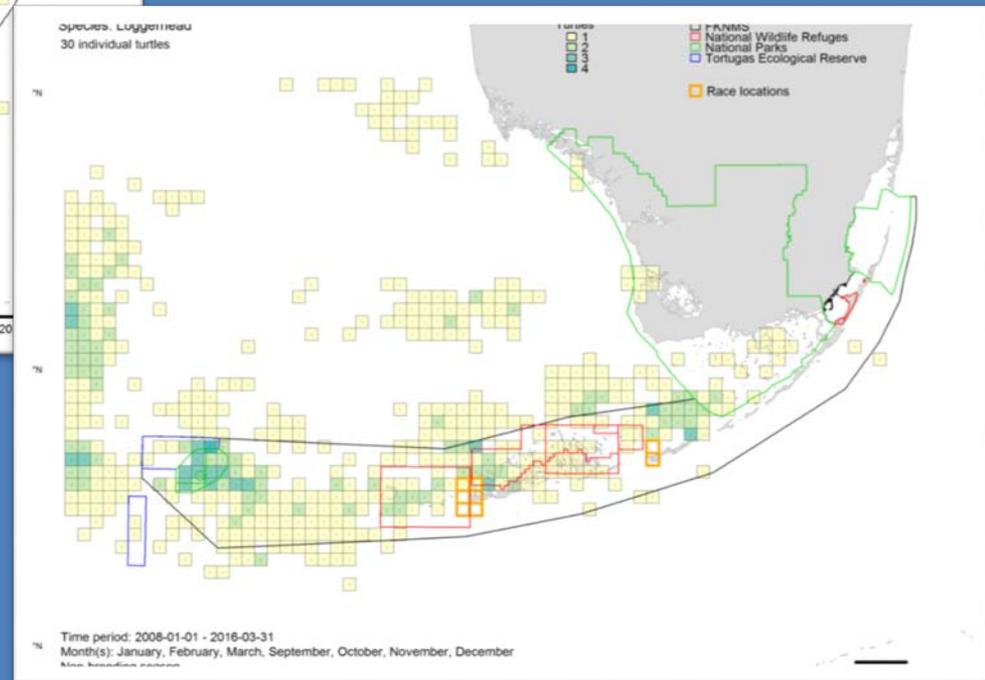
Marine turtle use of habitats within and adjacent to the Florida Keys National Marine Sanctuary



Marine turtle use of habitats within and adjacent to the Florida Keys National Marine Sanctuary



Breeding



Non-Breeding



Photo: Brett Seymour, NPS



Photo credit: Kaare Iverson

Summary for DRTO and ENP

Loggerheads:

- ✓ 69% Bahamas and FL Keys; 14% W. FL shelf; 6% Northern Gulf of Mexico; 6% Mexico (Yucatan) and Nicaragua, 5% Atlantic FL/GA

Green turtles:

- ✓ Some are year-round residents of DRTO; high proportion of others are resident in FLKMNS

Hawksbills:

- ✓ Use of DRTO as foraging areas, connection to Cuba



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*FL FWCC and Mote colleagues: Mike Feeley, John Hunt, Rod Bertelsen, Danielle Morley, Wes Pratt, Tony
Tucker*

Others...



Questions?