



STAT: Satellite Tracking & Analysis Tool



seaturtle.org



seaturtle.org

User supported portal for sea turtle research,
conservation and education

*Organize the world's sea turtle information and
make it universally accessible and useful*

> 13,000 registered users

Observation Database

Stranding Database

Satellite Tracking

News

Maptool

Glossary

Links

Mail Lists

Job Board



Image Library

Directory

Marine Turtle Newsletter

> 2.4 million hits per month

Components of Success

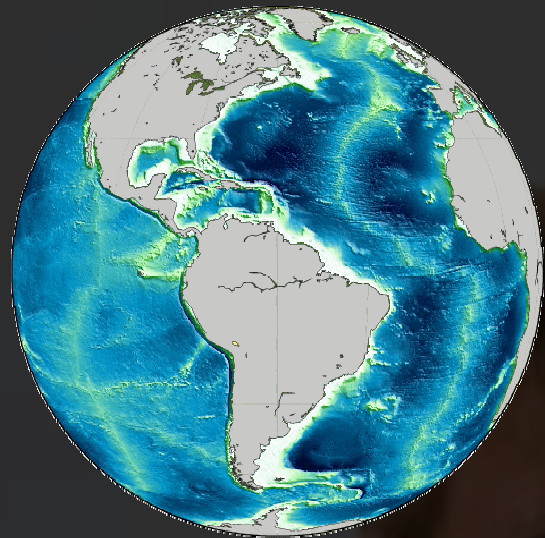
Compelling Tools

- Save time
- Save money
- User-friendly
- Power tools
- Collaboration
- Education & Outreach
- Fund raising

Low barrier to Entry

- No special software or hardware requirements
- Platform independent
- Open access
- Autonomous
- FREE

*Photo: Cape Verdean Loggerhead
(Lucy Hawkes)*



Satellite Tracking and Analysis Tool

A Comprehensive System for Managing Satellite Tracking Data

- Data Retrieval
- Data back-up
- QA/QC Protocols
- Data Filtering and Analyses
- Map Creation
- Remote Sensing
- Education and Outreach
- Collaboration

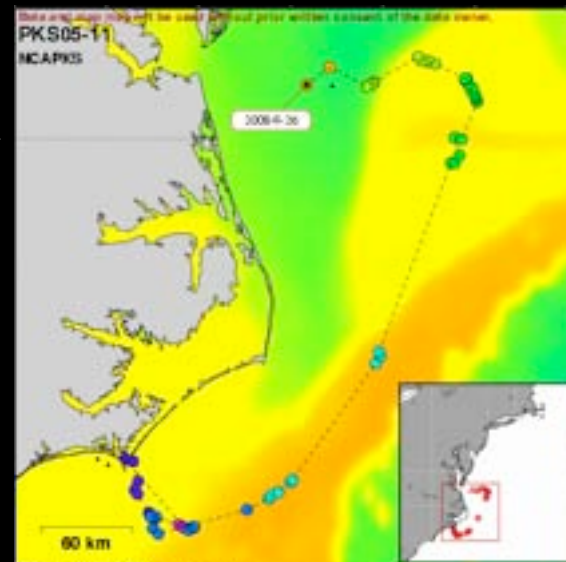
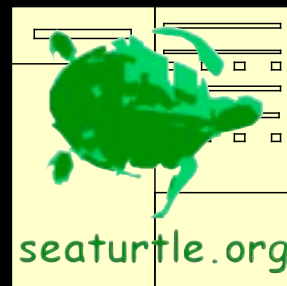
Photo: Ivory Gull (Adrian Aebischer)

Argos

SEATURTLE.ORG

Maps Updated

E-mail Notification



SEATURTLE.ORG Satellite Tracking Update

Bald Head Island 2008: Loggerhead Turtles

To stop receiving these e-mail updates please click here.

Has your favorite animal stopped transmitting? Check out our Frequently Asked Questions (FAQ) to learn some of the reasons why this might happen.

ANIMAL	LOCATIONS
Uga VI	4
Howard	16
Miss Hucktable	3
TOTAL	23

Please note that not all of these locations will be of sufficient reliability to be plotted on maps.

Fact of the Day: Loggerhead sea turtles are the most common species nesting in North Carolina.

Project Co-ordinator: Marine Turtle Research Group
 E-mail: mcoyne@seaturtle.org
 Website: <http://www.seaturtle.org/mtrg/>

WORD OF THE DAY
 Spongivore
 An animal that eats mainly sponges. Hawksbill sea turtles are spongivores, although they also sometimes eat algae and coral.

ADOPTION PROGRAM
 GIVE A GIFT THAT COUNTS!

Edisto
 Loggerhead
 South Carolina
 Aquarium Sea Turtle
 Rescue Program

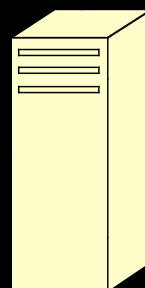
E-mail Summary

1430 uplinks read from ARGOS for last 9 days.
 41 new uplinks were added to the database.
 2 modified uplinks were replaced in the database.

Total processing time: 27 secs

New Data Summary:

Tag	Total	3	2	1	0	A	B	Z	-
75966	2	0	0	0	0	0	0	0	2
75967	2	0	1	0	0	0	1	0	0
75968	3	0	0	0	0	0	1	0	2
75970	1	0	0	0	0	0	0	1	0
75973	1	0	0	0	0	1	0	0	0
75974	5	0	0	0	0	0	0	0	5
75975	1	0	0	0	0	0	0	0	1
77171	2	0	0	1	0	0	0	0	1
80620	1	0	0	0	0	0	0	0	1
82836	5	0	0	0	0	0	1	0	4
82839	5	1	0	1	1	0	0	0	2
82840	2	0	0	0	0	0	2	0	0
82843	1	0	0	1	0	0	0	0	0
82844	2	0	0	1	0	1	0	0	0
85274	4	0	0	0	0	0	2	0	2
85275	4	0	0	0	0	1	2	0	1



Offsite Backup



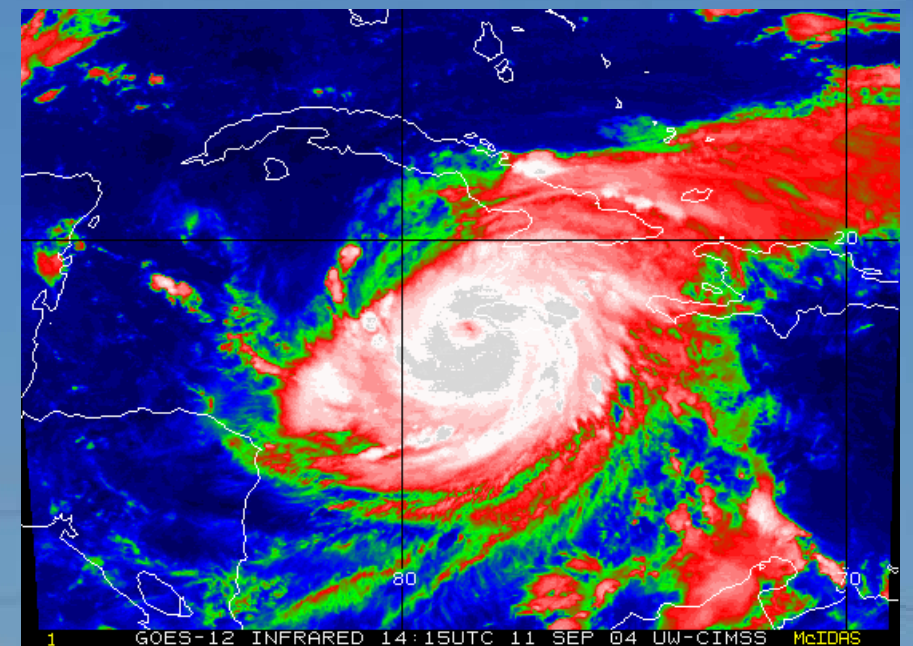
>200 Programs
 823 live data streams

Photo: Greater Shearwater
 (Zach Swaim)

Do You Know Where Your Data Are?

“reliable OFF-ISLAND back-up for data (e.g. the "national hurricane plan" was for government documents to be archived at the National Archives, which got twelve feet of flooding during Ivan – the rest of the “plan” was worse...)”

Janice Blumenthal
Cayman Island Dept of Environment
and Marine Turtle Research Group





Satellite Tracking and Analysis Tool

[Program Index](#)[Home](#)[Edit Profile](#)[Projects](#)[Tags](#)[Metadata](#)[Launch Maptool](#)

There are **86** tags in your program that have been inactive for more than a year. Please archive  these tags at your earliest convenience so that they will not interfere when those tag IDs are recycled.

[Upload DIAG Data](#) - [Retrieve New Data](#) - [Export All Data](#) - [Invoice Center](#) ^{NEW} - **Server Load:**



Filter:

submit

Data Summary

- ☒ **Bald Head Island 2003: Loggerhead Turtles** (4 tags)    
- ☒ **Bald Head Island 2004: Loggerhead Turtles** (4 tags)    
- ☒ **Bald Head Island 2005: Loggerhead Turtles** (4 tags)    
- ☒ **Bald Head Island 2006: Loggerhead Turtles** (4 tags)    
- ☒ **Bald Head Island 2007: Loggerhead Turtles** (4 tags)    
- ☐ **Bald Head Island 2008: Loggerhead Turtles** (4 tags)    

Tag	Locs	3	2	1	0	A	B	Z	-	deploy date	last loc	days ago	uplink	at large	
85274 Uga VI 	720	20	57	49	26	192	373	3	562	2008-06-26	2008-09-26	0	2008-09-26	92	   
85275 Howard 	1520	85	234	262	258	275	388	18	353	2008-06-28	2008-09-26	0	2008-09-26	90	   
85276 	78	4	8	0	1	14	48	3	151	2008-07-08	2008-09-15	11	2008-09-24	69	   
85277 Miss Huckstable 	364	10	4	6	19	105	213	7	214	2008-07-31	2008-09-26	0	2008-09-26	57	   

- ☒ **British Virgin Islands 2003: Leatherback Turtle** (1 tags)  
- ☒ **British Virgin Islands 2004: Hawksbill Turtle** (1 tags)  
- ☒ **British Virgin Islands 2005: Leatherback Turtle** (1 tags)  
- ☒ **Cape Verde (Cabo Verde) 2004: Loggerhead Turtles** (10 tags)        
- ☒ **Cape Verde (Cabo Verde) 2005: Loggerhead Turtles** (3 tags)   
- ☒ **Cape Verde (Cabo Verde) 2006: Loggerhead Turtles** (12 tags)          
- ☒ **Cayman Islands 2003: Loggerhead & Green Turtles** (3 tags)   
- ☒ **Cayman Islands 2004: Loggerhead & Green Turtles** (5 tags)     
- ☒ **Cayman Islands 2005: Green Turtles** (3 tags)   
- ☒ **Cayman Islands 2006: Green Turtle** (1 tags)  
- ☒ **Colola, Michoacan 2003: Black Turtle** (1 tags)  
- ☒ **Dominican Republic 2008: Hawksbill Turtles** (4 tags)    
- ☒ **Gabon 2005-07: Leatherback Turtles** (9 tags)       
- ☐ **Gabon 2007: Olive Ridley Turtles** (5 tags)     

[Update Configuration](#)

Please be patient! Static maps are regenerated whenever settings are updated.

Education Program ☒

Animal Name

Date Line ☐ DO NOT check this box unless your animal crossed the Pacific Ocean!

Release Information

Date and Time GMT *yyyy-mm-dd hh:mm:ss*

End Date GMT *yyyy-mm-dd hh:mm:ss*

Location *locale name*

Latitude *decimal degrees (-90 to 90)*

Longitude *decimal degrees (-180 to 180)*

Data Filters

Distance Filter Any "good" point farther from the previous "good" point than the "distance filter" value will be skipped. Default value is 1000 km. Set to zero for no filtering.

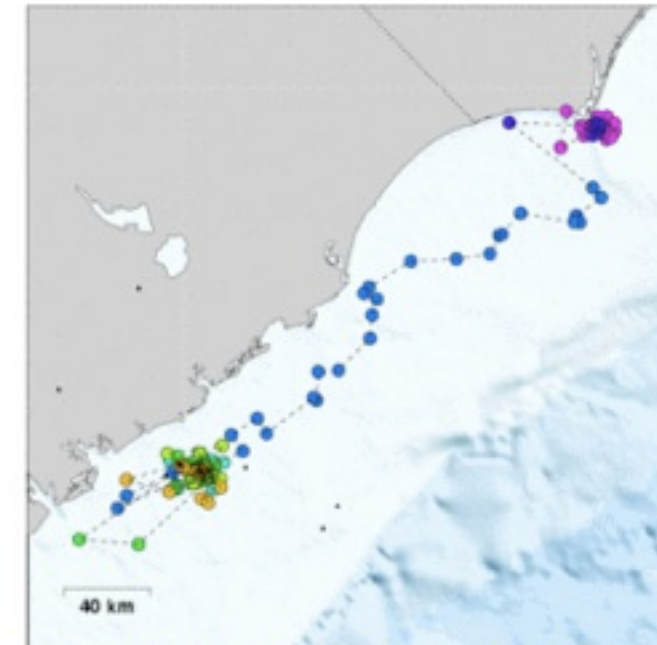
Speed Filter Any "good" point with a speed calculated from the previous "good" point as greater than the "speed filter" value will be skipped. Default value is 5 km/h. Set to zero for no filtering.

Time Filter Any "good" point with a time calculated from the previous "good" point as less than the "time filter" value will be skipped. Default value is zero, which results in no time filtering. You can use this option to control the number of points that are plotted per day or to exclude consecutive points very close in time.

Topo Filter Any "good" point with a height calculated to be greater than the "topo filter" value in meters will be skipped. Default value is zero, which results in no topo filtering. This may be useful for filtering locations that occur over land. Depth values are extracted from the ETOPO2 global dataset.

Turning Angle Filter Any "good" point with an inside angle (between previous and next "good" points) calculated to be smaller than the "angle filter" value in degrees will be skipped. Default value is zero, which results in no angle filtering.

Wet / Dry Filter Select "wet" to remove locations over water or "dry" to remove locations over land. Uses GMT full resolution coastline database to determine wet or dry condition. Coastline database contains inaccuracies at very small scales, but possibly more accurate than topography used for topo filter above.



[Download high-resolution PDF file.](#)

Map Preferences

Inset Map Select whether to display inset map and location of inset map. Default is lower-left corner.

Scale Position Select where on map to place scale.

Gridlines ☐ Draw gridlines every one degree.

Paint Land ☒ Paint land areas with solid grey color.

Paint Water ☐ Paint water areas with solid blue color.

Label Countries ☐

Label Major Cities ☐

Label Minor Cities ☐

Bathymetric Layer ☒ Include bathymetry surface grid. Maps smaller than 4x4 degrees will appear pixellated if you select this option.

SST Layer ☐ Include latest available sea surface temperature grid. Selecting SST will override the bathy layer, if selected. If you data are restricted to the western hemisphere (30W to 180W) then GOES SST will be used, otherwise weekly AVHRR data will be used.

SSH Layer ☐ Include latest available sea surface height grid. Selecting SSH will override any layers selected above.

Chlorophyll Layer ☐ Include latest available MODIS Chlorophyll grid. Selecting chlorophyll will override any layers selected above.

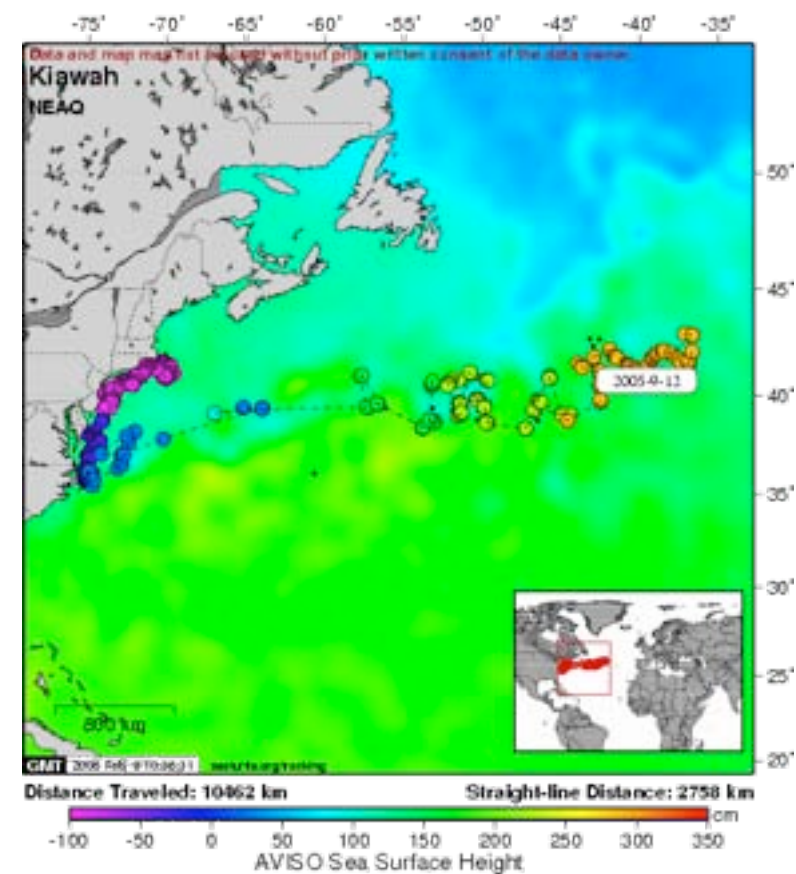
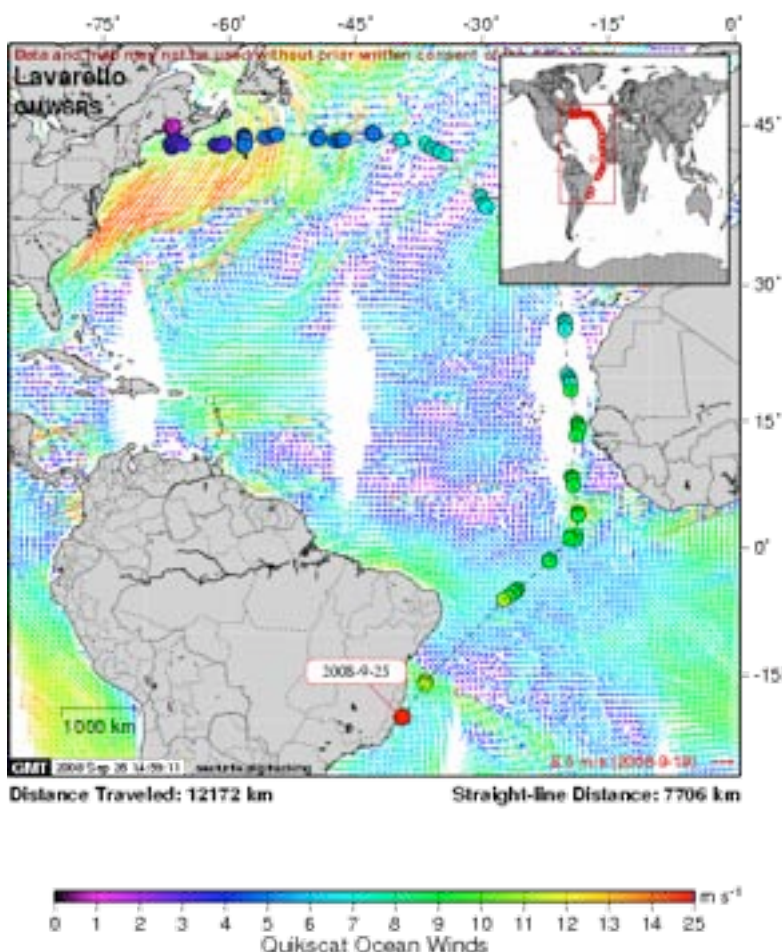
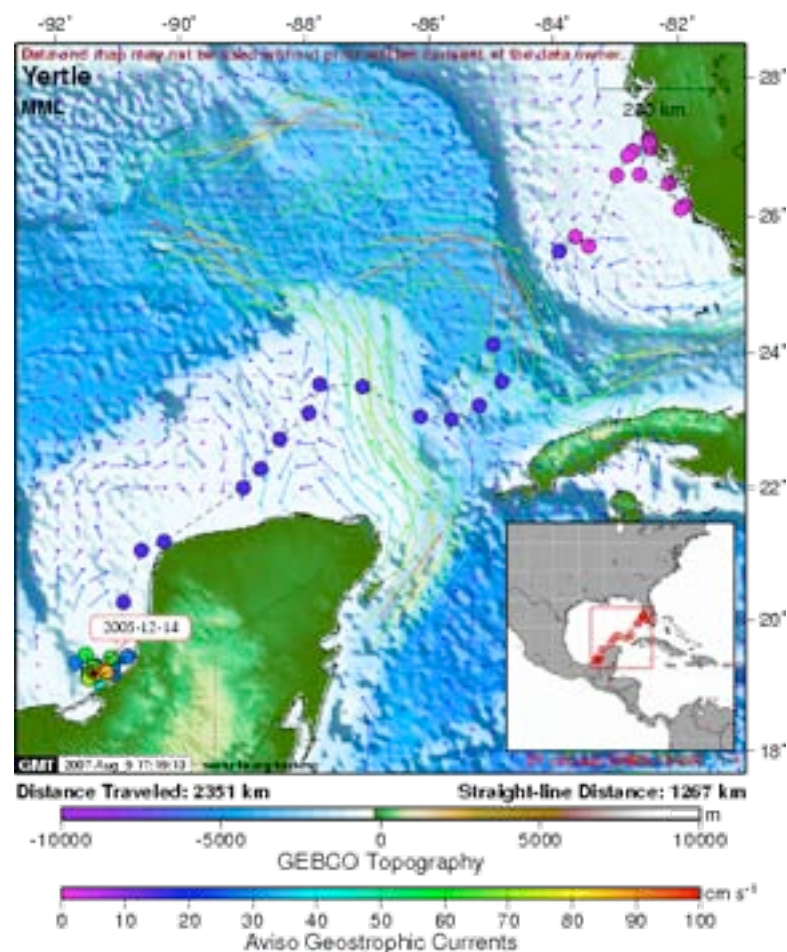
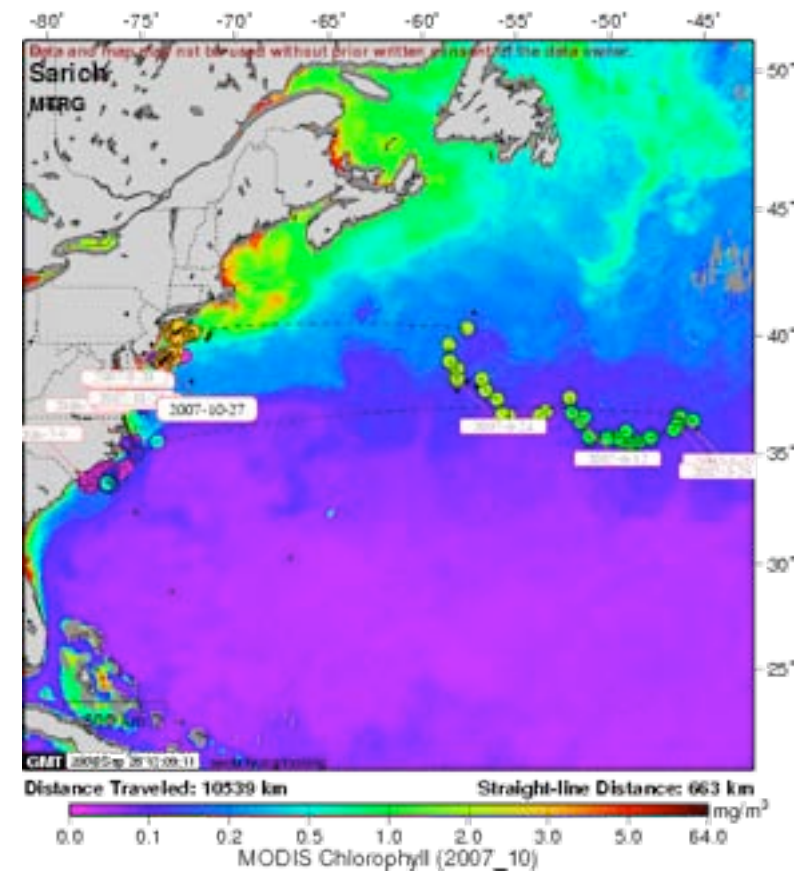
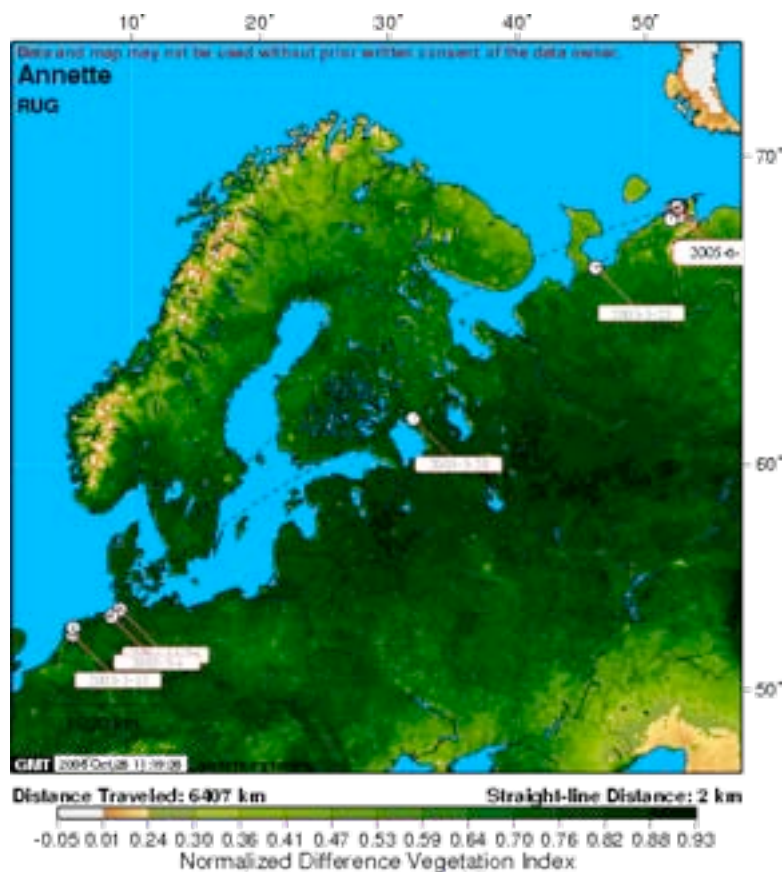
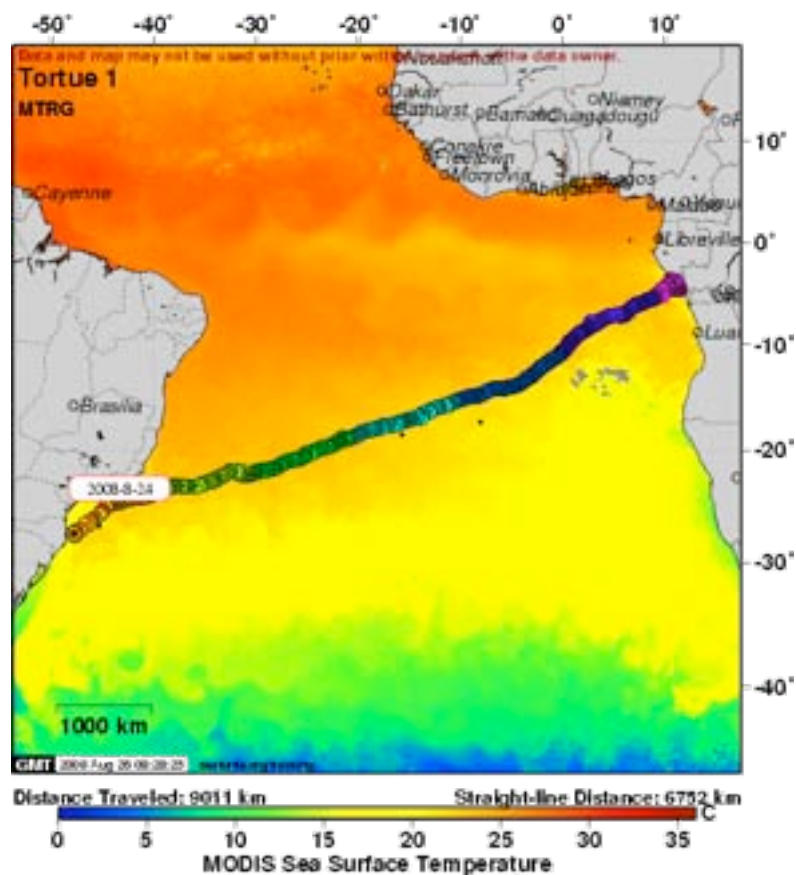
NDVI Layer ☐ Include latest available normalized difference vegetation index grid. Selecting NDVI will override any layers selected above.

Shaded Grid Relief ☒ Shade bathymetry or SST grid with side illumination.

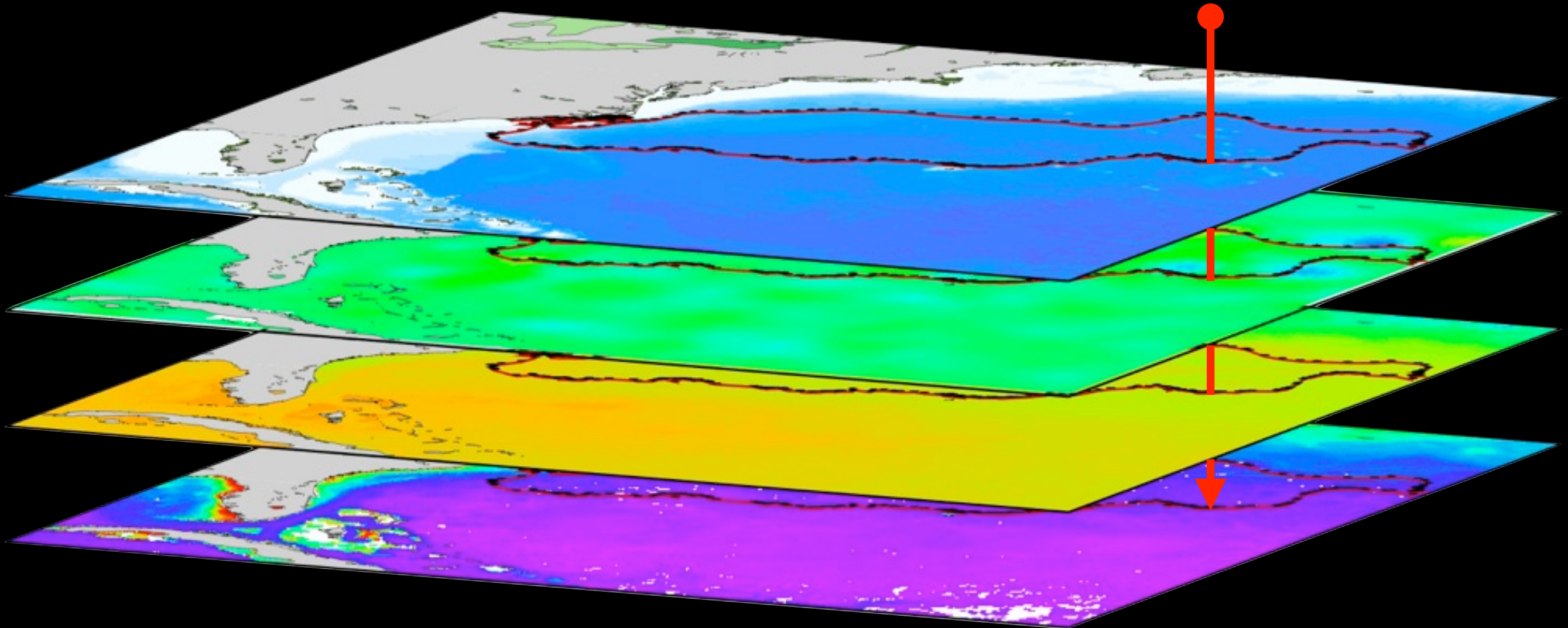
Ocean Currents ☐

Ocean Winds ☐

Bathymetric Contours



Depth	5003 m
Sea Surface Heigh	13 cm
Sea Surface Temperature	20.1° C
Chlorophyll	0.16 mg/m ³





Satellite Tracking and Analysis Tool

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Program Number: 01892 Tag ID: 89071 (Parterine)

Load Filter Set:

Filter Options

Exclude locations based on the following criteria

LC: ☐ 3 ☐ 2 ☐ 1 ☐ 0 ☐ A ☐ B ☐ Z Auto Swap: ☐ Show Excluded: ☐

Speed: > kph Distance: > km Topo: > m Hours: < Angle: <

Start Date: yyyy-mm-dd End Date: yyyy-mm-dd OR Use Release Data: ☐

☐ Generate Map

Export Options

Export/Maptool Filename

☒ Interpolate Output

Mode: Start Time:

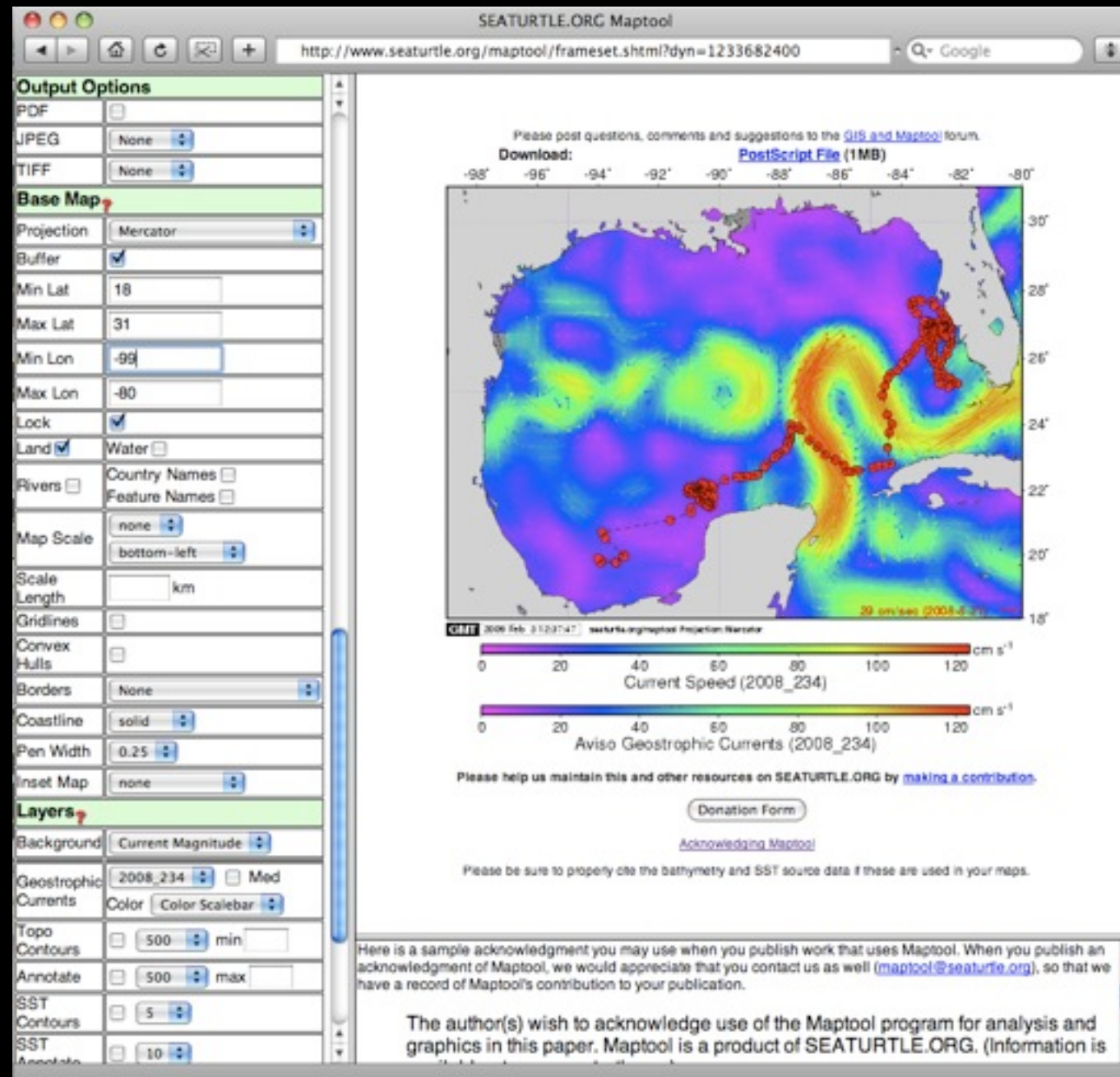
Interval: ☐ Fill Gaps

Release Date: 2008-12-09 00:18:00 Release Lat: 0.350 Release Lon: 9.354 [Add Data](#)

0.350 9.354 1228799880 554 of 554 records 7 suggested swaps in 3 seconds

uid	utc	lc	nb_mes	lat1	lon1	lat2	lon2	depth	distance (km)	azimuth	speed (kph)	hours	cumm (days)	incl	excl	options
2034322	2008-10-23 23:00:00	3	9	47.683	-122.135	55.374	-80.805	25.86	12934.83 (9996)		-11.69	-1106.30	-46.1	☐	☐	swap edit delete
2034323	2008-10-23 23:07:30	0	4	47.689	-122.120	36.766	-175.574	58.80	1.31 (4474)		10.48	0.12	-46.1	☐	☐	edit delete
2041681	2008-10-23 23:55:00	3	11	47.677	-122.136	51.464	-103.105	40.24	1.80 (1430)		2.27	0.79	-46.1	☐	☐	edit delete
2034325	2008-10-24 00:40:30	3	12	47.678	-122.134	46.535	-128.075	33.48	0.19 (467)		0.25	0.76	-46.0	☐	☐	edit delete
2034761	2008-10-24	3	10	47.678	-122.136	41.924	-140.860	38.17	0.15 (2260)		0.16	0.95	-46.0	☐	☐	edit delete

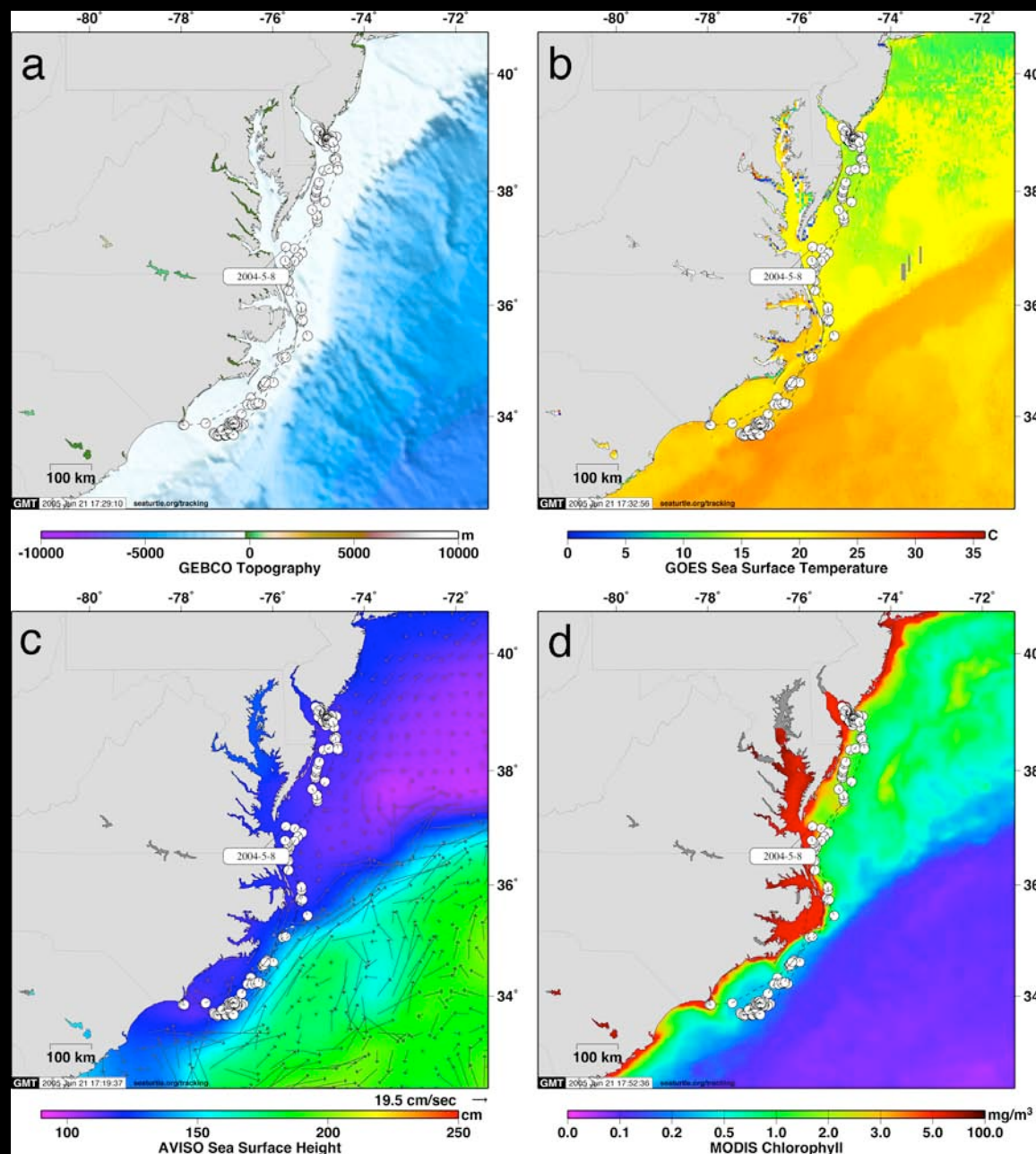
Maptool



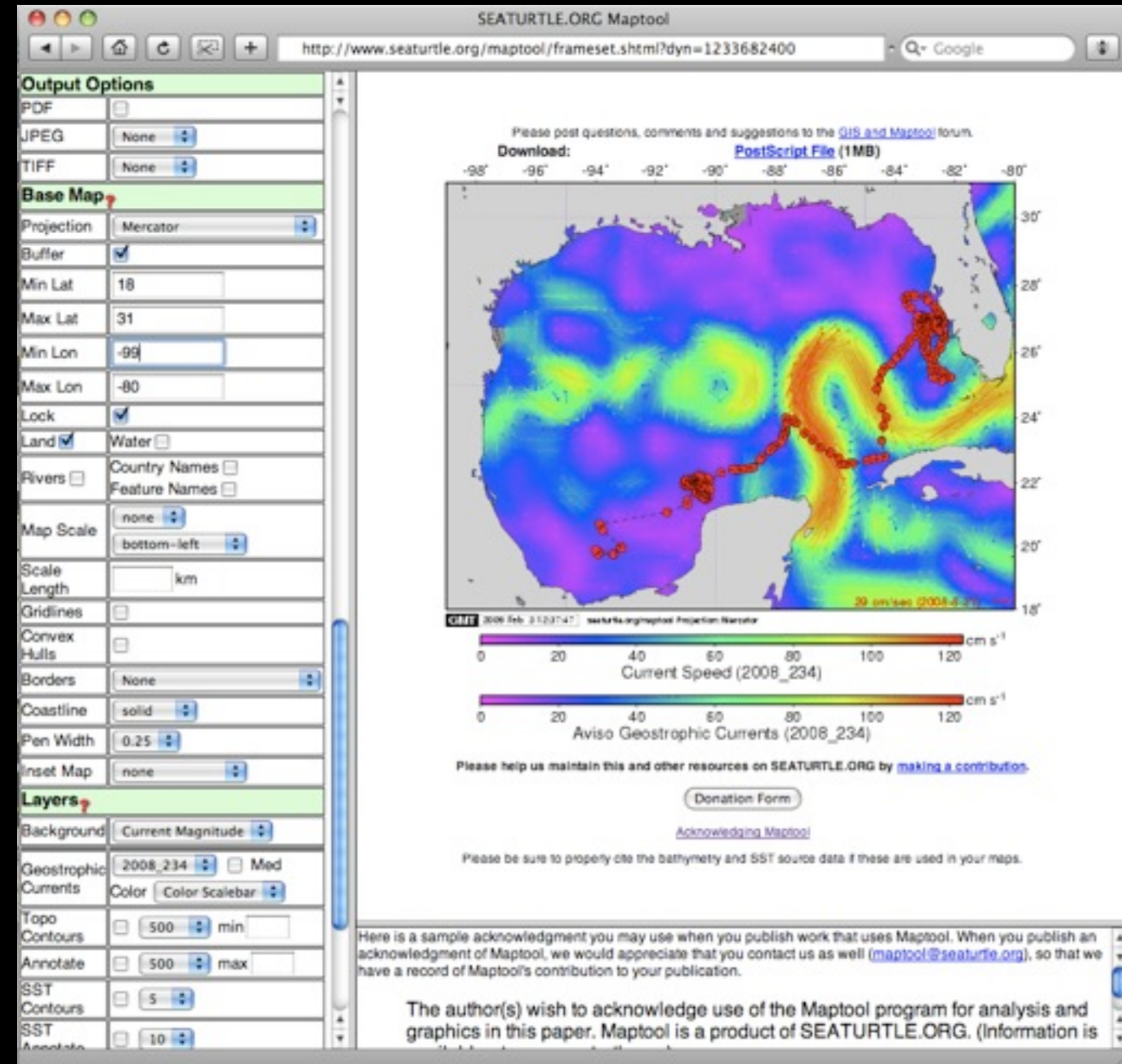
Track courtesy Mote Marine Lab
http://www.seaturtle.org/tracking/index.shtml?tag_id=72443

<http://www.seaturtle.org/maptool/>

Maptool



Coyne MS, Godley BJ (2005) Satellite Tracking and Analysis Tool (STAT): an integrated system for archiving, analyzing and mapping animal tracking data. Mar Ecol Prog Ser 301:1-7



Track courtesy Mote Marine Lab
http://www.seaturtle.org/tracking/index.shtml?tag_id=72443

<http://www.seaturtle.org/maptool/>



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Speed: > kph Distance: > km Topo: > m Hours: < Angle: <

Start Date: yyyy-mm-dd End Date: yyyy-mm-dd OR Use Release Data: ☐

☐ Generate Map

Export Options

Export/Maptool Filename

☒ Interpolate Output

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Interval: ☐ Fill Gaps

Release Date: 2008-12-09 00:18:00 Release Lat: 0.350 Release Lon: 9.354 [Add Data](#)

0.350 9.354 1228799880 554 of 554 records 7 suggested swaps in 3 seconds

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2034322	2008-10-23 23:00:00	3	9	47.683	-122.135	55.374	-80.805	25.86	12934.83 (9996)		-11.69	-1106.30	-46.1	☐	☐	swap edit delete
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2041681	2008-10-23 23:55:00	3	11	47.677	-122.136	51.464	-103.105	40.24	1.80 (1430)		2.27	0.79	-46.1	☐	☐	edit delete
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2034761	2008-10-24	3	10	47.678	-122.136	41.924	-140.862	38.17	0.15 (2268)		0.16	0.95	-46.0	☐	☐	edit delete

Aug 9, 1996

Google Earth 5.0





Satellite Tracking and Analysis Tool

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Speed: > kph Distance: > km Topo: > m Hours: < Angle: <

Start Date: yyyy-mm-dd End Date: yyyy-mm-dd OR Use Release Data: ☐

☐ Generate Map

Export Options

Export/Maptool Filename

☒ Interpolate Output

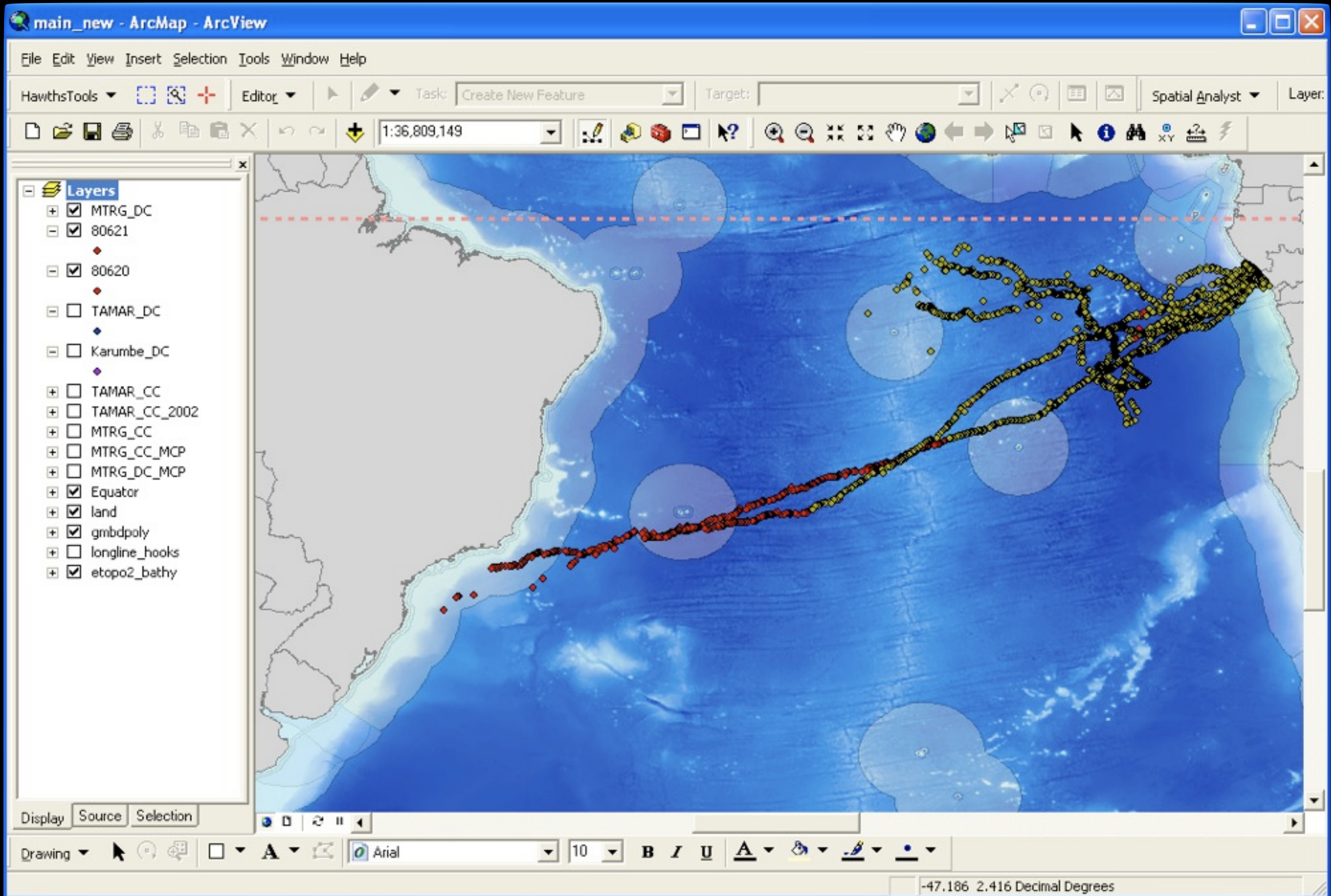
Mode: Start Time:

Interval: ☐ Fill Gaps

Release Date: 2008-12-09 00:18:00 Release Lat: 0.350 Release Lon: 9.354 [Add Data](#)

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2034761	2008-10-24	3	10	47.678	-122.136	41.924	-140.862	38.17	0.15 (2268)		0.16	0.95	-46.0	☐	☐	edit delete



seaturtle.org - Satellite Tracking

http://www.seaturtle.org/tracking/?project_id=290

seaturtle.org

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Welcome Michael!

Satellite Tracking

Bald Head Island 2008: Loggerhead

A project of the Marine Turtle Research Group in conjunction with partners and sponsors detailed below.

Subscribe to receive daily project updates

Bald Head Island 2008: Loggerhead Turtle

Name	Species	Life Stage	Release Date	Last Location
Uga VI	Loggerhead Adult		2008-06-26	2008-09-27
Howard	Loggerhead Adult		2008-06-28	2008-09-28
85279	Loggerhead Adult		2008-07-08	2008-09-15
Miss Huckstable	Loggerhead Adult		2008-07-31	2008-09-26

Click on an animal's name for maps and more information

Bald Head Island 2008: Loggerhead Turtles

Uga VI
Howard
85279
Miss Huckstable

200 km

Introduction

This project aims to find out more about the post nesting migratory movements of loggerhead sea turtles from Bald Head Island, North Carolina. Four nesting females were tracked each in 2003 through 2007 and made impressive movements north as far away as New Jersey, and south as far as the Florida Keys. Two of the transmitters from 2007 are still transmitting. The transmitters provided us with some interesting and useful data about the migratory and foraging behavior of the loggerhead sea turtle in this region. This study's deployments will complement the results from previous years and provide us with a wider insight into North Carolina sea turtles.

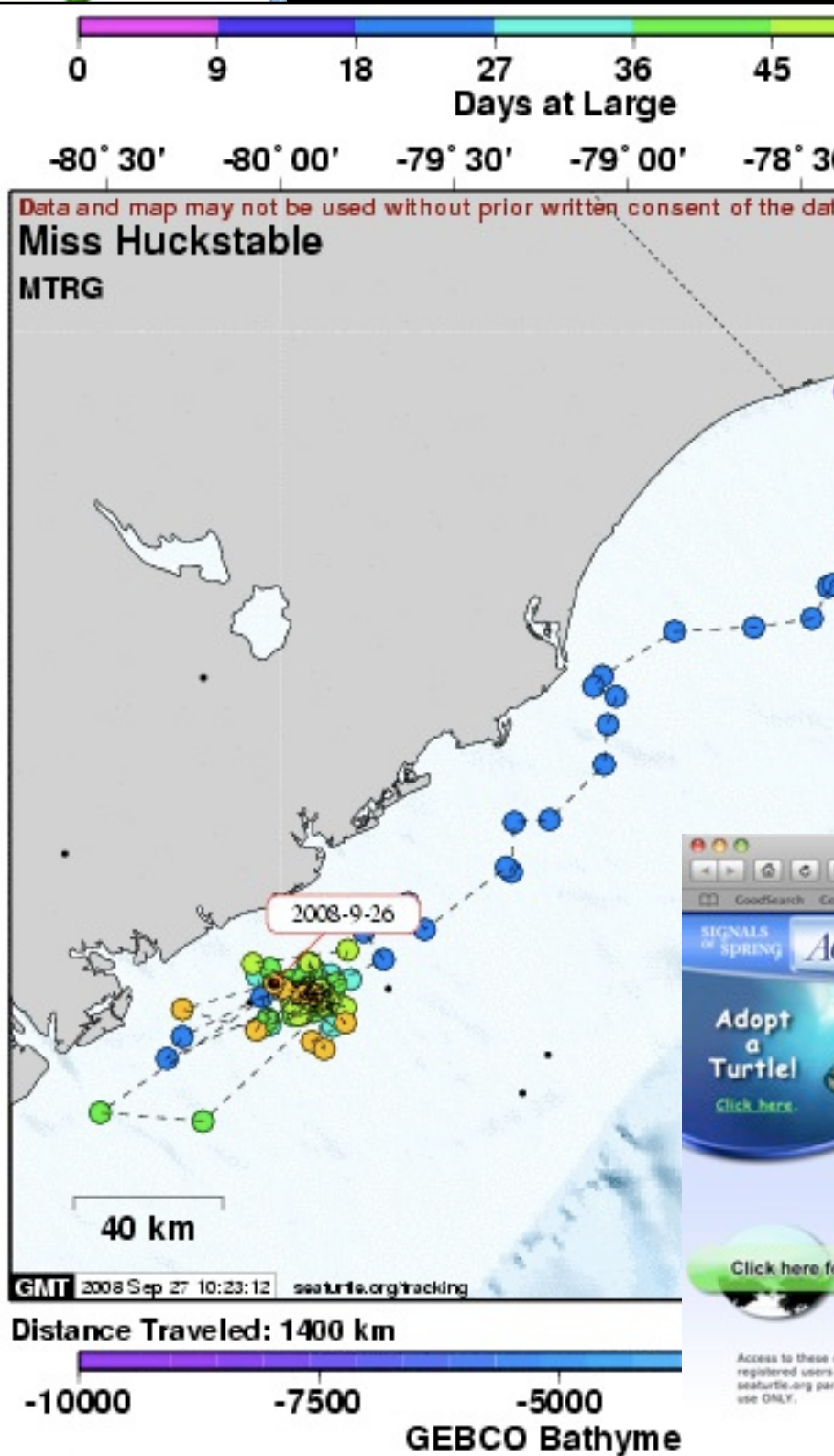
Project Partners

This project is a collaboration among the Marine Turtle Research Group (Brendan Godley and Annette Broderick), Michael (SEATURTLE.ORG), the North Carolina Wildlife Resources Commission (Wendy Cluse and Matthew Godfrey) and the Bald Head Island Conservancy.

Project Sponsors

This project was funded by a grant from the WAVE Foundation at the Newport Aquarium, Kentucky, and donations from the Bald Head Island Conservancy and SEATURTLE.ORG.

The presentation of data here does not constitute publication. All data remain copyright of the project partners. Maps or data on this website may not be used or referenced without explicit written consent.



OBIS SEAMAP

Home | Datasets | Species | Providers | About

Keyword:

Species:

Platform:

Taxon group: ☐ Seabirds ☐ Marine mammals ☒ Sea turtles

Provider:

Map | Satellite | Hybrid

Observations: 1-5, 5-10, 10-50, 50-100, > 100

Order by: Date added, Date added, Provider

Dataset name	Map	Platform	Year	Count
WWF Indonesia		tag	2008-2009	0 0 537
Green turtle tracking in the northern Great Barrier Reef		tag	2008-2009	0 0 472
Richard Sears, Mianan Island Cetacean Study		boat	1994-2007	24 4,829 0
World Wildlife Fund		tag	2008-2009	0 0 490
European Seabirds at Sea		boat	1970-1971	1,104 7,737 0

Signals of Spring - ACES - seaturtle.org

http://www.signalsofspring.net/aces/seaturtle/

GoodSearch | GoodShop | USPS Calculator | Email | Evernote | Twitter | Facebook | Share FB | Andy Brinko | TinyURL | my deLicious | CBookmark | Radar | MacCentral

Adopt a Turtle

Click here

seaturtle.org

SEATURTLE.ORG's mission is to organize the world's sea turtle information and make it universally accessible and useful. A primary focus is to support research and conservation efforts in the sea turtle community and to educate the public about sea turtles and the threats they face. These goals are achieved by providing information services and communication and collaboration tools through the www.seaturtle.org website.

How Can I Help?

Signals of Spring Schools around the world are [Adopting Sea Turtles](http://www.seaturtle.org)! Give a gift to your sea animal from seaturtle.org and show your support for marine conservation. All proceeds support the satellite tracking programs of SEATURTLE.ORG and the organization tracking the animal. Donating classrooms will receive an Adoption Certificate, with adoption packets available in amounts of \$25, \$50 and \$100.

For more information, go to www.seaturtle.org.

Click here to find out more about U.S. Satellite Laboratory and its pipeline of education programs.

Classroom Investigation

Sea Turtle Investigation (Student Version, 2.7 MB)

If you would like the Teacher Version, [register here](http://www.seaturtle.org) or sign in below.

Email:

Password:

Login

Sponsored by:

National Oceanic & Atmospheric Administration (NOAA Award NA06OEC4690006)

Open: http://www.signalsofspring.net/aces/seaturtle/maps_data_2008.cfm?seaturtle=yes in a new tab

Data Explorer

- ☒ Birds
 - ☒ Barnacle Goose
 - ☒ Black-footed Albatross
 - ☒ Bonelli's eagle
 - ☒ Common Loon
 - ☒ Golden eagle
 - ☒ Greater Shearwater
 - ☒ Montagu's harrier
 - ☒ Pink-footed Shearwater
 - ☒ Sooty Shearwater
 - ☒ Wood Stork
- ☒ Mammals
 - ☒ Harbor seal
- ☒ Reptiles
 - ☒ Flatback turtle
 - ☒ Green turtle
 - ☒ Hawksbill
 - ☒ Kemp's ridley
 - ☒ Leatherback
 - ☒ Loggerhead
 - ☒ Olive ridley

Last 24 hours

Intersecting

All Countries

[reset map](#) | [clear tracks](#) | [show tracks](#) | Matches 120

☐ Show collaborative data only

Map

Satellite

Hybrid

POWERED BY Google

5000 mi

5000 km

Imagery ©2008 NASA - Terms of Use

Tick "Show collaborative data only" check box to see projects interested in collaboration.

<http://www.seaturtle.org/tracking/explorer/>

Education

TURTLE TRACKS

USING REAL-TIME SATELLITE TELEMETRY DATA IN THE CLASSROOM

A loggerhead sea turtle spends 99% of its life in the great black box that is the ocean. As much as we have learned studying nesting females on the beach, there remains this barrier between us and our understanding of a sea turtle's life. Mote scientists, like Dr. Tony Tucker, employ satellite technology to fill in the gap. Like OnStarSM for a car, satellite tags feed data from ocean-migrating sea turtles directly to the computers of Mote researchers, who use the data to track foraging grounds, migration routes, responses to environmental changes, and more.

What if you and your students could access the same data in your classroom? You could conduct parallel studies of your own on live turtles in real time. With access to ocean sensing data, you could compare turtle migration routes to sea surface temperatures, ocean currents, or chlorophyll concentrations. You could evaluate the potential impact of human activities on migration routes and foraging grounds. All the data, tools and resources you need can be found in one place on: seaturtle.org.

HOW TO TAG A SEA TURTLE

FIND IT

Dig up info and look for tracks... turtle tracks. Hopefully, they lead to a turtle.

BOX IT

Build a home to enclose your turtle. Note your location, the conditions, and measure that turtle every which way. Add a flipper tag and an internal PIT tag, if necessary.

SCRUB IT

To prepare the shell, barnacles should be removed and the surface cleaned. Be careful around the head.

TAG IT

Attach the tag with a rubber band spray in several layers. Wash, apply a coat of anti-fouling paint to seal them on. Barnacle growth. The tag is fairly light and hydrodynamic, but you want to do everything you can to prevent the tag from being a burden on the animal.

WAIT...

The space takes about an hour to dry, then comes the pain. There are nights when you won't see a single turtle. Patience and discipline are absolutely required.

SET IT FREE

Finally, it's time to go. Pull up the turtle and set her free. This is a lot like a loggerhead released by a first grade class from Connecticut. When she returns to the ocean, her tag will send a signal to a polar-orbiting satellite every time she surfaces to breathe. Tags last about one year, and can send info on location, size profiles, even water conditions.

ADOPT A TURTLE

Help Mote M... Satellite tags don't track actual direction (just north/south), you'll turtle tagger's own. Adapted options a relative daily update in a solid year's view. For more information, Research Program.

REAL-TIME DATA @ SEATURTLE.ORG

REAL DATA

Track live animals in real time...

- Over 870 animals and 328 data sets available.
- Search by species or research project. Mote's Casey Key Loggerheads study alone placed 18 tags in 2007 (through June 30). These tags will transmit for about one year. Information on 13 additional turtles is available in the archives.
- Project pages feature summary maps with links for all tagged turtles in the study. Individual turtle pages show photo, information, foraging site tracks and notes from researchers. Anyone can sign up for daily project updates via email.
- From the Tracker Pages, get the raw data sets and track turtles the hard way, with detailed regional maps provided in PDF format - CSV - and raw data in the PSE MapTool.
- More than just turtles available! Check out tracking data on leather seals, golden eagles, great white sharks and common loons.

& RESOURCES

...and discover an ocean of information.

- Check out the latest news section on turtle sightings, including maps and data.
- Receive news highlights and subscribe to the newsletter.
- Get your own Seaturtle.org email address or web page. Ask questions in the Sea Turtle Forum.
- Check out researcher podcasts and other audio videos.
- Browse the extensive image library.
- Correspond with researchers and other sea turtle enthusiasts listed in the Member Directory.
- Explore an extensive directory of links in all manner of interrelated sites, including links to scientific and other classroom resources.
- Even more classroom sea turtle resources and materials at MoteScience.org/seaturtle. Click "What's New."

FREE! MAPTOOL

Turtle tracks + data layers = "nest"

The MapTool software is incredibly flexible and is best of all... it's FREE. You just upload a set of latitude/longitude points, or "nest" data from one of the affiliated research projects, and MapTool will:

- Create detailed, multilayered maps of any project.
- Add multiple data sets to track multiple animals.
- Add data layers based on ocean and weather sensing data (e.g., bathymetry, chlorophyll, temperature).
- Output maps in a variety of formats including TIFF and PDF.

MapTool is a free software tool for creating maps. It can be used to create maps of any project. It can be used to create maps of any project. It can be used to create maps of any project.

Jim Wharton | Director, Center for School and Public Programs
Dr. Tony Tucker | Sea Turtle Conservation and Research Program Manager

LEARNING With LOGGERHEADS

Third graders analyze real-time data while contributing to the conservation of an endangered species.

By Christine Lerner and Theodora Pinou

Kids tracking sea turtles? No, it's not a description for a new nature show on TV, it's a lesson, and it could be happening in your classroom! Sea turtle biologists worldwide are currently working together to track turtles to learn about sea turtle behavior and migration in an effort to conserve these endangered animals. We developed a unit using a modified version of published tracking activities (Sera and Eckert 2005) for third-grade students in which students develop and share computer-generated maps that are based on authentic data. With this information, students can evaluate sea turtle life history, behavior, and environmental hazards, just as scientists are doing today. Now, with only an internet connection, your students can engage in the global mission of sea turtle conservation while at the same time learn about the importance of technology in conservation and understanding of biodiversity.

Satellite Telemetry
Humans are able to track sea turtles across the world's oceans and follow their extensive migrations in real time through satellite transmission technology or telemetry. How does telemetry work? A biologist attaches a transmitter to the carapace (shell) of a sea turtle, usually at a nesting beach. When the turtle surfaces to breathe, the transmitter's antenna sends signals to satellite receivers that pinpoint the turtle's location and migratory pattern. A sea turtle can surface as often as every 10 minutes, sending multiple data points to satellite processing centers. Scientists translate these signals into points of latitude and longitude, which

help them monitor and map sea turtle movements. Scientists then post these data onto a collaborative sea turtle monitoring site, www.seaturtle.org, so they can communicate with colleagues globally about sea turtle movements throughout the world's oceans.

This sea turtle site is also accessible to educators on any basic internet server to teach students about sea turtle migration and mapping. In preparation for the activity, it's best if teachers reserve a computer lab ahead of time. In cases where computers are limited, teachers can group as many as three children to work cooperatively or rotate children between computer stations and manual mapping of the tracking points. Teachers are strongly recommended to prepare for this exercise by accessing the tracking data beforehand and modifying the points of latitude and longitude

If you would like to help develop the satellite tracking teaching resources please contact tracking@seaturtle.org.

The SEATURTLE.ORG Satellite Tracking Program provides a unique opportunity to engage students in a fun and exciting way. Satellite tracking can be used to develop lesson plans covering a number of subject areas, including biology, math, geography and even politics. Below is a list of suggested exercises divided by subject area. New exercises will be added to the list as they are developed.

Tracking Maps

Print and reproduce these maps for tracking and geography exercises.

- [Aleutian Islands](#) (109 K PDF)
- [Brazil](#) (91 K PDF)
- [Caribbean](#) (82 K PDF)
- [Eastern Tropical Pacific](#) (224 K PDF)
- [Equatorial Atlantic](#) (142 K PDF)
- [Gulf of Mexico](#) (132 K PDF)
- [Indian Ocean](#) (152 K PDF)
- [Mediterranean](#) (229 K PDF)
- [Northern Australia](#) (124 K PDF)
- [Pribilof Islands](#) (119 K PDF)
- [South Australia](#) (254 K PDF)
 - [Gulf Saint Vincent](#) (265 K PDF)
- [South Atlantic](#) (276 K PDF)
- [US Atlantic](#) (146 K PDF)
- [West Africa](#) (77 K PDF)
- [Western US](#) (93 K PDF)

Tracking Data

Access Data

Educator Created Products



Learning With Loggerheads (280 KB PDF)
Science and Children, September 2007



Sea Turtle Coloring Book (1.44 MB PDF)
Provided by the Ocean Conservancy in English and Spanish



Turtle Tracks (372 KB PDF)
Using real-time satellite telemetry data in the classroom

by rounding off to the nearest whole number. It is our experience that if the data are not rounded it becomes confusing for the children to find the specific decimal points to plot.

Preparing to Track

On the first day of the unit, we begin by asking the class about migration: What animals do you know that migrate? Why? Responses are written on the board and typically include whales, birds, and butterflies. Children often explain that migration occurs because animals (e.g., whales) are following their food or are migrating in response to the changing of the seasons (e.g., birds). It is during this first day that students are introduced to sea turtles (*Caretta caretta*) and the idea that sea turtles also migrate due to seasonal changes that affect water temperatures and food supply. In

addition, sea turtles migrate to find a mate and to find appropriate beaches to build nests and lay eggs.

Background information on sea turtle life history, migration, and threats to sea turtle survival can be read together in class and discussed as a whole-group activity. Alternatively, the teacher may choose to send home reading materials for students to read as homework prior to the lesson. Such information can be found in the Sea Turtle Migration: Tracking and Coastal Habitat Education Program educator's guides (see Internet Resources). These readings introduce students to sea turtle tracking patterns. For example, tracking points recorded from land indicate nesting (laying eggs); tracking points recorded offshore of the nesting beach indicate increasing (a female can return to nest multiple times in one season, revealing a zig-zag pattern); and the foraging grounds where turtles feed are char-



Adoption Program

More than 2,800 adoptions to date



Does it work?

Compelling Tools

- Save time
- Save money
- User-friendly
- Power tools
- Collaboration
- Education & Outreach
- Fund raising

Low barrier to Entry

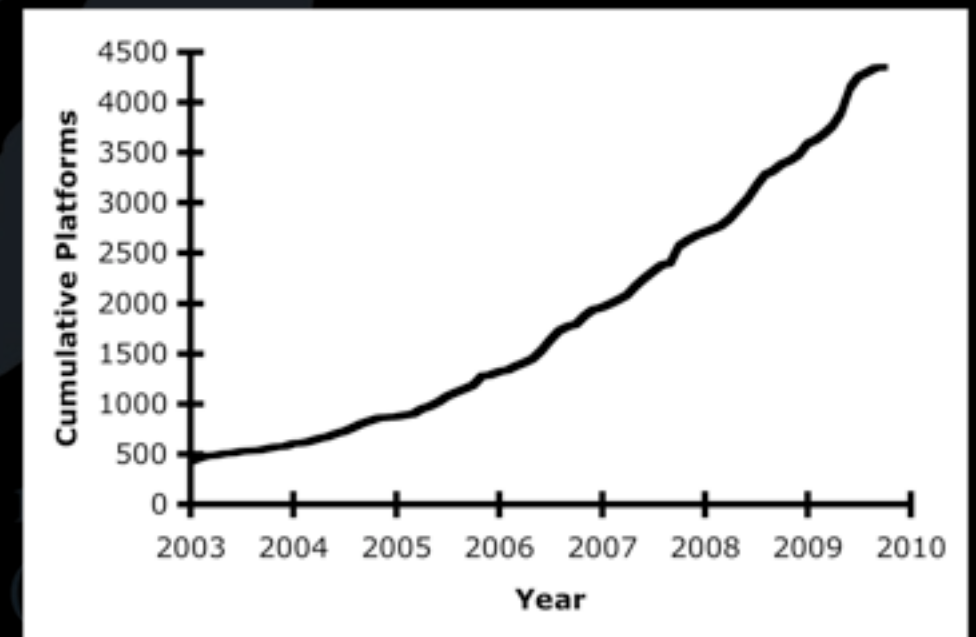
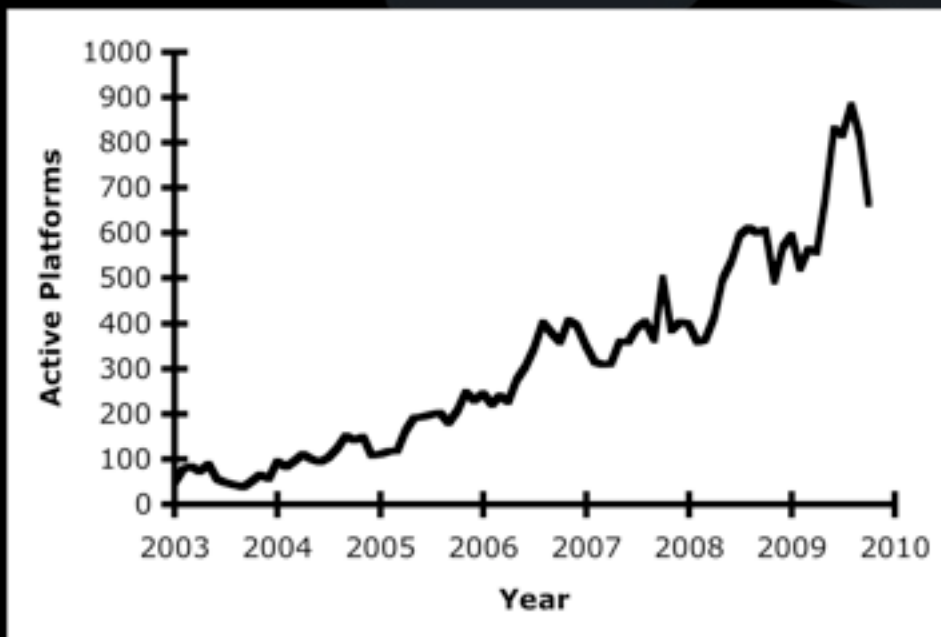
- No special software or hardware requirements
- Platform independent
- Open access
- Autonomous
- FREE

Measures of Success

>200 Argos programs
270 tracking projects
>5,100 animal tracks
>1,650 public tracks
>2.4 million locations
270,000 web hits per month
47 peer-reviewed publications
100s of press articles

Sea Turtles (1883)

Black Turtle
Flatback Turtle
Green Turtle
Hawksbill
Kemp's Ridley
Leatherback
Loggerhead
Olive ridley



Measures of Success

Birds (1467 - 65 species)



Adelie Penguin
Bald Eagle
Bar-Headed Goose
Barnacle Goose
Barrow's Goldeneye
Bearded Vulture
Black Scoter
Black-bellied Whistling Duck
Black-casqued Hornbill
Black-footed Albatross
Bonelli's Eagle
Common Eider
Common Loon
Common Murre
Cory's Shearwater
Crowned Solitary Eagle
Egyptian Vulture
Eleonora's Falcon
Eurasian Wigeon
European Wigeon
Fulvous Whistling Duck
Gadwall
Galapagos Petrel
Garganey
Golden Eagle
Great Bustard

Great Cormorant
Greater Shearwater
Great-Winged Petrel
Harpy Eagle
Hawaiian Petrel, Dark-rumped
Petrel
Herring Gull
Ivory Gull
King Penguin
Lesser Black-backed Gull
Lesser Flamingo
Little Penguin
Long-Tailed Duck
Magellanic Penguin
Mallard
Marbled Godwit
Montagu's Harrier
Northern Gannet
Pale-Footed Shearwater
Peregrine Falcon
Pink-Footed Shearwater
Razorbill
Red Kite
Red-crested Pochard
Rockhopper Penguin
Rosy-billed Pochard
Short-eared Owl



Marine Mammals (301 - 12 species)

Atlantic Gray Seal
Australian Sea Lion
Bottlenose Dolphin
Common Porpoise
Dugong
Harbor Seal
Harp Seal
Northern Fur Seal
Steller Sea Lion

Sharks (52 - 4 species)

Blue Shark
Shortfin Mako
Whale Shark
White Shark



Photo: Albatross
(David Hyrenbach)



Wildlife Tracking

no mountain too high
no ocean too vast

A service of seaturtle.org

WildlifeTracking.org

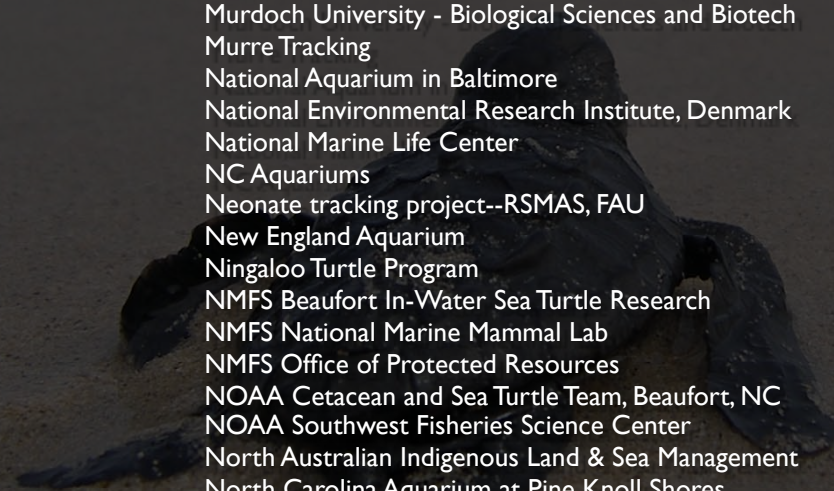
*Photo: Australian Sea Lion
(Aaron Machado, Project Dophlin Safe)*

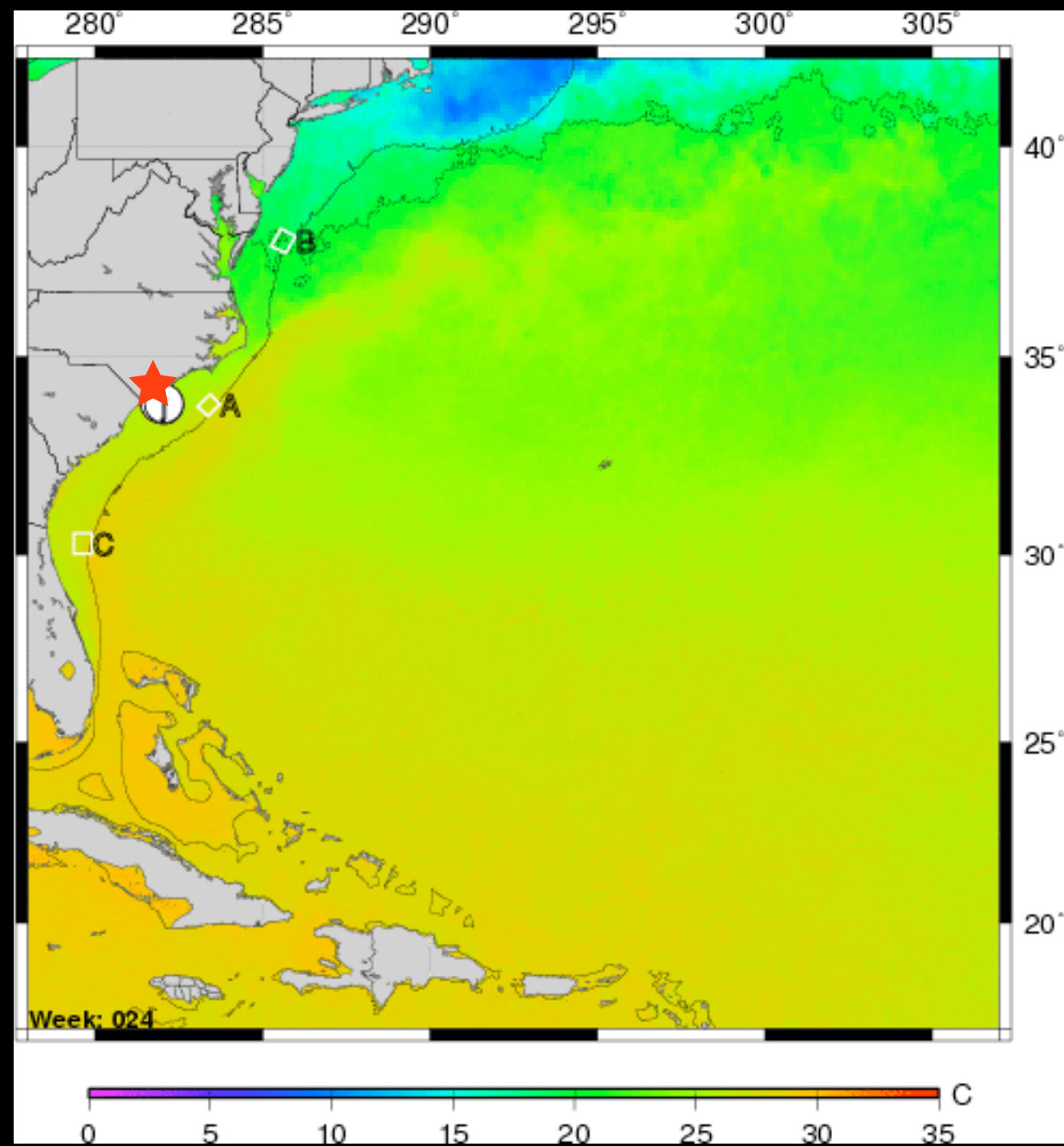
Acuario de Veracruz
Adelie Penguins
AFSC-NMML-AEG
Albatross Conservation Collaborative
Albatross South Georgia
American Museum of Natural History
American Samoa
Aquarium La Rochelle
Aquarium of the Pacific
ARCHELON
Asso Chene
Atlantic Seaduck Project
Bangladesh Sea Turtle Satellite Tracking Project
Bear River Migratory Bird Refuge
Biomarine International
Birds of Prey Northwest
BONAIRE TURTLE TRACKING PROGRAM
Bowen Turtle Collaboration
Caribbean Conservation Corporation
Caribbean Hawksbills - Mexico
Center for Conservation Biology
Centre for Animal Movement Research at Lund Univ
Centre for Ecology & Hydrology
Charles Darwin University
Chisholm Institute
Confederated Salish & Kootenai Tribes' Wildlife Program
Keewaydin Island Turtle Tracking Project
Conservation Biology, University of Berne, Switzerland
Crab Island Flatback Sea Turtle Research Project
CVA Eco Beach, WA- Flatback Monitoring Program
DFO Strait of Georgia Ecosystem Research Initiative
Dirección Nacional de Recursos Acuáticos
Dubai Turtle Rehabilitation / Release Project
Duke University Marine Laboratory
Dutch Caribbean Nature Alliance
Dutch Montagu's Harrier Foundation
Earthwatch Institute
Egyptian Vulture Feeding Resources
Environment Canada - Atlantic and Québec Regions
Environment Society of Oman
Oman Ministry of Regional Municipalities
Estacion Biologica Terra Natura
Fisheries Bycatch Research Group
Flatback turtles: Cape Domett, Western Australia
Florida Cooperative Fish & Wildlife Research Unit
French National Centre for Scientific Research
Fur seal, pelagic shark and seabird tracking
Gabon Olive Ridley Program
Galapagos Petrel 2009
Georgia Department of Natural Resources
Georgia Sea Turtle Center
GHD, Xstrata and DERM nesting flatback monitoring
Grand Manan Whale and Seabird Research Station
Great Bustards in Aragon (NE Spain)
Grey Faced Petrel Programme
Groupe de Recherche en Ecologie Arctique
Grupo de trabajo para la tortuga carey (Mexico)
Grupo Tortuguero
Grupo Tortuguero Tracking Project
Gumbo Limbo Nature Center Sea Turtle Research

Partners

Hong Kong SAR
International Wildlife Consultants (UK) Ltd
Islameta Group, Dept. of Biology - University of Pisa
James Cook University
Juvenile northern royal albatross
Karen Beasley Sea Turtle Rescue and Rehab Center
Karumbe
Kelly Tarltons Marine Turtle Rehabilitation Project
Large Pelagics Research Center, UNH
Louisiana Marine Mammal & Sea Turtle Rescue Program
LSU Gadwalls
Maret Island Marine Turtle Study
Marine Research Foundation - Marine Turtle Programme
Marine Turtle Conservation and Monitoring, Palau
Marine Turtle Research Group
Marion Island Wanderers & Winds
Max-Planck Institute for Ornithology
MCS-Seychelles
Mediterranean Association to Save the Sea Turtles
Migration and foraging ecology of Greater Shearwater
Monterey Bay Aquarium
Mote Center for Shark Research
Mote Marine Laboratory
Movements of Sea Turtles Released from Gillnets
Murdoch University - Biological Sciences and Biotech
Murre Tracking
National Aquarium in Baltimore
National Environmental Research Institute, Denmark
National Marine Life Center
NC Aquariums
Neonate tracking project--RSMAS, FAU
New England Aquarium
Ningaloo Turtle Program
NMFS Beaufort In-Water Sea Turtle Research
NMFS National Marine Mammal Lab
NMFS Office of Protected Resources
NOAA Cetacean and Sea Turtle Team, Beaufort, NC
NOAA Southwest Fisheries Science Center
North Australian Indigenous Land & Sea Management
North Carolina Aquarium at Pine Knoll Shores
Northern Gannets
Northern Territory Turtle Tracking, Australia
NT Crocodile Tracking
Observatorio Ambiental Granadilla
Ocean Research Institute (Hatase)
Pacific Procellariid Research Consortium
Padre Island National Seashore Kemp's Ridley Tracking
Pechora Barnacle Goose Project 2004/5
Pink-footed Shearwater Tracking
PRETOMA and Turtle Island Restoration Network
Programa para Protección de Tortugas Marinas
Projeto Tamar-Ibama
Proyecto Aegina

Pyrenean Bearded Vultures
Sea Turtle Research and Conservation of Argentina
Riverhead Foundation
Sarasota Dolphin
SCDNR Marine Turtle Conservation Program
Scott Reef Green Turtle Monitoring Programme
Sea Turtle Foundation: The Australian Geographic Turtle Race
Sea Turtles Conservation Program UJTL-Caribbean Colombian
SEATURTLE.ORG Animal Tracking Program
Seychelles Hawksbill Tracking
Singapore Sea Turtle Satellite Tracking Project
Smithsonian Tropical Research Institute
Snow Goose Project
South Carolina Aquarium Sea Turtle Rescue Program
South Carolina Marine Resources Research Institute
South Coast Purse Seine Managed Fishery By-catch Mitigation
Stazione Zoologica Anton Dohrn
Suivi 2007 CESTMED
TALCIN (Hays, FG, Suriname)
TALCIN Eckert
TAMUG Sea Turtle and Fisheries Ecology Research Lab
TAMUG Seals
Terengganu Turtle Conservation
Texas A&M University at Galveston
Tracking of penguins at sea
Tree Foundation
Turtle Group at Swansea University
Udayana University - WWF Joint Program
UFL Wading Bird Research Group
Undersea Explorer green turtle tracking project
Universidad del Mar
Universidade Federal Rural de Pernambuco
University of Bangor
University of British Columbia-Marine Mammal Research Unit
University of Hawaii at Hilo
University of Queensland
UPR Mona Island Hawksbill Turtle Tracking Program
USAKA Turtle Release Program
USGS Greater Everglades Sea Turtles
USGS Patuxent - Long-tailed Duck
VIMS Sea Turtle Research Program
Virginia Aquarium Stranding Response Program
WCS - Ocean Giants Program
Western Australian Sea Turtle Satellite Tracking Project
Western Washington University
Wheatstone Turtle Studies
Wildlife Institute of India
Wood Stork Tracking Program
Woodside Browse Turtle Studies
WWF
WWF Australia
WWF Emirates
WWF Indonesia Sea Turtle Satellite Tracking Project
WWF Italy's Sea Turtle Network
WWF-Gabon
WWF-Malaysia
WWF/KWS Kenya Integrated Sea Turtle Conservation Program
Zoomarine - Mundo Acuático SA





Lucy A. Hawkes¹, Annette C. Broderick¹, Michael S. Matthew H. Godfrey³ and Brendan J. Godley^{1*}

*Correspondence: Brendan J. Godley, Marine Turtle Research Group, Centre for Ecology and Conservation, School of Biosciences, University of Exeter, Cornwall Campus, Penryn, TR10 9EZ UK. E-mail: b.j.godley@exeter.ac.uk

Although the Atlantic waters of North America support loggerhead sea turtles (*Caretta caretta*), remarkably little is known about their migratory ecology and habitat use. We integrate satellite telemetry data to uncover two different migratory patterns of loggerhead turtles at the northern part of their range. Most turtles nested on a beach to forage at higher latitudes in summer and moved south to wintering grounds in the autumn. Others moved south to forage at lower latitudes in summer and moved north to wintering grounds in the autumn. Both groups of turtles made long resting dives of up to 7 h 24 min, effectively reducing their energy costs that would be incurred within the fast-flowing Gulf Stream during winter. Offshore federal waters of the USA constitute potential hotspots for interaction with fisheries and should receive special monitoring efforts.

Loggerhead turtle, *Caretta caretta*, environment, North
niche model.

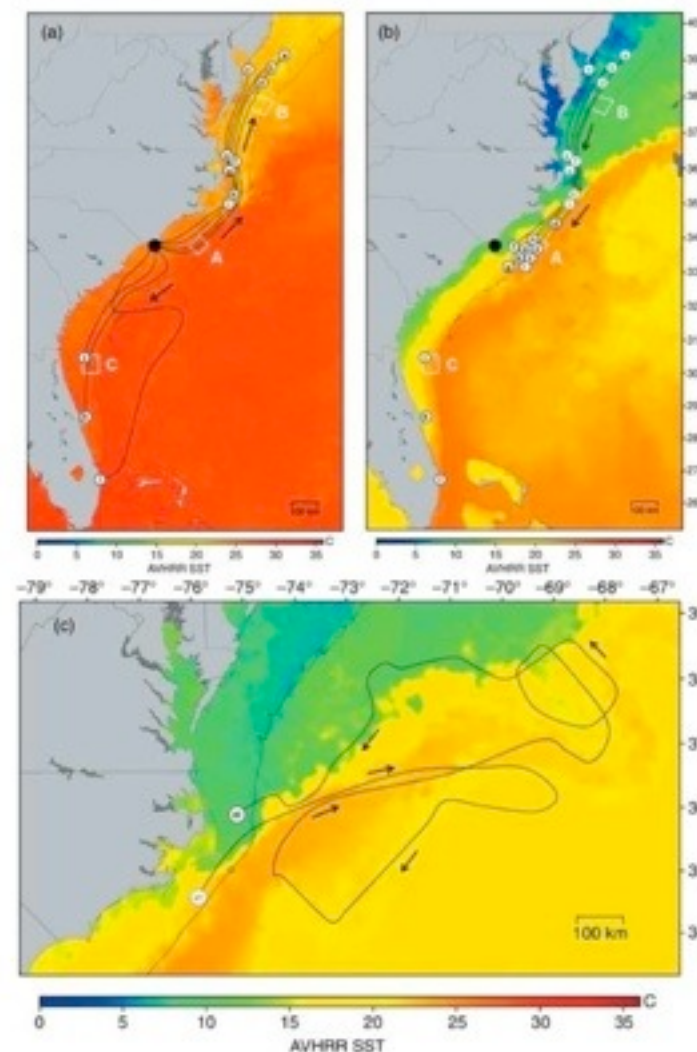
Distribution of the loggerhead sea turtle (*Caretta caretta*) is the most temperate of the hard-shelled marine turtles. The species

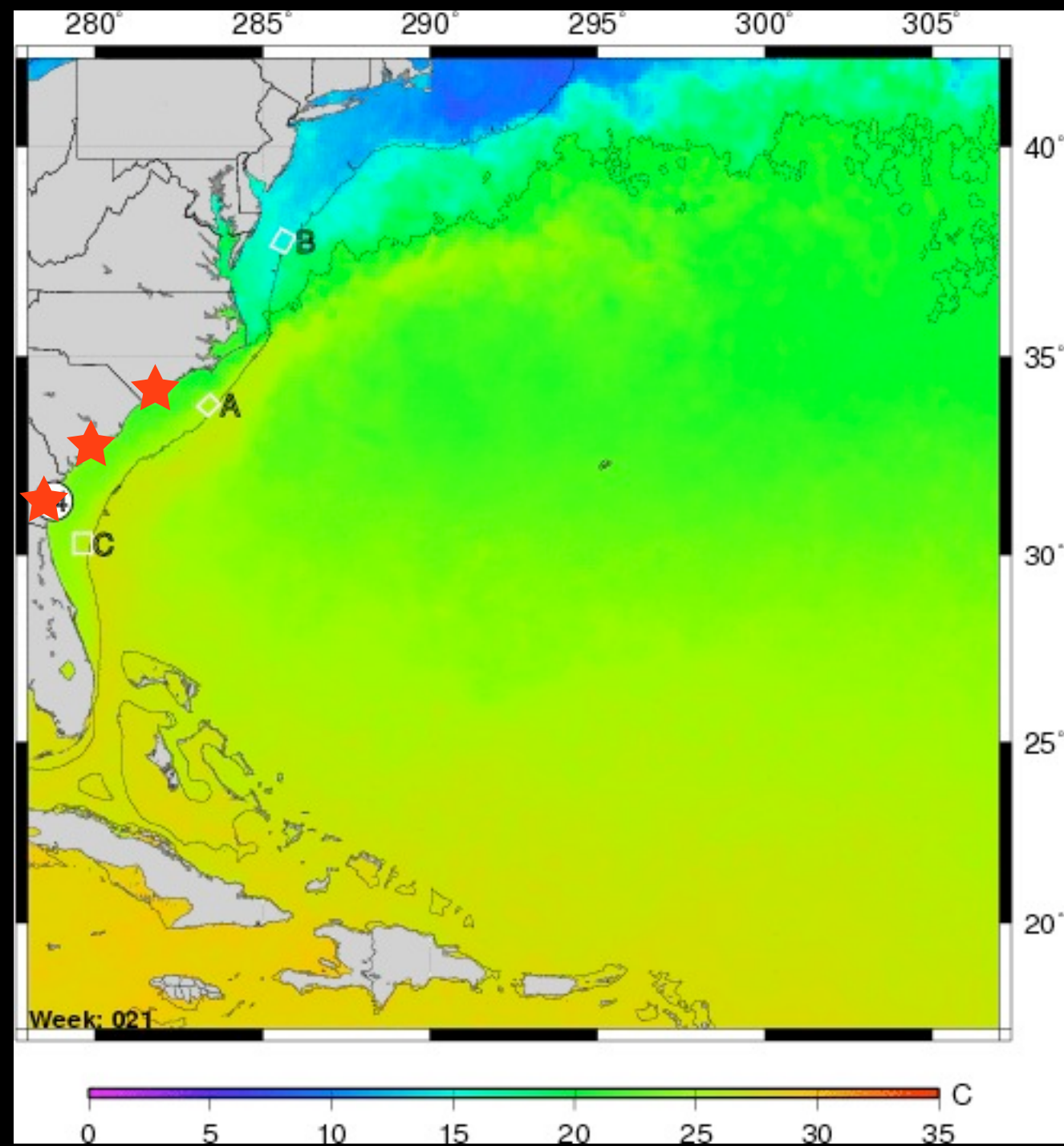
DOI: 10.1111/j.1472-4642.2007.00
www.blackwellpublishing.com/ddi

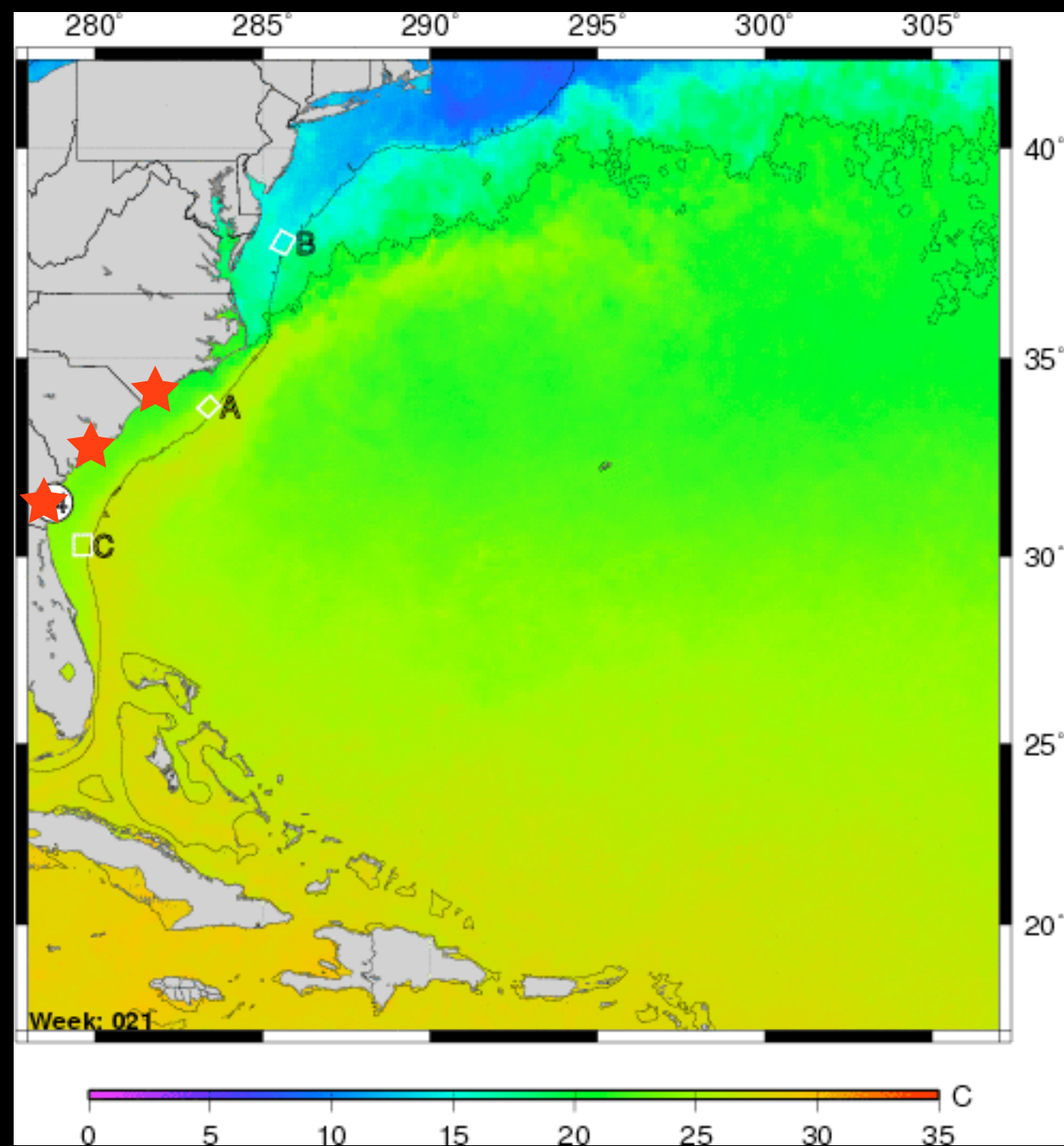
(a) Reconstructed route (black line) to foraging areas (labelled circles) for individuals a to l from release location (filled circle). Coloured background shading shows mean sea surface temperature (SST) for September 2004, and the 250-m isobath is delineated. (b) Reconstructed route (black line) from foraging areas (grey labelled circles) to wintering areas (black labelled circles) for individuals a to g (type 1). Individuals j, k, and l (type 2) are shown but did not make an autumnal migration. Coloured background shading shows mean SST from January 2004, and the 250-m isobath is delineated. (c) Pelagic excursion of turtle d between 15 March and 8 June 2005; coloured background shading shows mean SST for April 2005. For (a) and (b) polygons indicate three proposed sites for US Navy undersea warfare training ranges off (a) south-eastern North Carolina, (b) north-eastern Virginia, and (c) north-eastern Florida (Navy, 2005).

Although turtles undertaking the type 2 pattern of movement (Fig. 1a,b) did not make migrations to wintering areas, there were some similarities with conditions experienced by both groups. Specifically, type 2 turtles occupied the edge of the southerly portion of the Gulf Stream, on the coastal shelf (Fig. 1b). In winter, type 2 turtles experienced mean monthly SST to a minimum of 17 °C, while closer inshore, temperatures

Two turtles (a and f) exhibiting type 1 pattern were deployed with dive recording telemetry devices. Behaviour at summer foraging and wintering areas contrasted markedly (Fig. 4). At summer foraging areas, mean $\pm$ SD dive duration for turtle a was 19 ± 10 min (maximum duration: 47 min, Fig. 4a) and 35 ± 20 min for turtle f (maximum duration: 51 min, Fig. 4b) in a series of short dives. At wintering areas, dive duration was







Thank You!

