Sea Turtle Conservation & Sea Grant Fellowship

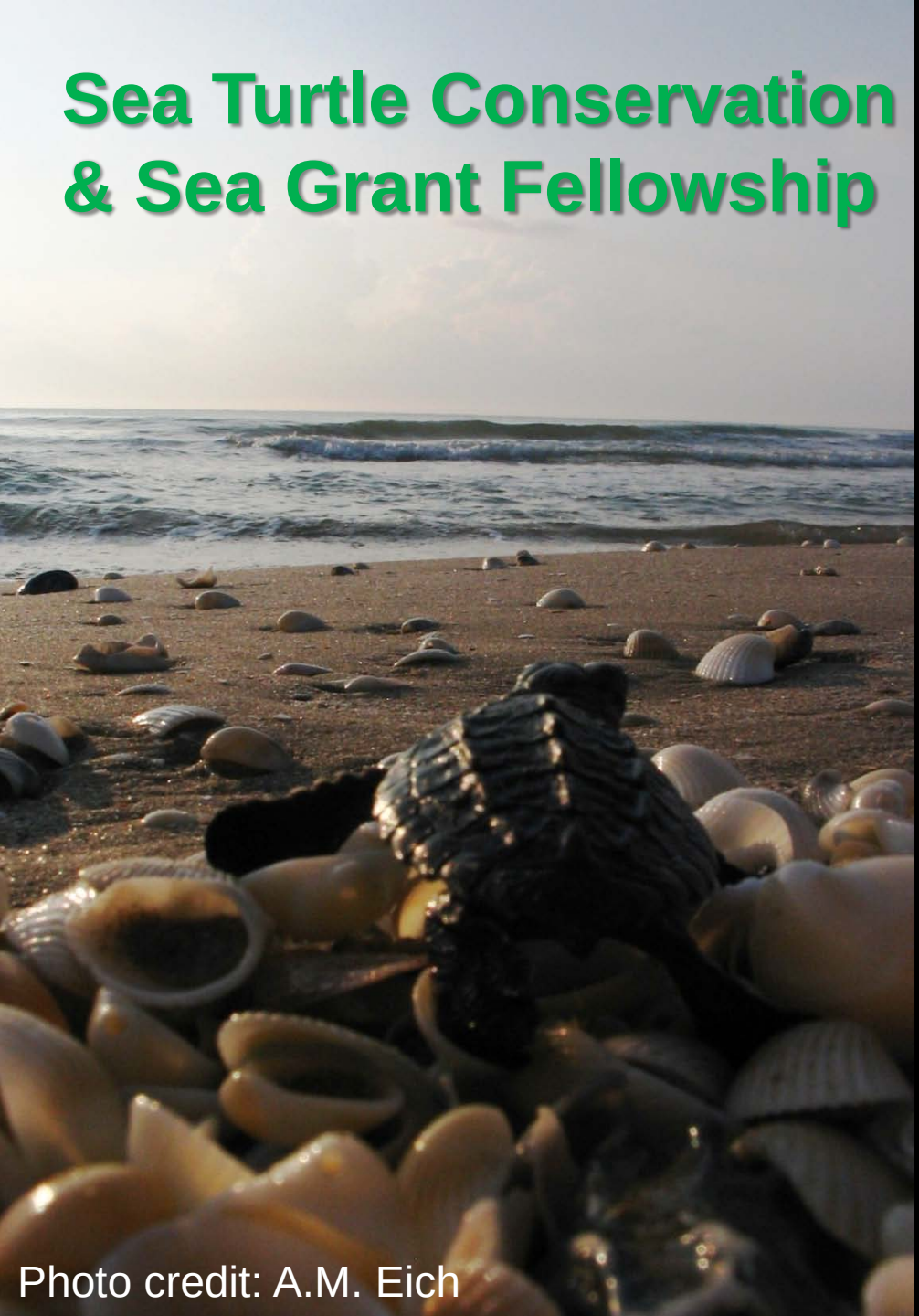

Photo credit: A.M. Eich

Anne Marie Eich, PhD

- 2010 Sea Grant Knauss Fellow
U.S. Fish and Wildlife Service
Branch of Aquatic Invasive Species

Outline

- Loggerheads on Blackbeard NWR
- Kemp's ridleys in Rancho Nuevo, MX
- Sea Grant Fellowship
  - U.S. FWS, Branch of Aquatic Invasive Species
- Detail FWS Southeast Regional Office
  - Fisheries and Ecological Services

Photo credit: A.M. Eich

Interesting Reproductive Biology

- **Long-distance migrations**
- **High fecundity**
  - **Compensates for high mortality during prolonged maturation period, 12-50 yrs**
- **Temperature-dependent sex determination (TSD)**

Photo credit: A.M. Eich

Examples of reptiles with TSD


Most turtles


Tuatara


Few lizards


All crocodilians

TSD Occurs in All Four Living Orders of Reptiles

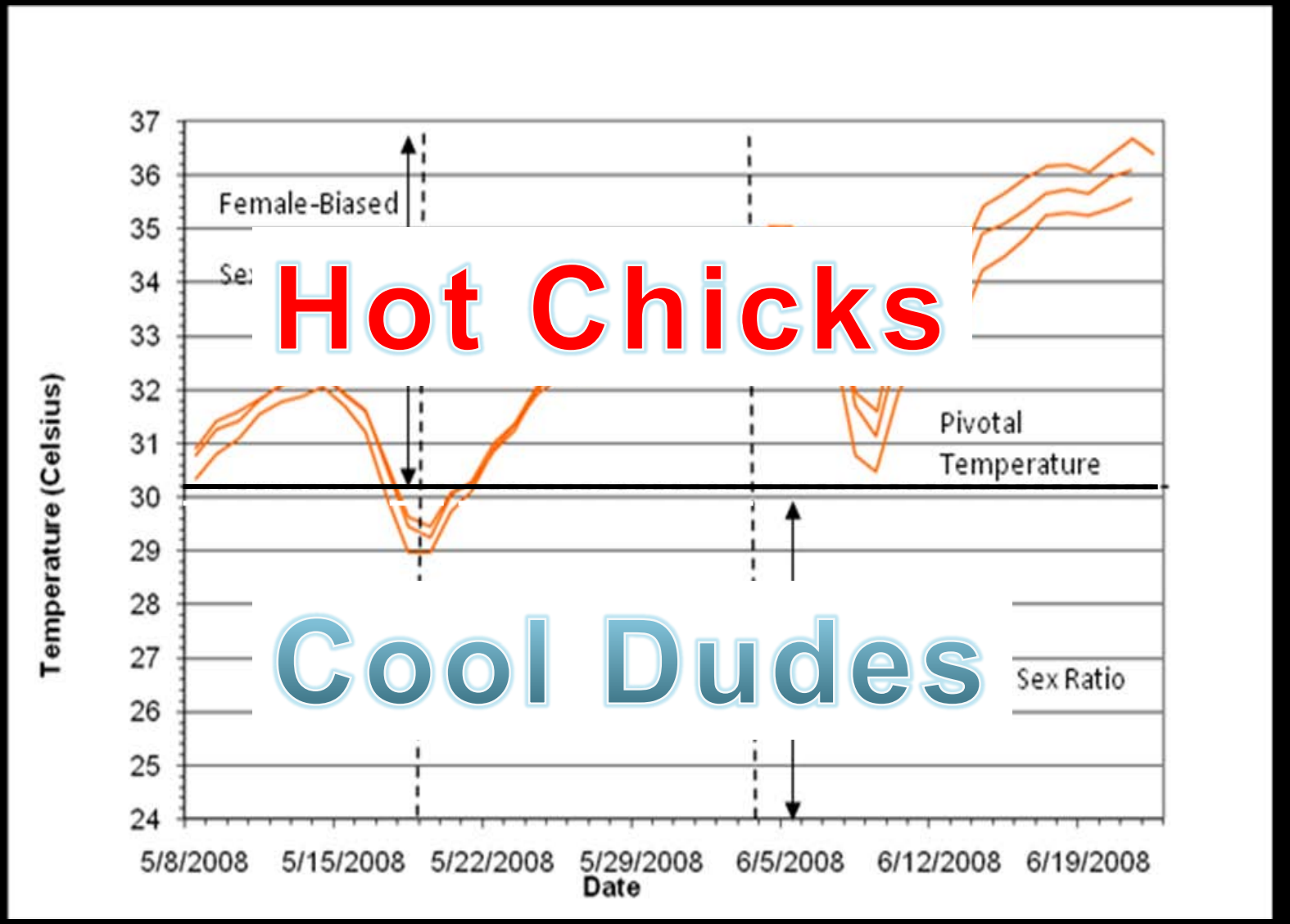
Hot Chicks
Cool Dudes
Female-Biased
Pivotal
Temperature
Sex Ratio
Temperature (Celsius)
37
36
35
34
33
32
31
30
29
28
27
26
25
24
5/8/2008
5/15/2008
5/22/2008
5/29/2008
6/5/2008
6/12/2008
6/19/2008
Date

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Photo credit: A.M. Eich

Temperature-dependent Sex Determination on Two Georgia Barrier Islands

Advisor: David C. Rostal

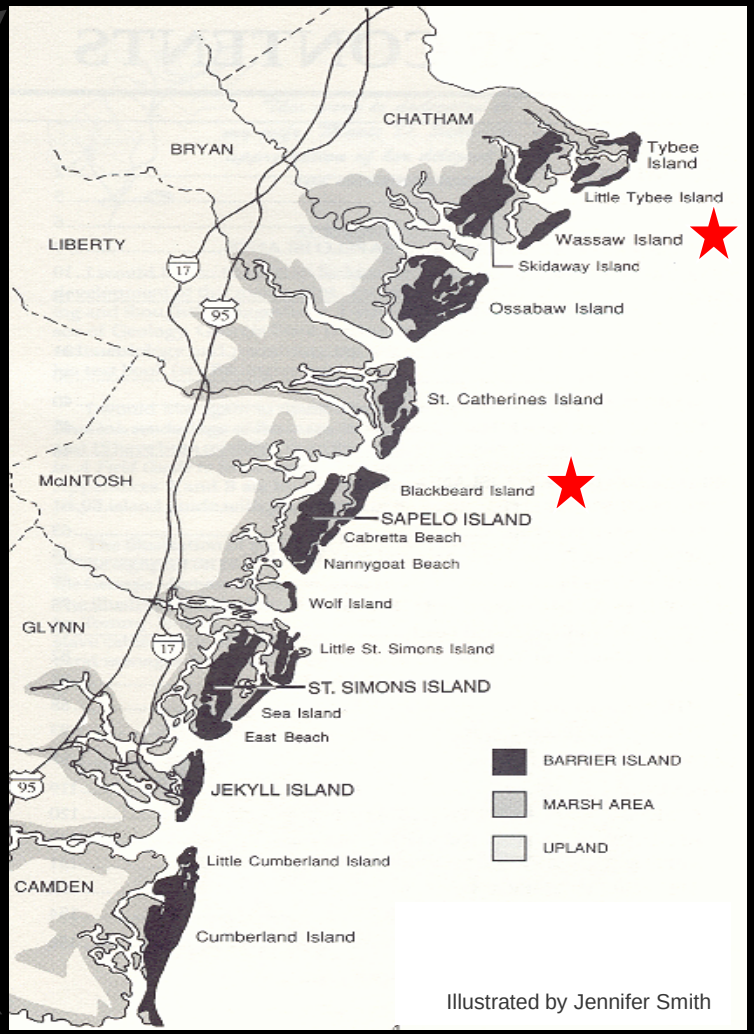
Georgia Southern University

Photo credits: A.M. Eich

Loggerhead Sea Turtles

- **Sexual maturity at 30-35 years**
- **Nesting season in United States May to August**
  - **Nesting occurs mostly at night**
  - **~120 eggs/clutch**
  - **~4-5 clutches/season at intervals of 11-14 days**
  - **Nesting usually occurs every 2-3 seasons**

Study Sites



- Blackbeard Island National Wildlife Refuge
- Wassaw National Wildlife Refuge

Site Photographs

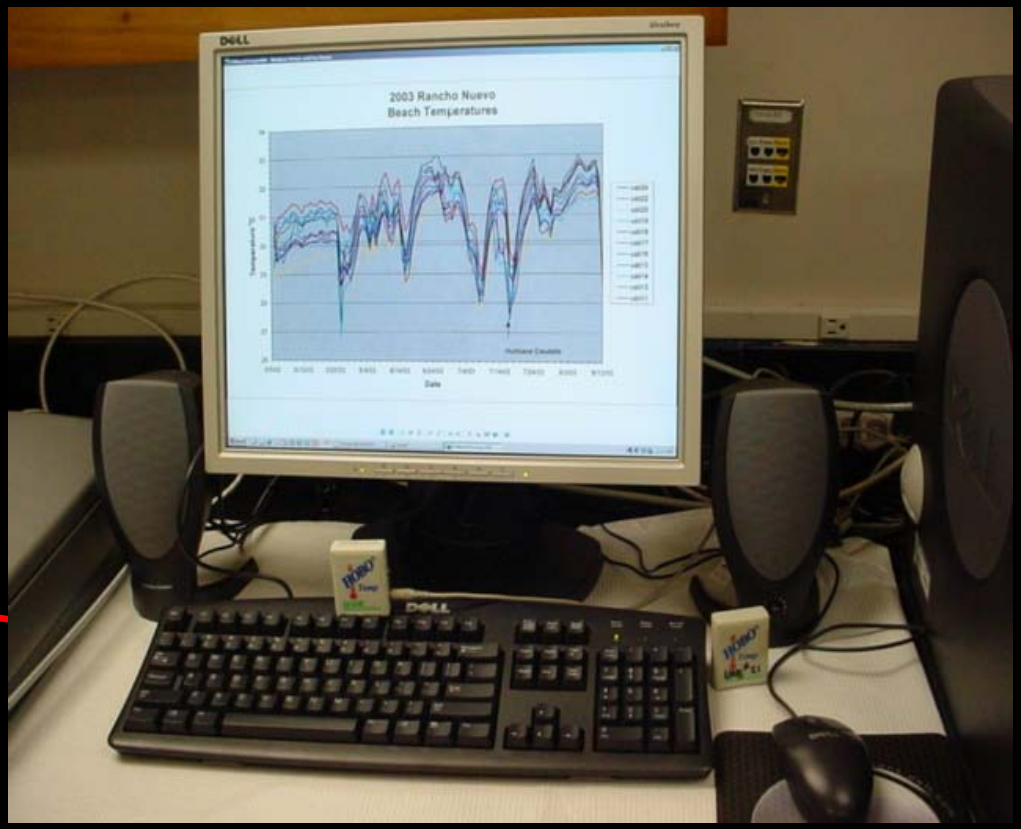
Photo credits: A.M. Eich

Photo credit: A.M. Eich

Photo credit: A.M. Eich

Data Loggers

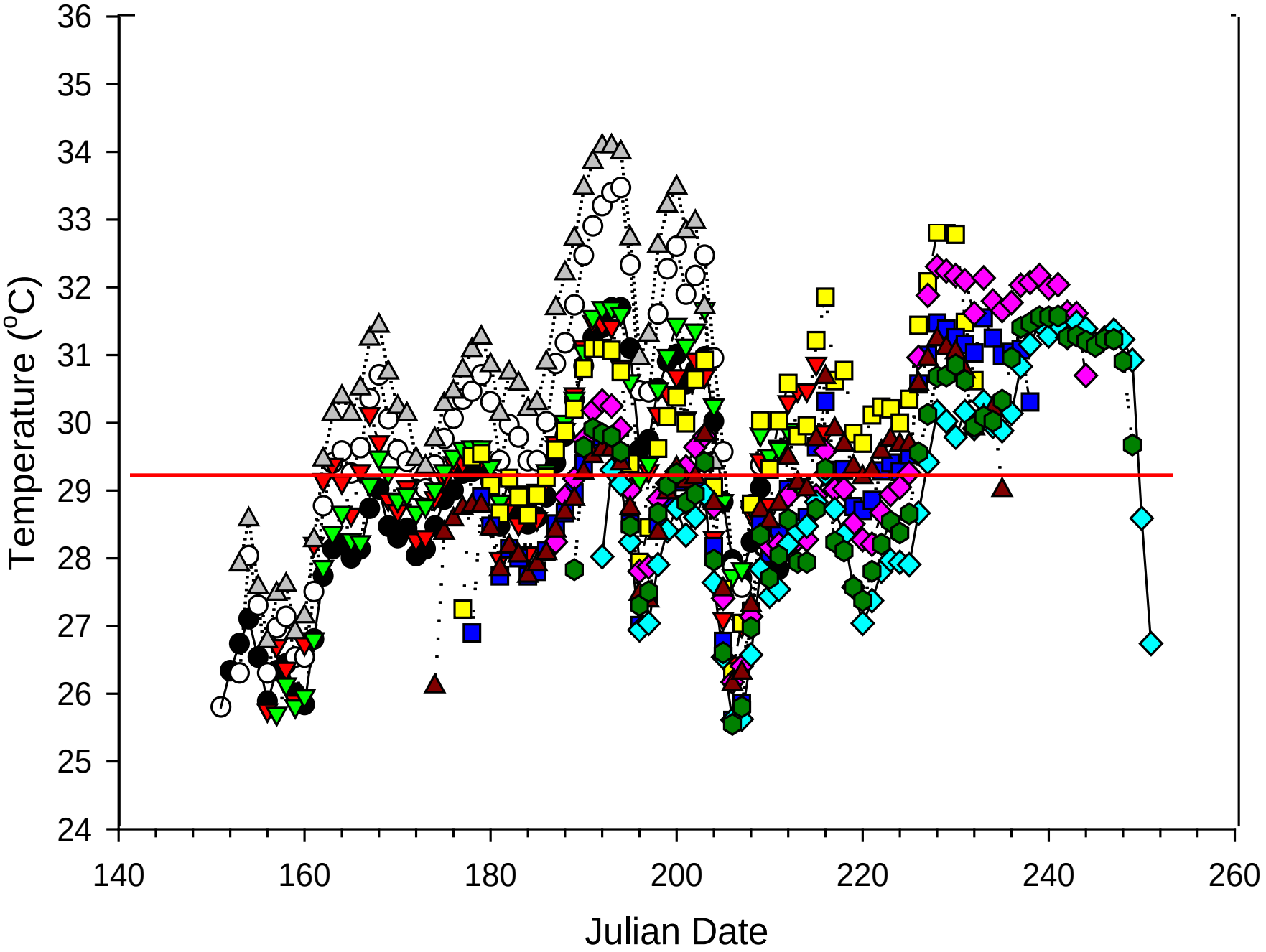
Data loggers are placed in the approximate center of the egg mass

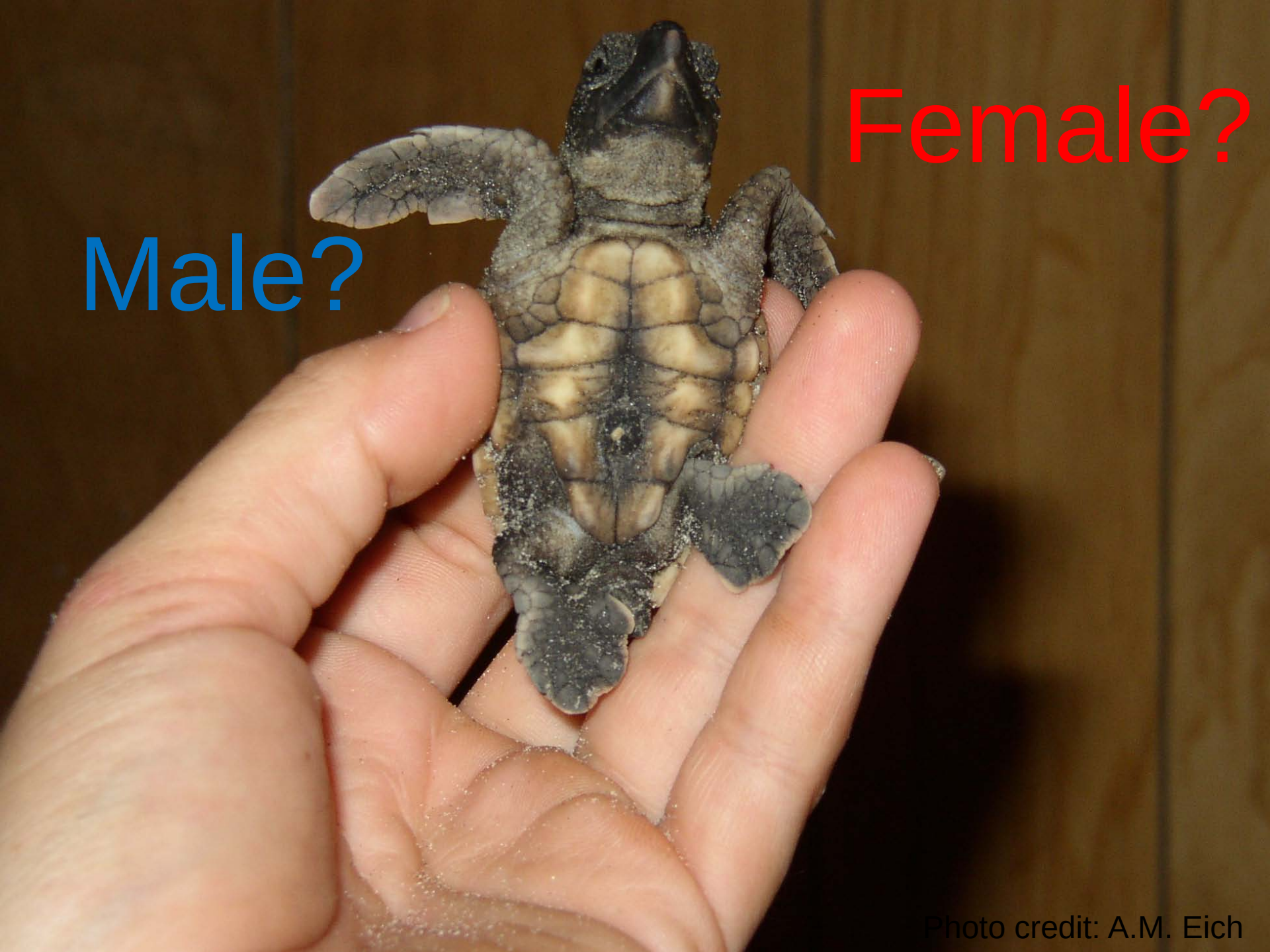


Temperature data is downloaded and analyzed

Photo credit: T. Wibbels

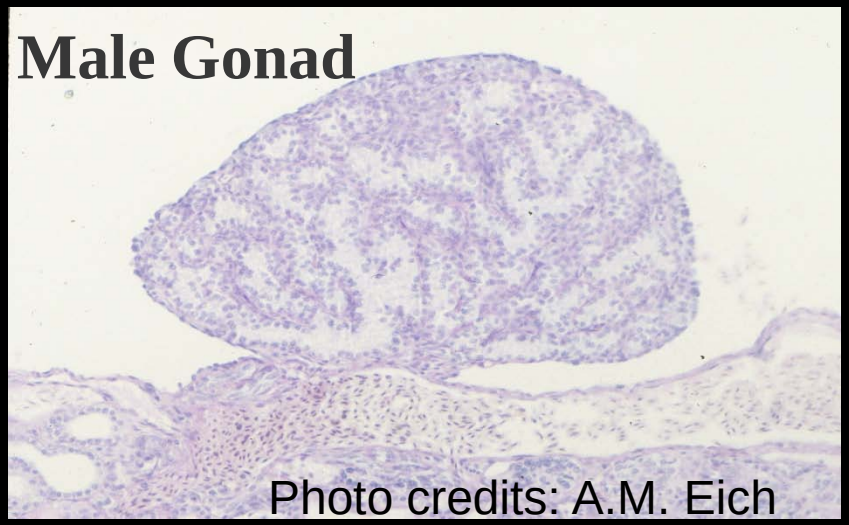
Photo credit: A.M. Eich

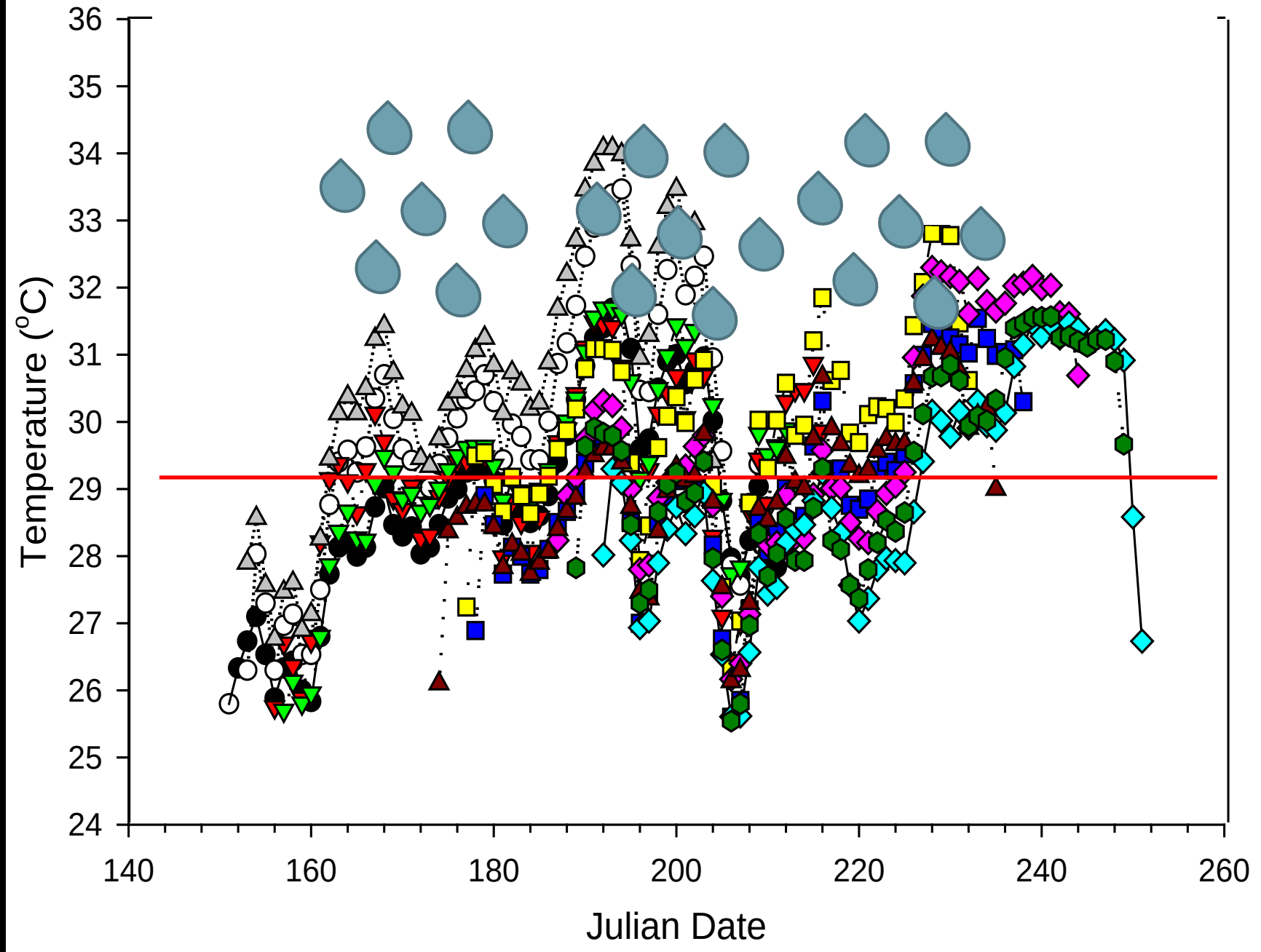

Temperature (°C)
36
35
34
33
32
31
30
29
28
27
26
25
24
140
160
180
200
220
240
260
Julian Date


Male?
Female?
Photo credit: A.M. Eich

Histology of Loggerhead Hatchling Gonads

- Compared to temperature predicted sex ratios




36
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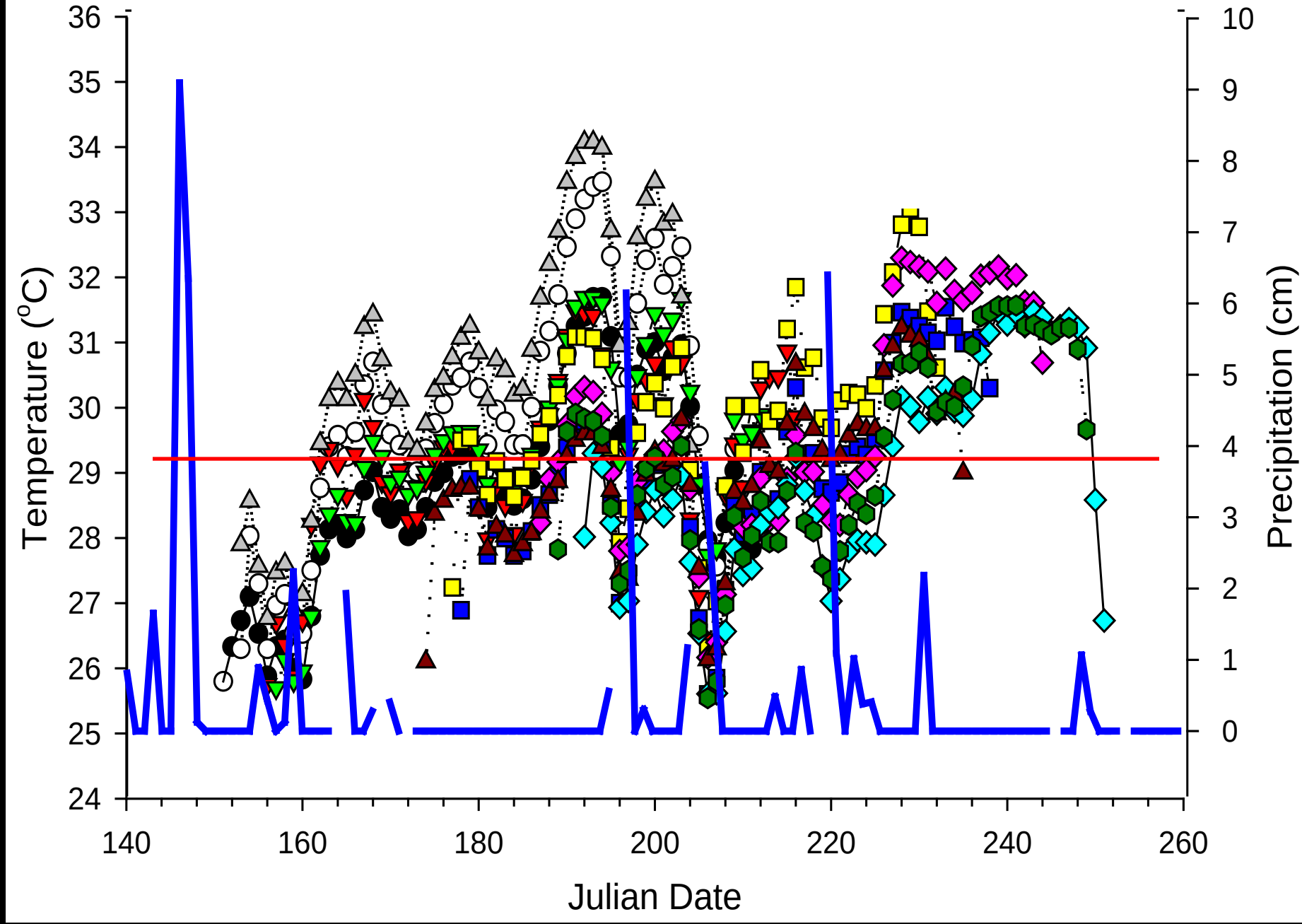
25
24
Temperature (°C)
140
160
180
200
220
240
260
Julian Date


Temperature (°C)
Precipitation (cm)
Julian Date
36
35
34
33
32
31
30
29
28
27
26
25
24
10
9
8
7
6
5
4
3
2
1
0
140
160
180
200
220
240
260

Georgia Beaches 2000-2004

- Significantly Female-biased
- Management Implications

Photo credit: A.M. Eich

Photo credit: A.M. Eich

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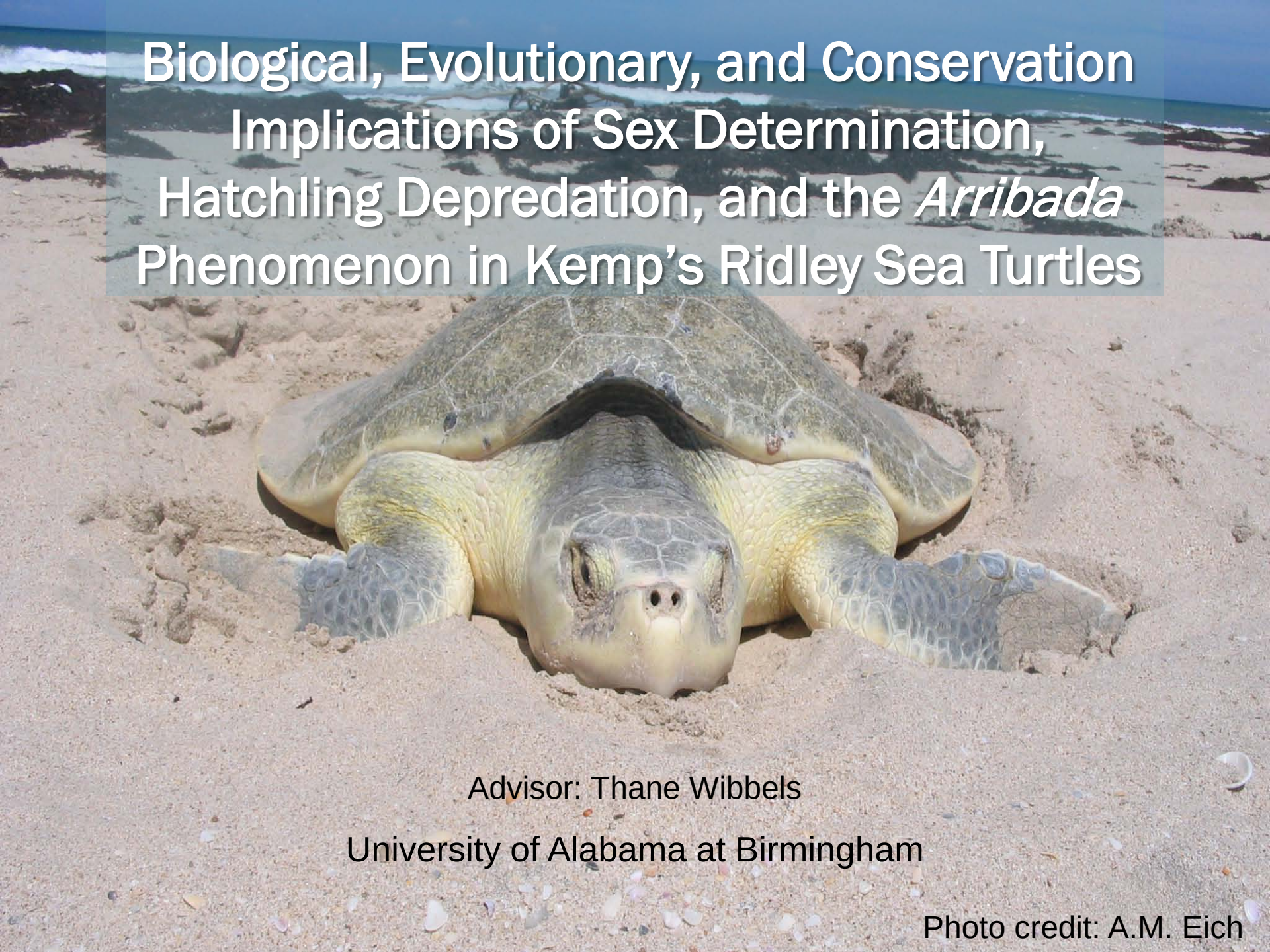
Photo credit: A.M. Eich

Biological, Evolutionary, and Conservation Implications of Sex Determination, Hatchling Depredation, and the *Arribada* Phenomenon in Kemp's Ridley Sea Turtles



Advisor: Thane Wibbels

University of Alabama at Birmingham

Photo credit: A.M. Eich

Objectives

I. **Evaluate sex ratios produced in Kemp's Ridley Recovery Program**

II. **Evaluate predation on natural nesting beach**

Photo credit: A.M. Eich

Photo credit: A.M. Eich

Conservation Interest

- Limited distribution
- One primary nesting beach

Study Site: Rancho Nuevo, Mexico

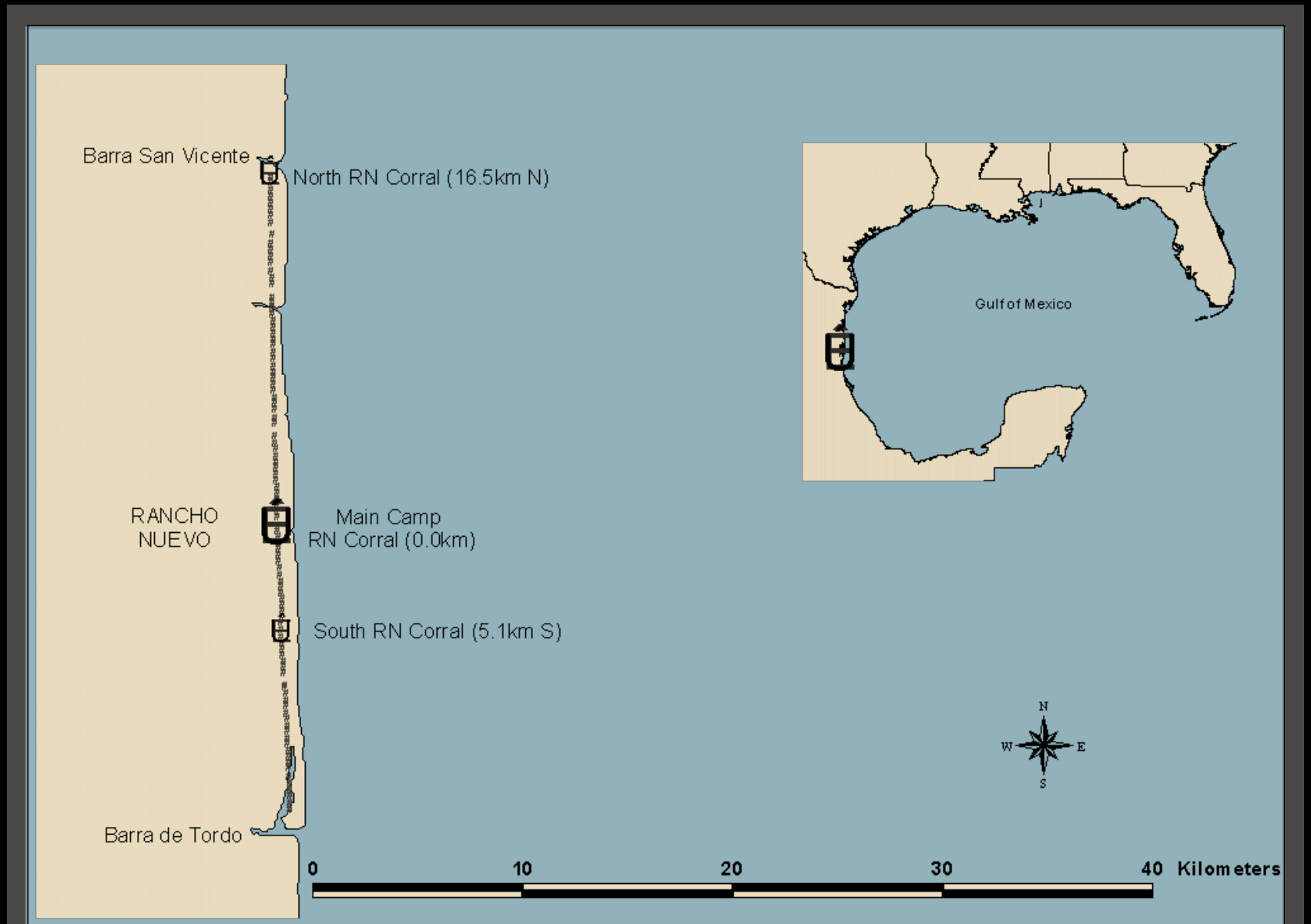
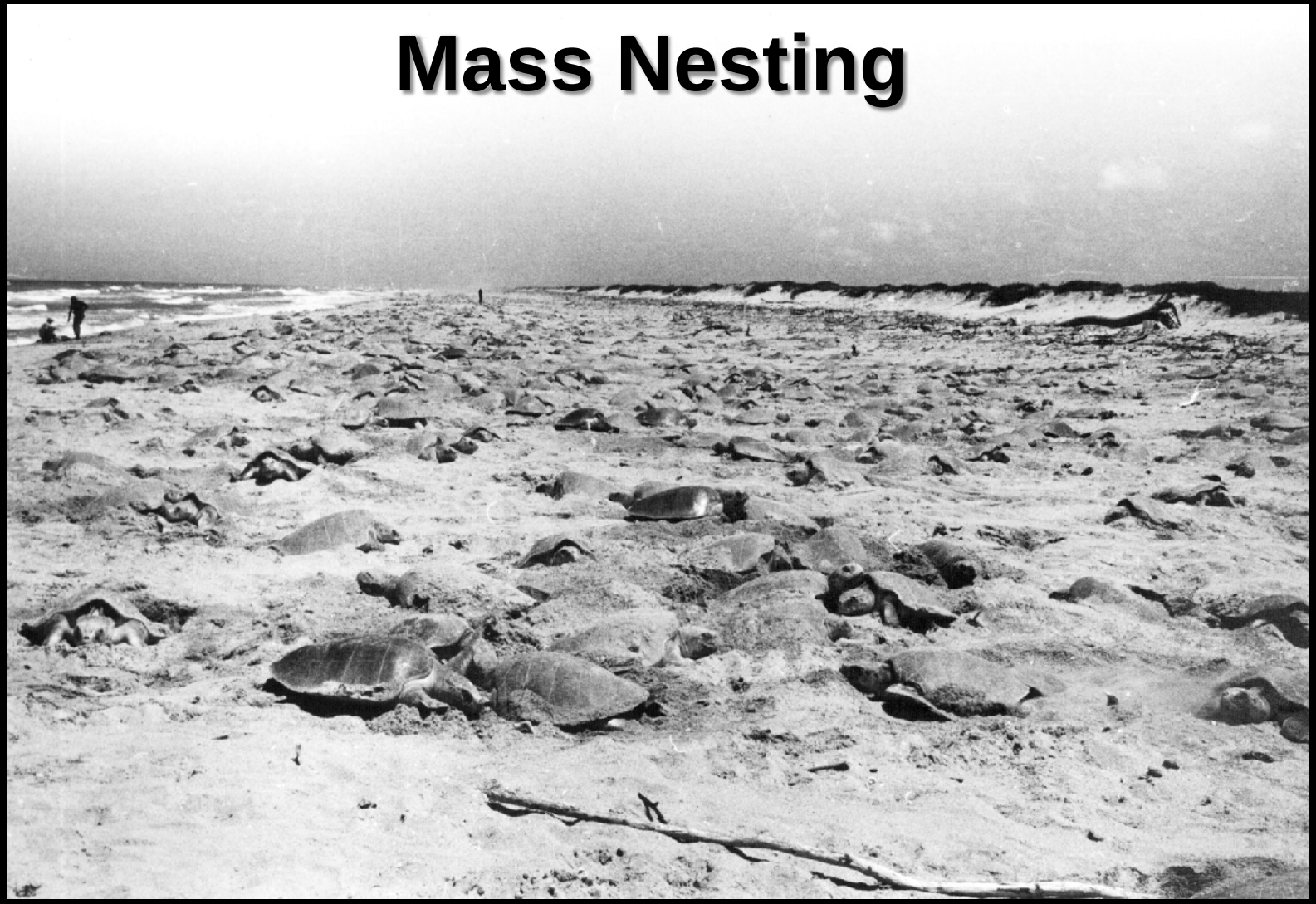


Figure credit: L. Belskis and A.M. Eich

The *Arribada* Phenomenon



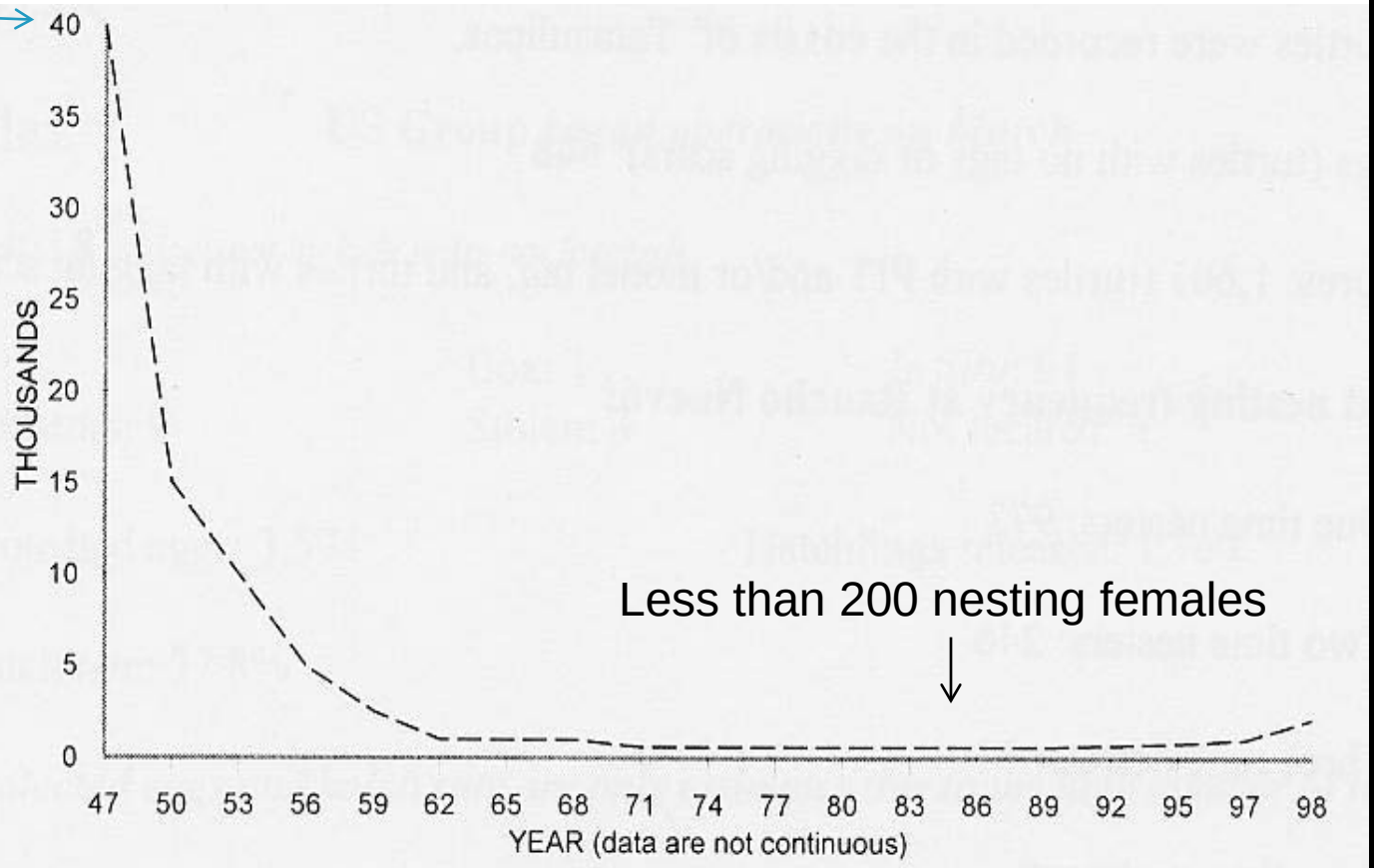
Threats

- Susceptible to exploitation
  - Egg harvesting
  - Incidental capture by shrimp fisheries
- Drastic decline for three decades

Photo credit: A.M. Eich

Conservation Interest

KEMP'S RIDLEY SEA TURTLE
TOTAL NUMBER OF NESTING FEMALES



From Jaime Peña

International Kemp's Ridley Recovery Program began in 1978

Programa Binacional de la Tortuga Lora

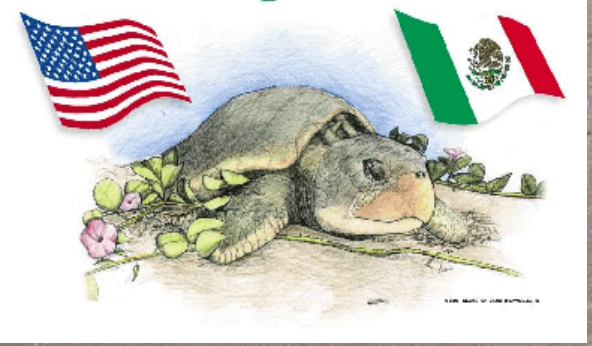


Photo credit: A.M. Eich

Rancho Nuevo Main Egg Corral

Photo credits: A.M. Eich

Transition From Egg Corral Back to the Natural *Arribada*

Photo credits: A.M. Eich

Photo credit: A.M. Eich

Objectives

I. **Evaluate sex ratios produced in Kemp's Ridley Recovery Program**

II. **Evaluate predation on natural nesting beach**

Photo credit: A.M. Eich

SEX RATIOS PRODUCED IN KEMP'S RIDLEY RECOVERY PROGRAM

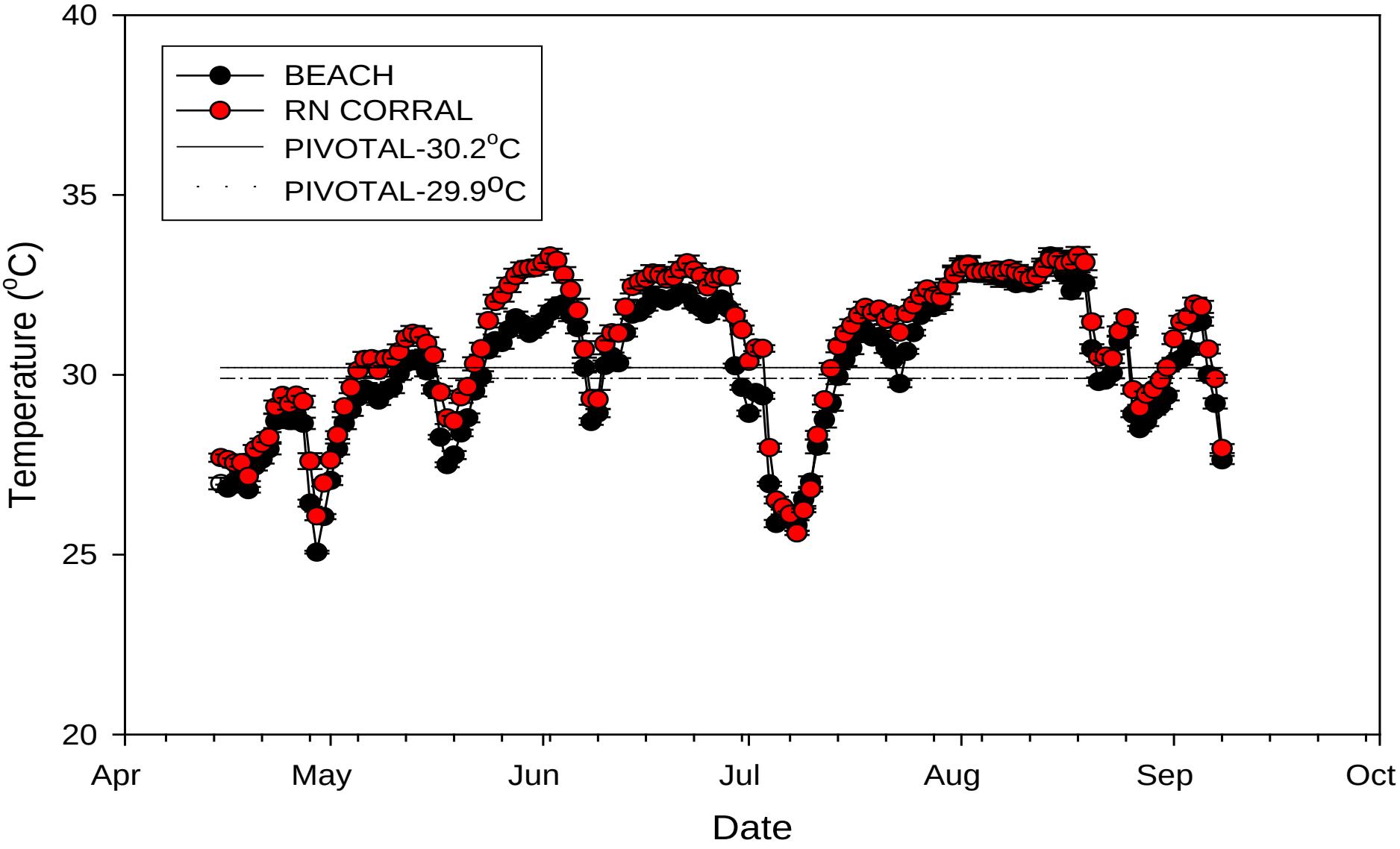
Photo credit: A.M. Eich

Corral & Natural Nests

- Monitored Sand Temperatures
- Monitored Subset of Nest Temperatures
- Predicted Sex Ratios for Nests Containing Data Loggers

Photo credit: A.M. Eich

Beach Temperatures at Rancho Nuevo

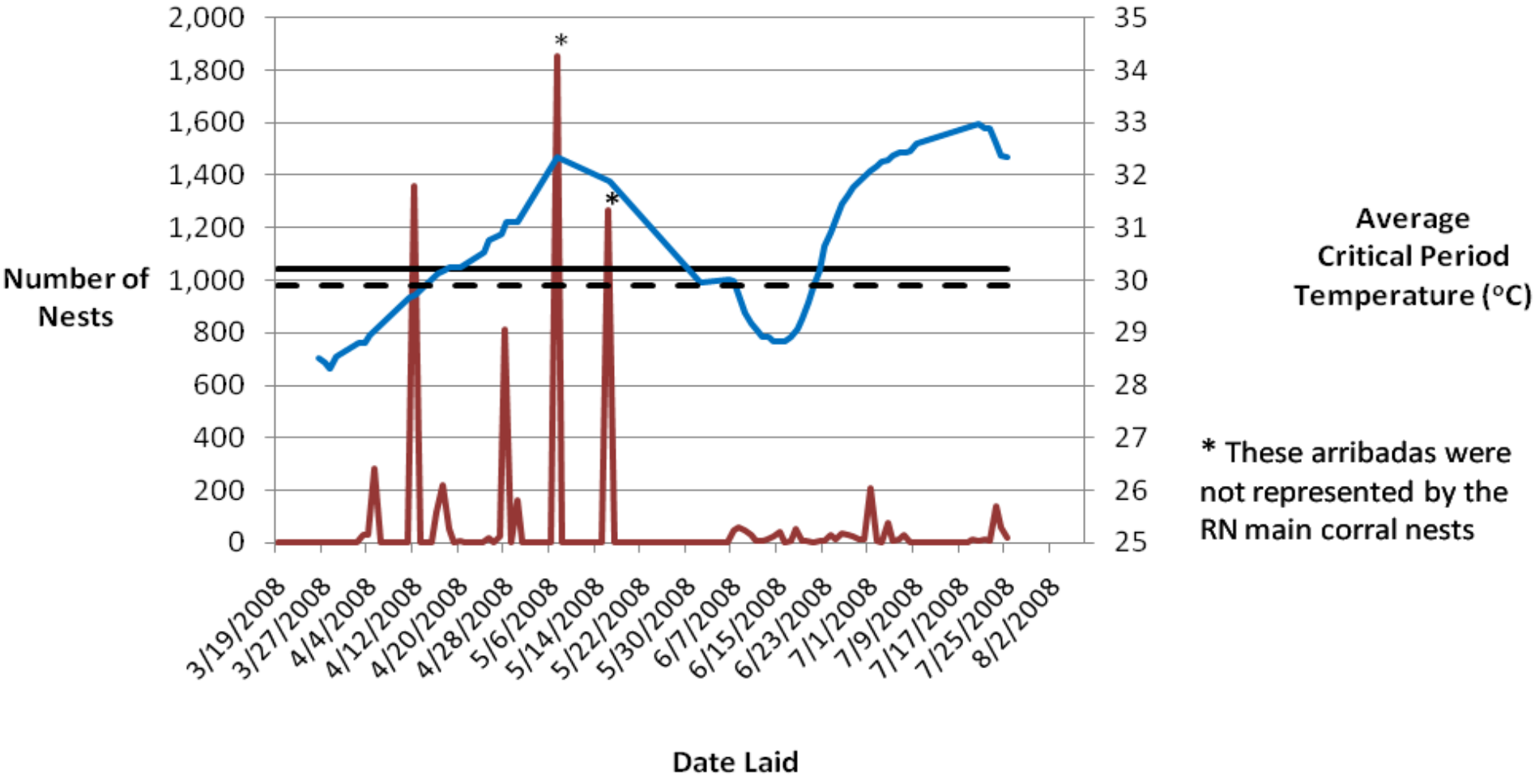


Sex Ratio Predictions

- Kemp's Ridley Recovery Program
- Conservation Implications of Shifting back to the Natural Nesting Beach

Photo credit: A.M. Eich

Results - 2008



Overall Predicted Sex Ratios for Rancho Nuevo Egg Corral

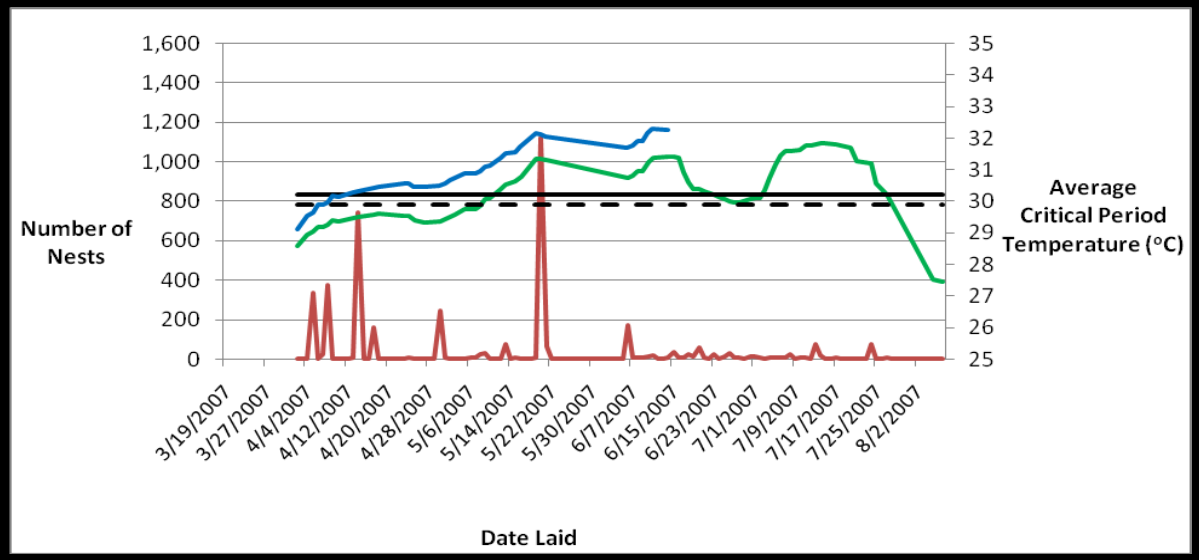
- 2007 overall sex ratio of approximately 75.5% female
- 2008 overall sex ratio of approximately 75.9% female

Photo credit: A.M. Eich

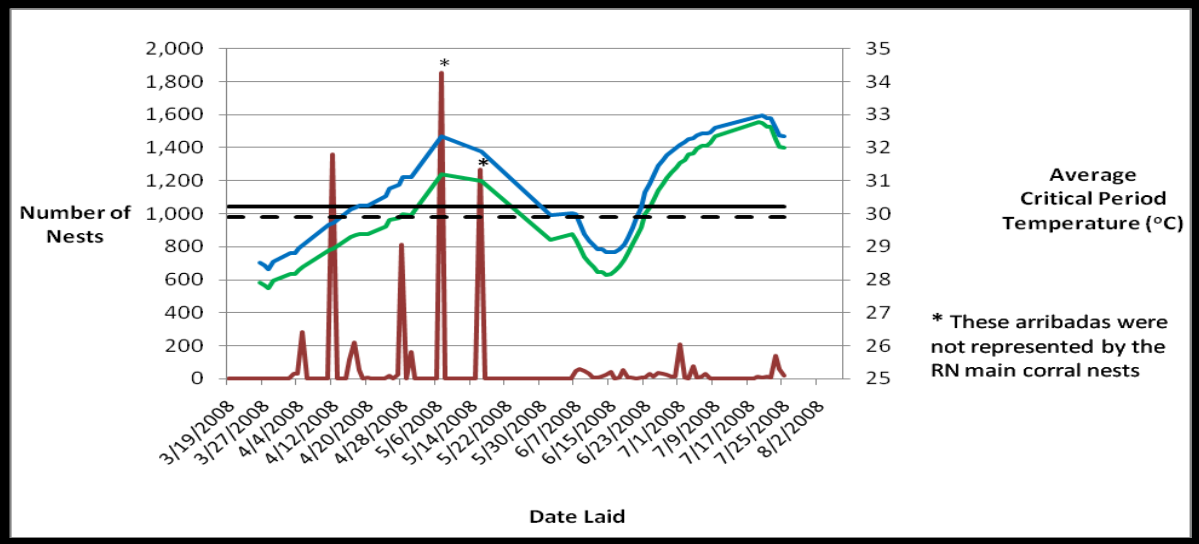
Transition From Egg Corral Back to the Natural *Arribada*

Photo credits: A.M. Eich

Results – Shift Back to Natural Nesting Beach



2007



2008

Overall Predicted Sex Ratios for the Natural Nesting Beach

- 2007 overall natural sex ratio of approximately 54.5% female
- 2008 overall natural sex ratio of approximately 60.1% female

Photo credit: A.M. Eich

Sex Ratio Conclusions

- *Arribada* may increase seasonal and yearly variation in sex ratios, thus preventing extreme population sex ratios.
- Natural nesting beach produces more males than the corrals.

Photo credit: A.M. Eich

Objectives

I. Evaluate sex ratios produced in Kemp's Ridley Recovery Program

II. Evaluate predation on natural nesting beach

Photo credit: A.M. Eich

Predator Evaluation Studies 2005-2008 Nesting Seasons

- Verification/Identification of Predators
- Quantification of Predators and Predation
- Evaluation of Hatchling Success from Nest to Surf

Photo credit: T. Wibbels

Predator Evaluation Studies 2005-2008 Nesting Seasons

- **Verification/Identification of Predators**
- **Quantification of Predators and Predation**
- **Evaluation of Hatchling Success from Nest to Surf**

Photo credit: T. Wibbels

Verification/Identification of Predators:

Observation Platform and Wildlife Cameras

Photo credit: A.M. Eich

Nocturnal Observation Study

- From Dusk to Dawn for up to 27 nights

- Using Night Vision Monocular and Infrared Camcorder

Photo credit: T. Wibbels

Results of 2005-2008 Nocturnal Animal Observation Study

- Limited number or predators: Territoriality?
  - 2-3 Raccoons
  - 1-5 Coyote
  - 1 Skunk
  - Also had at least one armadillo (2008)

- However, some predators were very efficient at examining beach and identifying nests with emerging hatchlings.

Photo credit: T. Wibbels

Automatic Wildlife Cameras

2007-2008

4 locations over 15 km of Beach

Early May 2008
4 Groups of Nests *In Situ* Along Nesting Beach

Photo credit: A.M. Eich

Birds

Photo credits: A.M. Eich

Coyote

Photo credits: A.M. Eich

Raccoon

Photo credits: A.M. Eich

Skunk

Photo credits: A.M. Eich

Armadillo

Photo credit: A.M. Eich

Succession of Predators Example

Photo credits: A.M. Eich

Photo credit: A.M. Eich

Photo credit: A.M. Eich

3

Photo credit: A.M. Eich


4
Raccoon
05/18/08 05:12 AM
Photo credit: A.M. Eich

General Overview of Verification/ Identification of Predators

- There were a limited number of predators in each location.
- Mammalian predators patrolled each evening.
- Observation: Once a predator depredates a portion of a nest it appears to initiate a succession of depredation events with that nest including flies and ants.

Predator Evaluation Studies 2005-2008 Nesting Seasons

- **Verification/Identification of Predators**
- **Quantification of Predators and Predation**
- **Evaluation of Hatchling Success from Nest to Surf**

Photo credit: T. Wibbels

Predator Tracks

Photo credit: A.M. Eich

Quantification of Predators

25-152 Nests Were Evaluated for Animal Tracks by Raking Twice Daily, at dusk and dawn

- Near Hatch (2005-2007)
- Throughout the Entire Incubation Period (2008)

Photo credits: A.M. Eich

General Results of Animal Track Study 2005-2008

- Primary Tracks
  - Nocturnal: Raccoons, Coyotes, Skunks
  - Diurnal/Nocturnal: Ghost crabs, Birds, Ants
- Frequency of Tracks
  - All nests were frequented by several predators (especially nocturnal predators) during each 24 hr period.
- Control areas were also visited frequently.
- More tracks at the scattered nests versus the dense *arribada* nests

Predator Evaluation Studies 2005-2008 Nesting Seasons

- **Verification/Identification of Predators**
- **Quantification of Predators and Predation**
- **Evaluation of Hatchling Success from Nest to Surf**

Photo credit: T. Wibbels

General Categories:

- All made it to the surf
- Most made it to the surf
- Most did not make it to the surf
- None made it to the surf

Photo credit: A.M. Eich

Photo credits: A.M. Eich

Quantification of Predation From Emergence to Surf

- **2007**
  - **66.4% hatchling success**
  - **Dense nesting**
- **2008**
  - **32.1% hatchling success**
  - **No dense nesting**

Conservative estimates, more than this probably made it to the surf.

Photo credit: A.M. Eich

Predator Satiation?

Supported by:

- Limited number and types of predators (2005-2008)
- More tracks at the scattered versus the dense nests (2007)
- Greatest predator impact on scattered nests (2007)
- Greatest hatchling success from nest to surf during dense *arribada* (2007)

Photo credit: A.M. Eich

Predation Conclusions

- *Arribada* advantageous as an optimal conservation strategy for enhancing hatchling survival by confounding and satiating predators.
- May need to reach a critical density in order to enhance survival.
- Conservation Implications

Overall Findings

- Sex ratios produced in the Kemp's Ridley Recovery Program, 3F:1M
- Conservation implications of the *arribada*
  - Sex ratio variation
  - Predator satiation

Photo credit: A.M. Eich

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Photo credit: A.M. Eich

The National Sea Grant College Program Dean John A. Knauss Marine Policy Fellowship

- February 2010 - January 2011
- MS-AL Sea Grant
- U.S. Fish and Wildlife, Division of Fisheries and Aquatic Resource Conservation
  - Branch of Aquatic Invasive Species

Photo credit: A.M. Eich

Branch of Aquatic Invasive Species

- Lacey Act Tiger Team
  - Team member, Facilitator, Briefings
- Aquatic Nuisance Species Task Force (ANSTF)
  - Presented at ANSTF Meeting
  - Assist with ANSTF Follow-up
  - Assist with ANSTF Research Protocol – Federal Register
  - Quagga-Zebra Mussel Action Plan –
    - Grant Committee, Grant Awarding, & Press Release
- Mississippi State ANS Management Plan
  - Joint review and drafting of letter
- Outreach opportunities (e.g., Scouts)
- National Invasive Species Council Interactions
- Training – ISRAP, HACCP, Coastal GIS
- Review of Snakehead Management Plan

http://upload.wikimedia.org/wikipedia/commons/thumb/2/2c/Monopterus_albus_2.jpg/300px-Monopterus_albus_2.jpg
http://upload.wikimedia.org/wikipedia/commons/1/18/Giant_salvinia.jpg
http://upload.wikimedia.org/wikipedia/commons/0/08/Snakehead_-_Channa_argus.jpg
Photo Credit: Leo G. Nico, USGS, Gainesville, FL
http://www.biolib.cz/IMG/GAL/76488.jpg
http://www.ceslas.com/.../admin/mudsnail.jpeg
/medium/sweeping_hydrilla_sb2.jpg
Photo Credit: Alex Kang
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http://cichlid.umd.edu/cichlidlabs/kocherlab/images/Adult-tilapia.jpg
http://conservationreport.files.wordpress.com/2009/12/asian-carp.jpg
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Photo credit: A.M. Eich

Fisheries-Aquatic Invasive Species

- Alabama State ANS Management Plan
  - Joint review and drafting of letter
- Helped R4 with reporting accomplishments to National Invasive Species Council and Aquatic Nuisance Species Task Force
- Helped draft AIS presentation for State Fish Chiefs at next meeting of SEAFWA
- Participated in AIS Coordinators call

Ecological Services-Recovery

- 5-Year Review: Summary and Evaluation
  - Alabama Sturgeon
  - Puerto Rican Sharp-shinned Hawk
  - Cumberland Rosemary
  - Armored Snail
- St. Andrew Beach Mouse Recovery Plan
- Recovery Outline
  - Georgia pigtoe mussel, Interrupted rocksnail, and Rough hornsnail

http://media.timesfreepress.com/img/photos/2010/02/11/0212_WEB_RG_muscle_V_t305.jpg

http://www.ces.ncsu.edu/depts/hort/consumer/factsheets/shrubs/images/a-l/common_names/cumberland_rosemary.jpg

http://images.nationalgeographic.com/wpf/media-live/photos/000/229/cache/news-mouse-tears_22908_600x450.jpg

http://blog.al.com/spotnews/2009/07/large_last%20sturgeon.jpg

Kemp's Ridley Recovery Plan

Photo credit: A.M. Eich

Acknowledgements

- U.S. Fish and Wildlife Service
- UAB Department of Biology
- Georgia Southern University
- Caretta Research Project
- SEMARNAT-CONANP
- SOPDUE
- National Marine Fisheries Service, NOAA
- Gladys Porter Zoo
- Texas Parks and Wildlife
- Padre Island National Seashore, NPS
- All of the biologists on the beach who have contributed to these projects

Photo credit: A.M. Eich

The End

Photo credits: A.M. Eich