Variation in nest temperatures of the American Alligator found on the Kennedy Space Center / Merritt Island National Wildlife Refuge

Russell Lowers ¹, Louis J. Guillette Jr. ², Stephanie Weiss³

1. IHA, Innovative Health Applications, NASA, Kennedy Space Center, USA
2. Marine Biomedicine and Environmental Sciences Center, Medical University of South Carolina, USA
56,656 ha or 140,000 acres
32,374 ha (80,000 acres) land
24,281 ha (60,000 acres) water
WHY ARE NESTING TEMPERATURES IMPORTANT?

- **Temperature Sexual determination**
  - FEMALES 29 deg C  50/50 31.5 deg C  MALES 34 deg C

- **Recruitment / Population structure**

- **Sea level rise / Global warming**

- **Provide information for long term management decisions**

MINWR

NASA

CNS

Other agencies
OBJECTIVES

- Implant 3 thermisters in egg cavity next to the eggs, recording depth, location and time.
- Put a thermister in the air next to the nest.
- Pull eggs for staging.
- Thermisters set to log every 5 minutes.
- Record time when they are picked up.
ALL 58 NESTS 2010 - 2015

- **NORMAL HATCHED NEST**
- **UNKNOWN IF HATCHED**
- **DEPREDATED NEST**
- **DEAD NEST**
THERMISTER NESTS THAT DID NOT HATCH
2010 - 2015

- 10 DEAD NESTS
- 5 DEPREDATED
- 2 UNKNOWN
Average TSD Temperatures

- Temp (°C)
- Substrate: Fern, Grass, PineNeedle, Spartina, Typha, Wood

The box plots show the distribution of TSD temperatures for different substrates, with each box representing the interquartile range, the median, and the observations falling within 1.5 times the interquartile range from the box.
THERMISTERS 2013
GRAPH 6
(HATCHED)
FERN 90%

TEMPERATURE C

DATE

TOP THERMISTER 18CM
MIDDLE THERMISTER 20CM
BOTTOM THERMISTER 27CM
NEST PD1 2012
HATCHED / SPARTINA

TEMPERATURE (°C)

06/27/12  07/04/12  07/11/12  07/18/12  07/25/12  08/01/12  08/08/12  08/15/12  08/22/12

TOP THERMISTER 20CM
MIDDLE THERMISTER 25CM
BOTTOM THERMISTER 30CM
DAY AND TIME OF HATCHING
2010 - 2014

TIME OF DAY (24HR)

DATE

9-Aug  14-Aug  19-Aug  24-Aug  29-Aug  3-Sep  8-Sep  13-Sep

[Graph showing data points for different years and times]
DAY AND TIME OF HATCHING
2010 - 2014
THERMISTER CALIBRATION

DATE

TEMPERATURE (°C)

58 Nests with temperature data loggers
41 Nests hatched (71%)
Average temperature in the alligator nests at TSD was 31.8 deg. C. indicating our recruitment here is close to 50/50
Range between the three different depth temperatures at sexual determination was only .27 deg. C
Rain had a big influence on the alligator nests dropping the temperature up to eight deg. C.
Highest temperature recorded was 78.5 deg C (173 deg F). Was a thermistor on the ground after hatching. Yes the swamp is HOT!
Overall summary

- High nesting success on KSC/MINWR
- TSD temperatures close to 50:50 for male to female ratio
Publications


Heather J Hamlin1,2,* , Russell H Lowers3,* , Satomi Kohno1,10, Naoko Mitsui-Watanabe4, Haruna Amano5,6, Akihiko Hara5, Yasuhiro Ohta7, Shinichi Miyagawa8,9, Taisen Iguchi8,9 and Louis J Guillette Jr. 2014 The reproductive hormone cycle of adult female American alligators from a barrier island population. Reproduction (2014) 147 855–863


SPECIAL THANKS TO:

- MINWR: Mike Legare, Jim Lyons, Jane Whaley,
- IACUC: Ramona Bober, Howard Levine, Dr. Moreland and committee
- IHA crew: Stephanie Weiss, Brenton Back, Doug Scheidt, Carly Bourtis, Shannon Small, Eric Reyier and Karen Holloway-Adkins,
- University of Florida: James Nifong, Racheal Nifong
- MUSC Personnel: Lou Guillette, Matt Guillette, Heather Hamlin, Ashley Boggs, Satomi Kohno, James Nifong, Brian Silliman, Brandon Moore
- USFWS Gainesville: Allen Woodward, Cameron Carter, Patrick Delaney, Arnold Brunell
- Dr. Shinsuke Tanabe Professor, Environmental Chemistry and Ecotoxicology
- Center for Marine Environmental Studies (CMES) Japan
- Stellenbosch University: Hannes Van Wyk
ANY QUESTIONS?