

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

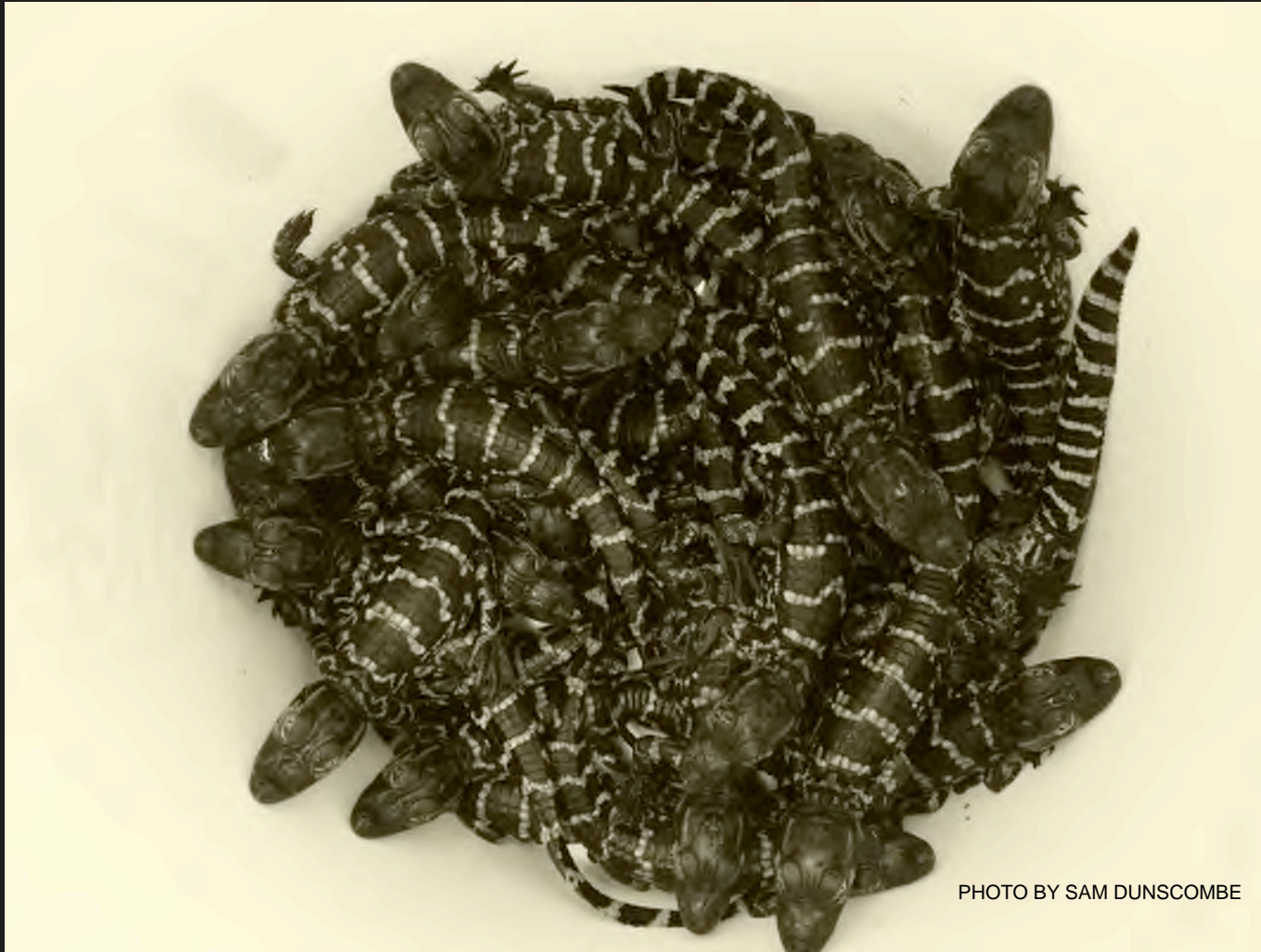


PHOTO BY SAM DUNSCOMBE

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↓ Kennedy Space Center



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**

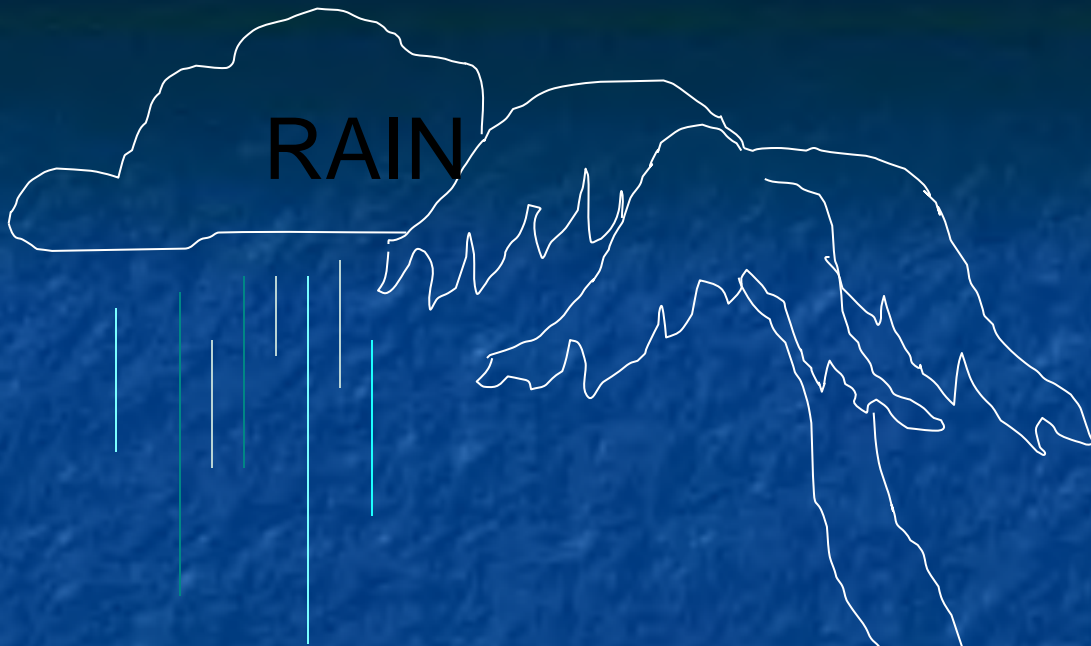
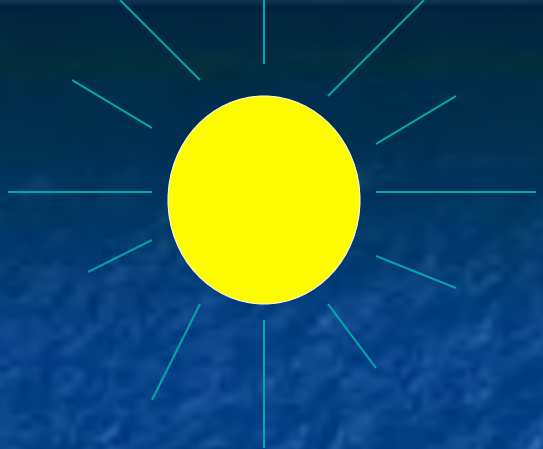
MINWR
NASA
CNS
Other agencies



OBJECTIVES

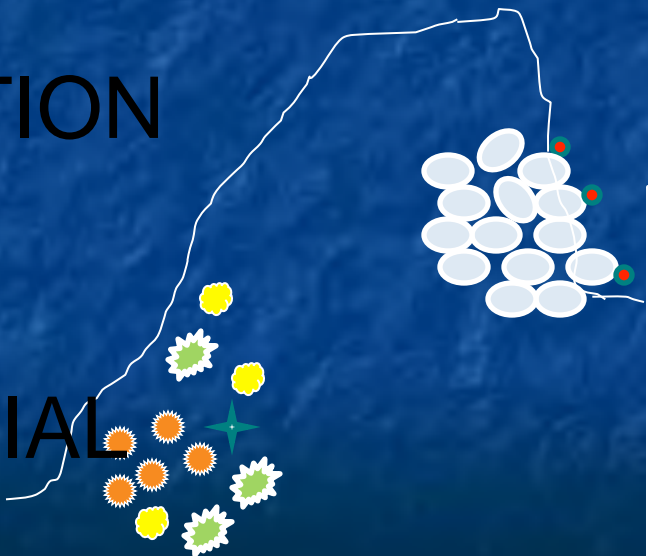
- IMPLANT 3 THERMISTERS IN EGG CAVITY NEXT TO THE EGGS, RECORDING DEPTH, LOCATION AND TIME
- PUT A THERMISTER IN THE AIR NEXT TO THE NEST
- PULL EGGS FOR STAGING
- THERMISTERS SET TO LOG EVERY 5 MINUTES
- RECORD TIME WHEN THEY ARE PICKED UP





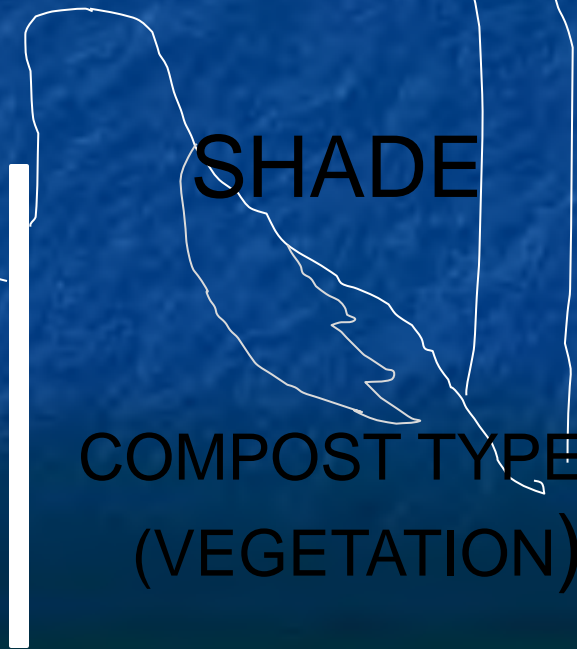
VEGETATION
COLOR

MICROBIAL
ACTION



SHADE

COMPOST TYPE
(VEGETATION)



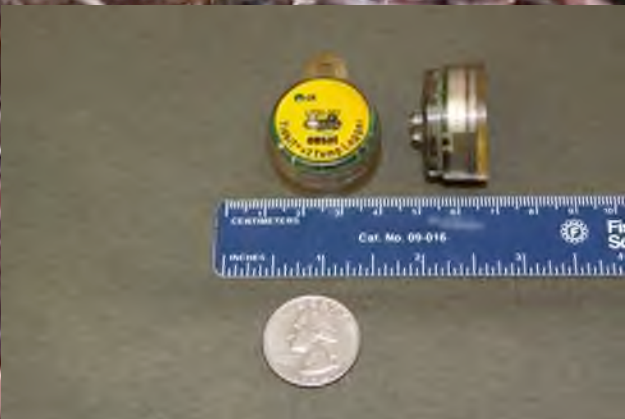






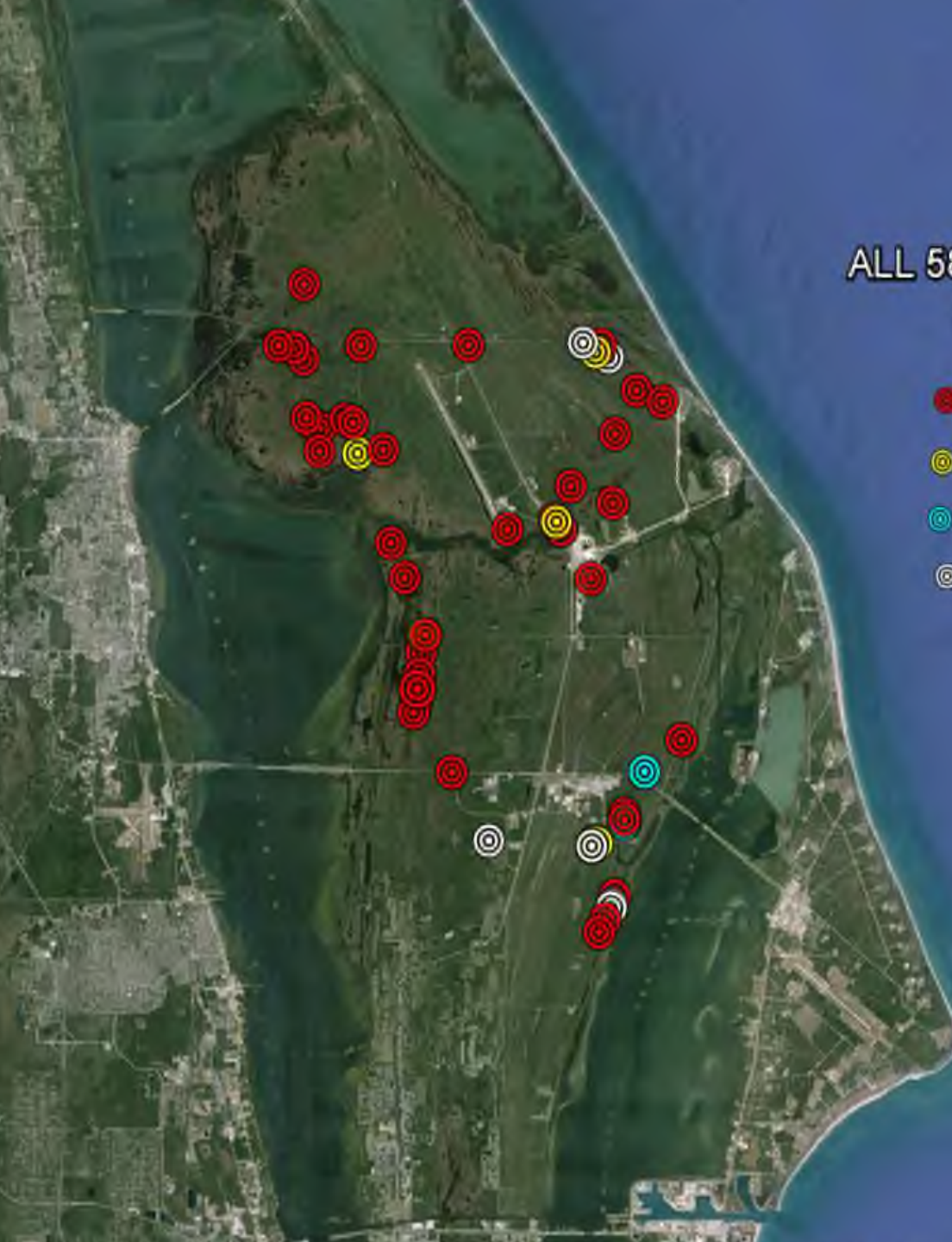






ALL 58 NESTS 2010 - 2015

- NORMAL HATCHED NEST
- UNKNOWN IF HATCHED
- DEPREDATED NEST
- DEAD NEST

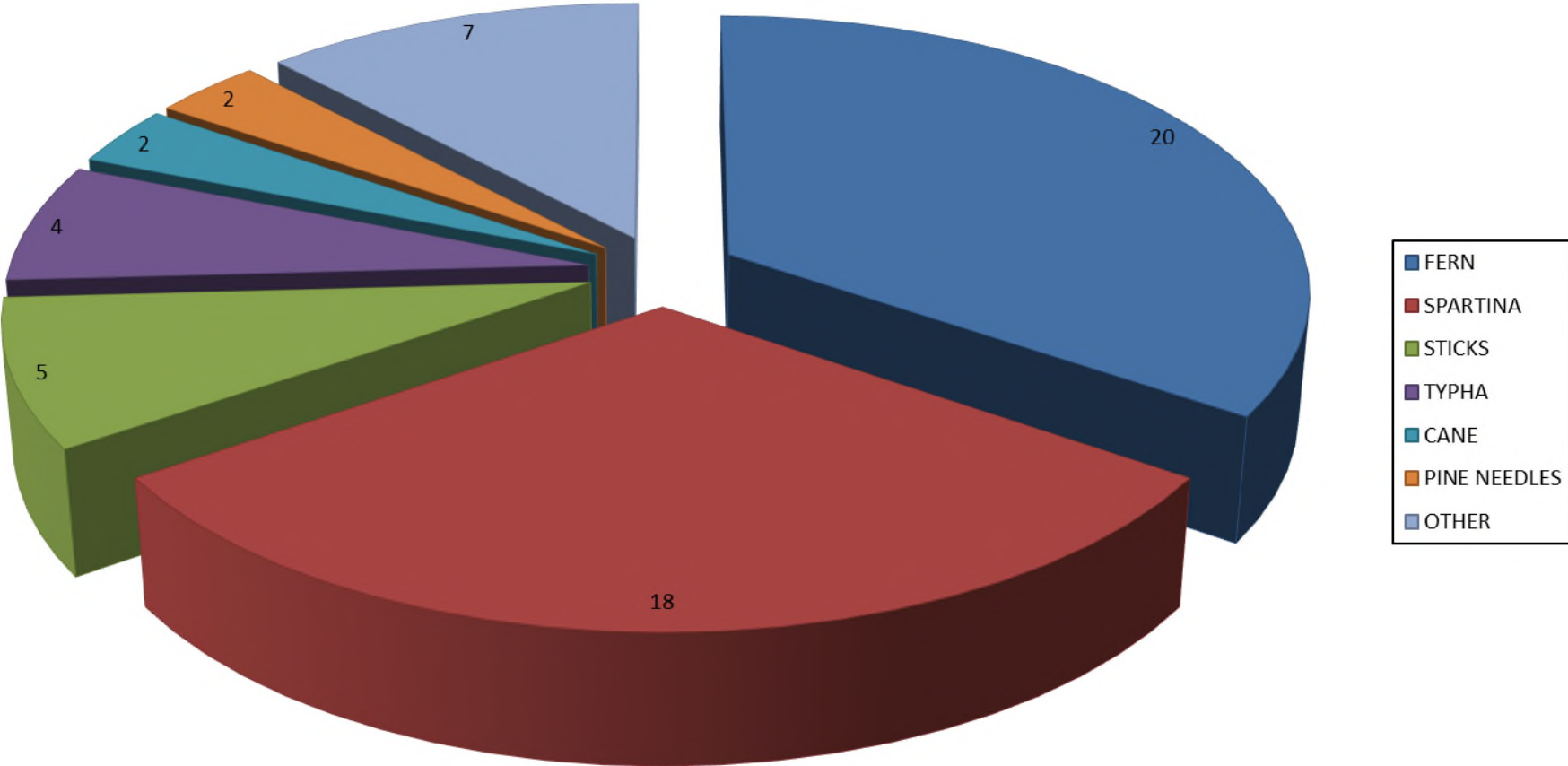




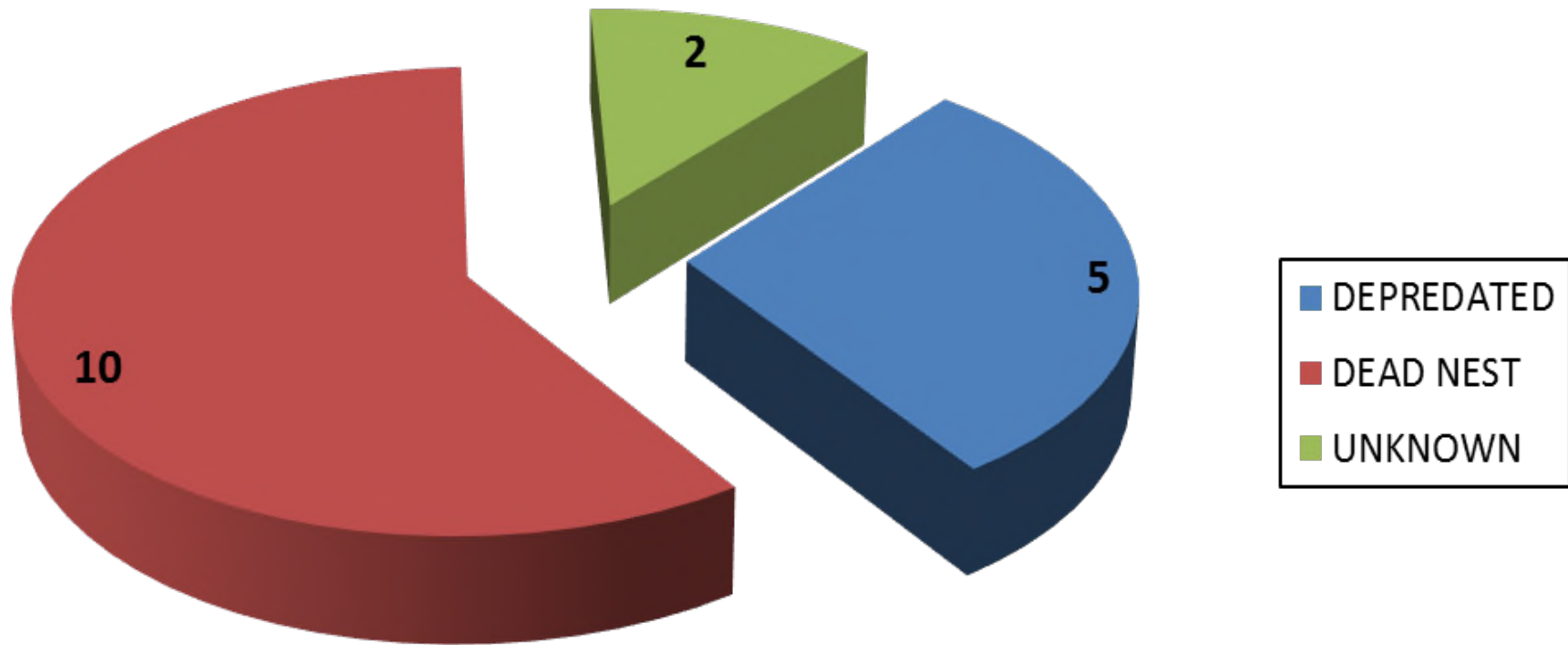




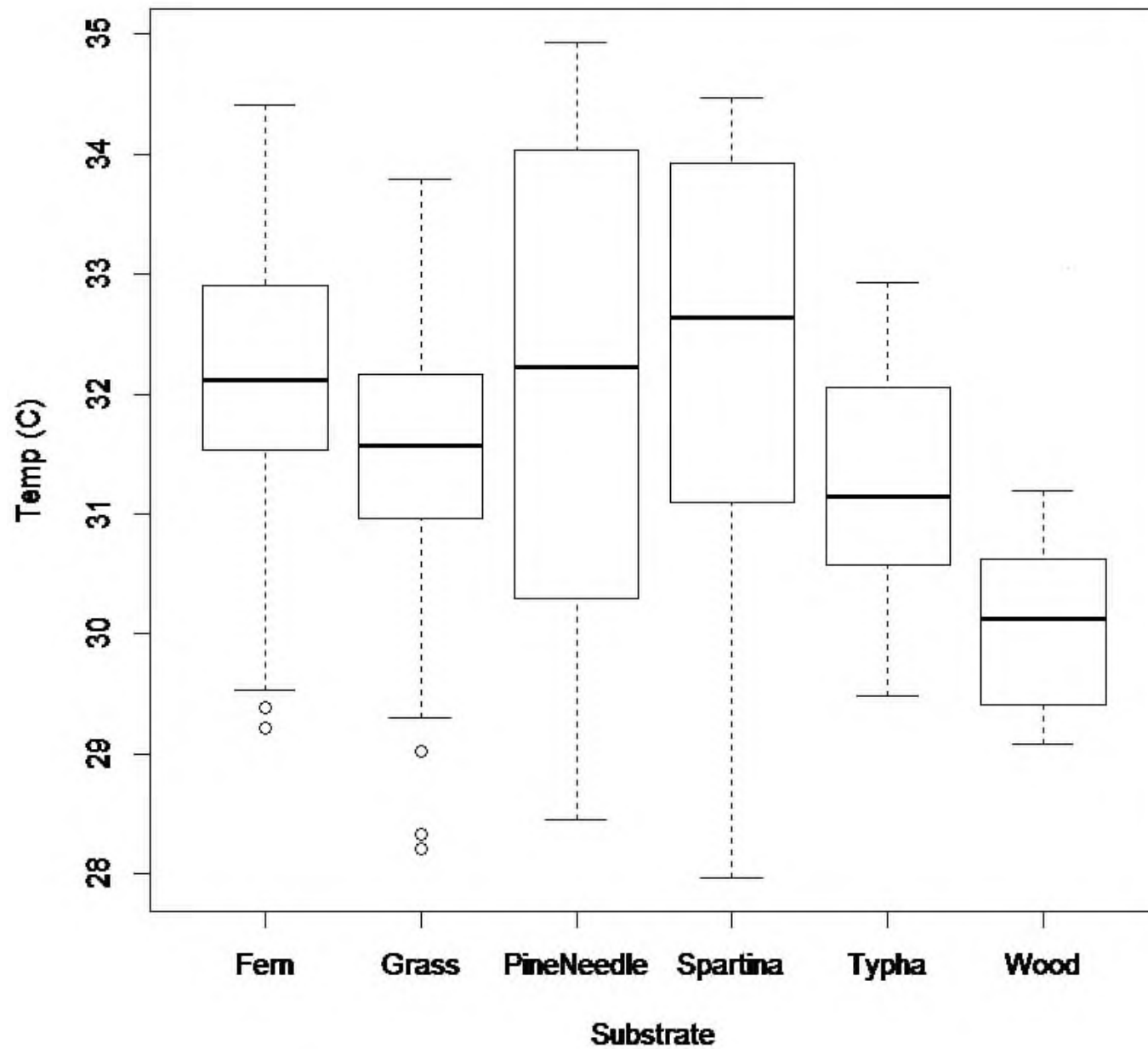
VEGETATION TYPES



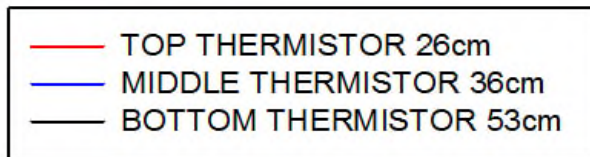
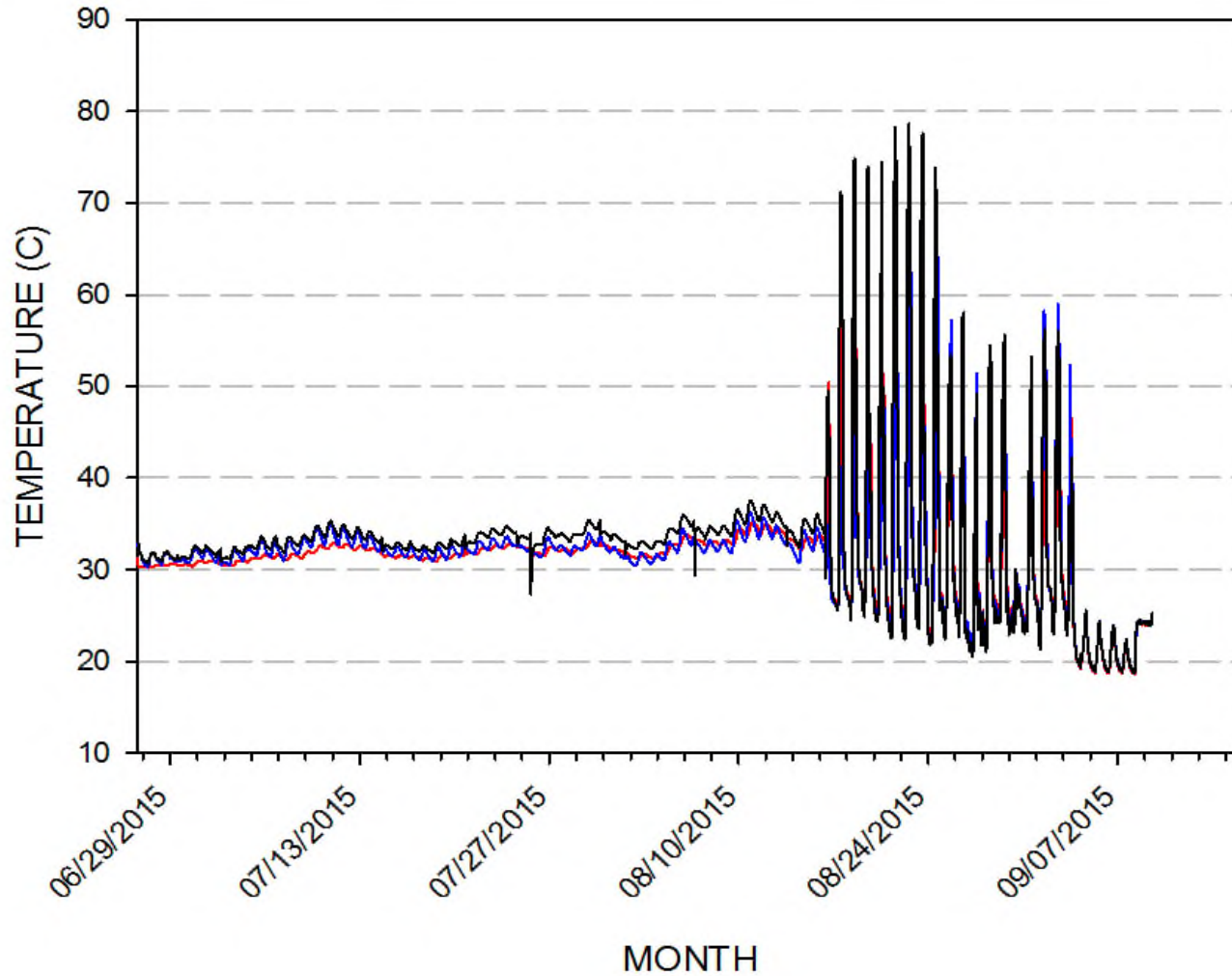
THERMISTER NESTS THAT DID NOT HATCH 2010 - 2015



Average TSD Temperatures

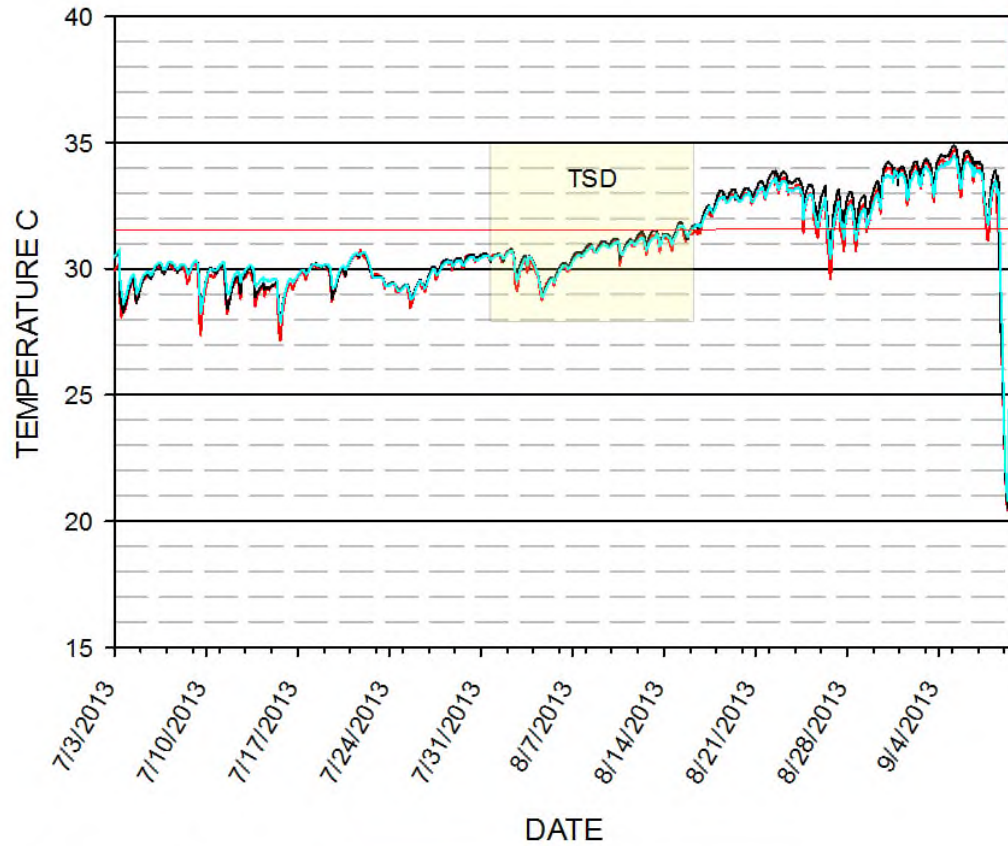


DMS 4 THERMISTORS 2015



60

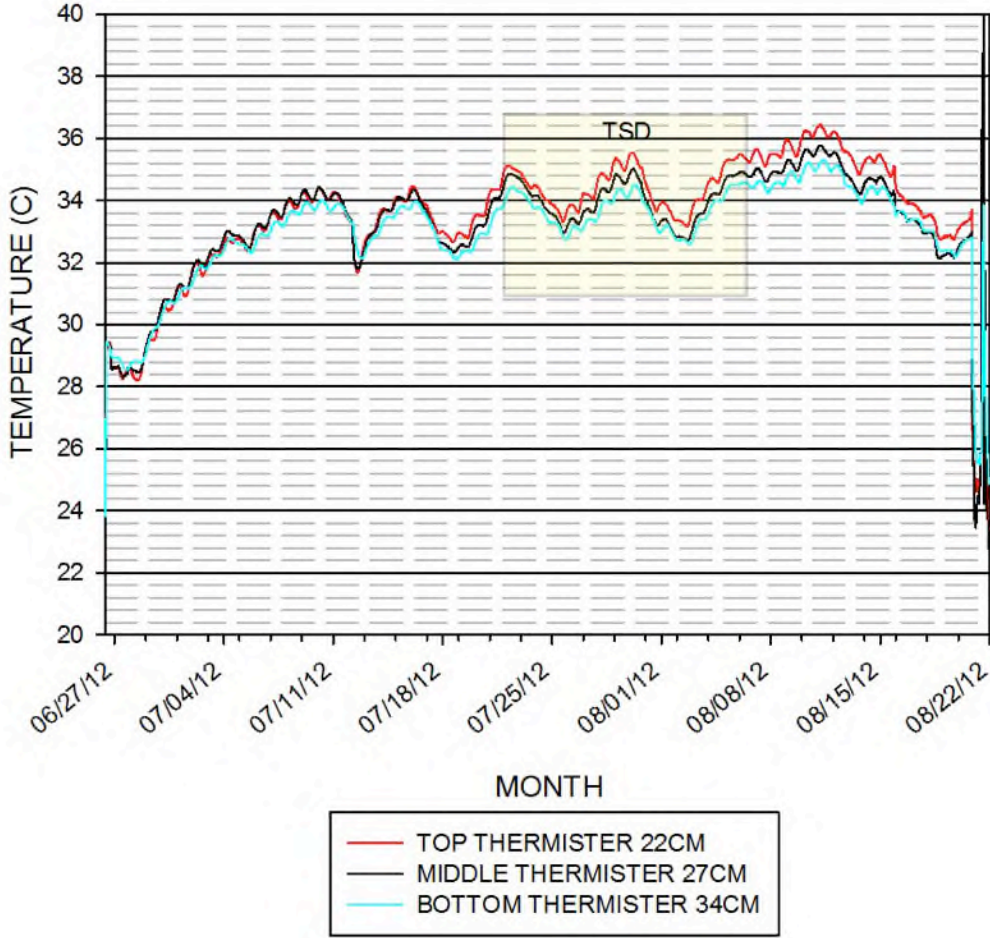
THERMISTERS 2013
GRAPH 6
(HATCHED)
FERN 90%



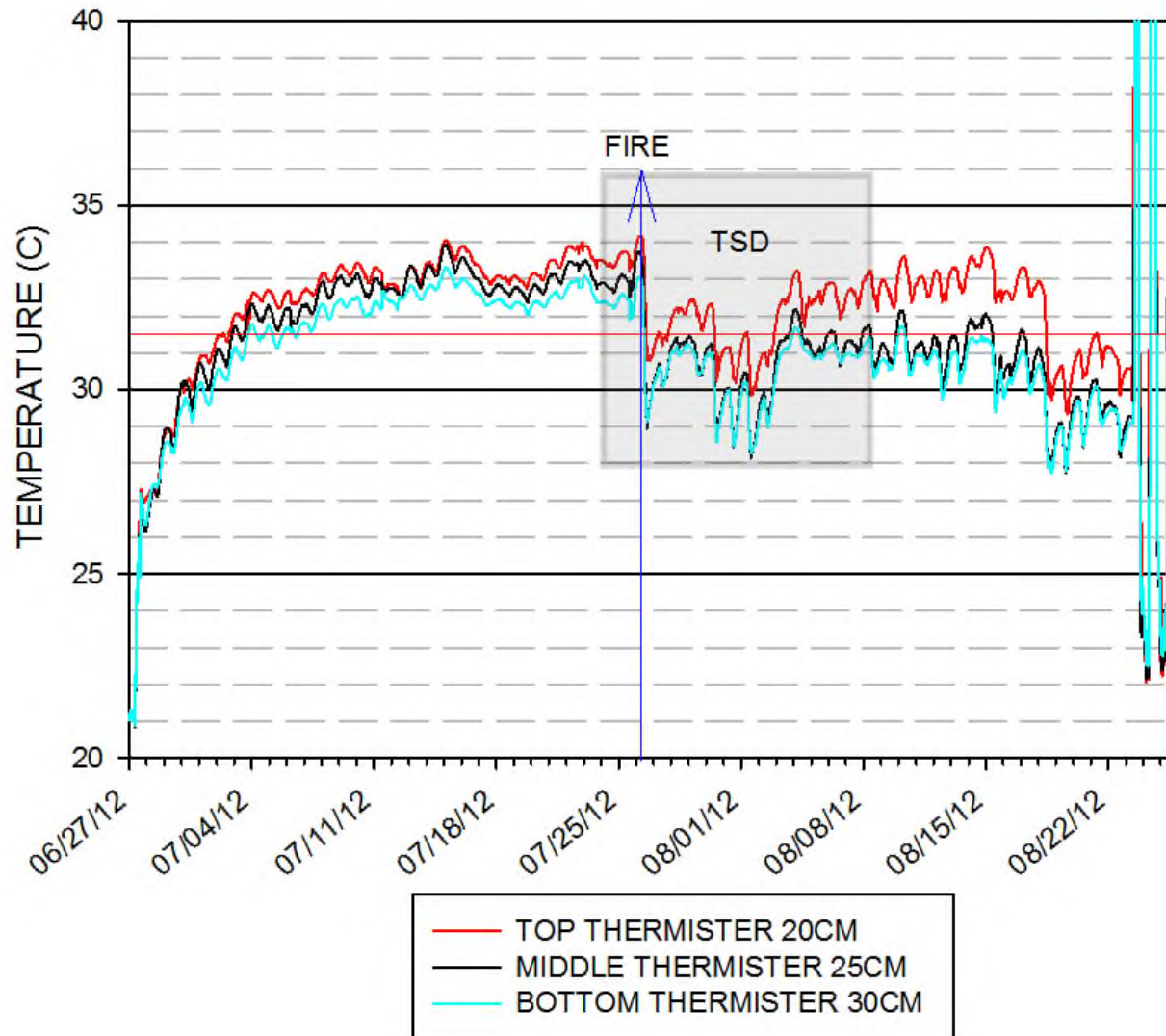
7

— TOP THERMISTER 18CM
— MIDDLE THERMISTER 20CM
— BOTTOM THERMISTER 27CM

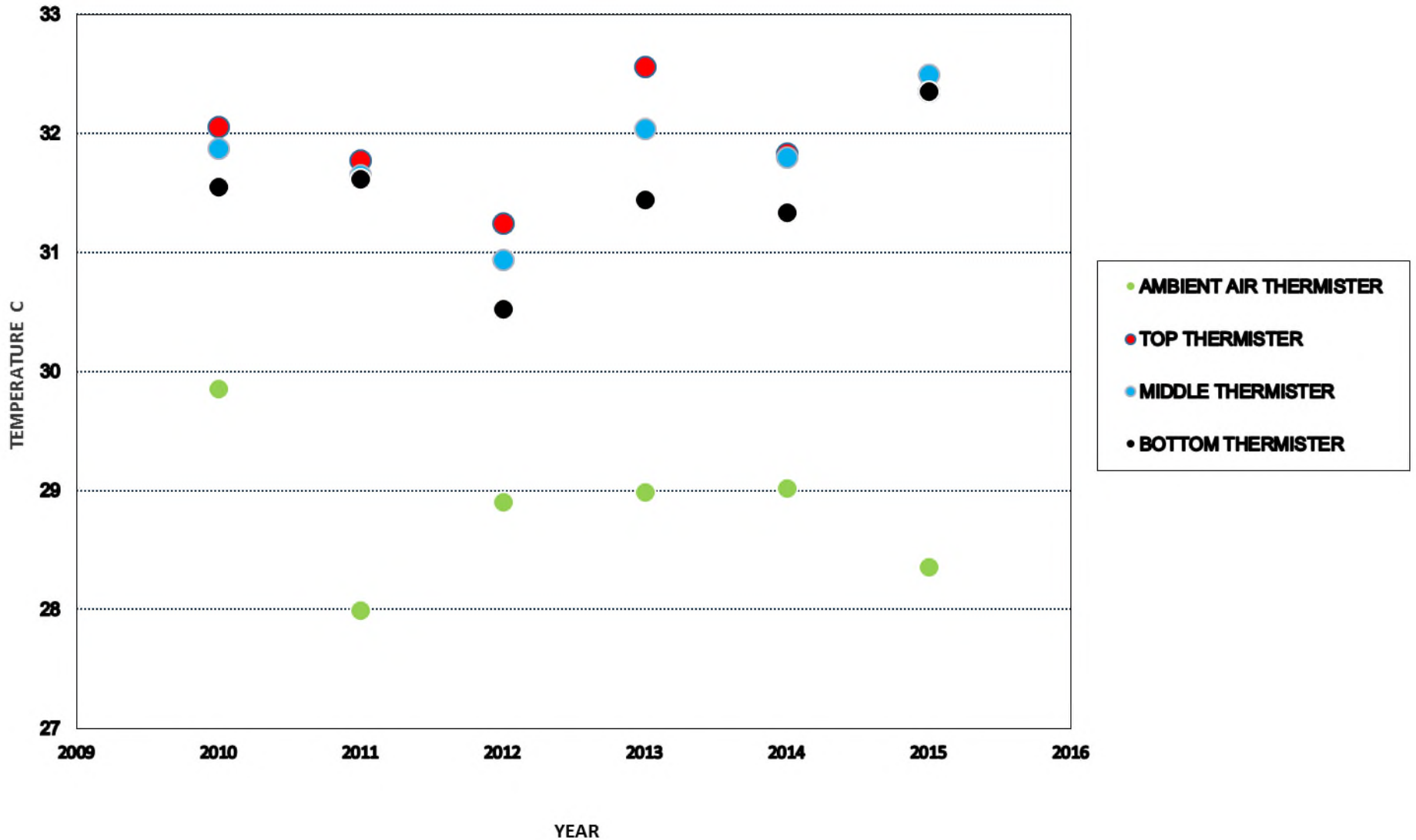
NEST RHL 01 2012
HATCHED / PINE NEEDLES



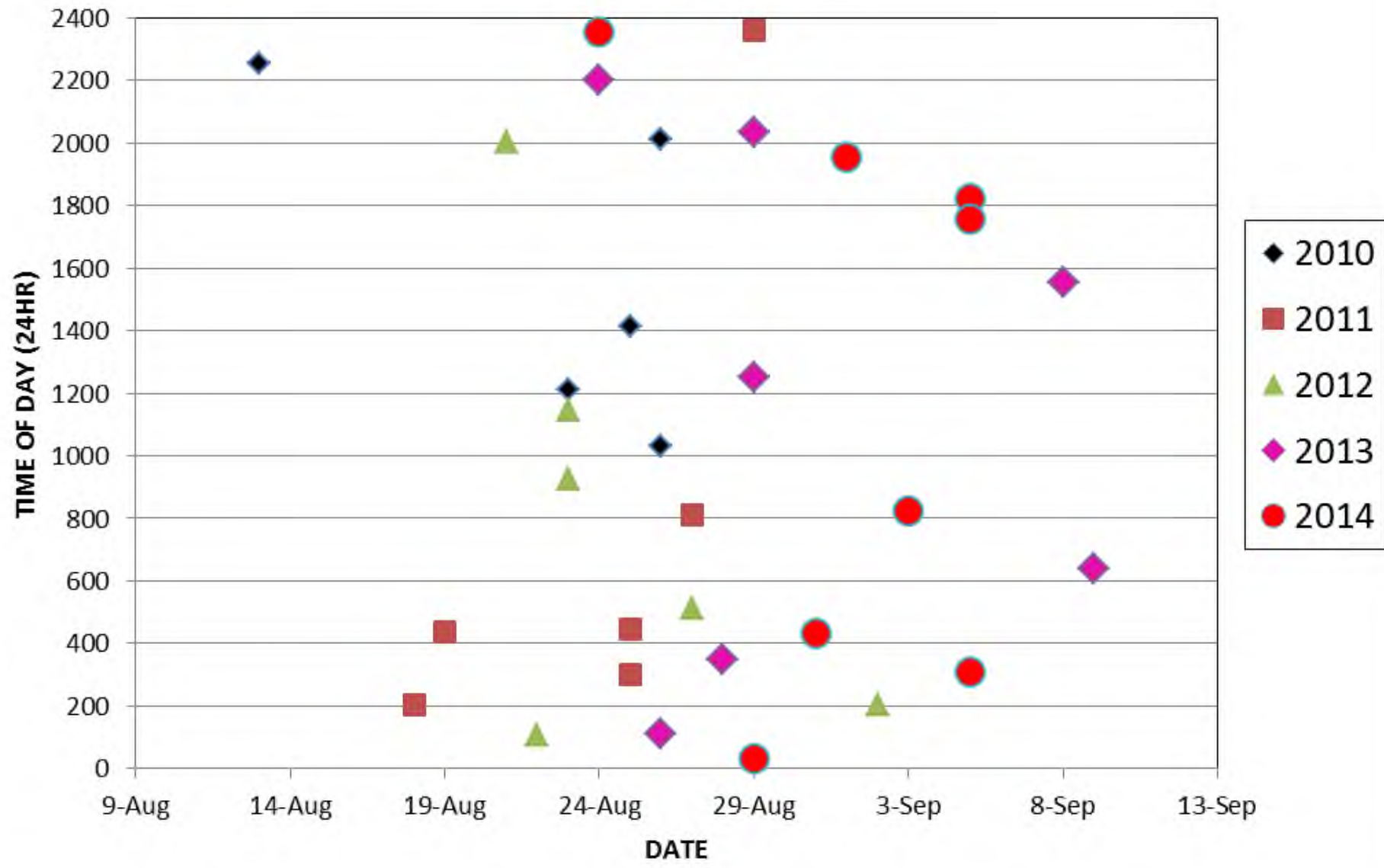
NEST PD1 2012 HATCHED / SPARTINA



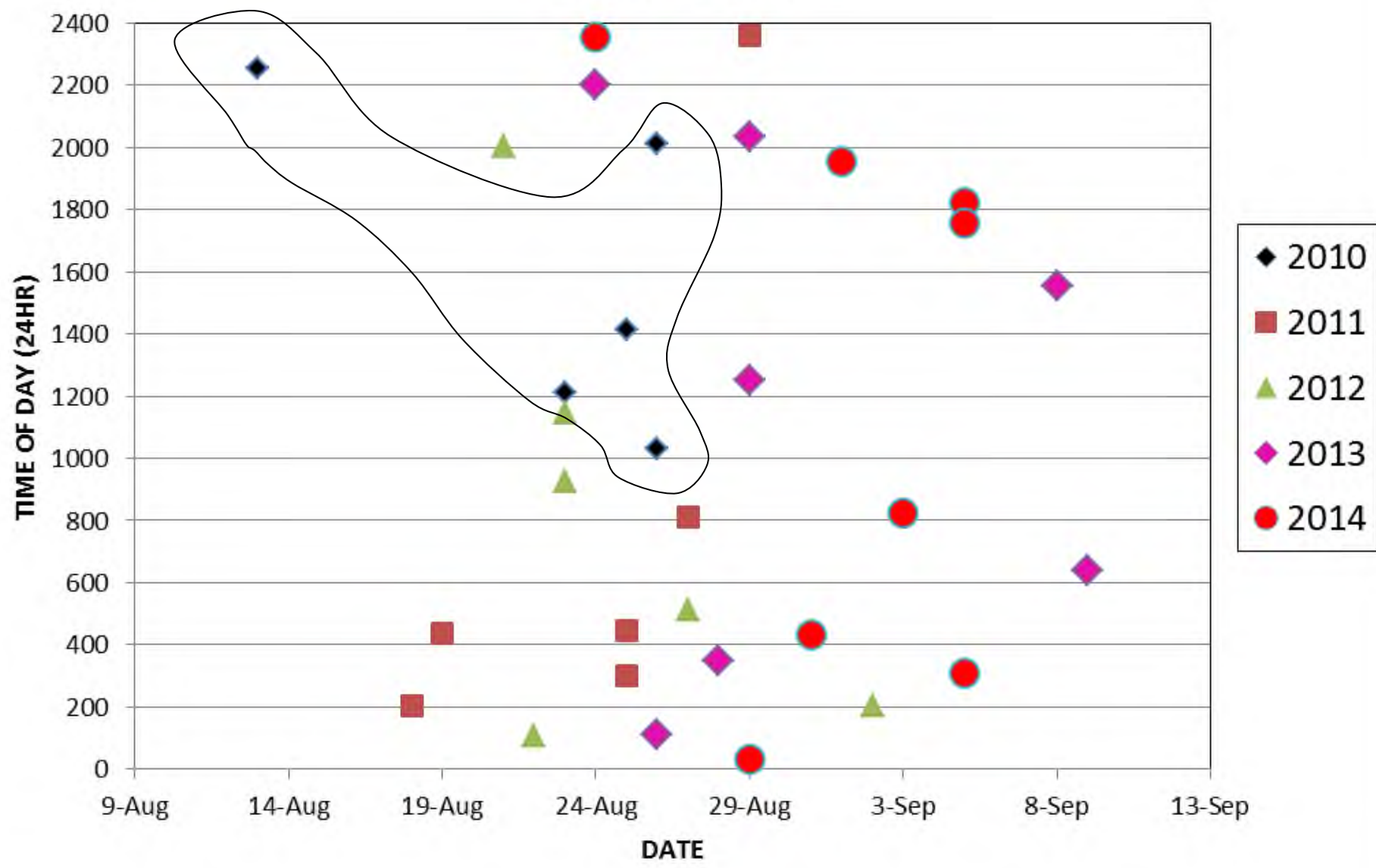
AVERAGE TEMPERATURE DURING TSD



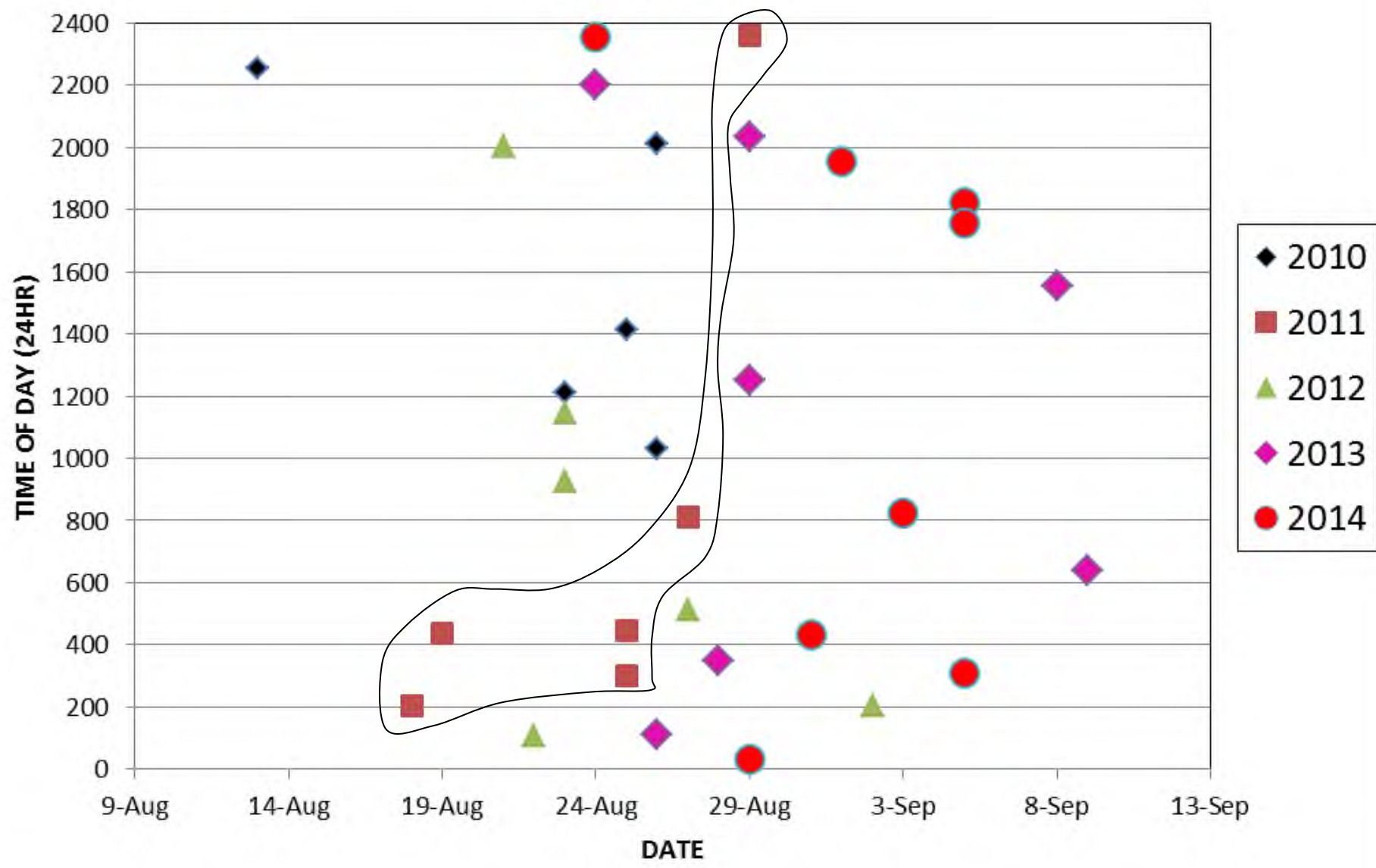
DAY AND TIME OF HATCHING 2010 - 2014



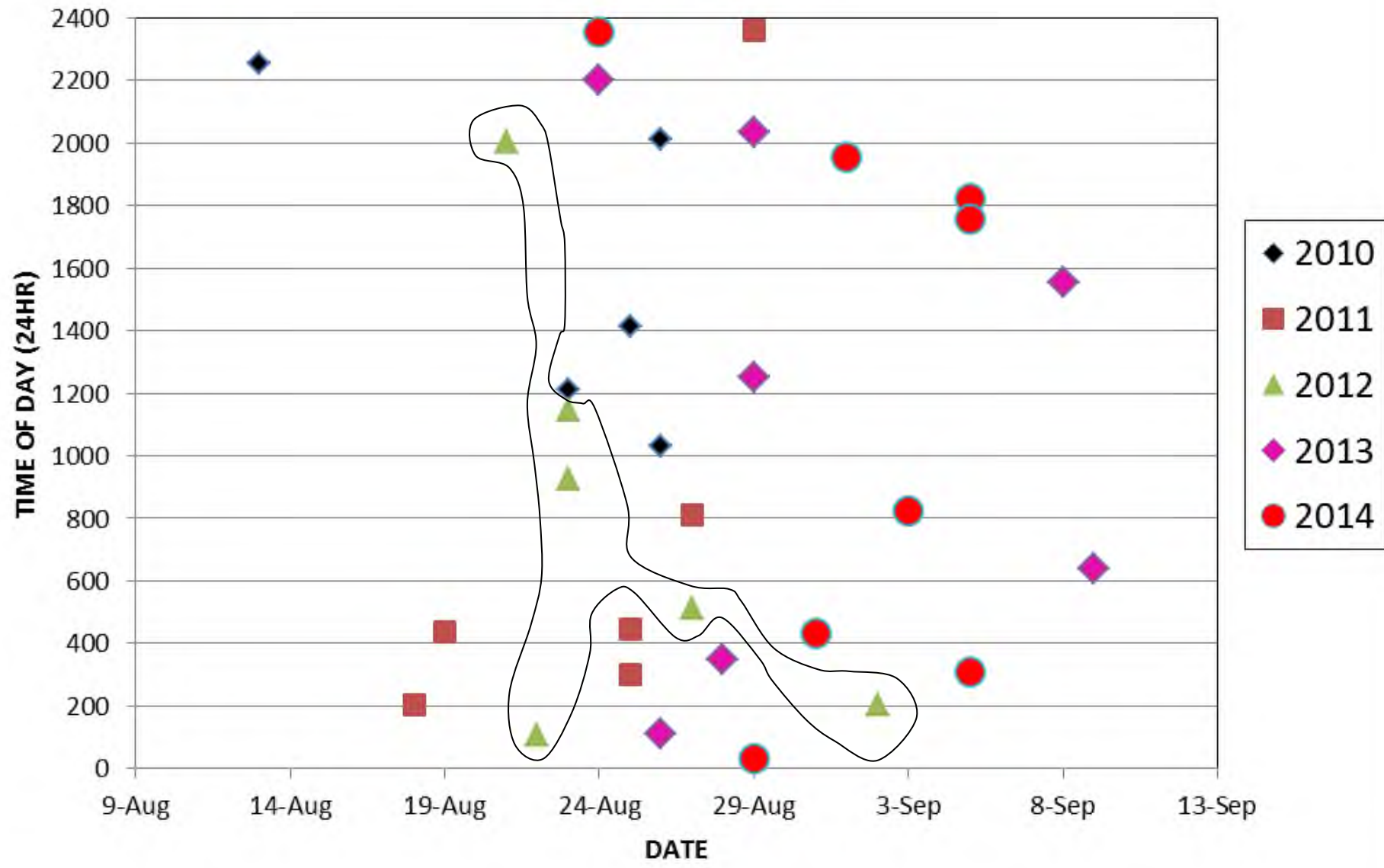
DAY AND TIME OF HATCHING 2010 - 2014



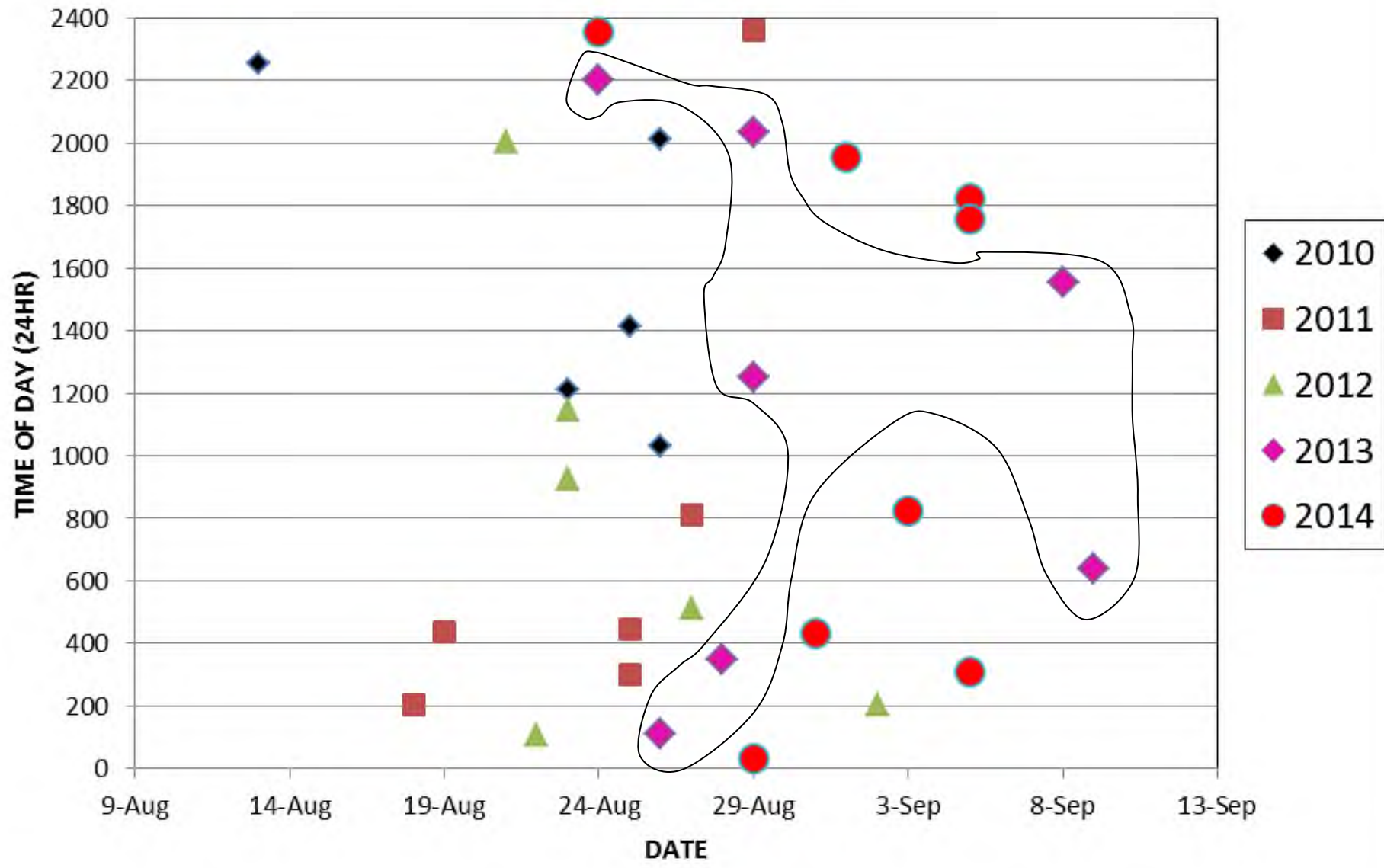
DAY AND TIME OF HATCHING 2010 - 2014



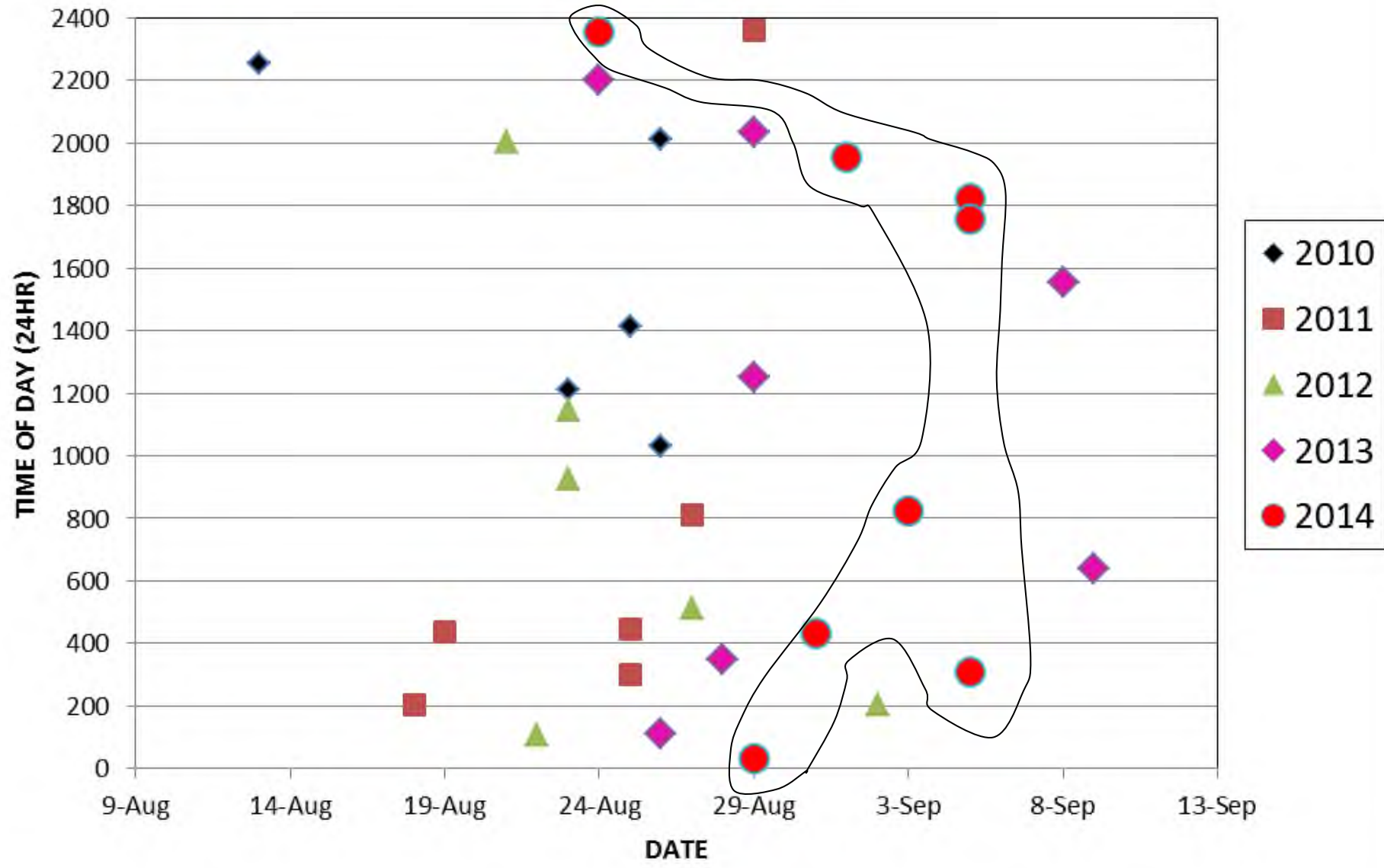
DAY AND TIME OF HATCHING 2010 - 2014



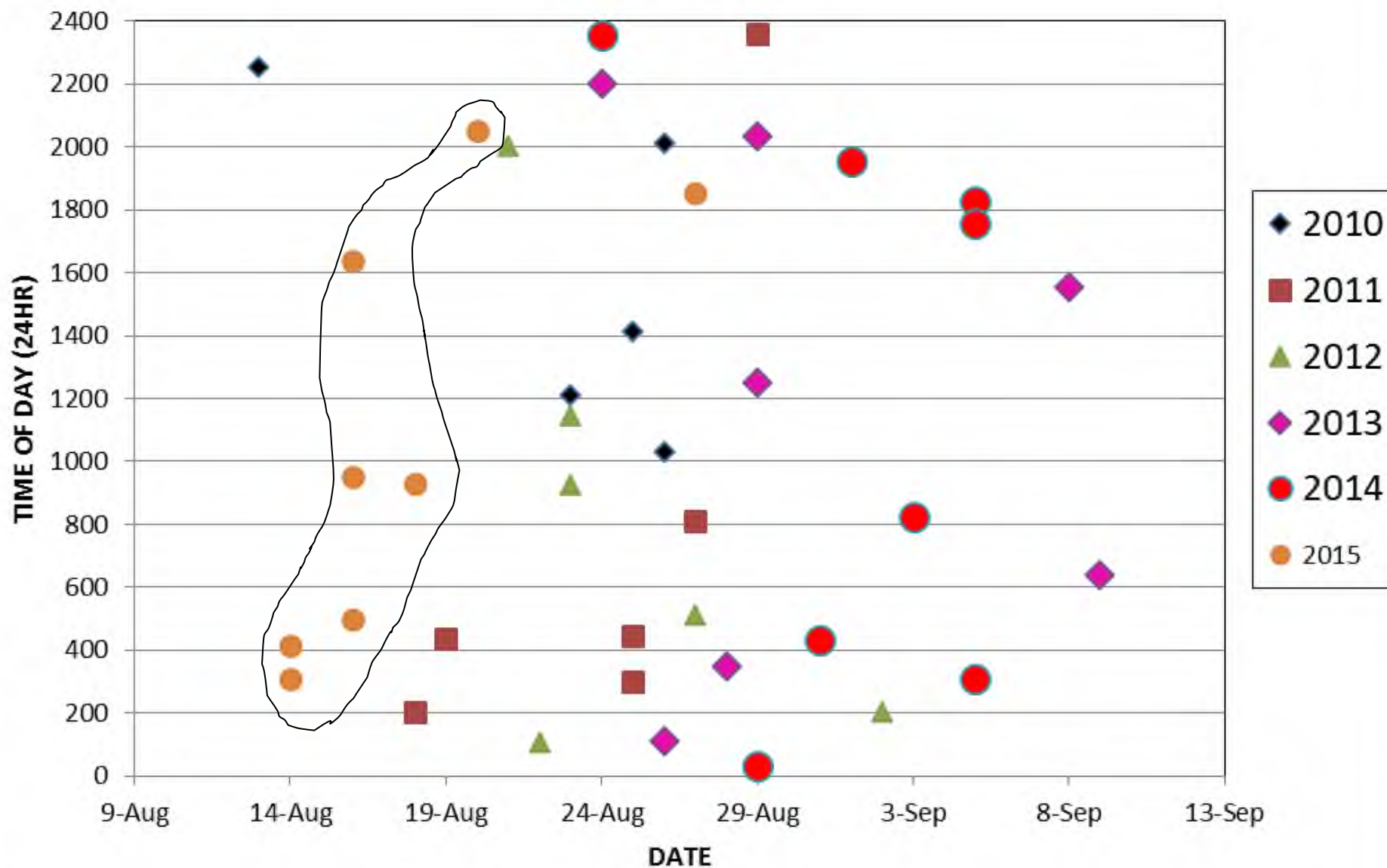
DAY AND TIME OF HATCHING 2010 - 2014



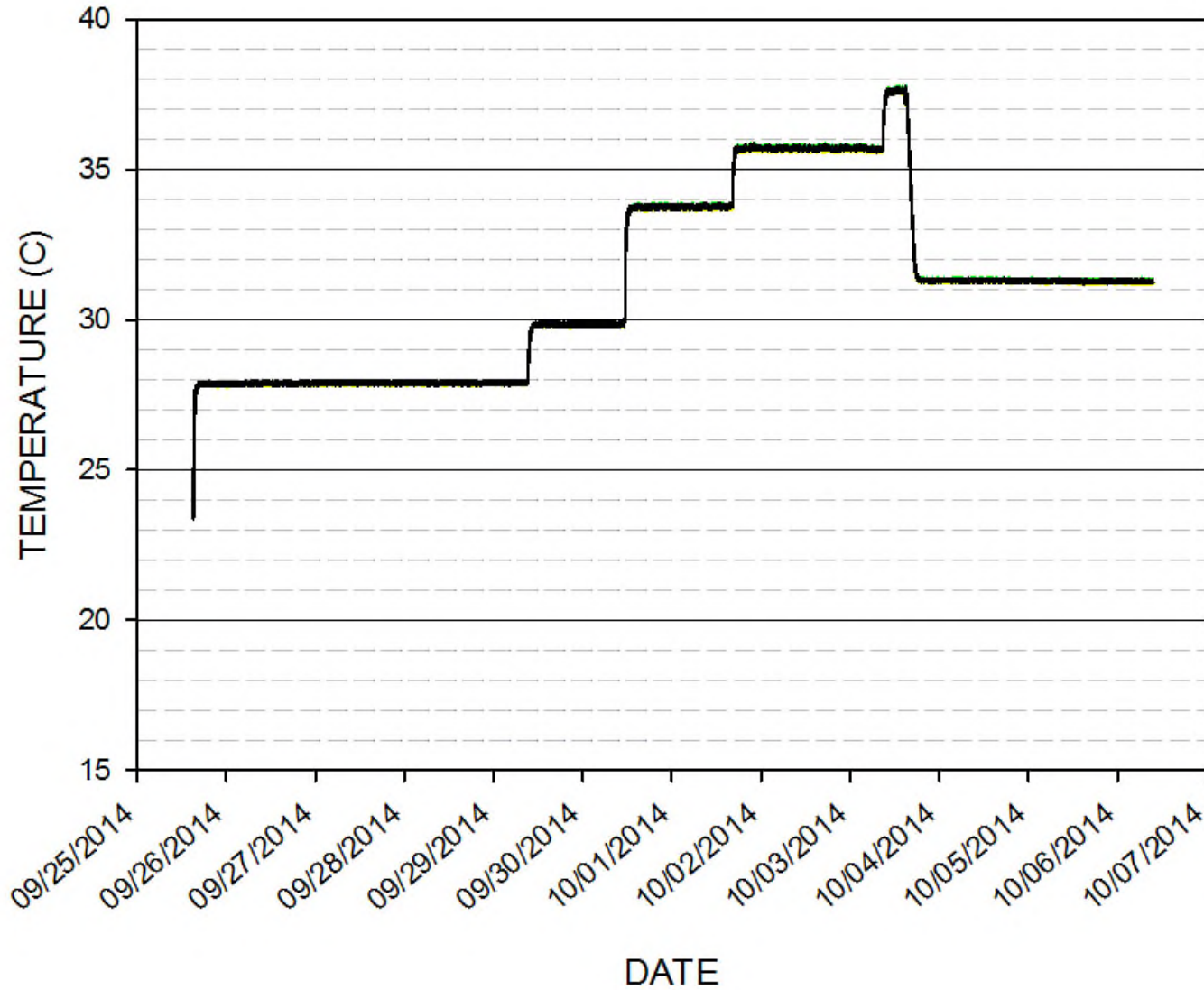
DAY AND TIME OF HATCHING 2010 - 2014



DAY AND TIME OF HATCHING 2010 - 2015



THERMISTER CALIBRATION



WILD NEST TEMPERATURE RESULTS

- 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

- ❑ Hamlin, H. J., R. H. Lowers, L. C. Albergotti, M. W. McCoy, J. Mutz, and L. J. Guillette.. Environmental Influence on Yolk Steroids in American Alligators (*Alligator mississippiensis*). *Biology of Reproduction*. 2010, 83:736-741.
- ❑ Boggs, A. S. P., H. J. Hamlin, R. H. Lowers, and L. J. Guillette Jr.. Seasonal variation in plasma thyroid hormone concentrations in coastal versus inland populations of juvenile American alligators (*Alligator mississippiensis*): Influence of plasma iodide concentrations. *General and Comparative Endocrinology*. 2011, 174:362-369.
- ❑ Hamlin, H. J., R. H. Lowers, and L. J. Guillette. Seasonal Androgen Cycles in Adult Male American Alligators (*Alligator mississippiensis*) from a Barrier Island Population. *Biology of Reproduction*. 2011, 85:1108-1113.
- ❑ Bowden, J. A. , B.A. Nocito, R H. Lowers, L J. Guillette, Jr., K R. Williams and V.Y. Young,. Environmental indicators of metal pollution and emission: an experiment for the Instrumental Analysis Laboratory. *J. Chem. .Educ.* 2012, 89 (8), 1057–1060
- ❑ Watanabe Y.Y., Reyier E.A., Lowers R.H., Imhoff J.H., Papastamatiou Y.P., Behavior of American alligators monitored by multi-sensor data loggers. *Aquatic Biology*. 2013, Vol. 18: 1–8,
- ❑ Boggs, A.S.P., Lowers R.H., Cloy-McCoy J.A., Guillette L.J.Jr., Organizational Changes to Thyroid Regulation in *Alligator mississippiensis*: Evidence for Predictive Adaptive Responses. *Plos One* 8, (2013) 1-9
- ❑ Nifong J. H, Nifong R.L., Silliman B.R., Lowers R.H.,Guillette L.G. Jr.,Jake M. Ferguson¹, Matthew Welsh⁵, Kyler Abernathy⁶, Greg Marshall⁶Animal-Borne Imaging Reveals Novel Insights into the foraging Behaviors and Diel Activity of a Large-Bodied apex Predator, the American Alligator (*Alligator mississippiensis*).*PLOS ONE* January 2014.,9 ;1

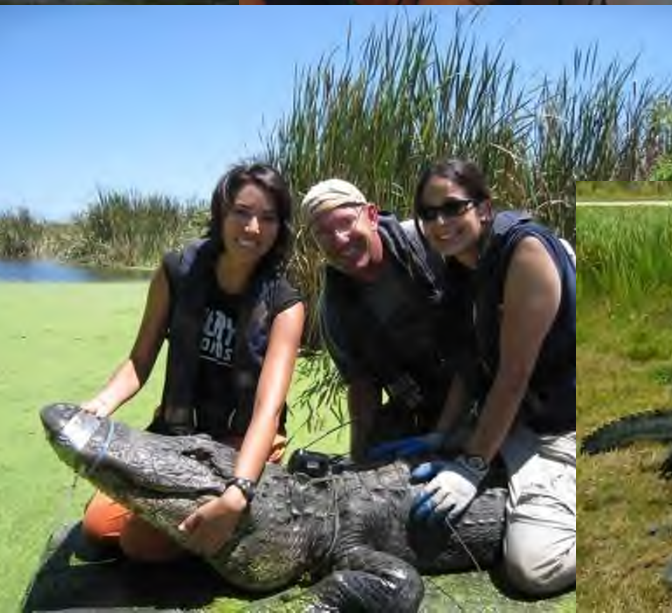
- ❑ Heather J Hamlin^{1,2,*}, Russell H Lowers^{3,*}, Satomi Kohno^{1,10}, Naoko Mitsui-Watanabe⁴, Haruna Amano^{5,6}, Akihiko Hara⁵, Yasuhiko Ohta⁷, Shinichi Miyagawa^{8,9}, Taisen Iguchi^{8,9} and Louis J Guillette Jr . 2014 The reproductive hormone cycle of adult female American alligators from a barrier island population. *Reproduction* (2014) 147 855–863
- ❑ Myburgh, J.G., Kirberger, R.M., Steyl, J.C.A., Soley, J.T., Boyse, D.G., Huchzermeyer, F.W. *et al.*, The post-occipital spinal venous sinus of the Nile crocodile (*Crocodylus niloticus*): Its anatomy and use for blood sample collection and intravenous infusions, *Journal of the South African Veterinary Association* 2014 85(1), Art. #965, 10 pages.
- ❑ Sawako Horai, Takaaki Itai, Takako Noguchi, Yusuke Yasuda, Haruki Adachi, Yuika Hyobu, Adi S. Riyadi, Ashley S.P. Boggs, Russell Lowers, Louis J. Guillette Jr., Shinsuke Tanabe, Concentrations of trace elements in American alligators(*Alligator mississippiensis*) from Florida, USA *Chemosphere* 108 (2014) 159–167



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- **Center for Marine Environmental Studies (CMES) Japan**
- **Stellenbosch University: Hannes Van Wyk**





ANY QUESTIONS?

