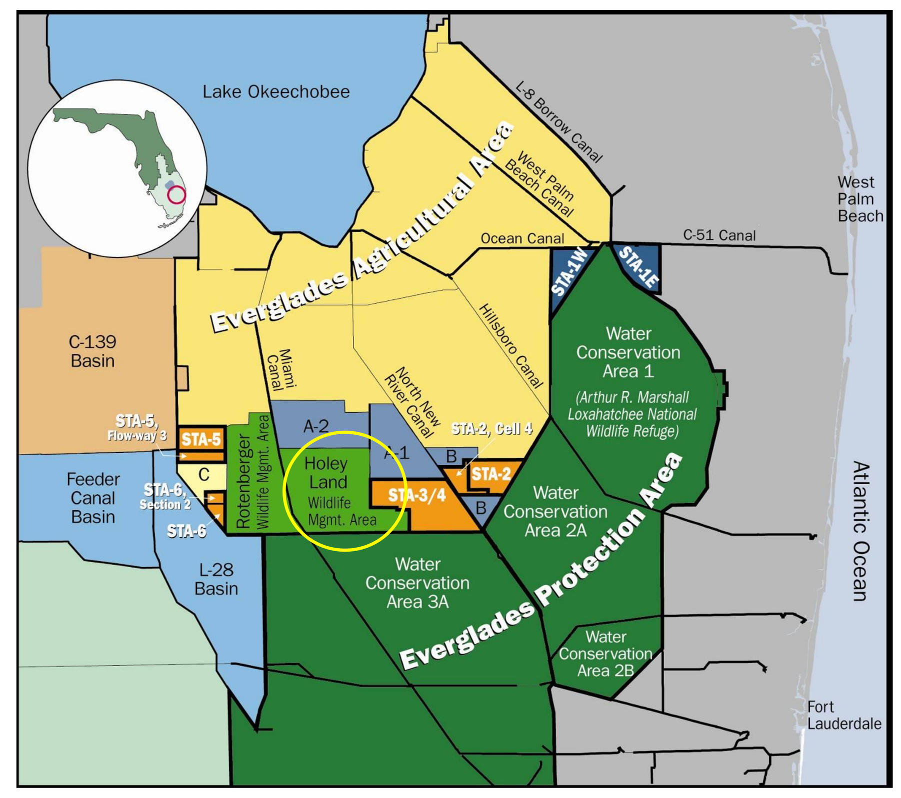
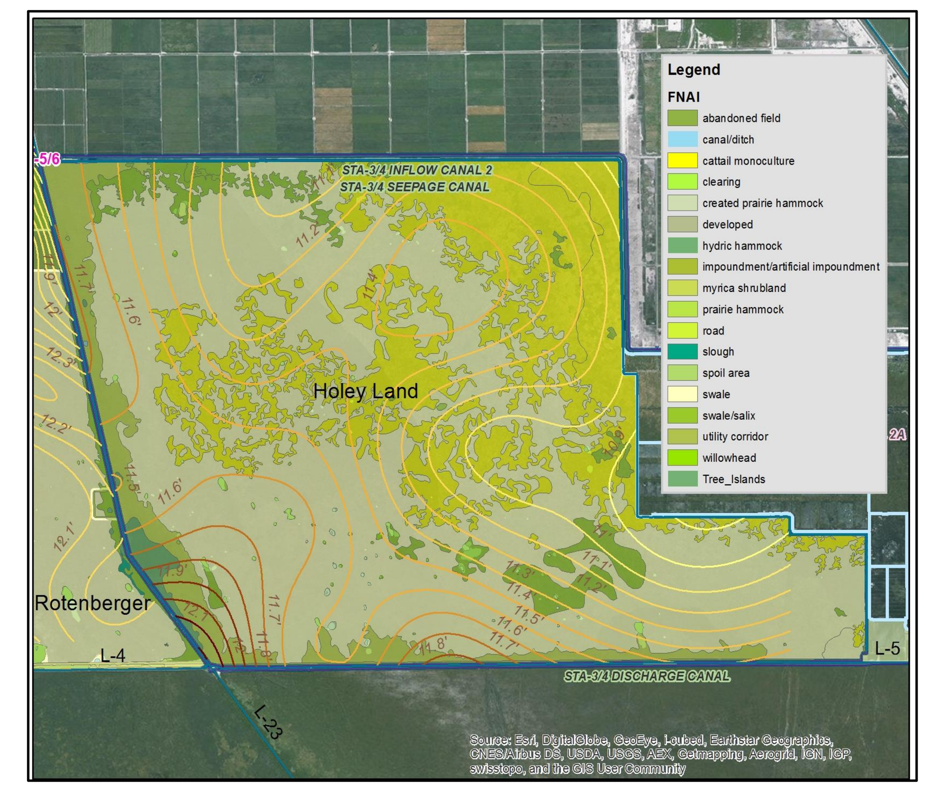
Assessing Impacts of an Active Water Schedule on Vegetation and Mammal Communities in Holey Land Wildlife Management Area

Sergio C. Gonzalez - sergio.gonzalez@myfwc.com
Florida Fish & Wildlife Conservation Commission; Holey Land and Rotenberger WMAs

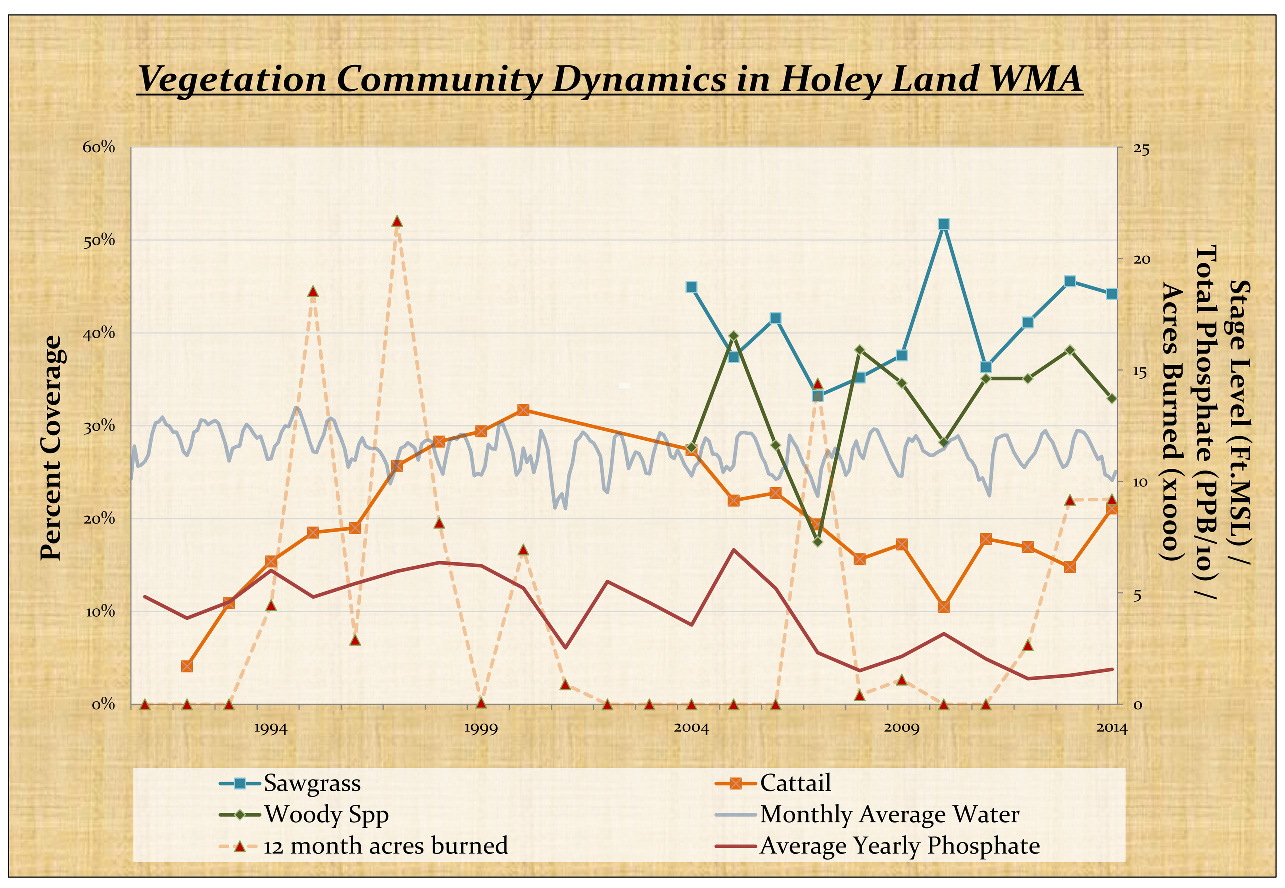
Introduction: The 35,350 acres of land that is Holey Land Wildlife Management Area (WMA) has been managed by the Florida Fish and Wildlife Conservation Commission since 1968. Water management is coordinated with the South Florida Water Management District. As part of the restoration of the area, a pump station (G200A) in the northwest corner of Holey Land WMA began delivering water from the Miami Canal in 1991. In 2005, Hurricane Wilma damaged the G200A pump to where it was mostly non-functional until repairs were made in September 2014. These events provide a unique opportunity to examine the impacts of water management activities on both the vegetation and wildlife communities in the Holey Land WMA.

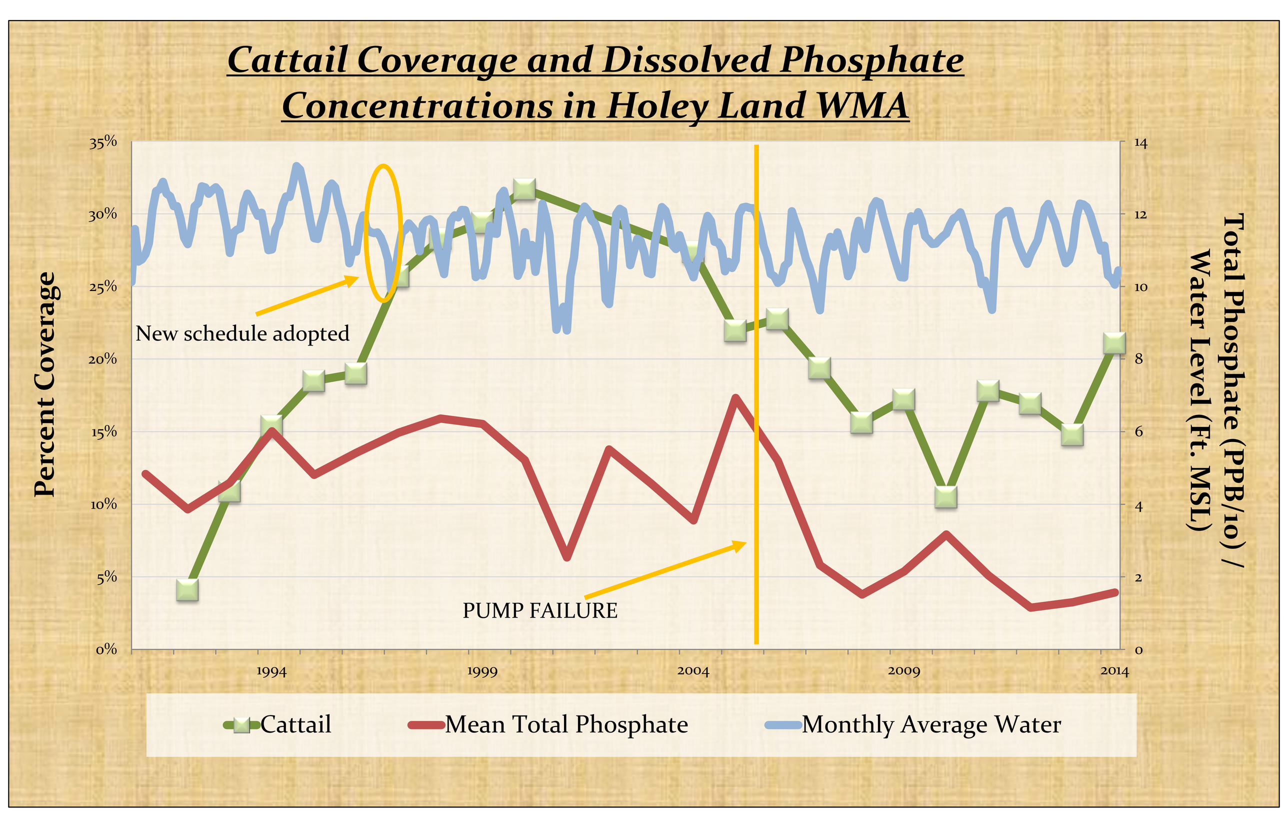




Changes in Vegetation

Data from aerial vegetation surveys were compiled and combined with records of all known prescribed and wildfire events in the area. Stage level and water quality data were obtained from the South Florida Water Management District (SFWMD) DBHYDRO online database. A linear regression analysis was conducted to identify drivers of changes in cattail coverage. Model parameters that were explored included acreage burned in the 12 months preceding the surveys; mean, min, and max monthly average stage level; and yearly mean total phosphate levels (mg/L) measured on the outflow side (HLWMA side) of the G200A. Stepwise regressions were conducted to select variables for three models predicting percent cattail coverage, yearly change in percent cattail, and percent sawgrass coverage.





Results:

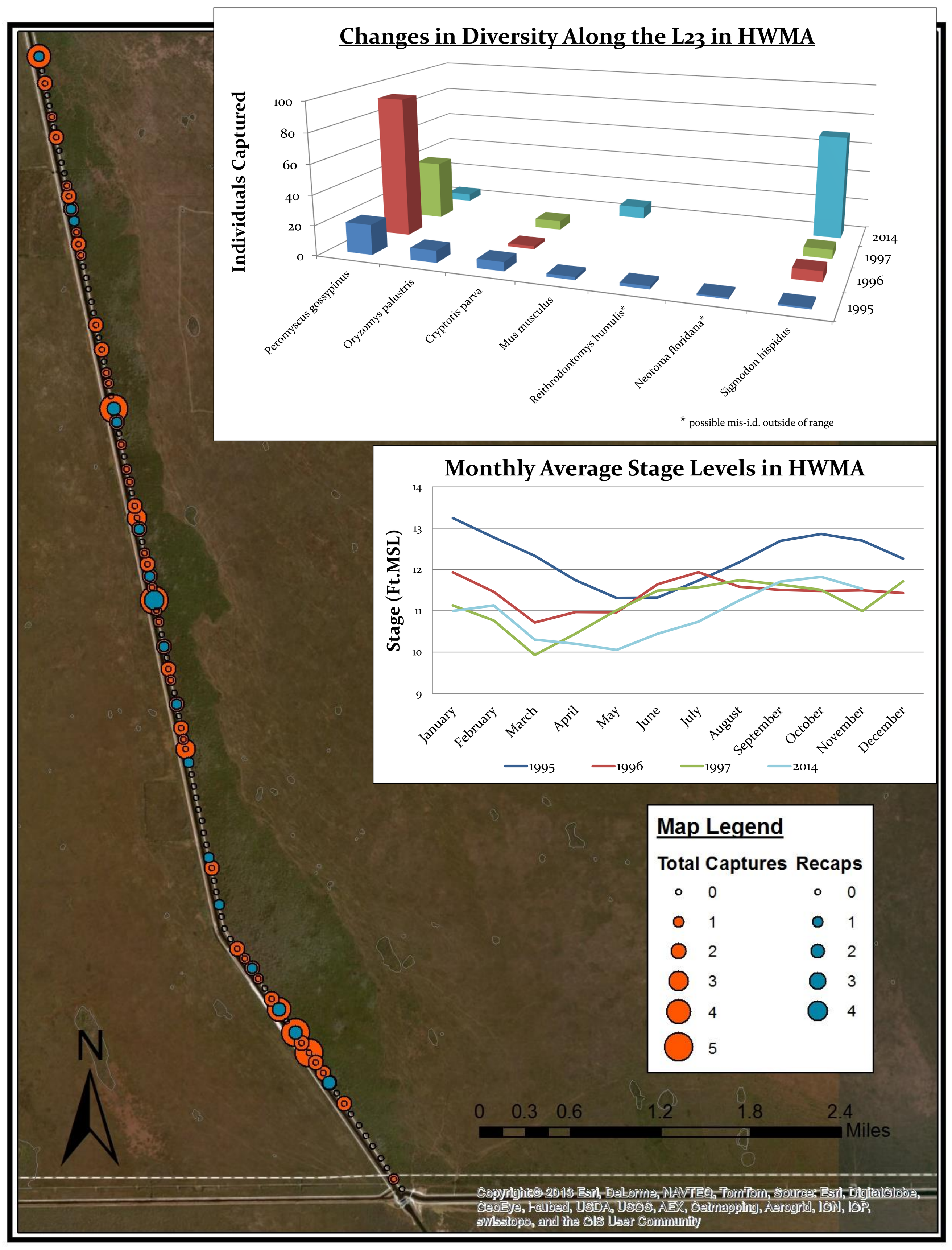
Predictors of cattail coverage:
An optimized linear model included only minimum monthly average stage level and yearly mean total phosphate concentrations. Both factors were significant predictors of percent cattail coverage. An increase in minimum average monthly stage level resulted in a decrease in cattail coverage (β =-0.07717; SE=0.02223; p<0.01). The total phosphate concentration parameter had a relatively stronger positive effect on percent cattail coverage (β=2.30703; SE=0.6495; p<0.01).

Change in percent cattail was predicted by minimum monthly average stage level (β=-0.06122; SE=0.02482; p<0.05) and mean monthly average stage level (β=0.10544; SE=0.03454; p<0.01).

Predictors of sawgrass coverage:
Parameters included in an optimized model were maximum and mean monthly average stage level and 12-month total acres burned. Only mean monthly average stage level was a significant predictor of sawgrass abundance (β=2.733e-01; SE=6.609e-02; p<0.01). It is unclear whether the negative effect of extreme high water is direct or indirect (via possible increases in cattail).

Small Mammal Community

The L-23 levee of Holey Lands WMA was surveyed for small mammals between October 19 and October 29, 2014. One hundred aluminum Sherman traps were set along the eastern base of the levee at 400 foot intervals along the entire length of the levee for ten nights. Animals were identified to species, sexed, and weighed. Prior to release, newly caught individuals were marked on their underside with a red permanent marker. Relative abundance indices were calculated for each species captured. Data were then compared to surveys conducted between 1995 and 1997.



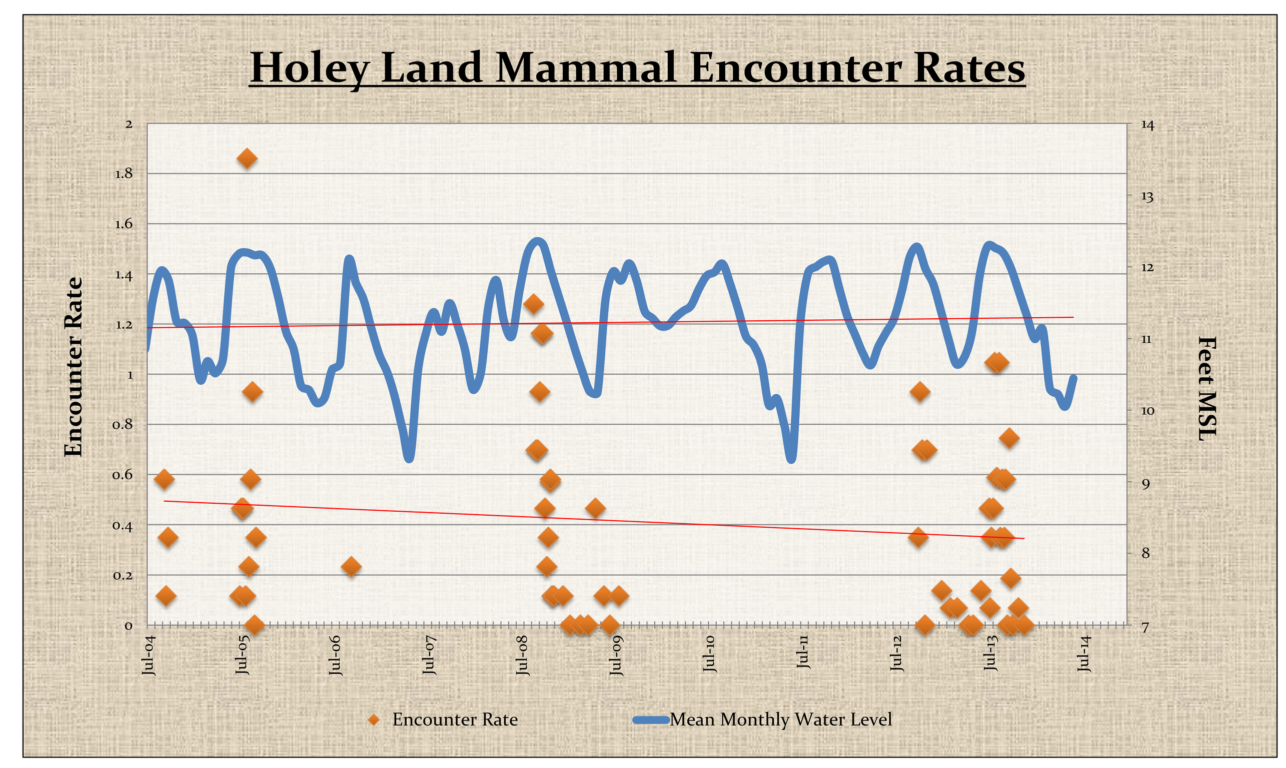
Results:

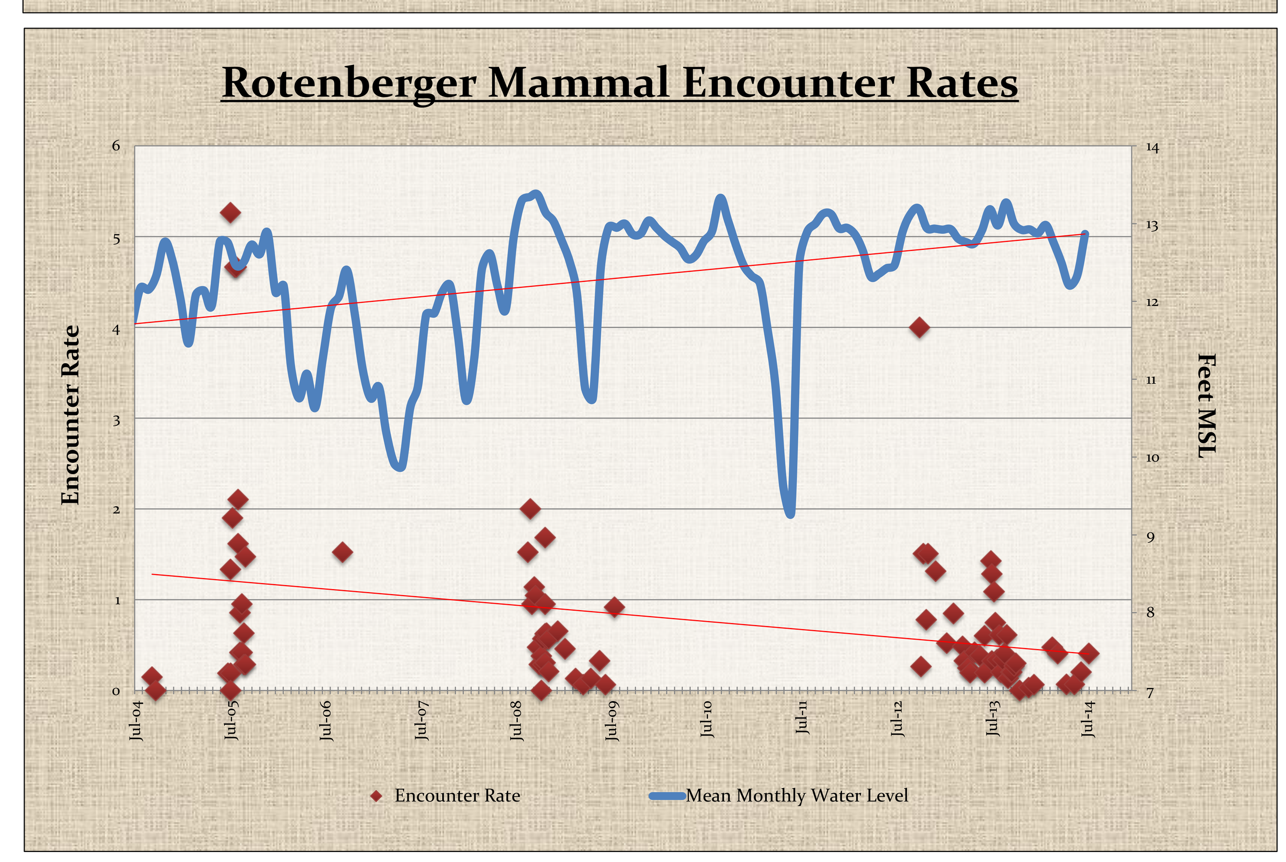
- Significant decline in species richness and evenness along the L-23
- Highest diversity sampled in 1995 accompanied by high species evenness can be explained by extreme high water forcing species to high ground on the levee.
- Decline in diversity and evenness observed in 1996 can be attributed to less extreme wet conditions disproportionately driving *P.gossypinus* towards higher ground.
- Low capture success in 1997 may have been due to dispersed mammal populations under drier conditions.
- Change in results between 1990's and 2014 is not explained by water levels.

The differences observed between the 90's and 2014 are likely caused by a combination of changes in hydrology since the pump failure of 2005, associated changes in vegetation, and resulting changes in spatial distribution of resident species. Future sampling of new areas should be considered in order to test this hypothesis.

Mammal Encounter Rates

Small and meso-mammal encounter rates (individuals/miles surveyed) were calculated for the perimeter levees of Holey Land and adjacent Rotenberger WMA's by compiling opportunistic observations from deer spotlight surveys going back to 2004. These data were supplemented with mammal observations from other levee herpetofaunal surveys from 2013. Mammal observations included in the analysis were of raccoon, opossum, armadillo, fox, rabbit, bobcat, hogs, rodents and otter. A linear regression analysis was used to determine if changes in mammal encounter rates could be detected over time, while controlling for fluctuations in water level which strongly drives encounter rates.





Results:
Simple Linear Model: **R=βtT+βwW,** where R is encounter rate, T is time in number of days from the start of the data set, and W is mean daily water level for each survey. For all models generated, the effect of water level on encounter rate was relatively strong, positive, and significant.

Holey Land – Analysis of the full dataset did not show a significant effect of time on encounter rate. However, a model fitted to the post pump-failure data (2008-2014) did show a significant negative effect of time on mammal encounter rates (βt=-1.030e-04; SE=5.408e-05; p<0.05).

Rotenberger – There is a significant negative relationship between time and encounter rate (βt=-2.352e-04; SE=8.463e-05; p<0.01).

The results suggest that mammal abundance in both areas has declined over time. This is supported by a similar decrease in the deer population in RWMA, attributed to higher water and a reduction of available high ground. The drier hydrology in HWMA after the G200A pump failure appears to have temporarily boosted mammal populations. A similar boost was observed in deer population estimates. The cause of the current declining trend in mammal abundance in HWMA is unknown.

Establishing a baseline encounter rate for mammals along the levees in these areas is important in light of the recent confirmation of the presence of Burmese pythons, which have had devastating effects on small mammal populations farther south.

Conclusions: The operation of the G200A resulted in dramatic changes in Holey Land's vegetation structure. Not only was hydroperiod affected, but the inflow of nutrient contaminated water promoted the explosion of cattail in the area. During the nineties when an active water schedule prolonged yearly hydroperiods, small mammal populations were likely concentrated closer to the L23 where elevation is highest. Despite declining trends in mammal encounter rates in both Holey Land and Rotenberger WMAs, the conditions resulting from the G200A pump failure may have slowed that trend in Holey Land WMA.