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Influence of Recreation on Water Quality in the San Marcos River

Rachel Byrne*, and George Guillen

University of Houston-Clear Lake, School of Science and Computer Engineering, Houston Texas 77058
Environmental Institute of Houston, University of Houston-Clear Lake, Houston Texas 77058

Background

In 2012 the Edwards Aquifer Authority & its partners issued a Habitat Conservation Plan for the aquatic ecosystems of San Marcos Springs, Comal Springs & the Edwards Aquifer. Eight species listed as threatened or endangered occur in these regions, including Texas Wild Rice (TWR, *Zizania texana*), an aquatic plant that inhabits only the upper portion of the San Marcos River. TWR was described to be abundant prior to anthropogenic alterations & loss of riparian habitat, with abundance reaching an all time low in the mid-1980s. Since then, conservation efforts have encouraged regrowth of TWR. Instream recreation is popular along the upper portions of the river but may negatively affect water quality by increasing turbidity & total suspended solids (TSS). Increased turbidity & TSS can adversely affect TWR by impeding photosynthesis. Here, we present preliminary data on the effect of recreation on turbidity in the upper San Marcos River and discuss further research on the implications of this data.

Study Area & Methods

- Sites along upper portion of San Marcos River (Figure 1)
  - Recreation common & TWR most abundant
- Game cameras & in-situ sondes deployed at 3 sites
  - Measure recreational activity & turbidity (Figures 1-3).
  - Monitoring occurred from July 2013 to July 2014
- Pearson correlation between Turbidity and Recreation was run using R (version 3.2.1) with 95% CI, α=0.05.

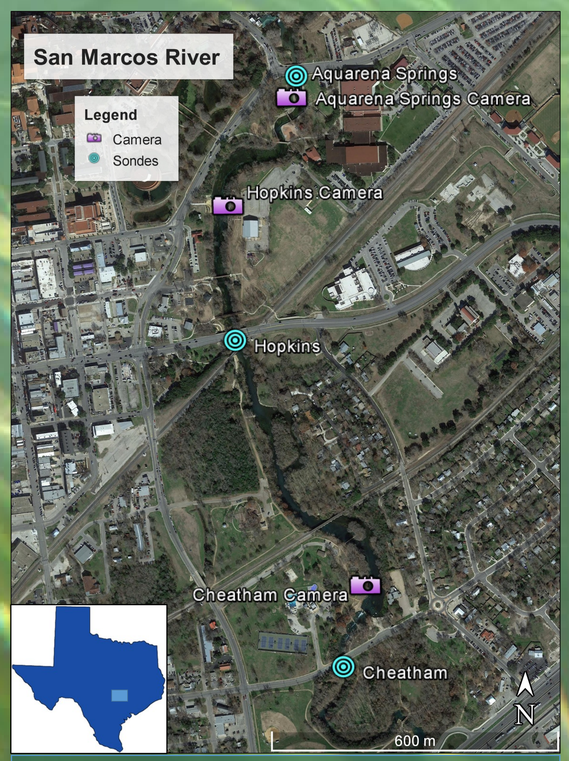

Figure 1. Upper San Marcos River site locations

Figure 2. Sonde

Figure 3. Game camera

Results

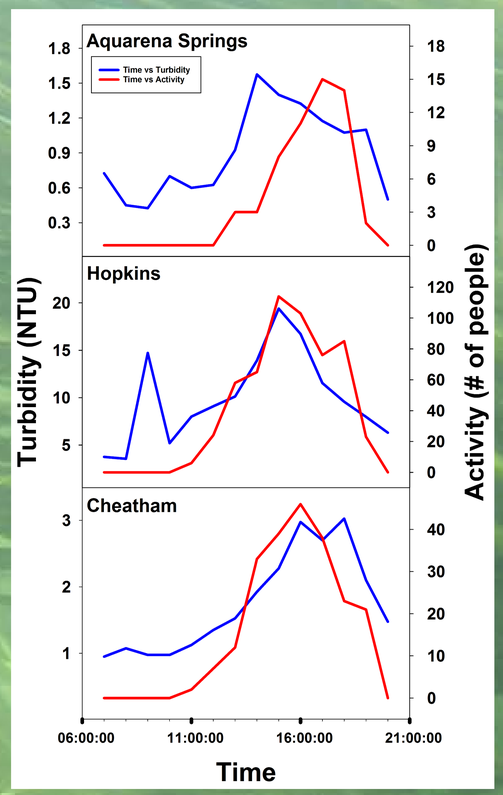

Figure 4. Time series of turbidity vs. recreation. High recreation - August 31, 2013 (Labor Day)

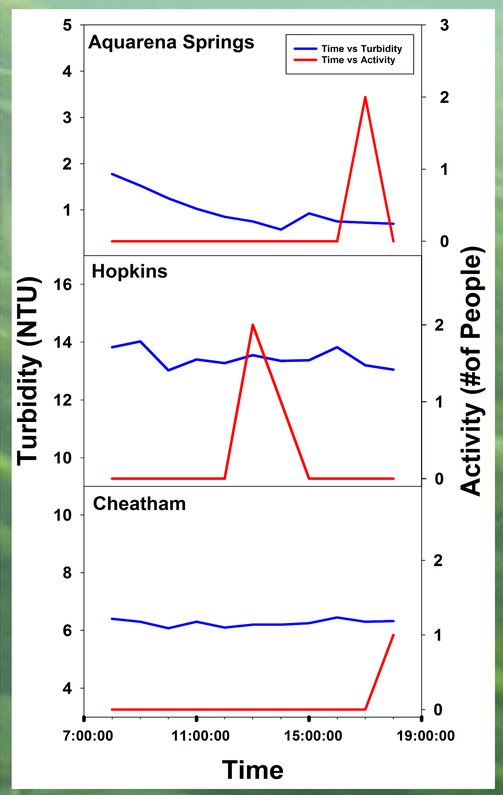

Figure 5. Time series of turbidity vs. recreation. Low recreation - October 28, 2013

Table 1. Correlation Coefficients for each study site by recreation level. * = Significance (α-0.05)

Site	High Recreation	Low Recreation
Aquarena Springs	0.647953 *	-0.2287
Hopkins	0.766468 *	0.053633
Cheatham	0.883545 *	0.17734

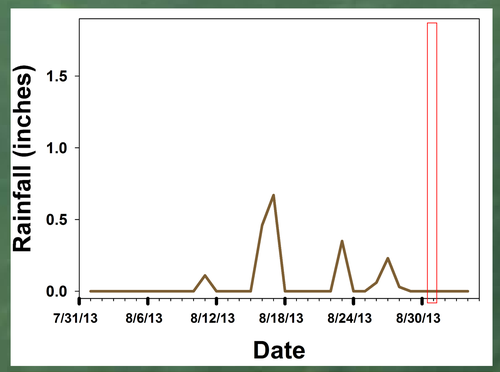

Figure 6. Precipitation for August, 2013

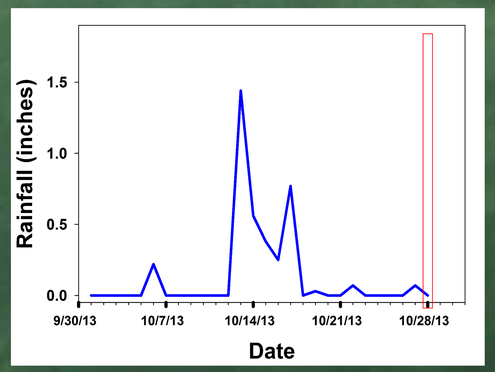

Figure 7. Precipitation for October, 2013

Results

- During high recreation we measured a correlated response in turbidity to number of people recreating (Figure 4 & 5).
- Though rain events occurred prior to dates presented, our data suggests there was sufficient time for the river to return to base flow conditions and not influence our results (Figures 6 & 7).
- We measured statistically significant positive correlation between turbidity and recreational activity at each site during the high recreation period (Aquarena Springs p-value: 0.0122, Hopkins p-value: 0.0014, Cheatham p-value: <2.789e-05).
- We did not observe any significant correlation between turbidity and recreation during the low recreational period at any site.

Conclusions

Our results suggest that recreational in-river activity decreases the clarity of the river water during the TWR growing season at critical periods of peak sunlight. We are currently examining various metrics of plant health to evaluate the potential impacts of this activity on TWR growth and survival.

Continued Analysis

Further analyses for this project include comparing the influence of recreation on spatial and temporal patterns of other factors such as nutrients, sedimentation rates, and periphyton growth as potential impacts that control the abundance and health of TWR. We also examined light attenuation with a photosynthetic active radiation (PAR) meter at sites along the river with turbidity gradients in order to establish a range of light intensities required by TWR.

Acknowledgments

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For further information

Please contact Byrne@uhcl.edu. For more information on this and related projects can be obtained at the EIH webpage:
http://www.uhcl.edu/portal/page/portal/EIH/

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