Report as of FY2006 for 2006SC30B: "A Statewide Biomarker Approach to Investigate Pollution Effects on fish in Wadeable Streams of South Carolina"

Publications

Project 2006SC30B has resulted in no reported publications as of FY2006.

Report Follows

Progress Report

June 2007

A statewide biomarker approach to investigate pollution effects on fish in wadeable streams of South Carolina.

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Executive summary

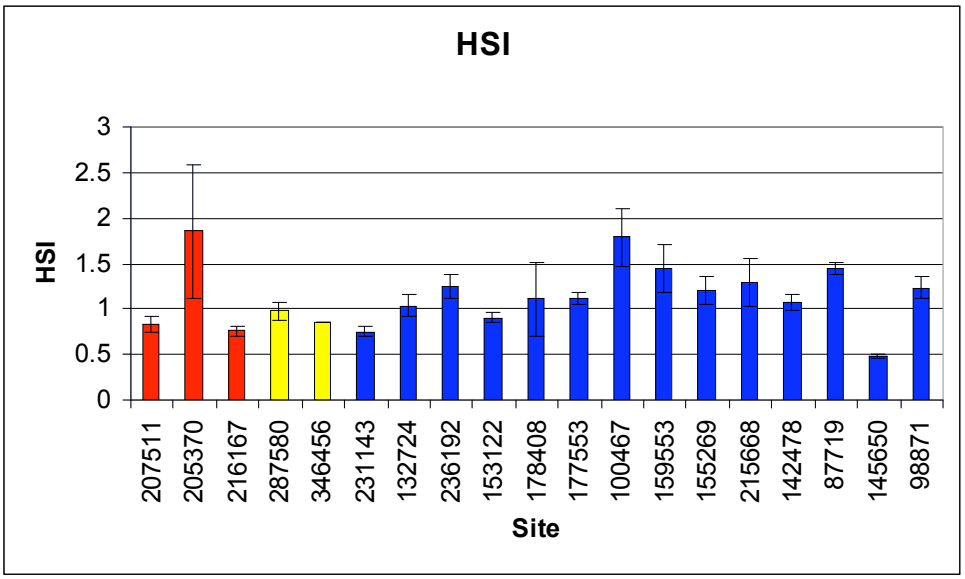
The numbers of freshwater species in South Carolina have been under pressure for many years. However, the threats that these organisms face from point and non-point source pollution is largely unknown. In May 2006 the South Carolina Department of Natural Resources (SCDNR) began a five year survey to establish the species richness and abundance of fish species in the wadeable streams of South Carolina. In addition to the fish population parameters, one of the goals of this study is to use molecular biomarkers of contaminant exposure to assess the health of fish populations in South Carolina's freshwater streams. Another objective of the project is to correlate the biomarker responses with fish population parameters and with land use data from the sampled watersheds.

During the first year of the study (2006), sunfish (*Lepomis* sp.) were sampled from May through September 2006 at randomly selected sites in three ecobasins in South Carolina (the Saluda Sandhills, the Savannah Sandhills, and the Pee Dee Atlantic Southern Loam Plains). Somatic indices, including hepatosomatic index (HSI), spleen somatic index (SSI), gonadosomatic index (GSI), and Fulton's condition factor (K) were measured to determine the overall physiological condition of the fish. Cytochrome p4501A induction (as measured by the EROD assay) and bile fluorescence were measured to estimate exposure to polycyclic aromatic hydrocarbons (PAHs). Glutathione-s-transferase (GST) was measured to estimate oxidative stress. Additionally, measurements of land use and fish assemblage structure were obtained by SCDNR.

The results indicate that the somatic indices (HSI, SSI, and GSI) were influenced by several factors, including sex, season, and probably by the presence of parasitic infections (Figures 1-4). Of the biomarkers, both EROD and GST were generally not induced beyond basal levels for the collected species (Figures 5, 6, 7). However, bile fluorescence was significantly elevated at specific sites within the Saluda Sandhills and Pee Dee Atlantic Southern Loam Plains, indicating transient exposure and metabolism to PAHs at these sites (Figure 8, 9,10). These ecobasins also had overall higher EROD activities, bile fluorescence, and HSIs than the Savannah Sandhills, again indicating that fish from these ecobasins are possibly exposed to higher levels of PAHs than specimens from the Savannah Sandhills.

Additionally, bile fluorescence and HSI were significantly correlated with the percentage of developed land and impervious surface cover within the watershed area at sites, indicating a possible link between PAH exposure and land use. This study provides a first estimate of the health of fish in specific ecobasins of South Carolina. As SCDNR's survey of wadeable streams continues for the next four years, a more complete assessment of the ecological health of the fish in South Carolina will be provided.

Figure 1. HSI by site and ecobasin. Red represents Saluda Sandhills. Yellow represents Savannah Sandhills. Blue represents PDALSP.



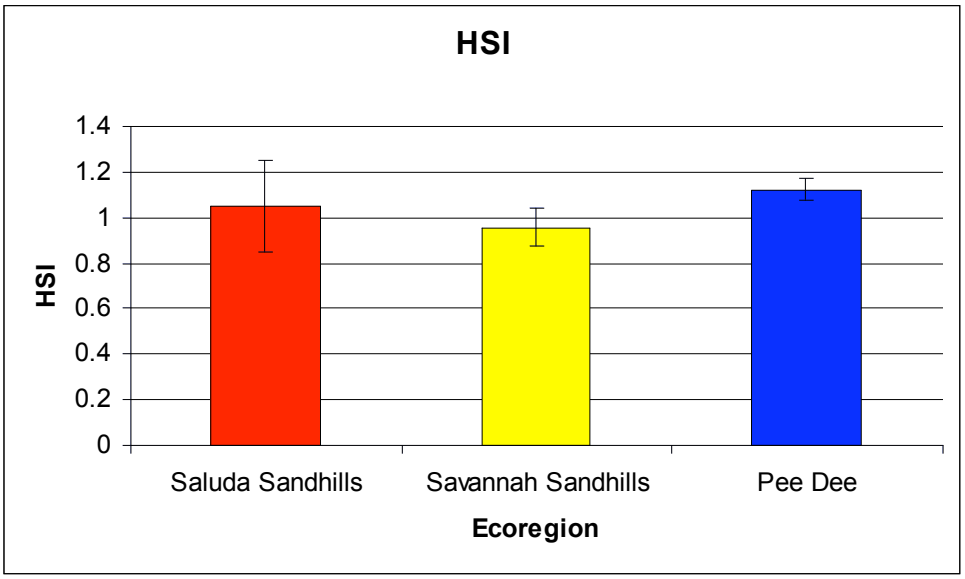
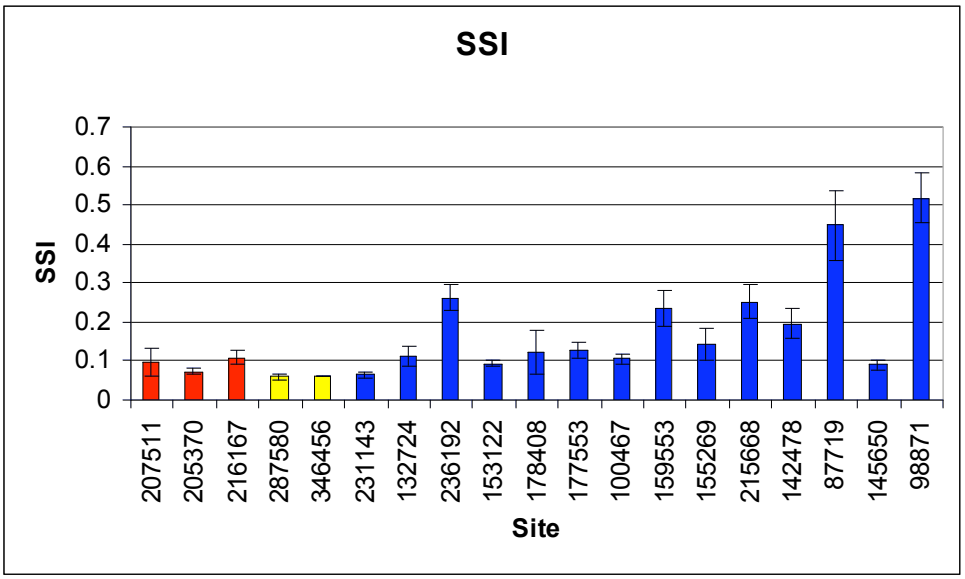


Figure 2. SSI by site and ecobasin. Red represents Saluda Sandhills. Yellow represents Savannah Sandhills. Blue represents PDALSP.



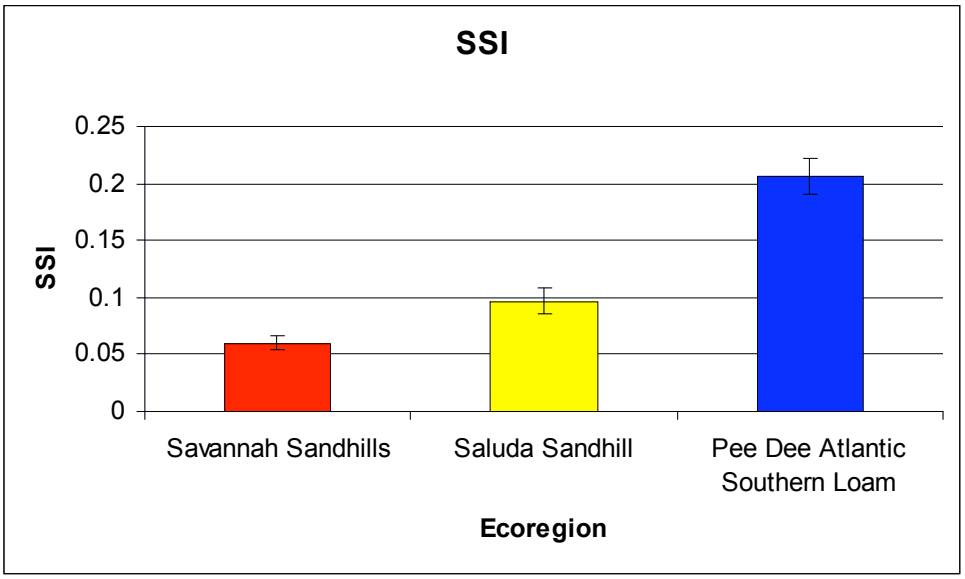
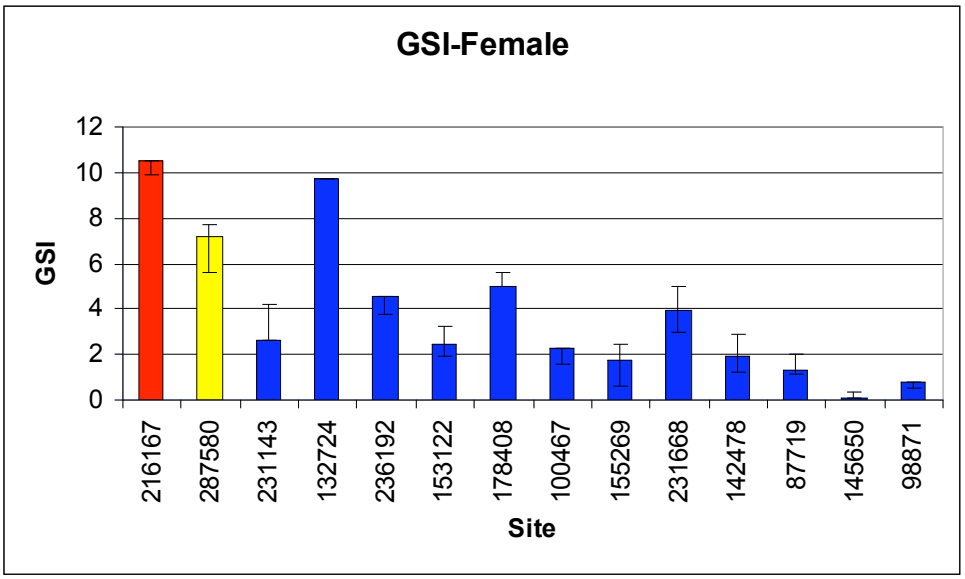


Figure 3. GSI female fish by site and ecobasin. Red represents Saluda Sandhills. Yellow represents Savannah Sandhills. Blue represents PDALSP.



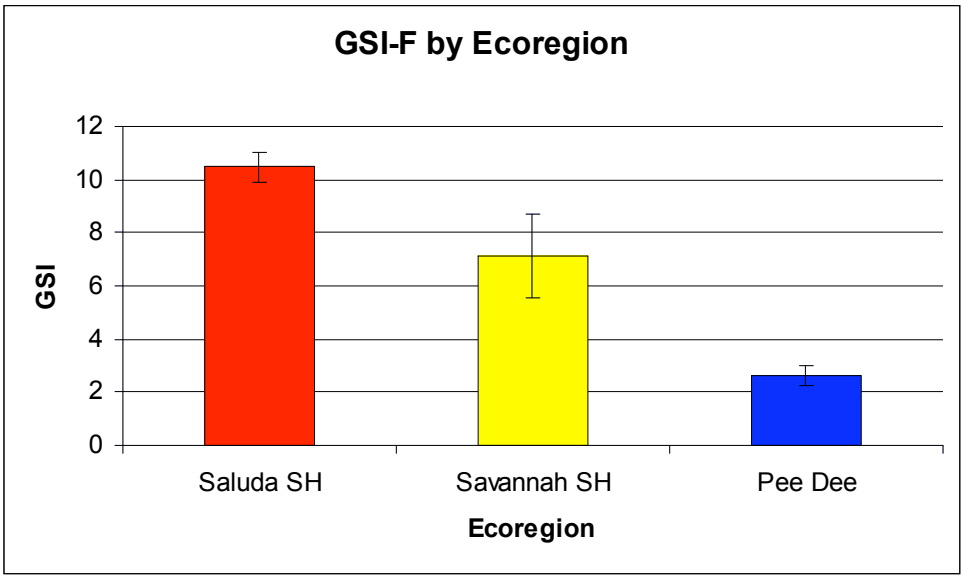
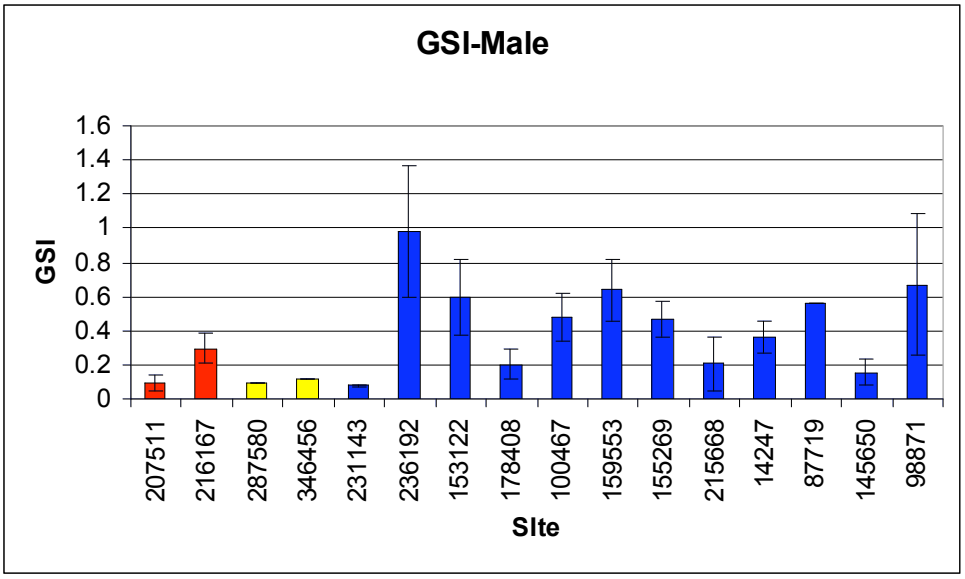


Figure 4. GSI male fish by site and ecobasin. Red represents Saluda Sandhills. Yellow represents Savannah Sandhills. Blue represents PDALSP.



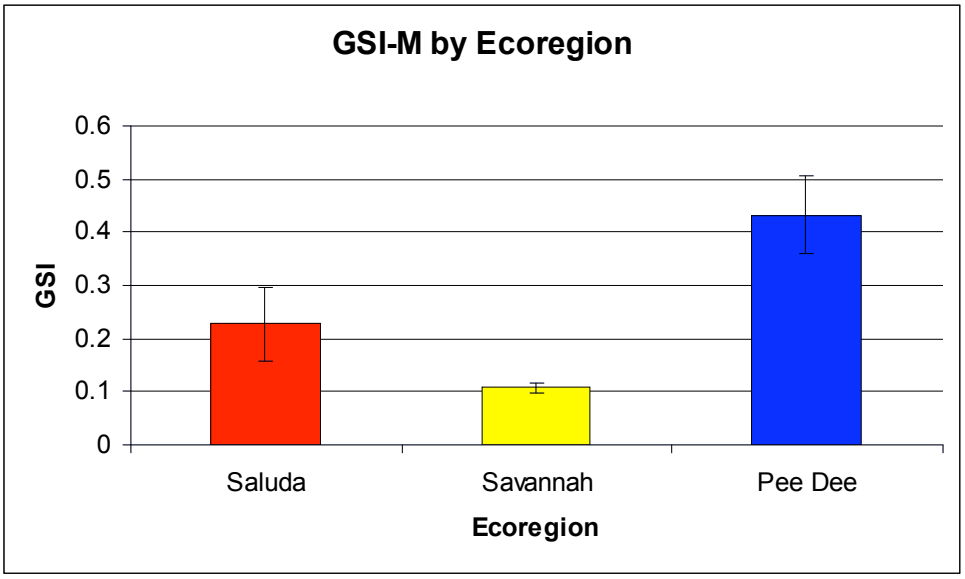
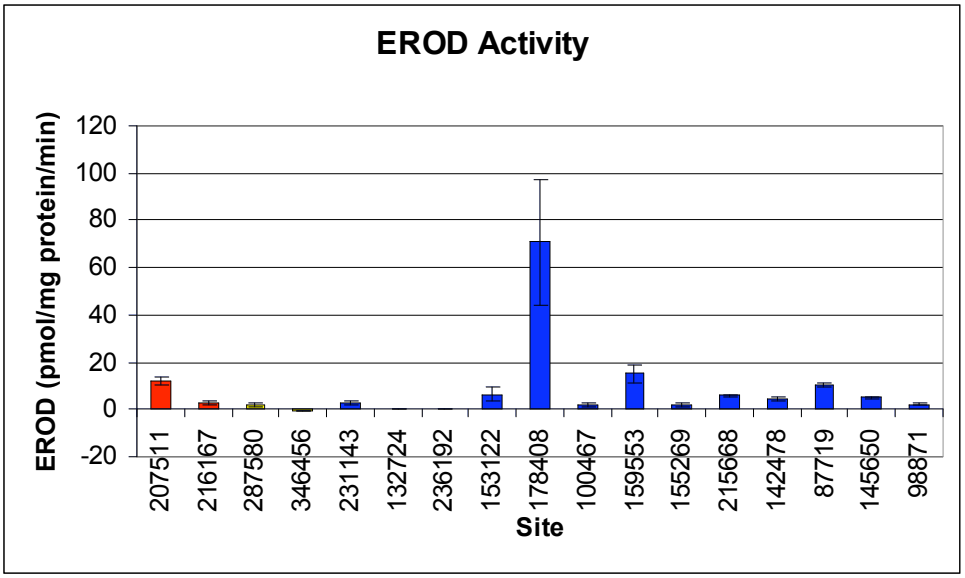


Figure 5. EROD activity by site and ecobasin. Red represents Saluda Sandhills. Yellow represents Savannah Sandhills. Blue represents PDALSP.



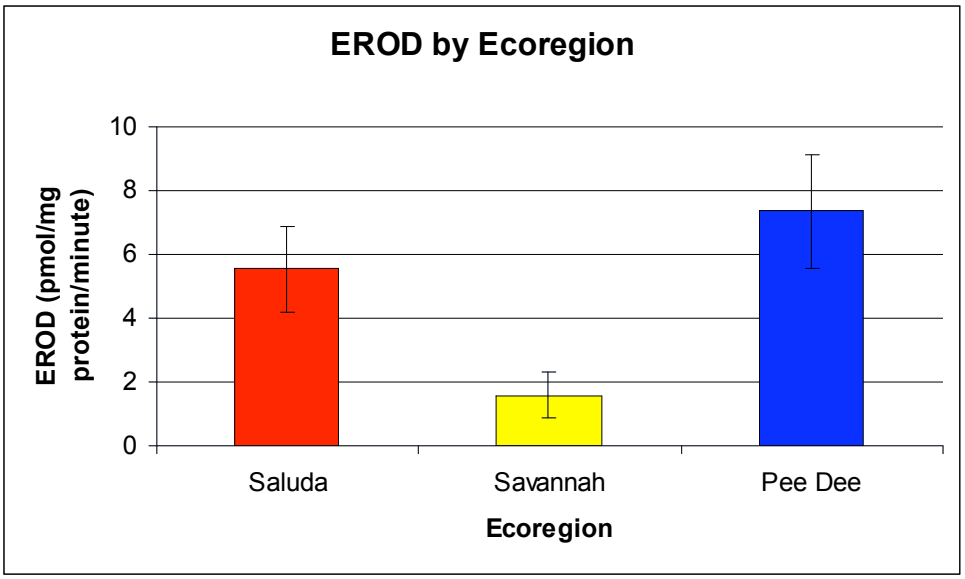
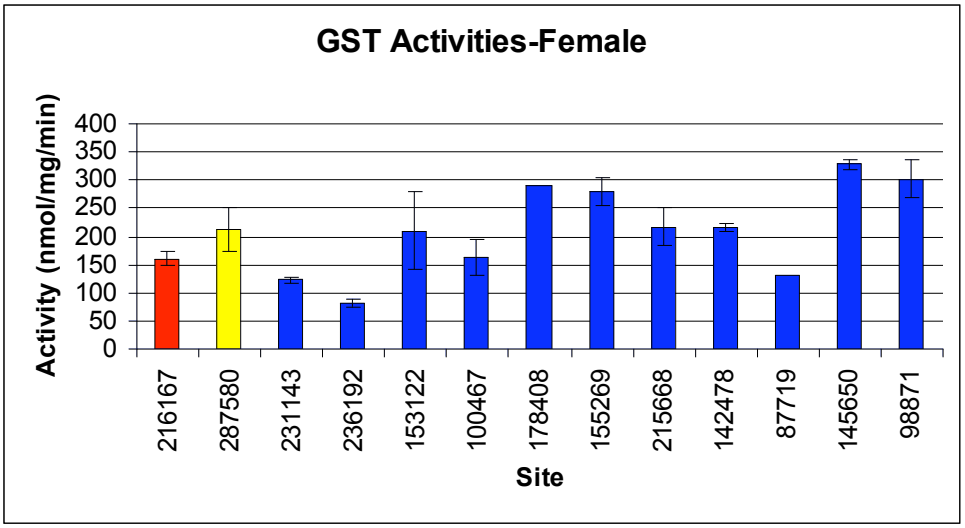


Figure 6. GST activities in female fish by site and ecobasin. Red represents Saluda Sandhills. Yellow represents Savannah Sandhills. Blue represents PDALSP.



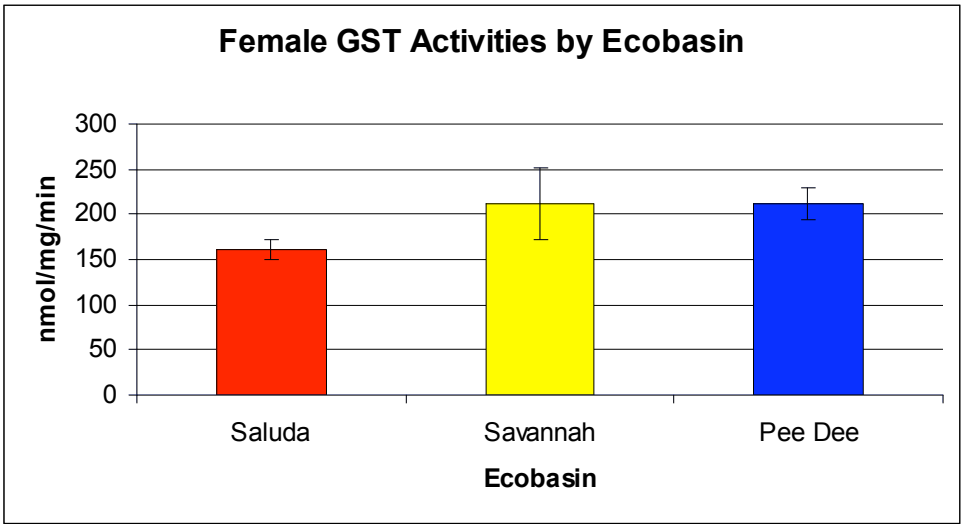
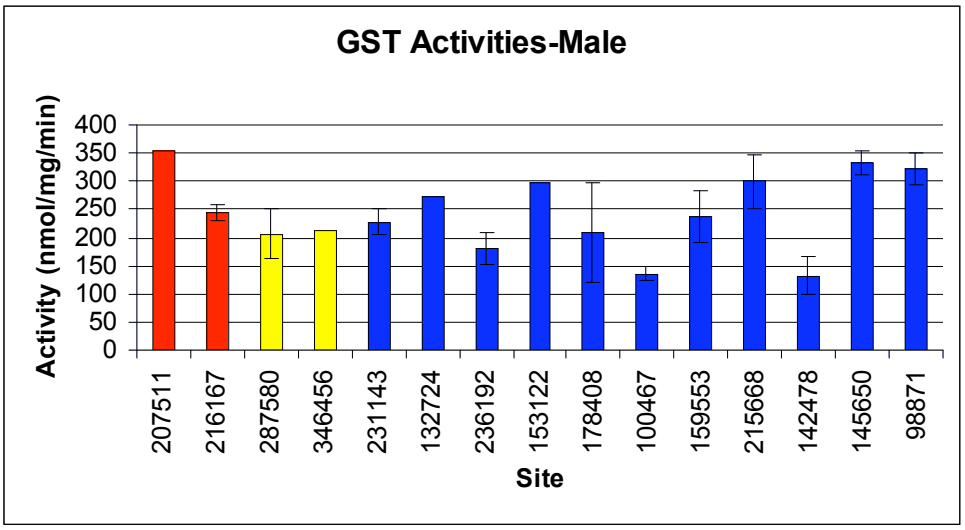


Figure 7. GST activities in male fish by site and ecobasin. Red represents Saluda Sandhills. Yellow represents Savannah Sandhills. Blue represents PDALSP.



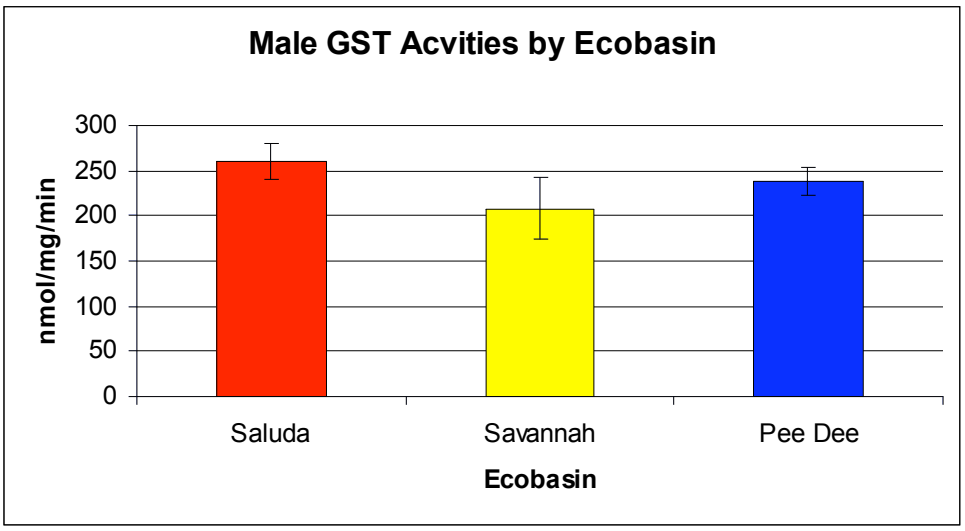
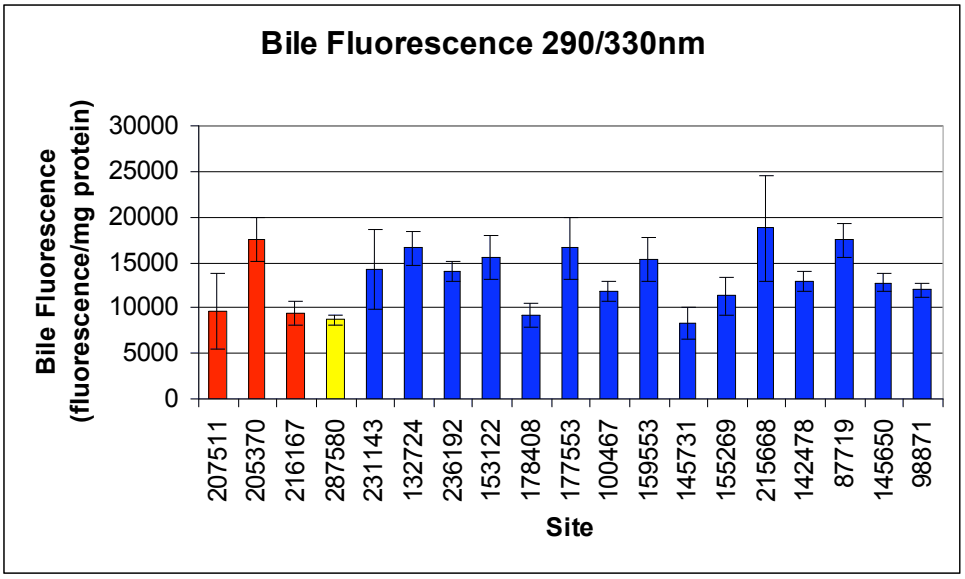


Figure 8. Bile Fluorescence at wavelength 290/330nm by site and ecobasin. Red represents Saluda Sandhills. Yellow represents Savannah Sandhills. Blue represents PDALSP.



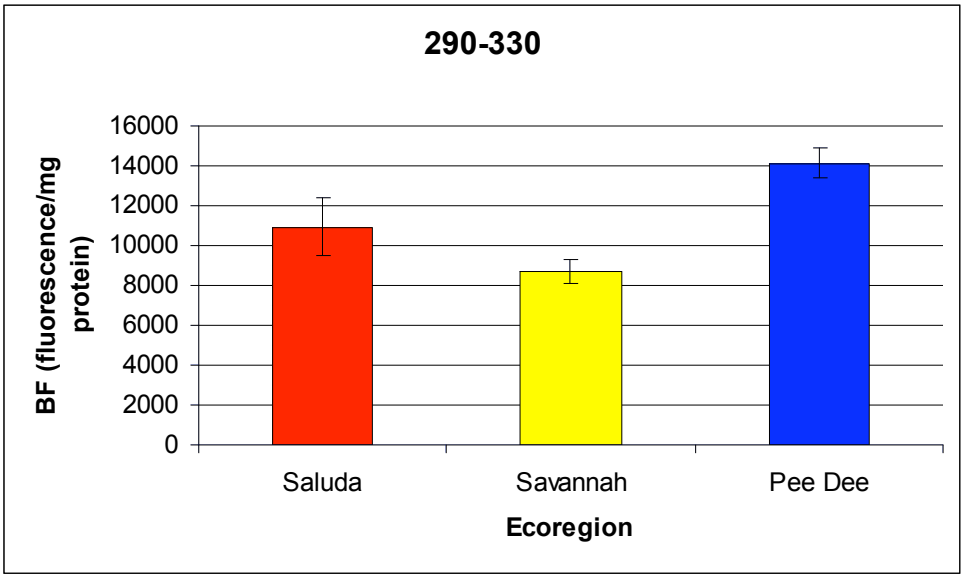
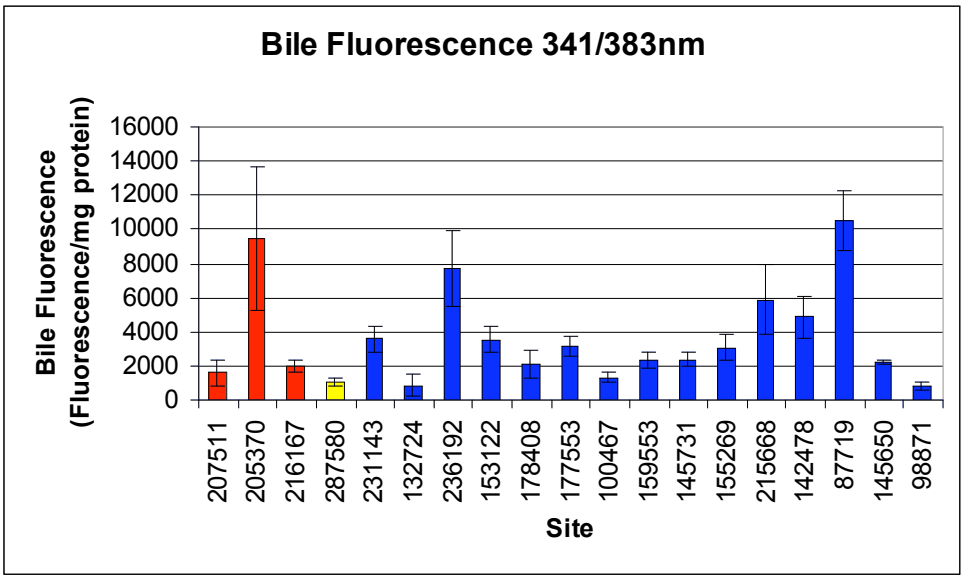


Figure 9. Bile Fluorescence at wavelength 341/381nm by site and ecobasin. Red represents Saluda Sandhills. Yellow represents Savannah Sandhills. Blue represents PDALSP.



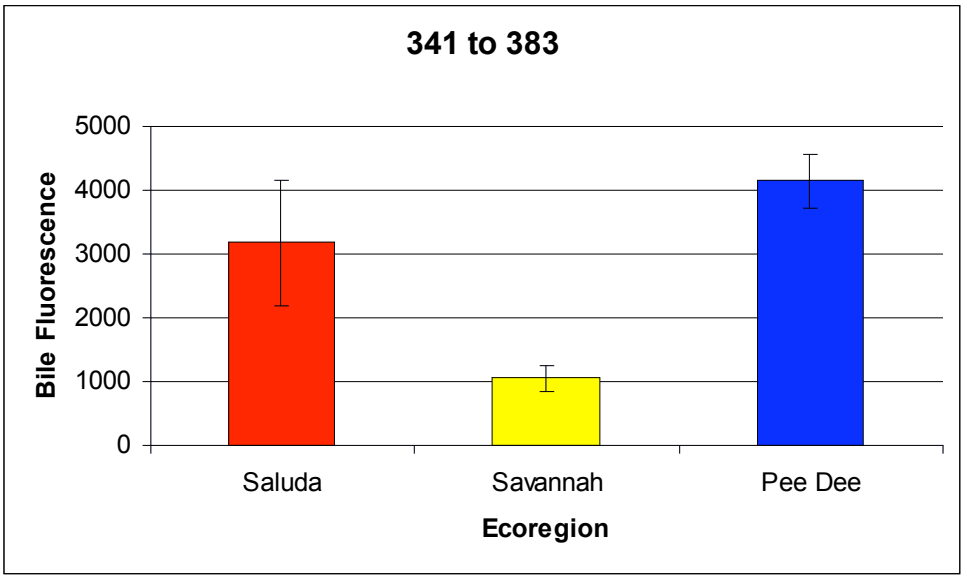


Figure 10. Bile Fluorescence at wavelength 380/430nm by site and ecobasin. Red represents Saluda Sandhills. Yellow represents Savannah Sandhills. Blue represents PDALSP.