Sapelo Island Freshwater Algae: A Taxonomic Survey and Evaluation of Pristine Habitats

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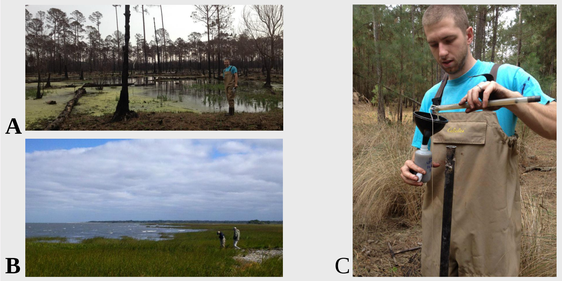
Introduction

Barrier islands in the Southeastern US are important reference sites due to their ecological isolation, low human impact and their dynamic hydrologic characteristics (Collins, Easley 1999, Herwitz, Wunderlin 1990). The freshwater environments found on barrier islands are confined by salt water generating site specific hydrology, aquatic ecology and speciation. The goals of the study were to conduct a preliminary taxonomic survey (dominant and subdominant genera) of the freshwater algae found on Sapelo Island, GA and to determine the major contributing source to the freshwater catchments found on the island.



Figs 1: Field work images, 2011-2012, Sapelo Is. GA

Study Site

Sapelo Island is a barrier island located roughly five miles off the coast of Meridian, GA. Sapelo Island is a Pleistocene (>40,000 YPB) island that was reshaped during the Holocene (5,000 YPB) oceanic regression (A Sapelo Island Handbook 1998). The top 4.6 meters of the island is mainly well sorted fine sands, which is under laid by a semi-confining silt and mud unit, generating a perched aquifer (Wilson *et al.*2011).

Bioassessment Methodology:

- Collection process followed EPA's *Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers*, chapter and section 6.1.1.2 protocol (Figs 1 A,B). Samples were assessed by placing 5 ml samples on microscope slides. The slides (3 or more replicates) were viewed under the light microscope on 400x and the present genera and species were identified using scientific literature.
- Taxa were designated as freshwater if the taxon appeared in the NAWQA list of 2007 (ANSP) for the last 20 years in rivers and lakes of the U.S. All other taxa were classified as marine unless they were originally described as brackish-water organisms.
- Pictures were taken using a Zeiss AxioCam® microscope camera and the accompanying Zeiss AxioVision® LE version 4.8.1 software.

Hydraulic analysis Methodology

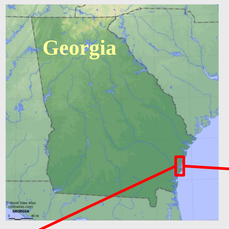
- Surface water was collected following the *Still Water Method* designated by USGS.
- 750 ml of rain was water collected in catch pans.
- Surface water was collected at all of the bioassessment locations. Dissolved oxygen, temperature and pH were recorded for each site using Extech Ex Stick® probes (figs 5 A,B).
- The ground water samples were taken from temporary wells by using a fence post driver (or augur depending on soil compaction) to insert a 1.52 m/3.05 m drive point piezometer into the ground, then purging the well, and bailing out 250 ml of water for analysis (figs 1C, fig 2, figs 5C.)
- Each sample was analyzed for specific conductance using Extech Ex Stick® probes and chloride (Cl^-) using the Low Range Chloride Hach Kit (silver nitrate titration method). These parameters functioned as source signatures for the water, which allowed tracing of the potential surface water inputs.

Algal Community Composition

- Based on the algae found at each site, 65.5% of the twenty nine samples were dominated by freshwater algae.
- Algae from four groups were recorded from the samples: Bacillariophyceae (Diatoms), Dinophyceae (Dinoflagellates), Euglenophyta (Euglenoids), and Chlorophyceae (Green aglae).
- Freshwater samples were dominated by representatives of the diatom genera *Fragilaria* and subdominated by genera such as, *Melosira*, *Navicula*, *Pinnularia*, *Euglena*, *Spyrogira*, *Cladophora*, *Gleocystis*, *Trachelemonas* and *Nitzschia*.

Fig 2: Field collection image

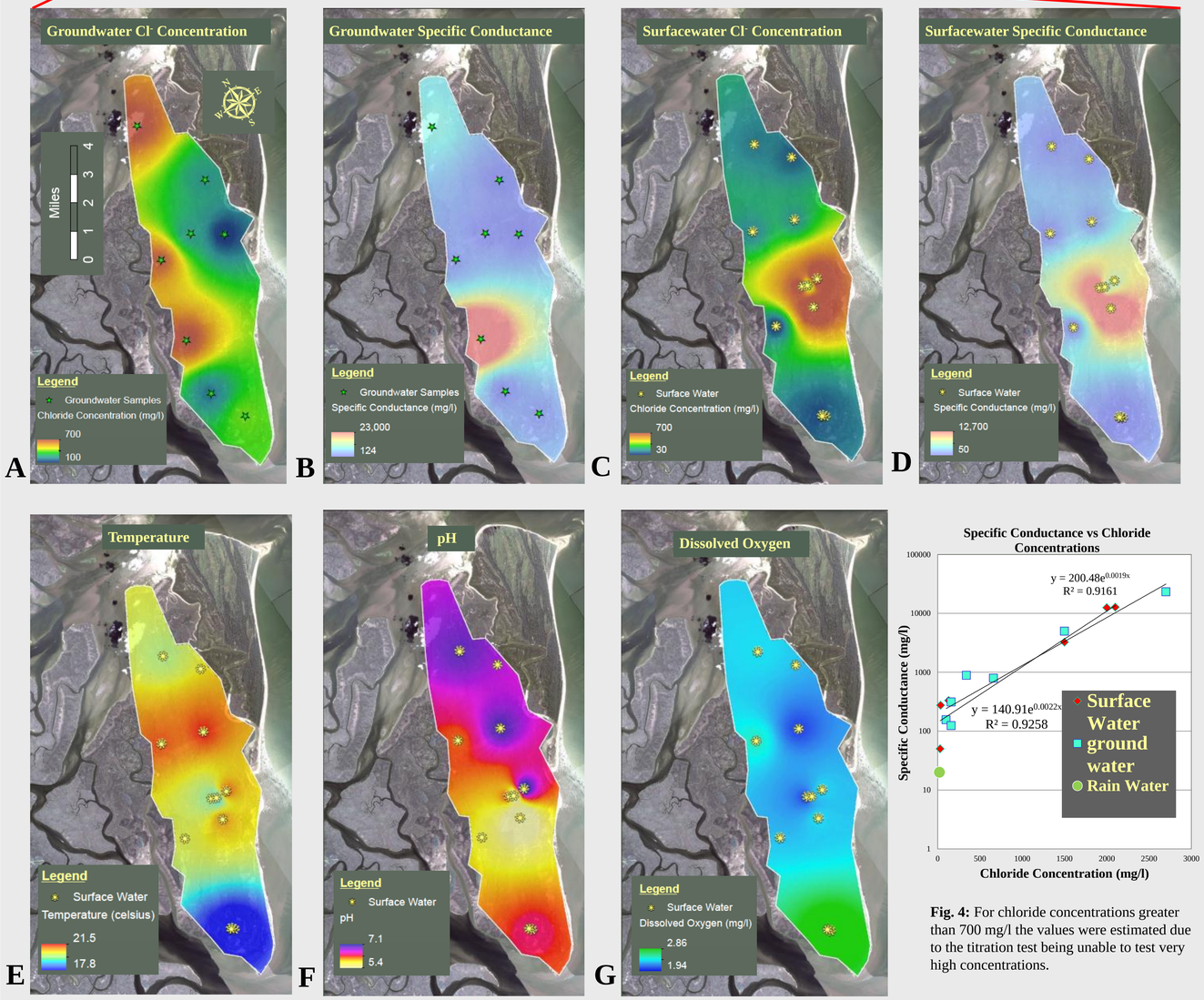
Hydrology Results



Ground water and surface water both exhibited high specific conductance and chloride concentration while the rain samples exhibited low concentrations (table 1). Plotting specific conductance and chloride for the samples generated a positive linear regression when displayed on a semilog graph(Fig.3,4).

Water Source	Average Chloride Concentration (mg/l)	Average Specific Conductance (mg/l)
Ground Water	803	4337
Rain Water	20	20
Surface Water	965	4849

Table 1: Average chloride concentration and specific conductance

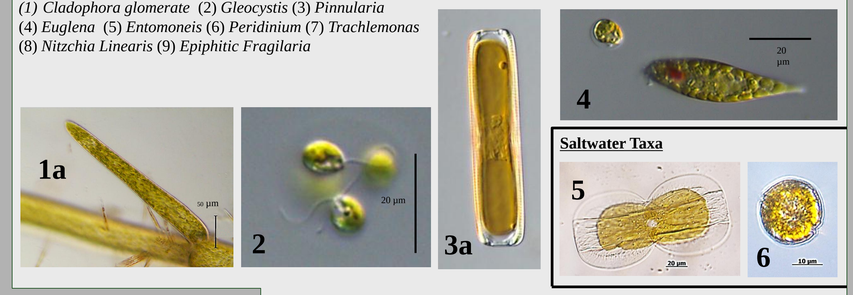


Figs 3: Chloride concentration, (A,C) specific conductance (B,D), pH, DO and temperature (E,F,G) for surface water and groundwater. March, 2012.

Fig. 4: For chloride concentrations greater than 700 mg/l the values were estimated due to the titration test being unable to test very high concentrations.

Plate 1: Freshwater Chlorophyceae/ Bacillariophyceae and saltwater Dinophyceae/ Bacillariophyceae.

(1) Cladophora glomerate (2) *Gleocystis* (3) *Pinnularia* (4) *Euglena* (5) *Entomoneis* (6) *Peridinium* (7) *Trachlemonas* (8) *Nitzchia Linearis* (9) *Epiphitic Fragilaria*



Figs 5: Field work images 2011-2012

Discussion

Based on the conductivity and chloride signatures, the freshwater catchments are primarily supplied by groundwater. When the island is experiencing droughts, there is no sufficient freshwater aquifer recharge to prevent salt water intrusion, hence the high chloride and specific conductance values. The ephemeral surface water sites undergo dry and near-dry periods which diminishes much of the aquatic biota. When precipitation increases, the depressions are filled and primary succession occurs. R-selected epiphitic diatoms such as *Fragilaria* are allowed to colonized the "new" environment. As the areas continue to increase in water volume, other genera begin colonizing. *Navicula*, *Euglena* and *Spyrogira* are indicators of high nutrient content. Even though these freshwater areas demonstrate very little human impact, the nutrient load can be attributed to the animals that utilize the ephemeral freshwater sources for drinking.

References:

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