

## **Project: ASSESSING THE IMPACT & POTENTIAL FOR CONTAINMENT OF NON-NATIVE FISHES ACROSS EVERGLADES HABITATS**

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### **Electrofishing Protocol for Canal Monitoring**

#### **Description of sampling effort**

Using a stratified random sampling design, we sample 10 randomly selected bouts per each canal sampling unit. Due to heterogeneity in connectivity to marshes (i.e., presence of levees) and among canal sections divided by water control structures, canals have been divided into sampling units. Bouts to be conducted each season are randomized for each sampling unit. Each canal sampling unit is divided into an X number of sampling stations, each 200 m apart. Bouts typically sample an 80-130 m stretch of shoreline, depending on catches, thus a 200 m stretch allows for a bout with a buffer zone, such that two adjacent units may be sampled and still be considered independent samples. The stations are sequentially numbered, and using a random number generator, the stations to be sampled at a particular sampling event are selected in advance of sampling. Sampling is repeated 4 times a year: Early wet (June-July), Late wet (October-November), Early dry (Jan-Feb), and Late dry (April-May).

We use a boat-mounted, generator-powered electrofisher (two-anode one-cathode system with a Smith-Root GPP 9.0 control box). All shocking is conducted at pulsed 60 Hz DC (this is a setting in the electrofishing box), with a target power output of 3000 W (Miranda 2005). We aim to keep all duty cycle adjustments (percent range) between 10-50% (Miranda & Dolan 2004, Miranda & Spencer 2005). Each electrofishing bout lasts 300 seconds. This is 300 seconds of pedal time, which, following USGS-NAWQA guidelines, is conducted using intermittent application of electrical current (Moulton et al. 2002). For all shocking the electrodes should be parallel to the boat, such that the anodes are between 1.9 m and 2.5m (Miranda & Kratochvil 2008). Note that the pattern of power density distribution across the electric field will remain constant as long as the electrodes remain fixed. Thus, please maintain the height and spacing of electrodes constant while shocking (Miranda 2009).

Sampling is conducted along the marsh side of each canal (not the leveed side), and when the canal is leveed on both sides, the side to be sampled is randomized for each bout. For all sampling, the boat is angled 45-90 degrees from the canal shoreline, and sampling is conducted with intermittent power application as the boat zig-zags from 2 m out of the littoral zone and into the littoral zone. Sampling can

datasheet. For instance in a canal that runs N-S, shocking can be done heading S or heading N starting at the preselected random coordinates, and should be done going into the wind for ease of control of the boat.

The operator of the boat takes data on the physical and chemical conditions of the canal site prior to sampling, and controls the settings of the electrofishing unit. Two netters at the bow of the boat, wearing polarized sunglasses for glare-free vision into the water, net stunned fishes. Two netters should always be used for both safety and consistency in sampling effort (Miranda 2009). The primary netter works power application with a pedal and nets on the shore side of the boat, while the secondary netter nets on the outside of the sampling area. Note: netting should never be done without polarized glasses.

Fish are captured with a net and brought aboard as they become immobilized with the application of power. All captured fishes are placed in a holding tank, and the end of each bout, we identify each individual to species, measure its length (to nearest 1 mm SL or TL), obtain a wet weight, and release it after full recovery. Only non-indigenous species are sacrificed, preserved in 10% buffered formalin, and brought back to the laboratory for processing (if within our permit's catch quota). Electrofishing typically targets large fish species, but smaller as also caught and kept track of if observed. Here are species that are counted & not counted as part of CPUE-the distinction between these categories boils down to our ability to get accurate numbers:

**We do not count:**

Poeciliids (mollies, mosquitofish)  
Smaller cyprinidontoids (flagfish, bluefins, sheepshead)  
Atherinids (silversides)

**We do count:**

All centrarchids, including very small ones  
All Fundulids  
Any other small fish that is rare (darters) Juveniles of all larger taxa

At times, fishes are stunned but not captured, or they may feel the electric field and escape before being stunned. We record the species and approximate lengths when either instance occurs, or these are counted (using a different catch code), if we can be absolutely confident of the identification.

**Instructions for sampling**

- Use the GPS to find the location of station to be sampled. Bout locations will be chosen prior to fieldwork by randomizing 10 of the preselected sampling stations. These will be loaded into the GPS in advance of sampling.
- Always approach the preselected bout location at idle speed to minimize disturbance to area to be sampled. Efforts should be made to prevent driving in the area to be shocked. If driving in the area to be shocked cannot be avoided, drive along the opposite shoreline to be shocked at idle speed (no wake) until reaching the start location.
- Before each bout, the boat will be positioned perpendicular to the shoreline (about 10-15m from the actual start of the bout to avoid disturbing the site), with the bow touching the shore, which will allow the netters to take measurements along the side of the boat.
- With the boat held in the above position, a member of the crew will take water depth and record the

to the canal bank that the electrodes can reach while electrofishing) to 2 meters out from the littoral zone edge. At each point, the water depth, % plant cover (@ 1m<sup>2</sup> scale), and plant composition (all taxa, ranked by abundance) will be called and noted. Make sure to indicate which meter point is the edge of littoral zone on the datasheet. These measurements will end at the edge of the littoral zone, denoted by an abrupt drop in water depth & disappearance of vegetation.

- Physicochemical measurements will be taken at this site 2 m outside the littoral zone: YSI readings (DO- both % and mg/L-, temperature, specific conductance, salinity-all taken outside the littoral zone at 1 m in depth-cable is marked), Secchi depth (2m out from the edge of the littoral zone), turbidity, and water depth. For the YSI, keep in mind that the DO should be calibrated at the beginning of the day by adding moisture to the cap & loosely closing it. Follow the menu options to calibrate it to sea level at 760 barometric pressure, make sure the calibration holds & that the unit does not drift. If the unit does not calibrate well in the field, forgo the DO readings, make a note in the datasheet & take other readings. Be sure to have spare batteries for the YSI, scale, & GPS units at all times. Turn off the unit between bouts & cover probes with cup.

- Once the littoral zone characterization and all abiotic conditions have been recorded, the crew leader will move to the center of the canal, where the booms will be set up, the generator will be turned on, & the settings for shocking (based on conductivity & temperature conditions) will be determined & tested, in order to reach the 3000 W power goal (Burkhardt & Gutreuter 1995). The crew leader/driver should ensure that the box is set to 60 Hz DC & identify target amps at different voltage settings using the 3000W power tables. Typically for low conductivity waters (< 2000 mS/cm) use higher voltage settings, and low current settings to reach your target. Prior to turning the generator on (use choke as needed), make sure control box is on the off position. Generator should never be turned on with box also on the on position. Do a final safety check prior to turning box.

- Test to ensure we are reaching our target amps by hitting the pedal and adjusting voltage setting and percent range rheostat (between 10-50%) to reach our target amperage goals. This will be done in the center of the canal some distance away from the bout to avoid disturbing the sampling site.

- Once the target settings are reached, the driver will move the boat slowly into position at the start coordinate with both netters ready to start. Netters should be wearing ear protection, PFDs, polarized glasses and covered shoes during all shocking. The boat will be oriented at a 45-90 degrees angle to the shoreline and intermittent pedal time will be applied starting 2m out from the littoral zone edge, so that the littoral zone + a fringe of 2 m of open water are sampled every bout. The operator will run the boat in a zig-zag fashion until the 5 min of pedal time have been reached. The operator will keep track of the distance traveled during the bout, this is key. Since all bout catch per unit effort (CPUE) are adjusted for distance). The operator should avoid sudden maneuvers, and fish chasing at all times.

- The primary netter will hit the pedal starting 2 meters out from the littoral zone edge and apply intermittent power (5-7 sec. on, then off for 2-3 seconds then reapply) as the boat moves toward the canal bank. As the driver backs out to reposition, primary netter does not apply power, unless there is a large amount of matted vegetation or if the point of entry into the littoral zone varies significantly from the point of exit (if the case, the primary applies intermittent power as needed). Note that releasing the pedal until specific types of vegetation or structure are encountered along a transect is not acceptable, since this likely biases sampling (Bonvechio 2009). Remember that the goal is to obtain a representative

certain species. At the same time, catch rates decrease if one electrofishes the same section over again. Never shocked a section already covered again.

- Once 300 sec pedal time is reached, the crew chief will turn off the box, shut down the generator, and immediately record the following info in the bout datasheet: time bout ended, ending GPS coordinates in UTM's, pedal time, length sampled, percent range and amps from box during bout.

- Throughout the bout, all fish are netted, and placed in the 100 gallon holding tank with clean water from the sampling site and running aeration. Stunned fish should be removed from the electric field as soon as possible and not be subjected to continuous shock in order to prevent injury. Netters will also record the identity and number of fish shocked but not caught using a counter (premarked for common species and by making notes throughout the bout. At the end of the bout, all fish viewed and shocked will be called to the operator first before processing. All fish caught will then be processed and data recorded on the catch datasheet (including all shocked and viewed fish). Fish will be identified, measured & weighed. Netters should check that fish do not have bruises (muscle hemorrhage), bent or broken backs (vertebral compression, misalignment or fractures), or long recovery times, and adjust settings downward if necessary. Settings should be as low as possible to avoid injury to fishes.

### **Safety reminders:**

- Safety is the underlying foundation of our electrofishing operations. Please keep this in mind at all times, and do not do anything that will compromise your safety or that of others.

- Electrofishing is an inherently hazardous activity. The power used during electrofishing is sufficient to cause electrocution.

- Cables should be connected to electrofishing box. Be careful to place cathode and anode cables in appropriate places. Note that cables from generator and pedal can only go in one way. Make sure to line up guides prior to inserting power cables & pedal cable into control box.

- Dry skin and clothing are good protection against shocking. Wear closed shoes and a rubber floor mat at all times while shocking. We have rubber gloves on board, although those are not required for operation. Wear ear protection at all times while shocking.

- Make sure all safety equipment (PFDs, fire extinguisher, flares, emergency kit, throwable PFD, etc.) is in good working order (not expired) and onboard at all times.

- PFDs should be worn at all times while shocking, as well as while operating the boat.

- Do not shock if it's raining. If a continuous sheen of water develops over equipment, stop shocking. Cover up electrofishing box to protect from rain and the generator (after it cools).

- There's a safety emergency shut off on the control box, which should be used in case of an emergency.

- During operations, it is critical to avoid contact with the electrodes and surrounding water. Do not put your hands/feet in the water at any time while shocking.

- Bystanders (other boats) should be at minimum 100 ft from the electrofishing boat while shocking.

- Never electrofish alone.
- Members of the crew should have knowledge of CPR and first aid. One certified electrofishing operator must be on the boat at all times.