Development of biometric and environmental DNA standardized protocols for early detection and population assessment of aquatic invasive species for Loxahatchee National Wildlife Refuge.

PROJECT DESCRIPTION

There is a need for decision support tools that would assist USFWS Refuge Managers with the management of aquatic systems on refuge lands and aquatic invasive species (AIS) that may inhabit these aquatic systems. It has been shown that the earlier AIS are detected in the invasion process, that more options will be available to the natural resource managers, and that costs will be lower than costs associated with projects that try to remove established AIS.

This project implemented standard practices for sampling and long-term monitoring of the fish community and aquatic invasive species of fishes at Arthur R. Marshall Loxahatchee National Wildlife Refuge. Biometric data, which will serve as baseline metrics for monitoring purposes, will include (but not limited to) catch per unit of effort, abundance, and biomass. Fish community results provide insight on species diversity, evenness, and stability across sites and seasons. In addition, we added a proof of concept element to the project which involved environmental DNA (eDNA).

The Arthur R. Marshall Loxahatchee National Wildlife Refuge is located in Palm Beach County, Florida, and the watershed is heavily influenced by agricultural practices and urban development. This refuge has a large marsh that is surrounded by an interconnected system of canals. Our project targeted this perimeter canal system.

OBJECTIVES AND ALTERNATIVES

As reported in the USGS 2001 *Summary Report of Nonindigenous Aquatic Species in U.S. Fish and Wildlife Service Region 4,* there are well over 300 AIS documented in the southeastern United States with more recognized introductions occurring every year. Florida, and areas near large urban centers, may be at a higher risk of being invaded by non-native species (e.g., unwanted pets may be released). Invasive species are a management issue for the USFWS NWR system. This management issue diverts resources from other program needs.

Objective I- Survey and biometrics. The objective of this portion of the study is to formulate and collect a standard set of fish (and aquatic invasive species (AIS) of fishes) biometrics. Biometric data, which will serve as baseline metrics for monitoring purposes, will include (but not limited to) catch per unit of effort, abundance, and biomass.

Objective II- Monitoring of AIS via eDNA. The objective of this portion of the study is to develop and implement eDNA protocols for monitoring of AIS. Specifically, we will develop molecular markers for two AIS species (e.g., African Jewelfish and bullseye snakehead). These data will provide for a proof of concept of early detection protocol.

METHODS AND PROTOCOLS

We used a stratified random sampling design. To accomplish this, we developed a standardized grid and corresponding coordinate system. There are a total of 58.4 miles (94 Km) of perimeter canals. The L-7, L-39, and L-40 canals were divided into 1 km grids and each 1 Km segment was numbered 1-94 starting at the NE corner at S 5A (Bend Area) of the refuge. Each 1 Km segment has a corresponding GPS coordinates (i.e., Latitude and Longitude).

This design considered unique sites, repeated visits to a sampling site, seasonality, and bank side sampled (levee v. marsh). Twenty sites were sampled each quarter. Each site was sampled using standard methodology and consistency in voltage output of using electrofishing boats equipped with a 9.0 GPP and certified operators.

Generally, a four or five-person crew was used for each sampling trip.

DATA MANAGEMENT

All data is compiled in MS EXCEL. The report is being developed in MS WORD. Publications are planned for fish community and eDNA results (SE Naturalist, USFWS Journal of Fish and Wildlife Management).

ACCOMPLISHMENTS AND MANGEMENT IMPLICATIONS

Our study applied standardized methods for fisheries work and resulted 102 Km being sampled using electrofishing, over 13,780 (w/o October 2013) individual fish measured, and over 30 species of fishes being detected. In addition, we describe the fish community diversity, evenness, and persistence. The biomass was calculated by each dominate species.

We also included genomic tools, and these were used to confirm fish morphological identifications for approximately 20 species-100 individuals-- (i.e., GenBLAST: Basic Local Alignment Search Tool). We also tested protocols for using eDNA for early detection and developed primers/ probes for African jewelfish and bullseye snakehead. Noteworthy was the collection of a bullseye snakehead during the January sample. A special biometric sub-study was completed for largemouth bass at the request of the refuge to support management decisions related to this important fishery. These efforts were also coordinated with the Wild Fish Health Survey.

The current status of the project is ongoing. We provided a final sample in mid-October to have a repeat of the annual month the project was initiated. Data analysis and report writing has been initiated and a final report will be delivered by Jan, 2013. A sit-down with managers and staff of Arthur R. Marshall Loxahatchee National Wildlife Refuge is being planned for February to provide a walk-through on the data and answer any questions regarding the final product.

PARTNERS

Partners involved in the project, representing agencies/organizations were Kelly Gestring from FL Fish and Wildlife Conservation Commission, National Wildlife Refuge staff, NWR I&M biologist, and Warm Springs Fish Health Center (i.e., Wild Fish Health Survey). The R4 USFWS AIS Program provided $20,000 for GenBLAST and $60,000 for eDNA support.

MORE INFORMATION

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