Progress Report I

Period: February - July, 2019

Ecological impact of the invasive armored catfish (Loricariidae) on fish assemblages and implications for conservation in North Guatemala

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Executive Summary

The invasive armored catfish has expanded throughout the Usumacinta River Basin, which harbors the richest ichthyofauna in Central America, leading to concerns for conservation and fisheries. This project will investigate the effect of armored catfish abundance on fish assembly patterns in the upper basin, including areas within the Maya Biosphere Reserve.

The analysis will provide information of invasion threshold levels to inform impact severity on different components of fish assemblages, including the influence of environmental and spatial factors on native biodiversity. This information will be used to identify threatened fish species and relevant abiotic factors to develop conservation plans for native fishes.

Area of Study

This study is been conducted in two large tributaries of the Usumacinta River: the San Pedro River (14,335 km2) which lies within the Maya Biosphere Reserve, and La Pasion River (12,083 km2) located outside the reserve (Fig. 1; MARN, 2011).

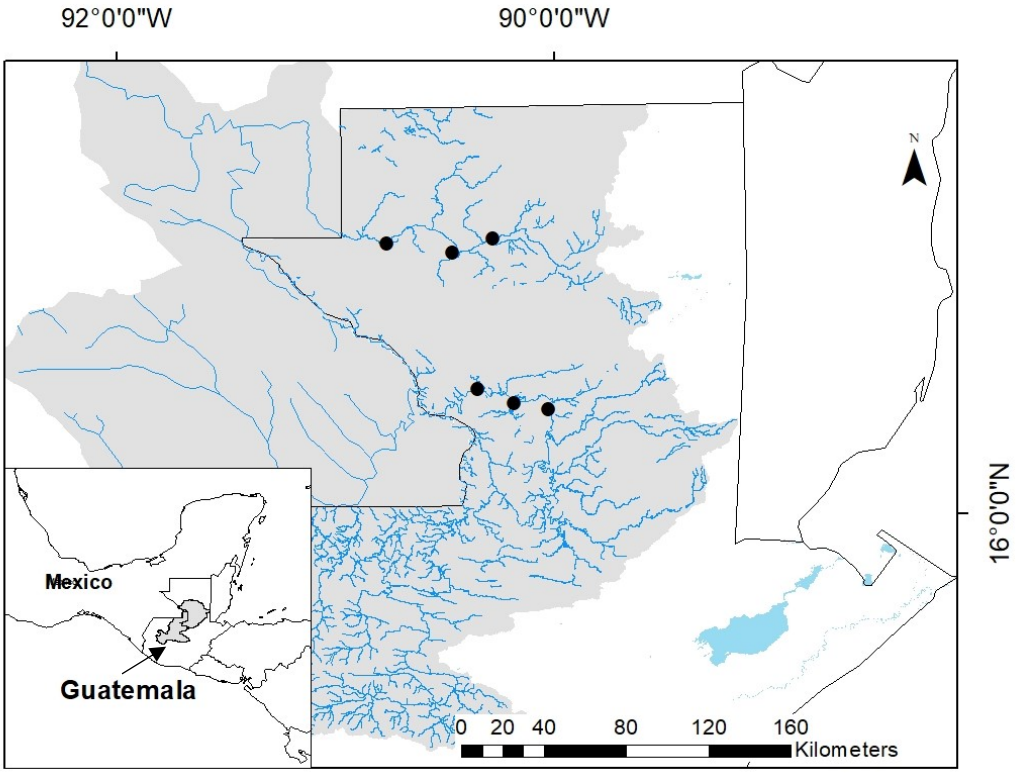

Figure 1. Area of study indicating the Usumacinta Basin in Guatemala and San Pedro and La Pasion rivers.

Activities programmed

Fieldwork (month I-V) February - July 2019. Fieldwork activities include the selection of sampling sites, fishes, environmental and spatial data collection. During the fieldwork period, we also will conduct a meeting with local stakeholders to discuss conservation issues in the basin, specifically caused by the invasion of armored catfish.

Fieldwork activities

The activities conducted the first months of this project where oriented to obtain research and collection permits from the Consejo Nacional de Areas Protegidas in Guatemala, as well as the logistics required to conduct the surveys in the area of study. The team also prepared the equipment and materials required for the fieldwork.

The data collection was performed from April to June 2019 in the San Pedro River and La Pasion River. The sampling locations were selected in the upper, middle and lower part of each river, and locations were separated by approximately 2 km to reduce potential influence from fish dispersal. At each location we measured water parameters (conductivity, pH, dissolved oxygen % and mg/L, salinity, and temperature) and collected water samples to measure total N and total P. Parameters such as transparency, depth, channel width, substrate depth, water flow were measured for habitat characterization.

The fish survey was conducted with gillnets, beach seine and castnets (Fig. 2 A-C). All captured fishes were identified, measured and weighed. Some specimens (a maximum of 30 per species) were retained to collect muscle tissue, stomach content and use as voucher for museum collection (Fig. 3 A-B). All procedures followed standardized methodologies such as the Guidelines for the Use of Fishes in Research (Use of Fishes in Research Committee (joint committee of the American Fisheries Society, the American Institute of Fishery Research Biologists, 2014) and the AVMA guidelines for the euthanasia of animals (Underwood, W., Anthony, R., Gwaltney-Brant, S., Poison, A. S. P. C. A., & Meyer, R., 2013). Tissue samples from snook were obtained from specimens caught during a fishing tournament held at La Pasion River in May (Fig.2 E). The tissue samples were stored in salt for transportation or dried in the field (Fig. 3).

At each site I collected samples of seston, plankton, periphyton, riparian vegetation, macrocrustacea and macroinvertebrates for stable isotope analysis (Fig. 4, 5). The plants selected were the most abundant according to field observations (Fig. 6). Samples were stored in salt for transportation. Later, the tissue samples for stable isotope analysis were soaked in distilled water for 4 hours to remove the preservative, and then dried at 60 ºC for 48 h. The laboratory processing was conducted at the Universidad de San Carlos de Guatemalan with collaboration from undergraduate students (Fig.7).

The fish collection was done with collaboration from local fishermen at each location. At least 10 fishermen worked in this project conducting different activities, from fish collection to fish identification and preservation.

Figure 2. Complementary fishing techniques. **A**. Gillnet technique. **B.** Castnet technique. **C.** Beach seining. **D.** Specimen of *Petenia splendida* collected in the San Pedro River during the fish survey. **E.** Snook caught in a local fishing tournament. Credits: A, B, C: Diego Juárez. D: César Fuentes. E: Yasmin Quintana.

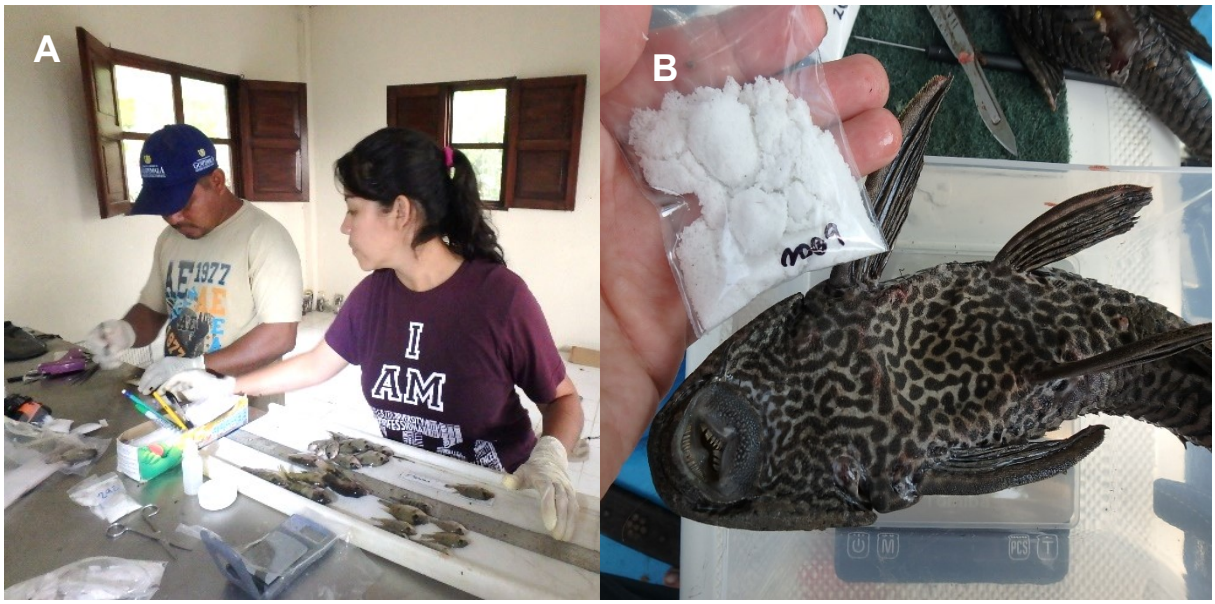

Figure 3. A. Processing fish samples and tissue samples with collaboration from fishermen. **B.** Stored tissue from the invasive armored catfish collected during the survey.

Figure 4. A. Filtering water to collect a sample of seston. **B.** Collection of periphyton.

Figure 5. A. Collection of macroinvertebrates from sediment and plant roots. **B.** Dragging a plankton net.

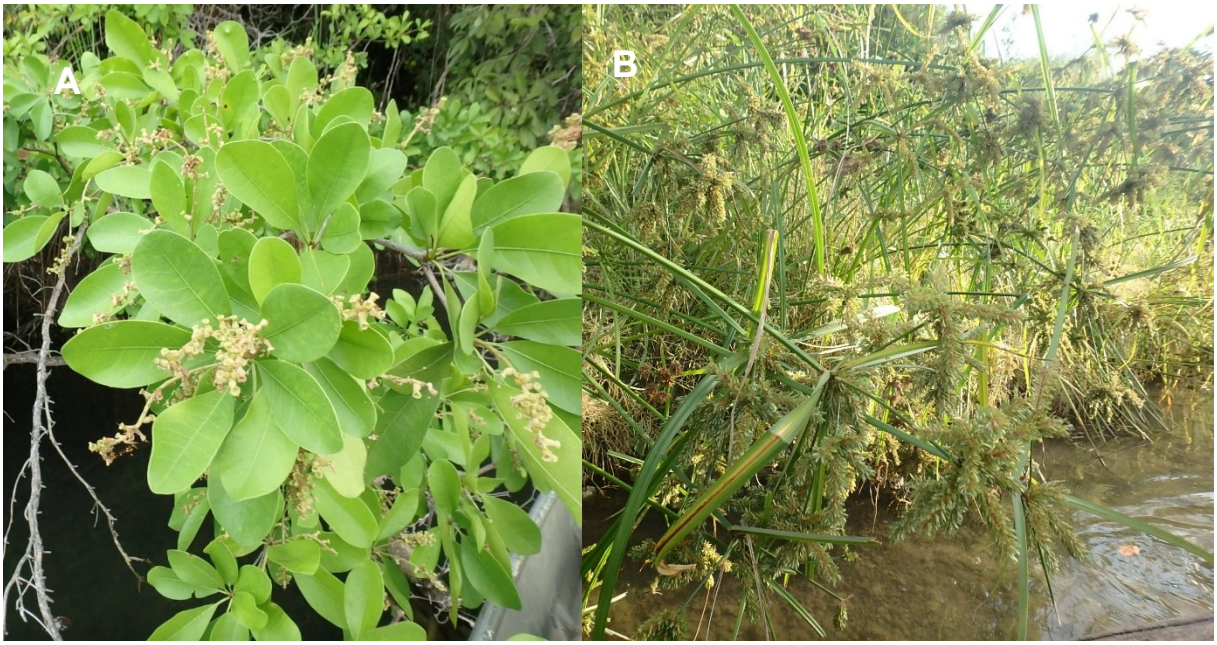

Figure 6. A. Pucte (Bucida buceras), a common tree in the shore of the San Pedro River. **B.** Sedge is a common graminoid observed in the shoreline of La Pasion River.

Figure 6. Tissue samples are soaked to remove the NaCl and later they are prepared for oven desiccation (right down).

Figure 7. A. Specimens of native fish collected during the survey.

Communication and Outreach

I had the opportunity to present this project to the scientific community at the Universidad San Carlos de Guatemala in Guatemala city. The talk was organized by the Department of Biology and their research institute (Instituto de Investigaciones Químicas y Biológicas). The audience from this talk were mostly undergraduate students, but also researchers, faculty and representatives from the government fishing authority. After this talk, I had the opportunity to share with students and discuss about their interest to collaborate to the project, as well as students interested in studying fish ecology and related topics.

Later, I was invited to present a talk at the symposio "*Situación actual y perspectivas de la cuenca del Lago Petén Itzá"* (Current situation and perspectives for the lake of Petén Itzá) (http://selvamaya.info/en/symposium-on-water-quality-peten-guatemala/). This symposium was held in Petén, Guatemala, the region where the project is been conducted. Presenting at this symposium was a good opportunity to introduce the work to managers, researchers and other stakeholders who work and live in the region of interest.

Figure 8. simposio "*Situación actual y perspectivas de la cuenca del Lago Petén Itzá"*

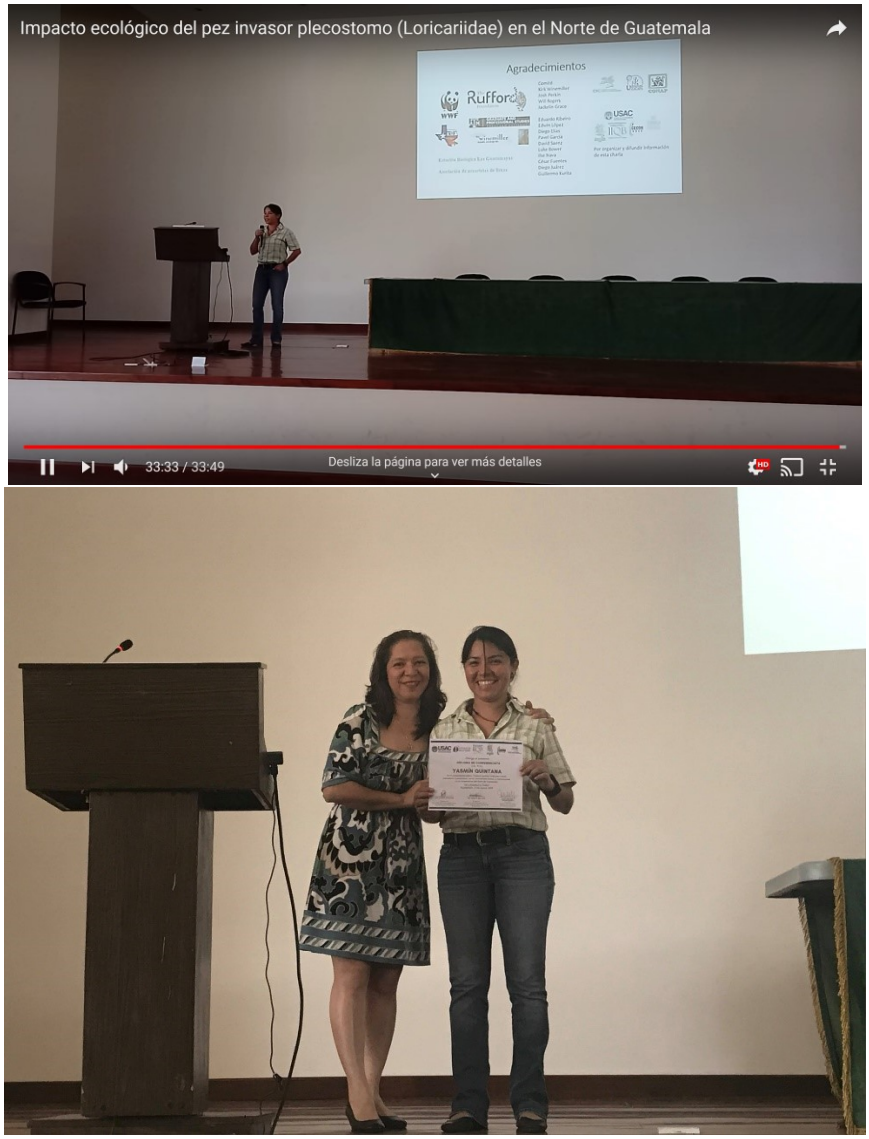

Figure 9. Project presentation at the Universidad de San Carlos de Guatemala organized with support from the IIQB-USAC and the Department of Biology(https://www.youtube.com/watch?v=qe8TYElUcnk&t=248s).

ANNEX

Wildfires observed during the survey. They occur during the dry season in north Guatemala, and were particularly intense this year.