

Mekong Fish Community Surveys Using Environmental DNA

Applying eDNA metabarcoding to study biodiversity across the Cambodian Mekong

Project Lead

FISHBIO

Project Timeline

2022-2023

Funding

USAID Wonders of the Mekong

Collaborators

Cambodian Fisheries Administration (FiA)

Inland Fisheries Research and Development Institute (IFReDI)

Young Eco Ambassadors (YEA)

Project Background

Environmental DNA (eDNA) methods can document the presence of species based on traces of genetic material they shed into their environment. Monitoring with eDNA has been broadly applied in temperate river systems around the world, and has yielded valuable information for fisheries managers. Further, comparisons of eDNA data with data obtained from traditional sampling methods (like nets and traps) have shown promise for this technique to effectively capture fish community diversity. Although eDNA methodology has been successfully implemented to detect rare species in the Mekong, including the Mekong Giant Catfish (*Pangasianodon gigas*), the use of eDNA to capture a “snapshot” of the entire fish community present in an area has not been broadly tested in the region, and indeed has only just begun to be used in tropical river systems. This community approach to eDNA relies on a methodology known as metabarcoding, in which fragments of DNA from a specific region of the mitochondrial genome are amplified and used to identify many species from a single water sample. This project, supported by Wonders of the Mekong, seeks to apply the first landscape-scale collection and analysis of eDNA samples in the Mekong Basin.

Objectives

The driving objective of this study is to evaluate how well eDNA metabarcoding is able to capture aquatic species diversity at sites throughout the Cambodian Mekong. This analysis has been designed to evaluate diversity at both the local scale and at the landscape-scale, with the goal to provide data on biodiversity (such as fish community composition), which may guide and inform management and conservation actions.

As the first large-scale application of eDNA technology in the Cambodian Mekong, the results of this study will be an important evaluation of how this monitoring approach may be used as part of fisheries research and management.

Key Points

- This study represents **the first large-scale application of eDNA** metabarcoding surveys in the Mekong Basin
- Results will provide insight into the effectiveness of eDNA for **documenting aquatic biodiversity** with comparisons to traditional sampling methods
- This study will help **inform best practices for eDNA sample collection** and analysis in the Mekong Basin
- eDNA technology may provide a **rapid and inexpensive means to effectively monitor** large watersheds



Water is pushed through a 5µm filter, which captures particles that may contain DNA.

Methodology

In March of 2022, Young Eco Ambassadors (YEA), FISHBIO staff, and IFReDI staff collected dozens of water samples throughout the Mekong watershed in Cambodia using kits supplied by Jonah Ventures, a U.S.-based laboratory. Water from each location was pushed through a 5µm filter using a syringe, and treated with a specially formulated solution to preserve any captured DNA. Water was filtered near the left and right riverbanks as well as in the middle of the river at each location to improve the detection of species using habitats across the entire river width.

In total, 60 samples have been collected from numerous waterways. These include the Sekong, Sesan, and Srepok (3S) rivers in northeastern Cambodia, the Tonle Sap Lake, and the mainstem Mekong River stretching from the border from Lao PDR to Phnom Penh (Figure 1). Although most samples were collected from surface waters, the entire water column was sampled at one location to test for differences in eDNA at varying depths. Additionally, one of the sample locations is adjacent to a site where IFReDI staff perform monitoring using traditional sampling gears (i.e., gill nets), which will allow for comparison of fish diversity data from eDNA and gill netting methods. Following laboratory analysis and data evaluation, additional samples may be collected to provide further biodiversity data and to test various sample collection methodologies.

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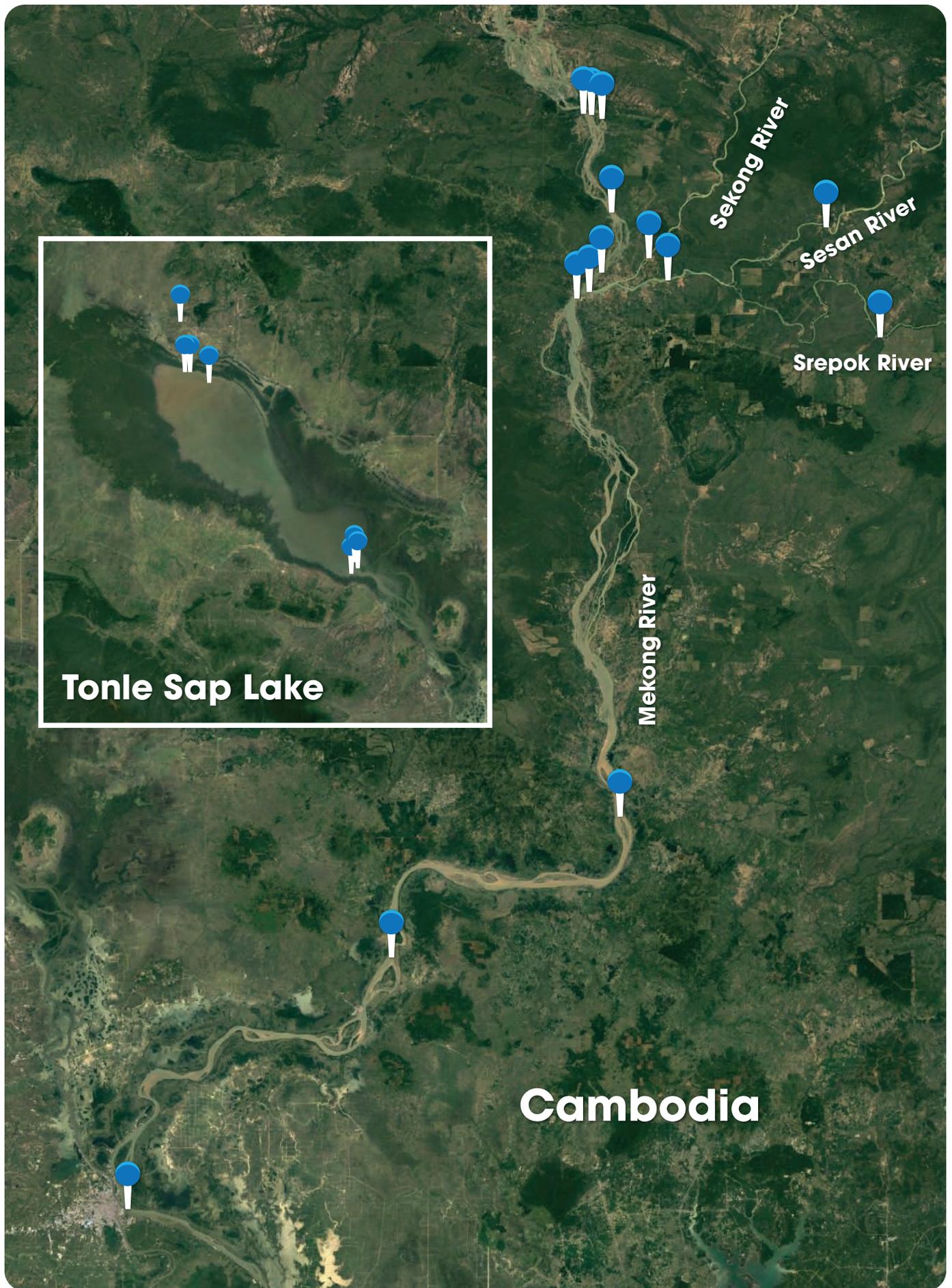


Figure 1. A map of the locations throughout the Cambodian Mekong where samples have been collected.