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eDNA Data Newsletter -

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Data & Results Newsletter

Hi all! This is the somewhat intermittent Newsletter of our project **New Technology for Old Problems - Developing eDNA Methods to Monitor Invasive Species and Biodiversity in Estuaries**. Here's an example from Hawai'i highlighting how eDNA can be used to asses restoration.

eDNA in He‘eia – bridging the gap between multiple methods to assess indicators of restoration success

Hawai‘i’s He‘eia National Estuarine Research Reserve (NERR), on O‘ahu, is the newest member of the Reserve System. Founded in 2017, its 1,385 acres include unique and diverse habitats, such as upland, wetland, stream, estuary, coastal, and marine, within a Native Hawaiian social-ecological region called the *ahupua‘a*. Here at He‘eia, with *kūpuna* (community elders) and Native Hawaiian non-profit groups Paepae o He‘eia and Kāko‘o ‘Ōiwi, we aim to restore the health of the *ahupua‘a* and promote sustainability and ecosystem resilience through a combination of Indigenous and contemporary management practices. We are striving for *‘āina momona* – land that is rich and abundant – full of food, landscapes, and animals that nourish our mind, body, and soul.

Marine waters of Kāne'ohe Bay, an 800-year-old ancient Hawaiian fishpond (loko i'a) stewarded by Paepae o He'eia, and He'eia wetland managed by Kāko'o 'Ōiwi.

Photo: Kalei

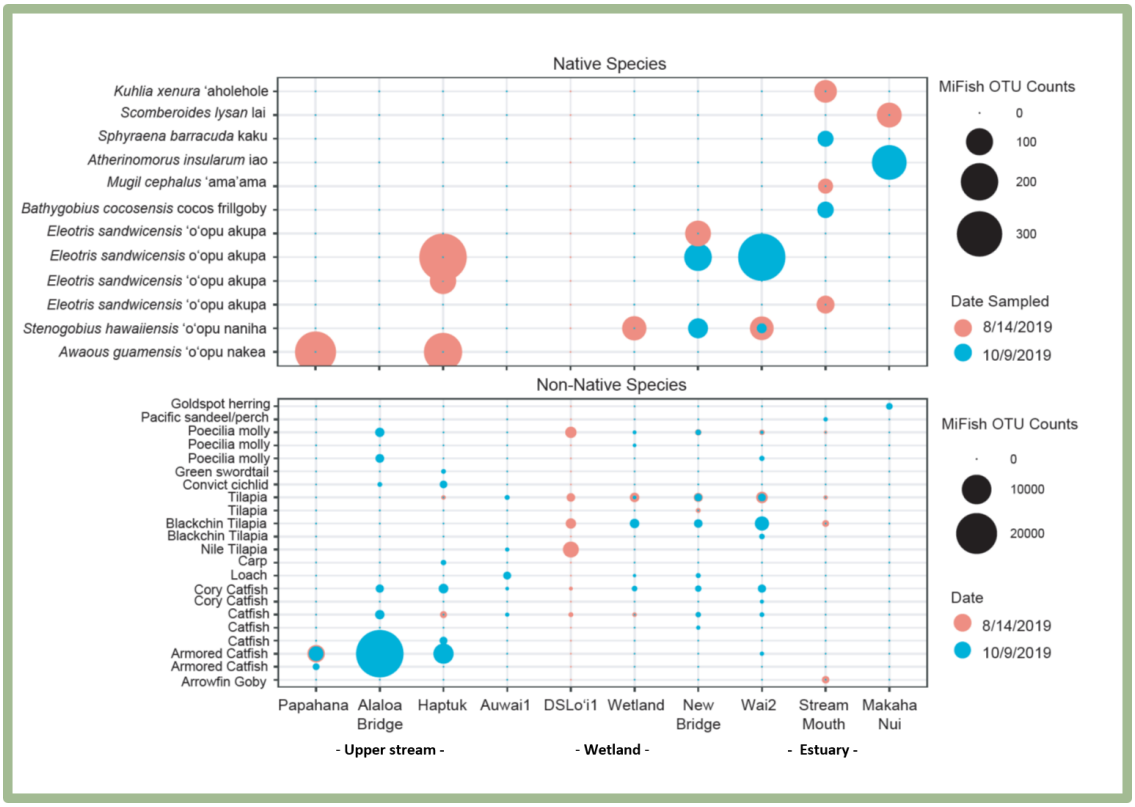
For centuries, He'eia was a nutrient-rich watershed dominated by native species, managed using Indigenous agroecology practices. However, red mangrove (*Rhizophora mangle*) was introduced to He'eia around 1922 as a 'quick-fix' solution to problems resulting from changes in land use. Proliferation of invasive vegetation started to block existing waterways and fish passage between the estuary and the wetland, and the diversity and abundance in a once-thriving wetland/estuarine ecosystem diminished, overtaken by invasive species and low-oxygen conditions.

eDNA can help identify native fish returning to restored habitat

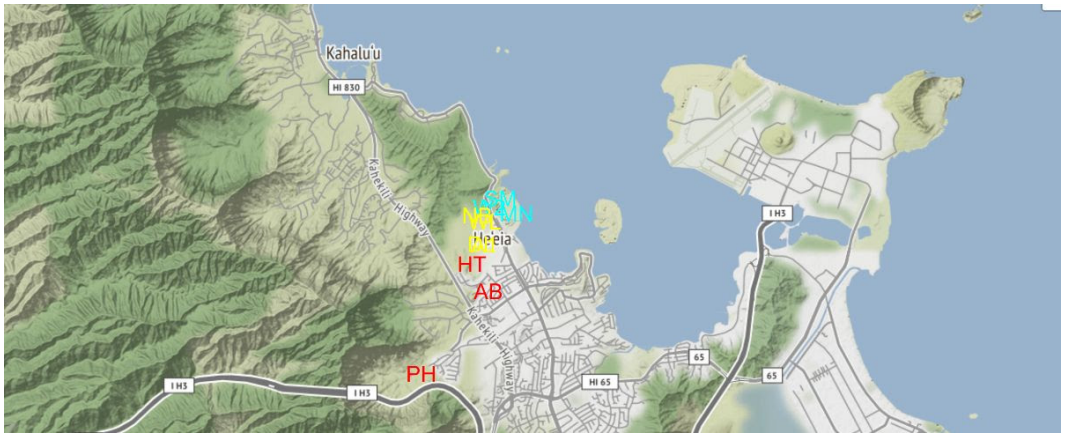
The Reserve is working in partnership with The Nature Conservancy and the State of Hawaii'i Division of Aquatic Resources to monitor biological indicators that will help us to understand how the system is responding and (hopefully) recovering. As we see with our own eyes how dense, anoxic mangrove mud gives way to water flowing down from the mountains and up from the sea, we start to see more and more fish. How do we effectively monitor their abundance and diversity among the variety of different habitats in He'eia?

Our study area includes very different types of waterbodies; from flowing streams (a), bridge overpasses (b), slow, shallow wetland areas (c), and open coastal waters. We are using three different methods to assess fish abundance and diversity; **Cast-net, catch-and-release method** allows the most detailed identification of fish count and size, but the process is labor-intensive, time-consuming, requires many volunteers and fish handling, and can only be conducted in areas that are large, free of debris, and shallow. The **visual survey method**, on the other hand, is non-invasive, but is difficult to identify the exact species while they move through the water, and clear, sunny days are needed to ensure maximum visibility. **The eDNA method *serves to bridge the gap between these methods, as its simple, non-invasive methodology allows us to sample all of the different environments with a consistent method.***

So how do the results compare? The main story is consistent amongst all methods: **there is a high abundance of introduced, aquarium-trade fish such as catfish and mollies in the upland and wetland areas, while some native fish are present in the estuary**. Our initial eDNA surveys have shown positive hits on some Hawai‘i-specific native fish, such as the striped mullet or the charismatic ‘o‘opu an indigenous, amphidromous, waterfall-climbing Hawaiian goby. The return of the abundance of both of these fish would be a sure sign that our restoration efforts are changing the landscape for the better.



eDNA results showing DNA sequence counts for two sampling time periods (August and October 2019) at 10 sites in the He‘eia ahupua‘a. The non-native species are more common in the upper, more disturbed, region. Hopefully, as the restoration continues the native species will return. Some of these species (like the ‘o’opu and other native Hawaiian species) were manually curated using sequences from voucher specimen. See this earlier Newsletter on primers for more info on how we match sequences, and why we sometimes need voucher specimens.



If your interested in more details, or the actual sequences in each sample, the full data is here. Or click on the map to see the species detected at each site. The method that we're using targets fish, but we sometimes get other common animals, like the ducks at New Bridge (NB).

New Technology for Old Problems - Developing DNA Methods to Monitor Invasive Species and Biodiversity in Estuaries is a collaborative project from the University of New Hampshire, Wells, Great Bay, Hudson, Apalachicola, South Slough and He'eia NERRs. We hope that these Newsletters are interesting, and provide topics for discussion. Let us know if you have questions or comments (or if you want to be removed from the mailing list) at alison.watts@unh,edu. The project is sponsored by the National Estuarine Research Reserve Science Collaborative.
