

## The ecology of native and introduced Poeciliid fishes in Jamaican freshwater ecosystems and evaluation of the predictors of species distribution and invasion potential

# endemic species # exotic invasive species

### Context

Freshwater ecosystems are undergoing rapid species decline. Invasive species have been identified as key contributors to this biodiversity loss.

Recent surveys indicate that invasive fish, particularly livebearers like *Gambusia affinis* (mosquitofish) and *Poecilia reticulata* (guppy), are widely distributed across Jamaica, posing significant risks to native species. These invasive fish often compete for resources, disrupt local ecosystems, and contribute to the decline of native fish populations in most areas into which they have been introduced.

While invasive species are a growing concern, little is known about Jamaica's native livebearing fish. Jamaica has only four endemic freshwater fish species, three of which are livebearers. Unfortunately, recent surveys show that invasive fish are now more common than native ones in some rivers, raising alarm about the future of these unique species.

This study will document species distributions, collect life history data, and investigate interactions between native and invasive livebearers. Such data are critical for predicting vulnerable ecosystems and guiding future conservation efforts, providing baseline information that is currently lacking for the proper management of Jamaica's freshwater systems.

### Objectives

The project hopes to achieve the following goals:

- Map the distribution of native livebearing fishes in major river systems across Jamaica and investigate aspects of their life history since this information is currently incomplete or unavailable.
- Determine life history and ecological traits associated with invasion success in livebearing fishes in Jamaican freshwater ecosystems which will hopefully help in understanding why certain species become invasive.
- Analyse the genetic diversity of native species to assess the viability of vulnerable populations and to understand evolutionary relationships among the species.
- Examine how native and invasive fish interact in terms of diet and reproduction.
- Determine which environmental factors can predict where native and invasive fish will thrive.



*Gambusia wrayi*

#### DATES

2021 - 2026

#### COUNTRY

Jamaica

#### STUDENT

Kerri-Ann Bennett

#### EDUCATION LEVEL

Doctorate



#### CONTACT

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## Methods

### *Life History and Ecological Traits*

The following traits will be measured and analysed in samples taken seasonally from both native and invasive fish species: maximum standard length, size & age at maturity, body mass, gonosomatic index, fecundity, egg diameter, and offspring size.

### *Population Genetics*

Genetic variation in two vulnerable native species (*Gambusia melaleuca* and *Limia melanogaster*) will be studied using the cytochrome b mitochondrial gene and microsatellite markers. DNA will be extracted from 10 individuals per population to assess genetic diversity and potential cryptic speciation.

### *Feeding and Sexual Interactions*

Seasonal changes in diet composition and dietary overlaps will be investigated by sampling 15–30 individuals of each species from sites with and without invasive poeciliids. Gut content, gut length, and food item volume will be assessed.

Reciprocal cross-breeding experiments between the invasive *Gambusia affinis* and native *Gambusia* species will be conducted in controlled tanks to determine if hybridisation is possible.

### *Physicochemical and Geospatial Parameters*

Various environmental parameters, including pH, salinity, temperature, dissolved oxygen, and proximity to urban centres or pet shops, will be measured seasonally to assess habitat quality. These data will also be used to inform species distribution models and to predict the resilience of various habitats to future invasive fish introductions.

## Preliminary results

At this stage in the research, meaningful conclusions cannot be drawn concerning life history, feeding and sexual interactions, and the physicochemical and geospatial parameters to be used for predictive modelling. Preliminary diet studies suggest an overlap in diet between the invasive swordtail *Xiphophorus hellerii* and the endemic *Limia melanogaster*. This is concerning since the number of *L. melanogaster* populations seems to be in decline and *X. hellerii* is widespread.

A previous study found evidence of cryptic speciation within *L. melanogaster* using the sequence of the mitochondrial cytochrome b gene. This study was based on only two populations. The number of populations was increased to five in the current study. The sample sizes were also increased. The species split was confirmed, and work is currently being done to expand the scope of this study to identify the ranges of both species.

The cytochrome b gene was also sequenced for *G. melaleuca*, however, to get a more meaningful picture of diversity within this genus more populations of *G. melaleuca* as well as populations of *Gambusia wrayi*, *Gambusia puncticulata* will be added to the study.

## About the research team

Kerri-Ann's academic background includes a BSc in Zoology and Molecular Biology and an MPhil in Zoology from The University of the West Indies (Mona Campus). Her research interests are freshwater ecology, fish biology, conservation biology, and genetics. She was introduced to the work of the Caribaea Initiative by Prof. Ingo Schlupp, a member of the Initiative. Her primary supervisors are Prof. Ingo Schlupp, an evolutionary biologist and expert in livebearing fishes from the University of Oklahoma and Dr Gale Persad, a marine biologist from The University of the West Indies. An important collaborator on this project is Prof. Ralph Tiedemann from the University of Potsdam. Ms Anja Ernst, also from the University of Potsdam, has also provided technical support in collecting molecular data.

