Outreach Learning Goals

List your top learning goal for this outreach. That is, what one thing do you want students to understand (better) by the end of our lesson? (This should be a big picture type thing related to your research area; i.e. a broad concept that may be poorly understood by the public, and inhibits the public's ability to understand your work). *

I'd like students to understand the importance of biological variation.

Why does understanding the above learning target matter for ordinary people? (We seek to encourage curiosity for its own sake, but this helps us make lessons more relevant and memorable for students). *

In a world that is rapidly changing due to environmental change, habitat loss, species endangerment and extinction, we stand to lose (and are losing) much of the biological variation that sustains the planet and also makes it beautiful. Humans also depend on biodiversity for resources and other benefits. Understanding where variation comes from and why it matters is important for appreciating the role of conservation and what various conservation strategies are trying to accomplish.

Brain dump: list as many other learning goals you have for this outreach, ranging from broad to very specific/technical. Put them in order from most to least important, if you can. *

Note: these aren't necessarily in order of importance. I started with more of the big picture background and got more specific, culminating with the study system

- The different levels of variation (genetic, trait, intraspecific, interspecific), and specifically why intraspecific variation matters
- Where does variation come from?
- What is genetic variation? How do we measure it? Why is it important?
- Genetic variation provides the "raw material" for natural selection to operate
- Population genetic consequences of habitat loss and fragmentation
- When populations lose genetic variation, they also often lose trait variation, and have reduced ability to adapt to changes in the environment
- Many populations today are increasingly small and fragmented AND experiencing rapid environmental change/stress
- Extinction vortex (ie, positive feedback loop where ecological and evolutionary factors interact to further reduce population size, ultimately leading to extinction)
- How do small and fragmented populations escape extinction vortex? One way is gene flow! What is gene flow?
- Wildlife corridors to promote natural dispersal and connectivity
- Human-assisted gene flow through translocations
- Genetic rescue: increased population growth cause by the infusion of genetic variation; famous examples include the recovery of the Florida panther, bighorn sheep, greater prairie chicken
- Potential risks and benefits of genetic rescue highlighting the complexity of conservation planning and decision-making. Also that deciding NOT to act is a decision nonetheless.
- What is a model system in biology? Why are model systems useful in conservation?
- Trinidadian guppy system as a model system for studying ecology and evolution in wild populations, and for this study – a model system for studying genetic rescue

Lay summary of your research. (We'll get more into this later, so can be very informal bullet points).

- My study focuses on two small and isolated populations of Trinidadian guppies in neighboring streams in the Northern Range mountains of Trinidad. These populations started out with extremely low levels of genetic variation and were likely experiencing some inbreeding depression
- Researchers from a separate study introduced guppies from a different population into previously guppy-free reaches of the two streams UPSTREAM of the two focal populations. The introduced guppies differed in terms of what traits they had and in genetic compostion. They also came from a source population with very high genetic variation.
- We individually marked (with a colored elastomer tattoo) and monitored 9,554 guppies throughout the course of 2.5 years to track every single guppy in our focal population. We sampled these populations exhaustively every month throughout that timeframe, so we know approximately how long each fish lived. From a genetic sample of each fish we know the genetic ancestry of each individual, that is, whether it was a resident individual, an immigrant, or a hybrid between the two. We also have photographs of each fish so we could characterize a suite of traits.
- We found that gene flow from the upstream translocated populations increased genetic variation in our focal populations and drastically increased population sizes.
- The most successful fish in terms of survival and reproduction were hybrid individuals, providing a clear case of genetic rescue

Research Relevance and Interdisciplinary Connections

(Optional, but helpful at this stage). To make lessons memorable and relevant for students, we want to highlight the broader systems view of your research. Please add details and any ideas you might already have for grades 5-12 activities related to your research in each subject. No worries if you don't have any ideas yet (that's what we're here for—we're just gathering data at this point).

Science connections: what are the broader connections of your research to technological advancement, engineering, medicine, or other areas of science?

- understanding genetic methods and tools

Math connections: what kinds of data, math, and data visuals do you routinely use?

- basic summary statistics on fish traits
- population size over time plot
- histograms

Social Studies connections: what are the broader connections of your research to technological advancement, engineering, medicine, or other areas of science?

- conservation decisions often require the collaboration among many different stakeholders (fish and wildlife managers, state and federal agencies, scientists, the public)
- cultural heritage of Trinidad & Tobago