DOES LAKE POLLUTION EFFECT LOCAL FROG POPULATION SIZE?

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Fig. 1: *Vermont Reptile and Amphibian Atlas*

Background

In recent years, global amphibian populations have been on a severe decline for a multitude of reasons (IUCN, 2008). Amphibians are highly sensitive to levels of pollution in an environment due to their highly absorbent skin and vulnerability in their life cycle (VT Dept. of Environmental Conservation), and as such are considered an indicator species for general ecosystem health. High populations of amphibians such as frogs can give insight into the overall health of streams and ecosystems and are applicable to the health of Lake Champlain.

Historic use of Lake Champlain has been traditionally as a trade port (Scott, 2020) but as Vermont transitioned to an agricultural state, trading slowed to an eventual stop. The transition into agriculture created high levels of phosphorus runoff into the lake in the form of nitrate-rich fertilizers and pesticides. The remnants of past and contemporary pollution is one of the most prominent issues facing the lake today. Frogs and other amphibians are sensitive to phosphorus uptake through their skin, as it is poisonous to them (King et al., 2010). As a result, it is important to have scientifically-backed literature denoting the effects that pollution has on the environment (specifically through an understanding of its impact on frogs) to aid our current understanding of the lake's health.

Objectives

We seek to determine the impact that lake pollution has on the local Northern Leopard Frog (*Lithobates pipiens*) (Fig 1) populations along the lake. Our hypothesis is that there is a relationship between lake pollution and frog populations, and that an increase in pollution will decrease frog populations due to their pollution sensitivity.

Methods/Approach

- *We plan to conduct an observational study where we measure frog populations on Lake Champlain at locations with varying degrees of pollution. Pollution in this study will be excess phosphorus in the lake due to fertilizer runoff.*
- *We plan to pick 6 locations along Lake Champlain to survey. Three of these locations will be in areas known for having high levels of phosphorus, and the other three will be in areas with low phosphorus levels (Fig 3). We plan to survey frog populations at night when they are typically the most active. We will measure frogs using systematic sampling, recording the number of frogs found every 5 meters for 40 meters. (USGS, 2015).*
- *In this experiment the independent variable will be pollution from excess phosphorus and the dependent variable will be frog population. We plan on using a T-Test to compile the data we collect at different testing sites to compare across a temporal scale.*
- *We plan to survey each site once in late March, late July, and late October. This timeline allows us to account for changes in frog population due to breeding season changes and different levels of phosphorus as human activities change seasonally. In winter, we anticipate less run-off from agricultural activities, and less activity in frog populations as they hibernate. We will not collect data during the winter.*

Expected Benefits, Management Implications or Greater Impact

- *Globally amphibian populations have been on the decline, most commonly due to human interference (Figure 2)*
- *Northern Leopard Frogs as an indicator species can help to indicate how pollution is affecting not only frog health, but overall lake health and health of other species.*
- *This study will provide evidence for the need for pollution control on a scale spatially-specific to Lake Champlain.*

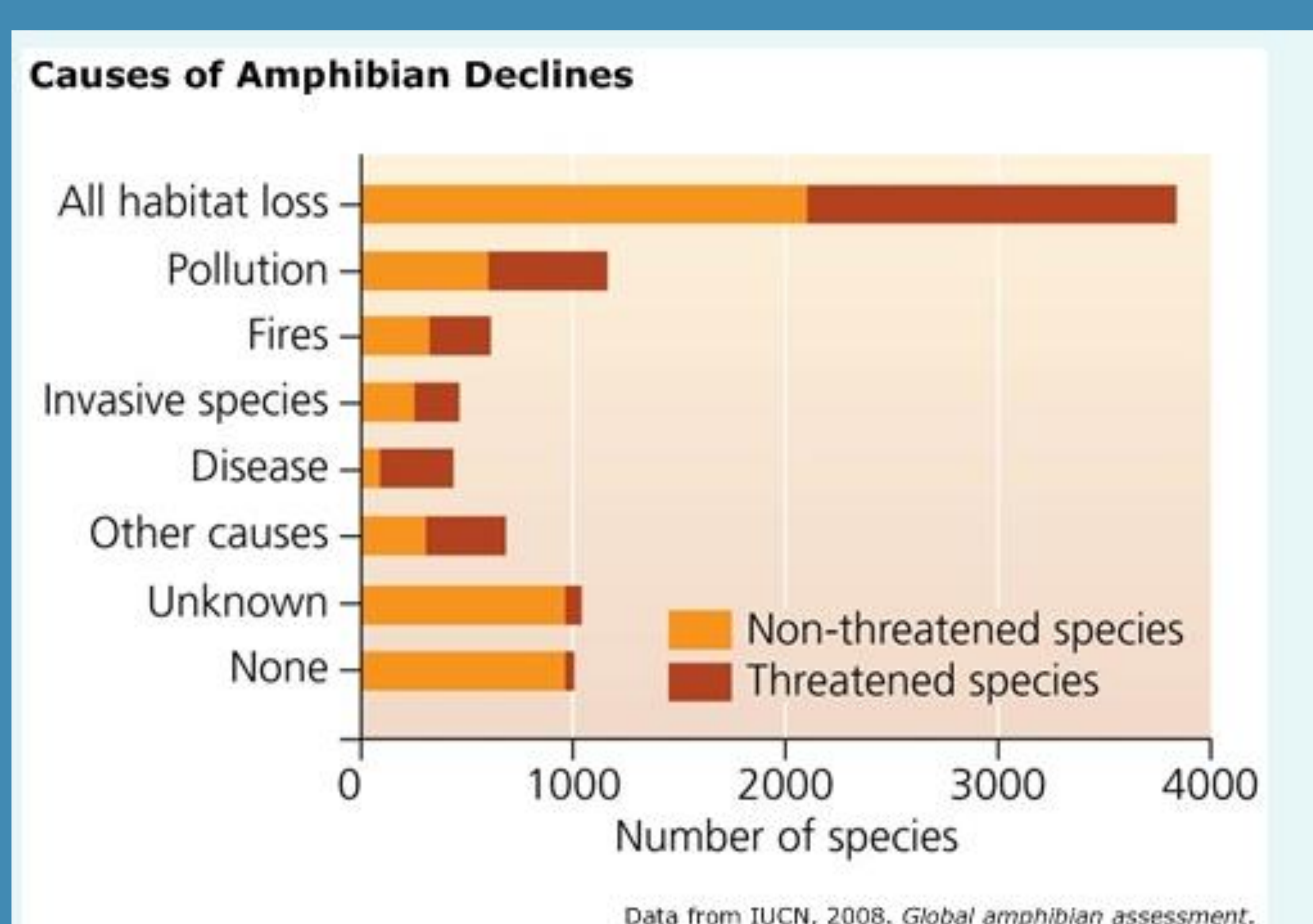

FIG 2: GRAPH: *B.C. SCHEELE ET AL/SCIENCE* 2019, FROG: B. GRATWICKE/SMITHSONIAN CONSERVATION BIOLOGY INSTITUTE

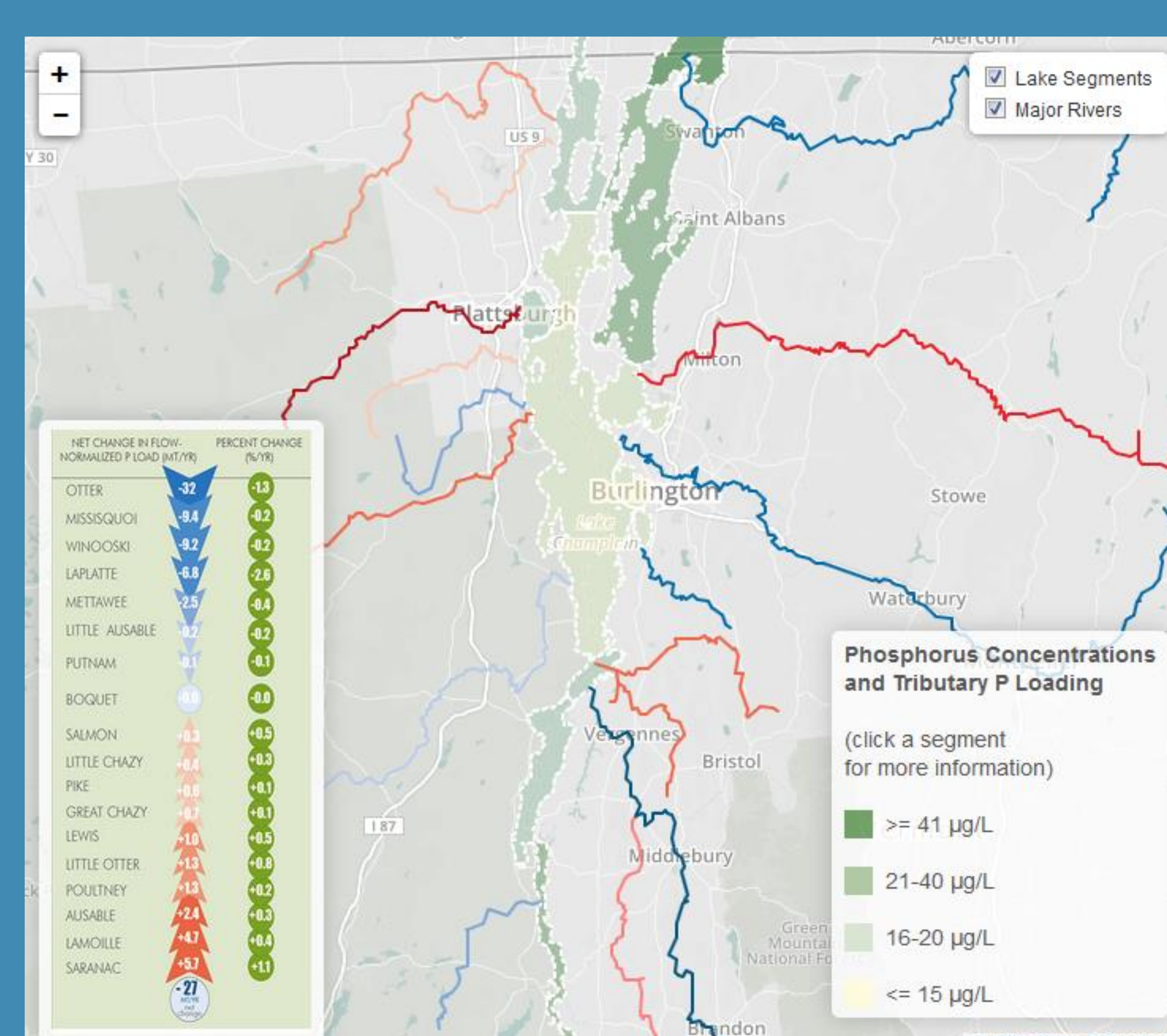

FIG 3: GRAPH: *LAKE CHAMPLAIN BASIN ATLAS*, PHOSPHORUS LEVELS.

Literature cited: *Vermont Department of Environmental Conservation,* Malformed frogs in Vermont. *Jason Scott,* Multi-Agency Contingency Plan for Emergency Environmental Incidents in the Lake Champlain Region, 2020. *USGS,* North American Amphibian Monitoring Program. *IUCN,* Global amphibian assessment, 2008. *King et al.,* Effects of agricultural landscape and pesticides on parasitism in native bullfrogs, 2010.