

Title: Using emerging technologies to understand the distribution of imperiled species

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Summary: Aquatic organisms are frequently ranked among the most imperiled groups and face a wide range of threats. As species decline, there is an increased need to be able to monitor populations and distributions effectively and efficiently; however, traditional survey methodologies can be time consuming, labor intensive, and invasive. Emerging technologies such as environmental DNA (eDNA) and unmanned aerial vehicles (drones) have recently been shown to be effective tools for wildlife research. eDNA assays are based on the capture of DNA shed from target organisms and have been shown to outperform traditional surveys as they are highly sensitive, making them well-suited for monitoring rare and cryptic species. Additionally, the use of drones has demonstrated the potential to bridge gaps in data collection by offering a less labor intensive, minimally invasive, and more efficient detection of species. Despite prior success of these methodologies, validation is needed to confirm their utility. Here, I present examples from studies using eDNA and drones to monitor three species of conservation concern: the Black-spotted Newt, the Rio Grande Siren, and the Rio Grande Cooter. Our recently developed eDNA assays have helped to better define and expand the current recognized distributions of these three species and identify sites where follow-up surveys are needed. We compared the efficacy of eDNA assays to traditional methods and found that these assays greatly outperformed traditional methods in siren detection. Finally, we found that drone surveys successfully detected target species and showed promise to outperform traditional survey methods at sites with high numbers of turtles. Collectively, our recent research has highlighted the strengths and utility of using eDNA and drones in conjunction with traditional survey methodologies to generate species occurrence data, which can help inform management decisions.

Related Papers:

- Bogolin AP, Davis DR, Kline RJ, Rahman FA. 2021. A drone-based survey for large, basking freshwater turtle species. *PLoS ONE* 16:e0257720
- Ruppert KM, Davis DR, Rahman MS, Kline RJ. 2022. Development and assessment of an environmental DNA (eDNA) assay for a cryptic *Siren* (Amphibia: Sirenidae). *Environmental Advances*. doi.org/10.1016/j.envadv.2021.100163 (early view pre-print)