Strengths, limitations, and practical considerations of using eDNA techniques to detect wildlife and their pathogens.

A webinar hosted by the Canadian Herpetology Society on Zoom at 8 pm EST on 18 Nov 2020

Presentation Abstract:
Increasingly, environmental DNA (eDNA) approaches are being incorporated into projects that seek to detect and monitor wildlife and their pathogens. The long list of highly desirable attributes of eDNA approaches includes the relative ease and non-invasive nature of collecting samples. However, eDNA approaches are not a panacea. They are vulnerable to poor study design, improper sample collection and storage, and a slate of potential issues in the lab come time to test the samples using PCR-based assays. It has been our collective experience that many studies that start out with the best of intentions end in meaningless and unpublishable eDNA results, frequently as a result of avoidable pitfalls. Please join us for a brief overview of what eDNA approaches entail followed by a panel discussion that will touch on practical considerations and recent developments from both field and lab perspectives.

Panelists:
Dr. Laura Brannelly, University of Melbourne, laura.brannelly@unimelb.edu.au
Dr. John Wood, Pisces Molecular, jwood@pisces-molecular.com
Dr. Alyssa Wetterau Kaganer, Cornell University, amw268@cornell.edu
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Dr. Danna Schock, Palustris Environmental, danna.schock@palustrisenvironmental.ca

Major Themes That Emerged:

1) Early, frequent, detailed discussions between the molecular biologists and the field biologists are critical to the success of any project. These discussions should happen during the earliest planning stages - well in advance of the first reagents being ordered and the first water sample being collected. Discuss everything.

2) Pilot studies are key to the success of a project.
Dr. Caren Goldberg (Washington State U) has shared some overview slides of a presentation she recently gave on the importance of pilot studies and things to consider when designing one.

3) Be informed about what can be learned with eDNA approaches: they are one tool, among many – they are not a 'silver bullet'. They are not necessarily 'cheaper', 'easier' or 'faster' than other approaches once the entirety of a project is considered, from proper field collection to obtaining a meaningful data point from an appropriately outfitted molecular lab. In general, eDNA approaches should be thought of as 'in addition to' other approaches, rather than 'instead of' other approaches.

4) Think holistically about the system of interest when deciding on when, where, how to sample.
For example, consider seasonal variation in microhabitat use, fluctuations in PCR inhibitors (eg. seasonal fluctuations in tannins), possible effects of temperature on DNA shedding (e.g., slower metabolism in

cooler temps – perhaps leading to less shedding of pathogens? Less shedding of frog cells?). Think holistically.

Selected Resources Recommended By The Panel

Bedwell and Goldberg (2019) Spatial and temporal patterns of environmental DNA detection to inform sampling protocols in lentic and lotic systems. Ecology and Evolution 10:1602–1612. DOI: 10.1002/ece3.6014

Goldberg et al. (2016) Critical considerations for the application of environmental DNA methods to detect aquatic species. Methods in Ecology and Evolution 7: 1299–1307. http://doi.org/10.1111/2041-210X.12595

McColl-Gausden et al. (2020) A field ecologist's guide to environmental DNA sampling in freshwater environments. Australian Zoologist: 2020, Vol. 40, No. 4, pp. 641-651

Rees et al. (2014) The detection of aquatic animal species using environmental DNA - a review of eDNA as a survey tool in ecology. Journal of Applied Ecology 51(5): 1450–1459. http://doi.org/10.1111/1365-2664.12306

Roussel et al. (2015) The downside of eDNA as a survey tool in water bodies. Journal of Applied Ecology 52: 823–826. doi: 10.1111/1365-2664.12428

Smith and Goldberg (2019) Occupancy in dynamic systems: accounting for multiple scales and false positives using environmental DNA to inform monitoring. Ecography 43: 376–386. doi: 10.1111/ecog.04743

Please also see other articles mentioned in overview presentation by Laura Brannelly

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