Identifying Bats via eDNA in Water

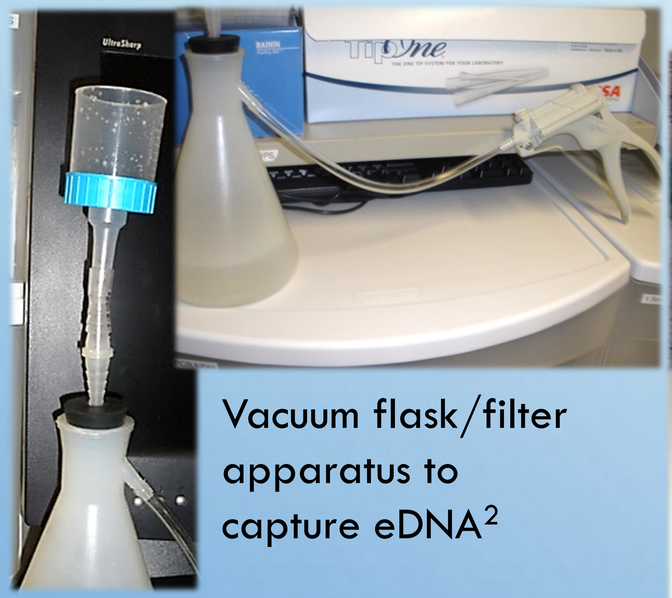
Colin J. Sobek, Faith M. Walker, Carol L. Chambers
Northern Arizona University School of Forestry and The Bat Ecology & Genetics Lab, Flagstaff AZ, USA

Can we develop a method to identify bats from environmental DNA in water sources?

Development


Faith Walker

No bats, but bat DNA



Vacuum flask/filter apparatus to capture eDNA[2]

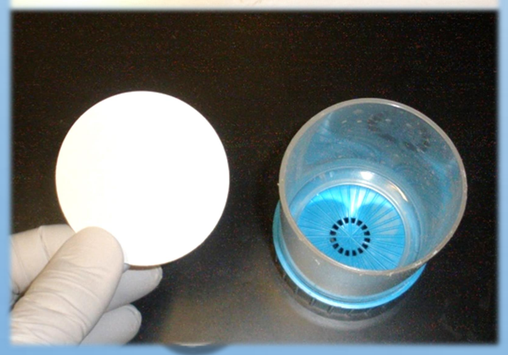
Screened for bat presence using the Species From Feces DNA mini-barcode assay[1] via Sanger and next-generation amplicon sequencing

Troubleshooting and Lab Testing

Problem: Turbid water clogging filter

Solution: Used two filter sizes; large pore first to remove most of the debris and small pore second to capture remaining cells and DNA


Faith Walker



Question: Can we detect trace amounts of bat DNA?

Tests: 2 dilution tests:

1) Small amounts of guano were diluted in DI water (lowest proportion = 0.000628g/L)
2) Individual buccal swabs from known bat species were placed in 1gallon of DI water.


Bruce Taubert

Dilution Test Results

All bat species were correctly identified at all dilutions.
They were:

Eptesicus fuscus, Big brown bat

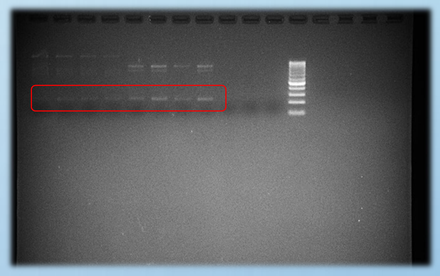
Myotis volans, Long-legged myotis

Myotis occultus, Arizona myotis

Field Results and Future Directions

Species-level identification was not achieved for water from a mine that was subjected to next-generation amplicon sequencing or from water from a cattle tank that was Sanger sequenced, likely because of DNA degradation and non-optimal sampling times.

Target fragment



Next: 1. Apply and test non-filter based approaches such as centrifugation[3] to capture bat eDNA.; 2) Apply next-generation amplicon sequencing to recently-collected water that was sampled during high bat activity.

References:
1) Walker FM, Williamson CHD, Sanchez DE, Sobek CJ, Chambers CL (2016) Species From Feces: Order-Wide Identification of Chiroptera From Guano and Other Non-Invasive Genetic Samples. PLoS ONE 11(9): e0162342. doi:10.1371/journal.pone.0162342
2) Laramie, M.B., Pilliod, D.S., Goldberg, C.S., and Strickler, K.M., 2015, Environmental DNA sampling protocol— Filtering water to capture DNA from aquatic organisms: U.S. Geological Survey Techniques and Methods, book 2, chap. A13, 15 p., http://dx.doi.org/10.3133/tm2A13.
3) Williams K.E., Huyvaert K.P., Piaggio A.J., 2016, No filters, no fridges: a method for preservation of water samples for eDNA analysis: BMC Research Notes. DOI: 10.1186/s13104-016-2104-5

Email: Colin.Sobek@nau.edu