

## Innovative eDNA Sampling Technology for Ecological Field Studies



eDNA sampling is a cutting-edge survey tool that offers an affordable and efficient solution to replace labor- and time intensive field surveys, and enables scientists to detect the presence of species that are rare or difficult to identify.

### Areas of Expertise

- Rare, Endangered, & Threatened Species Detection
- Invasive, Exotic, & Pathogenic Species Monitoring
- Baseline Species Inventories
- Environmental Impacts Avoidance, Minimization, Mitigation, & Permitting
- Project Feasibility, Siting Studies, & Permitting Strategy

### Overview

Environmental deoxyribonucleic acid (eDNA) sampling technology is an innovative tool that significantly increases certainty of presence or absence of a species through a non-invasive, cost-effective, and rapid sampling and analysis process — even in challenging field conditions. When the presence of a protected rare, endangered, or cryptic species cannot be confirmed, regulatory agencies typically presume presence, thereby triggering costly presence/absence surveys, regulatory oversight and permitting, avoidance and minimization measures, and mitigation land acquisition.

It is difficult to prove that a species is absent from a study area by using customary sampling methods, making it more difficult to satisfy project mitigation requirements that may be unnecessary. Traditional field studies can provide proof of presence but are limited in confirming proof of absence. eDNA solves this problem by replacing labor- and time-intensive field surveys with an affordable and efficient solution.

eDNA sampling surveys improve upon the deficiencies of less-effective sampling methods by being able to detect microscopic fragments of a target species' genetic material using assays designed to detect that species.

Our database of developed, species-specific assays is growing, and we are collaborating with local laboratories world-wide to expand our eDNA service line into new, global regions to accommodate changing client and partner needs. While we currently offer this service in Canada and the western U.S., we have practical methods in place to widen our reach quickly and affordably.

### Our Approach

AECOM's application of this innovative technology enables scientists to determine the presence of species that are rare or difficult to identify. Because genetic material is continually shed by all organisms and persists in the environment, eDNA technology can be used to discover the species assemblage within a study area. By using laboratory-based, cutting-edge, DNA barcoding techniques that identify species-specific DNA sequences, our team is able to analyze genetic material in samples of water, air, and soil to determine whether the DNA of a target species is present.

eDNA technology is flexible, enabling AECOM to employ it in various settings and provide our clients with customized services and approaches:

- **ADAPTIVE DESIGN** - Fieldwork plans, including timing, can adjust to target species
- **BIOSECURITY** - Field equipment is single-use, preventing transportation of pathogens/invasive species.
- **EFFICACY** - eDNA analyzes target species-specific genetic material.
- **NO ENVIRONMENTAL PERMITS REQUIRED FOR SAMPLING** - No delays associated with permitting.

- **LOW-COST STAFFING REQUIREMENTS** - Teams, led by a senior ecologist, utilize cost-effective staff members to collect the eDNA samples.
- **NO BIAS IN SAMPLING DESIGN** - Sample collection and results interpretation is entirely objective.
- **NONINVASIVE** - Collection of samples has little effect on the sampled medium.
- **MULTISPECIES ANALYSIS WITH A SINGLE SAMPLE** - Up to three distinct species can be analyzed in one sample, regardless of species group — e.g., amphibians and mammals concurrently.
- **UNRESTRICTED TIMING FOR SAMPLING** - Samples can be taken across all life stages and ecological processes, even under variable environmental conditions — in stark contrast to customary sampling techniques.
- **RETROACTIVE ANALYSIS OF A SAMPLE** - DNA can be stored for future analysis to identify a species not previously considered — avoids the need for re-sampling.
- **SAFETY OF SAMPLING** - Samples can be taken at arms-length, reducing riskier methods, e.g., in-water work.



*Single Species Detection – the Pacific water shrew, a difficult to detect, endangered mammal, can be detected through eDNA surveys with a simple water sample.*



## Innovative eDNA Sampling Technology for Ecological Field Studies *(continued)*

### Key AECOM ATTRIBUTES

- Based on sound science, eDNA enhances regulatory acceptance of results and study conclusions, ensuring the most appropriate level of permitting, monitoring, or avoidance, minimization, and mitigation requirements.
- AECOM partners with laboratories at the forefront of quantitative polymerase chain reaction (qPCR) detection methodologies for eDNA.
- AECOM senior biologists receive expert training in our stringent internal eDNA sampling protocols.
- Currently offered in Canada/western U.S., we have the tools to expand into new, global areas quickly and affordably.

### Areas of Expertise

- **RARE, ENDANGERED, & THREATENED SPECIES DETECTION** - Field sampling and laboratory analyses target DNA material to accurately identify the presence of a species within an ecosystem.
- **INVASIVE, EXOTIC, & PATHOGENIC SPECIES DELINEATION** - Early detection and range/distribution modeling helps control spread of invasive species and assists in conservation management, including maintenance of ecologically sensitive areas, preservation of habitats, and creation of future plans for species protection.
- **BASELINE SPECIES INVENTORIES** - Focusing analysis on key, target species reduces costs of lengthy field programs and ensures species presence is adequately assessed.
- **ENVIRONMENTAL IMPACTS AVOIDANCE, MINIMIZATION, MITIGATION, & PERMITTING** - Improved detection and delineation of a species' range helps stakeholders choose optimal levels of avoidance and minimization measure to inform permitting and mitigation planning.
- **PROJECT FEASIBILITY, SITING STUDIES, & PERMITTING STRATEGY** - Pre-project investigations significantly decrease unexpected finds of rare or endangered species, helping preclude surprise discoveries after baseline studies begin.



California tiger salamander



California red-legged frog



Western pond turtle



American bullfrog