



CALTRANS DIVISION OF RESEARCH,
INNOVATION AND SYSTEM INFORMATION

Research Results

Environmental

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Project Title:

Standardizing Environmental DNA Methodologies for Coho Salmon

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Standardizing Environmental DNA Methodologies for Coho Salmon

This task will develop standardized survey protocol for Coho salmon which is a state and federal listed species.

WHAT WAS THE NEED?

Caltrans is required to initiate Federal Endangered Species Act (FESA) Section 7 consultation and California Endangered Species Act (CESA) consultations for projects that may affect federal and state listed aquatic species. Species listed under CESA must be fully mitigated. Coho salmon (*Oncorhynchus kisutch*), a federally and state listed species with several Evolutionarily Significant Units (ESUs) throughout the state, is one such species. To effectively mitigate for this species, knowing their presence/absence, distribution and abundance is important. Using environmental DNA (eDNA) in water samples is an innovative approach that is less expensive, less invasive, and offers higher detection probabilities than traditional monitoring approaches used to detect aquatic species. However, the approach is not generally recognized in standardized survey protocols developed by federal and state regulatory agencies. By developing distribution and monitoring methodologies, Caltrans practitioners can efficiently establish environmental baseline conditions at culvert and bridge project sites, propose appropriate mitigation for project impacts, and demonstrate the efficacy of mitigation projects in aquatic habitats and at fish passage remediation project locations.

WHAT WAS OUR GOAL?

The goal of this Task was to develop standardized eDNA survey protocols for Coho salmon that will be adopted by federal and state agencies so that Caltrans practitioners can efficiently establish environmental baseline conditions at culvert and bridge project sites.



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WHAT DID WE DO?

This Task was designed to provide guidance for the application of eDNA approaches for monitoring Coho salmon. The initial steps involved conducting a series of laboratory and field experiment to study the ecological dynamics of eDNA, such as production, decay, and transit rates. Using the information from these initial experiments, a predictive statistical model was developed, applied for estimating local- and broad-scale species distribution and abundance in river networks using eDNA.

WHAT WAS THE OUTCOME?

This project undertook a rigorous examination of eDNA, exploring shedding and decay rates, analyzing eDNA transport in stream ecosystems, and demonstrating the robust capabilities of eDNA estimating Coho salmon presence and distribution. These detailed studies laid the groundwork for the precise interpretation of eDNA data, affirming eDNA's efficacy in species detection. Moreover, the application of eDNA in this initiative has not only deepened our comprehension of coho salmon ecology but also accentuated the methodology's vital role in modern conservation practices, ecological study, and the proficient governance of natural environments. This project's outcomes highlight the transformative potential of eDNA monitoring in the management and conservation of aquatic species. The advanced methods developed through this initiative will considerably enhance Caltrans' capabilities to meet regulatory mandates and support the preservation of vulnerable aquatic life. Looking to the future, the adoption of eDNA monitoring will allow for comprehensive biodiversity analysis and marks a significant step towards achieving thorough ecosystem assessments from water samples, allowing for the simultaneous detection of various species.

WHAT IS THE BENEFIT?

Since Caltrans is required to consult with federal and state agencies to mitigate for project impacts on Coho salmon, precise knowledge of their presence/absence, distribution, and abundance is critical. Traditional survey techniques are time and cost intensive resulting in lengthy consultation process with regulatory agencies. Well-developed and standardized survey protocols using eDNA can potentially help Caltrans practitioners establish baseline conditions when evaluating project impacts and develop mitigation plans efficiently and in a timely manner.