



YUKON RESEARCH CENTRE
Yukon College



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no limits. only possibilities.

#1 in
Canada

for research
intensity

- Research Infosource Inc.

Environmental DNA (eDNA):

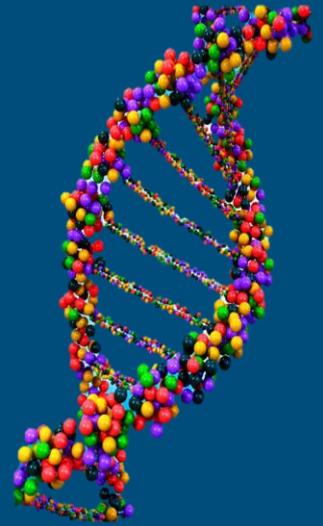
A sampling technique for aquatic ecological studies



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Outline

- Introduction of Yukon Research Centre & Hemmera Envirochem Inc
- Introduction to eDNA
- Yukon's Chinook Salmon Project
- Methods
- Future value of eDNA



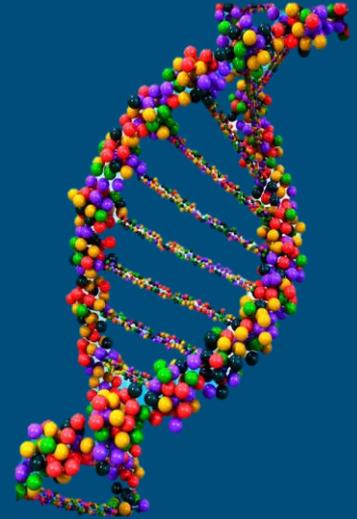
What is eDNA?

DNA

- molecules that carry an organism's genetic information
- unique identifier of species

Environmental DNA

- DNA that is released from an organism into the environment
- can identify the species present in the upstream system



Where does eDNA come from?

eDNA can come from skin cells, feathers, hair, feces, urine



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What can eDNA tell us?

DNA from water samples can be used to identify the presence of target species in or upstream of a sample location

Where can eDNA be found?

- Detectable in aquatic environments
- Subject to environmental degradation
- Lasts between 7-21 days



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Methodology



Water Sampling



Sample Filtering



qPCR

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What can eDNA tell us?

YES



Presence of target species
in or upstream of the
sample location during or
immediately prior to
sampling

NO



Abundance & density

Proximity of species to
sample location

Specific habitat use

Advantages of eDNA

- non-invasive to the species and less invasive to the habitat
- high detection probability
- minimize the risk of pathogen transfer between sites
- sampling staff requires less species-specific experience
- not as dependent on environmental conditions
- can check for multiple species in single sample
- can preserve and hold samples for later testing



Study Design Considerations

Consider sampling requirements to ensure they're appropriate for the system you're sampling...



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Chinook Salmon eDNA Project



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Chinook Salmon & the Yukon

The Yukon River

- One of the most northerly spawning rivers for Chinook
- Longest salmon migration in the world

Importance

- First Nations culture
- Fisheries
- Ecosystem function



scienceorder.com

Oncorhynchus tshawytscha

Project Purpose

One of the first eDNA projects in the north

First eDNA project on salmon in the north

eDNA: proof-of-concept



Hypotheses

H1: can eDNA detect Chinook salmon in the Yukon?

H2: can presence/absence of Chinook salmon be detected in areas where habitat use is known?

Pending secured funding:

H3: do our results match similar studies done in 1997/98

H4: can we detect differences in signal strength?



Research

- .Yukon River Panel Reports 1997/98
- .Al von Finster (fisheries biologist)
- .Yukon Placer Stream Classification



Study Design



fws.gov

3 types of sample sites

- Tributaries with documented salmon use
- Tributaries with natural barriers
- Tributaries with suspected but undocumented salmon use

30 Sample sites total

A subset of samples will be assessed for Bull Trout

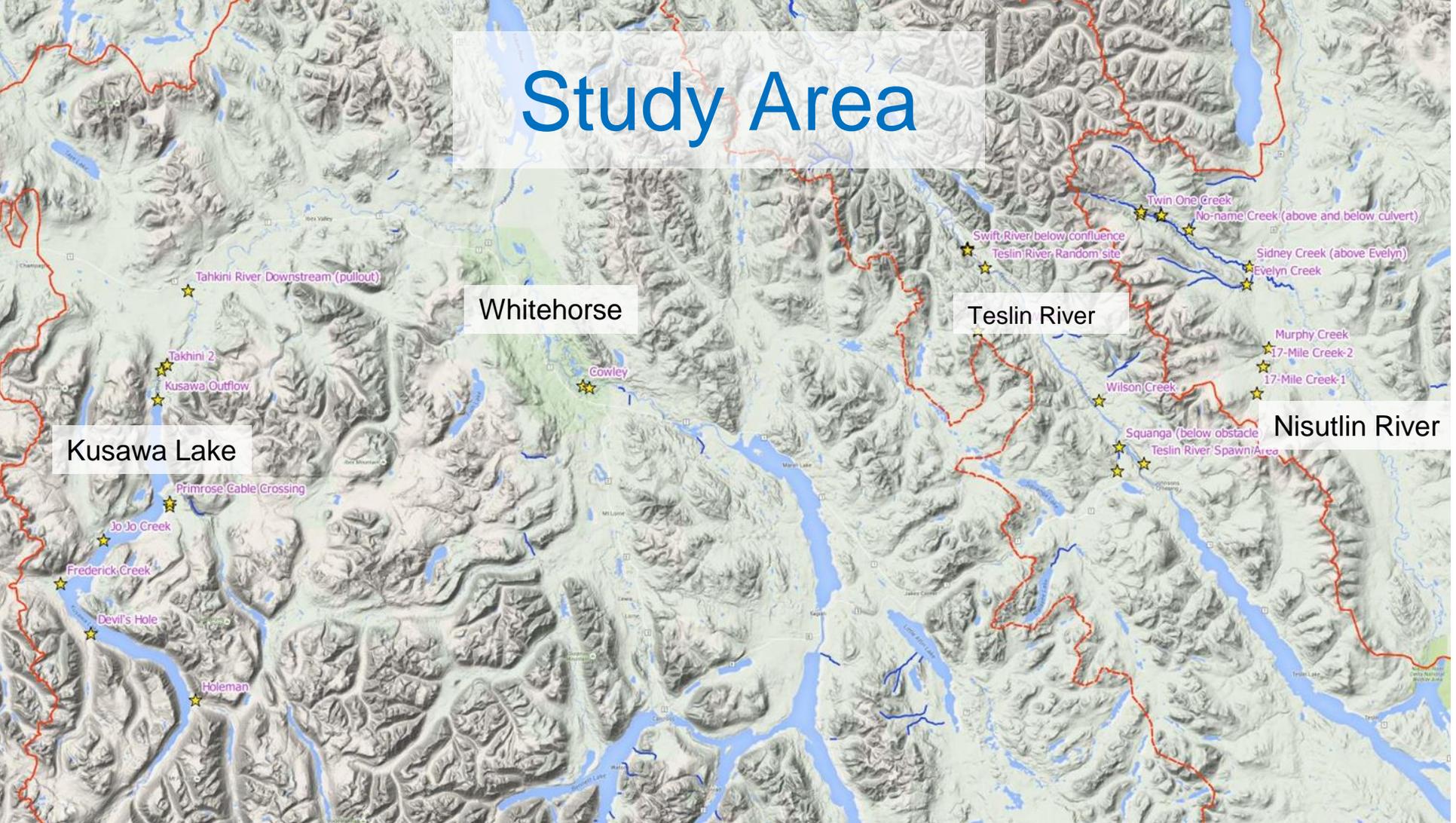
Study Area

Whitehorse

Teslin River

Kusawa Lake

Nisutlin River



How eDNA demonstrates species presence

A library of biomarkers exists at WSU

we compared our collected eDNA to these markers

will tell us if Chinook are present upstream of our sample sites

matching biomarkers indicate species presence upstream of sample sites

qPCR

- Amplifies unique sequences in the collected DNA using a primer from your target species
- Primers can be developed for any species



Project Work Completed

- Sample collection
- Sample filtering
- Shipment of samples to lab

Still to Come...

- qPCR
- Statistical Analysis
- Mapping
- Reporting of Results

Analysis

Is the eDNA technology useful?

Where are the fish?

Is there a relationship between a habitat and the concentration of eDNA collected?

All results of this research will be published on our website and submitted for peer review.

Results expected in Spring 2016.

Reporting Results

Identify sources of error or uncertainty.

Understand that eDNA concentrations depend on:

- environmental conditions
- animal density
- residence time (Pilliod et al. 2014)

Responsible analysis, interpretation, and reporting.



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Expected Results

Validate use of eDNA in Yukon and other northern systems for Chinook Salmon.

Determine probability of false positive samples.

Disseminate results to stakeholders, public, and scientific community.



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eDNA: Looking Forward



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Who's Interested in eDNA?

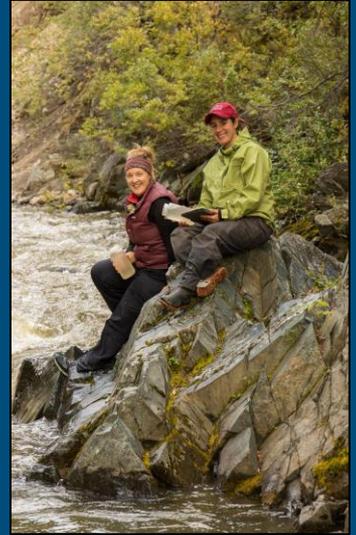


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- Regulators
- Developers
- First Nations
- Conservation & Research Organizations
- Government Agencies
- Private Industry
- Academic Institutions
- And more...

Recap: Benefits of eDNA

- . Cost effective
- . Efficient
- . Less invasive
- . More accurate
- . Detection of rare or inconspicuous species
- . Preserved samples can be kept and used again for other studies



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Recap: what can eDNA tell us today?

DNA from water samples can be used to identify the presence of target species in or upstream of a sample location



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Ideas for Future Studies in the Yukon

Continuation of Chinook Salmon Project

- 2016: Spawning vs. Rearing

Test other areas where Chinook use is uncertain

- Southern Lakes?

Test for other aquatic or semi-aquatic species

- Other fish species of interest
- Species at risk



Funders



Partners



Thank-You.
Questions?



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