

Using eDNA (single species qPCR assays) for aquatic invasive species in AK



Early Detection/ Rapid Response/Treatment Efficacy

Case study on Kendai Peninsula



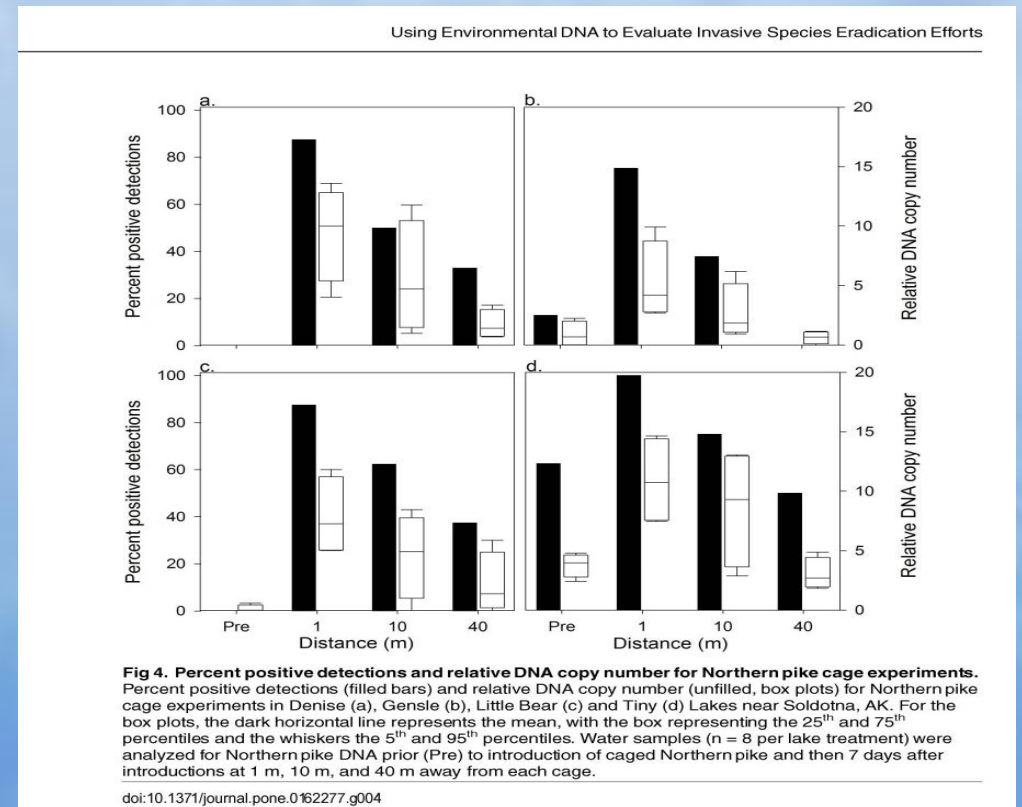
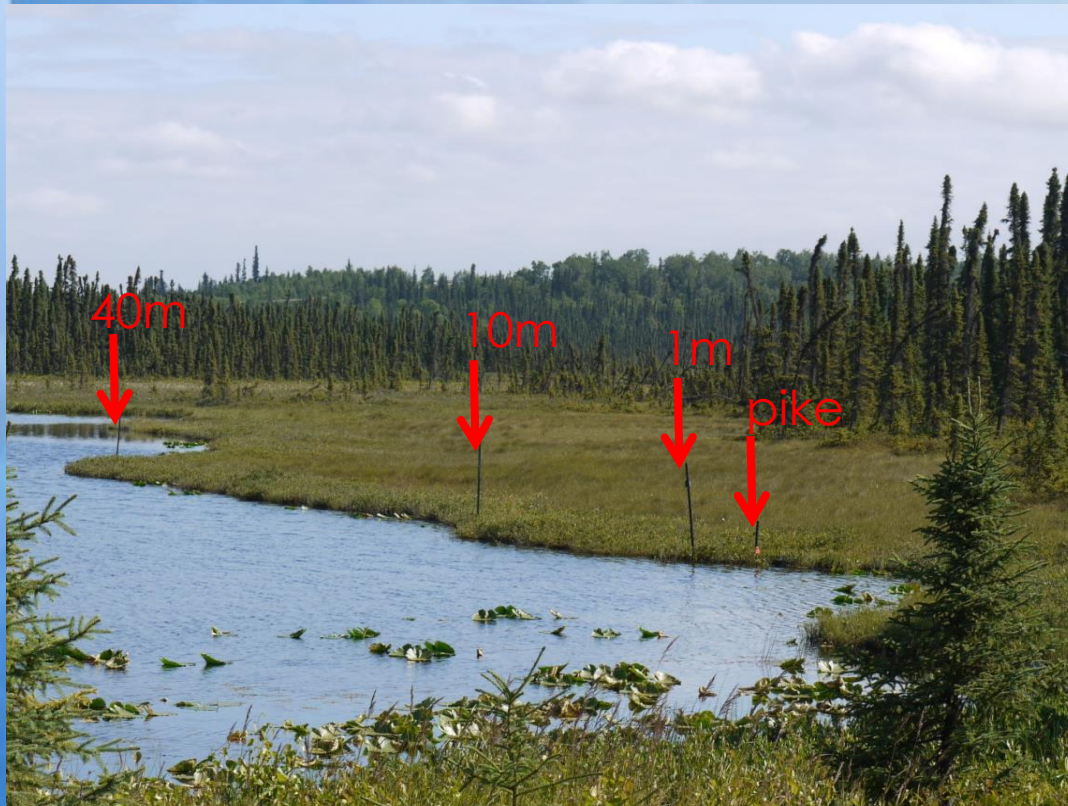
Potential of Environmental DNA to Evaluate Northern Pike (*Esox lucius*) Eradication Efforts: An Experimental Test and Case Study

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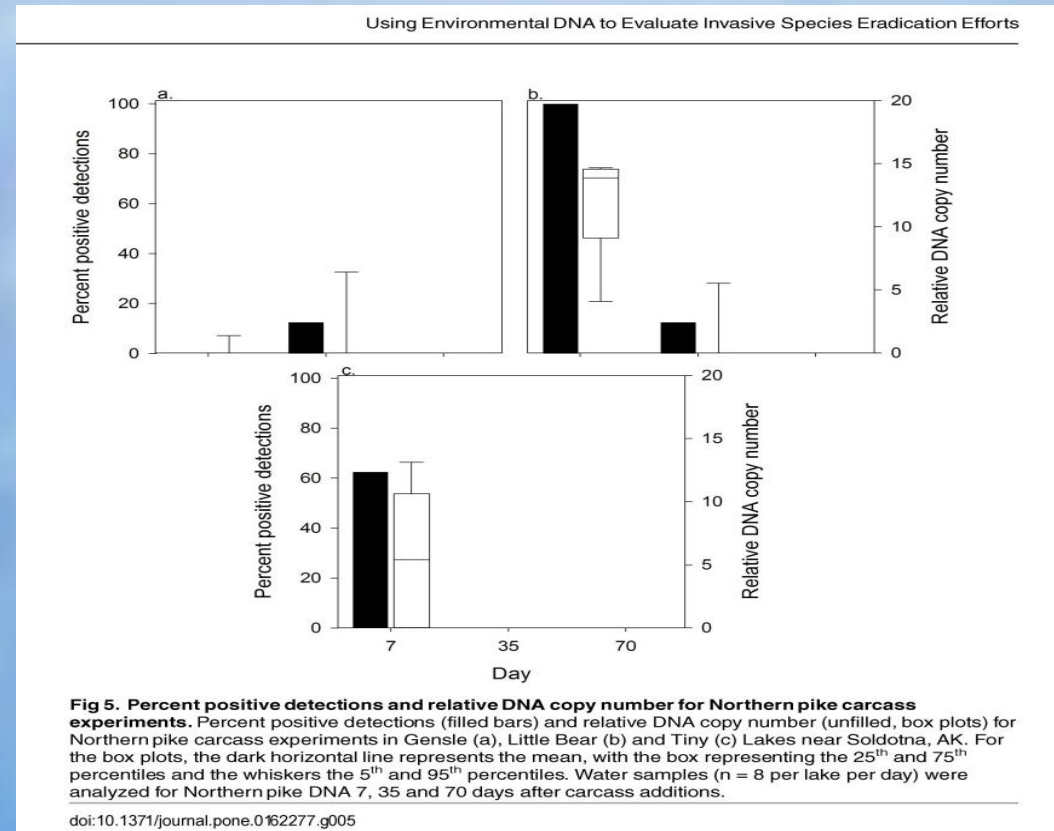
N. pike case study: take home 1

- › Detection probability decreases with distance*



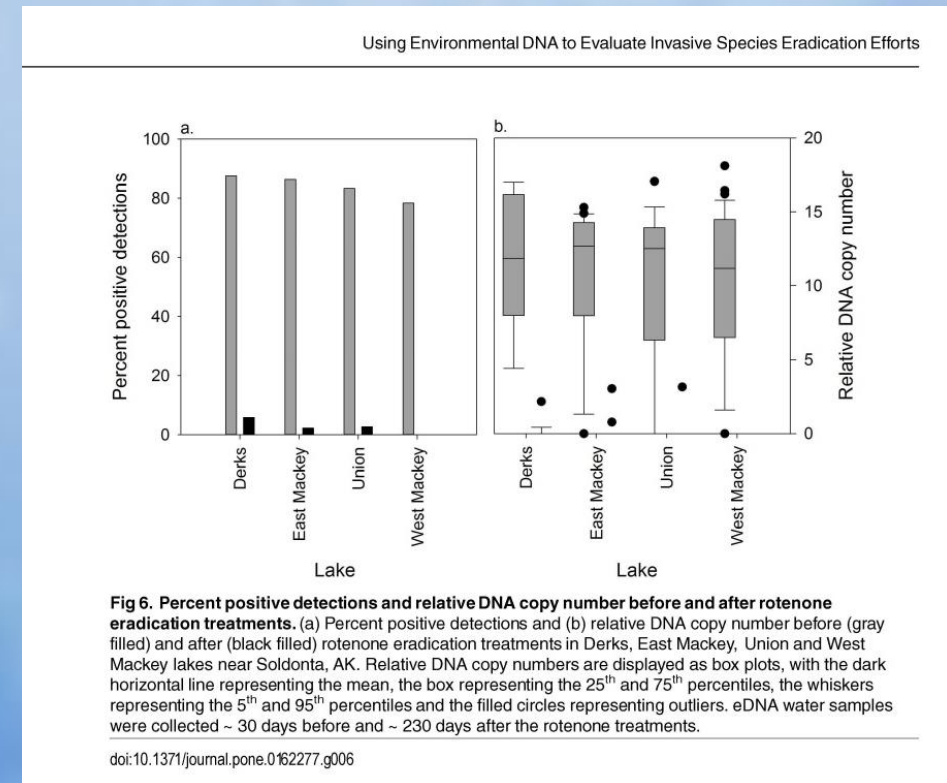
N. pike case study: take home 2

- › Detection probability decreases with time*



N. pike case study: take home 3

- › eDNA, together with other methods, confirms eradication*



Seasonal Variation in the Detection of Northern Pike eDNA in a Southcentral Alaska Lake

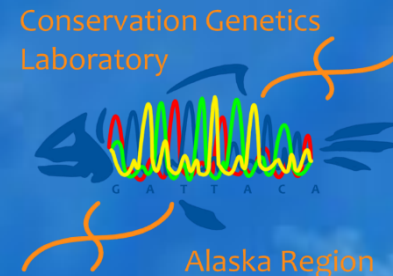
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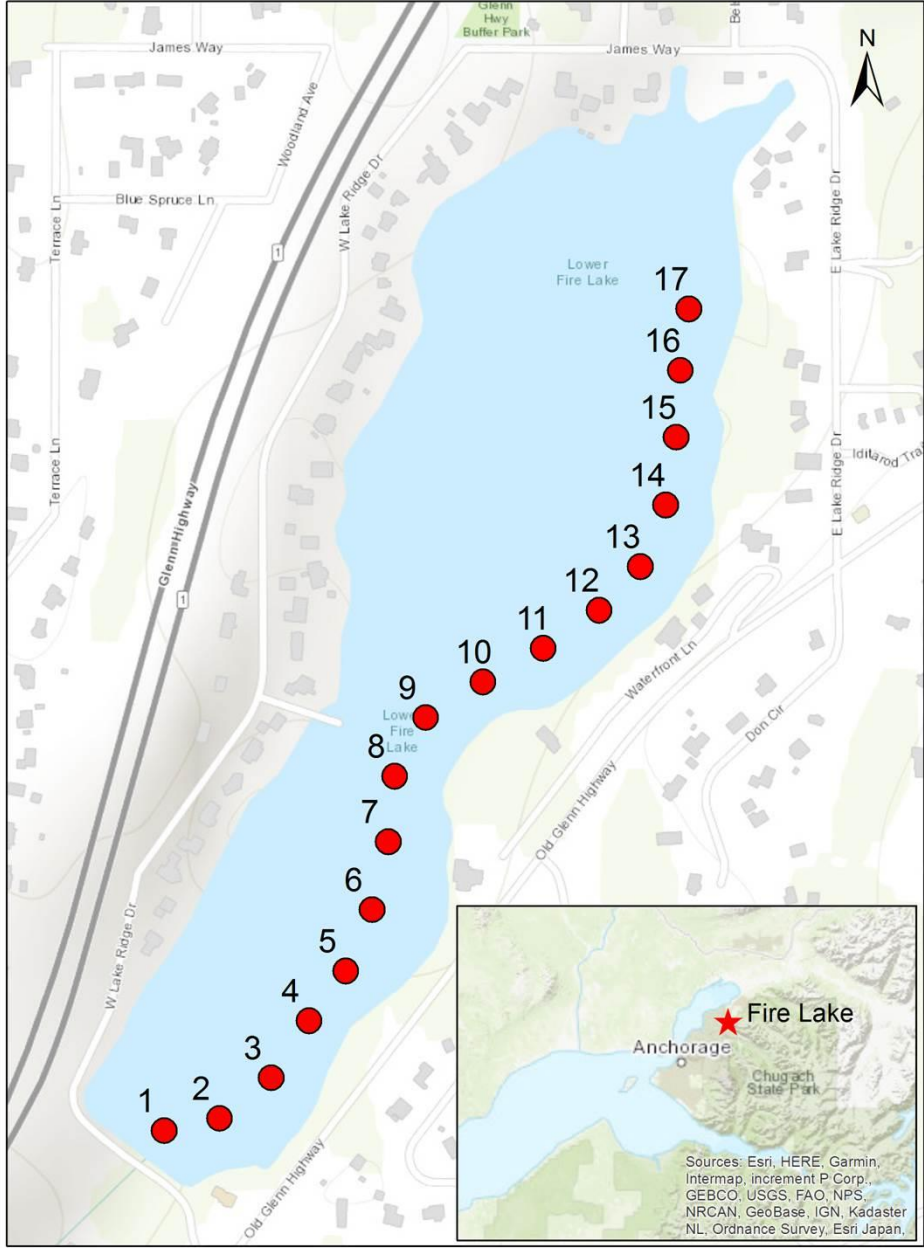
Objective:

Determine if there is a difference in detection probability of Northern Pike eDNA (in a known Northern Pike lake) among seasons.



Challenge for managers...
accessibility to remote locations

Fire Lake / 17 sites



Methods: field (1L water samples)



Fall 2016



Winter 2018

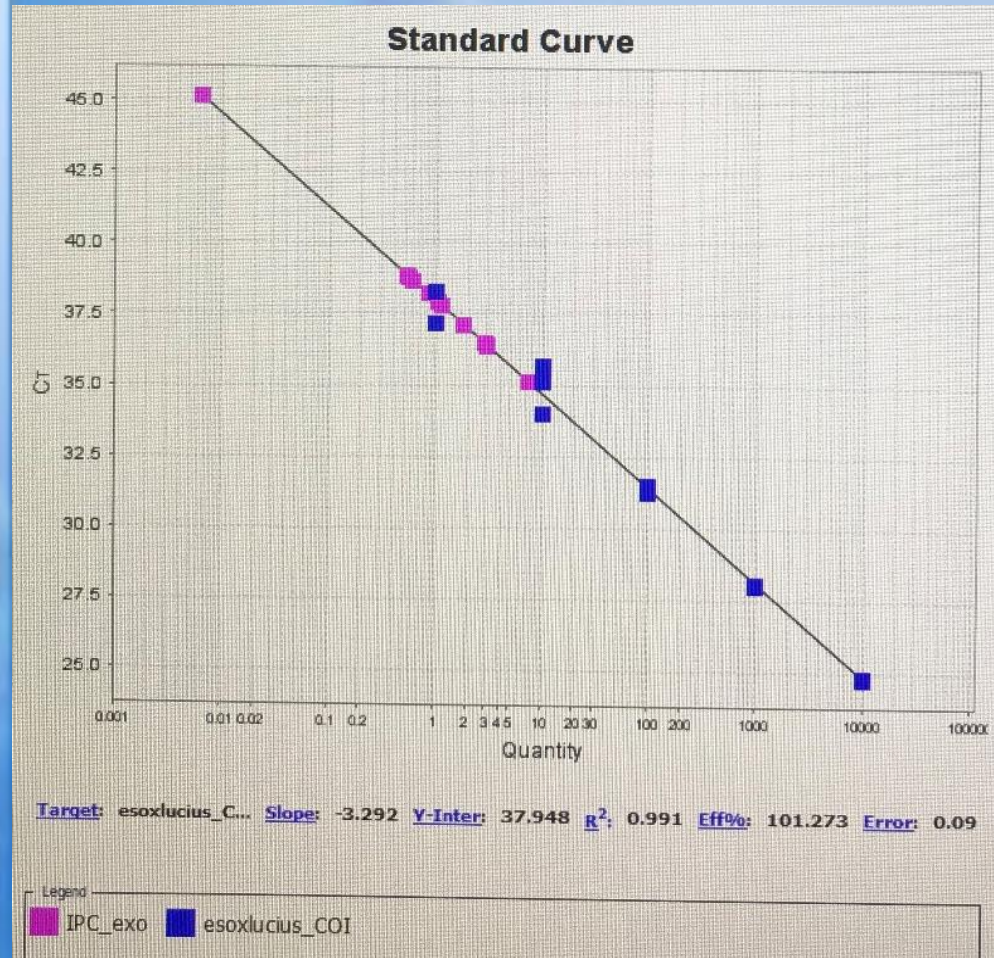


Summer 2018

- ★ one sampling occasion (day) each season
- ★ sampling day assumed to be representative of the season

Methods: Lab & Statistical

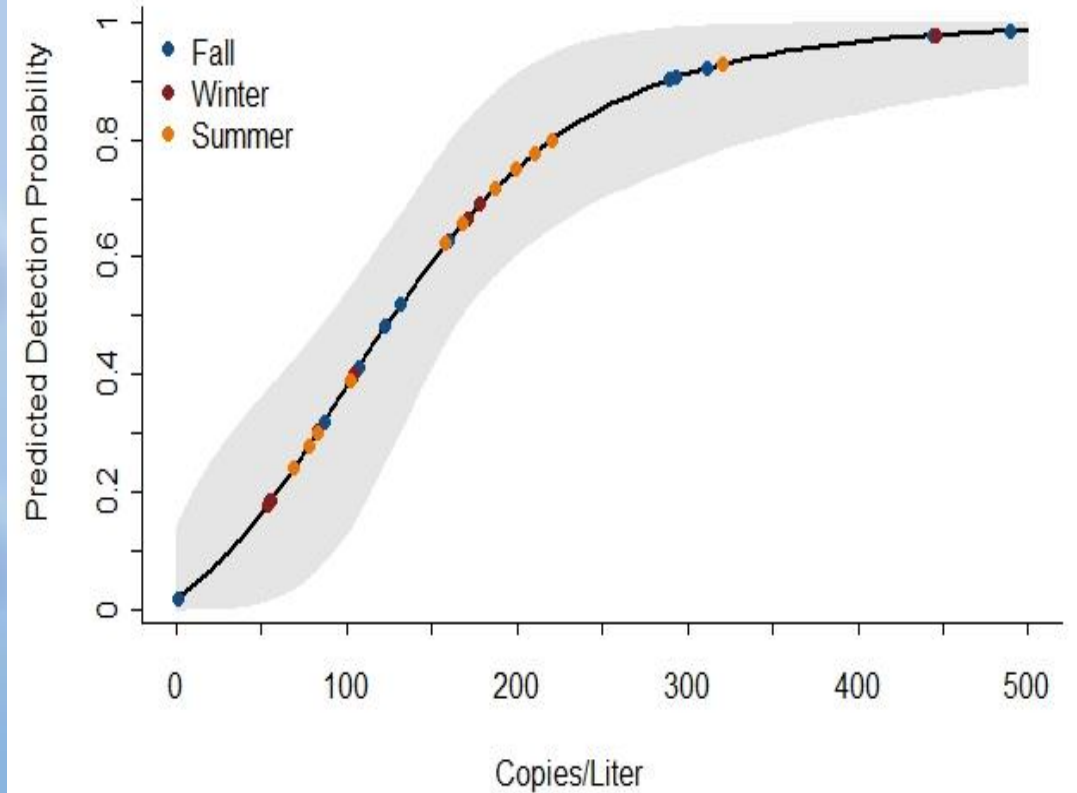
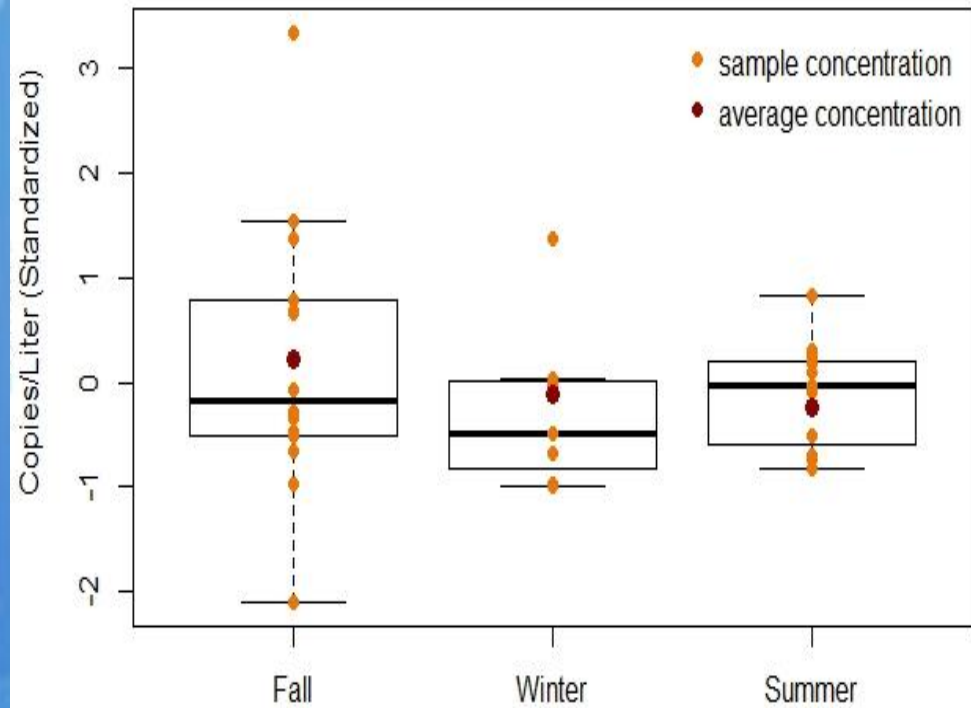
- ★ Single species qPCR assay
(Northern Pike COI)



Estimate relative eDNA concentration (copies/L) for each of 3 “Seasons” and put that data into Occupancy model...

Compare eDNA detection probability using a hierarchical Bayesian framework (following Kery and Schaub 2012)

Results:

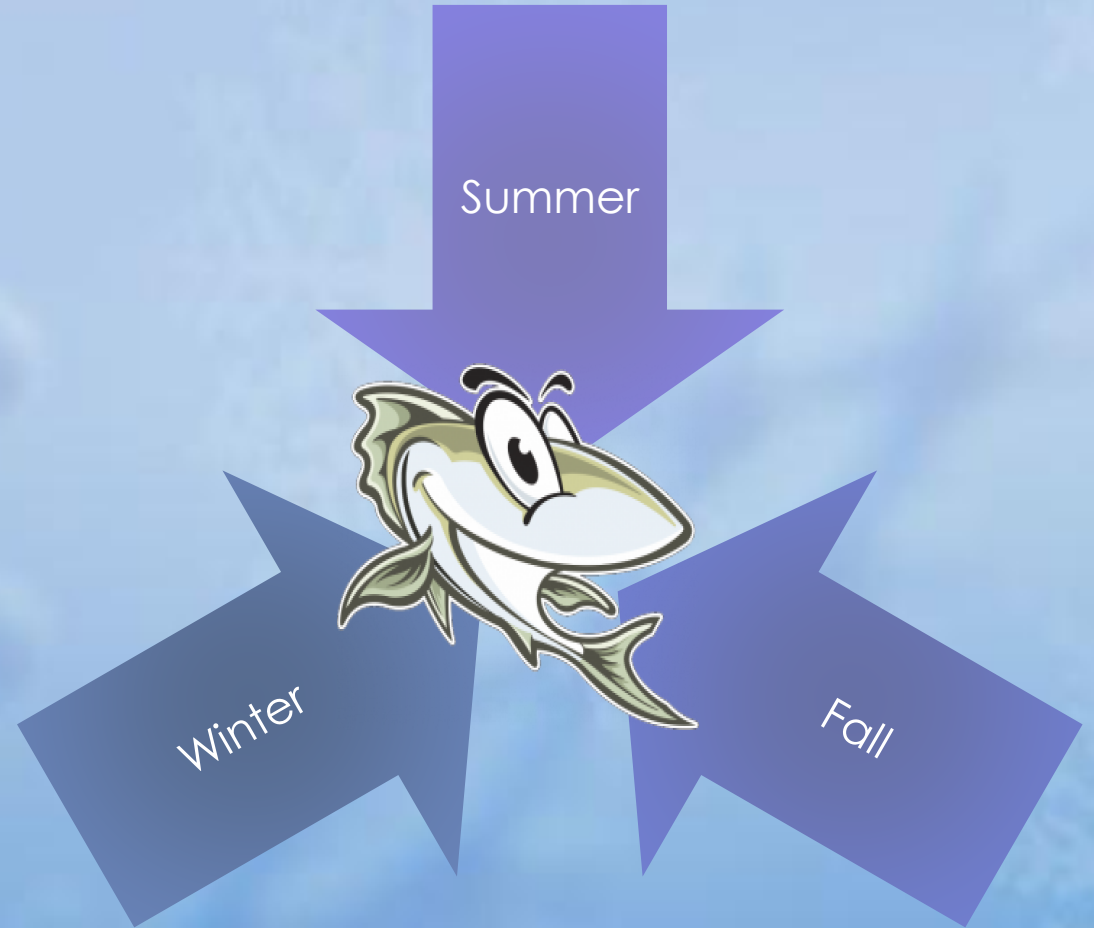


*Estimated copies/L varied, but were not significantly different among seasons (Kruskal-Wallis chi-squared = 1.08, p-value = 0.58)

*eDNA concentration strongly influences eDNA detection probability: 204 copies/L is avg eDNA conc. @which detection probability is 66.9%.

Discussion:

- ★ Northern Pike eDNA detection probability is driven by eDNA concentration (copies/Liter) more so than season.
- ★ More sampling sites or replication of samples may be required in Winter to achieve the same detection probability as Fall and Summer.



Conclusions:

Are you eDNA ready?....

- ★ Sampling strategy is key!! (wheey we explored seasonal ?)
- ★ Pilot studies essential to giving a good baseline and high confidence in eDNA results
- ★ eDNA can be a great complementary tool to observational data. Not meant to replace traditional tools. (Kenai pike study used netting + eDNA)



Elodea....From a cute little aquarium plant to a cold water adapted AK invasive plant



How should *Elodea* eDNA be applied moving forward?

-A controlled field study

USFWS: Jimmy Fox, Anna-Marie Benson, Ora Russ



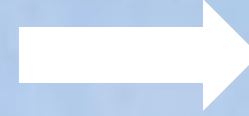
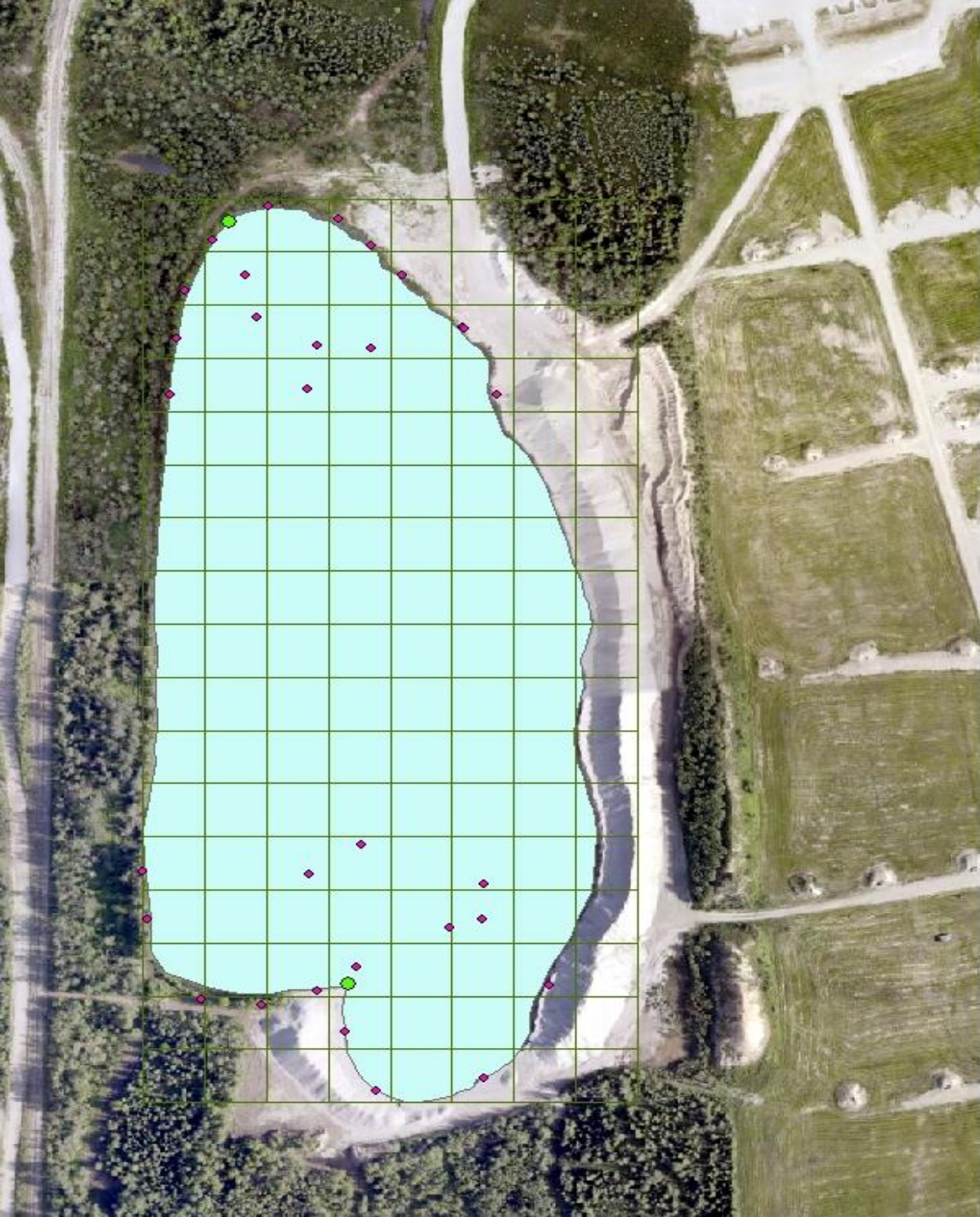
DOD Natural Resources Ft. Wainright: 5.6 hectare pond

eDNA assays for elodea

- › USACE has developed three qPCR assays
 - Generic elodea, *E. canadensis*, *E. nuttallii*

Objective: Detection probability
using occupancy modeling

- 1) 95% confident of detecting 80%
probability of site occupancy of *Elodea*
eDNA (50 m, 75m, 100m) Limit of
Detection
- 2) Estimate how quickly *Elodea* eDNA can
be detected in water samples at the above
distances (one month, 3-4 months, 6-8
months) after introduction.




Elodea was introduced to pond in custom mesh screen buckets (EloCondos) on August 14, 2018

Location of captive Elodea plants (green dots) and water samples (pink dots) collected at the Small Arms Complex Pond (SACpond) on 26 September 2018 on Fort Wainwright, Alaska. The 25m x 25m grid was used to define our sample units.

- *No detections from Sept 2018 sampling (N=30 replicated x 2)
- *March 26, 2019 under ice sampling (lab results in process)
- *Summer 2019 sampling planned




Happy to take questions.....



Aang
(Unangaŋ) "Yes / Hi"

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- Northern Pike
- Norway Rat
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Invasive Species

Overview

Overview

Methods of Introduction

Prevention

Legal Requirements

Report an Invasive Species

According to Presidential Executive Order 13112, an "invasive species" is defined as a species: 1) that is nonnative to the ecosystem under consideration, and 2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

Nonnative species become invasive in a new environment when the natural predators, diseases, or other biological mechanisms that kept the species in check within its former habitat are missing in its new environment. Lacking this biological balance, the invading species effectively changes the biodiversity of a locale. This can often cause millions of dollars in damage to local economies.

 [Invasive Species PSA](#)
By Kenai Watershed Forum

Scope & Effect

Approximately 50,000 nonnative species have been introduced to the United States as a result of human movements, commerce, and trade. Livestock, pets, food crops, and ornamental plants are examples of species that have been intentionally introduced to the benefit of society. Although many new species are unintentionally introduced to new environments each year, many cannot survive outside their native habitat. Other species thrive, yet have no known adverse effects to the ecosystem into which they are introduced.

- Atlantic salmon
- Chinese mitten crab
- Chytrid fungus
- [Didemnum vexillum](#)
- [European green crab](#)
- European starling
- [Gypsy moth](#)
- Invasive tunicates
 - Botrylloides violaceus*
 - Botryllus schlosseri*
- New Zealand mudsnails
- [Northern pike](#)
- [Norway rat](#)
- Quagga mussels
- [Red-legged frog](#)
- [Rock dove](#)
- Sargassum muticum*
- Zebra mussels