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**Date:** 12/29/15

To: Jeff Anderson

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 Soldotna, AK 99669

**From:** Rob Massengill

 ADF&G Fishery Biologist

 Division of Sport Fish – Soldotna

**Re:** Performance Report

Final Performance Report

**STATE:** Alaska **FWS Agreement Number:** F13AC00346

**PROJECT TITLE:** Kenai Peninsula Northern Pike Environmental DNA Study

**PERIOD COVERED:** May 1, 2013 - September 30, 2015

**PROJECT OBJECTIVES:**

1. Determine the minimum volume of water sample needed to get a consistent positive northern pike eDNA detections from PCR analysis under a controlled setting (75 L aquaria) during the spring of 2013.
2. Utilize PCR analysis to determine whether northern pike eDNA is detectable in water samples collected from lakes with known live northern pike densities and repeat the analysis for post-mortem sampling over weekly or monthly temporal strata during spring/summer of 2013.
3. Evaluate the success of the 2012 Stormy Lake restoration project (northern pike eradication using rotenone) by analyzing lake water samples for northern pike eDNA pre and post-treatment.
4. Test for northern pike eDNA in the Moose River, Soldotna Creek, Swanson River and Russian River in the spring of 2013.

**RESULTS/DISCUSSIONS:**

The first objective was redefined to accommodate new information learned during this study. Most results for Objectives 3 and 4 are delayed due to lab processing delays. To date, all northern pike aquaria and field trials for this study completed. However, the overall goal of evaluating eDNA detection methods as a tool to detect northern pike was successful. A summary of results and/or changes for each objective are listed below:

Objective 1: The USFWS Conservation Genetic lab (Anchorage) was able to estimate the number of northern pike DNA copies that were present in a 250ml sample of aquaria water that had been stocked with a known density of northern pike (~181 grams/75 liters). The lab also estimated how many DNA copies are needed to produce a desired probability of detection success. This information essentially answered the question that Objective 1 was designed to answer so it was agreed that processing the aquaria water samples was not required to determine a reasonable water sample volume to be used for the remainder of the study. Ultimately, we decided on collecting 1L samples for the remainder of the study.

A redefined Objective 1 is proposed as follows: Estimate the number of northern pike DNA copies present in a 250 ml water sample collected from an aquarium having a density of 181 grams of pike/75 L, and, estimate the minimum number of DNA copies needed in a sample for at least a 90% positive detection probability using qPCR methods.

Objective 2: We discovered that our eDNA detection methods could successfully detect northern pike DNA in all four “study lakes” each stocked with a very low density of caged live northern pike. Detection success was evaluated at three distances from caged fish (1m, 10m and 40m). The overall positive detection rates for the distances were 88%, 56% and 28%, respectively. The eDNA from stocked northern pike carcasses persisted for about one week in lake water during summertime conditions and by one month was not detectable in any study lake.

Objective 3: Stormy Lake was sampled for northern pike eDNA before and after a 2012 rotenone treatment to remove the invasive northern pike population. Those samples were all filtered and remain in cold storage and are awaiting processing by the USFWS Conservation Genetics lab. Delays in processing have occurred due to multiple factors including the slower than expected genetic marker development and testing and by prioritizing other samples needing processing above the Stormy Lake samples. The higher priority samples include those collected from the Soldotna Creek Restoration Project. The Soldotna Creek Restoration Project utilized eDNA detection methods developed and refined by this project to evaluate the success of an ongoing pike eradication effort. The Stormy Lake samples will likely be processed within the year.

Objective 4: The eDNA samples collected for Objective 4 were given lab processing priority ratings and only those collected from Alexander Creek and the Mackey Lake system have been processed by the USFW Conservation Genetics Lab. These samples represented waterbodies containing robust naturalized invasive northern pike populations. Results of these eDNA samples indicate a very high rate of eDNA detection success (90% for Alexander Lake (N=10) and 82% overall for the Mackey Lake system prior to a rotenone treatment (N=85)). Post treatment, the Mackey Lake system had a northern pike detection rate of just 1.6% (N=179). The three positive detections out of 179 samples are believed to have resulted from eDNA still present from pike carcasses. The remaining samples collected during the 2013 drainage-wide sampling effort (i.e. Moose, Swanson and Russian River drainages) will likely be processed within the year

**Results Summary**

Although there is a backlog of eDNA samples from this study still awaiting lab processing, results to date indicate our overall goal of evaluating the utility of eDNA detection methods was achieved. Results from the samples awaiting processing will only provide potential northern pike distribution information and are not considered vital to the core study goal of evaluating the effects of sampling distance and eDNA persistence to eDNA detection success.

Results from the eDNA samples from the stocked “study lakes” provided great insight into the utility of eDNA sampling for detecting ilow density northern pike populations. Further data analysis will provide guidance to researchers and managers on future eDNA sampling strategies, sampling intensity and timing, that is particularly applicable for evaluating the success of invasive northern pike eradication efforts. Results of eDNA samples collected pre and post rotenone treatment in the Mackey Lake system indicate eDNA methods can be a highly sensitive tool for detecting northern pike and will compliment other methods used to evaluate the success of invasive northern pike eradication efforts.

**FINAL REPORT STATUS:**

A journal manuscript is currently being drafted to report on several study components of this project (i.e. persistence of pike carcass eDNA, distance effects on eDNA detection and results of eDNA sampling of two naturalized northern pike populations ithat includes a comparison of eDNA sampling to traditional netting surveys for pre and post eradication effort evaluations. A draft is expected ready for submission during the winter of 2015/2016. Results of the drainage-wide sampling of the Moose, Swanson and Russian River drainages, including the Stormy Lake samples, will be included in a future ADFG Special Report, likely drafted in the winter of 2017/2018 and will also include the Soldotna Creek Restoration efforts wherein eDNA samples for this study were used.

**PREPARED BY:** Rob Massengill **DATE:** December 29, 2015