DIFFERENTIAL SURVIVAL OF TWO SIZE CLASSES OF RAINBOW TROUT ONCORHYNCHUS MYKISS AND THE PREDATORY IMPACT OF NORTHERN PIKE ESox LUCIUS IN A HIGH ELEVATION NEW MEXICO RESERVOIR

Interim Report

to

New Mexico Department of Game and Fish

7/1/2020 – 6/30/2021

from

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Problem Statement and Implications

The goal of this research project is to characterize differential survival of fingerling and subcatchable Rainbow Trout *Oncorhynchus mykiss* at Eagle Nest Lake and inform State managers of the potential contribution of the fishery to the anglers’ creel. Thus, our objectives will (1) evaluate the differential survival of two size classes (fingerling and subcatchable) of hatchery-reared Rainbow Trout, (2) quantify the top-down effects of an apex predator in the fish community through seasonal and long-term assimilated diet of Northern Pike *Esox lucius*, and (3) characterize the bottom-up effects that environmental variables have on food availability to the Rainbow Trout fishery. If Northern Pike selectively consume the smaller-bodied salmonids shortly after stocking, then survival will be reduced in the fingerling cohort when compared to the subcatchable cohort, regardless of the season stocked. Similarly, if zooplankton availability limits the Rainbow Trout fishery, these effects will result in further reduction in survival of the smaller bodied trout, as zooplankton are more important to this cohort than larger subcatchable. As such, subcatchable survival will be higher than that of the fingerling Rainbow Trout. If both cohorts are stocked during fall, fingerling and subcatchable fish will have the advantage of being stocked when the reservoir is no longer stratified (a period of hypoxia and reduced habitat availability) and benefit with increased survival. Results from this research will assist managers with the development of a stocking strategy that improves survival of stocked Rainbow Trout. The following narrative describes our accomplishments within the reporting period 7/1/2020 – 6/30/2021.

Accomplishments (7/1/2020 – 6/30/2021):

(1) Rainbow Trout Survival

Fingerling and subcatchable Rainbow Trout were batch-marked in July 2020, November 2020, and May 2021 using coded wire tags at Red River State Fish Hatchery and released into Eagle Nest Lake. A total of 21 coded wire tagged Rainbow Trout were recaptured (Table 1; Figure 1). During laboratory inspection some tags could not be located (false positive field detection). Coded wire tag detectors are very sensitive to interference from metal sources such as watches, net heads, or jewelry. We suspect that interference from metal on the boat or on the user caused the false positive readings. Care is recommended scanning fish in the future, but false positives are likely to continue. Because so few recaptures were detected, it is likely this data will not be sufficient for statistical analysis. As a result, only qualitative observations and hypotheses may be drawn.

(2) Northern Pike diet and food web dynamics

A total of 178 Northern Pike were collected in fiscal year 2020. Stomach contents consisted of Rainbow Trout, Kokanee Salmon *Oncorhynchus nerka*, Yellow Perch *Perca flavescens*, Iowa Darter *Etheostoma exile*, unidentifiable salmonid and unidentifiable fish. Interestingly, two coded wire tagged Rainbow Trout were recovered from stomach contents (summer 2020 stocked subcatchable; Table 1). In addition to fish prey, leeches and crayfish were also observed. Tissues were collected (spring and fall) for stable isotope analysis of carbon and nitrogen (n=184). Preliminary data analysis suggests that lipid content of most samples analyzed was high, thus a mathematical normalization will be employed to correct for bias associated with fat content.
(3) Water quality and plankton bottom-up characterization

Water quality sample collection of abiotic (water temperature, dissolved oxygen, pH) variables were collected monthly beginning July 2020 through October 2020 and monthly beginning in April 2021 (anticipated through October 2021). The biotic (phytoplankton and zooplankton) samples were also collected, however, the Flow Cam (device used to count phytoplankton) has malfunctioned. At the time of the report, we are waiting to hear if funding would be made available to repair the device. The samples are preserved and archived at 27°C until analysis. If the device is not repaired by October 2021, we will begin manually counting subsamples of phytoplankton. Zooplankton collected in 2020 and April 2021 have been enumerated.

Table 1. Coded wire tagged Rainbow Trout recaptured by electrofishing or gill netting (n=21) gear at Eagle Nest Lake, July 2020 through June 2021.

<table>
<thead>
<tr>
<th>Season Stocked</th>
<th>Size Class</th>
<th>Recaptures by Month</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>July 2020</td>
<td>August 2020</td>
</tr>
<tr>
<td>Spring 2020</td>
<td>Fingerling</td>
<td>1*</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Subcatchable</td>
<td>2**</td>
<td>0</td>
</tr>
<tr>
<td>Summer 2020</td>
<td>Fingerling</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Subcatchable</td>
<td>-</td>
<td>2*</td>
</tr>
<tr>
<td>Fall 2020</td>
<td>Fingerling</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Subcatchable</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Spring 2021</td>
<td>Fingerling</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Subcatchable</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>Both</td>
<td>3</td>
<td>3*</td>
</tr>
</tbody>
</table>

*Tag not recovered; assumed spring 2020 fingerling due to field tag detection and presence of adipose fin.
**Tag not recovered; assumed spring 2020 subcatchable due to field tag detection and absence of adipose fin.
▼Observed in Northern Pike stomach contents.
*Tag not recovered from one fish, this fish cannot be assigned to a cohort.
◊One false positive observed (i.e. tag was detected in the field, but absent upon laboratory inspection).
***Tags were not recovered from two fish; assumed to be spring 2020 subcatchable due to absence of adipose fin.
## Upcoming Schedule: 07/01/2021 – 06/30/2022

<table>
<thead>
<tr>
<th>Date</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 2021</td>
<td>Data collection: water quality, collect predators for stomach contents, Rainbow Trout condition and recaptures to assess survival</td>
</tr>
<tr>
<td>August 2021</td>
<td>Data collection: water quality, collect predators for stomach contents, Rainbow Trout condition and recaptures to assess survival; Stable Isotope Short-course at University of New Mexico</td>
</tr>
<tr>
<td>September 2021</td>
<td>Data collection: water quality, collect predators for stomach contents, Rainbow Trout condition and recaptures to assess survival</td>
</tr>
<tr>
<td>October 2021</td>
<td>Data collection: water quality, obtain tissues for stable isotopes, collect predators for stomach contents, Rainbow Trout condition and recaptures to assess survival</td>
</tr>
<tr>
<td>November 2021</td>
<td>Laboratory quality control / assurance trip to New Mexico State University</td>
</tr>
<tr>
<td>February 2022</td>
<td>Present research at the 2022 annual meeting of the AZ-NM Chapter of the American Fisheries Society and or to Annual Coordinating Committee Meeting of the New Mexico Cooperative Fish and Wildlife Research Unit</td>
</tr>
<tr>
<td>June 2022</td>
<td>Thesis defense; Final report to NMDGF (June 30, 2022)</td>
</tr>
</tbody>
</table>

Account (Index #131955 as of 6/30/2021): $17,470.20 final billing to NMDGF

Disbursement from 7/1/2020-06/30/2021:

<table>
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<tr>
<th>Description</th>
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<tbody>
<tr>
<td>Salary and Labor</td>
<td>$8,400.00</td>
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<tr>
<td>Travel</td>
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<td>University of Georgia Contract</td>
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<tr>
<td>Materials and Supplies</td>
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<td>Sub-Total</td>
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<td>NMSU IDC (10%)</td>
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<tr>
<td>Total</td>
<td>$17,470.20</td>
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</table>
Figure 1. Example of a laboratory extracted coded wire tag, this individual was stocked in spring 2020, photo credit: Rebecca Martinez.