Unique spawning movements and behavior of adfluvial bull trout in a protected watershed

INTRODUCTION

- A population of adfluvial bull trout (Salvelinus confluentus) resides in the upper Cedar River Municipal Watershed (CRMW) in one of the City of Seattle’s main water supply reservoirs, Chester Morse Lake (CML) (Figure 1 and 2).

- CML, located approximately 55 km east of Seattle, serves as a major reservoir in the water supply system for the City of Seattle, provides managed instream flows, a small amount of hydroelectric power, and limited flood control.

- The entire watershed landscape contributing water to CML is owned by the City of Seattle, closed to unsupervised public access, and managed under a Habitat Conservation Plan (HCP) (City of Seattle 2000) to protect fish and wildlife habitat while providing high quality drinking water to Seattle.

OBJECTIVES

As part of a concurrent movement/behavior study, objectives were as follows:
1) Determine characteristics of the spawning migration (initiation date, number of trips between lake and river, and time of movements)
2) Determine percent of tagged population exhibiting annual spawning behavior

DEFINITIONS

Movement = directed change of habitat from lake to river or river to lake
Trip = discrete time interval in which a fish moved from lake to river (and back) during a given year’s spawning migration; may be single for the year or multiple
Migration = one or more trips into river during a spawning season (mid-Sept to Nov)

METHODS

- An array of acoustic receivers (Vemco, Inc.) was established in CML, and individual receivers were placed in the Cedar and Rex rivers at locations where bull trout would likely hold or rest during a spawning migration (Figure 1 and 3).

- PIT tag antenna array was installed in the Cedar River (0.6 km upstream of CML) as part of a concurrent study examining juvenile bull trout and rainbow trout movements (Mesa et al. 2008) (Figure 1 and 3). Juvenile and adult bull trout were PIT tagged.

- Acoustic transmitters were surgically implanted in adult bull trout (Vemco, Inc.) (Figure 9).

- All acoustic and PIT tag detections collected between September 15th and November 30th were compiled for 69 individual bull trout.

- The duration of a movement into riverine habitat was determined by calculating the amount of time between a detection in riverine habitat and a subsequent detection in the lake (receiver array in the river was not dense enough to continuously monitor movement in riverine habitat.)

- In some cases, a bull trout disappeared during the spawning run and was presumed a mortality or a tag failure. These fish were excluded from analysis determining number of trips by individual.

RESULTS

- Spawning surveys (2000 – 2010) show that most bull trout spawn in habitat in close proximity to CML (Figure 5). 82 percent of all documented bull trout redds were less than 3.0 km from CML (N = 4,515) (Barnett et al., in prep. Figure 4).

- The initial movement of tagged bull trout into the river from the reservoir after Sept 15th declined gradually over the spawning year (Figure 5) with most activity initiating before the middle of October.

- 40% of tagged fish made an initial movement during the last two weeks of September – 39% made an initial movement during October.

- 73 percent of all tagged bull trout made 4 to 21 distinct trips between CML and riverine spawning habitat. 58 percent of female bull trout and 50 percent of male bull trout made 4-21 distinct trips between CML and riverine spawning habitat in 2008-2010 combined.

DEFINITION OF ANNUAL SPOINING MIGRATION

- 97 percent of annual spawning migrations were comprised of more than one trip (N = 60 of 62) (Figure 7).

- Maximum number of trips between CML and riverine habitat in a single season by an individual bull trout was 49 distinct trips.

- Number of trips to CML and River: 10/14 – 10/20 (Figure 6)

- 73 percent of all tagged bull trout made between 4 to 21 distinct trips between CML and riverine habitat (Figure 7).

- 24 percent made more than 22 distinct trips.

- 3 percent made only a single trip.

- Maximum number of trips between CML and riverine habitat in a single season by an individual bull trout was 49 distinct trips.

NUMBER OF TRIPS BETWEEN CML AND RIVER

- Number of Trips - Average

<table>
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CONCLUSIONS

1) Most bull trout make several trips between Chester Morse Lake and riverine spawning habitat during a single spawning season and move primarily at dawn and dusk hours.

- Most likely to spawn during daylight hours by retreating to deep water cover in the lake.
- Likely increased predation risk in river during daylight hours by retreating to deep water cover in the lake.
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POSSIBLE ADVANTAGES OF THIS BEHAVIOR

- Highly likely that some females dig multiple redd pockets, therefore annual redd count surveys should consider this possibility in adfluvial systems as in CML.
- Likely that one environmental event (e.g., peak flow, flood) could destroy many eggs from a single female (we observed partially spent females at river mouths during the spawning run, suggesting that more than one redd may be created by at least some individuals).

IMPLICATIONS FOR MANAGEMENT/RECOVERY OF BULL TROUT

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