

Viability of Atlantic Salmon, Brown Trout, and Bidirectional Hybrids During the Early Developmental Stage

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Background

- Brown trout are considered one of the World's 100 most invasive species (Lowe et al., 2000)
- Introduced to over 24 countries (Klemesten et al., 2003)
 - Newfoundland in 1883
- Ecological impacts are not well known in NL, but competition and hybridization with native species such as brook trout and Atlantic salmon have been documented (Westley & Fleming, 2011)



A background image showing several Atlantic salmon swimming in clear, shallow water. The fish are silvery with some darker spots on their sides. The water is a deep blue-green color. A large, semi-transparent white circle is overlaid on the left side of the image, containing the text and a list of bullet points.

Background

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- Atlantic salmon are indigenous to North America, and populations are declining
 - Factors include: habitat degradation, over exploitation, and unexplained marine mortality (ICES, 2015a)
 - Introduction of foreign fishes is a major factor affecting the conservation of Atlantic salmon (Gibson, 2017)

What causes these fish to hybridize?

Makrov, (2008)

- Closely related
- Live sympatrically
- Sneaker parr
- Escaped farmed fish
- Unstable river discharges
- Overfishing
- Introduction/invasion of foreign taxa



Problems with Hybrids

- Genomic dilution (loss of variation)
- Ecological and genetic homogenization (no variation)
- Outbreeding depression (hybrid offspring exhibit lower fitness)
 - Waste of reproductive effort (resources/energy)
- Increased invasiveness
- Extinction



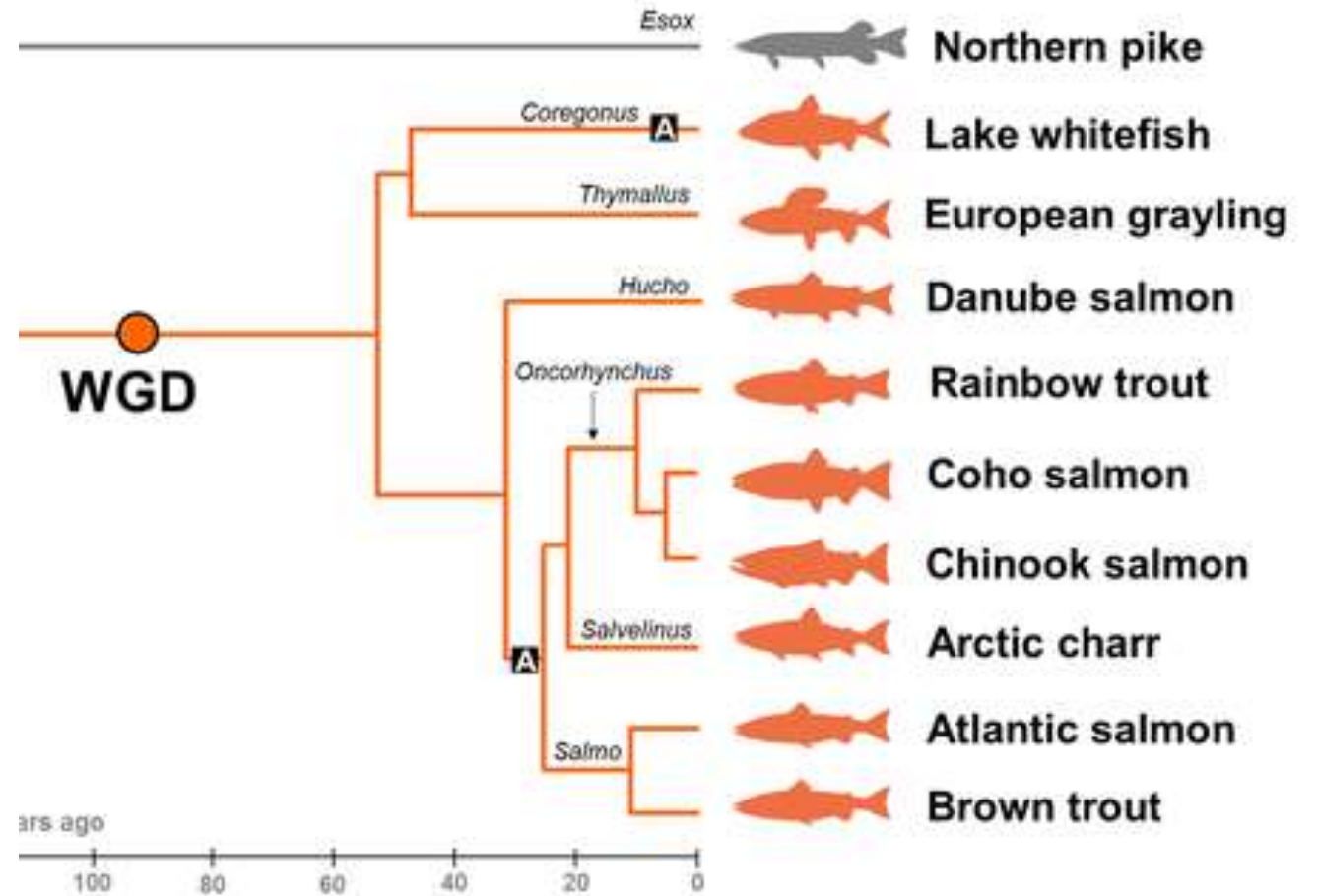
Hybridization Frequency



- Atlantic salmon and brown trout are closely related (Genus: *Salmo*)
- Evolved sympatrically in Europe
- Rates of hybridization are generally higher in North America (Makrov, 2008)
 - **0.1-2.8% hybrid frequency in Europe** (Garcia de Leaniz & Verspoor, 1989; Jansson et al., 1991; Beall et al., 1997; Paaver et al., 2001; Garcia-Vazquez et al., 2002)
 - **0.81-4.67% hybrid frequency in North America** (Verspoor, 1988; McGowan & Davidson, 1992b; Gephard et al., 2000)

Barriers to Reproduction

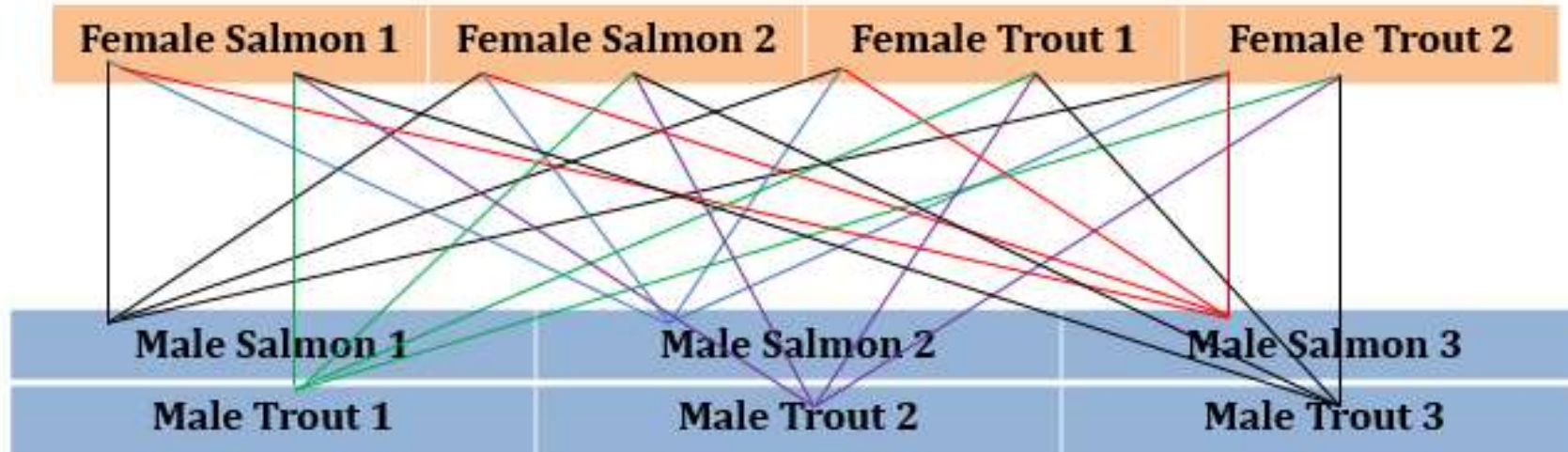
- Different habitat
- Temporal segregation (difference in peak spawning time)
- Behavioral differences
- Hybrid survival
- Developmental instability (deformities)



Because of potentially weakened reproductive barriers, does early developmental viability vary among pure and hybrid offspring?



Experimental Design / Methodology



2 species, 10 fish
24 half-sibling families
x 2 replicates
= 48 crosses
x 2 temperature treatments
= 96 crosses
x 25 eggs
= 2,400 total offspring

