Artificial Lighting Experiments 2014-15
Lake Washington and Lake Sammamish

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Background

- **2001-2005** Habitat use of juvenile Chinook salmon in the nearshore areas of lakes
  - Tabor et al. 2011 NAJFM - Habitat use in Lake Washington
  - Tabor et al. 2011 NW Science - Use of non-natal tributaries

- One preliminary experiment on artificial lighting was conducted in 2005 but no further evaluation was conducted

- Partnered with King County to conduct a more comprehensive evaluation in 2014 and 2015
Introduction

• January to May, juvenile Chinook salmon inhabit nearshore, shallow water (0-1 m deep)

• Shoreline of Lake Washington and Lake Sammamish is highly developed and nighttime artificial lighting is common

• Influence of nighttime artificial lighting on juvenile Chinook salmon and other salmonids is not well known
Study Design – Field Experiments

- Study sites – 156-m shoreline section
  - Uniform habitat conditions, good Chinook habitat and near major tributary, no nearby light sources
- Lake Washington 2014 - Gene Coulon Park
- Lake Sammamish 2015 - Lake Samm. State Park
- Nine treatment sections – each 4-m long with two lights, a light at opposite ends and pointed inwards
  - 3 sections with bright lights - max 50 lux
  - 3 sections with dim lights – max 5 lux
  - 3 sections with no lights
- 15-m buffer sections between treatments
- Treatments systemically assigned
- Incandescent light bulbs used
Study Design

- Light trials conducted on one night in March, April, and May
- Lights started at dusk and ran for one to two hours
- For each trial, also sampled one control night with no lights used (a few days before or after each light trial)
- Fish collected with small beach seine for each 4-m treatment section
- Fish counted and a subsample were measured for length
Total Number of Subyearling Salmonids
Chinook, Coho, and Sockeye

[Bar chart showing the number of subyearling salmonids in Lake Washington and Lake Sammamish for March, April, and May under control and light trial conditions.]
Chinook Salmon
Lake Washington 2014

Two-Way Anova

Light level, Month, and Interaction effects all significant (P < 0.001)

Multiple comparisons:
March – all different
April - bright different
May – no differences
Sockeye Salmon Fry
March - Lake Washington 2014

Number of Sockeye fry

- Bright: 340
- Dim: 30
- No light: 0
Fish Distribution along Shoreline Control Nights (No lights used)

Lake Washington 2014
Chinook only

- May
- April
- March

Lake Sammamish 2015
Chinook and Coho combined

- April
- March

Number of Fish

Section
1 2 3
Lake Sammamish 2015

Number of Fish

Section

Chinook - March
54.7 mm FL

Bright
Dim
No Light

Coho - March
36.5 mm FL

1 2 3

Coho - April
44.3 mm FL

Lake Sammamish 2015

Chinook - March
54.7 mm FL

Bright
Dim
No Light

Coho - March
36.5 mm FL

1 2 3

Coho - April
44.3 mm FL

Number of Fish

Section

Lake Sammamish 2015

Chinook - March
54.7 mm FL

Bright
Dim
No Light

Coho - March
36.5 mm FL

1 2 3

Coho - April
44.3 mm FL

Number of Fish

Section
Hatchery Chinook Salmon
Lake Sammamish, May 6, 2015
Other Fish – Lake Washington 2014

Cutthroat Trout (n = 25)
164 mm FL (range, 122-214 mm FL)

Yearling Coho Salmon (n = 177)
113 mm FL (range, 97-130 mm FL)
May only
Great Blue Heron

Lake Sammamish
May 6, 2015
n = 1
Conclusions

• Experimental field trials were effective in collecting preliminary information on artificial lighting and could be used for further evaluation (e.g., testing types of light)
• Subyearling salmonids appeared to be attracted to artificially lit areas
• Effect was strongest in March when fish were small – Our experiments were conducted in March-May but should have included January and February
• Nighttime lighting can have a strong effect on fish behavior and may increase their vulnerability to predation