

# Predation of Juvenile Salmonids by Trout in the Cedar River 2006-2010

Roger Tabor, Hans Berge, Matt Klungle, Dan Lantz, and Brad Thompson





# Acknowledgements

## SPU

Gary Sprague  
Paul Faulds

## Cedar River AFC

## Trout Unlimited

## Private Landowners

Tim Allen  
Julie Stachawiak

## King County

Kollin Higgins  
Jim Lissa  
Eleanor Bosman-Clark  
Ray Timm  
Frank Leonetti

## USFWS

Lindsay Wright  
Ben Price  
James Curtis  
Tracy Leavy  
Jeff Chan  
Scott Sanders  
Terence Lee  
Dan Spencer  
Steve Damm  
Keith Sweeney  
Howard Gearn  
Tim Romanski  
Nathan Hyde  
Eric Tallman

## NOAA Fisheries

Sean Naman  
Peter Kiffney  
Thomas Buehrens

## WDFW

Chad Jackson  
Brant Boelts  
Nathanael Overman  
Steve Foley  
Kelly Kiyohara  
Clayton Kinsel  
Scott Scheutzler  
Will Morris  
Nate Martens  
Yong-Woo Lee  
Todd Kassler  
Craig Busack  
Anne Bagley  
Bruce Bolding  
Shannon Vincent  
Devin West



# Outline

- Background and project schedule
- General methods
- Trout species and size composition
- Population estimates
- Summer diet and predation estimate
- Winter-spring diet and predation estimate



# Background

1995 Closed to fishing

2003 – Trout abundance estimate  
~17,500 trout > 200 mm (8")

2004 - Catch and Release fishery opened

2005 - WDFW tasked to predict the impacts of alternate fishery regulations

2006 - King County, USFWS, and WDFW collaborated to develop a study plan to estimate abundance, size distribution, and feeding habits of resident trout

2008/2010 – Additional funding provided by Cedar River AFC for winter-spring sampling







# Overall Project Schedule

Year - season	Population estimate	Diet and Predation
2006 – summer	X	X
2007 – summer	X	X
2008 – winter-spring	X	X
2008 – summer	X	
2009 – winter-spring	X	
2010 – winter-spring		X



# Piscivorous Fishes

- Cutthroat trout
- Rainbow trout/steelhead
- Coho salmon
- Torrent sculpin
- Prickly sculpin
- Riffle sculpin
- Coastrange sculpin
- Smallmouth bass





# Methods - Electrofishing Techniques

Summer

Tote-Barge electrofishing



Also angling used

Winter-Spring

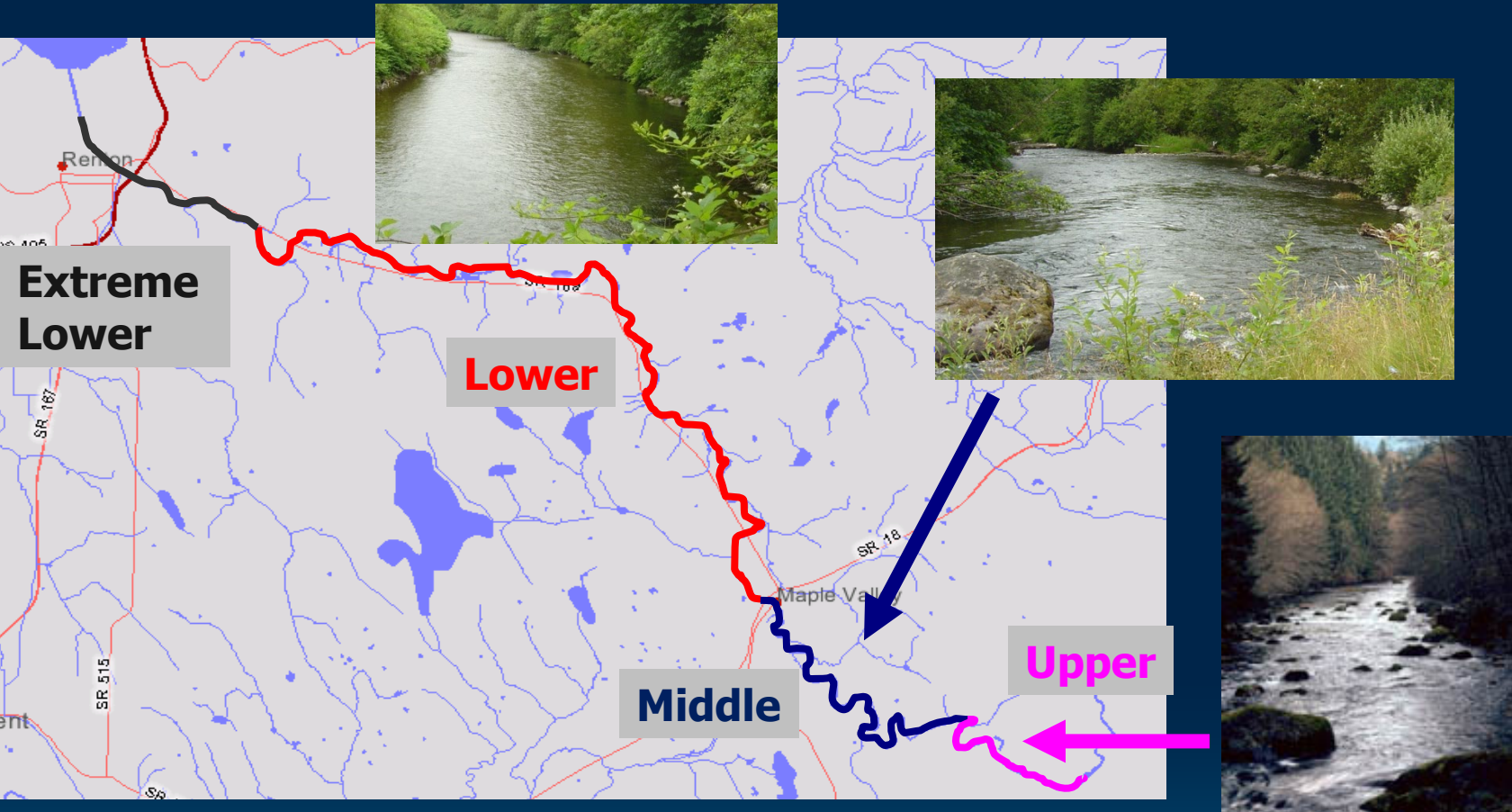
Raft electrofishing  
(available after mid-March 2008)



Also backpack electrofishing used



# Methods - Four Strata



- **Summer** – six sites; each 1.5-2.0 km long; sampled over one two-week period
- **Winter-Spring** – entire reach sampled except lower stratum; sampled once each month

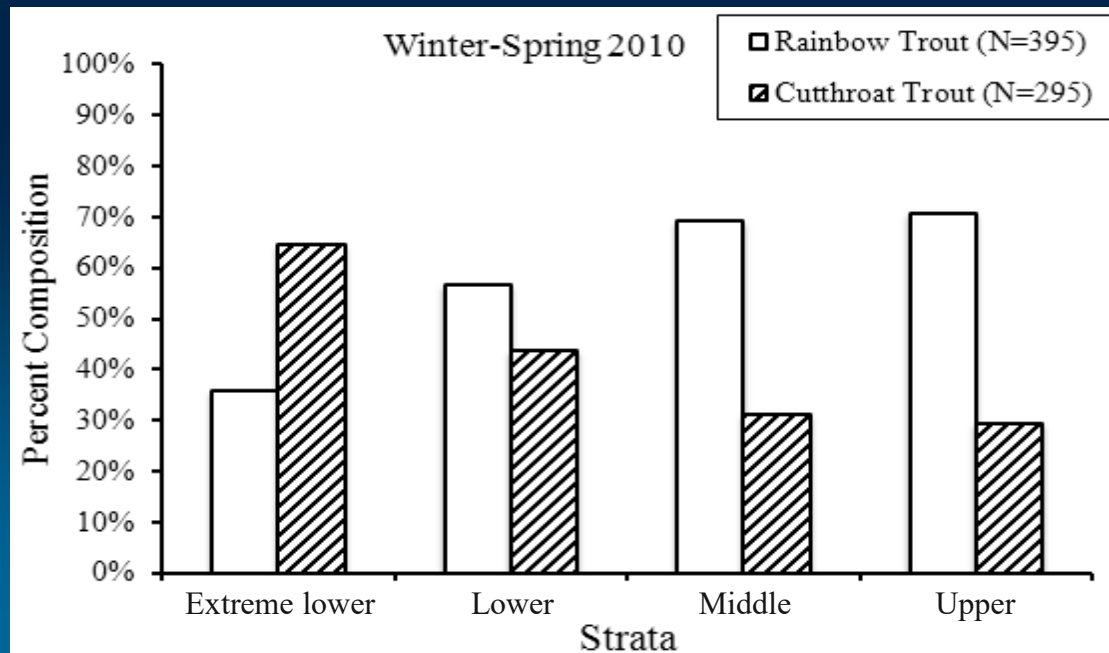
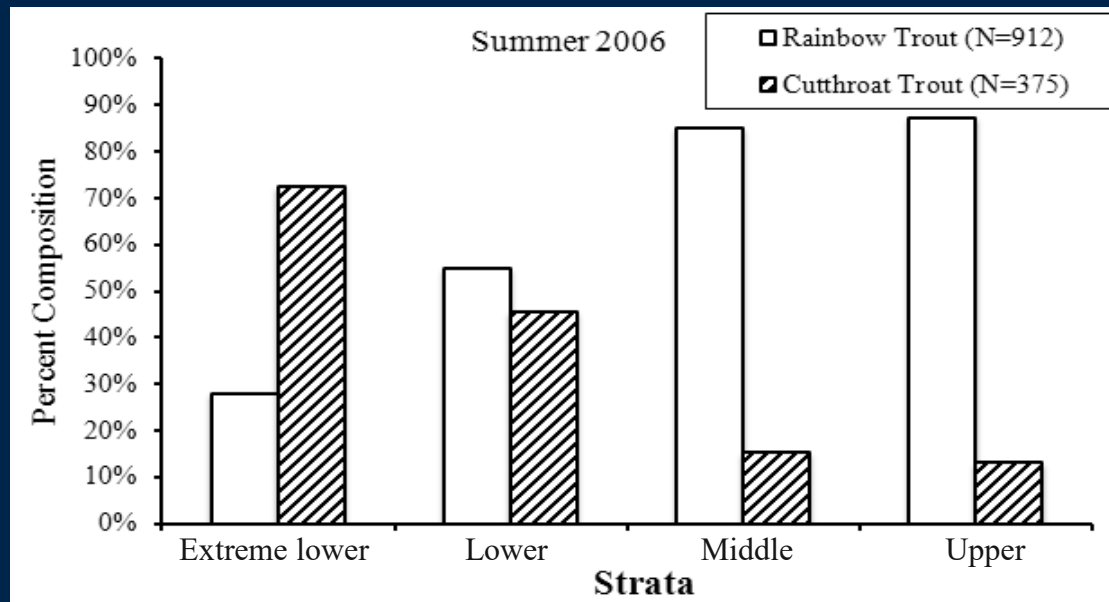


# Results

## Species and size composition

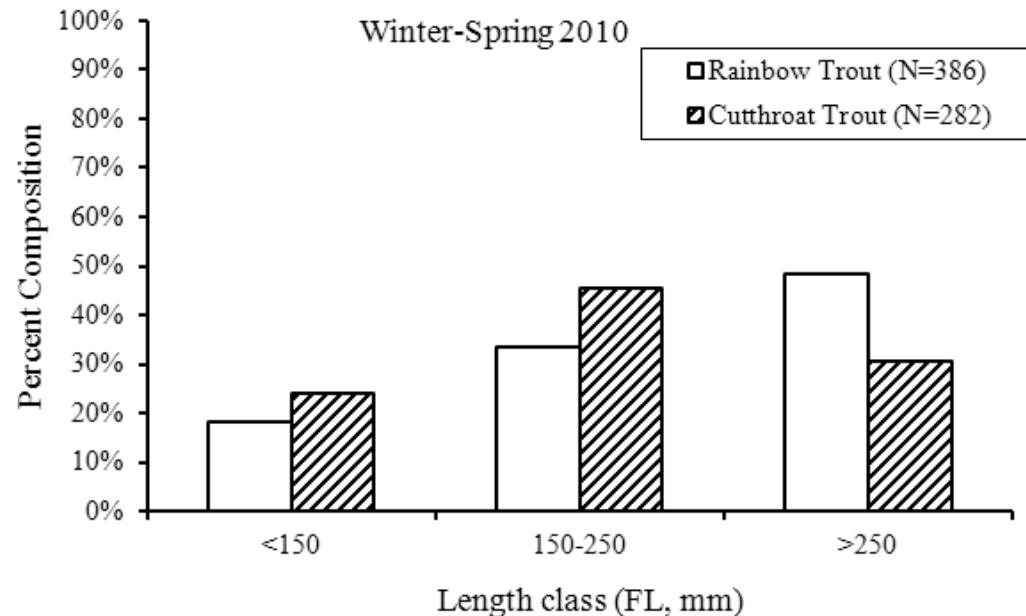
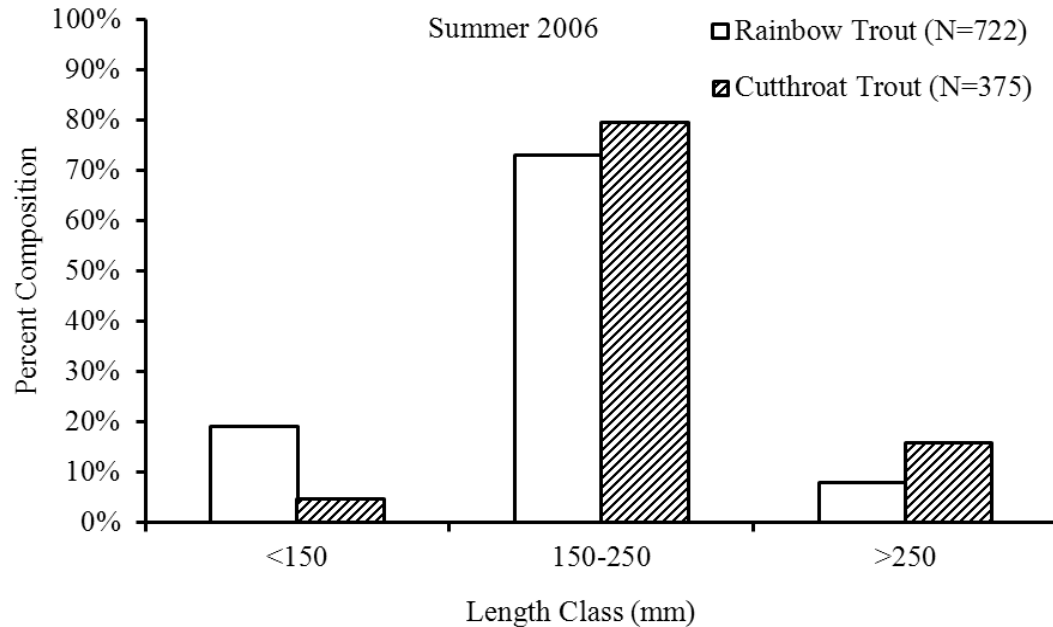


# Species composition by strata





# Size composition





# Population estimates - WDFW



- **Summer** – lower flows and trout are active during the day
- **Winter-Spring** – higher flows and trout are active at night



# Methods

- Summer 2006 and 2007 – Mark-resight method

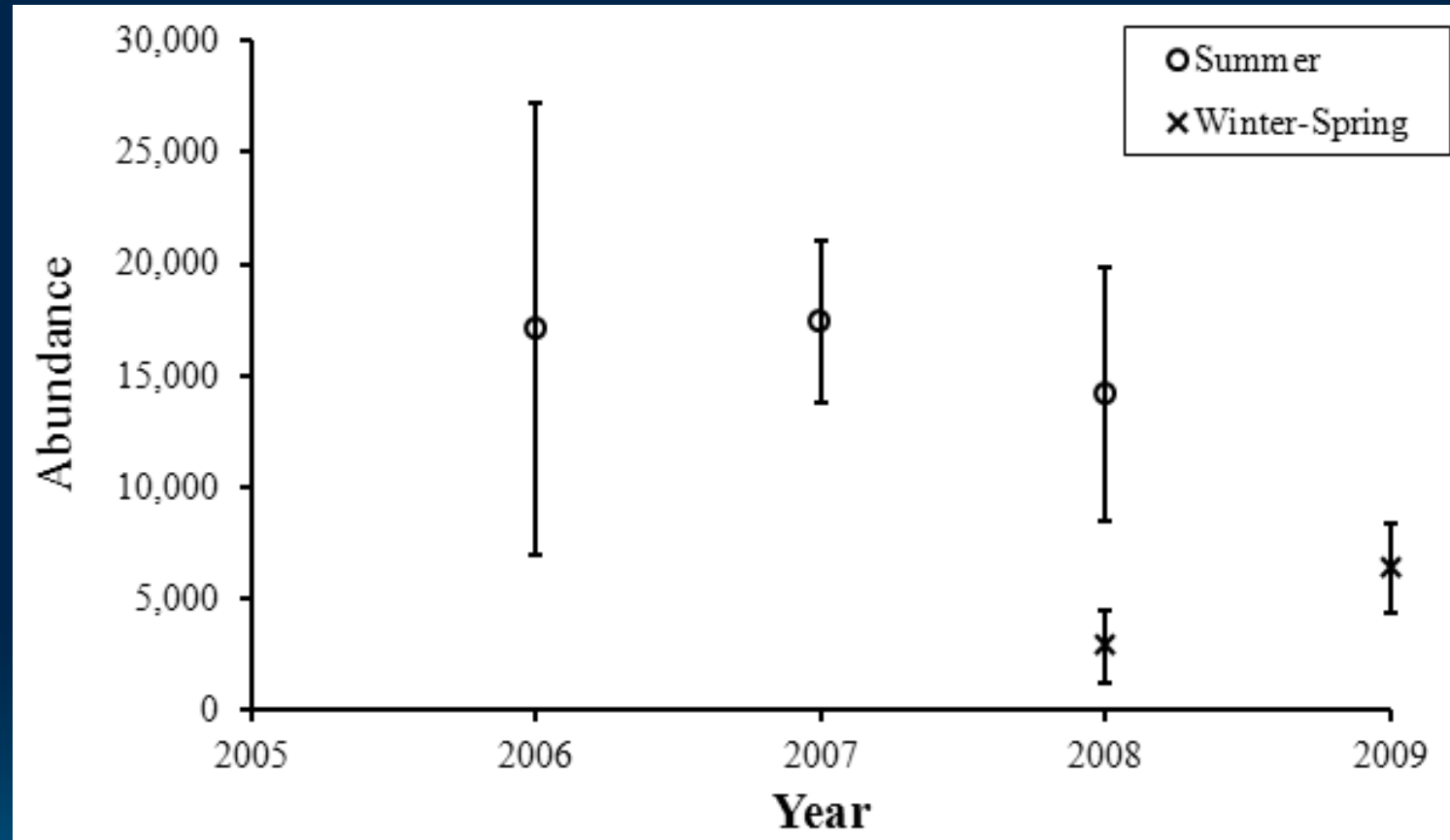


- Summer 2008 – Snorkel counts
  - Calibrated with 2006 and 2007 data
- Winter/Spring – Snorkel counts
  - Calibrated with literature values





# Population Estimates



2003 - 17,468 trout > 200 mm (Dave Seiler, WDFW)



# Diet and Predation Estimation

- Gastric lavage
- Identify stomach contents
  - including DNA analysis
- Predation estimation
  - Direct consumption model
  - Population estimate used to estimate total consumption





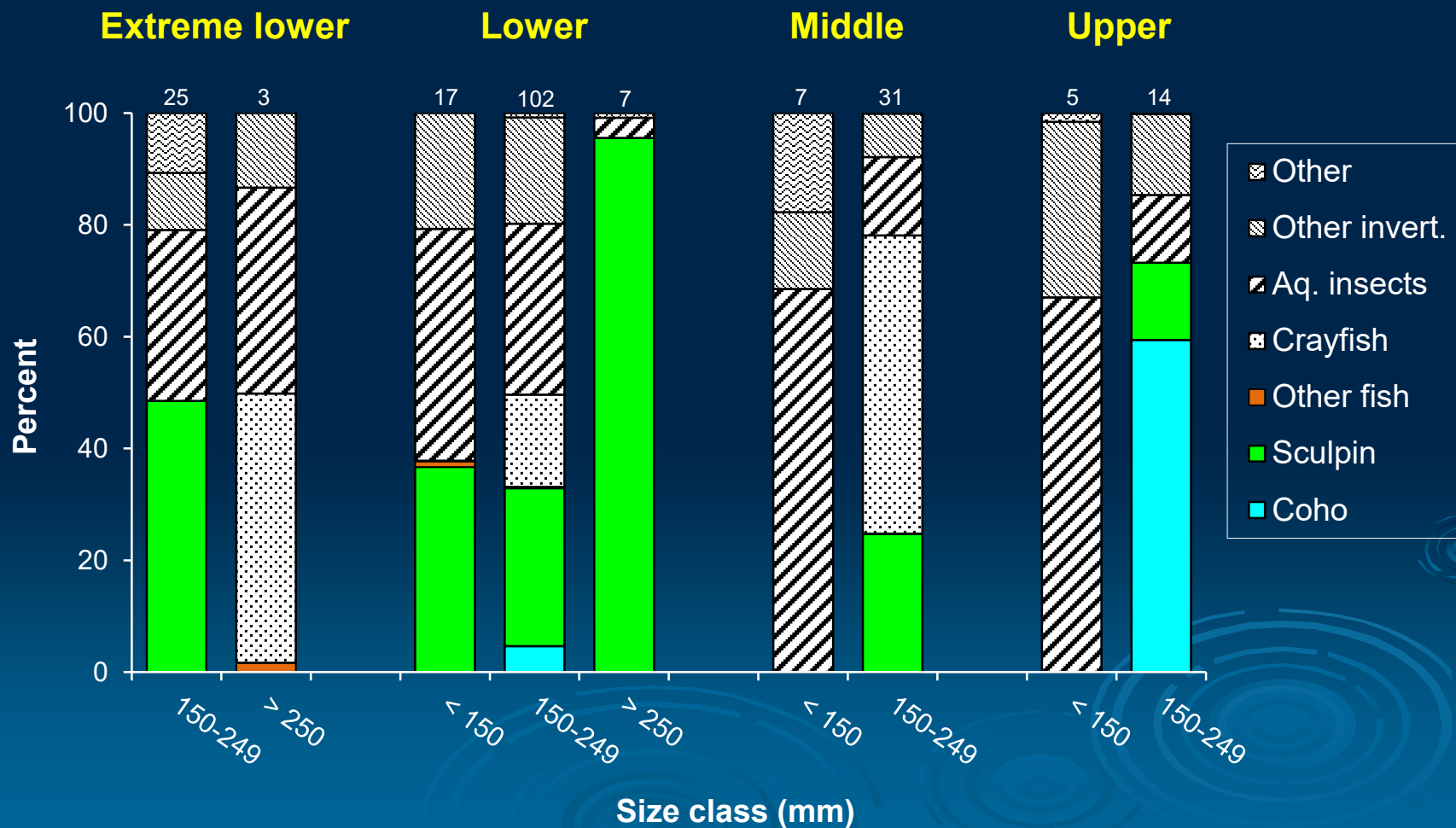
# Summer Diet and Predation

One two-week period (July-August) in 2006 and 2007



# Cutthroat trout – Summer Diet

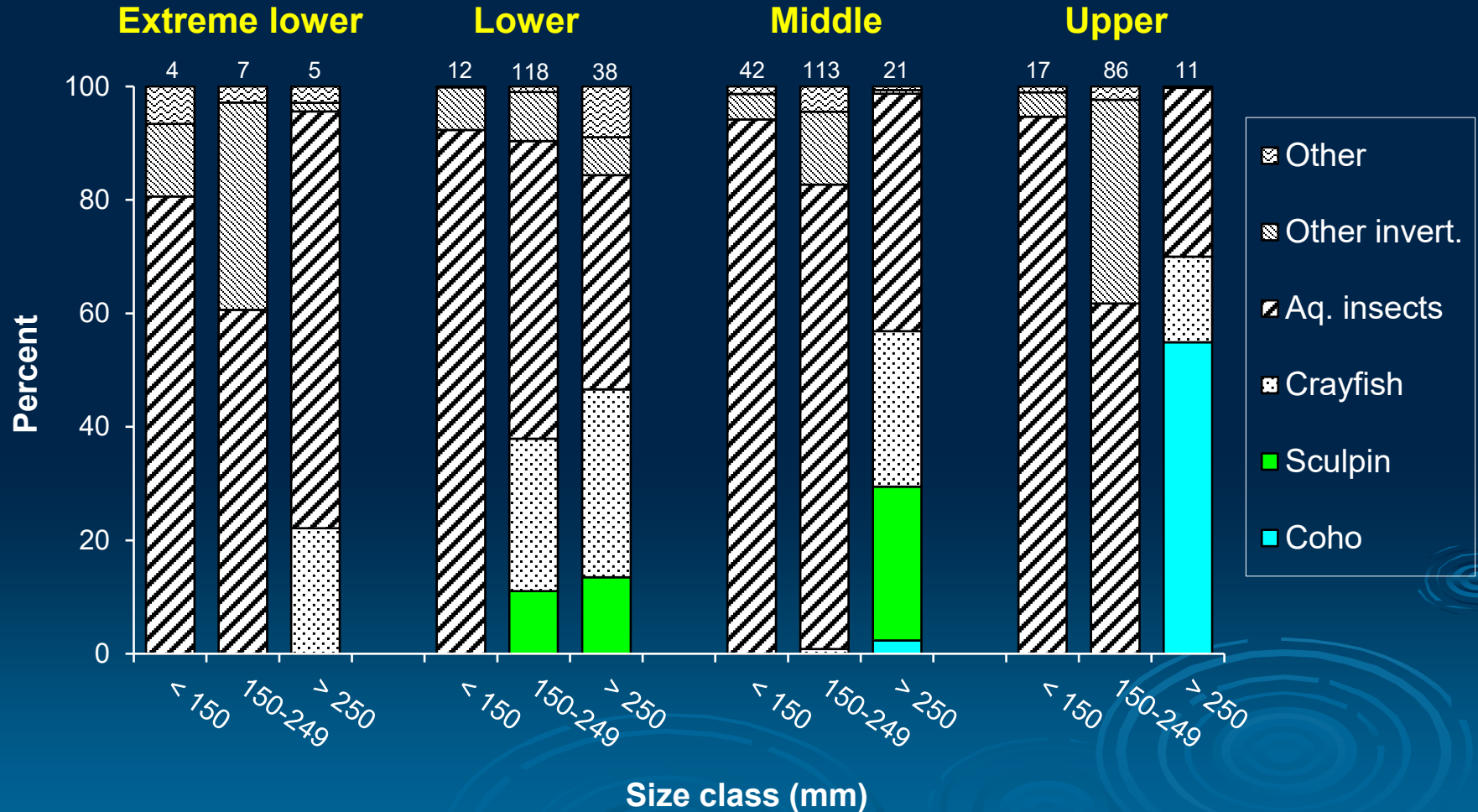
2006 and 2007 combined, percent by weight





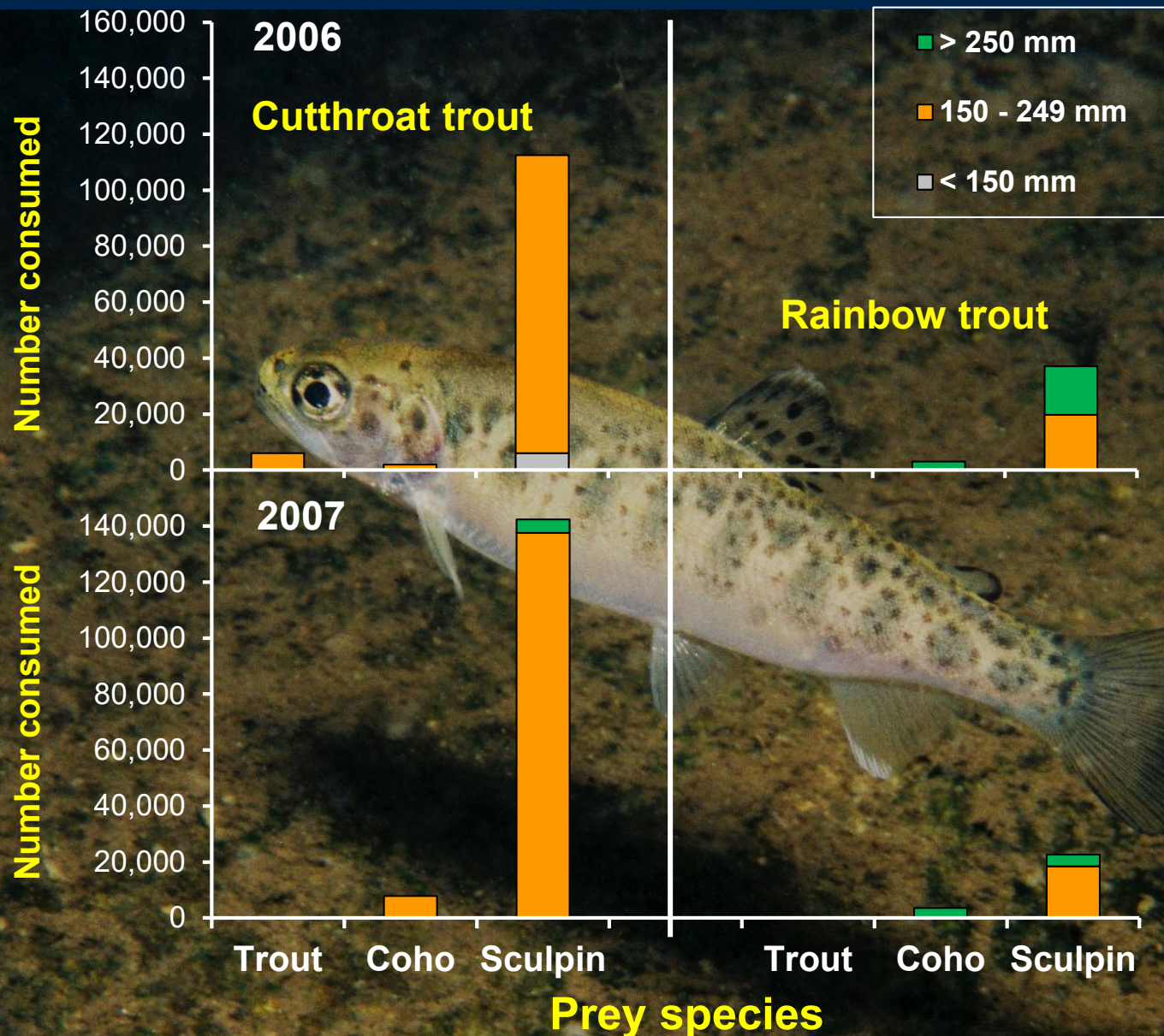
# Rainbow trout – Summer Diet

2006 and 2007 combined, percent by weight



# Summer Predation Estimates

Direct consumption model



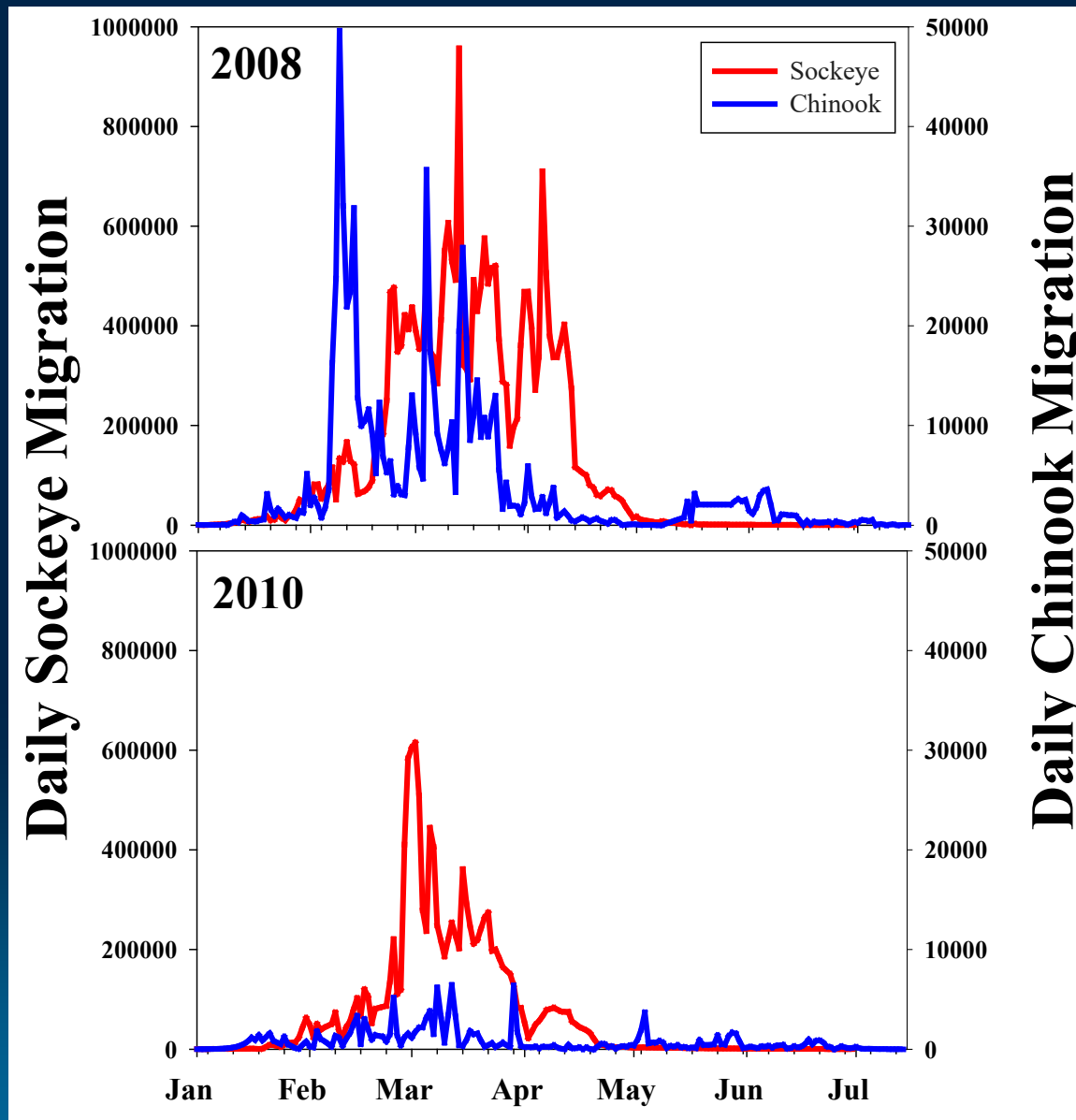


# Winter-Spring Diet and Predation





# Sockeye and Chinook Migration



## Totals

25,072,000 sockeye

619,200 Chinook

12,519,000 sockeye

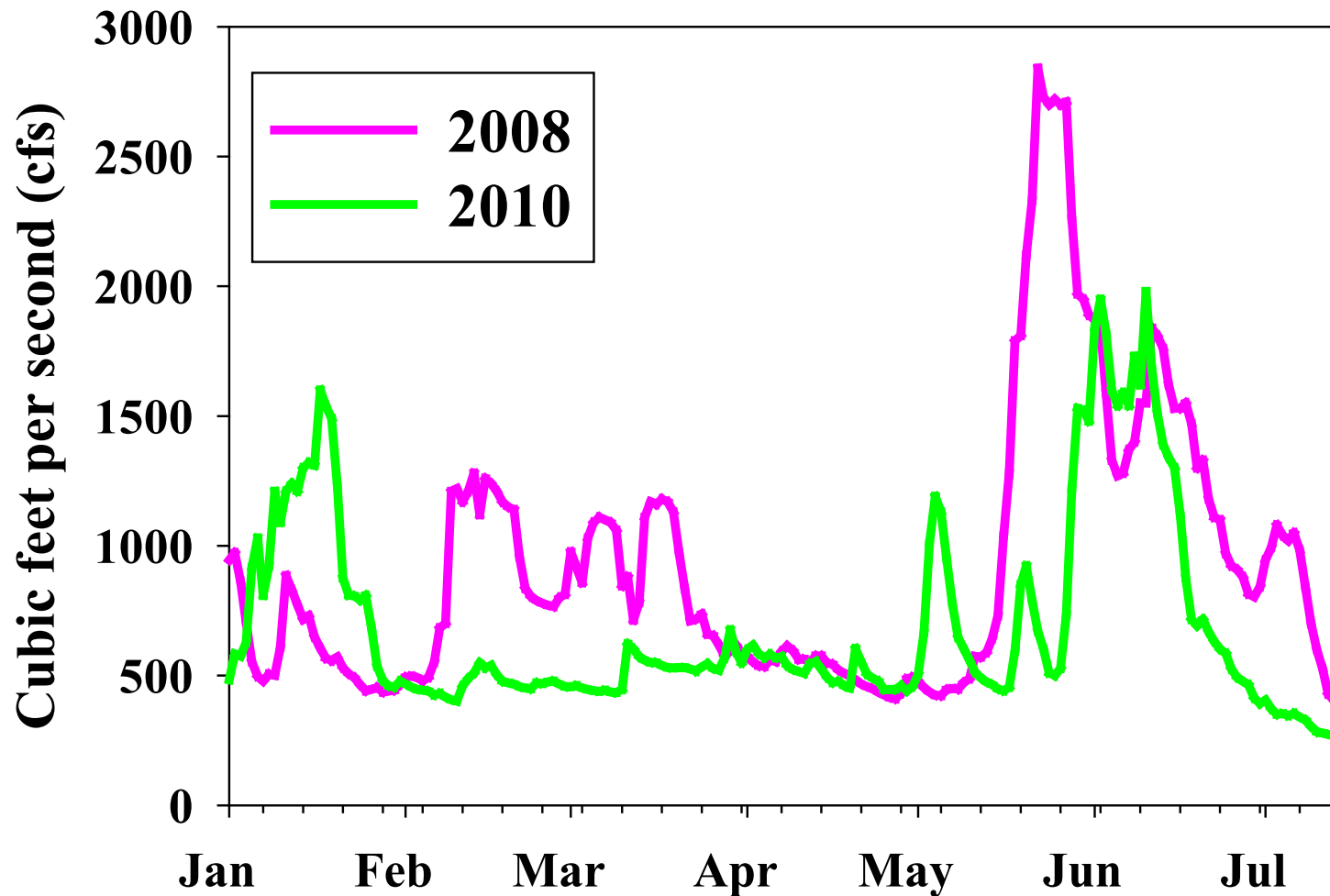
115,500 Chinook

Source: Kiyohara and Zimmerman 2009 and 2011



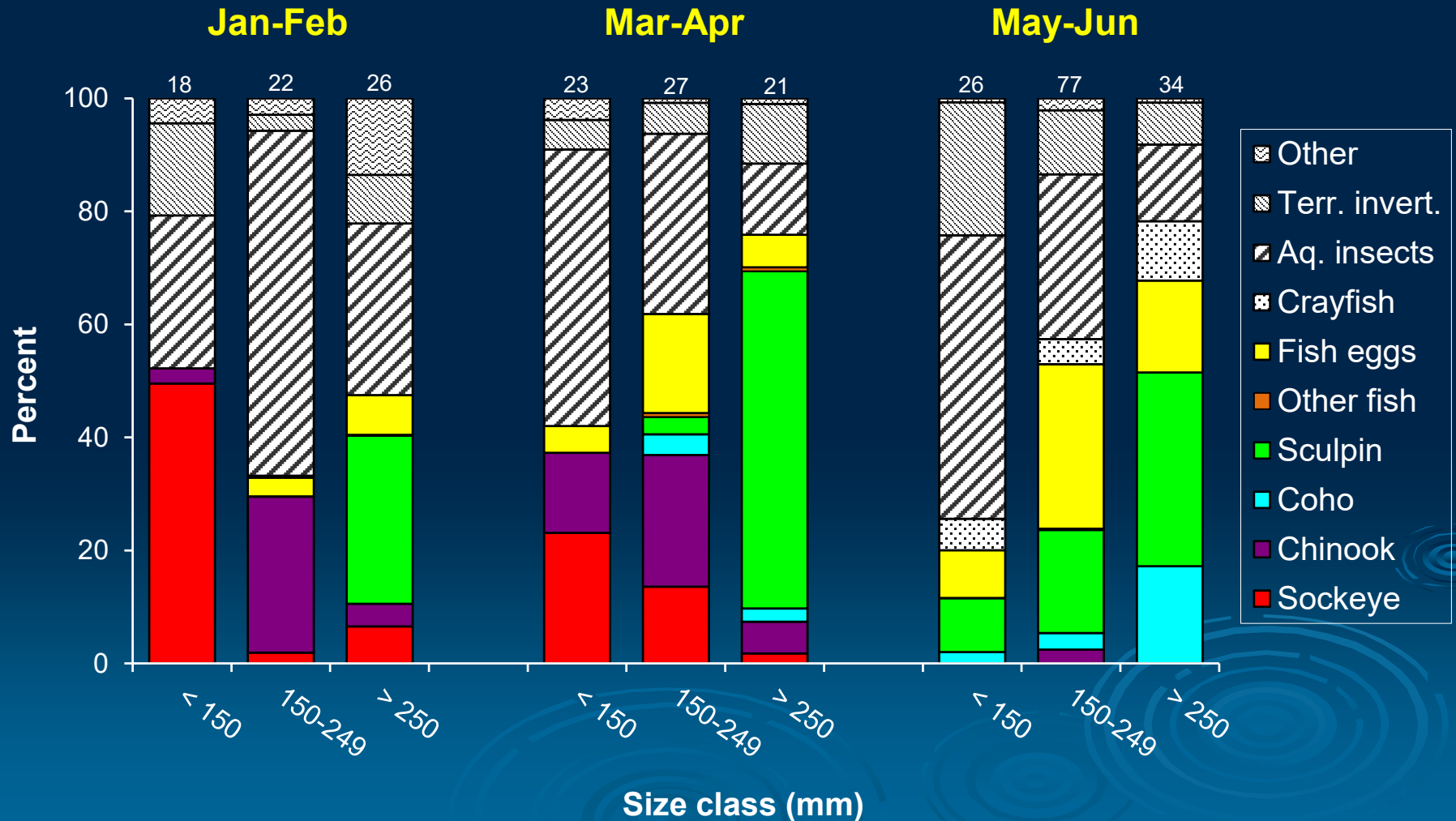
# Discharge Conditions

Renton gauge station, USGS



# Cutthroat trout - 2010

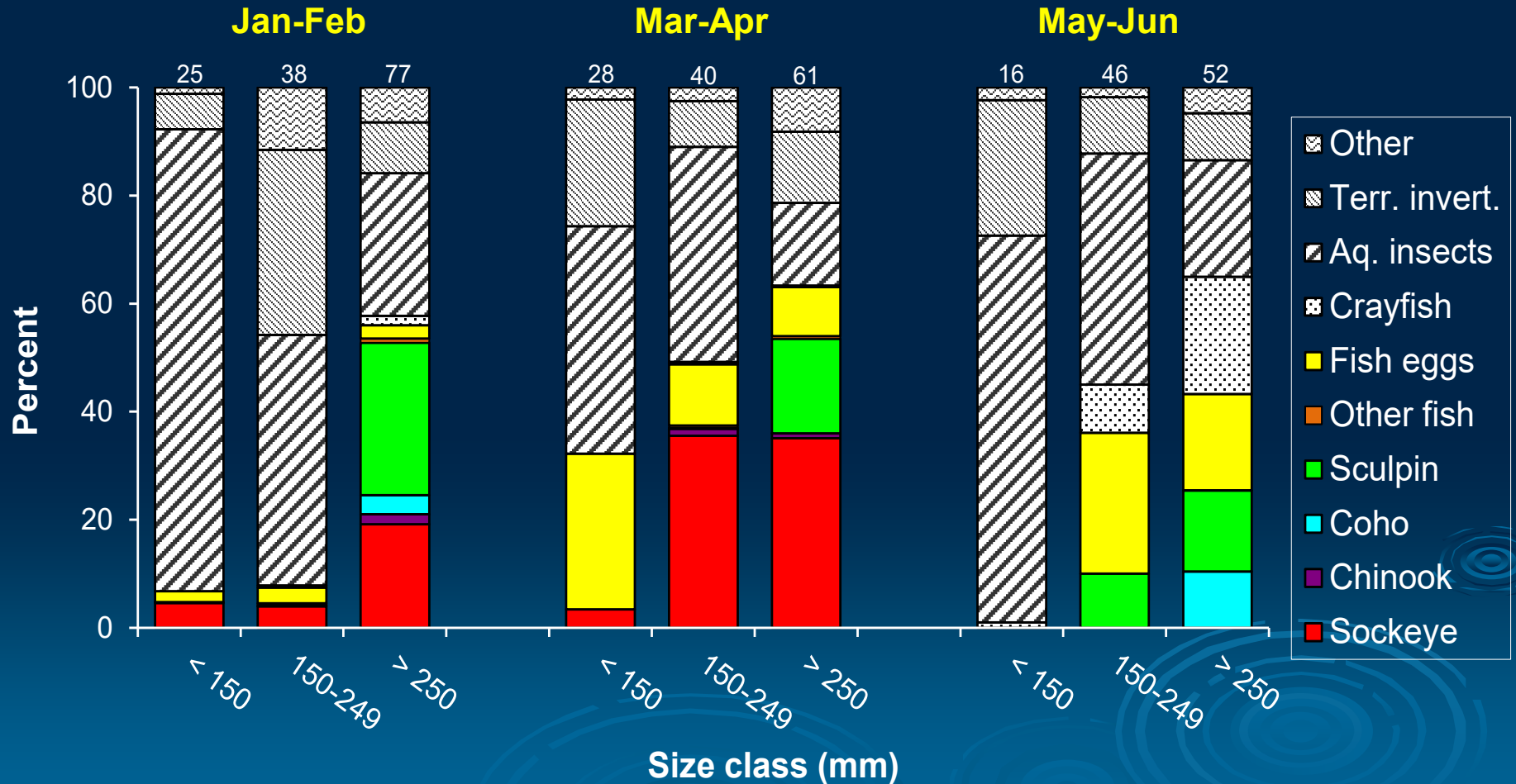
Diet, percent by weight, all strata combined



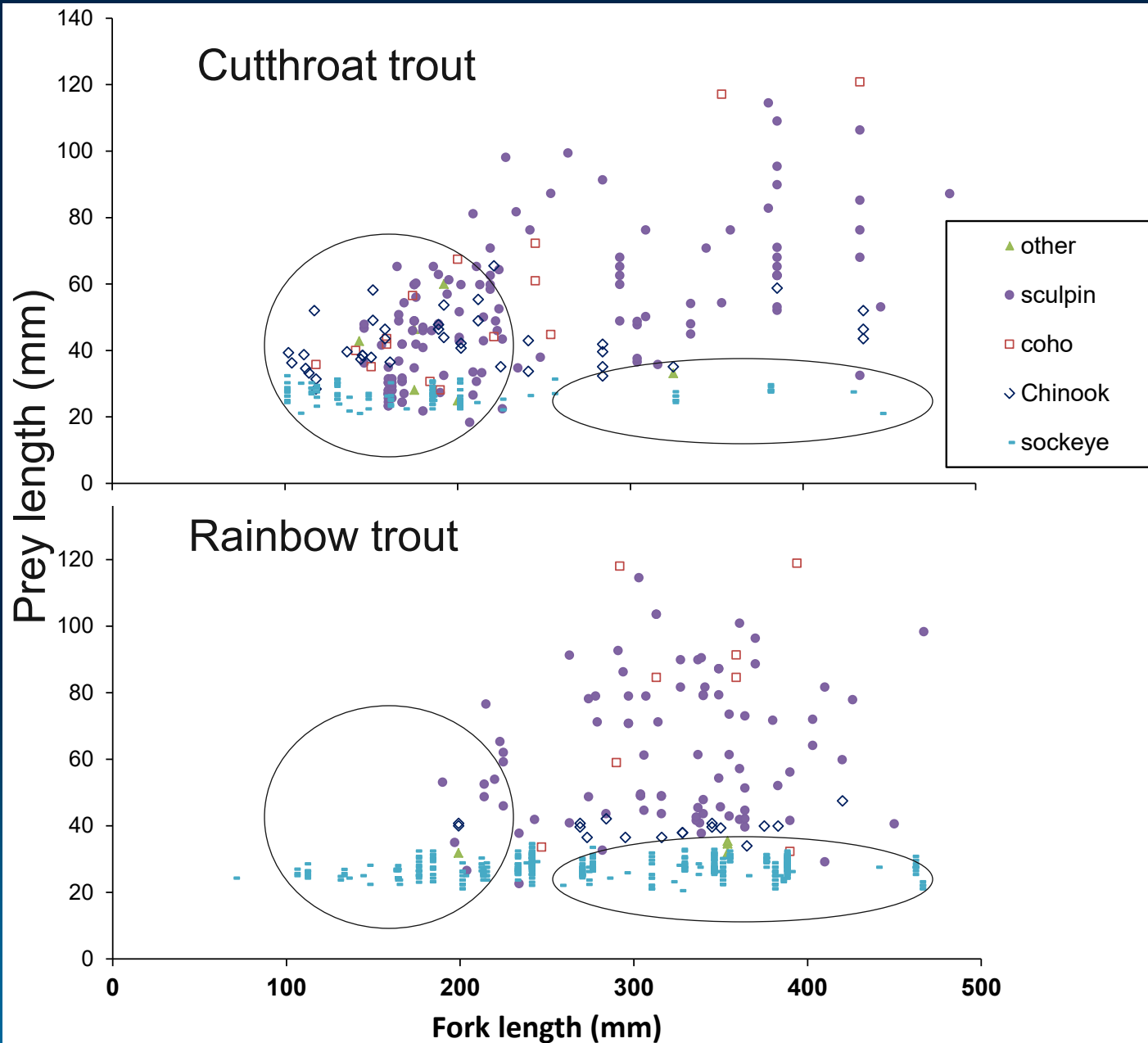


# Rainbow trout - 2010

Diet, percent by weight, all strata combined

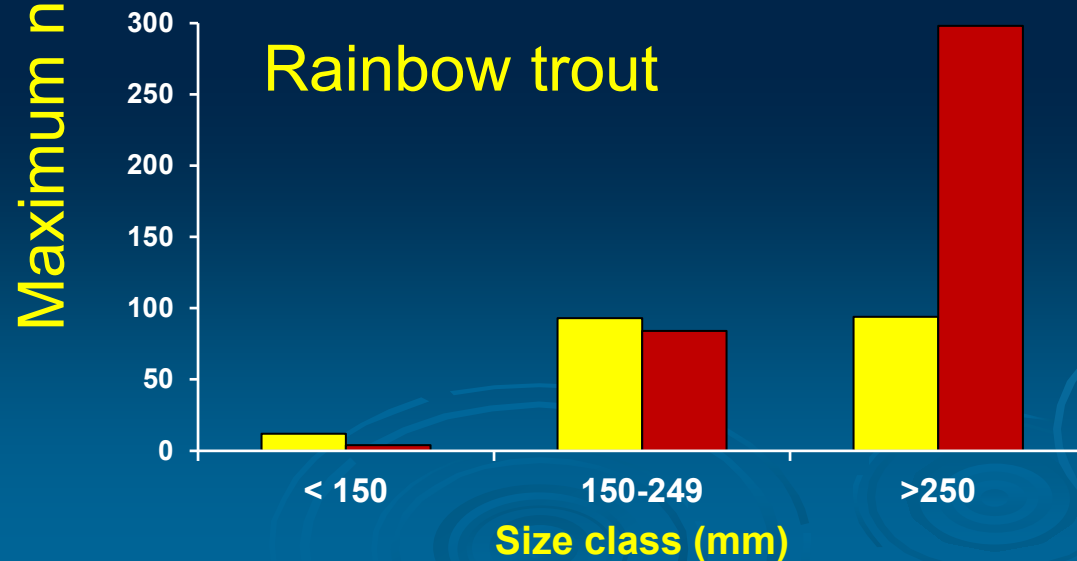
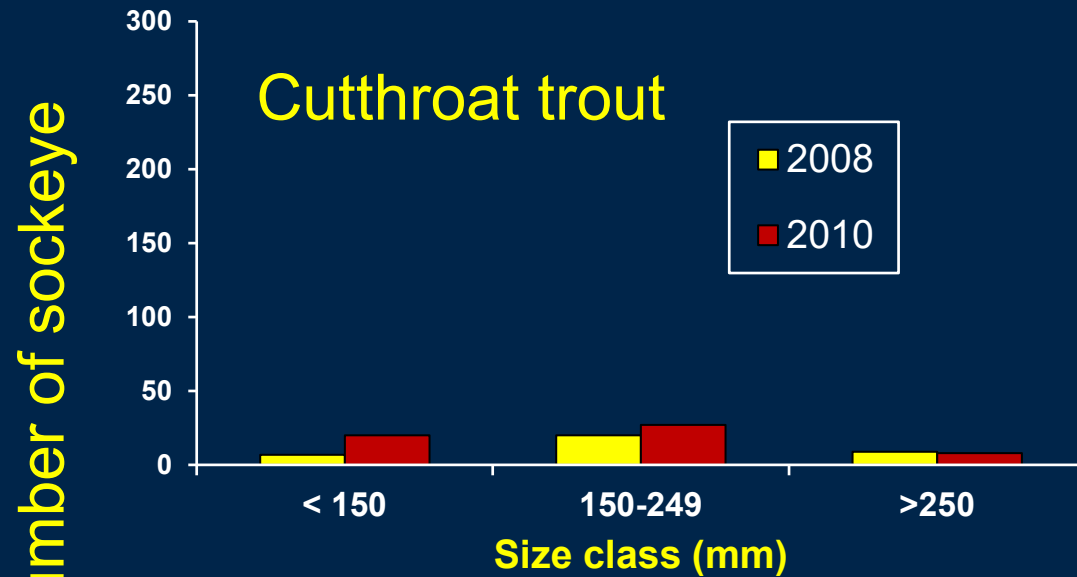


# Prey length – all trout





# Maximum number of sockeye



# Food Specialization by Individual Trout

(Bryan and Larkin 1972)



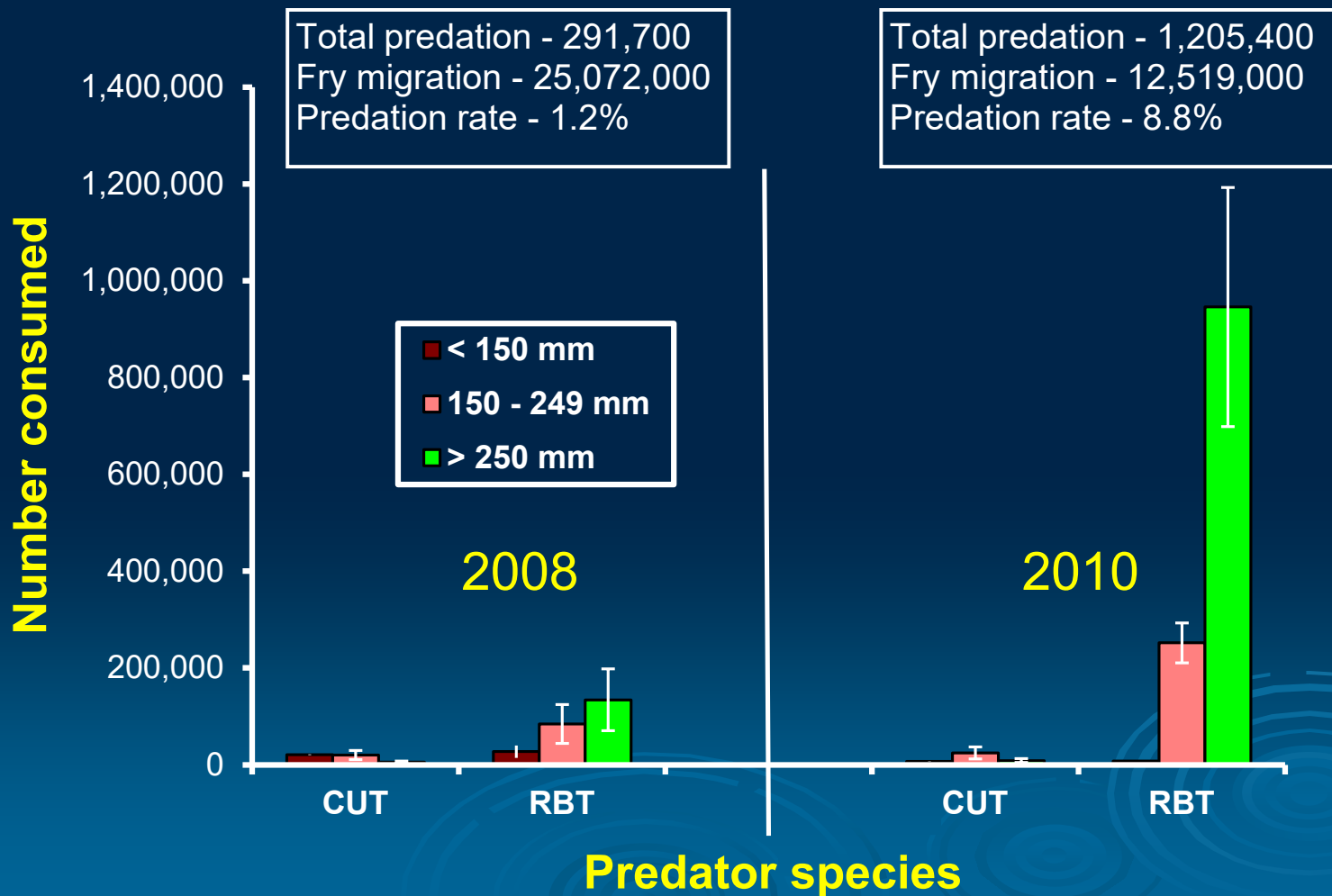
Four Rainbow Trout stomach samples





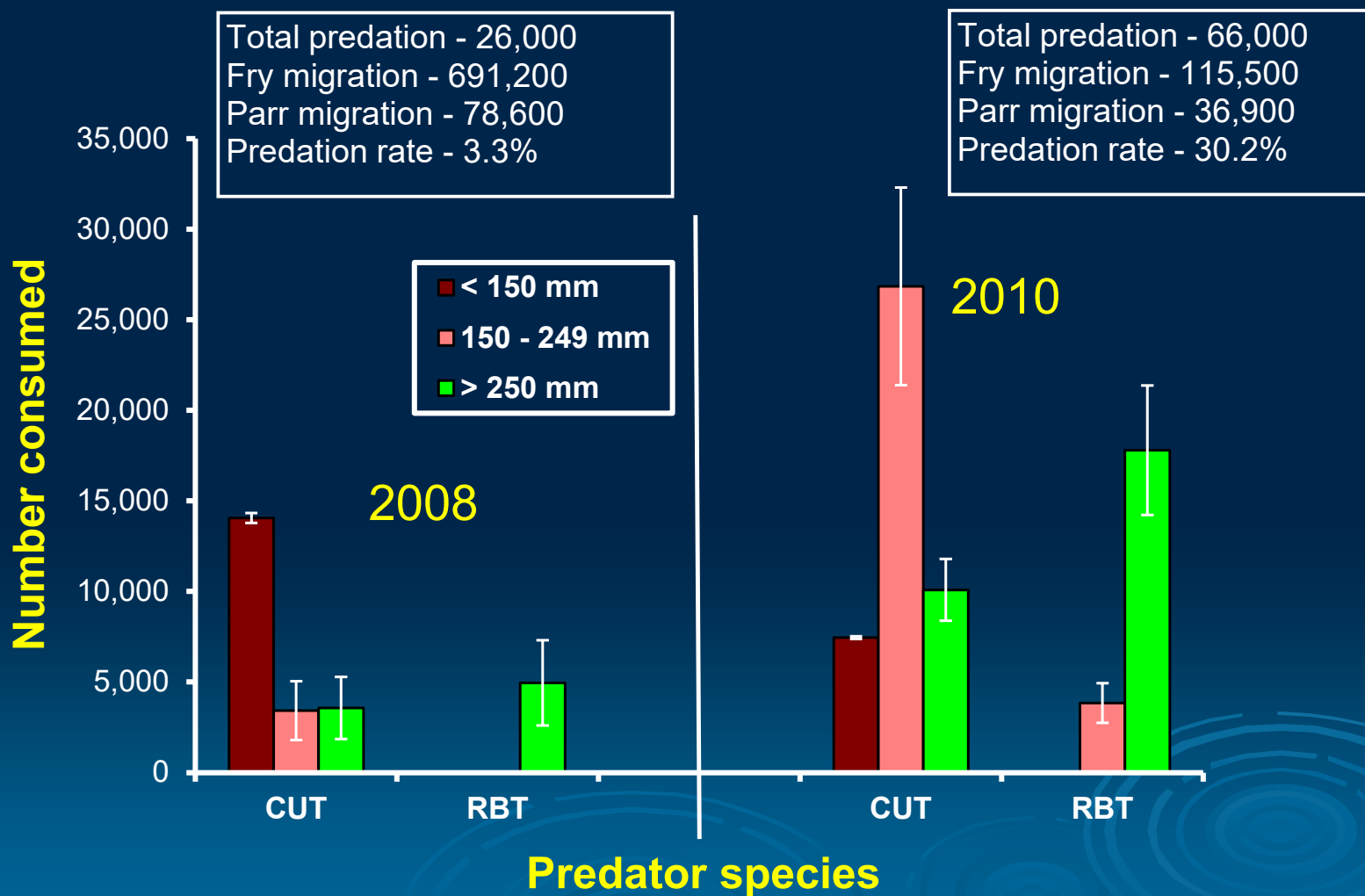
# Trout Consumption Estimates of Sockeye

## Direct Consumption Model



# Trout Consumption Estimates of Chinook

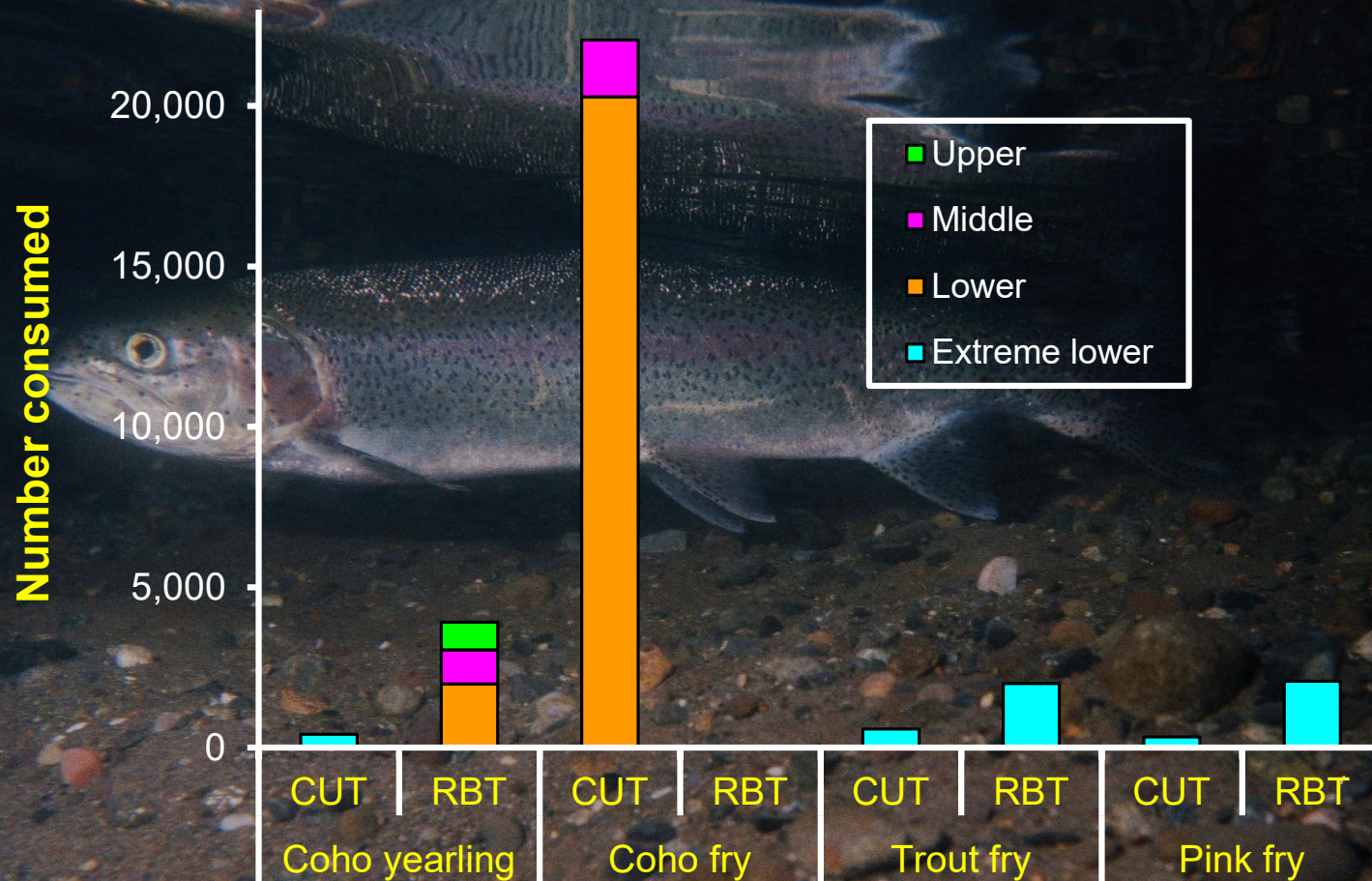
## Direct Consumption Model





# Trout Consumption of Other Salmonids - 2010

## Direct Consumption Model



# Summary - Summer

- Approximately 17,000 trout present
- Overall, 735 trout samples were analyzed
- Trout diets consisted primarily of aquatic insects
- Predation of salmonids was low; most were coho, few trout





# Summary – Winter-Spring

- Winter-spring trout abundance lower than summer
- In 2008, raft sampling equipment not available until mid-March and predation estimates may have been underestimated
- Good sample sizes of trout collected in 2010; 690 trout stomach samples analyzed
- Predation of salmonids appears to vary widely between species, size, strata, month, and individuals



# Summary – Winter-Spring

- Predation of sockeye was most evident in small cutthroat trout and large rainbow trout
- Total consumption of sockeye was highest in rainbow trout > 250 mm
- Predation of juvenile Chinook was observed primarily in cutthroat trout
- Predation levels were highest in the extreme lower and lower strata







U.S. Fish and Wildlife Service

# Predation of Juvenile Salmonids by Resident Trout and Other Fishes in the Lower Cedar River, Washington

Final Report, 2006—2010

February 2014 By Roger A. Tabor, Hans B. Berge, Matt M. Klungie, Brad E. Thompson, Daniel W. Lantz, and Benjamin E. Price.



Seattle  
Public  
Utilities  
King County



Funded by Seattle Public Utilities (City of Seattle) and the Washington Department of Fish and Wildlife

[roger\\_tabor@fws.gov](mailto:roger_tabor@fws.gov)





# Predator Abundance & Predation Mortality of Juvenile Salmon in Lake Washington

Dave Beauchamp and Casey Clark, USGS & UW [davebea@uw.edu](mailto:davebea@uw.edu)  
Erik Neatherlin, Washington Dept. Fish & Wildlife

**Cutthroat Trout**



**Northern Pikeminnow**



**Smallmouth Bass**  
-nonnative



**Walleye**  
-nonnative



**Prickly Sculpin**

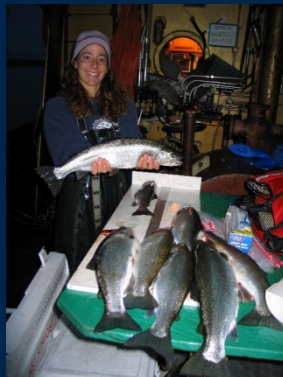


# Preliminary Predation Data 2015

## Number of Samples & Size Distribution

### Cutthroat trout

719 Marked thru Apr 2016

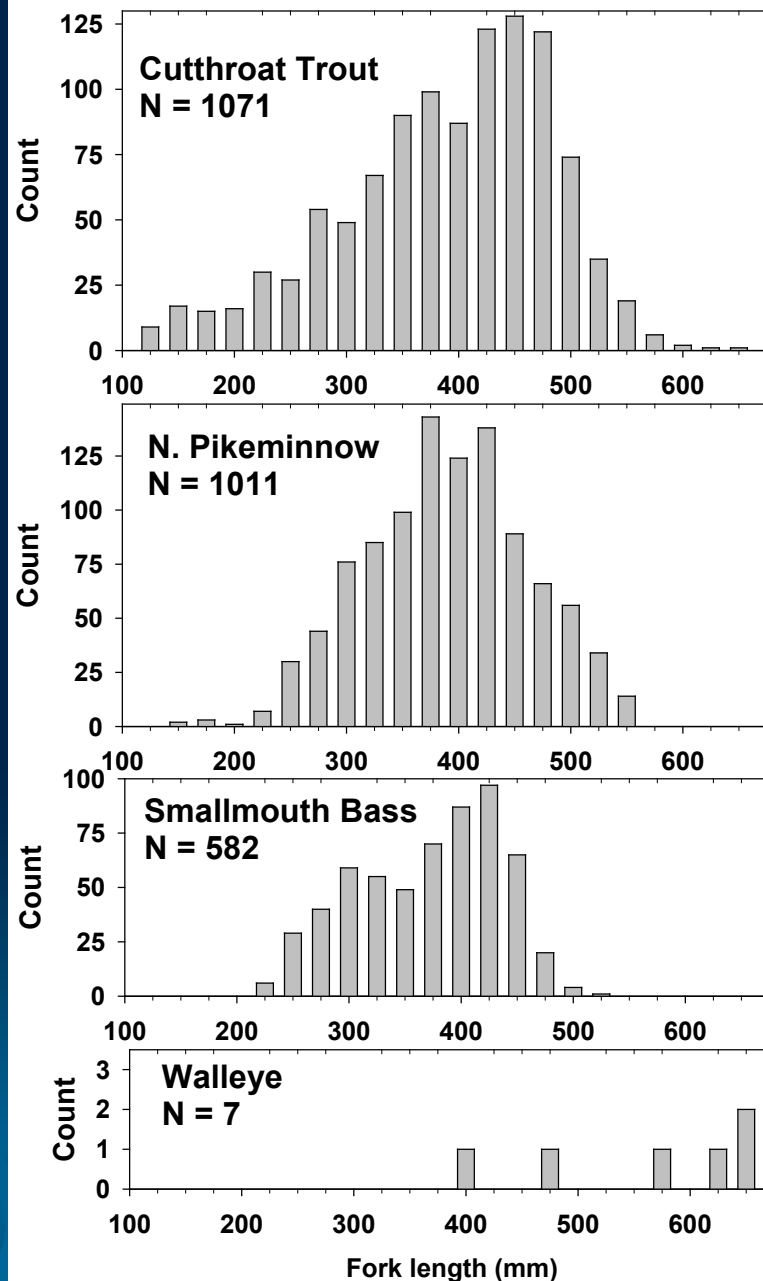


### Northern Pikeminnow

263 Marked in 2015



## All Capture methods combined



# Predator Abundance-Preliminary Results

(Data as of October 10, 2015)

<u>Predator</u>	<u>Total sampled</u>	<u>Abundance</u>
<b>Cutthroat trout</b>	<b>712</b>	<b>50,053</b>
<b>N. Pikeminnow</b>	<b>1,007</b>	<b>x</b>
<b>Smallmouth Bass</b>	<b>568</b>	<b>x</b>

Data from Casey Clark

**Diet analysis and preliminary abundance estimates  
confirm significant predation mortality**



# New Threats

## Non-native Walleye

2005



WACFWRU

2010



Seattle Times

2015



D. Garrett

15 pre-spawning adults  
Captured by MIT, WDFW  
& UW in 2015 in East Channel

# New Threats

## Non-native Smallmouth Bass

### Preliminary Conclusions:

- Rapidly expanding population
- May be significant source of mortality as juvenile salmon migrate out Ship Canal

