Fish and Fish Prey Variability Analysis for the Ecosystem Monitoring Project

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Parameters measured

- Fish community
  - Species richness
  - Species divesity
  - % non-native species
  - % fis that could be salmon predators
- Salmon species composition and habitat occurrence
  - % of salmon soecies in catches
  - Density of salmon species
  - Chinook salmon stock composition
- Salmon condition
  - Length, weight, condition factor, size ranges
  - Lipid content
  - Growth rate (otoliths)
  - Contaminants

Selmon Prey

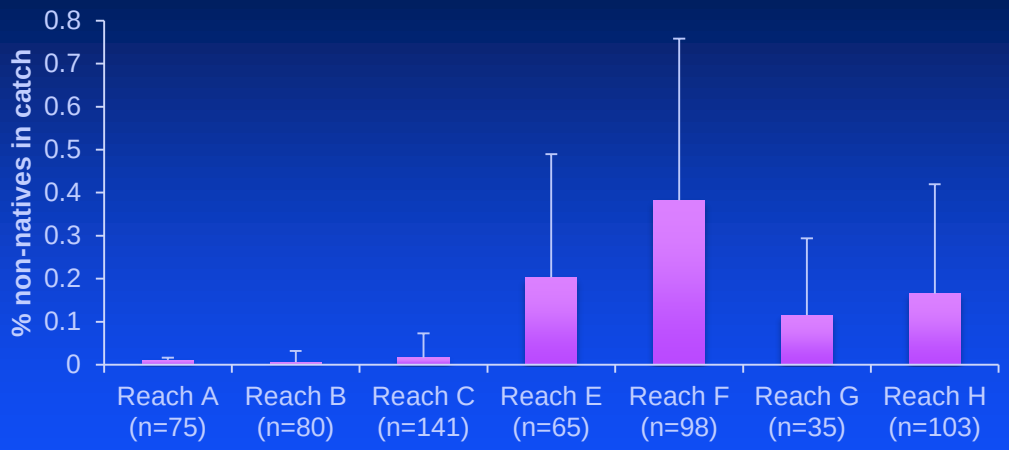
  - Prey composition and abundance in open water and emergent vegetation
  - Chinook salmon diets and prey preference

Fish communities and Salmon habitat occurrence and health

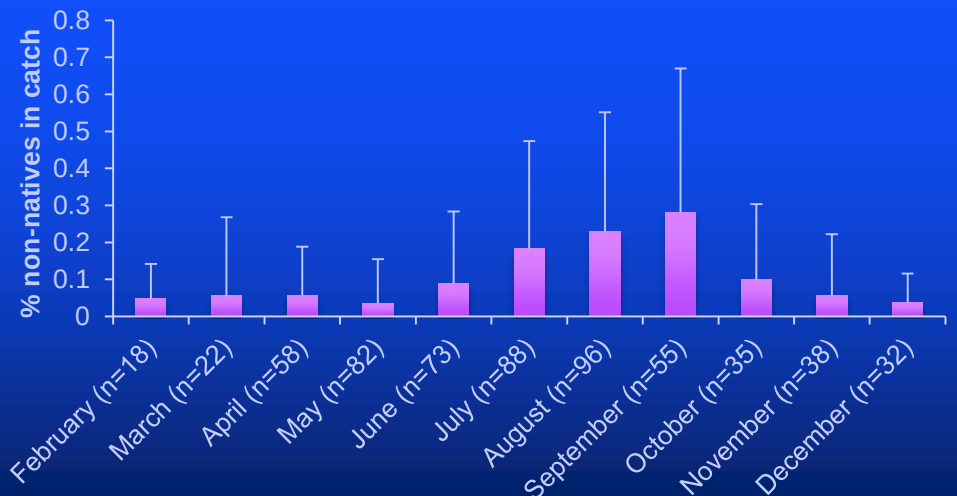
Sources of variability

- High variability among beach seine sets, tows
- Variabiity among individual fish
- Sampling site or reach
- Sampling month
- Sampling year
- Marked (hatchery) vs. unmarked (presumably wild) origin
- Stock origin
- Habitat type (emergent vegetation vs. open water) for prey

Fish Communities - % non-native species



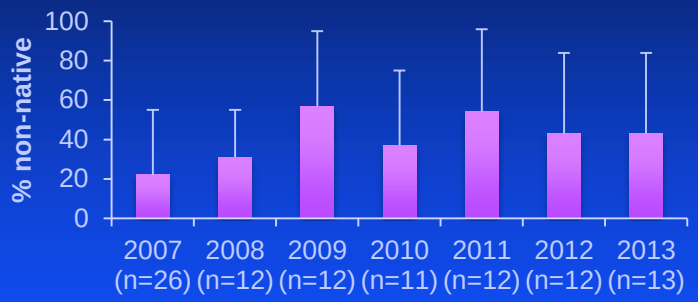
35% of variabiity
P < 0.0001
LSN = 83
N = 597



11% of variabiity
P < 0.0001
LSN = 149
N = 597

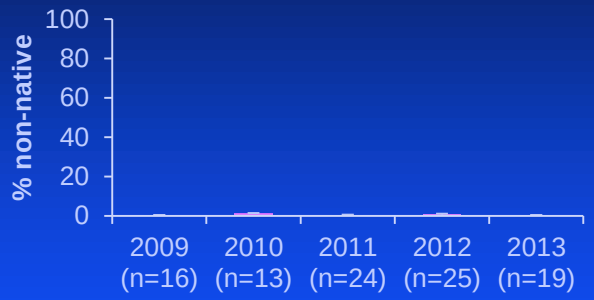
% non-native species – temporal trends

Campbell Slough



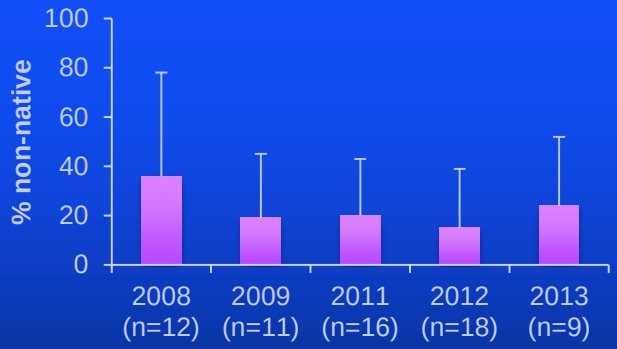
P=0.0894, LSN=113, n=98
Range – 22-57%

Whites Island



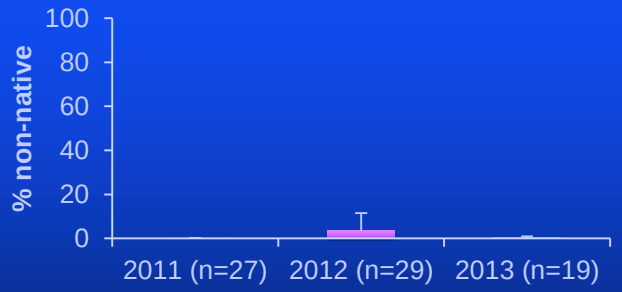
P=0.2729, LSN=171, n=91
Range - 0.1-1%

Franz Lake



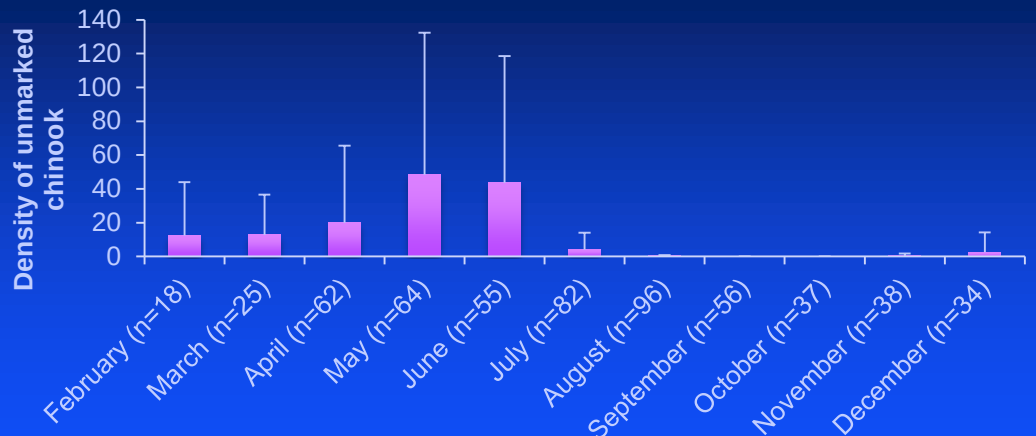
P=0.3647, LSN=144, n=65
Range - 15-36%

Ilwaco Slough

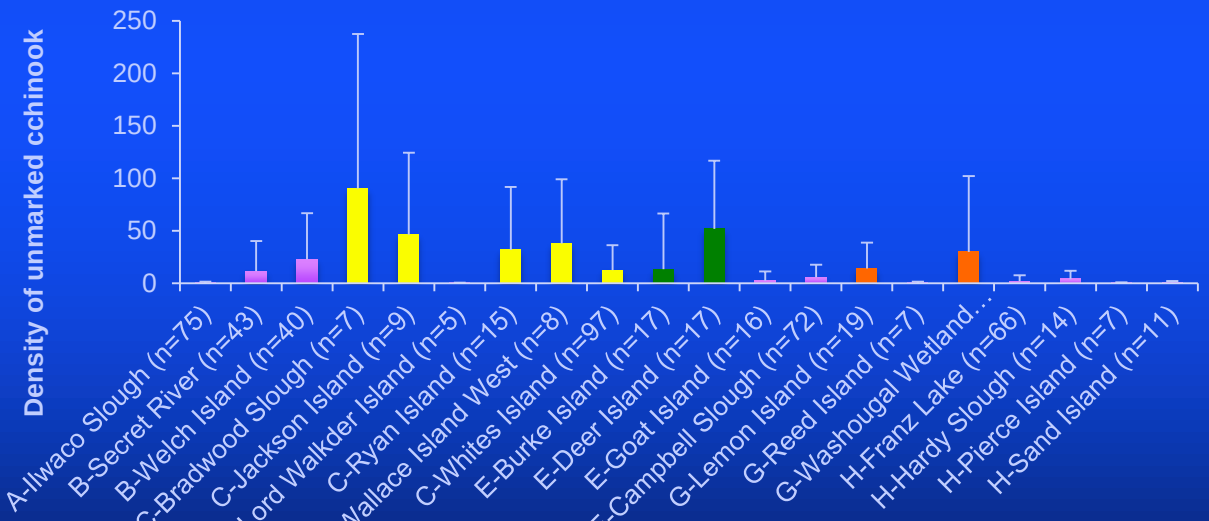


P=0.1198, LSN=106, n=75
Range – 0-3.6%

Fish Densities – unmarked Chinook salmon

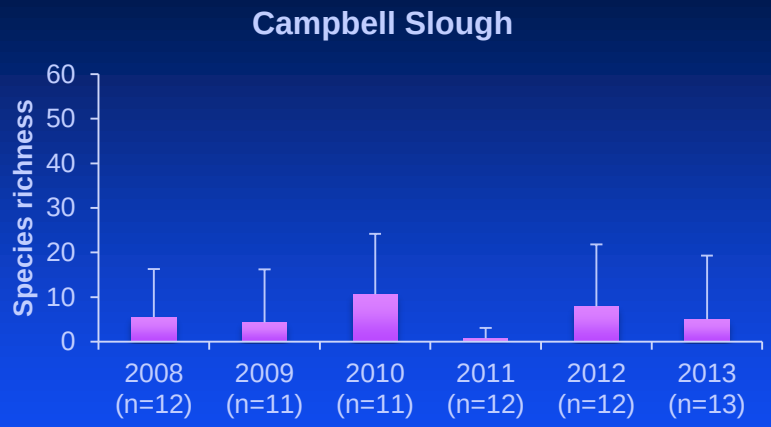


16% of variabiity
P < 0.0001
LSN = 100
N = 597

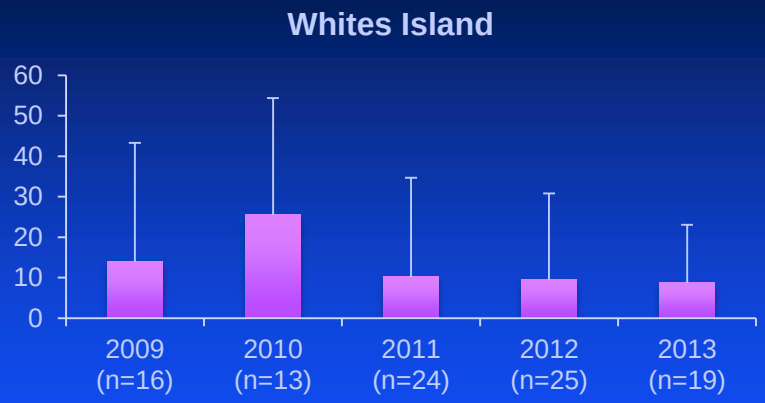


15% of variabiity
P < 0.0001
LSN = 160
N = 597

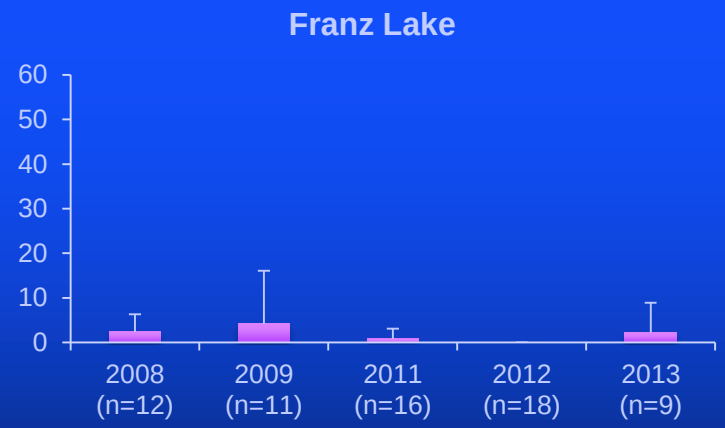
Unmarked chinook density- temporal trends



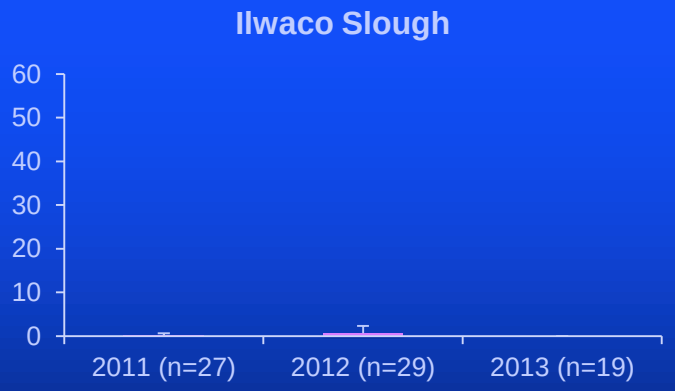
P=0.4280, LSN=180, n=72
Range – 0.7-10.6 fish/1000 m2



P=0.1043, LSN=120, n=97
Range – 8.7-25.5 fish/1000 m2

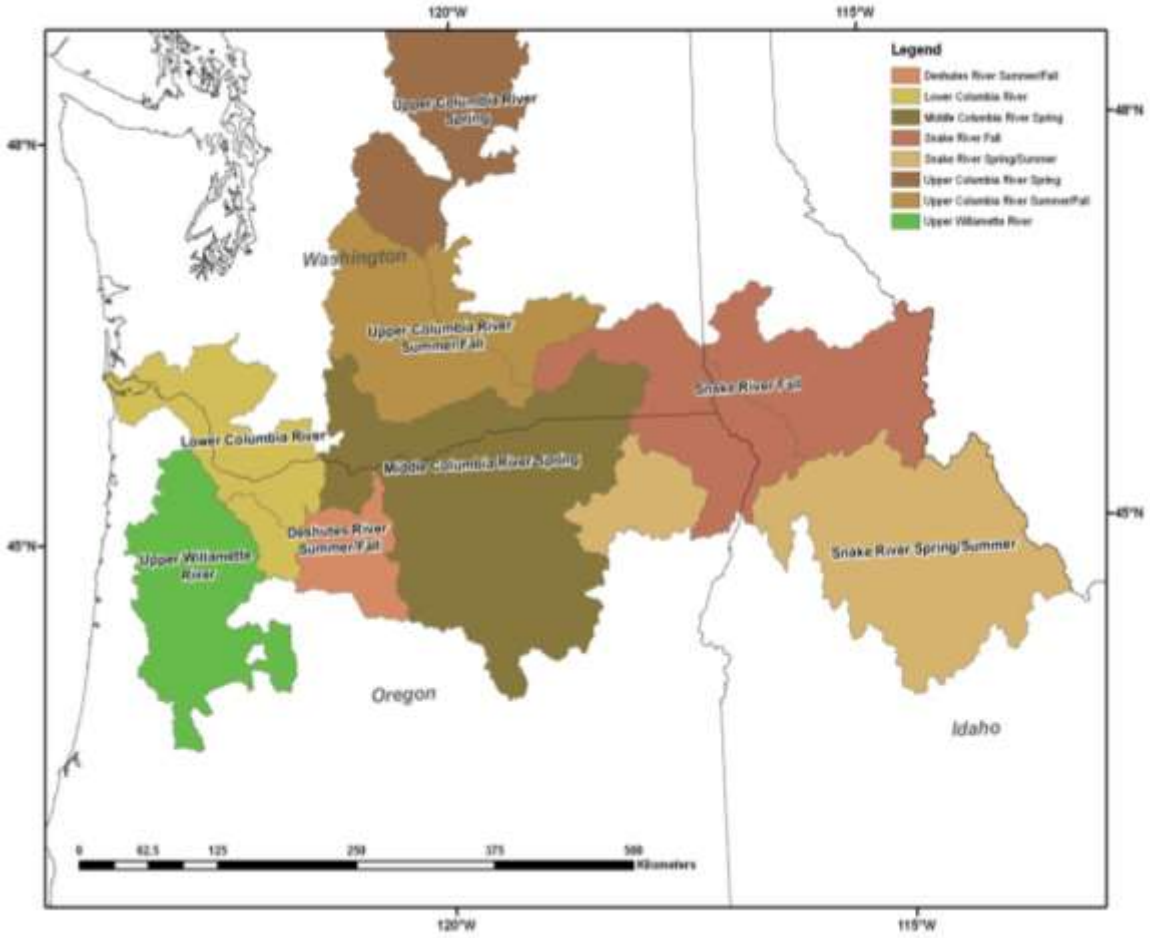


P=0.3814, LSN=150, n=66
Range - 0-4.2 fish/1000 m2



P=0.1198, LSN=256 n=75
Range – 0-0.62 fish/1000 m2

Chinook Salmon Genetic Groups



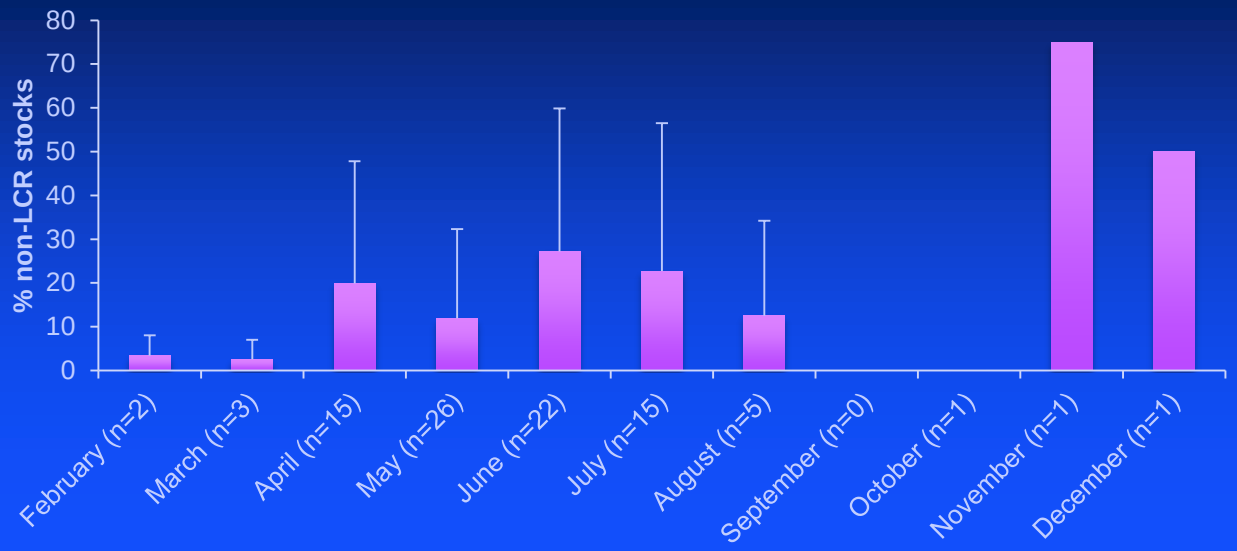
Lower Columbia/Willamette Stocks:

- West Cascade Range Falls
- West Cascade Range Springs
- Spring Creek Group Falls
- Upper Willamette Springs

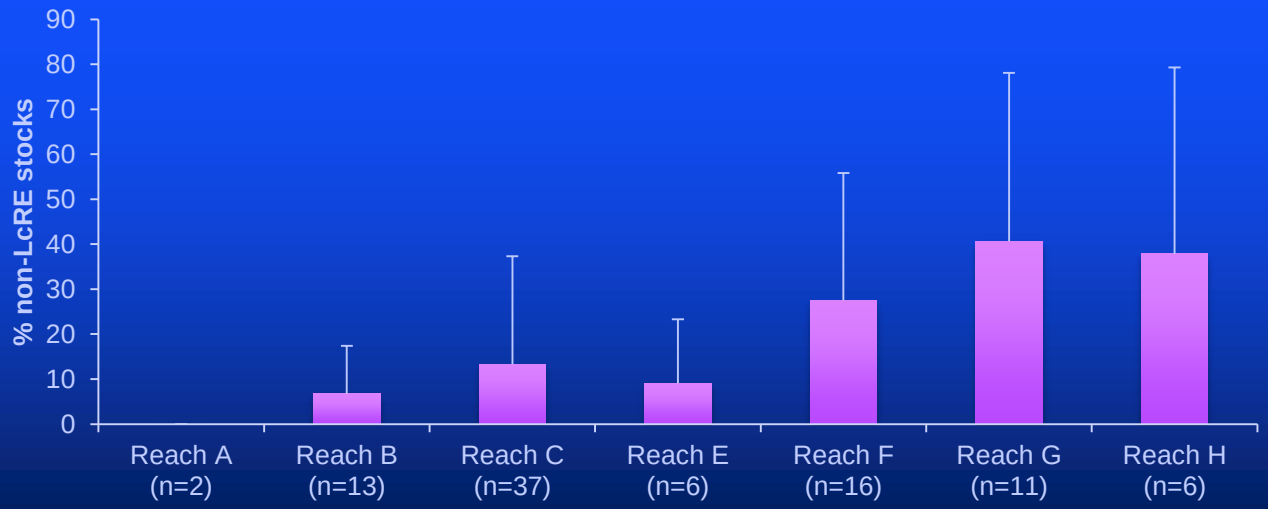
Interior Columbia Stocks:

- Upper and Middle Columbia Springs
- Snake River Spring/Summers
- Snake River Falls
- Deschutes River Summer/Falls

Stock Distribution - % non-LCR stocks

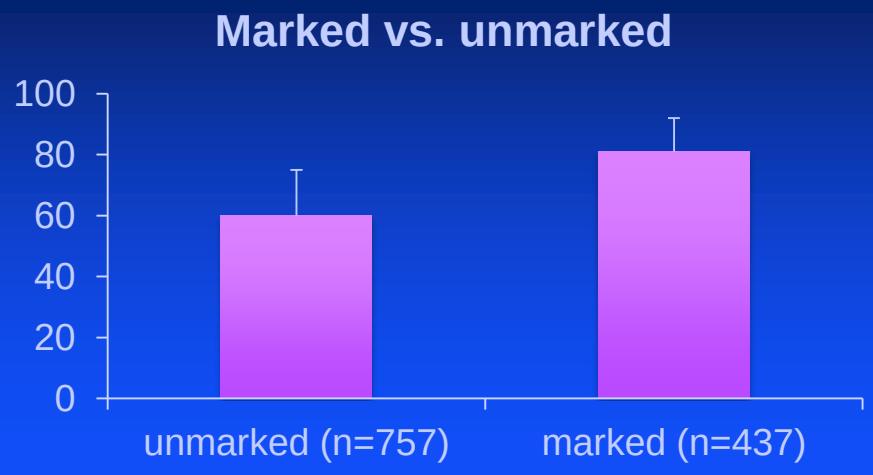


9% of variabiity
P = 0.49
LSN = 136
N = 91

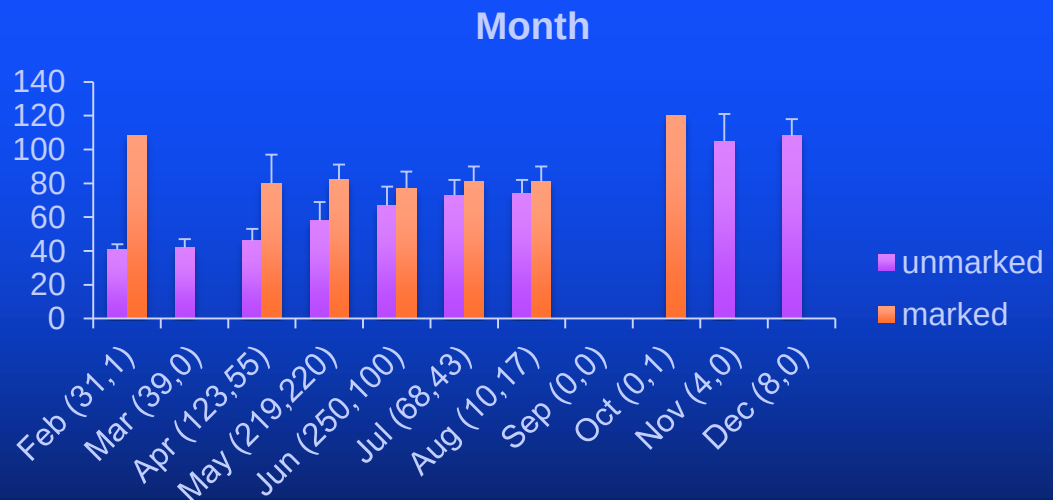


18% of variabiity
P = 0.0079
LSN = 65
N = 91

Chinook salmon size

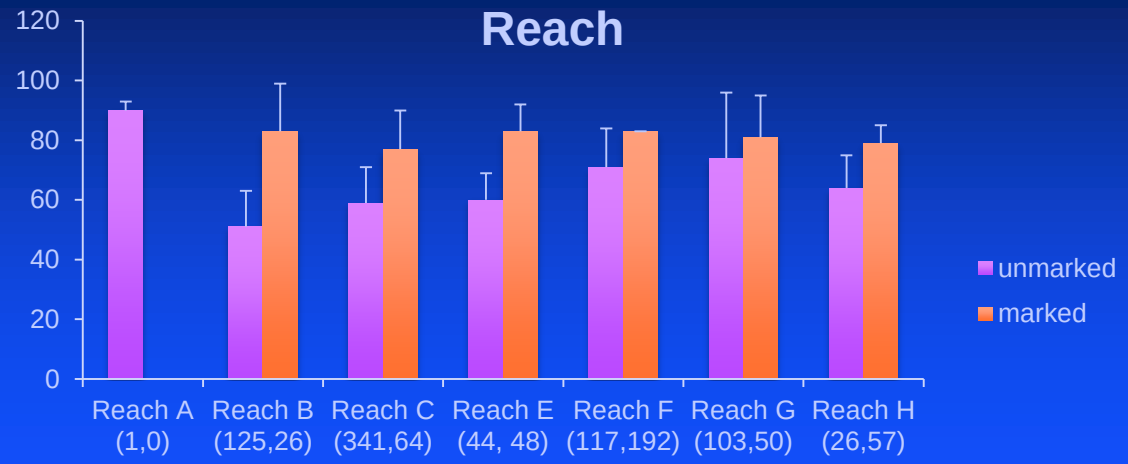


35% of variabiity
P < 0.0001
LSN = 10
N = 1196

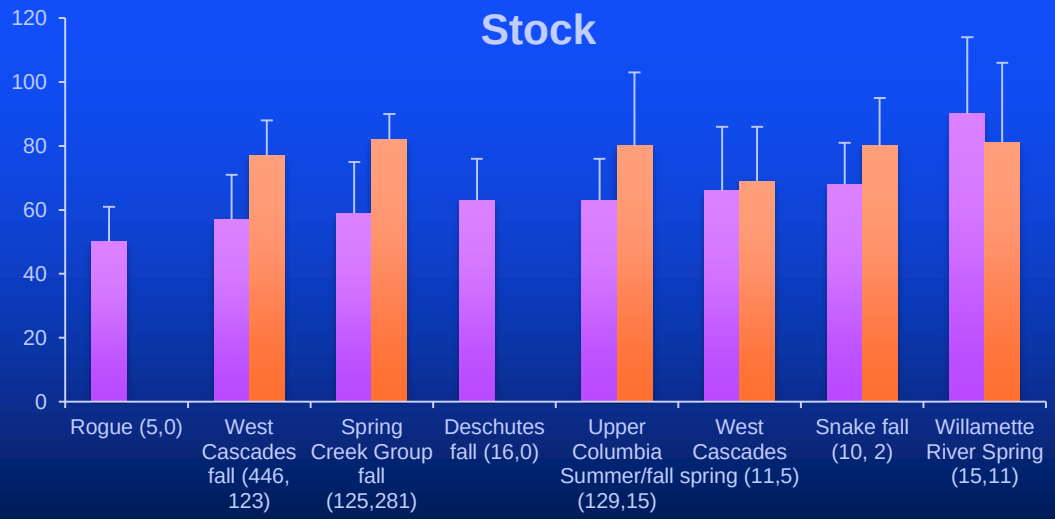


24% of variabiity
P < 0.0001
LSN = 46
N = 1196

Chinook salmon size



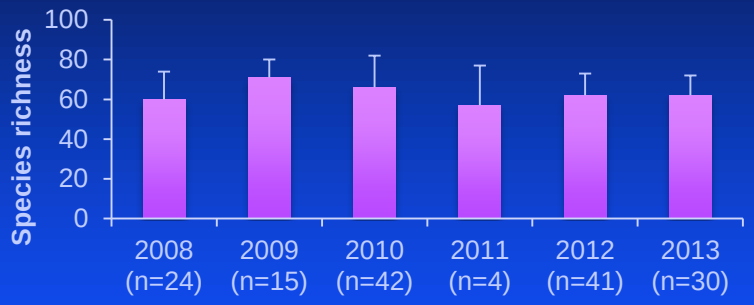
7% of variabiity
P < 0.0001
LSN = 48
N = 1196



2% of variabiity
P < 0.0001
LSN = 78
N = 1196

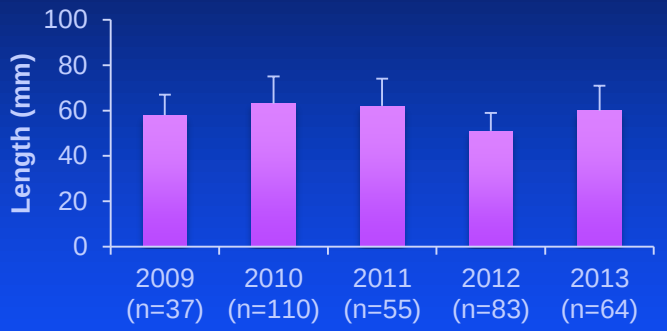
Unmarked chinook size - temporal trends

Campbell Slough



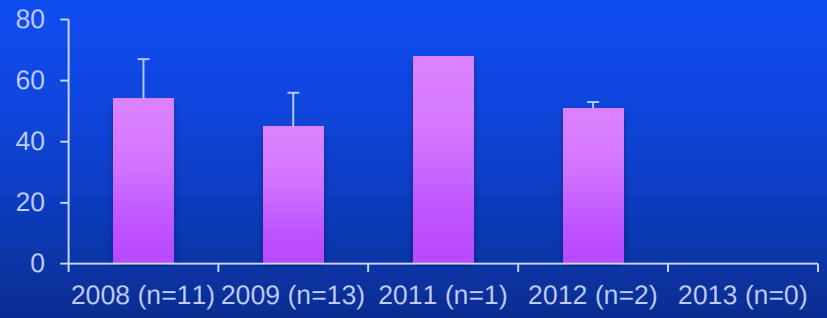
P=0.0636, LSN=165, n=156
Range – 57-71 mm

Whites Island



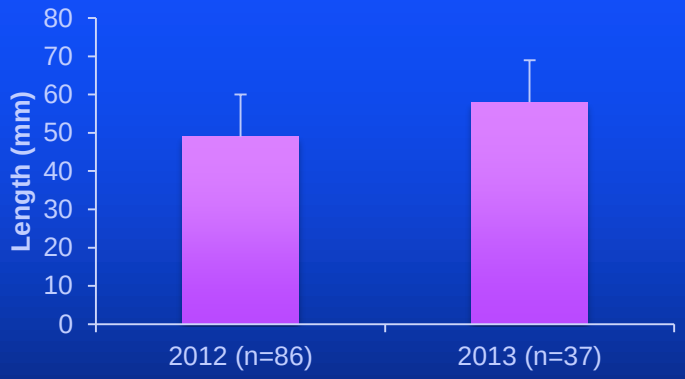
P=0.0001, LSN=50, n=348
Range – 51-63 mm

Franz Lake



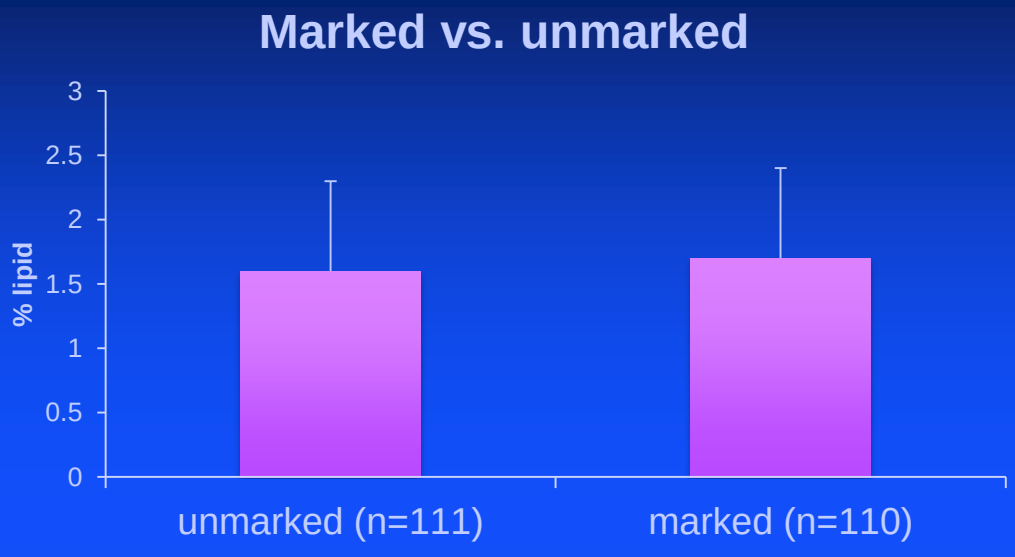
P=0.1281, LSN=37, n=27
Range - 45-68 mm

Secret River

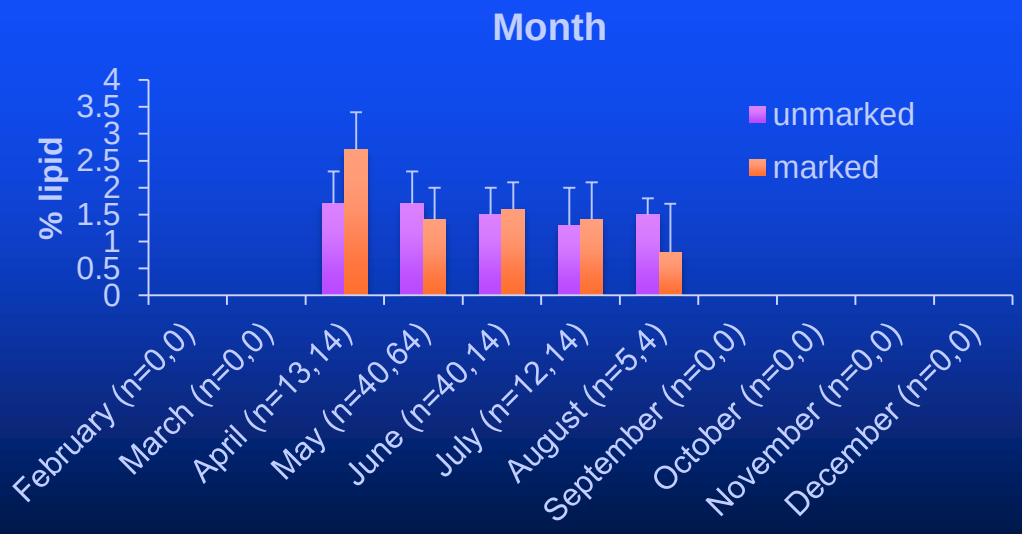


P=0.0001, LSN=29 n=123
Range – 49-59 mm

Chinook lipid content



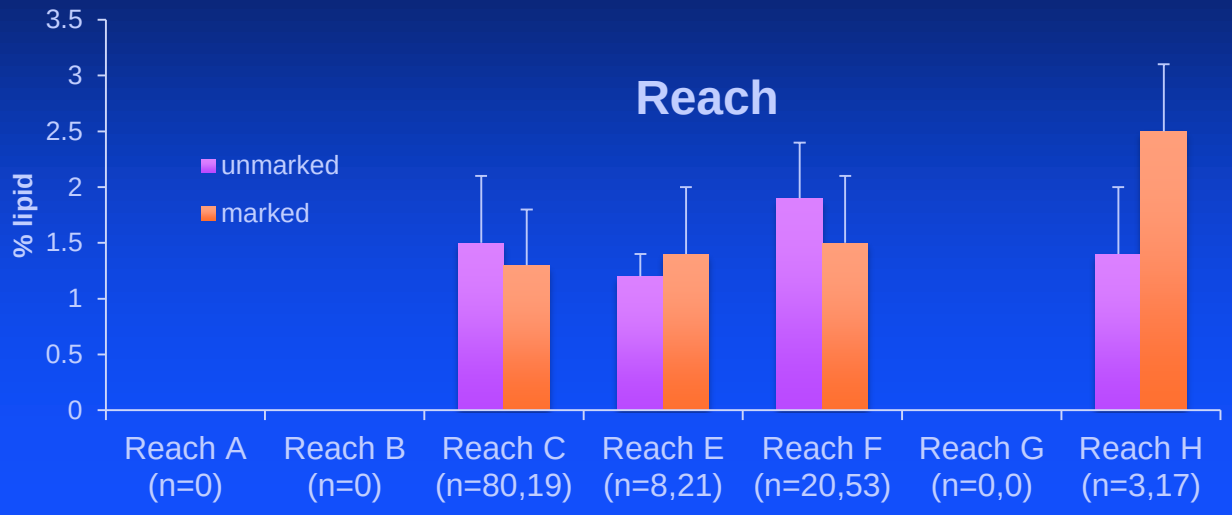
NS
P = 0.44



39% for marked
LSN = 20
N = 110

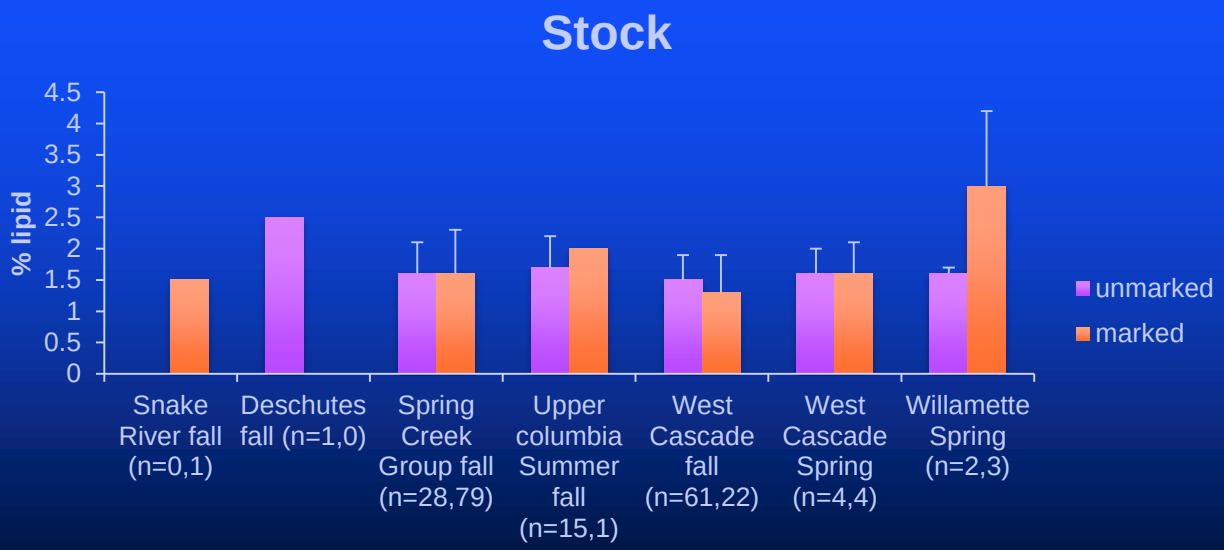
NS for unmarked
LSN = 290
N = 111

Chinook lipid content



30% for marked
LSN = 23
N = 110

11% for unmarked
LSN = 69
N=11



4% for marked
LSN = 73
N=110

NS for unmarked
LSN = 255
N = 111

Fish Prey

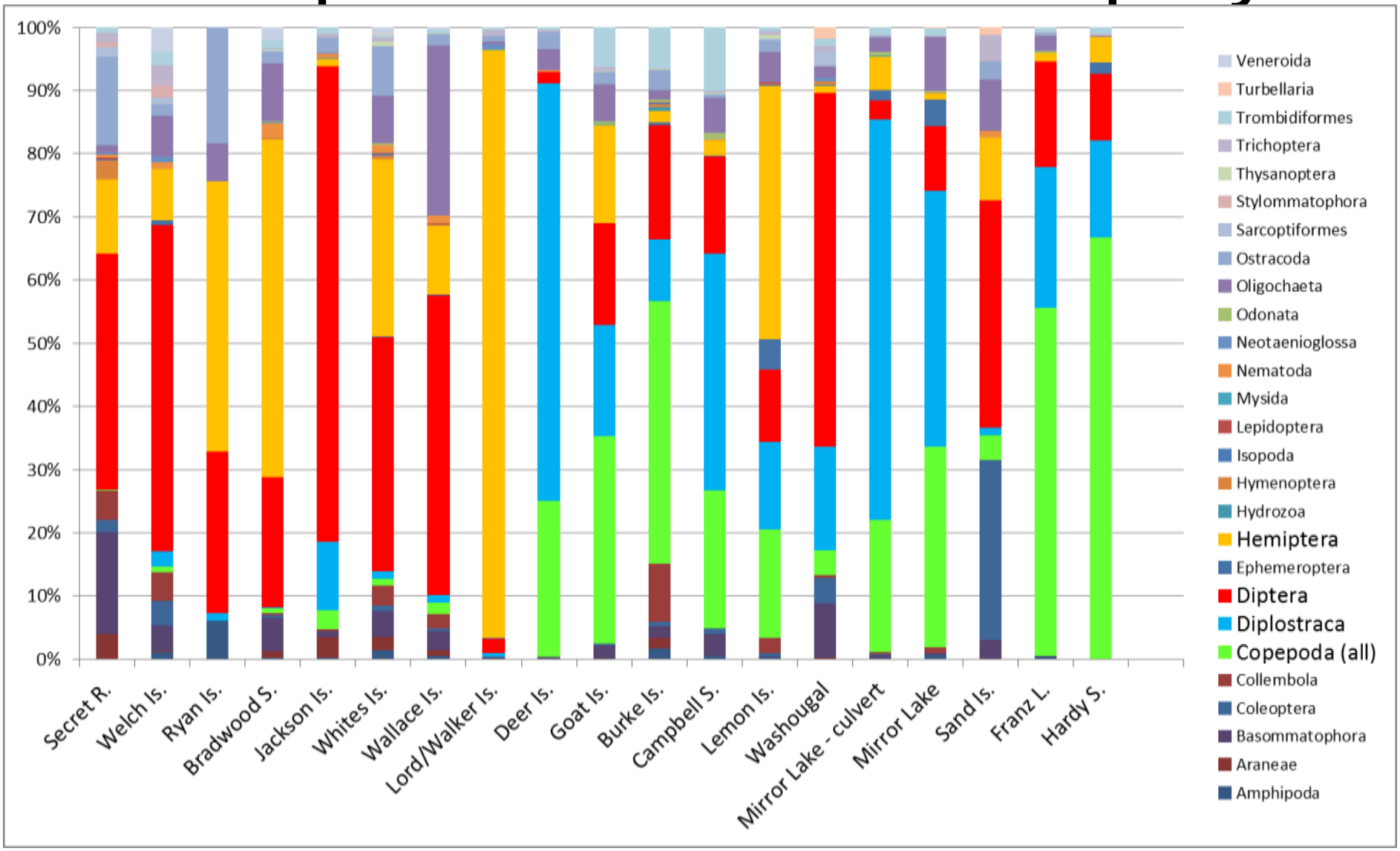
Parameters measured

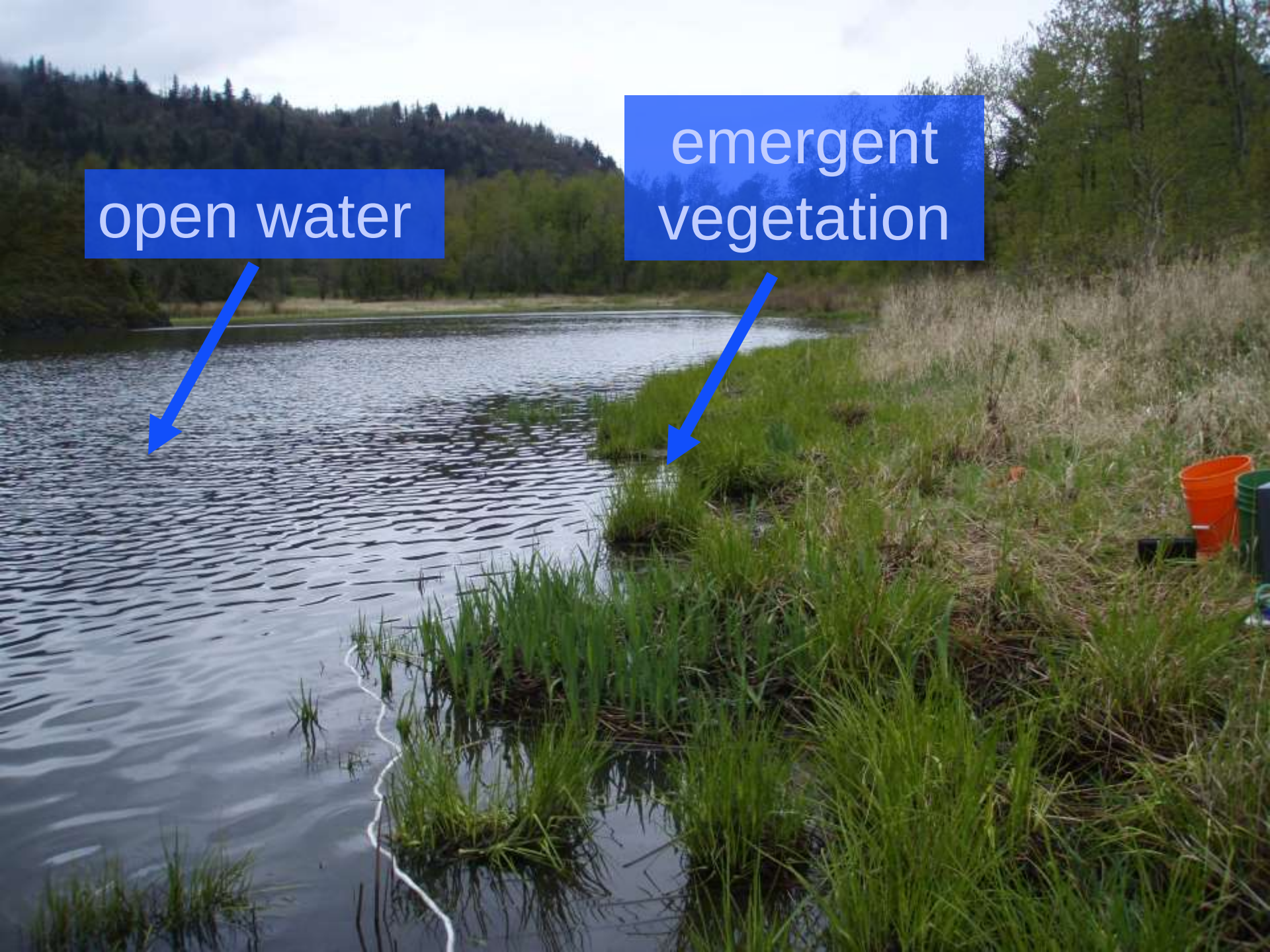
- Fish community
  - Species richness
  - Species divesity
  - % non-native species
  - % fis that could be salmon predators
- Salmon species composition and habitat occurrence
  - % of x in catches
  - Density of
  - Chinook salmon stock composition
- Salmon condition
  - Length, weight, condition factor, size ranges
  - Lipid content
  - Growth rate (otoliths)
  - Contaminants

Selmon Prey

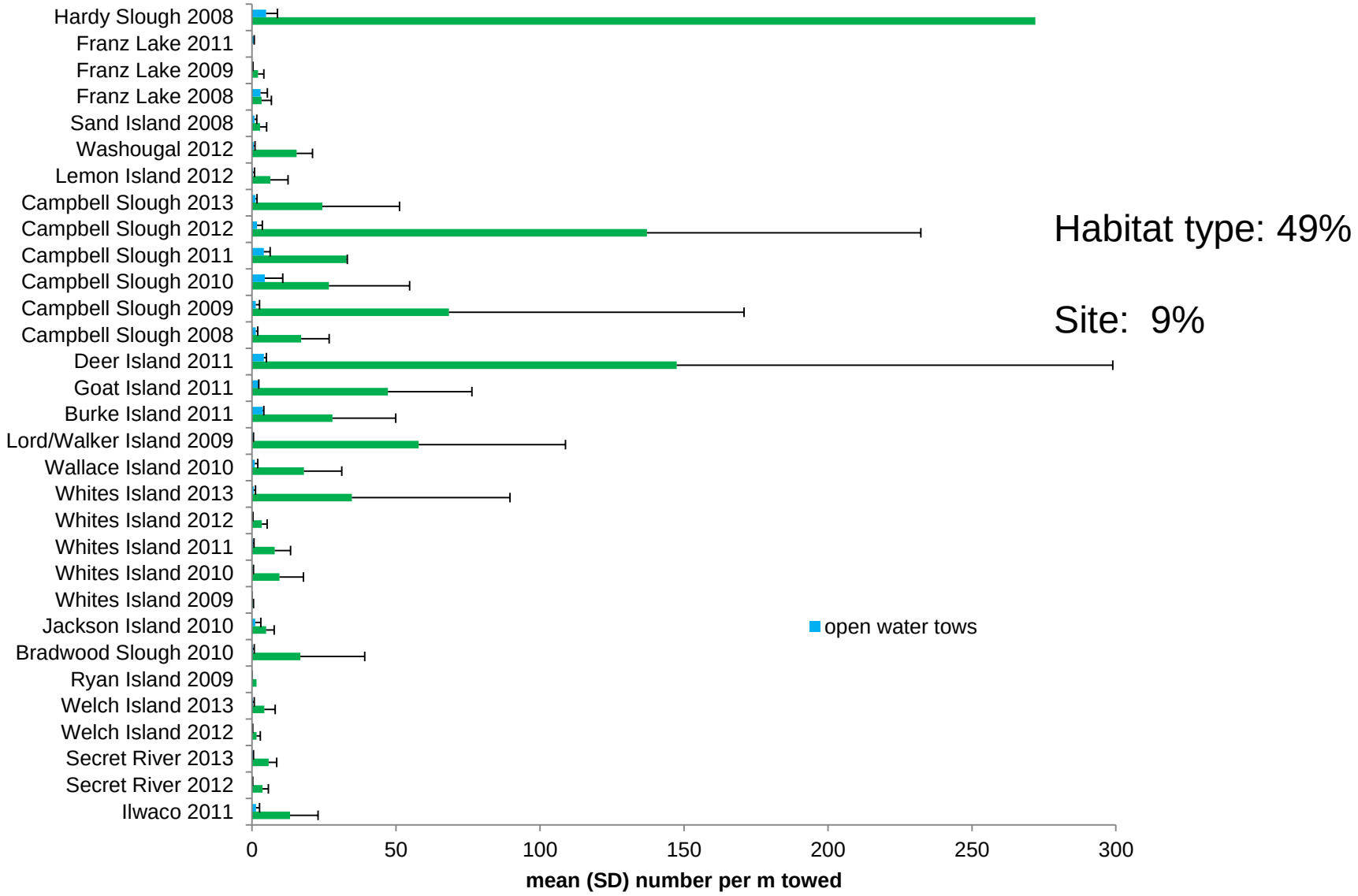
- Prey composition and abundance in open water and emergent vegetation
- Chinook salmon diets and prey preference

Composition of available prey

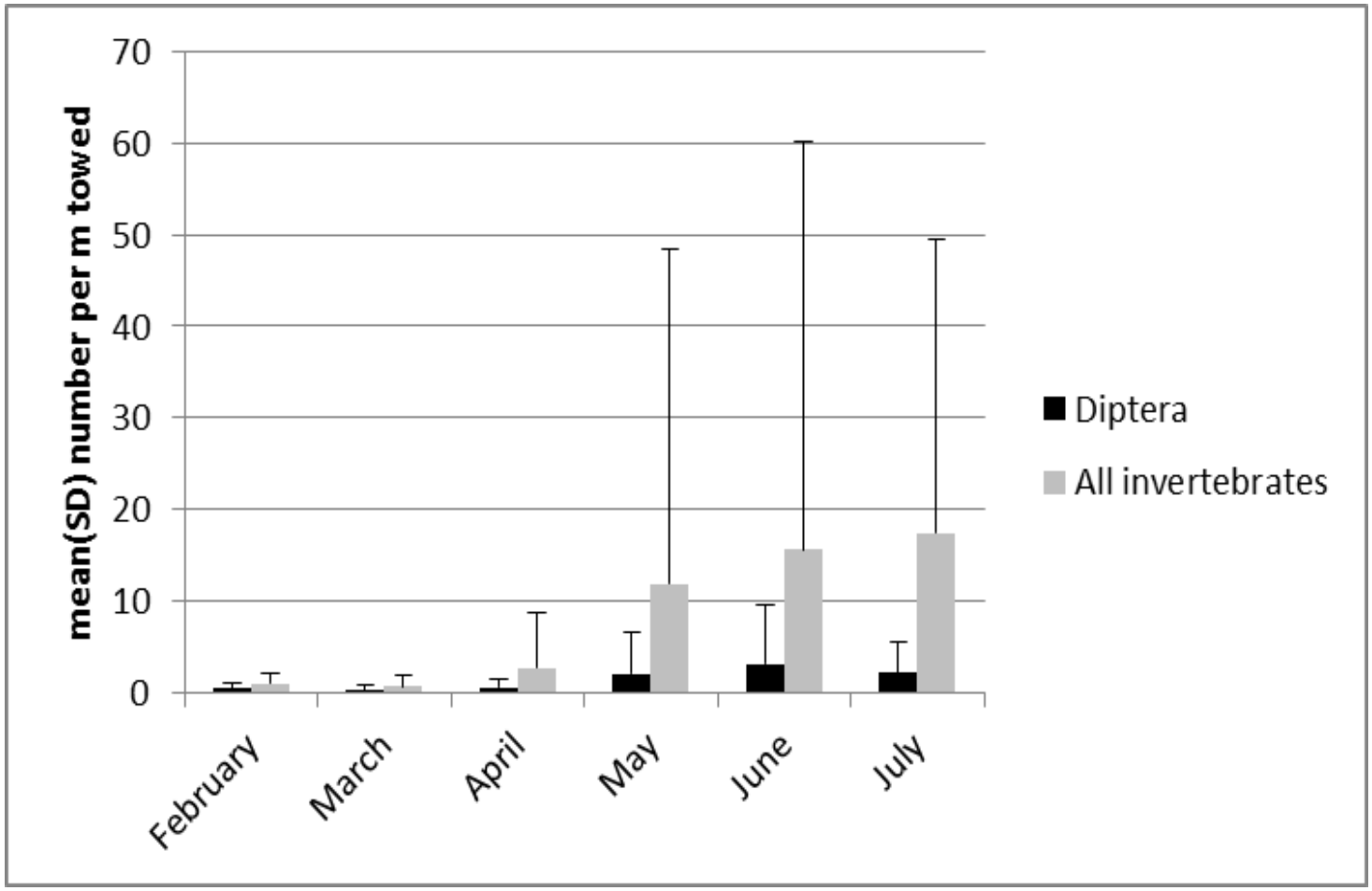



open water
emergent vegetation

Number of prey by site, year, and habitat type

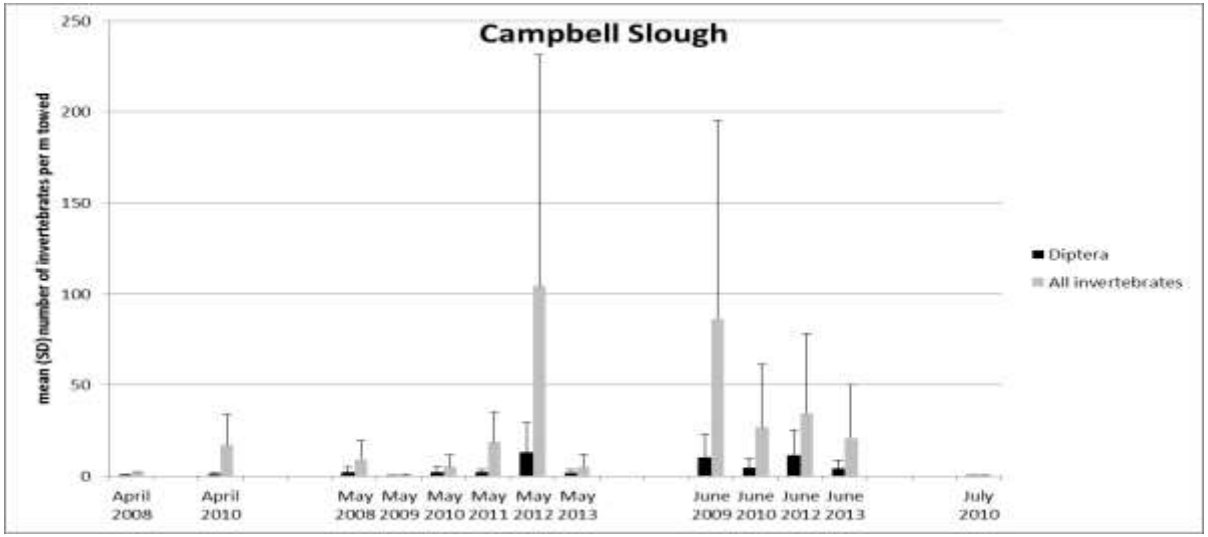


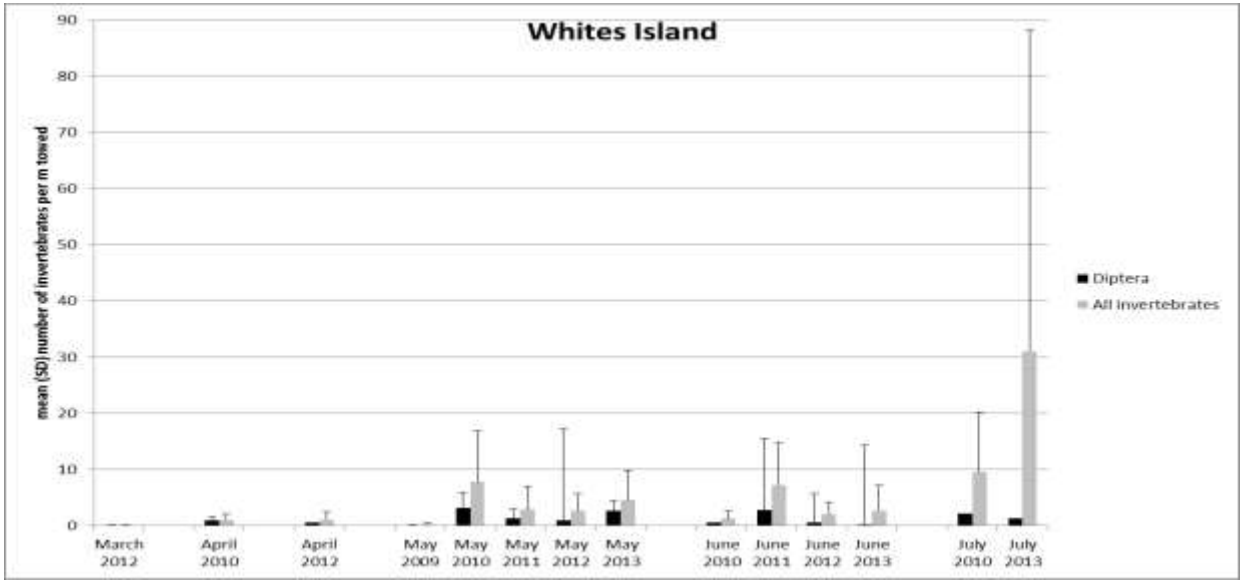
Number of prey by month



1% of variation after site and habitat type taken into account

Prey availability - trends

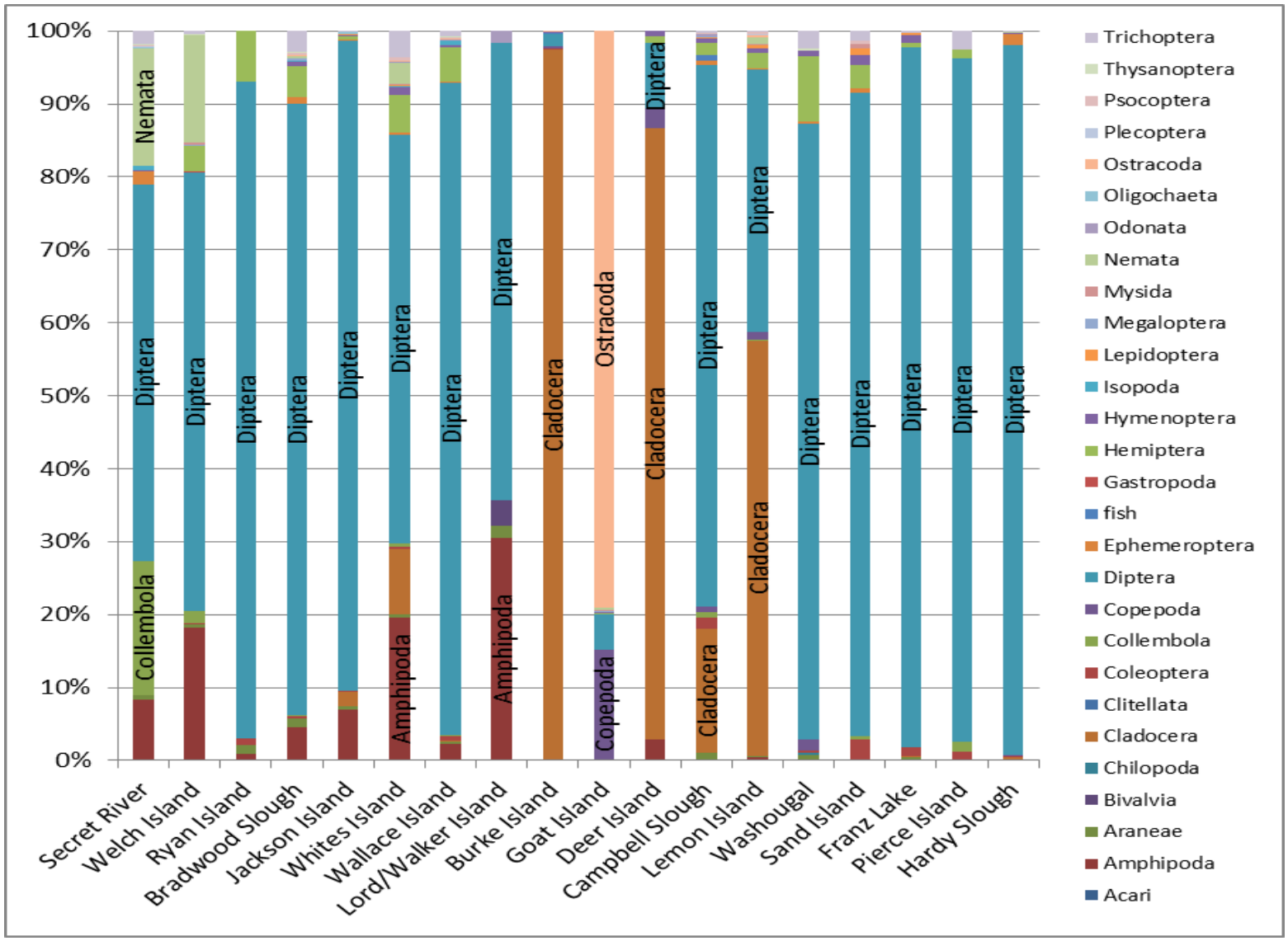




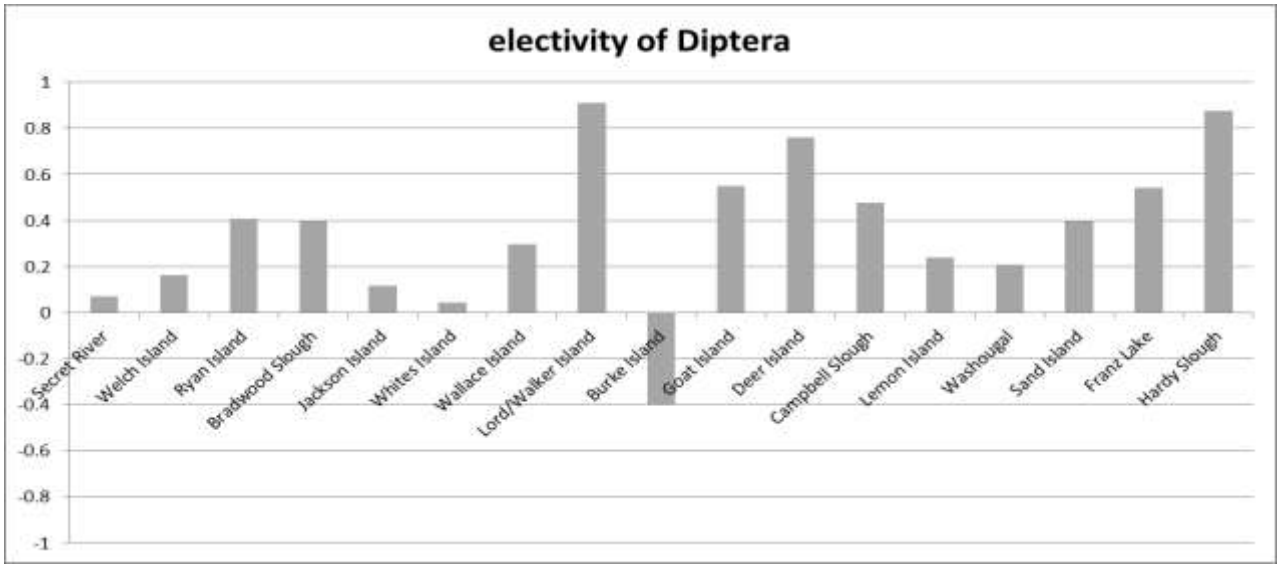
No consistent differences

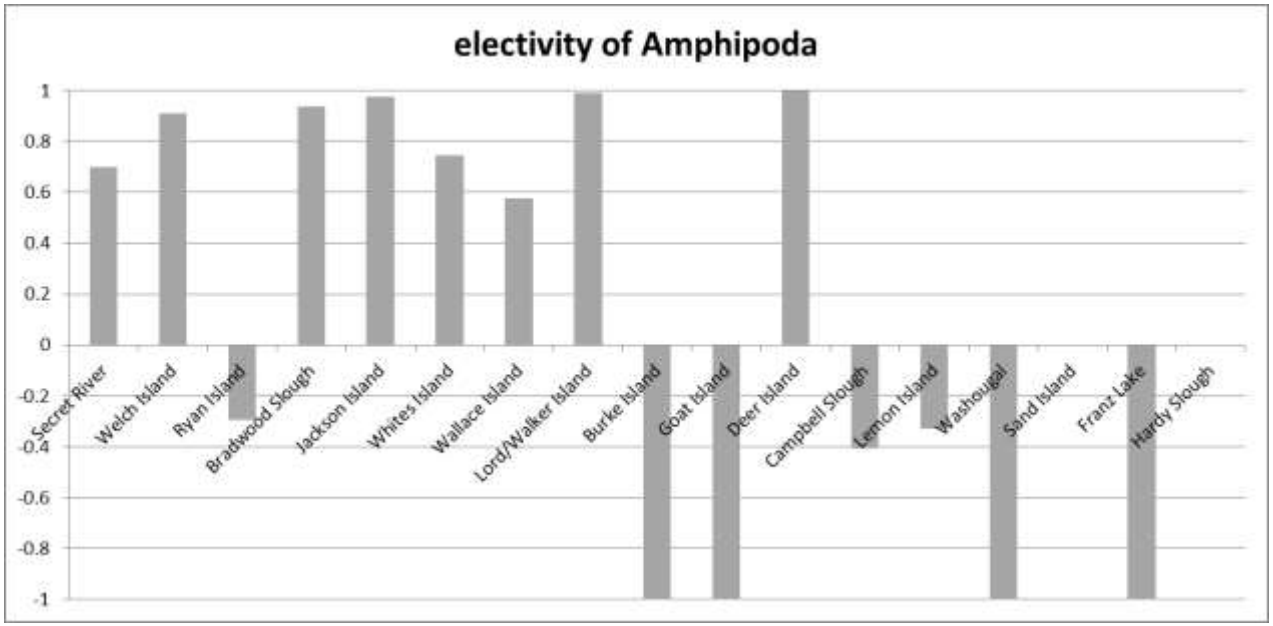
Not significantt in explaining variability

Diet composition

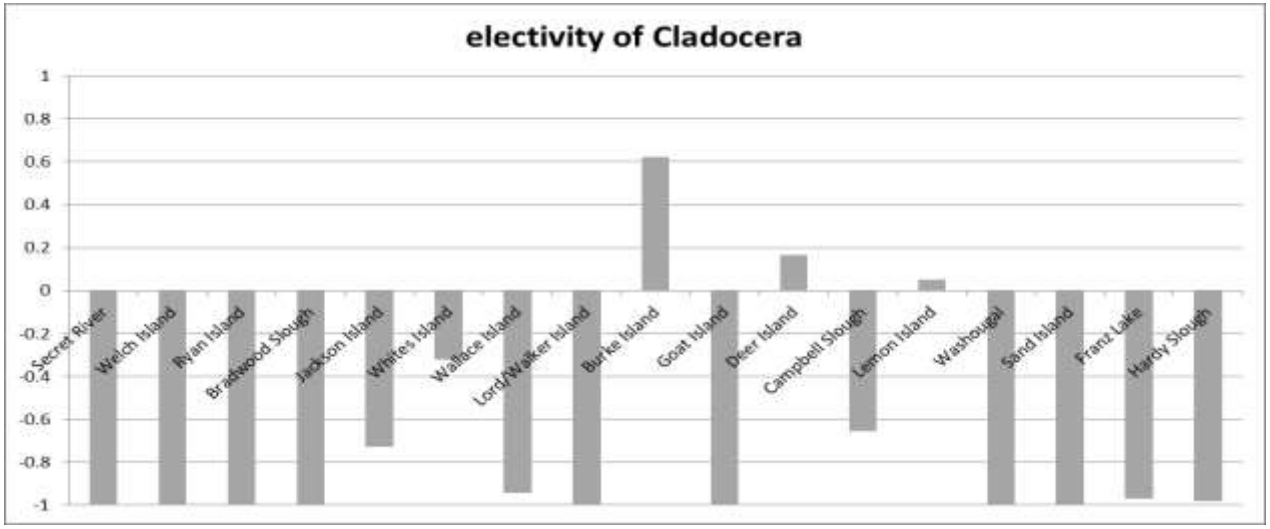


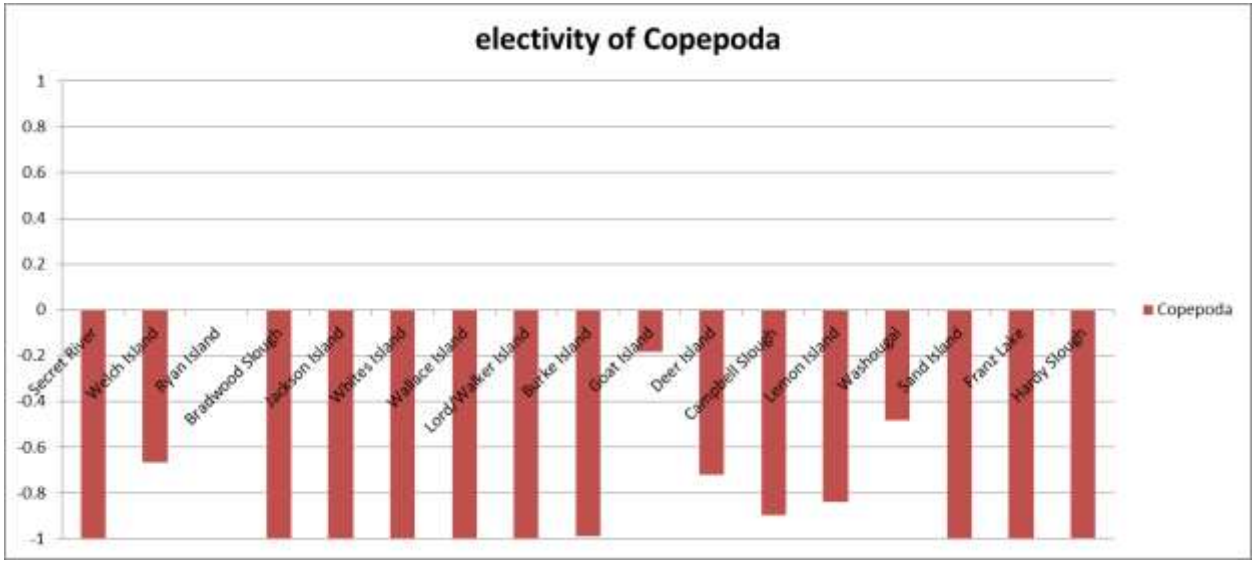
Electivity – what they love



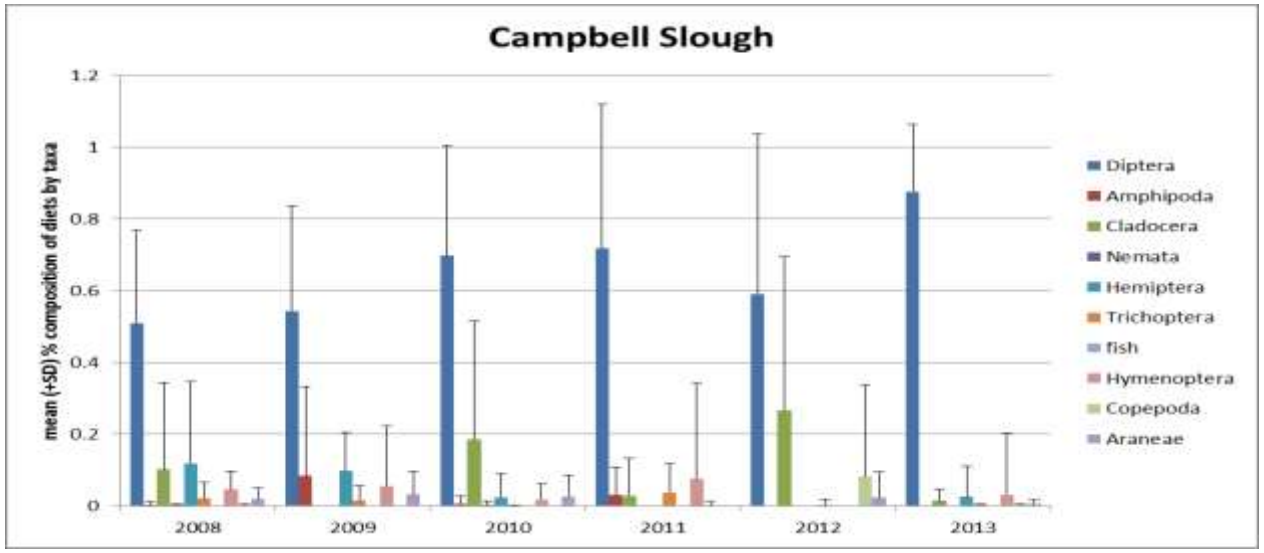


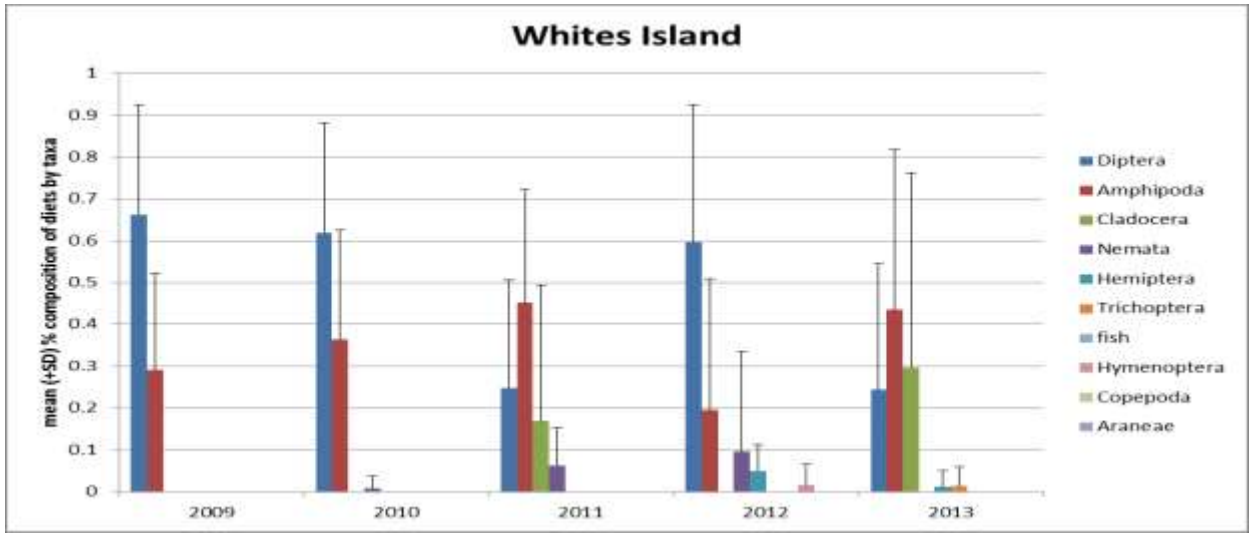
Electivity – what they hate





Temporal Trends in Diet Composition





Year of sampling did not contribute significantly to variability

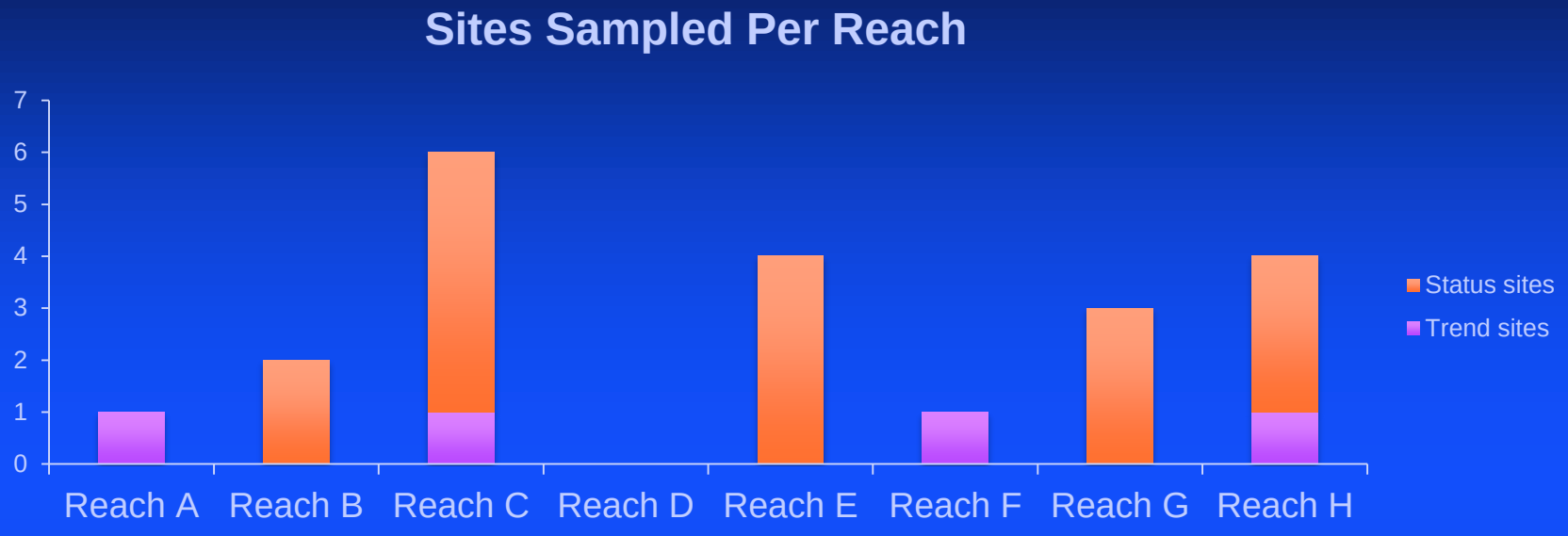
Summary of Findings

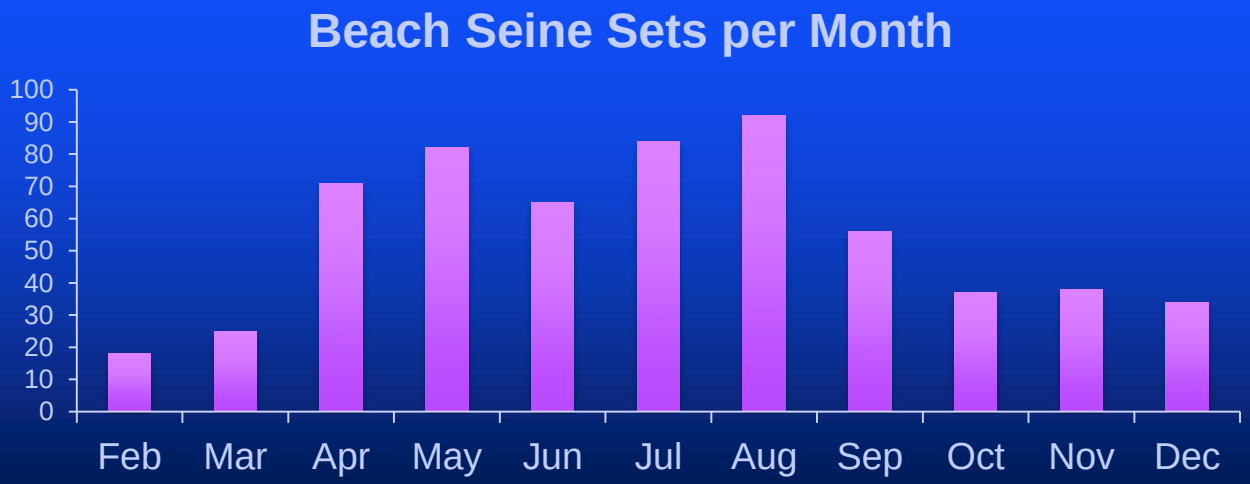
- Significant spatial and seasonal patterns for many factors
- Differences between marked and unmarked fish
- Influence of stock less clear
- Some temporal variation at trend sites but less evidence of increasing or decreasing trends
- Variety of prey but consistent preference by Chinook for Dipteran prey; found at highest densities in nearshore emergent vegetation
- Habitat type, month, site, contribute to variation in prey

But . . .

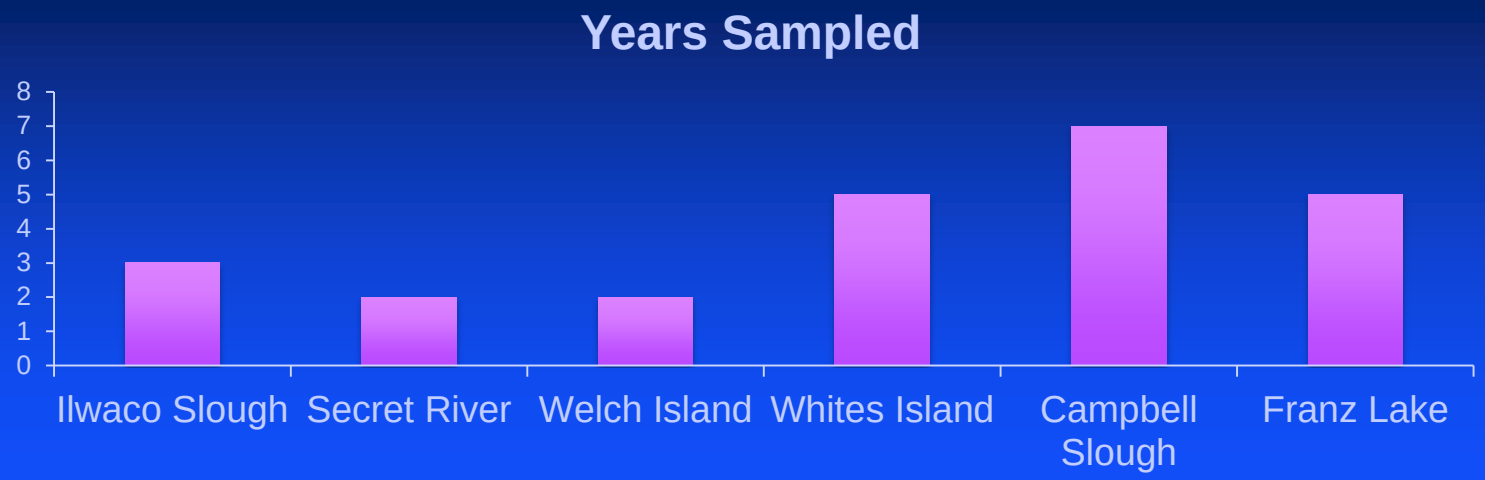
Spatial, seasonal, stock and temporal data gaps

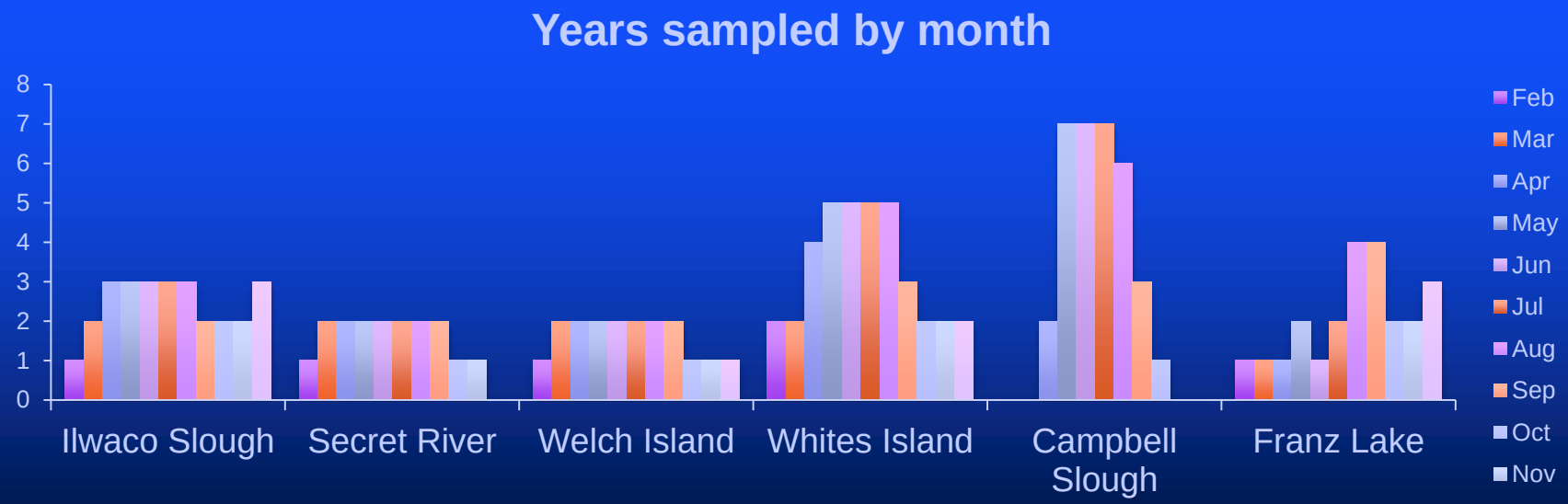
Spatial and Seasonal Gaps



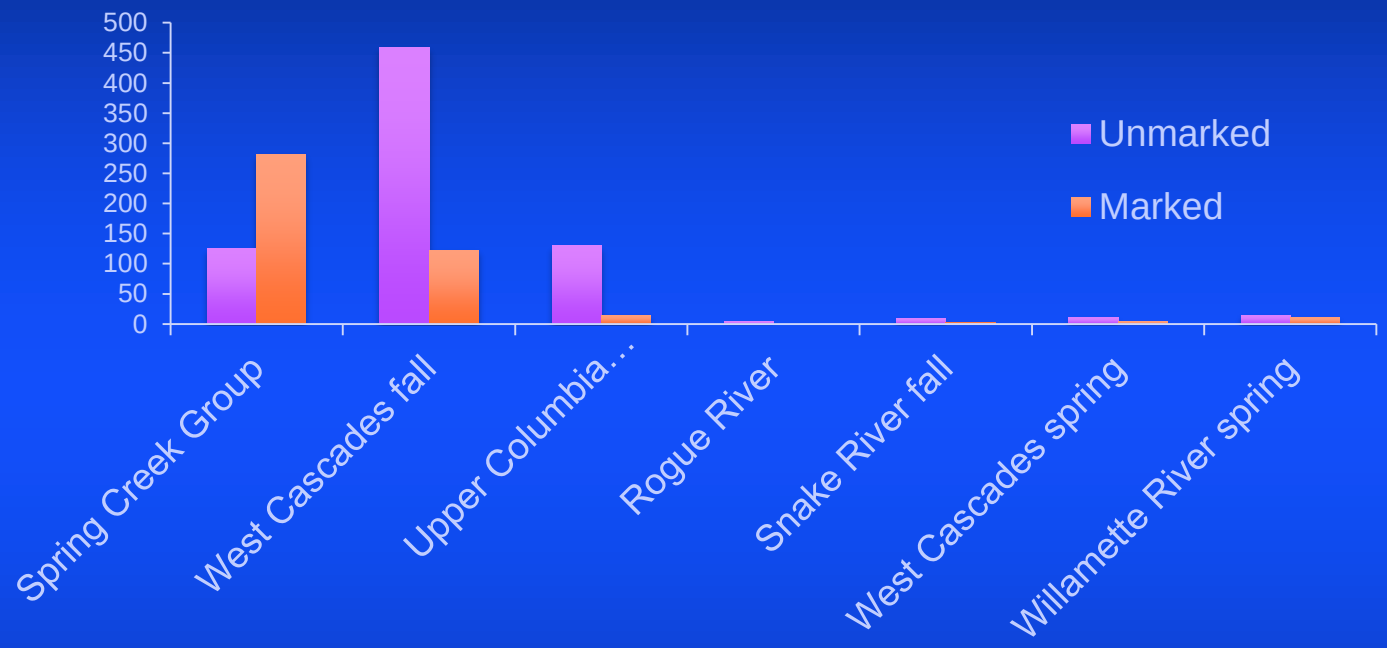


Temporal and Seasonal Gaps at Trend Sites





Limited samples from non-LCR ESU stocks



Implications for Future Sampling

- Spatial patterns well-described, although some reaches represented by just one site
- Seasonal sampling schedule could be modified to focus on months when data are most needed
- Trends monitoring still needed - but consider frequency, suitability of some sites
- Could focus lipid and genetic analyses unmarked fish, stocks with less data