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Direct benefits of habitat restoration on juvenile salmon: site-scale evaluation

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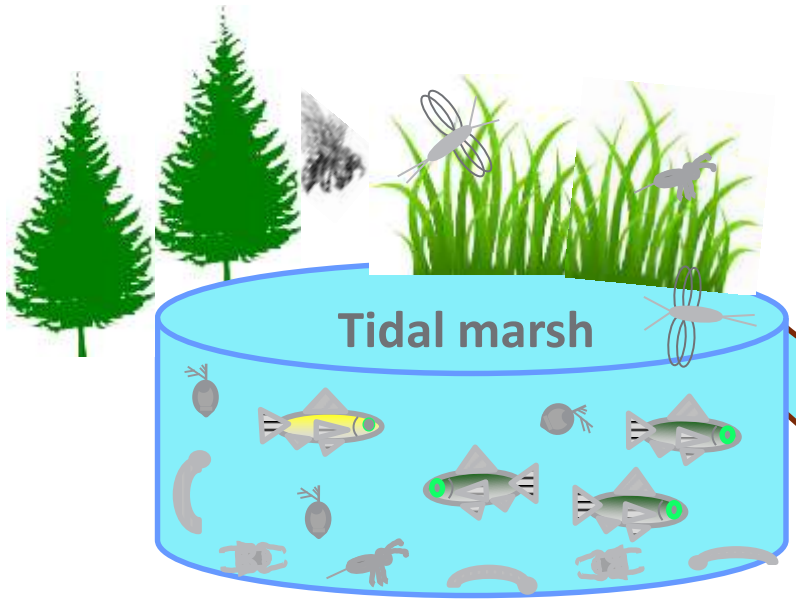
Conceptual model: Prey production in restored tidal wetlands benefit juvenile salmon directly onsite and indirectly offsite

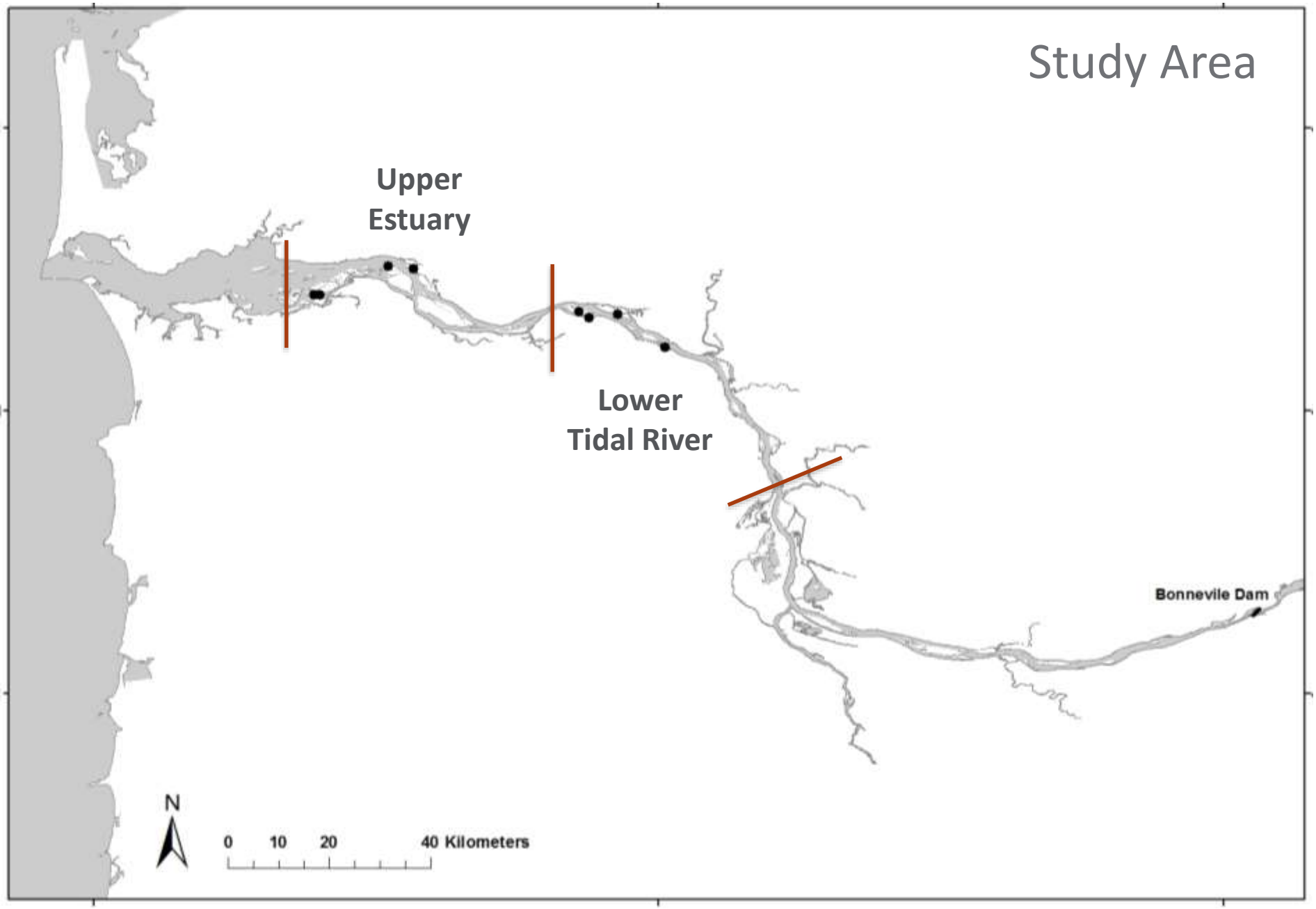


Direct benefits: Restored tidal wetlands provide refuge and prey resources for juvenile salmon (site-scale)

Flux: Quantifying prey exported from tidal wetland restoration site to mainstem

PIT antenna: Tagged salmon detected entering restored tidal wetlands

Indirect benefits: Restored tidal wetlands export material that support mainstem foodwebs (landscape-scale)


Study Area
Upper
Estuary
Lower
Tidal River
Bonneville Dam
N
0 10 20 40 Kilometers

Wetland Channels

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Crims
rkm 90

Batwater
rkm 92

Fisher Island
rkm 96

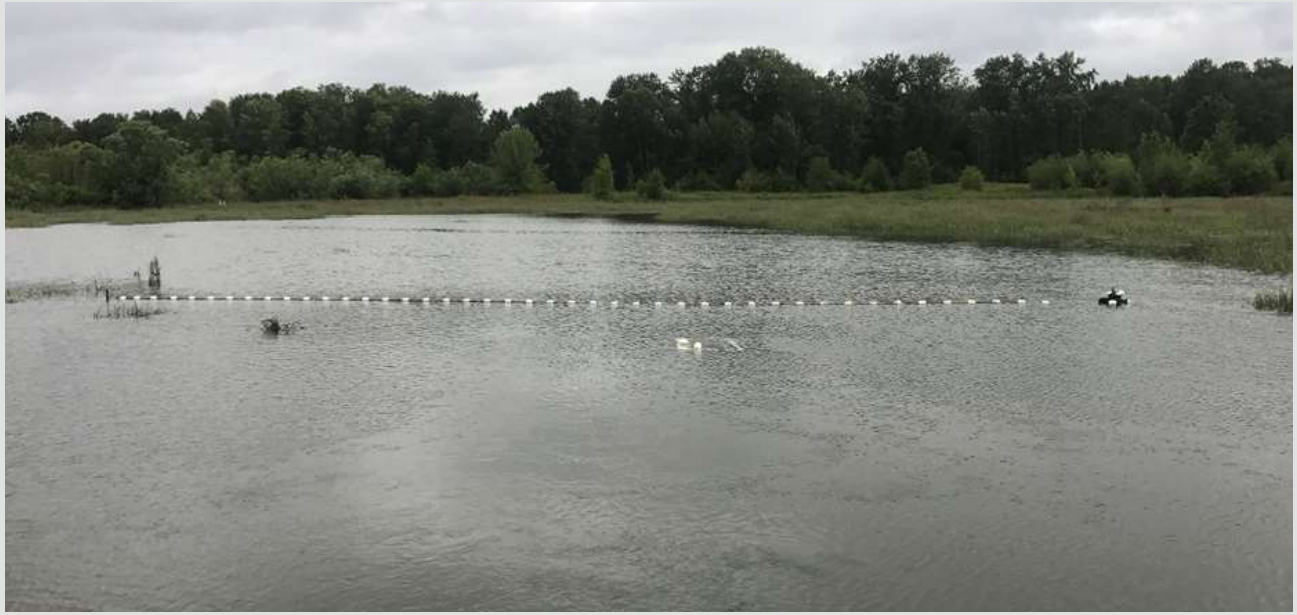
Dibblee
rkm 105

Karlson Reference
rkm 42

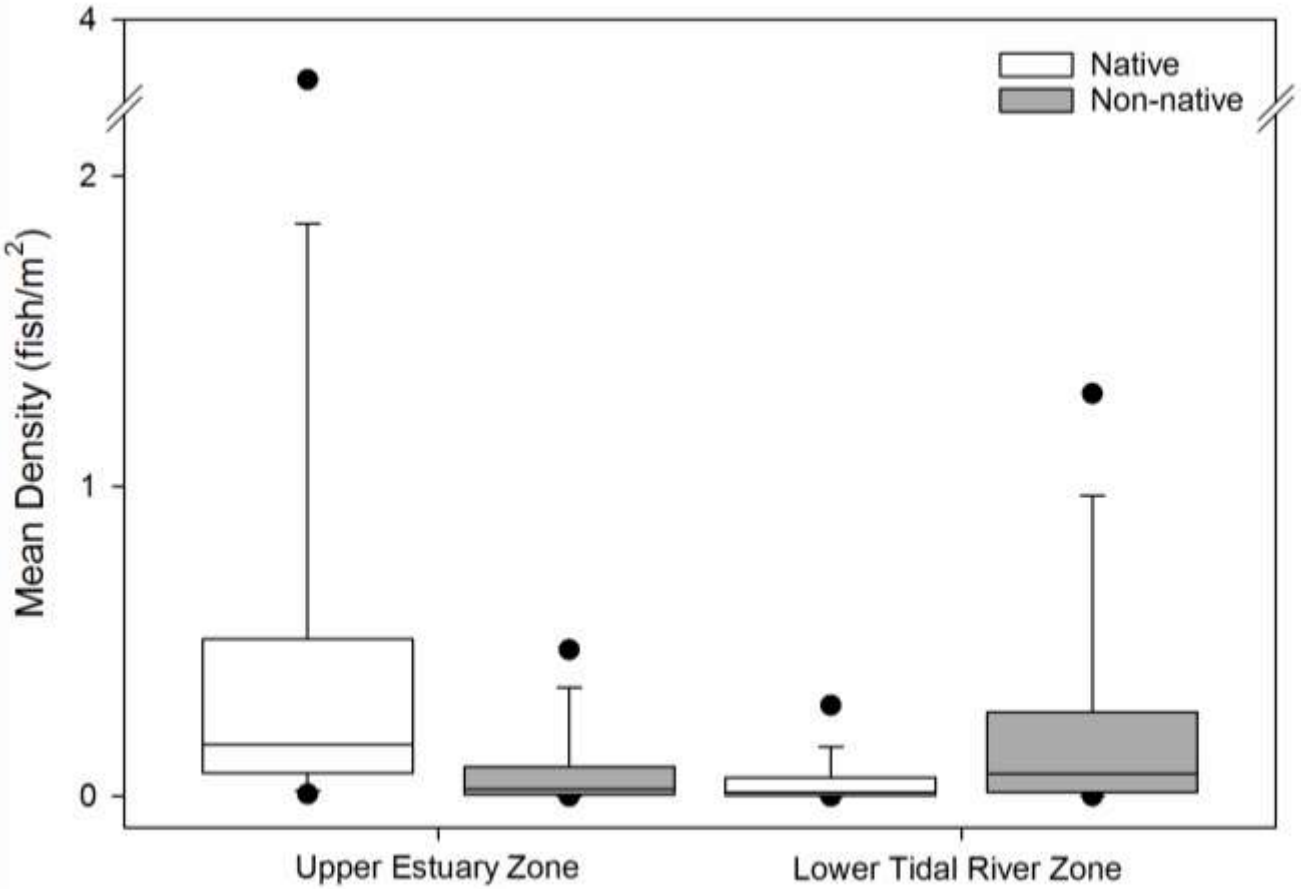
Karlson Restoration
rkm 43

Welch
rkm 53

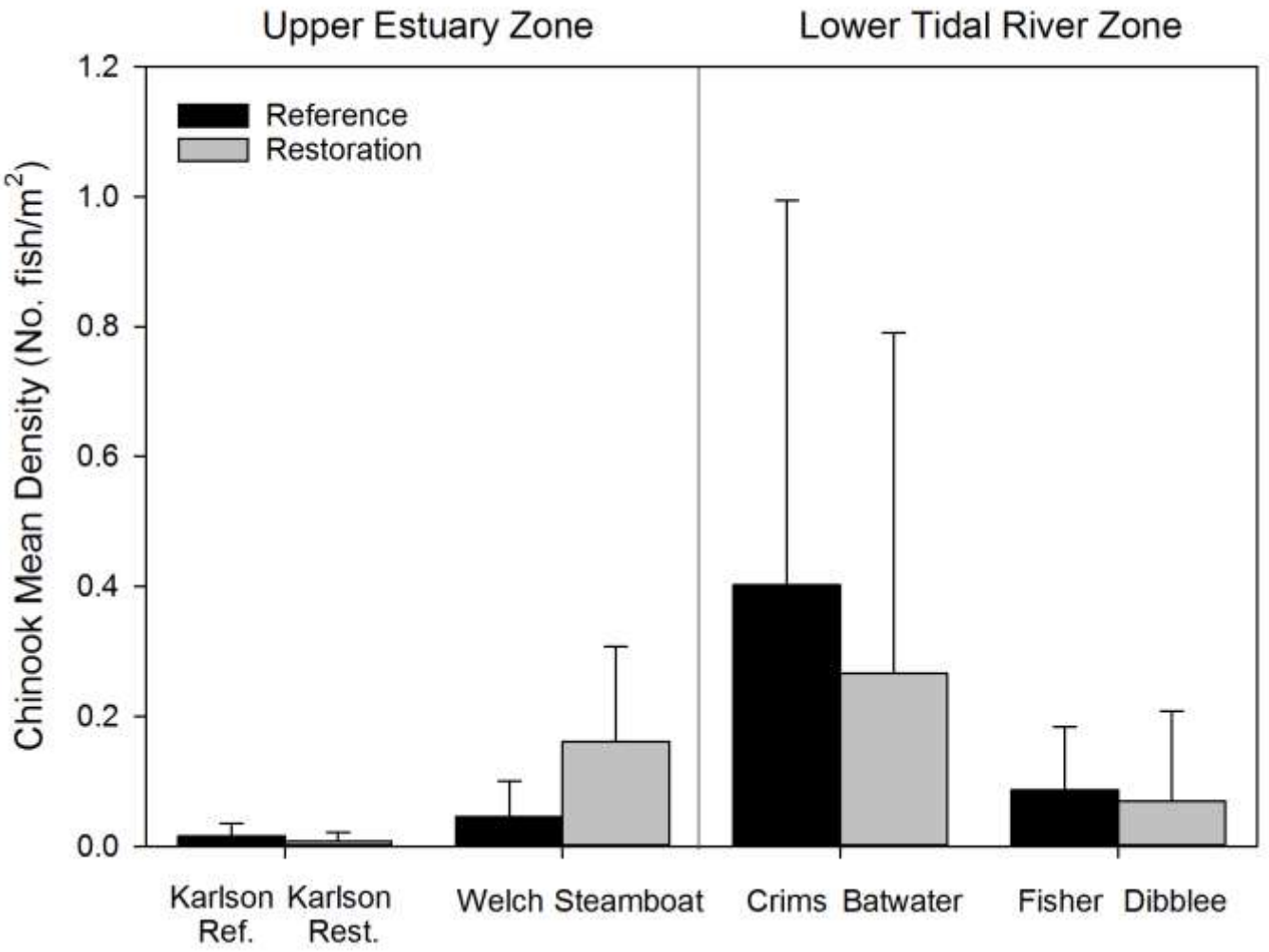
Steamboat
rkm 56



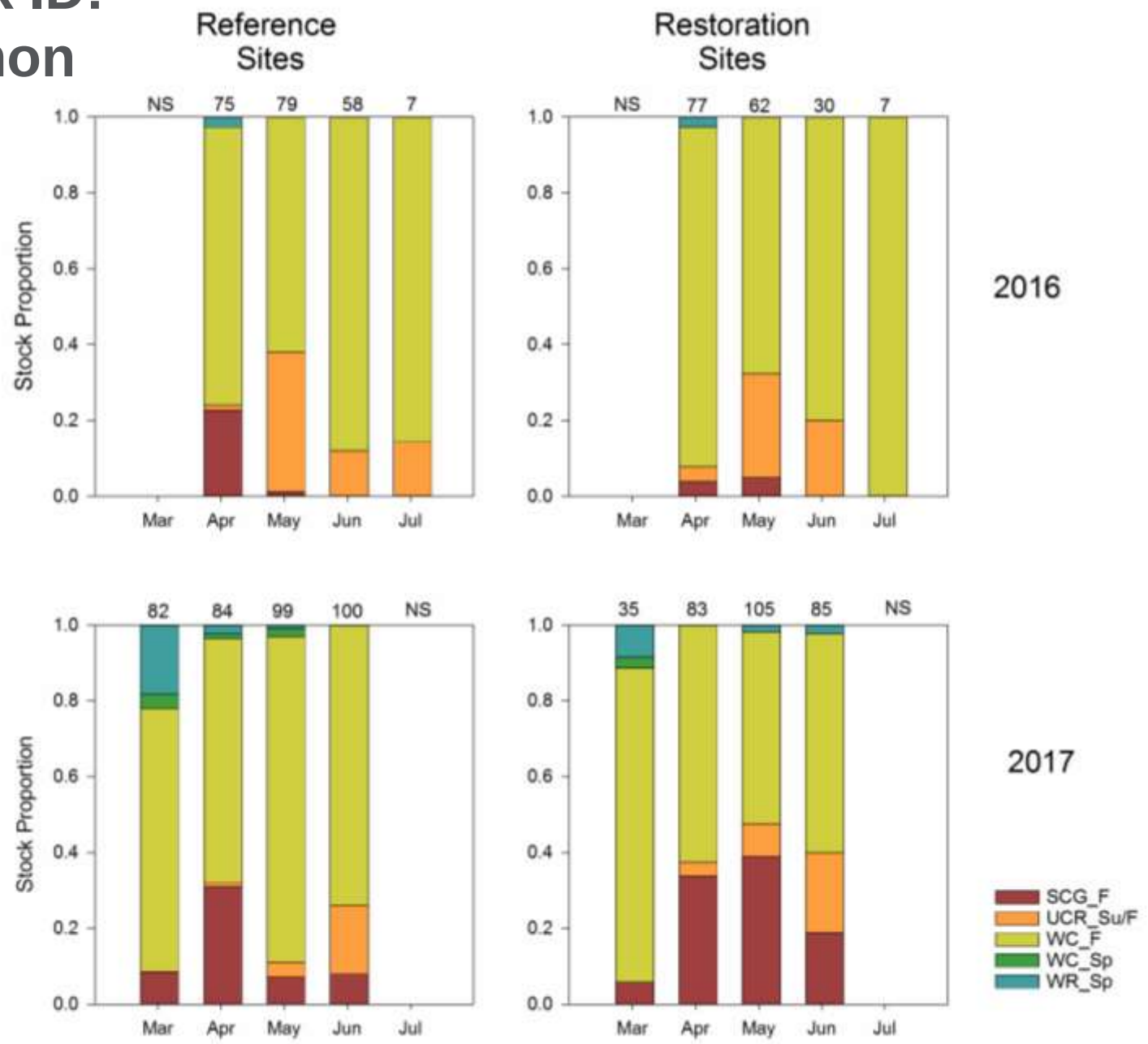
Native and Non-native fish



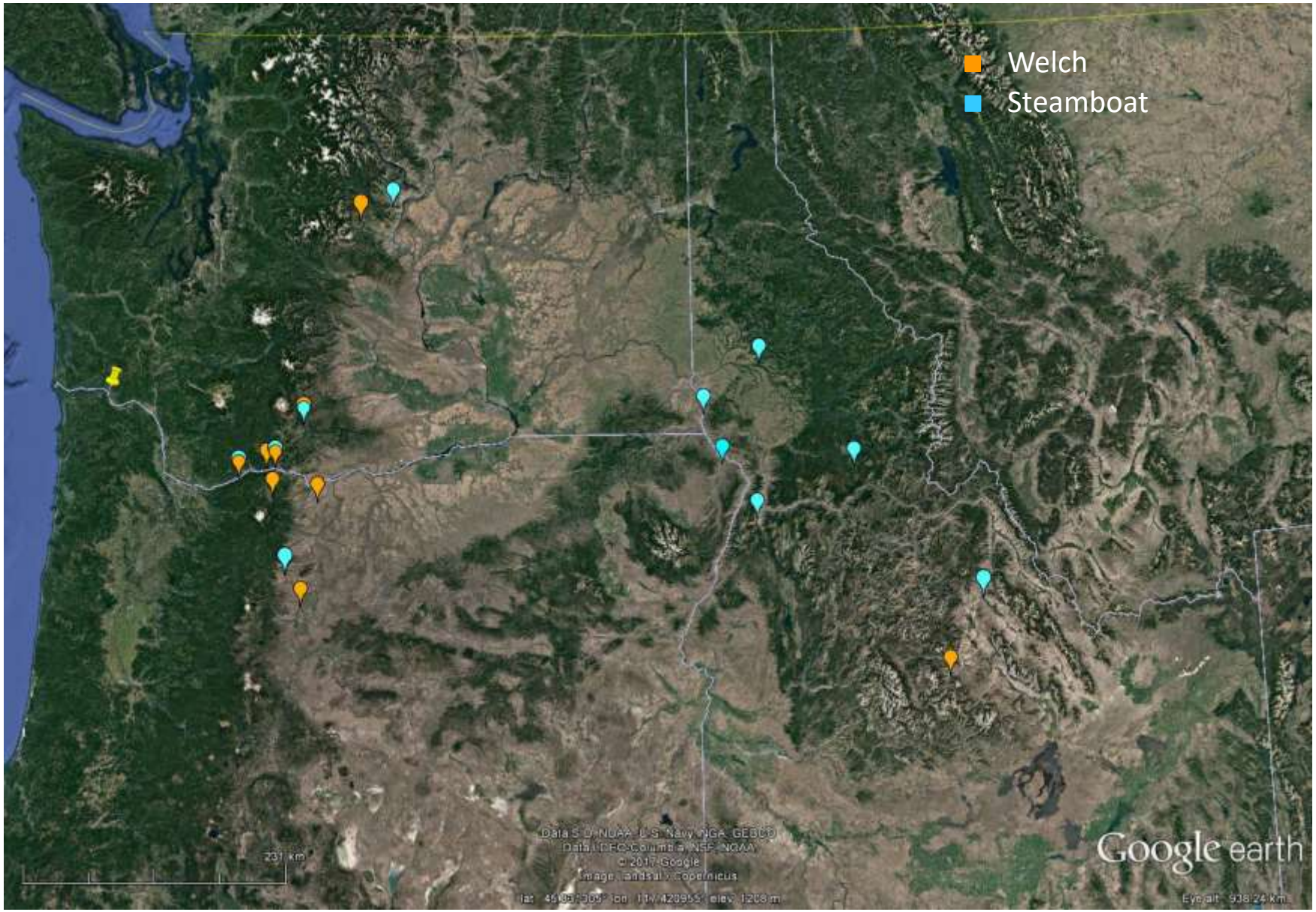
Unmarked Chinook Salmon



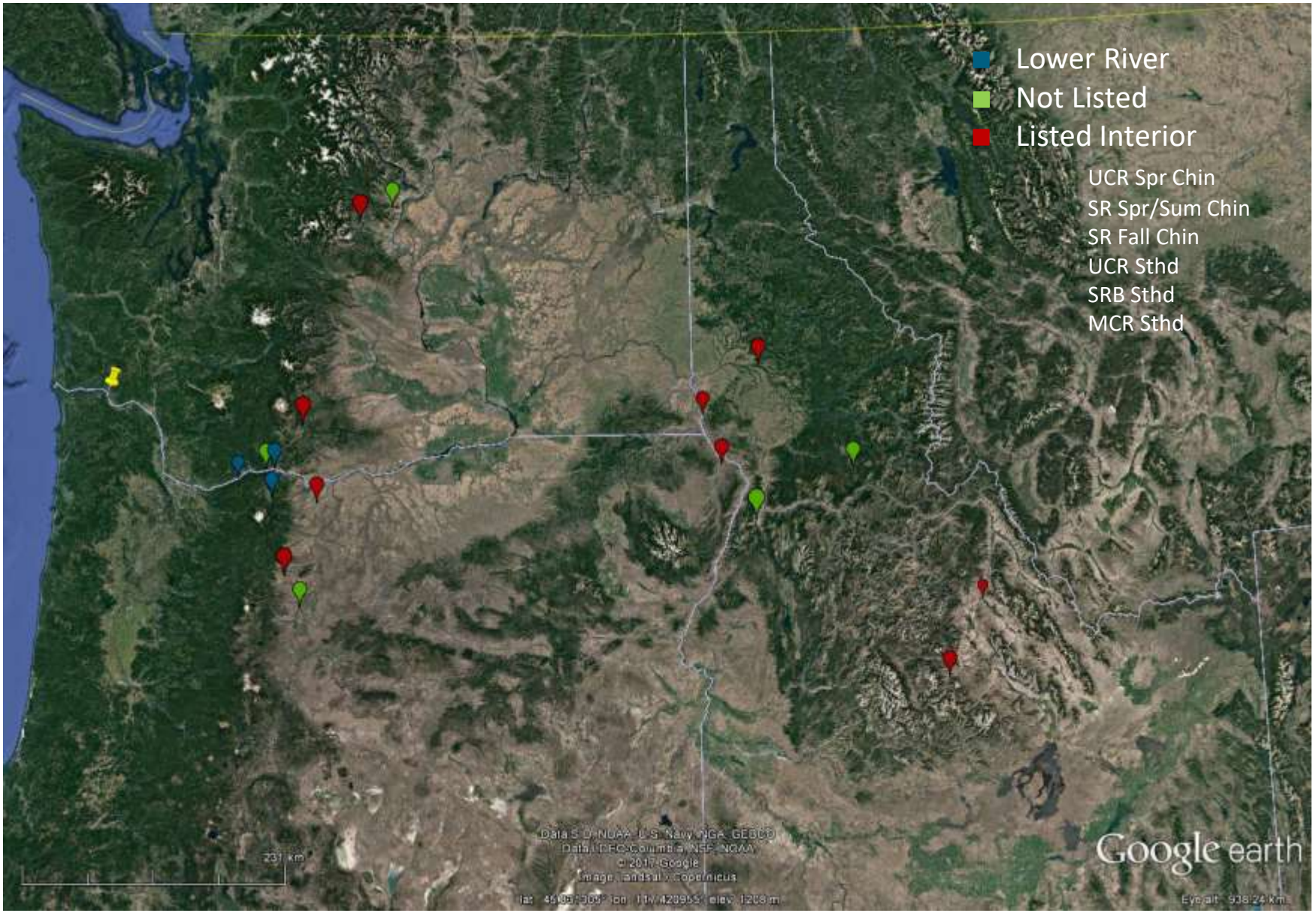
Genetic Stock ID: Chinook salmon



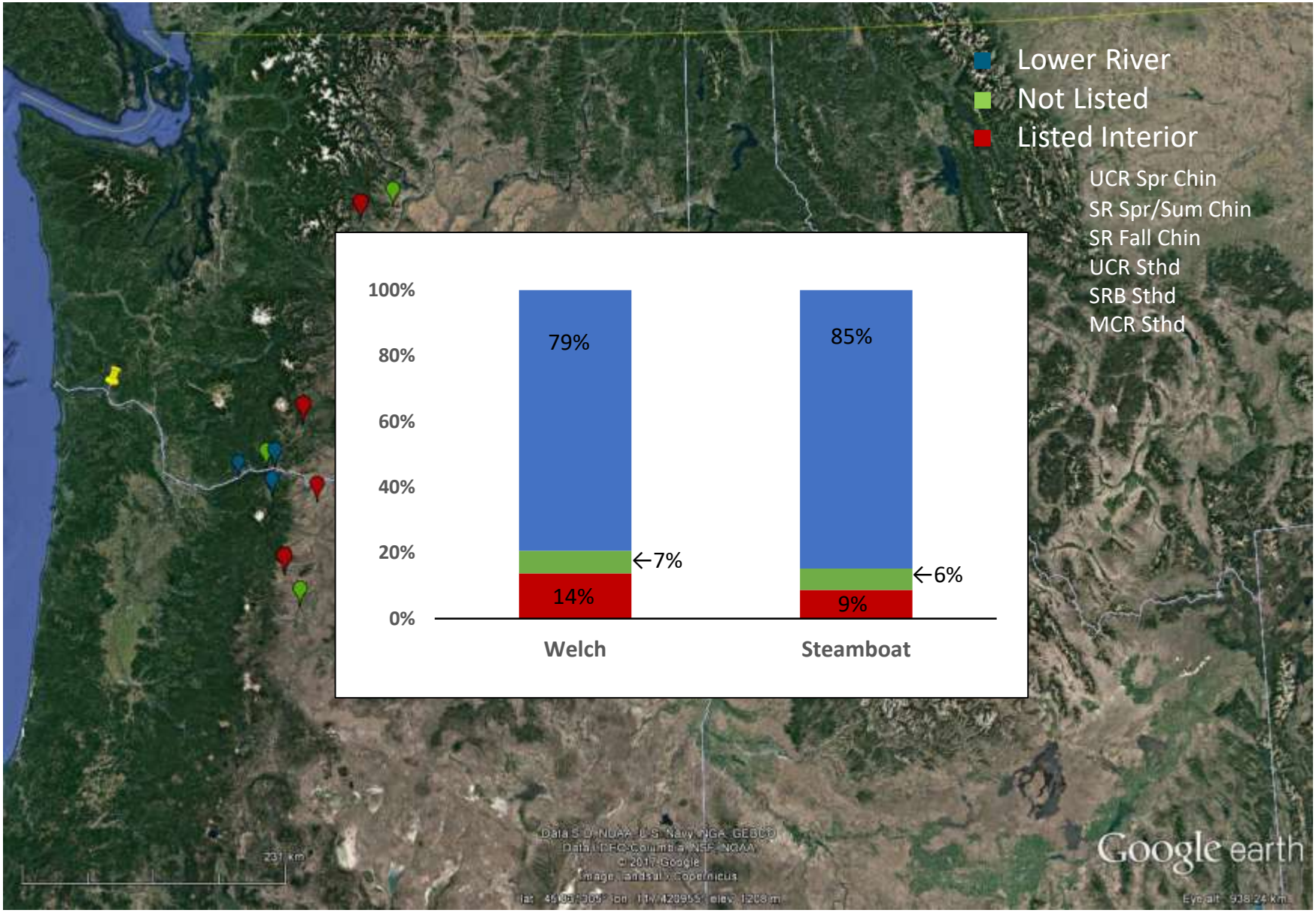
Geographic Origins



Genetic Stock

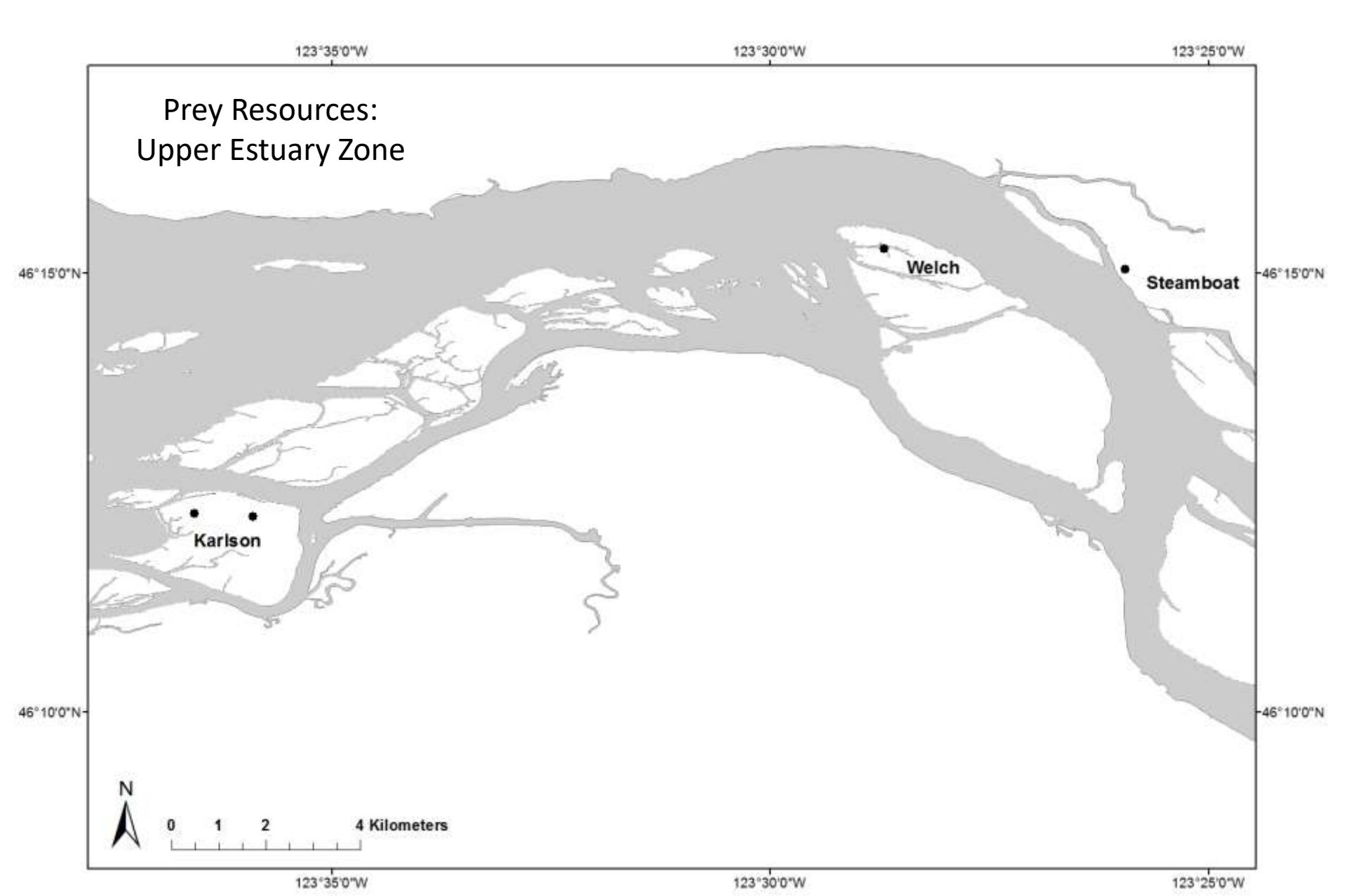


Classification of Detections

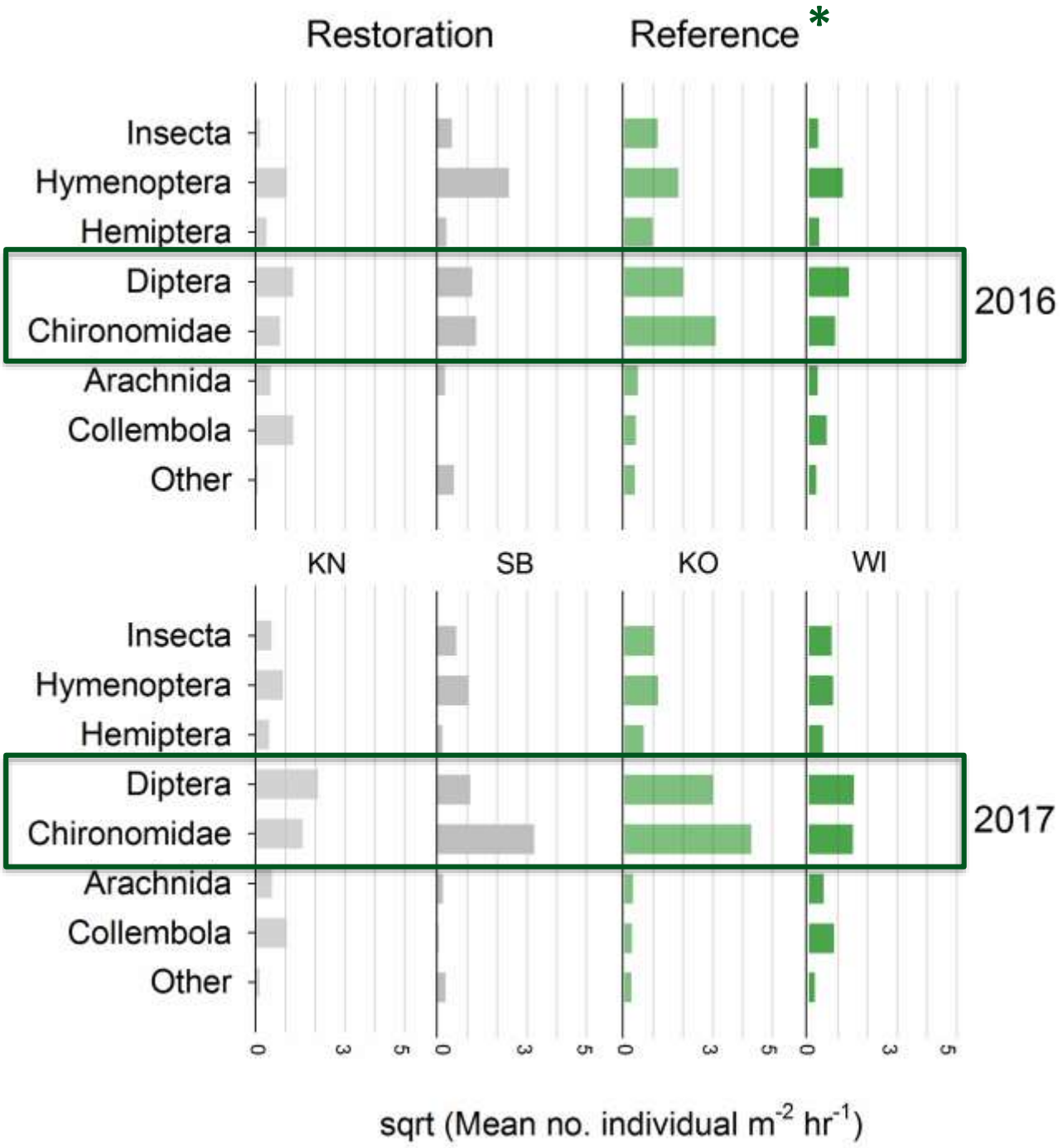


Detection Overview

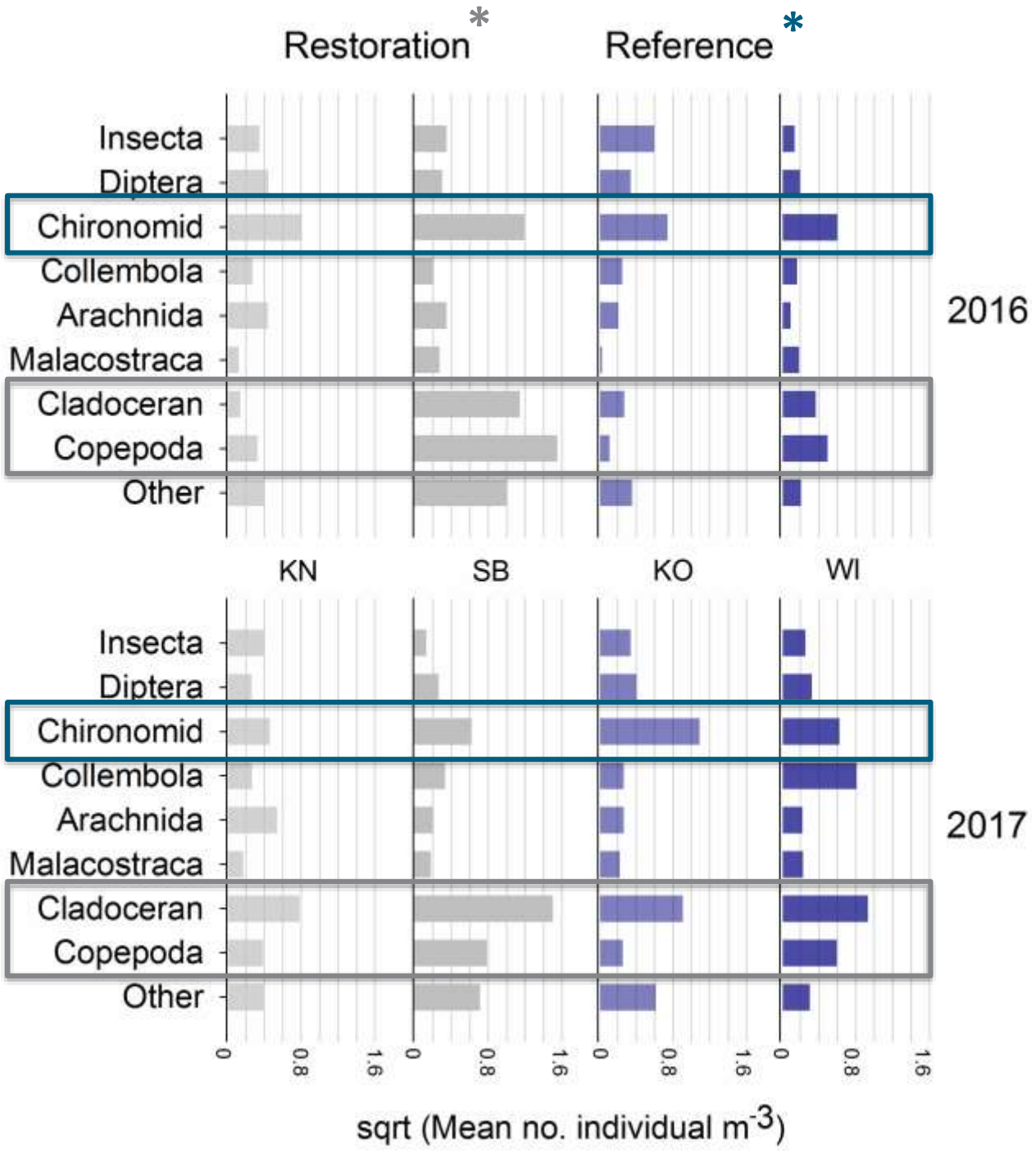
	Unique detections	Fall Chinook	Spring Chinook	Steelhead	Northern Pikeminnow	"Orphans"
Welch	33	23	1	5	1	3
Max residence		13.4 d	10 m	1.3 d	0	20.9 d
Median residence		1.2 d		2 s		12 m
Steamboat	57	40	4	5	5	3
Max residence		21.6 d	1.8 h	1.0 d	106.7 d	23.5 d
Median residence		3.5 d	11 s	30 m	1.5 m	5 m


Prey Resources:
Upper Estuary Zone
123°35'0"W
123°30'0"W
123°25'0"W
46°15'0"N
46°10'0"N
Welch
Steamboat
Karlson
N
0
1
2
4 Kilometers

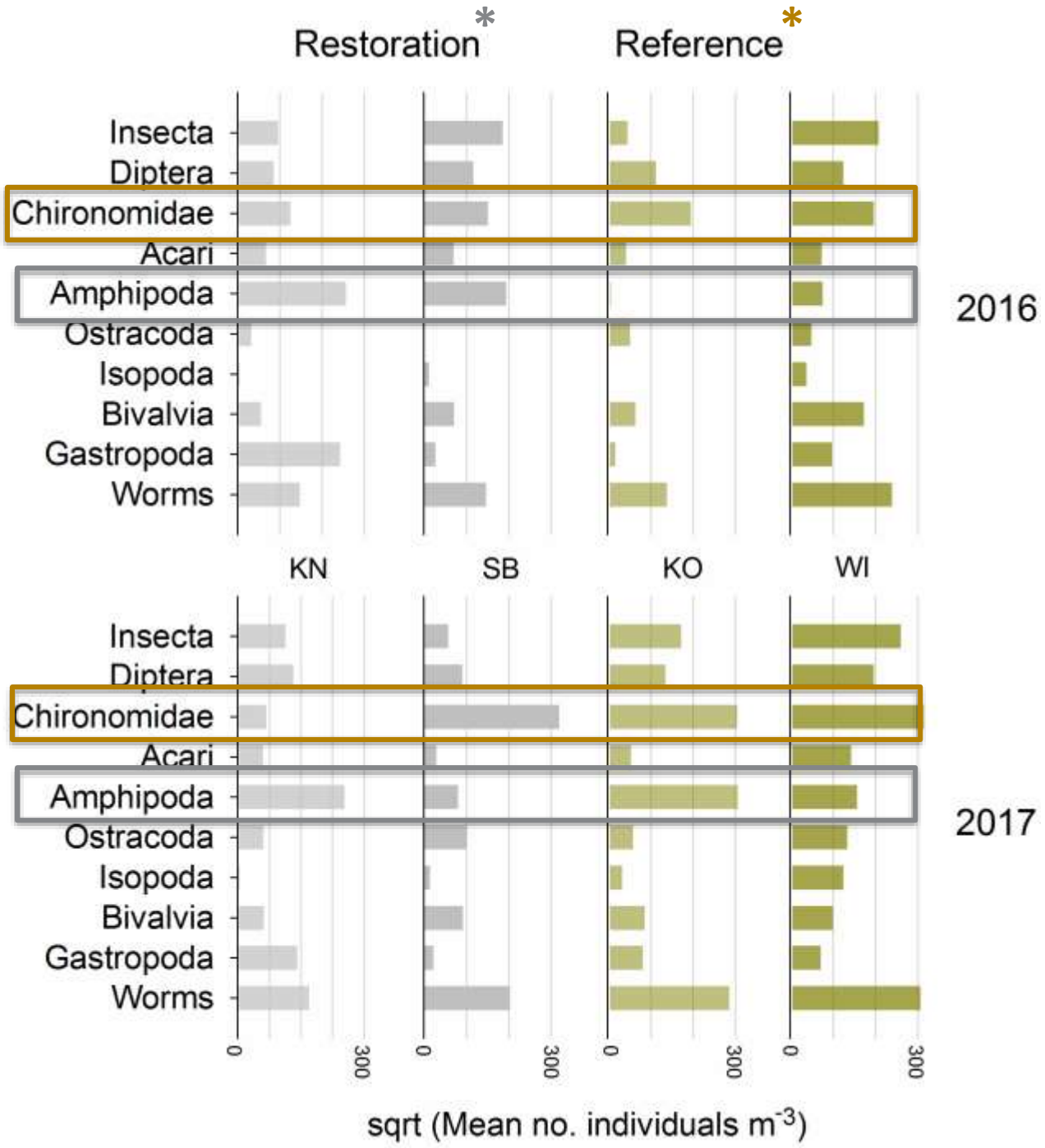
Salmon Prey: Marsh surface



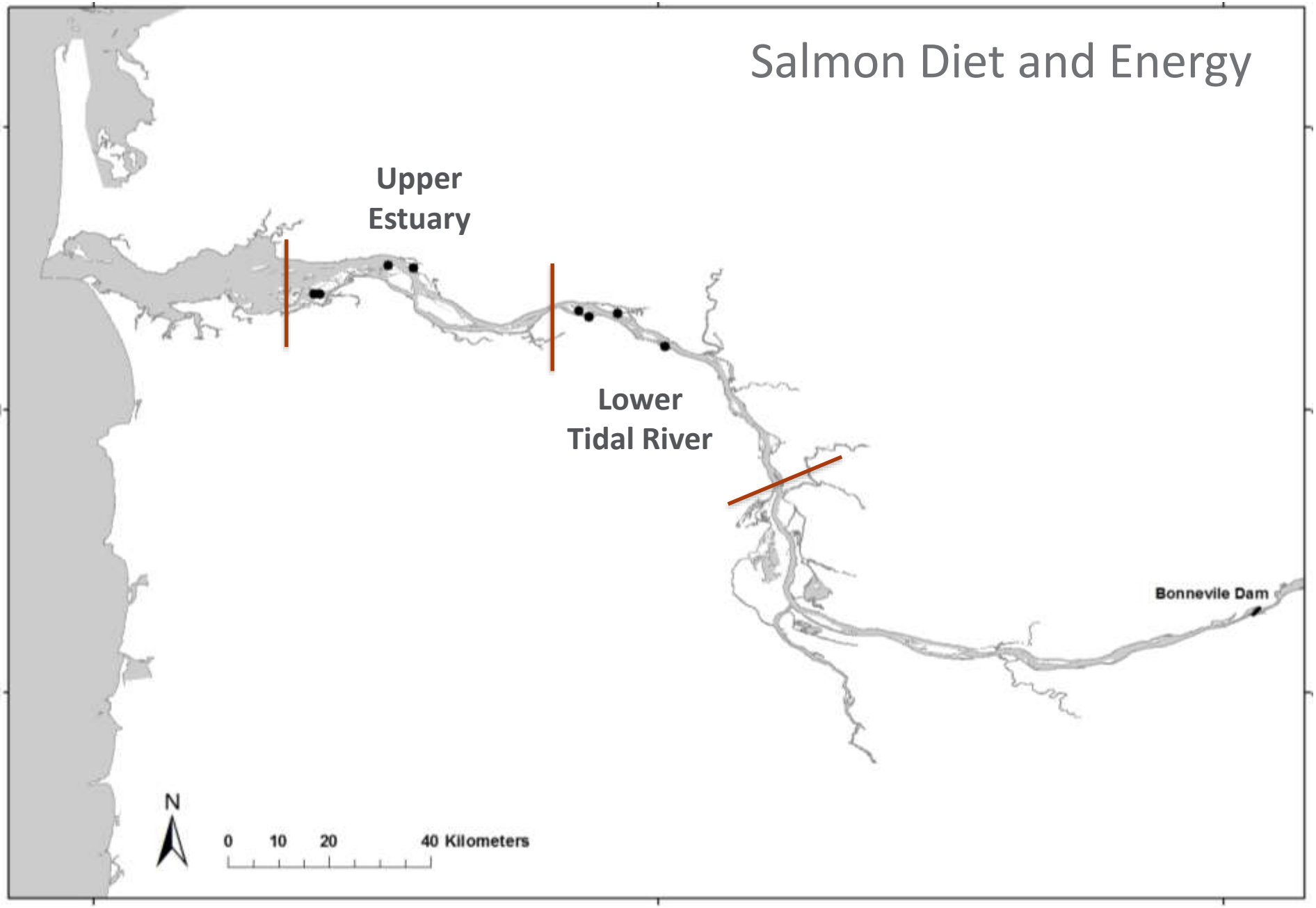
Salmon Prey: Water surface



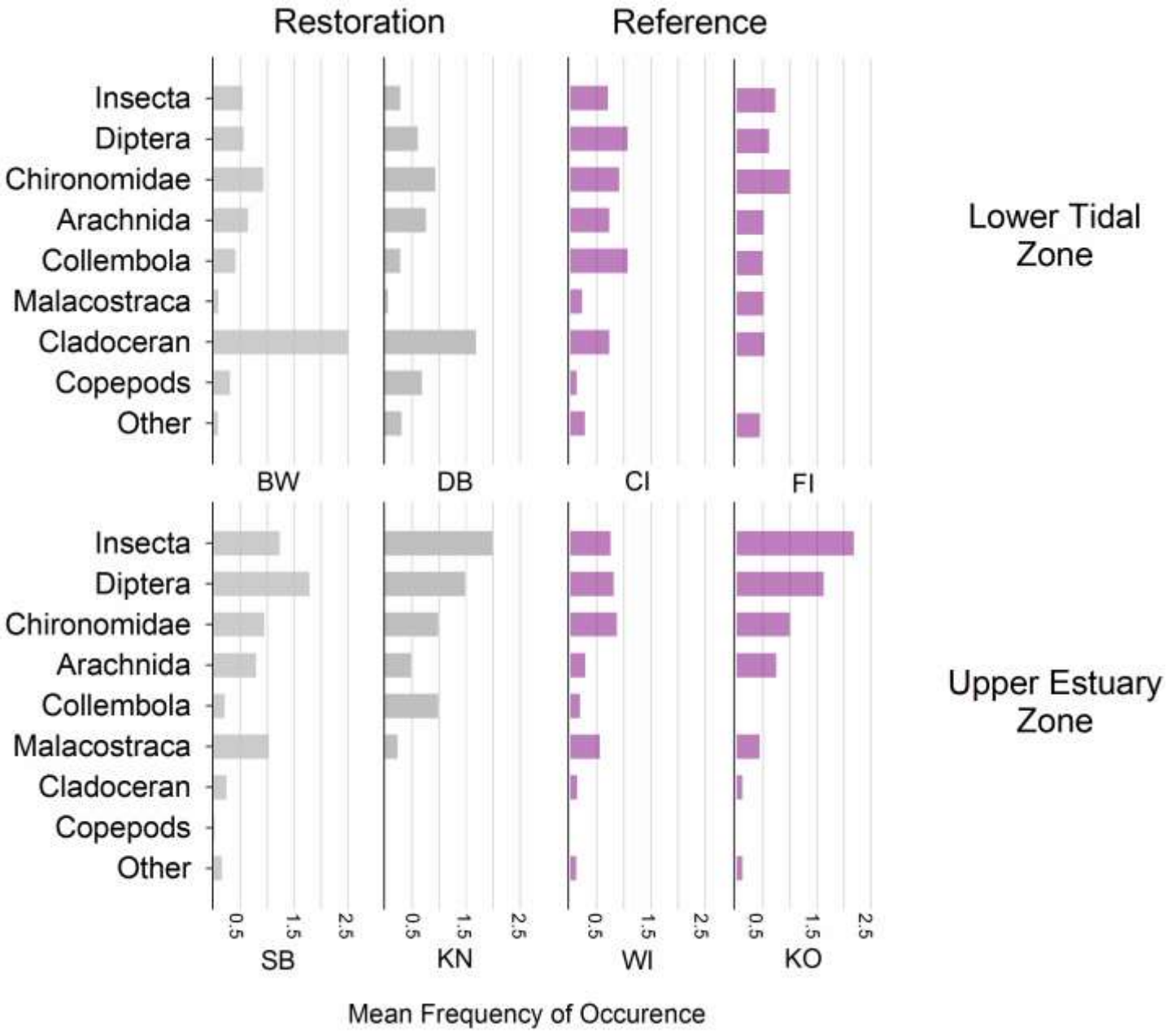
Salmon Prey: Benthos



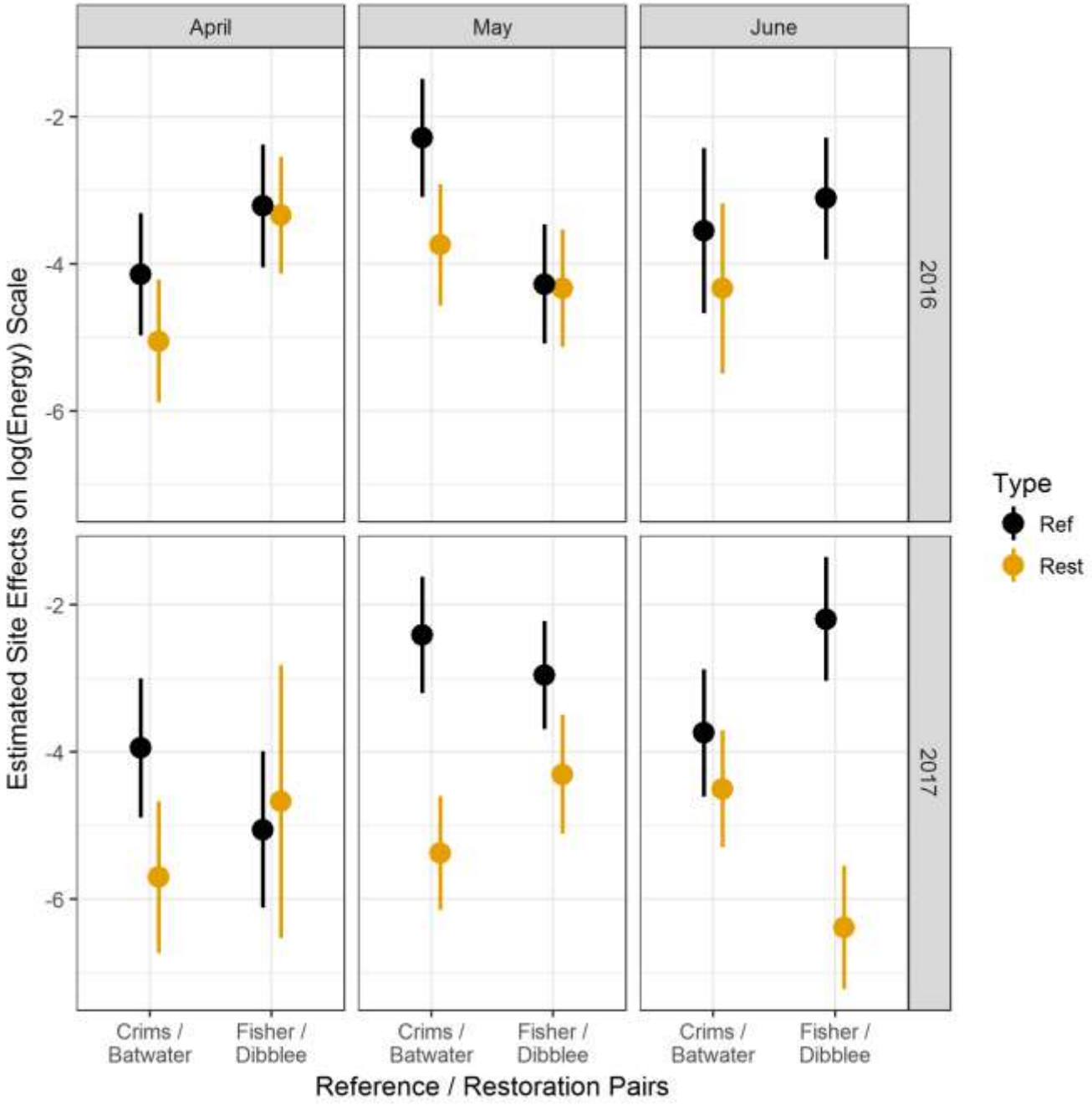
Salmon Diet and Energy



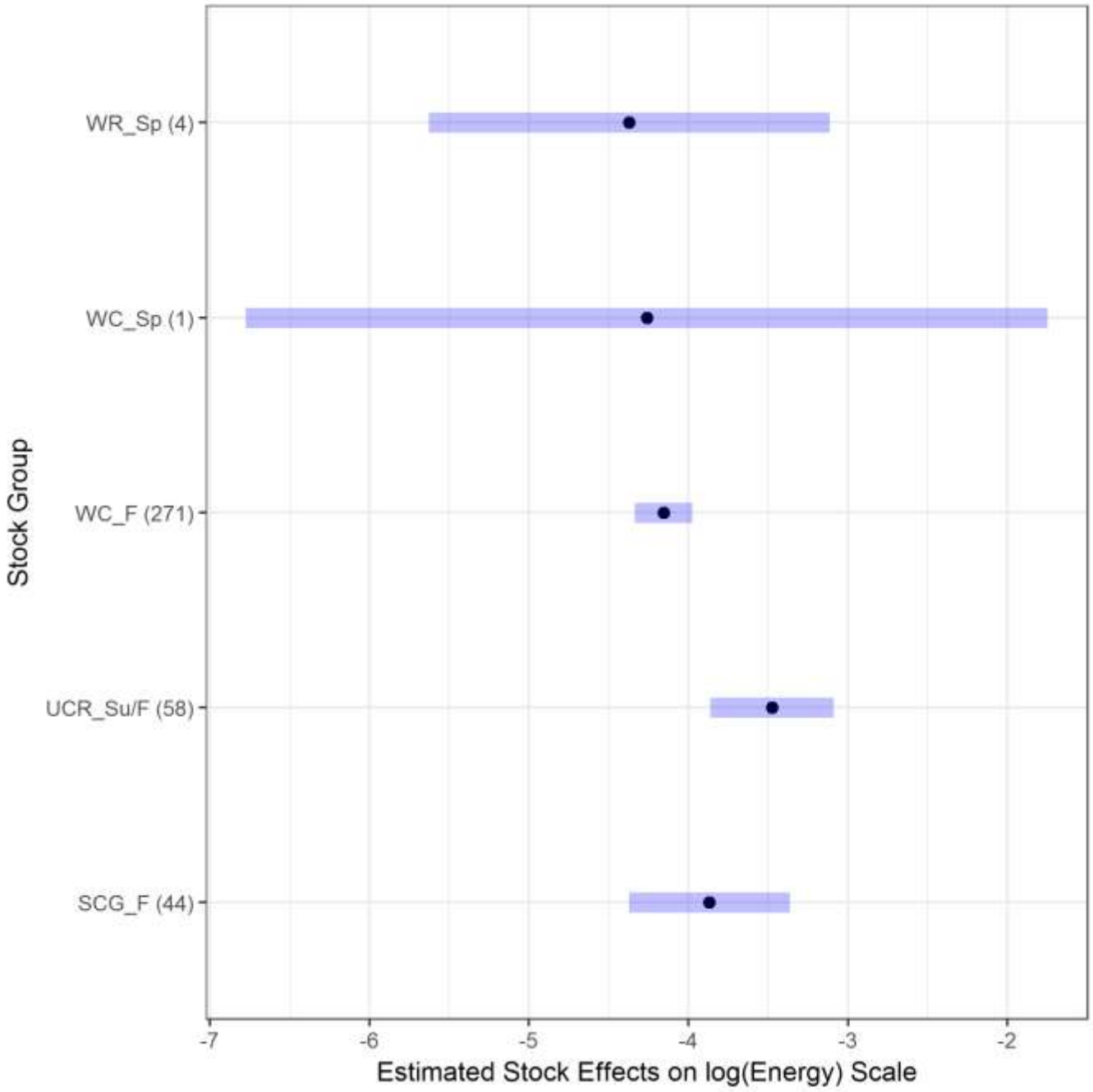
Salmon Diet


Restoration
Reference
Insecta
Diptera
Chironomidae
Arachnida
Collembola
Malacostraca
Cladoceran
Copepods
Other
BW
DB
CI
FI
Lower Tidal Zone
SB
KN
WI
KO
0.5
1.5
2.5
Upper Estuary Zone
Mean Frequency of Occurence

Salmon Diet: Energy Content



Salmon Diet: Energy Content



AEMR Summary

- Juvenile salmon are using restored tidal wetland channels
- Wetlands are used by salmon from locations throughout the Columbia River basin.

  Interior stocks enter and use restored wetland channels
- Restoration sites produce prey resources
  - Common salmon prey items were on average more abundant at reference sites
- The energy derived from prey resources at restoration sites was similar to energy consumed in reference sites
- Position within the landscape is an important consideration for CEERP
  - Non-native species
  - Density of Chinook salmon
  - Salmon diets
- **Interactions --> complex relationships**

Next Steps

- Lab and Data analyses
  - Gut contents, stable isotopes of fish and prey
  - Environmental variables: water surface elevation and temperature
  - Integration
- Reporting
  - AEMR findings available in the SM2
  - AEMR integration report

Acknowledgements

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