



Western Washington University
Western CEDAR

Salish Sea Ecosystem Conference

2014 Salish Sea Ecosystem Conference
(Seattle, Wash.)

May 1st, 1:30 PM - 3:00 PM

Responses of river-dependent wildlife to dam removal, salmon restoration, and nutrient subsidies in the Elwha River Watershed, Olympic Peninsula, Washington

Kim Sager-Fradkin
Lower Elwha Klallam Tribe, Kim.Sager@elwha.nsn.us

Christopher M. Tonra
Smithsonian Migratory Bird Center

Peter P. Marra
Smithsonian Migratory Bird Center

Follow this and additional works at: <https://cedar.wvu.edu/ssec>



Part of the [Terrestrial and Aquatic Ecology Commons](#)

Sager-Fradkin, Kim; Tonra, Christopher M.; and Marra, Peter P., "Responses of river-dependent wildlife to dam removal, salmon restoration, and nutrient subsidies in the Elwha River Watershed, Olympic Peninsula, Washington" (2014). *Salish Sea Ecosystem Conference*. 204.
<https://cedar.wvu.edu/ssec/2014ssec/Day2/204>

This Event is brought to you for free and open access by the Conferences and Events at Western CEDAR. It has been accepted for inclusion in Salish Sea Ecosystem Conference by an authorized administrator of Western CEDAR. For more information, please contact westerncedar@wvu.edu.

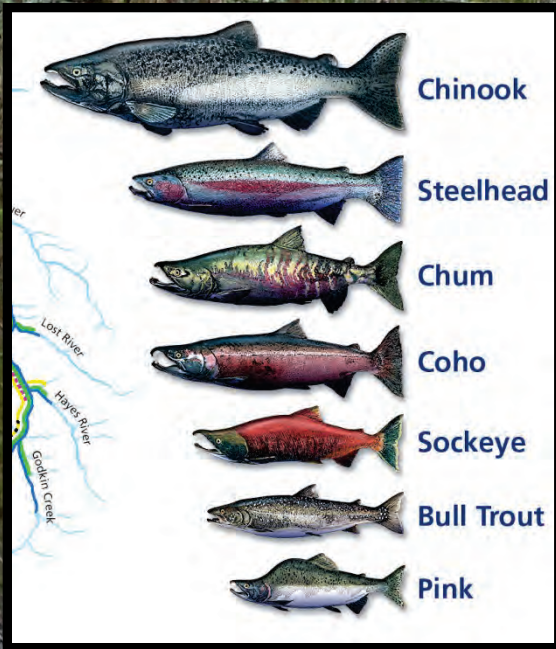


Responses of river-dependent wildlife to dam removal, salmon restoration, and nutrient subsidies in the Elwha River Watershed

Kim Sager-Fradkin, Lower Elwha Klallam Tribe

Chris Tonra and Peter Marra, Smithsonian Conservation Biology Institute, Migratory Bird Center





How will Elwha wildlife respond?





**Marine-Derived Nutrients
(MDN's)**





**Marine-Derived Nutrients
(MDN's)**



**Enhanced freshwater
nutrient pool**

River Otter



Photo: Florian Graner

River Otter

- **Objective:** Determine distribution and movement patterns. Examine contributions of marine-derived nutrients in diets of otters.



Photo: Florian Graner

River Otter

- **Objective:** Determine distribution and movement patterns. Examine contributions of marine-derived nutrients in diets of otters.
- **Hypothesis:** Otters will expand distribution following salmon restoration and will see an increase in marine nutrients in their diets.



River Otter



- **Methods:**

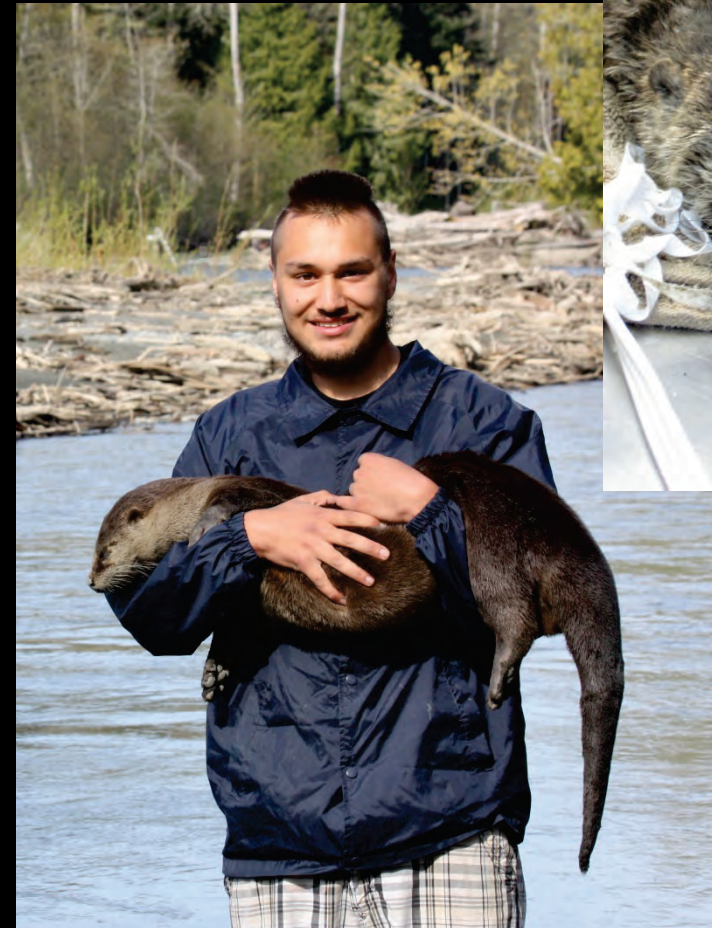
- Otter capture and implantation of radio transmitter for tracking otter movements
- Analysis of hair and claw tissues for stable isotope analysis to look at dietary contribution of marine-derived nutrients.



Methods: Animal Capture



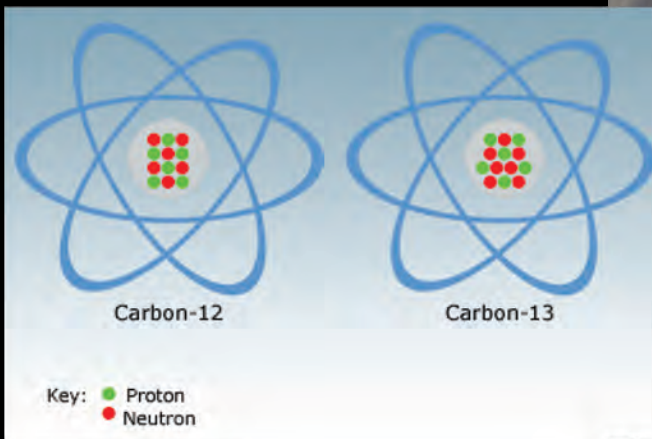
Methods: Otter Surgery



Methods: Sample Collection



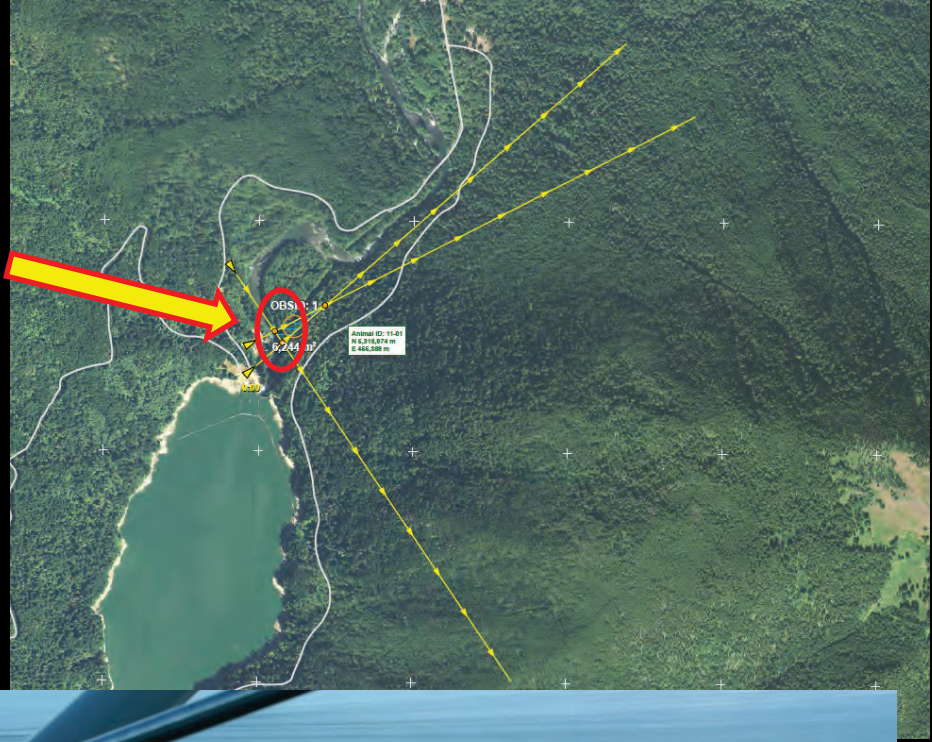
Methods: Sample Collection



More enriched
isotope ratio in tissue
=
More marine-derived
nutrients in animal's
diet



**Otter
Location**



Preliminary Findings

- Eleven otters (2 females and 9 males) implanted with radio-tracking devices to date.
 - Three otters have died in hatcheries.
 - Two male otters died in the Strait of Juan de Fuca.





18 miles west

9 miles east

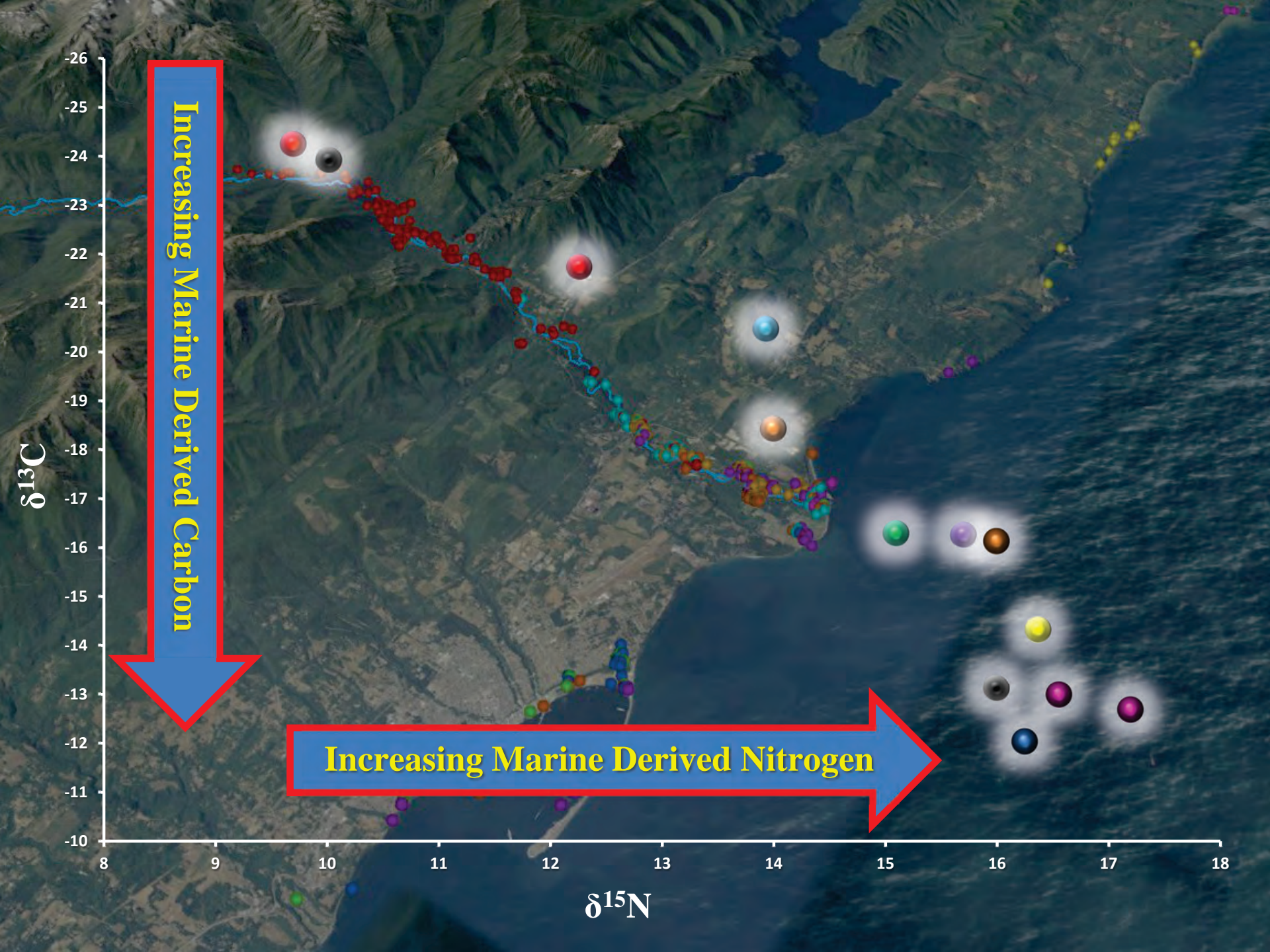




Photo: Florian Graner

American Dipper



Photo: Florian Craner

American Dipper

- **Objective:** Examine body condition and demographics in relation to marine-derived nutrients in diets of dippers across four watersheds.



American Dipper

- **Objective:** Examine body condition and demographics in relation to marine-derived nutrients in diets of dippers across four watersheds.
- **Hypothesis:** Dippers in areas with no obstructions to salmon migration will exhibit enriched nitrogen and carbon stable isotopes in tissues, have higher survival, and be in superior body condition to those behind obstructions.

American Dipper



- **Methods:**
 - Banding of dippers to monitor dispersal patterns and survival.
 - Using stable isotope analysis of blood, feathers, and claws to determine contributions of marine-derived nutrients over multiple time scales.



Elwha River



Dungeness River

Barnes Creek

Sol Duc River

Dam Sites

Sol Duc Falls

	Without anadromous fish
	With anadromous fish

© 2012 Ceres/Spot Image

Google

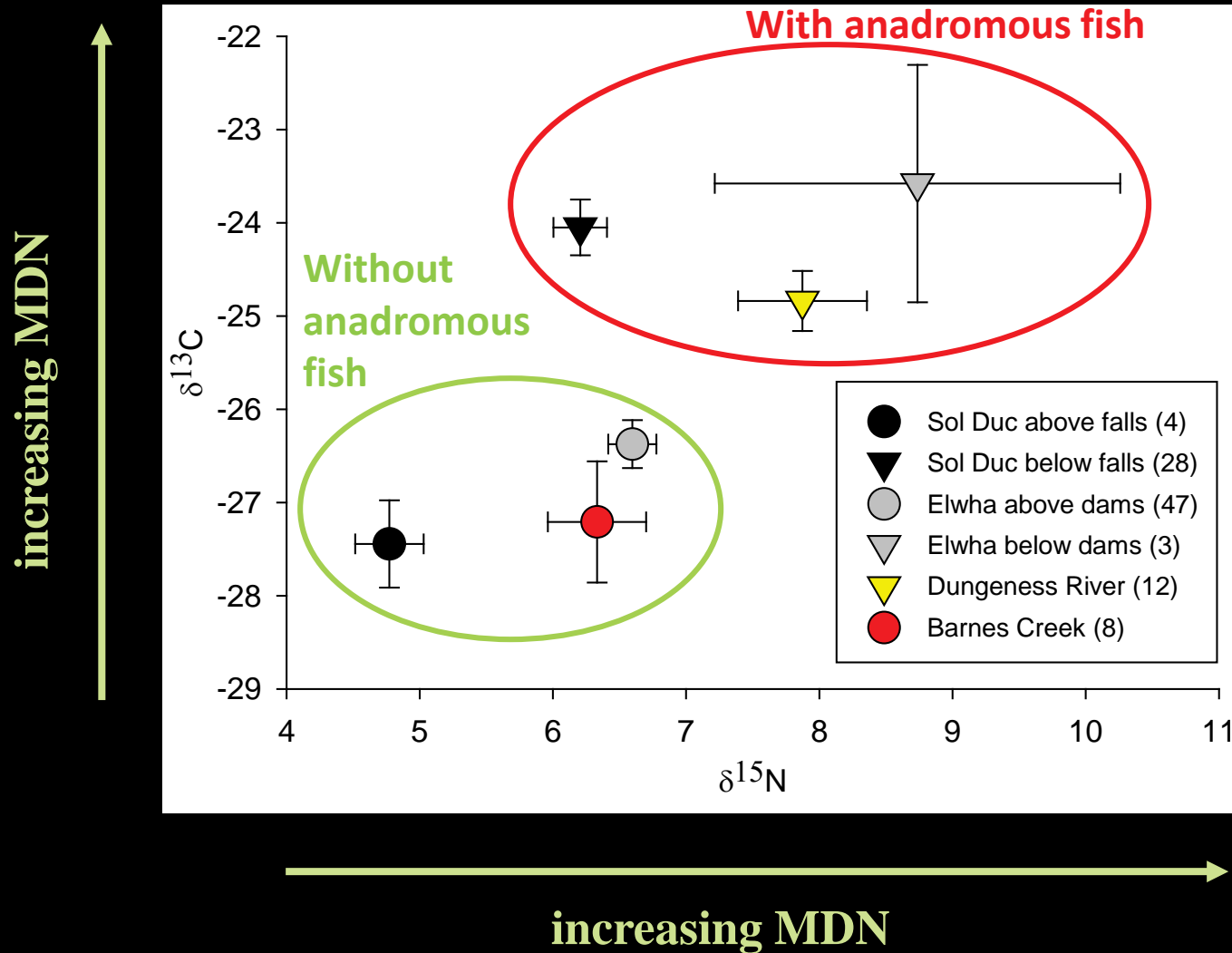
Preliminary Findings

- 246 dippers banded across four watersheds.
- Preliminary stable isotope analysis indicates direct consumption of marine fishes (enriched stable-carbon isotopes) in systems with salmon migration.



Photo: John McMillan

Preliminary Findings: Stable Isotopes



Preliminary Adult Annual Survival



area	2011-2012		2012-2013	
	n	% survival	n	% survival
no anadromous fish	13	0.46	33	0.48
with anadromous fish	11	0.55	33	0.58

Preliminary Adult Annual Survival



	2011-2012		2012-2013	
area	n	% survival	n	% survival
no anadromous fish	13	0.46	33	0.48
with anadromous fish	11	0.55	33	0.58

Do Salmon Influence Life History Variation?

location	# year round residents	total classified	residency rate
no anadromous fish	7	18	0.39
with anadromous fish	24	26	0.92

$Z = -3.82, P < 0.001$



Do Salmon Influence Life History Variation?

location	# year round residents	total classified	residency rate
no anadromous fish	7	18	0.39
with anadromous fish	24	26	0.92

$Z = -3.82, P < 0.001$



Do Salmon Influence Life History Variation?

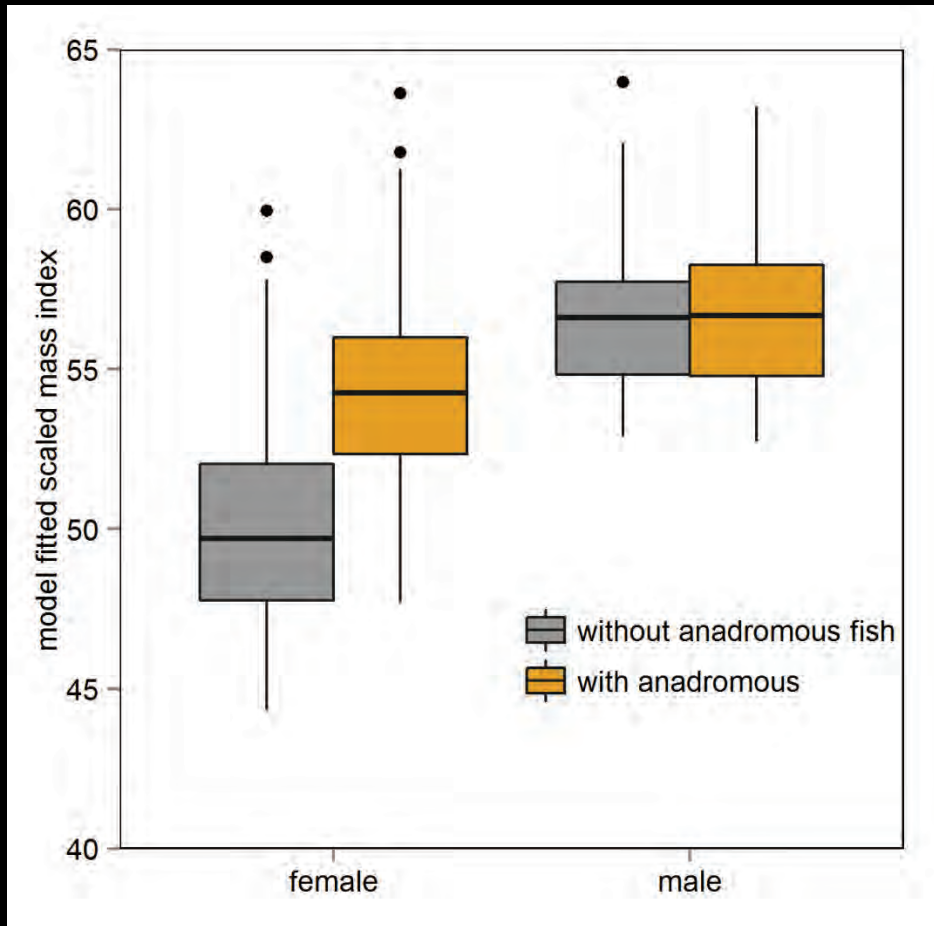
location	# year round residents	total classified	residency rate
no anadromous fish	7	18	0.39
with anadromous fish	24	26	0.92

$Z = -3.82, P < 0.001$

- Birds in areas with salmon 8-times more likely to attempt second brood ($Z = 4.82, n = 77, P < 0.001$)
- Double brooding is the primary source of variation in lifetime reproductive success (Gillis et al. 2008, Ecology)



Preliminary Findings: Body Condition



Adult: above/below restriction*sex: $\chi^2_1 = 5.12, P = 0.02$

Juvenile: above/below restriction: $\chi^2_1 = 4.68, P = 0.02$



Acknowledgements:

Dave Manson, Rebecca Paradis, Sara Cendejas-Zarelli and numerous other volunteers and collaborators.

Funding:

