

**HOW DO BEAVER DAM  
ANALOGUES (BDAS) CHANGE  
STREAM FOOD WEBS: WHAT  
STABLE ISOTOPES CAN TEACH  
US ABOUT FOOD WEBS IN BDAS**

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“The Shasta beaver, once relatively common in many of the streams of northern California, now is found only in scattered places within its former range. Most of the present colonies are remnants of what was once a flourishing native population” (Tappe, 1942).



Lanman et al. (2013), CFG Report

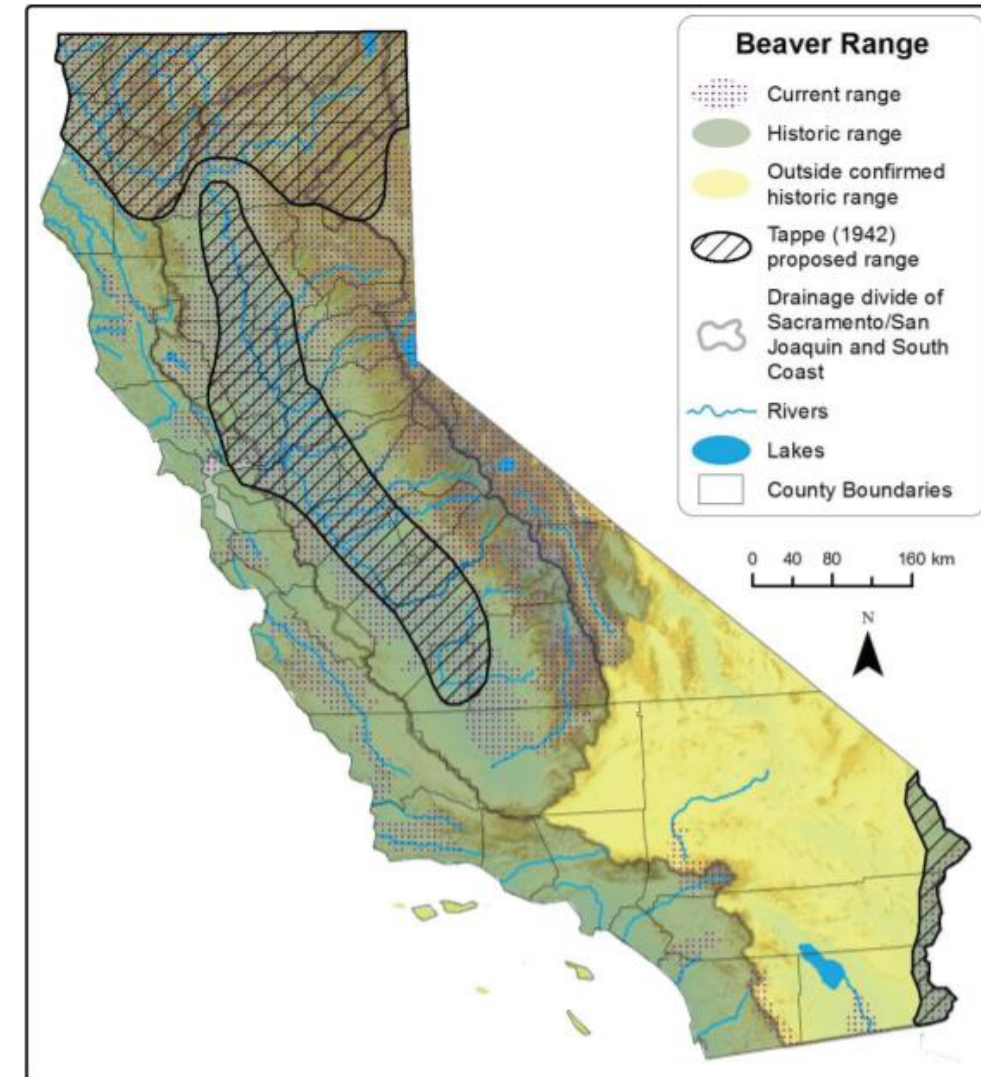





FIGURE 4.—Updated historical range map and current distribution of *Castor canadensis* in California. The current distribution was derived by combining ranges from CDFG (2005) and Asarian (2013) and conversion to 5th-field hydrologic units (watersheds) — except along the Mexican border where original CDFG polygons were retained — and removing Noyo River population in Mendocino County shown in

## Beaver Benefits:

- More variety in hydrology 
- Pooling habitat can stabilize water temperature 
- Increased carbon storage
- Increased complexity can drive increased biodiversity 
- Improve ecosystem services
- Potentially particularly good for restoring impacted rivers

# SONCC (Southern Oregon/Northern California Coast Coho Salmon

State and Federally Threatened

Scott River tributaries like Sugar Creek a remaining stronghold for these fish

Pooling habitat = higher smolt production (Roni et al. 2006 and Bouwes et al. 2016)

Beaver historically influenced the Scott Valley ecosystem

Beaver populations significantly reduced by fur trapping – and still haven't recovered

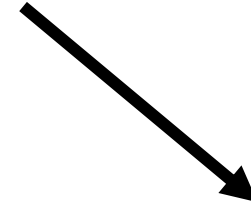
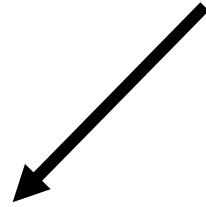
Beaver have significant benefits for stream organisms – including Coho salmon

Re-introductions can be hard, and are not always successful



## Beaver Dam Analogues

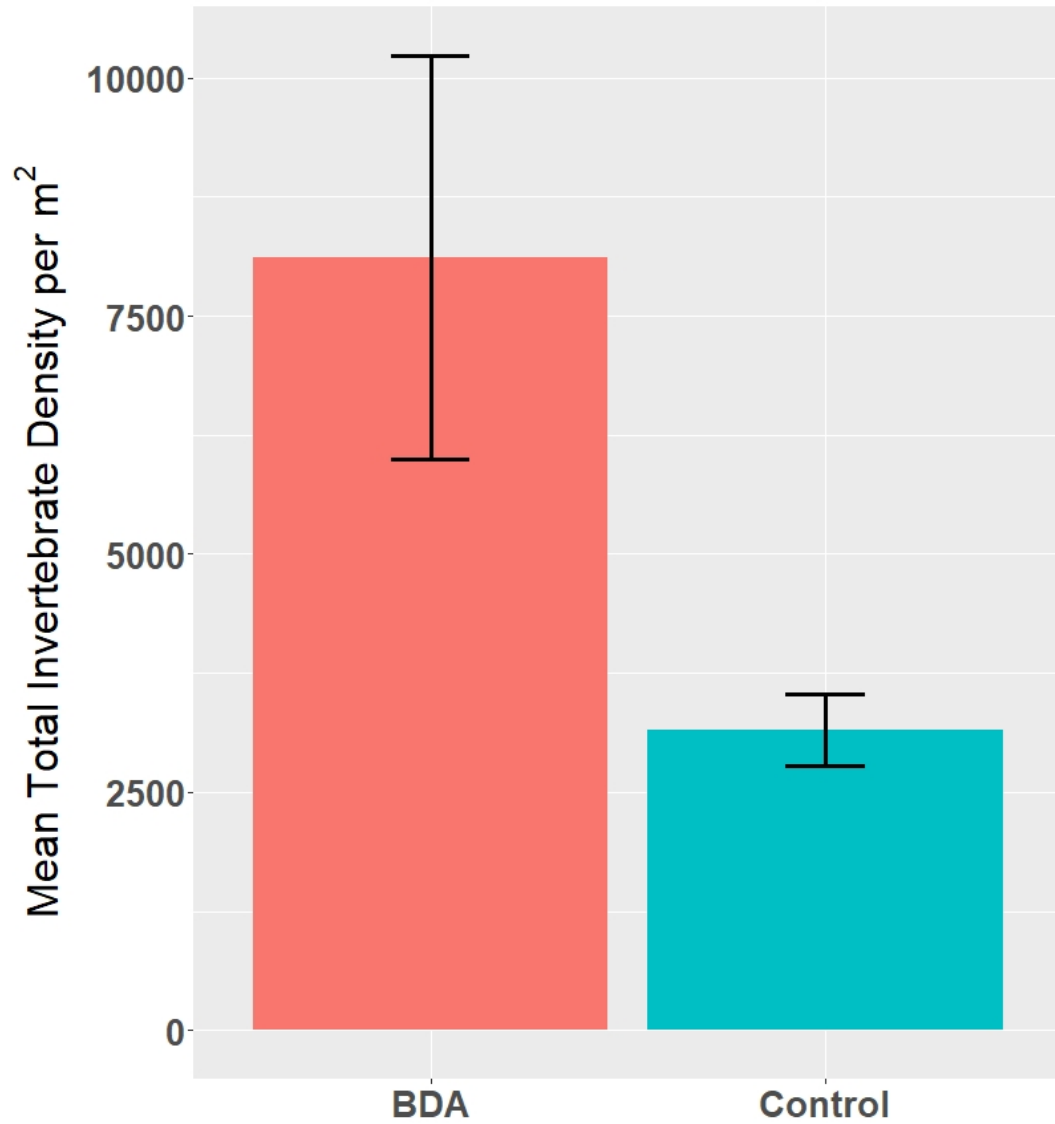
# Control vs. BDA



# Key Question: Food Webs

- Why are food webs important for Coho?
  - Increased food availability has been found to improve growth and survival of juvenile Coho (Lusardi et al. 2020)
  - Disturbance & Continuity!
- Do we have any evidence that BDAs impact food webs already?
  - Regional diversity increases with BDAs (Corline et al. In Review)
  - Density of Coho prey higher in BDAs (Corline et al. In Review)
  - My samples indicate this as well...

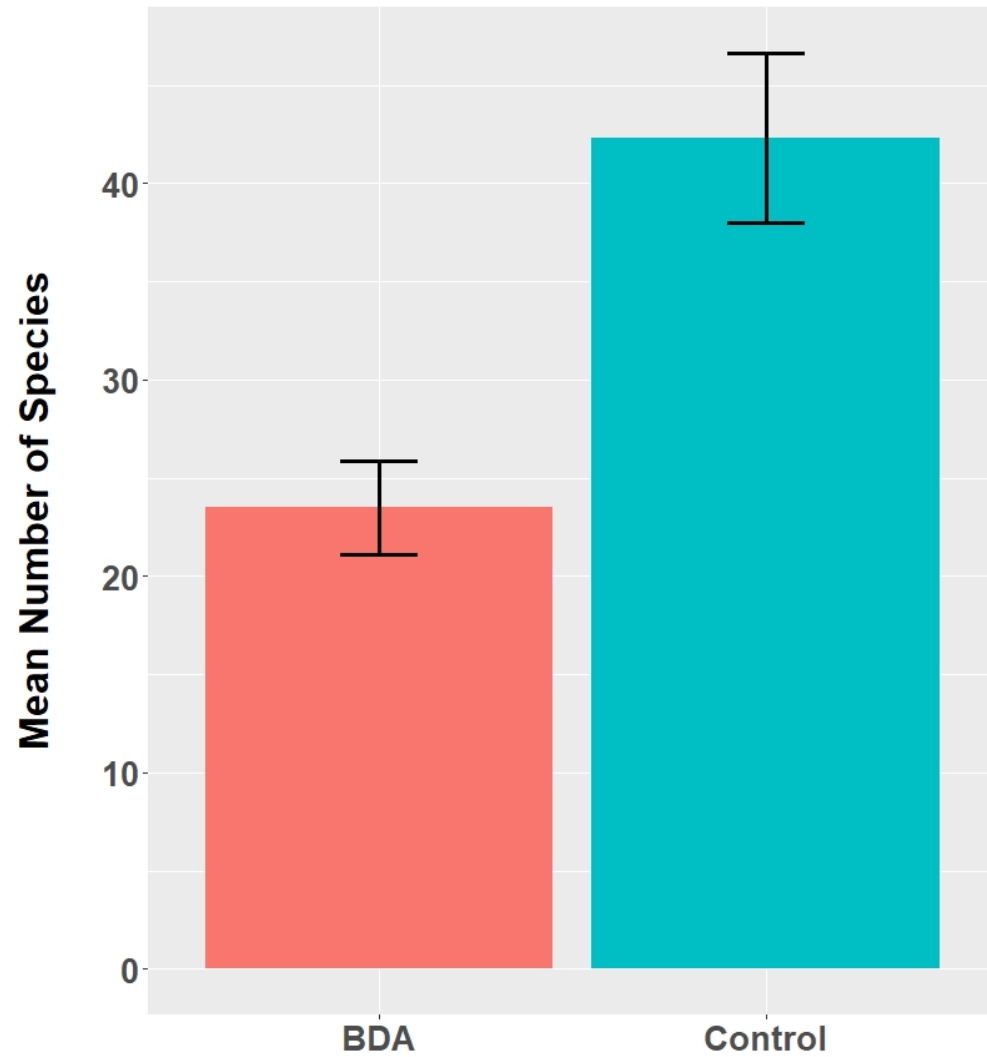




**Key Result:**  
**MORE bugs**  
available in the  
**BDA habitat!**

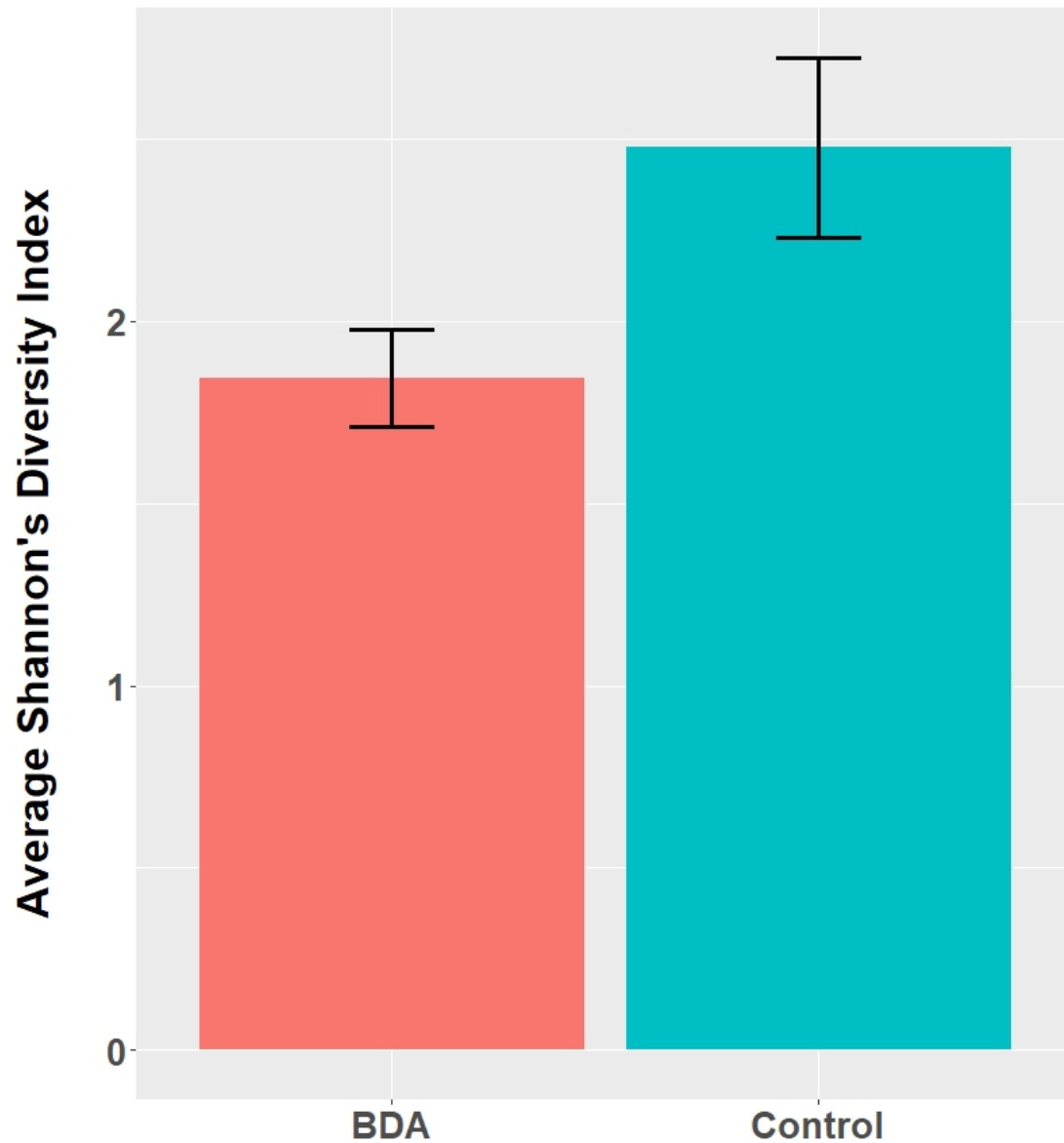
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**DENSITY**  
**BY SITE**



## SPECIES RICHNESS

- Main result – more total species in Control reach

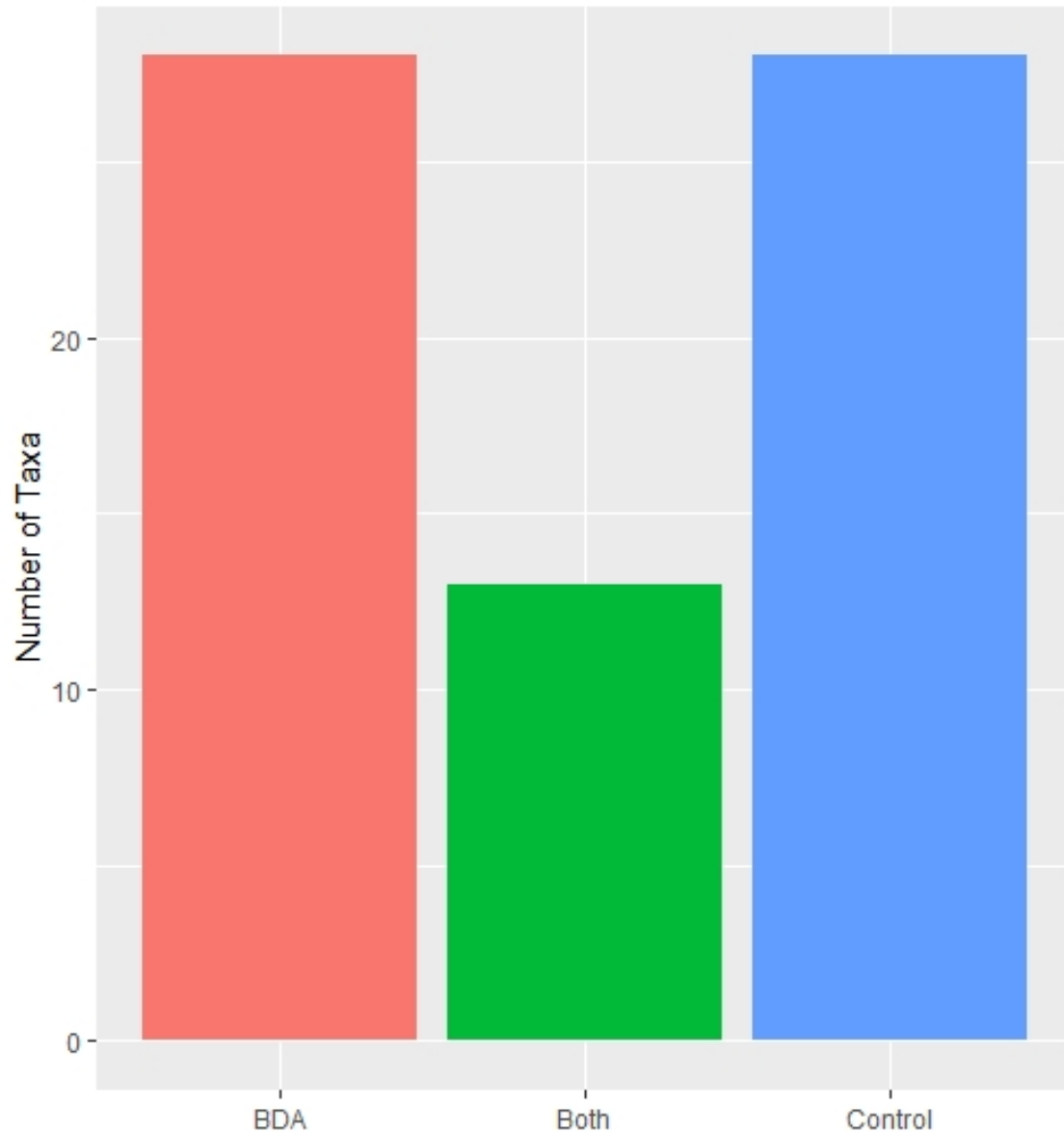


Main Result: This diversity metric is also higher in the Control reach.

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**SHANNON'S  
DIVERSITY**

# NUMBER UNIQUE TAXA



Main Result: There are lots of taxa unique to each habitat, and few that are found in both habitats.

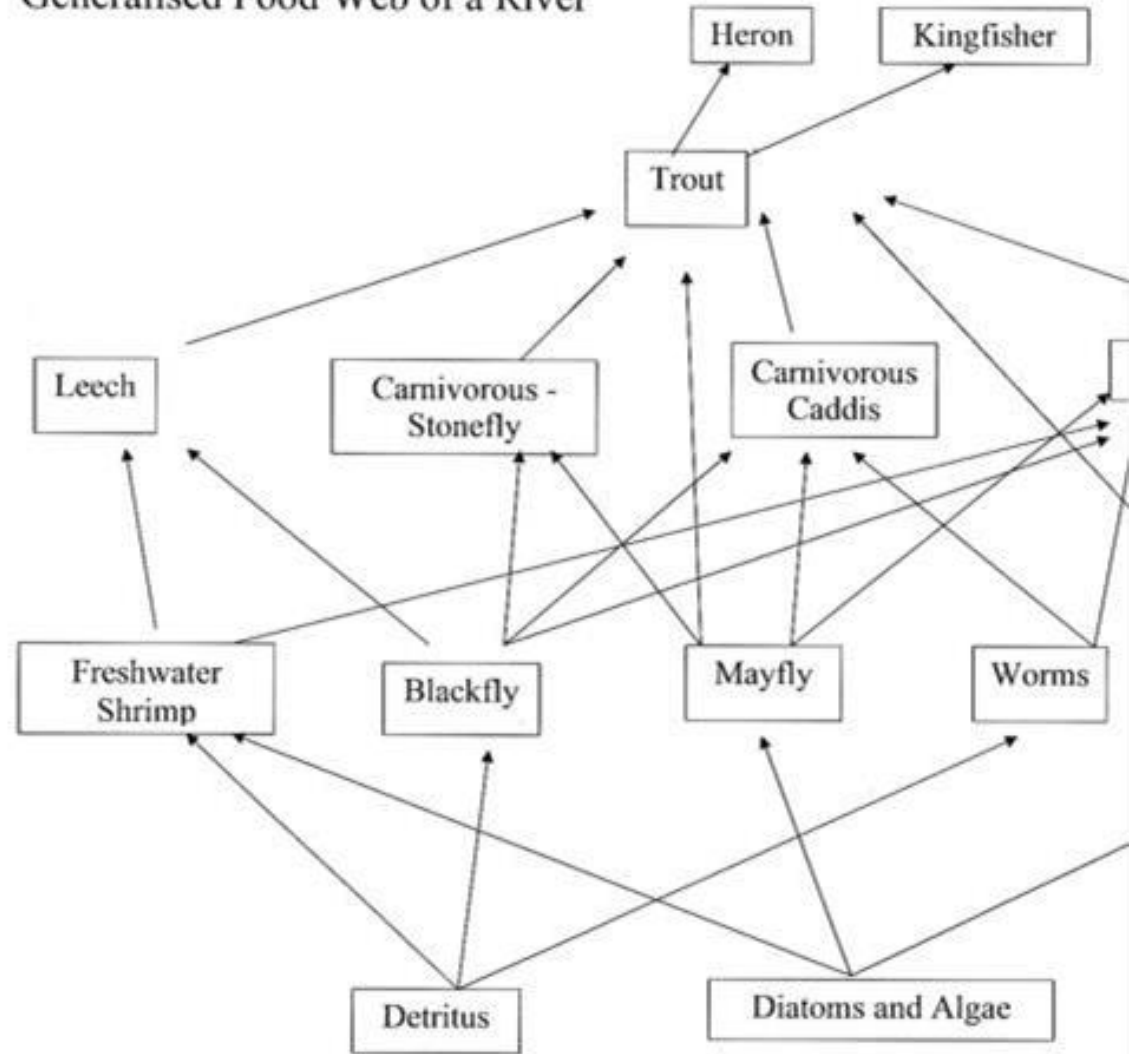
# What Are Stable Isotopes?

- Naturally occurring and derived from tissue of organism
- Commonly used to provide an understanding of trophic or feeding interactions within an ecosystem
- Carbon signature = ratio of the heavy to light forms of an element (isotopes)
- Nitrogen signature = ratio of heavy to light isotopes

# Why Use Stable Isotopes?

- Accuracy
- Primary Producers to Coho
- Time integrated information
- Little experimental design or manipulation is required and relatively inexpensive

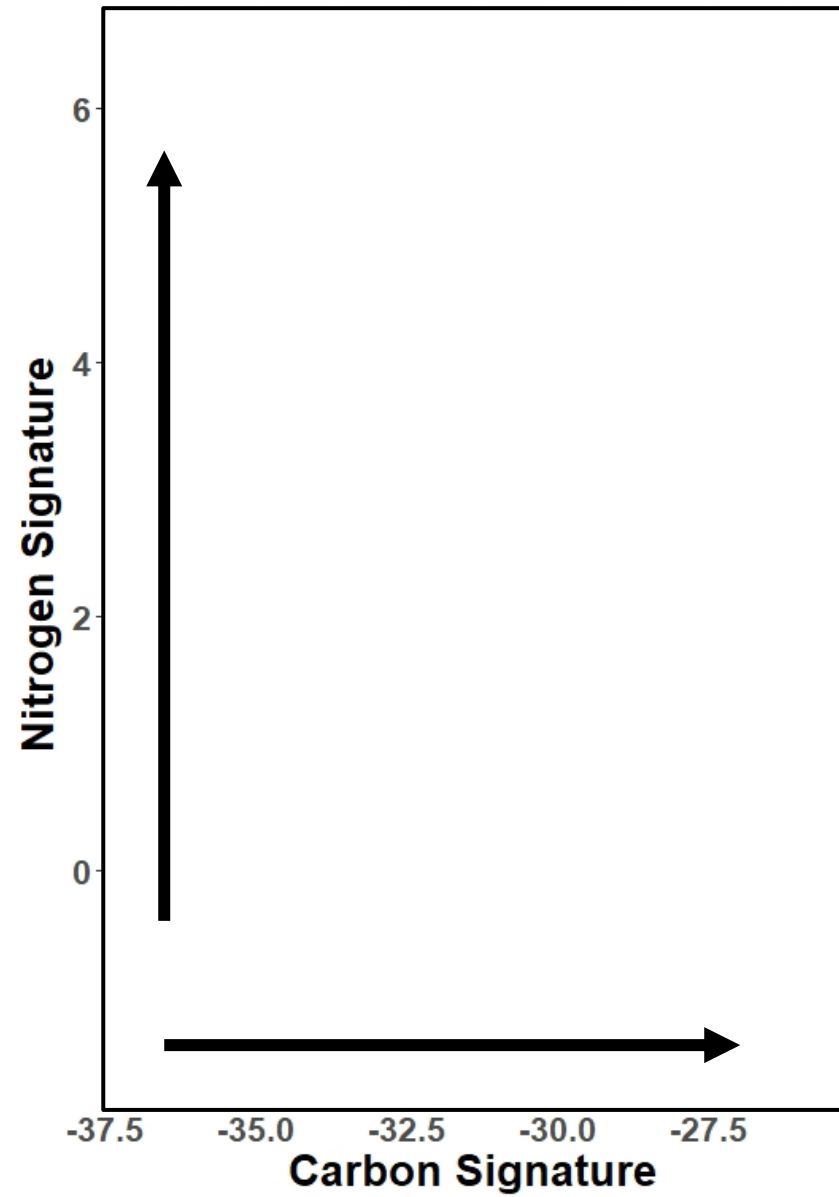
Generalised Food Web of a River



# Isotope Samples Collected

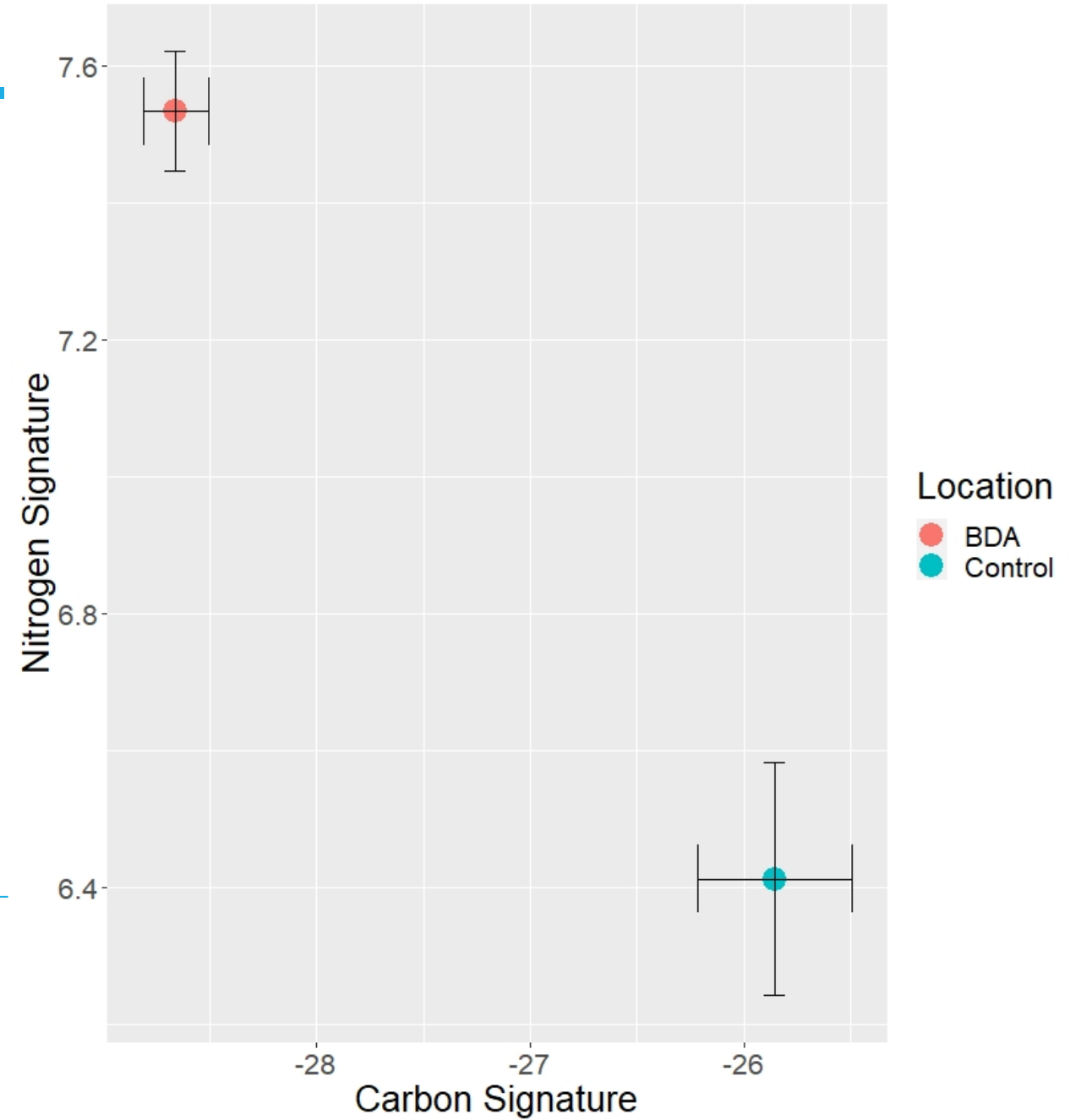


- Coarse Particulate Organic Matter (CPOM)
- Fine Particulate Organic Matter (FPOM)
- Primary Producers (moss, stringy algae, rooted plants)
- Aquatic Insects!
- Coho Fin Clips





# THE ISOTOPES – FIN CLIPS



# But What Are the Coho Eating?

## Functional Feeding Group



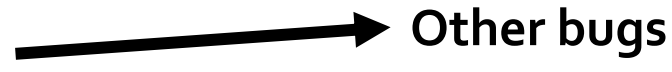
Collector



Seston or FPOM



Predator



Other bugs



Scraper



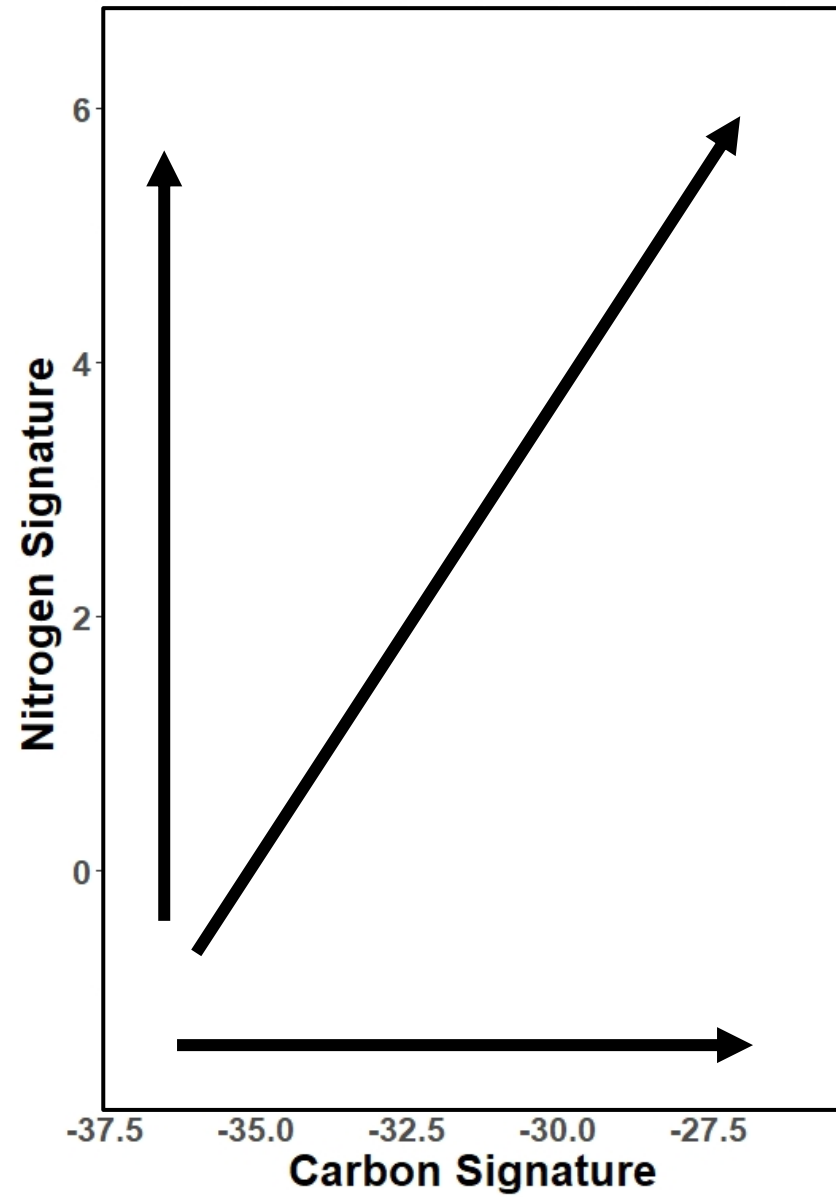
Algae growing on stuff



Shredder

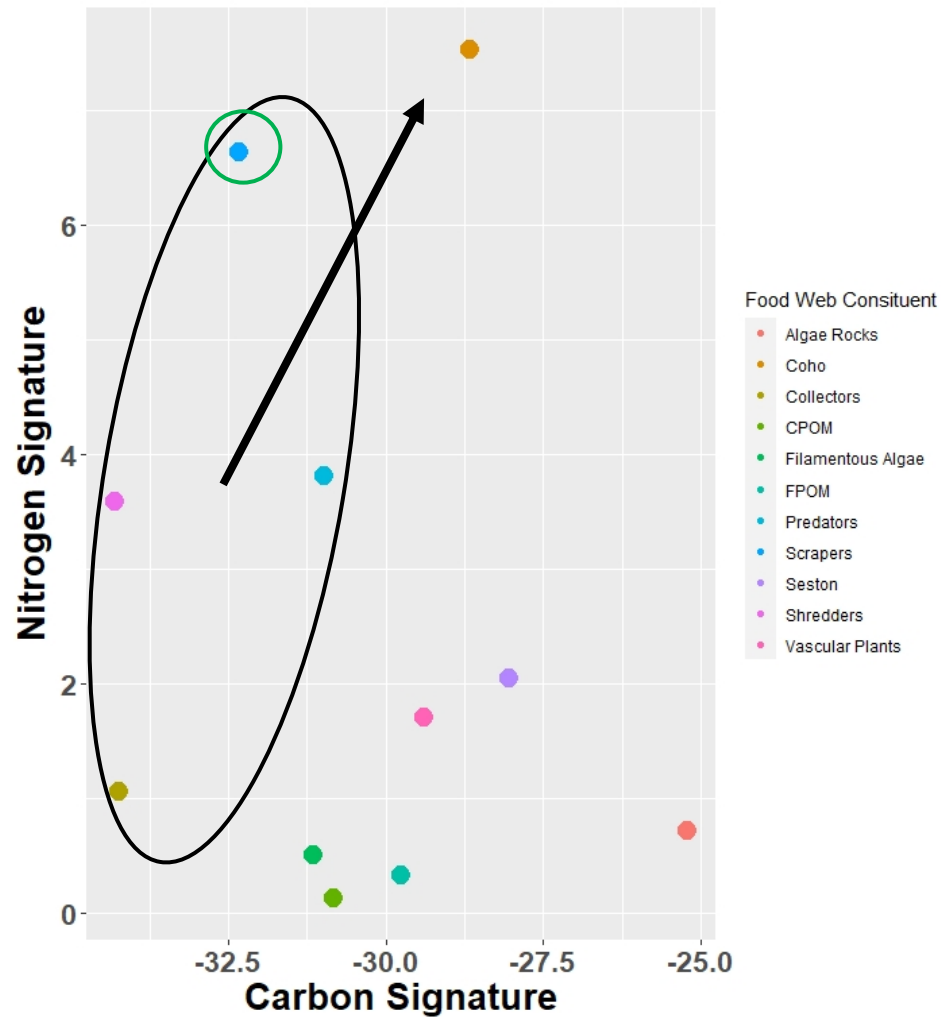


CPOM

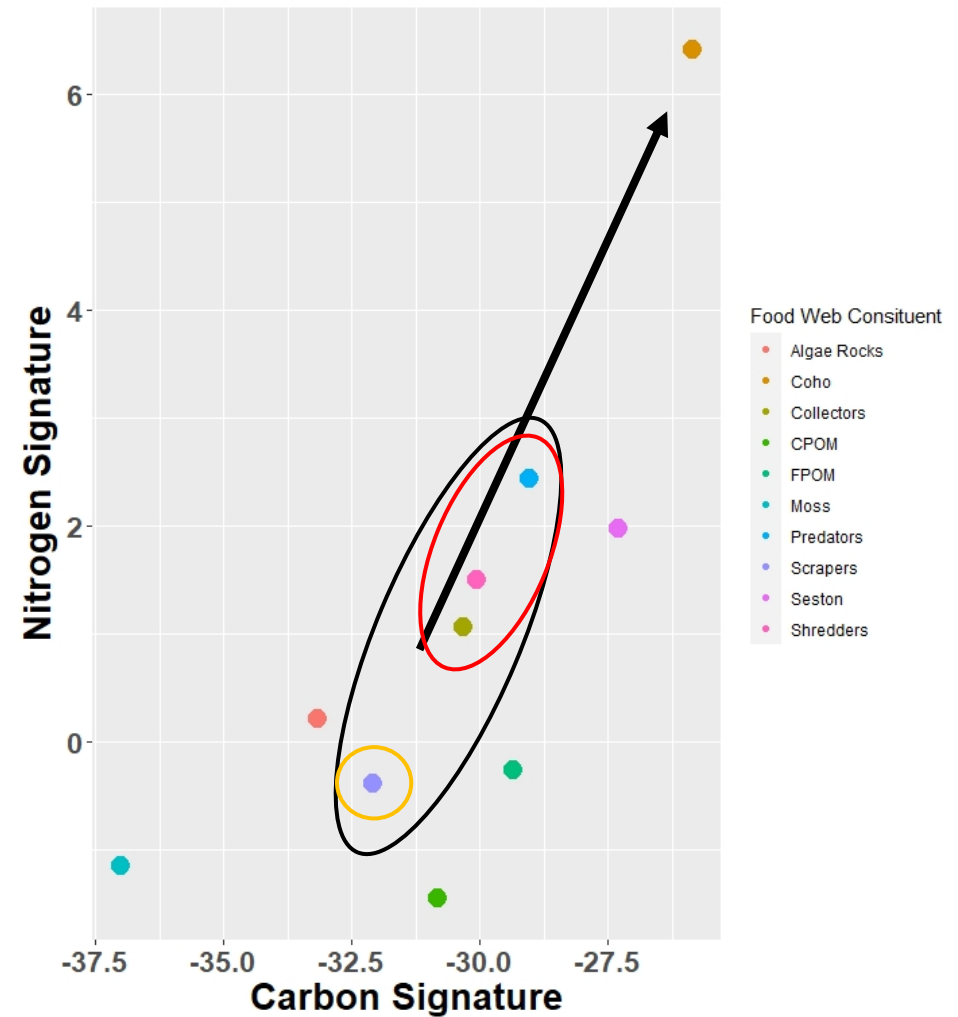


# The Isotopes – Putting It All Together

## BDA

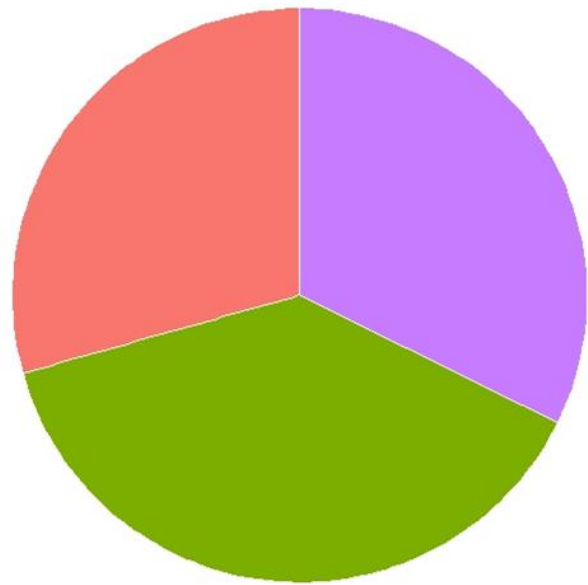


## CONTROL



# Isotope Model Results

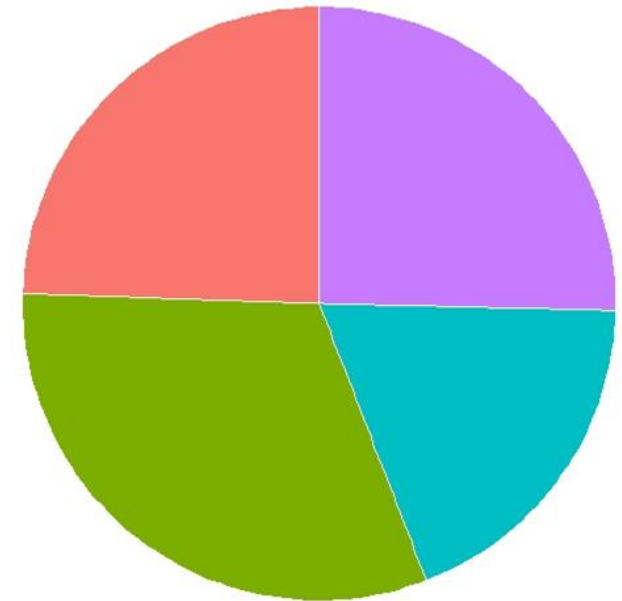
**BDA**



Functional Feeding Group



**CONTROL**



# Conclusions

- BDAs are a rich source of food and add to the regional bug diversity of streams where they are found
- Fish DO have different isotopic signatures, which may mean they're feeding on different bugs and therefore relying on different primary producers
- Isotope analysis shows us that there are some slight differences in the proportions of Coho diet in the two habitats. This could be important for foraging time or for food web resilience to disturbance, but more research is needed



## Next Steps

- Look more closely at proportions of different feeding groups in total insect abundances and how that affects how we interpret isotope results
- Dig more into what primary producers are at the base of Coho feeding pathways
- Samples collected summer 2021 – comparison of feeding pathways with a much drier year

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- Scott River Watershed Council

