

# Diet Comparisons between length and sex of Fourhorn Sculpin (*Myoxocephalus quadricornis*)



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## INTRODUCTION

In this study, we examined the diet of Fourhorn Sculpin (*Myoxocephalus quadricornis*) by using bulk carbon and nitrogen stable isotope analysis. Specifically, I wanted to observe how the diet differed between sex and length across individuals. Understanding the diet and trophic position among different life-history parameters of this understudied species located in the Arctic will help gain an understanding of how the Fourhorn Sculpin may respond to a changing Arctic environment. Dorsal muscle samples, length, sex, and otoliths were collected from each sample. Dorsal muscle samples were prepared for carbon ( $\delta^{13}\text{C}$ ) and nitrogen ( $\delta^{15}\text{N}$ ) stable isotope analysis using the Alaska Stable Isotope Facility at the University of Alaska Fairbanks. Results from the nitrogen and carbon stable isotopes help establish where the Fourhorn Sculpin reside on the food chain and whether their diet is composed of marine or terrestrial carbon sources.

## METHODS

- Samples were collected from four sites near Prudhoe Bay, Alaska, during the 2023 Beaufort Sea Long-Term Nearshore Fish Monitoring Program (Figure 1).

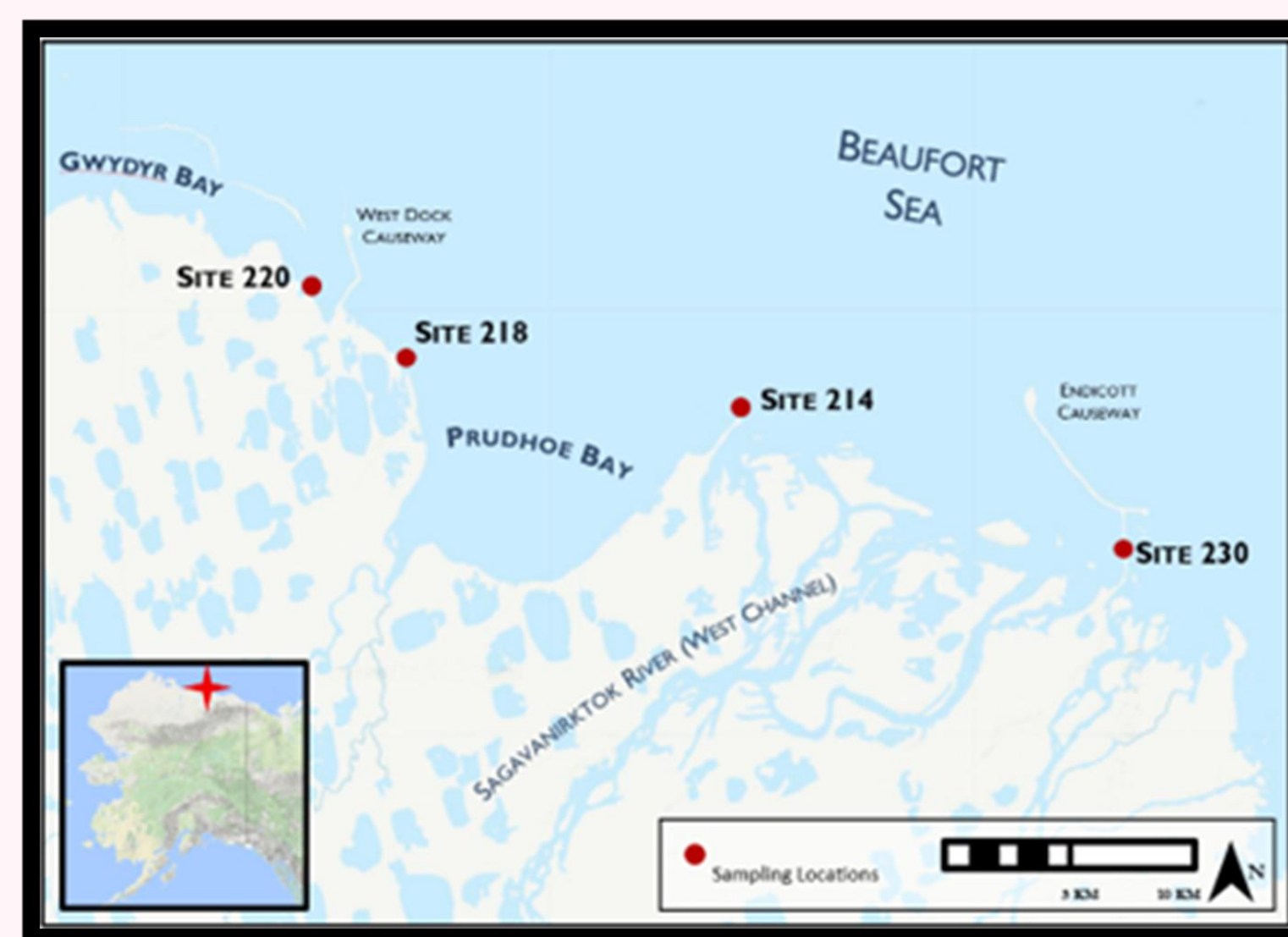


Figure 1: Map of sampling sites.



Figure 2: A Fourhorn Sculpin with a dorsal muscle sample removed.

- Dorsal muscle samples, length, sex, and otoliths were collected from each sample.
- 135 muscle samples were dried and homogenized into a fine powder.
- The dried samples were then placed into small tin capsules for analysis (Figures 3a and 3b).

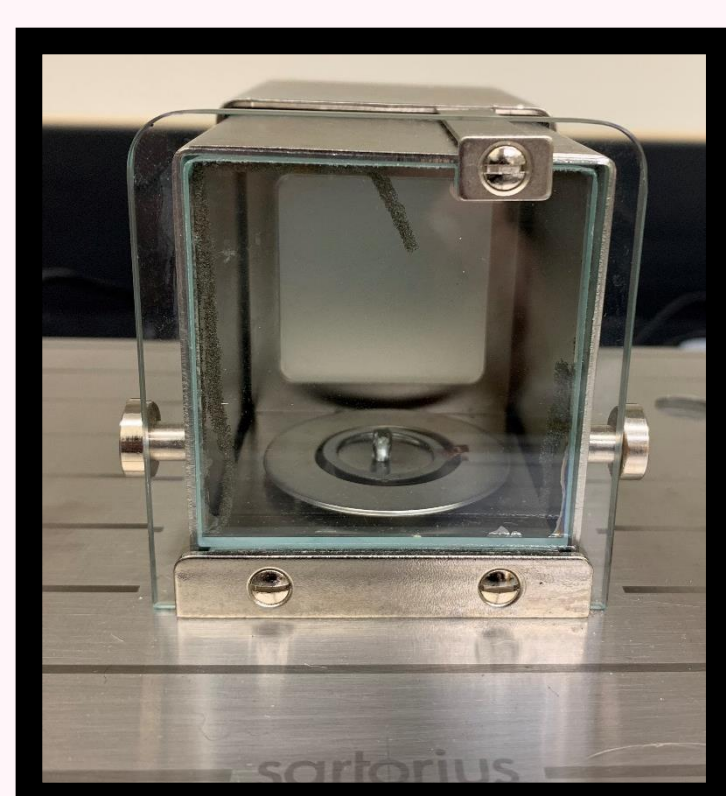


Figure 3a: Size of the tin capsule.



Figure 3b: Weighing dried samples into capsules.

## RESULTS

- Using the Alaska Stable Isotope Facility at the University of Alaska Fairbanks, the muscle samples were analyzed for carbon and nitrogen-stable isotopes.
- CF-IRMS was used to measure the ratio of heavy-to-light carbon ( $^{13}\text{C}/^{12}\text{C}$ ) and nitrogen ( $^{15}\text{N}/^{14}\text{N}$ ) isotopes relative to the ratio of the international standard material of Vienna Pee Dee Belemnite (VPDB) for  $\text{CO}_2$  and atmospheric nitrogen for  $\text{N}_2$ . Stable carbon and nitrogen isotope ratios were reported in  $\delta$  notation ( $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$ , respectively) as parts per thousand (‰) where:

$$\delta X = \left[ \left( \frac{R_{\text{sample}}}{R_{\text{standard}}} \right) - 1 \right] \times 1000,$$

with X the isotope being measured ( $^{13}\text{C}$  or  $^{15}\text{N}$ ), R the isotope ratio.

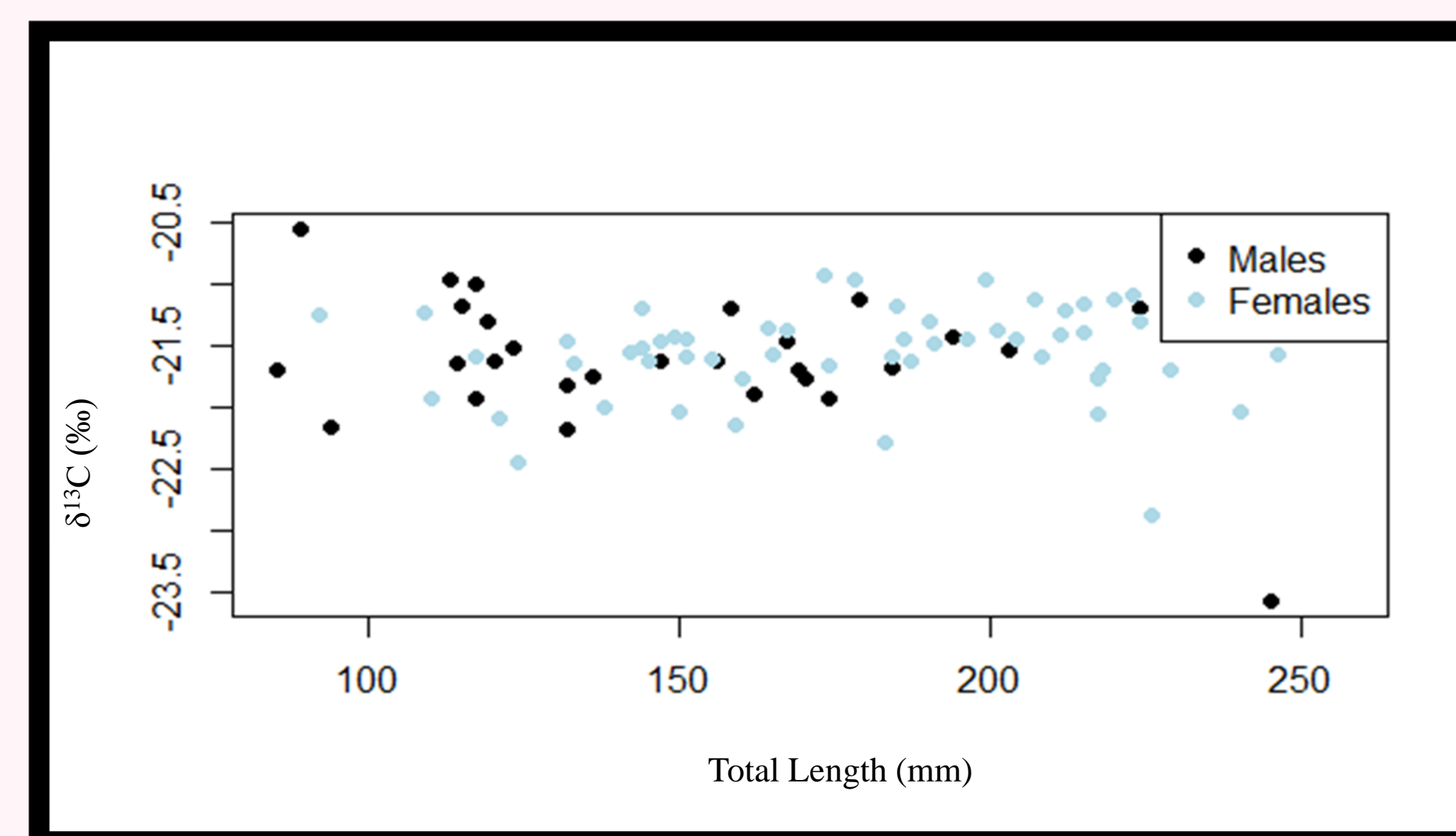


Figure 4b: Scatter plot of  $\delta^{13}\text{C}$  values against total length (mm) between sexes.

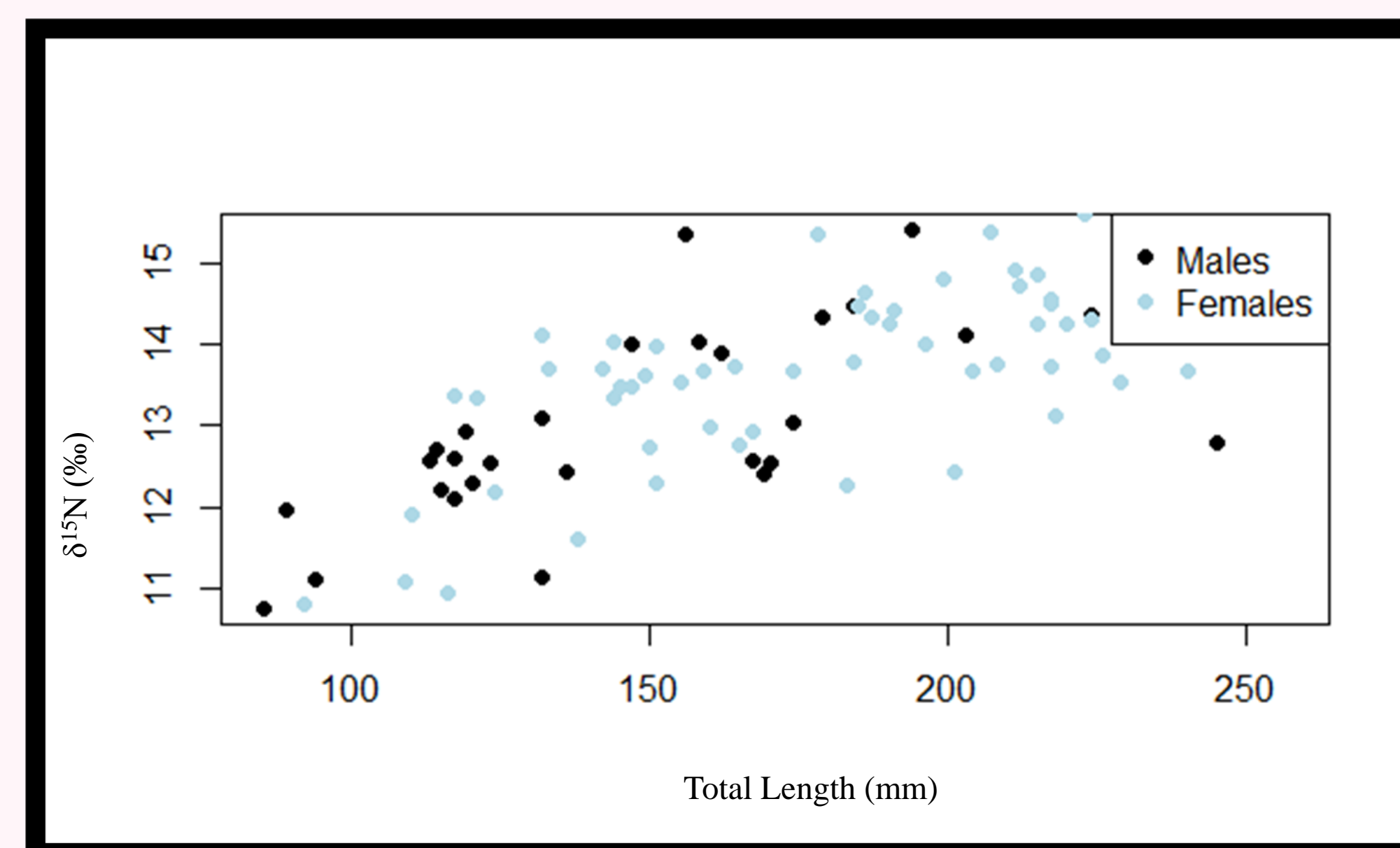


Figure 4a: Scatter plot of  $\delta^{15}\text{N}$  values against Total Length (mm) between sexes.

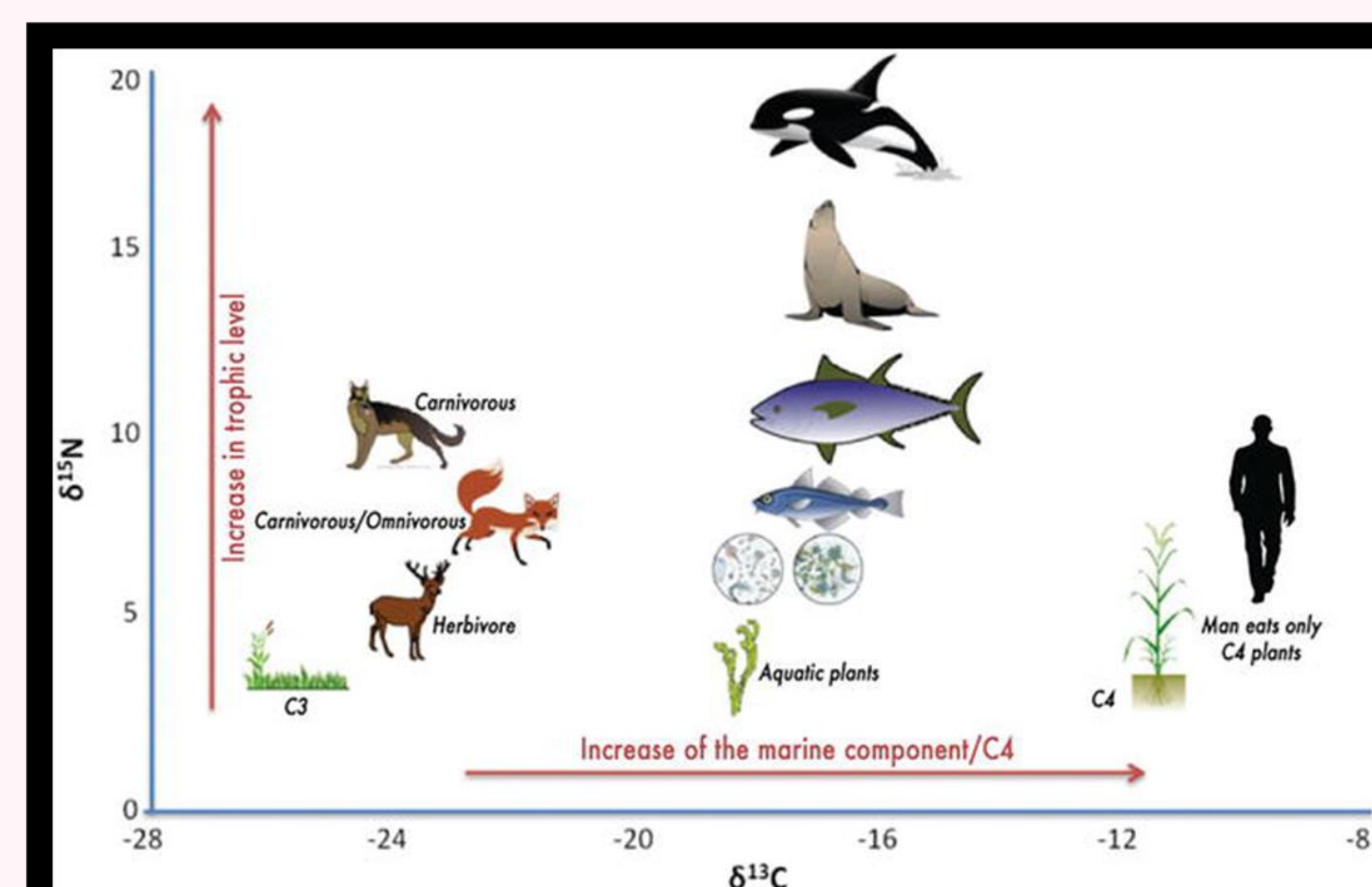


Figure 5: Scatter plot depicting different species  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values (Berto et al. 2019).

## CONCLUSIONS

- Nitrogen levels indicate where a species resides on the trophic scale. The collected female Fourhorn Sculpin are larger and have a higher  $\delta^{15}\text{N}$  in their muscle samples (Figure 4a). Based on this experiment, sex and length affect the nitrogen content in Fourhorn Sculpin.
- $\delta^{13}\text{C}$  indicates the composition and the source of carbon in a species' diet. The more negative the carbon content is, the more terrestrial-based the diet carbon source is. The sex and length of the Fourhorn Sculpin did not appear to affect the overall distribution of food sources (Figure 4b).

## FUTURE RESEARCH

- Aging otoliths to gain a better understanding of length and age in diet composition.
- Potentially examining the liver samples to gain knowledge on recent or current dietary estimates.
- Examining strontium (Sr) stable isotope ratios of otoliths (Figure 6) to determine Fourhorn Sculpin life-history phenotypes and how they may influence diet types.

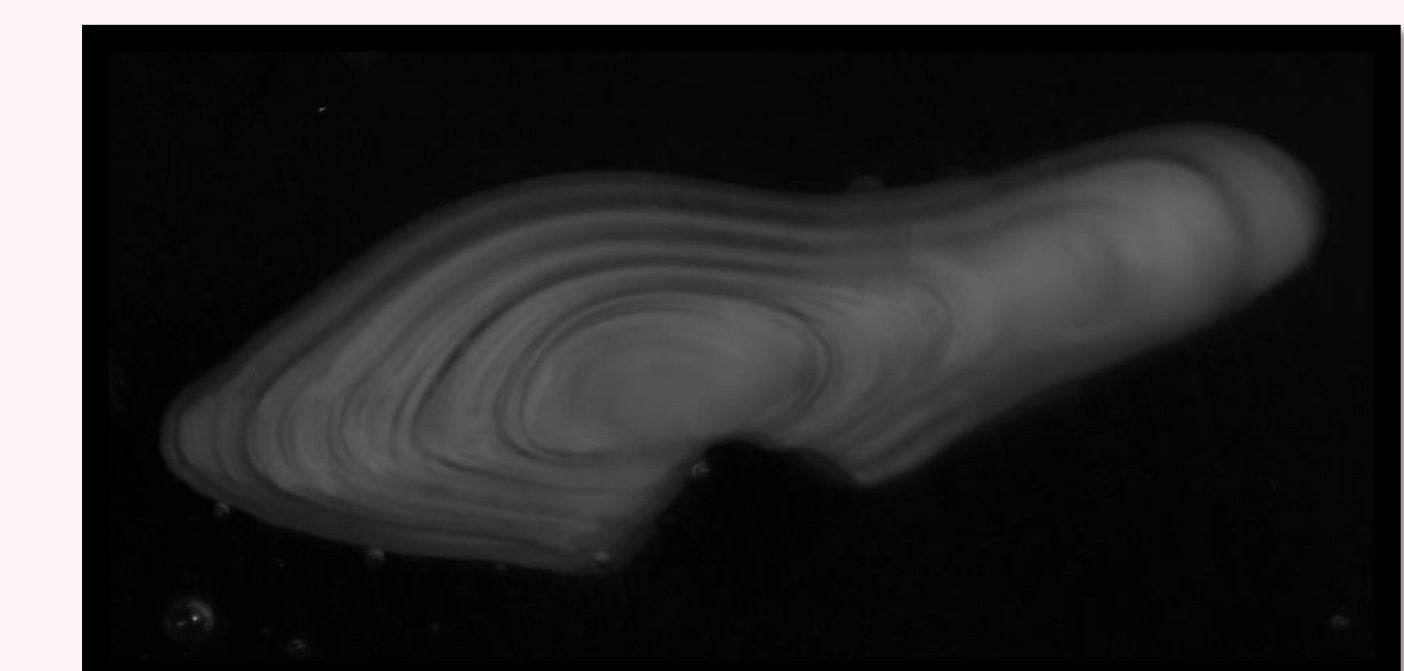


Figure 6: Thin-sectioned otolith prepared for Sr stable isotope analysis.

## REFERENCES

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