Bivalves in Jakolof Bay, Alaska occupy different positions in the food web

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Introduction

- Mariculture is an important industry and is rapidly expanding in the Northern Gulf of Alaska
- Shellfish farms support native and non-native populations of bivalves
- A niche is the range of environments where a species is found
- Analysis of stable isotopes can be used to estimate the sources of organic matter that is entering the food web
- $\delta^{13}C$ can be used to estimate the proportion of primary producer cardon assimilated by an organism & $\delta^{15}N$ values indicate trophic position
- $\delta^{13}C$ signature range is phytoplankton at –20.0 to macroalgae at –12.0

Figure 2. Oyster farm in Jakolof Bay, AK

Objectives

1. Are native and non-native species eating the same food?
2. Are mariculture and wild species eating the same food?
3. Are native and non-native species at the same trophic level(s)?

Table 1. All bivalve species included in study. Wild = Subsistence; Farmed = Mariculture (McDowell Group.)

Scientific Name	Common Name	Native vs Non-native	Farmed vs Wild
Clinocardium nuttallii	Cockle	Native	Wild
Crassostrea gigas	Pacific oyster	Non-native	Farmed
Macoma nasuta	Bent-nose macoma	Native	Wild
Mya arenaria	Soft-shell clam	Non-native	Farmed
Mytilus trossulus	Blue mussel	Native	Farmed
Patinopecten caurinus	Weathervane Scallop	Native	Wild & Farmed
Saxidomus gigantea	Butter clam	Native	Wild

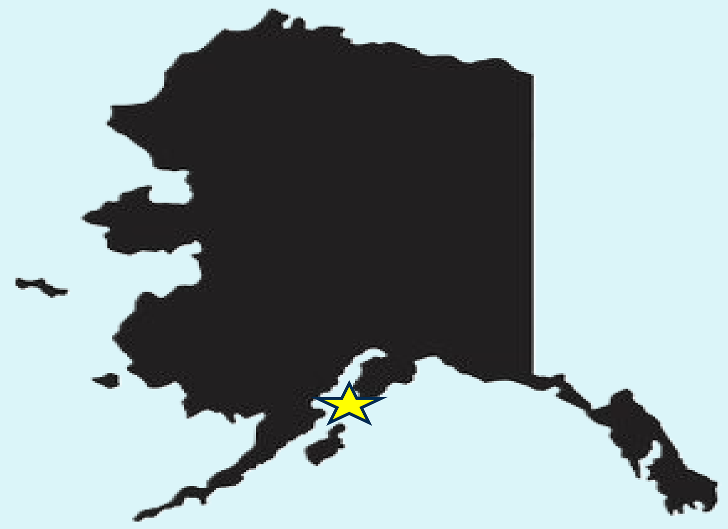

Figure 1. Map of Alaska. Yellow star is area of Jakolof Bay, AK

Materials & Methods

- Bivalves acquired in April 2024 from Jakolof Bay, AK and transported to UAF for dissection
- Bivalve adductor muscles were freeze dried at the Alaska Stable Isotope Facility & analyzed with infrared Mass Spectrometer™ on April 29
- Data analysis conducted in RStudio
- Ellipses generated through Stable Isotope Bayesian Ellipses in R, to allow for characterizing the trophic overlap of species from the same location
- Mixing models were generated through Bayesian Mixing Models in R (MixSIAR) using functional JAGS (Just Another Gibbs Sampler)

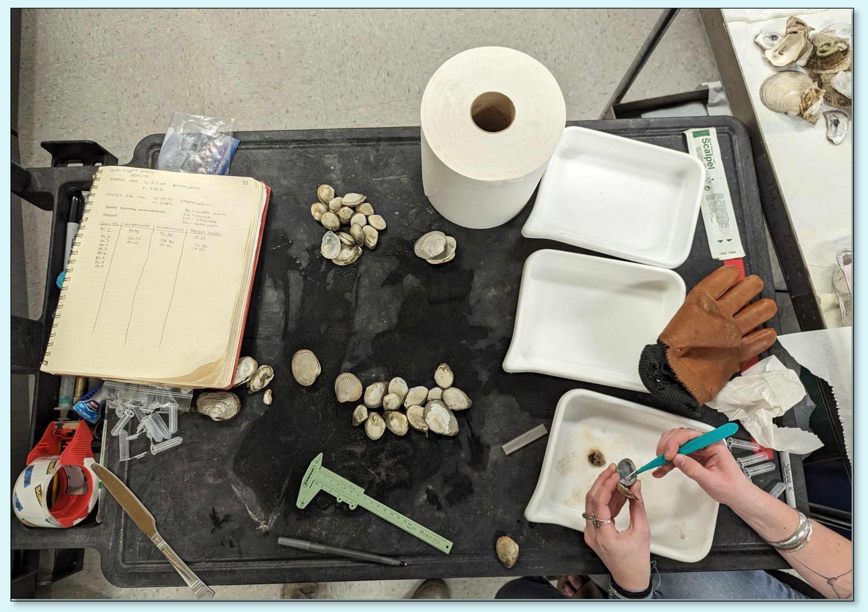

Figure 2. Dissecting bivalve adductor muscles for bulk stable isotope analysis

Results & Discussion

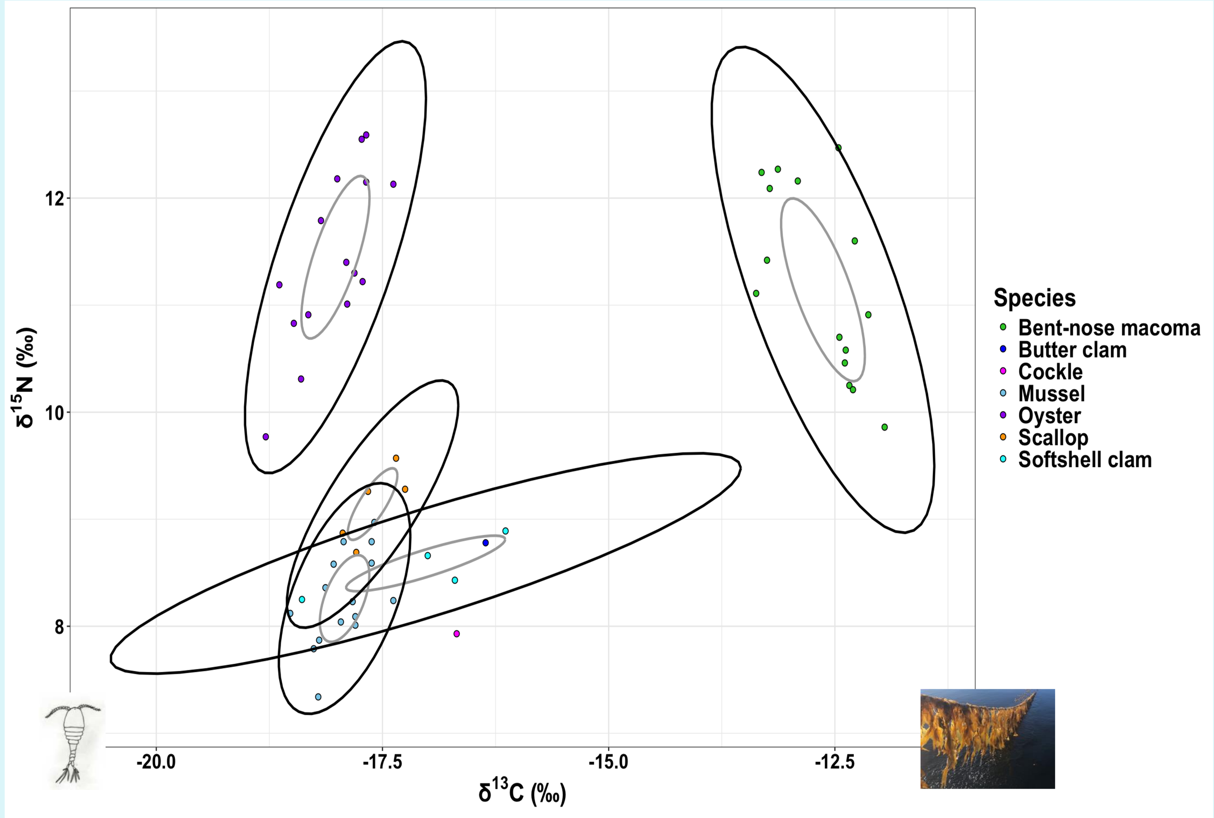

Figure 3. Carbon and nitrogen stable isotopes for the 7 bivalve species sampled.

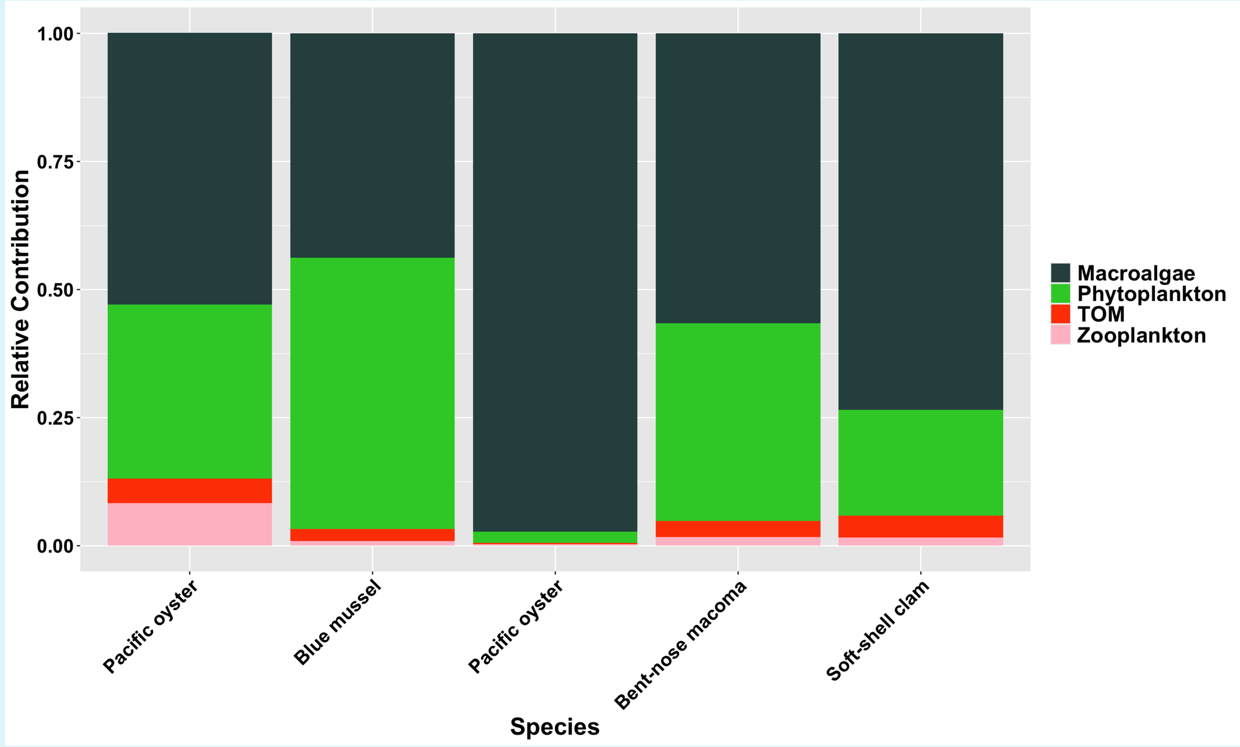

Figure 4. Proportion of endmember contributions of food sources for each species. TOM: terrestrial organic matter.

Trophic Levels ($\delta^{15}N$):

- Butter clams & Pacific oysters exhibited similar values, which show they're at the same trophic level
- Blue mussels, Weathervane scallops, & Soft-shell clams had similar values, which suggest they're at the same trophic level

Food Sources ($\delta^{13}C$):

- Blue mussels, Pacific oysters, Weathervane scallops, & Soft-shell clams have similar values, which signal they have the same primary production source
- Butter clams have a different value, which show that they have a different primary production source

Ellipses:

- Ellipses size indicates niche size & diet variety
- Overlap represents shared trophic niche within the trophic level
- Butter clams have the largest ellipses size, that show a large niche size, show that they're generalists
- Weathervane scallops have the smallest ellipses size, showing a small niche size, and that they're specialist

Resource Proportions:

- Macroalgae & Phytoplankton are the dominant food sources
- Weathervane scallops consumed majority macroalgae
- Pacific oysters consumed the most zooplankton
- Pacific oysters & Soft-shell clams consumed the same proportions of Terrestrial Organic Matter

Conclusions

Major findings:

- Butter clams & Pacific oysters are at the same higher trophic level than Blue mussels, Weathervane scallops & Soft-shell clams
- Butter clams have a different primary production source

Objective Findings:

- Soft-shell clams have the same primary production source as native species
- Pacific oysters are at the same trophic level as Butter clams, which is higher than the other species
- Soft-shell clams are at the same trophic level as Blue mussels and Weathervane scallops

Future Directions:

- Compare bivalves between multiple bays
- Expand on bivalve species

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References

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