

2019 State of the Coast Poster Exhibition Runner Up

Author: Britta Baechler

Title: Microplastic Concentrations in Two Oregon Bivalve Species: Spatial, Temporal, and Species Variability

Abstract: Microplastics are an ecological stressor with implications for ecosystem and human health when found in seafood. We quantified microplastic types, concentrations, anatomical loadings, geographic distribution, and temporal differences in Pacific oysters (*Crassostrea gigas*) and Pacific razor clams (*Siliqua patula*) collected from 15 Oregon coast sites. Organisms were chemically digested and visually analyzed for microplastics, and material type was determined in a subset of particles using Fourier Transform Infrared Spectroscopy (FTIR). Microplastics were present in organisms from all sites sampled. On average, whole Pacific oysters and Pacific razor clams contained 10.95 ± 0.77 and 8.84 ± 0.45 microplastics per individual, respectively. Contamination was quantified but not subtracted from averages. Over 99% of identified particles were microfibers. Spring samples contained more anthropogenic debris than summer samples in oysters but not razor clams. This study provides a baseline of microplastics in Oregon bivalves and is the first to determine Pacific razor clam concentrations.



MICROPLASTICS IN TWO OREGON BIVALVE SPECIES

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SPECIES STUDIED



Pacific oyster
Crassostrea gigas
HABITAT: ESTUARIES



Pacific razor clam
Siliqua patula
HABITAT: SANDY BEACHES

BACKGROUND

What are microplastics?

- Plastics <5mm manufactured for cosmetics or cleaners, broken down from larger plastics, or synthetic fibers released from washing clothes^{1,2,3}

Why are they a problem?

- Marine plankton, bivalves, fish, marine mammals, sea turtles, sharks, and seabirds mistake them for food^{4,5,6,7}
- Ingested particles carry harmful chemical contaminants, and both plastics and contaminants can accumulate in marine predators and humans^{8,9,10}
- Microplastics disrupt metabolism, reproduction, growth, and health of marine and freshwater organisms¹¹
- Trophic transfer of microplastics has been demonstrated¹²

RELEVANCE

Why study microplastics in Oregon bivalves?



Important for fisheries/aquaculture



Oregon lacks microplastic data



Known to impact bivalve health

OBJECTIVES

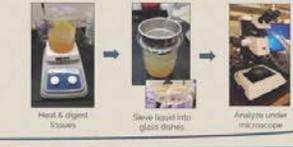
1. Quantify the **number & type** of plastic pieces in each species.
2. Examine the **geographical gradient & temporal variability** of microplastics in bivalves across locations and species.
3. Count & categorize microplastics in organism **gut vs. non-gut** tissues.

METHODS

COLLECTION



PROCESSING



ANALYSIS



SITES

Collected April and July 2017



Samples

- 15 sites
- 142 razor clams
- 141 Pacific oysters

RESULTS

Table 1. Average microplastic concentrations ± Standard Error

	Pacific oysters	Razor clams
# plastics/g tissue	0.35 ± 0.04	0.16 ± 0.02
# plastics/individual	10.95 ± 0.77	8.84 ± 0.45
	* p < 0.0001	

- Both species contained plastic at all 15 sites
- **3,053 microplastics** found in 320 samples (whole, gut, tissue)
- >99% of particles were fibers (82% colorless)
- Material types identified: **PET, acrylic, aramid, zein, cellophane**
- Significant **seasonal differences** in oysters (spring higher)
- Few geographic differences (2 oyster site pairs, 1 clam site pair)
- No differences between gut and non-gut tissue concentrations

Figure 1. Number of microplastics per individual by species and season.

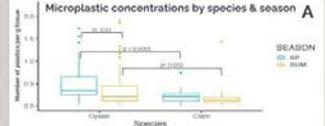
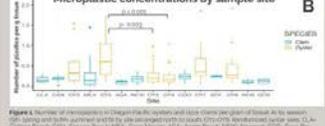


Figure 2. Number of microplastics per individual by site.



ACKNOWLEDGMENTS

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2019 State of the Coast Poster Exhibition People's Choice Award

Author: Keala Pelekai

Title: Evaluation of Pacific Lamprey statoliths and eye lenses as records of age, natal origin, and trophic history patterns

Abstract: The Pacific Lamprey (*Entosphenus tridentatus*) is an anadromous species native to the North Pacific Ocean and its adjacent freshwater tributaries. Pacific Lamprey are both ecologically and culturally important to the Pacific Northwest of the United States. In that last 50 years, Pacific Lamprey have experienced declines in abundance throughout the Columbia River Basin, USA. More information on the biology and ecology of this species is needed for conservation and management. Anatomical structures have been widely used in fisheries science for biological inference. The Pacific Lamprey is a cartilaginous fish that lacks the common hard structures used in teleosts to elucidate age and life history patterns. Statoliths, analogous to otoliths in function, are calcium-fluorapatite concretions found in the auditory capsules of lampreys. Statoliths have potential for aging and microchemical analysis but require further validation that bands represent annual deposition and are chemically reflective of the individual's environment. Eye lenses are another structure with potential for trace element and stable isotope analysis but remain relatively unexplored for lamprey. The goal of this project is to broaden our understanding of lamprey by evaluating the efficacy of different structures for determining age, natal origin, and trophic history patterns. These objectives will be achieved by evaluating lamprey statoliths and eye lenses taken from known age and origin specimens.

Evaluation of Pacific Lamprey Statoliths and Eye Lenses as Records of Age, Natal Origin, and Trophic History

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Pacific Lamprey Are Important!

Pacific Lamprey (*E. tridentatus*) are an ancient species of fish that live in the North Pacific Ocean and its adjacent freshwater habitats. They are cartilaginous and have a similar life cycle as salmon (anadromous).

- The filter-feeding larval stage helps facilitate nutrient cycling in freshwater systems.
- The adults represent a fat-rich source of food for aquatic and terrestrial predators.
- Migrating lamprey may help alleviate sealion predation on salmon.

Statoliths

Image of a 4-year-old larval lamprey statolith showing bands that may relate to age.



Statoliths are apatite "ear stones" found within the inner ear of lamprey¹. Similar structures (otoliths) have been used to determine age and natal origins of other fish².

Eye Lenses

Image of a lamprey eye lens cross-section showing laminae layers. These layers act as a record, with the core layers representing the oldest cells.



Lamprey have spherical multifocal eye lenses that begin to develop when they are still in the egg³. Eye lenses have been used in other fish to infer trophic position⁴.

Lamprey Populations Are ↓

Pacific Lamprey populations are in decline throughout their native range⁵. Very little is known about the life history of this species.

- Can we determine their age?
- Can we determine their birthplace?
- Can we determine their food web position?

We Want to ↑ Lamprey Knowledge

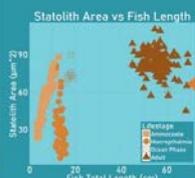
- Evaluate utility of statoliths and eye lenses for age determination.
- Analyze statolith chemistry and use it to predict natal origins.
- Analyze lens carbon and nitrogen stable isotopes to infer trophic history.

How Will This Help Lamprey?

- Knowledge of population age structure is important for fisheries assessment and tracking cohort survival.
- Natal origin determination is useful to assess recovery efforts and monitor supplementation projects.
- Better understanding of host trophic position is useful to understand diet and prey selection.

Statoliths Analysis

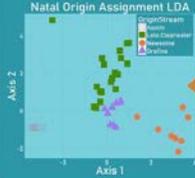
Statolith Area vs Fish Length



Can we determine their age? **Maybe!** Statoliths may stop growing and thus may only reflect larval age.

For a structure to be used to determine the age of a fish, it must grow continuously throughout their lifetime and accumulate layers at a consistent rate (such as a day or year).

Natal Origin Assignment LDA

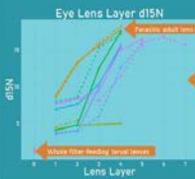


Can we determine their birthplace? **Yes!** ~85% accuracy when using statolith chemistry to predict lamprey origins.

Analysis of naturally occurring chemical signatures of fish structures can be used to determine their birthplace. This is done by matching the chemistry of the structure with the chemistry of their habitat.

Eye Lenses Analysis

Eye Lens Layer δ15N



Can we determine their food web position? **Maybe!** Increasing δ15N in the eye lens layers suggests increasing food chain position in lamprey.

Analysis of Nitrogen isotopes in fish tissues can be used to determine their food web position. Changes in isotope ratios mirror changes in position, where increased ratios relate to higher food web positions.

