Overview of Pacific Northwest Benthic Habitats Used for Bivalve Aquaculture



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Bedrock: Open (Substrate: energy) Hardpan Mixed-Coarse: Open Gravel Open

ESTUARINE (salinity) Intertidal (depth)

Partly enclosed Sand Open Partly enclosed Lagoon Mixed-Fine Partly enclosed

Lagoon Mixed-Fine and Mud

Lagoon Channel-Slough Mud: Partly enclosed and enclosed Organic: Partly enclosed Artificial (e.g. pilings, tires, concrete) Reef Subtidal Bedrock-Boulder: Open Cobble: Open Mixed-Coarse: Open Sand Partly enclosed Mixed-Fines: Open Mud Open Partly enclosed Sand and Mud: Channel Organic Artificial Reef

"Open" = open to wave energy and/or currents

ESTUARINE INTERTIDAL MIXED-FINES: PARTLY ENCLOSED

These habitats occur in backwaters or on deltas away from large distributary channels. They consist of mixed sand and mud with small amounts of gravel or with some clay and peat. The substratum is generally stable, firm, and organicrich. Productivity is high due to eelgrass, micro- and macro-algae, and salt marsh vegetation. Drift algae and seagrass may be abundant seasonally. Areas with gravel are characterized by an abundance of hard-shelled clams.

DIAGNOSTIC SPECIES

Diagnostic benthic species in lower zones are Zostera marina, Protolhaca staminea, Saxidomus giganteus, and Callianassa californica.

MARINE INTERTIDAL SAND: EXPOSED AND PARTIALLY EXPOSED

Pure marine sands without significant silt or organic content are found only in high and moderately-high energy areas such as on the outer coast and in the Straits of Juan de Fuca. They tend to be erosional beaches, are well-drained, and moderately sloped. Due to their unstable nature, they have no permanent vegetation and are low-diversity habitats, although a few species may be abundant. These areas are used extensively by loons, scoters, and grebes at high tide, and by gulls, sanderling and other sandpipers, and herons at low tide.

DIAGNOSTIC SPECIES

Phoxocephalid amphipods and *Eohaustorius* spp., the polychaete *Paraonella* platybranchia, the mysid *Archaeomysis grebnitzkii*, and the olive shell *Olivella biplicata* and the nazor stam *Silique* patule (patchy but locally abundant on the outer coast). Diagnostic fish species are juvenile Pacific tomcod and English sole, Pacific staghorn sculpin, sand sole, and redtail surfperch.

Economically Important Bivalves Live in Many Different Physical Habitats:

Intertidal Bedrock: Open: Pacific Oysters Hardpan Mixed-Coarse: Open Gravel Open Partly enclosed Sand Open Partly enclosed Lagoon Mixed-Fine Partly enclosed: Littleneck Clams Lagoon Mixed-Fine and Mud Partly enclosed: Pacific Oysters Lagoon Channel-Slough Mud: Partly enclosed and enclosed: Geoducks

Subtidal

Bedrock-Boulder: Open Cobble: Open Mixed-Coarse: Open Sand

Open: Geoducks Partly enclosed Mixed-Fines: Open: Butter clams Mud

Open Partly enclosed: Olympia Oyster

Sand and Mud: Channel

Habitat types are important to know.... Where are they?

The Shorezone Mapping Effort

- In 1994-2000, all shorelines of the state 'flown' by helicopter at low tide
- Shorelines mapped according to substrate, energy, slope, and a wide variety of other physical features
- · Data exist in publicly available database
- http://www.dnr.wa.gov/htdocs/aqr/nshr/inventory.html
- Some biotic features also mapped





Habitats are napped... where do we look for, or try to grow, shellfish?

Native Shellfish in Nearshore Ecosystems of Washington State Prepared in support of the Puget Sound Nearshore Partnership

Dr. Megan N. Dethier University of Washington

Technical Report 2006-04

•Where shellfish live in Puget Sound

•How they rely on nearshore habitats and processes

•What we know about trends in natural populations



Attribute	Native Littleneck Clam			Olympia Oyster			Geoduck		
	<u>Larvae</u>	<u>Juveniles</u>	<u>Adults</u>	Larvae	<u>Juveniles</u>	<u>Adults</u>	Larvae	<u>Juveniles</u>	Adults
Tidal elevation/depth	pelagic, 3 weeks	low-mid intertidal	mean Iower Iow water	Pelagic 11-16 days	intertidal and subtidal	0-10m deep	pelagic, 4-6 weeks	mostly subtidal	shallo subtid
Salinity (ppt)	27-32	saline	24-31					saline	
Temperature (°C)	10-15								
Dissolved Oxygen	high	high	high	high	high	high	high	high	high
Wave exposure		moderate	Mod.					moderate	Mod.
Sediment grain size		gravel- sand	gravel- sand		mud + coarse	mud + coarse		mud or sand	mud o sand
Other elements		surface gravel	Surf. gravel	stable settling site			stable settlement site		

 Most bivalves are found in habitats with a rather narrow range of physical parameters
These parameters vary considerably among economically important species

>Are species always found in areas where they grow best?

>For example, predation by crabs or seals might reduce survival of a species in the shallow subtidal, even though it might grow fastest there



Not much research on:

- •Where the larvae of local bivalve species settle •How well they survive in different places
- •WHY survival differs in different places



Temperatures and salinities vary considerably within Puget Sound, and may make a big difference to natural or cultured bivalves



How does this information relate to bivalve aquaculture?





Geoduck habitats: subtidal sand to intertidal mud...

Associated organisms, culture impacts, and harvest



This isn't the Chesapeake...

Research done on bivalve aquaculture there or in other distant environments may not apply directly here



ake-home messages:

 Habitats used for bivalve aquaculture are varied, depending on the species

♦We know where species live in nature, but not if this is necessarily where they do best

♦Because species and habitats are so diverse, it would be a mistake to assume that we know the outcome of aquaculture practices based on experience with other species or in other regions

 General caution: Different habitats experience different physical and ecological processes



