

## DEER HARBOR BENTHIC SURVEY

### Part I: Otter trawl and dredge, April 25-26 2007

Russel Barsh – KWIAHT (Center for the Historical Ecology of the Salish Sea)

Long-time residents of Deer Harbor, Orcas Island (San Juan County, WA) report significant declines in wildlife in Cayou Lagoon and Deer Harbor over the past 30 years. Likely causes of this decline include constriction of the tidal prism by the Channel Road bridge, which filled more than 75 feet of the original channel; and subsequent diversions and impoundments along Fish Trap Creek, reducing the peak spring freshwater flows that had historically helped flush silts from the lagoon.

The impact of changes in land-use patterns on benthic substrates and communities in Deer Harbor, from the marinas to Wasp Passage, has not previously been investigated. To assess benthic impacts we trawled along four transects, each approximately one-third of a nautical mile in length. Two transects (numbered 1 and 2 on the attached map) were laid in the deepest parts of the wide bay between Fawn, Reef, and Crane Islands. A third transect 3 was laid in deeper water between McConnell and Crane Islands, and the fourth transect explored an even deeper channel off the west side of McConnell. This provided us with data on the east and west sides of Deer Harbor at a distance of approximately one nautical mile downstream from the marinas; and data on the mixing zone on the east and west entrances to Deer Harbor approximately 1.5 nautical miles downstream.

After experimenting with both a beam trawl and otter trawl in parallel paths along transects 1 and 2, we decided that the otter trawl had less of an impact on the benthos and produced better results: less substrate clogging the gear and a greater diversity of species, especially more fish. Only otter trawls were run on transects 3 and 4. To our obtain data on substrates along transects 3 and 4, we dropped a clamshell dredge at the end-points of our otter trawls. Otter trawl data for all transects are attached in tabular form.

This study was made possible by a grant from The Russell Family Foundation to the San Juan Nature Institute for its Partners in Science Program; the assistance of Friday Harbor Laboratories in providing use of its research vessel *Centennial* and the assistance of Dr. David Duggins; Deer Harbor residents Bob Conner and Ken Brown for providing lighter service between Deer Harbor Marina and *Centennial*; and above all, Orcas Island science teachers Marta Branch and Ron Claus and their students, who helped identify and count organisms on the deck of *Centennial*.

### Results

Our beam trawl of transect 1, and dredges at the end-points of transects 2 and 3, recovered evidence of thick re-deposited gray clay substrates. Numerous pebble clams (*Nuticola lordii*) were found in the recovered clays. It should be noted that marine charts

report mud, sand and shell between Deer Harbor and Reef Island, but we found no sandy bottoms. This suggests that the plume of suspended silts and clays from Cayou Lagoon is larger and migrating farther downstream than previously.

In biomass terms, the major components of our four trawls were pandalid shrimp (chiefly two commercially-significant species, coonstripe and humpy shrimp), and pink scallops. Shrimp form large migratory swarms, hence their distribution can be extremely patchy, and their residence at any particular location may be brief.<sup>1</sup> Scallops, by contrast, while somewhat mobile, do not move very far from where their larvae settle. Outer Deer Harbor appears to be a pink scallop nursery, with older scallops moving down the benthic slope into deeper water. A significant amount of shell was present in our beam trawls of the bay, and a large part of it consisted of very large, deteriorated shells of the giant rock scallop *Crassidoma giganteum* (formerly *Hinnites giganteus*), apparently once abundant here, probably within the last 50 years.

Flatfish dominated the vertebrate fauna (65 percent of the individuals we counted) as would be expected from the soft substrate. Flatfish diversity was relatively high (nine species). Flatfish were followed in order of abundance by the sculpins (*Cottidae*), which is also consistent with the character of the substrate. We were surprised, however, by the presence of juvenile white-spotted greenlings, a fish which in its adult form is associated with deep rocky habitats. Relatively little is known about the habitat preferences of early life history stages of the greenlings, ling cod and rockfish (Families *Hexagrammidae* and *Scorpaenidae*). The possibility that Deer Harbor is a greenling nursery deserves further examination.

Species diversity was greatest along our deepest and shallowest transects, thus not simply correlated with depth, but also other factors such as substrate and current velocity. There were no clear species presence/absence correlations with depth. It should be noted, in addition, that pandalid shrimp were abundant at both our high- and low-diversity sites. As migratory algal and detrital feeders, pandalid shrimp should be relatively independent of local variations in the diversity of more sedentary animals.

Many juvenile organisms were taken in the two otter trawls closer to Deer Harbor (transects 1 and 2), most notably a number of juvenile red and green urchins and juvenile pink scallops that were attached to macroalgae detritus. It is significant that these species are recruiting in the shallower reaches of the bay. At the same time, it is intriguing to see so many of them relying on floating detritus as attachment surfaces. Are there no harder surfaces available to them, due to a rapid accumulation of clays and silts in the sediment plume of Cayou Lagoon? Or did our collection method create a bias in favor of animals attached to floating debris? The fact that we tried both beam and otter trawls in shallow parts of the bay—and found most juvenile animals attached to detritus by both methods, despite the fact that the beam trawl harvested abundant cobbles—suggests that there was no methodological bias. However, this question cannot be resolved until we return to the bay with submarine video (ROV) capacity to observe animals *in situ* on the seafloor.

---

<sup>1</sup> Consistent with the experience of shrimp fishers, however, we found older and larger pandalid shrimp in deeper water—roughly twice as large at 44 meters than at 28-30 meters.

**Deer Harbor otter trawl results, April 25-26 2007**

<b>Transect (refer to map)</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>Average depth (meters)</b>	28	24	30	44
<b>Vertebrates</b>				
Skate <i>Raja bioculata</i> (juvenile)				1
Northern spear-nosed poacher <i>Agonopsis vulsa</i>		1		4
Sturgeon poacher <i>Agonus acipenserinus</i>				1
Great sculpin <i>Myoxocephalus polyacanthocephalus</i>	1		5	
Staghorn sculpin <i>Leptocottus armatus</i>		1	3	6
Ribbed sculpin <i>Triglosps pingeli</i>			3	
Scalyhead sculpin <i>Artedius harringtoni</i>				7
Plainfin midshipman <i>Porichthys notatus</i>				1
White-spotted greenling <i>Hexagrammos stelleri</i> (juv)	1		1	
Walleye Pollock <i>Theragra chalcogramma</i>	1			4
Flathead sole <i>Hippoglossoides elassodon</i>	1	8	1	
Dover sole <i>Microstomus pacificus</i>				10
English sole <i>Pleuronectes vetulus</i>	5	6		28
Rock sole <i>Pleuronectes bilineata</i>	6	3	1	
Slender sole <i>Lyopsetta exilis</i>		1		1
Pacific sand dab <i>Citharichthys sordidus</i>				4
Speckled sand dab <i>Citharichthys stigmaeus</i>	3	4	3	
Butter sole <i>Isopsetta isolepis</i>		1	1	
Sand sole <i>Psetichthys melanostictus</i>		1		
Blackbelly eelpout <i>Lycodes pacificus</i>				2
Shiner perch <i>Cymatogaster aggregata</i>	1			2
Herring <i>Clupea pallasii</i> egg mass on kelp		1		
<b>Crustaceans</b>				
Crangonid shrimp <i>Crangon spp</i>		15		32
Spot shrimp <i>Pandalus platyceros</i>		1		61
Coonstripe shrimp <i>Pandalus hypsinotus</i>		23		
Humpy shrimp <i>Pandalus goniuris</i>	3200	70	1400	1580
Spiny shrimp <i>Lebbeus groenlandicus</i>	5	8	3	50
Pea crab <i>Pinnixa tubicola</i>				2
Tanner crab <i>Chionoecetes bairdii</i>		1		2
Graceful decorator crab <i>Oregonia gracilis</i>	8	20	24	21
Northern kelp crab <i>Pugettia producta</i>		1		
Pacific lyre crab <i>Hyras lyratus</i>				2
Dungeness crab <i>Cancer magister</i>	7			
Red rock crab <i>Cancer productus</i>		3	3	
Graceful crab <i>Cancer gracilis</i>		20	3	2
Hermit crab <i>Pagurus spp</i>				

<b>Echinoderms</b>				
Sunflower star <i>Pycnopodia helianthoides</i>	1		4	1
Dawson's sunstar <i>Solaster dawsoni</i>		1	2	
Rose star <i>Crossaster papposus</i>			2	1
Stimpson's sunstar <i>Solaster stimpsoni</i>				1
Blood star <i>Henricia leviuscula</i>	3		2	3
Small sea star <i>Henricia sanguinolenta</i>	1		2	
Short spined sea star <i>Pisaster brevispinus</i>				
Red urchin <i>Strongylocentrotus franciscanus</i> <2cm	3	12	8	
Green urchin <i>Strongylocentrotus droebachiensis</i>			1	1
Brittle star <i>Ophiopsilla californica</i>		1		
California sea cucumber <i>Parastichopus californicus</i>			2	2
White sea cucumber <i>Cucumaria piperata</i>				1
<b>Brachipods</b>				
Lampshell <i>Terebratalia transversa</i>			2	
<b>Mollusks</b>				
Pink scallop <i>Chlamys rubida</i>		5		204
Blue mussel <i>Mytilus edulis</i>		1		
Jingles <i>Pododesmus spp</i>		1		
Lined chiton <i>Tonicella lineata</i> <2 cm				2
Pebble clam <i>Nuticola lordii</i>				
Northwest shipworm <i>Bankia setacea</i>		1		
<b>Tunicates</b>				
Spiny tunicate <i>Boltenia villosa</i>		2	2	
Glassy tunicate <i>Ascidia paratropa</i>				2
<b>Anthozoa</b>				
Sand-rose anemone <i>Urticina columbiana</i>		1		2
Orange sea pen <i>Ptilosarcus gurneyi</i>		1		
<b>Annelid worms</b>				
Colonial sand tube worm <i>Phragmatopoma californica</i>				2
Peanut worm <i>Sipunculus spp</i>				2
Sandworms <i>Nephtys spp</i>				2
<b>Insects</b>				
Caddisfly (Order <i>Trichoptera</i> ) larvae		3		
<b>Average depth (meters)</b>	28	24	30	44
<b>Total number of species</b>	16	31	24	36