

## Chapter 5. Nearshore Assessment: Fish use and water quality of the Pysht nearshore

J. Anne Shaffer<sup>1</sup>, J. Schilke<sup>1</sup>, M. McHenry<sup>2</sup>, and J. Murray<sup>3</sup>

<sup>1</sup> Washington Department of Fish and Wildlife 332 E. 5<sup>th</sup> Street Port Angeles Washington 98362

<sup>2</sup> Lower Elwha Klallam Tribe 51 Hatchery Road Port Angeles, Washington 98362

<sup>3</sup> Merrill and Ring Inc. 813 E. 8<sup>th</sup> Street Port Angeles Washington 98362.

### **Introduction**

Located along the western shore of the north Olympic Peninsula, the Pysht nearshore extends from Pillar Point Rocks east to Butler Creek, and includes the area of tidal influence approximately RM 3 to minus 30 m MLLW. It includes the tidally influenced main channel and estuary of the Pysht river, as well as the large sand spit feature that separates the river from the Strait of Juan de Fuca. Nearshore area on northern side of the spit consists of a sandy shoreline and tideflats, and eelgrass and kelp beds (Figure 1).

The Pysht estuary is the largest estuary on the western Strait of Juan de Fuca, and one of the largest estuarine complexes on the Olympic Peninsula (Todd et al 2006). Historically the Pysht estuary supported fall Chinook, coho, and chum runs, as well as winter steelhead (McHenry et al. 1996).

The Pysht nearshore has a diverse history and is highly valued culturally (Charles et al 2004). The spit and lower river was a settlement site for the Elwha Klallam Tribe. Following European settlement the lower river area was used extensively for commercial logging operations and associated log decking, rafting, and barging operations that resulted in significant diking, channelizing, and filling of the Pysht estuary and lower river (Todd et al 2006). Logging operations in the estuary ended in 1974. Many of the remnant structures remain, and are theorized to have contributed to the significant degradation of estuary function. The Pysht estuary is classified as severely impaired

(Todd et al 2006) and is owned by Merrill and Ring, a private commercial timber company.

The Pysht estuary, classified as a large stream delta system, is characterized by the low gradient Pysht River (Todd et al 2006; McHenry et al 1996). It includes approximately 100 acres of estuarine and lower river habitat. Vegetation along the spit includes both exotic and native species. Eelgrass (*Zostera marina*) is found in the main east and west side channels of the Pysht estuary (Shaffer pers obs.).

The Pysht foreshore is an exposed sandy shoreline characterized by wind driven waves from the Strait of Juan de Fuca. Dominant wind direction is westerly, with less prevailing northwest winds in fall, and northeasterly winds in winter. This zone of the Pysht nearshore includes two drift cells. The first extends from Pillar Point east to the mouth of the Pysht river and includes a large sand spit. Net transport is from west to east. The second extends from the river mouth east to Jim Creek, and is listed as having no appreciable net shore drift (WDoE 1991).

The Pysht shoreline is characterized by intertidal and shallow subtidal sand flats fringed with sparse eelgrass beds and offshore kelp beds. The intertidal beach west of the Pysht river mouth supports sand lance spawning (Shaffer et al 2004). The western Pysht shoreline is privately held. The shoreline east of the river mouth is a mix of public and private ownership.

Given the historic high cultural and biological importance of the Pysht and its large and degraded state, the landowners and co-managers of the Pysht have identified the Pysht nearshore as an area of high priority for restoration (North Olympic Lead Entity (NOPL) strategy 2008).

The Pysht nearshore was one of fourteen sites included in the 2007 WDFW lead and Salmon Recovery Funding Board (SRFB) funded Central Strait of Juan de Fuca nearshore assessment for fish use. The Pysht was also one of a number of lower river

mouth nearshore areas of WRIA 19 that was sampled for water quality for one year. Results of these two Pysht studies follow.

### **Methods and Materials**

The shoreline, east, and west side channels and main channel of the Pysht estuary were seined bi-weekly from April-December 2007 and then monthly from December 2007 - March 2008. The east and west side channels were sampled as tide provided, using a 24.4 meter Puget Sound Ambient Monitoring Protocol (PSAMP) design seine and protocol. The Pysht lower river main channel and shoreline were sampled using the standard 37 meter PSAMP design seine and protocol. A minimum of two seines were sampled each from east and west side channels, the mainstem lower river of the estuary and shoreline. Side channel sampling was infrequently precluded by too low of a tide. Over the duration of the study juvenile Chinook salmon were sampled opportunistically for genetic tissue analysis.

Basic water quality of the west side channel, at the mouth of Reed creek, and mainstem of the Pysht river at mile post 3.28 (adjacent to highway 112), was sampled once a month during daylight hours on a falling neap tide between +6 and +3 MLLW. Point data on turbidity, DO, temperature, salinity, and conductivity were sampled using a YSI meter.

### **Results**

#### *Fish use.*

Over sixty seines were sampled along the Pysht nearshore from April to September 2007. An additional 20 seines were sampled from September 2007 to February 2008. Surf smelt, shiner perch, cottids, and three spine stickleback were the dominant species collected along the Pysht shoreline and side channels (Table 1). The Pysht nearshore had the higher smelt and stickleback densities than all other sites sampled in the study. Salmonid abundance, in contrast, was among the lowest of all areas in the study (Figure 2). Ecologically the Pysht varied from other sites as well. For example, the Pysht shoreline had the highest species richness of all sites sampled, but lower diversity. Within the estuary, the Pysht side channel had consistently higher diversity than other side

channel sites across the western Strait. (Figure 2 and 3). Chapter 2 of this report provides a more detailed comparison of Pysht to other central Strait nearshore sites.

Seining of the Pysht nearshore over the last ten months revealed a seasonal trend in basic ecological parameters of species richness and diversity for all sites, with highest richness and abundance during summer months. The Pysht shoreline and main channel had consistently highest richness and diversity.

Among salmon, coho and chum were the most abundant salmon collected. Coho were consistently collected from the main and side channels of the estuary, Chum from the main channel and shoreline (Figure 4-6).. Chinook were collected at the shoreline and main channel only, infrequently, and in much lower numbers than the other two species. With the exception of chum, no trends in fish size were observed, likely due to low numbers. (Figure 9-11). Chum size increased steadily over the sampling period. Genetic analysis of five juvenile Chinook collected from the Pysht shoreline revealed that over 50% of those from the Pysht shoreline originated from Columbia River stocks (Figure 4, Shaffer et al in prep, chapter 6 this report).

Forage fish were dominant along the shoreline followed by the main channel of the lower river during spring and summer months. Juvenile smelt were the most abundant, followed by adult smelt and juvenile and adult herring. Sand lance were found in fewer numbers than other forage fish species, and infrequently during spring, summer and fall (Figure 7-8).

#### *Water quality*

Water quality parameters of temperature, turbidity, and dissolved oxygen in the Pysht estuary appears very similar to other WRIA 19 nearshore areas (Figure 15-17). A strong seasonal trend was seen in all parameters, with highest turbidity and DO in winter months, and lowest DO during summer. Water quality parameters at the three sites within the Pysht also followed similar trends overall.

**Discussion**

From a water quality perspective the Pysht appears to be similar to other nearshore areas of the western Strait. Overall, water quality was good by state standards (DoE 2006). That said, the Pysht estuary consistently had the highest temperatures of all the nearshore sites sampled. While the monthly point temperatures for the Pysht estuary met state standards for excellent water quality, these data were quite limited and taken during high tide and early morning hours. Summer temperatures during low tides and later in the day likely are higher. These point data should therefore be interpreted to confirm that the Pysht estuary does experience high temperatures during spring and summer months. Temperature is also a concern in the watershed (MchHenry, pers comm.). A more intensive estuarine water quality monitoring effort is warranted, and recommended.

Ecologically the Pysht appears to be functioning a bit differently than other areas sampled for fish use. While seasonally very species rich, diversity of fish in the Pysht nearshore appears to be middle of the road, or lower, relative to other areas of the central Strait nearshore. On a more species specific level, juvenile salmon, which depend on estuarine areas for migration and refuge, were consistently lower in abundance than other estuarine areas of the western Strait nearshore, including areas that we might intuitively expect to have similar fish use, such as the Elwha and Salt Creek. Salmon that were collected at the Pysht were more consistently observed later in the season and for the most part along the shoreline.

Little information exists on historic salmon use of the Pysht estuary. Miller et al 1980 sampled the Pillar Point area as one of the MESA study sites, but only sampled well offshore by tow netting. In this three year effort they similarly observed that Pillar Point had some of the highest total species numbers along the Strait, and only found juvenile Chinook in any numbers in 1977. In their study of fish use of kelp beds Shaffer 2002 seined the Pysht shoreline area monthly from June-August 2001, but observed no salmon in seining, and very few salmonids in kelp beds at Pillar Point. These few comparisons compared with the results of this study indicate that juvenile salmon along the Pysht nearshore may be depressed relative to other nearshore areas of the Strait.

The documentation, and dominance, of Columbia river stocks in the composition of juvenile Chinook salmon collected from the Pysht shoreline lends another element of complexity to salmon use of the Pysht nearshore. Even if used at lower numbers than other areas of the central Strait, the Pysht nearshore is clearly highly important for juvenile salmon.

In contrast, forage fish, which seasonally use the nearshore shoreline for migration and spawning, had extremely high densities along the Pysht shoreline. This is consistent with Miller et al's 1980 tow netting observations and Shaffer 2001 kelp bed snorkeling results, although both sand lance and surf smelt, had the highest abundance in Shaffer's kelp snorkeling surveys. Combined these ecological indices and forage fish observations may indicate that the shoreline of the Pysht nearshore appears to be more functionally intact (for semi-pelagic schooling forage fish at least) than its estuarine counterparts.

Given the history of alteration in the Pysht estuary it is reasonable to interpret lower ecological indices and abundance information for key species observed in the Pysht nearshore as a result of decreased estuary habitat function. Additional, more intensive sampling of the estuary is recommended to verify these observations. These should include sampling throughout the salmon outmigration (which typically begins in March) and more intensive sampling methods, such as fyke netting. An intensive pilot fyke netting study of the east and west side channels of the Pysht estuary begin in March 2008.

It will be important to monitor fish use and water quality of the Pysht estuary over the course of the restoration as well as how the Pysht is functioning relative to the rest of the Pysht watershed and other nearshore areas. A more focused and detailed study on genetic composition of salmon using the Pysht nearshore is also warranted. Restoration planning should include all of these elements.

### **Acknowledgments**

This work was funded by the SRFB with in kind support by WDFW and the Lower Elwha Klallam Tribe. Tara Galuska, project manager RCO. The Clallam Marine Resources Committee provided funding for a number of college interns with Peninsula College Fisheries Program and Center of Excellence, and the Western Washington University REU program. Mr. Jack Ganzhorn and Dr. Dwight Barry provided student supervision. Nancy Bleustein Johnson provided student guidance. Interns that assisted in the project include Jesse Charles, Chris DeSisto, Bryan Hara, Erica Hirsh, Mario Laungayan, Romy Laungayan, Ross McDorman, Sean Oden, Tiffany Nabors, Rebecca Paradis, Jacob Ray, Tyler Ritchie, Melanie Roed, Justin Rondeau, Trista Simmons, Ben Warren, Karen Wilkie, Eric Wood, and Steve Wyall. Project in kind partners in order of contribution included Cathy Lear (Clallam County), Pat Crain (ONP), Ross Fuller, Chris Byrnes, Roger Mosley, Dan Penttila, Dan Doty, and Tim Quinn (WDFW). Sue Nattinger, Streamkeepers, provided water quality sampling equipment and expertise.

### **Literature cited**

- Charles, B., V. Cooke, E. Grinnell, C. Morgonroth, L.M. Morganroth, M. Peterson, V. Riebe, A. Smith, and J. Wray 2004. When the tide is out: an ethnographic study of nearshore use on the Northern Olympic Peninsula. *In* Native American Traditional and Contemporary Knowledge of the Northern Olympic Peninsula. Coastal Watershed Institute and Olympic National Park. Port Angeles, Washington.
- McHenry, M, J. Lichatowich, and R. Kowalski-Hagaman. 1996. Status of pacific salmon and their habitats on the Olympic Peninsula Washington. Report to the Department of Fisheries, Lower Elwha Klallam Tribe, Port Angeles, Washington.
- Miller, B. C.A. Simenstad, J.Cross, K.L.Fresh, S.N. Steinfort 1980. Nearshore fish and macroinvertebrate assemblages along the Strait of Juan de Fuca including food habits of common nearshroe fish. EPA-600/7-80-027.

Shaffer, J. A. 2002. Preferential use of nearshore kelp habitats by juvenile salmon and forage fish. Puget Sound Research Proceedings, PSAT, Olympia, Washington.

Todd, S., Fitzpatrick, N., Carter-Mortimer, A., and Weller, C. 2006. Historical changes to estuaries, spits, and associated tidal wetland habitats in the Hood Canal and Strait of Juan de Fuca regions of Washington State. Unpublished technical report, PNPTC TR 06-01, Kingston, Washington. 101 p. plus appendices.

Washington Department of Ecology 1991. Net shore drift in Washington state volume 1. Pacific Ocean and the Strait of Juan de Fuca. Shorelands and Coastal Zone Management Program, Washington Department of Ecology. Olympia, Washington. 98504.8711.

Washington Department of Ecology water quality statute effective 12/21/06. RCW 90.48.035. 06.23.117 (order 06-04) 173-201A-210.



Figure 1. The Pysht Estuary. Red box includes Indian Creek (east side channel) and lower river; Blue box includes west side channel, lower river, decking area of spit, and shoreline.

Table 4. Percent of dominant species by site from beach seines March-September 2007 by geomorphic habitat type.

	<u>Cumulative</u>						<u>Surf</u>	<u>Surf</u>	<u>Smelt</u>	<u>Sand</u>	<u>3-</u>					
	<u>percent</u>	<u>Chinook</u>	<u>Coho</u>	<u>Cut</u>	<u>Unid'</u>	<u>ed (adult =</u>	<u>&gt;120)</u>	<u>(juv = 50-</u>	<u>pl =</u>	<u>(juv =</u>	<u>(juv =</u>	<u>stickle</u>	<u>Shiner</u>	<u>Staghorn</u>	<u>Prickley</u>	<u>Cottids &lt;30m</u>
<u>Site</u>				<u>throat</u>	<u>Trout</u>			<u>120)</u>	<u>&lt;50)</u>	<u>50-120)</u>	<u>50-120)</u>	<u>back</u>	<u>perch</u>	<u>sculpin</u>	<u>Sculpin</u>	
Embayed shoreline																
Crescent Beach	97.95	2.00	0.92	1.41	0.00	0.00	46.33	9.00	0.25	25.76	2.99	0.02	0.97	1.95	0.00	0.00
Fresh Water Bay	96.50	13.23	0.00	0.09	0.00	0.00	50.97	2.10	0.00	24.78	2.10	0.03	2.21	0.24	0.00	0.00
Pysht Shoreline	98.92	0.02	0.01	0.26	0.00	0.00	10.86	79.57	0.00	0.05	2.18	0.00	0.00	2.38	0.00	0.07
Twins Shoreline	65.72	0.00	0.00	0.39	0.00	0.00	10.77	47.79	0.02	0.00	0.44	0.00	0.16	0.25	0.00	0.00
Bluffs																
Elwha Bluffs	98.80	12.35	1.66	10.92	0.00	0.00	0.92	53.70	18.06	0.92	0.21	0.00	0.00	0.00	0.00	0.00
Dungeness Bluffs	95.31	0.29	0.22	1.70	0.00	0.00	2.64	22.51	58.74	0.88	5.76	0.18	0.18	0.18	0.00	0.00
Spits																
Dungeness Spit	97.93	0.19	0.00	7.34	0.00	0.00	4.26	61.62	4.70	6.28	12.56	0.09	0.02	0.07	0.00	0.00
Ediz Hook	99.01	11.41	0.80	6.17	0.00	0.00	10.30	1.60	1.05	23.67	43.53	0.31	0.00	0.00	0.00	0.00
Lower river/estuary																
Elwha Side Channel	98.89	24.82	4.28	2.30	0.83	0.00	0.01	0.01	0.49	0.00	0.00	40.23	0.00	7.73	1.44	10.58
Salt Creek Side Channel	99.03	0.42	0.71	1.60	0.04	0.00	0.01	0.01	0.00	0.00	0.00	12.20	54.54	21.66	0.42	7.40
Pysht Side Channels	99.66	0.00	0.15	0.02	0.05	0.00	0.00	0.01	0.00	0.00	0.00	50.02	27.90	18.82	0.10	1.60
Lower river/estuary																
Pysht Main Channel	98.01	0.07	1.25	1.52	0.09	0.00	0.03	0.15	0.00	0.00	0.00	0.66	0.38	7.18	0.01	84.54
Salt Creek Main Channel	99.24	0.12	1.83	2.67	0.45	0.00	0.02	0.00	0.01	0.00	0.01	5.41	67.92	13.95	0.03	6.79
Twins Main Channel	98.60	0.00	0.00	1.14	6.28	4.68	0.00	0.00	0.00	0.00	0.00	0.07	0.00	4.81	28.41	53.21

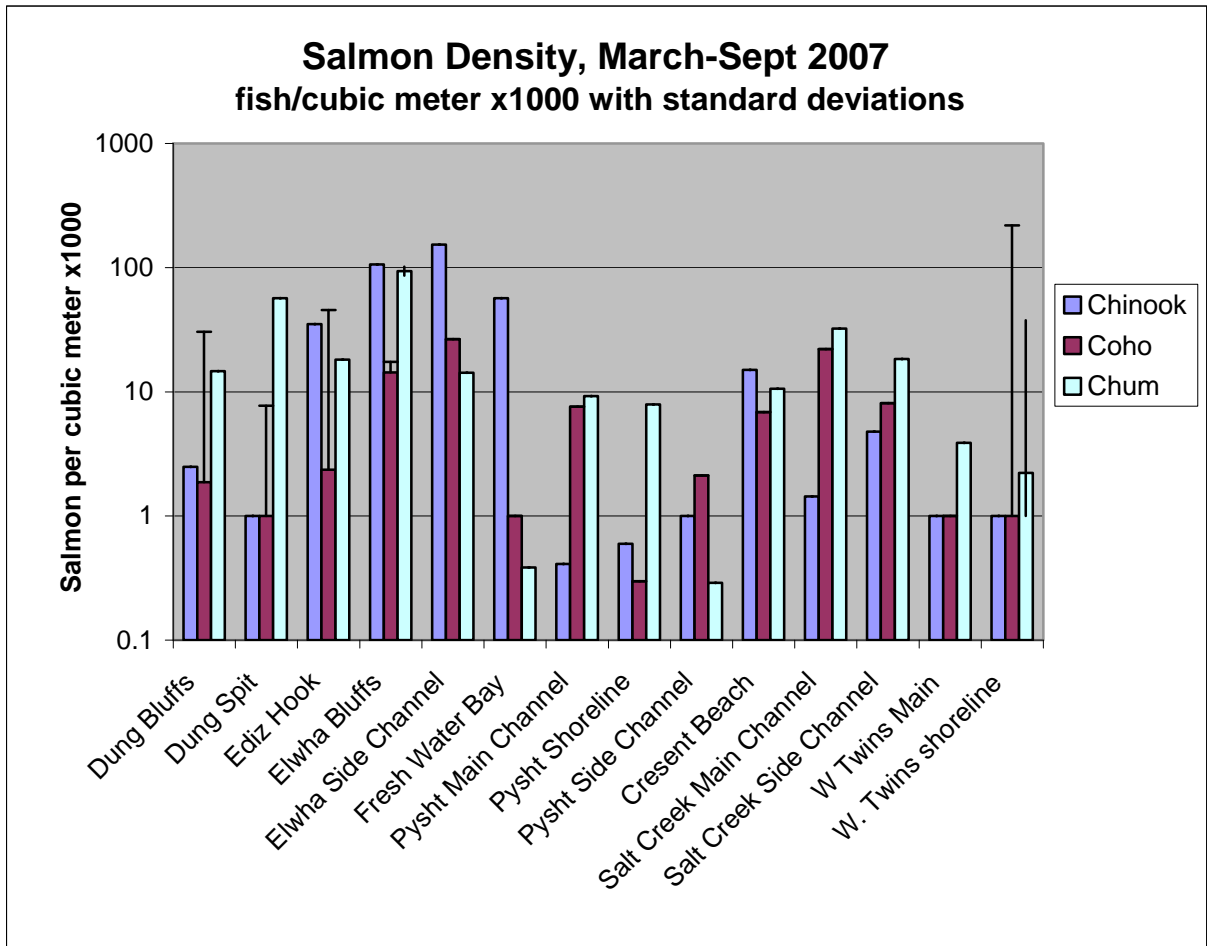
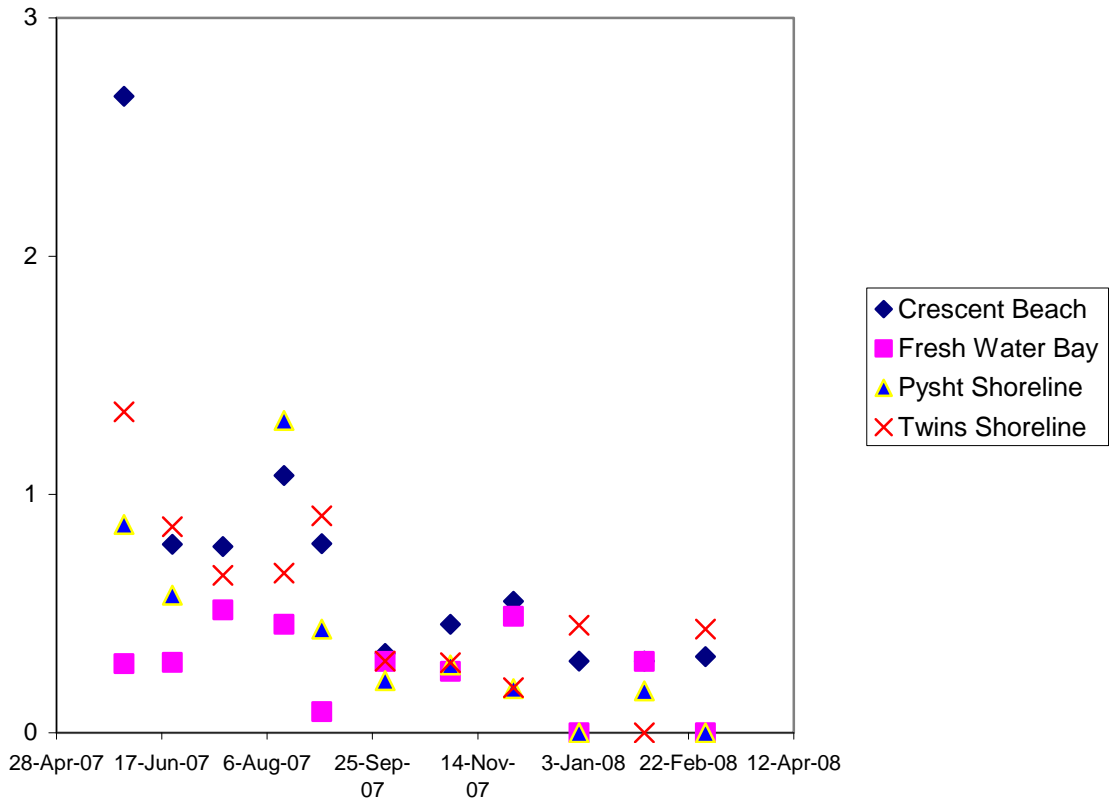


Figure 2

**Shannon Weiner Diversity (H') for Shoreline Sites**



**Shannon Weiner Diversity (H') for Lower Rivers**

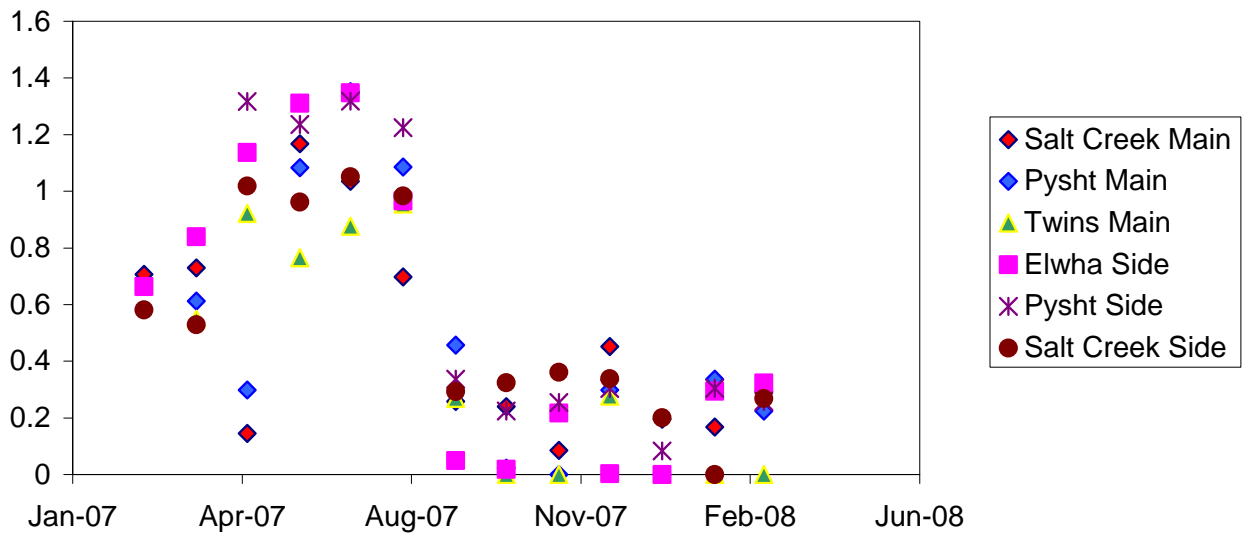


Figure 3 a and b. Shannon weiner diverisity for central Strait nearshore.

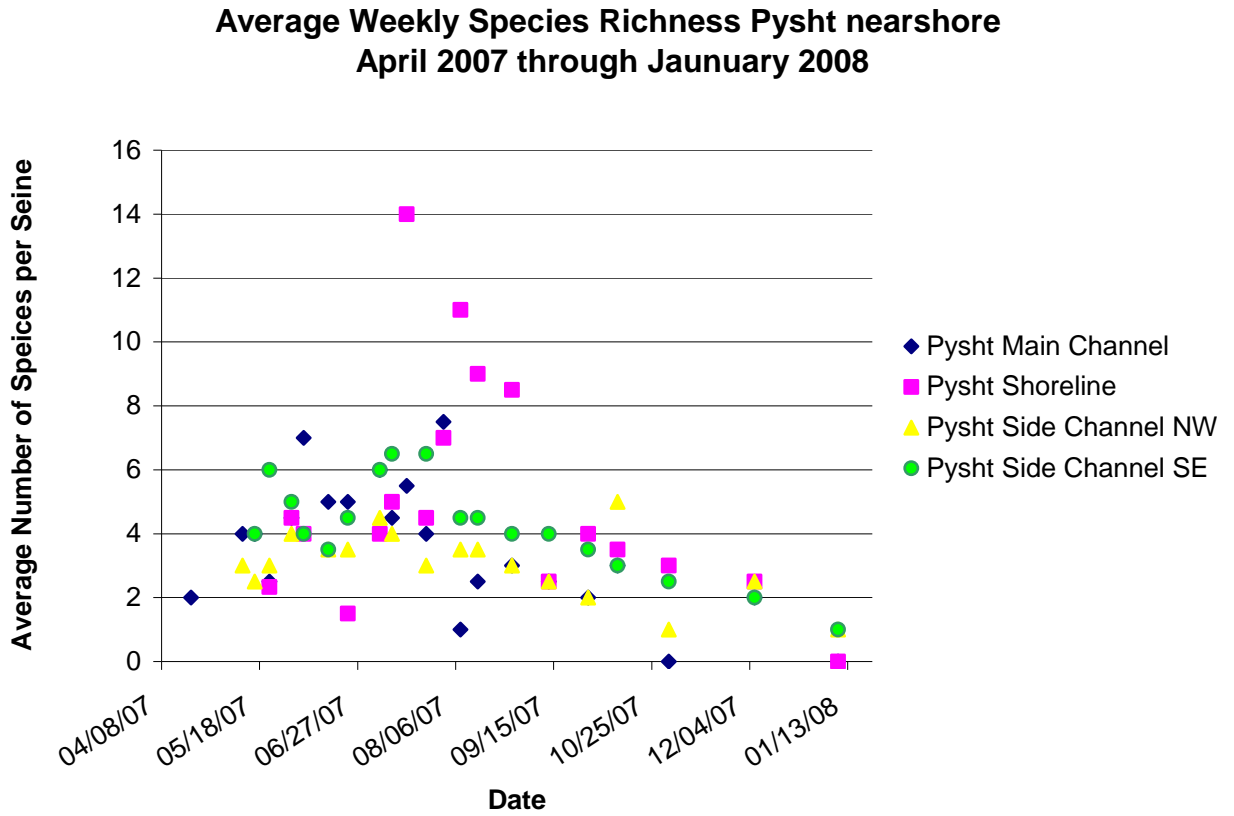


Figure 4.

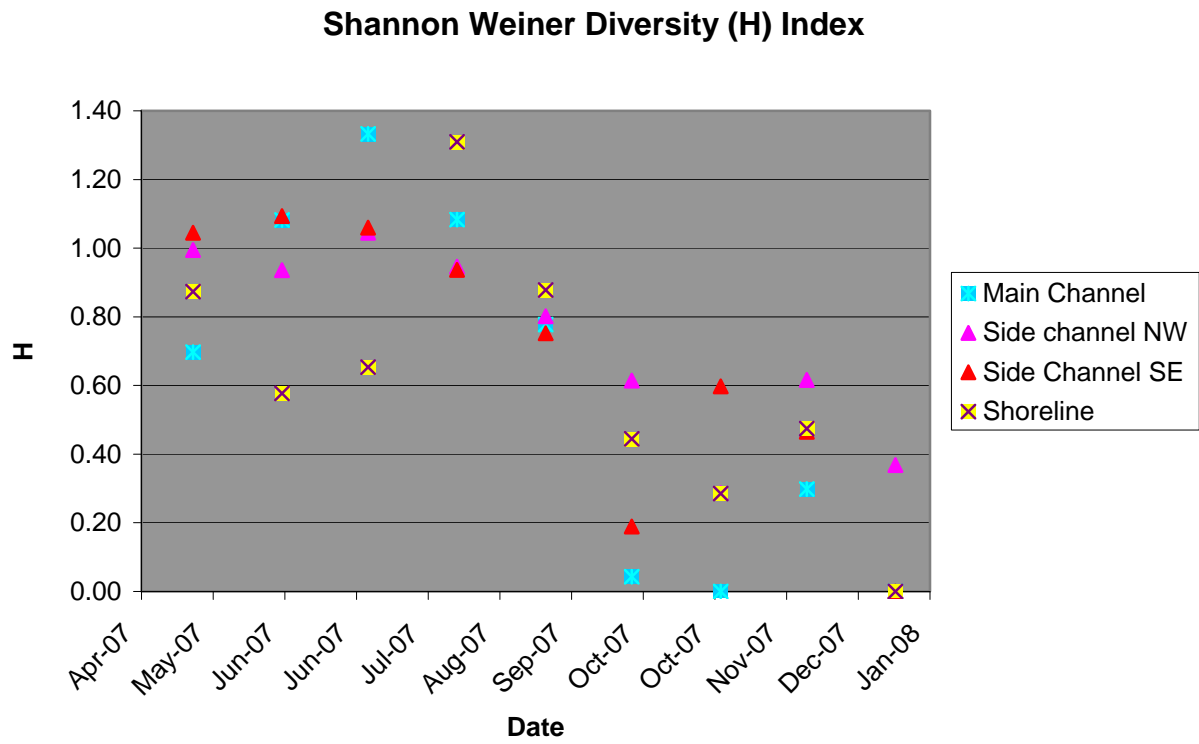


Figure 5.

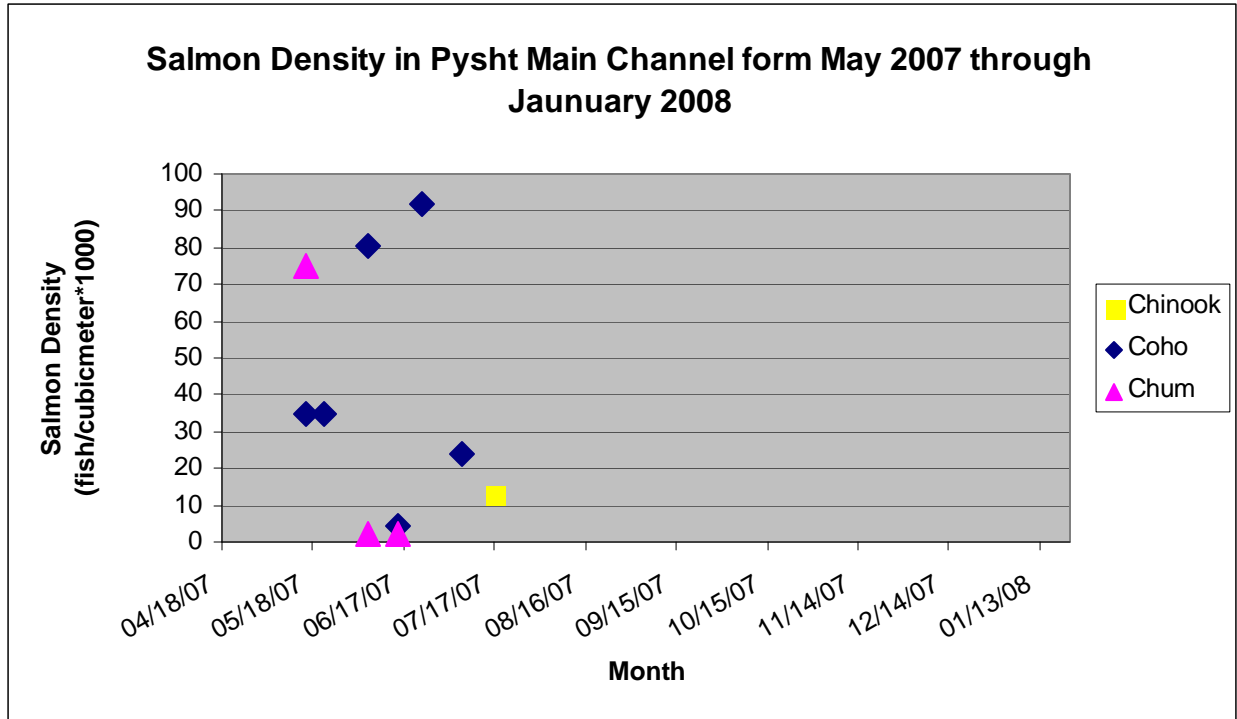


Figure 6.

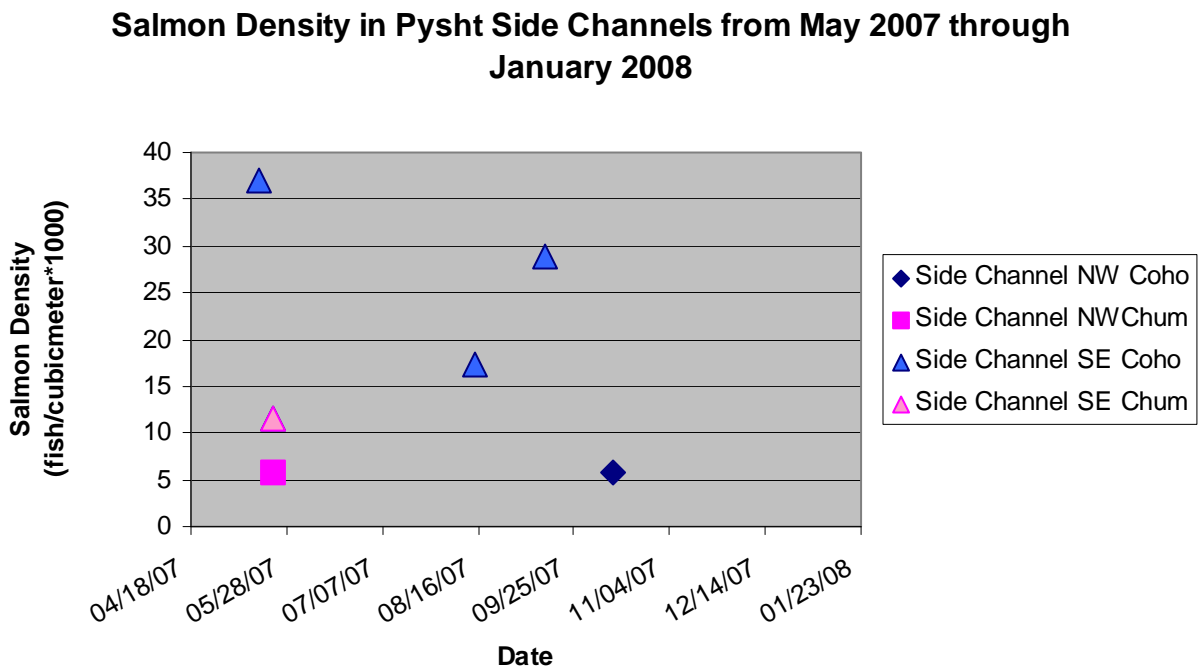


Figure 7

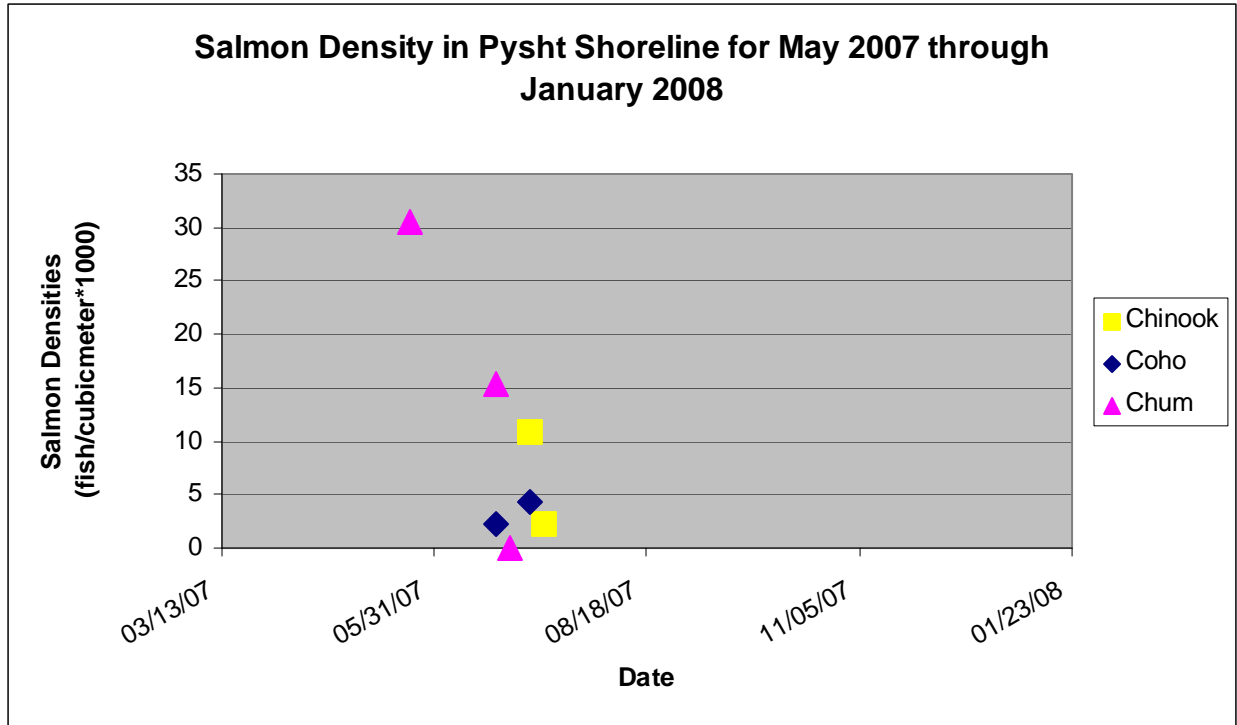


Figure 8.

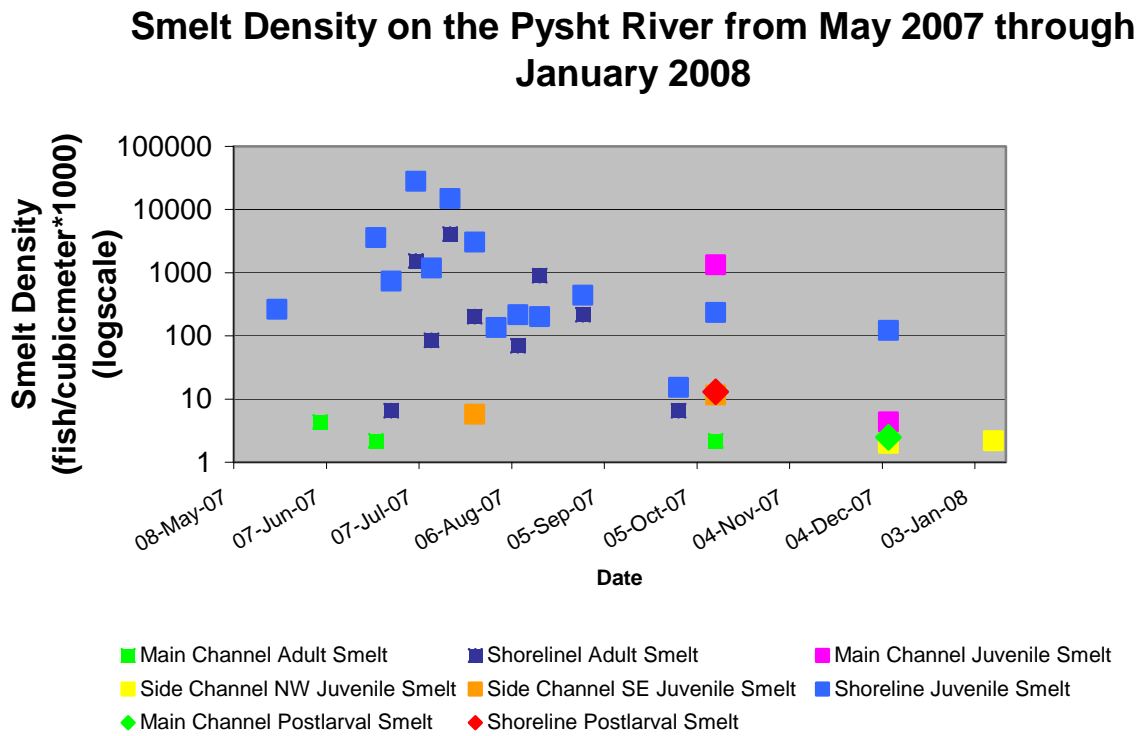


Figure 10.

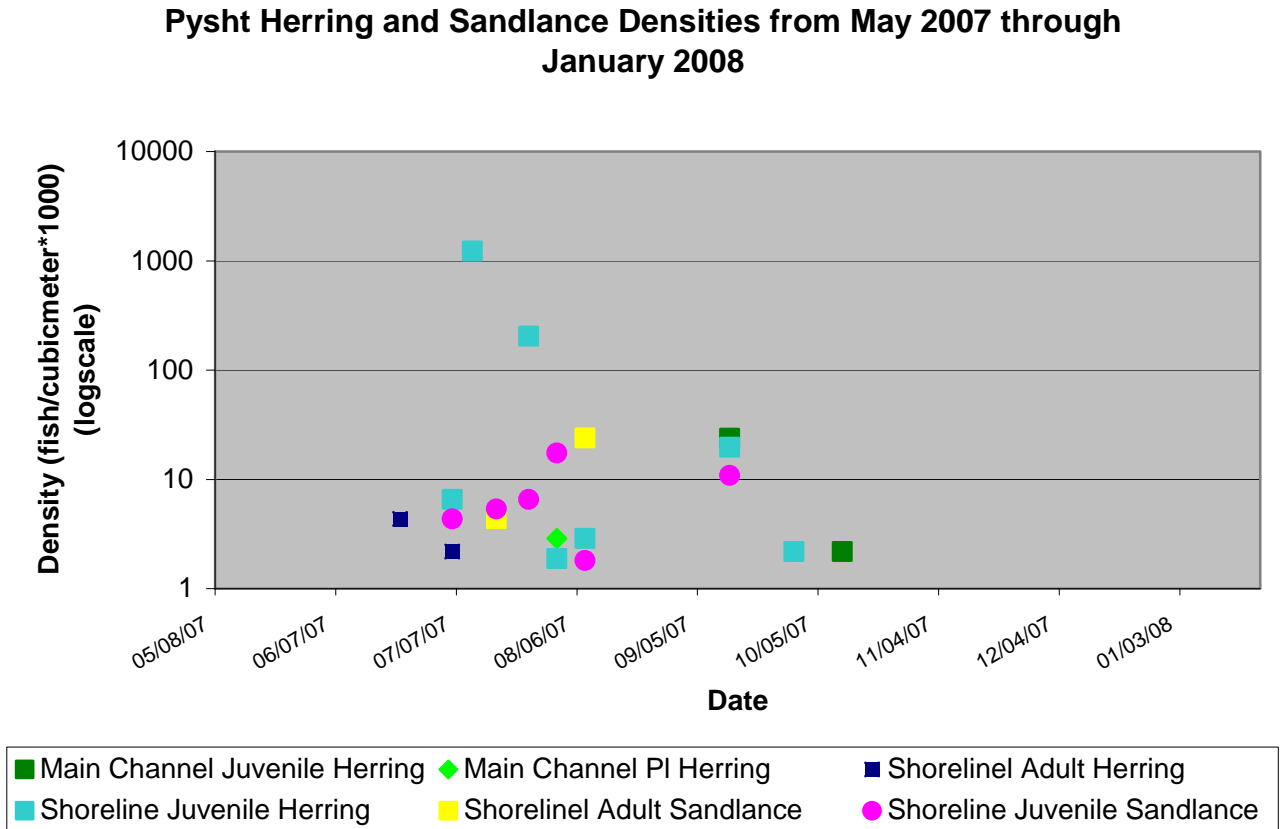


Figure 11.

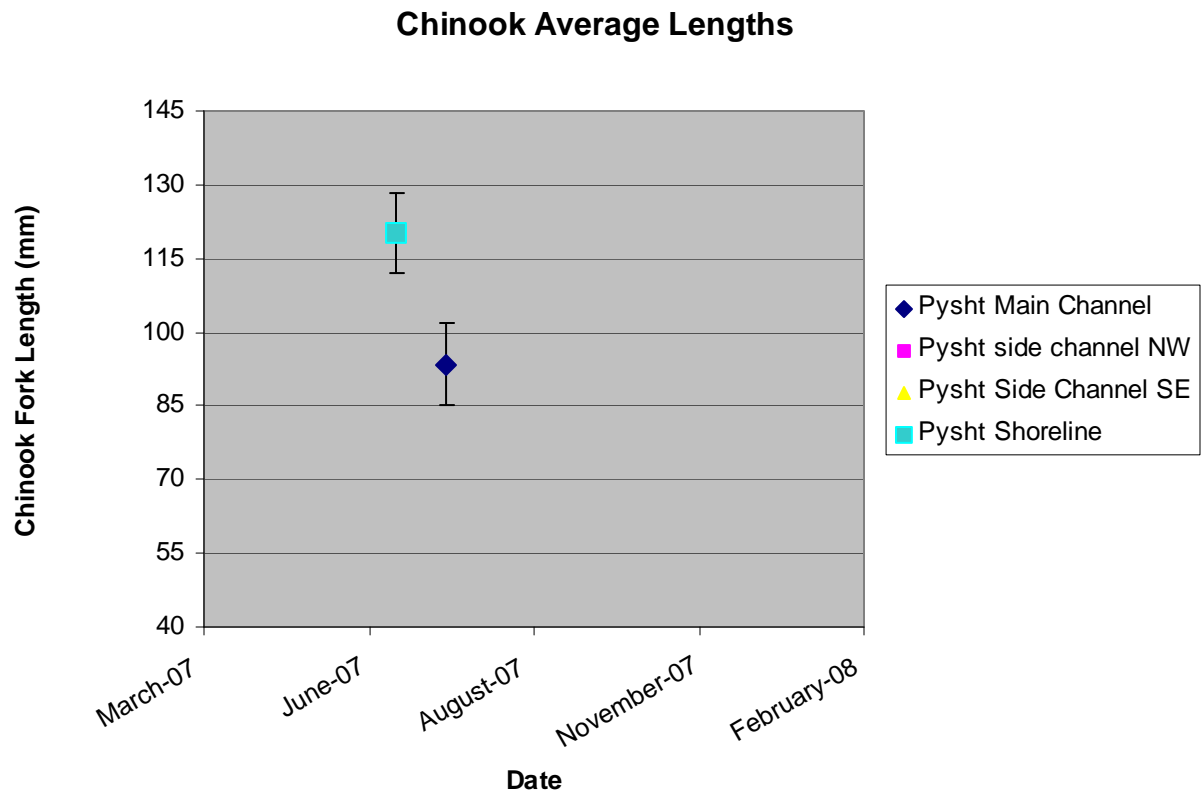


Figure 12.

**Coho Average Lengths from March 2007 through January 2008**

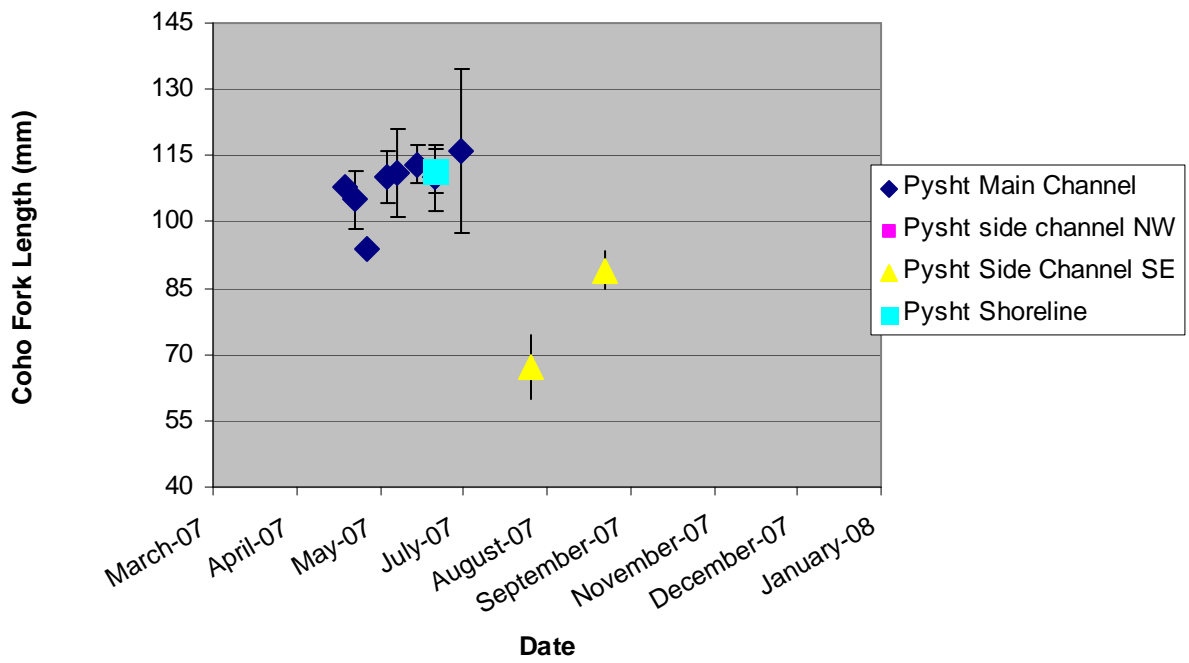


Figure 13

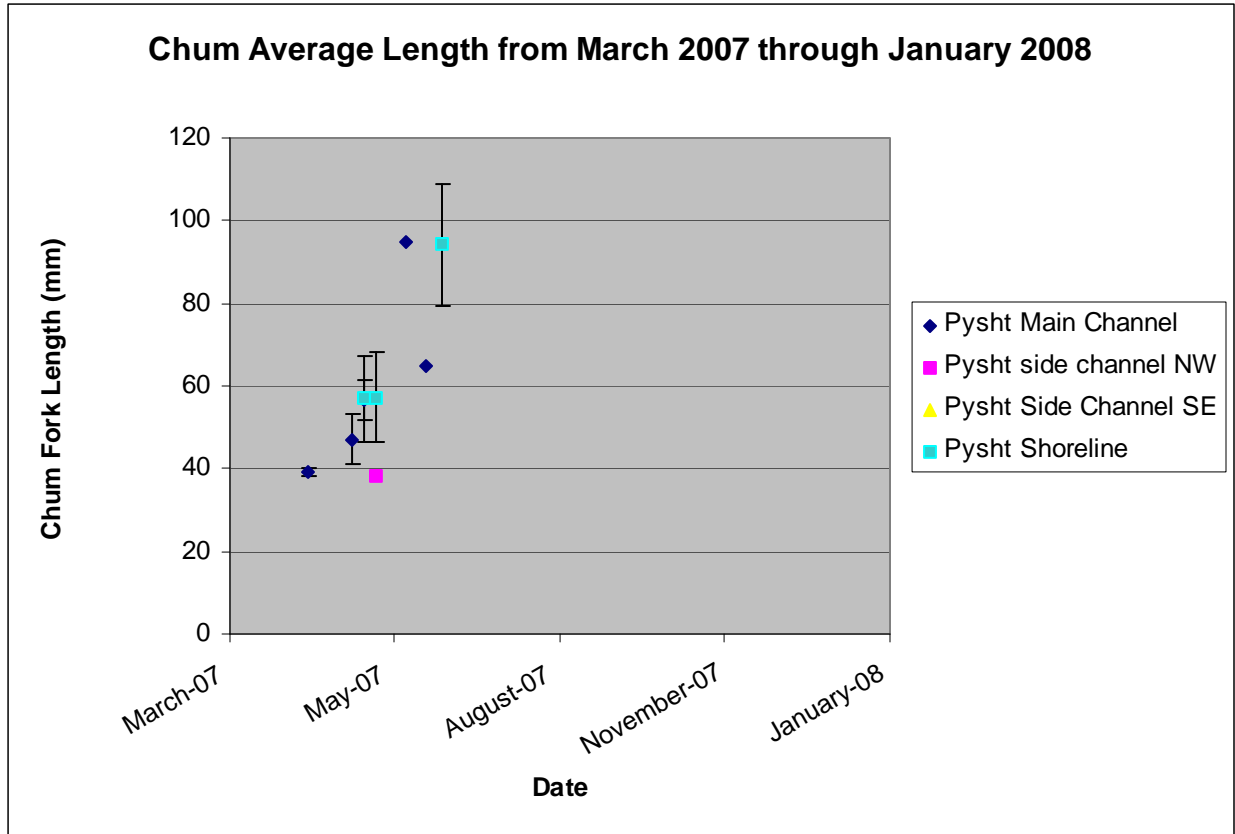


Figure 14.

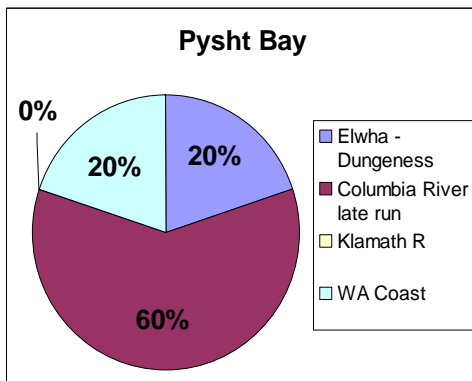


Figure 15.

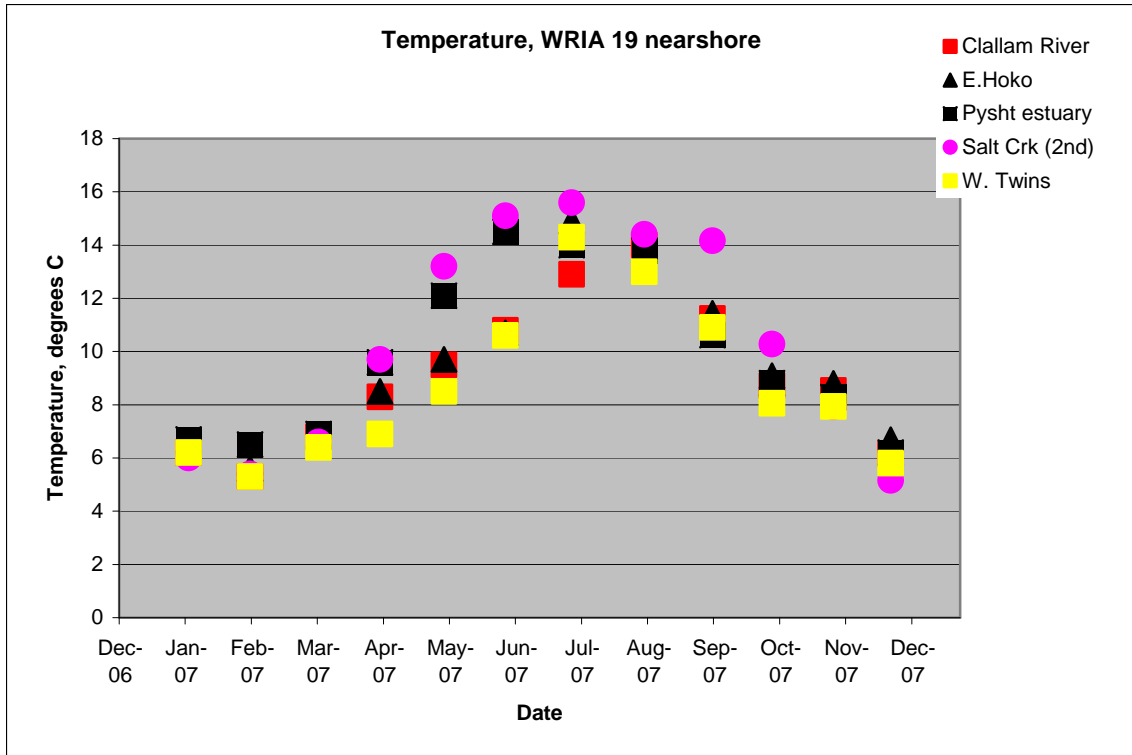


Figure 16

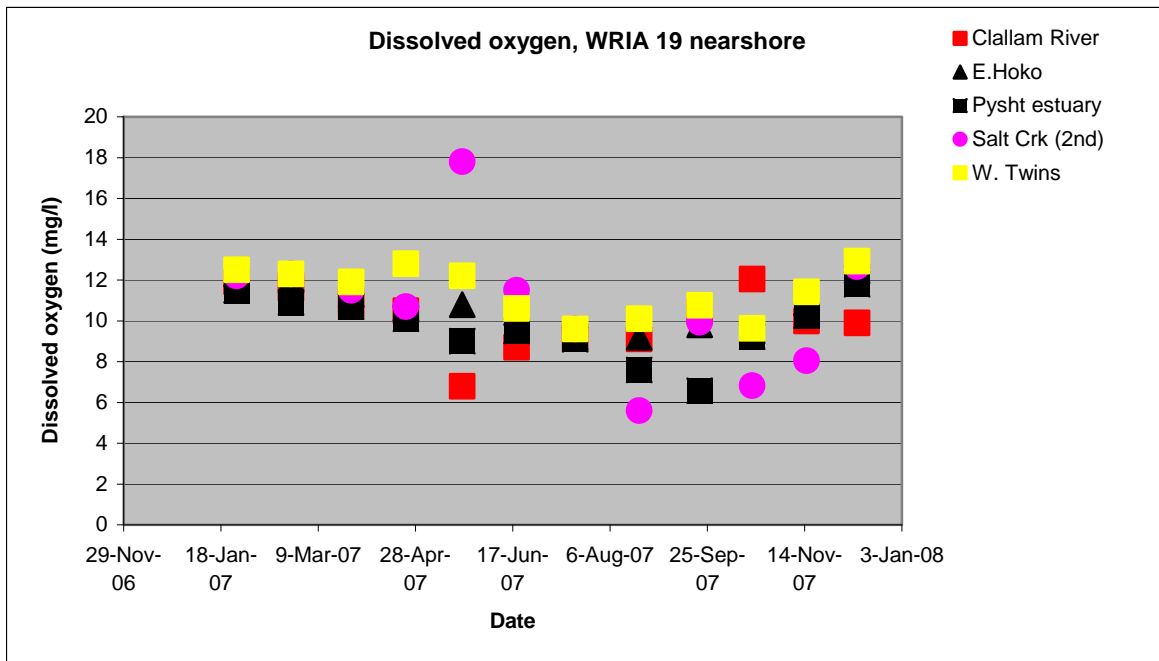


Figure 17.

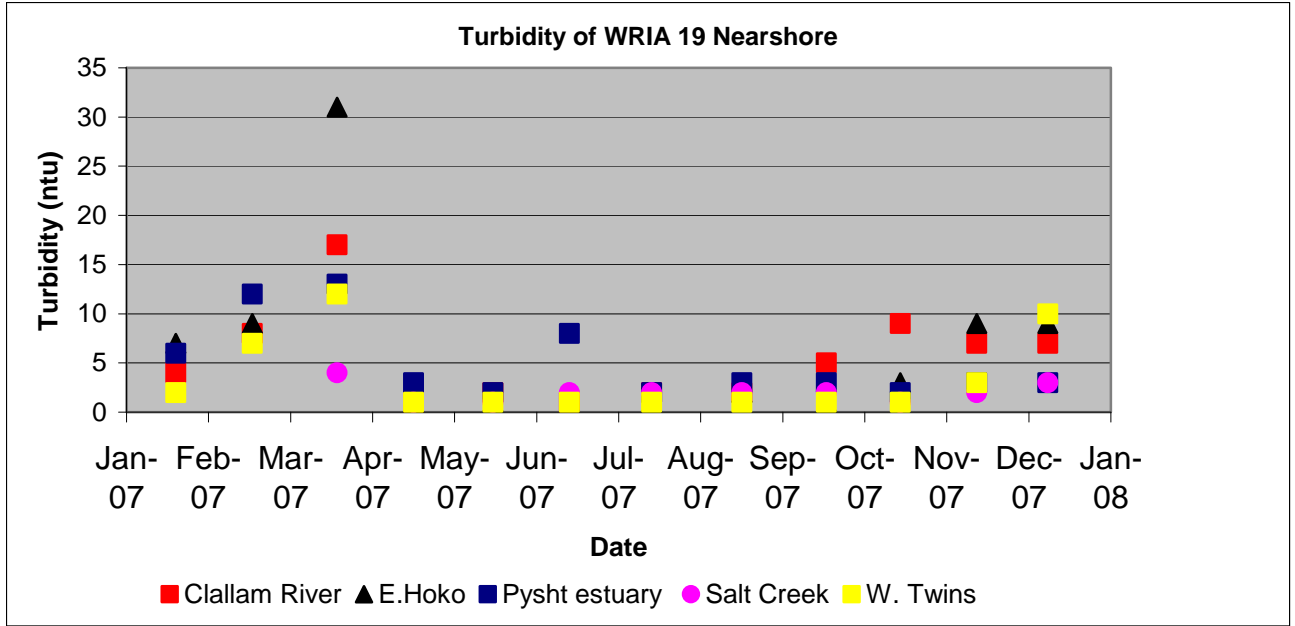


Figure 18

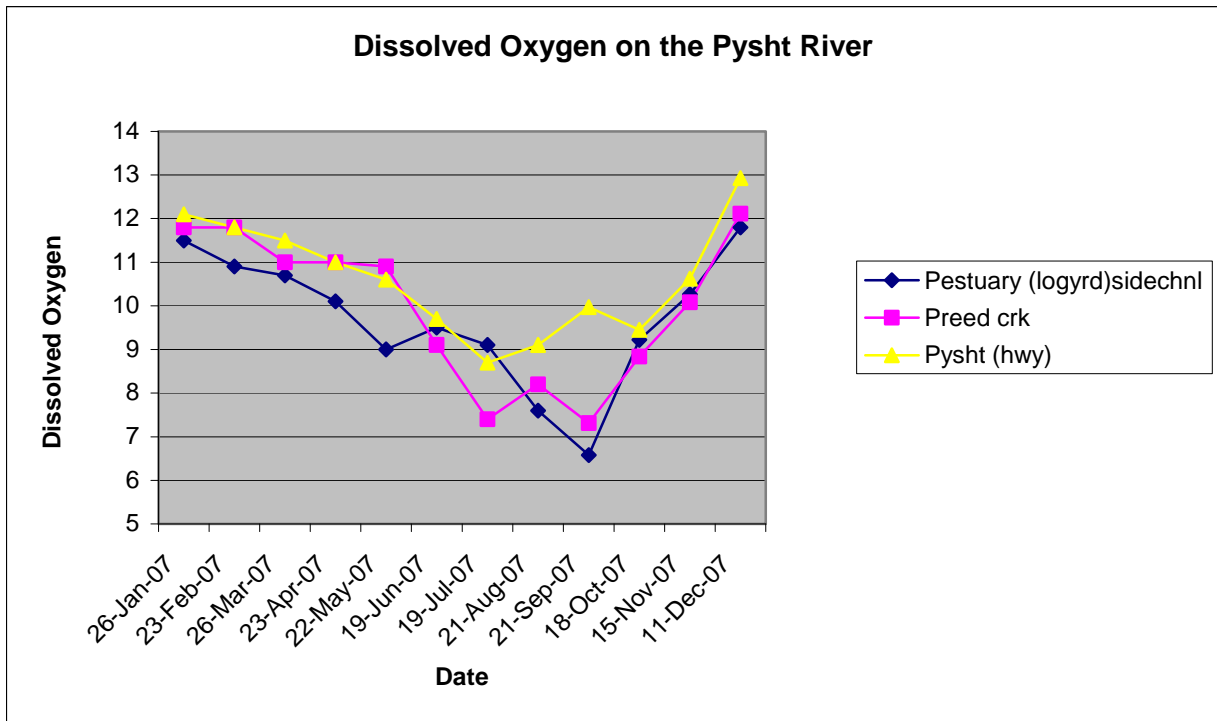


Figure 19.

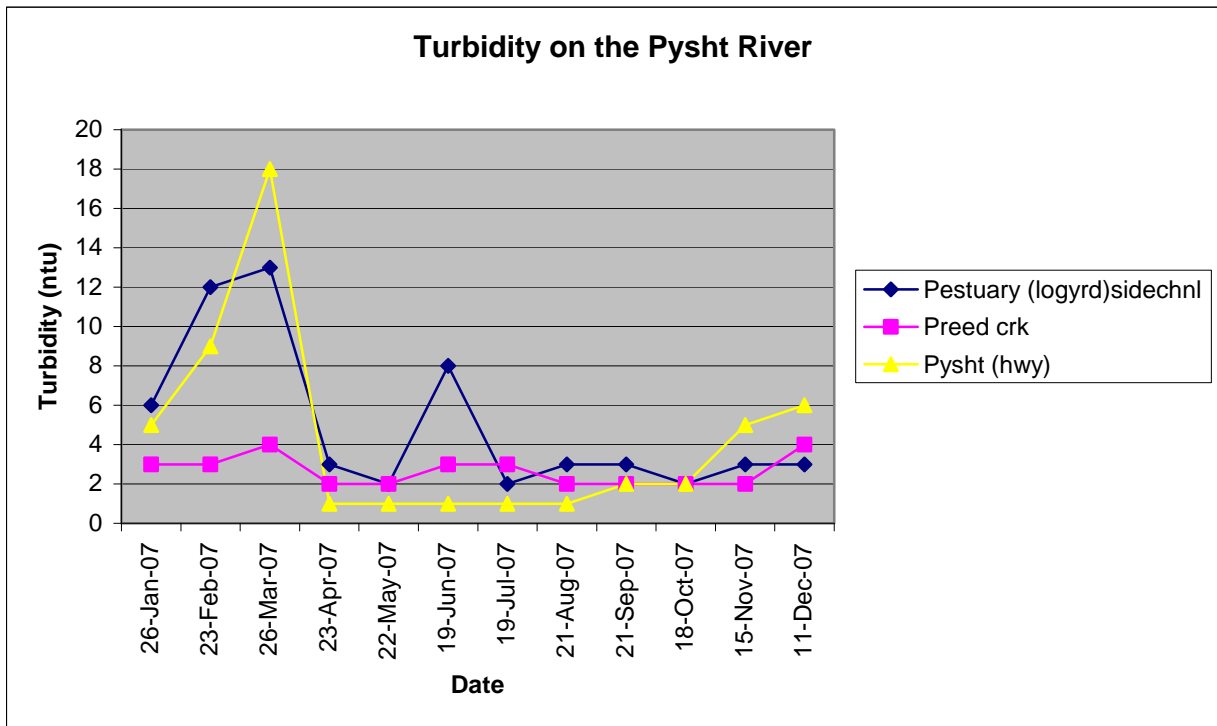


Figure 20

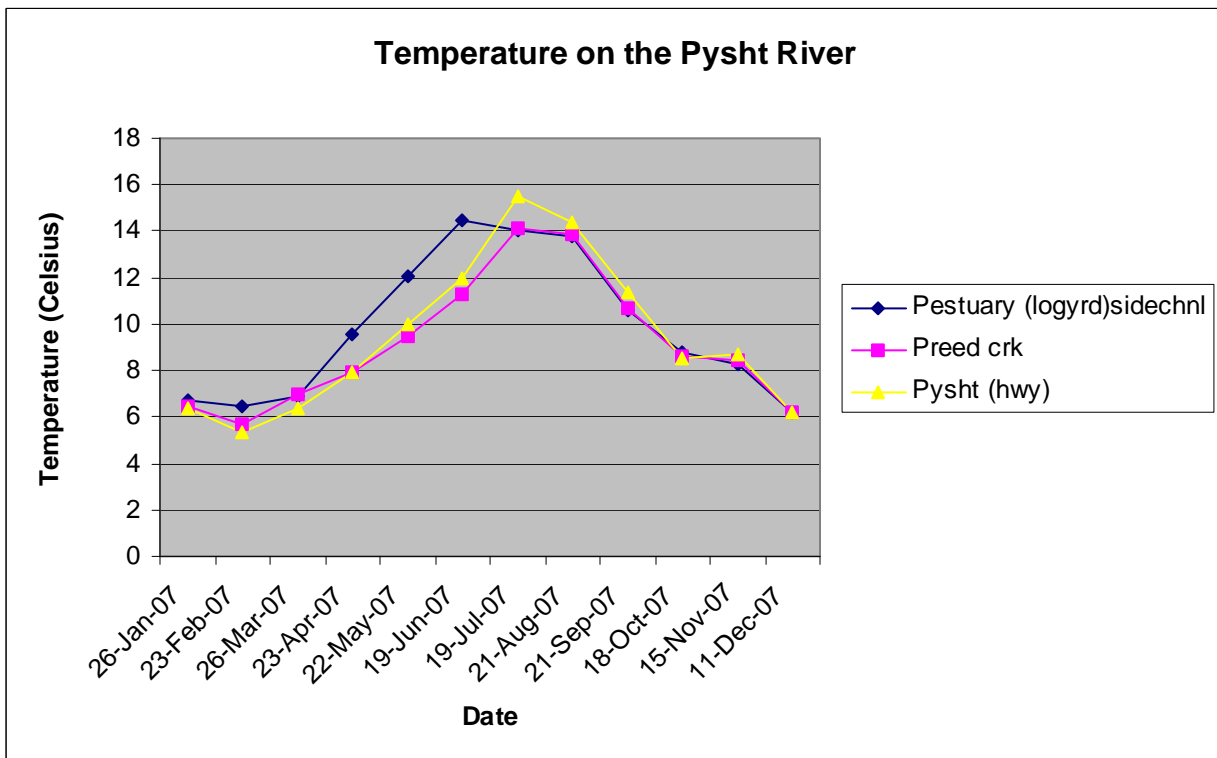


Figure 21

Appendix 1. Raw data for seining Pysht nearshore 2007-08.