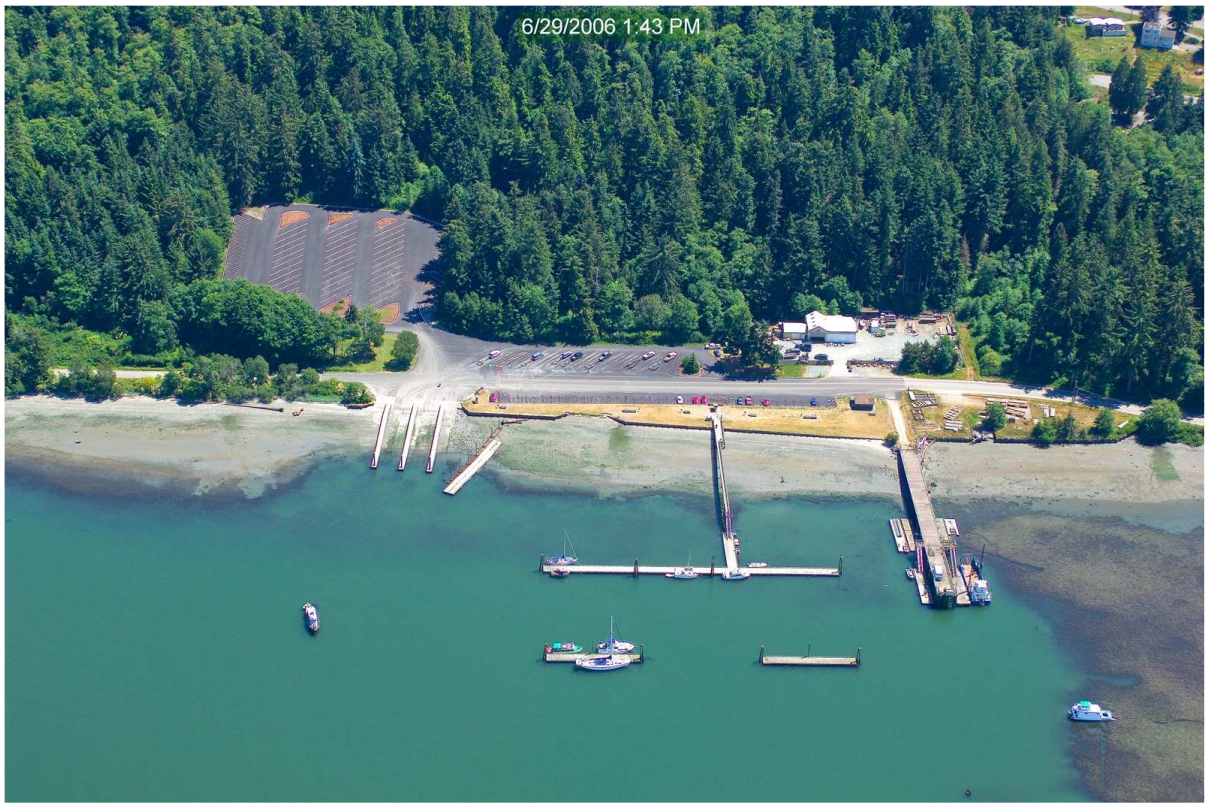
JUVENILE SALMON AND NEARSHORE FISH USE IN SHALLOW INTERTIDAL HABITAT ASSOCIATED WITH CORNET BAY, 2011

March 2012



2006 oblique aerial photo of Cornet Bay (courtesy WA Department of Ecology)

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- Cornet Bay Nearshore Restoration project partners: Island County Marine Resources Committee, Northwest Straits Foundation and Washington State Parks
- Cornet Bay Nearshore Restoration project funders: National Fish and Wildlife Foundation, Northwest Straits Commission, Salmon Recovery Funding Board, U.S. Fish and Wildlife Service, City of Oak Harbor
- The format of this report is based on a template developed by Skagit River System Cooperative staff for other juvenile salmon seining projects.

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PURPOSE

The WSU Island County Beach Watchers are working collaboratively with the Island County Marine Resources Committee and Washington State Parks. Collecting data about juvenile salmonid use of the nearshore at Cornet Bay is a part of the characterization process of the bay prior to nearshore habitat enhancement projects that are occurring at this location. The focus of this report is on fish abundance and size in Cornet Bay in 2011. This report is meant to inform local citizens and Cornet Bay project partners about fish populations currently using the Cornet Bay area.

The use of beach seining techniques to understand juvenile salmon utilization of coastal lagoon habitats and adjacent beach sites started in Island County in 2002 with research focused on juvenile Chinook at sites in Skagit Bay (Beamer et al. 2003). Since then a number of studies have utilized this technique to assess nearshore fish use throughout Island County. The Beach Watchers have been a part of these research efforts since 2005 (Beamer et al. 2006, Beamer 2007, Beamer et al. 2007, Henderson et al. 2007, Kagley et al. 2007, Beamer et al. 2011).

STUDY AREA

Cornet Bay is located on the northern shoreline of Whidbey Island, in Deception Pass (Figure 1). This bay is located behind Ben Ure Island on the south shoreline of Deception Pass. The shoreline has been developed with boating and other recreational facilities; a road along the shoreline; and residences.

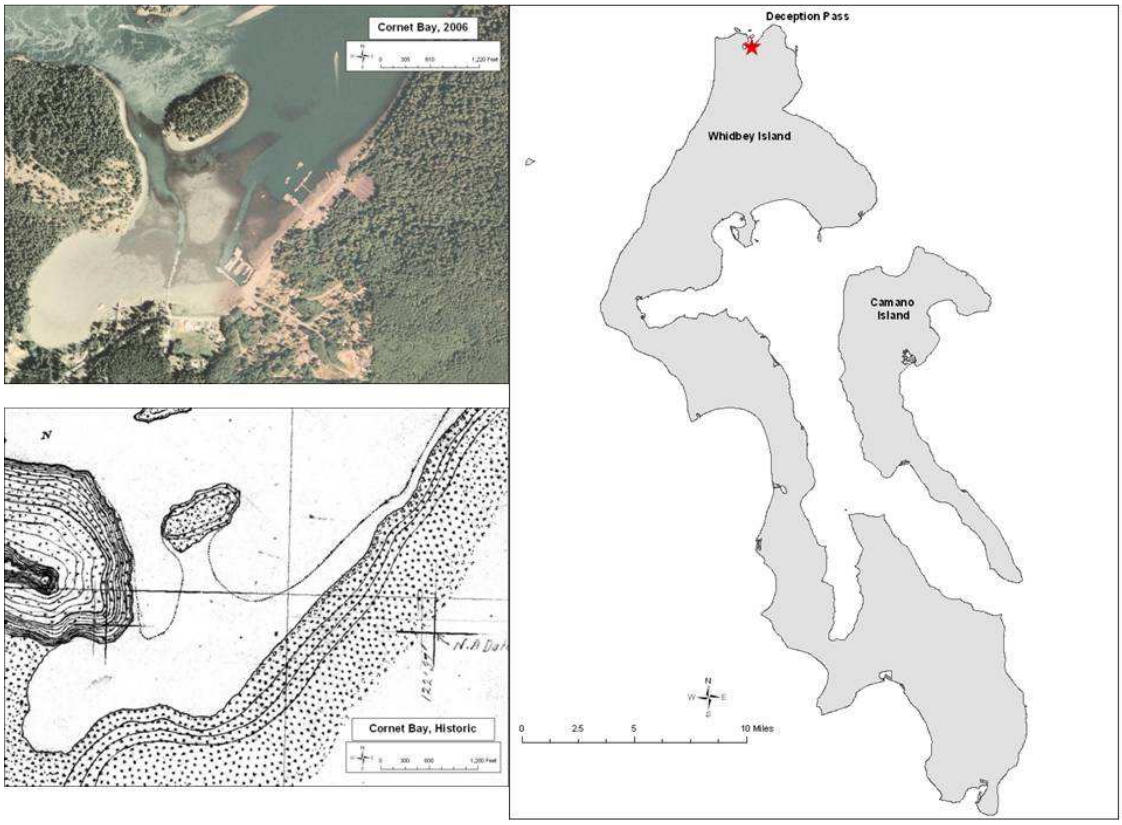

Figure 1. Location of Cornet Bay on north Whidbey Island, along with contemporary (2006) and historic views of the site. The 2006 view is from an aerial photo, National Agriculture Imagery Program. The historic view is from the T-sheet (U.S. Coast and Geodetic Survey), available at the Puget Sound River History Project (http://riverhistory.ess.washington.edu).

METHODS

Nearshore areas like Cornet Bay and its vicinity can potentially have many different local-scale habitat types based on variations in water depth, aquatic vegetation, substrate, protection from wave energy, and freshwater inputs (creeks or seeps). The illustration of these different habitats is from Skagit River System Cooperative and provides a conceptual nearshore beach cross-section that includes a lagoon impoundment behind a spit beach (Figure 2). For this study, small beach seines were used to sample for fish in shallow intertidal areas within the bay.

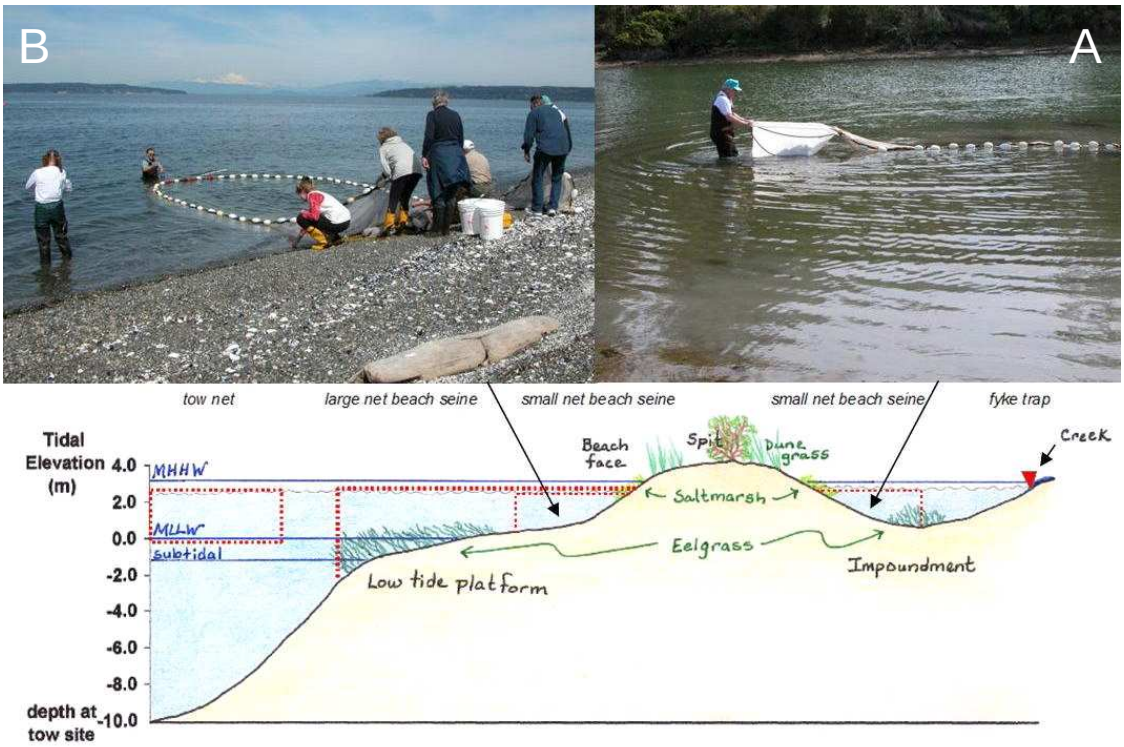

Figure 2. WSU Beach Watcher volunteers working with NOAA staff to beach seine sites at Harrington Lagoon. The diagram is a cross-sectional view of a nearshore beach that includes a coastal lagoon. The red dotted lines illustrate the relative difference in depth, cross-sectional area of the water column, and position along the nearshore continuum that each gear type effectively samples. The different gear types are labeled directly above the red dotted lines. The two photos are of small net beach seine sets at Harrington Lagoon. This study did not sample any deeper nearshore or offshore habitat adjacent to the Cornet Bay beaches. (Skagit River System Cooperative)

This study focused on only one of five habitat types shown in Figure 2 (briefly described above), the beach face. These sites were sampled on eight days about two weeks apart, from mid-February through June, using a small beach seine. The study did not sample the deeper intertidal-subtidal fringe habitats with larger beach seines or offshore habitat with tow nets. No tidal creeks or blind tidal channels are present within Cornet Bay, so use of fyke traps was not necessary.

The specific beach seine locations are shown in Figure 3. The areas seined are typically less than four feet deep (1.2 m), and have relatively homogeneous habitat features (water depth, velocity, substrate, and vegetation). Small net beach seine methodology uses an 80-foot (24.4 m) by 6-foot (1.8 m) by 1/8-inch (0.3 cm) mesh knotless nylon net (SSC Research Department, 2003). The net is set in "round haul" fashion by fixing one end of the net on the beach while the other end is deployed

by wading "upstream" against the water current (if present), hauling the net in a floating tote (Figure 2A), and then returning to the shoreline in a half circle. Both ends of the net are then retrieved (Figure 2B), yielding a catch. One beach seine set was made at each site per sampling day. Average beach seine set area is 96 square meters.

For each beach seine set, we identified and counted the catch by species. Fork length was recorded on the first 20 of each species. We recorded the time and date of each beach seine set and measured several physical habitat parameters associated with each set, including water temperature, salinity and dissolved oxygen using a YSI meter.

Beach seine sites were along the Cornet Bay shoreline (Figure 3). The sampling sites were selected to compare the fish community, including juvenile salmon, at different sites along the Deception Pass State Park Day Use Area of Cornet Bay that is used for recreation and boating. Six sites (#4-9) are along the modified shoreline west of the boat ramps and four (#1-3, 10) along the natural shoreline east of the boat ramps. In this report results are summarized for each sampling date.

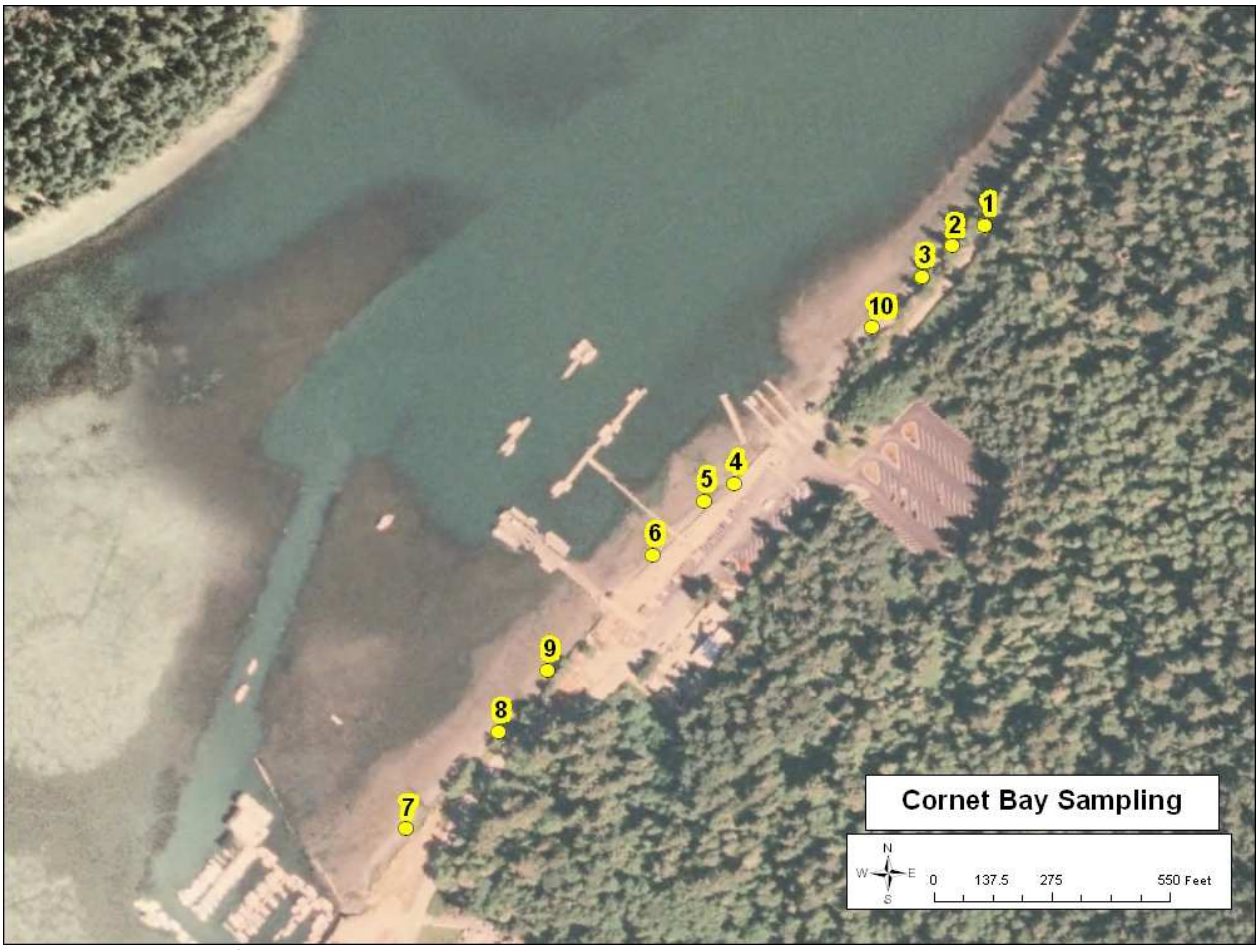

Figure 3. Location of beach seine sites at Cornet Bay, 2011. Yellow circles represent sampling sites. Beach seining was always done at the water's edge, independent of tidal stage.

RESULTS AND DISCUSSION

Beach Seine Effort

The Cornet Bay sampling effort in 2011 consisted of 80 beach seine sets made during the February through June time period (Table 1).

Table 1. Summary of beach seine effort (number of sets) at Cornet Bay, 2011.

Sampling effort (number of beach seine sets)	
Month	Seine Sets
February	10
March	10[1]
April	20
May	20
June	20
Total	80

Environmental Conditions During Beach Seine Sampling

Tidal Stage and Water Depth, and Substrate

The majority of beach seine sampling occurred at depths slightly shallower than one meter of water (Table 2). Sampling dates were selected for tides that fell between +9 and +5. If sites 4-9 were not seined before the tide fell to +5 the substrate was too soft to walk in safely.

Data sheet notations of substrate type (i.e., gravel, mixed coarse, mixed fines, mud) were inconsistent and did not accurately portray the variation in substrate conditions that the seining crew experienced along the natural and altered shoreline, so they are not used. Substrate surveys will begin in 2012.

Table 2. Water depth during beach seine sampling at Cornet Bay sites in 2011.

Depth of beach area seined	
	Depth
Maximum	1.1 meters
Minimum	0.3 meters
Average and 1 standard deviation (in parentheses)	0.9 (0.2) meters

Temperature, Salinity, and Dissolved Oxygen

Monthly patterns of salinity, water temperature, and dissolved oxygen in Cornet Bay are shown in Figures 4A, 4B, and 4C. Skagit River flow, which accounts for the majority of freshwater influencing Deception Pass, is shown in Figure 4D. The salinity, temperature and dissolved oxygen measurements are spot measures taken during the time of beach seining and are not a continuously measured record.

In 2011 the minimum salinity measured was 24.7 ppt and the maximum was 29.37 ppt. In the 2009 seining season, higher Skagit River flows appeared correlated with lower salinities at Cornet Bay sites, but this pattern was not reflected in the spot measures for 2010 or 2011 (compare Figure 4A with Figure 4D). Likely two spot measures a month are insufficient for determining whether the monthly pattern of salinity for Cornet Bay varies as a function of overall Whidbey Basin salinity, which is strongly influenced by the major rivers flowing into the Whidbey Basin.

[1] One March seining had to be canceled due to tsunami cautions after an earthquake in Japan.

Water temperature in the Cornet Bay nearshore shows a seasonal increase from March through June (Figure 4B). Minimum water temperature was 7.4 degrees Celsius and the maximum was 10.3 degrees Celsius. Dissolved oxygen fluctuated between 7.0 mg/L and 8.1 mg/L (Figure 4C).

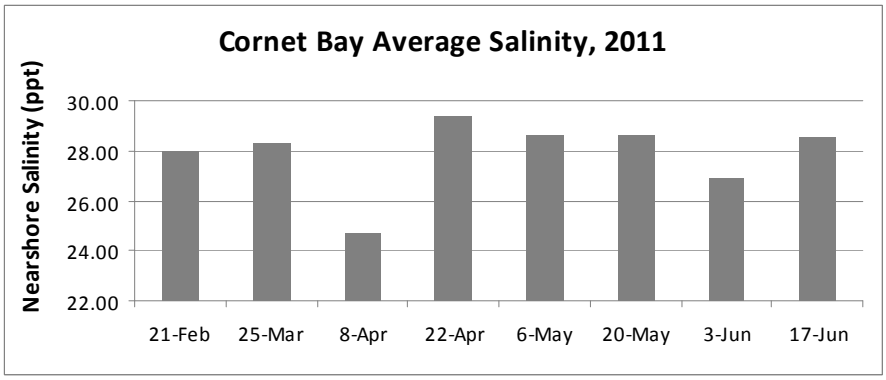

Figure 4A. Average salinity at Cornet Bay beach seine sites during the time of beach seining in 2011.

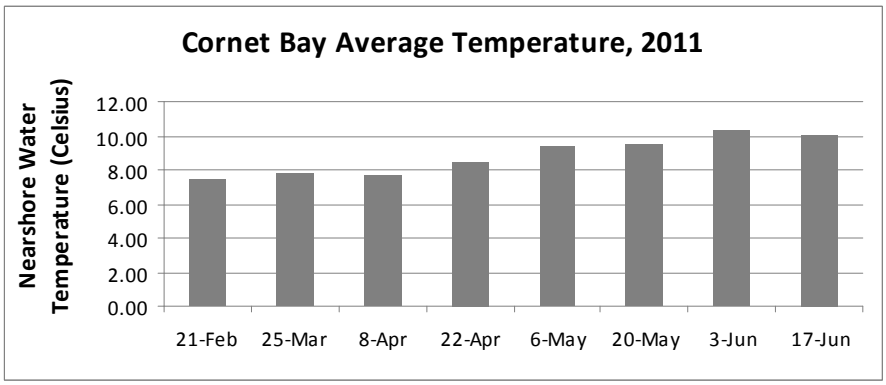

Figure 4B. Average temperature at Cornet Bay beach seine sites during the time of beach seining in 2011.

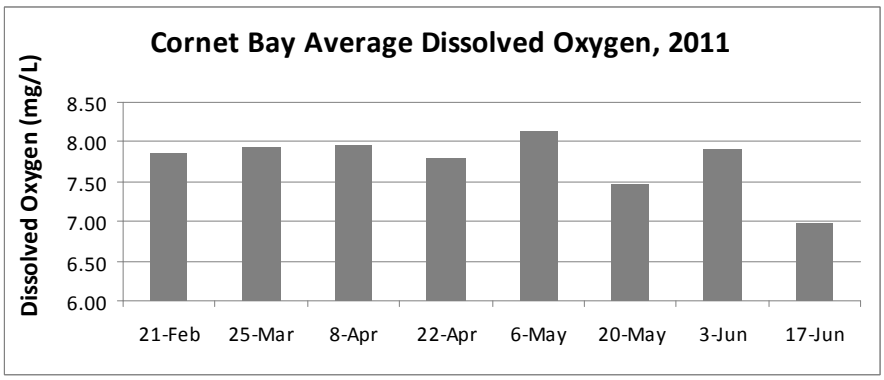

Figure 4C. Average dissolved oxygen at Cornet Bay beach seine sites during the time of beach seining in 2011.

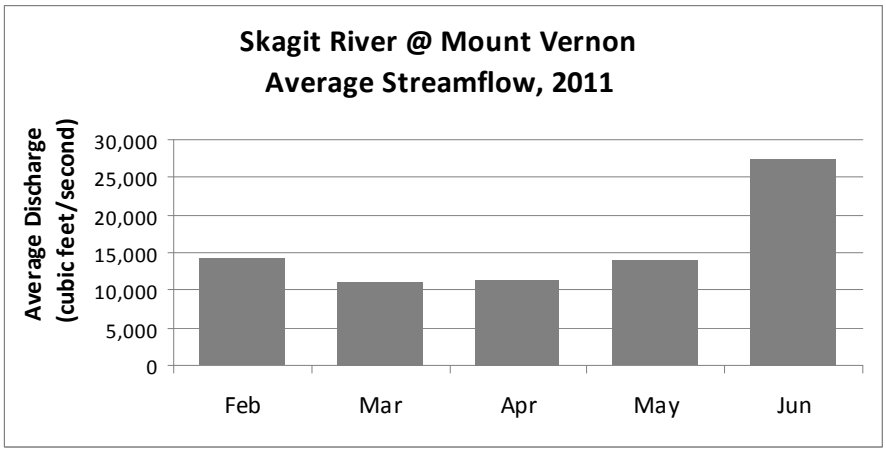

Figure 4D. Monthly average streamflow of the Skagit River at Mount Vernon for 2011.

Catch by Species

We caught over 8,260 fish representing at least 14 different species during the sampling period February through June, 2011 (Tables 3 and 4). Although all species in Table 4 were identified on one or more occasions, accuracy of identification of sculpin, gunnel and flatfish species was variable depending on the knowledge of the crew and the intensity of the catch on any given day. Therefore for quantitative analysis they are combined under unidentified sculpins, gunnels and flatfish.

Juvenile salmon represented 92.7% of the total catch. The juvenile salmon catch was dominated by chum (over 7,600), but included 31 Chinook salmon. No other salmonid species were caught.

Sculpins, primarily Pacific staghorns, accounted for 6.2% of the total catch. The other 1.1% of the catch included flatfish, greenling, surf smelt, snake prickleback, gunnels, threespine stickleback shiner perch, and cutthroat.

Table 3. Total fish catch (and mean catch per beach seine set in parentheses) by fish species at Cornet Bay sites in 2011.

Fish species	***Nearshore Catch***	
Juvenile salmon:		
Chum salmon *Oncorhynchus keta*	7,625	(95.31)
Chinook salmon *Oncorhynchus tshawytscha*	31	(0.39)
Total juvenile salmon	**7,656**	
Trout species		
Cutthroat trout *Oncorhynchus clarkii*	1	(0.01)
Sculpin species:		
Unspecified sculpin	509	(6.36)
Flatfish species:		
Unspecified flatfish	39	(0.49)
Forage fish species:		
Pacific herring *Clupea pallasii*	0	
Surf smelt *Hypomesus pretiosis*	14	(0.18)
Gunnel species:		
Unspecified gunnel	7	(0.09)
Other nearshore or estuarine fish species:		
Unidentified greenling	19	(0.24)
Threespine stickleback *Gasterosteus aculeatus*	4	(0.05)
Snake prickleback *Lumpenus sagitta*	9	(0.11)
Shiner perch *Cymatogaster aggregata*	2	(0.03)
Total catch	**8,260**	**(103.25)**

Table 4. Fish species captured in 2011.

Fish Species
Chum salmon *Oncorhynchus keta*
Chinook salmon *Oncorhynchus tshawytscha*
Cutthroat trout *Oncorhynchus clarkii*
Pacific staghorn sculpin *Leptocottus armatus*
Great sculpin *Myoxocephalus polyacanthocephalus*
Sharpnose sculpin *Clinocottus acuticeps*
Starry flounder *Platichtys stellatus*
Surf smelt, postnatal *Hypomesus pretiosis*
Saddleback gunnel *Pholis ornate*
Crescent gunnel *Pholis laeta*
Unidentified greenling
Threespine stickleback *Gasterosteus aculeatus*
Snake prickleback *Lumpenus sagitta*
Shiner perch *Cymatogaster aggregata*

This was the third year of sampling fish using shallow intertidal habitat at these sites in Cornet Bay. Salmon continue to make up the large majority of fish captured (Table 5).

Table 5. Summary of 2009-2011 fish seining at Cornet Bay.

	Number of days	Number of sets	Total catch	Chinook salmon	Chum salmon	Pink salmon	Other fish species	**% catch salmon**
2009	7	65	6,877	2	5,058	0	1,817	**74%**
2010	10	99	17,152	102	396	15,893	761	**95%**
2011	8	80	8,260	31	7,625	0	600	**93%**

Juvenile Salmon

In this section we discuss the timing, abundance, and size of juvenile salmon in Cornet Bay.

Chinook

Juvenile Chinook salmon were present in Cornet Bay from February to May (Figure 5). Among the 31 captured, 30 were measured. Fork length ranged from 40 mm to 92 mm, with an average of 52 mm (1 standard deviation 14).

Chum

Juvenile chum salmon were present in Cornet Bay from March into June. Peak chum salmon abundance occurred in April and May, with a high of 3,744 captured on 6 May. Of 7,625 captured, 684 were measured. Fork length ranged from 30 mm to 78 mm, with an average of 46 mm (1 standard deviation 7).

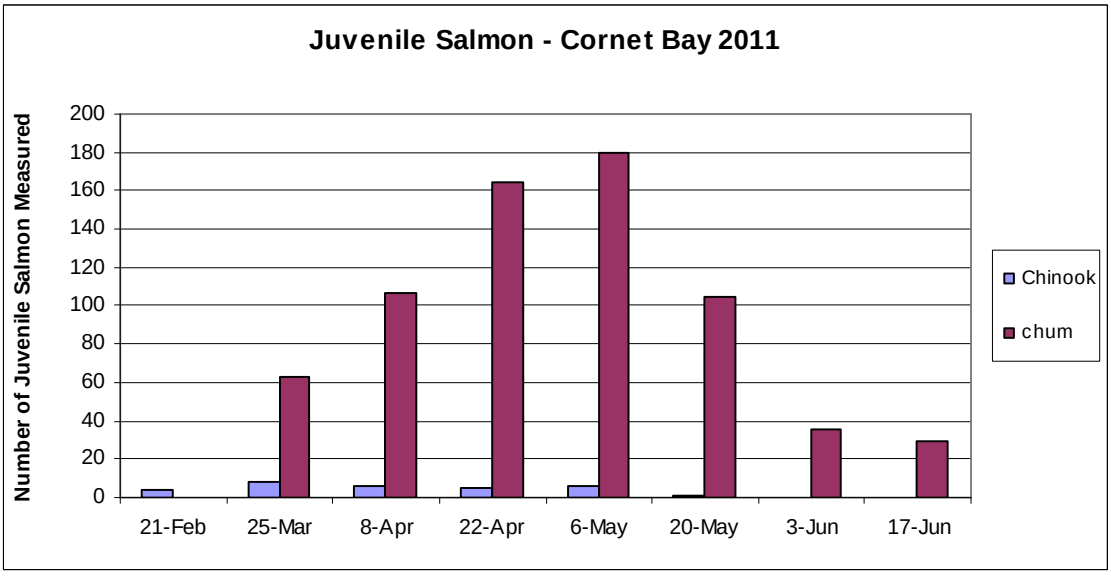

Figure 5. Number of juvenile salmon measured at Cornet Bay, 2010.

Fish Size

The size of juvenile salmon was characterized by measuring fork length on 30 Chinook and 684 chum caught at Cornet Bay sites (Figure 6). To compare them, we calculated mean fork length for each species on each sampling date. For Chinook, mean fork length ranged from 43 mm to 79 mm. Average fork length for chum was from 38 mm to 51 mm.

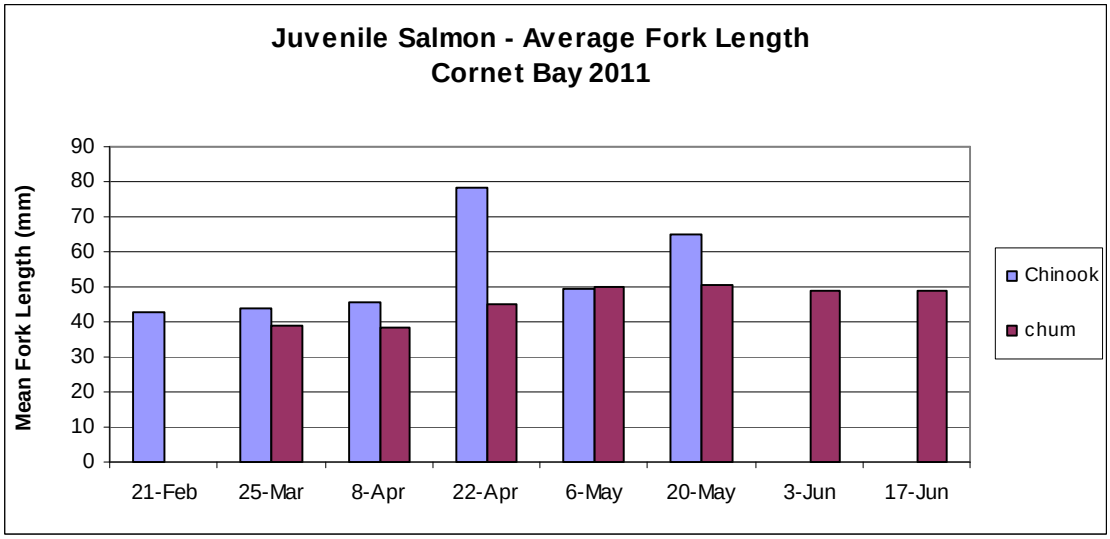

Figure 6. Average fork length of juvenile salmon measured at Cornet Bay, 2011.

Fish Community Composition

This section describes the fish community composition over the 2011 February through June sampling period in Cornet Bay. Together salmon and sculpin represented over 99% of the total catch. The other fish species that comprised less than 1% of the catch have been combined (Figure 7).

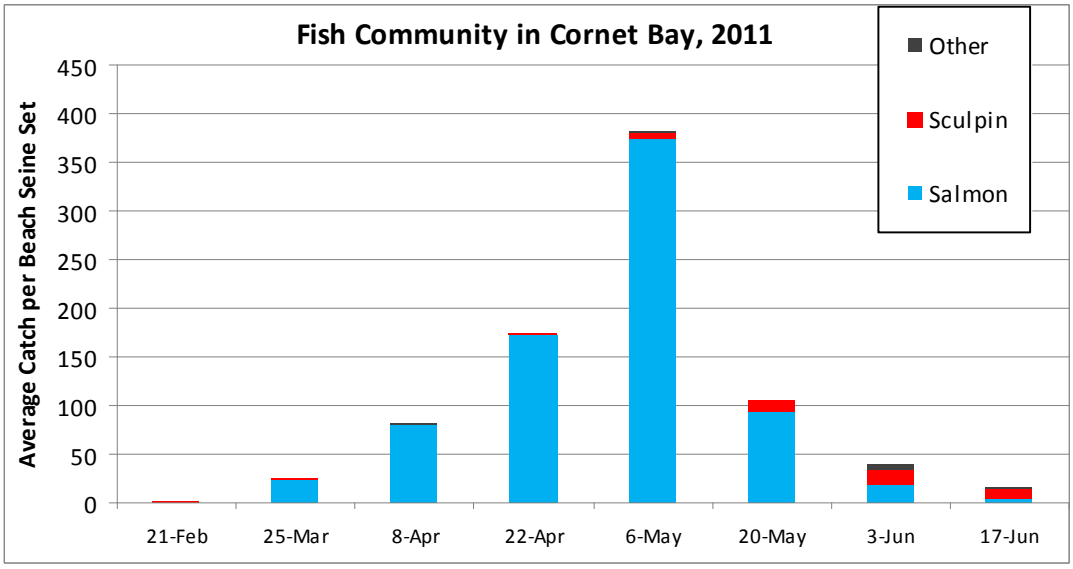

Figure 8. Fish Community and Relative Abundance in Cornet Bay, 2010.

For most of the season the fish community was dominated by juvenile salmon. The peak fish density was in mid-May and was driven by juvenile chum salmon (Figure 7). By June the fish community was dominated by other species, primarily sculpin.

Variation in Fish Catch Among Sites

We were interested in comparing the number of fish netted at each sample site to see whether there appear to be any differences in fish use among the ten netting sites. All fish captures at each site over the season were combined. In 2009 and 2010 the fewest fish were caught at the three western-most sites and the highest number of fish captures were at the sites along unmodified shoreline east of the boat launch (Figures 8A and 8B). This trend did not continue in 2011, when the numbers were more evenly dispersed and the highest number of fish captures were at site 9 west of the marine pier (Figure 8C).

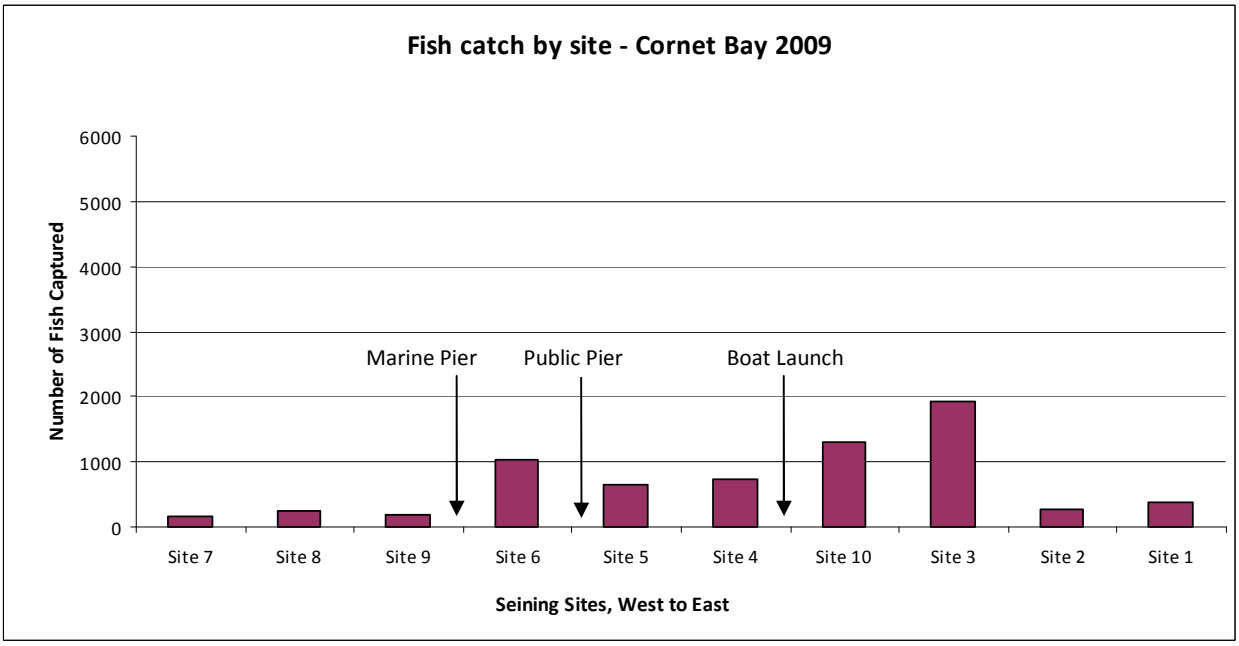

Figure 8A. Fish captures at each site in Cornet Bay, 2009.

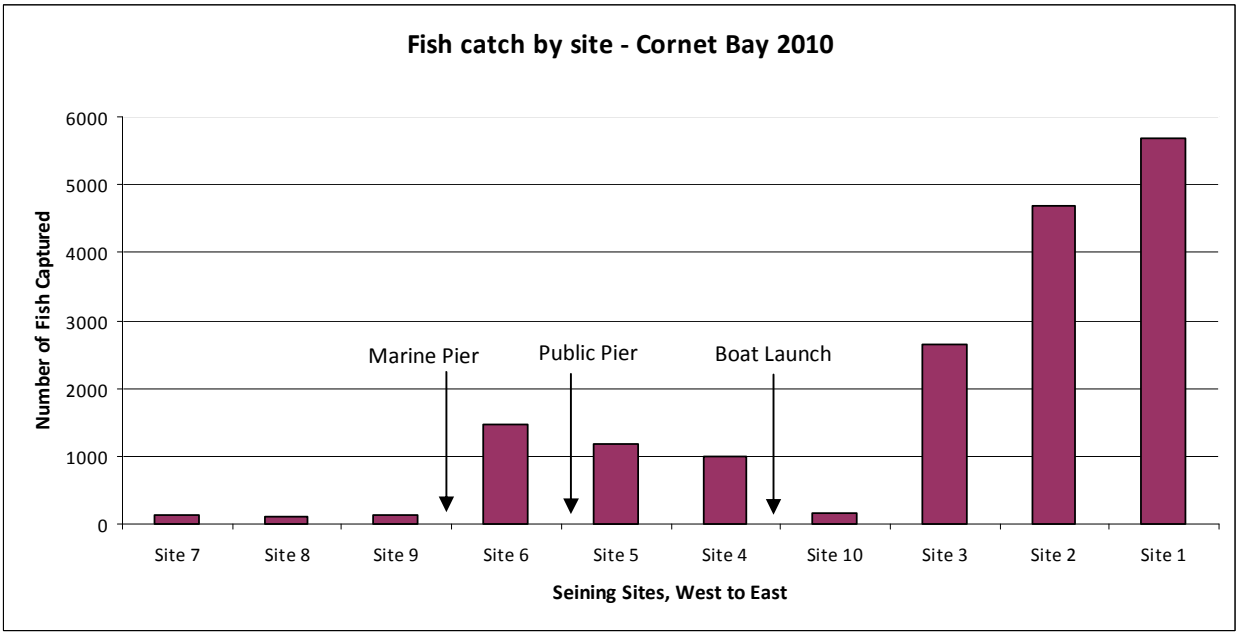

Figure 8B. Fish captures at each site in Cornet Bay, 2010.

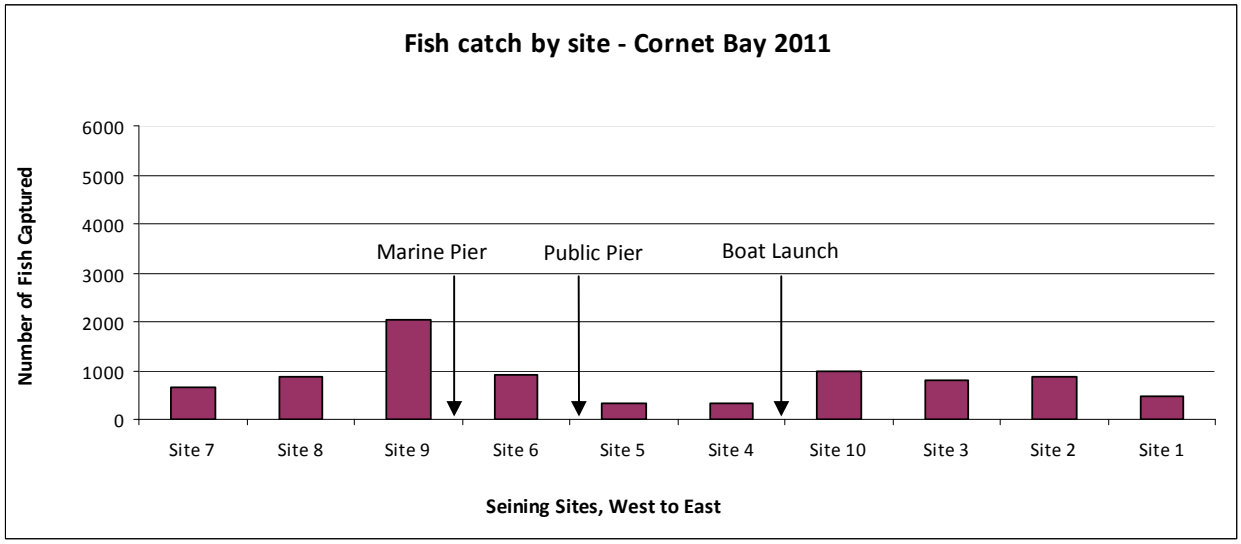

Figure 8C. Fish captures at each site in Cornet Bay, 2011.

Although these graphs are interesting, they cannot be used to draw conclusions about shoreline areas preferred by fish. Netting a single large school of fish can have a strong influence on the data.

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