JUVENILE SALMON AND NEARSHORE FISH USE IN SHALLOW INTERTIDAL HABITAT ASSOCIATED WITH CORNET BAY, 2009

June 2009

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

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- Cornet Bay project partners: Island County Marine Resources Committee and Washington State Parks
- The format of this report is based on the template developed by Skagit River System Cooperative staff for other juvenile salmon seining projects.

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PURPOSE

The 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 planned at this location. The focus of this report is on fish abundance and size in Cornet Bay in 2009. 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.

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.

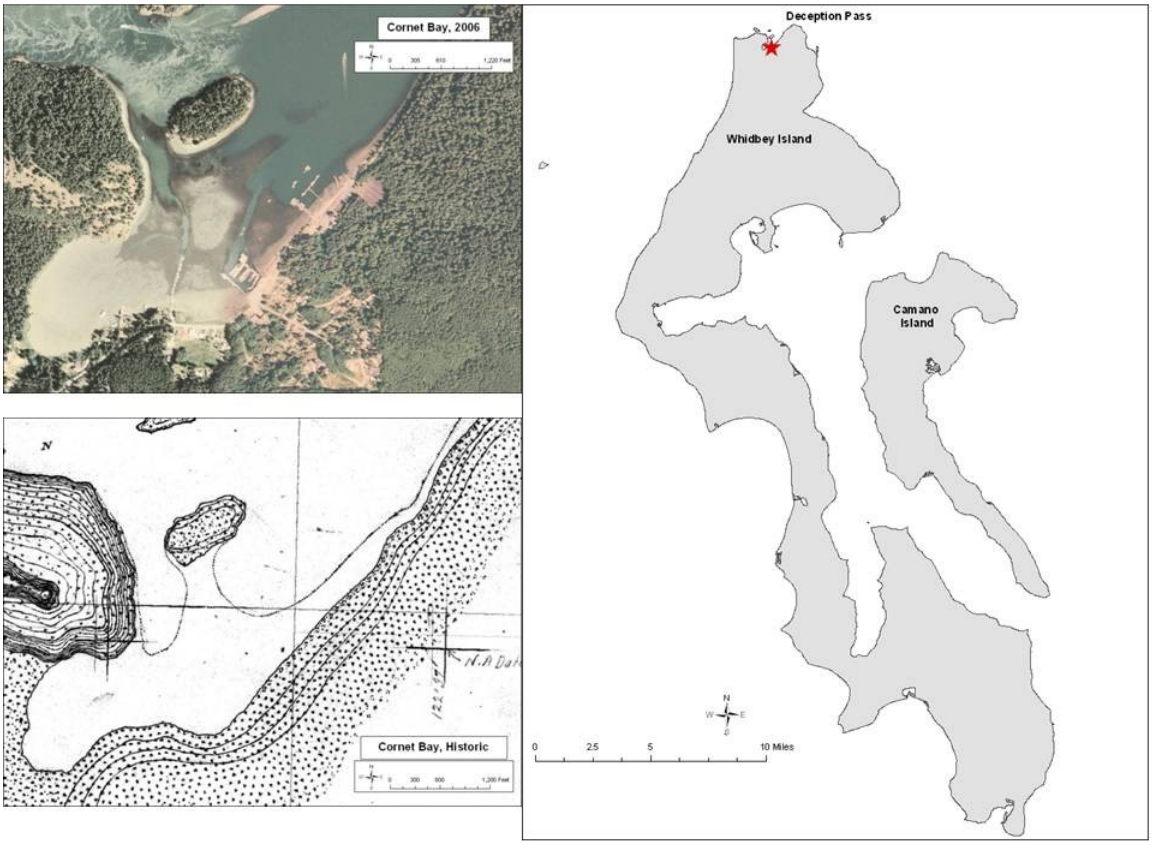

Figure 1. Location of Cornet Bay on north Whidbey Island, along with contemporary (2006) and historic views of the site. The 2006 view is from an aerial photo, National Agriculture Imagery Program. The historic view is from the T-sheet (U.S. Coast and Geodetic Survey), available at the Puget Sound River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

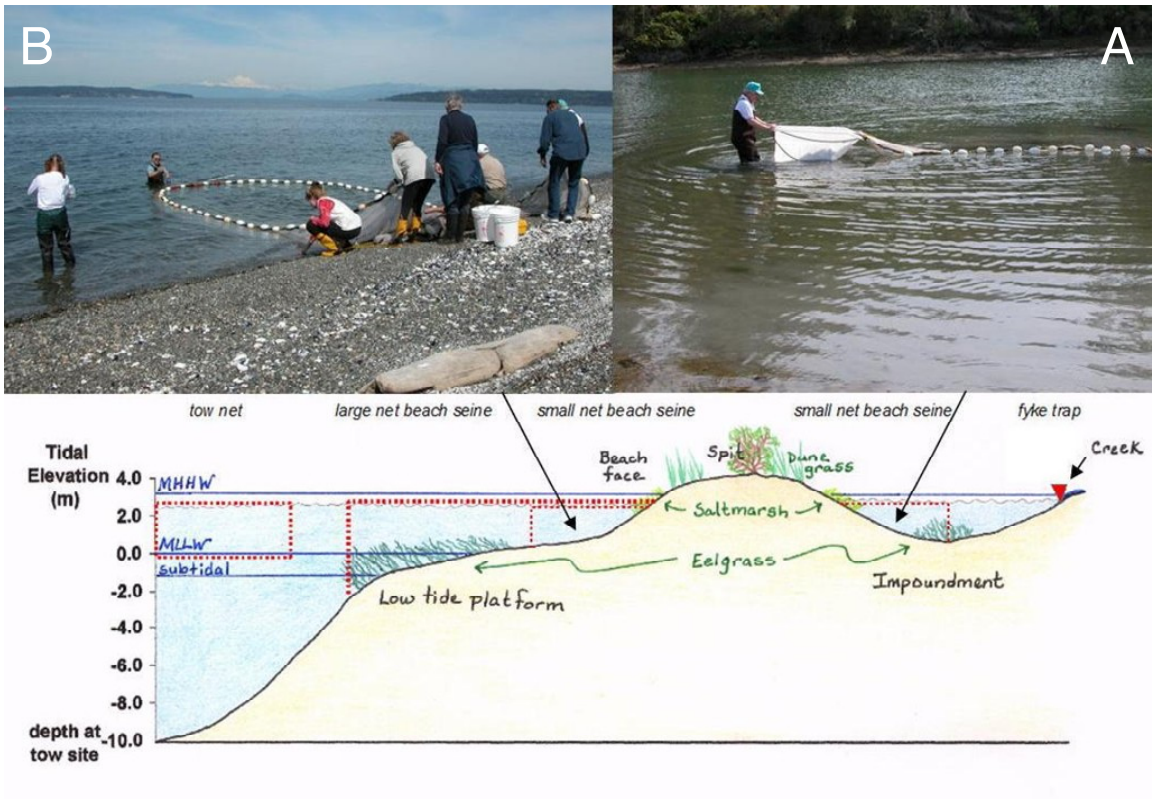

Figure 2. WSU Beach Watcher volunteers working with NOAA staff to beach seine sites at Harrington Lagoon. The diagram is a cross-sectional view of a nearshore beach that includes a coastal lagoon. The red dotted lines illustrate the relative difference in depth, cross-sectional area of the water column, 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). These sites were sampled twice monthly, March 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. 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, and sub-sampled individual fish lengths by species. We also recorded the time and date of each beach seine set and measured several physical habitat parameters associated with each set, including:

- Tidal stage (ebb, flood, high, low)
- Substrate type defined as follows (based on Skagit System Cooperative 2003):
    - Gravel - 75% of the surface is covered by clasts 4 to 64mm in diameter.
    - Mixed Coarse - No one size comprises > 75% of surface area. Cobbles and boulders are >6%.
    - Mixed Fines - Fine sand, silt, and clay comprise 75% of the surface area, with no one size class being dominant. May contain gravel (<15%). Cobbles and boulders make up <6%. Not difficult to walk on without sinking.
    - Mud - Silt and clay comprise 75% of the surface area. Often anaerobic, with high organic content. Tends to pool water on the surface and be difficult to walk on without sinking.
- Surface and bottom water temperature of the area seined using YSI meter.
- Surface and bottom salinity of the area seined using YSI meter.
- Maximum depth of area seined

Beach seine sites were selected both along the Cornet Bay shoreline (Figure 3). The sampling sites were selected to compare the fish community, including juvenile salmon, at different sites along area of Cornet Bay actively used for recreation and boating. In this report results are summarized for each sampling date.

Figure 3. Location of beach seine sites at Cornet Bay, 2009. 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 2009 consisted of 65 beach seine sets made during the March through June time period (Table 1).

Table 1. Summary of beach seine sampling effort at Cornet Bay sites in 2009.

A - Sampling effort (number of beach seine sets)

Month	Seine Sets
March	19
April	20
May	6
June	20
Total	65

Environmental Conditions During Beach Seine Sampling

Tidal Stage, Water Depth, and Substrate

The majority of beach seine sampling occurred at depths slightly shallower than one meter of water (Table 2). The majority of the sampling are had mixed substrate consisting of fines, gravel and cobble. A few of the sites were predominantly coarse or fine material (Table 2).

Table 2. Summary of water depth and substrate conditions during the time of beach seine sampling at Cornet Bay sites in 2009.

Maximum depth of area beach seined	
	Depth
Average and 1 standard deviation (in parentheses)	0.82 (0.19) meters
Percentage of beach seine sets by substrate type	
Substrate Type	Percent
Gravel	14%
Mixed	78%
Fines	8%

Temperature, Salinity, and Dissolved Oxygen

Monthly patterns of surface salinity, surface 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.

Overall, higher Skagit River flows are correlated with lower salinities at the Cornet Bay sites (compare Figure 4A with Figure 4D). Since Skagit River flow is the dominant freshwater source entering the Whidbey Basin and moving through Deception Pass, it is hypothesized that 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. The minimum salinity was 24.9 ppt and the maximum salinity measured was 29.9 ppt.

Water temperature in the Cornet Bay nearshore shows a seasonal increase from March through June (Figure 4B). The minimum water temperature was 5.9 degrees Celsius and the maximum measurement was 11.5 degrees Celsius. Dissolved oxygen in the Cornet Bay nearshore fluctuates between 6.3 mg/L and 10.4 mg/L.

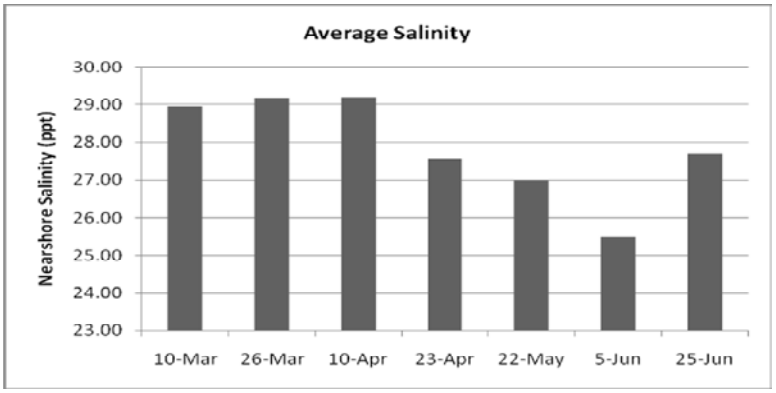

Figure 4A. Monthly average salinity at Cornet Bay taken at the beach seine sites during the time of beach seining.

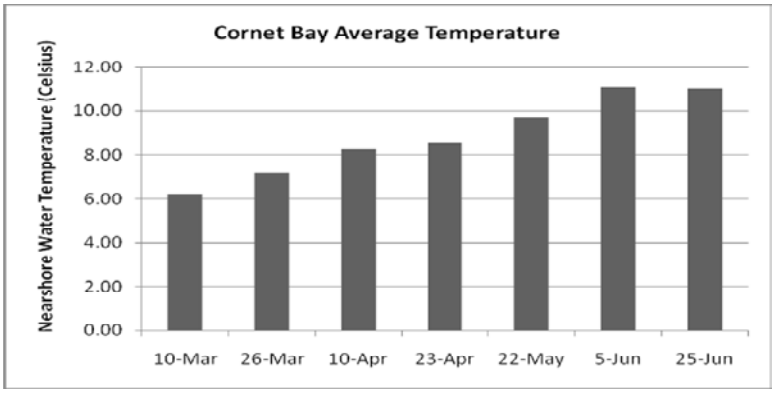

Figure 4B. Monthly average temperature at Cornet Bay taken at the beach seine sites during the time of beach seining.

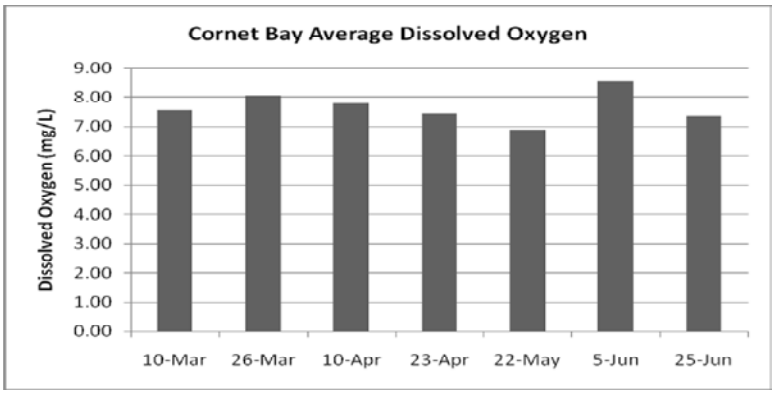

Figure 4C. Monthly average dissolved oxygen at Cornet Bay taken at the beach seine sites during the time of beach seining.

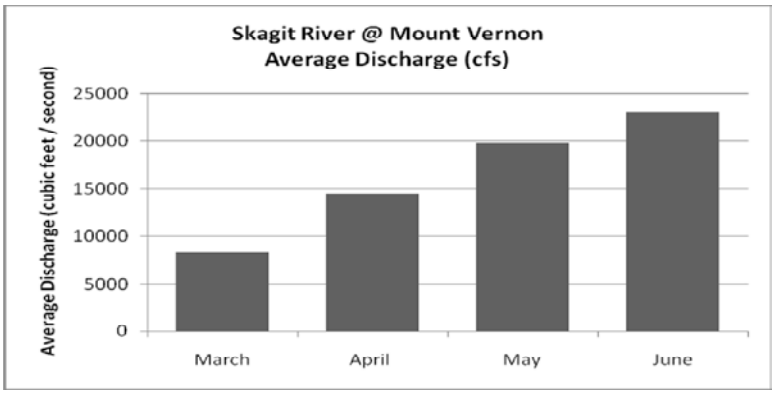

Figure 4D. Monthly average streamflow of the Skagit River at Mount Vernon for 2009.

Catch by Species

We caught over 6,850 fish representing at least 22 different species during the sampling period March through June, 2009 (Table 3). Juvenile salmon represented about 74% of the total catch. The juvenile salmon catch was dominated by subyearling chum, but 2 subyearling Chinook salmon were also caught. No other salmonid species were caught.

Sculpins, primarily Pacific staghorns, accounted for 17% of the total catch. Flatfish accounted for 5% of the catch. Gunnels, primarily Crescent gunnels and Saddleback gunnels, accounted for a little over 2% of the catch. The other 2% of the catch included threespine stickleback, snake prickleback, arrow goby, pipefish, sand sole, English sole, snailfish, greenling, herring, surf smelt.

Table 3. Total fish catch (and mean catch per beach seine set in parentheses) by fish species at Cornet Bay sites in 2009.

Fish species	***Nearshore Catch***
Juvenile salmon:	
Chum salmon, subyearling *Oncorhynchus keta*	5058 (77.82)
Chinook salmon, unmarked subyearling *Oncorhynchus tshawytscha*	2 (0.03)
Total juvenile salmon	5060
Sculpin species:	
Pacific staghorn sculpin *Leptocottus armatus*	1031 (15.86)
Buffalo sculpin *Enophrys bison*	12 (0.18)
Great sculpin *Myoxocephalus polyacanthocephalus*	5 (0.08)
Sharpnose sculpin *Clinocottus acuticeps*	16 (0.25)
Unidentified sculpin	109 (1.68)
Total sculpins	1173
Flatfish species:	
Starry flounder *Platichtys stellatus*	36 (0.55)
English sole *Parophrys vetulus*	9 (0.14)
Sand sole *Psettichthys melanostictus*	7 (0.11)
Unidentified flatfish	314 (4.83)
Total flatfish	366
Forage fish species:	
Pacific herring *Clupea pallasii*	22 (0.32)
Surf smelt *Hypomesus pretiosis*	2 (0.03)
Gunnel species:	
Penpoint gunnel *Apodichthys flavidus*	17 (0.26)
Red gunnel *Pholis schultzi*	3 (0.05)
Saddleback gunnel *Pholis ornate*	74 (1.14)
Crescent gunnel *Pholis laeta*	48 (0.74)
Unidentified gunnel	12 (0.18)
Total gunnels	154
Other nearshore or estuarine fish species:	
Unidentified greenling	31 (0.45)
Unidentified snailfish	3 (0.05)
Threespine stickleback *Gasterosteus aculeatus*	2 (0.03)
Snake prickleback *Lumpenus sagitta*	62 (0.95)
Bay pipefish *Syngnathus griseolineatus*	1 (0.02)
Arrow goby *Clevelandia ios*	1 (0.02)
Total catch	6,877 (105.8)

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 in late May and early June. Just two Chinook were caught. One with a fork length of 56 mm and the other with a fork length of 65 mm.

Juvenile Chum

Juvenile chum salmon were present in Cornet Bay throughout the sampling period (Figure 5). Peak chum salmon abundance occurred in April and May. There was just one juvenile chum caught at the end of June.

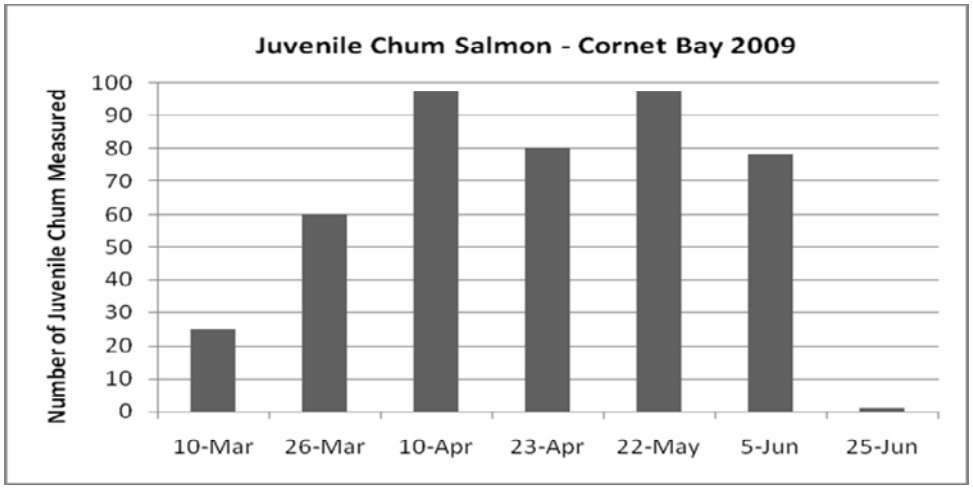

Figure 5. Number of Juvenile Chum Measured at Cornet Bay, 2009.

Fish Size

The size of chum salmon was characterized by measuring fork length on 438 of the 5058 juvenile chum salmon caught at Cornet Bay sites (Figure 6, Figure 7). The mean fork length ranged between 41 mm and 47 mm. Most chum were less than 70 mm.

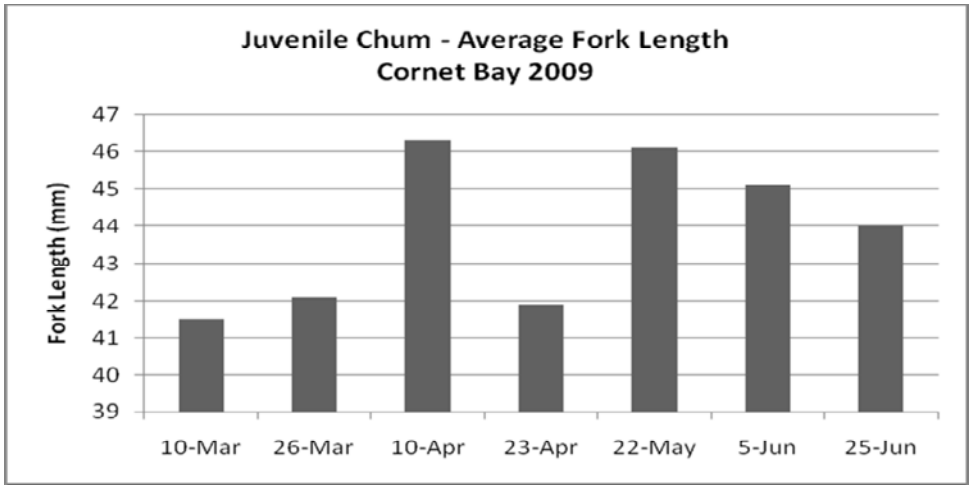

Figure 6. Average fork length of juvenile chum salmon caught at Cornet Bay, 2009.

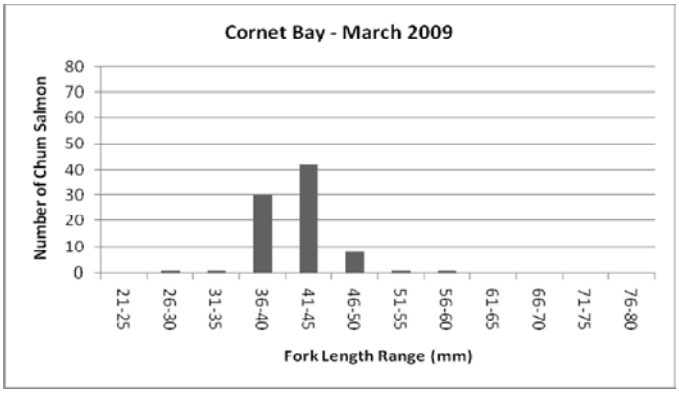

Figure 7A. Fork length frequency distribution of juvenile chum salmon captured at Cornet Bay sites in March, 2009.

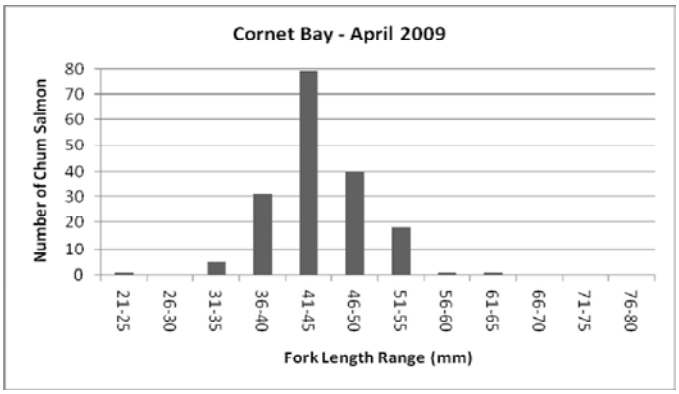

Figure 7B. Fork length frequency distribution of juvenile chum salmon captured at Cornet Bay sites in April, 2009.

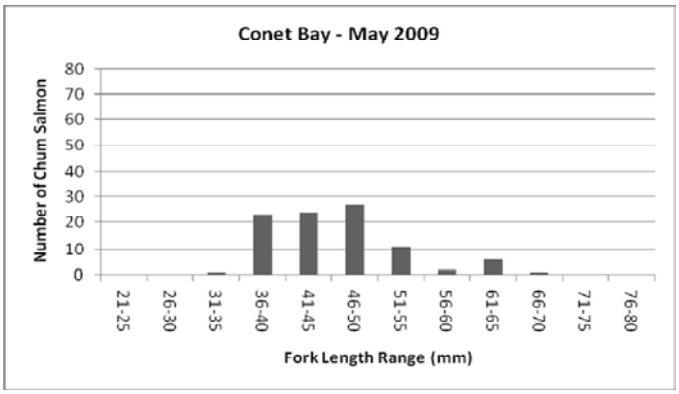

Figure 7C. Fork length frequency distribution of juvenile chum salmon captured at Cornet Bay sites in May, 2009.

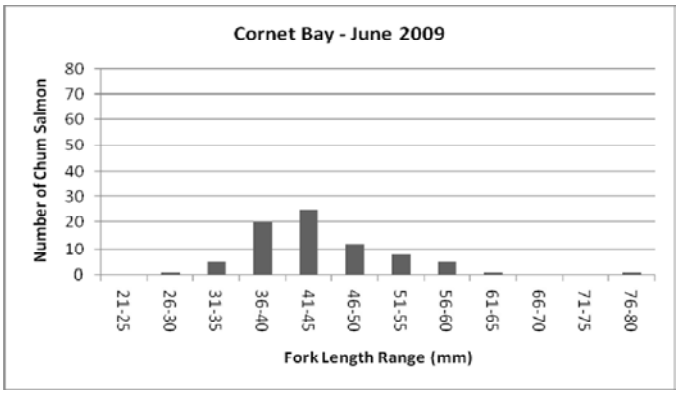

Figure 7D. Fork length frequency distribution of juvenile chum salmon captured at Cornet Bay sites in June, 2009.

Fish Community Composition

This section describes the fish community composition over the March through June sampling period in 2009 for Cornet Bay. The four fish species groups that represent 98% of the total catch are included in this section. The four species groups are: juvenile salmon, sculpins, flatfish, and gunnels (Figure 8).

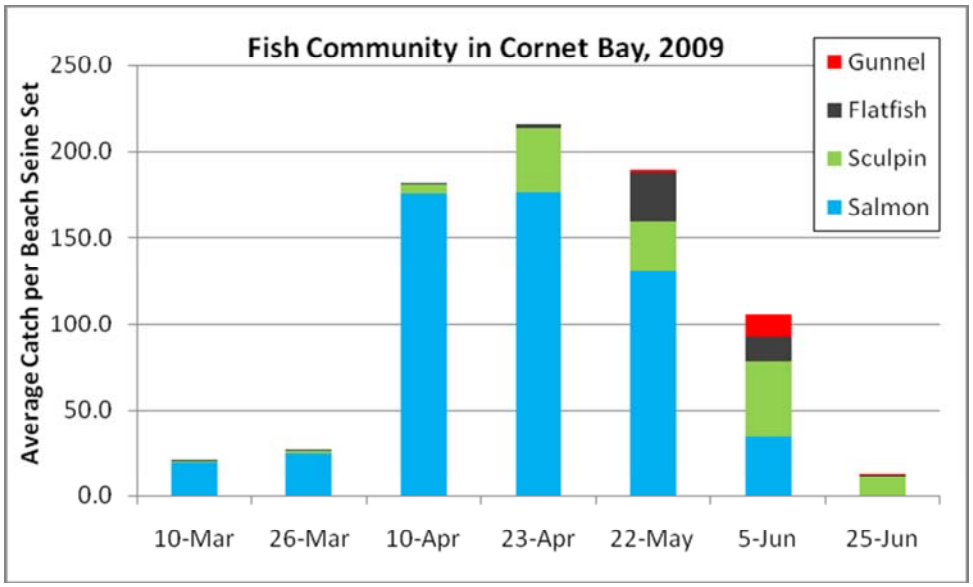

Figure 8. Fish Community and Relative Abundance in Cornet Bay, 2009.

The peak fish density was in April and was driven primarily by juvenile chum salmon (Figures 8). Early in the season the fish community was dominated by juvenile salmon. Later in the season the fish community was dominated by the other species – sculpins, flatfish, and gunnels.

REFERENCES CITED

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