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FORAGE FISH SPAWN SURVEYS,

CORNET BAY BEACH RESTORATION PROJECT SITE,

DECEPTION PASS STATE PARK, WHIDBEY ISLAND, WA,

JUNE-AUGUST, 2015

SUMMARY REPORT

IN PARTIAL FULFILLMENT OF ISLAND COUNTY'S DEPARTMENT OF NATURAL RESOURCES/

PUBLIC HEALTH AND MARINE RESOURCES COMMITTEE'S

PURCHASE ORDER #10077

BY:

DANIEL E. PENTTILA BSc., MSc.

SALISH SEA BIOLOGICAL

DUNS#: 079866121

WA ST UBI #: 603-043-575

5108 Kingsway, Anacortes, WA 98221

Tel: (360) 293-8110

E-mail: depenttila@fidalgo.net

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PUGETSOUND PARTNERSHIP

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INTRODUCTION:

The shoreline restoration project along the Cornet Bay sector of Deception Pass State Park was completed in late 2012. This report will summarize observations made during the summer of 2015, the third regional summer surf smelt spawning season since project completion. This report will also include discussions of certain additional forage fish spawn survey data from late 2013 and 2014 that could be summarized for the Cornet database, as well as several sets of project-site photographs that could be formally added to the Cornet database.

The summary report for the 2013 summer surf smelt spawn survey series (Penttila 2013) summarized background for the Cornet Bay restoration project for the Island County MRC contract, should be readily available in-house, and thus need not be repeated here. Penttila (2013) was also included in Penttila (2015), "Summary of Information for Development of Plans for Renewed Forage Fish Spawn Surveys...in Island County", as Appendix H.

METHODOLOGY:

Again during the summer of 2015, protocols for the collection of bulk beach sediment samples intended for possible detection of forage fish (the surf smelt, *Hypomesus pretiosus*) spawn generally followed those field and laboratory methods used by WDF/WDFW surveyors and other trained NGOs for the mapping of forage fish spawning habitats in Washington State since 1991 (Penttila 1995, Moulton and Penttila 2001, rev. 2006). It should be noted that an alternative forage fish spawn sample processing protocol, the so-called "Vortex" method, was under development and review during mid-2015, but was not put to use for this contract.

Beach sediment samples were collected from the same 6 fixed sites that have been used for forage fish spawn-monitoring in Cornet Bay since the first pre-project base-line spawn surveys begun in 2009 (Table 1). Sediment sampling involved the collection of a roughly 15-pound sample of beach material from the surface one-inch of the beach at intervals along a 50-foot transect parallel to the near-by high tide line, through fine-gravel/sand material judged to be most likely to yield incubating surf smelt eggs, if they happen to be present. The bulk samples are wet-screened so as to obtain the size fraction between .5 mm and 2 mm in diameter. Surf smelt eggs and their adhering sand-grains are commonly about 1 mm in diameter.

The egg-sized material is agitated in a pan of shallow water to concentrate the lower-density material on the surface, after which a subsample of this "light" material, which from long experience is known to contain a high-graded concentration of forage fish eggs if present, is skimmed-off and preserved for lab examination under a stereomicroscope at 10X. Any forage fish eggs found are identified to species, judged to be live or counted as "dead", and the intact embryos counted into embryological stage

categories, with all data entered on standard WDFW forage fish spawn sample data forms that have been in use since the early 1990s.

As has been customary over the years, standard WDFW forage fish spawn survey field/lab reports were produced within days of each field survey and the completion of lab analyses, and sent monthly to Island County MRC staff to document the progress of the contracted work.

This contract also entailed the procurement of a new "DUNS#" specifically for Salish Sea Biological, as per the stipulations of the WDOE/Island County "NW Straits Agreement SEANWS-2014-IsCoPH-00002", gratefully with the able assistance of Island County staff. Considerations of the potential impacts of the project's biological sampling were to be covered by WDFW Scientific Collection Permit # 14-325b, with new Cornet Bay sampling activities included courtesy of L. Kaufman, Northwest Straits Foundation, Bellingham, WA.

2015 SUMMER SURVEY RESULTS:

June 28, 2015:

On this first survey of the 2015 summer series, the long-time fixed sampling sites used for forage fish spawn monitoring on the project site were re-flagged, using the GPS readings from previous years (Table 1). Outwardly, both natural and restored beach sites appeared to be in the same condition as in the previous years, in terms of the texture and width of the potential forage fish spawning habitat. Although the surveys were timed to begin well within the likely surf smelt spawning season of the immediately-adjacent Skagit Bay-Saratoga Passage region to the east and south, no evidence of surf smelt spawn was found within the Cornet Bay project site.

July 23, 2015:

This second survey of the series again found no evidence of surf smelt spawning within the project site. The survey contract for this month included photo-documentation of the condition of the upper intertidal beaches on and around the flagged sampling sites, using oblique eye-level views of each site from opposite directions (northeast and southwest views). Photos were taken with a Nikon CoolPix 520 DSKLR camera. Prior to taking photos, the bulk sediment samples were collected in the usual manner, with the ends of the 50-foot sampling transects marked with red markers, so as to be visible in the photos. The day's 12-image photo set was captioned as to date, site number, direction of view, then copied to a flash-drive, and forwarded to the Island County MRC along with the survey field/lab data report.

August 11, 2015:

The third and final spawn survey of the contracted series again failed to find evidence of surf smelt spawning activity within the Cornet Bay project site, at a time when spawning is commonly still underway with high frequency and density within the Skagit Bay/Saratoga Passage region. Again this year, the upper intertidal beaches of the Cornet Bay project site were found to largely free of "forage fish egg-like objects" that might possibly be misidentified as fish eggs with the naked eye, objects that can be common in upper intertidal beach sediment samples from other parts of Puget Sound. At sites #5 and #6, un-restored natural beaches south-west of the restoration activities, quite sheltered from wave action and relatively rich in particulate organic matter, commonly yielded abundant juvenile sphaeromatiid isopods in the lab subsamples. These tiny "pillbugs" commonly curl up into spherical shapes when disturbed. Many are the same size as forage fish eggs, and behave similarly in the winnowing process as the lab samples are gathered. They could conceivably be mistaken for fish eggs with the naked eye, but their segmented structure becomes quite obvious at 10X magnification under a stereomicroscope.

DISCUSSION:

Surf smelt spawn absent in summer 2015:

For the third consecutive summer season since the restoration of the Cornet Bay shoreline, no evidence of new usage of the project site or immediate vicinity by spawning surf smelt was found. As was suggested in Penttila (2013), the degree to which surf smelt either return to the beaches of their hatching, or the degree to which they "explore" for additional spawning beaches elsewhere in the vicinity of presently-used beaches is unknown. The species must surely include a certain element of exploratory behavior in their pre-spawning movements, whether random or purposeful, or else the vast reaches of the existing Greater Puget sound Basin would not have been re-occupied by the many surf smelt spawning populations we find today in such a geologically-short period of the few thousand years since the last Ice Age ended, and Puget Sound returned to marine/estuarine habitat conditions.

Our knowledge of what truly constitutes a suitable surf smelt spawning habitat context is also unknown. It is almost assuredly more than the simple outward-visible presence of suitable spawning habitat, in terms of the "preferred" grain-size of substrate at the "proper" high tidal elevation. It very likely also includes a micro-oceanographic element of perennially-suitable larval "nursery grounds" within perennially-likely transport distance from hatching sites. One could hypothesize that Cornet Bay's very protected, shallow waters could support such a nursery ground. It is even possible that surf smelt larvae dispersed from the Skagit Bay/Saratoga Passage spawning areas might come to rest in Cornet Bay for rearing. Why these factors have not resulted in present-day surf smelt spawning in the immediate vicinity of Cornet Bay must remain a mystery for now.

Suggested winter spawn surveys:

As stated in Penttila (2013), surf smelt are not the only possible forage fish spawning in Cornet Bay. The Pacific sand lance, *Ammodytes* , is actually known to spawn within the restoration project site, from a few eggs found in 1993 by WDF forage fish spawn surveys at present-day site #3. However, no additional sand lance eggs have been recovered in any of the forage fish spawn surveys conducted in the Cornet Bay area since restoration-project-related surveys began in 2009. Puget Sound sand lances spawn only in the late-fall-winter months, November-February. Thus, it is suggested that, given that there are data indicating past usage of the restoration project site by spawning sand lances, contracted forage fish spawn surveys of a scale and frequency similar to the just-completed summer effort be undertaken in and around the project site during the November 2015-January 2016 period. Sampling protocols could be identical to those used during the summer surveys, since surf smelt and sand lance eggs incubate in similar tidal elevations and substrate types, and behave similarly during the egg extraction process.

Availability of additional existing survey information:

Summary spawn survey reports:

Penttila (2013) was the last formal summary report prepared for a Cornet Bay forage fish spawn survey series(summer 2013). Subsequent contracts involved forage fish spawn survey series for the winter of 2013-14 (four surveys between November 20, 2013 and February 26, 2014)., and the summer of 2014 (three surveys between July 10, 2014 and August 12, 2014). Contracts included timely monthly mailings of individual surveys' field/lab reports to contracting entities, but did not specifically include season-ending summary reports of observations and discussions. Even though Cornet Bay-derived individual forage fish survey data have been shared between contracting agencies through this recent time period, contracted summary reports could be drafted after-the-fact for these survey seasons at minimal cost, if such were thought to be of value.

Photographic image sets:

Prior to the summer of 2015, generation of sets of images photo-documenting the Cornet Bay spawn sampling sites and the visual appearance of their shoreline contexts were not an specific element of forage fish spawn survey contracts. However, such sets of images were, in fact, generated off-contract by Salish Sea Biological, for future reference of its regional work. Three sets of images could be made available to Island county WDNR/MRC, if some value could be envisioned for them. On October 16, 2012, shortly after the completion of the restoration project, 18 photos were taken of mixed views of the project shorelines. On May 16, 2013, a set of 12 photos were taken of NE/SW views of the 6 fixed sampling sites, with the day's samples in place on the beach, roughly replicating the photos taken in July 2015. On February 26, 2014, another set of 12 photos of NE/SW views of the 6 fixed sites with their

samples in place were taken, again replicating the July 2015 photos. These photo sets could be copied, dated, labeled, and transferred to Island County at a minimal cost.

Enhancement of shading vegetation along project site:

It has been demonstrated that "marine riparian" forested zones along Puget Sound shorelines appear to enhance the survival of summer-spawned incubating surf smelt eggs, by moderating beach surface temperatures during hot weather (Penttila, 2002, Rice, 2006), and serve other positive ecological functions well. The positive shading effects are most pronounced when the upper intertidal zone is well-shaded by over-hanging tree canopies. The Cornet Bay restoration project did include a shoreline re-vegetation element after the bulkhead-fill structures were removed. However, the low-growing plant species used to occupy the new gentle slope just above the EHW line will not likely ever attain a height sufficient to provide shade below the OHW mark.

It should be noted here that the lack of summer surf smelt spawning at the Cornet Bay project site is likely not directly caused by a lack of overhanging shade. Summer-spawning smelt will frequently use unshaded portions of their perennially-used spawning beaches, despite the subsequent high in-situ mortalities of their eggs at those sites. Parts of the upper beach around forage fish spawn sampling sites #1 and #5 are shaded by shoreline trees, yet evidence of surf smelt spawn has never been found there.

However, there is an existing example of a tree species very near the project site that might provide material for future plantings along the restored beaches that could provide useful shade and other ecological functions to potential surf smelt spawning habitat zones and near-shore-migrating juvenile salmonids' migratory corridors. Between forage fish sampling sites #4 and #5, south of the State Parks maintenance pier, a dense growth of an apparently salt-resistant willow (*Salix sp.*) occupies several lateral yards of shoreline. It could possibly serve as a source of rooted cuttings that could be placed at intervals just above the EHW line along the restored parts of the shoreline that could eventually be "trained" into overhanging shade trees. They might also be placed appropriately so as to not interfere with shoreline viewscapes, or perhaps could be pruned of lower branches so that there would be viewscapes beneath their canopies for visitors seated along the shore.

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Table 1. GPS coordinates of fixed forage fish spawn sample sites, Cornet Bay beach restoration project area, N. Whidbey Island , WA.

Site	2009 (pre-project)	2013 (post-project)	Remarks
1	N 48 deg., 24,114'	N 48 deg., 24.115'	natural /suitable beach,
	W 122 deg., 37.271'	W 122 deg., 37.296'	NE of launch ramps
2	N 48 deg., 24.051'	N 48 deg., 24.051'	armored/restored beach,
	W 122 deg., 37.379'	W 122 deg., 37.383'	SW of launch ramps
3	N 48 deg., 24.028'	N 48 deg., 24.025'	armored/restored beach,
	W 122 deg., 37.419'	W 122 deg., 37.429'	Just S of St. Pk. moorage pier
4	N 48 deg., 23.989'	N 48 deg., 23.988'	armored/restored beach,
	W 112 deg., 37.467'	W 122 deg., 37.467'	S of St. Pk. maint. pier
5	N 48 deg., 23.951'	N 48 deg., 23.950'	natural/ suitable beach,
	W 122 deg., 37.517'	W 122 deg., 37.515'	SW of restored project site
6	N 48 deg., 23.919'	N 48 deg., 23.919'	natural marginal habitat,
	W 122 deg., 37.559'	W 122 deg., 37.561'	SW of restored project site