ANNUAL PATTERNS OF INTERTIDAL SPAWNING HABITAT USE BY SURF SMELT AND PACIFIC SAND LANCE AROUND CAMANO ISLAND

Timothy Quinn*, Dan Penttila, Kirk Krueger, David Price, Kurt Perry, Tiffany Hicks, and Brian Benson

Washington Department of Fish and Wildlife, Habitat Program

Introduction

Surf Smelt (*Hypomesus pretiosus*) and Pacific Sand Lance (*Ammodytes hexapterus*) are important components of the marine food web. These species spawn in marine intertidal areas, and evidence of spawning activity by both species occurs on many beaches throughout the Salish Sea. Despite relatively good information on the general distribution of spawning beaches throughout Puget Sound for these species (Penttila 2007), we do not understand which beach characteristics are most important to these species for spawning.

Surf Smelt (top) and Pacific Sand Lance spawn on intertidal beaches throughout much of the Salish Sea

There is growing concern that shoreline development can negatively affect intertidal forage fish spawning habitat. For example, Surf Smelt eggs are sensitive to the removal of shade along the shoreline (Rice 2006, Penttila 2002) and shoreline armoring can starve beaches of fine sediments on which forage fish species spawn.

We are interested in determining how physical beach characteristics relate to forage fish spawning habitat quality as measured by egg abundance and egg mortality. In particular we want to know how human disturbance may affect physical processes responsible for creating and maintaining forage fish spawning habitat.

Methods

We collected forage fish spawning data every two weeks at 51 Camano Island beaches from September 2007 through August 2008 (Fig. 1). Samples were taken along transects at two tidal elevations (+10.0 ± 0.7 ft MLLW and ~ +8.0 ft MLLW). A sample consisted of 4, 475 ml subsamples, taken 6 m apart, from the top 2-3 cm of surface material (Fig. 2). We estimated egg density and egg mortality for Surf Smelt and Pacific Sand Lance. We also measured beach (site) and ShoreZone characteristics hypothesized to be important determinants of spawning habitat suitability at each site. In this preliminary analysis, we summarized live and dead egg counts (combined samples at each transect) by site and through time for both species.

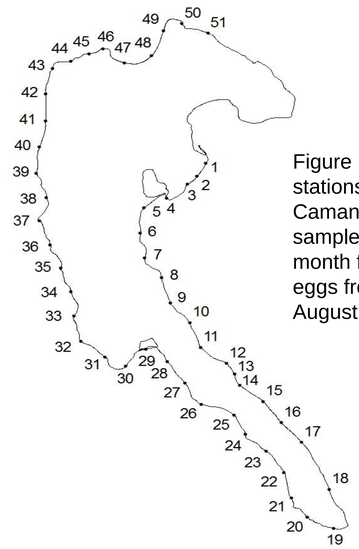

Figure 1. Fifty-one stations around Camano Island were sampled twice each month for forage fish eggs from Sep 2007 to August 2008.

Figure 2. A sample at a site consisted of 4, 475 ml scoops of sediment taken at 6 m intervals at each of two beach elevations. This photo shows location of 4 scoop subsamples at a single beach elevation

Results

Surf Smelt

Surf Smelt egg counts were strongly seasonal with peak abundance in late summer and early fall, although live eggs (albeit in small number) were found during all sampling periods (Fig 3). Mortality rates peaked in late spring and tended to decline as peak spawning occurred. The spatial distribution of egg counts around the island was highly skewed with about 20% of the sites contributing the vast majority of eggs (Fig. 4).

Pacific Sand Lance

Pacific Sand Lance egg counts were strongly seasonal with peak abundance in early winter. In contrast to Surf Smelt, Pacific Sand Lance eggs were found during a short period of time - November through January (Fig 5). Percent egg mortality rates were an order of magnitude lower for Pacific Sand Lance than Surf Smelt. The spatial distribution of Pacific Sand Lance was highly skewed with the vast majority of eggs coming from a single site (Fig. 6).

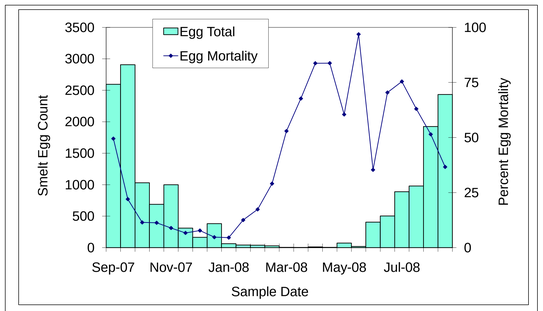

Figure 3. Mean annual counts of Surf Smelt eggs and mean percent of eggs found dead by sampling date.

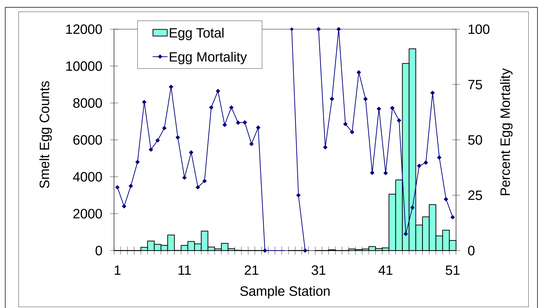

Figure 4. Mean annual counts of Surf Smelt eggs and mean percent of eggs found dead by sample station.

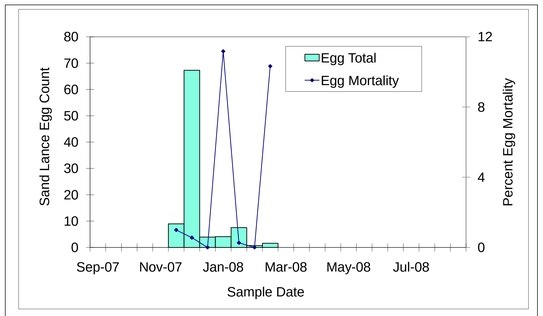

Figure 5. Mean annual counts of Sand Lance eggs and mean percent of eggs found dead by sample date.

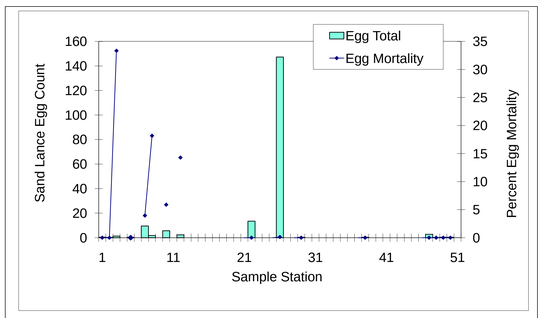

Figure 6. Mean annual counts of Sand Lance eggs and mean percent of eggs found dead by sample station.

Conclusions

Surf Smelt

Surf Smelt spawning activity is concentrated over an 8 month period with peak activity in late summer and early fall.

Surf Smelt egg mortality peaked in late spring and tended to decline as peak spawning occurred. Egg mortality for Surf Smelt reaches nearly 75% during June and July and is dramatically higher than Pacific Sand Lance egg mortality.

A small percentage of sites (20%) appear to support the vast majority of Surf Smelt spawning activity around Camano Island. These sites as well as sites with little or no spawning activity appear to be spatially clustered.

Pacific Sand Lance

Pacific Sand Lance egg counts were much smaller than Surf Smelt egg counts even during peak spawning. Spawning activity is strongly seasonal with peak abundance in early winter.

The spatial distribution of Pacific Sand Lance eggs was highly skewed with the vast majority of eggs coming from a single site.

In the near future we will explore how site and ShoreZone characteristics explain patterns we see here.

Literature Cited

Penttila, D. 2002. Effects of shading upland vegetation on egg survival for summer-spawning surf smelt on upper intertidal beaches in Puget Sound. *In Puget Sound Research*- 2001 Conference Proceedings, Puget Sound Water Quality Action Team, Olympia, Washington. 9 p.

Penttila, D. 2007. Marine Forage Fishes in Puget Sound. Puget Sound Nearshore Partnership Report No. 2007-03. Published by Seattle District, U.W. Army Corps of Engineers, Seattle, Washington.

Rice, C.A. 2006. Effects of shoreline modification in northern Puget Sound: beach microclimate and embryo survival in summer spawning surf smelt (*Hypomesus pretiosus).* Estuaries and Coasts 29(1):63-71.

Acknowledgements

We thank the Puget Sound Action Team and Puget Sound Partnership for helping fund this work and the residents of Camano Island that allowed us access to their property.

Timothy Quinn
Science Team, Habitat Program
Washington Dept. of Fish and Wildlife
600 Capitol Way, North
Olympia, WA 98501-1091
360-902-2414
quinntq@dfw.wa.gov