Reporting date: 10/22/2012 (Update from 10/15/2011)

Project number: 2011-03

Title: The role of benthic habitat in larval rock sole settlement dynamics – Yr 1 of 2

PIs: Laurel and Stoner

Funding year: 2011

Funding amount: $42,740

Status: ☒ Complete ☐ Incomplete, on schedule ☐ Incomplete, behind schedule

Planned completion date if incomplete:
Sept 2012

Reporting: Field work was successful in 2011 and all proposed elements are now complete with a manuscript anticipated in FY13. We originally proposed to characterize rock sole distribution (towed sled), sediment (PONAR benthic grab) and predator distribution (baited camera) at two Kodiak sites (Pillar Cove and Holiday beach) by depth (2 – 25 m) from settlement (May) through post-settlement (June, July and August). All four sampling trips were carried out in 2011 and all towed sled sampling was fully completed and analyzed. Baited camera assessment were not conducted in 2011 but were conducted in 2012 as part of combined fieldwork with Ryer et al. examining juvenile tanner crabs in the same region. Replicate deployments (n=3) were conducted at 5 depths across 3 months (May, July and Aug) at both Pillar Cove and Holiday Beach. These data were needed to test the hypothesis that settlement patterns trend with changes in predation risk.

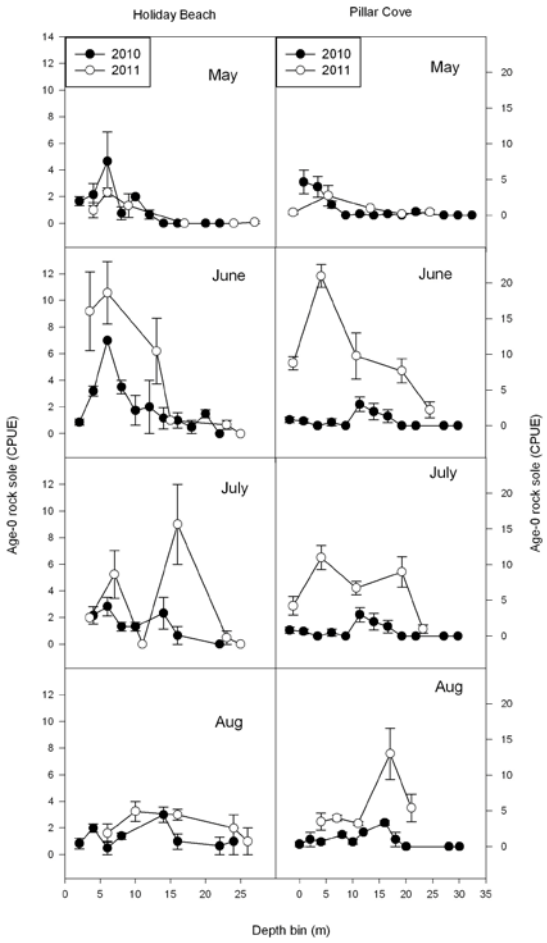

Figure 1: Seasonal distribution of age-0 juvenile rock sole at two sites (Pillar Cove and Holiday Beach) during 2010 and 2011 in coastal Kodiak. May sampling shows a narrow depth band in which newly settled juvenile rock sole are distributed.

All laboratory experiments are now complete. NRS eggs were successfully collected and cultured from Program broodstock in spring FY11 (see Laurel and Blood 2011 for protocols) and larvae were reared across multiple

temperatures (2 – 12° C) to ensure a variety of sizes and ages were available for the proposed settlement experiments. Approximately 1200 larvae survived through metamorphosis over a period of 120 rearing days, and 603 of these larvae were used in settlement trials.

We originally designed experiments to test: 1) if larval rock sole choose habitat during settlement, 2) whether habitat variables mediate the rate of settlement i.e., water depth and sediment size, and 3) how pigmentation and sediment associations interacted to regulate predation rates. Components 1 and 2 were examined in FY11 and Component 3 was conducted as part of experimental work in FY12. As a value added component, we quantified and included the interactive effects of growth (mass- and length-based), condition, development (e.g., eye migration, pigmentation, etc) and age in the settlement models.

A manuscript using laboratory and field data is in currently slated for FY13. Working title is:

Laurel BJ, Basillio A, Danley C (in prep) The role of habitat on settlement timing in Northern rock sole (*Lepidopsetta polyxystra*). Mar Ecol Prog Ser

In addition, an NSF-REU student (Research Experiences for Undergraduates) Anthony Basilio reported and presented his research results to the REU chair and faculty at the Hatfield Marine Science Center in August 2011.

Results: What is the most important result of the study?

1) Fish densities were higher in 2011 than in 2010, but the patterns in settlement over the sites were identical (Fig. 1), suggesting that these settlement dynamics are an important and consistent characteristic in this species. NRS initially settled in shallow water (~5 m) and gradually occupied deeper water substrates through the course of the season. Given the consistency of the pattern, no further towed sled survey is proposed for 2012.

2) The most important findings from the first series of laboratory experiments were that 1) pre-settled larvae chose habitat during settlement, 2) pre-settlement habitat choices were size-dependent i.e., smallest pelagic larvae choose finer substrate whereas larger larvae had a wider range of occupation and 3) there was no difference in habitat selection between pre-settled and post-settled rock sole (Fig. 2). Newly settling flatfish were capable of burial only in the finest substrates, and agreed with the size-based logistic burial model proposed by Stoner and Ottmar (2003).

3) The most important findings from the 2nd was that settlement rates were size-dependent and best described by a logistic model (Fig. 3). All settlement occurred between the sizes of 12 – 18 mm TL in our experiment. However, two interesting findings were found around the size-dependent model. First, larvae exposed to preferred habitat (fine sediments) settled at smaller sizes compared to those exposed to gravel (Fig. 3). Secondly, variance around each of the size-dependent habitat models (as examined

by residual analyses) was explained by differences in growth and condition. That is, larvae that were growing fast and in good condition delayed settlement compared to fish on slow growth trajectories and in poor condition

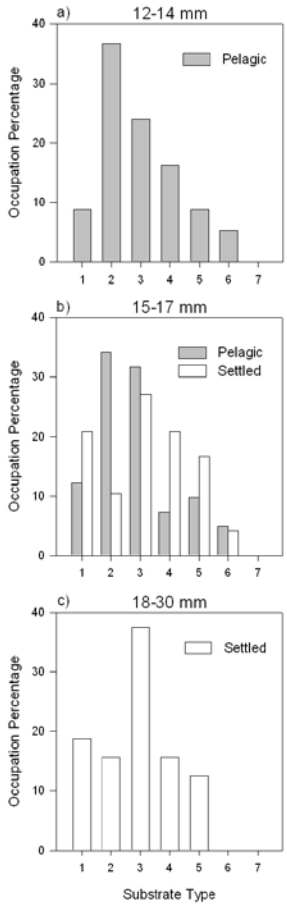

Figure 3 Habitat use (%) of rock sole introduced to aquaria as a) small pelagic larvae (12-14 mm TL) , b) medium-sized pelagic and settled larvae (15-17 mm) , and c) large settled larvae (18 - 30 mm). Sediment types listed from finest to largest (muddy sand (1) - pebble (7))

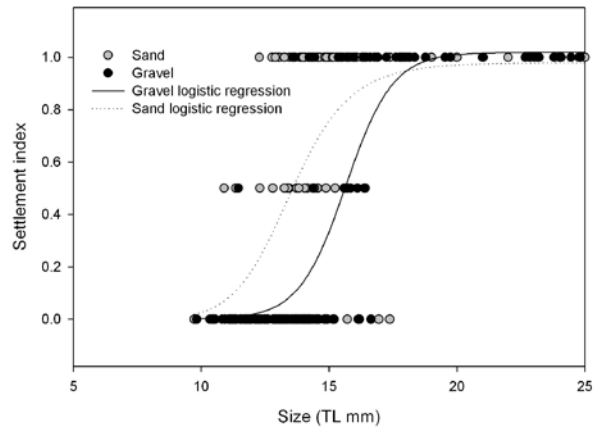

Figure 2: Size-dependent settlement model varies with habitat for northern rock sole (Component #2). The settlement index (y-axis) indicates whether a larvae did not settle (0), occasionally settled (0.5) or settled and remained on the substrate (1) over a 24 hr behavioral trial. Data based on 273 individual trials.