Essential Fish Habitat project status report

Reporting date: 10/22/12

Project number: 6

Title: Characterization of Benthic Infauna Community for Modeling Essential Fish Habitat in the Eastern Bering Sea - Reduced Plan

PIs: Yeung, C, Yang, M.-S., McConnaughey, R.A.

Funding year: 2009

Funding amount: $77,800

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

Planned completion date if incomplete:

Reporting: Have the project results been reported? If yes, state where the results were reported and attach an electronic copy of the report.

Yang, M.-S. and Yeung, C. Habitat-associated diets of some flatfish in the southeastern Bering Sea. Abstract. 8th International Symposium on Flatfish Ecology. November 7-11, 2011, IJMuiden, the Netherlands.

Yeung, C., Yang, M.-S., Jewett, S.C., Naidu, A.S. Polychaete assemblage as prey availability index for eastern Bering Sea flatfish habitat suitability. 17th Western Groundfish Conference. February 6-10, 2012. Seattle, Washington, USA.

Yeung, C., Yang, M.-S., Jewett, S.C., Naidu, A.S. 2012. Polychaete assemblage as surrogate for prey availability in assessing southeastern Bering Sea flatfish habitat. Journal of Sea Research. xxx:xxx-xxx. (uncorrected proofs attached) http://dx.doi.org/10.1016/j.seares.2012.09.008 (online)

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

Alaska plaice and northern rock sole primarily feed on polychaetes in the eastern Bering Sea. Their stomach contents averaged about 60% polychaetes by weight. Yellowfin sole have a more diverse diet averaging about 25% polychaetes by weight. Bivalves, amphipods, and echinoderms are the other prey groups for all three flatfish. Competition among these co-occurring species may be mitigated by spatial distributions that are slightly offset from each other due to physiological or prey preference. For example, Alaska plaice, the more cold-tolerant polychaete-feeder, are known to be distributed further offshore over the middle shelf. The middle shelf has high benthic production and a sandy-mud habitat that favor polychaetes in the infauna. The coarser-grained inner shelf

sediments are dominated by bivalves. In 2009 - a cold year in the EBS in which the cold pool of bottom water spread extensively over the middle shelf, all three flatfish were concentrated on the inner shelf. It is hypothesized that extreme cold bottom temperature alters flatfish response to habitat and prey, and increases competition by shrinking suitable habitat. Where competition for food among flatfish is low, through spatial-temporal partitioning of habitats or abundance of prey, polychaetes may be the choice prey because of its higher energy content than other infauna groups. Bioenergetics studies and habitat modeling are key to examining these hypotheses.

8th International Symposium on Flatfish Ecology. November 7-11, 2011, IJMuiden, the Netherlands. Abstract.

Habitat-associated diets of some flatfish in the southeastern Bering Sea

M.-S. Yang and C. Yeung

A total of 886 Alaska plaice (*Pleuronectes quadrituberculatus)*, northern rock sole (*Lepidopsetta polyxystra*, and yellowfin sole (*Pleuronectes asper*) stomachs collected from 27 stations in the eastern Bering Sea in 2009 were analyzed. Grab samples were collected in each of the 27 stations. The habitat types for the stations were categorized, from northeast to the southwest of the study area, as sandy (%sand $\geq$80), muddy sand (50 $\leq$%sand <80), sandy mud (50 $\leq$%mud <80), and muddy (%mud $\geq$80). The objective of this study is to correlate the diets of the small-mouth flatfish with their specific habitats in the eastern Bering Sea area. The main diet of Alaska plaice included clams and polychaetes. In the sandier stations (northeast of the study area), Alaska plaice consumed high proportions ($\geq$ 49% by weight) of clams (mainly Tellinidae). Toward southwest muddier stations, the diet of Alaska plaice shifted to higher proportions of deposit-feeing polychaetes (Ampharetidae, Terebellidae, and Trichobranchidae). Comparing with the benthic data, we found diet-shift from the sandier stations to the muddier stations matched relatively well with the shift of the benthic data. The main food of northern rock sole included clams, polychaetes, and amphipods. Diet variations were also found among different habitat stations. In the muddier stations, polychaetes Terebellida and Sabellida comprised higher proportions in the stomach contents of northern rock sole. On the contrary, more bivalves were consumed by northern rock sole in the sandy stations. Yellowfin sole diet included clams (mainly *Macoma sp*.), gammarid amphipods, polychaetes, ophiurids (mainly *Ophiura sarsi* and *Amphipholis sp*.) and sand dollars (Clypeasteroida). More polychaetes (Phyllodocida, Terebellida, and Sabellida) were consumed by yellowfin sole collected in the southwest muddier stations whereas more Tellinidae clams were consumed in the northeast sandier stations. Diets varied among different predators, between different size-groups of the same predator, and in different habitats. The interesting finding was the diet shifted from different habitat to habitat, even for the same predator species. The results indicate that it is important to combine

the habitat information with the food habits study to get better understanding of the predator-prey relationships in the marine ecosystem.

17th Western Groundfish Conference. February 6-10, 2012. Seattle, Washington, USA. Abstract.

Polychaete assemblage as prey availability index for eastern Bering Sea flatfish habitat suitability

C. Yeung, M.-S. Yang, S. C. Jewett, A. S. Naidu

Yellowfin sole, northern rock sole, and Alaska plaice in the eastern Bering Sea prey mainly on infauna. Spatial correspondence between their stomach contents and infauna assemblages across habitat types were examined to identify potential indices of prey availability for habitat quality assessment and characterization. Benthic samples and stomachs were collected at 31 stations along three cross-shelf transects in the southeast near the Alaska Peninsula. Polychaetes and clams were the most dominant infauna groups, each comprising 35-60% by weight in each infauna sample. These two were the only prey groups that frequently averaged >50% of stomach contents. Clams dominated the infauna biomass on the inner shelf (0-50 m depth). The middle shelf (50-100 m) had the highest infauna biomass, which was dominated by deposit-feeding polychaetes. Prey availability appeared to be the main factor in prey choice. Alaska plaice and rock role are known to prey primarily on polychaetes, and yellowfin sole on amphipods. In this study, the diet compositions of these flatfish varied spatially in correspondence with the infauna assemblage. The diet composition of Alaska plaice, in particular, showed significant spatial correspondence with the assemblage of polychaete families. Polychaete assemblage could be a good surrogate for the infauna for characterizing habitat or prey environment of these flatfish. The dominance of polychaetes in flatfish diets and in the infauna, and their high nutritional value implicate polychaete biomass as an index of habitat quality for flatfish. Different proportional consumption of polychaetes among the three co-occurring flatfish may be a result of interspecific competition. Unconstrained by interspecific competition, all three flatfish may maximize polychaete consumption. Polychaete-rich habitat would thus be high quality flatfish habitat. Since predation on polychaetes is apparently not taxon-specific, assessment may be based simply on the aggregate polychaete group without taxonomic resolution, or on dominant polychaete families.