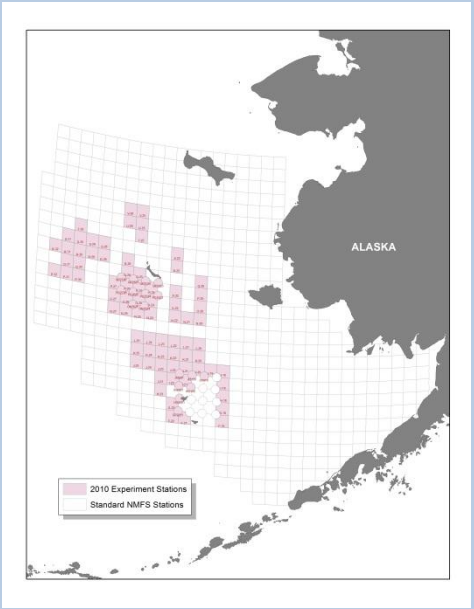
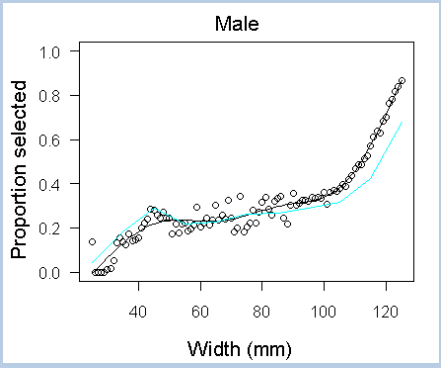
2010 Bering Sea Snow Crab Trawl Efficiency Cooperative Survey

NMFS and the Bering Sea Fisheries Research Foundation again jointly conducted side-by-side towing to assess the NMFS standard survey trawl efficiency of capturing snow crab. Unlike all previous experiments however, sampling occurred over a broad geographic area in order to capture the biological and environmental variability of the snow crab population (see map). The main objective of this research was to measure the efficiency of the standard NFMS survey trawl by collecting snow crab cpue data during side-by-side towing with the *Nephrops* and standard NMFS trawls. This study was similar to the 2009 snow crab cooperative surveys but used improved methods where temporal and spatial lag effects between the two vessels with different trawls were minimized.



Side-by-side trawling was conducted at 92 standard NMFS stations chosen to best represent the size distribution of male snow crab as well as to capture the variability of depth and sediment type within the area occupied by the snow crab population. At each of the 92 locations, the NMFS and BSFRF vessels towed simultaneously on parallel courses that were roughly 0.2 nm apart. The NMFS vessel towed the standard survey trawl at 3 knots for 30 min while the BSFRF vessel towed the *Nephrops* trawl at 2 knots for 5 min. On both vessels the snow crab catch was separated by sex before measurement of carapace width in mm. In addition to depth and net width measurements at time of sampling, at all NMFS survey stations where snow crab were caught, sediment type was later interpolated from an existing Bering Sea sediment database. A statistical model relating the paired catches from the two trawls as a function of sex, carapace width and the spatial covariates was developed. Unlike the 2009 study where the catches were expressed as the catch ratio (i.e., $nmfs_{cpue}$:$bsfrf_{cpue}$), this study expressed the catches as the catch proportion (i.e. $nmfs_{cpue}$/($nmfs_{cpue}$+$bsfrf_{cpue}$), which is consistent with the standard approach used by the International Council for the Exploration of the Sea (ICES) working groups (Wileman et al 1996). This approach allowed for more comprehensive analysis of data from this experiment which was completed by Alaska Fisheries Science Center.



Based on the catches of the NMFS survey vessel at the 92 experimental stations, the carapace width frequency distribution in the experimental area was dominated by an extremely high abundance of both sexes near 45 mm. For both sexes, few large individuals were encountered and males >125 mm and females >70 mm were extremely rare and patchily distributed. The best fitting model describing trawl selectivity (proportion captured) included a smooth function of width and a smooth bivariate function of sediment size and depth. For both sexes the patterns of change with increasing size did not fit a logistic function in shape and therefore required the use of a non-parametric smooth function. Survey selectivity for both sexes varied with size in a pattern similar to trawl selectivity. For both sexes the uncertainty at the largest modeled size (males, 125 mm; females, 70 mm) was high due to the high incidence of catch proportions based on the combined catch of only a single crab.

Results from this survey again showed that proportions of snow crab in front of the standard NMFS trawl were less than 0.5 for most sizes and further supported the general results from the 2009 snow crab net efficiency survey. While the 2010 experiment was designed to minimize concerns that arose from results of the 2009 survey, new results from 2010 highlighted some of the strengths evident in the 2009 experiments. After review by both the NPFMC Crab Plan Team and Scientific and Statistical Committee, research partners agreed to use results from both 2010 and 2009 trawl efficiency studies for improving the accuracy and precision of biomass estimates within the snow crab stock assessment model. The recently reviewed and approved Bering Sea snow crab stock assessment model utilized data from both 2009 and 2010 cooperative experiments and a preferred model alternative was chosen with an estimated Q value for snow crab of 0.58.