**Spatial patterns in near bottom oceanographic variables collected during AFSC bottom trawl surveys.**

Principal Investigators - Chris Rooper (AFSC – RACE), Jerry Hoff (AFSC – RACE)

Contact: Chris.Rooper@noaa.gov

**Last updated: October 2013**

**Description of index**: In 2012 the RACE Division purchased four SeaGuard CTD units (funded by the North Pacific Research Board and Deep Sea Coral Research and Technology Program). These units were purchased to increase the oceanographic data collections during bottom trawl surveys of the eastern Bering Sea slope, Gulf of Alaska and Aleutian Islands.

The CTD units collect concurrent depth, temperature, salinity, pH, oxygen and turbidity data. The units are deployed on the headrope of the AFSC bottom trawls during most survey hauls. To date, the data has been collected on the 2012 EBS slope and the 2013 GOA bottom trawl surveys.

The data is presented here as a series of maps of bottom variables (the average value of each variable during the on-bottom period of the bottom trawl haul). The data have been interpolated to a 1 km by 1 km raster using R software. For salinity, pH and oxygen kriging with a fitted exponential semi-variance model was used based on the spatial pattern in semi-variance plots. The turbidity data exhibited a linear decrease in semi-variance with distance, so inverse distance weighting was used for this variable. In the Gulf of Alaska in 2013, this data was not collected during parts of the second and third survey legs resulting in a substantial data gap from Kodiak Island to the Fairweather Ground (Figure 1). The EBS slope data collection in 2012 covered the entire continental slope. The Gulf of Alaska data were not corrected for time of the year, so some within-season temporal effects could be present because of the prosecution of the survey from west to east from June to August.

**Status and trends**: Patterns in salinity on the eastern Bering Sea slope mirrored depth, with high salinity water on the deeper portions of the slope and less saline waters on the upper slope and shelf(Figure 2). Oxygen concentrations were also higher in shallow areas of the slope, but there were also some areas of low oxygen concentration in the middle of Pribilof and Zhemchug canyons. pH distribution followed oxygen very closely. Turbidity was higher in the southern EBS slope in Bering Canyon and Pribilof Canyon and lower along the northern stretches of the slope, with the exception of the northern arm of Zhemchug canyon.

Salinity in the Gulf of Alaska was highest on the upper slope southwest of Kodiak Island and on the southeastern Alaska outer shelf (Figure 3). Oxygen concentration was highest in areas to the west of the Shumagin Islands the on the middle and inner shelf and was uniformly low in SE Alaska. pH was low in a band across the shelf near the Shumagin Islands and generally was low on the outer shelf elsewhere in the Gulf of Alaska. Turbidity was low in all areas with the exceptions of what are probably some individual bottom trawl hauls on the inner and middle Gulf of Alaska shelf.

Since this was the first year of data collection in both areas, no time-series trends are reported.

**Factors causing observed trends**: The observed spatial trends in near bottom salinity are likely caused by relationships to depth in the EBS and freshwater runoff in the GOA. There may be a seasonal signal in the Gulf of Alaska salinity signal. The patterns of high turbidity in the Gulf of Alaska are probably caused by high turbidity in a select number of individual tows. The trends in other variables are likely the result of areas of differential primary production and other oceanographic features.

**Implications**: As more of this data is collected relationships between fish and invertebrate distributions will be explored. When multiple years of data have been collected for each area, variability of spatial patterns may be important.

**Figure captions**

Figure RooperHoff1. Sampling locations where bottom trawl hauls collected oxygen, pH, salinity and turbidity data from the net headrope. Light blue points were sampled on the eastern Bering Sea slope in 2012 (n = 167). Purple points were sampled in the Gulf of Alaska in 2013 (n = 164).

Figure RooperHoff2. Maps of interpolated pH, oxygen, salinity and turbidity for the eastern Bering Sea upper slope. The data were collected at bottom trawl survey stations during the 2012 bottom trawl survey and were interpolated to a 1 km by 1 km grid for the upper slope and shelf. The salinity map includes data collected on the EBS shelf survey that allowed interpolation to the outer domain of the EBS shelf.

Figure RooperHoff3. Maps of interpolated pH, oxygen, salinity and turbidity for the Gulf of Alaska shelf and upper slope. The data were collected at bottom trawl survey stations during the 2013 bottom trawl survey and were interpolated to a 1 km by 1 km grid for the upper slope and shelf. No data was collected in the area from Kodiak Island to the Fairweather Ground.