Variability in California Current Rockfish Recruitment and Ecosystem Structure

Fisheries Ecology Division, Southwest Fisheries Science Center

INTRODUCTION

The Groundfish Analysis Team, at the Southwest Fisheries Science Center's Santa Cruz Laboratory, has been monitoring the recruitment (year class success) of rockfish (*Sebastes spp*.) and other groundfish in the California Current since 1983. The survey began in a "core" area, off of central California, but expanded to all of California waters in 2004. Comparable data has been collected in northern waters in collaboration with the NWFSC and (historically) the Pacific Whiting Conservation Cooperative in most years since 2001.

The survey relies on midwater trawling, conducted at night due to the ability of pelagic young-of-the-year (YOY) rockfish to avoid gear during daylight hours. Rockfish and other species are sorted, measured and enumerated at sea. In addition to quantifying YOY rockfish and other micronekton, we collect and analyze oceanographic data , marine mammal and seabird abundance data, acoustic data, and support other research efforts as resources allow.

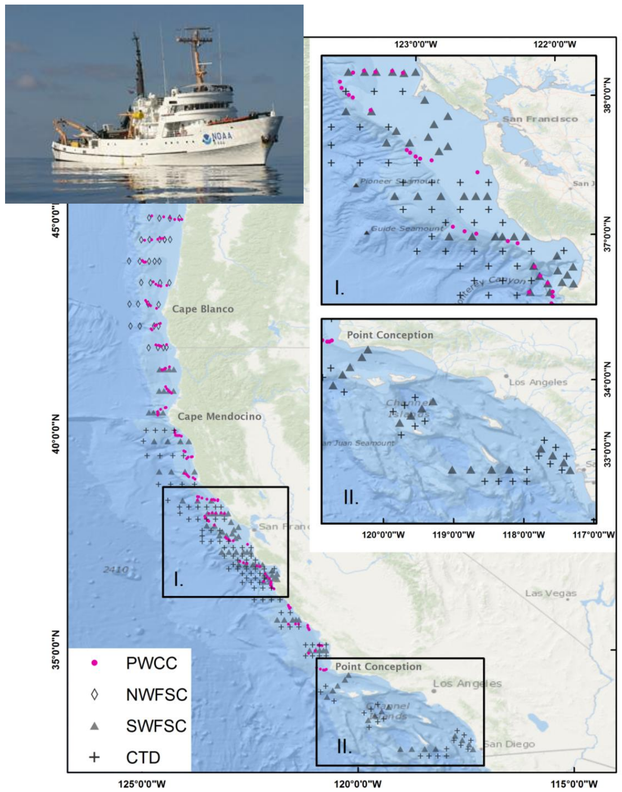

Figure 1: Map of survey area and most frequently occupied stations

PROJECT GOALS

The primary objective of the survey is to provide the data necessary to develop estimates of abundance of rockfish and other groundfish for use as pre-recruit indices in stock assessments. However, the survey also fills many other key research objectives. These include studies into the physical and biological ecosystem factors that lead to strong or weak year classes (Process studies) as well as studies that relate spatial and temporal variability in the micronekton (forage) assemblage to both climate (as a driver) and dependent predators (Ecosystem studies). For example, Figure 2 (right) shows the spatial organization of the forage community in the Central California region, based on an integration of environmental, micronekton and predator distribution data collected during the survey (Santora et al. 2012).

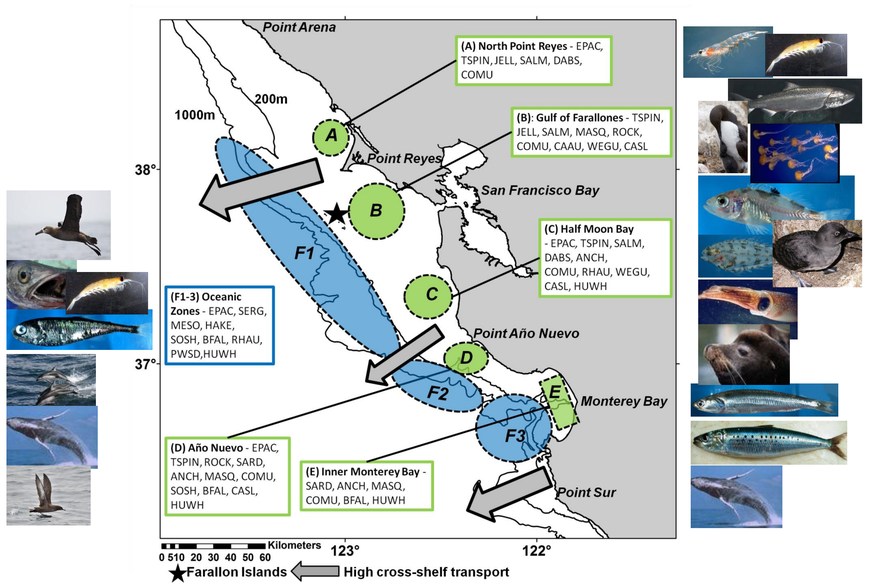

Figure 2: Spatial organization of forage and predator community in the core (Central California) survey area (from Santora et al. 2012).

RESULTS

The standardized catch rate time series of YOY rockfish abundance in the core area are shown in Figure 3 (below), updated from Ralston et al. (2013). The results show that interannual fluctuations of all ten species are strongly coherent, but highly variable, with both high- and low-frequency components. We have shown that sea level anomalies, which relate to the intensity of equatorward flow in the California Current, are best correlated with these recruitment trends. Equatorward anomalies in alongshore flow are associated with elevated YOY survival, while poleward anomalies (often associated with El Niño events) are associated with poor survival. The 2013 survey saw the highest juvenile rockfish catches in the time series, suggesting that strong recruitment of most rockfish and many other groundfish species should be expected in the next 2 to 5 years as these fish recruit to adult populations and fisheries.

Additional research efforts have demonstrated broad-scale temporal coherence between rockfish, other YOY groundfish, and other key components of the ecosystem. These studies have shown that krill, squid and other species that covary with YOY groundfish also tend to be more abundant in years of high southward transport and greater productivity, while coastal pelagic and mesopelagic species tend to be more abundant (in the survey area) during years of low transport and productivity. The abundance of YOY groundfish and other forage as indexed by this survey has also been linked to seabird and salmon productivity, suggesting that indices of community structure from this survey represent a good metric of ecosystem status and productivity.

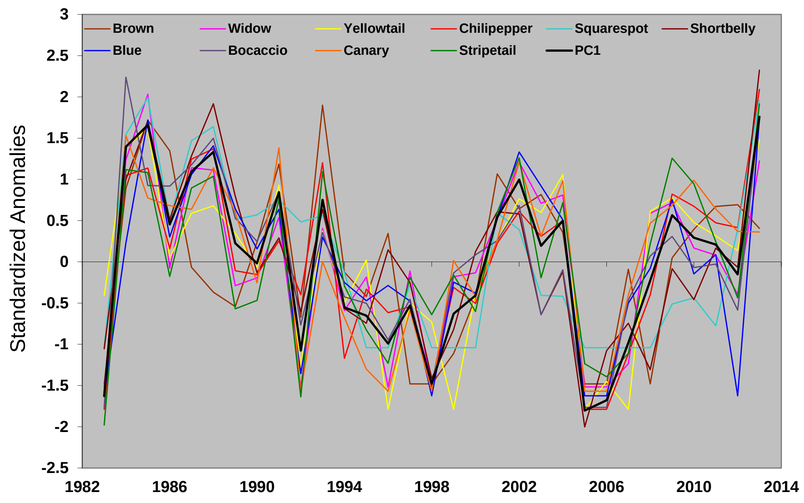

Figure 3: Standardized anomalies of recruitment indices for the ten most frequently encountered rockfish species (from Ralston et al. 2013)

COLLABORATORS

Over the years, we have collaborated with dozens of individuals and institutions outside of NOAA to accomplish research objectives. Key partners have included UC Santa Cruz, the Farallon Institute for Advanced Ecosystem Studies, Hopkins Marine Station, San Francisco State Romberg Center, and Point Blue (formerly PRBO Conservation Science).

KEY REFERENCES

Ralston, S., K.M. Sakuma and J.C. Field. 2013. Interannual variation in pelagic juvenile rockfish abundance– going with the flow. Fish. Oceanogr. 22: 288–308.

Santora, J.A., J.C. Field, I.D. Schroeder, K.M. Sakuma, B.K. Wells and W.J. Sydeman. 2012. Spatial ecology of krill, micronekton and top predators in the central California Current: implications for defining ecologically important areas. Prog. Oceanogr. 106: 154-174.