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Squid Squad Update

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Overview

During and after the 2022 *Illex* squid Research Track Assessment, a group of fishery participants, scientists, and managers have been meeting to seek an ongoing collaborative approach to improving our knowledge of *Illex* squid. Kim Hyde, Anna Mercer, and Sarah Salois of NMFS' Northeast Fisheries Science Center will provide an overview of the approaches and results of this "Squid Squad," as well as the potential for future work.

The Squid Squad facilitated several working papers for the last *Illex* assessment, and two resulting papers are in the publication process. Two related presentations were also given at recent cooperative research workshops, and abstracts for those presentations are copied below as primers for this agenda item:

Using a collaborative framework to identify oceanographic indicators of *Illex* illecebrosus: Origination of the Squid Squad

Climate-driven variations in oceanic conditions can impact population dynamics of commercially important species, including *Illex* illecebrosus, a highly migratory species whose migration patterns are largely influenced by regional oceanography. The U.S. *Illex* fishery has high spatial and interannual variability, posing a particular set of challenges to the management and assessment of the species. Through interdisciplinary collaboration we developed conceptual and statistical models that identified important environmental variables to serve as oceanographic indicators of *Illex* availability. This team, affectionately referred to as the "Squid Squad" continues to work together sharing knowledge and developing lines of research. Our highly collaborative research team includes federal (NEFSC; GARFO), academic (Woods Hole Oceanographic Institute; University of Massachusetts), industry (fishing captains; processors), and management (MAFMC) partners. Together we are improving data collection and visualization, analyzing biological and oceanographic data, developing models, creating platforms for tracking oceanographic conditions, and coordinating field sampling efforts between commercial fishing and research vessels. Recent successes include development of a collaborative framework for the identification of fine-scale oceanographic indicators for *Illex*, which can also be applied to other commercially important species. The U.S. *Illex* fishery serves as an example of the insights and understanding of a data-limited stock that is achievable through open collaboration and cooperative research.

Deriving metrics from remote sensing and modeled data to relate oceanographic conditions to availability for the Northern shortfin squid fishery

Oceanographic satellite imagery is a powerful tool for assessing dynamic marine systems in a changing world. Remotely sensed data are well suited for environmental analyses and ecological forecasting as they provide long-term synoptic, near real-time coverage of oceanographic conditions at high spatial (1-4 km) and temporal (daily) resolutions. This study utilizes these long term time series, as well as global ocean reanalysis physical data to generate high resolution metrics which are then paired with high resolution fishery dependent catch data to serve as indicators for understanding the distribution of the commercially important Northern shortfin squid, *Illex* illecebrosus. *Illex* are a data poor species due to their sub annual lifespan and offshore migrations. Recent years have seen above average availability to the U.S. fishery, yet the drivers associated with the high abundance years are unknown. It is thought that the variable population dynamics exhibited by *Illex* in the U.S. Mid-Atlantic fishery are largely influenced by oceanographic conditions of the Northwest Atlantic, which have documented significant changes over the past decade. Using generalized additive models to examine the relationships between *Illex* catch and environmental covariates, we identified a suite of oceanographic indicators of habitat condition and primary productivity that may influence *Illex* availability throughout the fishery footprint. In particular, we found that cooler bottom temperatures, higher instances of warm core ring (WCR) occupancy in the winter and early spring months (ahead of the summer fishery), as well as physical processes that promote upwelling (e.g.: frontal dynamics and interactions between WCRs and subsurface features) are associated with greater CPUE. Understanding relationships between the spatiotemporal distribution of *Illex* catch and specific properties of oceanographic features (e.g.: mesoscale eddies, fronts) has important implications for understanding the mechanistic processes influencing the availability of this species.