

## Connecting ocean physical and biogeochemical properties with the spatial distribution of mesopelagic fish abundance/biomass

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Estimates of the global distribution of mesopelagic fish biomass/abundance are based on a very limited number of studies (i.e. Gjøsæter and Kawaguchi (1980), Proud et al. (2017), Sutton et al. (2017)). Spatial distribution estimates are coarse and are not linked with specific mesopelagic physical and biogeochemical properties. Current constructions of mesopelagic biogeographic domains are mainly based on cluster analyses that do not provide dynamic linkages to underlying variables (i.e. temperature, dissolved oxygen, surface productivity). We are building and testing a set of models using supervised machine learning that utilize ocean physical and biogeochemical parameters that are consistent with prior global scale mesopelagic biomass/abundance estimates to model the distributions on the grid scale ( $\sim 1$  deg resolution). The models would include temperature, salinity, and dissolved oxygen data from World Ocean Atlas, GEBCO ocean bathymetry, surface chlorophyll from the NASA MODIS satellites, oceanographic current data from the Simple Ocean Data Assimilation (SODA3) reanalysis, global estimate of ocean turbulent mixing based on Argo floats data, and biomass/abundance data from Gjøsæter and Kawaguchi (1980) and Ocean Biogeographic Information System. We hypothesize that areas of high mesopelagic fish biomass correlate with high surface primary production as well as particular physical conditions (i.e. specific bathymetric feature, temperature range, dissolved oxygen levels, ocean fronts, and turbulent conditions that maximize food availability and organismal interactions). The goal of this study is to identify what those physical conditions are and how they influence mesopelagic fish distribution and density. The study will test a variety of models ranging from simple linear models to more complex neural networks.