Modeling the Challenging Impacts of Climate and Fishing on the South Pacific Jack Mackerel

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For the last 50 years, the South Pacific Jack Mackerel (SPJM, *Trachurus murphyi*) stock has been heavily exploited in the entire South Pacific but no management strategy has yet been developed in national nor in international waters. In addition to a likely multi-national overexploitation, the current precipitous decline of SPJM population could be explained by climate-driven decadal fluctuations as observed for other small pelagic species (anchovies, sardines etc.). Furthermore, previous studies on the stock structure of SPJM suggested a mismatch between an assumed one-stock-population and the biological reality. Since ignoring spatial population structure and dynamics may negatively impact stock assessments and hence management effectiveness, the Spatial Ecosystem And Population Dynamic Model (SEAPODYM) is used to investigate the dramatic changes in SPJM population under the influence of both environment and fishing. The interannual to decadal variability in SPJM population is investigated in relation with Pacific climatic modes (ENSO, PDO). A first optimised parameterisation of the model was achieved in the South Pacific Ocean using environmental fields predicted from a coupled bio-physical model (NEMO-PISCES) forced by an atmospheric reanalysis. A unique multi-national dataset, combining effort-catch data and associated size frequencies, biomass acoustic estimates and eggs-larvae density, was used to optimize the model parameters with a maximum likelihood estimation methodology, allowing robust parameter estimation. A second configuration is used to forecast the future of SPJM populations under an IPCC scenario for the 21th century. Preliminary results are compared to those obtained with the reanalysis for the historical period, and the sources of uncertainty in the projected trends of the population are discussed. These first results enable the use of Seapodym as a predictive and management application tool to test, in future work, various CJM spatial management strategies.