IV ROSS SEA CONFERENCE 2023

Topic: Marine biology and ecology

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ABSTRACT Subject :

RESURGENCE OF THE ANTHROPOCENE IN THE ROSS SEA, ANTARCTICA

Abstract   15/01/2023 22:14:10

The Ross Sea, during the late 20th century, was classified as the ocean area least affected by human activities, despite appreciable exploitation of whales and seals as well as intense local pollution before the period of classification. Those direct impacts were removed by the 1980s under the Antarctic Treaty and International Whaling Commission. Subsequently (2019), the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) included most of the Ross Sea within a marine protected area (MPA), proposed proposing "to protect [undefined] ecosystem structure and function [undefined]." CCAMLR selected three upper-trophic-level species to be "indicator species": Adélie Penguin (Pygoscelis adeliae), Emperor Penguin (Aptenodytes forsteri), and Weddell Seal (Leptonychotes weddellii). Populations of each in the southwestern Ross Sea, monitored for several decades, were stable for a couple decades, but during 1998-2018 increased to attain or surpass historical levels. Therefore, ecosystem structure and function is changing. We review historical impacts to populations and trends, decadal data sets of ocean climate, as well as fishing pressure of a trophic competitor and another selected indicator species, the Antarctic Toothfish (Dissostichus mawsoni). Statistical modeling for populations having sufficiently continuous data sets --- Adélie Penguins and Weddell Seals --- indicates that variability in a few climate factors, plus cumulative extraction of toothfish, may well explain the indicator trends. Some effects were expected, e.g. negative correlation with large-scale sea ice extent (noted in previous studies for an earlier time period), but reasons behind effects of other variables are less certain. These mesopredators, and the toothfish, prey heavily on Antarctic Silverfish (Pleuragramma antarcticum). The fishery targets the oldest, largest toothfish, which owing to an extreme k-selected demography are not easily replaced, indicated by decreasing prevalence in the catch, supported by independent scientific fishing and CCAMLR modeling. Despite decades of ocean/weather variables changing, penguin and seal increase began only after fishery initiation. We hypothesize that toothfish removal may be altering intraguild predation dynamics, leading to competitive release of the intraguild prey, the silverfish. The fishery has reduced toothfish spawning biomass by >25% since initiation; management should be re-evaluated in keeping with the rational use, ecosystem-based viewpoint espoused by CCAMLR and its Ross Sea Region MPA.