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Multi-model ensemble projections indicate high degree of change for Southern Ocean fish under climate change

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Climate change is altering the abundance and distribution of marine species with direct consequences for seafood supply and human well-being. Recent projections of future trends, however, are highly contingent on model choice. The Fisheries and Marine Ecosystem Model Intercomparison Project (Fish-MIP) is a network of more than 40 global and regional marine ecosystem modellers from around the world. Our goal is to bring together disparate marine ecosystem models to better understand and forecast the long-term impacts of climate change on fisheries and marine ecosystems. We use earth-system models (ESMs) and emission scenarios (RCPs) with shared socioeconomic pathways (SSPs) based on human population growth and GDP - but with some adaptations to represent future fishing scenarios in the ocean. Marine ecosystem models use very different basic structures to represent food-web or ecosystem components and the links between them. Ecosystem components can be represented by size classes, functional groups, trophic levels, species groups, and life-history stages, whereas links can be represented by who-eats-whom networks, diet composition or energy transfer. We conducted ensemble projections combining 6 global ecosystem models with 8 standardized climate-change scenarios. By 2100, average global fish biomass decreased by 5% under low and 17% under high emissions, primarily driven by increasing temperature and decreasing primary production. Declines were stronger with fishing and for larger organisms. Regional changes ranged from 50% biomass increase in high latitudes, with highest uncertainties in polar and coastal regions. Our results highlight widespread climate impacts projected for Antarctic fish production.