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TITLE: The cumulative effect of trawl fishing on a multispecies fish assemblage in south-eastern Australia

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ABSTRACT:

Summary Understanding the effect of anthropogenic pressure on animal assemblages over time is a challenging problem that integrates human activities and community ecology. Our ability to make informed decisions for managing pressures depends on estimating their ecological effects, and a rigorous and objective approach should be used. There are three requirements for this type of approach to be successful: sufficient biological and ecological data, congruent data describing human activity and an appropriate statistical method that can link the ecological information to the pressures. In this work, we explore the effects of cumulative bottom-trawl fishing on fish assemblages over a 20-year period. The analysis captures assemblage responses during the early period of the fishery's development and shows the changes in the abundance of many species as a small and coherent set of 'archetypical' responses to cumulative pressure. The effect of the cumulative pressure is heterogeneous: some archetypical responses show consistent decline with increased fishing effort, some are less sensitive, and some show an increase in abundance. Some, but not all, archetypical response groups are composed of species with similar ecological and life-history traits. Most obviously, the archetype showing greatest decline in abundance is made up of species that have the highest mean values of generation time, oldest age at maturity and longest life span. Applications of the methods include identifying spatially explicit system-level trade-offs between species, species groups (archetypes) and fishery subareas for ecosystem-based management. Synthesis and applications The impact of fishing pressure, accumulated over time, induces heterogeneous patterns of change in fish assemblage composition. The patterns of change are grouped into 'archetypical response groups' to provide an interpretable and robust description. The composition of the species groups show that life-history traits are indicative but do not always provide a complete description of how a species might respond to the pressure.

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