

**Forage fish fisheries management requires a tailored approach to balance tradeoffs**

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**Abstract**

Ecosystem-based fishery management requires considering the effects of actions on social, natural and economic systems. These considerations are important for forage fish fisheries, because these species provide ecosystem services as key prey in food webs and support valuable commercial fisheries. Forage fish stocks fluctuate naturally, and fishing may make these fluctuations more pronounced yet harvest strategies intended to ameliorate the effects of these fluctuations might adversely affect fisheries and communities. We evaluated trade-offs among a suite of management objectives by simulating outcomes from several harvest strategies on forage fish species. We find that some trade-offs (like those between catches and minimizing collapse length) were universal among forage species and could not be eliminated by using different control rules. We also demonstrate that tradeoffs vary among forage fish species, with strong tradeoffs between stable, high catches and high-biomass periods (“bonanzas”) for menhaden- and anchovy-like fish, and counterintuitive tradeoffs for sardine-like fish between shorter collapses and longer bonanzas. We find that a harvest strategy designed to maintain stability in catches will result in more severe collapses. Finally, we show that the ability of assessments to detect rapid changes in population status greatly affects control rule performance and the degree and type of tradeoffs, increasing the risk and severity of collapses and reducing catches. Together, these results demonstrate that while default harvest strategies are useful in data poor situations, management strategy evaluations that are tailored to specific forage fish may better balance trade-offs.

**Keywords**

ecosystem-based fisheries management, management strategy evaluation, population dynamics, small pelagics

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