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Local management of a "highly migratory species": the effects of long-line closures and recreational catch-and-release for Baja California striped marlin fisheries

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Management of highly migratory fish species is generally assumed to require complicated international agreements. The effects of spatial closures for such species are thought to be diluted by their extensive movements. We tested these assumptions using a case study of striped marlin (*Kajikia audax*) fisheries off of Baja California, Mexico. Beginning in 1977, Mexico instituted a series of long-line fishery closures and closed areas to reduce commercial fishing mortality rates on billfishes. Using data from the Japanese long-line fishery and the recreational billfish fishery in a stock reduction analysis (SRA) model, we show that temporary closures of Mexico's EEZ to longlining from 1977-1980 and 1984-1985 had a rapid effect on local abundance of striped marlin. Regional striped marlin abundance likely increased by 12%-22% following the four-year closure and 6%-12% following the two-year closure. Increases near Baja California may have been larger. Recreational catch-and-release appears to have a more modest effect because catches in the recreational fishery are substantially smaller than historic long-line catches. A 100% release rate over the 10-year period for which recreational catch data were available would likely have increased regional abundance by 2.8%-7.5% relative to no recreational release. There is also evidence for a small effect of the El Niño Southern Oscillation (ENSO) on recruitment or net immigration, with stronger recruitment or net immigration during the cooler La Niña phase.

Palabras clave: Tendencias espaciales, Specialist, El Niño southern oscillation, *Tetraps audax*, billfish, Marine protected area, marine reserve, postrelease mortality, recreational fisheries

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