

Tradeoff Analysis of the Conservation and Fisheries Benefits of Temporal Closures in a Spawning Aggregation Fishery

Análisis de Compensación de la Conservación y la Pesca Beneficios de los Cierres Temporales en una Pesca de Agregación de Desove

Analyse des Compromis entre les Bénéfices en Termes de Conservation et les Bénéfices pour les Pêcheries de Fermetures Temporaires d'une Pêche Ciblante une Agrégation de Ponte

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EXTENDED ABSTRACT

Fisheries that target fish spawning aggregations are often unsustainable, such that even moderate exploitation of spawning fish can result in overfishing and marked population declines (Russell et al. 2014). Therefore, it is preferable for management and conservation measures to take a precautionary approach (e.g. spatial or seasonal closures) initially to avoid overfishing and rapid stock declines while the dynamics of spawning and interactions with fishing activities become better understood (Sadovy de Mitcheson 2016). Nevertheless, the long-term goal of fishery management is to balance utilization with conservation as a means for supporting sustainably exploited stocks. Therefore, it is important to investigate the degree to which fish spawning aggregations may be sustainably exploited and to identify management scenarios that may produce a balanced outcome (Erisman et al. 2015).

We designed a parsimonious, non-spatial, per-recruit model to evaluate the effects of seven time-closure scenarios on egg-production-per-recruit (reproductive capacity; a conservation metric) and yield-per-recruit (exploitable biomass; a fisheries metric) of Gulf Corvina (*Cynoscion othonopterus*), a vulnerable marine fish species that is heavily exploited at its only known spawning grounds in the Gulf of California, northwest Mexico (Erisman et al. 2012). Results of the model indicated that exploitable biomass was enhanced in five of the seven time-closure scenarios. Moreover, three scenarios offered a reasonable compromise between reproductive capacity and exploitable biomass, in which measurable increases in egg-production-per-recruit (16 - 42%) were accompanied by proportional increases in yield-per-recruit (33 - 44%) that resulted in a sustainable fishery.

Our preliminary findings suggest that the implementation of specific time closures during the spawning season (e.g. closures during the peak spawning day each migration period) can benefit both the conservation of Gulf Corvina and its fishery through the sustainable exploitation of fish spawning aggregations. Results of the study illustrate how detailed information on spawning and fishing activities can be directly incorporated into stock assessments and used for evaluations of management measures for aggregation fisheries. More broadly, our study provides empirical evidence that sustainable harvesting of fish spawning aggregations may be possible, even in fisheries that specifically target them.

KEYWORDS: Fish spawning aggregations, Gulf of California, marine conservation, fisheries management, small-scale fisheries

LITERATURE CITED

- Erisman, B.E., O. Aburto-Oropeza, C. Gonzalez-Abraham, I. Mascareñas-Osorio, M. Moreno-Báez, and P.A. Hastings. 2012. Spatio-temporal dynamics of a fish spawning aggregation and its fishery in the Gulf of California. *Scientific Reports* 2:284.
- Erisman, B., W. Heyman, O. Aburto-Oropeza, T. Ezer, R. Nemeth, S. Pittman, and S. Kobara. 2015. Fish spawning aggregations: where well-placed management actions can yield big benefits for fisheries and conservation. *Fish and Fisheries* 18:128-144.
- Russell, M.W., Y. Sadovy de Mitcheson, B.E. Erisman, R.J. Hamilton, B.E. Luckhurst, and R.S. Nemeth. 2014. *Status Report – World's Fish Aggregations 2014*. Science and Conservation of Fish Aggregations, California, USA. International Coral Reef Initiative.
- Sadovy De Mitcheson, Y. 2016. Mainstreaming fish spawning aggregations into fishery management calls for a precautionary approach. *BioScience* 66:295-306.