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An ecosystem modelling approach to deriving viable harvest strategies for multispecies management of the Northern Gulf of California

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An ecosystem analysis was developed focusing on resource exploitation and biodiversity conservation for the Northern Gulf of California. The main tools employed were a trophic ecosystem model and time dynamic simulations. The ecosystem was represented by an Ecopath model that included 34 functional groups, from primary producers to top predators. It included relevant species in the area such as commercially important shrimp (e.g. Litopenaeus stylirostris) and highly endangered species (Phocoena sinus and Totoaba macdonaldi). Temporal simulations of changing fishing effort allowed the evaluation of fishing impact on the ecosistema components and, particularly, on protected species. Formal optimization methods were applied with the purpose of searching viable temporal patterns of fishing effort that might minimize social, economic and conservationist conflicts in the area. The results of those simulations showed the capability of the model to represent reference temporal series of relative biomass. The search for viable fishing strategies resulted in effort allocation consistent with those proposed by other studies; that is, a decrease in the industrial shrimp fleet (35-65%), a decrease in the gillnet fishing fleet (52-57%), and an increase of the artisanal shrimp fishery (63-222%). The main conflicts in the Northern Gulf of California seem to take place between social and conservation interests, while the economic and ecological benefits seem to be relatively independent. The next steps towards conflict resolution and ecosystem management should consider the design and operation of MPAs already established in the region.

Palabras clave: Phocoena sinus, Totoaba macdonaldi, Gulf of California, Ecopath with Ecosim, ecosistema, fishery optimization, conflict resolution