

Sustainable Management of Commercial Demersal Fisheries of Sistan and Baluchestan Province

Abstract:

Based on empirical observations and research results, resource sustainability and marine biodiversity are among the most important issues in the fisheries sector. In this regard, the "Bio-Economics" modelling based on the concept of "Ecosystem-Based Fisheries Management" and on the basis of "Co-viability approach" under the "control theory", is considered as a strong "Decision Support System" to examine the sustainability of the complex systems of natural resources and environment. Because this is such a modeling process that takes into account the simultaneous equilibrium of ecological, economic, and social goals, and the uncertainty and complexity of dynamic interactions that are a feature of systems and biodiversity. Marine and coastal ecosystems increasingly encounter to the subject to changes in relation to populations, species, and unions on a variety of vital scales, with some warning processes (extinction, depletion, ...) and large unknown consequences. Therefore, harvesting of commercial fishes, which are mainly done by small-scale fishermen in coastal areas, has direct and indirect effects on various human societies and provides economic benefits. Therefore, the harvesting sustainability regard to the above-mentioned fishes is one of the most important social concerns. Therefore, in the present study, the above-mentioned sustainability management modeling has been used to assess the management strategies for the analysis of fishery sustainability with an emphasis on the fourteen demersal fish species that are the most important economically, and have harvested by the "small-scale (coastal)" fishing sector of the coastal area of the Sistan and Baluchestan province (Mokran Sea). Due to the lack of biological information on the dynamics of the fish species studied in this study, which is one of the most important types of the data and information that used in sustainable fisheries management models, the "Bayesian State-Space Generalized Surplus Production stock assessment" models have been used to provide the above-mentioned information. Also, one of the most important data used to estimate for the estimation of the above-mentioned stock assessment is the "catch per unit effort" which is belong to the fishing information that can be extracted from the commercial fishing data. And given the fact that the nominal indices of "catch per unit effort" are usually influenced by the variables such as environmental, time and space factors, so they have been purified or standardized before using in the stock

assessment models, by using "generalized linear models" And "generalized additive models". In addition to data management and drawing of some charts using Excel software, the calculations and estimations of the current research have been done by the softwares, such as (OpenBugs version 3.2.3), software packages (R2OpenBUGS), (CODA), (MuMin), (mgcv), (Glm2) under open source software R, open source software (Scilab 5.2.2) and the software package of genetic algorithm (optim_ga) under open source software (Scilab 5.2.2), also the map of study area was designed by software (version 2.16.2 QGIS). Finally, the results of the standardization of the "catch per unit effort" were analyzed in detail and showed that the status of the stocks of fourteen fish species that studied in current research had unfavorable conditions and faced with overfishing. Also, the standardized values of "catch per effort unit" have been provided to estimation of the stock assessment models. In the following, the results of the simulations of the "Markov chain Monte Carlo Algorithm" in relation to the models " Bayesian State-Space Generalized Surplus Production stock assessment" for the studied fish species have been discussed. As a result, the average of biomass of all studied fish species are at the lower level and less than the amount of biomass that produces maximum sustainable yield, therefore, in future under such conditions, there will be a possibility of extinction of the studied fish species of the current study. Finally, the results of various scenarios for sustainable management of fisheries in the studied area have been described in detail. According to the results, "Management Strategy of Co-viability Scenario" for multi-purpose sustainability requires limiting the fishing effort of the surveyed vessels. However, the above-mentioned scenario can be attractive for all fisheries-dependent groups by satisfying the profitability constraints for each vessels, species richness and regional food security. Therefore, the " Co-viability " strategy, potentially can be operated through fishing cooperation and understanding. In the end, solutions and recommendations tailored to the obtained results have been provided to improve the results and practical application of the "Decision Support System" of the present study.

Keywords:

Ecosystem-Based Fisheries Management, Co-Viability Method, Control Theory, Decision Support System, Bayesian State-Space Stock Assessment, Markov chain Monte Carlo Algorithm, Generalized Linear Models, Generalized Additive Models, Small-Scale Fishing Sector, Coastal of Mokran



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