Coastal ecosystems management

Predictive Modelling Of Coastal Habitats For Marine Spatial Planning

Tarek Hattab [(1)], Frida Ben Rais Lasram [(1,2)], Mohamed Salah Romdhane [(1,3)] and François Le Loc'h [(4)]

(1) UR 03AGRO1 Ecosystèmes et Ressources Aquatiques, Institut National Agronomique de Tunisie, 1082 Tunis, Tunisia
Telephone: +216-22-772-973 Email: hattab.tarek@gmail.com
(2) Telephone: +216 71 28 71 10 Email: frida.lasram@gmail.com
(3) Telephone: +216 71 28 71 10 Email: romdhane.medsalah@inat.agrinet.tn
(4) UMR 212 Ecosystèmes Marins Exploités (IRD-IFREMER-UMII) Avenue Jean Monnet,, 34203 Sète , Tunisia
Telephone: +33 (0)4 99 57 32 17 Email: francois.le.loch@ird.fr

The use of statistical models to predict the distribution of marine species is becoming an increasingly important tool in conservation planning and fisheries management. In this study, we first aim at testing the relevance of a hybrid methodological approach that combines Ecological-Niche Factor Analysis (ENFA) and Regression Kriging (RK) to predict distribution of marine species. We exemplify this approach by modelling the spatial distribution of 27 commercial marine species based on bottom trawls survey data carried out in the Gulf of Gabes. Then, the model outputs were used for the identification of areas required to meet the conservation targets of Artificial Anti-trawling Reefs. To do so, we proposed a fuzzy logic framework that allows accounting for the uncertainly arising from different model predictions. For each species, the model predictive accuracy was classified as ‘high’ with a mean AUC and Kappa criterion of 0.90 and 0.72, respectively. A better result was observed when a large number of occurrences are used to develop the model. When confirmed absences data are not available, we recommend the use of this method combining ENFA and RK predictions to deal with the imperfect ability to detect a species and to incorporate spatial dependence in predictions. The map resulting from the fuzzy overlay shows three main areas with a high conservation criterion, which is in agreement with ecological expert knowledge, and hence confirms the relevance of the proposed methodology.