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3.8. APPLYING ECOSYSTEM-BASED APPROACH TO THE FISHERIES MANAGEMENT IN THE BLACK SEA. FOCUS:
TURBOT (*Psetta maxima maeotica* Pallas, 1814)

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The FP7 project *MareFrame: Co-creating Ecosystem-based Fisheries Management Solutions* aims at applying the ecosystem approach in the assessment and management of fishery resources. The Black Sea Case Study is focused on turbot (*Psetta maxima maeotica* Pallas, 1814), one of the most valuable commercial species in the area.

Fishery is the most affected sector by the changes of the Black Sea ecosystem. In the same time, fishing activities contribute themselves to the worsening of the ecological situation and for the depletion of the fish stocks.

The objective of the Black Sea case study is the restoration of turbot fisheries to more productive levels, considering both the effect of fisheries and the ecosystem change that has occurred in the last 30 years. Three scenarios for the two ecosystem models will be applied: unique stock; one of the stocks in western part of the Black Sea and national stock. In all these scenarios, as a first management measure we will eliminate the Illegal, Unreported and Unregulated fisheries (IUU), also we will consider the condition of prey species, state of the predators and environmental conditions. Depending on the results, we will consider in the assessment models also other management measures, like: spatial restrictions; temporal restrictions; effort restrictions; minimum size; participatory restrictions etc.

Keywords: turbot, Black Sea, depleted stocks, ecosystem-based approach to the fisheries management (EAFM)

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APPLYING ECOSYSTEM-BASED APPROACH TO THE FISHERIES MANAGEMENT IN THE BLACK SEA. FOCUS: TURBOT (*Psetta maxima maeutica* Pallas, 1814)



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Background

The paper refers to the context in which the case study on the ecosystem approach in the assessment and management of the Black Sea turbot was proposed within the FP7 project MareFrame: Co-creating Ecosystem-based Fisheries Management Solutions. This case study is a Romanian initiative which very much relies on the ecosystem-based approach to the fisheries management (EAFM), taking into account that the Black Sea ecosystem is seriously affected by dynamic changes directly related to fishing, climate change and pollution. Fishery is the most affected sector by the changes of the Black Sea ecosystem. In the same time, fishing activities contribute themselves to the worsening of the ecological situation and for the depletion of the fish stocks.

The paper presents some aspects such as:

- Biological and ethological characterization of turbot in current environmental conditions;
- Current state of the Black Sea environment in general and especially in the western part of the sea;
- Evolution of the turbot fishery at regional and national level;
- State of the turbot stock;
- Motivation of the choice of two ecosystem models: GADGET (Globally applicable Area Dis-aggregated General Ecosystem Toolbox) and EwE (Ecopath with Ecosim).

Material and Methods

The current assessment for the Black Sea turbot is based on the analysis of the best available information, obtained from combined data of all Black Sea countries and assuming the stock as representing a single unit in the entire Black Sea (STECF/BSSA-EWG).

The State-Space Assessment Model (SAM) approach was applied to catch-at-age data for age-classes 2 to 10+ from the period 1950 to 2013. The estimated F for 2013 (1.33) exceeds the previous historical high level (in 2001) and is more than five times the estimated FMSY (0.26). The assessment indicates that the spawning stock biomass continues to be at very low levels (around 1,634 t) and it is estimated to be less than half of Blim (3,535 t).

Taken into account that most scientists from the Black Sea area consider that the turbot is represented by several local populations mixing in the adjacent zones, in our case study we want to follow three scenarios for the two ecosystem models: stock unique; one of the stocks in western part of the Black Sea and national stock.

In all these scenarios, as a first management measure we will eliminate the IUU (Illegal, Unreported and Unregulated fisheries), also we will consider the condition of prey species: fish (whiting, gobies, spry, anchovy), bivalves, decapods; state of the predators (cetaceans) and environmental conditions. Depending on the results we will consider in the model also other management measures, like: spatial restrictions; temporal restrictions; effort restrictions; minimum size; participatory restrictions.

The NIMRD oceanographic data set contains physical and chemical data collected during survey cruises in the framework of different national/international projects, as well as the National Monitoring Program for the period 1963-2013 (<http://www.nodc.ro>). In addition, biological data will be included in the models, with particular focus on fisheries data.

Results

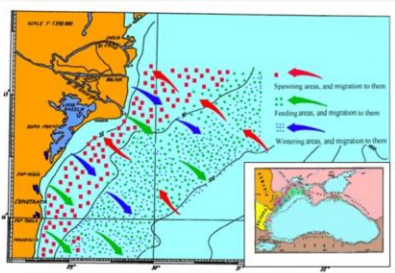
The expected outputs from the GADGET model are:

Total biomass (for all stocks/stock components); Biomass by age, length, area, time step and stock component; Catches and landings (both total and by model dimensions); Predation (both total and by model dimensions); Recruitment (by length, area, time step and stock component); Mortality; Numbers by any model dimension (i.e. by age, length, area, time step and stock component); Length distributions; Stock (component) proportions; Fitted values on the same dimensions as the observations

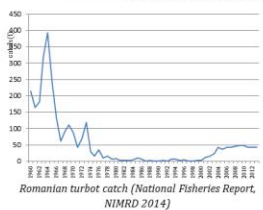
The Ecopath with Ecosim (EwE) will be used to:

Evaluate biomasses and fluxes; Address ecological questions; Evaluate ecosystem effects of fishing; Evaluate effects of environmental changes; Explore management policy options; Evaluate the impact and placement of marine protected areas.

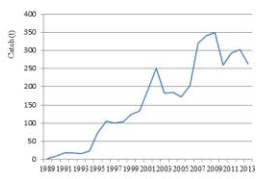
NIMRD will examine to what extent the two ecosystem models fulfill the ecological and socio-economic criteria. Although the Black Sea is considered "data poor", NIMRD has a series of data available for modeling. For modeling have been identified the necessary data, being given detailed descriptions of: spatial units, oceanography, functional groups, commercial activities, surveys (bottom trawl and pelagic), stomach data, stock definition and socioeconomic data.



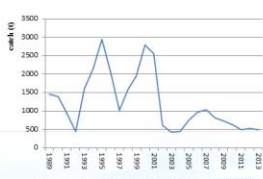
Distribution of turbot in the Romanian marine area



Romanian turbot catch (National Fisheries Report, NIMRD 2014)



Turbot catch (t) in the Western Black Sea (National Fisheries Report, NIMRD 2014)



Turbot catch at Black Sea level (National Fisheries Report, NIMRD 2014)



IUU fisheries for turbot in the Black Sea (original photos)



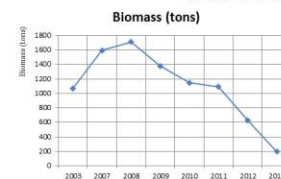
Cetaceans by-caught while illegally fishing for turbot in Romanian waters (original photo)

The following parameters have been calculated for growth and mortality rates for turbot:

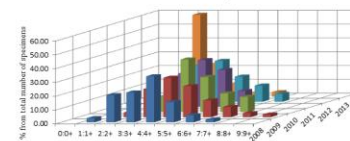
- a = 0.0898
- b = 2.812
- r = 0.9911
- K = 0.21 - average
- to = -1.638 - Bertalanffy
- L_∞ = 82.9cm - Gulland and Holt
- Z = 0.572 - Beverton and Holt
- Z = 0.439 - Ault and Erhart
- M = 0.317 - Rikhter and Efanov
- M = 0.36 Pauly



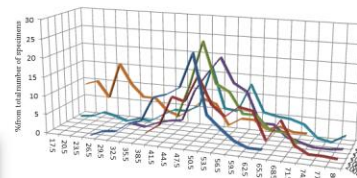
Black Sea turbot *Psetta maxima maeutica* Pallas, 1814



Romanian turbot biomass (National Fisheries Report, NIMRD 2014)



Percentage on age classes for turbot in the period 2008-2013 (National Fisheries Report, NIMRD 2014)



Percentage on length classes for turbot in the period 2008-2013 (National Fisheries Report, NIMRD 2014)

Conclusions

The objective of the Black Sea case study is the restoration of turbot fisheries to more productive levels, considering both the effect of fisheries and the ecosystem change that has occurred in the last 30 years. Three scenarios for the two ecosystem models will be applied: unique stock; one of the stocks in western part of the Black Sea and national stock. In all these scenarios, as a first management measure we will eliminate the Illegal, Unreported and Unregulated fisheries (IUU), also we will consider the condition of prey species, state of the predators and environmental conditions. Depending on the results, we will consider in the assessment models also other management measures, like: spatial restrictions; temporal restrictions; effort restrictions; minimum size; participatory restrictions, etc.

Acknowledgement

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