

Defining Policies for Management Strategy Evaluation in DISPAS

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Management Strategy Evaluation (MSE) [1] is a simulation technique useful to determine whether a harvest control policy might be successful or not. It uses data collection schemes and control policies in order to generate simulations. The analysis of simulation results will determine which policies are more suitable for the decision makers or the stock-holders aims. MSE evaluates the harvest control rules for a particular fishery. DISPAS [2] is an agent-based simulator for the fish stock evaluation, validated for the stock of common sole (*Solea solea* L.) in the Northern and Central Adriatic Sea.

In this work, we extend the capabilities of DISPAS in order to support MSE. We start by transforming *policies* into a proper set of parameters that can be introduced as part of the simulator. For example, consider policies based on the parameters of the **catch rate (C)**,

$$C = q * E * B$$

where:

- q represents the catchability, i.e. the efficiency of a particular fishery;
- E describes the fishery effort, e.g. expressed as number of fishing ships and/or as number of working hours;
- B is the total biomass, i.e. the sum of the all fish weights.

The biomass can be calculated at runtime in each time step of a DISPAS simulation. The other parameters can be given by the policy or considered constant. Then, the extended DISPAS will be able to simulate the evolution of the stock given the policy. The results can be analyzed w.r.t. the original aims of the policy makers. For example, the effects on the stock of a policy in which the effort E is doubled can be evaluated by simulating a certain number of years considering a fixed catchability q.

References:

- 1) Smith, A. D. M. "Management strategy evaluation – The light on the hill". In: Population Dynamics for Fisheries Management, Australian Society for Fish Biology Workshop Proceedings, Perth 24–25 August 1993 (ed. D.A. Hancock). Australian Society for Fish Biology, Perth, **1994**, pp. 249–253.
- 2) Penna, P., Paoletti, N., Scarcella, G., and Tesei, L., Marini, M., Merelli, E. "DISPAS: An Agent-Based Tool for the Management of Fishing Effort." In: Software Engineering and Formal Methods. SEFM 2013 Collocated Workshops. Vol. 8368 of Lecture Notes in Computer Science, Springer International Publishing, **2014**, pp. 362-367.