WHAT IS IT?

TunaFisher ABM simulates the decisions of fishing companies and fishing vessels of the Philippine tuna purse seinery operating in the Celebes and Sulu Seas.

High fishing effort remains in many of the world's fisheries, including the Philippine tuan purse seinery, despite a variety of policies that have been implemented to reduce it. These policies have predominantly focused on models of cause and effect which ignore the possibility that the intended outcomes are altered by social behavior of autonomous agents at lower scales.

This model is a spatially explicit Agent-based Model (ABM) for the Philippine tuna purse seine fishery, specifically designed to include social behavior and to study its effects on fishing effort, fish stock and industry profit. The model includes economic and social factors of decision making by companies and fishing vessels that have been informed by interviews.

The model has 196 (14 x 14) fishing sites, which has fish stock.

The model consists of two levels of agents: fishing companies and fishing vessels. Companies have no physical location, and are therefore not spatially explicit (but they are shown at the upper right corner of the simulation world). The second agent level is the operational level (represented by the vessel figures).

HOW IT WORKS

The simulation starts with initialization of parameter values.

An overview of the actions for each time-step is as follows:

1. Vessel actions:
   a. Decision to harvest or not harvest for the week (every 1st day of simulation week)
   b. Harvest action for those vessels who have decided to harvest
2. Skipjack growth and diffusion
3. Year-end actions (only every 365th time step)
   a. update year-end variables
   b. companies compute probabilities to buy and sell vessel
   c. vessel (dis)investment decision of companies
   d. Entry of new vessels

One time-step is equivalent to one simulation day, 7 time-steps to one simulation week, and 365 time-steps to one simulation year.

The code contains description of each parameter and variable, and of each process.
A complete model description in ODD format is available as online supplement of the publication by Libre et al. (2015).

HOW TO USE IT

The first step is to press the "set-up" button. This initializes the parameter values.

To run the simulation using the nominal values, press “nominal values”. Otherwise, adjust the value of the parameter as you will. The parameters are categorized into 1/ company parameters, 2/ parameters that affect the probability of buying a vessel (P(buy)), 3/ parameters that affect the probability of selling a vessel (P(sell)), 4/ parameters that affect the probability of entry of a potential entrant (P(entry)), 5/ cost parameters, 6/price parameters, 7/vessel parameters, and 8/ecological parameters.

To run the simulation, you can press: 1/ go = run for one simulation step (= 1 day), 2/go forever = simulation runs until you again press the “go forever” button; 3/ go 7 days = run for 1 simulation week; or 4/ go 365 days = run for 1 simulation year.

Test how changing the values of parameters affect the different outputs: 1/total number of vessels, 2/number of companies, 3/fishing days, 4/total catch, 5/total fishing days, and 6/industry profit.

THINGS TO NOTICE

What happens to the outcomes when you change the values of the following?

1. Resistance to exit (resistance-to0exit)
2. Congestion threshold
3. Potential entrants
4. Fuel cost per liter (fuel-cost-liter)
5. Target harvest to capacity ratio (target-catch-capacity)

CREDITS AND REFERENCES

This ABM is a part of the project of Stella Libre under the BESTTuna project of Wageningen University, the Netherlands. A paper titled “Effects of social factors on fishing effort: the case of the Philippine tuna purse seine fishery” by S.V. Libre, G. van Voorn, G.A. ten Broeke, P. Berentsen, M. Bailey and S. Bush is published using this model.

The model was coded by Stella Libre, with the assistance of Guus ten Broeke. It was tested by Stella Libre, and tested independently by Guus ten Broeke and George van Voorn.

Libre, S. V., van Voorn, G., ten Broeke, G.A., Bailey, M., Berentsen, P., & Bush, S. R. (2015). Effects of social factors on fishing effort: the case of the Philippine tuna purse seine fishery. *Fisheries Research, 172*, 250-260.

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