



HAL
open science

Agent-Based Modeling Approach in Single Fish Population Management

Quynh Anh Tran-Thi, Tri Nguyen-Huu, Doanh Nguyen-Ngoc

► **To cite this version:**

Quynh Anh Tran-Thi, Tri Nguyen-Huu, Doanh Nguyen-Ngoc. Agent-Based Modeling Approach in Single Fish Population Management. GAMA Days 2024, Nov 2024, Online, France. ird-04889264

HAL Id: ird-04889264

<https://ird.hal.science/ird-04889264v1>

Submitted on 15 Jan 2025

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Agent-Based Modeling Approach in Single Fish Population Management

Quynh Anh Tran-Thi ¹, Tri Nguyen-Huu ², Doanh Nguyen-Ngoc¹

¹ VinUniversity-Center of Environmental Intelligent

² UMI 209 UMMISCO, IRD, Sorbonne Université

tran.lia.05@gmail.com

Keywords

Agent-based model, Fishery management, MEY, MSY, Sustainable fishery

Abstract

Maximum Sustainable Yield (MSY) and Maximum Economic Yield (MEY) are key concepts in population and resource management, critical for optimizing exploitation and ensuring long-term sustainability. MSY represents the largest possible yield that maintains the resources' ability to regenerate, while MEY maximizes the economic benefits. Traditional models, such as Schaefer's logistic growth, provide valuable insights but often oversimplify ecological dynamics, social influences, and spatial factors. In contrast, Agent-Based Modeling (ABM) offers a dynamic and flexible approach by simulating complex interactions between agents and their environment and incorporating stochastic events, thus better capturing real-world complexities. This paper explores the potential of ABM to enhance the understanding of MSY and MEY in fisheries management, using the case of anchovy fisheries in the Gulf of Thailand as a study. Results from simulations demonstrate ABM's effectiveness in analyzing both biological and economic outcomes, revealing differences between traditional and ABM-derived estimates of MSY and MEY. While still in the early stages of application, ABM shows promising results for fisheries management, making it valuable for both scientists and stakeholders. The research may also open various developing and application opportunities in similar fields. However, it also suffers from some notable drawbacks in the development stage such as intensive requirements of time and resources, thorough consideration of the model's realism trade-off, and lack of initial input.

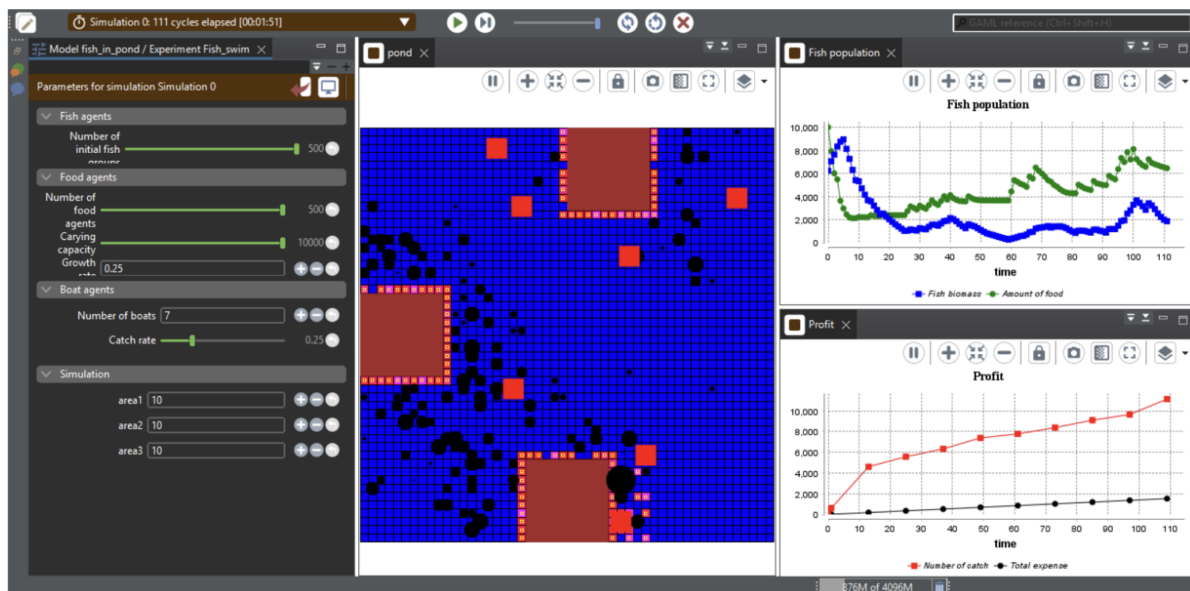


Figure 1: The parameter panel on the left enables users to configure agents and environment inputs. The map in the center represents the sea environment, where black dots depict fish agents, red squares show fishing boats that pursue and capture fish, brown geometries represent land, and food is indicated by a heat map that ranges from blue, signifying scarce food, to red, denoting abundant food. This helps visualize the schools' movement, their population density, and interactions with the environment. The charts track performance metrics, with the "Fish population" chart showing fish biomass and food availability, and the "Profit" chart displaying catch numbers, expenses, and profits to assess ecological and economic outcomes.