

Title: Employing Pattern-Oriented Modeling Strategy in Developing Agent-Based Model of Socio-Economic Systems: the Experience From Hawaii's Longline Fishery

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Abstract: Pattern-oriented modeling (POM) strategy has been successfully applied to build, calibrate and validate agent-based models (ABM) in ecology. Instead of the traditional modeling strategy that often requires comparison of the magnitude of model outputs to a selected set of observed responses, POM focuses on the ability of the model to reproduce a set of identified important patterns observed in the real system. POM allows identification of pertinent behavioral rules at the individual agent level that are deemed important in generating a wide range of emergent system-level responses. It avoids the difficulties and formidable expenses of calibrating the model precisely. In addition, it allows testing of model structure at various sub-system levels against the relevant patterns observed. Furthermore, it avoids several pitfalls encountered in traditional statistical comparison of model and observed system responses. This paper presents the experience of using POM as an alternative strategy in an on-going project of developing an agent-based model for simulating the fishing decision and activities of individual vessels in Hawaii's longline fishery (HLF). To our best knowledge, POM has not yet been employed in modeling socioeconomic systems. Using the logbook data of HLF for the period 2004-2008, several pertinent patterns have been extracted to guide our model development effort. They are seasonal distribution of fishing effort, spatial distribution of fishing effort, length of fishing trip, seasonal and spatial distribution of high-liners fishing efforts, and entry and exist of vessels in HLF. The patterns recognized in this study provide a vivid picture of HLF at a deeper level. It is the first step of employing POM in developing the agent-based model. The patterns will be used to develop and validate the agent-based model of HLF. We believe that the methods and patterns documented in this paper are invaluable for advancing ABM and POM in studying socioeconomic systems such as fishery.