Potential Application of Agent-Based Modeling in Hawaii Longline Fishery Management

Run Yu¹, Minling Pan² and PingSun Leung¹

¹University of Hawaii at Manoa
²Pacific Islands Fisheries Science Center

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Project Objectives

- Develop a simulation model for Hawaii’s longline fishery, using agent-based modeling approach.

- Evaluate alternative fishery regulatory policies in Hawaii’s longline fishery, using the developed model.
Preliminary Results

The Prototype Model

- 120 individual vessels (diverse sizes, fishing holding capacities, fuel holding capacities, and operating costs)
- 1 by-catch species: loggerhead turtle
- 2 types of fishing trips: tuna (deep set) and swordfish (shallow set)
- 3 fish species: bigeye tuna, yellowfin tuna, and swordfish
- Daily CPUE and turtle catch rate at 1 degree grid level (estimated based on sea surface temperature, moon phase, and historical logbook data)
- 3 possible management regimes: no regulation, turtle cap and area closure.
The Prototype Model

Click to play the Flash
Policy Evaluation

• No Fishing Regulation (based on 1999 data)
  – Results are close to the actual performance

• Turtle Interaction Cap On Shallow Sets
  – Swordfish fishery will be closed in the 1\textsuperscript{st} quarter.
  – Predictions are close to the situation of 2006

• Close North Central Year-round
  – Reduce fish catch by 6% (consistent with Nemoto, 2005)
  – Reduce turtle interaction by 40%
Future Research Plan

• To calibrate the prototype model, using more recent data.
• To test alternative decision rules for fishing activities, e.g., revenue targeting.
• To include possible communication mechanisms (i.e., social networks) among fishermen.
• To incorporate more management regimes such as ITQ.
Why ABM?

- Somewhat poor predictive performance of existing economic models.
- ABM takes the bottom-up approach, and could reveal the impacts of fishery policies at both the individual and industry levels.
- ABM could easily incorporate the spatial-temporal and behavioral aspects of a fishery.
ABM is an Open Platform

- It could easily incorporate new outcomes from biological and sociological research (e.g., GIS map, the effects of migration patterns of fish/turtle on CPUE and the ethnic background of fishermen on fishing activities).

- We look forward to the opportunities of integrating many of the PFRP research findings into our model.
Mahalo!