

Predator-Prey Population Dynamics

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Objective: To provide an overview of agent based modelling in a predator-prey landscape and to compare this with classical approaches.

The study of PPPD has a long history. There are several classical deterministic models (xx, yy) typically based on ODEs. More recently, stochastic models have been developed, including agent based models. The ODE approach treats the populations as homogeneous groups and sub-groups, while agent based approaches ascribe each individual with a variable and changing set of qualities and interaction properties. Insight into PPPD has practical implications in management of endangered species. Typically, it is important in the setting of commercial fish catch quotas, and at the other end of the ocean spectrum it plays a key role in the debate over whale-hunting. Both these examples illustrate the challenges of importing the scientific method into the wider commercial/emotive arena.

The Big Questions Are

- What are the key challenges of PPPD modelling?
- What are the classical PPPD models?
- What are the pros and cons of the classical models vs agent based approaches?
- How is stochasticity an advantage in PPPD modelling?
- Are there limits to agent based modelling?
- How can agent based models be reconciled with classical approaches?

Possible Contents of Presentation

- PPPD – what it is
- Classical approaches and models
- Agent based approaches
- Practical – foxes and rabbits
- Practical II – the impact of human intervention
- Reconciling agent based and deterministic approaches
- To the opportunity areas for agent based approaches

Recommended Literature

- Predator-Prey Ecosystem: A Real-Time Agent-Based Simulation
[<http://demonstrations.wolfram.com/PredatorPreyEcosystemARealTimeAgentBasedSimulation/>]
- The Application of Agent-Based Co-Evolutionary System with Predator-Prey Interactions to Solving Multi-Objective Optimization Problems
[<http://ieeexplore.ieee.org/Xplore/login.jsp?reload=true&url=http%3A%2F%2Fieeexplore.ieee.org%2Fiel5%2F4222970%2F4222971%2F04223019.pdf%3Farnumber%3D4223019&authDecision=-203>]
- Are classical predator-prey models relevant to the real world?
[<http://www.ncbi.nlm.nih.gov/pubmed/12381433>]
- Predator-Prey Models - a Generalization of Lotka-Volterra Model
[http://www.allacademic.com/meta/p_mla_apa_research_citation/2/7/3/1/1/p273113_index.html]
- Predator-prey model [http://www.scholarpedia.org/article/Predator-prey_model]
- PREDATOR-PREY DYNAMICS: LOTKA-VOLTERRA
[<http://www.tiem.utk.edu/bioed/bealsmodules/predator-prey.html>]