Simulator of Salmon Attraction to Turbulence

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http://math.humboldt.edu/~simsys: Information on this and several other agent-based ecological models.

Model Objectives: A major issue in managing the Columbia River is mortality of salmon smolts (juveniles migrating downstream to the ocean) in the turbines at hydropower dams. Approximately 10% of smolts that are entrained into a turbine die. Scientists have observed that salmon smolts appear to be attracted to turbulence, leading to the concept that turbulence created by pumps or propellers in the reservoir upstream of a dam could attract smolts to a bypass around the turbines. This model's objective is to simulate how smolts would move, and how turbulent attractors should be placed, given specific assumptions about how smolts respond to turbulence.

Screenshot: The band of small red dots from northeast to southwest are nodes from a hydraulic model of the river (points indicate coordinates where the direction and magnitude of river flow is known). The river reach has a dam at its southwest end.

The irregularly spaced small white dots are salmon smolts. They drift downstream with the river flow and a random swimming direction. The yellow dots just upstream of the dam represent turbulent attractors. The closer a smolt is to a turbulent attractor, the more likely it is to swim towards, not away, from the turbulent attractor.

Software: Written in Objective-C using the *Swarm* simulation system.

The *Swarm* animation window allows the user to interactively create new turbulent attractor objects "on the fly": mouse clicks insert new turbulent attractor objects into the model during a simulation. *Swarm*'s probe facilities allow model parameters to be changed interactively during a simulation. The "FlowSpace" window allows the user, at any time, to change the magnitude of attraction (the amount of turbulence) and to save the current attractor configuration to a file.