This model is loosely based on the water quality monitoring procedure of the Save Our Streams project of the Izaac Walton League of America. The underlying premise is that water quality affects the biodiversity of a stream. Thus, surveying the macroinvertebrates in a stream is a way to indicate water quality.

Model Details

When the model opens, the world-view will show a section of stream, with sixteen sample buckets below (Figure 1). Various controls (Table 1) and data monitors (Table 2) surround the world-view. When 'Run' is clicked the stream will begin to flow, and a variety of invertebrates (Table 3) begin to flow downstream (as if stirred up by an unseen researcher upstream). The appearance of animals in the stream is stochastic, both in how many, and in what species are in view at any given time. Stochastic aspects of the models are based on pseudo-random numbers (typical in computer programming) which appear random but are in fact generated by Netlogo from a deterministic process (Mersenne TwisterFast class) that is initiated based on date and time in the computer clock.

When 'Open Seine' is clicked, a net will appear in the middle of the stream, and remain open for the amount of time set on the 'Sampling-Time' slider, or until 'Close Seine' is clicked. Animals which get caught in the seine are immediately sorted into their appropriate bins which are labeled in their corresponding count monitors below. In actual stream sampling you would sort through the net after a round of seining, but during the simulation, students can observe the progression of the species discovery curve shown in the 'Cumulative Species vs. Time' plot (Fig. 1).

The 'Reset' button will clear all monitors and the plot. Students can replicate rounds of seining and overlay curves on the plot by clicking 'Release' (which lets all the captured animals go downstream), and then re-opening the seine. Clicking 'Clear Plot' will erase all the traces on the plot. Along with the plot, the model continuously monitors the counts of each species caught (individual species abundance), the total number of individuals caught (total abundance), and the number of different species caught (species richness).

The primary variable that students will explore the effect of is the level of pollution and its effect in the stream. This variable can be set to none, moderate, or severe, from the 'Pollution' drop-down menu, and changes the probabilities of each animal appearing in the stream based on their sensitivities to pollution (Fig 1). When 'Pollution' is set to none, all species have similar probabilities of appearing. In the moderately polluted stream, the pollution sensitive species have very low probabilities of appearing, the less-sensitive species have intermediate probabilities, and the tolerant species have higher probabilities. When pollution is severe, sensitive species will not appear, less-sensitive species have a low probability, and most of the species captured will be pollution tolerant.

Fig. 1 The user interface of the Estimating Stream Diversity simulation.
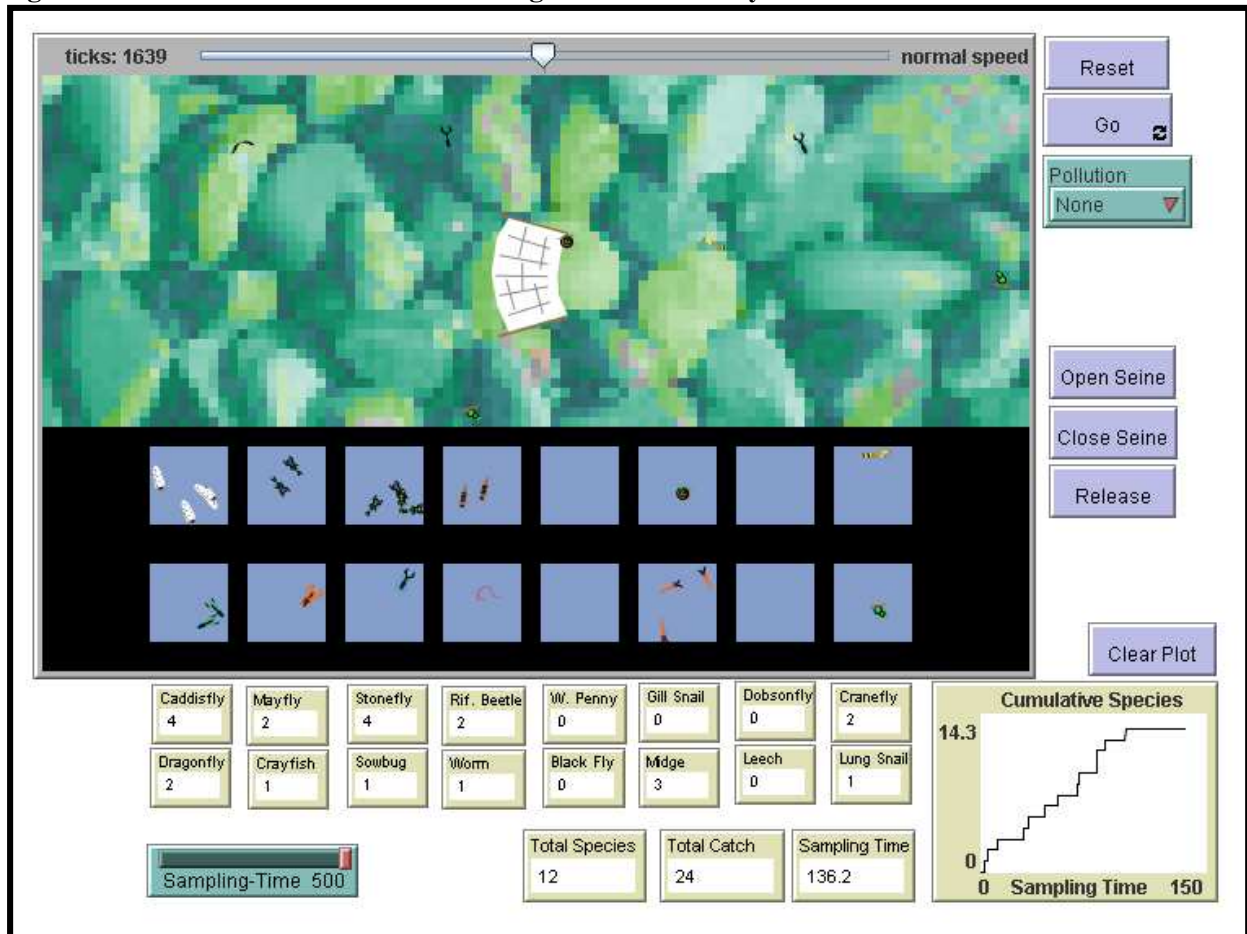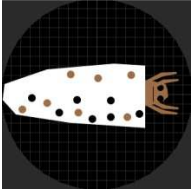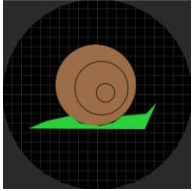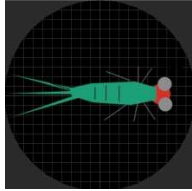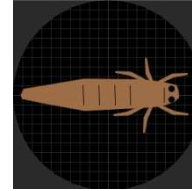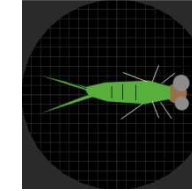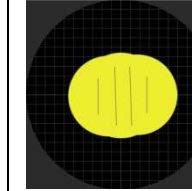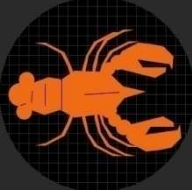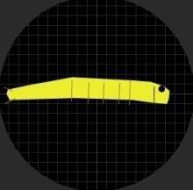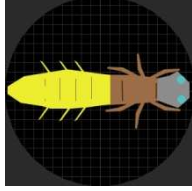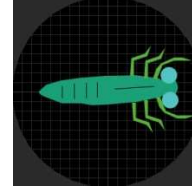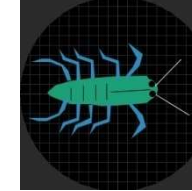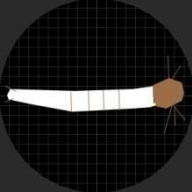

Table 1: Controls for the Estimating Stream Diversity simulation
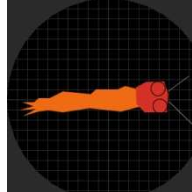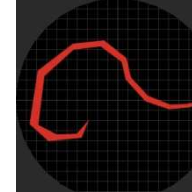
Button	Action
Reset	Clears the graph, sets time to 0, removes the seine, releases animals
Go	Sets the stream in motion with animals drifting down
Open Seine	Places the seine in the middle of the stream, starts sampling & plotting data
Close Seine	Removes the seine, stops plotting data
Release	Dumps captured animals downstream, clears graph
Speed	The slider above the world-view, controls the speed of the simulation

Table 2: Reporters for the Estimating Stream Diversity simulation

Reporter	Description
Individual Species Counts	The numbers of each species caught (row below world-view)
Total Catch	Number of all individuals caught
Total Species	Number of different species represented in sample
Line Graph	Cumulative species vs. Sampling time

Table 3: Cast of characters for Stream Diversity simulation

Pollution Sensitive Species					
Caddisfly	Gilled Snail	Mayfly	Riffle Beetle	Stonefly	Water Penny
Pollution Less-Sensitive Species					
Crayfish	Cranefly	Dobsonfly	Dragonfly	Sowbug	
Pollution Tolerant Species					
Blackfly	Leech	Lunged Snail	Midge	Worm	