# The Challenge: Predicting Ecosystem Collapse, Engineering Recovery
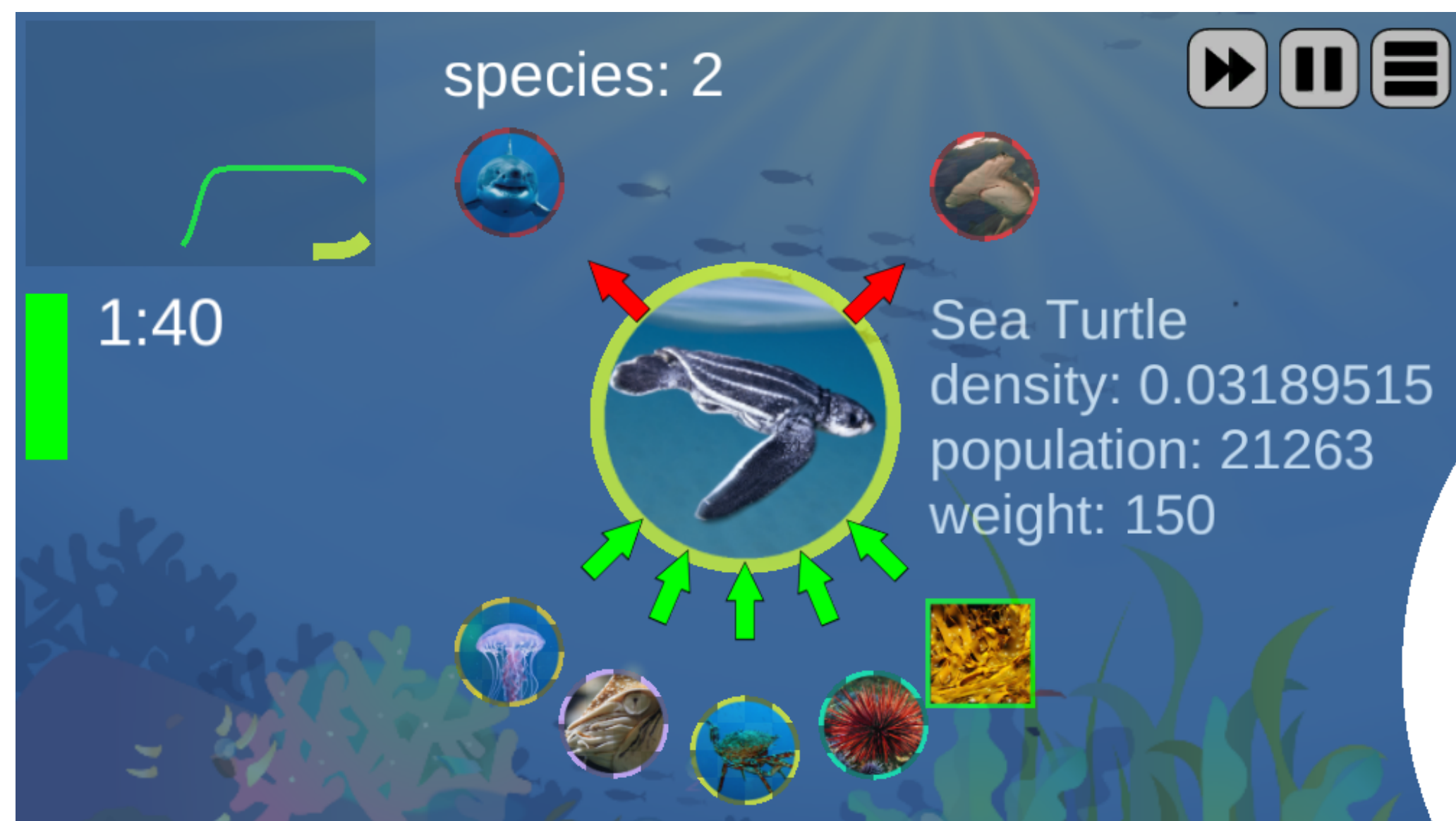
ecobuildergame.org | **Imperial College London**

## Ecosystem Models and Data

species: 2

1:40

Sea Turtle
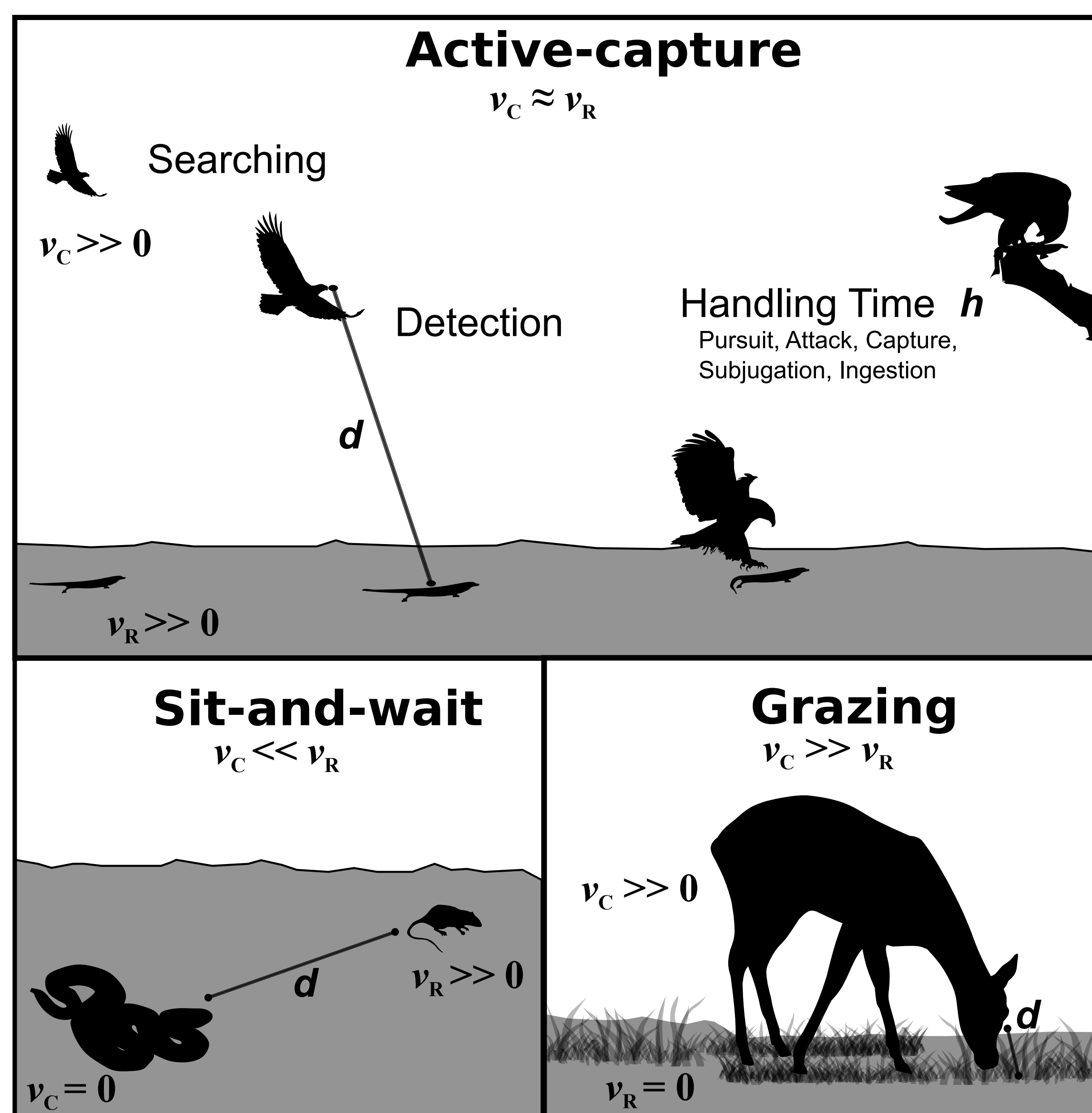density: 0.03189515
population: 21263
weight: 150

- We are building increasingly **realistic mathematical models of ecosystems** using **theory and data on species interactions** in food webs (the living "fabric" of ecosystems).

- Like the real stuff, these model ecosystems have **complex behavior** (Ecosystems are not a sum of their parts) — Understanding and predicting these complex behaviors require **computer simulations**.

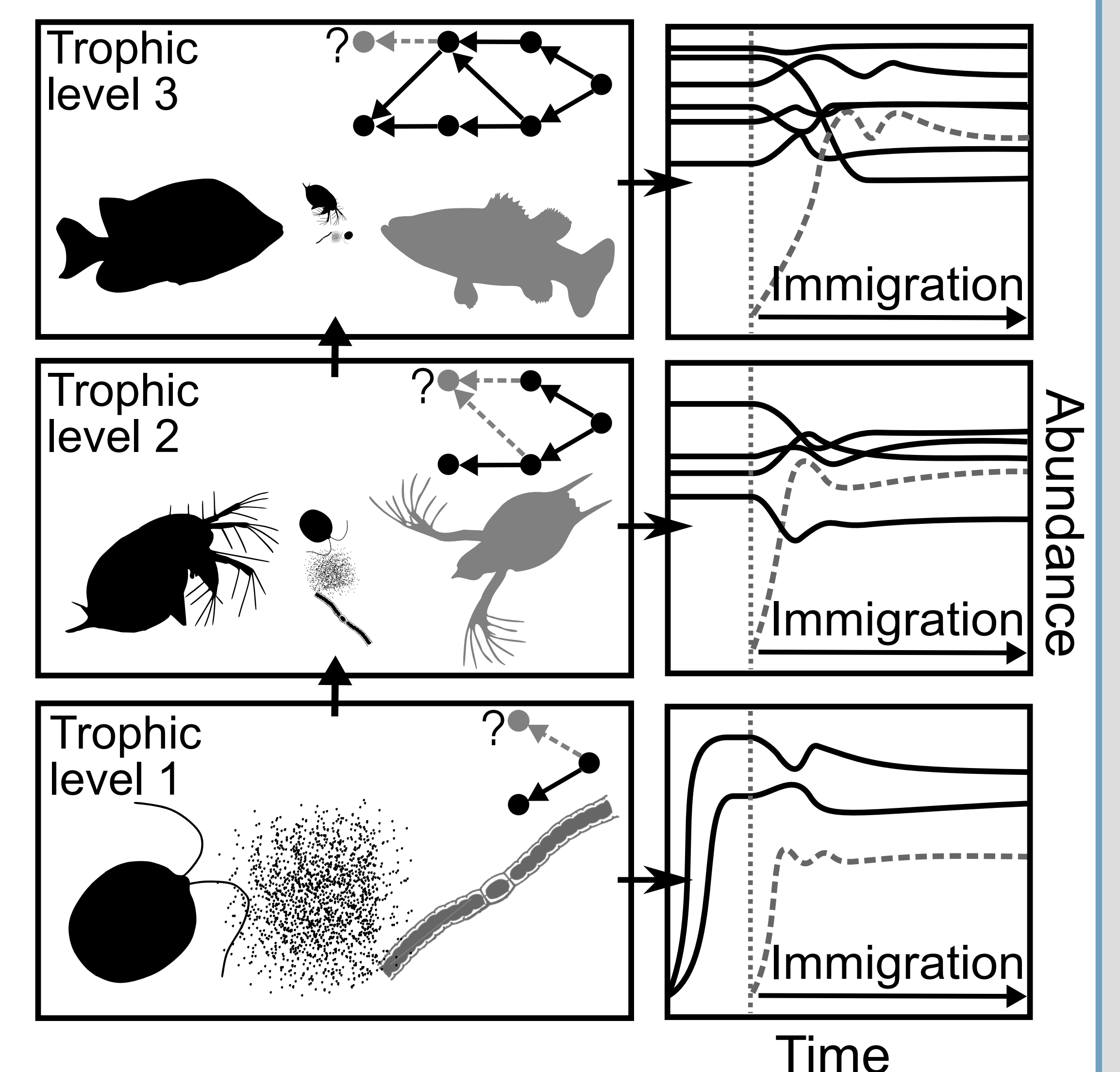- The **EcoBuilder game** uses one such ecosystem model.

species: 13

Wolf
density: 0.01905171
population: 1905
weight: 50
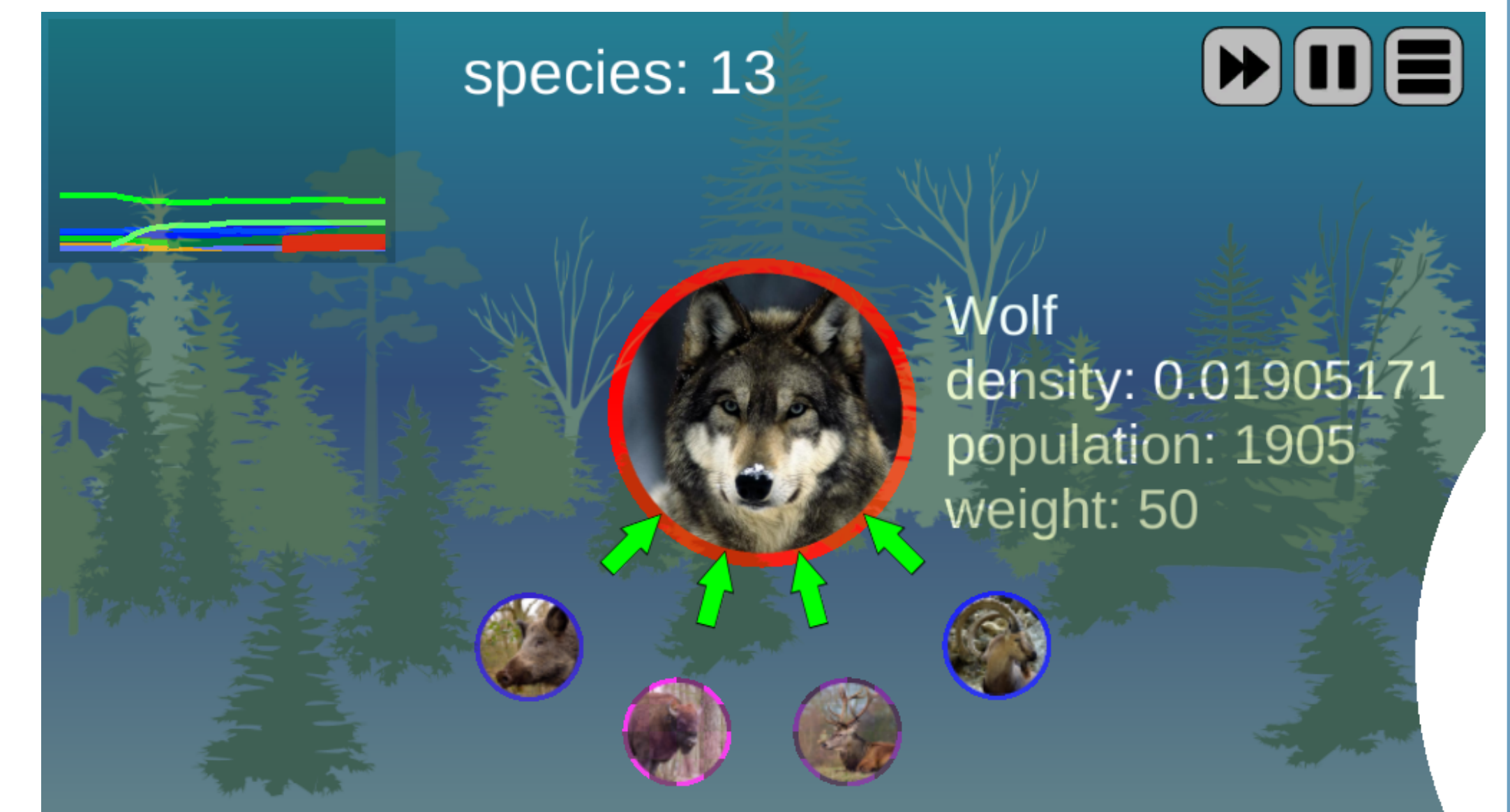
## How do we model species interactions?

- We use biomechanics and metabolic theory to generates realistic "rules" for species interactions
  - Larger-bodied species grow more slowly!
  - Larger predators eat proportionally larger prey
  - Increasing climatic temperature speeds up species interactions
  - Certain foraging strategies are more common

**Active-capture**
$v_C \approx v_R$

Searching

$v_C \gg 0$

Detection

Handling Time $h$
Pursuit, Attack, Capture,
Subjugation, Ingestion

$d$

$v_R \gg 0$

**Sit-and-wait**
$v_C \ll v_R$

$v_R \gg 0$

$d$

$v_C = 0$

**Grazing**
$v_C \gg v_R$

$v_C \gg 0$

$d$

$v_R = 0$

## How do we model ecosystem collapse and recovery?

- We use species interaction rules to sequentially build or break foodwebs in computer simulations

- You can try this out yourself using the **EcoBuilder game!**

Trophic level 3

Trophic level 2

Trophic level 1

Immigration

Immigration

Immigration

Abundance

Time

## EcoBuilder

- EcoBuilder allows players to build an ecosystem by controlling the arrival of different types of species imto the underlying food web.

- Each introduction has a "butterfly effect" that the player may not necessarily foresee.

- This makes the game inherently challenging!

*Try your hand at building an ecosystem: ecobuildergame.org!*

**eco BUILDER**

## What else is going on?

We are testing our models with real ecosystem data at the Silwood Park Campus!