

# How to build a spatial- ABM with Netlogo

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# Objectives

- Become familiar with **Netlogo**
- Understand the **pros/cons and challenges** of using data in models
- Become familiar with the **modeling process**
- Learn approaches to **clean/process data** with QGIS
- **Create a spatial-ABM** with Netlogo

# Our plan

## **Foundation**

- Intro to Netlogo
- Spatial-ABM discussion: pros, cons, challenges
- Overview of model process

## **Build a spatial-ABM**

- Find data
- \*\* Take a break \*\*
- Process data with QGIS
- Build spatial-ABM with Netlogo

# Examples of Netlogo with GIS data

**Model of Transportation and Residential Development for Reston, VA, USA**

**Instructions:**

- Set model to fastest setting, press Setup to load display (~15 secs)
- Adjust population and optimize commute
- Press Create Commuters (~15secs+ based on pop-size)
- Adjust settings for commute related variables
- Press Commute to show movement of commuters each minute (~15-45 secs based on pop)

- To reset model, adjust settings, press Create Commuters, do not need to press Setup

**Setup**

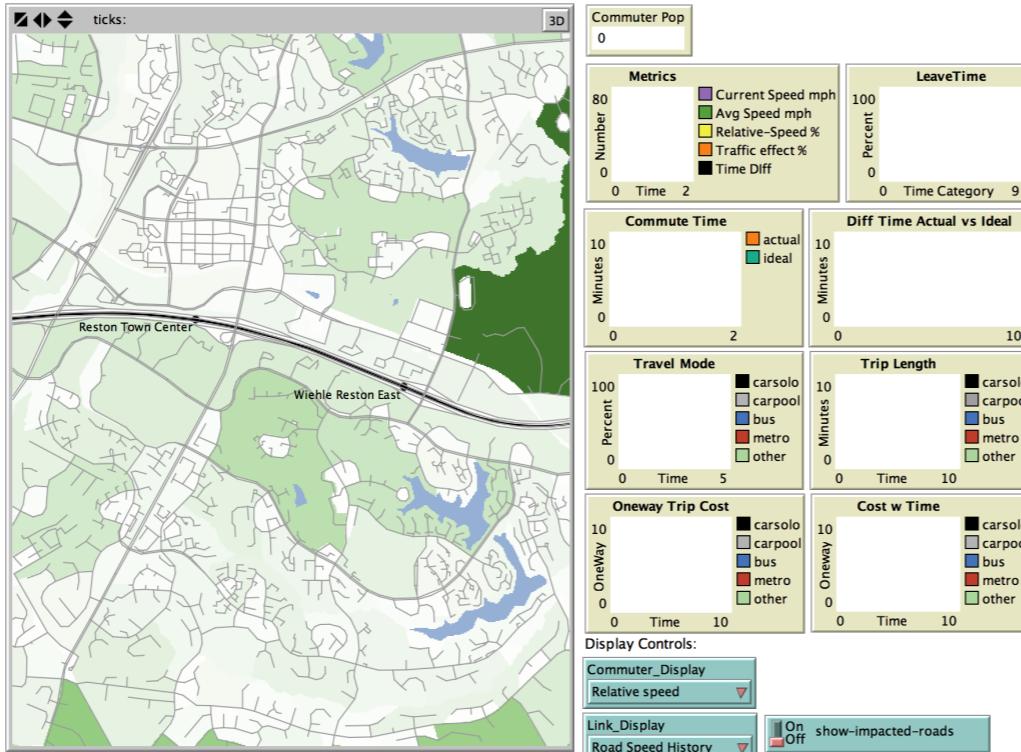
Optimize-Commute  
Time: pop-size 2 percent  
On/Off develop?  
On/Off reduce-cars

On/Off traffic-effects  
road-capacity 1 cars fit in 20m  
to-control-speed  
Posted speed limit  
set-constant-speed 50 mph  
value-of-time 100 % hr-wage

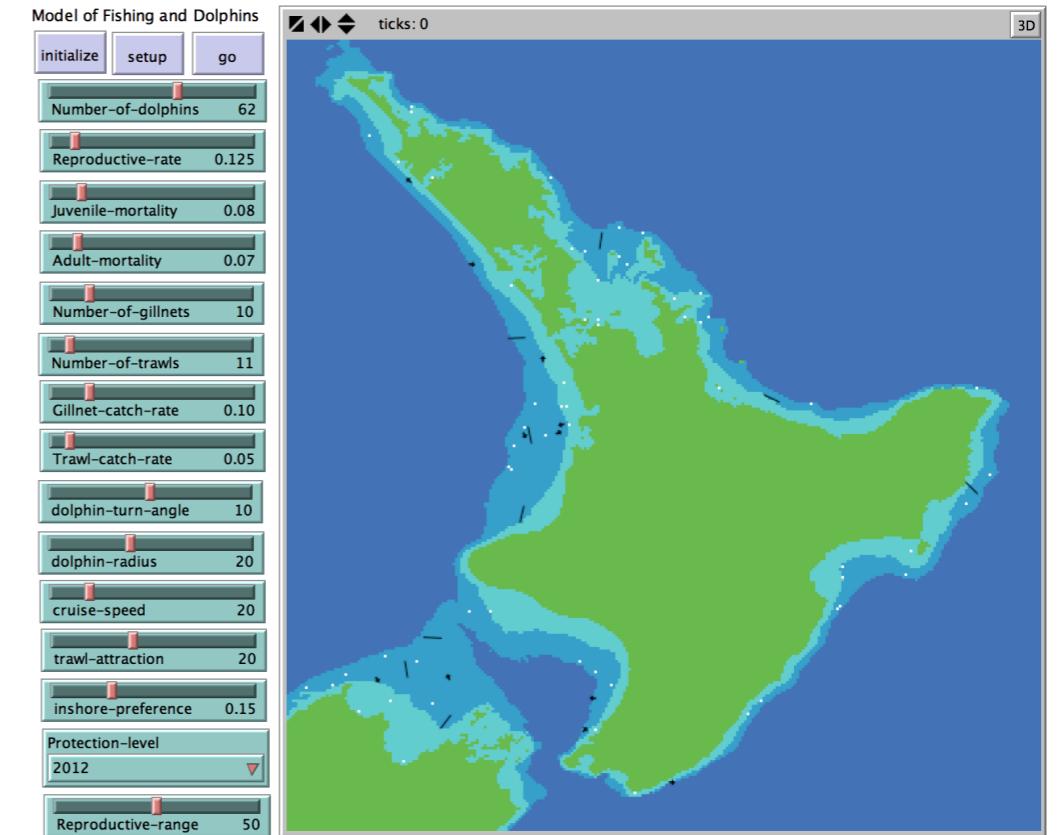
**Create Commuters**

3. Commute

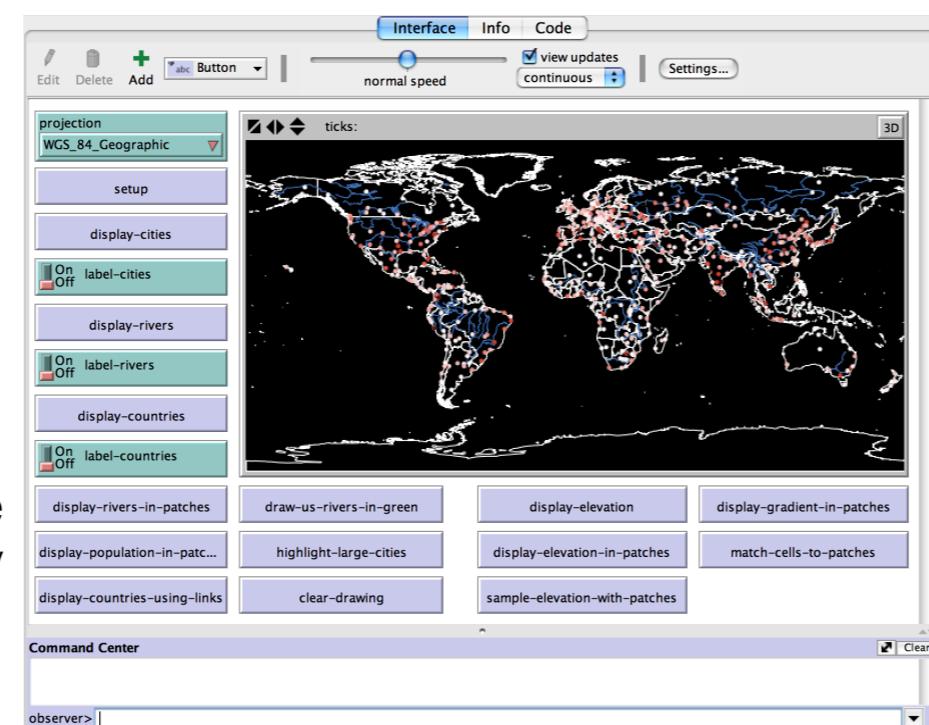
Optional settings - oneway total commute trip costs and length:  
avg-mpg 25 gas-price 3.00 \$/gal base-car-cost 0.31 \$/mi  
car-tolls 3.50 \$oneway bus-fare 1.75 \$ metro-fare 5.90 \$  
car-trip 26 miles bus-trip 40 min metro-trip 60 min



Commuters in Reston  
to evaluate impact of new  
developments on traffic



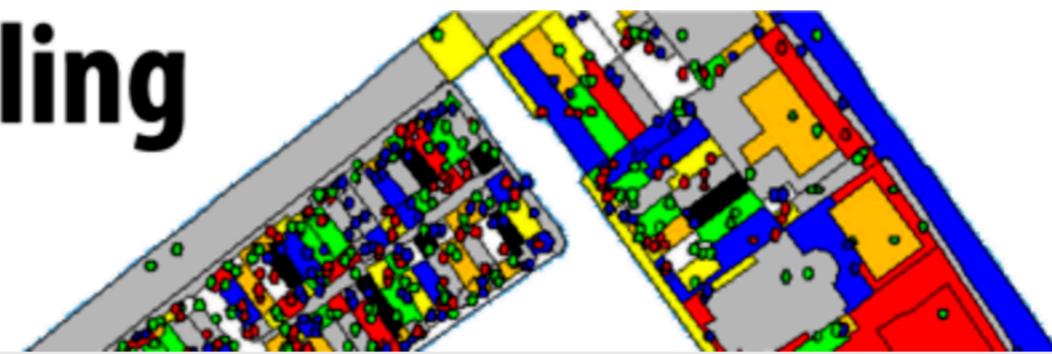
Model of impact of fishing policies on  
endangered New Zealand dolphins



Netlogo GIS example  
in model library

# GIS and Agent-Based Modeling

Exploring Geographical Information Science (GIS)  
and Agent-Based Modeling (ABM)



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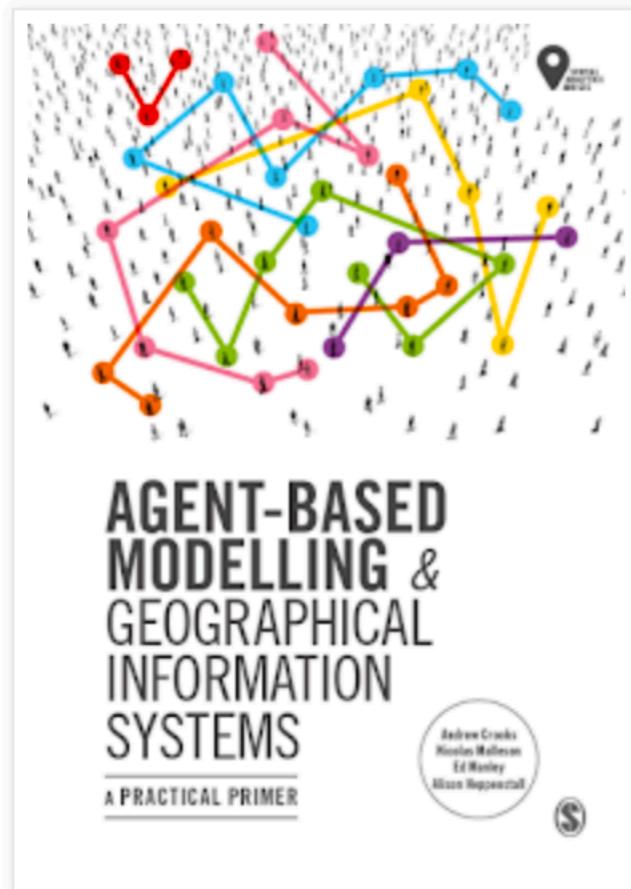
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FRIDAY, JANUARY 18, 2019

## Agent-based Modelling and Geographical Information Systems: A Practical Primer



It's been a long time in the making but now "[Agent-Based Modelling and Geographical Information Systems: A Practical Primer](#)" has been published by Sage. We ([Nicolas Malleson](#), [Ed Manley](#), [Alison Heppenstall](#) and myself) approached this book from two standpoints. First, to provide a synthesis of the underpinning ideas, techniques and frameworks for integrating agent-based modelling and geographical information systems (GIS). Second, building on our experiences of teaching at various levels, to provide a practical set of information for the development of agent-based models for geographical systems.

From these two standpoints we have developed a book that provides a practical primer in the integration of agent-based modelling and geographical information systems. In outlining the subject we cover many examples of geographical phenomena, from linking the individual movements of pedestrians to aggregate patterns of urban growth, to the integration of social networks into modelling mobility. Through this text, we hope the reader will understand how the field has developed, how agent-based models are different from other modelling approaches, and

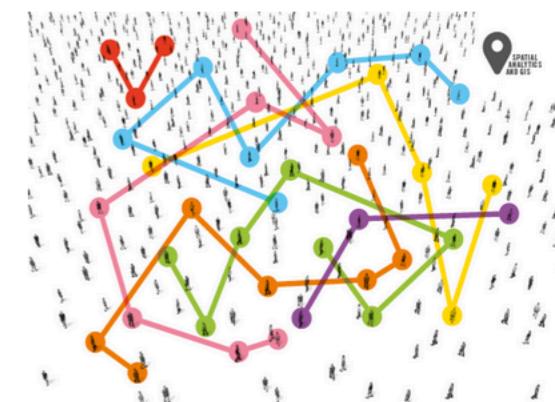
the future challenges we see lying ahead.

By using sample code and data (all of which can be found on the accompanying website <https://www.abmgis.org/>) we provide the reader with many of the basic building blocks for constructing agent-based models linked to geographical information systems. Throughout the book we use the software package [NetLogo](#), as it provides an

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**AGENT-BASED  
MODELLING &  
GEOGRAPHICAL  
INFORMATION  
SYSTEMS**

A PRACTICAL PRIMER

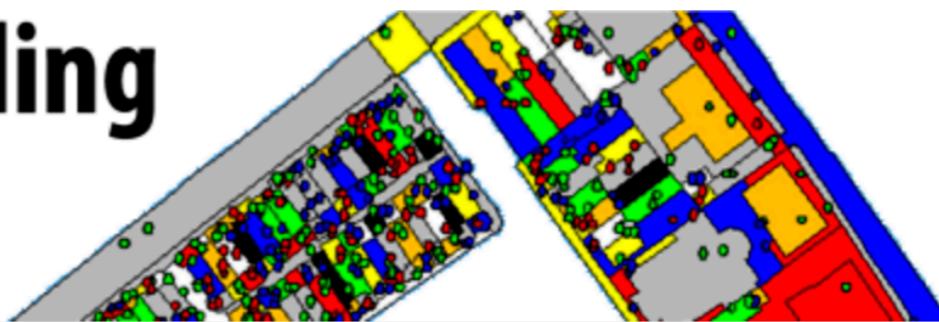


[More details](#)



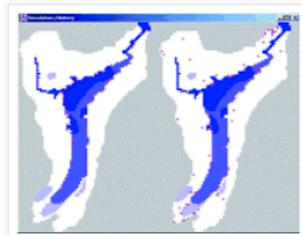
# GIS and Agent-Based Modeling

Exploring Geographical Information Science (GIS)  
and Agent-Based Modeling (ABM)



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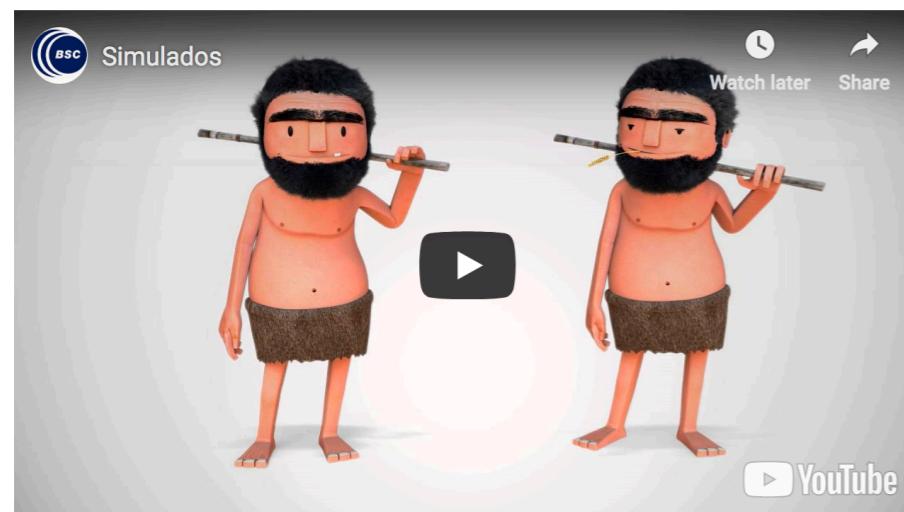
## Understanding the past with Agent-based Models



I have had a long fascination with the use of agent-based modeling (ABM) to explore past cultures and civilizations. There are a number of very good models which I will not do justice to in a single post, unless I write a very very long one. Some works which spring directly to mind include Axtell's et al. (2002) "Population growth and collapse in a multiagent model of the Kayenta Anasazi in Long House Valley" or the collection of papers in Kohler and Gumerman (2000) edited volume "Dynamics in Human and Primate Societies: Agent-Based Modeling of Social and Spatial Processes". Even I have attempted to dabble with them ([click here](#)).

Why am I writing about this now? I recently came across a great movie below produced by the [Barcelona Super-computing Center](#) which simply shows the utility of ABM for such endeavors and why ABM can be used as a tool more generally. Or to quote from the [YouTube description of the movie](#), its:

"a documentary around the lives of a prehistoric virtual family trying to survive the moody conditions imposed by the scientists studying them."

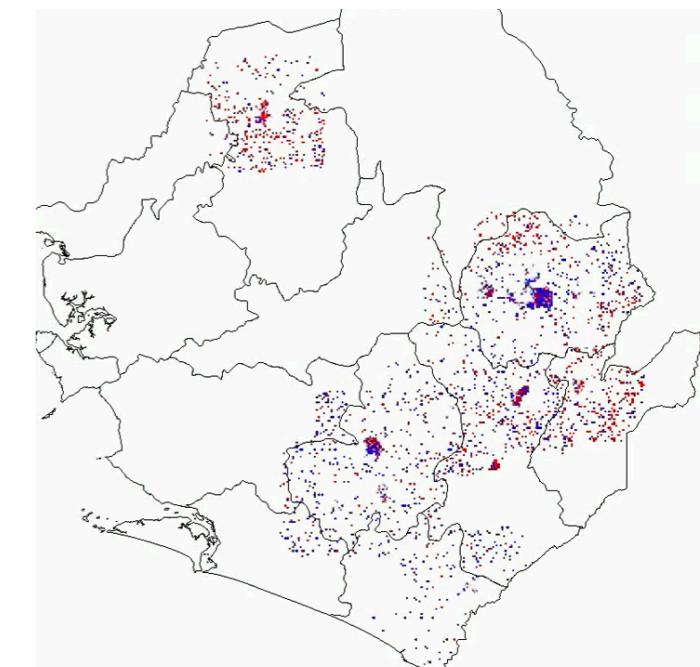
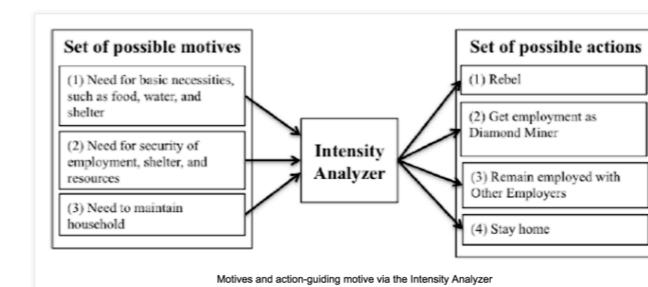


[https://www.gisagents.org/2016/09/  
understanding-past-with-agent-based.html](https://www.gisagents.org/2016/09/understanding-past-with-agent-based.html)

## The Geography of Conflict Diamonds: The Case of Sierra Leone

**SBP-BRIMS 2016**

At the forthcoming [2016 International Conference on Social Computing, Behavioral-Cultural Modeling, and Prediction and Behavior Representation in Modeling and Simulation](#). we will be presenting a paper is entitled "[The Geography of Conflict Diamonds: The Case of Sierra Leone](#)" The abstract and some of the figures from the paper are below. At the bottom of the post you can find the full reference and a link to the paper and model.



<https://www.gisagents.org/2016/06/the-geography-of-conflict-diamonds-case.html>

# Geospatial Computational Social Science

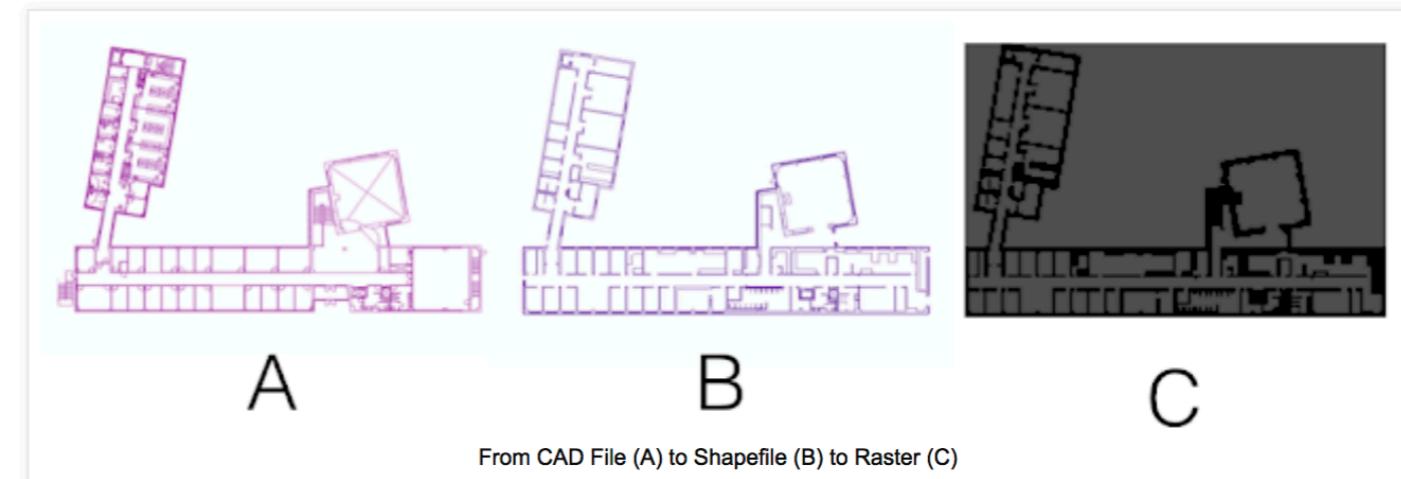
<http://geospatialcss.blogspot.com/>

<https://www.gisagents.org/2016/02/pedestrian-modeling-examples.html>

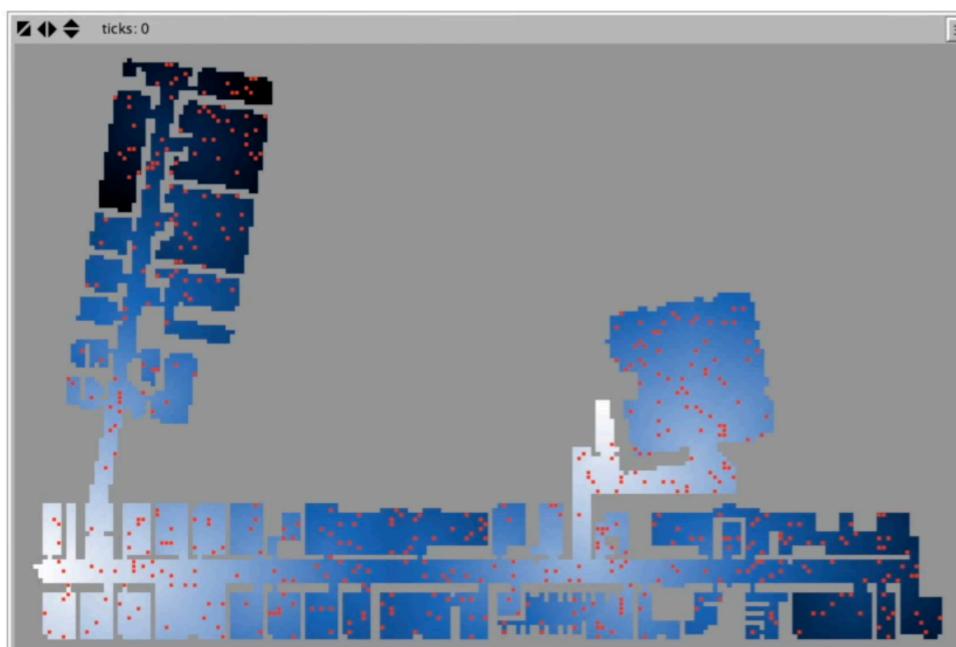
## Step 1: Model the behavior



## Step 2: Process data inputs



## Step 3: Add spatial data and verify model behavior



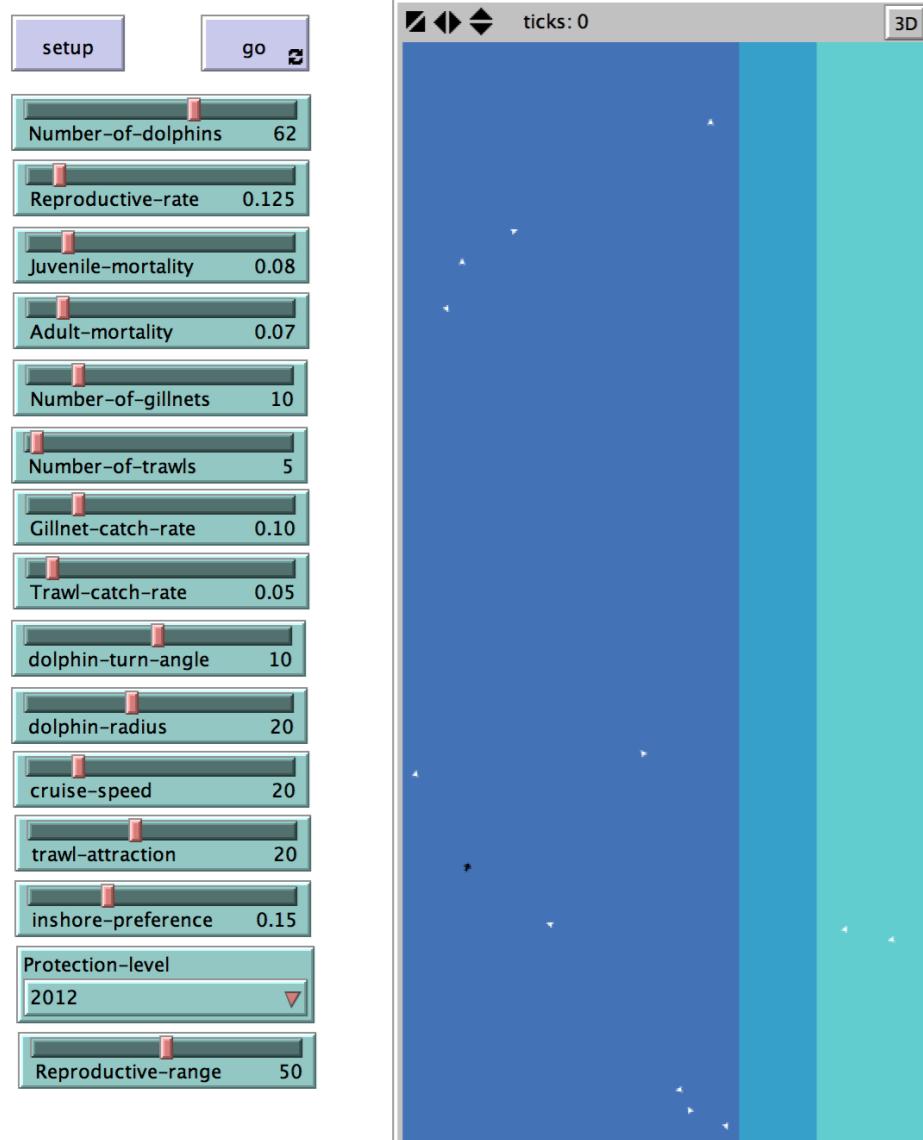
## Step 4: Spatial ABM experiments



# Abstract to spatially explicit model

Modeling impact of fishing on endangered dolphins

Abstract Model  
without GIS data



Same model applied to case-study  
area by incorporating GIS data

