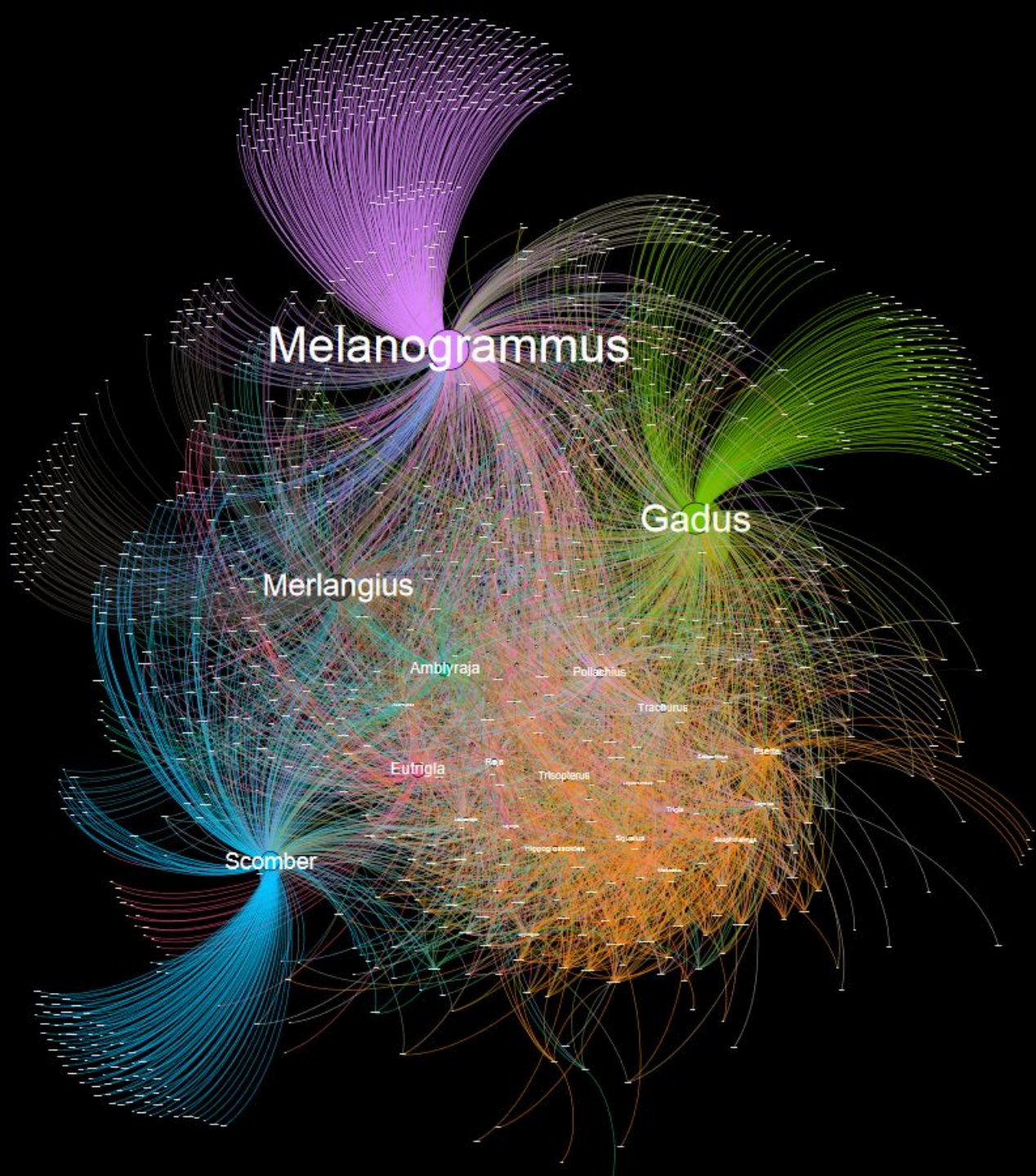




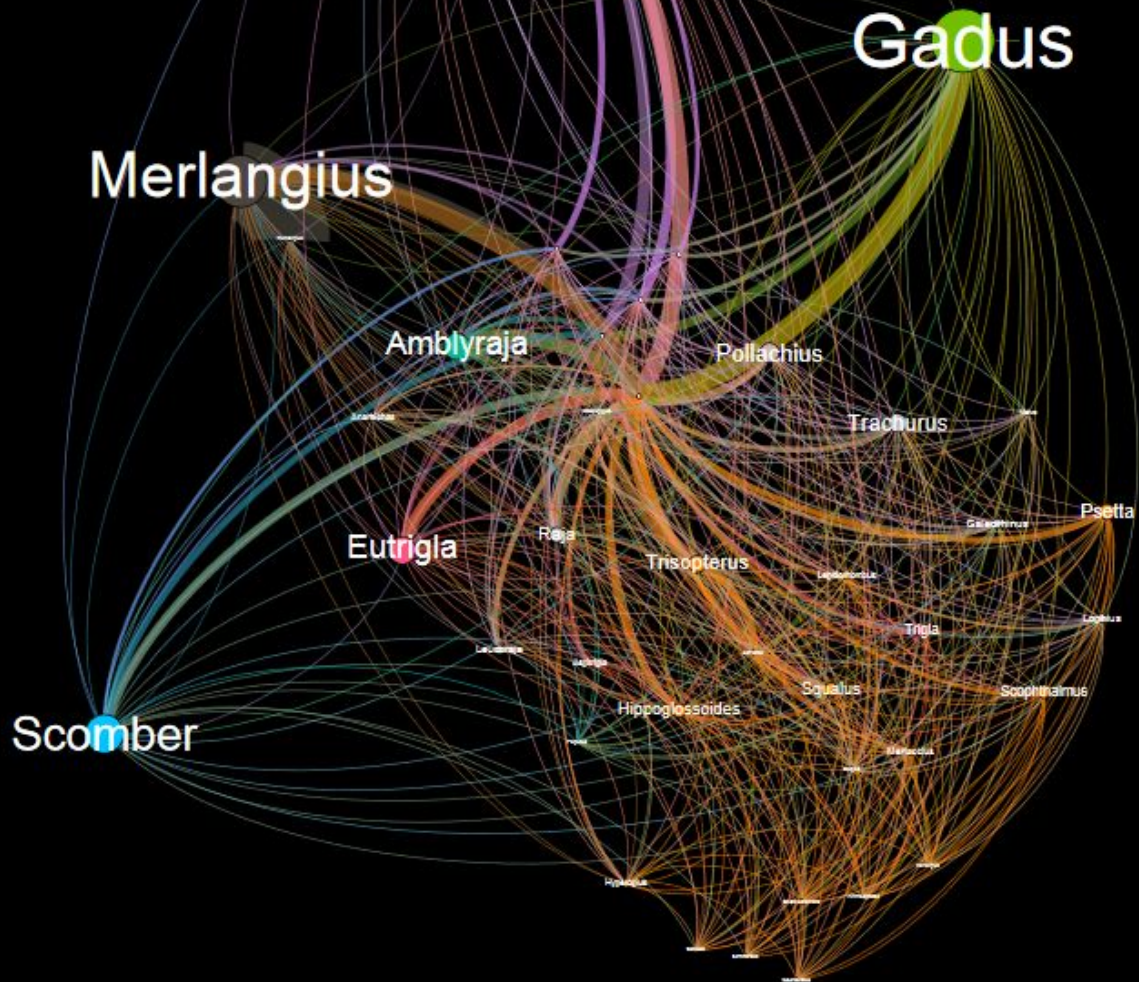
**Controlled environment sensitivity
analysis**

The food chain

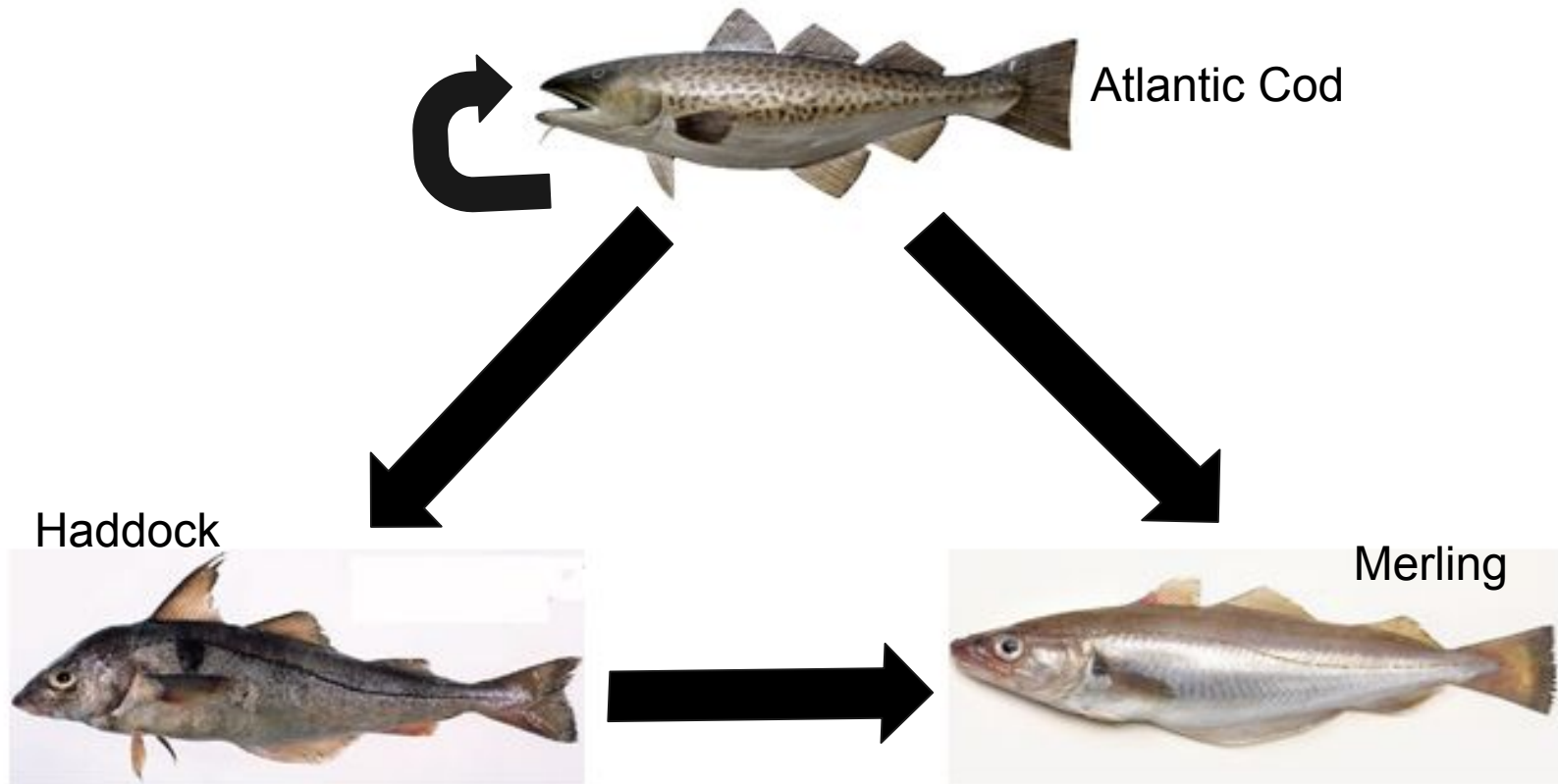
- Dynamical network
- Used Stomach data to build the food chain network
- Focused on species of the North Atlantic region



Melanogrammus



3 species

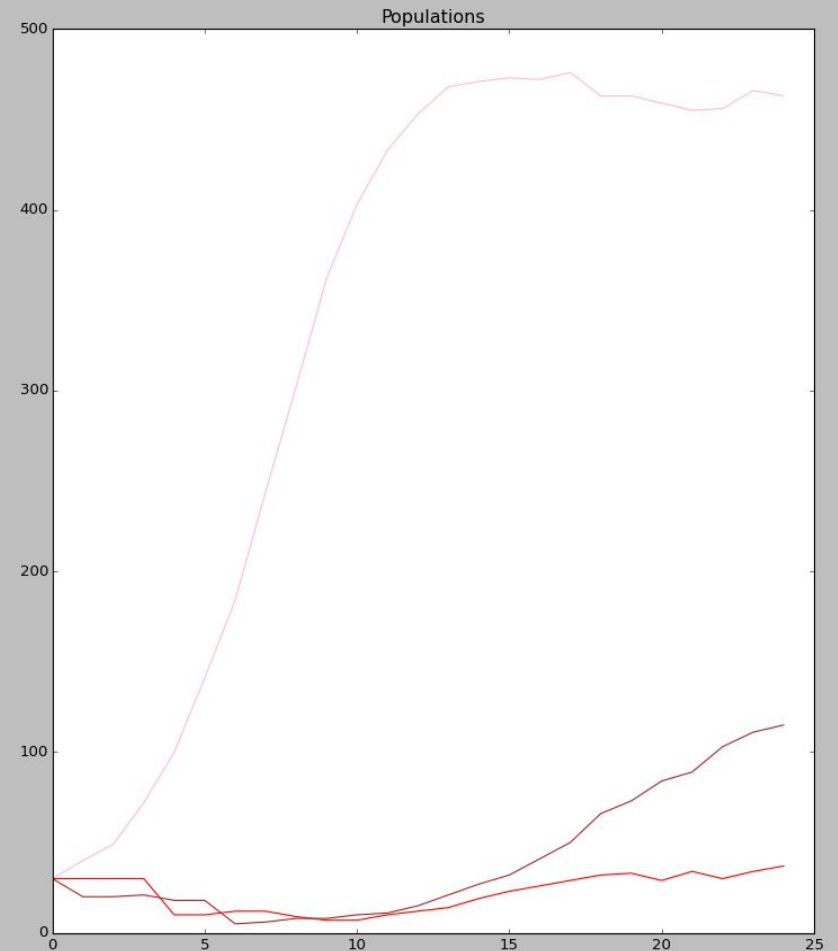
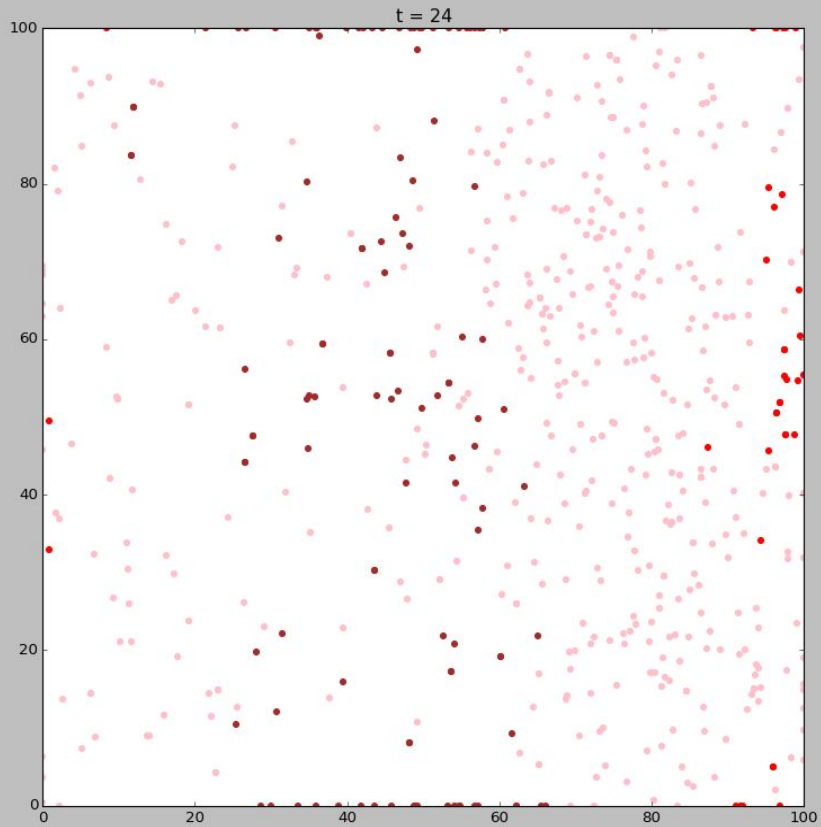


Predator Prey Model

→ Agent-based model

- Reproduction Rate
- Swimming Speed
- Hunger
- Self-Competition (Canibalism)
- Tracking Behaviour for predators
- Initial population proportions
- Proportional predation
- Fishing Rate

Simulation example



Sustainability

How can our model help to improve sustainability?

Old approach

- Change in the environment (climate, catches, etc.)
- Link the change in the environment to the change in the food network
- Create rules to understand how the network is affected

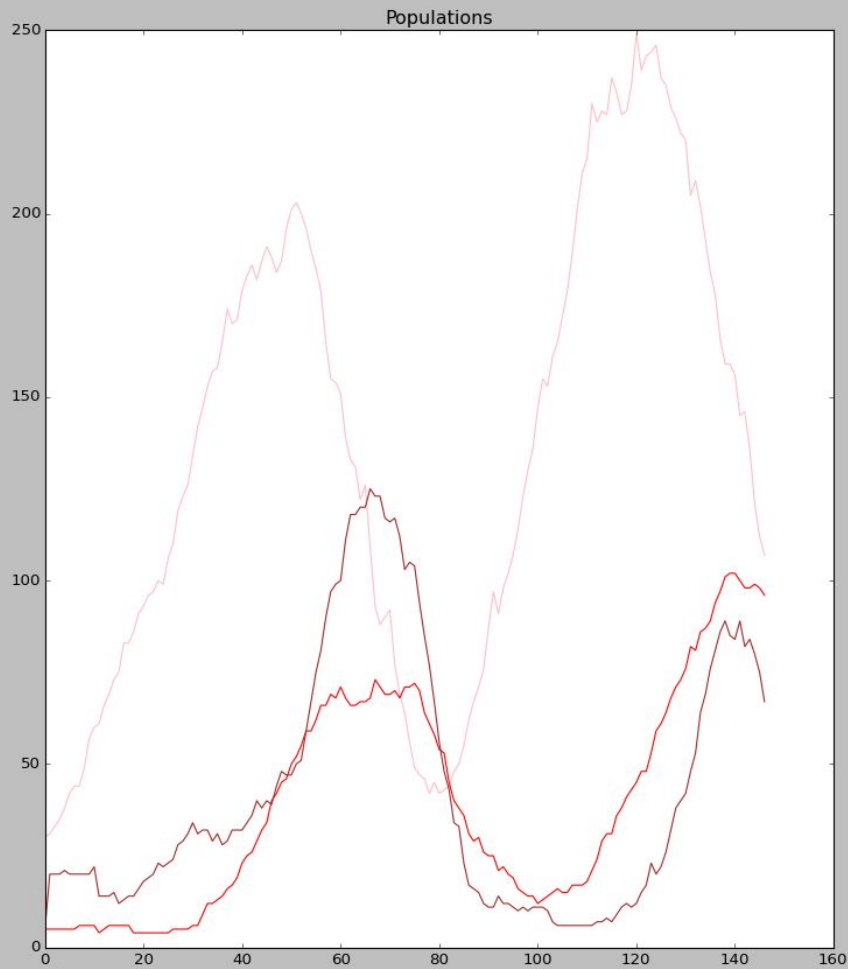
→ Outside in

New approach

- Using the model, look at how the network can be affected through the parameters
- Rank changes in the parameters based on their impact in the network
- Find how external factors affect the parameters and apply that to improve the stability of the network

→ Inside out

Cyclic Population

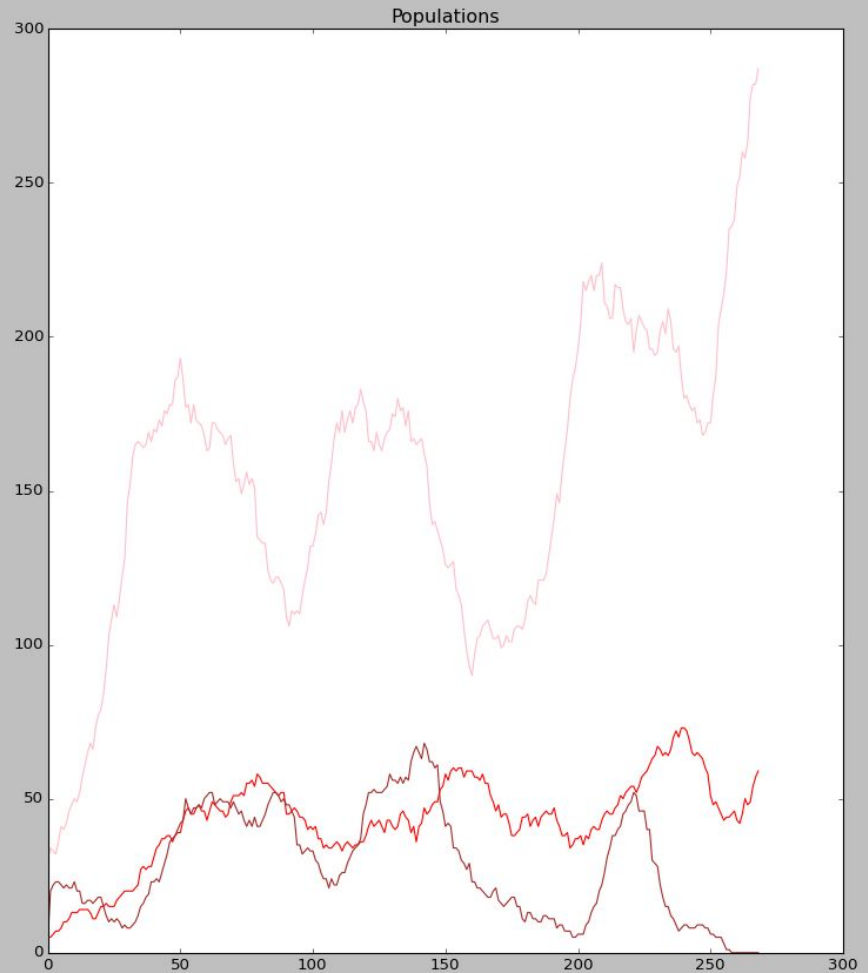


Danger Zone

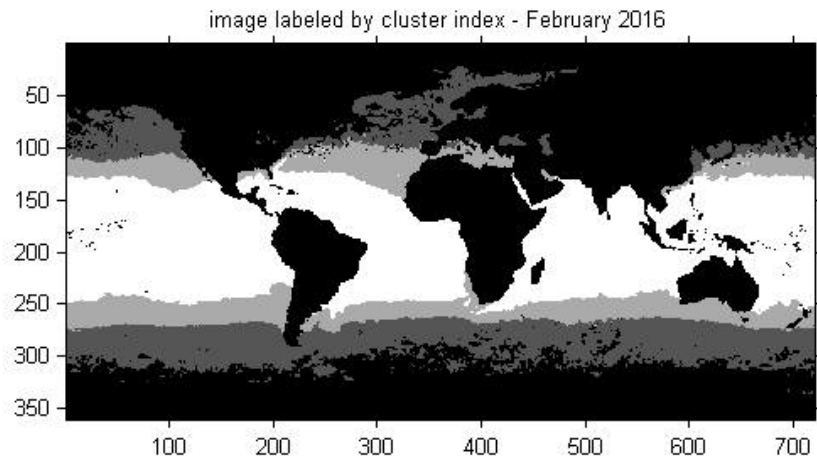
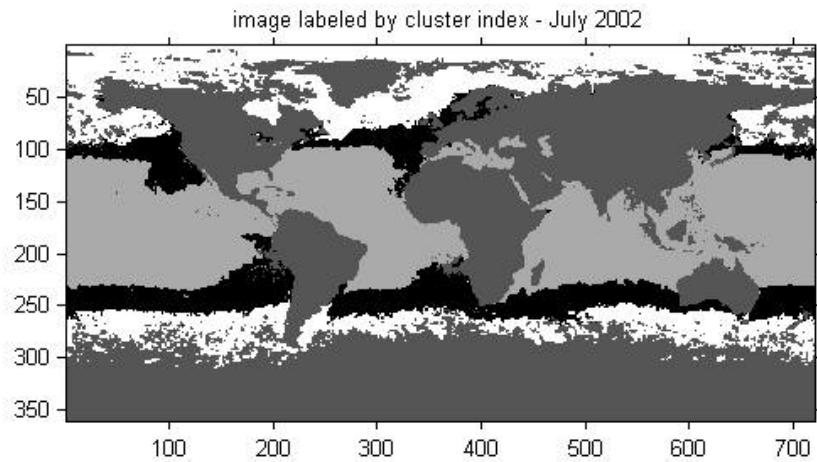
High Cod
Population

Low Merling
Population

Low Haddock
Population



Global Warming



Global Warming

image labeled by cluster index - July 2002

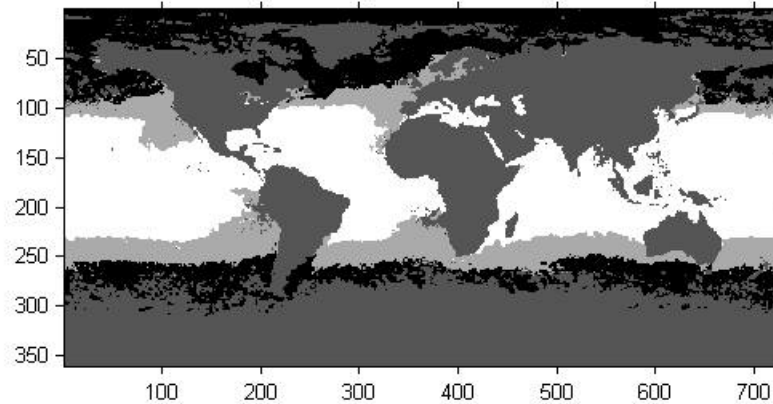
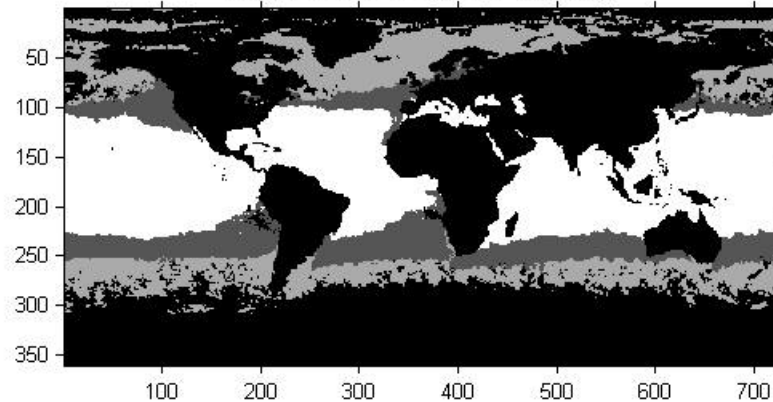


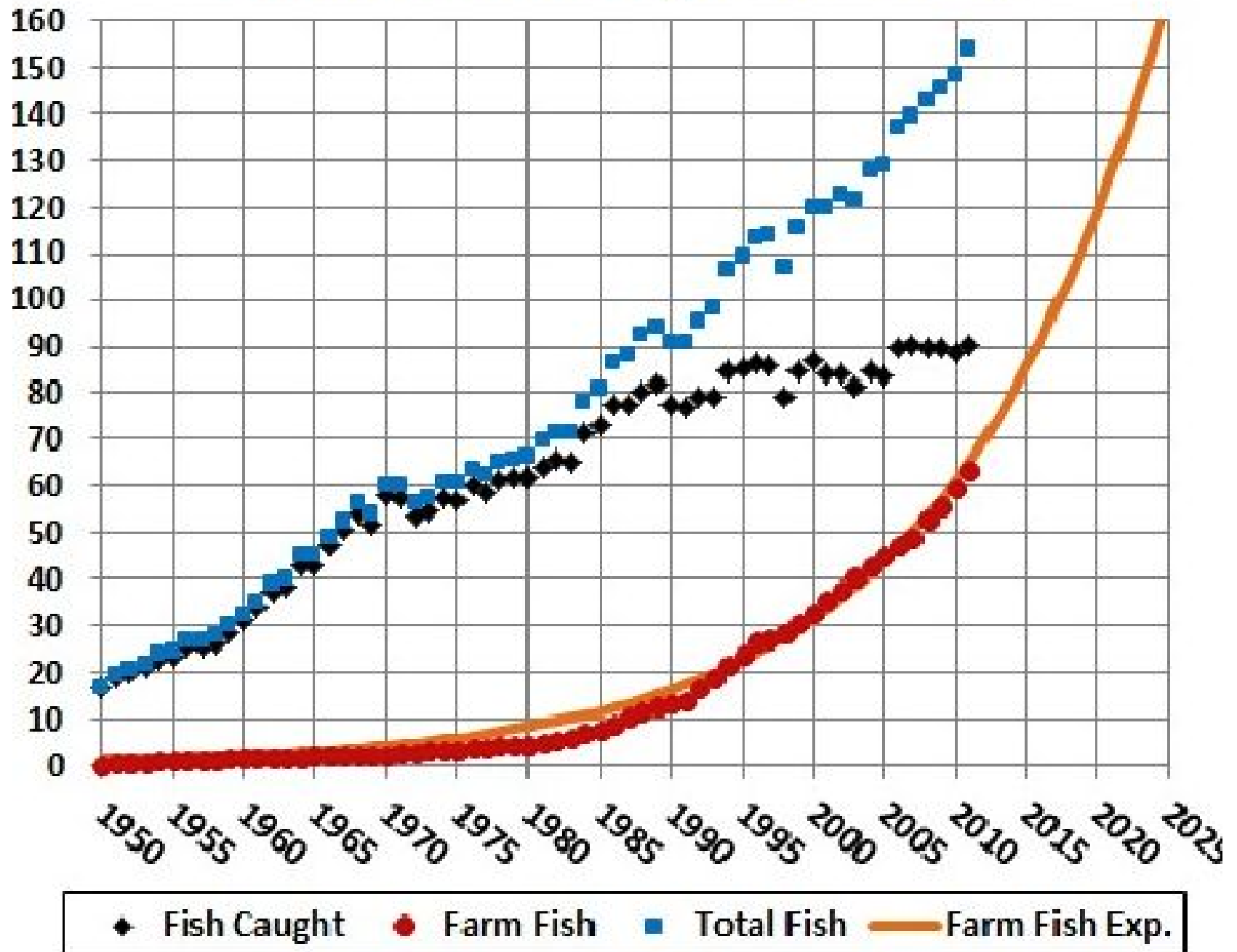
image labeled by cluster index - July 2015



Farm fishing

- 3-fish model can be applied to aquaculture
- Stable parameters can be learned and updated through experience
- Improved techniques could reduce amount of pesticide and wasteful products in the water
- Better aquaculture practices could be shared globally

World Fish Catch (10⁶ tonnes)



Thank you for you attention

Any questions?