Exploring uncertainties and subjective decisions in ecosystem modeling: the Icelandic Atlantis model

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MareFrame

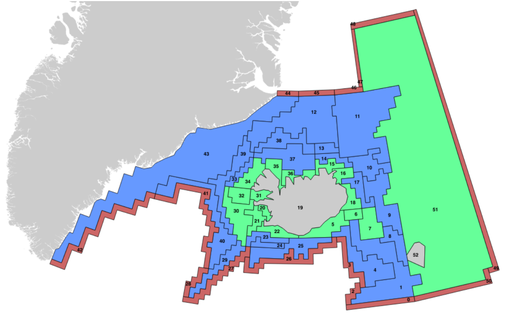
Introduction

- Atlantis is a whole-of-system ecosystem model
- Deterministic biodemographic and biogeochemical box model
- Tracks the flow of nitrogen through biological and detrital groups
- Includes the following submodels:
  - Oceanographic
  - Biological
  - Fisheries
  - Economic
  - Assessment
- Models all the major processes
- Models invertebrates as biomass pools (mg N/m^2 or mg N/m^3) and vertebrates as age-structured models
- Intended to be used strategically not tactically
- Data intensive
- Uncertainty and subjectivity during model development and calibration

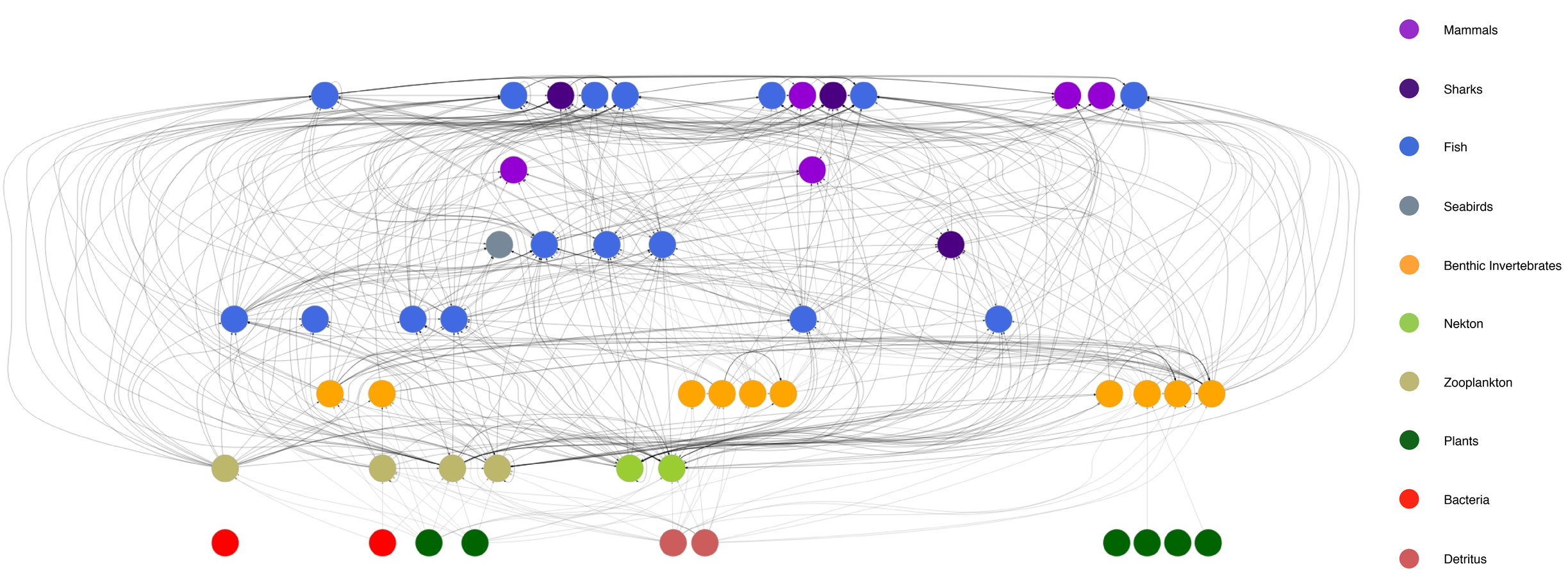
Modelling decisions

- Spatial structure
- Diet/prey availability
- Functional group assemblages
- Consumption & growth
- Mortality
- Tuning is model specific, can not start with simple model

Iceland Atlantis Model



Prey availability



Functional group assemblages

- 52 functional groups
- Individual or aggregates
- Determined based on expert opinion or cluster analysis

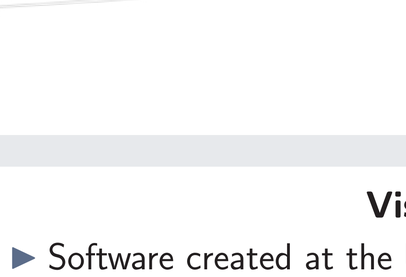
Type	Number of groups
Bony fish	16
Cartilaginous fish	3
Seabirds	1
Pinnipeds	1
Baleen whales	2
Toothed whales	2
Shrimp	1
Cephlapods	1
Zooplankton	4
Benthic invertebrates	10
Phytoplankon	3
Plants	3
Bacteria	2
Detritus	2

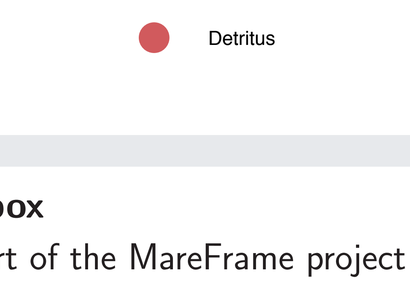
Tuning parameters

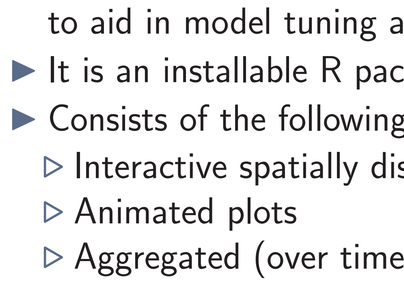
- Can get initial estimates for many parameters
- However, many parameters must be tuned to prevent explosion or extinction
- How tuning is done:
  - Subjectively: change parameters and see how it changes visually
    - Visualising Atlantis toolbox created for this purpose
  - Objectively: series of parallel runs with one parameter change, minimize some objective function, and select these parameters

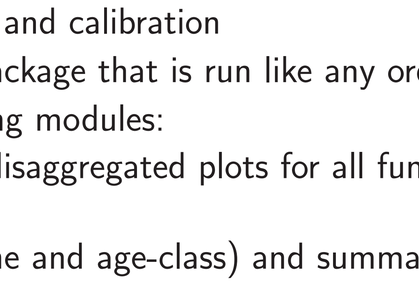
Visualising Atlantis Toolbox

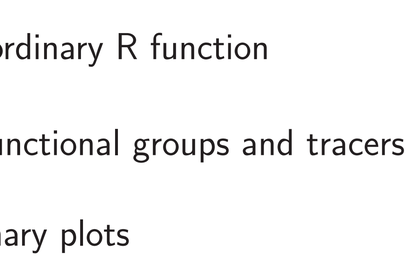
- Software created at the University of Iceland as part of the MareFrame project to aid in model tuning and calibration
- It is an installable R package that is run like any ordinary R function
- Consists of the following modules:
  - Interactive spatially disaggregated plots for all functional groups and tracers
  - Animated plots
  - Aggregated (over time and age-class) and summary plots
  - Diet plots and matrices
- Code is open-sourced, GPL'ed, and available at: https://github.com/cddesja/vat
- Demonstration of the program at: http://130.208.71.121:3838/vat/











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