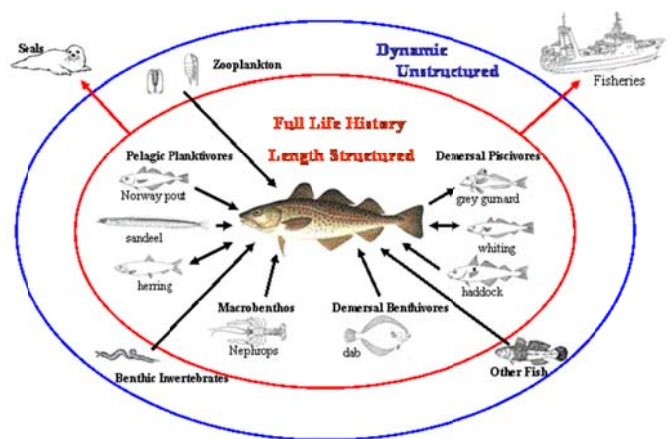


Marine Scotland fish population model (FishSUMS)

Model type: The model represents the changing size distribution and population size of a set of predator and prey species. The user can specify the set of key species of interest that are included in the model. Each of these species is represented by its abundance at length. The species are distinguished from each other by user-defined parameters that determine such things as how fast a species grows, the time of year of spawning, the numbers of eggs produced, natural mortality rate, fishing mortality rate, and the size and species composition of its prey. Predation imposes an additional source of mortality on the prey. Additional food resources that are not modelled at the species level are represented by size distributions of zooplankton, benthos, and "other fish". The main outputs from the model are time series of total species biomass (TSB), length distributions at annual census dates, annual recruitment, catch and landings for each species.



Existing Models for UK shelf seas:

The model has been configured for the North Sea with a set of nine structured species focused on cod and its main predators and prey. Subsequent work has extended this set of species to include plaice and saithe, so as to include the eight most abundant demersal species that make up >90% of the North Sea biomass. In general the model is configurable for any set of structured species and unstructured prey groups. The model was developed at Strathclyde University in collaboration with Marine Scotland Science, and has been developed as a package for the R software environment, available on request from <http://www.strath.ac.uk/fisheries/products/fishsums/>.

Existing uses:

- Assessment of cod yields and maximum sustainable yield (MSY) in relation to harvesting rates on other species, particularly herring.
- Simulation of North Sea Large Fish Indicator (adopted as an indicator of good environmental status under MSFD).
- Assessing the response of the LFI to changes in effort due to different fishing fleets.
- Evaluating the impacts of changes in fish diet in the North Sea.

Potential new uses:

- Use as a length-based multispecies stock assessment tool.
- Comparing fishery yields and MSY in different shelf sea regions.
- Comparing the effects through the food web (known as trophic cascades) due to fishing (top-down cascades) and due to changes in the base of the food web (bottom-up cascades).
- Population effects of alternative discard ban measures.

Key modelling issues:

- A considerable amount of data is required to specify the parameters that define each species, and their predator-prey interactions, and fishing mortality.
- Some parameters, particularly those associated with mortality and population control, need to be determined by tuning to observations such as survey length distributions.
- The model can be highly sensitive to the input parameters, so it is important to understand these sensitivities.

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