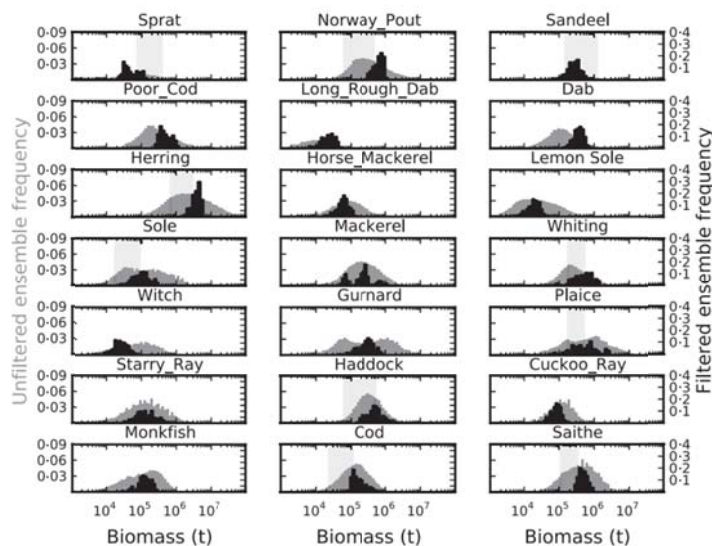


Length-based Multispecies Analysis by Numerical Simulation (LeMANS)

Model type: LeMANS is a size-structured multi-species model of a fish community with a realistic distribution of life-history attributes. This approach differs from that reported from most other size-based models in that it maintains both the identity of the species in the system and the size structure of the individual populations. The model has been applied to the North Sea and calculates biomasses of 21 fish stocks^{1,2}. Recruitment occurs each year and predation is based on size moderated by a diet matrix, but no starvation occurs. Ecosystem components not represented explicitly make up the pool of “other food”. An ensemble approach has been implemented by screening potential model set-ups against ICES abundance data to produce a subset of models consistent with data that can be used to generate probabilistic projections².



Existing Models for UK shelf seas:

The North Sea version was validated by considering fish community properties such as the size spectrum slope and biomass estimates from surveys in the North Sea which were compared to outputs from multispecies VPA models for 10 assessed stocks^{1,2}.

Existing uses:

- Evaluating the trade-offs between fishing and biodiversity¹.
- Assess the trade-offs between yield and risk of different harvest strategies for a multi-species fish community.

Potential new uses:

- Assessment of uncertainty in multi-species reference point estimates, trade-offs in idealised fleet management, multi-species harvest control rule evaluation, evaluating plausibility of diet matrix suggestions, assessment of signal to noise ratios for fish community indicators².

Key modelling issues:

- Growth is deterministic according to Von Bertalanffy Growth Equation – hence model is not valid for regions such as the Baltic where food-limited processes are known to be important.
- Model is not spatial in nature - hence not suitable for spatial issues, such as marine protected areas.
- Model is not appropriate for processes that are not size-structured, such as predation due to blue whales.
- Only the fish community is modelled explicitly, there are no seals or seabirds or benthos.

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¹ Rochet et al. (2011). Canadian Journal of Fisheries and Aquatic Science 68, 469-486.

² Thorpe et al. (2015). Methods in Ecology & Evolution 6, 49-58.