

StrathE2E2 Origin of the model (previous versions).

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StrathE2E2 was developed from an earlier version (StrathE2E1), which lacks horizontal spatial resolution and has a more sparse food web. The most radical difference between the two versions concerns the fishing fleet model which is a new development and absent from the earlier version.

StrathE2E1 is horizontally homogeneous, with two vertical water column layers overlying a single homogeneous sediment layer. The StrathE2E2 food web is essentially similar to StrathE2E1, but with the addition of refractory sediment detritus, macrophytes, planktonic larvae stages for benthos guilds, and migratory fish. In addition, the combined 'birds & mammals' guild in StrathE2E1 is disaggregated into separate guilds for birds, pinnipeds and cetaceans in StrathE2E2.

The methodology for applying external boundary driving data is essentially the same in the two versions of the model, with the exception of fishing. In StrathE2E1 the harvest ratios applied to each of the fish and benthos guilds are fixed parameters (external driving conditions). Discarding is represented in StrathE2E1, but not by-catch of birds and mammals.

R code for the North Sea implementation of StrathE2E1:

DOI 10.15129/c050f1e8-81d6-464f-9517-30d61816ff34

<https://pureportal.strath.ac.uk/en/datasets/strathe2e-marine-foodweb-model>

StrathE2E1 is described in:

Heath, M.R. & Steele, J.H. (2009). The relative roles of fishing and climate-driven changes in productivity and predator prey overlap in observed changes in the structure of upper trophic levels. Deliverable 3.5 Report to the EU-RECLAIM project (REsolving CLimate IMPacts on fish stocks, 044133 (SSP8)): 89pp. <https://pureportal.strath.ac.uk/en/publications/the-relative-roles-of-fishing-top-down-and-climate-driven-changes>

Heath, M.R. (2012). Ecosystem limits to food web fluxes and fishery yields in the North Sea simulated with an end-to-end food web model. *Progress in Oceanography*, **102**, 42-66. <https://www.sciencedirect.com/science/article/abs/pii/S0079661112000213>.

Open access author version:

https://pure.strath.ac.uk/ws/portalfiles/portal/12081105/Heath_REVISED_CAMEO_PIO_paper_24_02_2012_SINGLE_SPACED_with_diagrams.pdf

Publications using the StrathE2E1 model:

Heath, M.R., Cook, R.M., Cameron, A.I., Morris, D.J. & Speirs, D.C. (2014). Cascading ecological effects of eliminating fishery discards. *Nature Communications*, **5:3893** doi: 10.1038/ncomms4893 <https://www.nature.com/articles/ncomms4893>

Heath, M.R., Speirs, D.C. & Steele, J.H. (2014). Understanding patterns and processes in models of trophic cascades. *Ecology Letters*, **17**, 101-114.
<https://onlinelibrary.wiley.com/doi/full/10.1111/ele.12200>

Morris, D., Cameron, A., Heath, M. & Speirs, D. (2014). Global sensitivity analysis of an end-to-end marine ecosystem model of the North Sea: factors affecting the biomass of fish and benthos. *Ecological Modelling*, **273**, 251-263.
<https://www.sciencedirect.com/science/article/pii/S030438001300567X>
Open access author version:
https://pure.strath.ac.uk/ws/portalfiles/portal/30013190/Morris_et_al_2014.pdf

Hyder, K., Rossberg, A.G., Allen, J.I. *et al.* (2015). Making modelling count - increasing the contribution of shelf-seas community and ecosystem models to policy development and management. *Marine Policy*, **61**, 291-302.
<https://www.sciencedirect.com/science/article/pii/S0308597X1500216X?via%3Dihub>

Spence, M.A., Blanchard, J.L., Rossberg, A.G., Heath, M.R. *et al.* (2018). A general framework for combining ecosystem models. *Fish and Fisheries*, **19**, 1031-1042.
<https://onlinelibrary.wiley.com/doi/full/10.1111/faf.12310>

The StrathE2E1 model formed the basis for evidence provided at a public hearing of the European Parliament Fisheries Committee (13 April 2015, 'How to Improve Selectivity in the Context of the Discard Ban'):

Agenda for the European Parliamentary Hearing on the discard ban

http://www.europarl.europa.eu/cmsdata/78898/Programme_180315.pdf

Presentation to the European Parliamentary Hearing on discarding scenarios modelled with StrathE2E1 <http://www.europarl.europa.eu/cmsdata/78905/7.HEATH.PDF>

An intermediate version of the model, between StrathE2E1 and StrathE2E2, is described in the following report. This includes a prototype for the fishing fleet model:

Heath, M., Wilson, R. & Speirs, D. (2015). Modelling the whole-ecosystem impacts of trawling. A study commissioned by Fisheries Innovation Scotland (FIS)
<http://www.fiscot.org/> 86pp. <https://fiscot.org/wp-content/uploads/2019/06/FIS003.pdf>