Ecopath with Ecosim (EwE)

Model type: Whole Ecosystem model, quantifying food-web and fishery interactions. Biological components can include anything from plankton and detritus to fish, marine mammals and birds. Data from biological surveys and assessments is used to specify the abundance, productivity of groups and who eats (or catches) whom, and how much. Fishing fleets can be described at any level of detail and include landings, discards and economics. The EwE modelling framework is used worldwide (since 1980s) and models for any region can easily be developed at appropriate level of detail according to available data. Applications include fisheries impact and conservation, with models also often used to quantify changes in ecosystem indicators, including Good Environmental Status metrics. They are calibrated (tested) by comparing model predictions with data of historical changes in populations and fisheries. Spatial applications and risk-based evaluations of fisheries management plans can also be developed. There is a strong research community with ICES playing a key role in establishing the quality standards for their application in advice. The Joint Research Centre of EU Commission lists EwE as an important tool in its modelling suite, and like Cefas, is a member of the international consortium facilitating development and EwE.

Existing Models for UK shelf seas:

Area Modelled	Includes					Spatial Scale	Quality (data used)
	M[1]	B[2]	F[3]	I[4]	P[5]		
North Sea	3	1	44	13	3	1 x 0.5°	Calibrated (1991-2007, & 2012 key run)
Celtic Sea	3	6	34	17	1	0.5°	Calibrated (1991-2007, & 2012 key run)
Western English Channel	2	1	32	14	1	None	
Eastern English Channel	2	1	29	15	2	154 km^2	Calibrated (1973-2001)
English channel	2	1	29	15	2	None	
West Coast of Scotland	3	1	23	7	1	8.5 km	Calibrated (1985-2008)
Deep West Coast of Scotland	1	0	19	8	1	None	Calibrated (1974-2007)
Clyde Sea	2	1	21	11	1	7 x 6km	Calibrated (1985-2008)
Irish Sea	3	1	27	14	3	None	Calibrated (1973-2003)

1 M = mammals, 2 B = birds, 3 F = fish, 4 I = invertebrates, 5 P = primary producers

Existing uses:
- Evaluating the trade-offs among alternative fishing strategies particularly related to sustainable fishing and mixed fisheries. Recent work includes evaluation of discard policy (North Sea).
- Evaluating relative impacts of fisheries and climate effects (North Sea, Irish Sea, Celtic Sea)
- Evaluation of closed area management (North Sea)
- Evaluation of impact of aggregate extraction (Eastern Channel)
- Dynamics of the gadoid and demersal fisheries (West Scotland).
- Feasibility for ecosystem based management (Clyde Sea).

Potential new uses:
- Assessing impacts of fisheries and climate on structure and function of ecosystems (food-webs and biodiversity).
- Quantifying the performance and trade-offs between different management strategies to achieve both sustainable fisheries under CFP and MSFD environmental targets.
- Evaluating the benefits of spatial management policies (e.g. MPA, spatial closures) and impacts of pressures (e.g. aggregate extraction, oil and gas) on ecosystem structure and function.

Key modelling issues:
- Setting inputs (parameterisation) and testing outputs against real data (calibration) is an essential process to ensure quality and understand predictive performance. Quality of model depends on availability of data.
- Assessing what is eaten by different species and how this changes over time.
- Understanding the impact of changing inputs on the outputs from the models (sensitivity) and the effect of uncertainty in model parameters on robustness of model predictions.

For further details contact: Dr Steven Mackinson (steve.mackinson@cefas.co.uk)