# Population-Dynamical Matching Model (PDMM)

Model type: The PDMM is unique in its ability to resolve biodiversity to the level of interacting species across the entire marine food chain. The model is spatially unresolved. For strong technical and practical reasons, the model does not aim to provide a 1-to-1 representation of all species and their interactions in a study region, but only to reproduce the resulting high-level patterns and characteristic responses to pressures of species and the entire food-web. The model is theoretically very well understood and has been extensively tested in comparison with data from temperate shelf communities such as those of the North Sea and particularly the Celtic Sea.[1]
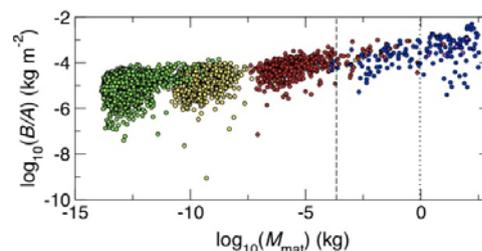
Existing Models for UK shelf seas:

Area Modelled	Includes					Spatial Scale	Quality (data used)
	M[1]	B[2]	F[3]	I[4]	P[5]		
Celtic Sea	0	0	around 200	several 100	several 1000	None	Calibrated and dynamics verified

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

Existing uses:
- Quantification of biodiversity ecosystem functioning (BEF) relations for exploited fish communities.
- Evaluation and comparison of 11 high-level management strategies to achieve multispecies MSY.
- Modelling and predicting recovery of fish-community size structure to changes in fishing pressure. (Celtic Sea)
- Identification of processes driving and constraining the dynamics of the Large Fish Indicator.
- Modelling and predicting recovery trajectories of Large Fish Indicator, Large Species Indicator, Mean Maximum Length, Mean Size at Maturation, and total fish biomass in response to changes in fishing pressure.
- Determination of time scales at which changes in fish community size structure affect fish species richness.

Potential new uses:
- Assessment of impacts of changes in ocean biogeochemistry on marine biodiversity across the food web.
- Assessment of impacts of changes in ocean biogeochemistry on fish production.
- Monetarization of changes in marine biodiversity.
- Quantitative risk assessment of impacts of invasive species.
- Quantification of adaptability of marine food webs to climate change and species composition.
- Tests of novel food-web indicators.

Key modelling issues:
- The PDMM shifts the focus from the fate of particular species to that of biodiversity at community level. Some adaptation of thinking by users of model outputs may be required.
- The PDMM does not currently distinguish between the benthic and the pelagic parts of the marine community.

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[1] Fung, T., Farnsworth, K. D., Shephard, S., Reid, D. G., and Rossberg, A. G. (2013). Why the size structure of marine communities can require decades to recover from fishing. *Marine Ecology Progress Series*, 484, 155—171.

Shephard, S., Fung, T., Rossberg, A. G., Farnsworth, K. D., Reid, D. G., Greenstreet, S. P. R., and Warnes, S. (2013). Modelling recovery of Celtic Sea demersal fish community size-structure. *Fisheries Research*, 140, 91—95.