**A spatiotemporal simulation framework for assessing the ability of fisheries-dependent data to support mixed fisheries management**

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Mixed fisheries, where more than one species are caught together during the same fishing operation, are the predominant type of demersal fishery worldwide. Fishers exploit populations that are heterogeneously distributed in space and time without full knowledge of species distributions and with fishing gear that is not fully selective. The ability to change catch composition is limited by species mix at a particular location and time and the capture characteristics of the fishing gear. Models capturing the dynamics of the fisheries (’fleet dynamics’ models) are often simplistic due to a lack of knowledge of the processes driving these catches, which occur both at large and small scales. Understanding the scale and drivers of these processes and how fish populations and fisheries interact in space and time in response to multiple drivers is vital to allow for better evaluation of gear, spatial and seasonal restrictions from the perspective of both fisheries and fish populations.

We develop a simulation framework to allow investigation of the importance of scaling on the interactions between fish populations and fisheries dynamics. The framework provides both i) a realistic but tangible biological model of fish population which includes a) full daily population processes (mortality, growth and recruitment) in space and time with population movement is a result of a combination of diffusive density dependent processes based on simulated Gaussian Random Fields (Lindgren et al 2011) representing directed ontogenetic niche shifts and migrations; and, ii) a realistic fishing simulation model to capture how fishers may exploit heterogeneously distributed fish populations with uncertain knowledge about the underlying spatial processes.

We capture the main processes in a simplified model that can be used for evaluating the suitability of using realised fisheries-dependent catch data. We generate a model system where we investigate the consequence of scaling and data aggregation within a framework where the true dynamics are fully known. We validate this simulated data against data collected on fisheries operating in the Celtic Sea and used for research into mixed fisheries (Gerritsen *et al*., 2012). The simulation allows for a more in-depth understanding of factors important when using fisheries-dependent data to develop fleet dynamics models, from the micro- to the large-scale and individual to population processes, not otherwise possible due to the limitations in ‘real-world’ spatiotemporal data on fish distributions. Thus, the framework supports development of methods for predicting how fishing effort in response to management interventions and how such changes might affect future catches and exploitation patterns.

**References**

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