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*Science*

1200 New York Avenue NW

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Dear Editor,

Enclosed is our manuscript “Spatial separation of catches in highly mixed fisheries”. Please accept it as a candidate for publication as a Report in *Science*.

How humans exploit heterogeneously distributed wild animal populations is an important research topic as it supports food security, sustainability and managing natural capital. Wild capture fisheries are spatially and technically complex, with fisheries simultaneously catching different size classes of multiple populations with different management or conservation goals. Understanding this multidimensional interaction is a challenge highlighted by recent research on selective and unselective fishing (Reconsidering the consequences of selective fishing, Science 335: 1045 - 1047). This work highlights the importance of species and size selection yet does not address the spatiotemporal complexities inherent. We develop a framework to reduce the complexity of spatiotemporal dynamics in mixed fisheries, capturing key spatial, fishery and species interactions that drive catches. We demonstrate how axes of maximal separation show the potential for - and limitations of - spatial harvesting and underline the importance of the approach in the context of the most significant policy change to face European fisheries in recent times – that of the forthcoming ban on discarding in Europe (‘landings obligation’).

We present an approach that goes beyond current practices to show how spatial mitigation can support adaptation to the new European fisheries management system. We feel our work merits review and publishing in *Science*, as it not only highlights the pressing challenges of a major policy reform with global implications but, moreover, it presents a possible solution to some of the challenges, thus enabling long-overdue scientific discourse on spatial mitigation to commence.

The manuscript is our original unpublished work and it has not been submitted to any other journals for review. Funding support has been given by the MARES joint doctoral research

programme (MARES 14 15) and Cefas seedcorn (DP227AC), with computing facilities provided by the Irish High-End Computing Facility (ICHEC; [www.ichec.ie](http://www.ichec.ie/)).

The manuscript has previously undergone internal review by Dr Robby Fonner at the North-West Fisheries Science Center, National Oceanic and Atmospheric Administration (NOAA) and Stuart Reeves at the Centre for Environment, Fisheries and Aquaculture Science (Cefas).

Suggested referees are:

* Dr Ana Parma (expert in fisheries modeling, assessment, and management)

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The fishery-independent trawl survey data used in our manuscript is available in an online repository at the International Council for the Exploration of the Sea (ICES; <http://www.ices.dk/marine-data/data-portals/Pages/DATRAS.aspx>) or available from the Cefas datahub (<https://www.cefas.co.uk/cefas-data-hub/>).

Code for undertaking the analysis is available via the authors github sites (<https://github.com/james-thorson/VAST>; <https://github.com/pdolder/JointProduction_study>).

We estimate a final draft to be approximately 2,500 words or 3 pages in *Science* with 27 references in the main text. There are four figures. The desired figure sizes are height x width in millimetres:

Figure 1: 100 x 170

Figure 2: 80 x 170

Figure 3: 90 x 170

Figure 4: 140 x 150

A Supplementary materials section is included.

We look forward to hearing from you on our submission.

Yours faithfully,

Paul Dolder, Cóilín Minto and James Thorson