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NEW PERSPECTIVES ON FISHERIES: COMBINING THE DISTRIBUTION OF INSHORE AND OFFSHORE COMMERCIAL FISHERIES IN SCOTLAND

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ABSTRACT

Scotland's seas support diverse commercial fisheries, including both inshore and offshore fishing fleets. The offshore fleet (overall vessel length ≥15 m) is covered by Vessel Monitoring System (VMS) offering bi-hourly location data which can be linked to landings information. On the other hand, Scottish inshore fishing vessels do not carry VMS, and their activity was recently mapped using an interview based approach with fishery stakeholders (the ScotMap project). Increasing competition over marine space highlighted the need for comprehensive spatial information on fishing activities. Combining commercial and stakeholders' data can provide a Scotland-wide spatial representation of fisheries to assist in marine planning for renewable energy, conservation and fisheries management. VMS data combined with landings were used to describe the spatial patterns of landings of the Scottish offshore fleet. The ScotMap data were analysed to derive monetary value distribution maps for the inshore fleet. ScotMap and VMS layers were added together to produce a combined data set, spatial information for landings value for the whole Scottish commercial fishing fleet. This provides a new perspective which can inform decision making in various policy areas including marine spatial planning, sustainable development of offshore renewable energy, nature conservation and fisheries management.

INTRODUCTION

Marine Spatial Planning relies on robust data of human usage of the sea, to minimise spatial conflicts and to inform decision making. Current planning in Scotland places high priority on renewable energy, aiming to cover the total electricity demand from renewable sources by 2020, and hence a large number of Marine Renewable Energy Developments (MREDs) are expected [1]. At the same time, Scotland's seas support diverse commercial fisheries, including both inshore and offshore fishing fleets, which make a significant contribution to the local and national economy [2]. Predicting and minimising environmental and socio-economic interactions between fisheries and the renewable industry is an important consideration in both marine planning and licensing. For this to be achieved, the spatial distribution of the Scottish commercial fishing fleet needs to be well represented, however historically, one of the key missing pieces of information has been the location and intensity of fishing effort. Due to increasing competition over marine space, the need for credible and comprehensive spatial information on fishing activities has been recognised by the fishing industry, marine renewable energy developers, regulators, marine planners, and other relevant stakeholders

When compared with other offshore activities, the fishing sector faces particular problems in mapping its activities. Notably, spatial distribution data for the two fleets (offshore and inshore) have different availability. On the one hand, the offshore fleet (overall vessel length ≥15 m) is covered by the automatic Vessel Monitoring System (VMS) offering bi-hourly location data which can be linked to low-resolution logbook data for landings information.

On the other hand, Scottish inshore fishing vessels (<15 m in overall length) do not carry VMS, and their activity was only recently mapped using an interview based approach with fishery stakeholders (the ScotMap project) [3]. ScotMap data were collected during face-to-face interviews with over 1000 skippers (72% vessel coverage overall) and relate to fishing activity for the period 2007 to 2011. During interviews, fishermen were asked questions about their fishing vessel, crew, home and landing ports, fishing areas, seasonality and the methods and gears used. They were also asked to provide an estimate of the annual gross vessel earnings from fishing and the percentage contribution each fishing area makes to earnings, an average over the last five years. The information provided accounts for 75% of the Scottish inshore landings with regional variations.

This study combines commercial and stakeholders' data to provide a Scotland-wide spatial representation of fisheries and maps of fishing activities across fleets to assist in marine planning for MREDs, conservation and fisheries management.

METHODOLOGY

VMS data for all UK registered commercial fishing vessels (≥15m length) for the period 2007-2011 in ICES areas VIa, VIb, IVa, IVb, IVc, IIa, VIId, and VIIa have been combined with landings

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information to develop GIS layers describing the spatial patterns of landings of the Scottish offshore fleet from within the Scottish part of the UK fishery limits (200 NM). Initially, VMS pings were filtered by speed (0 < speed < 5 knots; [4]) to distinguish fishing from steaming. Then, fishing pings were merged with landings data (i.e. logbooks). To avoid landings mis-allocation, fishing pings were assigned to overlapping ICES rectangles. Reported landings data were broken down by reported day and the daily landings in each ICES rectangle were equally distributed for those assigned pings in that day. All pings within a 2.5 km^2 radius of major fishing ports were removed since the speed threshold applied during filtering, included periods of relatively low speed as vessels approached port areas. Total trip landings associated with removed pings were re-allocated to all remaining pings of each trip (also see [5]). Next, a quadrate count analysis using a fine grid produced landings distribution maps of the offshore fleet. Grid resolution was selected as a trade-off between potential maximum resolution and a level of aggregation which did not reveal individuals' patterns.

The ScotMap data, comprising individual vessel's fishing areas (polygons) and attributed information including annual gross vessel earnings for 2007-2011, were rasterised using a grid at the same resolution as used in the VMS analysis above, to derive monetary value distribution maps. The value associated with each fishing polygon was calculated from the percentage contribution and gross vessel earnings data. Each polygon was overlaid with the grid and the polygon monetary value was divided by the number of overlapping grid cells to equally distribute the value to all overlapping grid cells irrespective of the extent of the overlap. This process was repeated for all polygons and the values associated with each grid cell were finally summed to produce a gridded dataset. Not all fishermen initially targeted for the ScotMap project were interviewed (72% vessel coverage overall) and not all those interviewed provided earnings information (10% decline to disclosure earnings information). As a result, collected data accounted for 75% of the overall Scottish inshore landings, and coverage varied regionally. Prior to merging landings value data from VMS, with that from ScotMap, ScotMap outputs were scaled up to approximate to 100% coverage. This was done in two different ways:

A. For the fleet sectors which are closely associated with specific habitats (e.g. nephrops trawl fishery which occurs over mud and muddy sand), the reported landings value of non-interviewed vessels was redistributed according to the spatial extent and intensity of the interviewed vessels. This was done on the basis that those consulted about the ScotMap outputs agreed that the monetary value maps provide a good indication of the most important inshore fishing areas and fisheries.

B. For remaining non-interviewed vessels, landings values were distributed across the ICES statistical rectangles, to which they were reported.

The scaled up value data from ScotMap and VMS layers were added together to produce a combined data set, spatial information for landings value for the whole Scottish commercial fishing fleet.

CONCLUSIONS

The combination of the spatial information from the two fleets (offshore and inshore), provides a comprehensive representation of fishing activities in Scotland. This new perspective can inform decision making in various policy areas including marine spatial planning, sustainable development of offshore renewable energy, nature conservation and fisheries management.

The outputs of the project will make an important contribution to marine spatial planning in Scottish waters, particularly in regional evaluations of the potential impacts of renewable energy development and proposed marine protected areas. The data set will inform future studies of fisheries displacement

By incorporating information into the planning process, it should be possible to establish cross-sector synergies, address economic growth and nature conservation objectives whilst minimising impacts on livelihoods and the environment.

REFERENCES

[1] Scottish Government. 2011. 2020 Routemap for Renewable Energy in Scotland (p. 124). Edinburgh, Scotland.

[2] Scottish Government. 2012. Scottish Sea Fisheries Statistics 2012 (pp. 1–110). Edinburgh, Scotland.

[3] Kafas, A., McLay, A., Chimienti, M., Gubbins, M. 2013. Mapping fishing activity in Scotland's inshore waters – analytical approaches applied to data from fishery stakeholders. ICES CM I:28.

[4] Lee, J., South, A.B., Jennings, S., 2010. Developing reliable, repeatable, and accessible methods to provide high-resolution estimates of fishing-effort distributions from vessel monitoring system (VMS) data. ICES Journal of Marine Science, 67: 1260–1271.

[5] Kafas, A., Jones, G., Watret, R., Davies, I., Scott, B. 2012. Representation of the use of marine space by commercial fisheries in marine spatial planning. ICES CM I:23.