

## MASTS Small Grant Award: SG263

### Digitisation of historical fish spawning distribution maps in UK waters

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This particular study focussed on fish spawning ground distribution in the North Sea over 150 years as a case study.

The first comprehensive collection of maps illustrating the distribution of fish spawning grounds in UK waters was published in 1883 by Norwegian born Ole Theodore Olsen (Olsen, 1883).

In recent years, a number of datasets have been created showing UK fish spawning grounds. Lee and Ramster (1981) compiled an atlas of the seas around the UK, including the spawning grounds of several commercial fish; currently not available in digital format. Present day distribution of UK fish spawning and nursery grounds are available in GIS shapefiles through CEFAS (Centre for Environment, Fisheries and Aquaculture Science) and Marine Scotland Science as published by Coull *et al.* (1998); Ellis *et al.* (2012); and Marine Scotland (2014) (nursery grounds) respectively.

The aims of this study were to i) explore new and innovative ways of recording historical data, through the digitisation of an 1883 atlas of fish spawning grounds (Olsen, 1883) and ii) use this new dataset (Olsen, 1883) as a case example, through which to explore a comparison with three present day fish spawning ground datasets (Coull *et al.*, 1998; Ellis *et al.*, 2012; Gonzalez-Irustra and Wright 2015). It was intended that this study outlines the potential use of historical fisheries data and how these and other types of data may be used in ecological or management studies.

The Olsen (1883) atlas contains distribution and spawning maps for 46 fish species. Fourteen maps were selected based on their relevance to the present day datasets: cod, haddock, herring, lemon sole, mackerel, plaice, sole, whiting, skate, thornback ray, ling, horse mackerel, hake and sprat. The majority of the Olsen (1883) maps were for species either no longer considered in a large commercial capacity in UK waters (e.g. anchovy, garfish, tusk etc.) and/or had no comparative present day dataset available (e.g. mussels, turbot etc.).

The National Library for Scotland, Edinburgh provided scanned copies of the requested maps in jpeg format. Of the 14 maps selected, the sprat map was subsequently discarded, as it was not possible to distinguish between the general distribution and spawning areas on the scanned version.

Touch table technology has been identified as a useful means by which to collate anecdotal spatial data in a digital format (Alexander *et al.*, 2012). The spatial extent of the distribution or spawning area for each species was 'drawn freehand' onto a digital map, displayed on the touch table, in the form of a polygon; automatically geo-referenced by the software; and saved. These GIS shapefiles were saved and used alongside available shapefiles from Coull *et al.* (1998); Ellis *et al.* (2012); Gonzalez-Irustra and Wright (2015) to compare change in distribution.

Through a comparison of the datasets, two key results were identified; firstly, the distribution of spawning grounds has changed between 1883 and present day for horse mackerel, mackerel, haddock, ling and hake. Secondly, overall spawning ground area decreased between the 1883 and present day datasets (discounting "low" intensity and 'occasional' spawning) for all species except lemon sole and Mackerel (Coull *et al.* only). Interestingly, data from the study showed that the spawning grounds of plaice have decreased in area when comparing the Olsen and present day datasets, but the spatial distribution has remained similar.

## Outputs

The digitised shapefiles from the Olsen (1883) atlas were submitted the CEFAS Data Hub and are available for public use and download by searching for “**Digitised Fish Spawning Distribution Adapted from the Olsen 1883 Piscatorial Atlas**” in the Data Hub home page <http://data.cefas.co.uk/#/>.

A draft paper has been written, and will be submitted in due course.

## Costs

Activity	Cost (£)
Scanning of Atlas at National library Scotland	200
Travel to Oban	90
5 night accommodation/subsistence (Oban)	210
<b>Total</b>	<b>500</b>

## References

Alexander, K. A., Janssen, R., Arciniegas, G., O'Higgins, T. G., Eikelboom, T. and Wilding, T. A. (2012) 'Interactive Marine Spatial Planning: Siting Tidal Energy Arrays around the Mull of Kintyre', Plos One, 7(1), e30031. <http://dx.doi.org/10.1371/journal.pone.0030031>

Coull, K. A., Johnstone, R. and Rogers, S. I. (1998) 'Fisheries Sensitivity Maps in British Waters. Published and Distributed by UKOOA Ltd'.

Ellis, J. R., Milligan, S. P., Readdy, L., Taylor, N. and Brown, M. J. (2012) 'Spawning and nursery grounds of selected fish species in UK waters. Sci. Ser. Tech. Rep., Cefas Lowestoft, 147: 56 pp.'

Gonzalez-Irustra, J. and Wright, P. (2015) 'Spawning grounds of Atlantic cod (*Gadus morhua*) in the North Sea', ICES Journal of Marine Science; doi:101093/icesjms/fsv180.

Lee, A.J. and Ramster, J.W. (Eds.) 1981. Atlas of the Seas around the British Isles, Ministry of Agriculture, Fisheries and Food, London.

Marine Scotland (2014) Updating Fisheries Sensitivity Maps in British Waters. Scottish Marine and Freshwater Science Report Vol 5 No. 10, published by Marine Scotland Science. ISSN: 2043-7722.

Olsen, O. T. (1883) The piscatorial atlas of the North Sea, English Channel, and St. George's Channels: illustrating the fishing ports, boats, gear, species of fish (how, where, and when caught), and other information concerning fish and fisheries Grimsby.