



The effective management of fish stocks in European waters is highly dependent on the quantity and quality of data available during the stock assessment process.

While some species in the northern North Sea are considered to have detailed and robust stock assessments, a number of key commercial species currently lack the data required to undertake quantitative analytical assessments. In some instances, data on key biological parameters such as growth and maturity, essential for the management of stocks, is also required.

The fisheries research team at NAFC Marine Centre UHI identified a number of species of significant local and international importance that were lacking in key fishery

Gathering data for key fish species

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As fisheries manager at NAFC Marine Centre UHI, Dr Paul Macdonald manages the centre's four research vessels and associated research and survey activity.

Research within the centre's fisheries section primarily focusses on studies that assist in the effective management of fishery resources, enabling these resources to be exploited in a sustainable manner while providing economic stability to local communities.

Dr Macdonald's research has contributed to the assessment and management of a number of commercially important fish species in the northern North Sea. He has also developed novel fishing gears that have enabled inshore fishing vessels to diversify into more environmentally friendly fishing methods.

His recent research projects have included investigating the biology and ecology of key demersal fish species in the North Sea, and assessing the potential to develop an inshore cod trap fishery with minimal discards in the Shetland Isles. These projects are particularly relevant in light of the forthcoming implementation of the landing obligation, EU regulations aimed at reducing the practice of discarding fish.

Dr Macdonald completed his BSc (Hons) degree in Marine Biology at the University of Aberdeen in 2004, completing an MSc in Marine and Fisheries Science at the university the following year. He then joined NAFC Marine Centre UHI as a project officer researching the potential of jig fishing – automated hand lining. He completed a PhD entitled *Increasing understanding of a data poor species to improve resource management: megrim (Lepidorhombus whiffiagonis) in the northern North Sea* in 2014.

Dr Macdonald has a unique perspective on fisheries science as, prior to attending university, he worked for ten years as a fisherman in the Western Isles.

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and/or biological data. From those, six species – hake, ling, lemon sole, megrim, anglerfish and plaice – were identified as being among the most important commercial species that required further study. The team undertook a two-year research project, funded by the Scottish Government in 2013/14 and the European Fisheries Fund in 2014/15, aimed at filling some of the key biological and fishery knowledge gaps for these species.

Over a two-year period, two fisheries observers undertook research trips on commercial fishing vessels in the northern North Sea in order to collect fishery and biological data. Key fishery parameters including catch and discard composition were recorded, as well as biological parameters including length, weight, sex and maturity. Reproductive tissue and otoliths (ear bones used to determine the age of fish) were also collected for further analysis.

Reproductive tissue was processed by technical staff at the NAFC histology laboratory and resultant data was used to describe spawning seasons and provide an estimation of length at maturity – an important metric for estimating the spawning potential of a stock.

Otoliths were removed from fish and processed in the department's fish ageing laboratories. Three different methodologies were used to process the otoliths in preparation for age reading. Many species'

otoliths can be aged whole under a microscope, by counting the annual rings. For species such as hake, reading of whole otoliths is difficult and a more accurate estimation of age is made by taking a 0.6 millimetre cross section of otolith. Species such as lemon sole require otoliths to be broken in half across the nucleus and lightly burned to make the annuli stand out. Growth models were then fitted to the age data for each of the six species.

Data collected during the project was submitted to Marine Scotland for dissemination to relevant working groups within the International Council for the Exploration of the Seas. It is anticipated that the data will be considered during stock benchmarking exercises for each of the species and will go some way to assisting in the management of these important resources.

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