Progress in Oceanography 117 (2013) 89–105

Contents lists available at SciVerse ScienceDirect

Progress in Oceanography

journal homepage: www.elsevier.com/locate/pocean

The fish and fisheries of Jones Bank and the wider Celtic Sea

I. Martinez [a,b,*], J.R. Ellis [c], B. Scott [a], A. Tidd [c]

[a] School of Biological Sciences, University of Aberdeen, Tillydrone Avenue, Aberdeen AB24 2TZ, Scotland
[b] Marine Laboratory, PO Box 101, 375 Victoria Road, Aberdeen AB11 9DB, Scotland
[c] Centre for Environment, Fisheries and Aquaculture Science (CEFAS), Lowestoft Laboratory, Pakefield Road, Lowestoft, Suffolk NR 330HT, UK

ARTICLE INFO

Article history:
Available online 22 March 2013

ABSTRACT

The Celtic Sea is a diverse fishing ground that supports important commercial fisheries for a range of demersal fish, large and small-bodied pelagic fish and a variety of cephalopods and other shellfish. A regional overview of the main commercial fish stocks of the Celtic Sea and of the fish that occur in the vicinity of Jones Bank are provided through analyses of landings data from English and Welsh vessels, and from scientific trawl surveys. Dedicated smaller scale sampling via trawl surveys combined with baited cameras on and around the Jones Bank were also analysed to investigate the importance of sandbank habitats with attention paid to the differences in the species occurring on the top of the bank in comparison to adjacent off-bank habitats. Official landing statistics for UK (English and Welsh) vessels indicated that the predominant commercial demersal species in ICES Divisions VIIg,h (in terms of quantities landed) were anglerfish, megrim, pollack and skates (Rajidae). There were, however, regional differences in the distribution of fish and fisheries, and the area surrounding Jones Bank (ICES Rectangles 28E1 and 28E2) supports fisheries for megrim, anglerfish, skates, hake, ling and turbot, with otter trawl, gillnet and beam trawl the main gears used. Recent survey data collected with GOV (Grande Ouverture Verticale) trawl from the Celtic Sea (ICES Divisions VIIe-h, 2007–2010) were used to highlight the broad scale distribution of the main fish assemblages in the Celtic Sea. Analyses of the fish and cephalopod catches from these surveys indicated that there were four broad assemblages in the area, including (i) a region around the Cornwall (which will also be partly influenced by the necessity to use rockhopper ground gear on these rough grounds), (ii) the shallower regions of the north-western Celtic Sea (including parts of the Bristol Channel), (iii) the deeper parts of the outer shelf and (iv) the central Celtic Sea. These data also provided information on the ichthyofauna of the Jones Bank. Further site-specific data for bank and off-bank habitats were collected during dedicated surveys on the Jones Bank in 2008 using commercial trawlers and baited camera deployments. Twenty-three species were recorded on the top of the bank, where horse mackerel, haddock and boarfish were the most abundant species; 18 species were found along the slope of the bank (with blue whiting, poor cod, hake and horse mackerel predominant) and 18 species observed off the bank (where catches were dominated by blue whiting, poor cod and hake). The differences between camera and trawls were important with cameras only picking up 28% of the species seen in the trawls. However both camera and trawl results suggest that some species are very habitat specific, with species such as haddock only observed on the top of the bank, whilst *Nephrops norvegicus* was abundant on the flat areas off the bank but was infrequent on the top of the bank. These results suggest that future surveys of offshore sandbank habitats should stratify sampling more specifically to deal with smaller scale features that may play an important role in providing a greater range of habitats than just their relative size would suggest.

1. Introduction

The Celtic Sea is a large area that includes ICES Divisions VIIg–h, the western parts of Divisions VIIe–f and the shelf waters in Division VIIj. It is limited to the north by the Irish Sea, to the west by the continental slope of the Porcupine seabight and east by the western English Channel. The shelf waters of the central Celtic Sea are about 100–150 m depth and host a number of shallower banks, including the Labadie Bank, the Jones Bank and the Great Sole Bank. The area has a gravel and sandy bottom in the north but it is muddier towards the south, with patches of rocky ground in some areas (Le Danois, 1948; Pinot, 1974).

The Celtic Sea is a major spawning and fishing site for commercially important pelagic species such as mackerel *Scomber scombrus* and horse mackerel (or scad) *Trachurus trachurus*, demersal fish such as hake *Merluccius merluccius*, haddock

* Corresponding author at: School of Biological Sciences, University of Aberdeen, Tillydrone Avenue, Aberdeen AB24 2TZ, Scotland.
E-mail address: igoak2@hotmail.com (I. Martinez).

0079-6611/$ - see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.pocean.2013.03.004

Melanogrammus aeglefinus, anglerfish *Lophius piscatorius* and megrim *Lepidorhombus whiffiagonis* (Warnes and Jones, 1995) and shellfish, including *Nephrops norvegicus*. Blue whiting *Micromesistius poutassou*, *S. scombrus* and *N. norvegicus* are some of the main prey species found in the stomach contents of predatory fish such as *M. merluccius*, *L. whiffiagonis*, *L. piscatorius*, whiting *Merlangius merlangus* and cod *Gadus morhua* (Pinnegar et al., 2003; Trenkel et al., 2005). Pinnegar et al. (2002) documented a decline in the abundance of large piscivorous species, such as *G. morhua* and *M. merluccius*, in the area and an increase of small, non-commercial pelagic species like boarfish *Capros aper* in French and UK survey catches (ICES, 2008). Increases in *C. aper* have been documented elsewhere in the north-east Atlantic (Fock et al., 2002; Blanchard and Vandermeirsch, 2005), although it should also be noted that Günther (1889) observed that *C. aper* would occur off the Irish coast in large numbers at irregular intervals. Changes in species composition may be part of larger regional species shifts due to climate change, or related to the effects of commercial fishing (Quéro and Cendrero, 1996; Poulard and Blanchard, 2005). Meta-analyses of fish abundance and species distributions in the OSPAR maritime area have shown the important influence of changes in hydrodynamics and sea surface temperature (Tasker, 2008).

The study of offshore demersal habitats have traditionally used invasive sampling, using gears such as trawls, grabs and dredges, with more limited use of visual techniques (e.g. towed video camera and remote operated vehicles) (Kaiser et al., 2004). Traditionally, trawl surveys for fishery resources have been carried out using various kinds of trawl (e.g. beam and otter trawl). Trawling is an extractive technique which can result in detailed species-specific population studies, including length-weight relationships, age-structure and reproductive state. More recently, non-extractive methods, including visual census with video and underwater camera, have become increasingly popular in marine biological studies. The main advantages of the latter methods include a reduced impact on the environment, observation of species *in situ* without the need to remove individuals, and direct images of the species' habitat. Most importantly, cameras can be deployed in habitats difficult to trawl, such as the deep sea (Priede et al., 2010), Marine Protected Areas and other sensitive habitats (Willis et al., 2000) and untrawlable areas (e.g. reefs and oil and gas platforms). However, visual sampling techniques, including baited underwater cameras (BUC) are highly selective and changes in environmental variables such as current speed, tide, light level, time of the day, visibility and bait soak time have been shown to affect the results of BUC studies (Løkkeborg and Johannessen, 1992; Stoner, 2004; Martinez et al., 2011), and they are less effective for small-bodied and cryptic species and non-scavenging species. Nevertheless, the use of different sampling techniques can provide a more holistic picture of the marine habitat(s) of interest and the associated biological communities.

Sandbanks are generally formed by the physical processes of seabed currents in combination with seabed topography (Kaiser et al., 2004). Sandbanks may have distinct faunal assemblages, with subtle differences between the species occurring on the top of the bank in comparison to adjacent off-bank habitats (Kaiser et al., 2004; Ellis et al., 2011, 2013). Previous work in the North Sea carried out by Aberdeen University and Proudman Oceanographic Laboratory (POL) found that piscivorous predators foraged in high numbers in areas with a high sub-surface concentration of chlorophyll and pronounced internal wave activity at the edge of sandbanks (Scott et al., 2010). Such banks also occur in the Celtic Sea, and so could also constitute important topographic features and foraging areas that support higher concentrations of fish and other top-predators (including seabirds and marine mammals). Such sites may also be utilised by commercial fishing vessels and, consequently, may have potential implications in fisheries management.

The Vessel Monitoring System (VMS) recently implemented by Member States of the European Union has showed fishing activity on the continental shelf to be strongly associated with small banks such as the Jones Bank (Sharples et al., 2013). High levels of fishing activity may result in local overfishing and habitat disturbance, and so an improved knowledge of the fauna of sandbanks is required to facilitate the appropriate management of human activities in such habitats. There is need to understand and describe the role that individual sandbanks and sandbank networks play as distinct habitats for the local marine fauna to meet the requirements of Good Environmental Status of the Marine Strategy Framework Directive and to inform on the selection of sites for conservation and marine planning of the EU Habitats Directive. The present study examines the main regional fish assemblages of the wider Celtic Sea and a site-specific description of the ichthyofauna associated with the Jones Bank using official landing data from UK vessels, trawl survey data and observations from baited underwater camera deployments.

2. Methods

2.1. Commercial landings data

Landings data for UK (English and Welsh) vessels were extracted from the Fishing Activity Database (FAD) for the years 2000–2009. The mean annual landings for the main species were examined for ICES Divisions VIIg,h (which covers much of the Celtic Sea) and for ICES statistical rectangles 28E1 and 28E2 (see Fig. 1), over which Jones Bank extends.

2.2. Data from Vessel Monitoring Systems (VMS)

Larger commercial vessels ($\geqslant$15 m overall length) have VMS on board, thus enabling the locations of the vessels (with associated trawl speed) to be reported approximately every 2 h. These data were analysed for the English and Welsh fleets for the years 2005–2008 and over a grid of pixel squares of 3′ by 3′, so providing 200 cells per ICES rectangle (given that each ICES rectangle covers 60′ longitude and 30′ latitude). To identify likely sites of fishing activity, data for otter and beam trawlers were selected by trawl speed, so that steaming (non-fishing) locations were omitted. These data enabled areas of higher effort to be identified. Determining effort for offshore gillnetters is more problematic, as a gillnetter may deploy different nets in terms of mesh size, type of gillnet and number of fleets (i.e. total length of net) over the course of a single trip. Hence, no estimates of effort were provided, and data were simply provided as the proportion of reported vessel locations in each square.

2.3. Scientific trawl surveys

Jones Bank was initially sampled with 2 m beam trawl during a groundfish survey in March 2002 (Ellis et al., 2013), and was then sampled with a Portuguese high headline trawl in March 2003 and 2004. This survey, which is not currently undertaken, was described by Tidd and Warnes (2006). Since 2003, CEFAS have undertaken a fishery-independent trawl survey of the Irish Sea and Celtic Sea in November as part of the internationally-coordinated International Bottom Trawl Survey (IBTS) of the southern and western waters of the North-east Atlantic continental shelf (ICES, 2010a,c).