The Sizewell C Project

6.3 Volume 2 Main Development Site

Chapter 22 Marine Ecology and Fisheries

Appendix 22F - Review of Commercial and Recreational Fisheries activity in the vicinity of Sizewell Power Station: Edition 3

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Review of commercial and recreational fisheries activity in the vicinity of Sizewell Power Station: Edition 3

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Please note that the red line boundary used in the figures within this document was amended after this document was finalised, and therefore does not reflect the boundaries in respect of which development consent has been sought in this application. However, the amendment to the red line boundary does not have any impact on the findings set out in this document and all other information remains correct.

Executive summary

The information presented within this report is intended to provide the basis for evaluating the impacts that the build and operation of a proposed new nuclear build at Sizewell, on the Suffolk coast (National Grid Reference TM 473 635) will have on the local fishing industry and on commercially and recreationally important finfish and shellfish species.

The Primary Area for the study is the Greater Sizewell Bay, extending from Dunwich to Thorpeness. This area lies within ICES statistical rectangle 33F1 (the most localized aggregation unit for fisheries catch data), which extends from Lowestoft to Orford along the Suffolk coast and approximately offshore to the UK 12-mile limit. The relevant information is placed in a more regional context (referred to as the wider Sizewell area) by also presenting data from the area from the Thames Estuary to north Norfolk, offshore to 3 °E, and enclosed by ICES statistical rectangles 32F1, 32F2, 33F2, 34F1 and 34F2. Finally, data are presented for the southern North Sea (ICES Division IVc), which is the sea area between the English coast and the continental European coast from 30.5°N (between Folkestone and Dungeness) to 35.5°N (near Grimsby).

Most of the information presented in this report was obtained from published sources (referenced as appropriate), from the MMO (Marine Management Organisation) landing statistics, and from the Eastern Inshore Fisheries and Conservation Authority (EIFCA).

In 2017, 58 commercial fishing vessels were recorded as operating from 8 ports (Lowestoft, Pakefield/Kessingland, Southwold, Dunwich, Sizewell, Aldeburgh/River Alde, Orford, and Felixstowe Ferry/Orwell Estuary); compared with an estimate of 66 in 2014. Furthermore, vessel observation surveys by Anatec Ltd. in 2014 showed that fishing boats comprised 14.7% and 10.3% of total vessel occurrences in summer and winter, respectively. (Cargo vessels were the most frequent vessel type in both seasons.)

Shellfish was the most valuable component (in terms of first sale value) of landings from ICES rectangle 33F1 in 2017, by both the ≤10m and >10m fleets, whereas in 2008, demersal landings were the most valuable. Whelks were the most valuable species landed between 2015 and 2017, whereas historically (2008 - 2014), Dover sole was generally the most valuable species. One exception to this was in 2010, which saw cod as the most valuable. Shellfish was also the most valuable component of landings from the wider Sizewell area in 2017, whereas demersal fish were the most valuable in 2008. As with landings from 33F1 alone, pelagic fish made up only a small amount of the landed value. Through the time period in question, shellfish have been the most valuable component of landings from the southern North Sea (ICES Division IVc), with minimal pelagic landings. In 2017, in IVc, the proportion of demersal landed catch was small for the >10m fleet, whereas demersal landings made contributed to ~25% of the ≤10m fleet.

Of the ten most valuable species landed from rectangle 33F1 in 2017, four are regarded as ‘key’ taxa within the Greater Sizewell Bay area, namely sea bass, Dover sole, thornback ray, and herring. Similarly, in the wider Sizewell area sea bass, Dover sole, thornback ray and plaice were the key taxa present in the top ten for that area, and in the southern North Sea sea bass, Dover sole, thornback ray, plaice and horse mackerel were in the top ten. Cod, mackerel and whiting were also key species landed from 33F1, but they did not contribute to the top 10 most valuable species.

Marine recreational fishing is a high participation activity with significant social and economic benefits, but also impacts fish stocks. Sea angling is a diverse and dispersed activity with large spatial and temporal variation in activity and catches. At present, there are no studies of sea angling that focus on the UK’s eastern region. National surveys have generated estimates of participation, catches, economic impacts, and social benefits, but do not have the sampling effort needed to provide estimates for specific sites such as the Greater Sizewell Bay.

There is a lack of evidence of recreational fishing at Sizewell. However, existing studies have characterised the species targeted, locations fished, and platforms. Sea angling at Sizewell was carried out both onshore and from small boats. The main species caught were bass, cod, flatfish, small sharks and rays, but many other species were caught less often. Strong seasonality was observed in catches with cod, whiting, and flounder from September to May, bass and mackerel in summer and autumn, and flatfish throughout the

year. Shore angling occurred at many locations throughout the area and around part-time 21 charter boats operate across the region. Private boats are also occasionally used for angling.

There was evidence of regular sea angling activity at Sizewell throughout the year. Data were sparse and inconsistent, particularly for boat angling, with limited information generated from surveys and expert judgement. Between 2015-2017, 1,570 sea anglers were found in approximately 6% of fixed camera images, with a maximum of 15 in a single frame. Sea angling was most common in summer and winter, but it was not possible to estimate effort due to the issues with coverage (e.g. gaps in the time series, no overnight images), overlap between cameras, and obstruction or corruption of images. There was information on the number of charter boats, but not the number that target the area around Sizewell. Activity by private boats was not recorded, but these were present in some fixed cameras images.

Several studies have been undertaken that assess both the economic impact and value of sea angling in the UK. These have been designed to provide economic information at a national level, and there are no specific studies of the area around Sizewell. A method was applied to assess the impact of sea angling in the eastern region from national studies, but caveats surround the robustness of the approach. Regional and county level estimates of the economic impact of sea angling were generated and it was clear that sea angling brings large benefits to the region (millions of pounds supporting hundreds of jobs).

1 Background

The Sizewell site lies on the Suffolk coast (Figure 1 and Figure 2) exposed to easterly winds and the North Sea, having little in the way of safe berths or anchorages other than in river estuaries at Lowestoft, Southwold, Orford, Felixstowe and Ipswich. Elsewhere, including at Sizewell, boats (known locally as longshore boats) are drawn up onto the beach; their activity is severely restricted by the wind and tides.

There are currently two nuclear power stations at Sizewell, A and B (SZA and SZB, respectively). SZA is owned by the Nuclear Decommissioning Authority and ceased generating electricity on 31st December 2006 followed by a 3-year period of defueling, from August 2009 until 2012. SZB currently generates electricity from a Pressurised Water Reactor and is owned and operated by British Energy Generation Ltd, part of EDF Energy. Under the Radioactive Substances Act, 1993, these companies are authorized to discharge gaseous radioactive wastes via separate stacks to the atmosphere, and liquid radioactive wastes via adjacent outfalls of warmed cooling water into the North Sea.

EDF plans to build a new Nuclear Power Station, Sizewell C (SZC) adjacent to SZA and SZB. As part of the planning process, the developer is required to assess the impacts of the construction and operation of the station on the marine environment.

The southern North Sea has several commercial fisheries for both finfish and shellfish species that have the potential to be impacted by the new nuclear build (NNB). This report describes the commercial fisheries in the Greater Sizewell Bay and the wider geographic area and, in conjunction with fish ecology impact assessments, will form the basis upon which the commercial fisheries impact assessment will be made.

A review of the commercial and recreational fisheries was initially made using data from April 2009 to March 2010 (BEEMS Technical Report TR123), and subsequently revised to include data up to 2013 (BEEMS Technical Report TR123, Ed2). This report has been further updated to include data up to 2017.

Comments on an earlier version of this report and received from the MMO in 2013 have been incorporated into the Edition 3 revisions, largely with more recent data. Information on spawning and nursery grounds is given in the Sizewell fish characterisation report (BEEMS Technical Report TR345). The Cod Recovery Zone has been revoked.

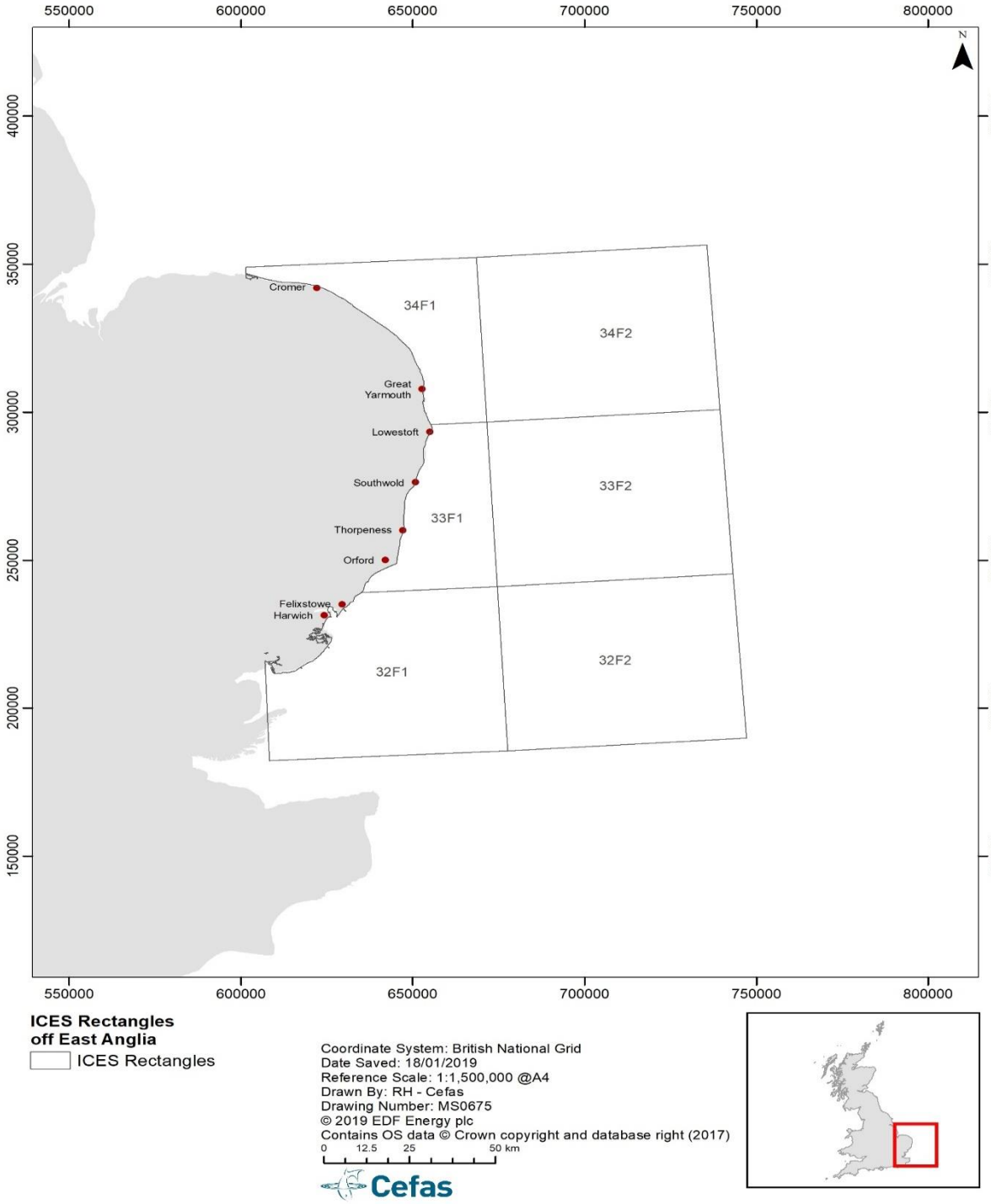

Figure 1 The study area around Sizewell in Suffolk, showing place names and other locations mentioned in the text

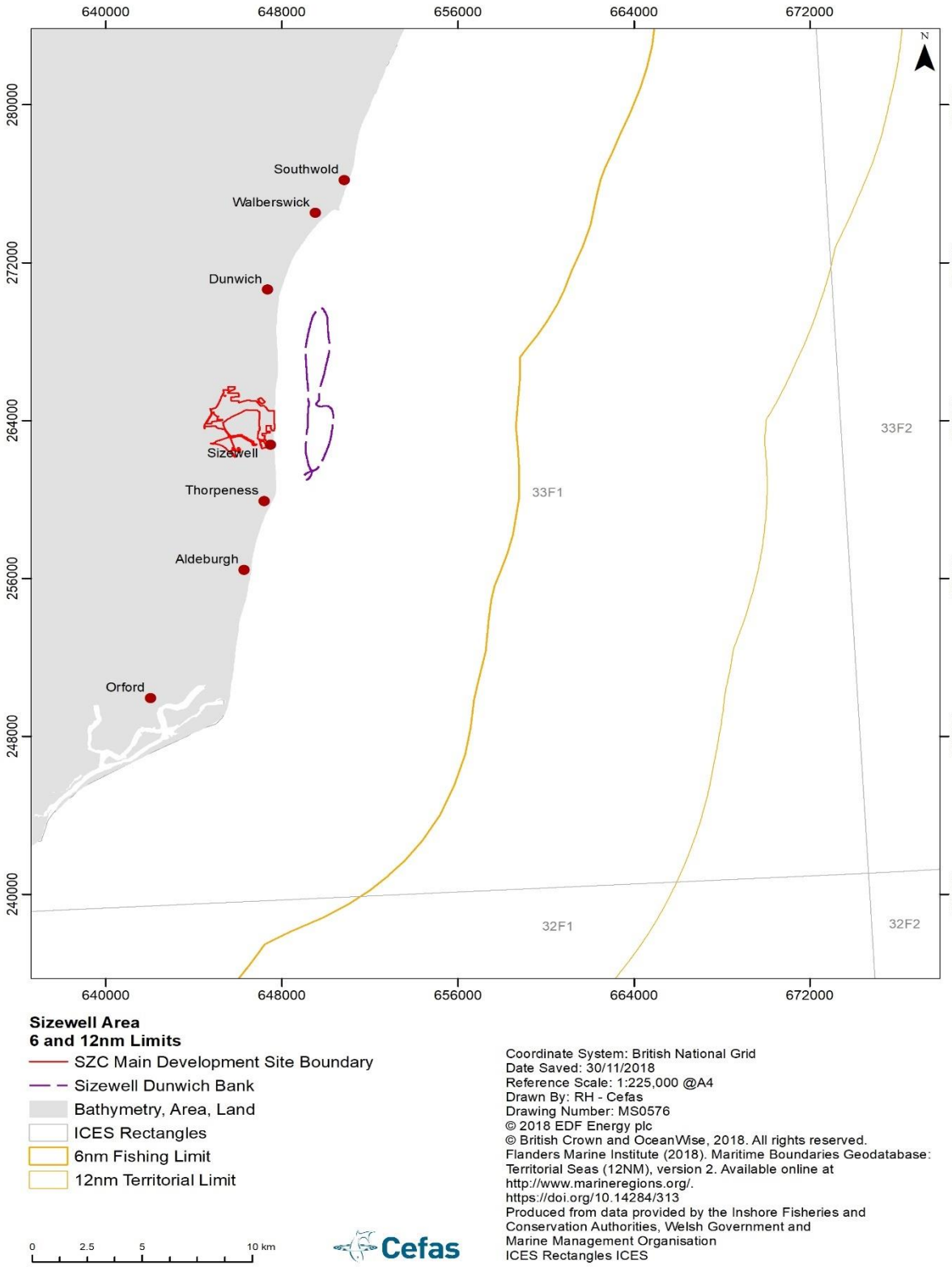

Figure 2 Site boundary of SZC in relation to local ports, the Sizewell-Dunwich Bank, and the 6nm (nautical miles) and 12nm limits

2 Data & Methods

2.1 Summary of Data Sources

The sources used to inform this report include logbooks, landing declarations, sales notes and personal contact with fishers and merchants. Port harbour masters also provided details of individual vessels landing at main coastal locations. Legislation covers the supply of data on log sheets for all vessels over 10m (>10m) overall length in respect of catches of all species. Much information on the value of catches is provided by the industry in the form of sales notes. Historically for vessels under 10m (≤10m) overall length, there was no statutory requirement under either EU or national legislation for fishers to declare their catches and information for this sector was collected with the co-operation of the industry. It comprised log sheets and landing declarations voluntarily supplied by fishers as well as sales notes and assessments of landings derived from market sources and by correspondents located in the ports. In 2005, the Registration of Buyers and Sellers and Designation of Fish Auctions and Site Regulations (SI 2005 No. 1605) was introduced (UK Government 2005). The purpose of this legislation was to record the first sale of fish landed in the UK to improve the monitoring and control of landings. It also aimed to aid secondary buyers in determining whether the fish they were buying were landed legitimately. This new legislation was particularly important in the improved recording of the landings by vessels <10 m length, as sales notes related to these sales must be reported to Fisheries Administrations. These data are used in addition to the voluntary information from fishers. Full documentation is not required for most non-TAC species (Total Allowable Catch), including shellfish.

During 2005 and 2006, UK Fisheries Administrations introduced a system of restrictive licensing for activities targeted at shellfish. As part of this system, new reporting requirements were introduced involving a requirement for fishers to complete diaries of their daily activity which must be submitted monthly. Summary information from these diaries is now in use, in addition to sales notes and other information supplied voluntarily by the industry, and from a variety of local sources and surveys run by local Inshore Fisheries Conservation Authorities (IFCAs).

2.2 MMO data

The Marine Management Organisation (MMO) licenses, regulates and plans marine activities around England with authority out to 12nm (nautical miles). UK fisheries statistics data are primarily compiled from log sheets, landing declarations and sales notes. When filling in their logbooks, fishing skippers are required to report which ICES rectangle the fish were caught. ICES rectangles were created in the 1970s to allow for simplified analysis and visualization of the gridded data. ICES rectangles, for example, 33F1[1] (Figure 2), are approximately 30x30nm and amalgamated into ICES Divisions (e.g. IVc for the southern North Sea) and Subareas (e.g. IV for the North Sea). Fishers supply this data to the MMO on their daily catches, including the dates, species and volumes caught, gear type used and area of fishing.

Data extracted from the MMO database for this report included the year, month, port of landing, nationality of vessel, ICES rectangle, whole weight of fish, and value of the catch at first sale, and represent landings by UK vessels and foreign vessels into English waters as well as landings by England and Wales vessels into foreign ports.

Data on overflight/surveillance data around IVc were requested from the MMO via e-mail in January 2019, in order to establish a better understanding of the spatiotemporal distributions and behaviours of the fishing fleets. As of 28 January 2019 however, the MMO informed Cefas that they were unaware of any such data.

It should be noted that for reporting official landings data to the MMO there is no requirement to declare individual transactions of less than 30kg of fish. This is the case no matter how many transactions there are,

[1] The first part of the ICES rectangle designation (e.g. 33) is the latitudinal row of the grid, and these range from 01 to 99, increasing northwards. The second part of the rectangle number (F1) designates the longitudinal column and these are coded from A0 to M8.

so a fisher selling 20kg of seabass to each of ten buyers would not be recorded. Furthermore, the MMO dataset depends on fishers and purchasers completing accurate returns (Jessop et al., 2013).

Landings data are also compiled by local Eastern Inshore Fisheries Conservation Authority (EIFCA) Officers. The quality of EIFCA data depends on the Area Officer being able to sample the landings – either by personally checking, telephone conversations, or being in general contact with fishers. If the officer is unable to verify landings data, then data quality suffers. As much of the finfish activity is on small boats operating from small harbours or the open beach, it can be extremely difficult to monitor these activities.

Comparisons between MMO data and EIFCA estimates have been conducted for selected species. For seabass landed at Southwold in 2010-2012, comparisons showed that the EIFCA estimates were twice those of the official landings data. However, for sole landed at Aldeburgh and Orford during the same period, during two of the compared years there were no EIFCA estimates, and for the third year the landings estimates of the two methods were almost the same (~20t) (Jessop et al., 2013).

While it is noted that the MMO data may underestimate catches, these have been used as the baseline as they represent the official catch statistics.

2.3 Radiological Habits Surveys

During 2005, Cefas (Centre for Environment, Fisheries and Aquaculture Science) carried out a survey (Clyne *et al*., 2006) aimed at obtaining site-specific and general habits data related to public radiation exposure from the Sizewell site via aquatic, terrestrial and direct radiation pathways in order assess critical group doses. These data were used to establish exposure pathways for the local population and the characteristics of those most exposed. The aquatic survey area covered 25km of the coastline between Southwold and Orford Ness and included fisheries up to 6nm from the coast, within IFCA (Inshore Fisheries Conservation Authority) districts. The fieldwork component of the survey was carried out over 31 person-days in June 2005, involving interviews with individuals who were most likely to be exposed to radioactivity from the Sizewell site. This included commercial fishers, boat owners and anglers.

The 2005 survey of Clyne *et al.,* (2006) survey was repeated in 2010 (Garrod et al., 2011) and observed that some 27 commercial fishing boats, all ≤10 m, operated within the survey area.

2.4 Coastal fisheries reviews

Cefas has conducted regular reviews of the inshore fisheries of England and Wales, covering the years 1981 (Pawson and Benford, 1983), 1988 (Pawson and Rogers, 1989), 1992–1994 (Gray, 1995) and 1999–2001 (Pawson *et al.,* 2002), with the most recent published report in 2007 (Walmsley & Pawson 2007). These reports utilise the first-hand knowledge of the Fishery Officers of the District SFCs (Sea Fisheries Committees); in this case the Eastern Sea Fisheries Joint Committee (ESFJC;). This report is currently being updated using 2016 data (Walmsley *et al.,* 2019, in prep.). The description of fisheries and their seasonal activities in the Sizewell study area (Section 5) is based on this report and serves as a framework within which landings statistics and economic information can be interpreted.

3 Legislation that governs fishing activities in the Sizewell study area

3.1 European Legislation

European Commission (EC) Directives and Council Regulations relevant for UK marine fisheries are listed and described in detail in the MMO "Blue Book", which can be found at: www.mmo.gov.uk/protection/legislation.htm.

Fisheries management in UK waters is ultimately directed by the European Union (EU) under the Common Fisheries Policy (CFP; see European Commission, 2009). The main principles of the CFP were agreed and implemented in its current format in 1983 and was further reformed with effect from 1st January 2014 (Hirst, 2015). CFP regulations extend to conservation, management and exploitation of fisheries resources, aquaculture, and the processing, presentation and marketing of fisheries products.

The CFP's reform includes rules which require catches of quota species to be landed in regulated fisheries of each Member State (Catchpole *et al.,* 2017). Specimens of quota species which are below their minimum conservation reference size (MCRS) must be landed and sold for purposes other than direct human consumption (e.g. fish meal, cosmetics industry, pharmaceuticals, pet food etc.). Some exemptions apply such as for species which have scientifically-proven 'high survivability', or are damaged by predators, disease or other contaminants. Furthermore, *de minimis* exemptions apply which exempts the landing obligation in certain fisheries which have proven difficulties in increasing gear selectivity and/or disproportionate costs in sorting through unwanted components of the catch. *De minimis* exemptions, however, do not apply within ICES Subarea IVc.

Fishing boat licences are administered by the MMO and give an entitlement to fish and to catch a certain quantity of each of the main commercial species via annual quota allocations. Quota management is either via Producer Organizations (the Lowestoft PO, in this case), which have various monitoring and reporting responsibilities, or through "non-sector" quotas managed by Defra (Department for Environment, Food and Rural Affairs) for boats that are not members of Producer Organizations. The latter situation applies to most of the inshore <10 m fleet, which may be severely restricted in catching opportunities for some species for which the national non-sector quota is small or exhausted towards the end of the year.

Although much of the authority for managing Europe's sea fisheries lies at EU level, the Nation States have exclusive rights to fish within 6 nautical miles (nm) of baselines (essentially, the mean high-water mark along the coast and in estuaries unless otherwise designated). Between 6 and 12 nm, fishing by non-nation state boats is restricted to those with historical rights relating to specific fisheries and specific countries. Along the Suffolk coast, this applies only to French boats, which can fish for all species, and Belgian boats, which can fish for and retain demersal fish species only. Within the 12 nm zone, the Nation State can implement non-discriminatory conservation measures, provided that the EU has not already legislated in the area.

3.2 UK Legislation

In view of the above, there is now much less scope (or need) for Nation States to introduce their own management measures in inshore fisheries. In the UK, however, there are two areas of legislation that are particularly relevant to the fisheries in the Sizewell area.

Monitoring of landings by the ≤10 m fleet, particularly those fishing against the national non-sector quota, has been greatly improved following the implementation by the UK government of the Buyers and Sellers Regulation in 2005 (UK Government, 2005). This requires that everyone engaged in the first sale or purchase of more than 30 kg of fish per day anywhere in the UK must register as either a buyer and/or seller of fish. This regulation applies to designated ports with registered fish markets and to fish sold under contract between boats and processors and to private sales between skippers, or their agents, and buyers elsewhere, so covering sales of fish on the harbour side or from a fisher's home.

The Marine and Coastal Access Act 2009 (Great Britain Parliament, 2009) has had an impact on the management of inshore fisheries through the creation of new management bodies (the MFA (Marine and Fisheries Agency) became the MMO in 2009, and English Sea Fisheries Committees were subsumed into IFCAs on 1st April 2011) and the implementation of policy decisions such as the creation of Marine Conservation Zones (MCZs) in English and Welsh territorial waters. Those MCZs that are designated will likely have attendant restrictions on activities such as fishing and may even take the form of No-Take Zones (NTZs). There are no MCZs in the Greater Sizewell Bay area.

3.3 Inshore Fisheries and Conservation Authority (IFCA) Byelaws

At a local level, management of inshore fisheries in England falls mainly to the regional IFCAs, of which ten exist around the English coast. The Eastern IFCA (EIFCA) has responsibility for regulating sea fishery activities within 6nm from the coastal baselines between Haile Sand Fort, Lincolnshire in the North, and Felixstowe, Suffolk in the south (including the Stour and Orwell estuaries). Since the original Sizewell fisheries report was prepared in 2010, Section 6 of The Marine and Coastal Access Act 2009 (Transitional and Saving Provisions) Order 2011 came into force, transferring those byelaws having been made by both Eastern Sea Fisheries Joint Committee (ESFJC) and North Eastern Sea Fisheries Joint Committee (NESFC) to EIFCA for those parts of its district that were covered by both ESFJC and NESFC.

Within the Sizewell study area, the EIFCA District does not extend into any river beyond the highest point to which ordinary tides flow, or beyond the road bridges on the A12 at Lowestoft, the A12 across the River Blyth, the B1069 across the River Alde, the A1152 across the River Deben, and the A137 across the River Orwell. The Environment Agency is responsible for management of fisheries upstream of these limits and in freshwater, and of sea trout and eel fisheries out to the 6 nm limit (although the EIFCA essentially manages the coastal sea trout fishery).

The EIFCA byelaws that specifically apply to fisheries within the Sizewell study area have not been modified or amended since the transition from ESFJC to EIFCA and are summarized below (the full byelaws are available at www.eastern-ifca.gov.uk).

- **Byelaw 3**: No person shall fish for oysters, mussels, cockles, clams or scallops except by hand; with a hand rake; or with an instrument or fishing gear used under the authority of a certificate of approval (valid until 31 December each year) issued by the Committee and signed by their Clerk.
- **Byelaw 4**: No person shall remove from any fishery, or from one part of a fishery to another part thereof, any mussel less than 50 mm in length.
- **Byelaw 5**: No person shall use any edible/brown crab for bait.
- **Byelaw 6**: No person shall remove from any fishery any brown crab or lobster that is soft-shelled or berried (egg-bearing).
- **Byelaw 7**: No person shall remove from any fishery any brown crab, velvet crab, or lobster, or parts thereof, which cannot be measured to ensure compliance with the Undersized Crabs Order 1986, the Undersized Velvet Crabs Order 1989, or the Undersized Lobsters Order 1993 or any Statutory Instrument that supersedes these Orders.
- **Byelaw 8**: The Committee may, for the purpose of fishery management, close for a specifiable period any shellfish fishery or part thereof. No person shall, without written authority signed by the Committee's Clerk, remove, take or disturb any shellfish from any fishery, which, in the opinion of the Committee is severely depleted, contains mainly immature or transplanted shellfish, or which is closed to fishing for management of the fishery.
- **Byelaw 9**: Any person who takes any shellfish, the removal of which from a fishery is prohibited by any of the byelaws, or the possession or sale of which is prohibited by, or in pursuance of, any Act of Parliament or Statutory Instrument, shall return such shellfish to the sea immediately or as directed by the Committee.
- **Byelaw 11**: No person shall use any boat in fishing for shellfish unless, if the Committee so require, the skipper, owner or charterer provides to the Committee a record for any specified daily period of actual catch taken, area fished, fishing effort (time and method) and any other information required by the Committee.

Byelaw 12: No person shall in fishing for sea fish in that part of the District which lies within three nm from baselines, use any kind of trawl net, provided that this byelaw shall not apply to the use (in the Sizewell study area) with a boat whose overall length does not exceed 15.24 m between Mundesley in Norfolk and Dovercourt in Essex. This byelaw shall not apply to persons using larger boats who were engaged in fishing with a trawl net in the area between Mundesley and Covehithe in Suffolk (15 km north of Sizewell) previously derogated (so called "grandfather rights"), until the boat changes ownership or ceases to fish.

- **Byelaw 13**: The placing of "fixed engines" (i.e. nets and pots, as defined in the Salmon and Freshwater Fisheries Act 1975) is authorised throughout the ESFJC District. Otherwise, Section 32.1 of the Salmon Act 1986 (Great Britain Parliament, 1986) effectively prohibits the placing of any fixed engines within 6 nm from baselines (to protect migratory salmon and sea trout).
- **Byelaw 14**: No person shall remove from a fishery any tope which, if caught, shall be returned immediately to the sea.
- **Byelaw 15**: No person fishing for bivalve molluscs in the ESFJC District shall use any kind of towed fishing gear, unless using a boat the overall length of which does not exceed 14 m in the area between Mundesley in Norfolk and Dovercourt in Essex, or where evidence can be provided by the owners of having fished in these areas prior to 1st January 2008. Any boat issued with such derogation may continue to fish until such time as the boat changes ownership or ceases to fish.

3.4 Legislation for Sea Bass (*Dicentrarchus labrax*)

On 19th January 2015, the EU began phased measures to help protect sea bass stocks, following concerns about their status. Firstly, a short-term ban on pelagic trawling until 20th April 2015 was enforced, then for recreational fishers, a 3-fish bag limit was set on 25th March 2015, allowing anglers to retain 3 sea bass specimens per day. The third measure saw commercial monthly catch limits and closed area around Ireland from 19th June 2015. On 2nd July 2015, the EU increased the minimum landing size for northern sea bass from 36cm to 42cm total length.

In 2016, further measures saw a complete ban on sea bass fishing for the first half of the year, a 1-fish bag limit for recreational fishers and a 1t catch-limit per commercial vessel during the second half of the year. The Irish area remained closed.

Following 2018's December Council, Council Regulation (EU) 2019/124 Article 10 sets legislation for northern stock of sea bass, which includes ICES Division IVc. In summary, this legislation:

1. Prohibits Union fishing vessels, as well as for any commercial fisheries from shore, to fish for sea bass. It prohibits the retention of sea bass on board, being transhipped, being relocated or landed.

2. Allows Union fishing vessels in IVc to fish for sea bass from 1st April to 31st December 2019, and retain on board, tranship, relocate or land sea bass caught in that area with the following gears and within the following limits:

(i) Using demersal trawls, for unavoidable by-catches not exceeding 400 kilogrammes per month and 1 % of the weight of the total catches of marine organisms on board caught by that vessel in any single day;

(ii) Using seines, for unavoidable by-catches not exceeding 210 kilogrammes per month and 1 % of the weight of the total catches of marine organisms on board caught by that vessel in any single day;

(iii) Using hooks and lines, not exceeding 5.5t per vessel per year

(iv) Using fixed gillnets, for unavoidable by-catches not exceeding 1.4t per vessel per year.

3. Allows recreational fishers (including from shore) to catch-and-release sea bass. It is prohibited to retain on board, relocate, tranship or land sea bass caught in the area. Furthermore, not more than one specimen of sea bass may be retained per fisher per day between 1 April 2019 and 31 October 2019.

4 Commercial fishing gear types used in the primary area

4.1 Otter trawls

Otter trawl nets are usually towed behind a vessel (Figure 3) as opposed to beam-trawlers (Figure 4) which tow off the port and starboard sides. Otter trawls are kept open with the aid of otter doors and are towed in midwater (to target pelagic species) or on the bottom (to target demersal species). The groundline helps keep the bottom of the net mouth in contact with the seabed, whilst bridles help to maximise the spread of the net. Those bridles in contact with the seabed also help to create 'herding' of flatfish and maximise their capture in the net. Floats on the headline keep the mouth of the net open. The length of the warp lines and towing speed help dictate the depth of the net. Some fishers may also fish two, three or four otter trawls at once.

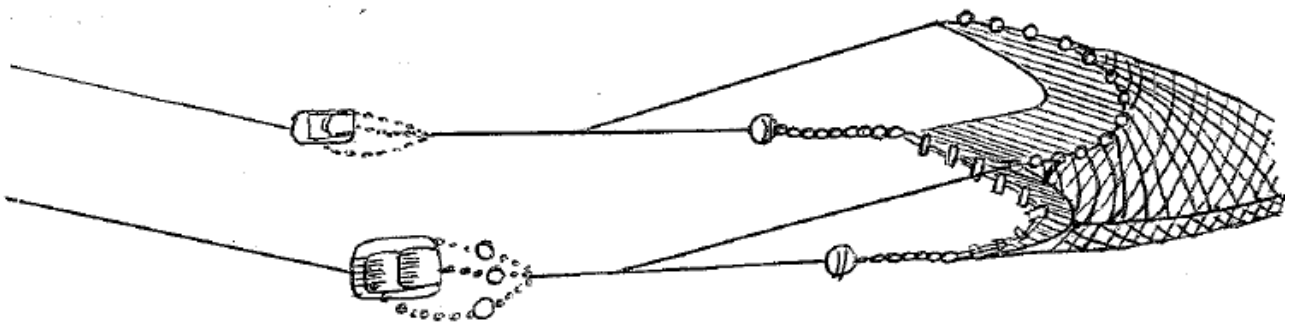

Figure 3 Diagram of an otter trawl (used with permission)

4.2 Beam trawls

Beam trawls (Figure 4) operate in a similar manner to otter trawls, though they are usually fished in pairs with each one mounted from a boom on the port and starboard sides of the vessel. The gear is towed from a single warp and the chain weight helps keep the gear parallel to the seabed as it is towed. The mouth of the trawl is held open by the beam and a buoyant headrope maintains the maximum gape of the net's mouth.

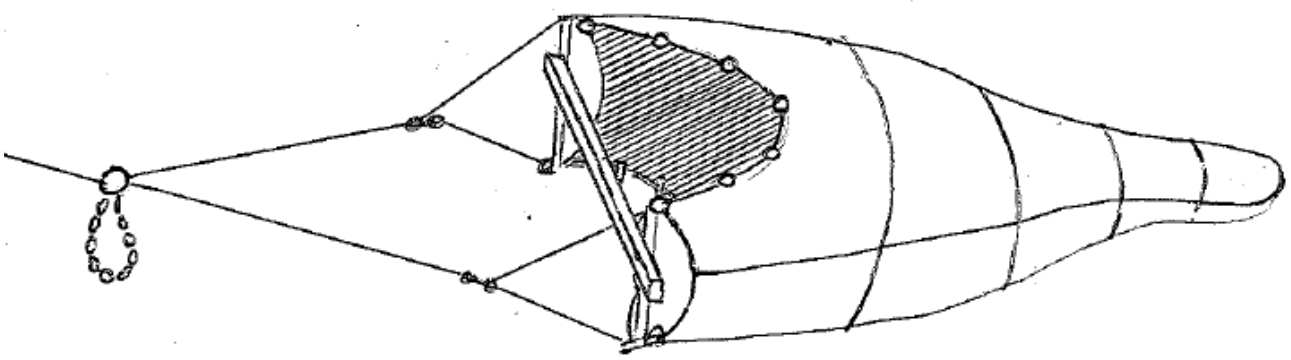

Figure 4 Diagram of a beam trawl (used with permission)

4.3 Long lines

In long line fisheries, baited hooks are hung from branch lines (sometimes called ‘snoods’), connected to a main line (Figure 5). Buoys keep the main line from sinking to the seabed and the gear is usually anchored on each end whilst the gear is in the water (referred sometimes as a ‘soak time’). The size of the hook used, and the type of bait used help influence the catchability of the target species.

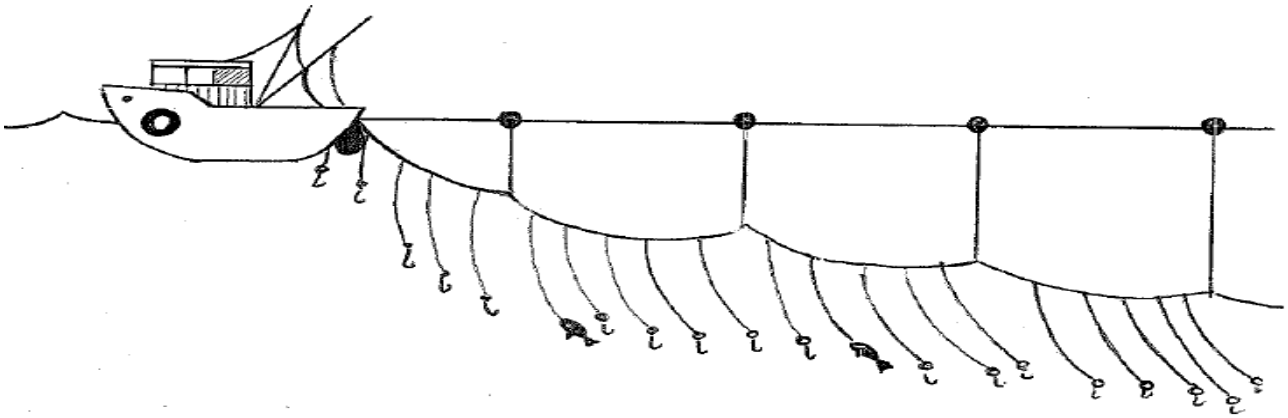

Figure 5 Diagram of a long-line (used with permission)

4.4 Pots/traps

Crab/lobster pots/trap fishing (Figure 6), involves setting a main line known as a ‘string’ (also known as ‘shanks’ depending on the region) along the seabed, anchored at each end and marked with buoys known as ‘dans’. Pots (usually between 8 and 30) are connected to the string, with the actual number of pots fished determined by vessel size. Depending on the pot/creel type, two non-return entrance ‘eyes’ usually exist and a bait (often fish) is used to attract crabs and lobsters. Whilst selective, catchability is dependent on a range of factors, including (but not limited to) bait type, lunar cycle, pot size, proximity of pots to one another, tidal strength and direction, and specimens in the pots (i.e. the presence of a large male crab may deter smaller specimens; Miller, 1990). It is common for pot gear to be left to ‘soak’ for one or two days, though it has been known for some fishers to allow soak times of weeks or months.

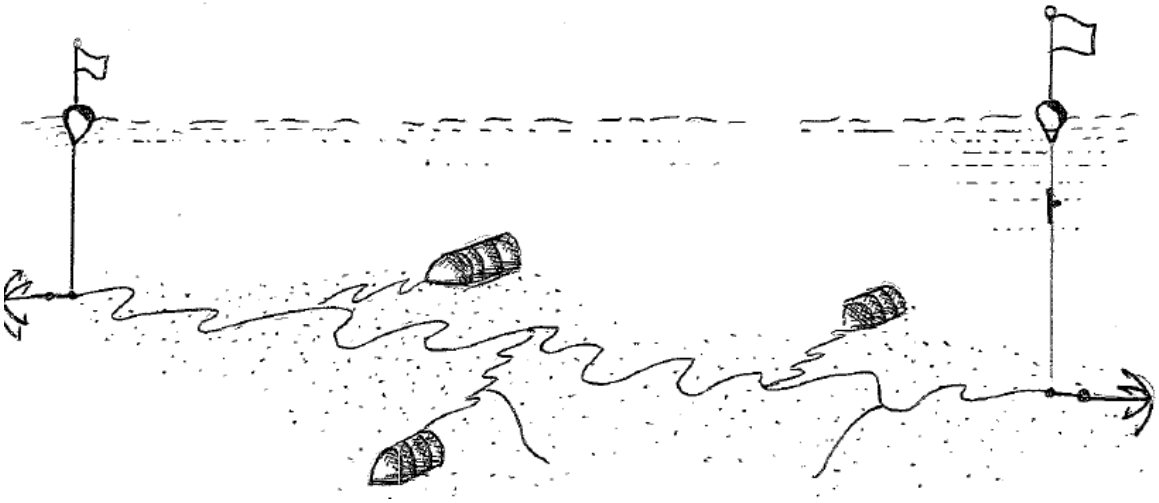

Figure 6 Diagram of crab/lobster pots/traps (used with permission)

4.5 Nets (gill/trammel/drift)

Gill and trammel nets (represented by the diagram of a gill net; Figure 7), like long lines and pots, are static gear which are anchored to the seabed and marked at either end with a marker buoy known as a ‘dan’. The mesh sizes and hanging ratios (defined as the length of a rope on which a net panel is mounted, divided by the actual length of stretched netting on the rope (Sainsbury, 1996)) have the greatest impact on the net’s selectivity. Gill nets are so called as they allow only the head and gill covers to pass through the mesh, trapping the fish. The mesh size determines the size range of the target species that will be caught. Trammel nets are more complex and consist of three panels of netting; the inner panel is of smaller mesh and hangs loosely between the large outer panels. As a fish hits the net, the inner-net is pushed forward through the outer, large mesh, thus causing the fish to become trapped in the pocket.

Drift nets are not anchored to the seabed and are mobile, moving with the tide. The net hangs vertically in the water with the aid of floats along the top of the net and weights along the bottom of the net. The gear is usually used to target pelagic fish and rely on snagging the fins, then entangling the struggling fish.

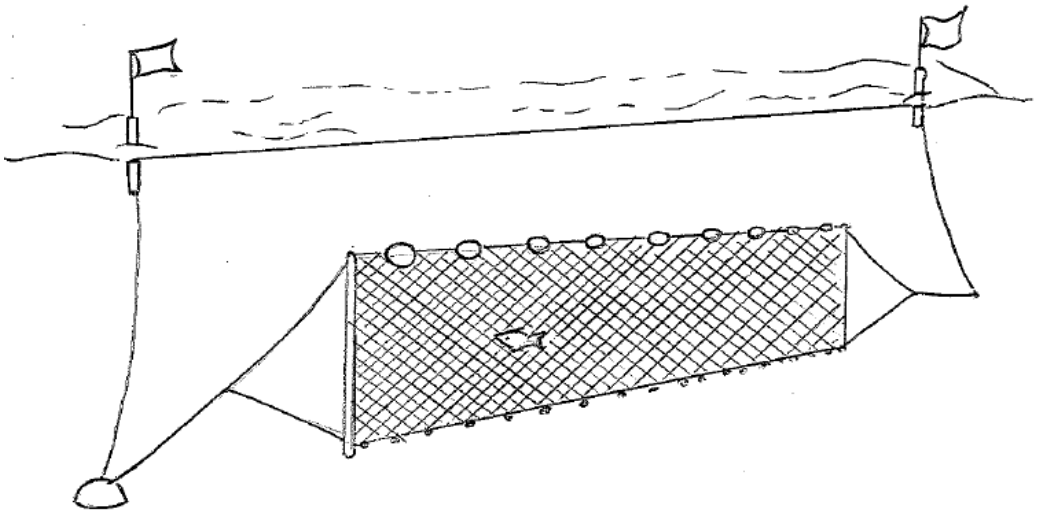

Figure 7 Diagram of a gill-net (used with permission)

5 Description of the Sizewell study area and its commercial fisheries

Figure 8 A commercial longshore fishing boat on Sizewell beach, equipped with gillnets and net/pot hauler

The Primary Area for the study is the Greater Sizewell Bay, extending from Dunwich southwards to Thorpeness. This area lies within ICES statistical rectangle 33F1 (the most localized aggregation unit for fisheries catch data), which extends from Lowestoft to Orford along the Suffolk coast and approximately offshore to the UK 12-mile limit. The relevant information is placed in a more regional context (defined as the wider Sizewell area), that encompasses an area from north Norfolk southwards to the Thames Estuary and offshore to 3°E. This area is covered by ICES statistical rectangles 32F1, 32F2, 33F2, 34F1 and 34F2, and contains the ports of Lowestoft, Pakefield/Kessingland, Southwold, Dunwich, Sizewell, Aldeburgh/River Alde, Orford, and Felixstowe Ferry/Orwell Estuary. Finally, the data are compared with the southern North Sea (ICES Division IVc), which is the sea area between the English coast and the continental European coast from 30.5°N (between Folkestone and Dungeness) to 35.5°N (near Grimsby).

Cefas reviewed the coastal fisheries of England and Wales in 2007, utilizing the first-hand knowledge of the Fishery Officers of the District SFCs; in this case the ESFJC (Walmsley & Pawson, 2007). This information has further been updated by Walmsley *et al.,* (2019, in prep.), based on official 2016 landings data. The following description of fisheries and their seasonal activities in the Sizewell study area in 2017 is based on this report, updated through correspondence with the MMO (August 2018) for the latest breakdown of registered vessel numbers per port, and with 2017 monthly landings data from the MMO.

5.1 Lowestoft

There is a fleet of 24 commercial boats at Lowestoft; an increase of 8 since 2014. Two visiting beam trawlers from King's Lynn occasionally join these boats to fish for brown shrimp *Crangon crangon* along the coast. One >10m boat fishes for sole *Solea solea* and sea bass using an otter trawl. Another of the larger vessels pots for whelks *Buccinum undatum* between February and June. The beam and otter trawlers fish within 20km of the coast, landing mainly, sole, turbot *Scophthalmus maximus*, rays (particularly thornback ray *Raja clavata* and blonde ray *R. brachyura*), dab *Limanda limanda*, cod and whiting *Merlangius merlangus*. Many of these boats also set longlines and often set nets for whitefish on their way out to longlining grounds. Most trips last around 6h, and easterly winds may prevent fishing. Fixed nets are used to target demersal species such as sole, rays and cod, and driftnets to target sea bass, grey mullet *Liza ramada*, herring *Clupea harrengus*, and mackerel *Scomber scombrus*. Pots may be set for lobsters *Homarus gammarus* and brown crabs, also known as edible crab *Cancer pagurus*.

Longlining for cod takes place during February to April, weather permitting, and the main season for catching rays and sole is from March to November, although there have recently been delays in switching from longlining to nets in spring because of cod fishing opportunities up to eight miles off the coast.

In October, herring and sprat *Sprattus sprattus* begin to appear along the Suffolk coast, and pilchard *Sardina pilchardus* may be caught in the nets along with the herring, which may not be fished because of the poor prices. By April, the sprat usually migrate, but herring may still be found close inshore.

5.2 Southwold

Southwold harbour is located near the mouth of the Blyth Estuary, where 9 commercial boats target sea bass, grey mullet and sea trout during the warmer months, mainly using driftnets. Two of these vessels fish part-time. Sole is the main target species from spring onwards, with fixed trammel nets being the dominant gear used. Brown shrimp are taken in the estuary and along the coast by several boats using beam trawls. Five stern trawlers ≤10m in length take sole, plaice, rays, dab and flounder.

From January to March, most of the fishing boats longline for cod and rays, but they may have to go farther offshore than in December (often targeting large sea bass), while the smaller boats continue to deploy driftnets for herring close inshore. In March, one boat sometimes nets and trawls for sole and brill *Scophthalmus rhombus*.

In April and May, if cod are still available, most fishers continue to use a longline rather than change to nets and pots, although large lobsters may be taken at this time and one netting boat takes good catches of sole close inshore, along with red mullet *Mullus surmuletus*, sea bass and brill on the banks farther out. In June, commercial fishers move to sole nets and pots for lobster and brown crab, and cod and rays are taken within 2 nm of the shore through summer. There has been a recent increase in potting for whelks, which may interfere with fixed nets and long lines being fished close into shore.

Fishing effort tends to be light in July and August, though crabs, sole, sea bass and smooth-hounds *Mustelus mustelus* may be landed.

In September, most fishers still target sole using driftnets and trawls. One fisher has been driftnetting for sea bass across the banks and catches them on rod and line. Sole fishing tends to slow down in October and November, when cod are caught on longlines, fishing in the same areas as the Lowestoft boats. Lobster and crab fishing tend to finish in October, though lobsters may still be taken in pots on offshore wrecks. Some fishers may then switch to netting for herring and sprat inside the banks during November. In December, boats may "buy in" quota so that they can continue to land catches of cod and rays.

5.3 Dunwich and Sizewell

At Sizewell, a single commercial ≤10m boat is operated off the sand and shingle beach (Figure 8). The vessel fishes within 1nm of the coast and 1nm north and south of the power station, using drift nets during

the winter for cod, herring and sprat, fixed and drift nets in the spring and summer for seabass, sole and thornback ray and pots for brown crab and lobster. Nets are also used to catch cod in January through to April when catches start to decline. In spring and summer fixed and driftnets are used to target sea bass, sole and thornback ray. By September, sole and sea bass are the main fish caught by driftnets. Fishing for sole tends to end during October, when there is good fishing for sea bass, herring, cod and whiting, and the first sprat are usually landed in November. Commercial fishing tends to be curtailed in December by quota constraints. Pots are set for lobster (peaking in June – August) and brown crab (peaking in August and September).

A hobby fisher at Sizewell also uses pots to catch crab and lobster for his own family's consumption.

5.4 Aldeburgh

Aldeburgh has a sand and shingle beach from which 5 commercial fishers launch their ≤10m boats, using gillnets and longlines for sole, cod, rays, sea bass and mullet during summer and autumn, and for cod and sea bass during winter. Pots are set for brown crab and lobster between February and November, with increasing quantities of crab taken early in the season. South of Aldeburgh, the River Alde runs parallel to the beach and is separated from the sea by a flood embankment. Three commercial fishers moor their boats in the area and fish with nets for sole, grey mullet and sea bass. Fyke nets are sometimes set for eel in the River Alde, where there are several mussel *Mytilus edulis* beds from which two individuals collect mussels for their own consumption, although there appears to be no commercial mussel fishery.

In January and February, commercial fishers use nets to catch sprat and herring or longlines for cod and, from March, rays. In view of the large quantities of cod caught recently associated with an incoming strong year class, commercial boats have continued to use longlines into April, and may defer changing to nets for sole and sea bass until May or June. In 2014, however, good landings of sole, cod, sea bass, rays and smooth-hound were made from April onwards, with a few turbot, brill and red gurnard *Chelidonichthys cuculus*.

Crab and lobster are also taken in pots from June into the August holidays, when the increased demand for shellfish on the fish stalls on the beachfront may require crab and lobster to be bought in from north Norfolk.

In September and October, cod and sole are taken in nets set on the banks close inshore, and sole netting may continue until December if the cod quota is low, although strong winds often keep the boats on the beach. All pots are brought ashore for the winter, when most fishers are not able to launch their boats due to bad weather.

5.5 Orford

The River Alde becomes the River Ore at the town of Orford, where there are four ≤10m boats that fish between Orford Ness and Sizewell. One fisher drifts trammel nets during summer and autumn for sole and thornback ray. Two or three small single-handed boats use driftnets for sea bass and grey mullet on the local banks, and set pots for lobster and crab in season. Pacific and native oysters *Ostrea edulis* and, to a lesser extent, mussels are cultivated commercially in the River Ore and Butley Creek, where holding pits have been constructed to store molluscs prior to their first sale. Sole, sea bass, grey mullet, brown crab and lobster are also caught in the river.

Between December and February, cod are targeted with longlines, although fishing trips may be severely limited by strong easterly winds or quota limits. Longlines may also be used to catch sea bass, and driftnets for herring. Catches tend to improve in March and April, with cod and rays being caught on longlines up to 8 nm offshore.

By May, the fishers tend to change to sole nets and to pots for lobster and brown crab. During summer, one or two boats are used for commercial rod-and-line fishing or for angling charter, on wrecks and banks up to 30nm offshore, for cod and sea bass.

Landings of sole (by netting and trawling), lobster and crab continue through summer and into November (especially when the fishers have a small cod quota), although cod tend to move closer inshore in October

and November and start appearing in longline catches. Most fishers bring their pots ashore for winter, apart from leaving a few on offshore wrecks for lobster.

5.6 Felixstowe

Fifteen <10m boats fishing out of Felixstowe Ferry use driftnets during winter to catch herring, and fixed and drifting trammel nets during summer for thornback rays, sea bass, dogfish *Scyliorhinus canicula*, sole and other flatfish.

In January and February, many fishers replenish their nets and pots, but some may use longlines to catch cod and sea bass. In March and April, longlines and trawls are used for cod and rays in the area around the north Shipwash and across to the Inner Gabbards. By the end of May, most boats that were longlining for cod will have switched to nets for sole, sea bass, rays and herring, and will also be potting for brown crab and lobster, although cod may still be taken in trawls along with sole. After catching their cod quota, most boats are lifted out of the water for annual maintenance before the summer season.

Through June and July, brown crab catches begin to decrease and the lobster catches tend to peak, though good catches of both species may be made through to November. Netting for sole continues through to October, when cod, rays and sea bass are also caught. Mullet and sea bass are caught in the local rivers using drift nets or trammel nets along the bottom.

By the end of October, fishers begin to bring in their pots for winter and cod longlining begins alongside netting for sole, rays and herring. However, fishing can be curtailed by strong easterly winds and lack of quota until the New Year, and most commercial fishers lay up their boats in December. One <10 m dredge fishes for clams and oysters over the winter.

5.7 Selling fish

Clyne *et al*., (2006) reported that fish caught in the survey area were either sold locally or transported to Lowestoft fish market. At Southwold, a small number of boats sell their catch from huts in the harbour. The fisher at Dunwich sells fish to the local fish and chip shop as well as from his home. At Sizewell, fish are sold directly from a fisher's home. Fishers have huts on the beach at Aldeburgh and on the quay at Orford, and sell fish directly from their boats to the public and to local hotels and restaurants. A lack of fish-processing capacity at Lowestoft, and the opportunity for better prices for cod and sole, have led fishers to send some catches by lorry to the fish market at Brixham (Devon).

6 The distribution and number of commercial fishing vessels operating in the Sizewell area

The estimated number of commercial fishing vessels operating from ports in the Sizewell area are summarised in Table 1. Data were obtained from several survey or datasets using a variety of data collection methods. For example, the figures for 2005 were obtained during radiological habitats surveys, while those of 2008 were obtained from an ESFJC census. These were further updated in April 2010 and October 2014 according to the knowledge of the EIFCA relevant fishery officer. Consequently, differences between estimates do not necessarily represent annual changes in the number of active boats.

Table 1 Estimates of the numbers of commercial fishing boats operating in the Sizewell study area and their home ports

	Number of boats operating						
Port/beach	**2005 (Clyne *et al*., 2006)**	**2006 (Walmsley & Pawson, 2007)**	**2008 (ESFJC)**	**2009 (MMO)**	**2010 (ESFJC)**	**2014 (EIFCA)**	**2017 (MMO, 2018)**
Lowestoft	-	12	17	61	18	16	24
Pakefield/ Kessingland	-	3	2	-	4	3	-
Southwold	13	8	5	-	13	13	9
Dunwich	1	1	1	-	1	1	-
Sizewell	1	1		1	1	1	1
Aldeburgh/ R. Alde	6	6	6	9	9	10	5
Orford	3	3	2	7	5	6	4
Felixstowe Ferry/ Orwell Estuary	-	11	13	4	11	16	15
Total	**24**	**45**	**46**	**82**	**62**	**66**	**58**

Changes in the number of boats fishing actively will depend on the availability of local resources, market conditions and fuel price, and there is a continuous flux of boats being removed from (e.g. decommissioning) or entering the fishery. During 2009, for example, *Relentless* (IH327) began fishing commercially, *Lady Sara* (RX112) was decommissioned and replaced by *Lou Annie* (IH36) to be used out of Felixstowe, *Romy-Jay* (ML1086) began fishing from Lowestoft but was later re-named *Radiance* (LT3), *Avril-Rose* (LT16) was launched at Felixstowe, and *Catherine Annie* (LT45) joined another boat pair-trawling for black bream off the Sussex coast in spring, returning to Lowestoft in late June to net for sole and to rod-and-line for cod on wrecks.

In view of these fluctuations, and the disparity between the numbers of boats known to be operating in an area (EIFCA data) and those registered in ports within the area (MMO data), interpretation of official fishing activity and landings statistics requires first-hand knowledge of boat identity and fishing area, and this is reflected in Section 5.

In addition to fishing vessels, a variety of other vessels utilise the waters adjacent to the location of the SZC development. In 2014, Anatec Ltd conducted a marine traffic survey as part of the Navigation Risk Assessment (NRA) of the proposed SZC development. Vessel occurrences were recorded for 28d each during the summer and winter, in the surrounding area, using radar, Automatic Identification Systems (AIS) and visual observations. Cargo vessels were the most frequently observed vessel type in the summer and winter (Table 2). In the summer, the next most numerous vessels were recreational craft, windfarm support vessels and fishing vessels. In the winter, wind farm support vessels were the second-most frequently observed followed by fishing vessels.

Table 2 Vessel-type occurrences in the SZC area in the summer and winter of 2014 (Anatec, 2014 & 2015)

Vessel Type	Summer 2014 (%)	Winter 2014 (%)
Cargo	23.5	47.9
Fishing	14.7	10.3
Recreational	22.1	0.8
Wind farm support	18.5	12.7
Military	0.8	0.4
Dredger/Subsea	5.6	9.3
Tug	3.0	1.6
Tanker	3.9	8.7
Passenger	4.5	5.9
Other	3.4	2.4

7 Recreational fishing in the Sizewell area

Marine recreational fishing (MRF) is a high participation activity with significant social and economic benefits, but can impact on fish stocks (Hyder et al., 2017, 2018). Recreational removals (kept fish plus post release mortality) can be significant for some species representing between 2-43% of the total catch (Hyder et al., 2017, 2018; Radford et al., 2018). There are many existing definitions of MRF in the literature both from a scientific perspective (e.g. FAO, 2012; ICES, 2013) and legislation (e.g. EU, 2015). Most scientific definitions are based on the reason for the activity (e.g. leisure or sport), description of the gears (e.g. rod and line), may include some statement about consumption (e.g. for personal consumption), and exclude the sale of the majority of the catch, although they acknowledge that small amounts can be sold or traded (e.g. FAO, 2012; ICES, 2013). The legal definition of recreational fisheries covers any non-commercial activities, often excludes the sale of the catch and contains specific gear restrictions (e.g. spearfishing) (e.g. EU, 2001, 2006, 2015). Here, marine recreational fishing was defined following the ICES definition (ICES, 2013) as: *"the capture or attempted capture of living aquatic resources mainly for leisure and/or personal consumption. This covers active fishing methods including line, spear, and hand–gathering and passive fishing methods including nets, traps, pots, and set–lines"*. Sea angling is a subset of marine recreational fishing, where species are targeted using rod and line.

There are no complete lists of recreational fishers nor any licensing schemes in the UK, but several studies have been undertaken to estimate the numbers of sea anglers and participation rates in the individual countries of the UK (e.g. Drew Associates, 2004; Simpson and Mawle, 2005, 2010; Radford and Riddington, 2009; Armstrong *et al.*, 2013; McMinn, 2013). Omnibus surveys using face-to-face methods with a variety of sample rates have been completed. In 2003, there were an estimated 1.1 million sea anglers equating to a participation rate of 5% for over 16 year olds in England and Wales (Drew Associates, 2004). Surveys to assess public attitudes to angling in England and Wales found that of individuals aged 12 years or over, 2 million (or 5%) and 1.9 million (or 4%) in 2005 and 2010 respectively, had been sea angling in the past year (Simpson and Mawle, 2005, 2010). The most recent survey of participation and effort in Great Britain was in 2012, and found that 2.2% or 1.08 million people of 16 years or older had been sea angling in the previous year, with 884,000 from England, 125,00 from Scotland, and 76,000 from Wales (Armstrong *et al.*, 2013). In 2009, there were an estimated 125,000 sea anglers in Scotland (Radford and Riddington, 2009) and 64,800 or (3.6%) in Northern Ireland in 2012 (McMinn, 2013).

A survey of sea angling in England was carried out as part of a baseline study in relation to MCZs (Smith *et al.*, 2011). Regional surveys were undertaken in the northeast, northwest and southeast England, and the last is likely to have many common characteristics with the Sizewell area (Smith *et al.*, 2011). This study obtained information on fish species targeted and the seasonal variations in angling activity by shore and boat (charter and private) anglers, using face-to-face interviews in the southeast in January 2009, at popular angling sites and tackle shops along the English coast from Deal in Kent to Southampton (Smith *et al.*, 2011). Although 66 shore-anglers completed and returned questionnaires, it was found to be particularly difficult to intercept boat-anglers, and only five returns were made from this category (5%). Only two returns were received from charter-anglers. Considerable bias may be introduced in surveys of this type by the data-collection method chosen and the behaviour of anglers (Pollock *et al.*, 1994; ICES, 2010). The raw information from such surveys will provide reliable information on angling behaviour and the fishing methods, estimates of annual catch (for example) will be biased because the anglers that fish more often are likely to catch more fish in total. Avidity bias-adjusted averages for annual fishing effort, catch and catch per unit effort (Thomson, 1991) were produced to account for bias (Smith *et al.*, 2011).

The most comprehensive survey of recreational sea angling (RSA) activity, catches, economic impact and social benefits of sea angling in England was in 2012 (Armstrong *et al.*, 2013). A nationwide Office of National Statistics (ONS) Opinions and Lifestyle survey (12,619 geographically stratified private households) was used to estimate the number of sea anglers in England, how often they go fishing from the shore or on private or charter boats, and to collect other information about them and their fishing patterns. An on-site survey included face-to-face interviews conducted around the coast during the year to estimate daily catches, and monthly random sampling of known charter boats was used to estimate the total catches of the angling charter fleet. Face-to-face surveys at case study locations, including Lowestoft, provided some

information about the fishing habits and expenditure in the East of England (Armstrong *et al.*, 2013). All data obtained by the economic on-line survey were re-weighted using demographic and frequency-of-angling data from the surveys to reduce bias. The survey was designed to provide estimates with an acceptable precision for England as a whole, so the estimates for individual IFCA strata were much less precise and were therefore not presented.

Since 2015, sea angling participation, catches, and economics have been calculated from estimates of effort from the Watersports Participation Survey and catch per unit effort (cpue) from a diary panel of over 1,000 anglers (www.seaangling.org). The Watersports Participation Survey has been undertaken annually since 2002, involving a face-to-face omnibus survey of 12,000 UK households each September. Targets based on interview participants' gender and employment status were used to ensure a representative sample. The results were raised to the total population based on demographics and location, using information on the UK population. Since 2015, questions have been added to the survey about sea angling, with an average participation rate of 1.6% or 823,000 sea anglers in the UK. Again, these surveys have been designed to provide data at a national level, so are imprecise at smaller spatial resolutions.

There are few studies that include information on activity in the Eastern region. Clyne *et al.* (2006) found that recreational angling was popular on many of the beaches in their survey area. Anglers were observed at Southwold, the River Blyth, Dunwich, Sizewell, Thorpeness and Aldeburgh, and approximately seven angling charter boats were operating in 2005 (2 from Southwold Harbour; 3-5 from Orford). In 2010, shore angling was popular throughout the Sizewell area, whilst two charter angling boats operated from Southwold harbour and one from Orford where several private angling boats were based (Garrod *et al.*, 2011).

There are no comprehensive studies of sea angling participation, catches or economics for the eastern region of the UK. National surveys have generated estimates of participation, catches, economic impacts, and social benefits, but do not have the sampling effort needed to provide estimates for Sizewell. Here, sea angling in the eastern area is characterised (species, locations, platforms) based on knowledge from existing studies. Then the activity of sea anglers in the areas is assessed from expert judgement, existing surveys, and analysis of fixed camera footage.

7.1 Characterisation

7.1.1 Legislation and data requirements

The impact of Marine Recreational Fishing (MRF) was recognised by the European Commission and it is a statutory requirement under the Data Collection Framework (DCF) for the UK to report Recreational Sea Fishing (RSF) catches and releases of cod (*Gadus morhua*), sea bass, pollack (*Pollachius pollachius*), elasmobranchs, eels (*Anguilla anguilla*), salmon (*Salmo trutta*), and highly migratory species (EU, 2001, 2008, 2010, 2016). There is also the requirement to report all catches of recovery plan species by boats flying the UK flag under the Control Regulations, which covers charter boats (EU, 2009). The main use of sea angling data is to support stock assessment, with inclusion of RSF in stock assessments for western Baltic cod (Eero et al., 2015a, 2015b) and European sea bass (ICES, 2016). In addition, it is needed to support: local, national, and regional management of fish stocks, delivery of Marine Strategy Framework Directive (MSFD) and Water Framework Directive (WFD), Maritime Spatial Planning (MSP), and development of the blue economy (ICES, 2015). Information is used by local (e.g. IFCAs), national (e.g. Defra, MMO), and European (e.g. ICES, STECF) agencies to inform marine management and policy, and by the angling community for development of their own policies (ICES, 2017). There are also UK national instruments that focus on migratory fish and Marine Protected Areas (MPAs), and many local bylaws. Some of these may apply to sea angling in the Sizewell area.

7.1.2 Species

A variety of species are targeted by sea anglers in East Anglia and this varies between fishing platform and season (Table 3; Table 4). The main species caught include bass, cod, flatfish, small sharks and rays, but many other species are caught more rarely (Table 3). A study of the south-east of England found that cod, bass, flounder and smoothhound were included in the top five target species for most sea-anglers, with mackerel, dab, rays and whiting targeted less often (Table 3) (Smith *et al.*, 2011). Garrod *et al.* (2011) observed that shore angling was aimed particularly at cod, whiting, bass, dab, and sole, whilst boat anglers

caught the same species as well as mackerel and thornback ray. In 2012, sea bass was the primary target for the majority of shore anglers fishing in East Anglia, whilst cod, mackerel and smoothhound were also important (Armstrong et al. 2013). Trips recorded in the Sea Angling Diary study included catches of several species including cod, bass, flatfish, and elasmobranchs.

Table 3. Species caught by diarists in 2016 and 2017 sea angling surveys (greater than 1 record) and species targeted in southeast (Smith et al., 2011).

Area	Species
Suffolk (Sea Angling 2016 & 2017)	Bass, bib, bull huss, cod, dab, sole, flounder, eel, goby, lesser spotted dogfish, lesser weever, mackerel, mullet, plaice, pollack, sandeel, sea bream, rockling, smoothhound, spurdog, starry smoothound, thornback ray, three-bearded rockling, tope, whiting, wrasse
Southeast (Smith *et al.*, 2009)	Bass, bib, black bream, cod, conger eel, dab, eel, flounder, garfish, grey mullet, gurnard, lesser spotted dogfish, mackerel, plaice, pollack, rays, smoothhound, sole, thornback ray, tope, whiting, wrasse

Table 4. Species targeted by charter boat anglers by month (ESFJC pers. comm.).

Target species	April 2009	May 2009	June 2009	July 2009	Aug. 2009	Sept. 2009	Oct. 2009	Nov. 2009	Dec. 2009	Jan. 2010	Feb. 2010	March 2010
Cod	X	X	X	X	X	X	X	X	X	X	X	X
Bass			X	X	X	X	X	X	X			
Smoothhound		X	X	X	X	X	X					
Skate/rays		X		X	X	X	X	X	X			
Whiting						X	X	X	X			

7.1.3 Seasons

There are strong seasonal patterns in terms of species targeted on the east coast of the UK. The main fishing season for cod, whiting and flounder was from September to February, followed by March to May, though boat-anglers indicated that they were still able to catch cod in summer when they are less accessible from the shore (Smith *et al.*, 2011). The main fishing season for bass and mackerel was summer, followed by autumn and then spring, whereas smoothhound featured most in spring and summer (Smith *et al.*, 2011). Dab and plaice were captured throughout the year (Smith *et al.*, 2011). These seasonal trends in the southeast region are in general agreement with other sources of sea angling for Sizewell (e.g. internet). In addition, sea patterns are observed in charter boats catches of cod, sea bass, smoothhound, skate/rays and whiting (Table 4).

For Sizewell, the most important species that anglers are likely to be targeting in winter are cod, whiting and bass from both beach and boat. They might also expect to catch dab, flounder, bib or rockling from the beach, and thornback ray from boats during late March. In spring, cod, bass, dab, sole and dogfish are the main species caught from the beach, and boat-anglers target cod, bass, rays, lesser spotted dogfish and smoothhound. Angling on the East Anglian beaches tends to be less successful in summer, where sole is targeted when they come close inshore during darkness and bass and mullet are fished for in the estuaries. In contrast, boat-fishing in summer for cod, bass, rays, smoothhound and tope can be rewarding. Autumn is considered to be the best period for angling from the beach, where large numbers of anglers target cod and whiting, with bass and bib also taken. At that time, cod, whiting and bass are the principle species caught by boat anglers (Table 4).

7.1.4 Locations

7.1.4.1 Lowestoft and Pakefield

Between Lowestoft and Kessingland there is beach-angling for cod and whiting from September to November, especially at night, although shore-fishing is less successful from December to mid-February,

due to the cod moving to deeper water. In autumn, there are many angling matches on Pakefield beach, which fishes especially well at night, with good catches of cod, whiting, bass, dab and bib reported. During winter, beach-anglers catch dab, flounder and whiting, and bib and flounder are caught in spring, with only the odd small bass and flatfish being caught in summer.

7.1.4.2 Southwold and Walberswick

At Southwold, anglers fish from the beach and the pier to take sole, cod and bass in season, and in the River Blyth for bass and grey mullet. Holidaymakers in August fish on the sands and river wall for small bass in particular, and children fish for green shore crabs (*Carcinus maenus*) at Walberswick on the southern side of the mouth of the Blyth Estuary. From September to December, and again from March to May, angling charter boats target large cod close inshore and catch a lot of whiting, although catches can be affected if these species are feeding on sprat and bookings may be cancelled if cod are not available in the immediate area. From June to August, when the water clears, the charter boats fish over wrecks and sandbanks, first catching mackerel and sandeel which are then used as bait for cod and large bass.

7.1.4.3 Dunwich and Sizewell

Angling on Dunwich and Sizewell beaches tends to be quiet from December to March, with dab, flounders, whiting and rockling being caught in the deeper water. By May, however, anglers may take good catches of cod, and sole, bass, smoothhound and dab are taken in June. The best beach-fishing in this area is from July to November, when bass, whiting, dab, flounder and rocking are caught by day and large sole and bass and cod (October onwards).

7.1.4.4 Thorpeness, Aldeburgh and Orford

Beach-fishing at Aldeburgh tends to be quiet between December and February, when the fish appear to move out to deeper water, although dab may still be caught. In March, angling from the beaches can be excellent, with large cod, whiting, bass, bib and dab being caught, plus rockling, flounder and dogfish. In April, cod continue to be caught from the beaches, especially at night, along with sole at Thorpeness. Between June and September, only small bass and dab are caught by angling from the beach, but from September through November, cod and whiting are taken from Thorpeness to Aldeburgh and Orford. Although large whiting can be caught by day, the better-sized cod are caught at night. Orford Ness is considered to be the premier beach for angling in East Anglia, having adjacent deep water and fast tidal currents, and the vessel “Regardless” can take anglers from Orford across to this venue most days of the year. Cod, bass, whiting, smoothhound and rays are taken from September to November, with a quiet period in December/January until the cod return in March and April, when anglers can again catch cod, along with bass, dab, dogfish, whiting and smoothhound. Both large and small bass are caught in the River Ore, where children fish for crab during the August holidays.

7.1.4.5 Felixstowe

As with other Suffolk beaches, Felixstowe beach provides good angling for cod, whiting and flounder in autumn, with less activity in winter. Cod and whiting are caught between February and May, particularly at night, and there is good daytime fishing for bass, small cod, flounder and eels from June onwards in the Rivers Orwell and Deben. On the beaches small cod and bass are caught along with smoothhound and thornback ray in August and September. One recent innovation is rod-and-line fishing from a kayak, several of which are used to catch large cod and bass in the River Orwell.

7.1.5 Boat fishing

Information on the number of angling charter boats is more certain, because their activity is more visible than that of beach-anglers or those using private boats. Private boats are also occasionally used for angling, but the number and activity is unknown. In 2010 it was estimated that up to 18 charter boats may be used in the Sizewell study area, 21 in 2013, and 19 in 2014 (breakdown of vessels per port of the latter two years in Table 5). Between November and April, the locations fished tend to be within 5 miles of the coast, whereas from May on, the charter boats venture farther offshore on sandbanks and wrecks, sometimes up to 30 nm from the coast, on the Inner and Outer Gabbards, Rough Towers, Shipwash, Cutler, Washington, Dunwich Bank and Felixstowe Ledges and the Sunk, Galloper and South Falls, which are south of the Sizewell study area. Felixstowe is an important venue for angling charter boats, which target large cod and rays around the

Washington and Cutler banks and on Felixstowe or Wadgate Ledges from September through to December. In January, the charter boats may catch cod and small whiting, dab or flounder, but by March and April larger catches of cod, whiting and bib are taken on the Felixstowe Ledge or the Cutler. In May, charter boats start on the summer species, with smoothhound and rays targeted in the gullies across the banks, and cod and bass on wrecks. A summary of angler charter activity in the area between Pakefield and Felixstowe between April 2009 and March 2010, showed fewer trips in winter (because of the poor weather) and that cod, bass, smoothhound and rays were the main target species.

Table 5. Angling charter boats operating out of ports in the Sizewell study area in 2013 (Substance, pers. comm.) and 2014 (EIFCA pers. comm.).

Port	2013	2014
Felixstowe	2	2
Levington	3	3
Lowestoft	11	8
Orford	1	0
Ramsholt	0	1
Shotley	3	2
Southwold	1	3
Total	21	19

7.2 Activity

In this section, an assessment of angling activity was made using three approaches for the Sizewell area: 1. expert judgement of sea fisheries officers; 2. review of all trips reported during national surveys; and 3. counting the numbers of anglers captured in images from fixed cameras on the turbine hall building of SZA. These are discussed in the sections and some key conclusions from the different approaches highlighted.

7.2.1 Expert judgement

Estimates of sea angling activity were provided by a fishery officer from the ESFJC and from discussions with angling clubs in 2010 (Smith *et al.*, 2011). Expert judgement was used to estimate the number of shore and boat angler visits to the Sizewell study area by quarter rounded to the nearest hundred (Table 6). For the whole area, there were an estimated 23,500 shore trips and the majority were thought to be in winter (Table 6). There were 18,000 boat trips with most occurring in summer (Table 6), but the number of private boats was unknown.

In 2013-14, it was estimated that up to 21 charter boats may be used in the Sizewell study (Table 5) although none were classed as fishing full time (fishing more than four times a week) (EIFCA pers. com). Charter activity in the area between Pakefield and Felixstowe between April 2009 and March 2010 was estimated to be 567 trips carrying 3,813 anglers (Table 7). There was a seasonal pattern with fewer trips in winter due to poor weather (Table 7).

7.2.2 Angling surveys

Surveys have been carried out across the UK to estimate participation, activity, catches, and expenditure by sea anglers as part of UK statutory requirements under the Data Collection Framework that support the CFP. In 2012, an onsite approach was used to estimate catch per unit effort of shore-based and private boat angling that included sampling across Suffolk (Armstrong *et al.*, 2013). In addition, a logbook approach was used to collect catches and effort from charter boats. The survey was designed to provide national level estimates, so will not provide robust estimates for Sizewell. No charter boat trips were recorded in ICES rectangle 33F1 and 13 site visits were made to the area around Aldeburgh. Hence, there was insufficient information to provide any indication of sea angling activity at Sizewell. Sea angling surveys have been done annually since 2016 using an offsite approach. In this study, a panel of diarists have been recruited that provide details of all sea angling trips and catches (www.seaangling.org). There were 379 sessions recorded by 54 diarists, of which 29 sessions by 14 sea anglers were at Leiston, near Sizewell. In addition, the numbers of sea anglers recording data changed over the 2 years of the survey, making it impossible to assess seasonal patterns. The evidence provided from the sea angling surveys indicated that there was

angling activity in the area throughout the year, but it was not possible to generate robust estimates of either activity or patterns of sea angling from the shore or boats.

Table 6 Estimates of the number of beach- and boat-angler visits to the Sizewell study area, by quarter, rounded to the nearest hundred in 2009/10 (ESFJC pers.comm.).

Area	Jan-Mar		Apr-Jun		Jul-Sep		Oct-Dec	
	Shore	Boat	Shore	Boat	Shore	Boat	Shore	Boat
Lowestoft to Walberswick	2200	700	1200	600	1000	2800	3000	1500
Dunwich to Orford Island	3500		1200		1000		5200	
Hollesley Bay to Felixstowe, including River Orwell	1200	2300	600	2300	900	5000	2500	2800
Total trips	**6900**	**3000**	**3000**	**2900**	**2900**	**7800**	**10700**	**4300**

Table 7 Charter angling activity in the area Pakefield to Felixstowe, numbers of trips and anglers each month from April 2009 to March 2010.

Measure	Apr 2009	May 2009	Jun 2009	Jul 2009	Aug 2009	Sep 2009	Oct 2009	Nov 2009	Dec 2009	Jan 2010	Feb 2010	Mar 2010
Number of trips	80	80	80	90	62	51	40	14	18	8	8	36
Number of anglers	480	500	500	630	420	380	390	96	97	48	56	216

7.2.3 Camera analysis

The diverse and dispersed nature of marine recreational fishing make surveys challenging, but useful and robust approaches have been developed (Pollock *et al.*, 1994; ICES, 2010). Digital cameras have been used to monitor activities (Lynch *et al.*, 2015; Wakefield *et al.*, 2017), with recognition as a cost-effective alternative to traditional approaches of monitoring recreational fishing activity. However, there are many challenges to maximize utility (Hartill *et al.*, 2016; ICES, 2018). Several studies of recreational fishing effort have been done using digital cameras including in New Zealand (Hartill *et al.*, 2015, 2016) and Australia (e.g. Keller *et al.*, 2016). Fixed cameras have been mounted at SZA since 2015, but images have not previously been used to assess the activity of recreational sea anglers. In this study, images from digital cameras were analysed to assess temporal patterns of sea angling activity on Sizewell beach. Images were viewed, assessed for quality, and discarded where it was not possible to view. Shore anglers were counted in the remaining images and the temporal variation in activity assessed.

7.2.3.1 Methods

Four digital cameras have been mounted on the turbine hall of SZA since 2015, recording different sections of the shoreline during daylight hours (Figure 9). A total of 61,114 images were available between 2015 and 2017, with most from 2016 (Table 8). Time constraints meant it was not possible to analyse all images, so a total of 15,778 images were selected to cover at least one annual cycle. Images were viewed, assessed for quality, and 1,338 (9%) were discarded due to corrupted files (Figure 10A) or heavy obstructions (e.g. pipe/ structural). A further 2,799 (19%) were possible to analyse, but only partially, due to camera obstructions (e.g. spiders' webs or dust), weather (e.g. snow or rain), or low light levels. These conditions reduced the clarity of the images but still allowed the beach to be viewed (Figure 10B), but with some degree of uncertainty. Many of the images from camera 4 were rejected due to weather issues (Figure 10C&D) and camera 2 was obstructed by a large permanent structure at the end of 2015. In addition, the orientation of cameras 1 and 3 was changed in December 2015 and June 2017, respectively. The images covered the period from April 2015 to December 2017 between 4am and 8pm (Table 8), but given that beach/sea anglers commonly fish at night, this activity is not detected in these images.

In each image, sea anglers were counted (Figure 11) and other activities noted including bird aggregations, dog walking, and vessels (Figure 12). No further action was taken for other activities, but it is useful to note that the images could be used to assess more general usage of the area. Camera 1 was difficult to analyse accurately due to the large expanse of coastline and the low image quality, so was likely to provide an underestimation of true numbers. Cameras 1 and 2 overlap, so some duplication is likely. Given the issues with the images and coverage, a fully quantitative analysis of the counts of sea angling effort was not possible. Instead, a simple approach was adopted that assessed the coverage in terms of the numbers of frames analysed, the numbers of frames with anglers present, and the maximum number of anglers in a

frame, for the whole times series, months of the year, and whole years. This was used to assess the peak times that sea angling could take place and the associated caveats with respect to coverage of images.

Figure 9 Orientation and field of view covered by the fixed digital cameras at SZA including numbering.

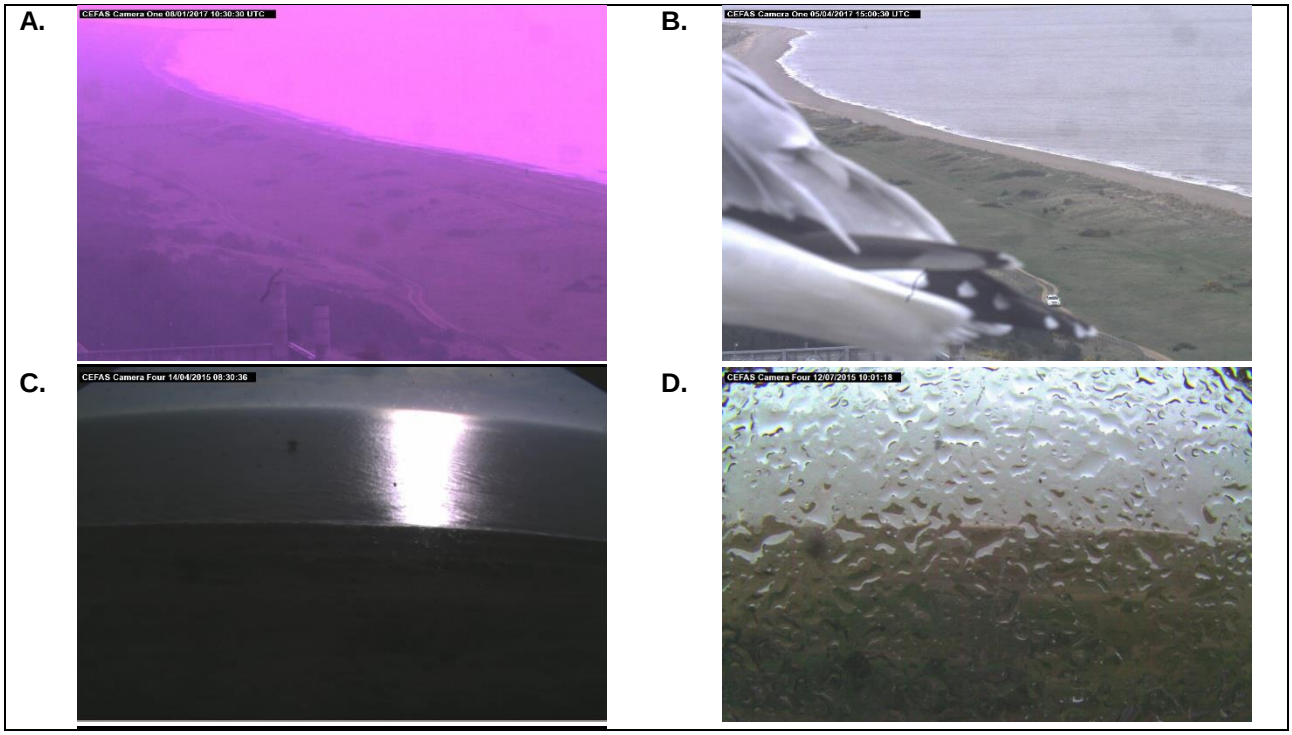

Figure 10 Examples of camera images that were (A) corrupted, (B) had physical obstruction, and (C&D) obscured by weather.

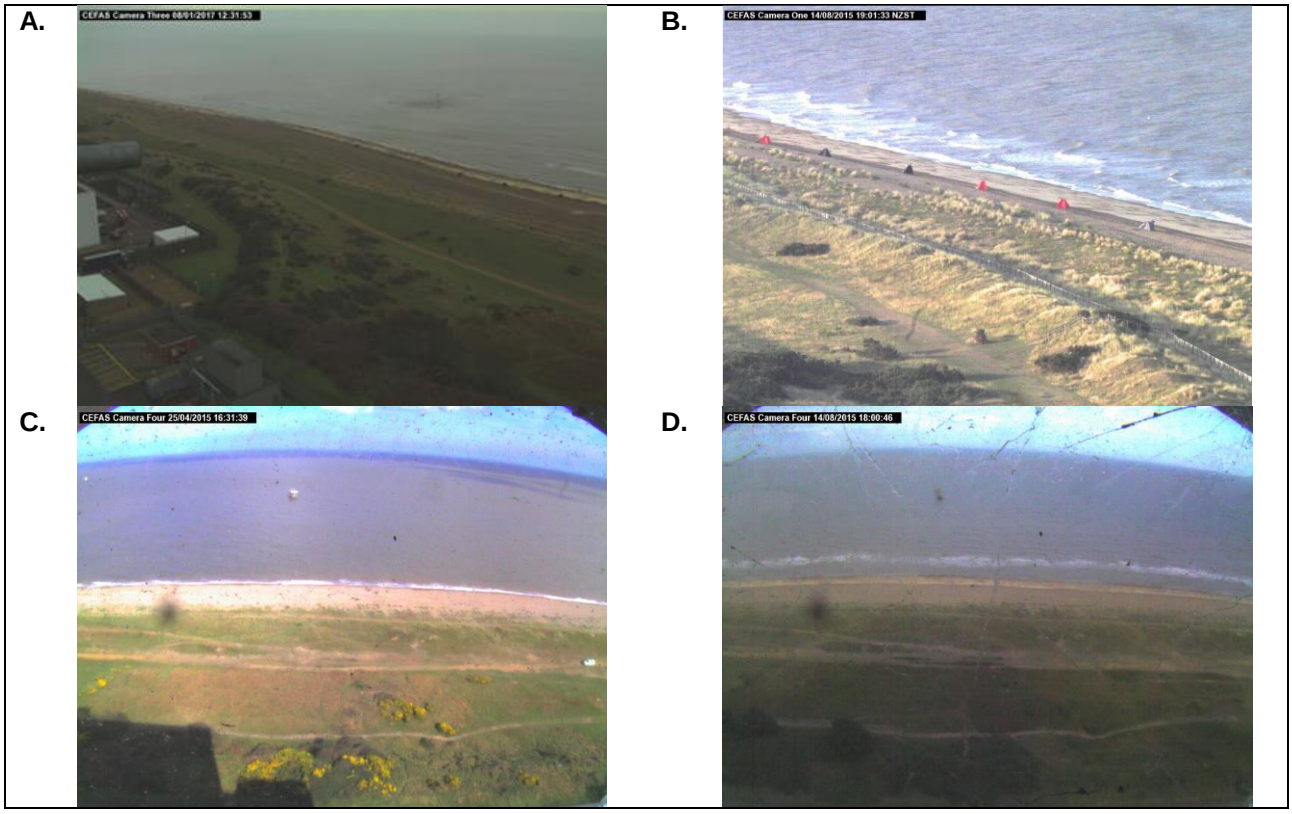

Figure 11 Examples of images where (A&B) anglers could be counted in the whole frame or (C&D) only partial analysis was possible.

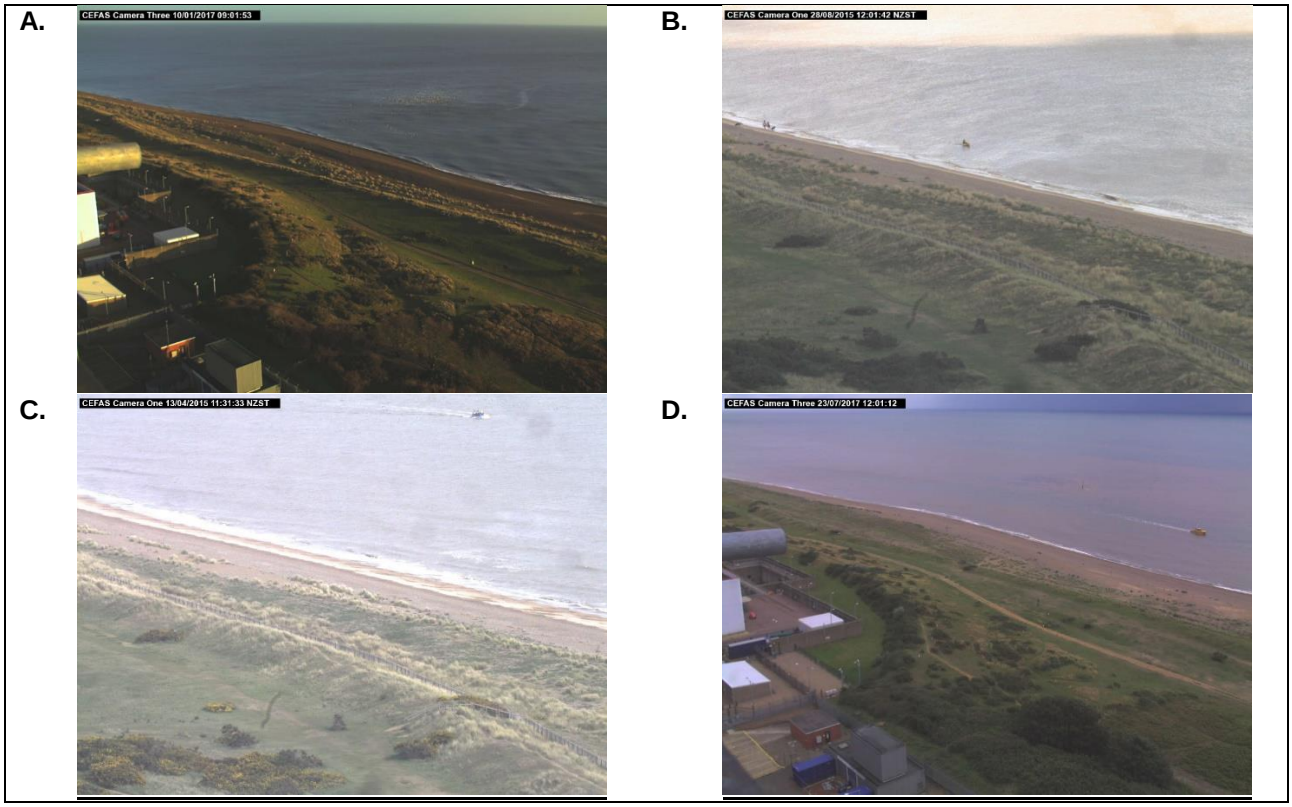

Figure 12 Examples of other activities that were observed in image analysis including (A) bird aggregation, (B), dog walking (C) recreational activity, and (D) other vessels

Table 8 Summary of camera data availability, frames analysed, and number of anglers present. * represents unique days in the sample.

Category	Measure	Camera 1	Camera 2	Camera 3	Camera 4	All cameras
Images	Total	15268	15268	15289	15289	61114
	2015	1502	1502	1508	1508	6020
	2016	7882	7882	7897	7897	31558
	2017	5884	5884	5884	5884	23536
Sample	Total	6167	1369	6731	1511	15778
	Days	270	76	337	86	769 (377*)
	2015	1394	1252	1445	1043	5134
	2016	0	0	1502	0	1502
	2017	4274	28	3502	0	7804
Quality	Visible	5068	1127	5307	139	11641
	Partial	600	153	1142	904	2799
	Discarded	499	89	282	468	1338
Analysed	Total	5668	1280	6449	1043	14440
Date	Start	10-Apr-15	10-Apr-15	10-Apr-15	10-Apr-15	10-Apr-15
	End	20-Dec-17	17-Jul-17	20-Dec-17	31-Dec-15	20-Dec-17
Time	Start	04:00	06:00	04:00	06:00	04:00
	End	20:00	20:00	20:00	20:00	20:00
Anglers	Present	16	94	486	204	800
	Unclear	10	0	29	16	55
	Absent	6141	1275	6215	1291	14922
	Proportion	0.003	0.069	0.072	0.135	0.051
	Minimum	0	0	0	0	0
	Maximum	11	7	15	8	15
	Total	123	125	970	352	1570
	Average	0.02	0.09	0.14	0.23	0.10
	Average present	4.73	1.33	1.88	1.60	1.96

7.2.3.2 Results

More frames were analysed in 2015 and 2017 than 2016 (Figure 13A), and more frames were recorded during the summer due to day length (Figure 13B). There was an even distribution of frames across the cameras in 2015, but images were only available from cameras 1 and 3 in 2017 (Figure 13C). A total of 1,570 anglers were observed in 800 images representing about 6% of all images (Table 8). A maximum of 15 anglers were found in a single image, with on average 0.1 angler per frame in all frames analysed and 2 anglers for only the frames with anglers (Table 8). Due to the poor coverage in 2016 (Figure 13A,D&G), only the proportion of frames with anglers present (Figure 13E) and maximum of anglers in a frame (Figure 13F) were assessed. Fishing activity appeared to peak in winter and summer, with less in spring and autumn (Figure 13E&H).

7.2.3.3 Discussion

Analysis of the fixed camera images confirmed that recreational sea angling occurs on Sizewell beach. From 2015-17, 1570 sea anglers were recorded in about 6% of images analysed, with a maximum of 15 recorded in a single frame. Sea angling was most common in summer and winter, which corroborates expert knowledge of the area. It was not possible to estimate recreational fishing effort due to the issues with coverage (e.g. time series, no images at night), overlap between cameras, and obstruction or discolouration of images. The lack of complete and consistent time series from each camera and ease of counting anglers, means that this is likely to represent an underestimate of numbers and presence of anglers, as well as temporal trends. In addition, information from angling forums, suggested that night fishing occurs at Sizewell in summer, which was not captured in the camera data. Despite these caveats, this represents the most comprehensive data set of shore-based sea angling activity around Sizewell. It was clear that sea angling is a sporadic activity that can happen at any time or place along the shore line.

7.3 Summary

There is evidence of regular sea angling activity at Sizewell throughout the year. However, the data available on is sparse and inconsistent, particularly for boat angling. Data from sea angling surveys are not at sufficient resolution to provide useful information and much of the initial data is based on expert judgement. For shore angling, the data from fixed cameras gave the most robust assessment of sea angling at Sizewell, but it was not possible to derive robust estimates of effort. There is information on the number of charter boats in the area, but no information on the number that target the area around Sizewell. Activity by private boats was not captured in any of the methods. However, boats were not recorded in many of the images from the fixed cameras, so are likely to be moving through rather than angling. To provide robust information and to assess potential impact, it would be prudent to consult the local angling community and develop a camera-based approach to provide an independent estimate of sea angling activity in Sizewell.

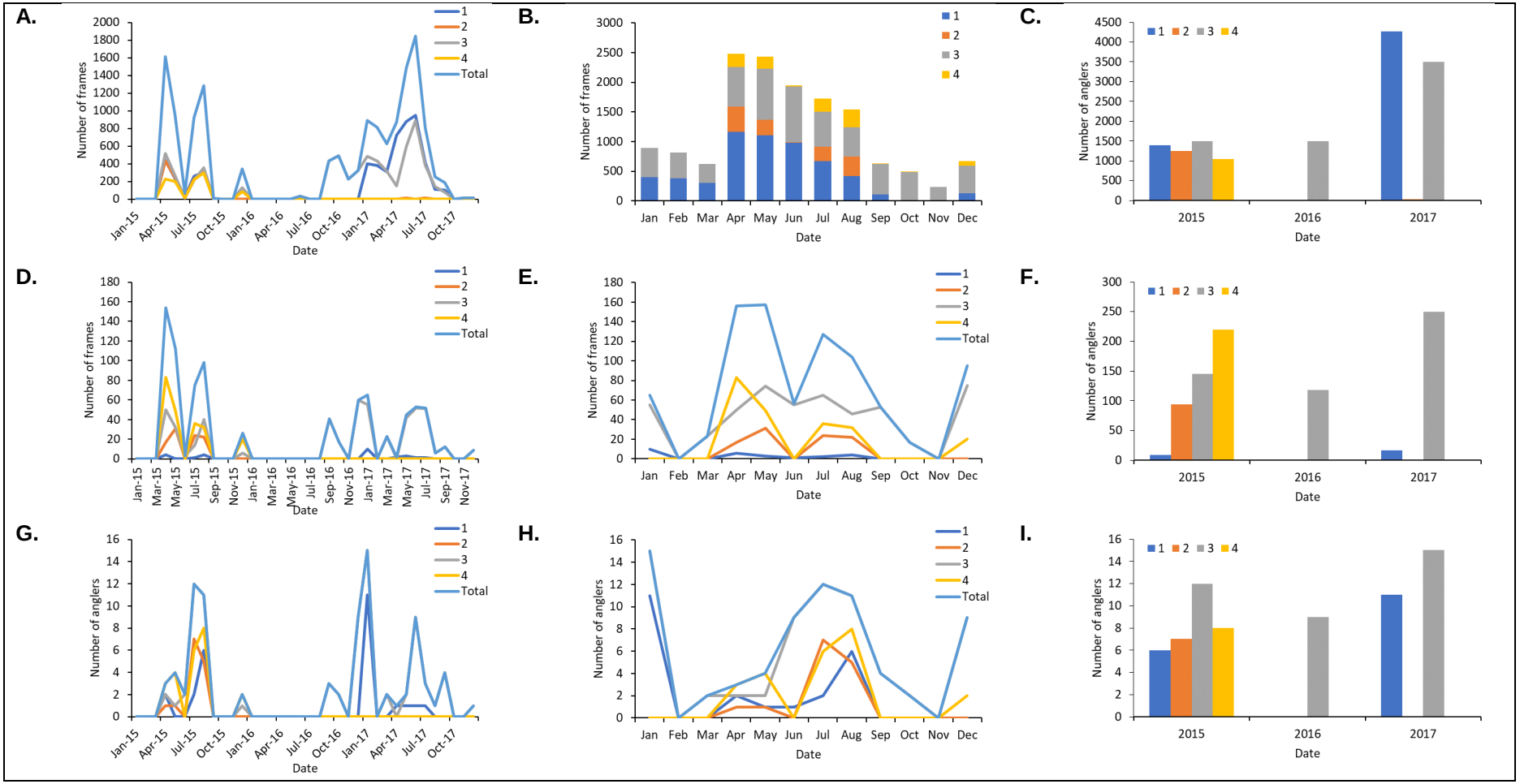

Figure 13 The numbers of frames analysed (A-C), frames with anglers present (D-F), and maximum number of anglers in each frame (G-I) presented as a times series (A, D, G), for each month (B, E, H) and for each year (C, F, I) for each camera and in total.

8 Landings and first sale value of commercial species

8.1 Landings from ICES rectangle 33F1

8.1.1 Landings by species groups

In 2017, a total of 375t of finfish and shellfish was landed from ICES rectangle 33F1, with a first sale value of £579,583. This contrasts with landings of only 267t but a first sale value of £911,866 in 2008 (Figure 14). For both years, most landings and landed value were by vessels ≤10m length. In 2008, the first sale value of the landings from the ≤10m vessels was £739,667, whilst that of the >10m vessels was £172,199. In 2017 however, the value of the ≤10m landings was £529,224 compared to £50,359 for the >10m vessels, consistently indicating that it is the inshore components that are the most economically important.

Notable shifts in the contribution of three species groups to the total landings can be seen. Within 33F1, demersal (those fish living on or near the seabed) landings by ≤10m vessels, reduced by 29 % between 2008 and 2017 (Figure 14) from £644 k first sale value to only £188k first sale value. Shellfish (invertebrates, usually with an exoskeleton) fisheries became far more valuable to the ≤10m fleet in 2017 and the first sale value of pelagic (those fish occupying the middle of the water column to the surface) almost doubled, despite landed quantities only increasing slightly. Demersal (bottom-dwelling fish) fisheries greatly reduced in both landed quantity and value between 2008 and 2017. In the >10m fleet, almost all landings in 2008 were demersal fish, though by 2017, shellfish were the main landing at £35,946 and 18.4t. Demersal landings reduced to £9,134 (3.8t), whilst pelagic landings increased from £255 (0.06t) to £5,729 (9.1t).

8.1.2 Landings by species

Within ICES rectangle 33F1, the 10 most valuable species landed by ≤10m and >10m vessels are summarized in Figure 15. Please note that the y-axis scales differ throughout. Between 2008 and 2014, sole was the most valuable species landed from 33F1 (except for 2010), with this species generally contributing the majority of the first sale value of landings by both ≤10m and >10m vessels. Sole was landed in the second largest quantities between 2008 and 2010 (Figure 16), with 2009 seeing a majority landing by the >10m fleets. It should be noted that whilst some species have a small landing (refer to Figure 16), their high price per kg may still make them valuable to the fishery.

As well as sole, cod has generally contributed significantly to the first sale value of landings from 33F1 and was ranked first in 2010. Most of this value was from the >10m sector, whilst the ≤10m sector contributed to similar values of cod and sole. Possible reasons for the increase in cod value in 2010 may be due to the implementation of the cod management plan in 2009 whereby vessels were incentivized to utilize more selective gear to reduce cod capture in conjunction with stricter catch limits and introduction of closed zones. Because of the measures introduced in 2009, cod catches were lower and as such, buyers were forced to pay more per kilo. Furthermore, cod were landed in the greatest quantities between 2008 and 2010 (Figure 16), with the ≤10m fleets being responsible for the greatest landings in all cases. In 2010, cod was the fourth largest landing, at over 40t (Figure 16).

Between 2015 and 2017, whelks were the most valuable species landed. The species was landed predominantly by <10m vessels, and this was particularly the case in 2017 (Figure 15). This is primarily due to displacement of effort from trap and whitefish fisheries., (Figure 15). By weight, whelks were the species of greatest landings between 2012 and 2017 (Figure 16), with almost 300t landed in 2017; a similar quantity to 2015.

Sea bass and thornback ray (*Raja clavata*) have always featured in the top ten most valuable species for 33F1. Brown crab and lobster also contributed to the ten most valuable species in all years except for 2012, when brown crab were of low value.

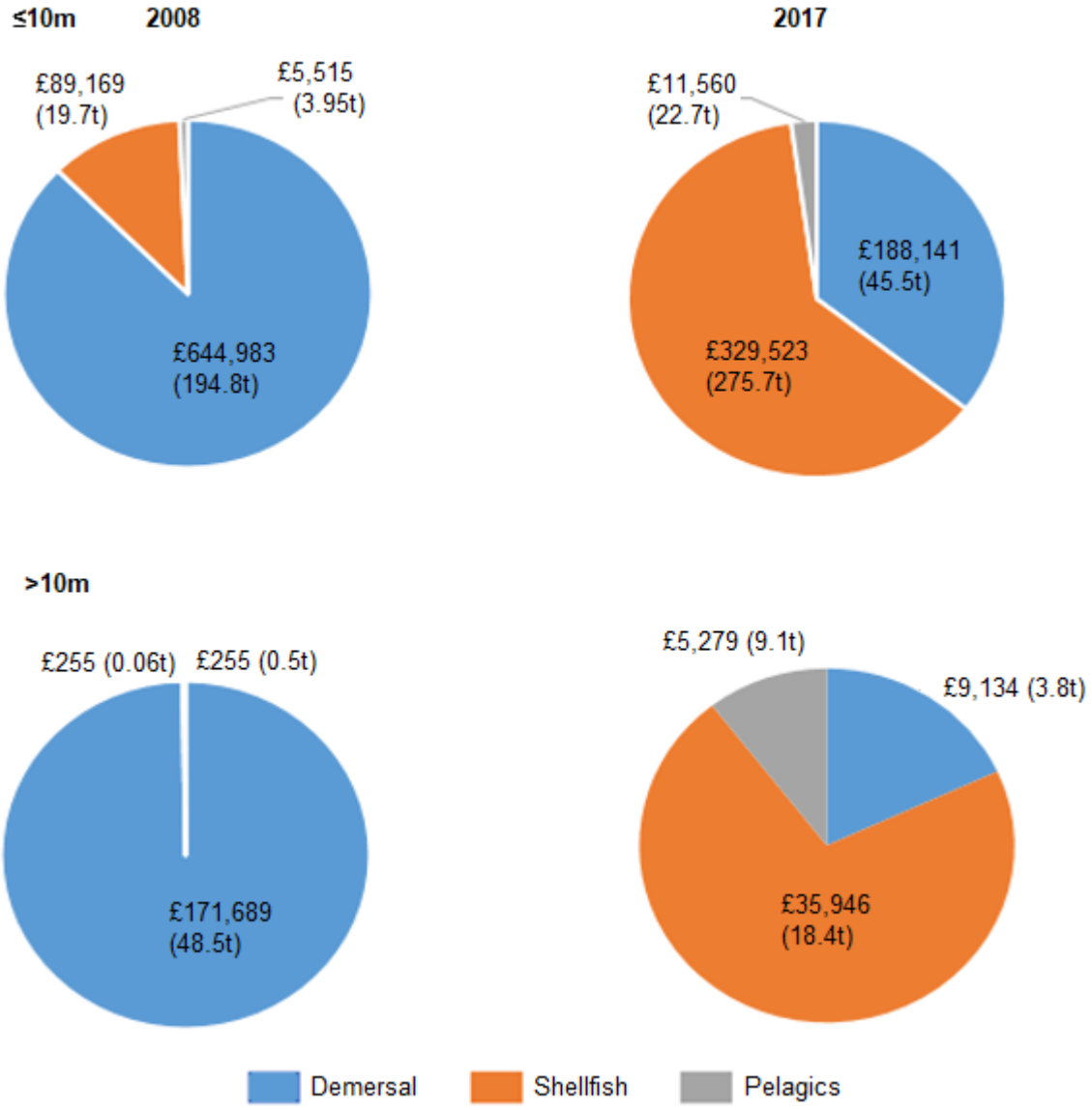

Figure 14 First sale value and landed weight (t) of demersal, shellfish and pelagic fisheries by ≤10m (top) and >10m (bottom) vessels from ICES rectangle 33F1 in 2008 (left) and 2017 (right)

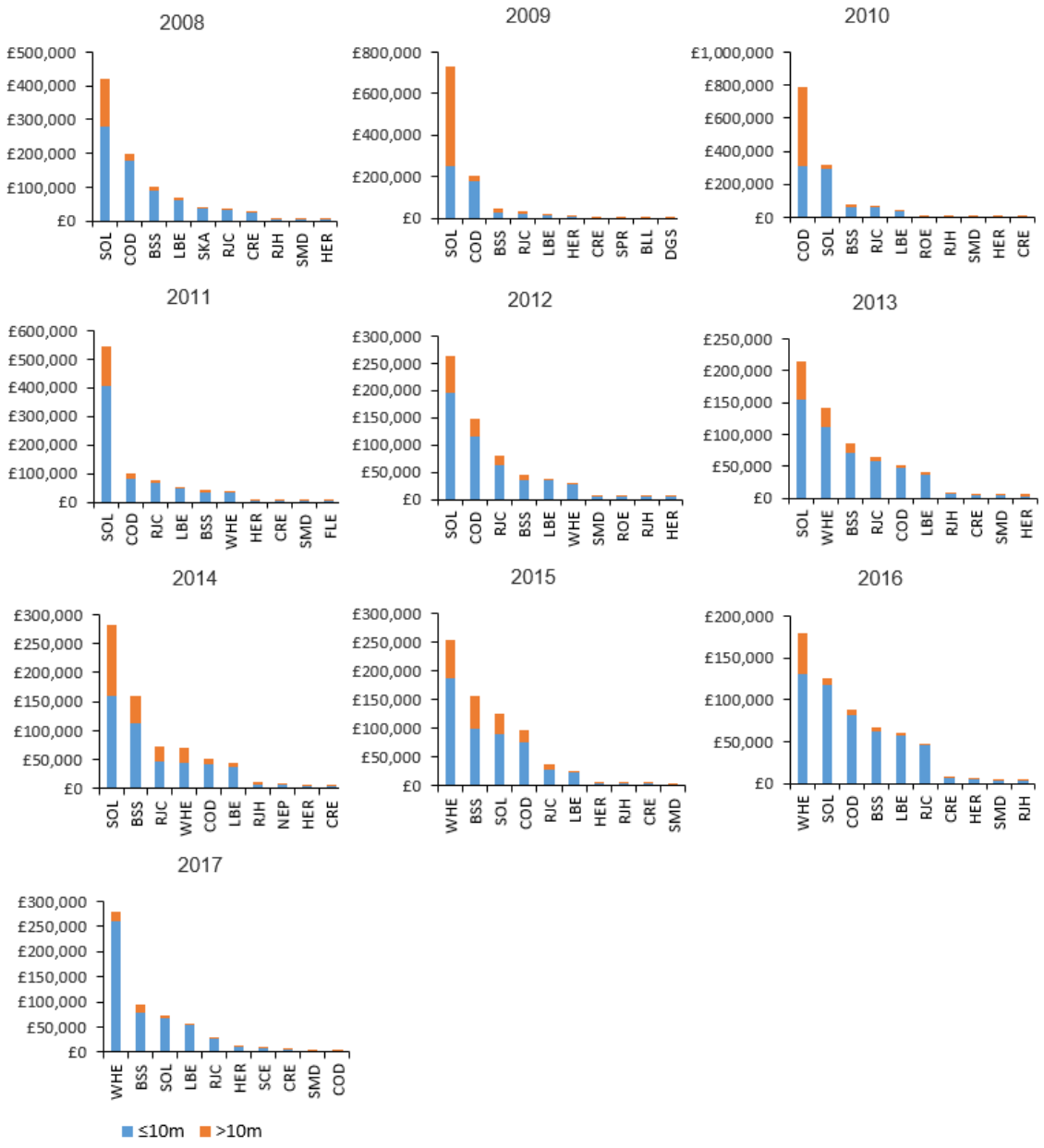

Figure 15 The top 10 most valuable species (by first sale value) landed from 33F1 in 2008-2017 by ≤10m and >10m vessels. Note that the y-axis scales differ throughout. BLL = brill; BSS = sea bass; COD = cod; CRE = brown crab; DGS = spurdog; FLE = flounder; HER = herring; LBE = lobster; NEP = Nephrops; RJC = ray; RJH = blonde ray; ROE = fish roe; SCE = scallops; SKA = skate; SMD = smoothhound; SOL = sole; SPR = sprat; WHE = whelk

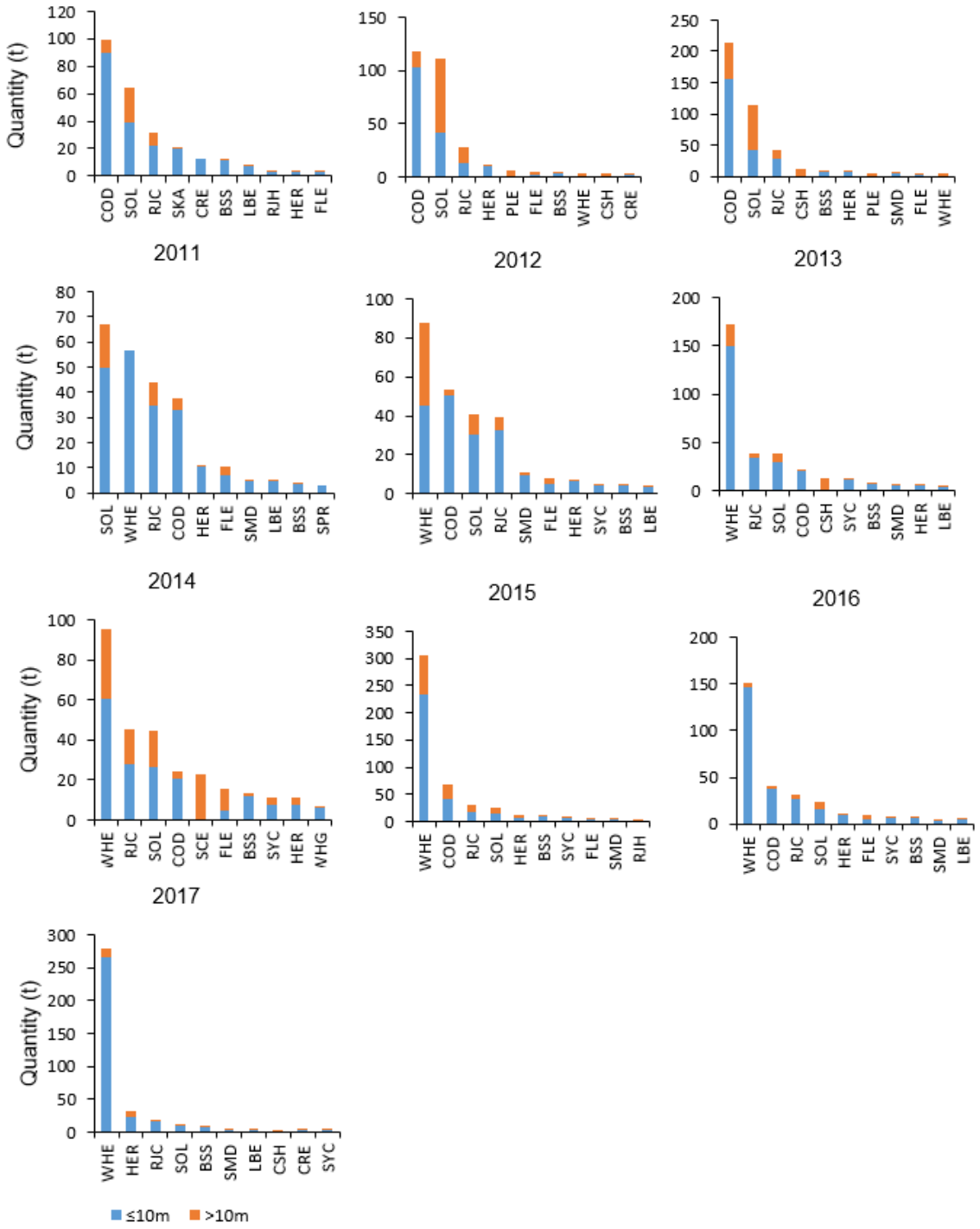

Figure 16 The top 10 species landed by weight (t) from 33F1 in 2008-2017 by ≤10m and >10m vessels. Note that the y-axis scales differ throughout. CSH = Brown shrimp; PLE = plaice; SYC = dogfish

8.1.3 Landings by gear

Catches in ICES rectangle 33F1 are almost all made with one of 5 gear types. Vessels ≤10m use pots (79.3% of landings in 2017), longlines (6.7%), driftnets (6.4%), gillnets (3.4%), and other trawls (2.7%) (Figure 17). Vessels >10m also use pots (47.1 % of landings), driftnets (31.0%), otter trawls (12.1%) and longlines (8.5%), but gillnets are not an important gear for this group. For some gear groups, such as pots and driftnets, only one or two species are targeted by that gear – whelks are caught in pots and driftnets are used for herring (Figure 18). For other gears such as longlines, a similar species composition is seen irrespective of vessel size – thornback ray, sea bass, smoothhound, dogfish, blonde ray and cod. However, for otter trawls, the species composition between vessels ≤10m and >10m is markedly different. Vessels ≤10m catch a diverse range of species, while the catches of otter trawlers >10m were dominated by brown shrimps.

8.1.4 Landings of key taxa

As part of the characterisation of the fish fauna in the Greater Sizewell Bay area, taxa were considered 'key' in the ecosystem if they met at least one of the following criteria (Beems Technical Report TR345):

- Socio-economic value: Species that are commercially exploited in the southern North Sea, or species that may have a beneficial or detrimental impact on local tourism.

- Conservation importance: In order to assess the conservation status of the fishes recorded in the Greater Sizewell Bay, we used the "species designations" spreadsheet collated by the Joint Nature Conservation Committee (JNCC, http://jncc.defra.gov.uk/page-3408). This collation has been built largely from the same components used for the Species of Conservation Concern listing produced as a part of the UK Biodiversity Action Plan (UK BAP) process in 1999–2000. Measures in place to provide protection for the named species apply to the adult stock rather than the eggs or larvae, and focus on halting the decline of the spawning stock biomass mainly via restriction on exploiting recruited species.

- Ecological importance: If a taxon is present in at least 30% of samples or contributes to the first 90% of the total abundance, we consider it to be common and/or abundant enough to play a key trophic role within the ecosystem. Moreover, we considered the most abundant pelagic fish species to be ecologically important as food for the key seabird species in the area.

Under the socio-economic definition, 12 fish species were considered key: sole, plaice, Atlantic cod, sea bass, Atlantic herring, thornback ray, flounder, dab, whiting, sprat, mackerel and horse mackerel *Trachurus trachurus*. Table 9 shows the proportion of 33F1 landings to the international, southern North Sea landings, along with their ICES stock assessment group and primary fishing gears (see Appendix A2 for acronyms). All proportions of 33F1 landings to their international landings were very low. The highest proportion was for thornback rays, at 1.72% of North Sea landings coming from 33F1.

Figure 19 gives the landed quantities and values of the key species from 33F1, for 2017. Thornback rays were caught in high quantities throughout the year, whereas species such as Dover sole and cod showed distinct peaks in abundances, in March and August, respectively. Herring and mackerel landings were sporadic and were only caught in spring and winter, and summer and autumn, respectively. For clarity, flounder, dab, horse mackerel and sprat were landed to 33F1 in such low volume during 2016 that they have been omitted from graphical representation.

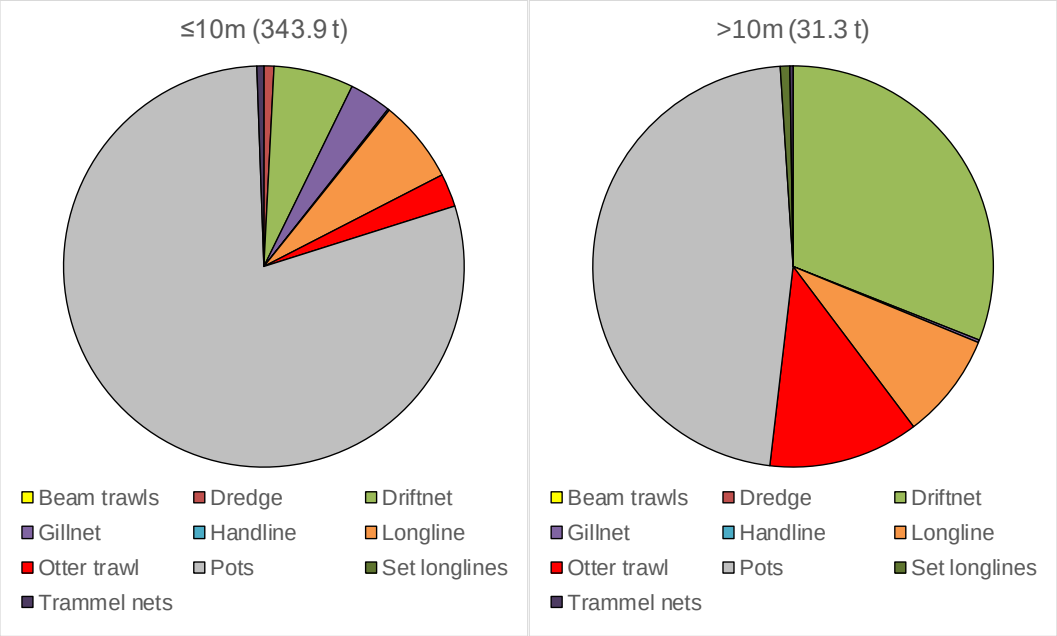

Figure 17 Landings (t) of (Left) vessels ≤10m length and (Right) vessels >10m length, by gear type, in 2017 from ICES rectangle 33F1

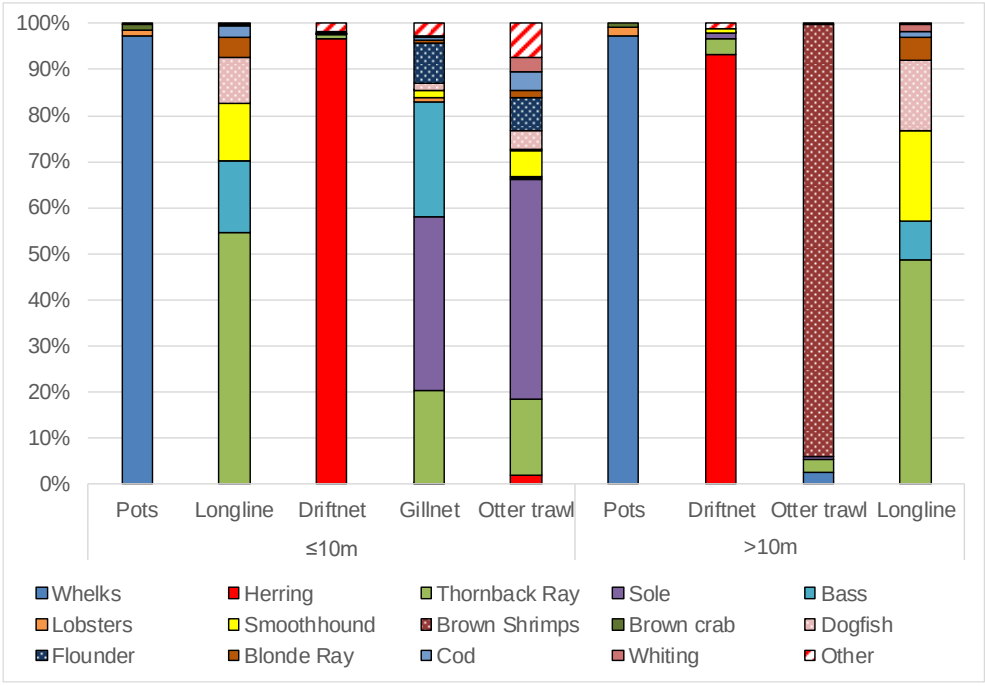

Figure 18 Proportion (%) by weight contributed by species to the total landings of the main gears fished in ICES rectangle 33F1, by vessel size, in 2017

Table 9 The proportion of local landings to international landings of key species, the ICES expert group in which they are assessed, and primary gear(s) of capture (2016)

Species	Assessment Group*	Primary Gear Type(s)	International landings (North Sea stock area) - 2016	Local landings (33F1) - (2016)	Proportion of 33F1 landings to international landings
Dover sole	WGNSSK	Trawls	12,651t	23.1t	0.18%
Plaice	WGNSSK	Trawls	81,059t	0.16t	0.0001%
Atlantic cod	WGNSSK	Trawls and seines	33,035t	40.4t	0.12%
Sea bass	WGCSE	Trawlers, nets, hooks, lines	1,259t	6.08t	0.48%
Atlantic herring	HAWG	Pelagic trawls	563,600t	11.29t	0.002%
Thornback ray	WGEF	Beam trawls, nets	1,825t	31.47t	1.72%
Flounder	WGNSSK	Trawls	1,630t	9.06t	0.55%
Dab	WGNSSK	Trawls	4,953t	0.46t	0.009%
Whiting	WGNSSK	Trawls	12,709t	0.53t	0.004%
Sprat	HAWG	Pelagic trawls	240,700t	0.36t	0.0001%
Mackerel	WGWIDE	Freezer trawlers, purse seiners, pelagic trawlers	248,041t**	0t	0%
Horse mackerel	WGWIDE	Freezer trawlers, purse seiners, pelagic trawlers	15,341t***	0.0005t	0.000003%

* For Working Group acronyms, please refer to Appendix A1

**Data from ICES subareas III and IV

*** Data from ICES subareas IIIa, IVb-c, VIId

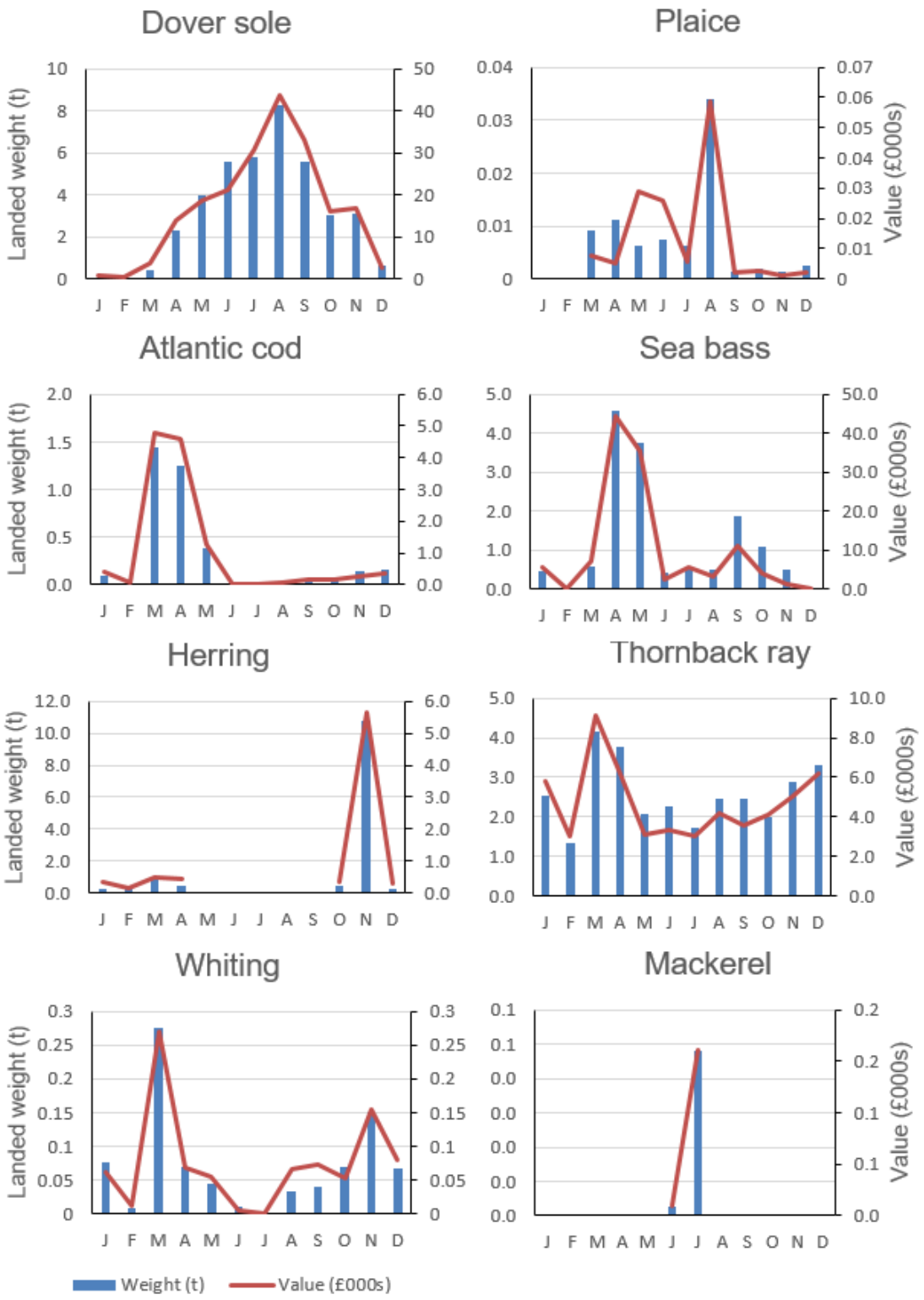

Figure 19 Landed weight (t) and first sale value (£000) of key species from 33F1 in 2016, by month

8.2 Landings from the wider area

Between 2008 and 2017, the first sale value of demersal landings from the wider Sizewell area (Figure 20), declined for both the ≤10m and >10m fleets. In 2008, total landings were 2,409t, with a first sale value of £4 million, but by 2017 although landings were still high (around 2,214t) the first sale value of those landings had decreased to £3.3 million. In 2008, the ≤10m fleet was were worth £3,105,299, whilst the >10m fleet was worth £915,110. In 2017, the ≤10m fleet was worth £2,051,477, whilst the >10m fleet was worth £1,314,234.

For the ≤10m fleet, the first sale value of the pelagic catch remained similar (£20,868 in 2008 versus £28,361 in 2017), but landings in 2017 were double those of 2008, implying a lower value per kg in 2017. Shellfish values were also similar (£1,231,424 in 2008 versus £1,243,898 in 2017), with very similar landed weights. For the >10m fleet, pelagic values decreased from £36,045 (127.6t) to £5,525 (9.5t) between 2008 and 2017, whilst shellfish increased from £282,024 (761.6t) in 2008, to £1,226,970 (1,153t) in 2017.

In 2008, the first sale value of landings from the southern North Sea were almost £16.5 million, compared with £14 million by 2007. However, this is contrasted by an increase in landings from 6,093t to 11,398t (Figure 21). Much of this was the result of a significant increase in the landings of shellfish.

In 2008, the ≤10m fleet was worth £12,216,505, compared to £4,200,189 for the >10m fleet. By 2017, the ≤10m fleet was worth £5,978,490, but the first sale value of landings from the >10m fleet was greater than that of the <10 m fleet (£8,084,856).

For the ≤10m fleet, the first sale value of shellfish and demersal fish doubled between 2008 and 2017, whilst the landings of shellfish quadrupled. The first sale value of the pelagic fishery almost tripled from 2008 and 2017, and their landings increased five-fold. A similar trend was noted for the >10m fleets; shellfish first sale value and landings in 2017 were more than double than in 2008. Demersal fisheries decreased from £957,476 (854.3t) in 2008, to £194,450 (142.4t) in 2017, and the pelagic fisheries also decreased from £86,570 (270.4t) in 2008, to £7,601 (11.8t) in 2017.

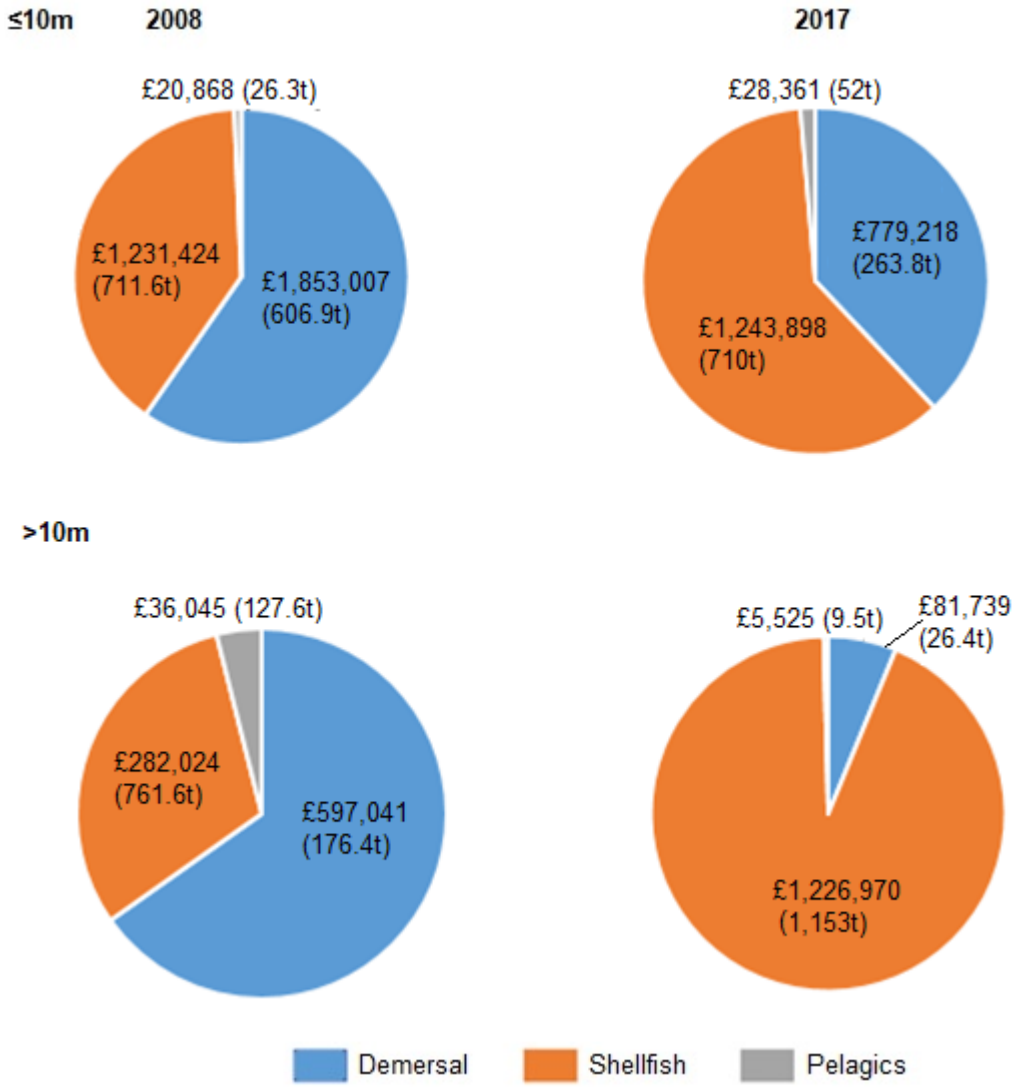

Figure 20 First sale value (£) and landed weight (t) of demersal, shellfish and pelagic fisheries from ≤10m (top) and >10m (bottom) vessels within the wider Sizewell area in 2008 (left) and 2017 (right)

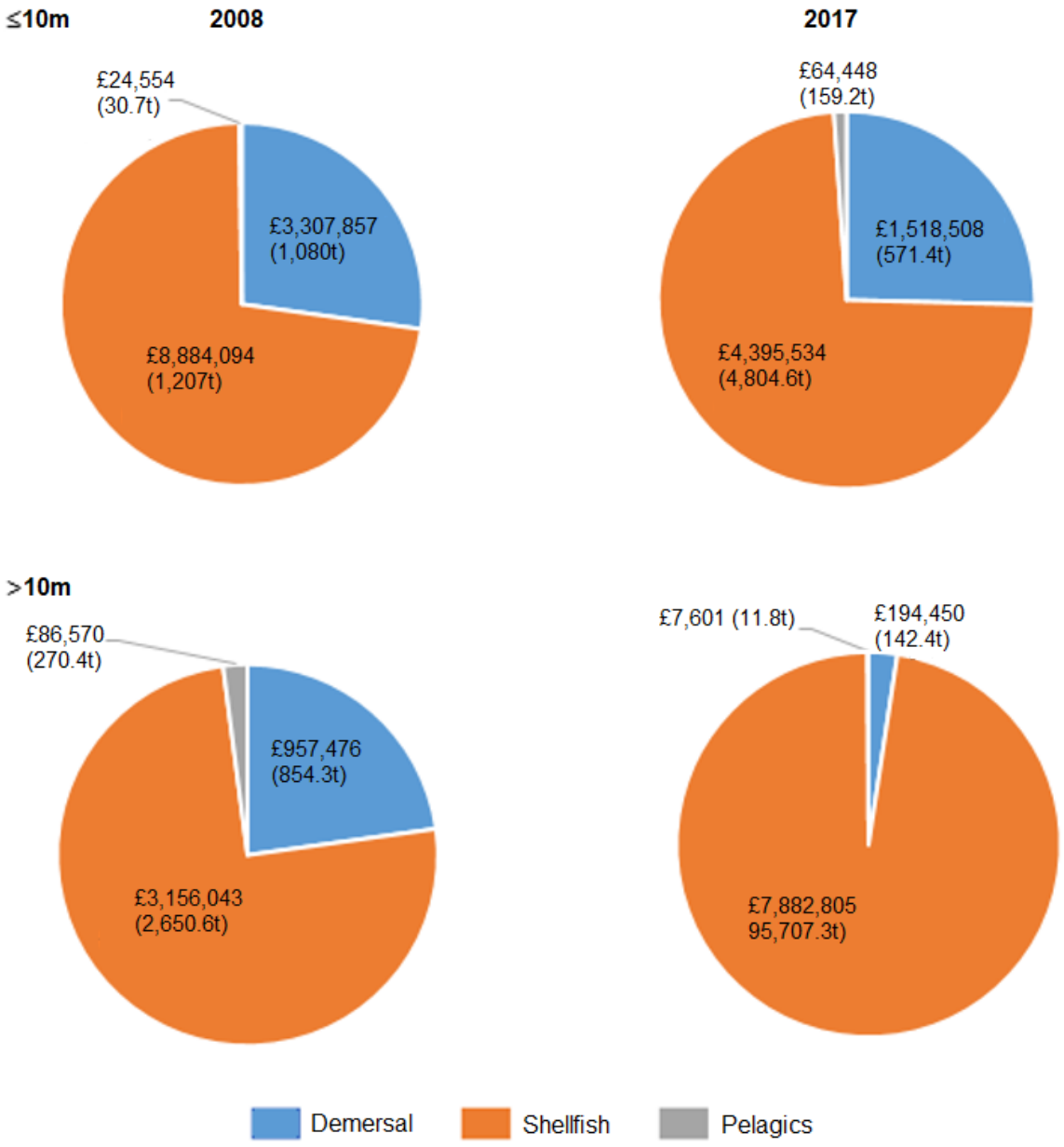

Figure 21 First sale value (£) and landed weight (t) of demersal, shellfish and pelagic fisheries from ≤10m (top) and >10m (bottom) vessels within the southern North Sea in 2008 (left) and 2017 (right)

9 Economic importance of recreational fishing

Marine recreational fishing is a high participation activity with significant social and economic benefits, but can impact on fish stocks (Hyder et al., 2017, 2018). This economic impact is often produced in declining coastal communities making it important socially (Cisneros-Montemayor and Sumaila, 2010). Furthermore, the expenditure by recreational fishers stimulates growth in multiple sectors, such as tourism, retail and manufacturing, as many fishers travel large distances, purchase expensive equipment from tackle shops, eat at retail facilities, and use charter vessels (Toivonen et al., 2004; Dillon, 2009; Radford and Riddington, 2009; Veiga, 2012; Armstrong et al., 2013; TDI, 2013; Roberts et al., 2017; Hyder et al., 2018).

Several studies have been carried out in the UK to assess the economic value and impact of sea angling (Drew Associates, 2004; Cappell and Lawrence, 2005; Radford and Riddington, 2009; Armstrong *et al.*, 2013; Monkman *et al.*, 2015; Roberts *et al.*, 2017). In 2004, the expenditure by sea-anglers (residents in England and Wales) was estimated to £538 million per year based on 12.7 million angler days of activity, and this spending supporting nearly 19,000 jobs directly and £71 millions of supplier income (Drew Associates, 2004). In southwest England in 2006, it was estimated that 240,900 residents and 600,000 visitors are active sea-anglers and spend in total £165 million (Cappell and Lawrence, 2005). The impact of sea angling in Scotland in 2009 was £70 million and supported 3,148 jobs, and complete cessation of sea angling would lead to a net loss of 1,675 jobs and £37 million annual income (Radford and Riddington, 2009). In Wales, the total annual expenditure of sea anglers was £39 million for visitors and a further £87.08 million for residents and supported around 1,700 jobs (Monkman *et al.*, 2015). Further studies have been done for particular sectors (e.g. Williams and Davies, 2018a, 2018b) and species (e.g. Grilli *et al.*, 2018). In addition, there are several studies of the economics of freshwater angling in the UK (Simpson and Mawle, 2005, 2010), which are not considered.

The most comprehensive study for England was in 2012 with economic impact estimated using a household survey of effort (numbers of anglers) and an online survey of expenditure (spend per angler), with an input-output methodology used to calculate total economic impact, jobs, and GVA (Gross Value Added) (Armstrong *et al.*, 2013; Roberts *et al.*, 2017). The study found that sea anglers with residence in England spent £1.23 billion on the sport, equivalent to £831 million direct spend (excluding tax and imports), and supported 10,400 full-time equivalent jobs and almost £360 million of GVA (Armstrong *et al.*, 2013; Roberts *et al.*, 2017). Taking indirect and induced effects into account, sea angling supported £2.1 billion of total spending, and a total of over 23,600 jobs, (Armstrong *et al.*, 2013; Roberts *et al.*, 2017). An assessment of the economic impact in the Eastern IFCA area was generated from the outputs from the 2012 survey (Armstrong and Hyder, 2013). The analyses contained some major assumptions due to the poor resolution of the Sea Angling 2012 survey results at the scale of IFCA regions, so represented crude inferences based on stated assumptions and cannot be construed as statistical estimates. However, the economic impact of sea angling in the eastern region was thought to be tens of millions of pounds (Armstrong and Hyder, 2013).

Sea angling economics have been estimated within the sea angling diary programme (www.seaangling.org). The total economic impact, GVA, and employment supported by sea angling in the UK in 2016 and 2017 was estimated using an Input-Output method. Expenditure on trips and major items (capital) was collected from a sample of sea anglers and raised to the total population using information from a national survey of sea angling participation. Taxes were removed, and expenditure partitioned between industrial sectors accounting for imports. Expenditure on trips and major items (capital) was collected from 250 sea anglers in 2016 and 576 in 2017 and raised to the total population giving an annual expenditure of £1.11 billion in 2016 and £1.32 billion 2017. The total economic impact was estimated to be £1.57 billion, providing £696 million of GVA and supporting in total around 13,500 jobs in 2016, and was slightly higher in 2017, with a total economic impact of sea angling was £1.94 billion, providing £847 million of GVA and supporting directly and indirectly around 16,300 jobs. Comparison with 2012 surveys showed similar per angler expenditure, but lower total economic impact, GVA, and employment in 2016 and 2017.

Several studies have been done that assess both the economic impact and value of sea angling in the UK. These have been designed to provide economic information at a national level, and there are no specific studies of the area around Sizewell. A method was developed to assess the impact of sea angling in the eastern region, but major caveats surround the robustness of the approach (Armstrong and Hyder, 2013).

Here, this method is applied to generate an estimate the potential economic impact at a regional and county level using data from national surveys.

9.1 Methods

Assessment of sea angling economic impact have been done at a national level, but provide information on regional participation that allows regional level assessments to be derived. The robustness of the estimates is questionable due to the major assumptions that need to be made due to the poor resolution of survey results at a regional scale. As a result, these figures provide crude inferences based on stated assumptions, and cannot be construed as statistical estimates (Armstrong and Hyder, 2013). Here, the approach proposed by Armstrong and Hyder (2013) to generate regional and county level estimates of the economic impact of sea angling was applied to national surveys from 2012, 2016 and 2017. The regional level impact (I_R) can be expressed in terms of expenditure, economic impact, GVA or jobs created. This can be calculated from the total impact nationally (I_T), using the proportion of spend in the location relative to the average (α) and the numbers of anglers in the region based on the number of sea anglers nationally (n) and participation rates in the region (γ) using the following equation:

$$I_R = \alpha n \gamma I_T \quad (1)$$

It is not known precisely how the annual total spend per angler varies between regions, due to the small sample sizes by region in both the ONS and economic surveys. Site-specific case studies in five locations around England (Deal, Liverpool, Northumberland, Lowestoft, Weymouth) were done in 2012. For Lowestoft, the mean expenditure was below the average across all sites for day (64%) and overnight (54%) trips, and capital items (75%) (Armstrong *et al.*, 2013). Hence, there is some evidence that sea anglers in Lowestoft have a below-average expenditure on sea angling. These results are, however, heavily driven by the inclusion of Weymouth where charter boat fishing was most prevalent and spend per angler on individual trips and on major items was relatively high. This highlights the difficulty in making regional inferences from small sample sizes. Despite these issues, a value of 0.75 was used for the proportion of spend in the location relative to the average.

An average of the number of anglers in England was used of 720,512 (n) and participation rate of 6% in the eastern region (γ). The expenditure, economic impacts (direct, indirect and induced), and GVA (direct, indirect and induced) were correct for inflation using the harmonised index of consumer prices for the UK from EUROSTAT (https://ec.europa.eu/eurostat/web/hicp/data/database accessed on 17 January 2019). Then the average expenditure, economic impacts (direct, indirect and induced), GVA (direct, indirect and induced) and FTEs were estimated for the Eastern region. Assuming that expenditure and participation rates are the same across the Eastern region (Lincolnshire, Norfolk, Suffolk), all quantities were estimated for Suffolk based on relative population size in 2017 from the ONS (https://www.ons.gov.uk). The population of Suffolk was around 31% of the total population of the region (Suffolk 756,978, Eastern region 2,406,539).

9.2 Results

The average per angler spend in 2018 prices was £993, that gave estimates of expenditure of £45.4 and £14.3 million in the Eastern region and Suffolk, respectively (Table 10). The total economic impact was £76.9 million with GVA of £24.9 million that supported 733, and £14.3 million economic impact, £7.8 million GVA and 231 FTEs in Suffolk (Table 10). Given the uncertainty in the data and the assumptions made, it is unlikely that these results are robust, but it was likely that expenditure, impact, and GVA in the region was in the order of tens of millions.

Table 10 Estimates of the total economic impact of sea angling in the Eastern and Suffolk regions (M represents million).

Measure	Per Angler (Eastern)	Total Eastern region	Total Suffolk
Angler spend	£993	£45.4M	£14.3M
Annual - direct impact	£711	£32.6M	£10.2M
Annual - indirect impact	£969	£44.4M	£14.0M
Annual - total impact	£1,681	£76.9M	£24.2M
GVA - Direct	£231	£10.6M	£3.3M
GVA - Indirect & induced	£313	£14.3M	£4.5M
GVA -Total	£544	£24.9M	£7.8M
FTEs - direct	----	369	116
FTEs - indirect & induced	----	364	115
FTEs - total	----	733	231

9.3 Discussion

Sea angling has a large economic impact on the UK economy, creating significant GVA and supporting many jobs. This macro-economic approach calculates the impact of the demand for recreational fishing on the regional or national economy. However, it is difficult to use this approach to judge the impact on the economy of a change in policy or management as these are usually incremental changes and needs information of marginal utilities. In addition, in the absence of recreational fishing, this expenditure could go to other activities (e.g. other hobbies, cars, etc.), so would still contribute to the economy.

Assessments of sea angling economic impact have been done at a national level, but provide information on regional participation that allows regional level assessments to be derived. The robustness of the estimates is questionable due to the major assumptions that need to be made due to the poor resolution of survey results at the regional scale. As a result, these figures provide crude inferences based on stated assumptions, and cannot be construed as statistical estimates (Armstrong and Hyder, 2013). Here, the approach proposed by Armstrong and Hyder (2013) to generate regional and county level estimates of the economic impact of sea angling was applied to national surveys from 2012, 2016 and 2017. It was clear that sea angling brings benefits to the region, but it was not possible to quantify the effect of the proposed build in the Sizewell area.

To assess the impact of the build and operation on sea angling, it would be necessary to capture the use and non-use value of recreational fishing and how this might change under different management scenarios, and usually willingness-to-pay (WTP) studies are applied (Parkkila *et al.*, 2010; EFTEC, 2015). This could be done using either choice experiments or travel cost modelling, but a simple first approach would be to consult with the local angling community. A simple focus group approach could be done to assess the impact on activity of the different phases of construction and operation. This should include understanding how angler behaviour might change, for example, would this lead to fewer trips or simply displace angler to other local areas. This would allow the impact of construction on sea angling to be assessed properly.

10 Spatiotemporal distribution of commercial fisheries

Table 11 gives the 10 most valuable species (by first sale value) landed from increasingly wider spatial areas (ICES rectangle 33F1, the wider Sizewell area and ICES Division IVc), in 2017 (MMO, 2018; 2017 data in prep). Species considered as key (Section 8.1.4) are shaded blue. In 33F1, whelks were the most valuable species, contributing to 49.1% of the total first sale value. This was followed by sea bass (14.5%) and sole (12.2%). Within the wider Sizewell area, whelks remained the most valuable species, contributing to 28.3% of the total first sale value, followed by sole (22.6%) and lobster (13.9%). Cockles were the most valuable species landed from IVc, contributing 25.3% to the total first sale value, followed by whelks (19.9%) and brown shrimp (12.7%).

Table 11 Top 10 most valuable species landed from ICES rectangle 33F1; the wider Sizewell area; and the southern North Sea in 2017, along with their rank in the top 10 and the percentage of the species value to the total fisheries first sale value (%).

	ICES Rectangle 33F1		Wider Sizewell area		ICES Division IVc	
	First sale value (£) rank	%	First sale value (£) rank	%	First sale value (£) rank	%
Whelks	279,001.61 [1]	49.1	1,232,784.01 [1]	36.6	3,367,726.89 [2]	23.9
Sea bass	82,261.95 [2]	14.5	234,607.80 [5]	7.2	372,462.42 [7]	2.6
Sole	69,218.93 [3]	12.2	387,514.20 [3]	11.5	790,826.31 [6]	5.6
Lobster	56,913.92 [4]	10.0	605,471.13 [2]	17.9	1,397,043.35 [4]	9.9
Thornback Ray	30,872.97 [5]	5.4	157,047.80 [7]	4.6	278,076.48 [8]	1.9
Herring	16,263.33 [6]	2.9	32,176.56 [9]	0.9	66,472.12 [10]	0.6
Brown shrimp	15,432.24 [7]	2.7	49,937.13 [8]	1.5	2,151,374.89 [3]	15.3
Scallops	8,676.92 [8]	1.5	8,686.92	0.3	92,026.84 [9]	0.7
Brown crab	5,375.22 [9]	0.9	224,988.84 [6]	6.7	901,359.67 [5]	6.4
Smoothhound	3,833.49 [10]	0.7	8,619.49	0.3	27,881.85	0.19
Cockles	-	0.0	1,784,295.24 [1]	0.5	4,279,545.46 [1]	30.4
Plaice	179.14	0.0	5,014.76	0.1	61,396	0.4
Turbot	317.68	0.1	3,581.67	0.1	38,535.35	0.3
Brill	387.78	0.1	2,057.92	<0.1	10,089.72	0.3
Horse mackerel	-	0.0	58.50	<0.1	730.34	<0.1
Cod	3,383.94	0.6	21,231.87 [10]	0.6	49,883.27	0.4

Monthly landings data to the ports of Lowestoft, Southwold, Aldeburgh, Orford, Felixstowe and Harwich; show distinct seasonality for many species (Table 12, MMO, 2018). Those species considered 'key' (see Section 8.1.4) have their names highlighted blue. The first sale value of sea bass peaked during mid-late spring, whereas cod peaked during early-mid spring (Table 12). Skates and rays are generally landed throughout the year, albeit peaking during March. Sole landings value peak from mid-summer to early autumn. Whelks peak in February and remain high throughout the spring. Brown crab are a late summer-autumn fishery, whereas lobster landings are high from April until winter, though landings noticeably peak during summer months. Shrimps and prawns (likely to be *Crangon crangon* and *Palaemon* spp.) peak to similar levels in January, May and June. Lastly, herring landings are high in March and more than doubles in November.

It could be considered that those species with consistently low values are being landed as bycatch, rather than as a target species.

Monthly landed weights for those species are given in Table 13. Sea bass, brill and cod were landed in the largest quantities within spring only, whereas mullet, sole and 'other' demersal species were at peak quantities within summer. Skates and rays were landed in large quantities throughout the year. Whelks were also landed in large quantities throughout the year, whereas lobsters peaked during summer. Herring were landed in biggest quantities within spring.

At the port level, whelks, sole, lobster, sea bass, brown crab, skates and rays, shrimps and prawns, herring, cod, and mullet contributed to the top 10 most valuable species (Figure 22) in 2017 (MMO, 2018). Most whelks tended to be caught by >10m vessels and landed to Lowestoft, with a smaller portion landed to Southwold. Sole, lobster, sea bass, skates and rays, cod, and mullet were landed to all five ports, whereas shrimps and prawns were exclusively landed to Lowestoft. As with whelks, brown crab were landed predominantly to Lowestoft.

The relative proportion of species landings to local ports are given in Figure 22. Whelks were landed to Lowestoft and Southwold only in almost equal measure, whereas ~75% crabs were landed to Lowestoft and the rest to Aldeburgh and Orford. Most sole was landed to Aldeburgh and Orford, Felixstowe, and Harwich, whilst cod was landed primarily to Felixstowe and Harwich. Sea bass landings appeared more evenly spread over the ports, albeit with Lowestoft, and Aldeburgh and Orford being landed to in the smallest proportions. All other species were landed to most or all ports.

Table 12 First sale value (£000s) of species landed to ports* near SZB in 2017, with months of most valuable landings highlighted; MMO (2018)

	Winter			Spring			Summer			Autumn		
	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Whelks	8.7	68.8	143.8	119.7	126.5	135.1	106.9	70.1	41.8	14.3	30.7	27.7
Sea bass	4.9	28.9	<0.1	7.0	46.2	43.4	7.1	6.8	5.4	11.8	3.9	1.2
Sole	3.9	0.7	0.6	4.0	14.5	23.2	26.5	38.3	53.5	38.9	18.7	20.7
Lobsters	4.2	2.8	0.9	2.8	<0.1	19.1	28.3	28.4	31.1	20.5	16.7	9.4
Skates and Rays	6.6	7.3	3.4	12.9	9.3	9.1	6.2	4.6	10.3	5.2	7.1	<0.1
Herring	2.1	0.6	0.9	4.3	2.1	0.1					2.3	9.5
Shrimps and Prawns	2.6	6.5	2.0	2.0	0.7	6.7	6.3	1.5	4.2		1.2	3.3
Crabs	0.4	0.2	<0.1	<0.1	0.1	0.4	1.0	0.9	77.1	27.7	0.9	38.4
Plaice	<0.1			<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1
Turbot	0.2	0.1	0.2	0.1	0.2	0.1		0.1	<0.1	0.1	<0.1	<0.1
Brill	0.1	0.1	<0.1	<0.1	0.5	0.1	0.1	0.1	0.1	0.1	<0.1	<0.1
Cod	0.5	1.0	0.4	5.7	5.2	1.5	0.2	<0.1	0.1	0.2	0.2	0.3
Cuttlefish						<0.1						
Dogfish	<0.1	0.1	0.5	0.1	0.1	0.4	<0.1	<0.1	0.1	0.1	0.1	0.8
Gurnard	<0.1	<0.1		<0.1	0.3	0.3	0.1	<0.1	<0.1	0.1	<0.1	<0.1
Lemon Sole	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1
Mackerel					<0.1		<0.1	0.2		<0.1	<0.1	<0.1
Mullet	<0.1					2.2	5.6	3.3	0.3	0.6		<0.1
Pollack	<0.1	<0.1		0.1	0.1	0.1	<0.1	<0.1		<0.1		
Squid												<0.1
Whiting	0.1	0.1	<0.1	0.3	0.1	0.1	<0.1	<0.1	0.1	0.1	0.1	0.2
Other Demersal	0.5	0.7	0.1	0.2	0.6	1.0	1.5	1.3	1.1	1.0	0.4	0.8
Other Pelagic	0.1	0.2										
Other Shellfish		1.4		4.0		2.9		2.1				

** Lowestoft, Southwold, Aldeburgh, Orford, Felixstowe, Harwich*

Table 13 Landed weight (t), by species, to ports* near SZB in 2017, with months of largest landed weights highlighted; MMO (2018)

	Winter			Spring			Summer			Autumn		
	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Whelks	8.7	62.5	131.2	110.1	117.2	122.2	98.7	66.1	40.6	14.3	28.9	26.7
Sea bass	0.4	2.6	<0.1	0.6	4.7	4.4	0.8	0.7	0.6	2.0	1.1	0.5
Sole	0.8	0.1	0.1	0.5	2.4	4.5	6.5	6.9	9.5	6.2	3.3	3.6
Lobsters	0.3	0.2	0.1	0.2	0.6	1.3	2.2	2.3	2.7	1.6	1.3	0.7
Skates and Rays	3.5	3.2	1.5	5.5	5.3	5.1	3.9	2.5	5.5	3.4	3.5	5.5
Herring	3.9	0.7	1.7	10.5	4.5	0.2					3.2	18.1
Shrimps and Prawns	0.6	1.0	0.4	0.3	0.1	0.8	0.9	0.2	0.5		0.3	0.7
Crabs	0.2	0.1	<0.1	<0.1	<0.1	0.2	0.5	0.4	44.6	15.9	0.6	21.8
Plaice	<0.1			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Turbot	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1
Brill	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cod	0.2	0.2	0.1	1.7	1.4	0.4	0.1	<0.1	<0.1	0.1	0.1	0.1
Cuttlefish						<0.1						
Dogfish	<0.1	0.9	1.6	0.3	0.5	1.6	0.2	<0.1	0.1	0.1	0.1	0.6
Gurnard	<0.1	<0.1		<0.1	0.1	0.2	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Lemon Sole	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1
Mackerel					<0.1		<0.1	<0.1		<0.1	<0.1	<0.1
Mullet	<0.1					0.7	2.8	2.0	0.2	0.3		<0.1
Pollack	<0.1	<0.1		0.1	0.1	0.1	<0.1	<0.1		<0.1		
Squid												<0.1
Whiting	0.1	0.1	<0.1	0.3	0.1	0.1	<0.1	<0.1	<0.1	0.1	0.1	0.2
Other Demersal	0.4	0.7	0.1	0.2	0.4	1.0	1.6	1.4	1.4	0.9	0.4	0.8
Other Pelagic	0.1	0.4										
Other Shellfish		0.4		1.3		0.7		0.5				

** Lowestoft, Southwold, Aldeburgh, Orford, Felixstowe, Harwich*

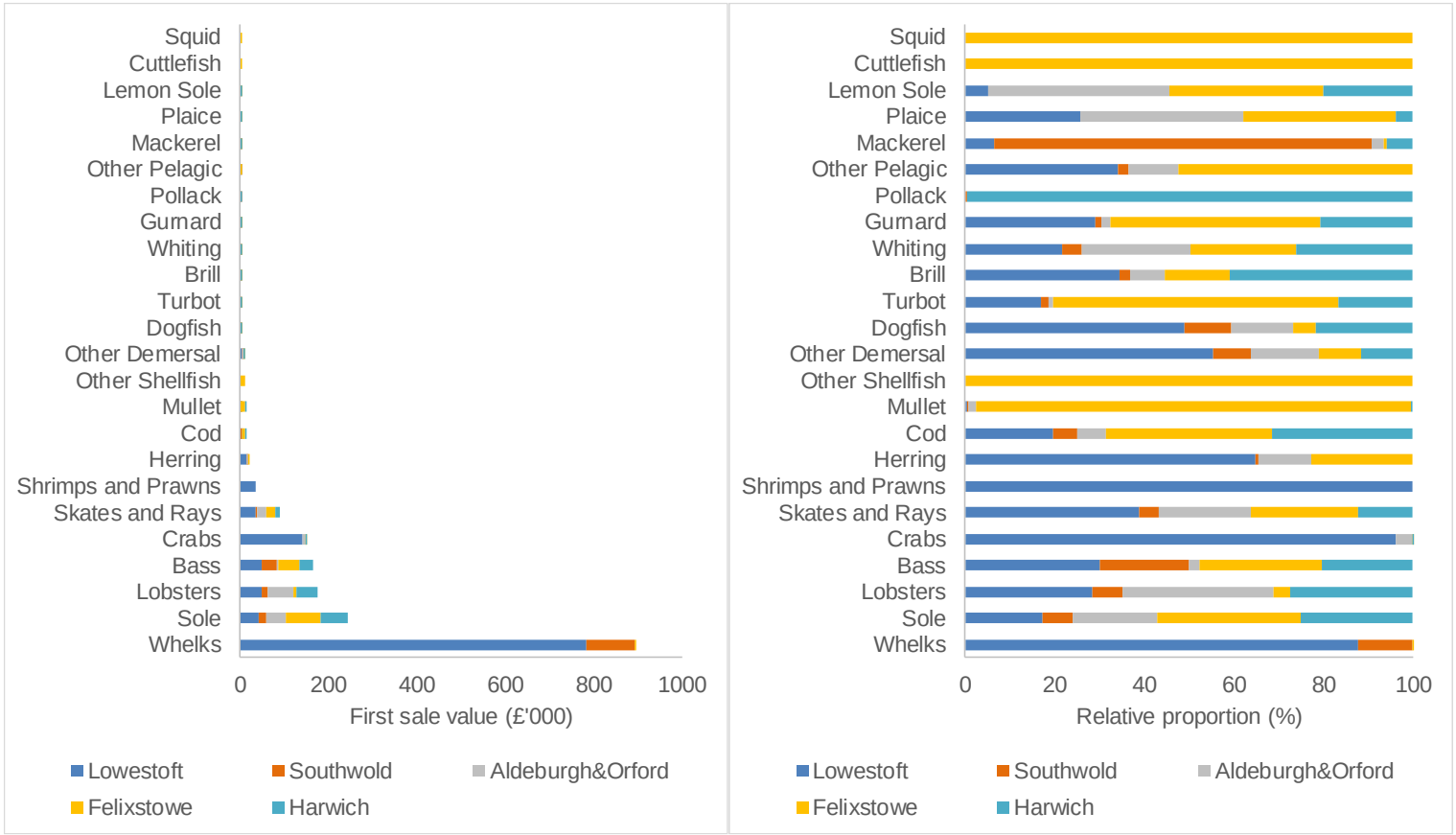

Figure 22 (Left) First sale value (£000s) and (Right) relative proportion (%) of species landed to ports near SZB in 2017; MMO (2018)

11 Summary of fishing activity in the study area

11.1 Commercial fisheries

58 fishing vessels operate close to the proposed Sizewell development, which contribute to up to 14.7% of the area's vessel activity. In ICES rectangle 33F1, shellfish are (as of 2017) the most valuable fishery by both ≤10m and >10m vessels, though with those ≤10m vessels generating the highest values.

Whelks were the most valuable species to the area in 2017, were primarily sold at Lowestoft, and contributed to almost 50% of species landings, followed by sea bass, sole, lobster, thornback ray, herring, brown shrimp, scallops, brown crab and smoothound.

Sea bass, sole, thornback ray and herring are further classed as 'key' species due to either their socio-economic value, though the proportion of their catches in 33F1, compared to their international catches from their stock units assessed by various ICES Working Groups, were very small. Nets were primarily responsible for the capture of sea bass in the local area, lines primarily responsible for the capture of thornback rays, and otter-trawls primarily responsible for the capture of sole. Whilst thornback ray were sold in consistent volumes throughout 2016, sole peaked in August and were in very low volumes over the winter months, and sea bass peaked in the summer, with no records during January and February.

11.2 Recreational fisheries

Sea angling is an important activity in the Sizewell area, with fishing throughout the year from both the shore and boats. However, there was limited data that focussed either on Sizewell or the eastern region of the UK. Hence, approaches had to be developed based on existing national surveys and utilise novel sources on data. Given the sparsity of the data available, the results from these analyses are very uncertain and not considered to be robust, rather providing a snapshot of the activities and interactions that are likely to occur.

There is evidence of regular sea angling activity at Sizewell throughout the year. However, the data available on is sparse and inconsistent, particularly for boat angling. Data from sea angling surveys are not at sufficient resolution to provide useful information and much of the initial data is based on expert judgement. For shore angling, the data from fixed cameras gave the most robust assessment of sea angling at Sizewell, but it was not possible to derive robust estimates of effort. There is information on the number of charter boats in the area, but no information on the number that target the area around Sizewell. Activity by private boats was not captured in any of the methods. However, boats were not recorded in many of the images from the fixed cameras, so are likely to be moving through rather than angling in the area.

Sea angling has a large economic impact on the UK economy, creating significant GVA and supporting many jobs. This macro-economic approach calculates the impact of the demand for recreational fishing on the regional or national economy. However, it is difficult to use this approach to judge the impact on the economy of a change in policy or management as these are usually incremental changes and needs information of marginal utilities as given by the demand function.

To obtain more information to assess potential impact, it would be prudent to consult the local angling community. A simple focus group approach could be done to validate the activity measures and assess the impact on activity of the different phases of construction and operation. This could include understanding how angler behaviour might change, for example, would this lead to fewer trips or simply displace angler to other local areas. To assess the impact of the build and operation on sea angling robustly, the use and non-use value of recreational fishing and how this might change under different scenarios is needed that would involve assessment of willingness-to-pay (WTP). An independent assessment of sea angling activity at Sizewell could be provided using bespoke camera-based approach. A combination of these approaches would allow a robust assessment of the impact of construction on sea angling to be assessed.

References

Anatec. 2014. Marine Traffic Survey – Summer 2014 - EDF Energy Sizewell C (Technical Note)

Anatec. 2015. Marine Traffic Survey – Winter 2014 - EDF Energy Sizewell C (Technical Note)

Armstrong, M., and Hyder, K. 2013. Sea angling 2012—a survey of recreational sea angling activity and economic value in England

Armstrong, M., Brown, A., Hargreaves, J., Hyder, K., Munday, M., Proctor, S., Roberts, A., et al. 2013. Sea Angling 2012 – a survey of recreational sea angling activity and economic value in England. Defra, London, UK. 16pp. 16 pp.

BEEMS Technical Report TR123. Review of commercial and recreational fisheries activity in the vicinity of Sizewell Power Station

BEEMS Technical Report TR345. Sizewell characterisation report – fish.

Cappell, R., and Lawrence, K. 2005. The Motivation, Demographics and Views of South West Recreational Sea Anglers and their Socio-economic Impact on the Region, *Invest in Fish South West* report, 1-121 pp.

Catchpole T., Ribeiro-Santos, Mangi, S.C., Hedley, C. and Grey, T.S. 2017. The challenges of the landing obligation in EU fisheries. Marine Policy. 82: 76-86.

Cisneros-Montemayor, A. M., and Sumaila, U. R. 2010. A global estimate of benefits from ecosystem-based marine recreation: Potential impacts and implications for management. Journal of Bioeconomics, 12: 245–268.

Clyne, F.J., Tipple, J.R. and McTaggart, K.A. 2006. Radiological Habits Survey: Sizewell, 2005. The Centre for Environment, Fisheries & Aquaculture Science, Environment (Cefas), Environment Report No. RL02/06.

Dillon, B. 2009. A Bio Economic Review of Recreational Angling for Bass (*Dicentrarchus labrax*). Thesis submitted to Scarborough Centre for Coastal Studies, University of Hull, UK. 27 pp.

Drew Associates. 2004. Research into the economic contribution of sea angling. Available from: http://resources.anglingresearch.org.uk/sites/resources.anglingresearch.org.uk/files/Economic_Impact_Sea_Angling_England_Drew_Report_2004.pdf (Accessed 19th March 2019).

Eero, M., Hjelm, J., Behrens, J., Buchmann, K., Cardinale, M., Casini, M., Gasyukov, P., Holmgren, N., Horbowy, J., Hùssy, K., Kirkegaard, E., Kornilovs, G., Krumme, U., Kòster, F.W., Oeberst, R., Plikshs, M., Radtke, K., Raid, T., Schmidt, J., Tomczak, M.T., Vinther, M., Zimmermann, C., and Storr-Paulsen M. 2015a. Eastern Baltic cod in distress: biological changes and challenges for stock assessment. ICES Journal of Marine Science, 72: 2180-2186.

Eero, M., Strehlow, H. V, Adams, C. M., and Vinther, M. 2015b. Does recreational catch impact the TAC for commercial fisheries? ICES Journal of Marine Science, 72: 450–457. https://academic.oup.com/icesjms/article-lookup/doi/10.1093/icesjms/fsu121.

EIFCA. 2014. see www.eastern-ifca.gov.uk

ESFJC. 2010. Data and information provided by email from the Eastern Sea Fisheries Joint Committee, April - May 2010 (not available at www.esfjc.com).

EU. 2001. Council Regulation (EC) No. 1639/2001 of 25 July 2001 establishing the minimum and extended Community programmes for the collection of data in the fisheries sector and laying down detailed

rules for the application of Council Regulation (EC) No. 1543/20. Official Journal of the European Union, L222: 53–115.

EU. 2006. Council Regulation (EC) No 1967/2006 of 21 December 2006 concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea, amending Regulation (EEC) No 2847/93 and repealing Regulation (EC) No 1626/94. Official Journal of the European Union, L409: 53–115.

EU. 2008. Council Regulation (EC) No. 199/2008 concerning the establishment of a Community framework for the collection, management and use of data in the fisheries sector and support for scientific advice regarding the Common Fisheries Policy. Official Journal of the European Union, L60: 1–12.

EU. 2009. Council Regulation (EC) No. 1224/ 2009 of 20 November 2009 Establishing a Community control system for ensuring compliance with the rules of the Common Fisheries Policy, amending Regulations (EC) No. 847/96, (EC) No 2371/2002, (EC) No. 811/2004, (EC) No. Official Journal of the European Union, L343: 1–50.

EU. 2010. COMMISSION DECISION of 18 December 2009 adopting a multiannual Community programme for the collection, management and use of data in the fisheries sector for the period 2011-2013. Official Journal of the European Union, L41: 8–71.

EU. 2015. COM (2015) 559. Proposal for a Council Regulation fixing for 2016 the fishing opportunities for certain fish stocks and groups of fish stocks, applicable in Union waters and, for Union vessels, in certain non-Union waters. 2015/0259. 40 pp.

EU. 2016. Commission Implementing Decision (EU) 2016/1251 of 12. July 2016 adopting a multiannual Union programme for the collection, management and use of data in the fisheries and aquaculture sectors for the period 2017-2019. Official Journal of the European Union, 207: 113–177.

Garrod, C. J.J., Clyne, F. J., Rumney, P., Elliott, J., Smedley, C. A. and Ly, V.E. 2011. Radiological Habits Survey: Sizewell, 2010, Final Report. CEFAS Environment Report RL 12/11: 168 pp.

Gray, M. J. 1995 The coastal fisheries of England and Wales, Part III: A review of their status 1992–1994. Fisheries Research Technical Report, MAFF Directorate of Fisheries Research (Lowestoft), 100: 99 pp.

Grilli, G., Curtis, J., Hynes, S., and O'Reilly, P. 2018. Sea Bass Angling in Ireland: A Structural Equation Model of Catch and Effort. Ecological Economics, 149: 285–293. http://linkinghub.elsevier.com/retrieve/pii/S0921800917315549.

Hartill, B. W., Edwards, C. T. T., and Jacobson, L. 2015. Comparison of recreational harvest estimates provided by onsite and offsite surveys: detecting bias and corroborating estimates. Canadian Journal of Fisheries and Aquatic Sciences, 72: 1379–1389. http://www.nrcresearchpress.com/doi/10.1139/cjfas-2014-0451.

Hartill, B. W., Payne, G. W., Rush, N., and Bian, R. 2016. Bridging the temporal gap: Continuous and cost-effective monitoring of dynamic recreational fisheries by web cameras and creel surveys. Fisheries Research, 183: 488–497. Elsevier B.V. http://dx.doi.org/10.1016/j.fishres.2016.06.002.

Hirst, D. 2015. Reforming the Common Fisheries Policy (CFP), 2014-20, Briefing Paper, CBP-05957, House of Commons Library.

Hyder, K., Radford, Z., Prellezo, R., Weltersbach, M. S., Lewin, W. C., Zarauz, L., Ferter, K., Ruiz, J., Townhill, B., Mugerza, E., and Strehlow, H. 2017. Research for PECH Committee - Marine recreational and semi-subsistence fishing - its value and its impact on fish stocks. European Parliament, Policy Department for Structural and Cohesion Policies, Brussels, 134pp. 140 pp.

http://www.europarl.europa.eu/RegData/etudes/STUD/2017/601996/IPOL_STU(2017)601996_EN.pdf

Hyder, K., Weltersbach, M. S., Armstrong, M., Ferter, K., Townhill, B., Ahvonen, A., Arlinghaus, R., Baikov, A., Bellanger, M., Birzaks, J., Borch, T., Cambie, G., de Graaf, M., Diogo, H.M.C., Dziemian, L., Gordoa, A., Crzebielec, R., Hartill, B., Kagervall, A., Kapiris, K., Karlsson, M., Kleiven, A.R., Lejk, A.M., Levrel, H., Lovell, S., Lyle, J., Moilanen, P., Monkman, G., Morales-Nin, B., Mugerza, E., Martinez, R., O'Reilly, P., Olesen, H.J., Papadopolous, A., Rita, P., Radford, Z., Radtke, K., Roche, W., Rocklin, D., Ruiz, J., Scougal, C., Silvestri, R., Skov, C., Steinback, S., Sundelöf, A., Svagzdys, A., Turnbull, D., Hammen, T.v.d., Voorhees, D.v., Winsen, F.v., Verleye, T., Veiga, P., Vølstad, J-H., Zarauz, L., Zoulubas, T., and Strehlow, H.V. 2018. Recreational sea fishing in Europe in a global context-Participation rates, fishing effort, expenditure, and implications for monitoring and assessment. Fish and Fisheries, 19: 225–243. http://doi.wiley.com/10.1111/faf.12251.

ICES. 2010. Report of the Planning Group on Recreational Fisheries (PGRFS). Bergen; Norway. ICES CM 2010/ACOM:34. 162 pp.

ICES. 2015. Report of the Working Group on Recreational Fisheries Surveys (WGRFS). 1-5 June 2015, Sukarrieta, Spain. 111 pp.

ICES. 2016. Report of the Working Group on Celtic Seas Ecoregion (WGCSE), 4–13 May 2016, Copenhagen, Denmark. ICES CM 2016/ACOM:13, Copenhagen, Denmark, p.1033. 1033 pp.

ICES. 2017. Report of the Working Group on Recreational Fisheries Surveys (WGRFS), 6–10 June 2016, Nea Peramos, Greece. ICES CM 2013/ACOM:23. 76 pp.

ICES. 2018. Report from the Working Group on Recreational Fisheries Surveys (WGRFS), 11–15 June 2018, Faro, Portugal. ICESCM 2018/EOSG:19. 109 pp.

Jessop, R. W., Strigner, R., Thompson, S., and Welby, P. R. 2013. Eastern IFCA research Report 2013. 339pp.

Keller, K., Steffe, A. S., Lowry, M., Murphy, J. J., and Suthers, I. M. 2016. Monitoring boat-based recreational fishing effort at a nearshore artificial reef with a shore-based camera. Fisheries Research, 181: 84–92. Elsevier B.V. http://linkinghub.elsevier.com/retrieve/pii/S0165783616300935.

Lynch, T. P., Alderman, R., and Hobday, A. J. 2015. A high-resolution panorama camera system for monitoring colony-wide seabird nesting behaviour. Methods in Ecology and Evolution, 6: 491–499. http://doi.wiley.com/10.1111/2041-210X.12339.

McMinn, C. 2013. Report on the Survey of Recreational Sea Angling in Northern Ireland. Belfast, Northern Ireland. AFBI Fisheries and Aquatic ecosystems branch, Belfast, North Ireland, 60pp.

Miller, R. 1990. Effectiveness of Crab and Lobster Traps, Canadian Journal of Fisheries and Aquatic Sciences 47(6):1228-1251

MMO (2018). UK Sea Fisheries Statistics 2017. See https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/742793/UK_Sea_Fisheries_Statistics_2017.pdf.

Monkman, G., Cambie, G., Hyder, K., Armstrong, M., Roberts, A., and Kaiser, M. J. 2015. Socioeconomic and Spatial Review of Recreational Sea Angling in Wales. Fisheries and Conservation Report No. 52, Bangor University. pp 176 pp.

Pawson, M. G. and Benford, T. E. 1983. The coastal fisheries of England and Wales; Part I: A review of their status in 1981. Internal Report, MAFF Directorate of Fisheries Research (Lowestoft), 9: 54 pp.

Pawson, M. G. and Rogers, S. I. 1989. The coastal fisheries of England and Wales, Part II; A review of their status in 1988. Internal Report, MAFF Directorate of Fisheries Research (Lowestoft), 19: 64 pp.

Pawson, M. G., Pickett, G. D. and Walker, P. 2002. The coastal fisheries of England and Wales; Part IV: A review of their status in 1999–2001. Science Series Technical Report, CEFAS (Lowestoft), 116: 83 pp.

Pollock, K. H., Jones, C. M., and Brown, T. L. 1994. Angler surveys and their application to fisheries management. American Fisheries Society, Special Publication 25, Bethesda, Maryland.

Radford, A., and Riddington, G. 2009. Economic Impact of Recreational Sea Angling in Scotland. Scottish Government, Edinburgh, UK. 259 pp.

Radford, Z., Hyder, K., Zarauz, L., Mugerza, E., Ferter, K., Prellezo, R., Strehlow, H. V., Townhill, B., Lewin W-C., and Weltersbach, M.S. 2018. The impact of marine recreational fishing on key fish stocks in European waters. PLOS ONE, 13: e0201666. http://dx.plos.org/10.1371/journal.pone.0201666.

Roberts, A., Munday, M., Roche, N., Brown, A., Armstrong, M., Hargreaves, J., Pilgrim-Morrison, S., Williamson, K., and Hyder, K. 2017. Assessing the contribution of recreational sea angling to the English economy. Marine Policy, 83: 146–152. Elsevier Ltd. http://linkinghub.elsevier.com/retrieve/pii/S0308597X16305474.

Sainsbury, J. 1996. Commercial fishing methods, 3rd ed. Oxford. Fishing News Books, 359 pp.

Simpson, D., and Mawle, G. W. 2005. Public Attitudes to Angling 2005. A survey of attitudes and participation in England & Wales. Environment Agency, Bristol, UK. 62 pp.

Simpson, D., and Mawle, G. W. 2010. Public Attitudes to Angling 2010. A survey of attitudes and participation in England & Wales. Environment Agency, Bristol, UK. 67 pp.

Smith, M. T., Pawson, M. G., and Bailey, A. 2011. A baseline study of Recreational Sea Anglers: the species and areas targeted, techniques used and acceptability of proposed Marine Conservation Zones. Report to Natural England. 744 pp.

TDI. 2013. Socio-economic study of recreational angling in Ireland. Tourism Development International, Dun Laoghaire, Ireland. 161 pp.

Thomson, C. J. 1991. Effects of the Avidity Bias on Survey Estimates of Fishing Effort and Economic Value. American Fisheries Society Symposium 12, 12: 356–366.

Toivonen, A.-L., Roth, E., Navrud, S., Gudbergsson, G., Appelblad, H., Bengtsson, B., and Tuunainen, P. 2004. The economic value of recreational fisheries in Nordic countries. Fisheries Management and Ecology, 11: 1–14. file:///E:/300/325 - Ontario Ministry of Natural Resources/3. Resources and References/Norway/Toivonen et al (2004) Fish. Mgmt & Ecology - The economic value of recreational fisheries in Nordic countries.pdf.

UK Government. 2005. The Registration of Fish Buyers and Sellers and Designation of Fish Auction Sites Regulations 2005 Statutory Instrument 2005 No. 1605: http://www.opsi.gov.uk/si/si2005/20051605.htm.

Veiga, P. 2012. Recreational shore fishing in southern Portugal: biological and socio-economic aspects and perspectives for management. Universidade do Algarve. 1-175 pp.

Wakefield, C. B., Santana-Garcon, J., Dorman, S. R., Blight, S., Denham, A., Wakeford, J., Molony, B. W., et al. 2017. Performance of bycatch reduction devices varies for chondrichthyan, reptile, and cetacean mitigation in demersal fish trawls: assimilating subsurface interactions and unaccounted mortality. ICES Journal of Marine Science: Journal du Conseil, 74: 343–358. https://academic.oup.com/icesjms/article-lookup/doi/10.1093/icesjms/fsw143.

Walmsley, S.A. and Pawson, M. 2007. The coastal fisheries of England and Wales. V. A review of their status 2005-06. Science Series Technical Report No. 140, Centre for Environment, Fisheries and Aquaculture Science (Cefas), Lowestoft, 83 pp

Walmsley, S. Mynott, F, and Ellis, J. R. 2019. The coastal fisheries of England and Wales, Part VI: A review of their status 2016–2017. Report to Defra, in prep.

Williams, C., and Davies, W. 2018a. The value of the small-scale commercial fishing fleet and recreational charter fleet to Weymouth : a tale of two fisheries . London, UK. 56 pp.

Williams, C., and Davies, W. 2018b. A tale of three fisheries. The value of the small-scale commercial fishing fleet, aquaculture and the recreational charter boat fleet, to the local economy of Poole. London, UK. 41 pp.

Appendix A Acronyms used in this report

A.1 Cefas 3-letter code, common name and scientific names of fish and shellfish

Acronym	Common name	Scientific name
BLL	Brill	*Scophthalmus rhombus*
BSS	Sea bass	*Dicentrarchus labrax*
COD	Cod	*Gadus morhua*
CRE	Edible Crab	*Cancer pagurus*
CSH	Brown Shrimp	*Crangon crangon*
DAB	Dab	*Limanda limanda*
DGS	Spurdog	*Squalus acanthias*
FLE	Flounder	*Platichthys flesus*
HER	Herring	*Clupea harengus*
LBE	European Lobster	*Homarus gammarus*
LEM	Lemon Sole	*Microstomus kitt*
NEP	Nephrops	*Nephrops norvegicus*
PLE	Plaice	*Pleuronectes platessa*
RJC	Thornback Ray	*Raja clavata*
RJH	Blonde Ray	*Raja brachyura*
RJM	Spotted Ray	*Raja montagui*
ROE	(Fish Roe)	-
SCE	Scallops	*Pecten maximus*
SKA	Skate	-
SMD	Smoothound	*Mustelus mustelus*
SOL	Dover Sole	*Solea solea*
SPR	Sprat	*Sprattus sprattus*
SYC	Lesser spotted dogfish	*Scyliorhinus canicula*
TUR	Turbot	*Scophthalmus maximus*
WHE	Common whelk	*Buccinum undatum*

A.2 ICES Working Groups and their acronyms

Working Group Acronym	Working Group Full Name
WGNSSK	Working Group for the Assessment of Demersal Stocks in the North Sea and Skagerrak
WGCSE	Working Group on Celtic Seas Ecoregion
HAWG	Herring Assessment Working Group
WGEF	Working Group on Elasmobranch Fishes
WGWIDE	Working Group on Widely Distributed Stocks