Science Series
Technical Report no.128

Catalogue of Defra historical catch and effort charts: six decades of detailed spatial statistics for British fisheries

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Contents

1. Summary

This report describes an inventory of over 37,000 historical and previously uncatalogued 'Statistical Charts' that provide detailed information on locations of catches landed by British fishing vessels. For over 60 years (1913–81 except war years), these charts were produced by the Directorate of Fisheries Research, now the Centre for Environment, Fisheries and Aquaculture Science (Cefas) Lowestoft, UK, where they are also currently held. Each chart shows, for a specific region, fleet component, and fish species, (1) the total quantity of fish landed in England and Wales and/or Scotland; (2) the average catch per 100 hours of fishing; and/or (3) the number of hours fishing. These statistics are shown for each ICES rectangle (1° longitude by 30' latitude) and combined for the entire region. The charts show either monthly or annual statistics, and comprise of 2,922 annual charts and 34,416 monthly charts. Regions and periods covered include: North Sea (1913–81 excluding both World Wars), Iceland (1952–73), Faroe (1946–80), West of Scotland and Rockall (1955–81), West of Ireland and Channels (including Irish and Celtic Sea, English and Bristol Channel: 1972–81). The majority of charts focus on demersal landings; from 1977–81, pelagic landings are also provided. The most complete region- and fleet-specific time-series is that on 'first-class steam trawlers' in the North Sea (1913–76). Detailed information is provided in this report on the temporal, regional, species and fleet coverage of the 'Statistical Charts'; searching is facilitated by a set of electronic spread-sheets included. The history of each fleet component is outlined, focusing on the periods and regions where charts are available. Combined, these charts provide a rich data source for analysing long-term, spatial changes in fisheries and fish stocks, including possible effects of environmental and anthropogenic factors.

2. Introduction

Historical fisheries datasets are of key importance for studies on long-term changes in fish stocks and fisheries, and on the possible effects of environmental and anthropogenic factors. Of particular usefulness are datasets collected in a consistent way over a number of decades, especially if they cover a large geographical area. However, such data are relatively scarce, especially for earlier periods. Moreover, much of the older information that there is, has remained uncatalogued, and therefore largely been neglected. The cataloguing of historical datasets is a first step towards identifying what information is available, and towards directing further research (for example, see Goodwin *et al*. [2001] for a catalogue on logbooks from British marine research vessels, covering the period 1904–1970).

The present report describes an inventory of over 37,000 unpublished historical 'Statistical Charts' held at the Centre for Environment, Fisheries and Aquaculture Science (Cefas), Lowestoft, UK. These charts provide annual and monthly fisheries statistics at a fine spatial scale for the period 1913–81 (excluding both World Wars). More specifically, they show the annual and monthly landings and catch rates per fish species, and the fishing effort for various components of the British commercial fishing fleet. These values are indicated separately for each rectangle of 1° longitude by 30' latitude (equivalent to ICES rectangles) as well as for the entire area charted (generally equivalent to ICES fishing areas). The largest subset of charts covers the North Sea (both pre- and post-war years); smaller but still substantial subsets of charts cover the Faroe Grounds, Iceland, West of Scotland and Rockall, the Irish and Celtic Seas and English Channel (post-war years). The focus is on demersal fisheries, with only a small proportion of charts devoted to pelagic fisheries. Combined, this set of 'Statistical Charts' provides consistent, standardised data over a considerable time-span, for Britain's former and current fishing grounds, covering an important portion of the fishing history of this nation.

This report first outlines the original source information of the charted data. Second, the general format of the charts is described. Third, a detailed overview is given of the temporal, spatial, species, and fleet coverage of the charts, where the full series of charts is subdivided into a small number of subsets according to fleet and region. Reference is made to an on-line set of electronic spread-sheets that may facilitate searching what material is available. Finally, locating individual charts is made possible via reference numbers provided in both the report and worksheets; these relate to the numbered box files, stored at Cefas, that contain the actual charts.

3. Source of the data

The charts were compiled by scientists and their support staff at the Directorate of Fisheries Research (DFR), which is the predecessor of Cefas, Lowestoft. The Directorate originally belonged to the Ministry of Agriculture and Fisheries (MAF), London, which later became the Ministry of Agriculture, Fisheries and Food (MAFF); it is currently an Executive Agency of the Department for Environment, Food and Rural Affairs (Defra).

The charts were based on detailed commercial fisheries statistics, collected by Ministry staff at fishing ports throughout Britain. The systematic collection of sea fisheries statistics was first undertaken in England and Wales in 1886, but was originally confined to records of the daily quantity and value of only 16 fish species landed. This collecting system was significantly improved in 1906, to include particulars of the fishing grounds visited and the number of days absence from ports, as well as an increased number of fish species. In 1913, information on the time actually spent fishing was first collected as a more accurate measure of fishing 'effort' than days absence. From 1906–19, origins of landings were ascribed to fairly broad depth-related regions in the North Sea; in 1920 the current system was adopted by which all landings are attributed to rectangles of 1° longitude by 30' latitude (strictly: attributed to those rectangles where at least 70% of the landing was caught). From 1923–66 many charts also included landings data for Scottish ports (some charts show exclusively Scottish landings). These were collected by the Scottish Home Department (SHD), Edinburgh, now the Scottish Executive Environmental Rural Affairs Department (SEERAD). Edser (1925) provides a fairly extensive description of the early development of fisheries statistics methodology; for a recent update see Appendix 2 of *UK Sea Fisheries Statistics 2003* (Defra, London, 2004).

Further processing and compiling of the data into charts was carried out at the Directorate in Lowestoft, where the rectangle-specific statistics on landings, catch rates, and fishing effort were hand-written on pre-fabricated blank chart outlines. To our knowledge, the majority of the original charted material has not been published before. However, subsets of the charts did form the basis for various publications, including a number of papers in *Fishery Investigations, Series II* (MAF, later MAFF, London). For example, see Borley and Thursby-Pelham (1925, 1926); Thursby-Pelham (1928, 1932); Graham (1934); and Gulland (1961).

The data in the charts stem from the same original source as those used for the annual series *Sea Fisheries Statistical Tables - England and Wales* (now incorporated in *UK Sea Fisheries Statistics*) produced by Defra and its predecessors MAF and MAFF, and the *Scottish Sea Fisheries Statistical Tables* (now *Scottish Fisheries Statistics*) produced by SHD (SEERAD). However, both these published 'Statistical Tables' series do not make any mention or reference to the 'Statistical Charts' covered in the present report and do not provide the geographical detail provided by the charts.

The blank charts were produced by the Ordnance Survey, Southampton, during the earlier decades (North Sea charts before 1965), and later by the cartographic section of the Directorate of Fisheries Research, Lowestoft (North Sea charts after 1965 and all charts for other areas).

4. Chart format

Figure 1 illustrates the typical format of the 'Statistical Charts', in this case for the North Sea (ICES Sub-area IV). The charts usually cover an entire ICES Sub-area or one to several Divisions, although a small number of charts do not match well with existing ICES fishing areas. The chart format for the other geographic regions broadly agrees with that illustrated here for the North Sea (see Section 5 for an overview of regions charted).

The charts provide either annual or monthly fisheries statistics, which are indicated separately for each ICES rectangle and usually also for the entire area. The specific chart of Figure 1 provides landings and catch rates for all kinds of demersal fish, captured in 1937 by British 'first-class' steam trawlers (see Section 5.1.1 for further information on this fleet). Upper figures in each rectangle show the quantity landed, lower figures show the average catch per 100 hours fishing. The bottom right-hand corner of the graph shows the global values for the entire North Sea and, under 'Rectangle unknown', the quantity landed that could not be assigned with reasonable confidence to any one rectangle (see Edser [1925] and Graham [1934] for details on assigning landings to specific rectangles).

Additional, separate charts show fishing effort as total number of hours fished per rectangle and per region. In a few charts, effort is quantified as the number of fishing trips, or the number of days absence from ports.

It should be noted that for most of the period covered by the charts, landings are shown in hundred-weight (cwt). The imperial measurement system was replaced by the metric system in 1973, whereafter the landings are shown in metric tonnes. The conversion from cwt to metric tonnes is as follows:

20 cwt = 1 ton (imperial), and
1 ton (imperial) = 1.016 tonne (metric), i.e.
1 cwt = 0.05080 tonne (metric).

It may also be noted that the numbering of rectangles in the 'Statistical Charts' differs from the present ICES numbering; this is illustrated in Figure 1. For example, Amsterdam is located in rectangle J3 according to the 'Statistical Charts' notation, and in rectangle 33F4 according to the ICES notation. Some of the charts produced after 1972 provide both rectangle notations (e.g. see Figure 20). As the latitudes and longitudes are shown on all charts, this should be no cause of confusion.

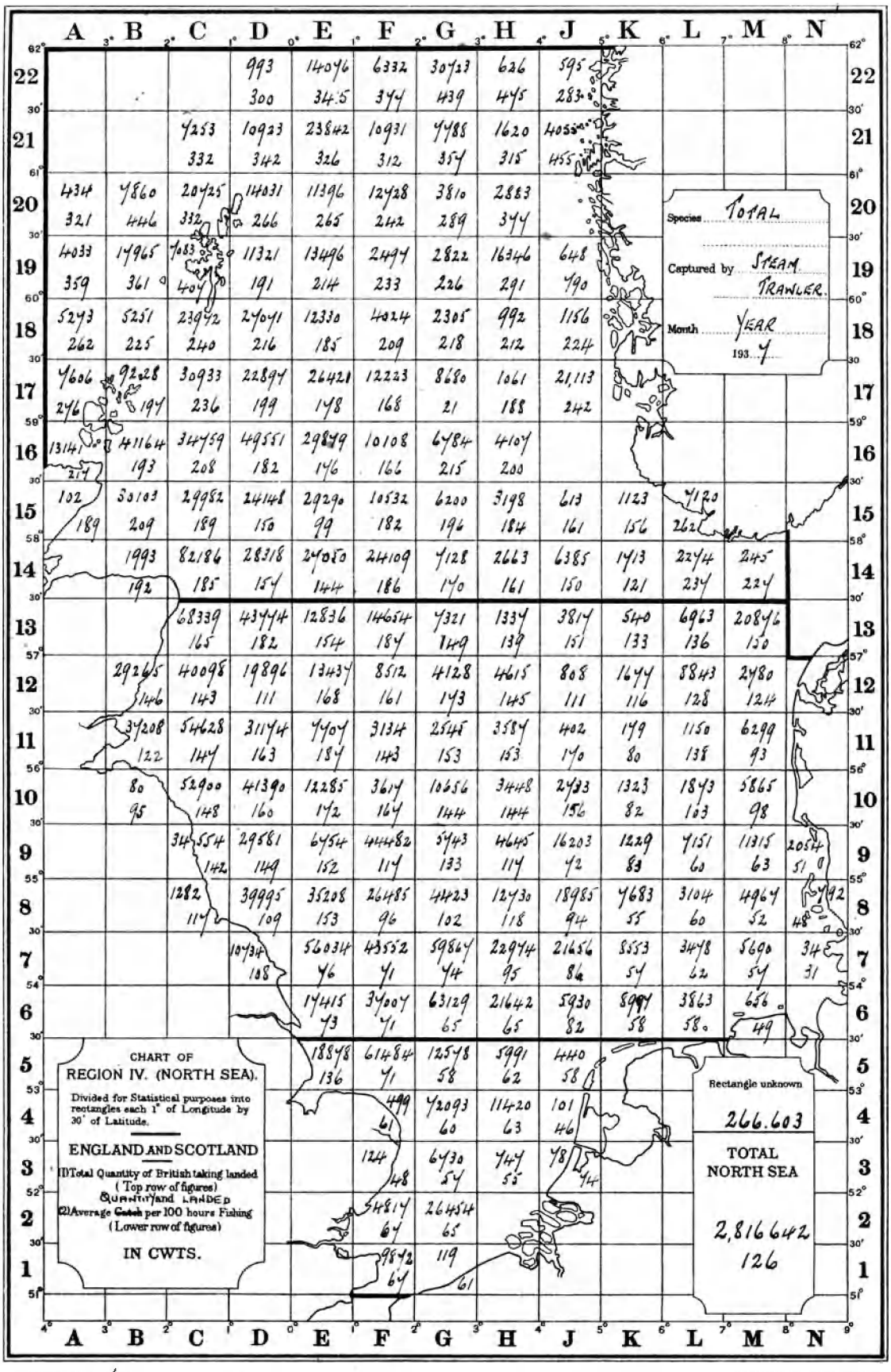


Figure 1. Example of 'Statistical Chart' for the North Sea, showing landings and catch rates of total demersal fish by British first-class steam trawlers in 1937. See text for explanation.

5. Overview of charts

This section describes regional, temporal, fleet, and species coverage of the 'Statistical Charts', based on an inventory carried out between October 2004 and February 2005. It includes all charts that could be recovered from various archives at Cefas. The list, however, may not be entirely complete for all statistical charts ever produced at Cefas. For example, no pre-war charts were found on North Sea brill and halibut distribution; but a paper by Borley and Thursby-Pelham (1926) suggests that such charts did exist. Neither were charts on distribution of North Sea plaice sorted by size recovered; yet they are referred to in another paper by these authors (Borley and Thursby-Pelham, 1925). Even though the number of 'lost' charts is unknown, the overview given below is, by and large, likely representative of the vast majority of charts produced over the years.

Annual and monthly charts – In total, 37,338 'Statistical Charts' were recovered. Of these, 2,922 and 34,416 charts, respectively, provide annual and monthly fisheries statistics (hereafter referred to as annual and monthly charts).

Demersal and pelagic landings – About 95% of the charts describe landings of demersal fish species, mainly caught by trawlers and to a lesser extent by vessels using Danish seine nets or long lines. Charts on demersal species are available for the entire time-span 1913–1981 exluding both World Wars. A much smaller number of 'pelagic charts' (5% of all charts) describe landings of pelagic species, available only for the years 1977–81. These were caught by liners, motor trawlers, pair trawlers, purse seiners and fixed nets. It may be mentioned that the above division between 'demersal' and 'pelagic' charts is not entirely strict: the former may sometimes include recordings of pelagic species (herring, mackerel) if these were caught in significant quantities by trawlers targeting demersal fish.

Regions – Table 1 describes the regions charted, with temporal coverage and number of charts per region. All recovered charts before WWII cover the North Sea. The statistical chart system was extended in 1946 to include the Faroes (ICES Division Vb), in the 1950s to include Iceland (Division Va) and the area 'West of Scotland and Rockall' (Sub-area VI), and in the 1970s to include the area 'West of Ireland and Channels' (Sub-area VII). About 2000 charts from the 1960s labeled 'Scottish charts', probably not produced at Cefas but at Fisheries Research Services (FRS), Aberdeen, cover an area around Scotland and the Faroes not corresponding well with definitions of ICES fishing areas.

Country – All charts show landings by British-registered vessels exclusively. However, the country into which landings were made may either be England and Wales; England and Scotland; Scotland only; or for some of the earliest charts, England only (there are no charts on landings in Northern Ireland). Table 2 provides an overview. Note that North Sea statistical charts initially only covered landings in England, from 1923–66 landings in England and Scotland, thereafter landings in England and Wales.

Table 1. Overview of charted regions, including temporal coverage and numbers of annual and monthly charts available per region.

Region	ICES notation	Temporal coverage	Annual charts	Monthly charts
North Sea	IV	1913	*5*	*60*
		1920–39	*1,290*	*11,929*
		1947–81	*893*	*10,963*
		All years	2,188	22,952
Iceland	Va	1952–73	70	1,496
Faroe	Vb	1946–80	177	2,154
West of Scotland and Rockall	VI	1955–81	310	3,606
Irish Sea	VIIa	1972–76	45	540
West of Ireland and Channels	VII	1977–81	124	1,489
Seas around Scotland and Faroe	IV (pt.), Vb, VIa	1961–66	0	2,111
North-east Atlantic		1925–30	8	68
All regions			**2,922**	**34,416**

Table 2. Country into which landings were made, as mentioned on 'Statistical Charts', for different regions of capture, including temporal coverage. All landings were made by British vessels exclusively

Region	Country	Temporal coverage
North Sea	England	1913, 1920–22
	England and Scotland[a]	1923–38, 1947–66
	England and Wales	1961, 1965–81
	Scotland	1966–67
Iceland	England and Wales	1952–73
	Scotland	1957–60
Faroe	England and Wales	1946–81
	Scotland	1955–60
West of Scotland and Rockall	England and Wales	1955–81
Irish Sea	England and Wales	1972–76
West of Ireland and Channels	England and Wales	1977–81
Seas around Scotland and Faroe	Scotland	1961–66

[a] Possibly more strictly, 'England, Scotland and Wales', on the grounds that British fisheries statistics are conventionally reported jointly for England and Wales (and separately for Scotland). However, the fraction of British catches from the North Sea landed in Wales was probably negligible.

5.1 Demersal charts – North Sea (IV)

5.1.1 Steam trawlers – North Sea (IV)

General – This is the most complete fleet- and region-specific time-series, specifically referring to the British 'first-class' (i.e., 15 tons gross and over) steam trawl fleet. Steam power had first been used in British sea fisheries as early as the 1850s and 1860s, in the form of paddle vessels, although these initial attempts proved commercially unsuccessful. It was in the 1880s that the steam trawling industry really took off (Figure 2), following the arrival of the first purpose-built steam screw trawlers in Scarborough (1881), Grimsby (1881) and Hull (1885); these vessels caught about 4 times as much as a sailing trawler (Garstang 1900).

The industry grew very rapidly in the following years. This was aided by the introduction and wide use of otter trawls on steam trawlers in the 1890s, replacing the beam trawl which previously had been adopted from the sailing trawler. In the otter trawl, two comparatively small 'otter boards', functioning as under-water kites, achieved and maintained the spread of the net, making the large and cumbersome beam of the old beam trawl obsolete. Not only was the otter trawl more efficient in catching large aggregations of fish than the beam trawl at that time in use (by a factor of 1.37 as estimated by Garstang [1900]; see also Lee 1915), but it could moreover much more conveniently be stowed aboard ship. By 1898 otter trawls were adopted on virtually all steam trawlers.

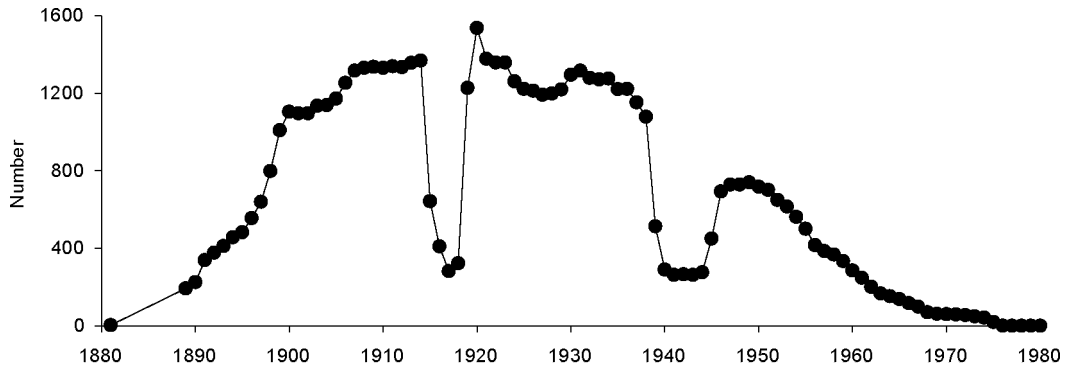


Figure 2. Rise and fall of steam trawling in England and Wales, 1880–1980. The graph shows numbers of first-class steam trawlers on the Register of British Sea Fishing Boats on 31 December of each year. Temporary drops in numbers during both World Wars are mainly due to vessels employed in War Service. Data for 1939–44 include an unknown but relatively small number (<70) of motor trawlers. Data for 1889–98 from Garstang (1900).

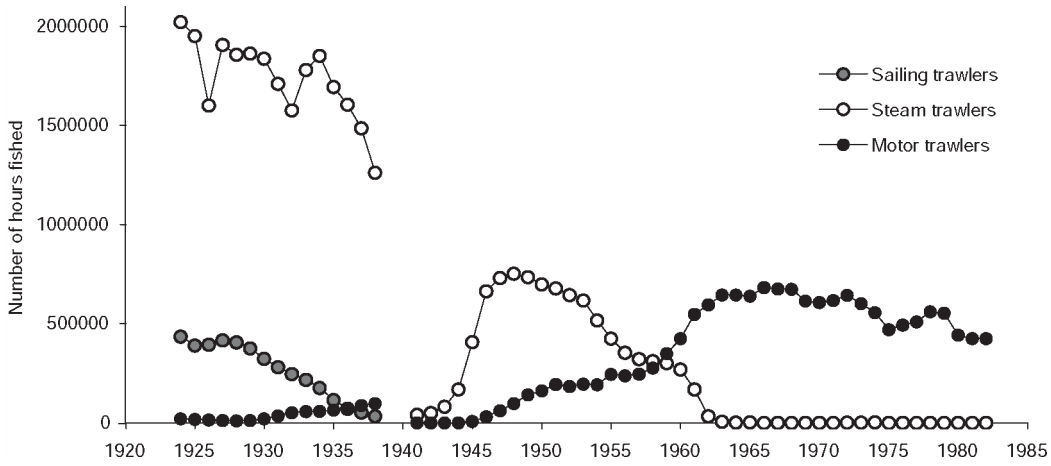


Figure 3. Trends in the number of hours fished in the North Sea by steam, motor, and sailing trawlers, 1923–1982 (British trawlers landing in England and Wales only). Note subsequent declines of sailing and steam trawling effort and rise of motor trawling effort; and very strong reduction in effort during WWII (no data for 1939–40).

An important modification to the otter trawl, the Vigneron-Dahl gear, was first introduced in 1923 and was in general use by 1926; it may have improved the fishing efficiency of otter trawls by a factor of 1.42 (Bowman 1932). This modification consisted of lengths of steal cable, introduced between each otter board and the net, with the effect of increasing the spread of the otter boards and collecting fish from a greater area of the sea floor into the path of the net; it also allowed a reduction in the size and hence resistance of the net (Graham 1956).

From the onset of the twentieth century until the late 1950s, steam trawlers comprised the most important component of the British fishing fleet in the North Sea, in terms of both landings and hours spent fishing (Figure 3). In most of these years, steam trawlers landed at least 80% of Britain's entire catch. There was, however, a general decline in steam trawling effort over much of that period (e.g., ~2.8 million hours fished in 1923, ~1 million hours fished in 1950, ~500,000 hours fished in 1959). Furthermore, landings and effort were strongly reduced during both World Wars, partly because vessels were lost due to hostilities, and partly because a large number of vessels were requisitioned by the Royal Navy to be employed in War Service (cf. Figure 2). Still, steam trawling recovered twice very quickly in the years immediately following both wars.

Originally, all steam trawlers burnt coal. Oil-fired steam trawlers were introduced in 1946; still driven by steam, these vessels replaced coal with a fuel much easier and cleaner to handle, less bulky, and at the time still relatively cheap. Soon after, all new steam trawlers were being built with oil burners and many old coal burners were being converted. Generally oil burners had a short lifespan due to competition with motor trawlers. In the post-war decades, technical innovations made diesel engines increasingly efficient and compact, leading to a gradual increase of the motor trawl fleet, which by 1960 had outgrown the steam trawl fleet. Steam trawling thereafter declined increasingly rapidly. The last landings from the North Sea, by steam vessels fishing from Hull and Grimsby, were in 1976[1]. Summaries of the methods and history of British steam trawlers are provided by Graham (1956) and Robinson (2000b); for Hull and Grimsby specifically see Thompson (1989) and King and Pulfrey (1991).

Temporal coverage – Charts on North Sea steam trawlers are available for 1913, 1920–39, and 1947–67. No charts are available for 1968 and 1971–74 although there was limited steam trawling effort in the North Sea in these years. For 1975–76, statistics on North Sea steam trawling are included in the statistical charts for North Sea motor trawlers (Section 5.1.2).

Spatial coverage – The charts provide good coverage of most of the North Sea from 1923–1961 (Figure 4). From 1962 onwards, the area trawled by steam trawlers contracted strongly.

Species coverage – See Table 3 for an overview. The initial charts (before 1923) are limited to a few species. Charts from 1923–1959 cover a wide range of demersal species (e.g. 23 species in 1923, 29 species in 1959). From 1960 until the end of the series, only selected species were recorded (brill, cod, dogfish, haddock, hake, lemon soles, plaice, saithe, skates and rays, soles, turbot, whiting).

Number of charts – 862 annual charts, 9776 monthly charts.

Box reference numbers – See boxes 1–32 for the years 1923–67; boxes 40–41 for 1975–76; and box 87 for 1913 and 1920–22.

[1] The last steam trawlers fished mainly in distant waters, especially Iceland, and more occasionally in the North Sea. *Northern Sceptre* (GY297), of 804 tons gross, appears to have been the very last to survive. After having been laid up for two years she left Grimsby in September 1977, to be scrapped in February 1979 (King and Pulfrey, 1991).

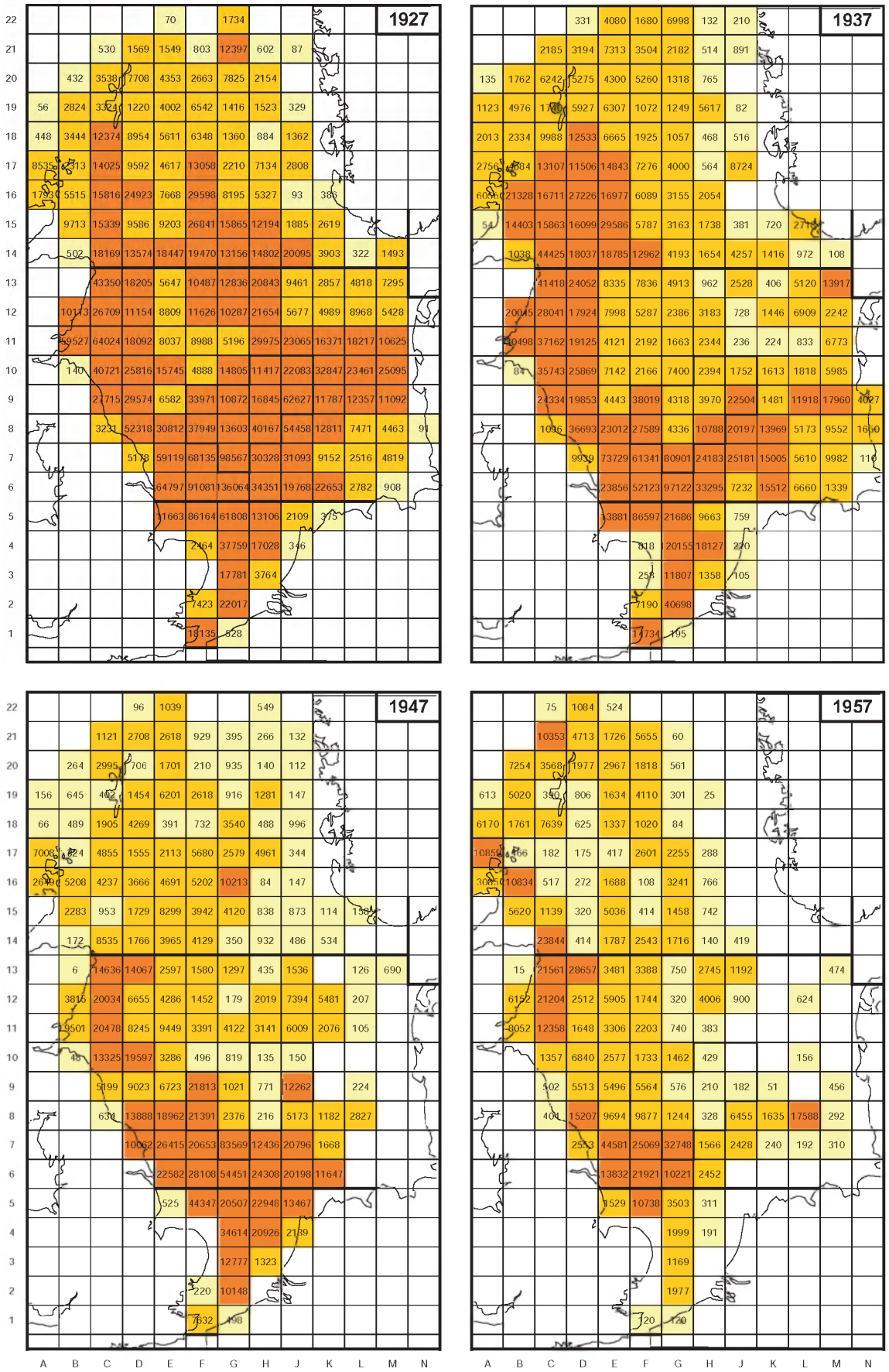


Figure 4. Distribution of British steam trawling effort over the North Sea in 1927, 1937, 1947, and 1957. Effort is expressed as total number of hours fished by British first-class steam trawlers landing in England and Scotland. Shadings indicate low (<1,000 hr, light), moderate (1,000-10,000 hr, darker) or high (>10,000 hr, darkest); white indicates absence of British steam trawling in corresponding rectangle.

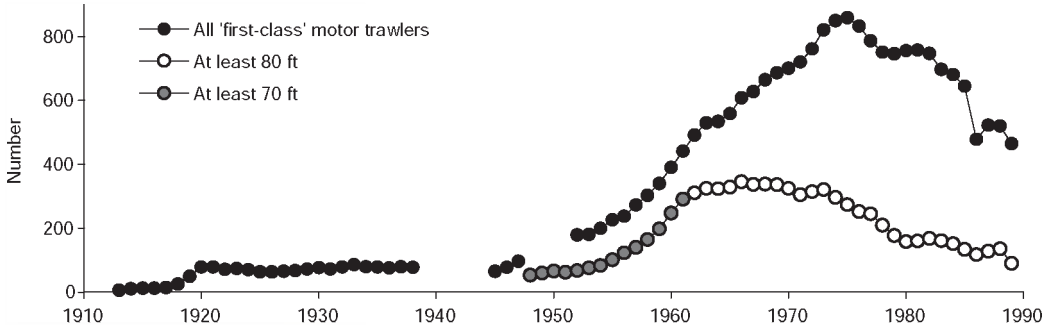


Figure 5. Trends in numbers of first-class motor trawlers on the Register of British Sea Fishing Boats on 31 December, 1912–89 (England and Wales only). Black symbols include all first-class motor trawlers, defined from 1912–54 as having at least 15 tons gross, and from 1955 onwards as having at least 40 feet length (no data before 1912, for 1939–44 and 1948–51). Grey and white symbols show numbers of motor trawlers of at least 70 feet (1948–61) and 80 feet (1962–89), respectively.

Spreadsheet reference – 'ChartsIV.xls'.

Remarks – No pre-WWII charts providing fishing effort (hours fished by rectangle) were found. For 1924–37, see e.g. Raitt (1939) for global data on hours fished in the North Sea by British steam trawlers landing in England and Scotland.

During 1913 and 1920–22, the first years in which data on the number of hours fished per rectangle were collected by Ministry staff, it was only possible to obtain such information for a subset of all first-class vessels landing in England and Wales. In 1913 the subset represented approximately 10% of all landings by first-class steam trawlers. In 1920 the "number of hours during which the trawl or Danish seine was actually in use was obtained for a considerable proportion of the voyages"; this proportion was further increased in the following years and was over 90% by 1923 (Edser, 1925)[2].

5.1.2 Motor trawlers – North Sea (IV)

General – Statistical charts on landings by motor trawlers from the North Sea are available for two distinct periods, 1924–32 and 1956–81. In the pre-war period, England's motor trawl fleet was small and, within the North Sea, confined to ~30–40 vessels active in the southern- and westernmost parts (fairly extensive motor trawling also occurred in Sub-area VII, mostly in the English Channel). Early motor trawlers were often converted sailing craft with small petrol or petrol-paraffin combustion engines installed. The size of England's motor trawl fleet was fairly stable throughout the inter-war years, but increased rapidly in the three decades following WWII (Figure 5). This was chiefly due to the introduction of marine diesel engines from the late 1940s onwards, which were more efficient and compact than steam engines, allowing significant savings on space. Diesel engines were, however, initially more expensive to install, and required several auxiliary motors to drive trawling and steering gear (Robinson, 2000b). The first diesel-electric trawlers, with engines capable of driving both propulsion and auxiliary systems, appeared in the 1950s. The various technical innovations led to the motor trawl fleet gradually replacing the steam trawl fleet, operating in an increasingly large part of the North Sea as well as in distant waters (Figure 3, 6).

The size and power of motor trawl vessels generally increased after the war. Nevertheless, motor trawlers remained on average considerably smaller than steam trawlers, although to a lesser extent in distant waters than in the North Sea. Accordingly, the catch rates of motor trawlers tended to be lower than those of steam trawlers for the same years. Since the 1960s, the fraction of smaller-sized (40–80 feet length) motor trawlers again increased (Figure 5); the present motor trawl fleet consists of relatively few large and many small (albeit powerful) vessels.

Two definition changes need to be mentioned. First, the definition of motor trawlers differs between the earlier and later time-series. Statistical charts for 1924–32 refer to first-class motor trawlers, including all vessels of at least 15 tons gross. This definition was later changed: "As from 1st January, 1955, the division of classes of fishing vessels is based on registered length. Those classified as 40 ft and over in these tables are the vessels formerly described as first-class vessels of 15 gross tons and over" (*Sea Fisheries Statistical Tables 1955* [MAFF, London, 1956]).

[2] However, a note on the folder containing charts for 1921 (landings in England only) states that these charts were "based on D2 returns covering all fishing by 1st class steam trawlers" (author unknown).

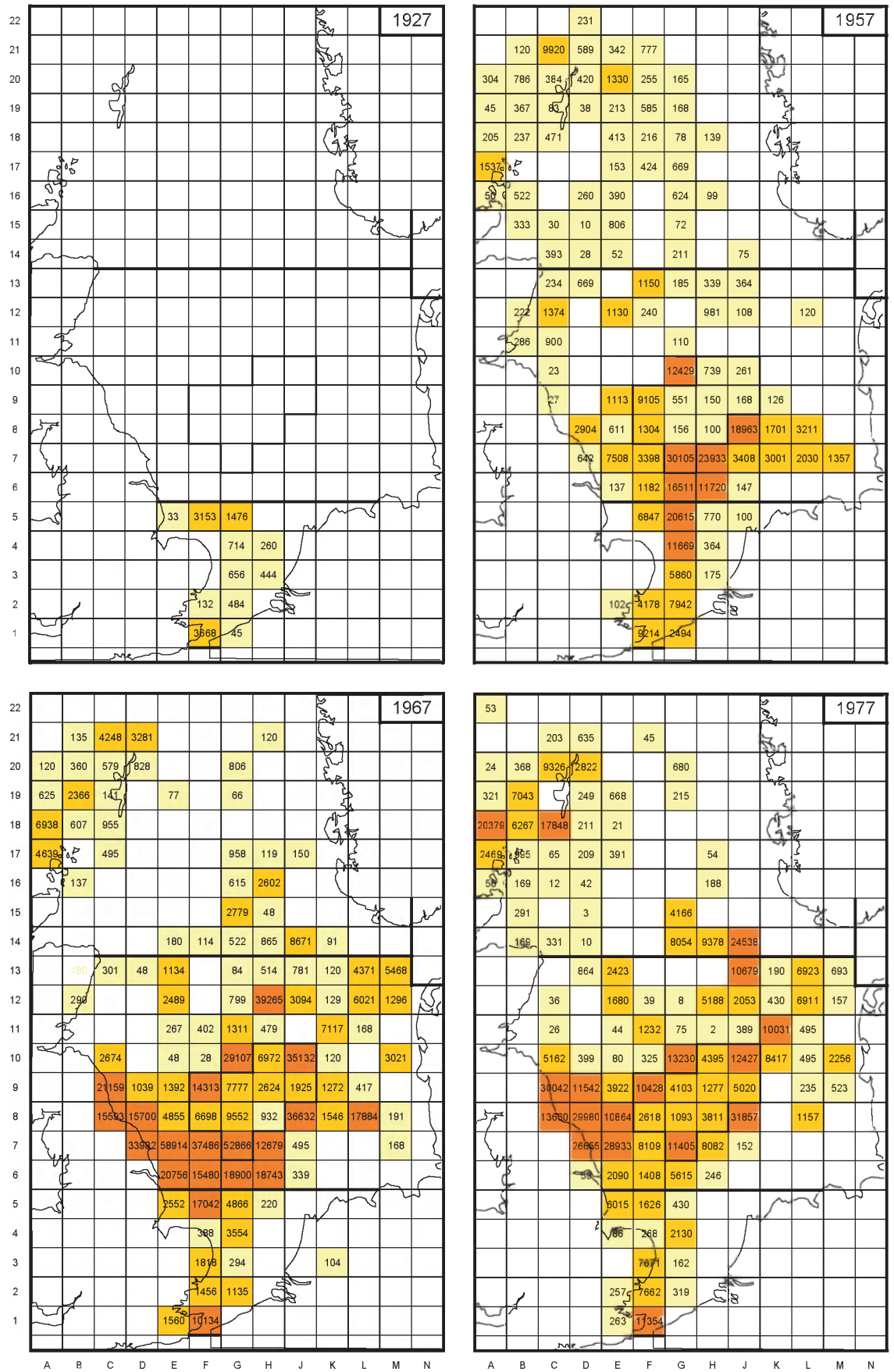


Figure 6. Distribution of British motor trawling effort over the North Sea in 1927 (vessels landing in England only), 1957 (vessels landing in England and Scotland), 1967 and 1977 (vessels landing in England only). Effort is expressed as total number of hours fished by rectangle. Shadings indicate low (<1,000 hr, light), moderate (1,000-10,000 hr, darker) or high (>10,000 hr, darkest) effort in corresponding rectangle.

Second, 1956–81 charts apparently refer to 'deep sea landings'[3]. Until 1959 these included only "catches made by vessels over 40 feet length where the voyages had exceeded 72 hours' duration". From 1960 onwards these included "catches of all vessels of 40 feet and over in length, whether or not from voyages of over 72 hours' duration" (*Sea Fisheries Statistical Tables 1960* [MAFF, London, 1961]).

Temporal coverage – 1924–32 and 1956–81. Note changes in the country of landing recorded: 1924–32, England; 1956–66, England and Scotland; 1961 and 1966–81, England and Wales; 1966–67, Scotland.

Spatial coverage – See Figure 6. For 1924–32 the spatial coverage is limited; in these years, English motor trawlers were restricted to the southern- and westernmost parts of the North Sea. Charts from 1957–66, including landings in both England and Scotland, provide good coverage of most of the North Sea. Charts from 1966–81, including landings in England and Wales only, provide good coverage of the southern and central North Sea, but only moderate coverage of the northern North Sea. The fraction of the North Sea covered by British motor trawlers in the 1960s and 1970s was, generally speaking, less extensive than that covered by British steam trawlers during the inter-war years, late 1940s and 1950s.

Species coverage – See Table 3. In pre-war years, ~15 species were recorded, providing a more or less complete picture. For the period 1956–81, only ~8 selected species were recorded on charts over longer time-spans.

Number of charts – 370 annual charts, 4569 monthly charts.

Box reference numbers – Boxes 33–42.

Spreadsheet reference – 'ChartsIV.xls'.

5.1.3 Sailing trawlers – North Sea (IV)

General – Statistical charts on North Sea landings by English first-class sailing trawlers are available for a relatively short period (1924–32) almost at the end of the era of trawling by sail. First-class sailing trawlers are here defined as vessels over 15 tons net tonnage, and are commonly known as smacks. The typical net used on sailing trawlers was the beam trawl (Davis, 1927; Graham, 1956).

The sailing trawl industry in the North Sea had previously grown rapidly during the late eighteenth and most of the nineteenth century (see Robinson [2000a] for an overview of the history, and Mackinson [2001] for a focus on the 1880s). The prosperity was partly a result of the industrial revolution, the consequent increase in Britain's population and, through the construction of the railway network, the opening up of inland markets for selling fish products. Trawling by sail in the North Sea peaked in the 1870s, but thereafter received strong competition from steam trawlers (Figure 3). The latter were not subject to the mercies of the wind, could roam further, trawl at considerably greater depths and tow fast enough to use an otter trawl, which was a more effective gear than the beam trawl used at that period. As a result, steam trawlers generally attained far greater catch rates than sailing craft (Garstang, 1900; Davis, 1927; Graham, 1956).

Sailing trawling in the North Sea only survived well into the twentieth century in the relatively shallow, southern waters (Division IVc) and by focusing on species with high market value such as sole, brill and turbot. Both World Wars had additional, negative effects on the sailing trawl fleet: the number of first-class sailing trawlers in England and Wales declined from 798 in 1914 to 385 in 1918; of the 41 vessels that remained in 1937, only a single remained active in 1946. During the last decades of this industry, Lowestoft was the main port of landing for the majority of sailing trawlers fishing in the North Sea.

Temporal coverage – 1924–32.

Spatial coverage – The activity of English first-class sailing trawlers during the inter-war years was almost exclusively restricted to the southern North Sea (Division IVc) and a few adjacent rectangles (Figure 7). This region was, however, trawled fairly extensively so that the spatial coverage within Division IVc is good.

Species coverage – See Table 3. A comparison with *Sea Fisheries Statistical Tables* shows that the species coverage is complete.

Number of charts – 153 annual charts, 1547 monthly charts.

Box reference numbers – Boxes 43–45.

Spreadsheet reference – 'ChartsIV.xls'.

Remark – Charts for 1924–25 mention 'England and Scotland' as countries of landing; however, a comparison with *Sea Fisheries Statistical Tables, 1924 and 1925* (MAF, London, 1925 and 1926) indicates that all charted landings were in England.

[3] 'Deep sea landings' as opposed to 'inshore landings'. Until 1959, inshore landings were defined as all "catches by second and third-class vessels, and by first-class vessels, other than Steam Trawlers, which make voyages of not exceeding 72 hours duration" (e.g. *Sea Fisheries Statistical Tables 1950* [MAF, London]. From 1960 onwards, inshore landings included all "landings by vessels under 40 feet in length" regardless of voyage duration (*Sea Fisheries Statistical Tables 1960* [MAFF, London]).

Table 3. Species monitored in 'Statistical Charts' for North Sea trawlers, with indication of temporal coverage per species.

	Steam trawlers	Motor trawlers	Sailing trawlers
Hours fishing	**1913, 1947–67[a]**	**1924–32, 1966–67, 1977–81**	**1924–32**
Bream	1923–59		
Brill	1925, 1929, 1947–66[a]	1924–32, 57–81	1924–32
Catfish	1923–59		
Cod	1913, 1921, 1923–67	1924–32, 56–81	1924–32
Conger eels	1923–59	1924–32[b]	1924–32
Dabs	1923–58	1924–32	1924–32
Dabs, long rough	1959		
Dabs, other	1959		
Dogfish	1923–67	1924–32	1924–32
Dory	1925–57[b]	1928	
Flounders (flukes)	1923–59	1924–27, 1929–32	1924–32
Gurnards and latchets	1935–59		
Gurnards	1923–34	1924–32	1924–32
Latchets (tubs)	1923–34		
Haddock	1923–67	1924–30, 1957–81	1924–27, 1929–30
Hake	1923–67	1925, 1929, 1957–80	1929–30
Halibut	1929, 1957–59[c]	1928–29	
Lemon soles	1923–67	1924–32	1924–32
Ling	1929, 1957–59[c]	1925, 1928, 1932	1927, 1929
Megrims	1923–59	1928	
Monks (anglers)	1923–59	1924–29, 1931–32	1924–26, 1928, 1931
Mullet, grey	1957–59		
Mullet, red	1927–59		
Norway pout		1977	
Plaice	1913, 1921, 1923–67	1924–32, 57–81	1924–32
Pollack	1923–59	1928	1931
Redfish	1935–59		
Saithe (coalfish)	1923–67	1929, 1977–81	
Sandeels		1977–78, 1980	
Skates and rays	1923–67	1924–32	1924–32
Soles	1923–66	1924–32, 56–81	1924–32
Torsk (tusk)	1923–59		
Turbot	1947–67[a]	1924–32, 57–81	1924–32
Whiting	1923–67	1924–32, 57–81	1924–32
Witches	1923–59		
Livers of fish	1959		
Roes of fish	1959		
Other kinds and mixed	1947–59		
Total demersal fish	**1913–22, 1934–67**	**1957–81**	
Herrings[d]	1923–33		1924, 1929
Mackerel[d]	1923–33	1925	
Total wet fish[d]	**1923–33**	**1924–32**	**1924–32**

[a] For steam trawlers in 1923–39, charts on hours fished, brill, and turbot were not recovered, but may well have existed (cf. Borley and Thursby-Pelham, 1926)
[b] Generally caught in low quantities, hence not recorded for all years
[c] For steam trawlers in 1923–28 and 1930–56, charts on halibut and ling were not recovered, but may well have existed (cf. Borley and Thursby-Pelham, 1926)
[d] Pelagic species (herrings, mackerel) occasionally caught by trawlers were included between 1923–33, excluded in other years

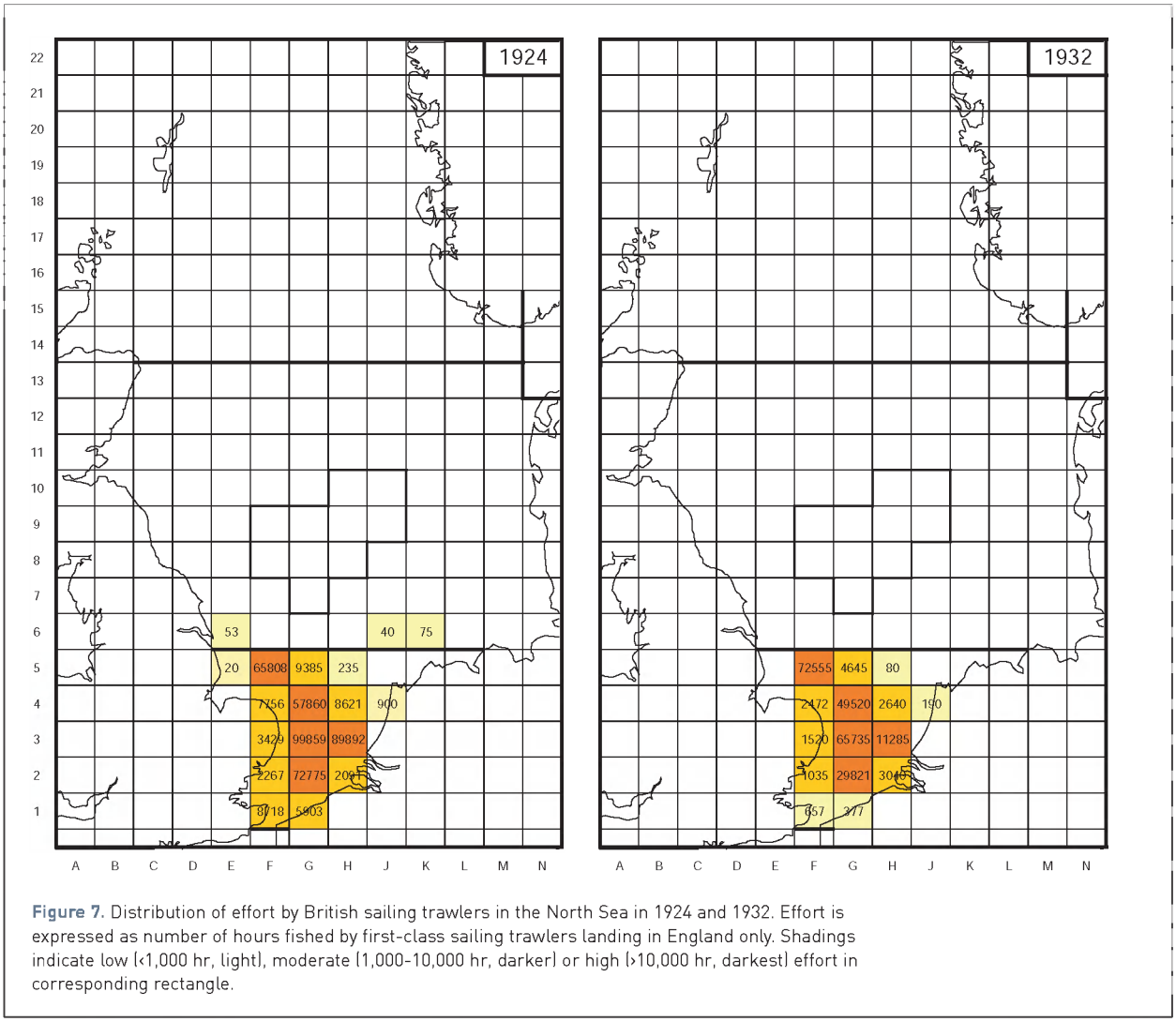


Figure 7. Distribution of effort by British sailing trawlers in the North Sea in 1924 and 1932. Effort is expressed as number of hours fished by first-class sailing trawlers landing in England only. Shadings indicate low (<1,000 hr, light), moderate (1,000-10,000 hr, darker) or high (>10,000 hr, darkest) effort in corresponding rectangle.

5.1.4 Steam Danish seiners (steam seiners) – North Sea (IV)

General – These charts, available only for inter-war years, refer to English first-class steam vessels (i.e., at least 15 tons gross) exclusively applying the 'Danish seine' for catching fish. This gear, also referred to as 'demersal seine' or chiefly 'seine', is used to catch species of groundfish, generally in shallower waters than otter trawls (up to about 200 m). It is a convenient way of fishing from relatively small vessels of about 40–75 feet length (Graham, 1956). Danish seines essentially resemble other seines in surrounding the fish, but are also dragged over the bottom. The method involves a vessel laying two weighted ropes on the seabed over about one to a few kilometres, with the net in the centre forming a pear- or diamond-shaped configuration. The two ropes are then recovered and drawn together onto the vessel; the rope movement herds bottom-dwelling fish into the path of the net. While hauling, the vessel may either remain in a fixed position or move forward (see Graham [1956] and Borley and Thursby-Pelham [1925] for descriptions of Danish seining in British fisheries).

The method originally evolved in Denmark. English fishermen, possibly impressed by the success of Danish seining for plaice and haddock during WWI, adopted the gear in 1921, mainly on steam vessels (Borley and Thursby-Pelham, 1925). The effort of steam Danish seiners rose very rapidly in the following few years (e.g., 1921: 356 landings from the North Sea into England; 1923: 5447 landings). After 1924, however, steam seining in the North Sea declined again (e.g., 1932: 639 landings; 1950: 31 landings), until it ceased in the late 1950s. Long-term trends in the numbers of Danish seiners registered in England and Wales are illustrated in Figure 8.

Temporal coverage – 1924–32, partly coinciding with the heydays of steam seining in the North Sea. Unfortunately, statistical charts for 1929 were found to be missing.

Spatial coverage – See Figure 9. Good coverage of the central North Sea (Division IVb), moderate coverage of the southern North Sea (IVc). There was very little steam seining in the, relatively deep, northern North Sea (IVa). The coverage of Division IVb was especially good from 1924–28 (~70–80% of rectangles), but contracted during 1930–32 (~40% of rectangles). Steam seining especially centrated on the Doggerbank and its surroundings.

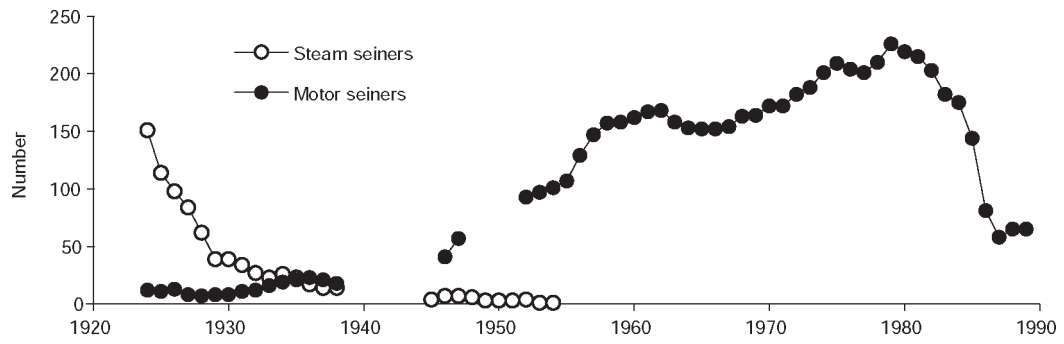


Figure 8. Trends in numbers of first-class steam and motor Danish seiners which were on the Register of British Sea Fishing Boats on 31 December, 1924–89 (England and Wales; data for 1939–44 and 1948–51 partly lacking). No data prior to 1924, when Danish seiners were recorded with trawlers.

Table 4. Species monitored in 'Statistical Charts' for North Sea seiners, with indication of temporal coverage per species.

	Steam seiners	Motor seiners
Hours fishing	**1924–28, 1930–32**	**1924–28, 1930–32, 1958, 1960[a]**
Brill	1924–28, 1930–32	1924–25, 1927–28, 1930–32, 1965–81
Catfish	1924–28, 1930–32	1924–28, 1930–32
Cod	1924–28, 1930–32	1924–28, 1930–32, 1956–81
Conger eels	1924–25	1927
Dabs	1924–28, 1930–32	1924–28, 1930–32
Dogfish	1924–28, 1930–32	1928, 1930–32
Flounders (flukes)	1924, 1926, 1928, 1930, 1932	1928
Gurnards	1924–28, 1930–32	1924, 1930–32
Haddock	1924–28, 1930–32	1924–28, 1930–32, 1957–81
Hake	1924–28, 1930–32	1924, 1926, 1930, 1977–81
Halibut	1924–28	1924–25
Latchets (tubs)	1924–25, 1927–28	
Lemon soles	1924–28, 1930–32	1924–28, 1930–32
Ling	1924–28, 1930–32	1931–32
Megrims	1924–25, 1928, 1930–31	
Monks (anglers)	1924–28, 1930–32	1926–28, 1930–32
Plaice	1924–28, 1930–32	1924–28, 1930–32, 1957–81
Pollack	1924–27	
Saithe (coalfish)	1924–28, 1931	1926, 1976–81
Skates and rays	1924–28, 1930–32	1924–28, 1930–32
Soles	1924–28, 1930–32	1928, 1930, 1976–81
Torsk (tusk)	1925	
Turbot	1924–28, 1930–32	1924–28, 1930–32, 1965–81
Whiting	1924–28, 1930–32	1924–28, 1930–32, 1957–81
Witches	1924–28, 1930–32	1924–27, 1931–32
Total demersal fish		**1957, 1959–81**
Herrings[b]	1924, 1925, 1928	
Mackerel[b]		1924
Total wet fish[b]	**1924–28, 1930–32**	**1924–28, 1930–32**

[a] For 1956–81, further charts on hours fished were not recovered, but may well have existed
[b] Pelagic species (herrings, mackerel) occasionally caught by seiners were included between 1923–33, excluded in other years

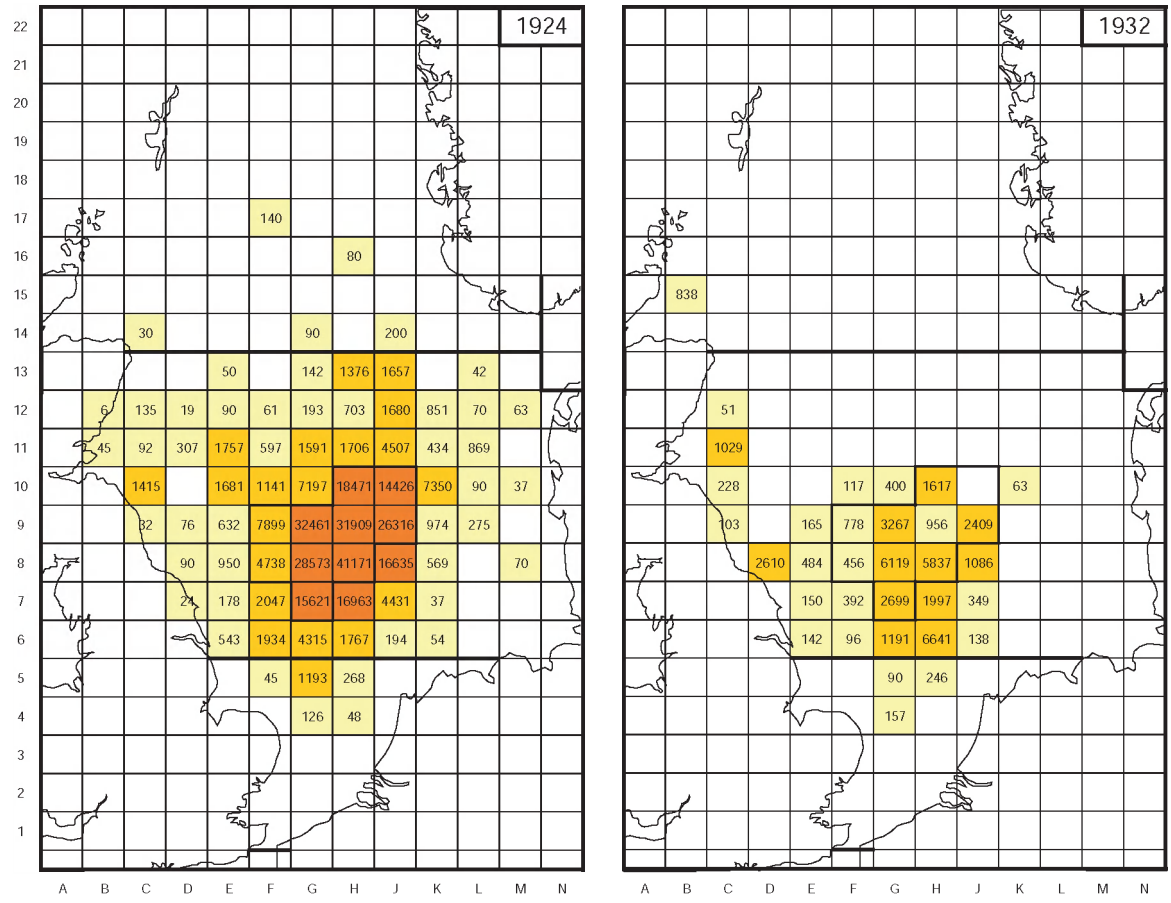


Figure 9. Distribution of effort by British steam seiners in the North Sea in 1924 and 1932. Effort is expressed as number of hours fished by all first-class vessels landing in England only. Shadings indicate low (<1,000 hr, light), moderate (1,000-10,000 hr, darker) or high (>10,000 hr, darkest) effort in corresponding rectangle.

Species coverage – See Table 4. A comparison with *Sea Fisheries Statistical Tables* shows that the species coverage is complete.

Number of charts – 194 annual charts, 1485 monthly charts.

Box reference numbers – Boxes 46–49.

Spreadsheet reference – 'ChartsIV.xls'.

Remarks – Although charts for 1924–25 mention 'England and Scotland' as countries of landing, a comparison with *Sea Fisheries Statistical Tables, 1924 and 1925* (MAF, London, 1925 and 1926) indicates that all charted landings were in England.

A single chart was recovered, showing the number of voyages by steam seiners to ICES rectangles in the North Sea, for the year 1921 (landings in England and Wales only).

5.1.5 Motor Danish seiners (motor seiners) – North Sea (IV)

General – Charts on motor vessels applying the Danish seine are available for 1924–32 and 1956–81 (the terms 'motor Danish seiners' and 'motor seiners', respectively, being used in these two periods). Already in 1921, when the Danish seine was first used by British fishermen, this gear was applied on board a small number of motor boats. Nevertheless, motor seining in the North Sea remained fairly unimportant during the 1920s; steam seiners made up for the vast majority of seine landings in these years. This changed in the 1930s and the post-war decades, when the importance of motor seining increased steadily (Figure 8). The success of the motor seiner was aided by the particular usefulness of the compact diesel motor, compared to the steam engine, for the relatively small vessel size used in Danish seining. The effort of motor seiners in the North Sea peaked in the 1960s, but declined in subsequent decades; currently, motor seiners account for only a small fraction of North Sea demersal landings (~4% in 2004). Motor seining played an especially important role in Scottish fisheries: during the 1960s and 1970s the number of seine landings was about ten times higher in Scotland than in England and Wales.

Temporal coverage – 1924–32 (England; charts for 1929 absent), 1956–64 (England and Scotland), 1965–81 (England and Wales). The following definition changes are relevant.

Charts for 1924–32 include landings in England by first-class motor seiners, defined as having at least 15 tons gross tonnage.

Charts for 1956–64 include landings in England by all motor seiners 40 feet and over; and landings in Scotland by all seiners 70 feet and over landing at Aberdeen only.

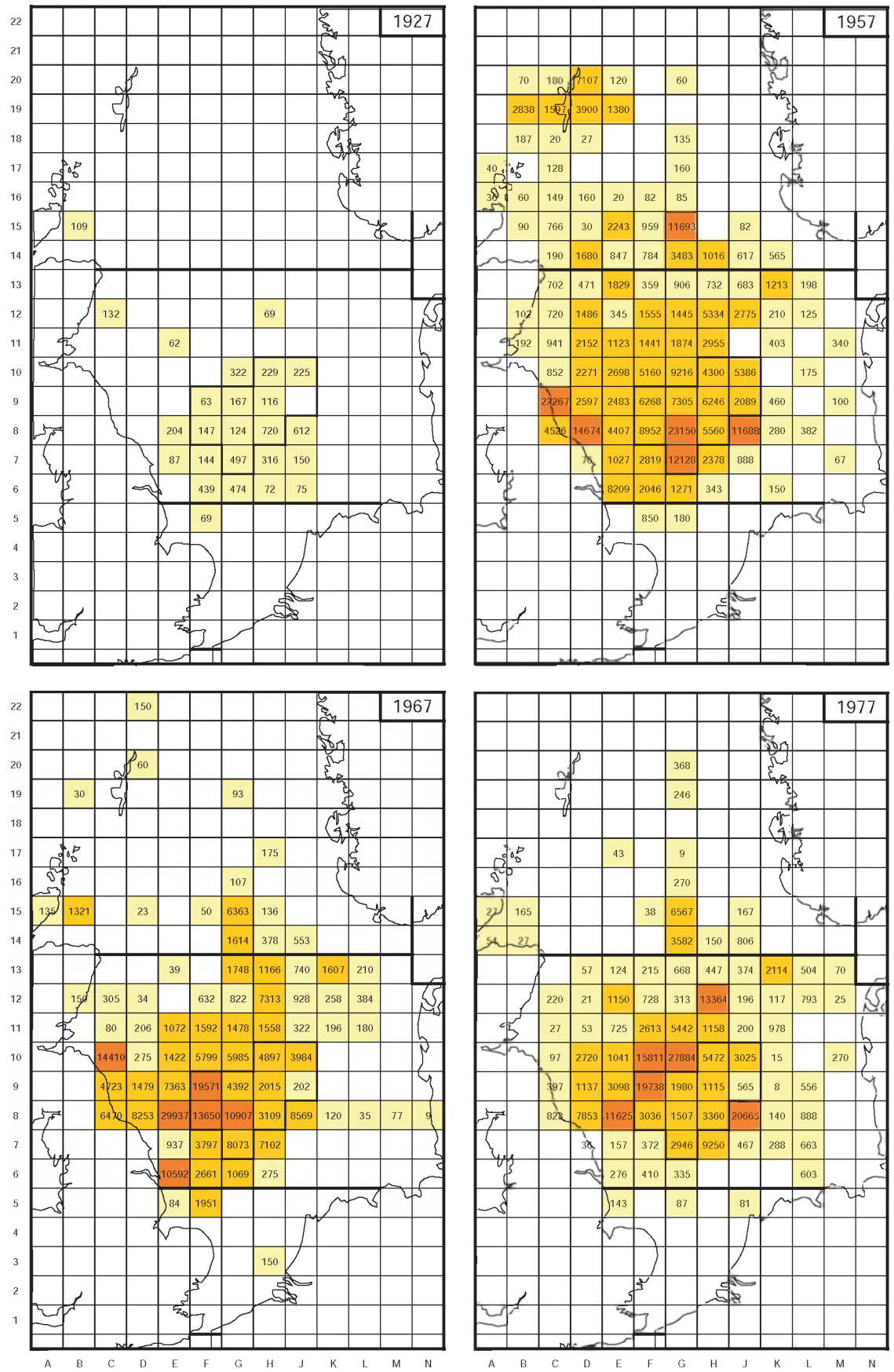


Figure 10. Distribution of effort by British motor seiners in the North Sea in 1927 (vessels landing in England only), 1957 (vessels landing in England and Scotland), 1967 and 1977 (vessels landing in England only). Effort is expressed as total number of hours fished by rectangle. Shadings indicate low (<1,000 hr, light), moderate (1,000-10,000 hr, darker) or high (>10,000 hr, darkest) effort in corresponding rectangle.

Charts for 1965–81 include landings in England and Wales by all motor seiners 40 feet and over.

Spatial coverage – See Figure 10. During 1924–32 (landings in England) moderate coverage of the central North Sea (Division IVb), concentrated on the Doggerbank. During 1956–64 (landings in England and Scotland), good coverage of the central North Sea, moderate or good coverage of the northern part (IVa), but only limited coverage of the southern part (IVc). During 1965–81 (landings in England and Wales), good coverage of the central, limited coverage of the northern and southern North Sea.

Species coverage – See Table 4. The 1924–32 charts provide consistent and apparently complete data for all 15 species recorded in *Sea Fisheries Statistical Tables, 1924 to 1932* (MAF, London, 1925 to 1933). The 1956–81 charts are more limited and include only 9 selected species. The recordings of these were initiated in different years (1956, cod; 1957, haddock, plaice and whiting; 1965, brill and turbot; 1976, saithe and sole; 1977, hake).

Number of charts – 194 annual charts, 1485 monthly charts.

Box reference numbers – Boxes 50–56.

Spreadsheet reference – 'ChartsIV.xls'.

Remark – Charts for 1924–25 mention 'England and Scotland' as countries of landing, but a comparison with *Sea Fisheries—Statistical Tables, 1924 and 1925* (MAF, London, 1925 and 1926) indicates that all charted landings were in England.

5.1.6 Steam liners – North Sea (IV)

General – These charts, available for inter-war years only, refer to first-class (15 tons gross and over) steam vessels exclusively catching fish by means of long lines, and include landings in both English and Scottish ports. The long line method, introduced from the Dutch around 1770, comprises a main line to which are attached branch lines, each fitted with one or more baited hooks for targeting predatory fish. Long lines may either be 'small lines', with relatively small hooks at intervals of about one meter, usually baited before putting to sea and used near the coast to catch fish such as haddock and small cod; or 'great lines', with bigger hooks at greater intervals (say 2–5 m), usually baited on board, and used offshore for larger fish such as halibut, ling, skates and especially cod (Coull, 1996)[4].

Steam liners were generally large vessels, comparable to steam trawlers in size, that predominantly used great lines. Large steam liners carried about 40 lines, each almost a kilometer in length, that would have been fitted with over 100 large hooks (Graham, 1956). Operating these was facilitated by steam-powered line haulers; however, baiting the lines was considerably labour-intensive work. The British steam liner fleet grew quickly in the late nineteenth century. The size of the fleet remained fairly stable during 1900–25, apart from the temporary engagement of vessels in War Service during 1914–18 (Figure 11). Thereafter a long-term decline commenced, partly due to severe competition from the trawler; very few steam liners remained after WWII.

Temporal coverage – 1924–32, which coincides with the period of general decline in the fleet.

Spatial coverage – See Figure 12. Good coverage of the northern North Sea (Division IVa), moderate coverage of the central North sea (IVb), almost absent from the southern North Sea (IVc). Steam liners fished especially in the deep waters of the Norwegian Trench in the northeastern North Sea. From the 1920s to the 1930s the area covered contracted to some extent, mostly in the central North Sea.

Species coverage – See Table 5; a fairly complete coverage of the species caught is available (cf. *Sea Fisheries Statistical Tables, 1924 to 1932* (MAF, London, 1925 to 1933)). The particularly high selectivity of this gear for large predatory fish, notably halibut, ling, cod and skate, should be noted.

Number of charts – 148 annual charts, 1189 monthly charts.

Box reference numbers – Boxes 57–59.

Spreadsheet reference – 'ChartsIV.xls'.

Remark – The statistical charts for liners do not include figures for catch rates (usually quantified as cwt per 100 hours fishing) by rectangle. In the case of liners, catch rates *per se* are generally not considered a satisfactory measure of fish abundance; hence no such data were collected for British fisheries statistics. Neither are data available on the total number of lines hauled and the average number of hooks per line, generally considered important components of liner fishing effort. As a crude measure of effort, data on number of days absent from port are available for English and Welsh steam and motor liners in *Sea Fisheries Statistical Tables, 1924 to 1932* (MAF, London, 1925 to 1933); these cannot be linked to single ICES rectangles.

[4] The original way of line fishing is by means of 'hand lines', that is lines with one or two baited hooks lowered directly from the boat and operated entirely by hand. Hand-lining in British fisheries dates back to at least the 15th century (Jones 2001).

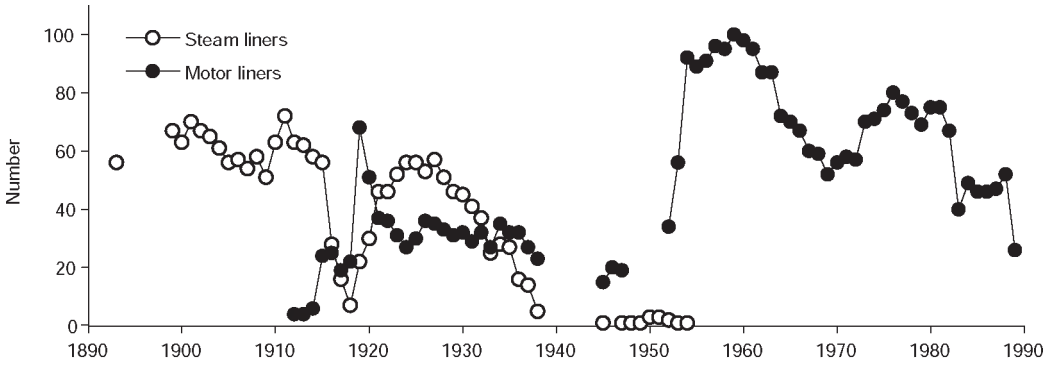


Figure 11. Trends in numbers of first-class steam and motor liners which were on the Register of British Sea Fishing Boats on 31 December, 1890–1990 (England and Wales only; for some years, data were lacking).

Table 5. Species monitored in 'Statistical Charts' for North Sea liners, with indication of temporal coverage per species. No charts on fishing effort available.

	Steam liners	Motor liners
Brill	1926, 1928–30	
Catfish	1924–32	1924–29, 1931
Cod	1924–32	1924–32
Conger eels	1924–32	1924–32
Dabs	1930	1924
Dogfish	1924–32	1924–32
Gurnards	1926	
Haddock	1924–32	1924–32
Hake	1924–32	1924, 1928
Halibut	1924–32	1924–31
Latchets (tubs)	1932	
Lemon soles	1927	
Ling	1924–32	1924–32
Megrims	1931	
Monks (anglers)	1924–25, 1930	1924
Plaice	1932	1924, 1931
Pollack	1924, 1926–32	1927
Saithe (coalfish)	1924–32	1924–32
Skates and rays	1924–32	1924–32
Soles		1929
Torsk (tusk)	1924–32	1927–28
Turbot	1924–32	1924–32
Whiting	1924–32	1924–29
Witches	1927	
Total wet fish	**1924–32**	**1924–32**

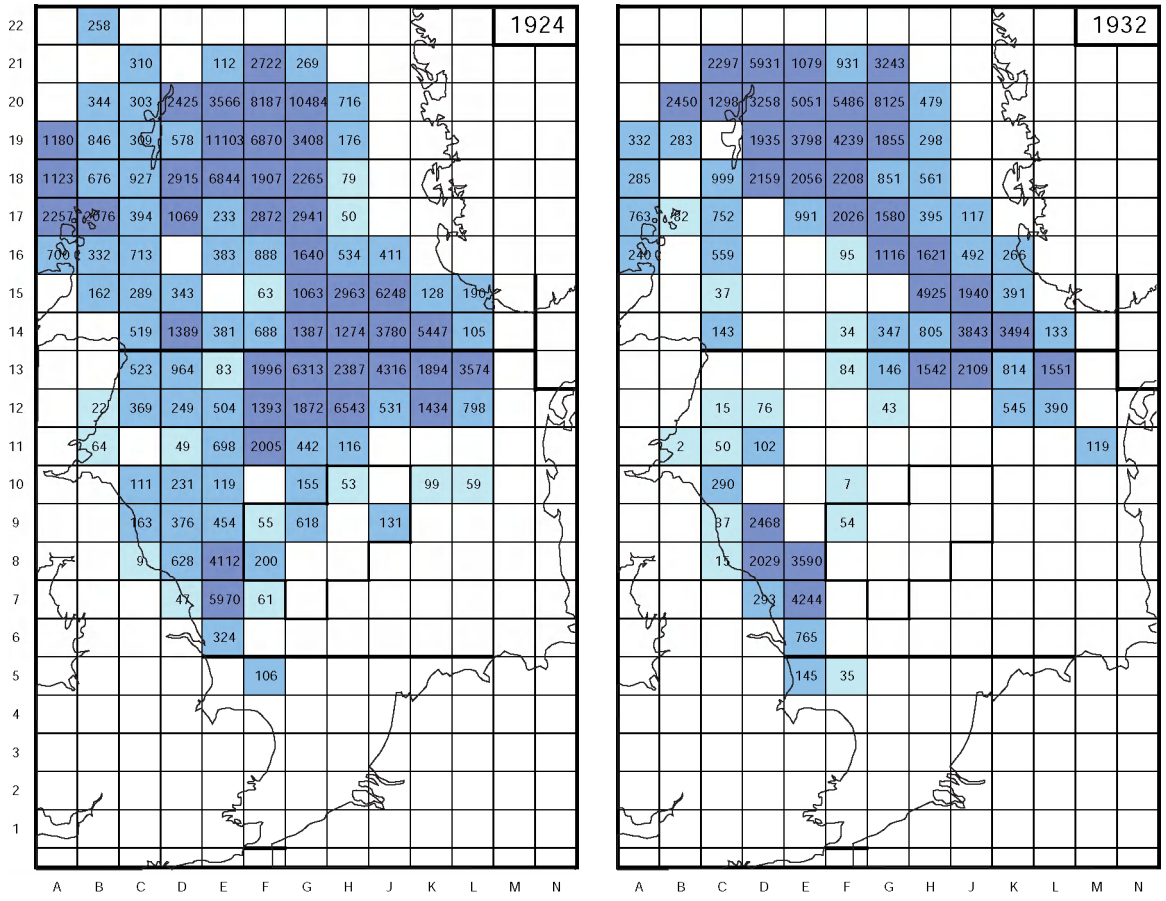


Figure 12. Distribution of total catches of wet fish (in cwt), taken by British first-class steam liners in the North Sea and landed in England and Scotland in 1924 and 1932. Shadings indicate low (<100 cwt, light), moderate (100-1,000 cwt, darker) or high (>1,000 cwt, darkest) total catches in corresponding rectangle.

5.1.7 Motor liners - North Sea (IV)

General – This series of charts covers the same, relatively brief period as those on steam liners, 1924–32. The charts refer to first-class motor vessels over 15 tons gross. Motor liners, which first appeared in English fisheries in 1912, were generally much smaller than steam liners. For example, in 1932 the average tonnage of first-class steam liners in England and Wales was 223 tons, of first-class motor liners 23 tons; in fact, most motor liners were second class (<15 tons gross) vessels. Motor liners typically used small lines or hand lines and operated in coastal waters, mainly off northeastern England and Scotland; they made short voyages of about 1 day duration, as opposed to about 4–5 days in steam liners. Landings by motor liners began to outnumber those by steam liners in the late 1930s. The number of motor liners was quite stable in the 1920s and 1930s, but grew quickly in the two decades following WWII, and declined again from the 1960s onwards. Small lines and hand lines remained the predominant type of British line-fishing in the North Sea. In 2004, catches by motor liners (mainly long liners) made up about 6% of British demersal landings from the North Sea in the UK.

Temporal coverage – 1924–32.

Spatial coverage – Concentrated in coastal waters off northeastern England and southeast Scotland (Figure 13).

Species coverage – See Table 5. Note selectivity of this gear for larger predatory fish.

Number of charts – 112 annual charts, 734 monthly charts.

Box reference numbers – Boxes 60–61.

Spreadsheet reference – 'ChartsIV.xls'.

Remarks – The statistical charts do not provide information on hours fished or on catch rate (usually quantified as cwt per 100 hours fishing) by rectangle. As a crude measure of effort, data on number of days absent from port are available (see *Sea Fisheries Statistical Tables, 1924 to 1932* (MAF, London, 1925 to 1933)), but these cannot be linked to single ICES rectangles.

The charts mention England and Scotland as the countries of landing. A comparison with *Sea Fisheries Statistical Tables, 1924 to 1932* suggests that at least in some years (1930–32) only landings in England and Wales were charted.

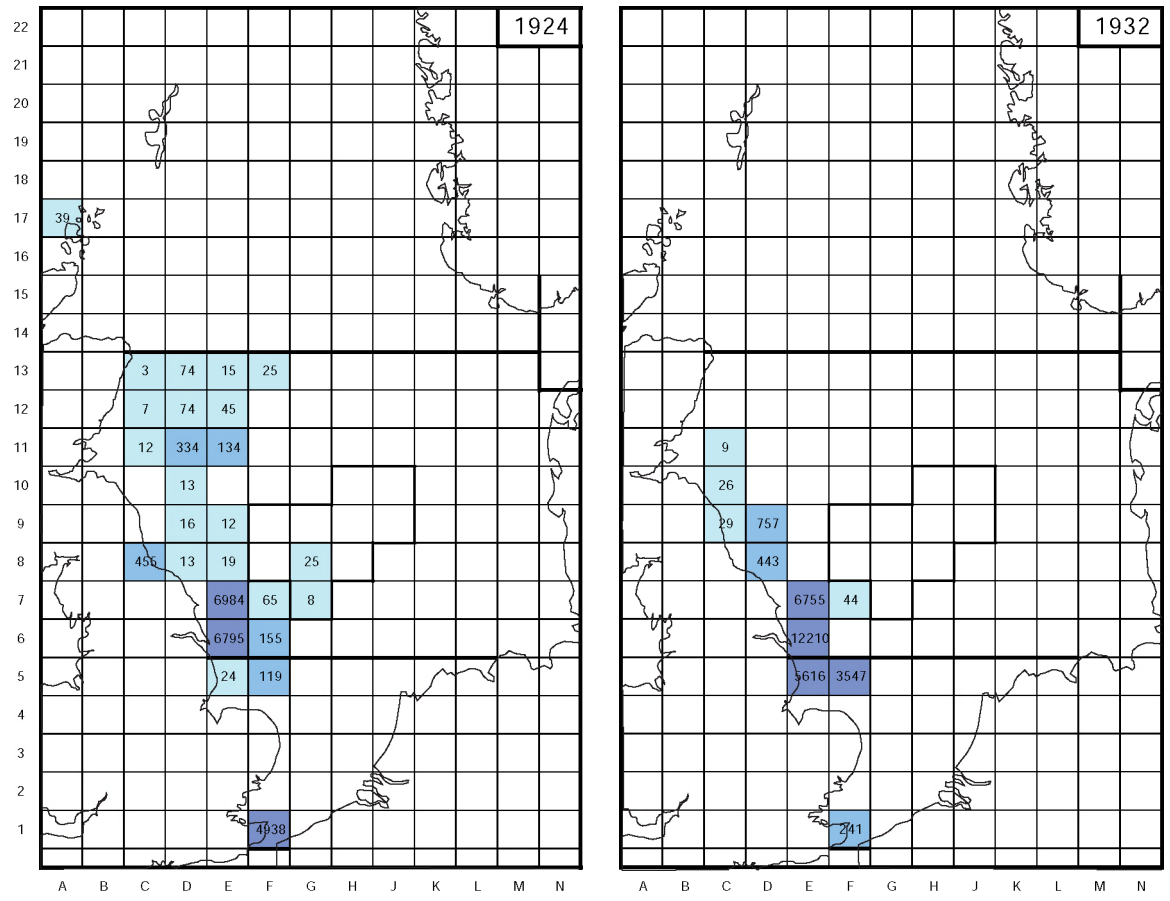


Figure 13. Distribution of total catches of wet fish (in cwt), taken by British first-class motor liners in the North Sea and landed in England and Scotland in 1924 and 1932. Shadings indicate low (<100 cwt, light), moderate (100–1,000 cwt, darker) or high (>1,000 cwt, darkest) total catches in corresponding rectangle.

5.2 Demersal charts – Iceland and Faroe (V)

5.2.1 Steam and motor trawlers – Iceland (Va)

General – This set of statistical charts covers Icelandic waters (Division Va) for the period 1952–73 (Figure 14). The charts refer to landings either in England and Wales (all years) or in Scotland (1957–60).

Although Iceland was already visited by line fishers from the east of England in the fifteenth century (Jones, 2001), British trawling in this highly productive region began in 1891. In that year, 3 steam trawlers from Grimsby fished there and returned with heavy catches. There were no trawling expeditions in the following years, but from 1902 onwards increasing numbers of British trawlers began to visit Icelandic waters (Graham, 1956). The main motivation was far greater catch rates, especially for cod, than in nearby waters such as the North Sea. Cod plays a particularly predominant role in the Icelandic bottom fish community, and can amount to about half of the total demersal catch. Other species important to demersal fisheries include haddock, saithe, plaice and halibut. British catches in Icelandic waters increased steadily from the 1890s until the 1930s. Catches and fishing effort were strongly reduced during WWII, but quickly returned to levels comparable of the 1930s during the post-war years (Figure 15; cf. Gulland, 1961).

It is well known that in the following quarter of a century, fisheries in Icelandic waters by Britain (and to a lesser extent, several other European nations) became the topic of repeated fisheries disputes. During these disputes, Iceland—a country unique among nations in its dependency on fisheries—successfully claimed the right to protect its fish stocks, by successively extending its exclusive fisheries limits: from 3 to 4 nautical miles in 1952, to 12 miles in 1958, to 50 miles in 1972, and to 200 miles in 1975. The latter three conflicts resulted in the Anglo-Icelandic 'Cod Wars' (1958–61, 1972–73, and 1975–76), each settled in favour of Iceland (e.g. Gilchrist, 1978; Jónsson, 1982). The total landings and fishing effort by British trawlers operating in Icelandic waters were not strongly affected by the first two conflicts, remaining at comparable levels from the 1950s to the early 1970s (Figure 14). However, after the loss of the Second and Third Cod Wars and the introduction of the 200-miles Exclusive Economic Zone (EEZ), British trawling in Icelandic waters ceased in 1977.

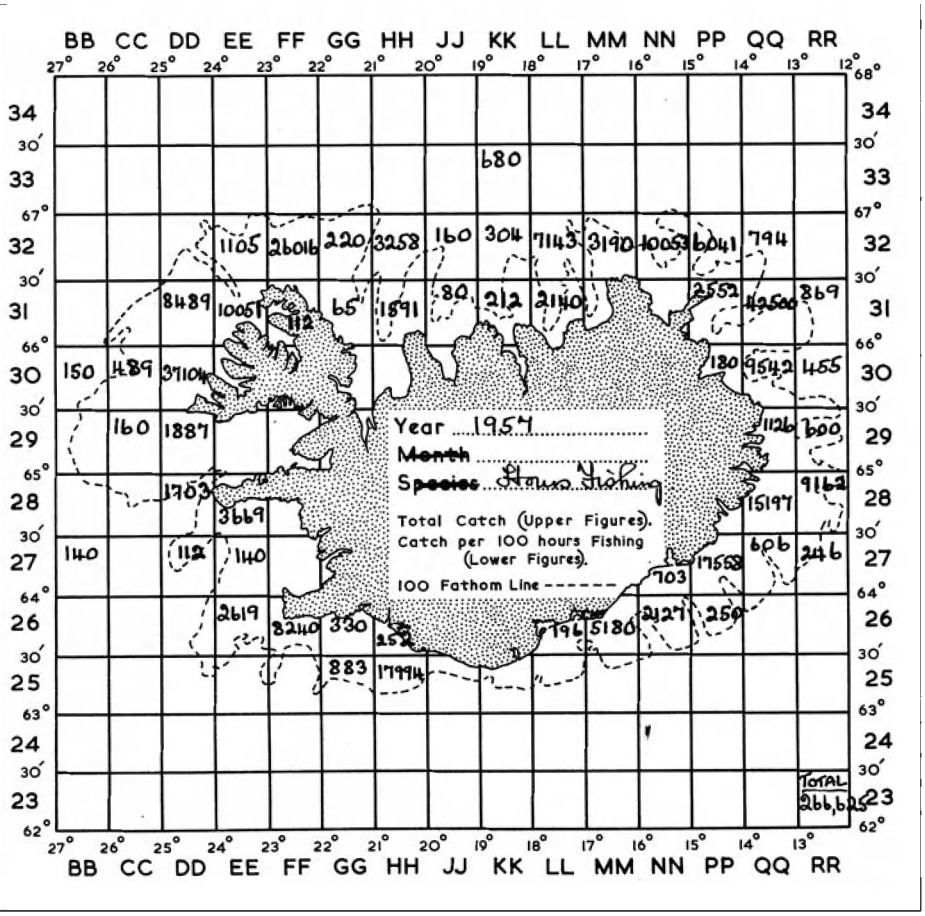


Figure 14. Example of 'Statistical Chart' for Iceland, showing number of hours fished for British steam and motor trawlers combined in 1957 (only 2% of effort was by motor trawlers). Only vessels landing in England and Wales are included. Broken line indicates the 100 fathom line. Note that rectangle notation differs from current ICES rectangle notation (see Section 4).

Temporal coverage – 1952–73, except for the years 1961 and 1972. For 1973, only charts on effort (hours fished) are available.

Spatial coverage – See Figure 14. The majority of rectangles covering the Icelandic shelf were visited in any given year. Within the year there was a strong pattern in spatial coverage, mainly reflecting migration patterns of cod (Gulland, 1961).

The typical chart format, whereby catches are shown by ICES rectangle, was not used in 1973, the last year for which statistical charts are available (coinciding with the Second Cod War). On the 1973 charts, hours fished are shown by 8 broader regions labelled A–H (compare with Jónsson (1982), p. 152).

Species coverage – Cod (recorded from 1952–73), haddock, plaice and redfish (recorded from 1954–73),

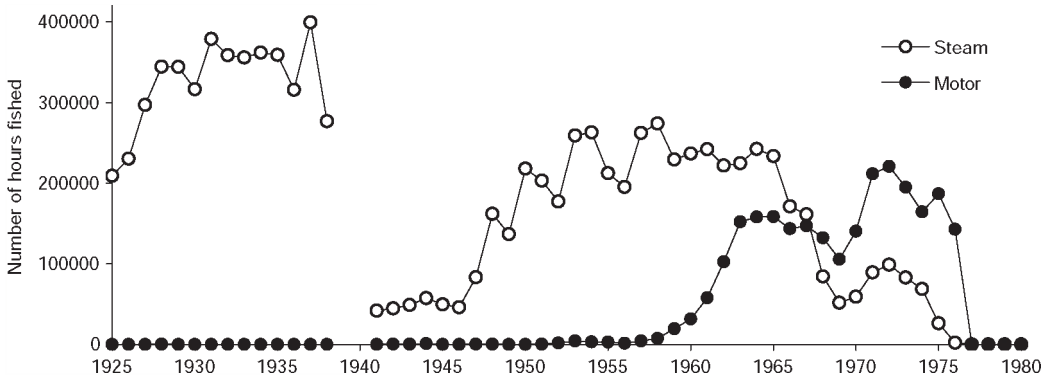


Figure 15. Number of hours fished by British steam and motor trawlers in Icelandic waters, 1925–80 (vessels landings in England and Wales only).

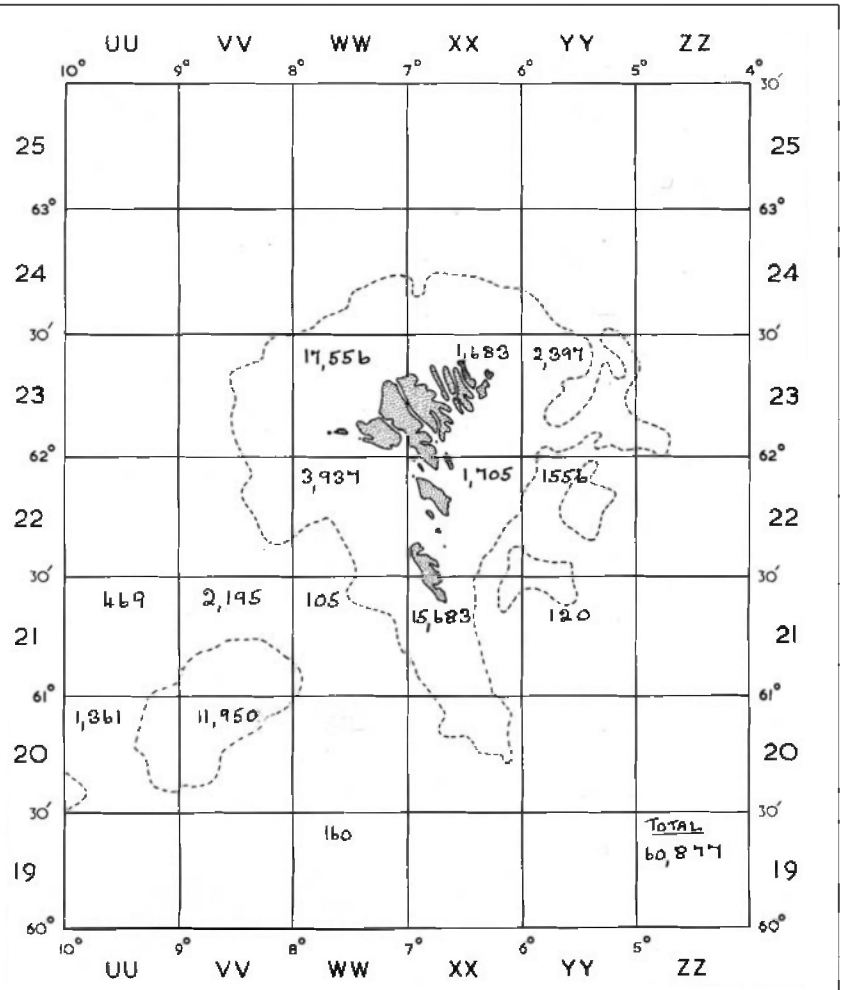


Figure 16. Example of 'Statistical Chart' for Faroe, showing number of hours fished for British steam and motor trawlers combined in 1957 (about 19% of effort was by motor trawlers). Only vessels landing in England and Wales are included. Broken line indicates the 100 fathom line. Note that rectangle notation differs from current ICES rectangle notation (see Section 4).

and saithe (recorded from 1962–73). By and large, these species comprise the major portion (>90%) of Icelandic trawl catches.

Number of charts – 70 annual charts, 1496 monthly charts. Annual charts are absent for the years 1954 and 1965–71.

Box reference numbers – Boxes 62–65.

Spreadsheet reference – 'ChartsVa.xls'.

Remark – The British trawl fleet in Icelandic waters consisted exclusively of large steam trawlers until the early 1950s. Large motor trawlers, of comparable tonnage to the steam trawlers, began participating in the fishery from the mid-1950s onwards, taking about 12% of the entire trawl catch in 1960, 66% in 1970, 87% in 1975, and 99% in 1976, the last year of the fishery. On the statistical charts for 1957–71, trawl catches by rectangle were not partitioned to either steam or motor trawlers. This is unfortunate, given that this period coincides with that of most change in the fleet in terms of propulsion method (cf. Figure 15).

5.2.2 Steam and motor trawlers – Faroe (Vb)

General – This set of statistical charts covers the waters around the Faroe (Faeroe) Islands (Division Vb) over the years 1946–80 (Figure 16). The charts refer to landings by trawlers either in England and Wales (all years) or in Scotland (1955–60).

The productive Faroese waters were first visited by British trawlers in 1898. This became an area of high significance for British fisheries during the first ten years of the twentieth century, and remained so until the early 1970s. During most of that period, English and Scottish trawl vessels took the majority of the Faroese catch. Landings were strongly reduced during WWII, but increased again until the 1950s. Nevertheless, from the mid-1930s onwards there was a generally declining trend in British trawling effort in the area (Figure 17). The total demersal catch, apart from the war years, remained fairly constant until the 1960s. In 1977 the 200-miles Exclusive Economic Zone (EEZ) was introduced. Since then, Faroese vessels have dominated the landings with negligible fishing effort by British trawlers (e.g. 1980: 1187 hours fished). Cod, haddock and saithe make up the majority of the demersal catch at the Faroe grounds.

Temporal coverage – 1946–80. This covers the entire post-war period during which a significant portion of British landings came from Faroese waters.

Spatial coverage – See Figure 16. From 1946–77, good coverage of most rectangles that comprise the shallower waters of the Faroe Plateau and the Faroe Bank. Following introduction of the EEZ the effort of British trawlers and hence spatial coverage became significantly reduced in 1978–80.

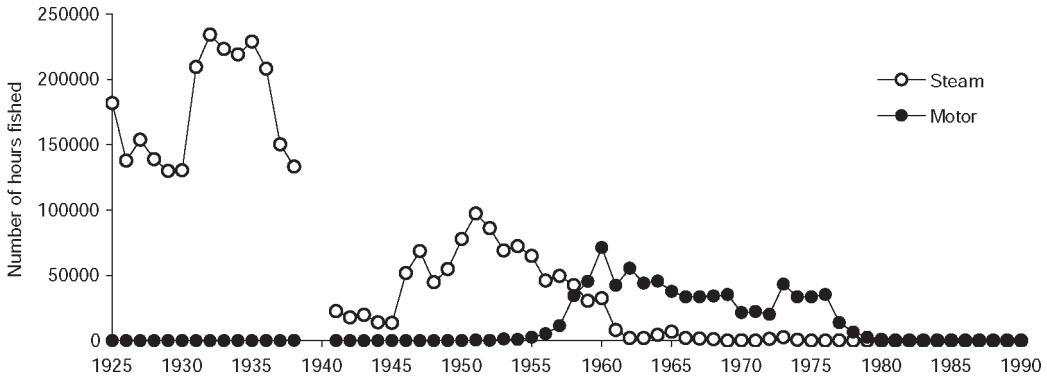


Figure 17. Number of hours fished by British steam and motor trawlers in Faroese waters, 1925–90 (vessels landings in England and Wales only).

Species coverage – From 1946–80: cod, haddock and saithe (which usually amounted for ~85–89% of the total demersal catch; their predominance has declined in recent years). From 1977–80, in addition plaice and whiting.

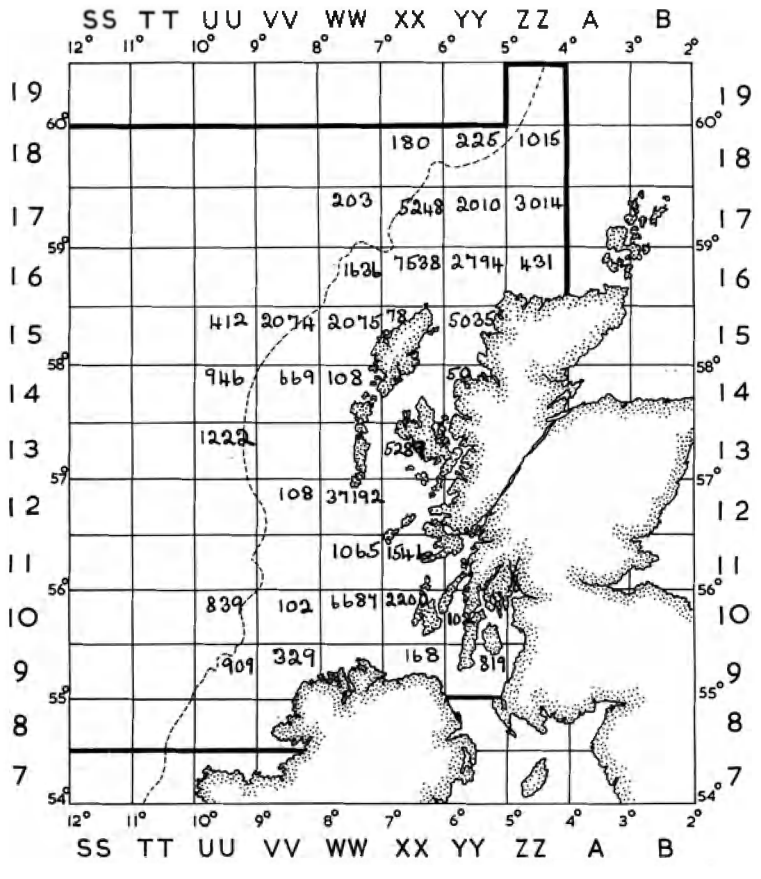
Number of charts – 169 annual charts, 2125 monthly charts.

Box reference numbers – Boxes 66–71.

Spreadsheet reference – 'ChartsVb.xls'.

Remark – On the statistical charts for 1957–71, trawl catches by rectangle were not partitioned to either steam or motor trawlers (as is also the case in the series of charts for Iceland; see Section 5.2.1). Regrettably, this coincides with a period of major change in the fleet from steam to motor propulsion. For example, the fraction of the total trawl catch landed in England and Wales, caught by motor trawlers, was 10% in 1956, 85% in 1965, 93% in 1972.

Figure 18. Example of 'Statistical Chart' for the area West of Scotland, showing number of hours fished in 1957 for British steam trawlers landing in England and Wales. Broken line indicates the 100 fathom line. Note that rectangle notation differs from current ICES rectangle notation (see Section 4).



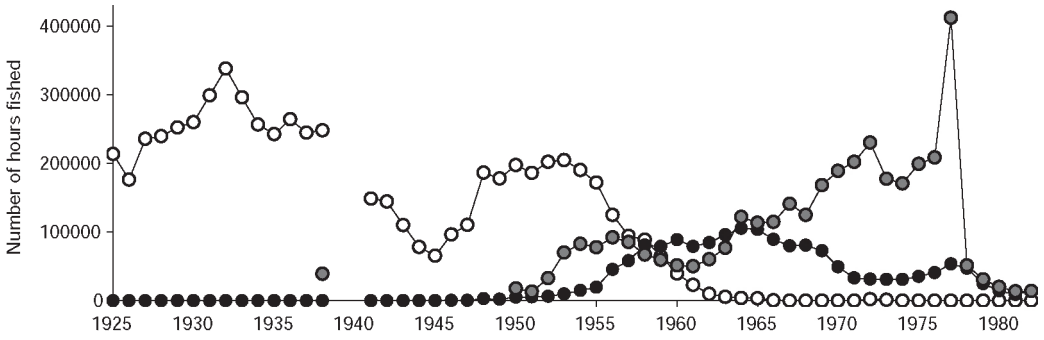


Figure 19. Number of hours fished in the area West of Scotland (Division VIa) during 1925–82, for steam trawlers (white symbols) and motor trawlers (black symbols) landing in England and Wales, and for steam and motor trawlers combined (grey symbols) landing in Scotland (no data for most years prior to 1950).

5.3 Demersal charts – West of Scotland and Rockall (VI)

5.3.1 Steam and motor trawlers – West of Scotland and Rockall (VI)

General – This set of statistical charts shows the landings by British trawlers from the area West of Scotland (Division VIa; see Figure 18) for the period 1955–81; from 1972 onwards, landings from the area around Rockall (Division VIb) were also indicated. All charts include landings in England and Wales only.

Steam trawling in the area West of Scotland goes back to around 1891 (Graham 1955). This has been an important area for the the British trawling industry since the beginning of the twentieth century, with landings over 500,000 cwt (~25,000 tonnes) in most years. In the first half of the century, most trawl catches were landed in England and Wales, but from the 1950s onwards an increasingly high fraction has been landed at Scottish ports (Figure 19).

Temporal coverage – 1955–81, largely coinciding with the period of decrease in landings in England and Wales.

Spatial coverage – In any given year, trawlers visited the majority of rectangles comprising the continental shelf within Division VIa (Figure 19). At a monthly scale the spatial coverage is less comprehensive, especially in later years when the fishing effort by trawlers landing in England and Wales had decreased. In the earlier years the fishery tended to be more offshore during the summer months.

The charts for 1972–81 include landings by rectangle from Division VIb (Rockall).

Species coverage – All years: cod, dogfish, haddock, hake, saithe, and whiting. From 1977 onwards: also plaice and (in very small quantities) sole. The species dominating the trawl landings were cod, saithe, haddock and (except in later years) hake.

Number of charts – 269 annual charts, 3434 monthly charts.

Box reference numbers – Boxes 72–78.

Spreadsheet reference – 'ChartsVI.xls'.

Remark – For the year 1977 only, 5 annual and 5 monthly statistical charts describe motor seiner catches, landed in England and Wales, from the area West of Scotland (Division VIa). There was only a single landing in that year, caught during 20 hours fishing. The charts show catches of total demersal fish, cod, plaice, whiting, and the number of hours fished. They have been included in Box 77.

5.4 Demersal charts – West of Ireland and Channels (VII)

5.4.1 Motor trawlers – Irish Sea (VIIa)

General – The charts show the landings in England and Wales by British motor trawlers, originating from the Irish Sea (Division VIIa), for the years 1972–76 only. For the years 1977–81, this series is continued on a set of statistical charts that includes the entire Sub-area VII (see Section 5.4.2). The charts include landings by vessels over 40 feet length only.

Temporal coverage – 1972–76.

Spatial coverage – All or most rectangles in the Irish Sea are covered.

Species coverage – Cod, hake, monks or anglers, plaice, saithe, skates and rays, sole, whiting.

Number of charts – 45 annual charts, 540 monthly charts.

Box reference numbers – Boxes 79–80.

Spreadsheet reference – 'ChartsVII.xls'.

Remark – All charts show the landings in metric tonnes.

5.4.2 Motor trawlers – West of Ireland and Channels (VII)

General – This series of charts, available for 1977–81, forms a continuation of the 1972–76 Irish Sea trawler charts, extended to include all landings by motor trawlers in England and Wales from the entire Sub-area VII (West of Ireland and Channels). Within this area, ~40–50% of the trawl landings

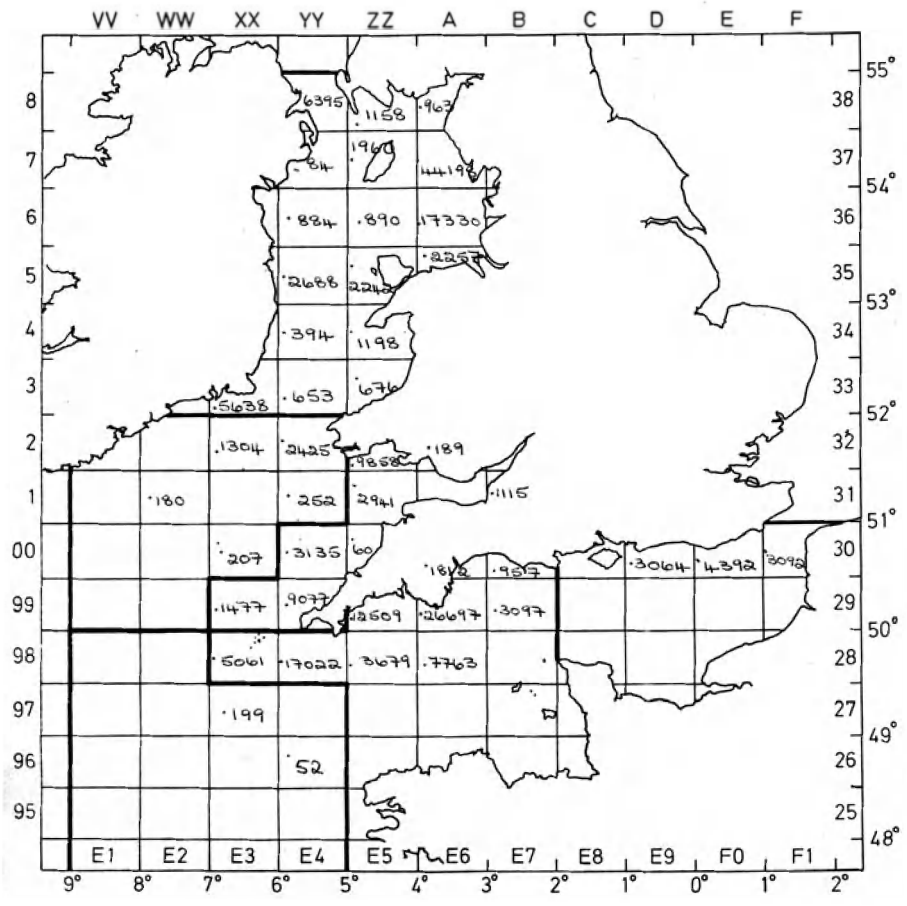


Figure 20. Example of 'Statistical Chart' for ICES Sub-area VII, showing number of hours fished in 1978 for British motor trawlers landing in England and Wales (vessels over 40 feet only). Landings from ICES Divisions VIIb–c and VIIj–k (not charted) by rectangle are included at the bottom of the chart. Note that rectangles are indicated following both ICES notation (bottom and right-hand margins) and traditional 'Statistical Chart' notation (top and left-hand margins; see Section 4).

during 1977–81 came from the Irish Sea (Division VIIa), ~30–40% from the English Channel (VIId and e), ~10% from the Bristol Channel (VIIf), 2–18% from the area South of Ireland and the Sole Banks (VIIg–k), and <1% from the area West of Ireland and Porcupine Bank (VIIb and c). The charts only include landings by vessels over 40 feet length.

Temporal coverage – 1977–81.

Spatial coverage – See Figure 20. During these years trawlers landing in England and Wales operated in most rectangles of the Irish Sea (VIIa) and Bristol Channel (VIIf). In the English Channel, British trawlers operated mainly in the northern rectangles; effort was considerably higher in the Western (VIIe) compared to the Eastern English Channel (VIId). The coverage of Divisions VIIg and VIIh (South-east of Ireland and Little Sole Bank) is less extensive and merely restricted to the shallower waters. There is very limited coverage of the areas to the west and south-west of Ireland (VIIb–c, VIIj–k). It should be noted that the average gross tonnage of trawlers visiting the more distant Divisions VIIb–c and VIIg–k was far greater (~100–200 tons) than that of trawlers fishing in the Irish Sea and Channels (VIIa, VIId–f; ~30–40 tons).

Species coverage – Cod, haddock, plaice, saithe, sole, and whiting recorded from 1977–81; Norway pout recorded in 1977 and 1978 (very small quantities); sandeels recorded in 1978 (very small quantity).

Number of charts – 35 annual charts, 451 monthly charts.

Box reference numbers – Box 81.

Spreadsheet reference – 'ChartsVII.xls'.

5.4.3 Motor seiners – West of Ireland and Channels (VII)

General – This set of charts, covering the period 1977–81, shows the landings in England and Wales by motor (Danish or demersal) seiners from Sub-area VII (West of Ireland and Channels). For the same region and period, landings by trawlers are also available (see Section 5.4.2). Over the years, most effort by British seiners generally occurred in the North Sea, but Sub-area VII is probably the region of second-most importance for this capture method. Still, during 1977–81 most of the demersal landings from Sub-area VII were taken by trawlers (>80%), with seiners being responsible for only about 4–8% of the catch. Seiners were active in a relatively small number of rectangles within the sub-area; this was mostly in the Irish Sea and to a lesser extent in the Western English Channel.

Temporal coverage – 1977–81.

Spatial coverage – Limited. Mainly in the north-eastern part of the Irish Sea (VIIa) and the northern part of the Western English Channel (VIIe), where Danish seining occurred in most months of the years 1977–81. In the other divisions of Sub-area VII, seining occurred only in a few rectangles, in some spring or summer months only.

Species coverage – Cod, haddock, plaice, saithe, sole, whiting. Of these species, plaice is generally caught in highest quantities.

Number of charts – 32 annual charts, 403 monthly charts.

Box reference numbers – Box 82.

Spreadsheet reference – 'ChartsVII.xls'.

5.5 Pelagic charts - all regions

General – Until 1977, statistical charts had exclusively covered landings of demersal fish species, but in that year the series was extended to include catches of pelagic fish landed in England and Wales. 'Pelagic charts' are available for the following ICES Sub-areas or Divisions: IV (North Sea), Vb (Faroe), VI (West of Scotland and Rockall), and VII (West of Ireland and Channels). The following fleet components are shown on separate charts: motor trawlers, pair trawlers (sometimes referred to as 'pareja' or 'parega'), purse seiners (including fixed nets), and liners (for descriptions and illustrations, see e.g. Graham, 1956; Jennings *et al.*, 2001). Landings by vessels both under and over 40 feet are shown. The charts show the total landings of all pelagic fish, herring, mackerel, and sprat. No information is provided on effort, or catch-per-unit-effort, by rectangle.

5.5.1 Pelagic charts - North Sea (IV)

Temporal coverage – 1977–81.

Spatial coverage – Highly localised and patchy; mainly in the western central North Sea (Division IVb). Most catches were taken by motor trawlers and pair trawlers.

Species coverage – Herring, mackerel, sprat, total pelagic fish. Herring has traditionally been the most important pelagic species in the North Sea, but pelagic landings in this specific period constituted mainly of sprat. At the time the herring fishery was in crisis and landings were extremely low, due to severe depletion of the stock in preceding decades (the stock has recovered in more recent years; Nichols, 2001).

Number of charts – 50 annual charts, 398 monthly charts.

Box reference numbers – Box 83.

Spreadsheet reference – 'PelagicCharts.xls'.

5.5.2 Pelagic charts – Faroe (Vb)

Temporal coverage – 1977–80.

Spatial coverage – Localised on the Faroe Plateau and Faroe Bank.

Species coverage – Mackerel, total pelagic fish. These were taken exclusively by motor trawlers.

Number of charts – 8 annual charts, 29 monthly charts.

Box reference numbers – Box 84.

Spreadsheet reference – 'PelagicCharts.xls'.

5.5.3 Pelagic charts – West of Scotland and Rockall (VI)

Temporal coverage – 1977–81.

Spatial coverage – Motor trawlers (responsible for the majority of landings) operated in most rectangles covering the continental shelf within Division VIa. Effort by pair trawlers and purse seiners was very localised. In each of the years 1977–81, some motor and/or pair trawlers took a small number of pelagic catches on the Rockall Bank (Division VIb).

Species coverage – Herring, mackerel, total pelagic fish. In this region, mackerel was the most important pelagic species during these years. Mackerel catches by British vessels increased very significantly from 1977 (161 tonnes) to 1979 (13,472 tonnes). This is readily explained by shifts in the distribution of fishing fleets following the introduction of Exclusive Economic Zones in 1977 (Lockwood and Shepherd, 1984). As a result, many British vessels previously fishing in distant waters moved to regions within the European Union's EEZ.

Number of charts – 36 annual charts, 167 monthly charts.

Box reference numbers – Box 84.

Spreadsheet reference – 'PelagicCharts.xls'.

Remark – All pelagic charts include landings in England and Wales only. It should be noted that of the United Kingdom's pelagic catch in Division VIa, the fraction landed in Scotland was far higher than that landed in England and Wales during the period considered.

5.5.4 Pelagic charts – West of Ireland and Channels (VII)

Temporal coverage – 1977–81.

Spatial coverage – Localised within Sub-area VII. Motor trawlers operated in most rectangles of the Irish Sea (Division VIIa) and Bristol Channel (VIIf); in most of the northern rectangles of the English Channel (VIId, e); and in some rectangles to the west and south of Ireland (VIIa–b, VIIg–k). Most effort by pair trawlers, purse seiners and liners was in a few rectangles of the Irish Sea (VIIa), the northwestern English Channel (VIIe), and the Bristol Channel (VIIf).

Species coverage – Herring, mackerel, sprat, total pelagic fish.

Number of charts – 57 annual charts, 635 monthly charts.

Box reference numbers – Box 85.

Spreadsheet reference – 'PelagicCharts.xls'.

Remark – Within Sub-area VII there are strong regional differences in the prevalence of the various species that make up the pelagic catch. Herring dominate catches in the Irish Sea (VIIa), while mackerel generally do so in the Bristol Channel (VIIf). In the English Channel (VIId and VIIe), mackerel, pilchards and herring each dominated the catches in different periods of the twentieth century (cf. Southward et al. 1988); mackerel was the most important species in the years covered by the statistical charts.

5.6 Miscellaneous charts

5.6.1 All fleets – All regions

General – For the years 1925–30, these charts provide information on the overall distribution of the British fishing fleet over the various fishing regions in the north-east Atlantic (see Figure 21 for an example). More specifically, for all British first-class vessels landing in England and Wales, these charts may show either (1) the total number of landings or (2) the total quantity (in 100 cwt) of wet fish landed from each rectangle of the northeast Atlantic. The values by rectangle are shown separately for the different fleet components—steam trawlers, motor trawlers, sailing trawlers, steam liners, motor liners, steam Danish seiners, motor Danish seiners, steam drifters, and motor drifters (see Sections 5.1.1–5.1.7 for brief descriptions of fleet components, with emphasis on the North Sea). The numbers of landings are not shown for drifters.

Temporal coverage – 1925–30 for charts on the total quantity of wet fish; 1925–26 for charts on the number of landings.

Spatial coverage – All regions where the British fishing fleet operated during these years (see Figure 21). The most important regions were ICES Sub-areas IV (North Sea; almost half of the total quantity landed in England and Wales), V (Iceland and Faroe; almost a quarter), and VII (West of Ireland and Channels; about one-tenth). Of moderate importance were ICES Sub-areas VI (West of Scotland and Rockall), I (Barents Sea) and (from 1928 onwards) II (Northward of Norwegian Coast); each of these three regions accounted for roughly one-twentieth of the total quantity landed. A very small fraction of the landings (<1%) came from ICES Sub-areas III (Skagerrak, Baltic), VII (Gulf of Biscay), IX (Portuguese Coast), X (Moroccan Coast), and XV (West Coast of Greenland; currently NAFO Sub-area 1).

Species coverage – Total wet fish. This includes all demersal and pelagic fish, but excludes any shellfish catches.

Number of charts – 8 annual charts, 68 monthly charts

Box reference numbers – Box 86.

Spreadsheet reference – 'AllRegionsCharts.xls'

5.6.2 Tonnage charts – North Sea

General – For each month of the period 1960–66, this interesting set of charts provides information on how fishing vessels of various sizes distributed over the North Sea. More specifically, for each rectangle the charts show the average gross tonnage per voyage per month, plotted separately for steam trawlers, motor trawlers, and motor seiners landing in England and Wales. This information can be very useful for interpreting spatial variability in catch rates of fish species, given that vessel tonnage and fishing power are generally closely correlated (for worked-out examples see e.g. Gulland, 1956; Beverton and Holt, 1957 [pp. 175–176]). Unfortunately, the charts are restricted to a fairly short time-span of only 7 years.

Temporal coverage – 1960–66.

Spatial coverage – North Sea.

Species coverage – Not applicable.

Number of charts – 252 monthly charts (no annual charts).

Box reference numbers – Box 87.

Spreadsheet reference – 'TonnageCharts.xls'

5.6.3 Scottish charts – Trawlers and seiners

General – This series of charts from the 1960s, labeled 'Scottish charts', was probably not produced at Cefas but at Fisheries Research Services (FRS), Aberdeen. They show the landings by trawlers and seiners from the sea area around Scotland and the Faroes, for Scottish ports exclusively. The area mapped on the charts does not match precisely with definitions of ICES fishing regions. From 1960–63 it is enclosed by latitudes 55° and 64°N and longitudes 15°W and 8°E; this includes ICES Divisions IVa (northern North Sea), Vb (Faroe) and VIa (West of Scotland) and part of Divisions IVb (central North Sea) and VIb (Rockall). From 1964–66 the charted area is smaller (between longitudes 9°W and 5°E only) so that it excludes Division VIb (Rockall).

One set of 'Scottish charts' shows landings and effort (hours fishing) for British trawlers landing in Scotland, distinguishing steam trawlers, motor trawlers, and (except in the initial year) light trawlers (cf. Main and Sangster, 1983).

A second set of 'Scottish charts' shows landings and effort for British seiners (all motor) landing in Scotland. Seiners are divided into 3 length groups, defined differently in the earlier and later years of the time series (1962–64: under 40 feet, 40–70 feet, and over 70 feet; 1965–66: under 40 feet, 40–65 feet, and over 65 feet). For the years 1962 and 1963, separate charts show the statistics for seiners landing in Aberdeen and for those landing in all other Scottish ports.

Temporal coverage – Trawlers: 1961–66. Seiners: 1962–66.

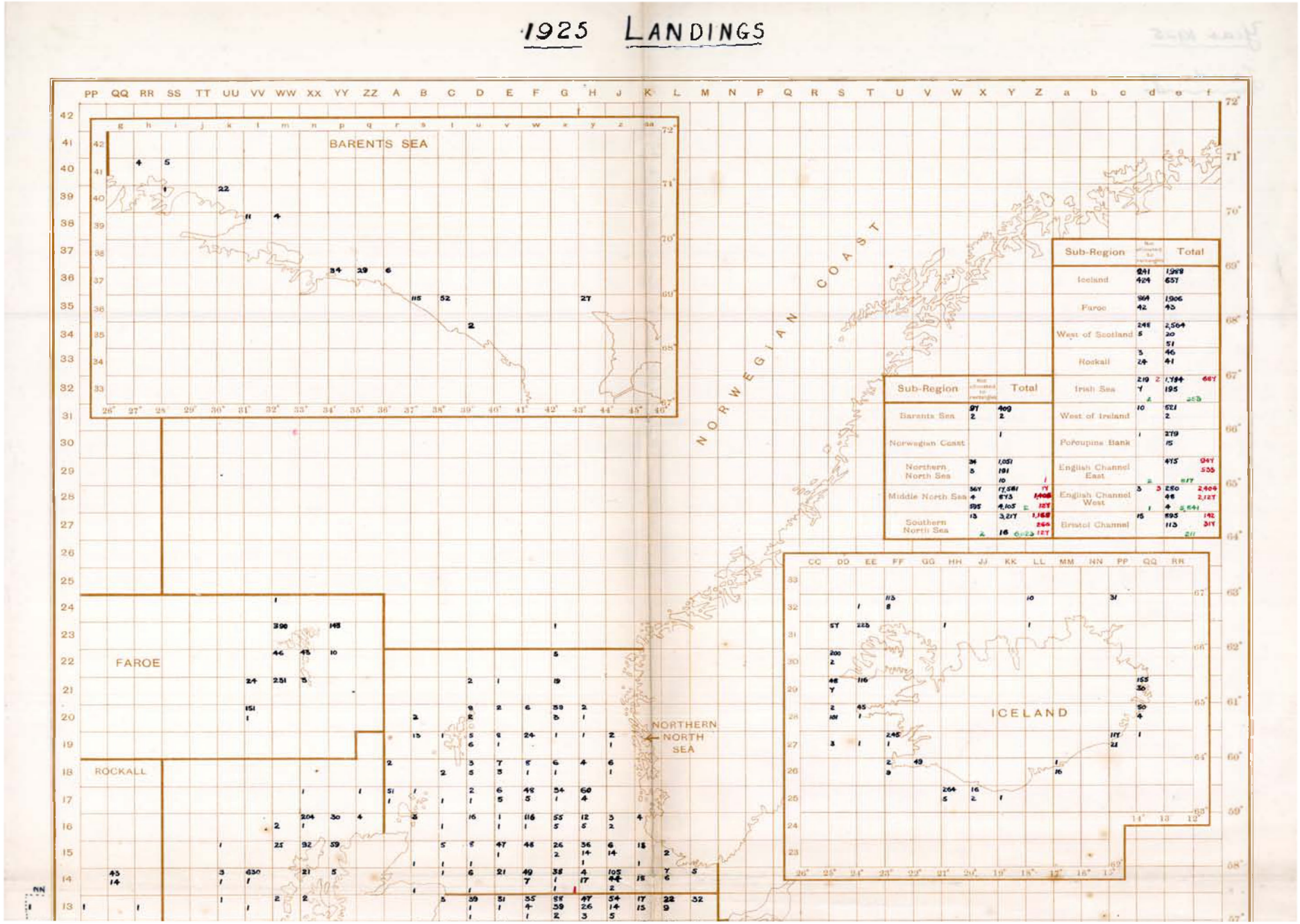
Spatial coverage – Seas around Scotland and Faroe.

Species coverage – Cod, haddock, hake, lemon soles, plaice, saithe, whiting, total demersal fish.

Number of charts – Trawlers: 897 monthly charts. Seiners: 1214 monthly charts. No charts with annual statistics available.

Box reference numbers – 88–93.

Spreadsheet reference – 'ScottishCharts.xls'


1925 LANDINGS
BARENTS SEA
NORWEGIAN COAST
FAROE
ROCKALL
NORTHERN NORTH SEA
ICELAND
Sub-Region
Total
Iceland
Faroe
West of Scotland
Rockall
Irish Sea
West of Ireland
Porcupine Bank
English Channel East
English Channel West
Bristol Channel
Sub-Region
Total
Barents Sea
Norwegian Coast
Northern North Sea
Middle North Sea
Southern North Sea

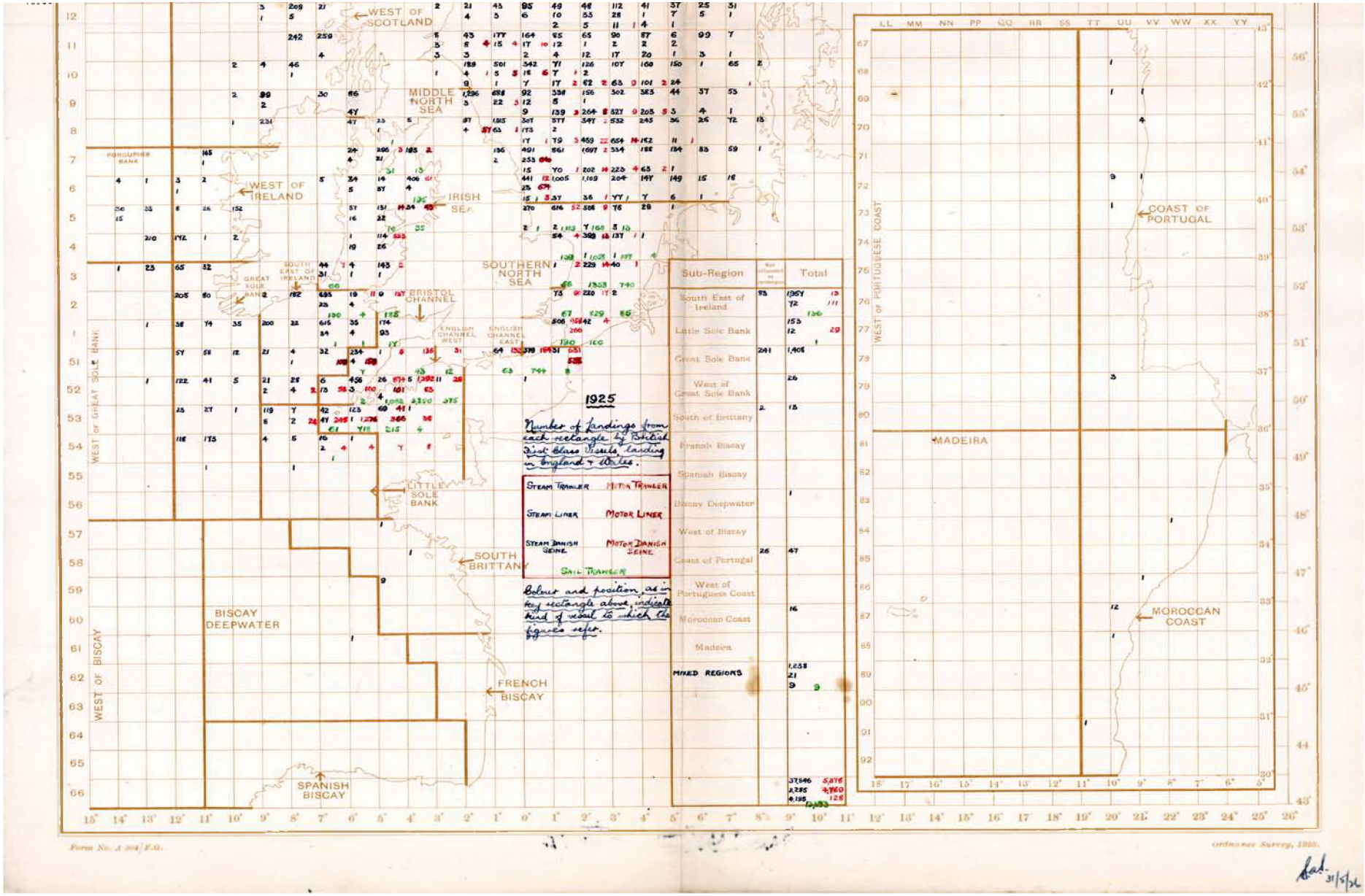


Figure 21. Example of 'Statistical Chart' showing the overall distribution of effort for the entire British first-class fishing fleet (excluding drifters) landing in England and Wales in 1925. Effort is shown as the number of landings originating from each rectangle in the north-east Atlantic, indicated separately for each fleet component: steam, motor and sailing trawlers, steam and motor liners, steam and motor Danish seiners.

6. Perspectives

The previous section clearly demonstrates the extensiveness of the 'Statistical Charts' series held at Cefas Lowestoft Laboratory, produced over almost 7 decades and numbering over 37,000 charts. The report thus underlines the potential of these charts as a rich data source for studies focusing on long-term changes in abundance and distribution for a range of fish stocks, as well as for the fishing fleets targeting these stocks (cf. Pope and Macer, 1996; Rijnsdorp *et al.*, 1996; Rijnsdorp and Millner, 1996; Greenstreet *et al.*, 1999; Rogers and Ellis, 2000).

It appears that during the past two decades the 'Statistical Charts' have not, or have only rarely been used for research purposes. One chief obstacle may simply have been a lack of funding to digitise the extensive material into a computer-readable format. The 1980s and 1990s also saw a trend in fisheries science whereby the importance of commercial catch-per-unit-effort (CPUE) data for stock assessments somewhat declined in favour of 'tuning series' based on research survey data. It should also be noted that from the 1970s onwards, rectangle-specific CPUE data are available in digital format (ICES, Copenhagen).

Some of the possibilities and challenges provided by the charts may be briefly discussed here. One complication which is perhaps fairly obvious, is that the charts show landings statistics, reflecting the quantities of fish brought ashore but not necessarily the quantities actually caught. For example, Borley and Thursby-Pelham (1926) mentioned that the 1923 and 1924 charts for dab and whiting, in all probability, did not represent the true catches at all, due to extensive discarding of these (at the time) low-value species. There is often hardly any knowledge on the extent of discarding especially for the early years. Different species were discarded to various extents in different periods, depending on factors such as monetary value, quota restrictions, mean fish size and abundance (haddock: see Bowman, 1932).

In addition, fishing grounds are often highly localised within rectangles. Thus, while figures on catches and catch rates may provide fair descriptions of the conditions at the grounds where most of the actual fishing took place, they may not necessarily be representative of the conditions for entire rectangles (R.C.A. Bannister, pers. comm.).

Furthermore, the definition of fish species may sometimes be problematic. For example, 'skates and rays' in the North Sea may include at least six species of Rajidae, and the prevalence of several of these has changed markedly over the past century (Rijnsdorp *et al.*, 1996; Walker and Hislop, 1998). 'Breams' are usually defined as any members of the Sparidae (sea breams), but on the earliest statistical charts the term apparently also included the scorpaenid *Sebastes* (Norway haddock; *fide* Borley and Thursby-Pelham, 1926).

Such complications should, however, not distract from the general usefulness of the 'Statistical Charts', which may primarily lie in the combination of spatial with temporal information on catch rates (see Figure 22 for an illustration). The spatial structure of fish stocks may be better described by commercial CPUE data (often derived from a large number of vessels per rectangle, each fishing a large number of hours) than by research survey data (often derived from a relatively small number of stations each sampled once or a few times only). On the other hand, temporal changes in fish stocks may be better described by survey data (if collected in a consistent way over the years) than by commercial CPUE statistics, due to inherent trends in fishing fleets affecting their fishing power. Examples are changes in vessel tonnage, horsepower, technology, and fishery regulations (see Hilborn and Walters, 1992, pp. 121–131 and 175–192).

For the northern North Sea, a comparison with Scottish groundfish surveys from 1929–56 and 1981–93 may help tackle such complications (e.g. Greenstreet and Hall 1996). Moreover, a good understanding of the history of a specific fleet component is essential before analyses of its CPUE for studies on changes in stock abundance can be carried out. Both the *Sea Fisheries Statistical Tables* series (Defra, London; previously MAF and MAFF), the *Scottish Sea Fisheries Statistical Tables* (SEERAD, Edinburgh; previously SHD) and the *Bulletin Statistique* (ICES, Copenhagen) contain valuable quantitative information on British and European fishing fleets. Unfortunately, it has been difficult to find datasets on average tonnage or average engine power that are collected in a consistent way over several decades, even though such data are available for shorter periods (Figure 23).

With this catalogue, an initial step has been made towards making better use of these historical 'Statistical Charts'. Indeed, Cefas' Systems Modelling Team is planning to further extend the work in the near future. A start has been made to digitise a subset of charts. Given the large amount of information and time required to enter all data in electronic databases, the team's priority in the short term is to focus on specific questions. In the long term, it is hoped to make the majority of data available electronically, depending on funding and priority considerations. We are confident that the study initiated with this catalogue can appreciably improve our understanding of fish stock and fleet dynamics—acknowledging, at the same time, the advantages and challenges posed by these data.

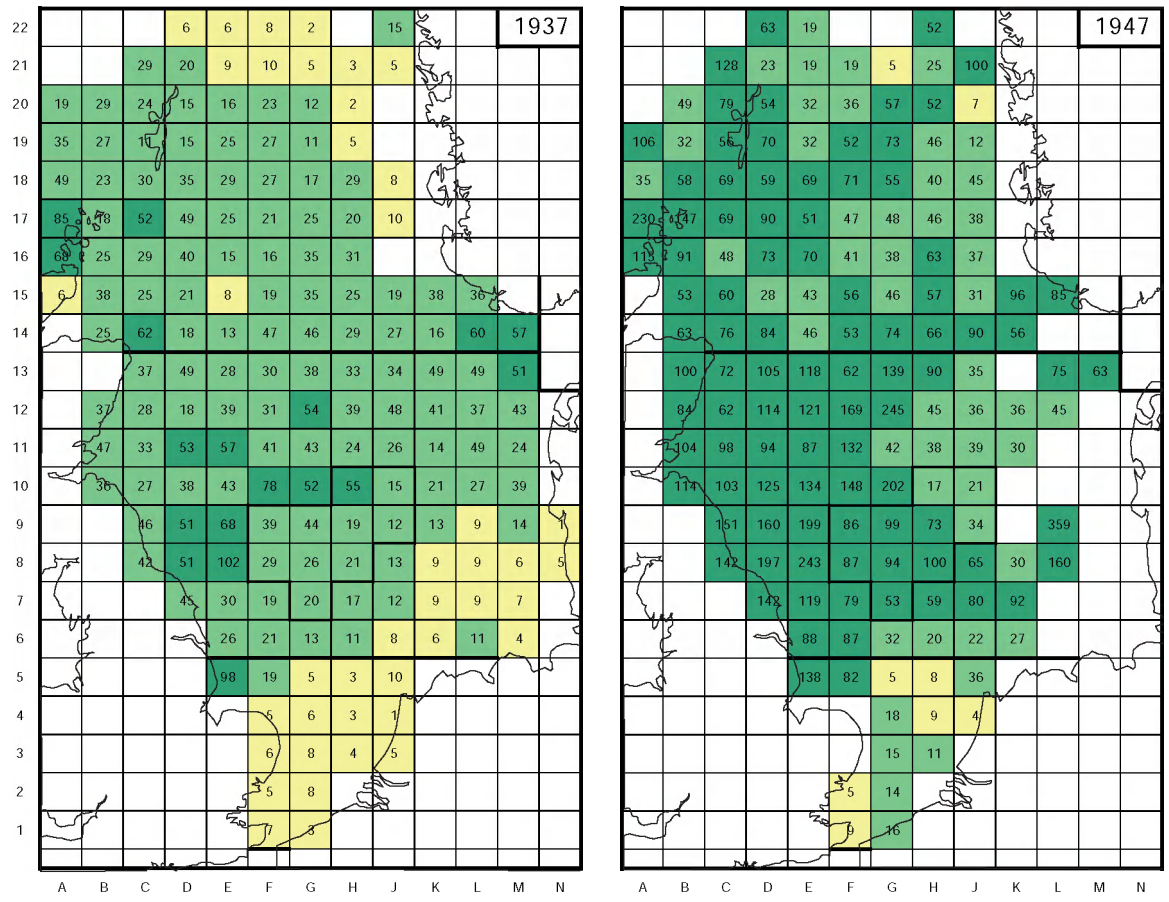


Figure 22. Illustration of spatial and temporal information available through 'Statistical Charts'. For each rectangle of the North Sea, catch rates of cod by British first-class steam trawlers are shown (in cwt per 100 hours fishing), for the years 1937 (left) and 1947 (right). Shadings indicate low (<10 cwt 100^{-1} hr^{-1}, light), moderate (10–50 cwt 100^{-1} hr^{-1}, darker) or high (>50 cwt 100^{-1} hr^{-1}, darkest) catch rates. White indicates absence of steam trawling in corresponding rectangle. Note far greater catch rates in 1947, following a period when fishing effort was significantly reduced during WWII (cf. Figure 3).

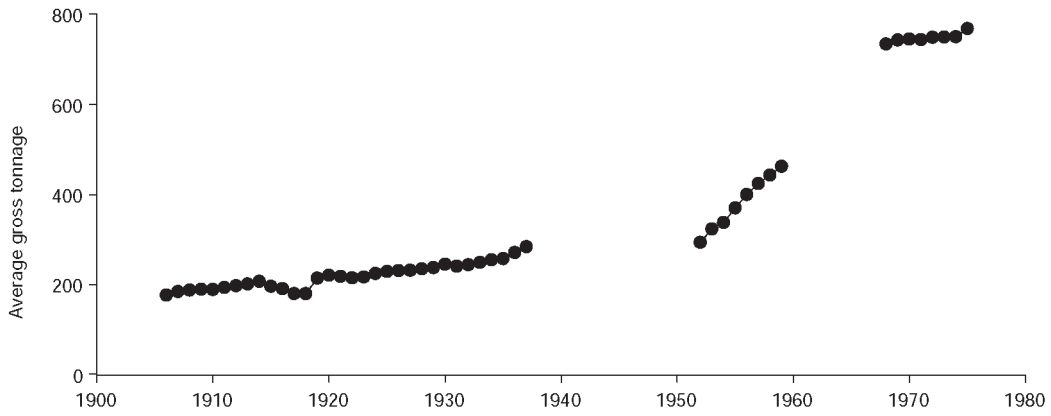


Figure 23. Average gross tonnage of first-class steam trawlers registered in England and Wales on 31 December, 1906–76. Values for 1952–59 include a relatively small fraction (~10%) of steam vessels applying other fishing methods than trawling.

7. Acknowledgements

This study was funded by the Department for Environment, Food and Rural Affairs of the United Kingdom (Contract M0322). It was the enthusiasm of Laurence Kell that initiated the inventory, and it was John Dann who located the boxes with charts in various storage spaces and offices of Cefas, with the help of Gary Burt. Richard Millner, John Pinnegar and the Cefas library staff provided useful support in tracking relevant old literature and data. Colin Bannister, Ewen Bell, Trevor Boon, Trevor Hutton, Simon Jennings, Graham Pilling, and Beatriz Roel are gratefully acknowledged for valuable discussions and support.

I dedicate this paper to my father, Captain Herbert G. Engelhard (born 12 June 1936, died 14 September 2003), who served on deep-sea cargo vessels from 1955 until 1984. His rich stories about life at sea, the history of ships, and the technology of steam and motor, were a source of inspiration for me in writing the sections on fishing fleets, even after his death.

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England and Wales:

Board of Trade, 1887. Sea Fisheries (England and Wales). First Annual Report of the Inspector For the Year 1886. London: Her Majesty's Stationery Office. *Thereafter published annually, until 1903 (providing statistics for 1902).*

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9. Electronic appendix

Supplementary information accompanies this paper in the form of an electronic appendix available at:

www.cefas.co.uk/publications/techrep/techrep128.htm

The electronic appendix contains extensive information on the numbers and coverage of the 'Statistical Charts' available at Cefas, Lowestoft Laboratory. It includes nine searchable Microsoft Excel Workbooks, each dealing with specific subsets of 'Statistical Charts', arranged according to a split in 'demersal', 'pelagic', and 'miscellaneous' charts and in case of demersal charts, also according to region. The workbooks in turn consist of one to several spreadsheets, each dealing either with a specific fleet component (demersal charts) or region (pelagic charts). The spreadsheets provide information on the numbers of annual and monthly charts available per year, species, fleet component, and region, indicating the number code of the corresponding box file containing the actual charts, as stored at Cefas.

An overview of the workbooks and spreadsheets included in the appendix is given in Table 6.

Table 6. Overview of Microsoft Excel workbooks and names of spreadsheets included in the electronic appendix to this report, available at www.cefas.co.uk, with reference to the sections in this report providing descriptions of regions or fleet components.

Workbook	Spreadsheets	Section in current report
ChartsIV.xls	SteamTrawl	5.1.1
	MotorTrawl	5.1.2
	SailTrawl	5.1.3
	SteamSeine	5.1.4
	MotorSeine	5.1.5
	SteamLine	5.1.6
	MotorLine	5.1.7
ChartsVa.xls	Trawl	5.2.1
ChartsVb.xls	Trawl	5.2.2
ChartsVI.xls	SteamTrawl	5.3.1
	MotorTrawl	5.3.1
	MotorSeine	5.3.1
ChartsVII.xls	MotorTrawl	5.4.1, 5.4.2
	MotorSeine	5.4.3
PelagicCharts.xls	NorthSea	5.5.1
	Faroe	5.5.2
	WestofScotland	5.5.3
	Channels	5.5.4
AllRegionsCharts.xls	AllFleets	5.6.1
TonnageCharts.xls	TrawlSeine	5.6.2
ScottishCharts.xls	Trawl	5.6.3
	Seine	5.6.3

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