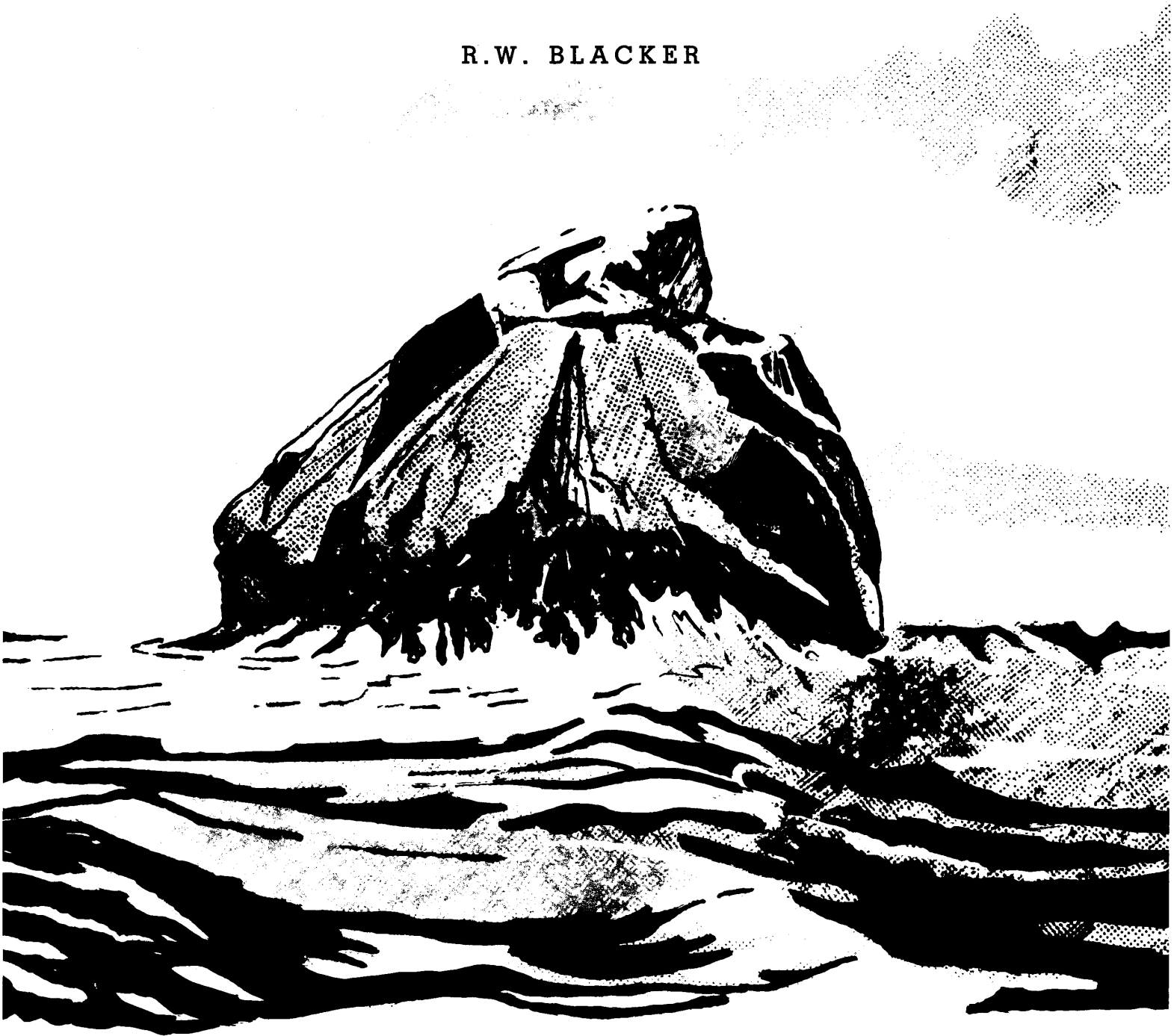


ISSN 0143-8018

MINISTRY OF AGRICULTURE, FISHERIES AND FOOD
DIRECTORATE OF FISHERIES RESEARCH

ROCKALL AND ITS FISHERY

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LABORATORY LEAFLET No.55
LOWESTOFT 1982

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Lab. Leaf1., MAFF Direct. Fish. Res., Lowestoft (55) 23 pp.

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1. INTRODUCTION

Rockall has probably been fished for more than two centuries: it was certainly on the fisherman's map long before its accurate geographic position was first fixed when HMS 'Endymion' visited the rock in 1810, and a landing party collected a few rock samples. Subsequently Royal Navy survey ships visited the area at infrequent intervals and their log books often mentioned the presence of fishing vessels near Rockall. One of them was HMS 'Porcupine' which surveyed the Atlantic Slope west of Ireland in 1862, giving its name to Porcupine Bank during the voyage. The vessels they saw probably came from Shetland, since Shetland fishermen regularly fished Rockall Bank whereas the cod fishermen from Harwich and other English east coast ports only fished Rockall occasionally as an alternative to Faroe Bank before the summer voyage to Iceland.

This report describes what is known of the topography and fauna of Rockall Bank and the hydrography of the area. What is known of the history of the fisheries is outlined and the English and Scottish fisheries for the most important species are reviewed from 1906, when the collection of detailed landing statistics began, to the present day.

2. TOPOGRAPHY

Rockall Bank is part of Rockall Plateau which stretches 400 miles SW from George Bligh Bank (58°50'N 13°10'W) and is 230 miles wide. George Bligh Bank lies at the northern end of the plateau while Rockall Bank occupies the SE side and Hatton Bank lies on the NW side (Figure 1).

Rockall Bank extends 25 miles N and 100 miles SSW from Rockall itself and has depths from 65-220 m (35-120 fm) over it (Figure 2). Two miles ENE of Rockall is the notorious Helen's Reef with depths of 1.8 m over it, and 1 cable N of the rock is the Hasselwood Rock, which is usually marked by breakers. The Admiralty Pilot states: "A narrow ridge with depths less than 75 m (40 fm) over it extends 6 cables S and 5 cables N from Rockall, and there are a large number of other pinnacles with depths from 65 to 110 m (35-60 fm) over them, lying within the 130 m (70 fm) line which extends 7 miles W and 9 miles NNE of Rockall. The sea has been reported to break on the E edge of this bank, 5 miles E of Rockall." (Admiralty, 1974; 1980). A warning is also included that "a local magnetic anomaly exists within an area of 10 miles of position 57°30'N 14°00'W". The eastern edge of the Bank falls away steeply from around 250 m (137 fm) to over 2000 m in the Rockall Channel. To the W and SW the Bank slopes gradually from 250 m to 1000 m. A bank 42 miles SW of Rockall, with a least depth of 102 m (56 fm) has been named Bryony Bank, and 100 miles SSW of Rockall is the Empress of Britain Bank with a least depth of 146 m (80 fm).

The sea bed on Rockall Bank shows a gradual transition from the rocky outcrops around Rockall itself, through low rock ridges or boulder fields partly covered in coarse carbonate sand, to an almost complete cover of fine carbonate sand on which patches of the cold-water reef coral Lophelia occur (Roberts, 1975).

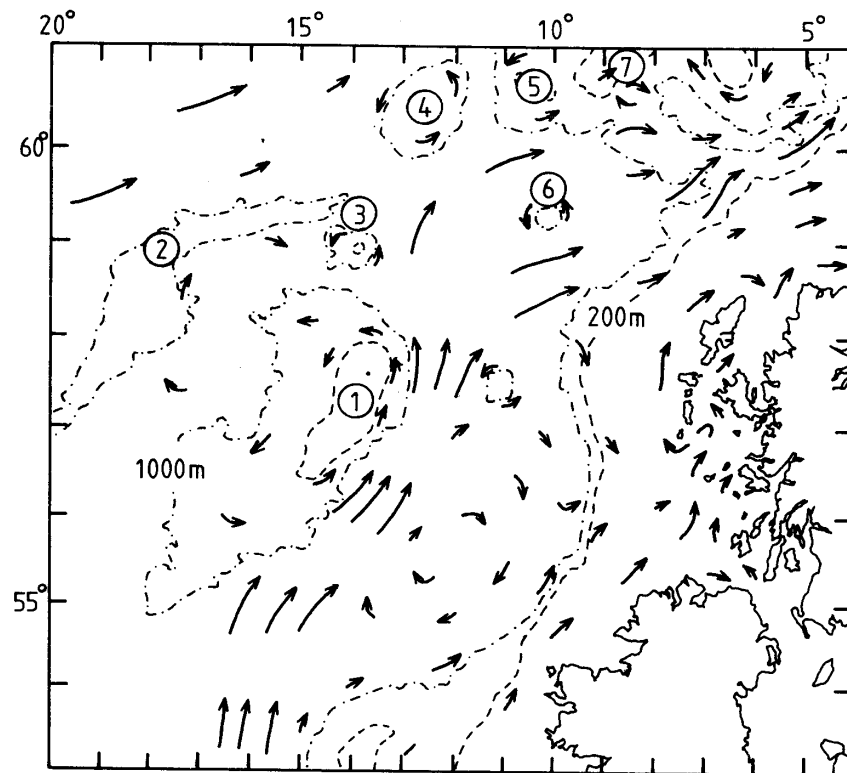


Figure 1 Surface currents of the north-western approaches to the British Isles (after Ellett, 1979). The offshore banks are numbered: 1. Rockall Bank, 2. Hatton Bank, 3. George Bligh Bank, 4. Outer Bailey or Lousy Bank, 5. Bill Bailey's Bank, 6. Rosemary Bank, 7. Faroe Bank.

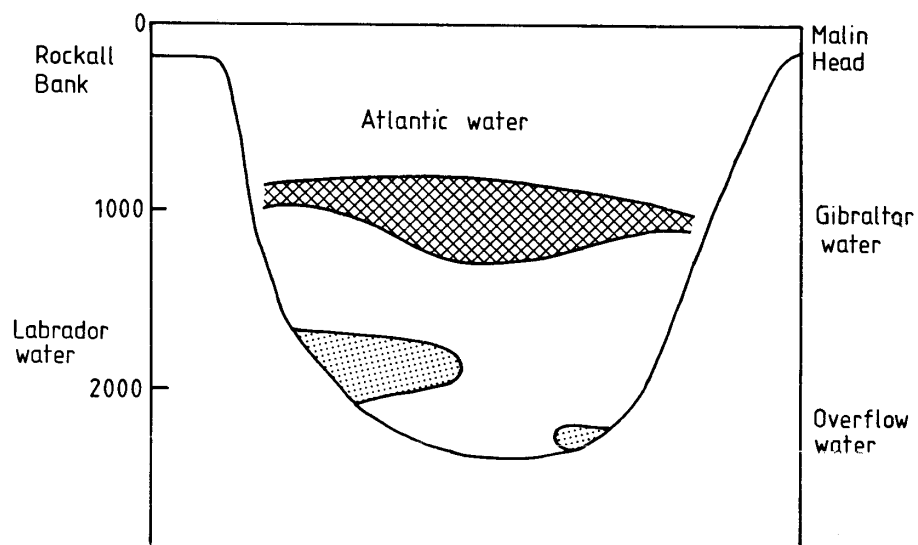


Figure 2 Water masses of the Rockall Channel.

The Rockall Channel (also known as the Rockall Trough or Trench), which separates Rockall Bank from the continental shelf west of the British Isles, is more than 2000 m deep, and channels more than 1250 m deep separate Rockall Bank from George Bligh and Hatton Banks.

3. HYDROGRAPHY

Between 1963 and 1968 numerous research cruises were made to the Rockall-Hebrides area in attempts to elucidate the current systems of the offshore waters. The basic current pattern in the upper layers (above 600 m) is shown in Figure 1. In the western half of the Rockall Channel the general water movement is in a northerly direction, and there is a counter clockwise flow around Rockall Bank. Between 800 and 1200 m there is a core of Gulf of Gibraltar water but the position in the Rockall Channel of the main axis of this varied from cruise to cruise. Deeper still, between 1600 and 1900 m, low salinity Labrador Sea water is evident, and at the bottom a cold mixture of Atlantic and Norwegian Sea water is found (Figure 2). (Hill, 1976; Ellett and Martin, 1973; Tulloch and Tait, 1959).

As far as the fisheries are concerned the important currents are those of the upper layers and there is some evidence to show that the current system has not always been that shown in Figure 1. In the early 1950s observations indicated that the surface water was originating north-west of Rockall Bank and flowing across the Bank itself before turning north-eastwards over the Rockall Channel, but even then there were indications from the plankton of some component from the Gulf of Gibraltar (Fraser, 1955). The degree of success of any fish spawning on the Bank will depend on which current system predominates while the eggs and young fish are in their planktonic phase. When the current is moving around the Bank spawning products will tend to remain over it, but when the current sweeps across the Bank eggs and larvae will be carried away over deep water and be lost as far as the Bank population is concerned. Recent data indicate that there is a clockwise bottom current around Rockall Bank (Dooley and Henderson, 1980).

4. THE FISH

More than eighty species of fish have been recorded in surveys of Rockall Bank and the deep water on its slopes. The fauna of the shallower parts of the Bank between 91 m (50 fm) and 183 m (100 fm) is much the same as that found in the same depth range on the shelf west of the Hebrides: haddock is the most abundant species, and cod, saithe, ling, tusk, lemon sole, megrim and monk (Lophius) occur regularly. Large turbot and halibut are caught occasionally, and non-commercial species such as the lesser silver smelt (Argentina sphyraena) and poorcod (Trisopterus minutus) are common.

Depths less than 75 m (40 fm) are restricted to a very small area immediately around Rockall itself (Figure 3) and shallow water species such as plaice, dab and whiting could not be found during English and Scottish research surveys (Rae, 1970). In water deeper than 300 m (164 fm) blue whiting is especially abundant along the eastern slope of the Bank during its spawning season in March and April; in shallower water on the Bank smaller blue whiting are common. The greater silver

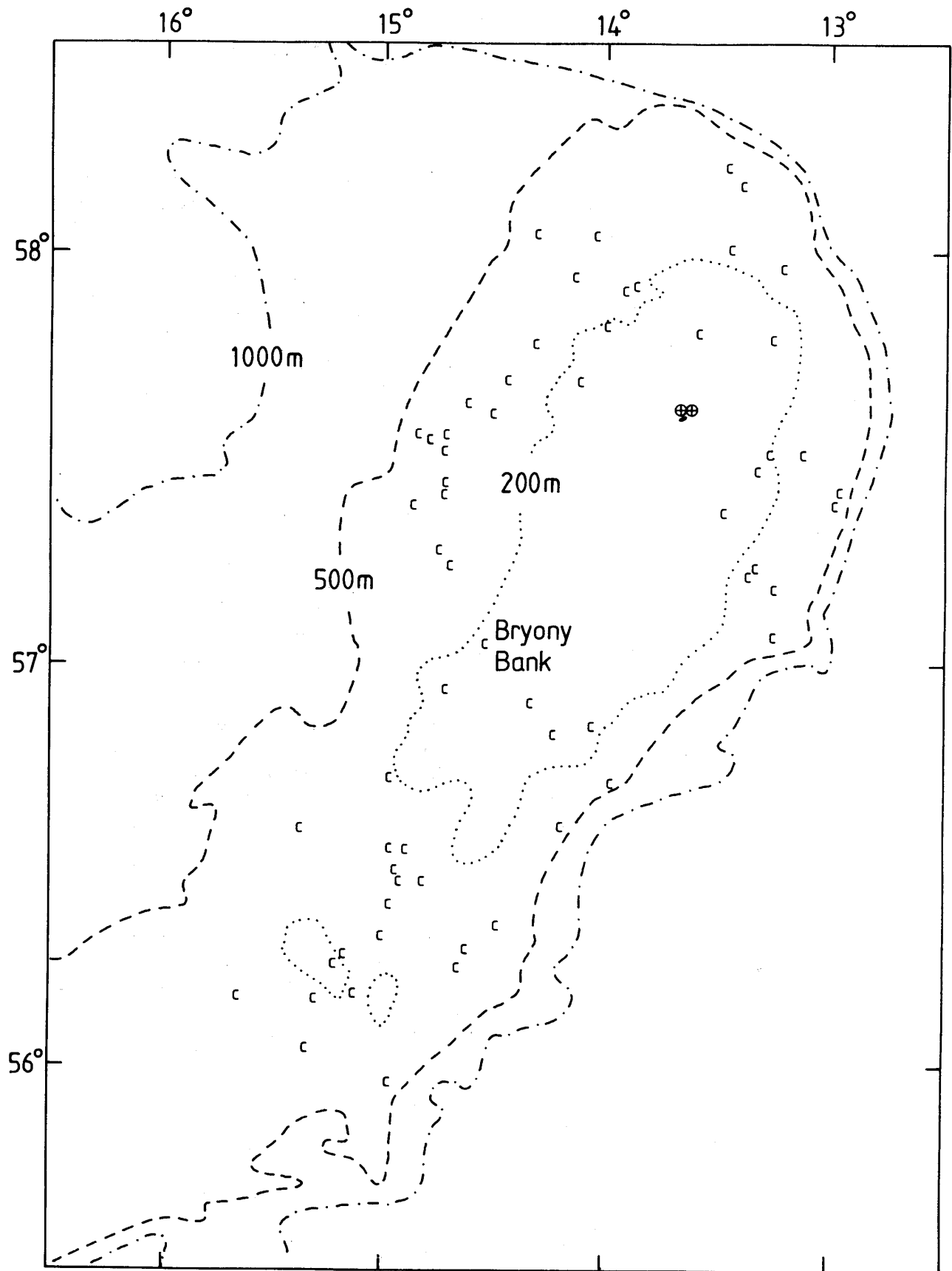


Figure 3 Rockall Bank showing the distribution of the coral, *Lophelia pertusa* (C).

smelt or argentine (Argentina silus) has often been caught in large quantities by research vessels. At depths greater than 366 m (200 fm) blue ling (Molva dipterygia), grenadiers (Coryphaenoides rupestris), chimaeras, and a wide variety of sharks and dogfish have been caught. The deep, north-flowing current of Gulf of Gibraltar water brings to the area some southern bathypelagic fish such as the black scabbard fish (Aphanopus carbo) which has frequently been reported from Rockall.

5. FISHING GROUNDS

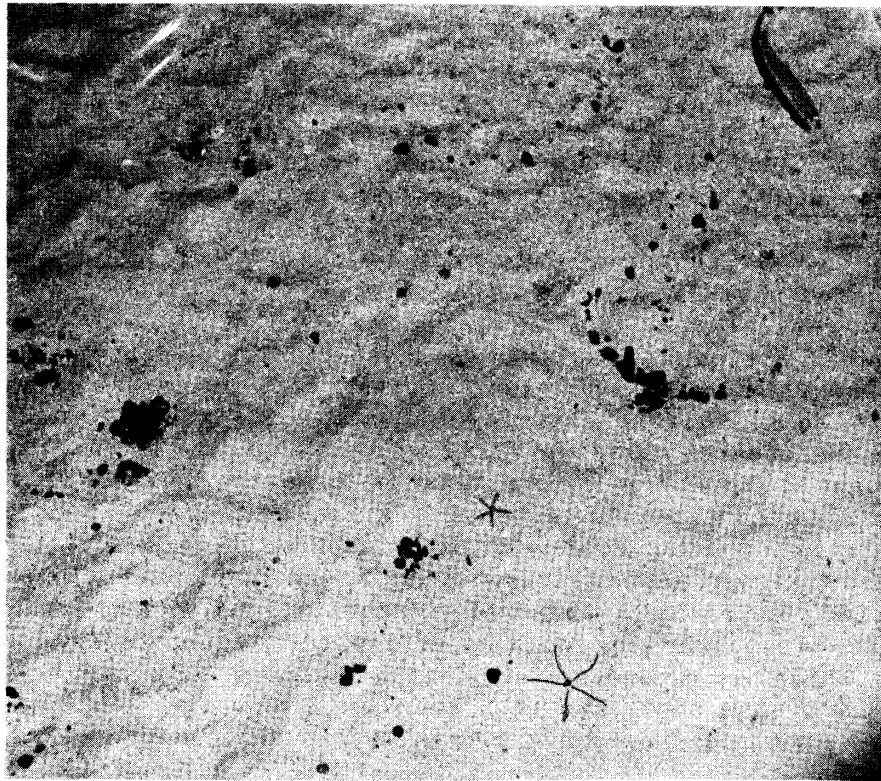
The traditional trawling grounds lie in depths less than 200 m (109 fm) where the ground, clear of the rocky pinnacles and reefs around Rockall itself, is generally level. The total area of these grounds is about 2000 square miles. Although the bottom is reasonably level, photographs taken by a camera mounted beneath the headline of a trawl show that it consists of extensive areas of exposed rock interspersed with patches of fine sand and small stones (Figure 4). Samples show that it is almost pure calcareous sand and the small stones are mainly basalt (J. B. Wilson, personal communication). The calcareous sand originates from colonies of the cold water reef-forming coral Lophelia pertusa which is abundant at depths between 220 and 350 m (Wilson, 1979a). Lophelia has also been found as shallow as 130 m and as deep as 400 m and occurs all around the bank within these depths (Figure 2).

Observations from a submersible show that the coral occurs in 'coppices' 30-50 m across. These appear to develop from a single colony by the settlement of larvae on stones or dead coral near the colony, or by the growth of any pieces of the original colony which survive breaking off (Wilson, 1979b). When a colony capsizes, as was seen to occur just from the effect of the submersible moving nearby, the polyps on the underside in contact with the sediment die but any of the living parts that remain clear of the sediment will continue to grow. At Rockall the observed coral patches are 1.0-1.5 m high, but in the sheltered waters of some Norwegian fjords Lophelia banks 38-60 m high have been recorded (Dons, 1944). The growth rate of Lophelia has been calculated, from colonies found on submarine cables, to be from 4.1 to 7.5 mm per year. Thus the Rockall colonies 1.5 m high are probably over 200 years old. Breaking up of colonies by trawling may actively increase the rate of colonization of the sea floor by Lophelia, but obviously it will take many years of growth before the colonies are large enough to obstruct trawling again.

Hauls made around Rockall Bank during exploratory voyages for deep water fish showed that much of the ground deeper than 366 m (200 fm) was rough and gear damage was frequent (Bridger 1978). The eastern slope of Rockall Bank is particularly steep and difficult to fish. Further west, on Hatton Bank, the only area that could be trawled without damaging the gear was on the north-west corner in over 1000 m depth.

According to Close's chart the area fished with lines is along the 100 fm (183 m) line from SW by S to SSE of Rockall.

A



B



Figure 4 Photograph of the sea bed on Rockall Bank between 135 and 165 m depth. The picture area is about 1 square metre, and all the fish are lesser silver smelts (*Argentina sphyraena*).
 A Fine coral sand with a few small pebbles. Two brittle-stars (ophiuroids) can be seen;
 B Fine coral sand and pebbles;

C



D

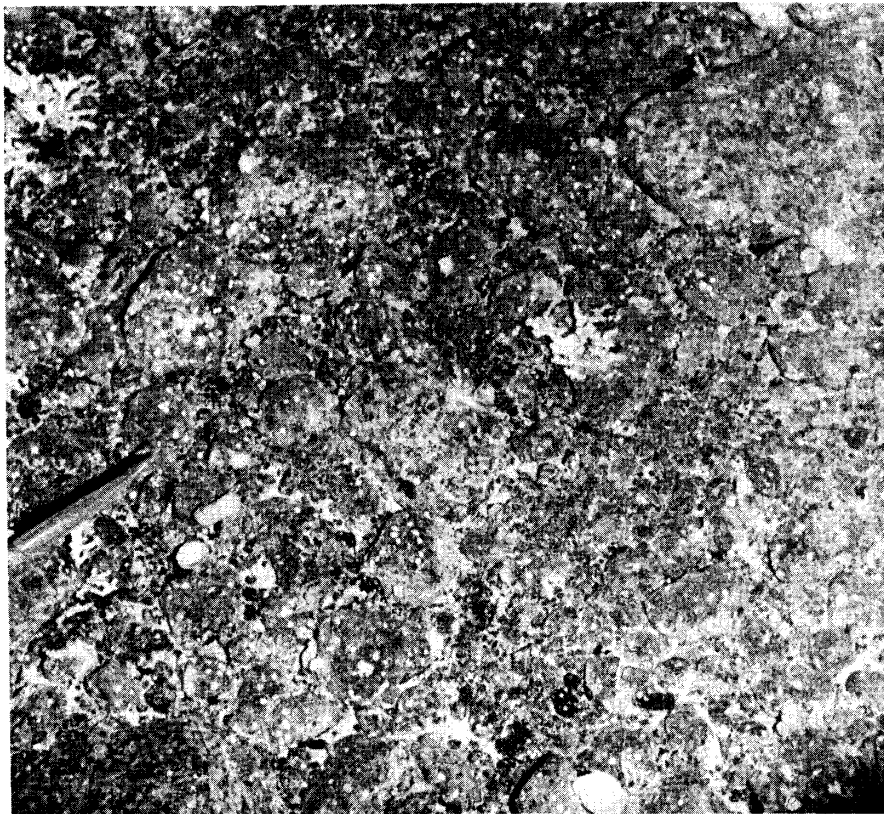


Figure 4 Photograph of the sea bed on Rockall Bank between 135 and 165 m depth. The picture area is about 1 square metre, and all the fish are lesser silver smelts (*Argentina sphyraena*).
 C Sand and stones. The stones support a fauna of sponges and other animals;
 D Rock and stones. Small colonies of coral and sponges are growing on the rocks.

6. THE FISHERIES

6.1 Early history

Exactly when Rockall Bank was first fished is unknown. Shetland 'Bank men' certainly fished there in the early years of the nineteenth century and the Dutch probably fished there before them. Halcrow (1950) quotes an earlier writer who stated that vessels from Shetland began fishing the 'Banks' for cod only in 1805-1807 and that the fishery increased from 1820 onwards. The 'Banks', which comprised Faroe Bank, Faroe Plateau and Rockall Bank, were fished from March until early August before the vessels went to Iceland in mid-August for the summer cod fishery. Rockall Bank was visited when fishing was slack on the favourite grounds around the Faroes. By 1865 there were over a hundred 'cod men' fishing from Shetland, and these were joined by other vessels from the English east coast ports of Barking, Harwich and Grimsby.

Judging from the little written information about the Rockall fishery it has always been sporadic. In 1861 the fishing there was 'great' but the next year the weather was bad and the fishing not so good. Few cod men went to Rockall in 1863, and in 1864 the fishing started well but fell off after a few days and the fishermen decided that they had been a fortnight too late (Anon., 1865). Holdsworth (1874) described the fishery and commented on the difficulties encountered from the small area of ground around Rockall not deeper than 50 fm with the consequent dangers of fishing close to the rock once it had been found (without modern navigational aids). He also stated "there is further discouragement in the fact that except in the early part of the season the fishery is not likely to be successful, and even then there is often a great scarcity on the ground."

Halcrow (1950) states that the hand line fishery for cod at Rockall reached its peak in 1870, but good fishing was found there at times in the 1880s: the smack SPELL reported "an immense shoal of cod lashing the sea into a froth close to the rock" and the schooner WILLIAM BARENDTS sailed in and filled up with cod fishing in 8 fathoms. The SPELL was lost with all hands soon afterwards, probably trying to repeat the trip. In 1886 Rockall Bank was "teeming with fish" and vessels were filling up in ten days; the schooner BENITO made four trips within fifteen weeks. Again in 1894 there was an abundance of cod at Rockall and the WILLIAM MARTIN made full trips in less than a month. One of the few recorded Rockall trips by a Harwich fisherman gave 30 tons in nine days fishing. The catch consisted of 25 tons of cod and "five tons of rough stuff as haddocks and coalfish, all mixed in" (Benham, 1979) - one of the rare mentions of anything other than large cod being brought back from Rockall.

The English cod smacks fished with hand lines in the deeper water; long lines were only used in shallower water on the Dogger Bank and elsewhere. A Shetland fisherman giving evidence to the 1864 Parliamentary inquiry into the sea fisheries of the United Kingdom said they used hand lines for cod but ling and other fish were caught only on long lines (Anon. 1865). Yet when statistics were first published for the English fisheries in 1906 the quantity of ling caught by liners at Rockall usually far outweighed the amount of cod. This probably signifies a change from hand lining to long lining brought about by the introduction of steam propulsion. The last of the cod smacks had been

launched in 1885 (Benham, 1979) and the same author records that the first two steam liners made the Iceland voyage in 1889. The following year there were fifteen steam liners sailing out of Grimsby and eight others, including two with wells, from Hull. No doubt these used steam power for hauling the long lines, which would allow their use in much deeper water than hand hauling did. By the end of the nineteenth century the cod smacks had virtually given up competing with steam liners and trawlers on the distant fishing grounds.

6.2 1906 to 1938

Steam trawlers first fished Iceland in 1892 and started to explore trawling grounds around the Faroes in 1898. Rockall was probably visited about this time, too, and English landing statistics for 1906 include 95 landings by trawlers fishing Rockall as well as 158 landings by liners. Thereafter the English line fishery declined. It never recovered after the 1914-18 war and by 1930 had almost died out: since then only a few English line fishermen have fished Rockall. Figure 5 shows the number of landings by trawlers and liners for the period 1906-1980.

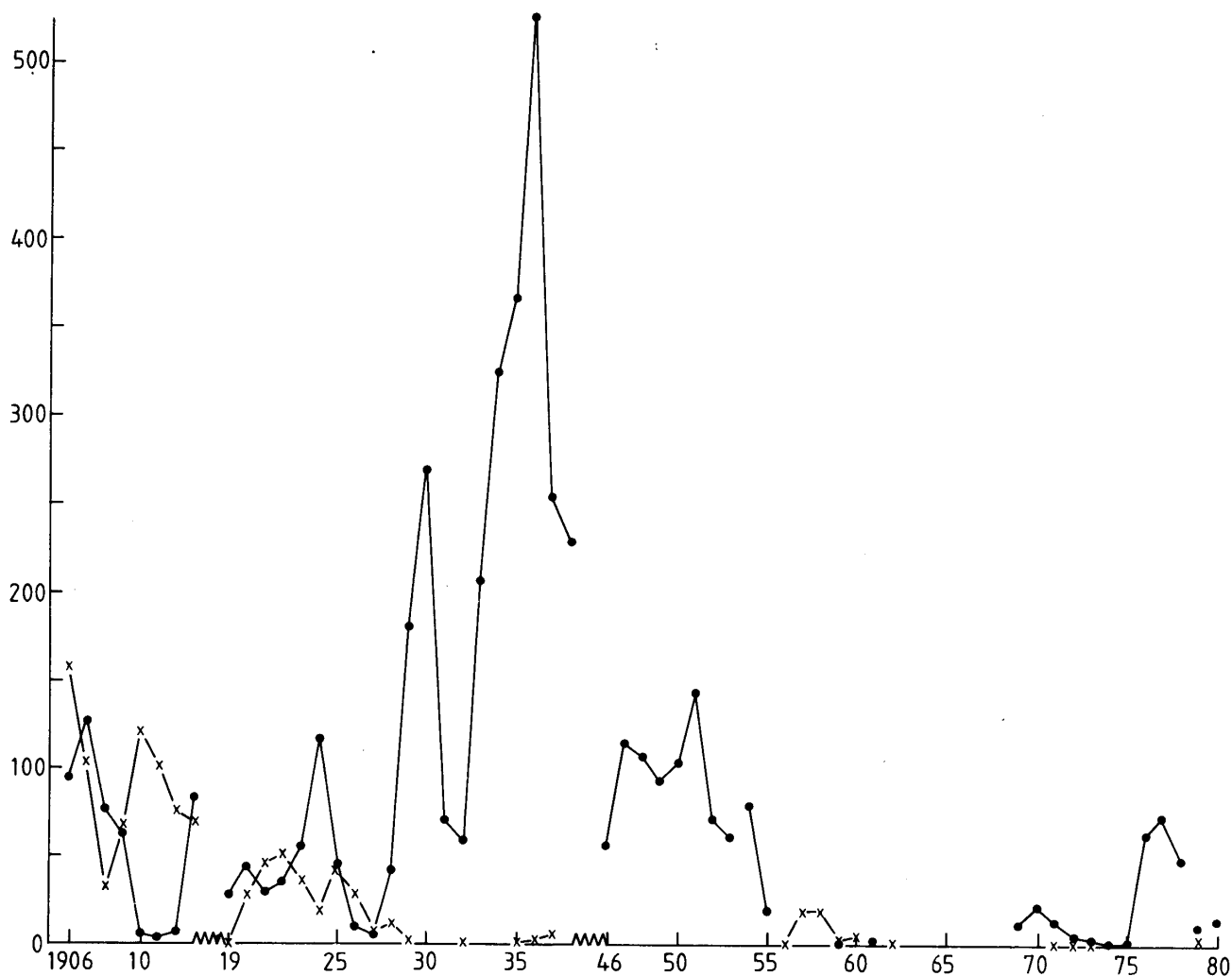


Figure 5 The number of landings from Rockall made in England and Wales by trawlers (●—●) and liners (x—x), 1906-80.

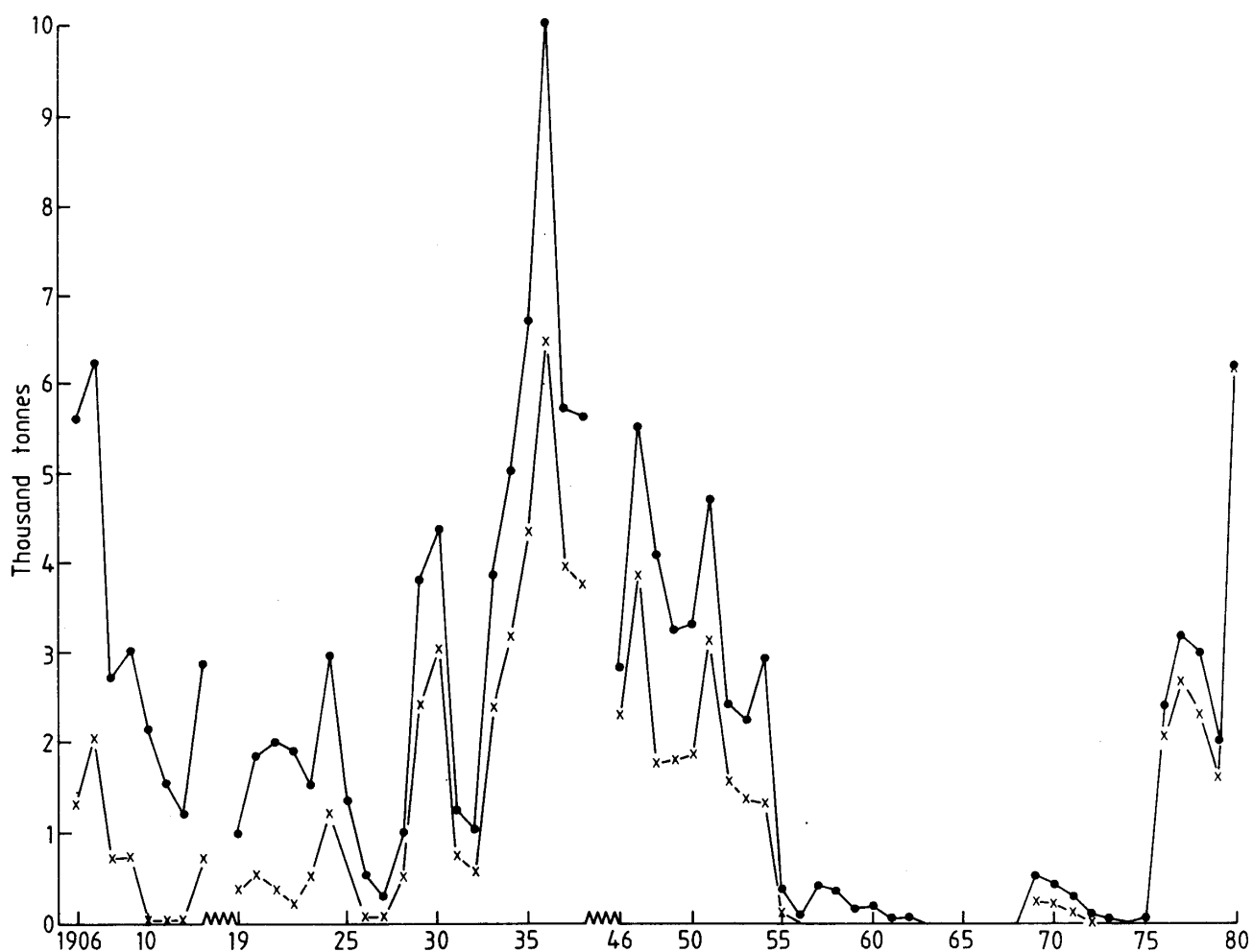


Figure 6 Quantity (tonnes) of all fish (●—●) and haddock (x—x) from Rockall landed in England and Wales, 1906-80.

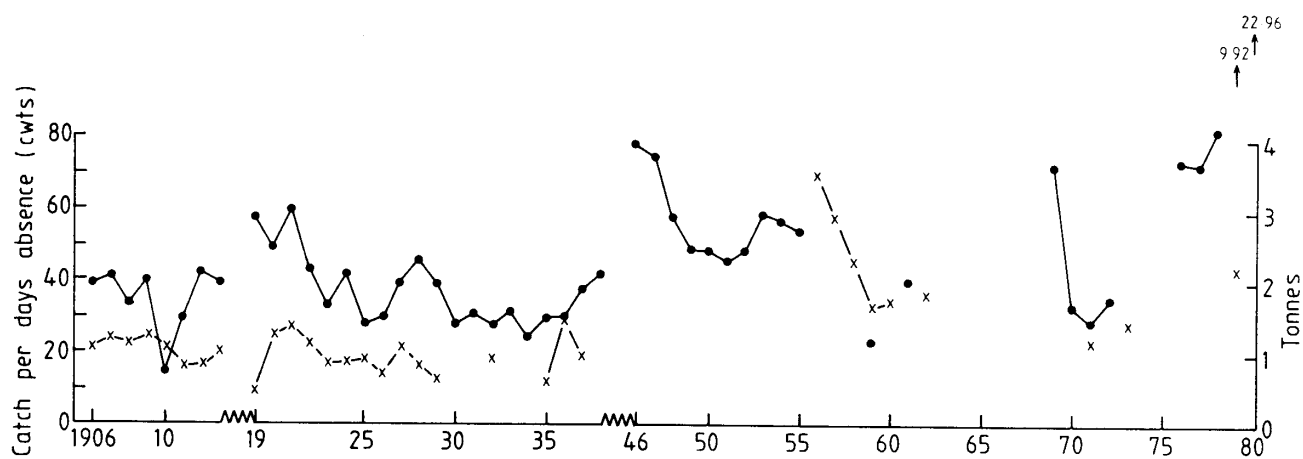


Figure 7 Catch per day's absence (tonnes) for vessels landing in England and Wales, 1906-80. ●—● trawlers and x—x liners.

Catch statistics for various sea areas have been published annually by the International Council for the Exploration of the Sea (ICES) since 1905 in the Bulletin Statistique, but the only continuous series of data for the Rockall area is that of landings in England and Wales from 1906 to the present day (with breaks caused by two world wars). Scottish vessels, especially great liners, have probably fished Rockall regularly, but unfortunately from 1929 to 1955 the data were included with those from the West of Scotland grounds. Other countries have fished there sporadically according to ICES statistics, but the reported quantities of species such as plaice and whiting (which are absent from or very rare at Rockall) cast doubt on the accuracy of many of these statistics. Even the English data include small quantities of some of these species, indicating hauls on other grounds on passage to or from Rockall.

The English fishery reached a peak in 1936 when 530 landings were made from Rockall; 526 by trawlers and only four by liners. The total catch was 10076 tonnes of which 6502 tonnes was haddock. Figure 6 shows the total weight of catches and the weight of haddock caught by English vessels from 1906 to 1980. The number of trawl landings has fluctuated wildly, and the fluctuations are probably related to economic factors such as the price of coal and the attractiveness of alternative fishing grounds rather than to changes in the catches or catch rates at Rockall. As evidence of this, immediately after the peak in 1936 the number of landings fell by half even though the catch per day's absence rose (Figure 7). Perhaps the skippers who knew Rockall best persisted while the less expert ones took their vessels to other grounds such as Iceland where fishing was easier.

6.3 1946 onwards

After the 1939-45 war the catch rate at Rockall (Figure 7) was much higher than in pre-war years, but the number of landings fell rapidly after 1951 as the old steam trawlers in the fleet operating from Fleetwood were replaced by modern motor vessels. These were more profitably employed at Iceland and other distant and middle water grounds.

From 1956 to 1975 few English vessels fished Rockall but Scottish liners continued to fish there and Scottish trawlers made sporadic visits. In 1961 Scottish trawlers caught 1500 tonnes of haddock and the total Scottish landings rose to over 4000 tonnes (Figure 8). The following year 4600 tonnes were caught, including 2300 tonnes of haddock, and in 1963 the haddock catch increased to nearly 2500 tonnes, although the total catch fell to 4200 tonnes. In 1965 the number of Scottish trawlers landing from Rockall fell sharply because of the abundance of haddock from the 1962 year class in the North Sea. They revisited the area in the summer of 1970 but the fishery was directed at squid, and haddock was a by-catch (Thomas, 1973). The squid fishery only lasted from 1970 to 1974: since 1975 only small quantities of squid have been landed from Rockall.

In 1969 and 1970 Russian scouting vessels fished at Rockall during searches for blue whiting (Shestov and Blagodelskaya, 1971). In April 1969 a Russian stern trawler caught 6 tonnes of haddock in an hour's tow, but in July 1969 and August 1970 only small numbers of haddock were caught. In 1971 ICES statistics record a Russian catch of 9 tonnes of haddock. That catch seems to have stimulated Russian interest in Rockall

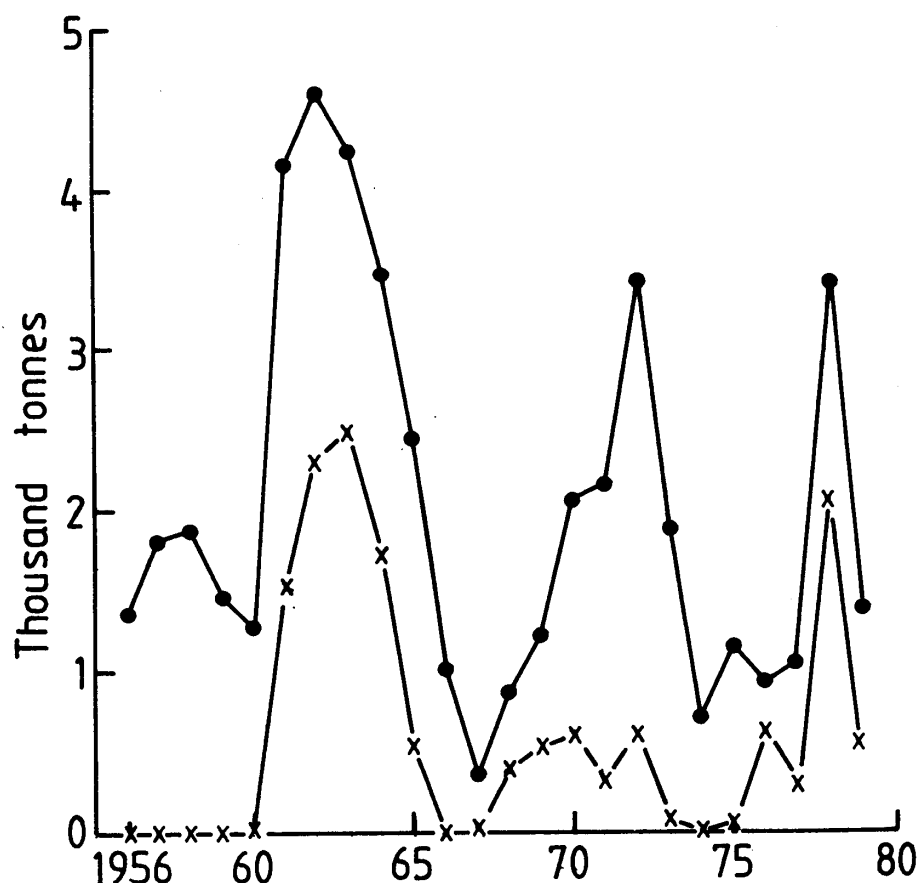


Figure 8 Quantity (tonnes) of all fish (●—●) and haddock (x—x) from Rockall landed in Scotland, 1956-79.

because in 1972 the total USSR catch rose to 8819 tonnes of which 7304 tonnes were haddock. It fell to 3387 tonnes (3291 tonnes of haddock) in 1973 when side trawlers (average 400 GRT) fished there. The following year large stern trawlers of 1500-2000 GRT fished Rockall intensively and reported catches of 50161 tonnes of which 48911 tonnes were haddock. The Russian fishery was repeated in 1975 yielding 50120 tonnes (49830 tonnes of haddock) and again in 1976 when the total catch was 45394 tonnes (40447 tonnes of haddock).

There have been speculations that these large Russian catches were taken elsewhere and merely reported as coming from Rockall which was an area not subject to quota restrictions at the time. However, large Russian trawlers were frequently seen at Rockall by British fishing vessels and their reported catch rates are comparable with those made recently by British freezer trawlers, so there seems to be no reason why these data should be disregarded.

The extension of UK fishing limits to 200 miles in 1977 prevented USSR from fishing most of the Rockall area, but the exclusion of UK vessels from Iceland and restrictions in other distant water areas stimulated English vessels to fish there again. English landings increased from 34 tonnes in 1975 to 2400 tonnes in 1976, over 3000 tonnes in 1977 and 1978, and, after falling to 2000 tonnes in 1979, leapt to more than 6200 tonnes in 1980. Landings in 1981 showed a further increase to about 9000 tonnes.

7. HADDOCK

Haddock has always been the main species sought by trawlers at Rockall and the fluctuations in total landings largely reflect those of haddock. Whenever less than half the catch has been haddock interest in fishing at Rockall has waned. Unfortunately observations on the biology of Rockall haddock and age and length data of the catches are very sparse. The following paragraphs summarize the little that is known.

7.1 Biology

There is little doubt that the population of haddock living on Rockall Bank is separate from the stock found on the continental shelf west of Scotland. Spawning certainly occurs there, since haddock larvae have been caught in quantity at Rockall and observed in the stomach contents of fish such as grey gurnards, and ripe female haddock have been caught in the trawl by Scottish research vessels. Scottish surveys for haddock eggs and larvae have never found any over the Rockall Trench away from the continental shelf west of Orkney and the Outer Hebrides. Eggs and larvae of other Rockall demersal fish such as lemon sole, long rough dab and witch have also been taken at Rockall, so there is no reason why, when the current system is favourable as in Figure 1, haddock eggs and larvae should not remain over the bank until the young fish become bottom-living after three to four months. The predominantly northward-flowing surface current between Rockall and the Hebrides would prevent eggs and larvae reaching Rockall from the east. This current system would also tend to keep the products of any spawning off southern Ireland on the Irish shelf. Of haddock tagged in Scottish waters, not one has been recovered from Rockall.

At Rockall, haddock are found in much deeper water than at most other places in the species' range. The main haddock fisheries at Faroe, Shetland and the North Sea are in depths shallower than 150 m and haddock are rarely caught as deep as 200 m. Only a small area of Rockall Bank is shallower than 140 m and haddock are abundant in the 140-190 m depth range. Appreciable quantities have been caught in hauls as deep as 420 m (230 fm) by RV ERNEST HOLT in 1961 and MT SWANELLA during deep-water fishing surveys of Rockall, although there is always the possibility that these fish may have been caught in mid water during shooting or hauling the trawl.

Haddock usually feed on small animals living on or in the surface of the sea-bed such as worms, small brittlestars (ophiuroids), sea urchins (echinoids), molluscs and crustacea. Few observations have been made at Rockall, but Shestov and Blagodelskaya (1971) confirm that haddock there feed on benthos (bottom living animals), although no fish were found feeding heavily. This may be correlated with the sparsity of benthic animals shown on a series of underwater photographs of the Rockall fishing grounds (Figure 4). Soft, muddy sediments which support an abundance of benthic animals seem to be absent from the main fishing areas shallower than 180 m. Possibly the haddock feed in deeper water where there may be more detritus to support richer populations of shellfish and brittlestars. On the other hand, the generally small size of Rockall haddock (see below) may be due to the lack of abundant food organisms.

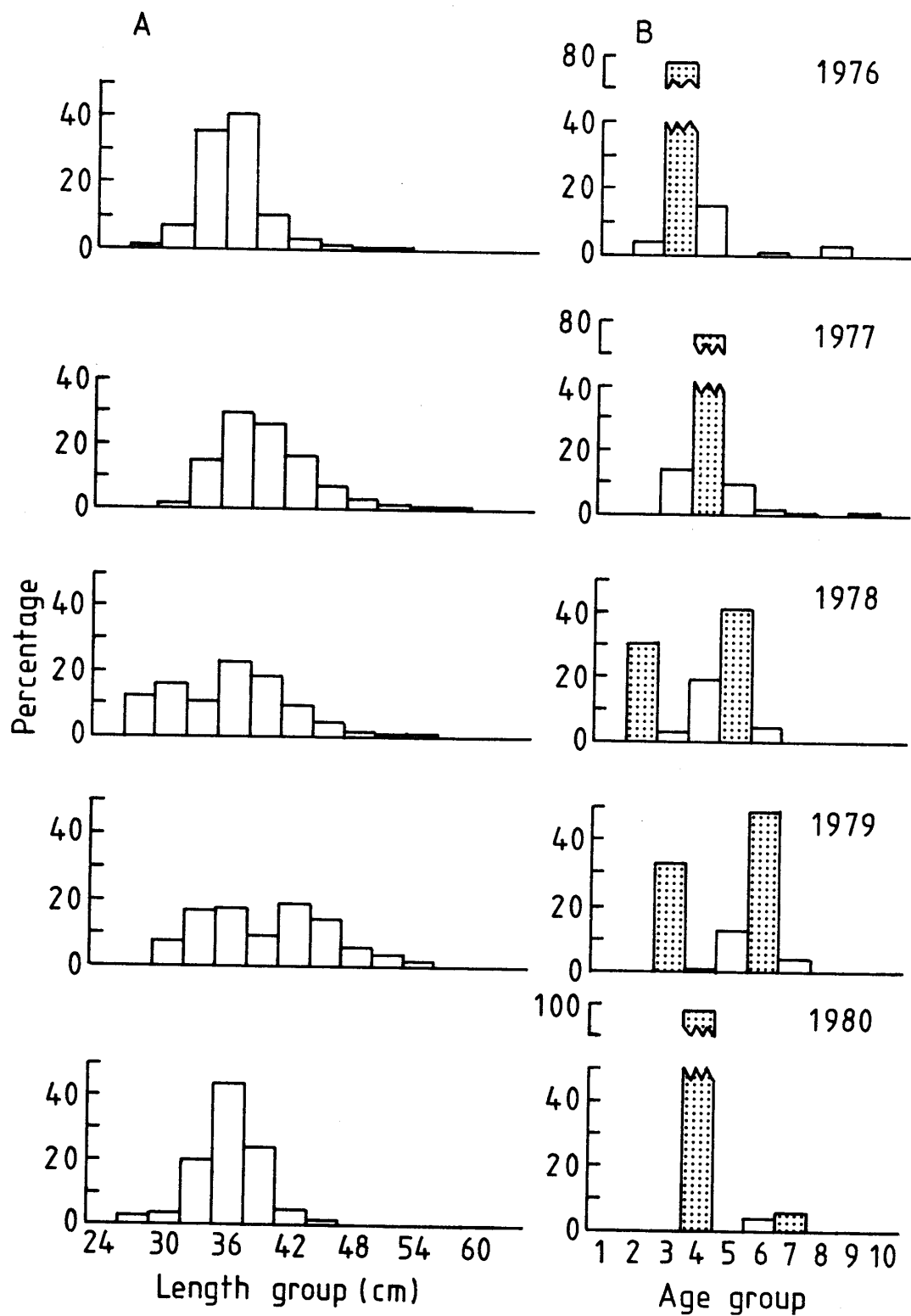


Figure 9 Length (A) and age (B) distributions of Rockall haddock landed in England and Wales, 1976-80.

7.2 Length distribution, age and growth rate

Rockall haddock are said to be recognisable on the fish market by their shape and uniform small size, and recent samples do show that the majority are between 30 and 45 cm in total length. Figure 9 gives the length distribution from some English landings in recent years.

No length or age data are available from the fishery before 1961 apart from a mention by Thompson (1930) that no haddock younger than four years old were landed from Rockall. He comments that the fish reached a maximum length of 70 cm and grew at a rate of about 3 cm per year after reaching the age of five years. This corresponds with the growth curve of the faster growing North Sea stock obtained from Scottish data (Jones and Jermyn, 1968; Blacker, 1971). Small samples from a commercial vessel in March 1960 and a research cruise in June 1961 indicate very much slower growth-rate: the fish ranged from 24-62 cm in length and from one to twelve years old (Blacker, 1963).

More recent data from a variety of sources show a faster growth rate than the 1960 and 1961 samples (Figure 10). Even the largest fish at each age in the latter samples barely reached the average size-at-age of fish from the recent samples. It is possible that the low growth-rate of the 1960 and 1961 samples was anomalous due to the small sample size, but it may well be an indication of a period of unfavourable feeding conditions for the haddock population at Rockall correlated with the hydrographic regime of the 1950s.

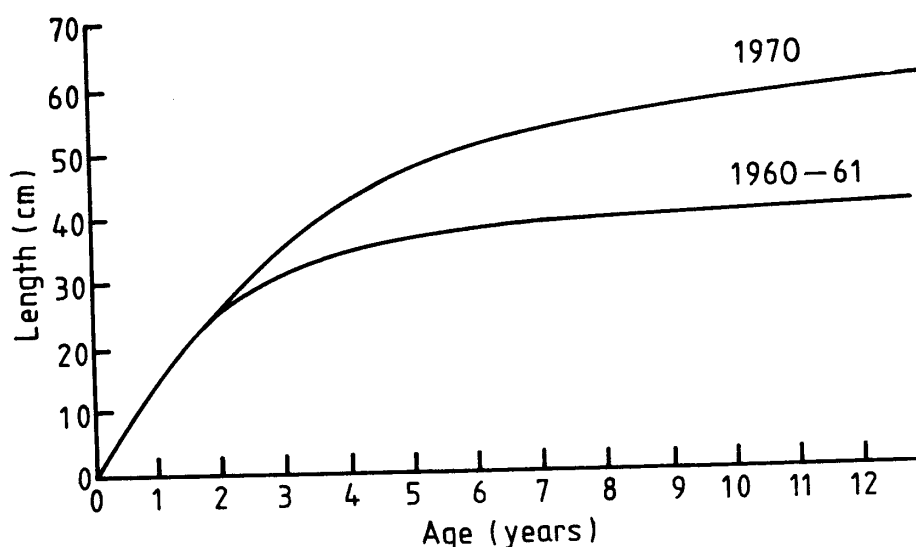


Figure 10 Comparison of growth curves for Rockall haddock for 1960-61 and 1970.

Rae (1961), commenting on the characteristic small to medium size of Rockall haddock, explained that it was probably caused by the successful survival of one or two broods and the failure of others so that the fishery was dependent on particular broods. At that time most of the fish were six- or seven-year-olds but most of the fish from four to

twelve years old were within the same length range. Nevertheless, haddock fisheries at Rockall and elsewhere appear to be highly dependent on the occasional production of rich year classes. In the North Sea, for example, the 1962 and 1967 year classes produced very good fishing for many years. Recent data from Rockall show that the 1968 year class was much more abundant than the 1967 year class and the 1973 and 1976 year classes are also rich (Figure 9). No data are available from the peak Russian landings but they may well have been fishing mainly on the 1968 year class to start with, supported by the 1973 year class during 1975 and 1976. This year class was still abundant in English landings in 1978 and 1979 (Figure 9).

7.3 Catches and catch rates

Between 1922 and 1938 English haddock landings from Rockall varied from less than 100 tonnes in 1926 and 1927 to 6500 tonnes in 1936, but trawlers' catch rates varied only from 5.6 to 17.8 tonnes per hundred hour's fishing, and the average for the period was 12.3 tonnes per hundred hours. After the 1939-45 respite from fishing, the haddock landings reached 3900 tonnes in 1947 and the fishery lasted only ten years. During the period 1946-1955 the catch rate varied from 43.8 tonnes per hundred hours in 1946 to 11.2 tonnes in 1955, giving an average of just over 20.3 tonnes per hundred hours for the ten-year period. These catch rates were surpassed by the fishing at Iceland where even higher catch rates of cod were obtained, so there the haddock amounted to only 20-30% of the quantity of cod landed, but these catches were probably taken by larger and more powerful trawlers.

Comparison with the North Sea fishery is difficult because most English North Sea trawlers fish primarily for species other than haddock but, even in selected areas where haddock made up a high proportion of recorded landings for 1948 and 1949, the haddock catch rate was lower than that at Rockall. Catch rates for Scottish trawlers, which might be expected to have concentrated on the North Sea haddock grounds, are given by Jones (1970) and they range from about 4.1 to 9.9 tonnes per hundred hours and averaged only 5.8 tonnes per hundred hours for the period 1946-1955. Making allowance for the probability that these trawlers were of lower power than the English trawlers, it looks as though the density of haddock on the Rockall grounds was at least double that in the North Sea.

According to ICES (1978) the high Russian catches in 1974-1976 gave a production of 18.1, 18.5 and 15.2 tonnes per square mile of the 2700 sq miles usually fished for haddock, compared with 1-6 tonnes per sq mile normally sustained from the North Sea. However, the Rockall fishery is a seasonal one from April to September and the fish may then be more concentrated in the shallower areas. If the haddock distribution spreads out to the 500 m contour the area available is at least 8000 sq miles and the density becomes 5-6 tonnes per square mile. There is no doubt that the haddock population reaches high concentrations, because the catch rates of English freezer-trawlers in 1980 and 1981 were restricted by processing capacity to about 30 tonnes per day which were often taken in one or two hauls.

8. COD

Rockall was first fished by line fishermen looking for large cod, and the first recorded landings by trawlers included a considerable proportion of cod. Between 1906 and 1926 the cod landings varied from 20% to 60% of the total landings. In 1907 trawlers landed 1100 tonnes of cod; the next best year was 1924 when 900 tonnes were landed, but in most years the cod catch amounted to less than 500 tonnes (Figure 11). After 1926 the proportion of cod declined to around 2% of the landings when haddock landings were at their greatest in 1936. Cod landings showed no increase after the 1939-1945 respite from fishing, although the percentage of cod increased in 1954 and 1955 when English haddock catches were declining. Scottish data for 1961-1979 include only two years, 1974 and 1975, when cod contributed a significant proportion of the catch, but in both those years total landings were very low.

Almost nothing is known about the biology of the cod at Rockall. Rae (1961) speculates that cod and other large fish like ling and halibut could reach Rockall from the west coast grounds but there appears to be no direct evidence that they do so. If haddock spawn at Rockall there seems no reason why cod should not. Early landing records giving size categories for landed cod always included a proportion of small cod. Recent age data from a small sample show a rapid growth rate: some cod over 80 cm long were only three years old. A rapid growth rate is also characteristic of Faroe Bank cod.

9. LING

By the time English statistics were first published in 1906 long lining had displaced hand lining and ling was the fish caught in greatest quantity at Rockall by line fishermen. In 1906 over 1000 tonnes of ling were landed by line fishermen compared with less than 100 tonnes landed by trawlers, but even then line fishing was declining and, apart from 1910 when over 900 tonnes of ling were landed, the quantity of ling declined steadily (Figure 12). Catches by liners averaged 0.39 tonnes per day between 1906 and 1914, but after reaching 0.50 tonnes per day in 1920 and 1921 the catch rate fell to 0.15 tonnes per day in 1927: few English liners fished Rockall after that date. Trawlers usually landed between 0.5 and 1.0 tonne per trip so the increase in trawling at Rockall during the 1930s produced larger landings of ling, amounting to 640 tonnes in 1936 when trawling activity was at its peak. After the post-war peak of 750 tonnes in 1946 and 1947 English landings of ling decreased rapidly and since 1959 less than 100 tonnes per year have been landed from Rockall.

Scottish great liners have fished Rockall more frequently than English vessels and their landings of ling have usually been much higher. Data for Scottish landings are only available for 1906-1928 and from 1956 to the present day (Figure 12). Landings totalled more than 1000 tonnes in several years and only from 1967 to 1969 did they drop much below 500 tonnes when the number of landings per year dropped from an average of 47 for the period 1956-1966 to 9 per year. There was a recovery after 1969 and 65 trips were made in 1972, but since then the average has dropped to about 20 each year, with a corresponding decline in landings of ling. The catch rate for 1956-1967 averaged 0.82 tonnes per day but it fell to 0.36 tonnes per day in 1968 and 0.21 tonnes in 1969. It recovered to 0.89 tonnes in 1972 but since 1976 it has not exceeded 0.50 tonnes per day.

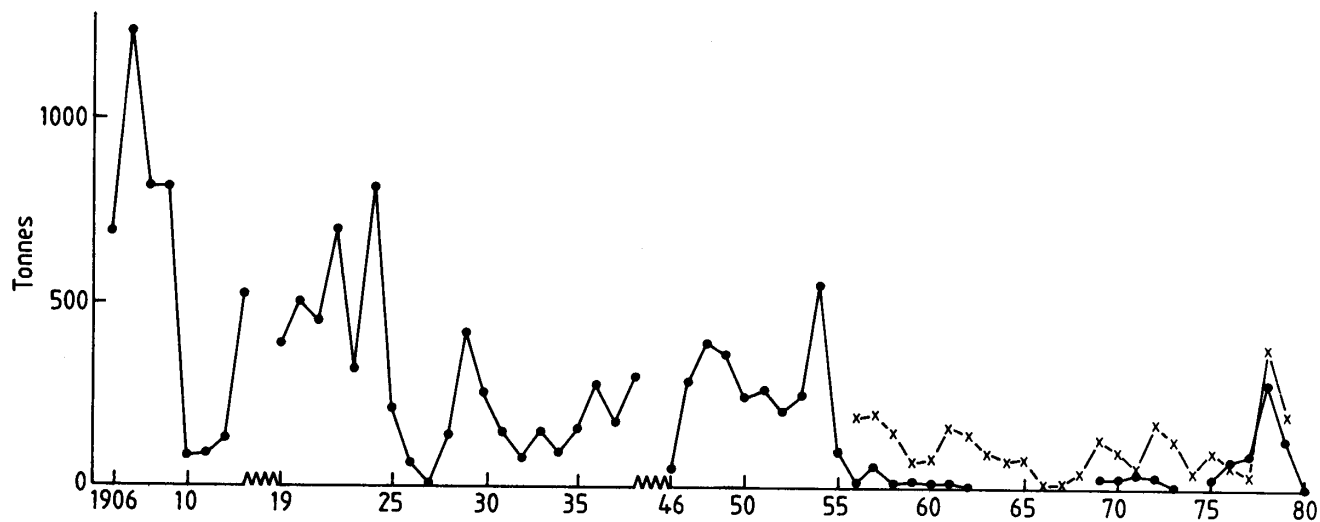


Figure 11 Landings of cod from Rockall: ●—● English landings, 1906-80; x—x Scottish landings, 1956-79.

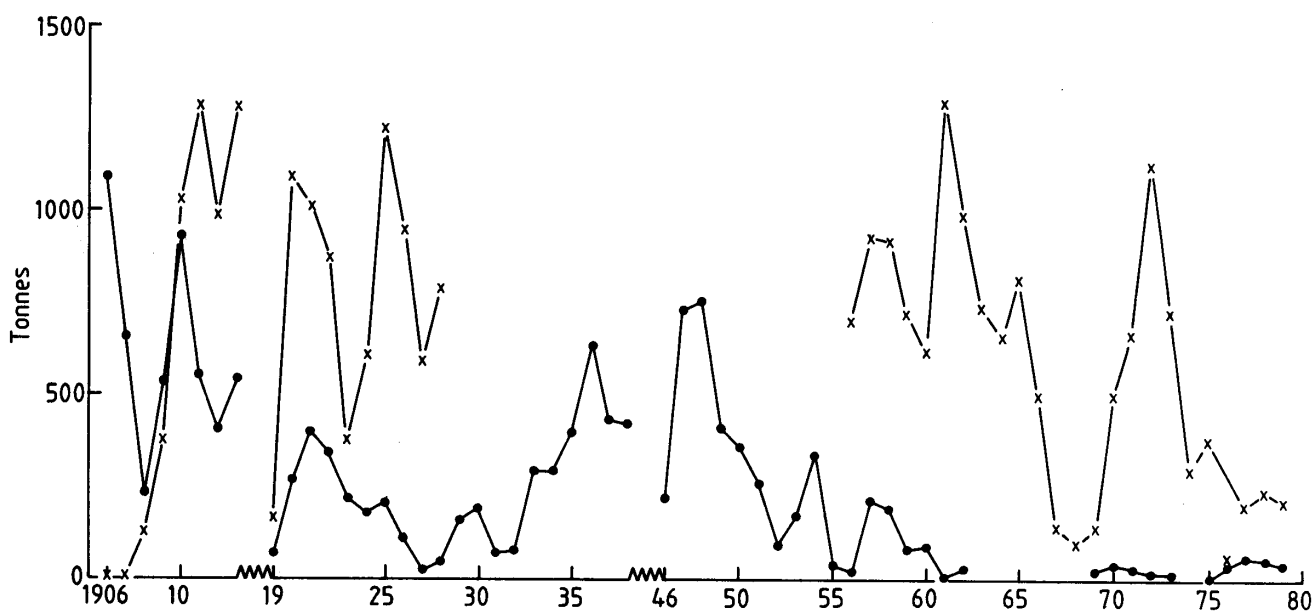


Figure 12 Landings of ling from Rockall: ●—● English landings, 1906-80; x—x Scottish landings, 1906-28 and 1956-79.

10. HALIBUT

In 1906 there were 880 tonnes of halibut landed in England from Rockall, most of it caught by liners. Seventy years later the landings of halibut in the whole United Kingdom from all areas totalled less than 700 tonnes and in 1979 the total had fallen further to 263 tonnes because of the loss of distant-water fishing grounds. Rockall halibut landings fell rapidly with the decline in the line fishery (Figure 13) although it is more likely that the line fishery declined because the valuable catches of halibut fell. The catch rate was 0.33 tonnes per day from 1906 to 1908, but in 1909 it fell to 0.22 tonnes and in 1914 it was only 0.17 tonnes per day. In 1920 the catch rate was 0.38 tonnes per day and in 1921 it was even better at 0.42 tonnes, but from 1922 to 1929 the average was 0.22 tonnes only. Small quantities were caught by trawlers and the high effort by English trawlers in 1936 produced over 100 tonnes but after reaching 70 tonnes in 1947 and 1948 English landings fell steadily to an average of less than 10 tonnes per year since 1955.

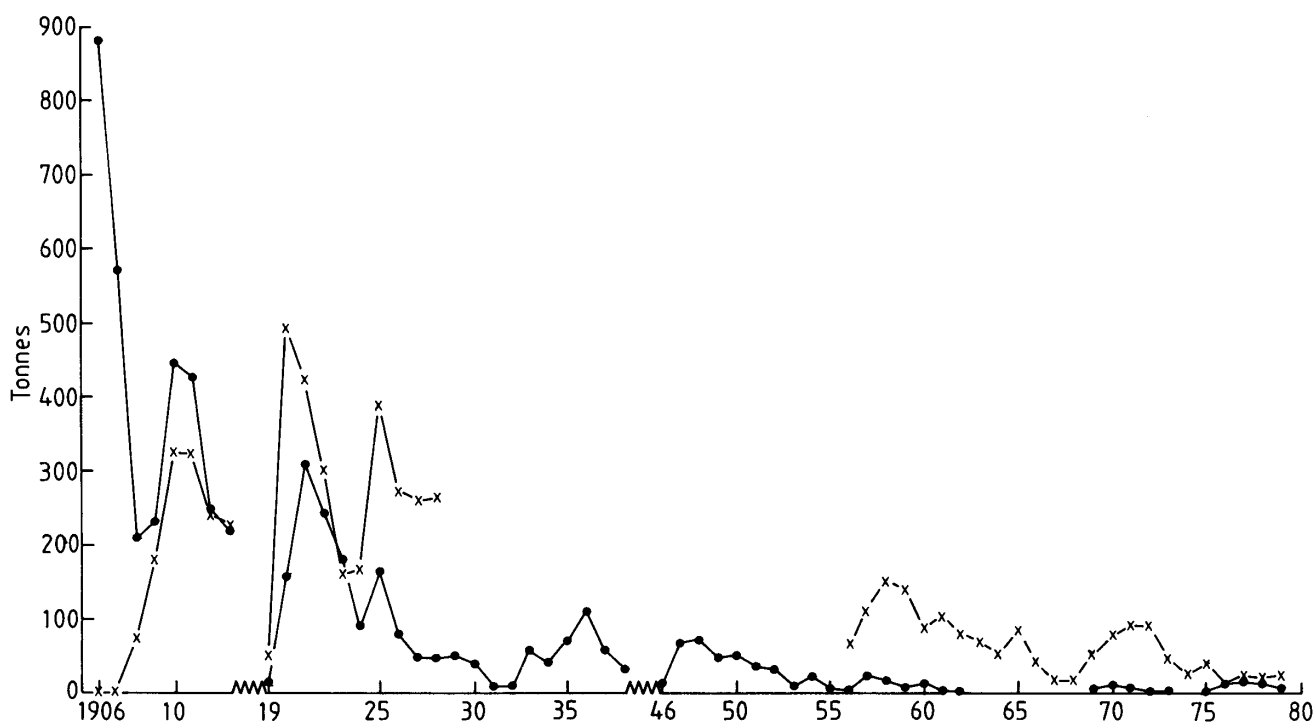


Figure 13 Landings of halibut from Rockall: ●-● English landings, 1906-80; x-x Scottish landings, 1906-28 and 1956-79.

Scottish statistics are incomplete but the peak of 500 tonnes of halibut landed from Rockall was in 1920. Thereafter Scottish landings continued to be higher than the English. In 1958 liners landed 150 tonnes: catch rates have fallen from 0.14 tonnes per day in 1958 to 0.05 tonnes per day in 1979, although the daily catch did reach 0.14 tonnes in 1968 and 0.19 tonnes in 1979.

11. OTHER COMMERCIAL SPECIES

A number of other species including turbot, lemon sole, megrim, tusk and skate make a useful by-catch in the trawl fisheries but none of them is likely to sustain increased fishing effort. Saithe is caught sometimes in quantity but its appearance at Rockall seems to be unpredictable. Blue whiting is abundant in the spawning season, especially along the eastern side of the Bank, but until processing problems have been overcome its exploitation is unlikely to be economic. The exploratory voyages for deep sea fish such as grenadiers did not find fishable concentrations anywhere around Rockall and, in addition, the grounds were difficult to work without serious gear damage.

In 1970 and 1971 there was a profitable summer trawl fishery for squid when Scottish catches averaged 31 tonnes per 100 hours fishing but in the following years catch rates fell and few squid have been taken at Rockall in recent years. Recent Scottish research has shown that there may be potential for a deep water crab fishery on the steep slope on the east side of Rockall Bank (Shelton, 1979). Catch rates of a large crab, Geryon affinis, which is closely related to a large red crab found in commercial quantities in the western Atlantic off the New England coast, were high compared with normal lobster fishing. Assessments by the Torry Research Station showed that the crab produced high yields of top quality meat, but further research is needed to assess the size of the stock.

12. CONCLUSION

Rockall Bank is a relatively small isolated fishing ground with a reputation for bad weather. The fish stocks are probably self-contained because there is no evidence of interchange with other offshore banks or with the populations on the banks west of Scotland. The success or failure of the breeding stocks depends upon the prevailing hydrographic conditions which determine whether eggs and larvae remain on the bank or drift away and are lost over deep water. After favourable spawning seasons when strong year classes enter the fishery trawler catches and catch rates of haddock are high. Very high catch rates were achieved by USSR freezer-trawlers in 1974-1976 when twenty or so of them operated during the short season at Rockall. Their catches of 45-50000 tonnes per year were taken at rates comparable with those for similar-sized English vessels in 1979 and 1980. The tonnages reported by the English freezer-trawlers cannot be easily equated with those of conventional fresh fishers, because their catches have been frozen whole and they are not subject to the restraint of sorting, gutting and icing fish to sell on a highly competitive fresh fish market. The only limitation on freezer-trawlers has been the daily freezing capacity of the vessels, whereas the wet fishers at times have discarded large quantities of the smaller, poor quality haddock: discard rates up to 60% have been reported.

During the peak fishing in 1933-1938 the English haddock landings alone averaged 4800 tonnes with no fall in catch rate, and from 1976 to 1980 English and Scottish landings of haddock averaged nearly 4000 tonnes. ICES originally calculated the long-term average as 2500 tonnes ignoring the high USSR catches which it regarded as atypical, and took that as the total allowable catch (TAC). However, when the recent data are corrected for discarding, the figure for average annual catch is in the region of 6000 tonnes. ICES recommended this as the TAC for 1981 and

1982, and also recommended a re-examination of the data because the recent UK observations on catch rates cast doubt on the decision to ignore the high USSR catch data in calculating the size of the exploitable stock.

Cod, ling and halibut were taken by liners in the early years of the fishery. The catches of cod and halibut declined rapidly and the stocks were probably over-exploited, but ling are still taken in quantity by line fishermen from Faroe and Norway, and UK catches could be increased by line fishing over rough ground where trawling is impracticable.

In summer squid may be an important by-catch, but there seems little scope at present for exploiting blue whiting and deep-water fish.

In view of the increasing interest in the haddock fishery at Rockall the Fisheries Laboratory, Lowestoft has undertaken trawl surveys in 1981 and 1982 to enable an evaluation of the haddock stock to be made. The results of these surveys will be the subject of a separate publication when the results have been fully analysed.

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