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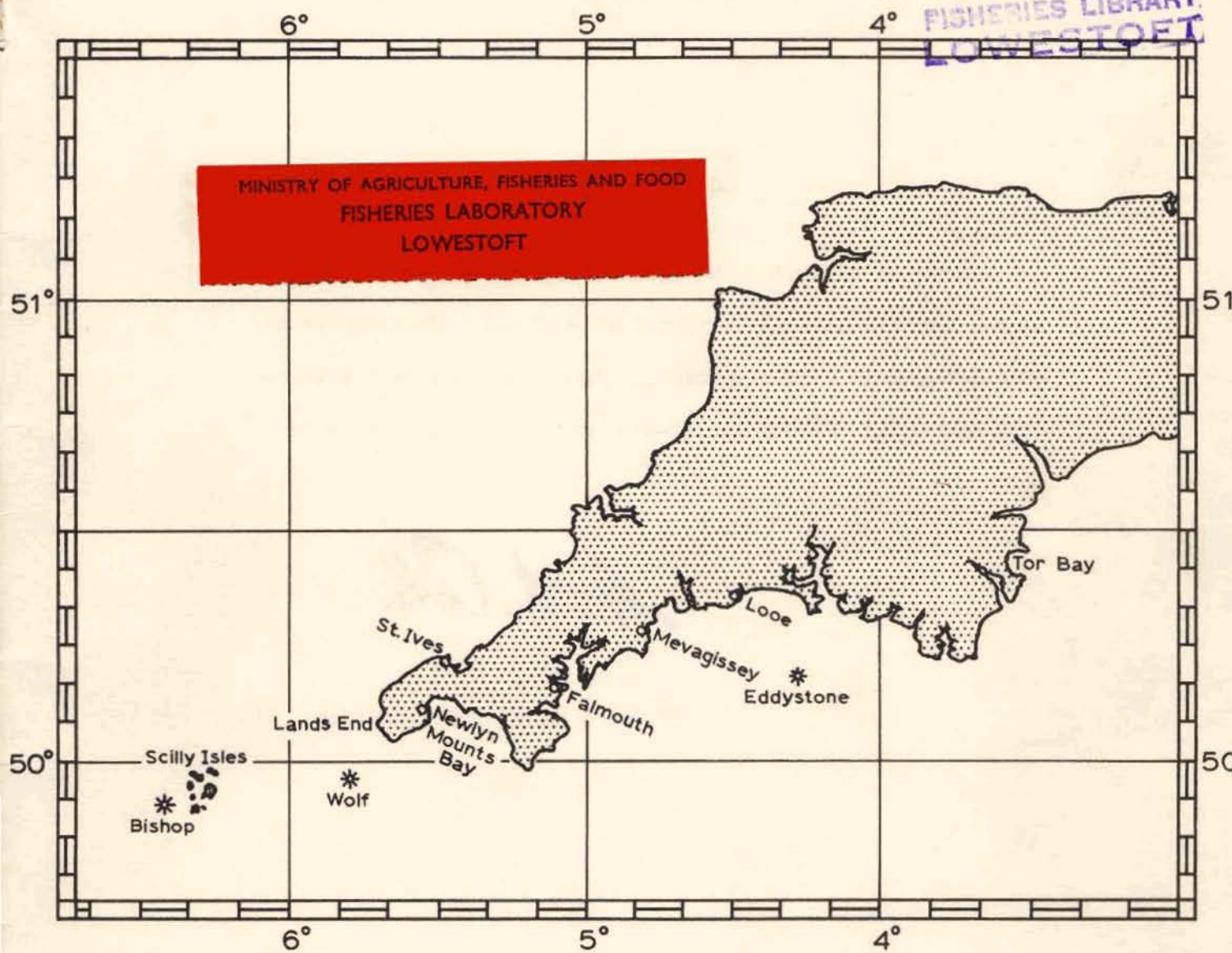
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THE CORNISH PILCHARD AND ITS FISHERY

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Laboratory Leaflet (New Series) No. 9

The Cornish pilchard and its fishery

INTRODUCTION

The stocks of the majority of edible fish in European waters are fairly heavily fished. The pilchard seems to be an exception and so it has come to be regarded as a valuable untapped natural resource.

In recent years, particularly during warm summers, adult pilchards and their eggs have been reported as far north as the Dogger Bank and the Minch. Their true home, however, is the English Channel and the Celtic Sea.

The main shoals usually appear near the Wolf Rock about the middle of March and move rapidly eastwards up the English Channel and between Cornwall and Ireland. Spawning begins almost at once and continues until September or even October, reaching a peak in June or July. By midsummer pilchard eggs may be found throughout the English Channel. Unlike the herring, the pilchard spawns several batches of eggs per season and these float in midwater. The spawning shoals are not as dense as those of the herring and there is no evidence of any restricted spawning ground. Rather, there is some evidence that the fish aggregate on plankton patches, feeding and spawning more or less simultaneously.

After two to four days the eggs hatch and the thread-like larvae float at the mercy of the currents, feeding on the plankton, until they develop into recognizable little pilchards at about four months of age. Little is known of the movements of the immature pilchard, or sardine; the only fishery for them is along the coast of Brittany. These fish are mainly from 12 to 17 cm long and one to two years old.

Age-determination in the adult pilchard is complicated by the fact that, in addition to the annual rings laid down on the scales each winter, other rings occur which are possibly formed by a check in the fish's growth while spawning. However, most of the fish taken in British waters are at least three years old and some of the biggest fish are probably over ten years old.

THE FISHERY

Although large catches of pilchards are sometimes made in the southern North Sea by drifters during the East Anglian herring fishery, most of the landings are provided by a dwindling fleet of small drifters working in the western English Channel from Cornish ports. The main ports are Newlyn, Mevagissey and Looe in summer, and Mevagissey, Falmouth and Looe in winter.

Table 1. British landings of pilchards at all south-western ports

Year	Landings (cwt)	Year	Landings (cwt)	Year	Landings (cwt)
1947	61,680	1953	104,333	1959	66,754
1948	66,421	1954	56,201	1960	57,366
1949	60,470	1955	91,758	1961	53,074
1950	78,707	1956	113,920	1962	39,710
1951	81,037	1957	52,350	1963	38,471
1952	93,077	1958	78,154	1964	33,577

French and German trawlers working around the Eddystone for herring from November to January take considerable quantities of pilchards in some years. Recently Russian and Polish fishing activity has greatly increased in that area but there is no evidence that any country is as yet systematically exploiting the pilchard stock. In 1950 Dr. Cushing, of this laboratory, using silk plankton nets to catch the eggs, estimated the stock to be about 800,000 tons.

British landings of pilchards at south-western ports since the war are given in Table 1. Although the decline since 1956 is well shown these figures give no idea of the seasonal changes which have occurred, or of the number of vessels and crews which have abandoned the fishery. The rapid decline of the winter fishery is shown clearly in Figure 1, which gives the quantities of pilchards landed at the major ports in the period November to February since 1952. Figure 2 shows how the fishing effort and catches of the vessels supplying one factory have remained steady or even increased somewhat in recent summers, but have dwindled to almost nothing in winter.

THE DEMAND

There is a local market for fresh fish and a small curing trade, but by far the biggest demand comes from the canneries. The annual consumption of tinned pilchards in this country amounts to some 15,000 tons, of which only about 10% are currently home-produced; the rest are imported, mainly from South Africa.

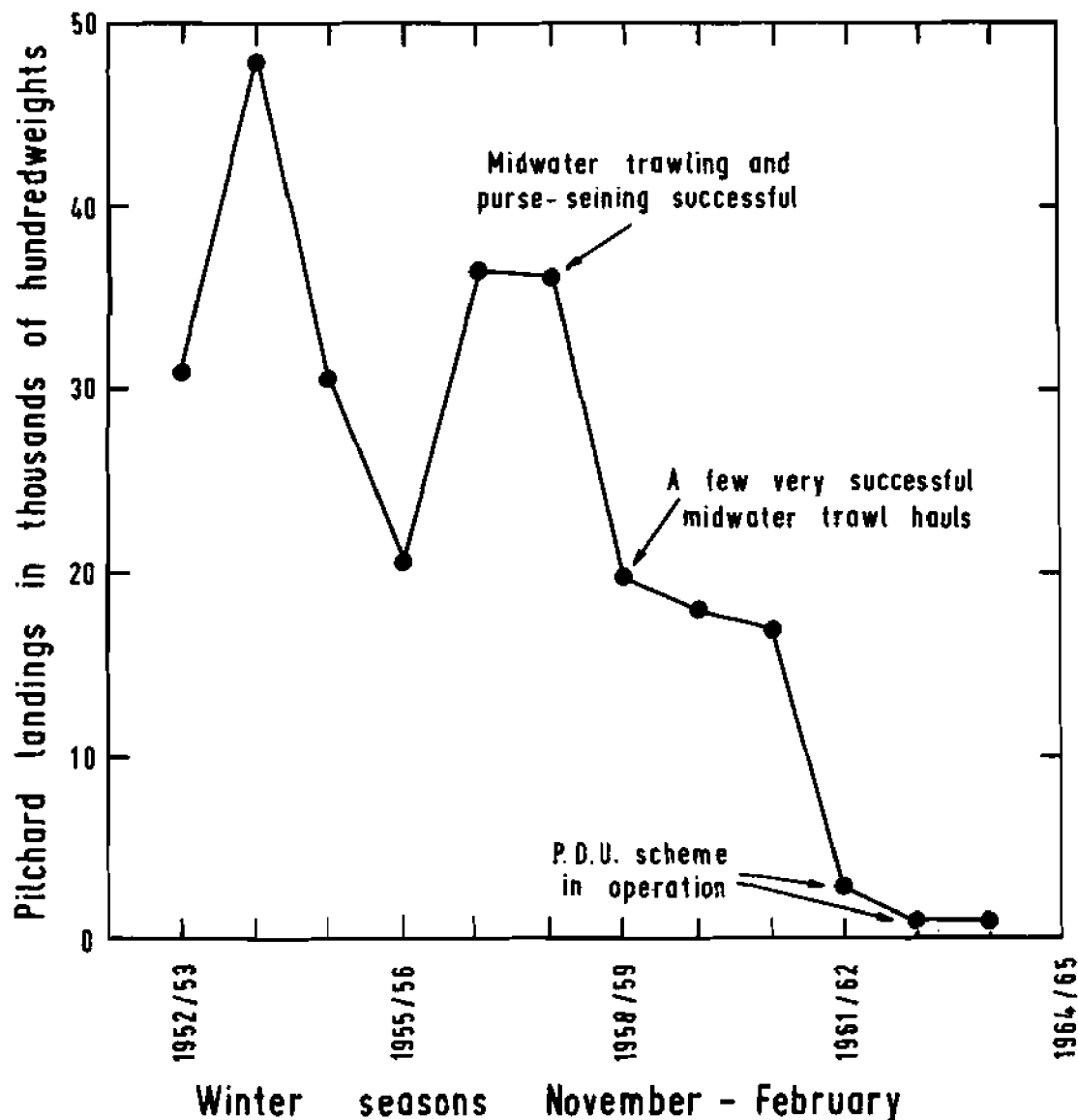


Figure 1 British landings of pilchards at Cornish ports during the winter months, November to February, 1952-1965.

Our canners could increase their production if larger and more regular supplies of fish were available. At present they are faced with long blank periods interspersed with occasional hectic spells when they are offered more than they can conveniently deal with, since they are geared to process the average-sized landing. If a canner has to restrict the fishermen's effort there is naturally some resentment. To put the matter in perspective, the purchases of pilchards by one factory geared to handle 3,000 stones per day or 15,000 stones per five-day week during three recent years are given in Table 2. This factory served

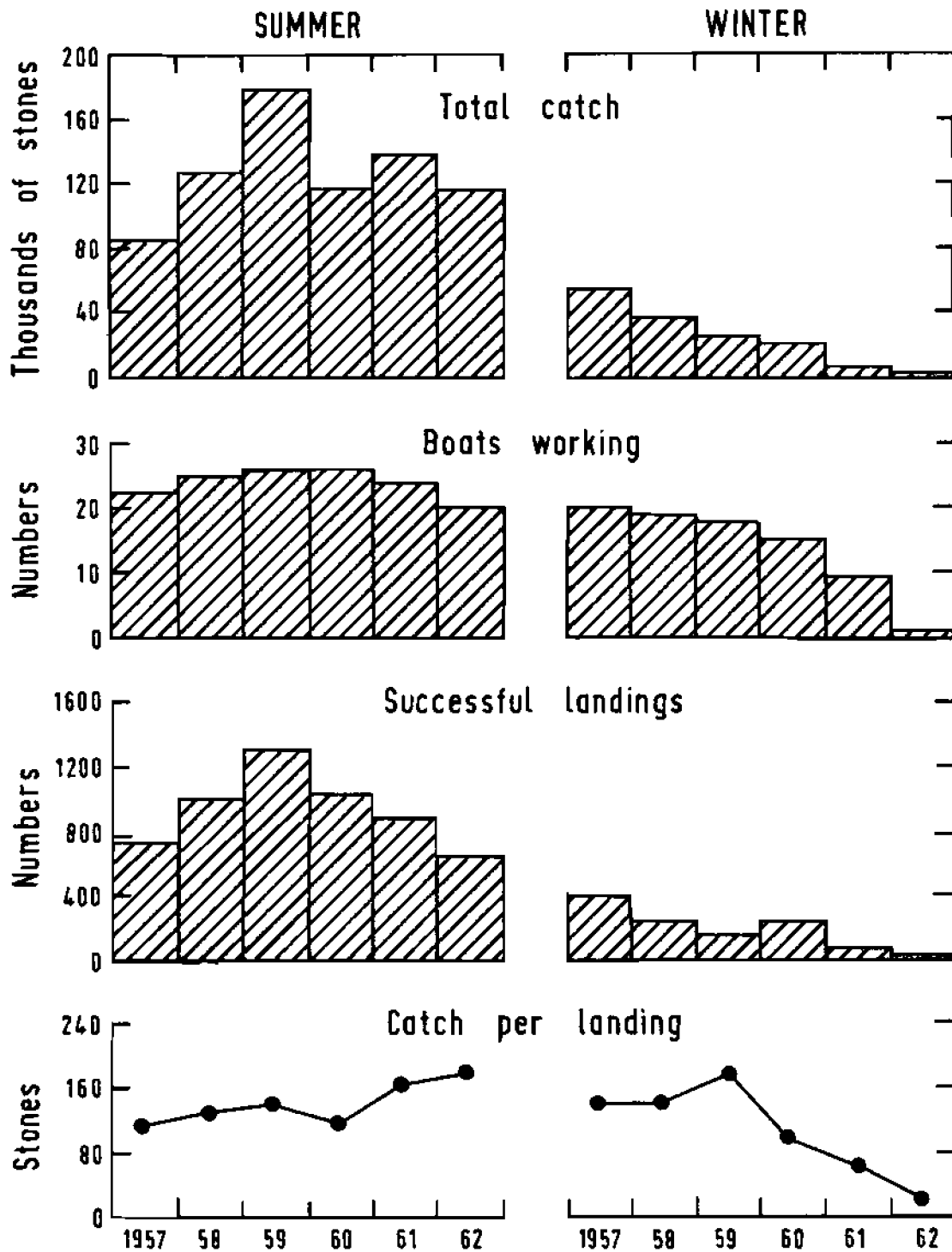


Figure 2 Details of the summer and winter catches and fishing effort of the drifters supplying one Cornish factory with pilchards in recent years.

Table 2. One factory's purchases of pilchards, and the details of that factory's working time, by months, 1960-1962

Month	1960			1961			1962		
	Quantity bought (stones)	Days employed on pilchards		Quantity bought (stones)	Days employed on pilchards		Quantity bought (stones)	Days employed on pilchards	
		Full	Part		Full	Part		Full	Part
Jan.	23,333	12	2	14,161	11	1	751	4	-
Feb.	11,753	5	3	6,801	11	-	1,869	7	-
March	-	-	-	1,173	7	-	1,262	3	-
April	Factory not taking pilchards								
May	" " " "								
June	3,258	4	-	28,909	10	6	2,996	3	-
July	30,198	20	2	13,640	8	-	16,016	13	-
August	30,149	12	4	66,936	19	14	27,129	14	3
Sep.	55,226	19	10	27,941	11	5	49,622	18	7
Oct.	363	3	-	2,082	6	-	21,597	15	2
Nov.	-	-	-	156	2	-	1,213	6	-
Dec.	3,944	9	-	18	1	-	214	3	-
Total	158,224	84	21	161,817	86	26	122,669	86	12

Factory was open for:-

<u>Year</u>	<u>Working days</u>
1960	152
1961	158
1962	158

Factory could have handled:-

<u>Year</u>	<u>Stones</u>
1960	456,000
1961	474,000
1962	474,000

20-30 drifters in summer and 10-20 in winter. The number of days of full and partial employment are also given, as well as the number of working days on which the factory was open and fish could have been accepted. It follows that on almost half the days in each season the factory received no pilchards to process at all. It is easy to see why our canneries find it very difficult to compete with the imported product.

In the Walvis Bay fishery 70-ft purse-seiners each land up to 6,000 stones per day with great regularity. This is about the same quantity as that landed by the entire Cornish fleet after an average night's fishing. The South African canners therefore have the advantage not only of cheap fish but also of regularity of supply, and this is of equal if not greater importance. Our problem is how to ensure larger and more regular supplies for the canneries at a price which ensures a reasonable living for the fishermen.

ATTEMPTS TO MODERNISE THE INDUSTRY

Since the war many attempts to improve catches have been made, mostly by vessels of 30-50 ft, using a variety of methods: ring-netting, purse-seining, midwater trawling (from single boats and from pairs), and bottom trawling. One drifter tried fixing underwater lights to her nets, without marked effect. All these attempts either failed completely or, after a promising start, faded away leaving the drifters to supply the bulk of the landings. Thus, despite all these efforts, the basic problem of producing larger and more regular catches remained unsolved.

THE PILCHARD DEVELOPMENT UNIT

In an attempt to resolve the problem, a committee was formed on which the White Fish Authority, the Ministry of Agriculture, Fisheries and Food, the Cornwall Sea Fisheries Committee, the canners and the fishermen were all represented. Funds were made available to provide, equip and run a vessel larger than those of the drifter fleet for about two years, to locate the shoals throughout the year and to find the most efficient method of catching pilchards regularly.

The vessel chosen and chartered for this task was M.F.V. MADELINE (PZ.88), a vessel of 65 ft with a 152 h.p. Gardner engine and a 2-ton trawl winch. After much refitting and alteration she was ready for sea late in March 1961. She carried a complement of nine: two scientific staff, a skipper, a mate, an engineer, three deckhands and a cook. She was equipped with a Kelvin Hughes Fisherman's Asdic and an MS 29 echo sounder, a Decca Navigator and track plotter, a Sestrel automatic pilot and a radio.

MADELINE's initial set of fishing gear comprised twenty staple nylon and four cotton drift nets (ranging from 35-41 rows per yard), a Courlene 520-mesh Vinge trawl and "Skagen" doors, and two nylon midwater trawls with British Columbia V-section doors. As the scheme developed, a 210 m x 60 m nylon purse-seine with a bunt at either end, as used by the sardine boats of Brittany, was added, together with a "Fifer" 4-speed hydraulic purse-seine winch and a "Puretic" power block for hauling it. Later still the trawl winch was removed and replaced by a "Beccles" coiler when fly-seining.

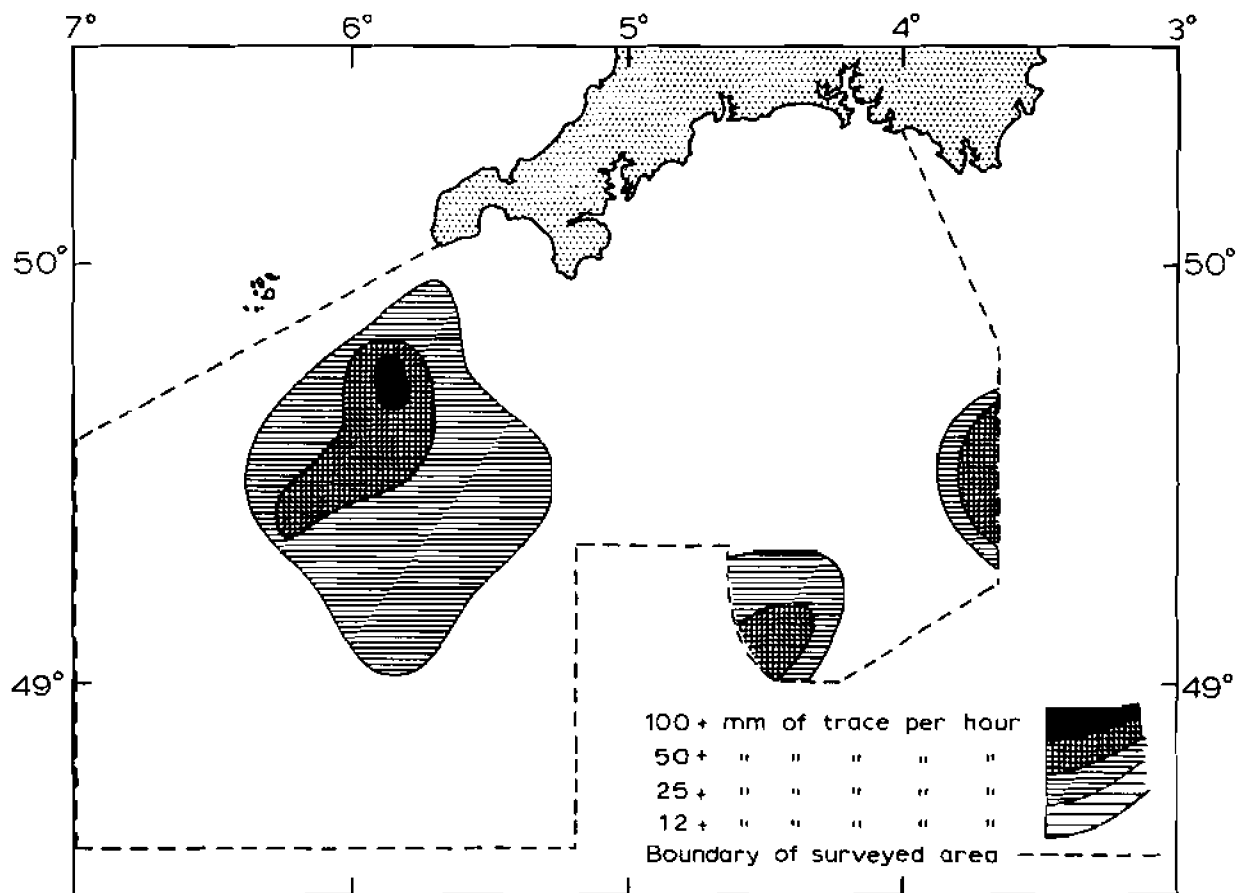


Figure 3 Results of the echo-survey by MADELINE in May 1961.

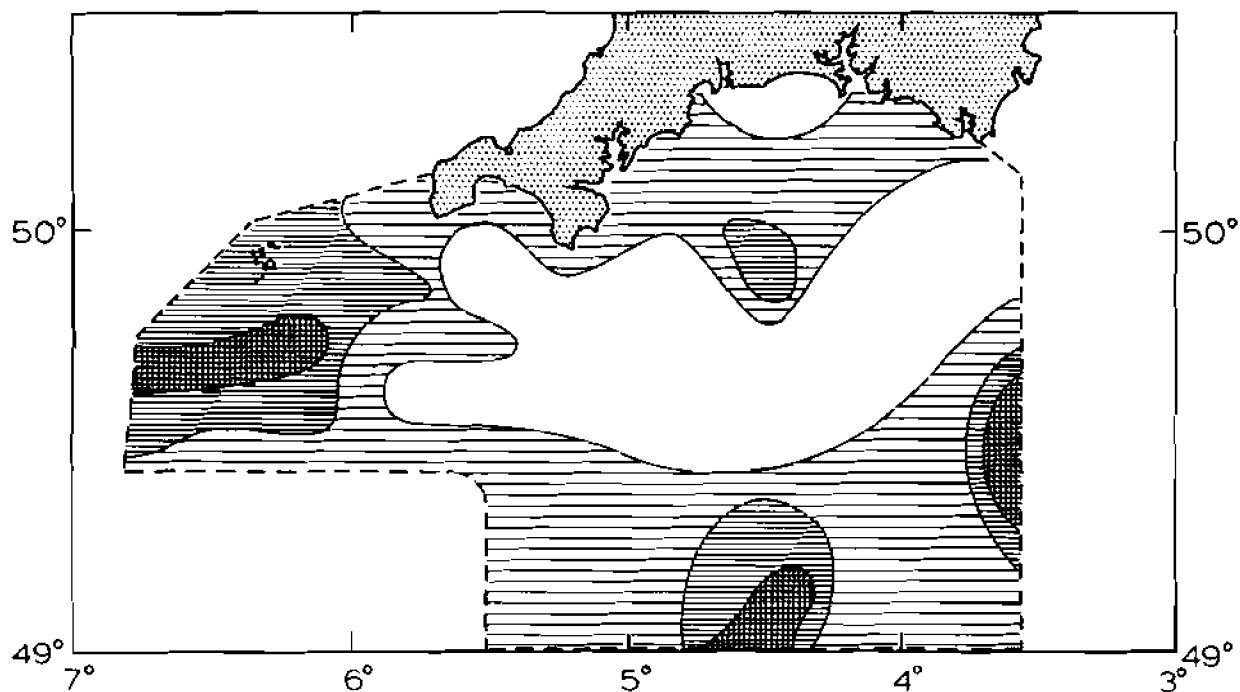


Figure 4 Results of the echo-survey by MADELINE in June 1961.

In addition to her main tasks of exploration and gear trials, MADELINE was also expected to search the traditional grounds when fish were scarce and to report any shoals found to the drifter fleet by radio. At first many drifters were reluctant to follow our advice, but after a few boats had made good shots from shoals located by MADELINE they answered the call so promptly that it was often difficult to get our own shot completed before the drifter fleet crowded us out.

The scheme ran from 27th March 1961 until 25th January 1963, 140 days being spent at sea in the first year and 172 in the second. In addition to the work at sea a certain amount of fish measuring and fat analysis of fish caught by MADELINE and other vessels was done ashore.

The work in summer

From April to November 1961 extensive echo surveys were made, interspersed with shorter trips to teach the crew the various fishing methods. This training naturally took some time. It must also be admitted that MADELINE, built as a drifter and subsequently used for long-lining and trawling, was not ideal for all purposes. This meant that one could not expect her catches to be as great as if well-appointed vessels with specialist crews had been chartered to try out each new method. However, the lack of success which met all the methods we tried, except drifting, was more probably due to the habits of the fish rather than to inadequacies in the vessel or her crew.

The accompanying charts (Figures 3-8) show the concentration of fish echoes expressed as millimetres of trace per hour. Since our echo sounder used 500 mm of paper per hour a score of 100 mm means that one sounding in five showed fish echoes. It is clear that not all the echo traces recorded were from pilchards; various nets as well as small explosive charges were used to try to identify the main concentrations, and where the traces produced species other than pilchard this has been noted on the charts.

Since operations did not begin until the last days of March we missed the start of the spring influx. The chart for May 1961 (see Figure 3) shows three areas of which only the one nearest Mounts Bay was being fished by a few drifters from Newlyn. By June (Figure 4) there were shoals all over the area but the most promising grounds were offshore. In August (Figure 5) a new concentration of fish entered the Mounts Bay-Wolf Rock area around Lands End, giving the drifters their best fishing of the season.

The start of the winter withdrawal to deeper water is seen at the end of September (Figure 6), while by October/November (Figure 7) there were virtually no shoals left in the area except some of small pilchards and anchovies between Falmouth and the Eddystone, and some sprats in Tor Bay.

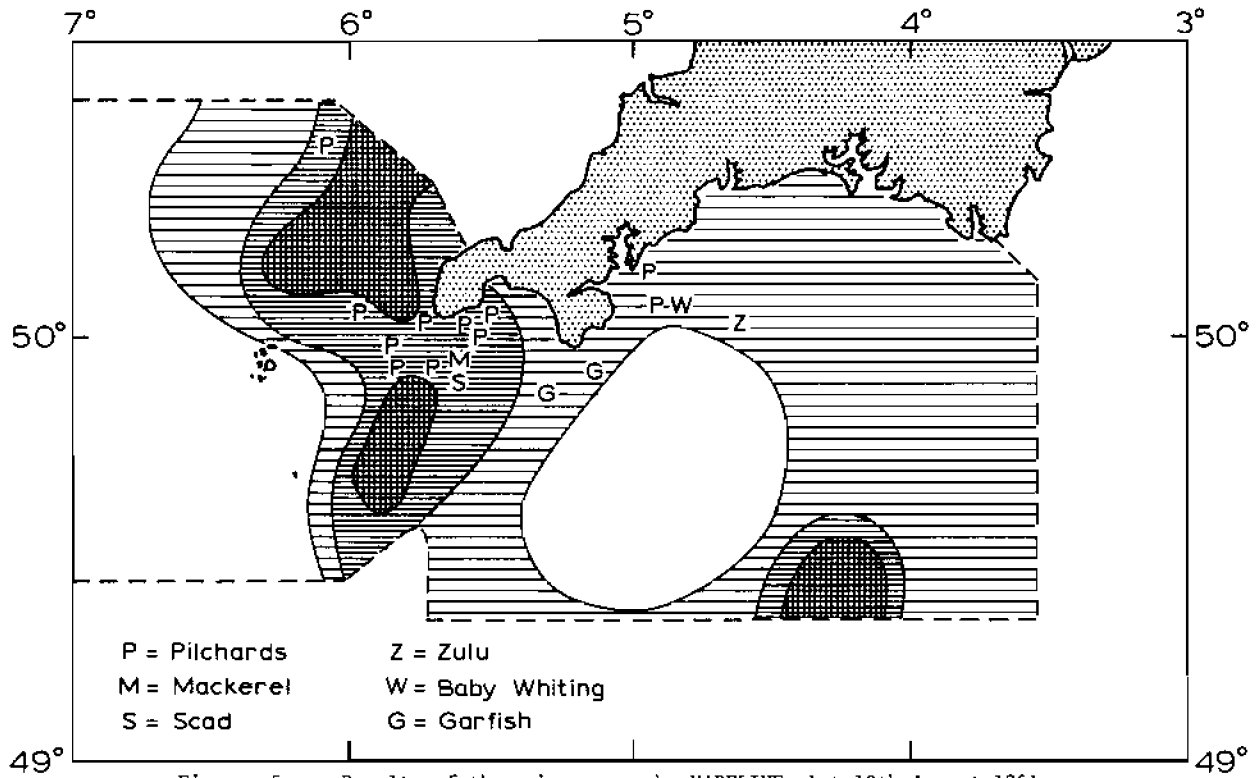


Figure 5 Results of the echo-survey by MADELINE, 1st-10th August 1961.

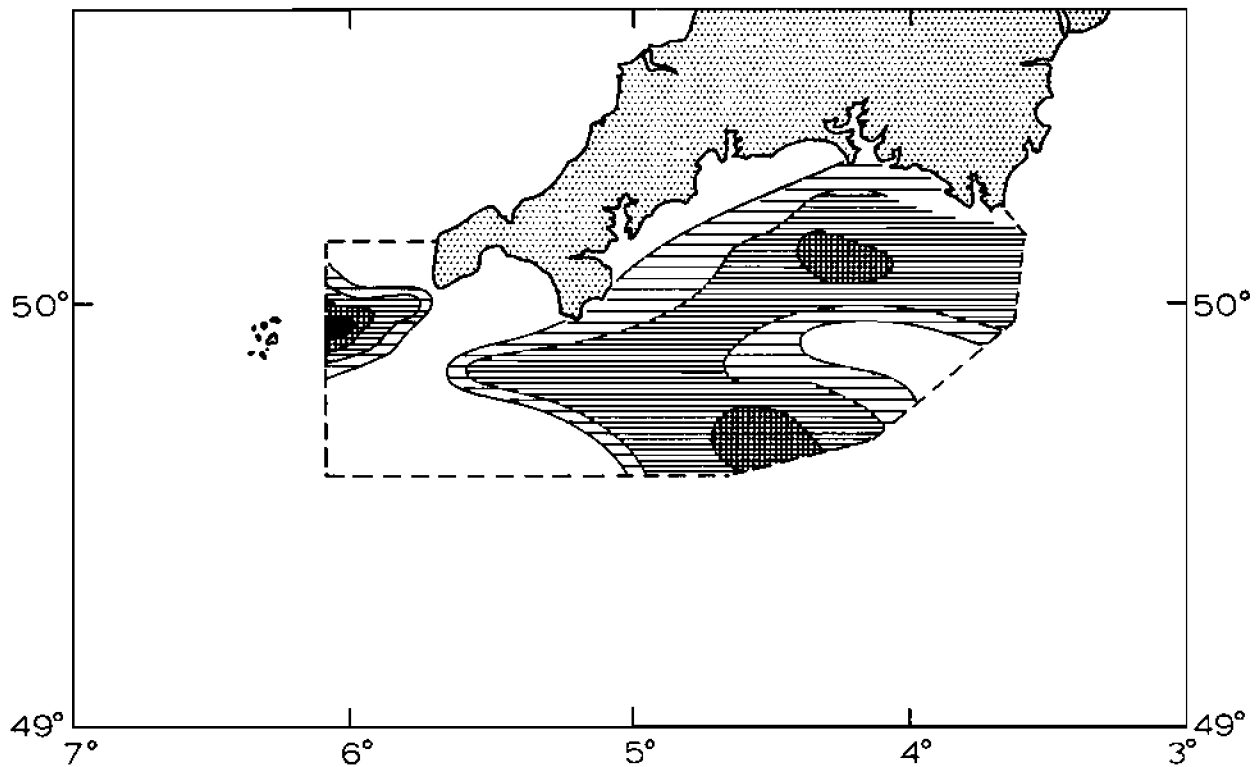


Figure 6 Results of the echo-survey by MADELINE, 21st-27th September 1961.

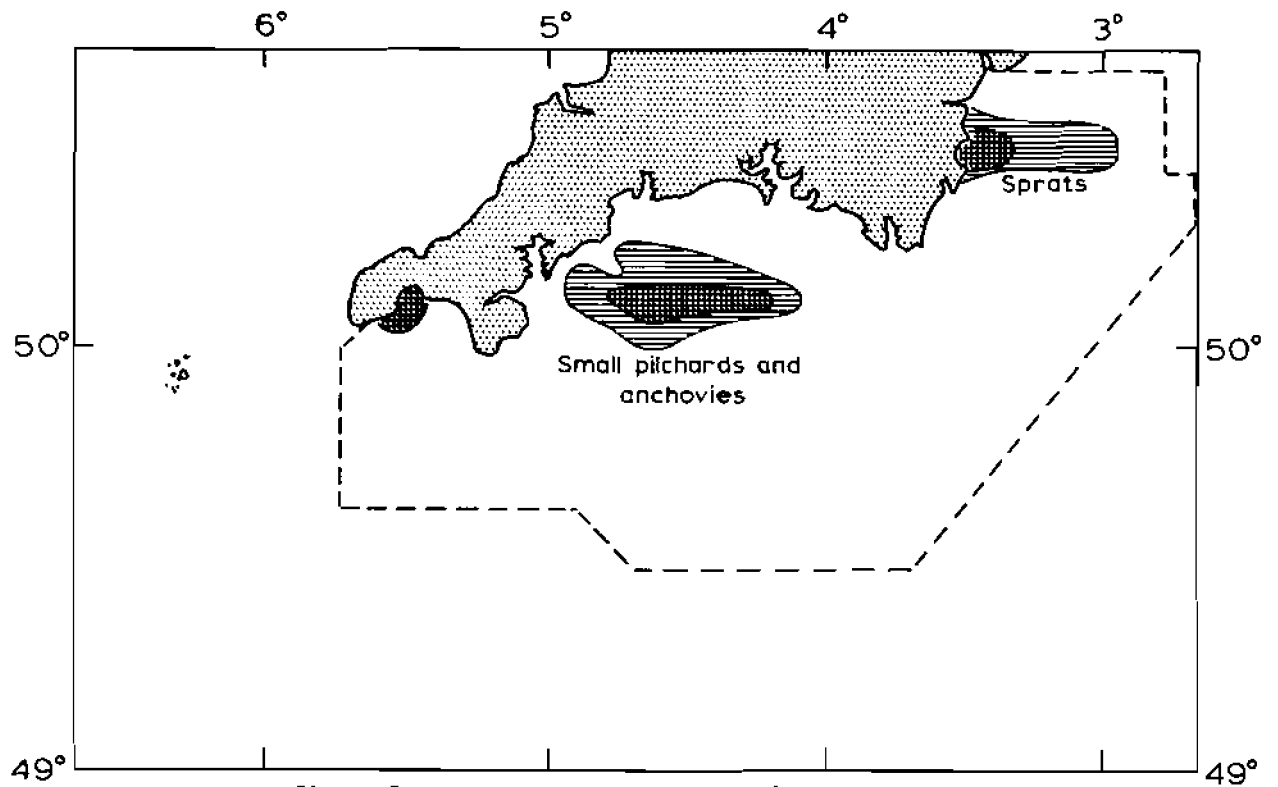


Figure 7 Results of the echo-survey by MADELINE, 28th October-10th November 1961.

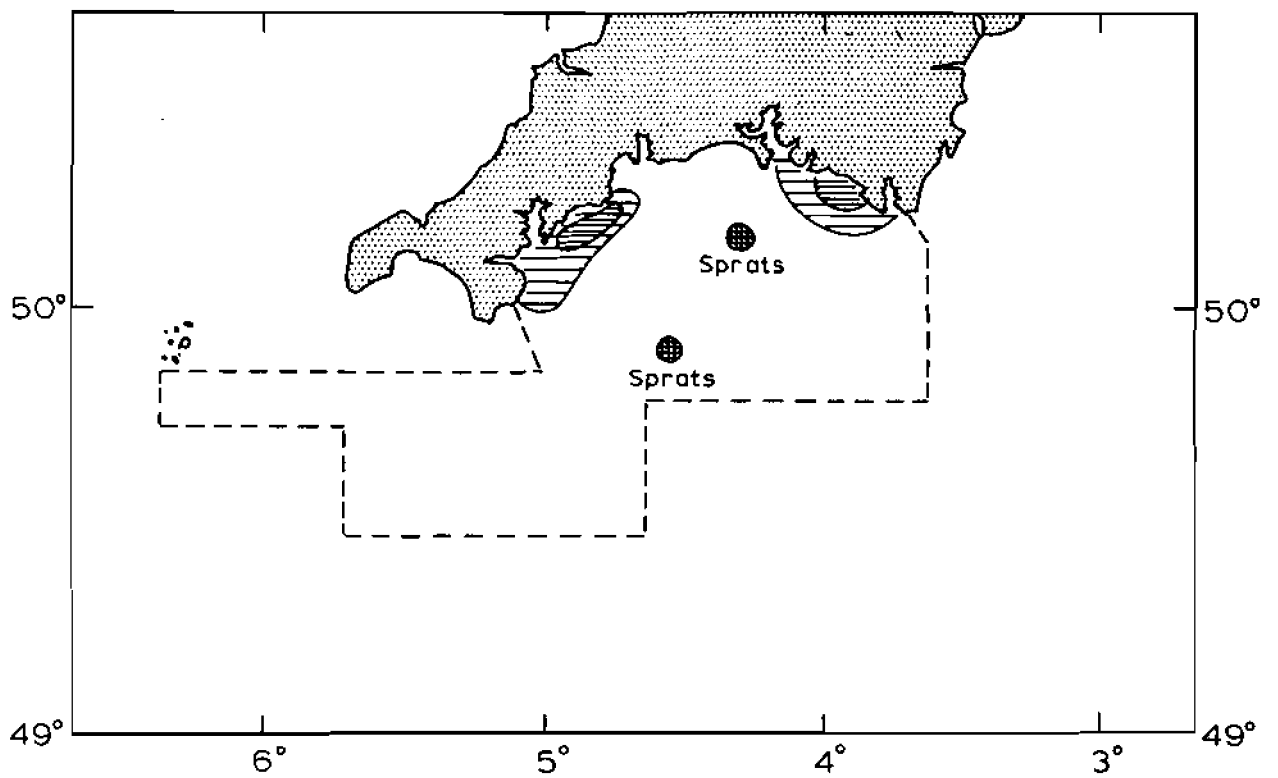


Figure 8 Results of the echo-survey by MADELINE, 27th-30th January 1962.

The shoals were normally found rising from the sea bed in the early evening but they dispersed long before reaching the surface. Just at dusk purse-seine shots of up to 40 stones were sometimes possible, soon falling off as the fish dispersed, so that even by making three or four "rings" a night we were unable to take more than 60-70 stones while the drifters averaged 130-150 stones for their night's work. The fish were simply not tightly packed enough for purse-seining, and phosphorescence in the water ("fire" or "brim" as it is locally known) was also detrimental to success.

The same was true of midwater trawling in summer. To increase the spread of the gear we worked as a stern trawler from the two after galleys, stacking the net on the purse-seine platform. The best performance was given by a four-panel net of 54-ft headline with two 20-fm bridles on each side and elevators and depressors lashed a fathom forward of the upper and lower wing tips respectively. With 50 fm of warp out one could stand on the wheelhouse roof at night and see the whole net lit up by phosphorescence right back to the cod-end. Door spread was about 50 ft and the net spread about 25 ft with 18 ft gape. Our towing speed was only 2-2½ knots and our summer catches were negligible, 17 stones per hour being the best shot achieved in summer. Often from quite good driftable traces we took only a handful of fish. As in the two previous private attempts to take summer pilchards in this way we eventually had to admit that there was no future in it for boats of MADELINE's size and power.

During the long summer days when the shoals were found on or near the bottom we used the Vinge trawl with a pilchard cod-end in the conventional side-trawling manner. Our catches of demersal fish were about equal to those of the local trawlers when working on good ground. The drag of the doors and net was rather high and so we could use only bights of chain on the ground rope, since the additional weight of wood bobbins or rubber ground ropes would have reduced our towing speed too much. Except for the odd stone or two we never took any pilchards with this gear, even when working on grounds where the drifters had done reasonably well the previous night.

In our second summer we also tried fly-dragging, using our Vinge trawl as a seine with 6-9 coils of rope each side. Our purse-seine winch provided the power, although it was not ideal since it was not designed for this purpose. The quantities of demersal fish, mainly whiting and lemon soles, taken from good ground around the Eddystone and Wolf might, if sustained, have provided a living for a 40-ft seiner, but we never took a single pilchard by this method.

Since drifting was the accepted local method we used the drift nets only when all other methods had failed to identify the shoals. The staple nylon drift nets consistently took their share of pilchards, did not unduly damage the fish, and gave us no trouble with knot slippage.

After two summers of frustration we reluctantly had to admit that while pilchards were there in abundance, and were by no means confined

to the traditional inshore grounds, the only feasible method of capture open to a small vessel of moderate power was drifting. The loosely packed nature of the summer shoals, combined with the phosphorescence, made paying catches by any of the more active methods next to impossible.

The only method known to us but not tried was the artificial aggregation of fish by the use of lights for purse-seining. However, a fully experienced Spanish crew had tried this some years before; although the fish had gathered around the light readily enough they escaped before the net enclosed them. It is therefore unlikely that we, with less experience, would have met with any greater success.

We did try to aggregate pilchards, both by day and by night, with salt cod roe purchased in France. By night it seemed to have no effect whatever; by day we thought it did attract and hold mackerel, but it certainly had no appreciable effect on pilchards.

The work in winter

All the previous successful attempts to take pilchards by methods other than drifting had been made in winter when the shoals were bigger and more tightly packed, and when there was no "fire" in the water. The trials had all been done in coastal waters prior to 1959 when numerous shoals were present, usually at dusk, although on occasions the shoals had remained sufficiently tightly packed until well after dark.

Although MADELINE was somewhat bigger than the drifters, in the weather conditions we encountered she proved unequal to the task of regularly surveying the offshore areas in winter. In short spells of finer weather we often reached 30-40 miles from land, but found no shoals there at all. A typical winter survey - the seaward limit indicated by a broken line - is given in Figure 8.

On the inshore grounds the winter of 1961/2 proved the least productive season to date. The drifters fared very badly and the only other vessel carrying a midwater trawl did not shoot it for the whole of the season, since they found nothing on which to shoot it. We took 90 stones of anchovies and small pilchards in one shot of the purse-seine in November, and a 30-stone haul of sprats and pilchards with the midwater trawl, but we returned from the majority of our surveys without shooting. Radio contact was maintained with the drifter fleet and there was a free exchange of information. If a shoal was found it was frequently impossible to fish our gear without risk to the driftermen's nets.

It was not until the middle of March that we encountered near the Wolf the sort of shoals we were looking for and these fish, although numerous, were far more difficult to catch than we had been led to expect. Many species were present, including mackerel, scads, anchovies and small pout whiting as well as pilchard. By day in midwater we caught very little and at night the shoals broke up before coming within purse-seine range. The quality of the first fish to appear was fair, ranging

from 8.8-11.8% fat, but by early April they were very mixed, with the fat content ranging from 3-13%.

In our second winter, 1962/3, conditions were similar but even worse, this being the only January on record when no pilchards were landed at Cornish ports. Before the bitter weather and south-east winds set in we had one reasonable shot of 408 stones by purse-seine, which represented over 30% of the canneries' total purchases for the season. By trial and error we did learn what has to be done to ensure a good shot: briefly, this is to find a shoal in daylight and stand by it until dusk. (We tried to ring shoals in daylight and failed every time.) While waiting for the light to fail, check and recheck the stacking of the net. Great care must be taken to avoid hitches, for a purse-seine is easily torn. When all light has faded, mark the shoal with a winkie light on a drift buff and ring the shoal with as little disturbance as possible. Ideally the shoal should not be seen on the echo sounder at all or, if it is, then only when laying the last quarter of the net. To record fish as shooting commences nearly always means that they are driven out of the ring before it is complete. Since there is no neighbour boat to hold the boat off the net, some wind is essential in order to avoid getting a bight of net around the propeller. Our net sank rapidly, so there was no need to delay pursing; once the ring was complete pursing was begun and carried out at full speed until all the 17 rings were aboard, and the bights in the lead line were then pulled by hand over the rail. Power was then transferred from the winch to the power block, and the net was "dried up" until the point where brailing began.

Given enough shoals, and winds of Beaufort force 2-4. purse-seining yields paying catches, as was demonstrated by a St. Ives boat in January 1958. Her catches for 15 nights amounted to 5,860 stones, as against the top drifter's catch of 4,741 stones and the average drifter's catch of around 2,000 stones for the same period. During the same month a 40-ft midwater trawler took 1,686 stones for 9 nights' work.

However, in January 1963, due presumably to the intense cold, the fish were simply not there to be caught and the Pilchard Development Unit scheme ended on the 25th of the month.

General conclusions from the Pilchard Development Unit project

Briefly these were that in summer drifting was the only consistently successful method open to small vessels of moderate power. There was no shortage of driftable traces, such as could well be exploited by drifters of 70-100 ft if a few such vessels could be persuaded to join the fishery. By virtue of their size they would be less restricted by weather than the present fleet and so should provide more regular supplies.

No recommendations could be made about the winter fishery until the wintering grounds were located and it was known what type of vessel and method of capture was most suitable. It was recommended that the Ministry

of Agriculture, Fisheries and Food should send one of its larger ships to Cornwall to assess the situation in winter.

The follow-up

Two such visits have now been made: a short one by R.V. CLIONE (155 ft and 960 b.h.p.) in March 1964, and a longer one by R.V. ERNEST HOLT (194 ft and 900 h.p.) from 19th November to 8th December 1964.

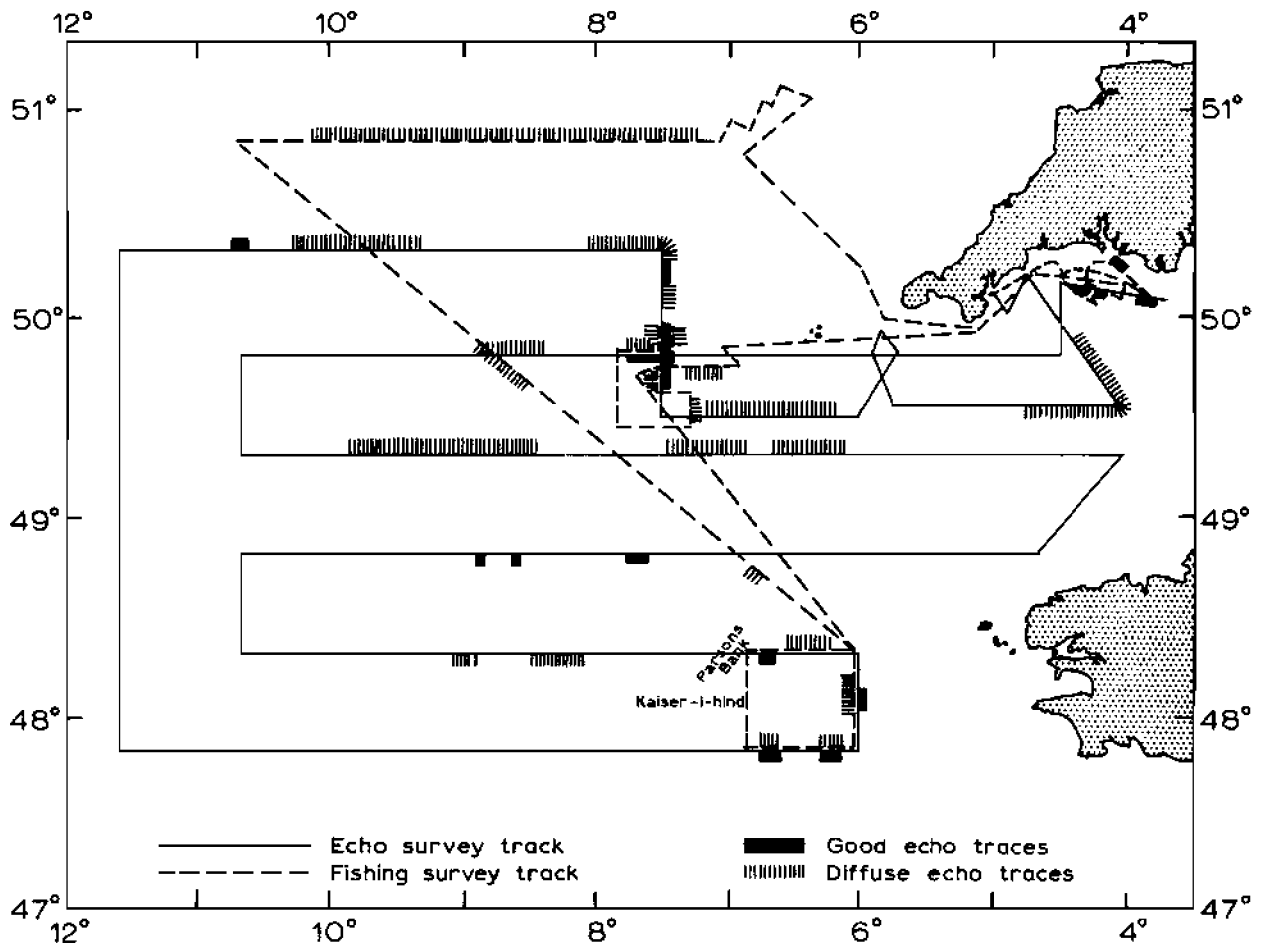


Figure 9 Results of the echo-survey made by R.V. ERNEST HOLT between 19th November and 8th December 1964.

R.V. CLIONE came equipped with her 800-mesh Engels two-panel mid-water trawl. Reasonable traces were found about six miles south-east of the Wolf at dusk on 5th March. The net, with a headline transducer fitted, was towed for two hours at a speed of 3-3½ knots. Of the four shoals encountered during the tow a part of one was seen to enter the net and the catch was 100 stones, but by far the majority of the fish were seen by the headline transducer to pass under the net. The next day two further shots were made on shoals close to the sea bed; both took part of two of the nine shoals encountered, the first shot yielding about 50 stones and the second about 170 stones. Unfortunately this work had to be fitted in with an Irish Sea cruise and no further time could be spared to perfect our techniques. It did show, however, that given a vessel of sufficient power and a net with a 6-fathom gape these fish (which were of fair quality) were catchable both by day and night. Therefore, when we returned with R.V. ERNEST HOLT we came armed with this same net in addition to a Dutch herring trawl and the ship's normal Granton trawl. The first step was to survey the area in order to find the missing winter shoals and to get an idea of the hydrography. This survey (see Figure 9) comprised six lines running east-west and totalling over 1,500 miles, and was accomplished in seven days of fine weather. Three areas showed real promise: around the Eddystone, 45-55 miles west of the Bishop Rock (Scillies), and a more general area around Parson's Bank and Kaiser-i-Hind Bank off Ushant. Apart from those near the Eddystone, the area that we had been able to cover with MADELINE was almost completely devoid of shoals. During the rest of the cruise bad weather dispersed the echo traces (see Figure 10), and no good catches of pilchards were made.

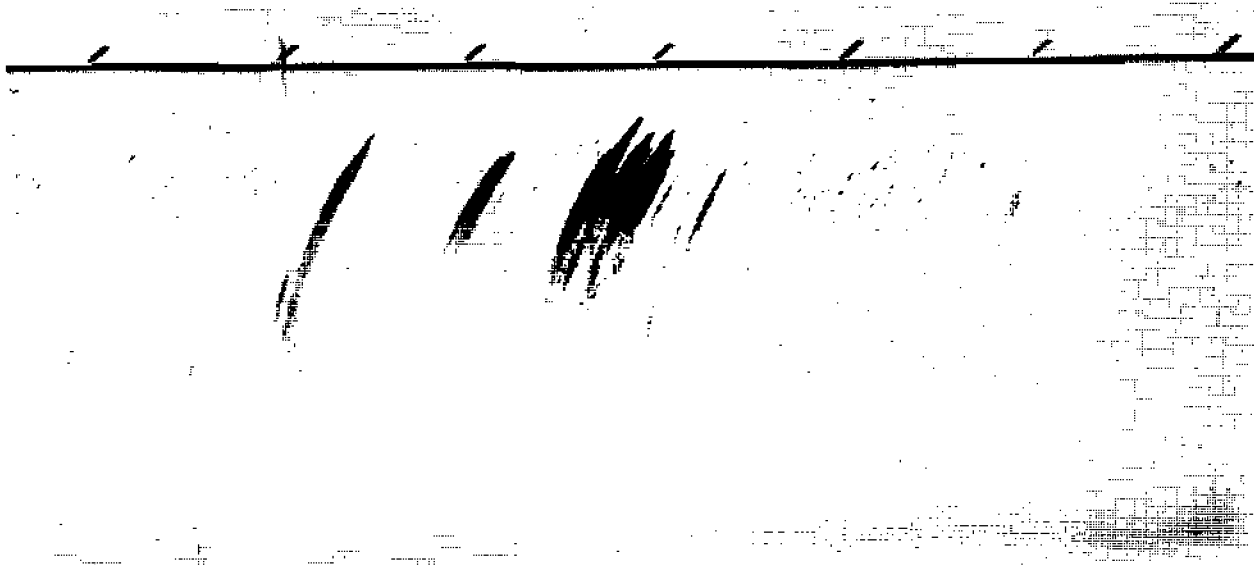
The conclusion was that in order to work this area regularly large vessels are essential. While such vessels might manage to make paying catches in good weather, in poor weather the shoals break up to such an extent that trawling and purse-seining would be unprofitable. The spells of good weather in this area in the period November-March are normally few and far between, so that only in exceptionally calm winters would vessels of this size be likely to catch the 15-20 tons per day they would need in order to show a profit.

Modern steel drifters of 90 ft and over can and do work the area for mackerel from February to early May, and could certainly fish for pilchards if they had nets of the right mesh size. However, because mackerel command a higher price than pilchards, unless the catches were very good the fishermen would soon revert to mackerel fishing. From the canners' point of view the fish would probably be suitable until early March, but from then until mid-June these fish are of very mixed quality and it is unlikely that a high-standard pack could be made from them.

One possible outlet for the spring fish is pet foods, but the catches would have to be regular and heavy to induce the buyers to arrange transport from West Cornwall.

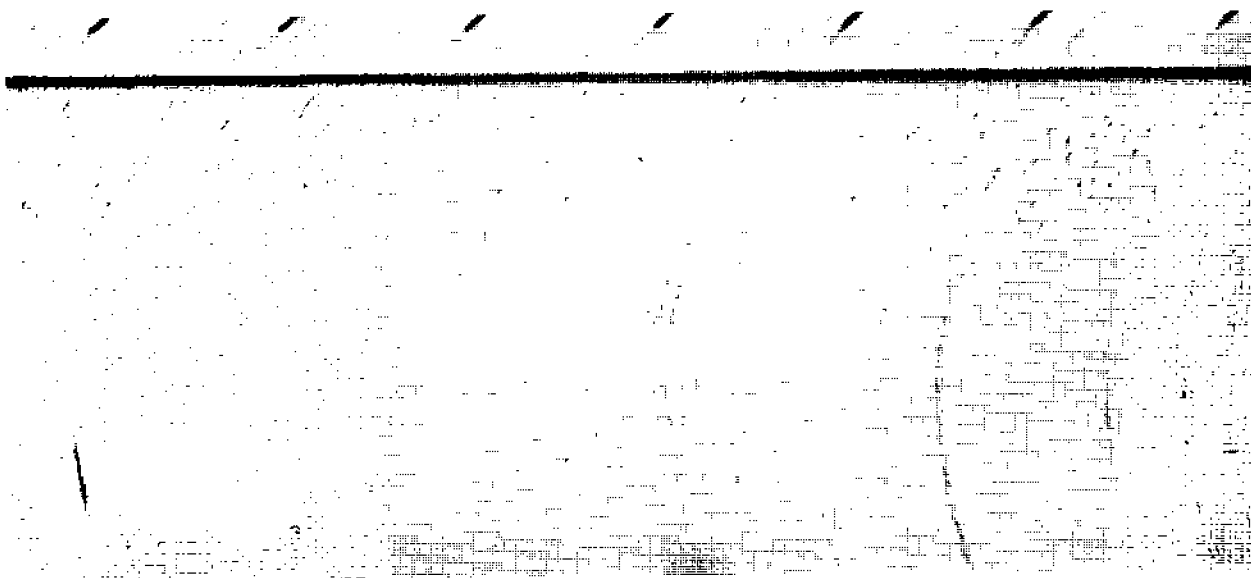
Figure 10

The type of echo-traces found by R.V. ERNEST HOLT west of the Scillies during the survey in November/December 1964.



A

Traces recorded in calm weather conditions, on 20th and 27th November.



B

B. Traces recorded from 2nd to 4th December, after a north-westerly gale.

FINAL CONCLUSIONS

Despite considerable effort the basic problem of irregularity of supplies remains unsolved. Of the fishing methods currently available only drifting holds any hope of regular success in summer. In winter the inshore areas are bare, and so are the grounds just to seaward of them. Since regular landings are needed the vessels used must be capable of working in the open Atlantic 60-100 miles from port. This means steel vessels of 100-200 ft, and such vessels are expensive to buy and to run; moreover, there is no fishing port nearer than Milford Haven with adequate facilities for vessels of this size. Finally there is no real proof that they could earn a living, since the shoals break up in bad weather, when again drifting would be the only feasible method.

If Great Britain ever develops an industrial fishery using distant-water vessels or big stern trawlers, then the pilchard might be exploited at times from November to March. At present there is no such fleet in existence that could be diverted to this area.