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Preliminary results of German investigations on Blue Whiting (Micromesistius poutassou)

by

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Until recently the Blue Whiting has been of little interest to German fisheries. It was caught only occasionally as bycatch and the landings amounted only to a few tons annually (1972: 30 t; 1973: 14 t). Since 1974, however, the German fishing industry shows increasing interest in using the Blue Whiting as fish for human consumption. German trawlers undertook some trial catches (pelagic trawling) in the waters west of the British Isles, and consequently the landings of Blue Whiting rose to 2 659 t in 1974. The development of a German fishery on this species will to a great extent depend on the future prospects for the fisheries for more conventional species such as cod, haddock and saithe.

In view of this commercial interest biological investigations on the Blue Whiting were started in 1974. Samples were collected during several cruises of the R.V. "Walther Herwig" to the waters west of Britain and Ireland between Faroe Islands and the Bay of Biscay (May 1974, November/December 1974, May 1975), and of the R.V. "Anton Dohrn" and "Solea" to the northern North Sea (July 1974, January/February 1975). Unless specified otherwise, all survey catches were made by bottom trawls (14o-2oo') with small-meshed inside cover. The collection of data at sea was supplemented through some sampling on commercial landings.

The location and timing of the samples taken is shown in Fig. 1.

Catches

A review on the mean catches of Blue Whiting made by R.V. "Walther Herwig" in different areas between the Faeroes and Cape Finisterre at various depth levels (Table 1) shows that generally the quantities obtained were much lower in late autumn than in spring. During all seasons the highest catches were made at depths between about 200 and 450 m. Here the mean catch per one hour trawling (bottom trawl) in spring (May) amounted to about 325 kg in the waters between Faeroe Bank, Rockall, and the Porcupine Bank. Above and below that depth the catch rates were declining very rapidly, and Blue Whiting was hardly found deeper than about 700 m. In November/December the mean catch in depths of 350-500 m around the Faeroes and Lousy/Bill-Baileys Banks was only about 37 kg/hr., and even lower off the Hebrides (15 kg/hr.). In the south (Great and Little Sole Bank, Gulf of Biscay and Cape Finisterre) fishing was carried out only during May 1975, and at depths between 130 and 400 m the overall mean catch amounted to only 50 kg/hr. Thus, it appears that within the depth zone of major concentration of the Blue Whiting (200-450 m) the density in May is roughly 6-7 times higher in the area north of 52°N than in the waters further south.

It should be mentioned, however, that in the Gulf of Biscay in May 1975 echo traces were found in a rather wide area, reaching sometimes down to the bottom. For technical reasons no pelagic trawling could be made on these traces but bottom trawl catches consisted mainly of Blue Whiting and Horse-mackerel.

In the northern part of the survey area (north of 52° N) the density of fish in May was found to be roughly 10 times higher than in November/December.

However, it should be kept in mind that these catch rates were obtained by bottom trawling. Pelagic trawls appear to be a much more effective gear for catching Blue Whiting. In using a midwater trawl (1000 meshes), the "Walther Herwig" caught in April/May 1975 off Barra Head (Hebrides) in depths of 200-350 m up to 26.25 tons of Blue Whiting per hour (average from 4 hauls: 16.8 tons/hr)(Mohr and

Freytag, 1975). Even larger catches might have been obtained if these hauls were not used also for behaviour studies. Still considerably larger catches were made in this area in April/May 1974 by a commercial trawler using midwater trawls at the same depths.

In the Hebrides area it was observed with the echo sounder that the Blue Whiting is concentrating in dense shoals, sometimes in two separate layers (see also Mohr, 1975). Fig. 2 shows an echogram with such layers at about 250 m and 350 m depth which were fished pelagically by the "Walther Herwig" resulting in a catch of 1564 kg in 25 minutes.

Very good catches with the pelagic trawl were also obtained by R.V. "Walther Herwig" during two hauls in January 1975 east of the Faeroe Islands in depths of 400-480 m with a quantity of 11 tons/hr. These catches are of special interest since these fish might have been from shoals immigrating from the north at the beginning of the spawning season.

In the North Sea Blue Whiting were caught by R.V. "Anton Dohrn" and "Solea" using bottom trawls in some out of many hauls in the Shetlands and Viking Bank areas (Fig.1). In July 1974 the average catch of 4 successful hauls amounted to 353 kg/hr. at depths of 180-185 m. At depths around 160 m the mean catch of 3 hauls was only 15 kg/hr. A haul of R.V. "Anton Dohrn" near the Viking Bank in February 1975 resulted in a Blue Whiting catch of 328 kg in one hour fishing, consisting mainly of very small fish (14-19 cm).

Environment

A direct correlation between the distribution of Blue Whiting and the water temperature is not apparent from the data at hand. The lowest temperatures were found around the Faeroe Islands. In the waters from the Hebrides south to the Gulf of Biscay temperatures showed little differences between the surface and

depth of 1ooo m. Catches of Blue Whiting were made in areas with water temperatures of 4.9 - 11.5° C, mostly between 8°C and 10°C. The range of salinity in the area of investigation between the Hebrides and Cape Finisterre was 35.16 - 35.70 ‰.

Length and age composition

The length composition of Blue Whiting in the various areas (Fig.3) shows an overall range of 12 to 48 cm. There are considerable differences between areas and seasons. The mean lengths by sexes are summarized in Table 2. A statistical test shows that in all samples the males are significantly smaller than the females, with the exception of the Cape Finisterre area where, however, the sample comprised only 35 fish.

In November/December the catches in the whole northern area contain small as well as large Blue Whiting, and the length freqency curves are rather similar in the waters between the Faeroes and the Porcupine Bank. Especially the Blue Whiting from the Lousy/Baileys/Faeroe Banks and Rockall areas show similarities in the length composition and little changes from November to May. 70 % or more of the fish are larger than 24 cm and the majority have lengths of 27-33 cm. The percentage of small fish (12 - 21 cm) varies in the sub-areas as follows:

Faeroe Islands	6.6 %
Lousy-Baileys-Faeroe Banks	32.5 %
Hebrides	17.4 %
Rockall	28.7 %
Porcupine Bank	2.9 %

The results from a rather limited number of age determinations made so far show that in the area Lousy/Bill Baileys/Faeroe Banks in November 1974 the catches had the following composition:

Rings	0	1	2	3	4	5	6	7	8	9	10+
Year-class	1974	1973	1972	1971	1970	1969	1968	1967	1966	1965	1964-
%	+	21.3	11.7	11.8	14.5	10.7	6.0	2.1	-	4.0	17.8
n = 51											

The year-classes 1970 and 1965 appear to be relatively strong ones. Also Bailey (1972) found Blue Whiting of 1965 year-class to be numerous around Rockall.

In January 1975 dense concentrations east of the Faeroes consisted mainly of Blue Whiting larger than 27 cm.

In May the share of small fish (less than 21 cm) is negligible in the catches in the northern area. The vast majority of fish have lengths of more than 27 cm. The length composition in the Lousy/Baileys/Faeroe Banks area and near Rockall is rather similar (modes about 30/31 cm), and it appears that here the fish are in the average somewhat larger than off the Hebrides (modes about 27/29 cm).

In the southern areas (Sole Bank, Gulf of Biscay and Cape Finisterre) which were so far only investigated in May 1975, the length composition is considerably different. Here small Blue Whiting 15-23 cm long, form the majority of the catches:

Sole Bank	79 %
Gulf of Biscay	77 %
Cape Finisterre	66 %

Very large fish over 34 cm which are found in quantities in the northern areas, are almost entirely absent in the south.

Some age readings indicate the following composition of the samples:

	Rings Year-class	2 1973	3 1972	4 1971	5 1970	6+ 1969-
Great and Little Sole Bank n = 99	%	79.7	2.5	7.5	8.3	2.0
Gulf of Biscay n = 92	%	75.6	5.0	6.1	5.8	7.4

About 75 - 80 % of the fish belong to the 1973 year-class, the 1972 brood is rather poorly represented, while the year-class 1970 seems also here to be a relatively strong one.

The length composition in the Porcupine Bank area shows some intermediate picture. In May 1974 there were only larger fish (over 23 cm) in the catches but in the average these fish were smaller than further north (mode about 26/27 cm). In May 1975 besides such larger fish there was a considerable share (48 %) of small Blue Whiting (17-24 cm). The difference might possibly be explained by the fact, that in May 1975 a special harder fishing bottom trawl had been used.

In the North Sea (Shetlands and Viking Bank) the catches in November and February consisted to 99-100 % of small Blue Whiting with lengths of 13-19 cm (modes 15 and 16 cm). Age determinations on 91 fish showed that in February on Viking Bank 99 % belonged to the 1973 year-class. In July 1974 the catches in the Shetland area contained mainly fish larger than 28 cm and the length distribution was rather similar to that for the Faeroes in November/January.

At the end of Fig. 3 some length frequency curves of Blue Whiting from the Bear Islands and Spitsbergen are shown for comparison. These fish were caught by R.V. "Anton Dohrn" (March 1974) and R.V. "Walther Herwig" (July 1974). The curves are rather similar, representing mainly Blue Whiting with lengths of 30-35 cm (modes about 33 cm).

Depth distribution

In Fig. 4 the length composition of Blue Whiting is shown for two selected areas and two depth levels (200-500 m and deeper than 500 m), separately for males and females. Off the Hebrides it appears that in April/May at the depth level of major fish concentrations (200-500 m) most Blue Whitings had a length of 24-34 cm. The females were considerably larger than the males (mean length of males: 27.7 cm (1974) and 28.2 cm (1975), of females: 28.4 cm

(1974) and 30.5 cm (1975)).

In waters deeper than 500 m the fish were only slightly larger than at a depth of 200-500 m in April/May (mean length of males: 28.6 cm, of females 30.7 cm). However in November the mean length of the males was 29.9 cm and that of the females even 34.6 cm at depths over 500 m.

In the Lousy/Baileys/Faeroe Banks and Rockall areas the differences in the length composition of Blue Whiting at the two depth levels in November/December are more distinct (Fig. 4). In waters of 200-500 m depth fish of sizes between 16 and 41 cm were found. Also here the females were slightly larger than the males (mean length of males: 25.6 cm, of females: 26.5 cm). In deeper waters beyond 500 m the length composition was quite different with males between 26 and 31 cm (mean length 29.4 cm) and females between 28 and 36 cm (mean length 32.5 cm).

Sex and maturity

As indicated in Tab. 2 and Fig. 4, the relation male: female is mostly near 50 : 50, but sometimes also quite unbalanced to either side (e.g. Gulf of Biscay - Viking Bank and Cape Finisterre).

During all investigations the Blue Whiting were found to be either spent and rather meagre or in early stages of maturity. Only very few fish, both males and females, showed more advanced maturity stages in November and January near the Faeroes and the Gulf of Biscay in May. In the dense concentrations found east of the Faeroes in January 1975 about 6 % of the males were advanced in their maturity (stage V) while the females were in a much less developed stage (41 % at stage III). The general lack in the catches of fish with ripe gonads seems to indicate that after a long time of rather slow progress in the development of the gonads, the final ripening and spawning may be a fairly speedy process.

Meristic characters

10 samples with a total of 1067 fish were investigated for counts of vertebrae (VS) and gill rakers (Rf). The results are summarized in Table 3.

It appears that for the mean number of vertebrae as well as gill rakers there is a general decline from the north to the south. A statistical examination with multiple range test reveals that for the mean number of vertebrae three groups of areas can be distinguished between which the mean values for VS show significant differences:

(a) Faeroe - Rockall - Viking Bank
(b) Lousy/Baileys/Faeroe Banks - Hebrides - Gulf of Biscay
(c) Sole Banks - Cape Finisterre

The value for Porcupine Bank falls between groups (b) and (c).

For the mean number of gill rakers the multiple range test only shows that the value for the Cape Finisterre area is significantly different from those for all other areas.

The decline in the mean number of vertebrae and gill rakers from the north to the south is more or less a steady one, with some exceptions. Nevertheless, it is possible that the differences in VS and Rf mentioned above, could give a hint to the existence of two separate stocks of Blue Whiting in the north and the south, with some overlapping in the intermediate zone. In this connection it is also interesting to recall that the length composition in the south was found to be considerably different from that north of 52° N. However, the data at hand so far are not sufficient to investigate this question in more detail.

Discussion

The preliminary results presented here fit well into the overall picture of Blue Whiting biology in accordance with observations made by previous authors. They show that Blue Whiting can be caught in the waters west of Britain and Ireland all the year round. However, the densities of fish are many times higher in spring during the spawning time than in autumn, when the major part of the population has left the area for feeding in the northern waters (see also Bailey, 1972). It is remarkable that none of the many hauls in our investigations contained Blue Whiting of less than 12 cm length. This could be due to the fact that most hauls were made with bottom trawls and these as well as hauls with midwater trawls were made over the continental shelf. According to Raitt (1968) juvenile Blue Whiting of 7-14 cm length were, however, mainly found more off-shore over deeper water.

Further investigations will include more age determinations on material already collected. First experience has shown that age readings from otoliths present difficulties as already discussed by Bailey (1970), and more exchange of samples and comparative reading of otoliths would be very desirable.

In the collection of further samples special efforts will be made to obtain also material from the waters south of the main area of investigation, e.g. Gulf of Biscay, and from the area north of Faeroe, to look in more detail into the question of stock (s) distribution.

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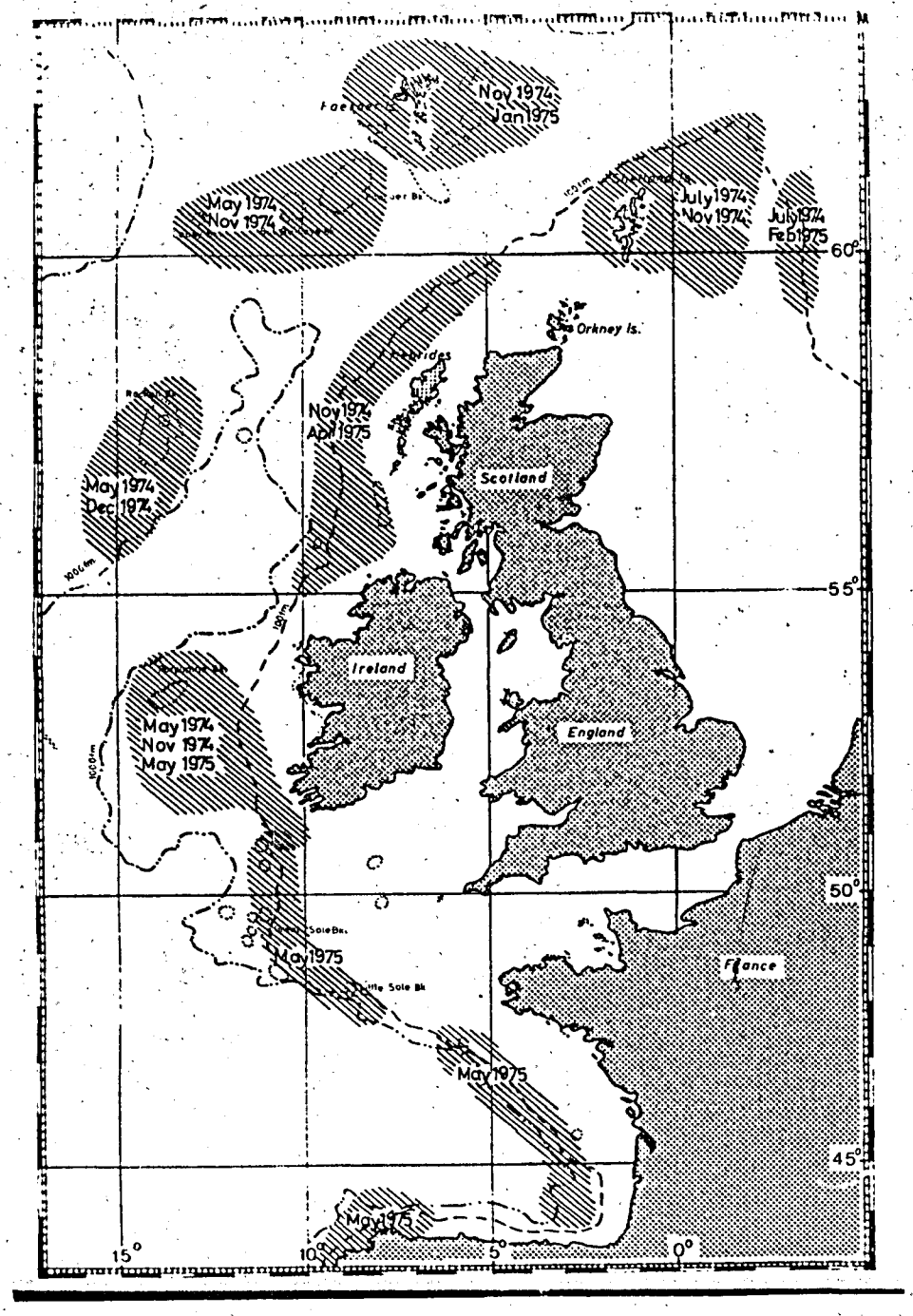


Fig. 1: Location and timing of Blue Whiting samples May 1974 - May 1975

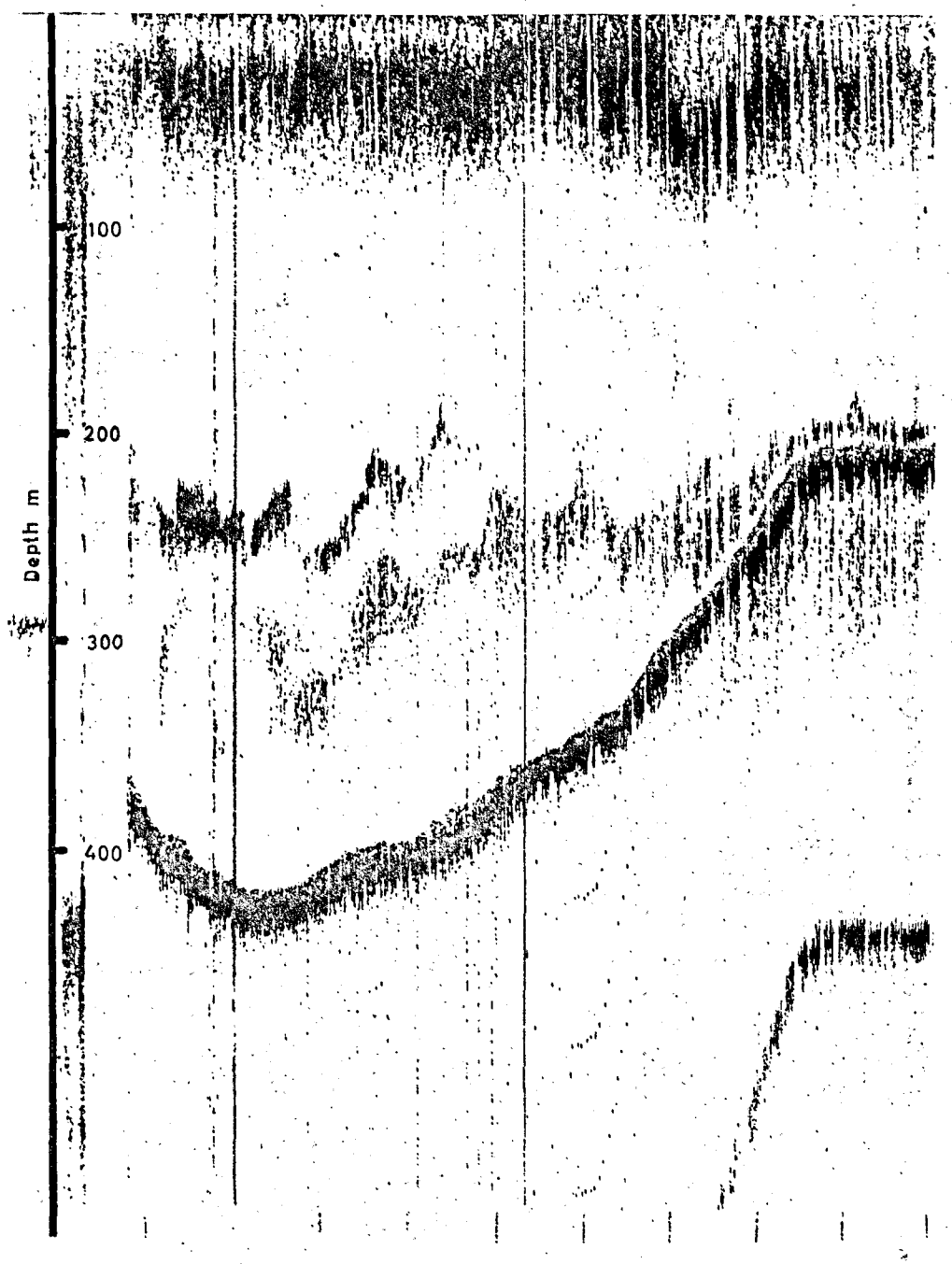


Fig. 2: Echogram from R.V. "Walther Herwig" showing distribution of Blue Whiting in two depth layers. Taken west of the Hebrides on 1 May 1975, 07.20 to 07.45 hours. Catch: 1564 kg in 25 min. with midwater trawl.

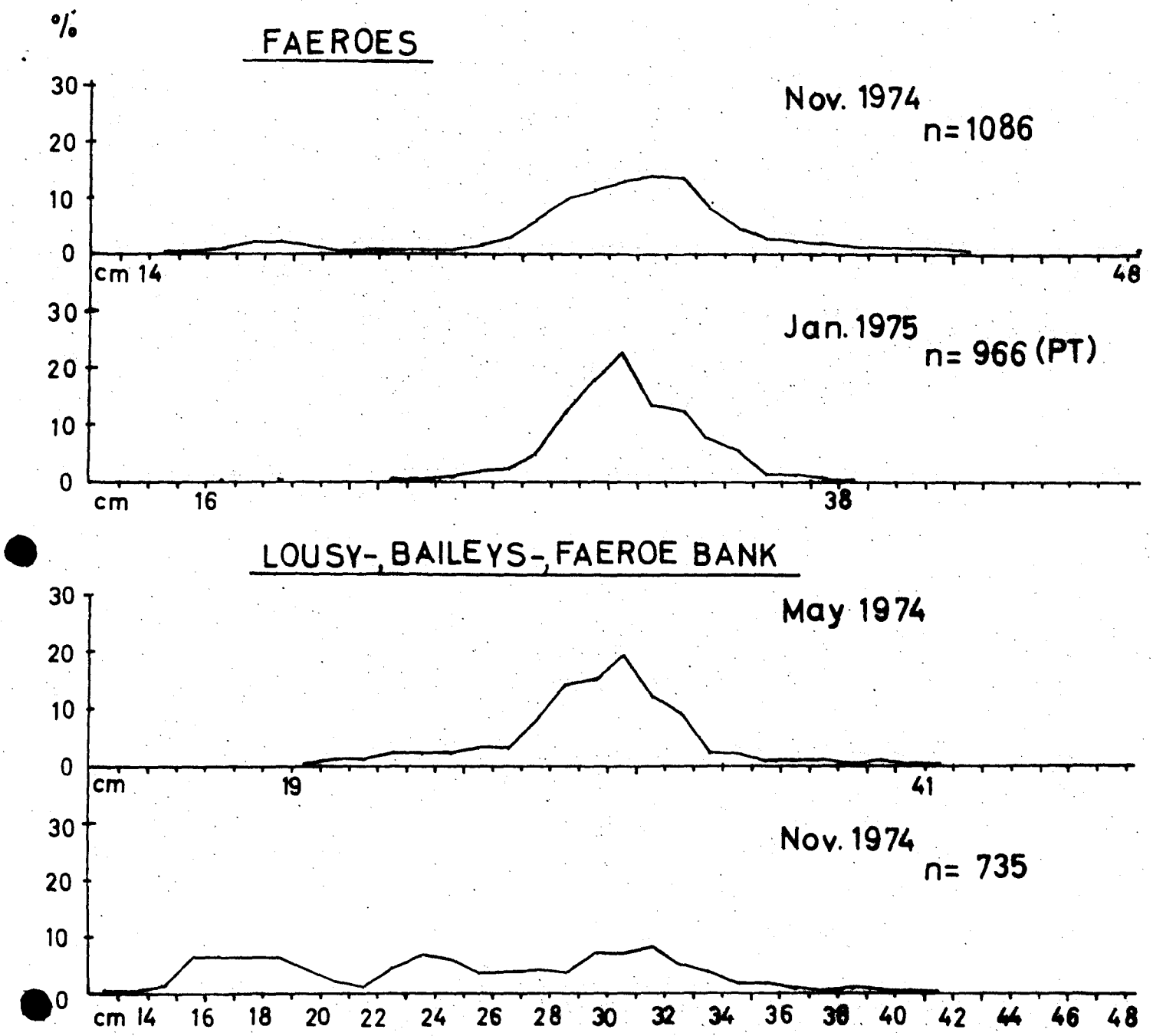
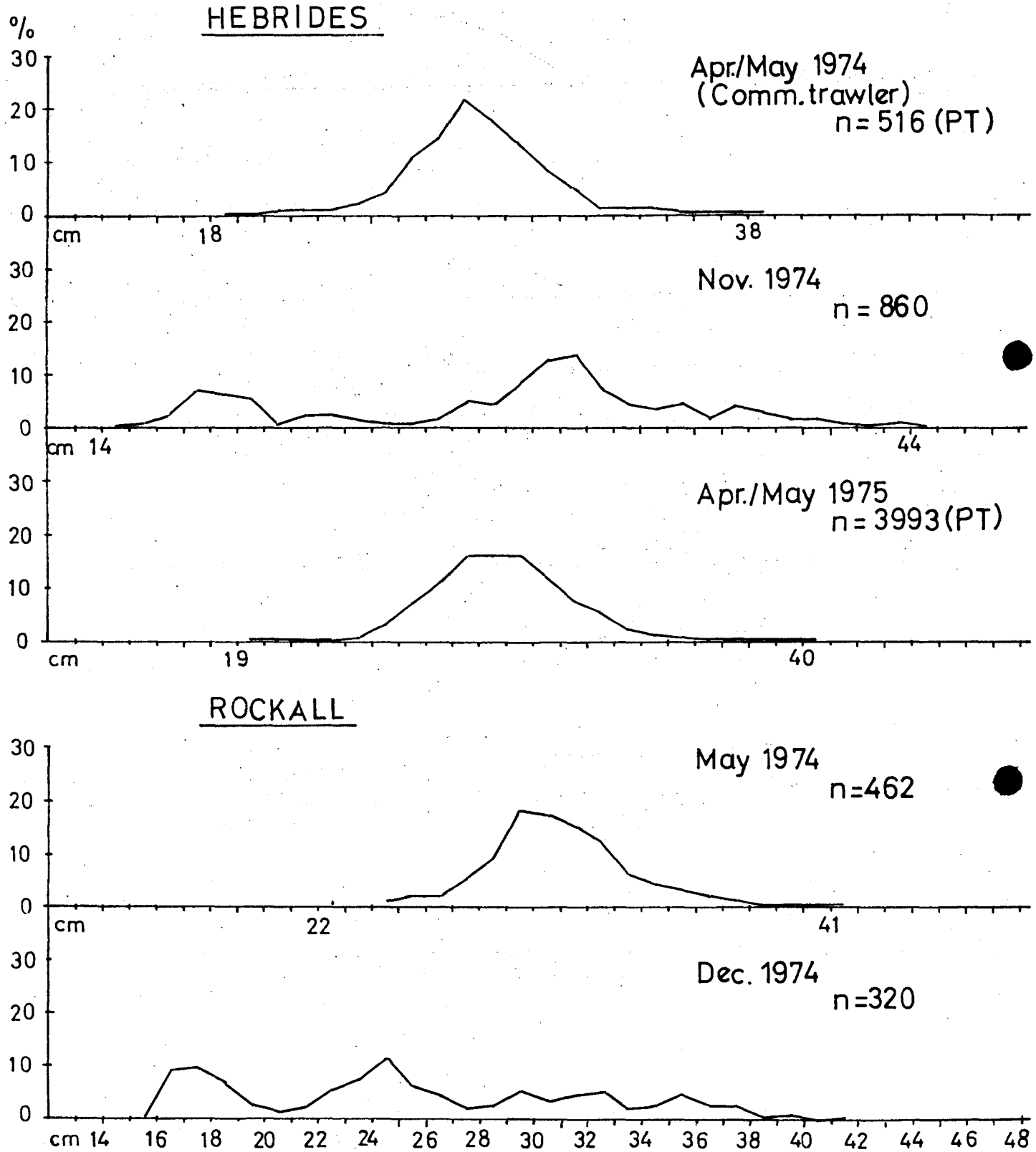


Fig. 3 : Length composition of Blue Whiting in various areas 1974-75 (in %; PT = catches with pelagic trawl, all other samples from bottom trawling)



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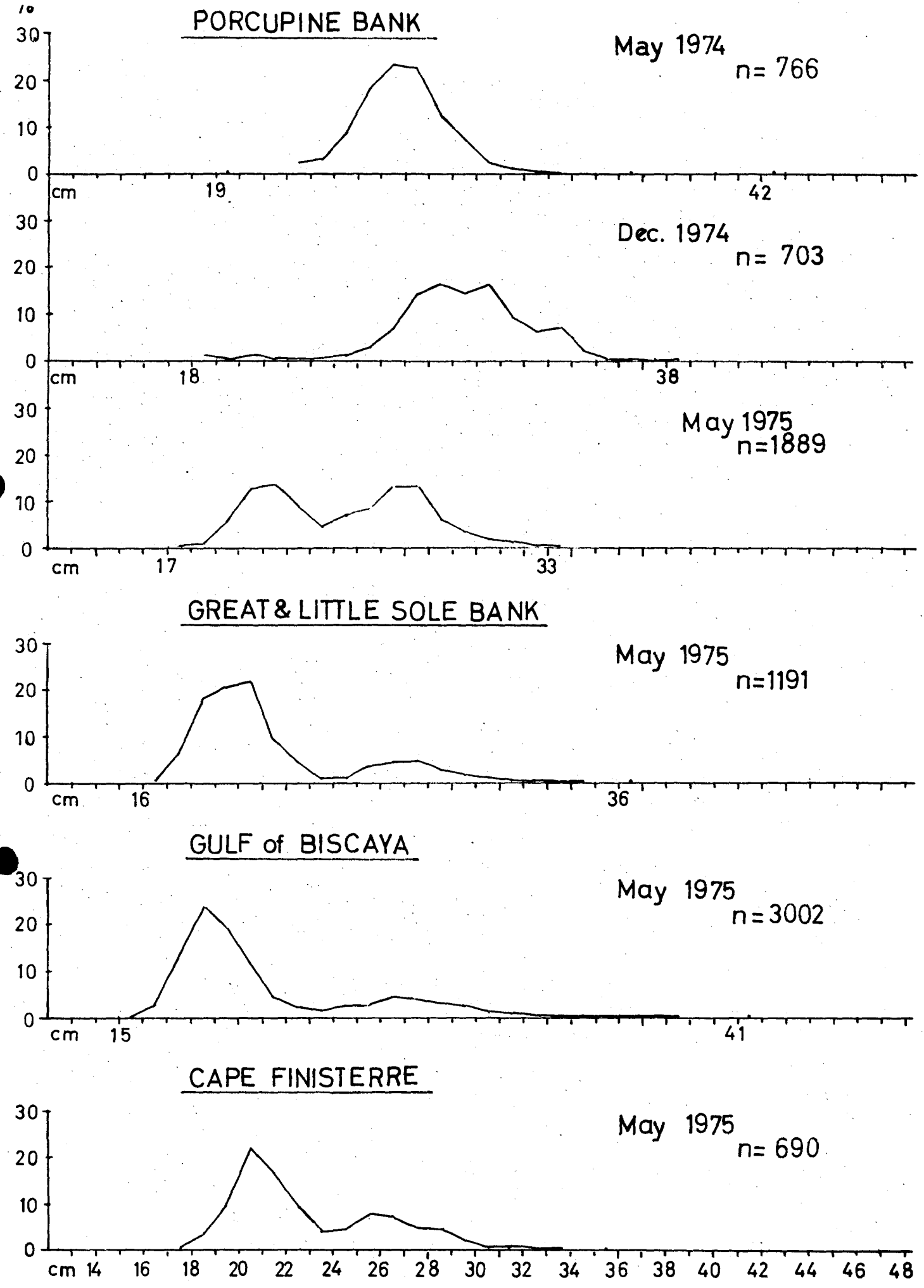

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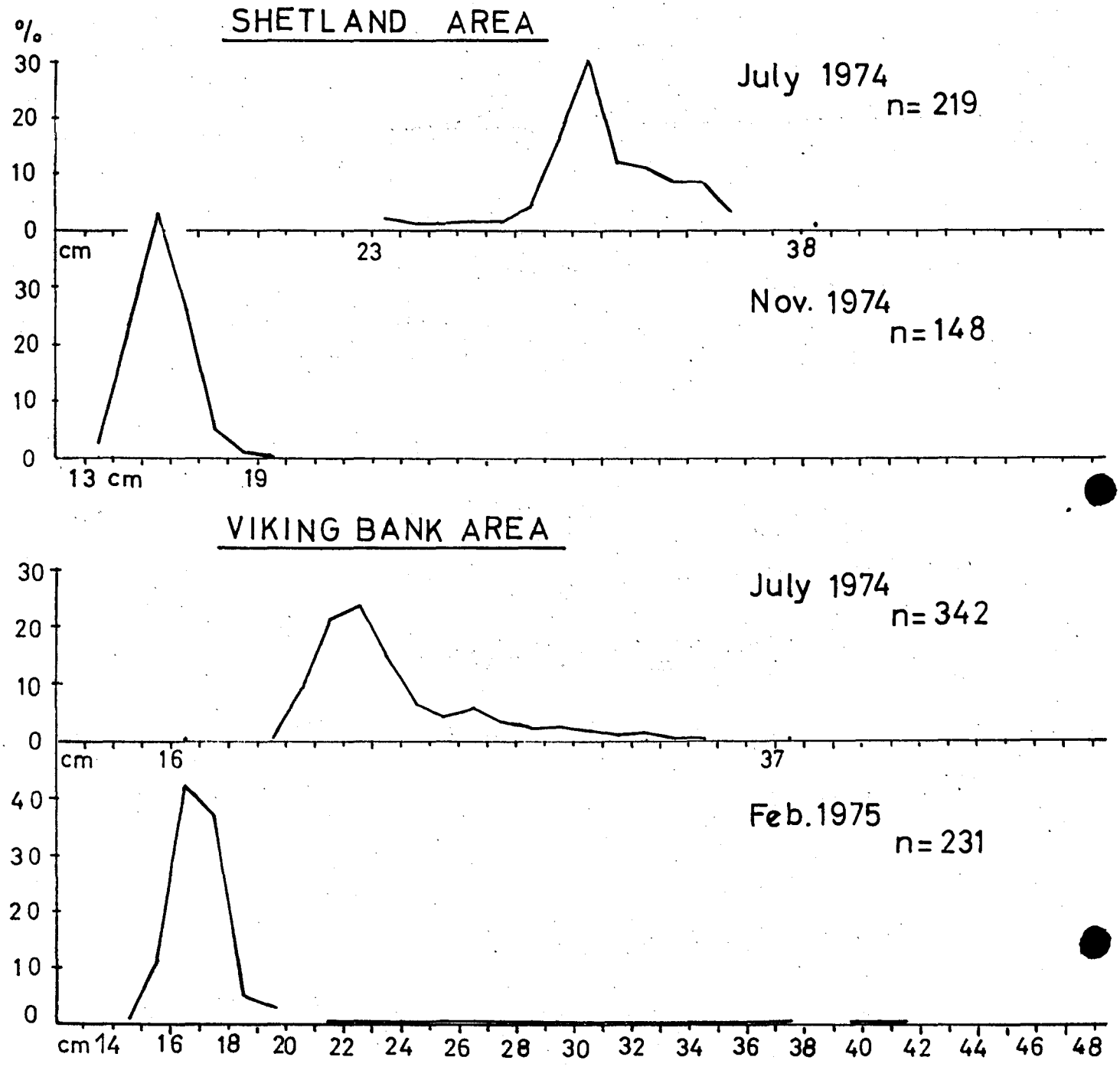

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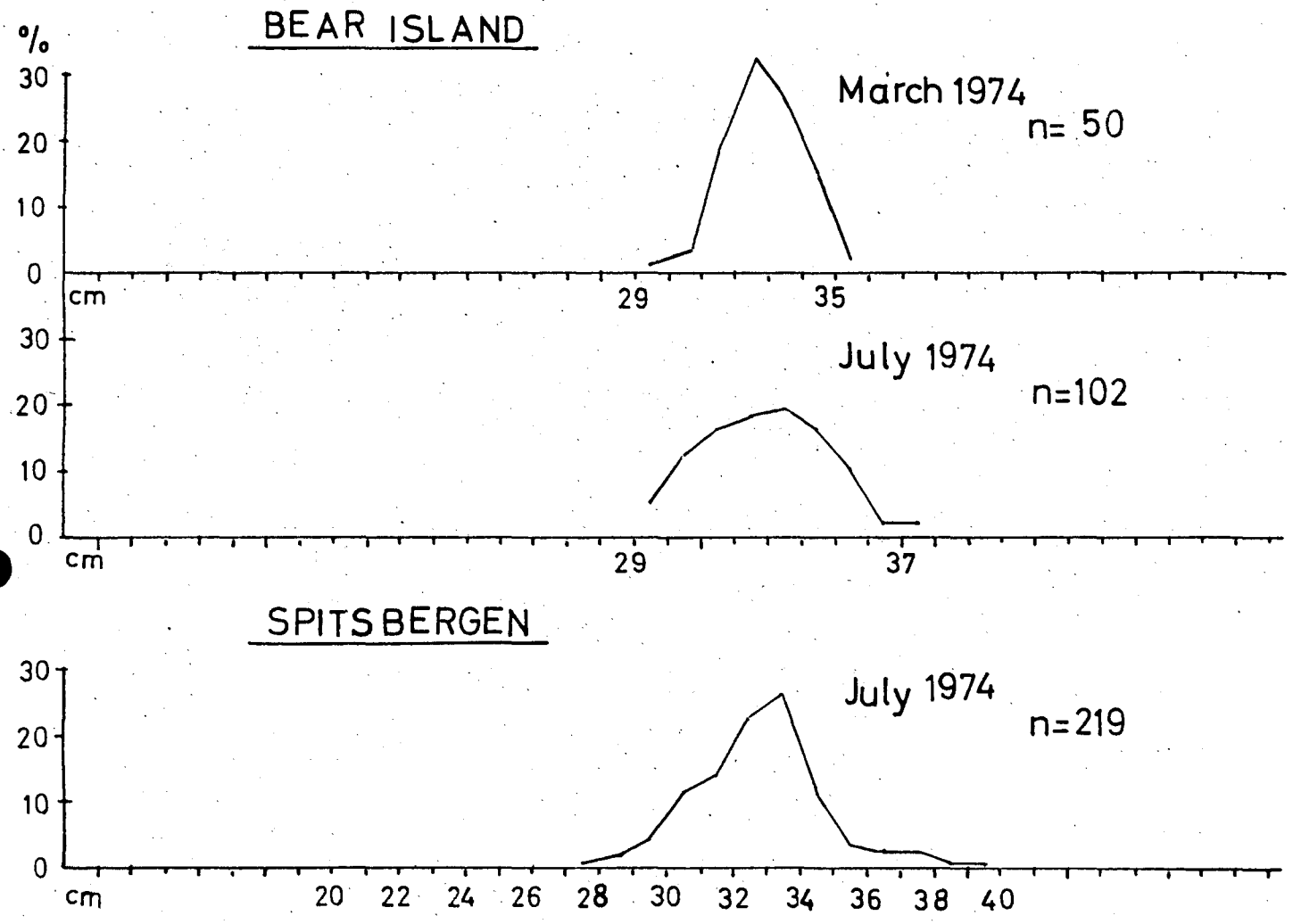

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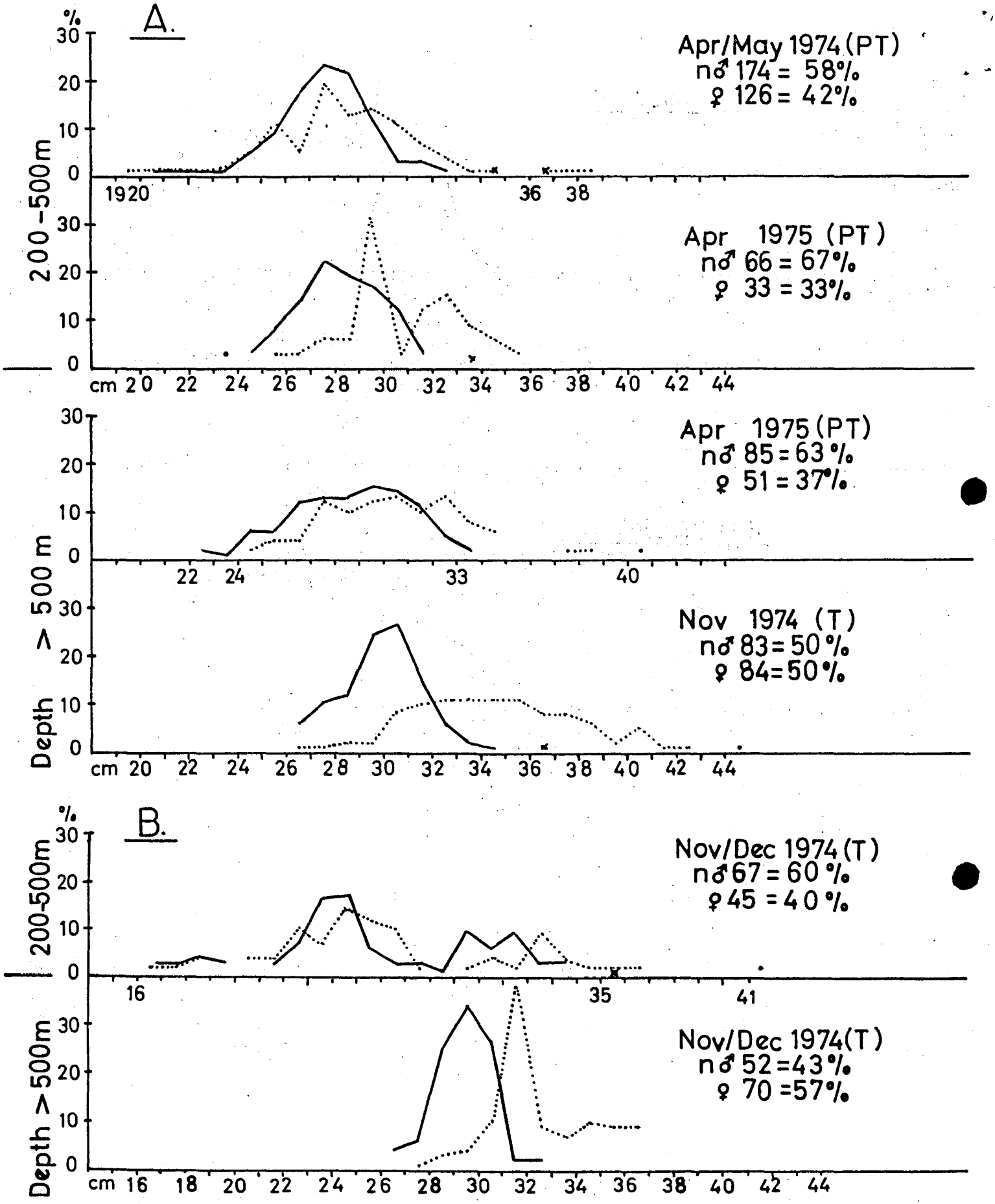

Fig. 4: Length composition of Blue Whiting in two selected areas, by sexes and depth levels (200-500 m and >500m).
A. Hebrides; B. Lousy-, Bailey-, Faeroer Banks and Rockall;
——— σ × ; .... ♀ • ; T = Trawl; PT = Pelagic trawl

Table 1: Mean catches of Blue Whiting made by R.V. "Walther Herwig" in the waters west of Britain and Ireland between Faeroe Islands and Cape Finisterre in 1974 and 1975 (in Kg per hour bottom trawling)

FAEROES

Nov. 1974

depth (m)	hauls	mean catch
200-350	3	6
350-500	5	39
500-600	4	12
> 600	1	0

LOUSY BK.- BAILEYS BK.- FAEROE BK.

May 1974

depth (m)	hauls	mean catch	range
349-418	4	391	130-1040
477-650	5	4	0- 15
650-1000	9	0.2	0- 1
> 1000	9	0	0

Nov./Dec. 1974 [1]

depth (m)	hauls	mean catch	range
400-500	2	36	10-62
500-600	1	20	20
600-700	3	10	1-28

HEBRIDES [2]

Nov./Dec. 1974

depth (m)	hauls	mean catch	range
100-200	6	0	0 [3]
200-300	3	11	1-30
300-500	4	15	3-35
500-700	2	10	1-20
> 700	5	0	0

PORCUPINE BANK

May 1974

depth (m)	hauls	mean catch	range
100-150	7	1	0- 2
150-160	6	19	0- 65
160-350	9	204	0-1048
> 800	6	0	0

May 1975

depth (m)	hauls	mean catch	range
160-200	3	27	4-50
200-250	4	342	160-580

ROCKALL

May 1974

depth (m)	hauls	mean catch	range
330-450	3	368	228-552
450-650	5	6	0- 30
650-1000	5	0.2	0- 1
> 1000	2	0	0

SOLE BANK GREAT + LITTLE

May 1975

depth (m)	hauls	mean catch	range
135-235	4	67	23-104

GULF OF BISCAY

May 1975

depth (m)	hauls	mean catch	range
100-200	1	20	20
200-400	11	31	0-113
400-500	6	6	0- 21
> 500	2	0	0

CAPE FINISTERRE

May 1975

depth (m)	hauls	mean catch	rang
190-300	3	85	30-18

1) estimated

2) pelagic trawling of "Walther Herwig" in April/May 1975 off Barra Head in depths of 200-350m (4 Hauls) resulted in a mean catch of 16.8 tons/hr (maximum catch 26.25 tons/hr). Further south (55°30'N, 09°00'W)3 hauls showed a mean catch of 2.7 tons/hr.

3) neglecting one haul with 164 Kg/hr.

Table 2 : Mean lengths (cm) of Blue Whiting by sexes, variances, and sex composition

	Faeroes		Lousy Bk. Baileys Bk. Faeroe Bk.	Hebrides		Rockall	Porcupine Bank	Gulf of Biscay	Cape Finisterre	Viking Bank
	Nov. 74	Jan.75[1]	Nov.74	Apr./May 74[1]	Nov.74	Dec. 74	Dez.74	May 75	May 75	Feb.75
♂♂ $\bar{x}$	29.16	30.06	29.22	27.72	29.92	25.40	27.86	29.61	26.83	21.13
♂♂ s^2	2.998	2.223	3.992	4.090	3.466	20.256	5.949	2.102	6.347	35.934
♂♂ n	55	80	58	174	83	61	50	27	21	27
♂♂ %	55	49	50	58	50	51	38	27	60	27
♀♀ $\bar{x}$	30.94	32.21	31.76	28.39	34.60	28.50	29.40	32.46	26.00	29.91
♀♀ s^2	8.343	4.999	5.733	8.947	12.641	35.368	15.299	6.678	15.807	38.328
♀♀ n	45	82	57	126	84	58	82	73	14	73
♀♀ %	45	51	50	42	50	49	62	73	40	73
diff.	1.78	2.15	2.54	.67	4.68	3.10	1.54	2.85	.83	8.78
t	3.63	7.22	6.17	2.18	10.67	3.19	2.79	6.93	.69	6.44
P	> .99	> .99	> .99	.97	> .99	> .99	> .99	> .99	< .5	> .99

1) catches from midwater trawling, all other from bottom trawling.

Table 3 : Mean number of vertebrae and gill rakers for Blue Whiting

Area	Vertebrae (VS)			Gill rakers (Rf)		
	$\bar{x}$	s^2	n	$\bar{x}$	s^2	n
Faeroe	57.61	0.376	250	25.50	1.365	262
Rockall	57.56	0.537	91	25.44	1.406	96
Viking Bank	57.52	0.520	98	25.22	1.345	100
Lousy/Baileys/ Faeroe Banks	57.38	0.361	99	25.24	1.124	99
Hebrides	57.37	0.401	86	25.27	1.492	86
Gulf of Biscay	57.36	0.335	98	25.32	1.517	98
Porcupine Bank	57.25	0.365	125	25.20	1.418	127
Sole Bank	57.10	0.360	98	25.13	1.462	99
Cape Finisterre	57.08	0.430	97	24.85	1.502	100