

III. Fluctuations in the Age Composition of the Plaice Stock in the Southern North Sea during the Period 1923 to 1926.

By

D. E. Thursby-Pelham.

Fisheries Laboratory, Lowestoft.

Dr. BÜCKMANN in his interesting paper on the predominance of the year class of plaice of 1922 in the German Bight¹⁾, appeals to other workers to publish the results of their investigations in order that it may be shown whether the phenomena found by him are common to other parts of the North Sea. Briefly summarised his investigations gave the following results:—

1. In the vicinity of Heligoland the year class of 1922 was more plentiful both in the actual quantity and the proportion per cent. than any other year group of plaice in September in 1924, 1925 and 1926 when present as the II, III and IV Age groups respectively. The same was true in July and August of 1925 and 1926 as the III and IV year groups, but in 1924 the highest percentage was of plaice of the III group (spawned in 1921) while the II group (spawned in 1922) came next in abundance.

2. The year class of 1923 was present in insignificant quantities and formed but a small proportion of the stock as the II and III groups in 1925 and 1926 in both the seasons mentioned in the preceding paragraph.

3. In a section trawled off Norderney in Sept. 1925 and 1926 the year class of 1922 was predominant in 1925 as the III group but in 1926 (as the IV group) it was exceeded by the year class of 1924, present as the II group. The year class of 1923 was again sparse as the III group in 1926.

The English material for comparative purposes comprises:

- (i) The collections of otoliths made from the Ministry's Research vessel "George Bligh" along a line of seven stations (8 in 1924) from the Leman ground to the Haaks light vessel in May of each year from 1923 to 1926. With the exception of 1923, all plaice caught were otolithed; in 1923 at 4 stations only a part of the catch was otolithed, but it was possible to apportion the whole catch to the various age groups by raising the sample to the total by means of the measurements. In all these investigations a covering net was put over

¹⁾ BÜCKMANN, A., Vorwiegen des Jahrgangs 1922 im Schollenbestande der Deutschen Bucht. Journ. du Cons. Vol. II, Nr. 1, 1927.

the codend in order to retain the smaller fish that would otherwise have escaped through the ordinary commercial trawl.

- (ii) Trawling investigations were made by the "George Bligh" with the ordinary uncovered commercial trawl in the vicinity of the Vyl Light vessel, Graa Dyb and South of Amrum (near Heligoland), in June 1926, and off Ymuiden, near Skiermonikoog, Heligoland, in the vicinity of Sylt, Horn Reef and Graa Dyb in Nov. 1926.
- (iii) The Age composition of the landings of plaice at Lowestoft was estimated for the month of October 1926 by means of samples of the Trade Categories of plaice recognised on the market.

The results of the investigations along the Leman Haaks line are given in Table 1.

Table 1. Catch per hour and Proportions per cent of each Age group of Plaice taken from the Leman ground to Haaks Light Vessel in May of the years 1923—1926.

Year		Age Groups							
		I	II	III	IV	V	VI	VII	VIII
1923	Catch per hour...	0.3	48.6	81.3	42.5	7.6	2.2	0.8	0.0
	Proportion percent	0.1	26.5	44.4	23.2	4.2	1.2	0.4	0.0
	Year of birth....	1922	1921	1920	1919	1918	1917	1916	1915
1924	Catch per hour...	0.6	27.3	62.0	27.8	11.5	1.5	0.4	0.4
	Proportion percent	0.4	20.8	47.1	21.2	8.7	1.2	0.3	0.3
	Year of birth....	1923	1922	1921	1920	1919	1918	1917	1916
1925	Catch per hour...	0.5	8.5	72.3	73.1	29.9	7.0	0.7	0.4
	Proportion percent	0.2	4.4	37.6	38.0	15.6	3.6	0.4	0.2
	Year of birth....	1924	1923	1922	1921	1920	1919	1918	1917
1926	Catch per hour...	6.4	20.2	18.2	50.1	20.5	5.1	0.8	0.1
	Proportion percent	5.2	16.7	15.0	41.3	16.8	4.2	0.7	0.1
	Year of birth....	1925	1924	1923	1922	1921	1920	1919	1918

With regard to the catch per hour, this cannot altogether be regarded as an indication of the actual abundance of any one age group since the data afforded by an average of only about 28 hours trawling in each year cannot be said to yield reliable results; the effects of weather, temperature and slight differences in gear would be sufficient to cause a considerable degree of variation in the amount of the catch. The proportion per cent, however probably gives a very fair idea of the distribution of the various age groups. The table, it will be seen, confirms Dr. BÜCKMANN's conclusions that the year class of 1922 was very prolific and that similarly the year class of 1923 was decidedly sparse. In addi-

tion, the year class of 1921 was equally if not more abundant than that of 1922 since it predominated in 1923, 1924 and 1925, when it was present as the II, III and IV groups respectively. In 1925, however, the year class of 1922 as the III group was very nearly as plentiful as the IV group of 1921, and in the following year as the IV group surpassed it considerably. This would be due, no doubt, to the effect of fishing on the older fish. Fig. 1 (drawn on the same plan as Dr. BÜCKMANN's Figs. 1 and 2) has points of resemblance to his Fig. 2. There

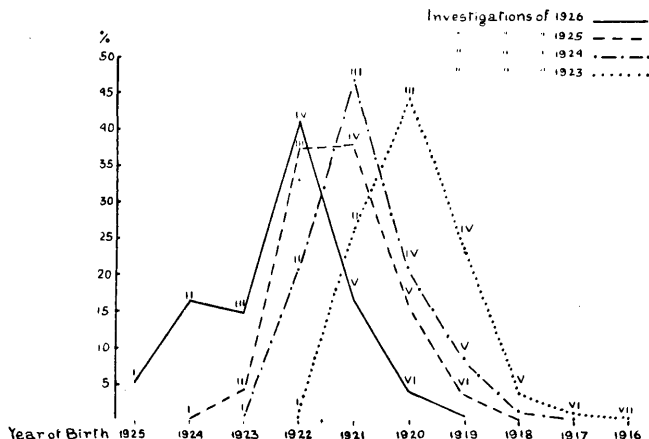


Fig. 1. Percentage of each year class of Plaice taken on the Leman Haaks line in May 1923 to 1926. (Roman numerals denote year groups).

are the same two apices for the 1922 and 1921 year classes. The year class of 1921 formed a higher proportion as the II and III groups than the same year groups of the 1922 year class, while the IV group of the 1921 formed a somewhat lower percentage than that of the same age of the 1922 year class. There is a minor peak for the II group of the 1924 year class in the Leman Haaks line which is not present in the Heligoland stock, and the percentage of the I group for the 1925 year class is unusually large. The 1923 year class bears an even smaller proportion to the whole in the English than it does in the German material.

Since in Dr. BÜCKMANN's figure 1 for the September investigations the 1922 year class predominates very markedly, it bears little resemblance to the proportions on the Leman Haaks line.

It is probable that the innermost station of the Leman Haaks line would furnish a better comparison with the Heligoland stock than the whole line since both collections were made in coastal waters.

Table 2 and Fig. 2 give the details.

Table 2. Catch per hour and Proportion per cent of each Age Group of Plaice taken at the Haaks Light Vessel in May of the years 1923—1926.

Year		Age groups							
		I	II	III	IV	V	VI	VII	VIII
1923	Catch per hour ..	2.0	72.0	68.5	38.3	6.7	5.2	0.5	..
	Proportion percent	1.0	37.3	35.4	19.8	3.5	2.7	0.3	..
	Year of birth....	1922	1921	1920	1919	1918	1917	1916	..
1924	Catch per hour ..	2.2	134.2	203.5	51.5	19.9	3.0	1.1	0.2
	Proportion percent	0.5	32.3	49.0	12.4	4.8	0.7	0.3	0.0
	Year of birth....	1923	1922	1921	1920	1919	1918	1917	1916
1925	Catch per hour ..	2.7	16.8	111.0	34.8	9.5	2.0	..	..
	Proportion percent	1.5	9.5	62.8	19.7	5.4	1.1	..	..
	Year of birth....	1924	1923	1922	1921	1920	1919	..	..
1926	Catch per hour ..	35.7	71.5	36.5	86.8	21.2	5.0	0.8	..
	Proportion percent	13.9	27.8	14.2	33.7	8.2	1.9	0.3	..
	Year of birth....	1925	1924	1923	1922	1921	1920	1919	..

At this station the year class of 1922 undoubtedly predominates and the scarcity of the 1923 class is even more pronounced than before. The year class of 1921 and 1922, present as III groups in 1924 and 1925 show the highest peaks, and made up 49 and 62 per cent of the stock; in 1923 although not quite so abundant as the II group it made up 35 per cent of the total; while in 1926 the III group (year class 1923) accounted for only 14 per cent. The peak of the II group of the 1924 year class was nearly as high as that of the same age of the 1922 year class but was considerably lower than that of the II group of the 1921 year class.

The English investigations carried out in June 1926 were, as already stated, to the north of Heligoland. Positions and details are given in Table 3 and shown graphically in Fig. 3.

At each position the IV group of the year class of 1922 predominates, but the III group of the year class 1923 shows a higher percentage than was the case in the Leman Haaks line; it must be remembered that since the cover net was not used on this voyage a considerable number of the I and II groups would escape through the meshes of the cod end,

since many would be too small for retention at this time of the year. This would inevitably tend to increase the percentage of the fish which were large enough to remain in the net. There can, however, be no doubt that the 1922 year class was considerably more numerous than that of 1923.

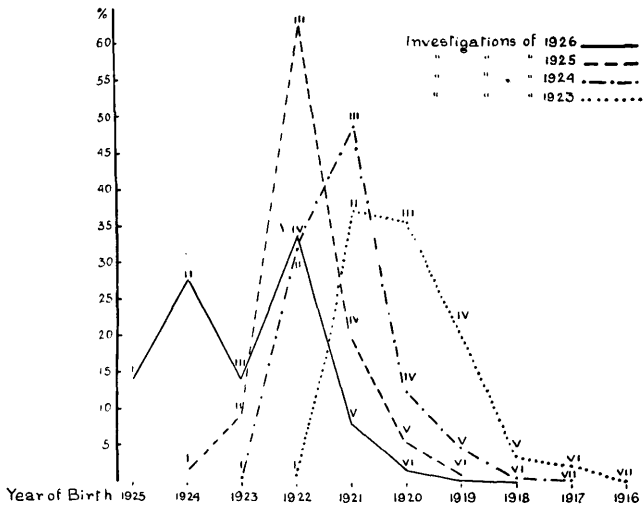


Fig. 2. Percentage of each year class of Plaice taken at the most easterly station of the Leman Haaks line in May 1923 to 1926.
(Roman numerals denote year groups).

In the stations worked in November the proportion of the year groups are entirely different to the North and to the South of Heligoland. Table 4, Figs. 4 and 5.

Off Ymuiden the year classes of 1925 and 1924 predominated markedly as the I and II groups (the same trawl was used as in the June voyage, but the young fish had grown sufficiently for the II group and a considerable number of the I group to be retained). The 1922 year class as the IV group was more numerous than the 1923 III group plaice. It is probable that many of IV group plaice had moved offshore and had not returned. In the further section on the landings on the market it will be noticed that very large quantities of these fish were captured by steam trawlers in the Southern Bight. Off Skiermonikoog the II group

Table 3. Catch per hour and proportion per cent of each Age group of Plaice taken at certain stations off the German and Danish Coasts in June 1926.

Position		Age Groups							
		I	II	III	IV	V	VI	VII	VIII
Station 1									
Near Vyl L.V.	Catch per hour ..	..	218	1134	1777	194	42	6	..
(55°22' N. by 7°42' E.13 fms.)	Proportion percent	..	6.5	33.6	52.7	5.7	1.3	0.2	..
Station 2									
Graa Dyb	Catch per hour ..	..	91	400	835	91	22	3	..
(55°22' N. by 8°5' E. 9 fms.)	Proportion percent	..	6.3	27.7	57.9	6.3	1.6	0.2	..
Station 5									
S. of Amrum	Catch per hour ..	..	15	74	147	45	23	17	2
(54°23' N. by 7°59' E. 11-9½ fms.)	Proportion percent	..	4.7	22.8	45.5	13.8	7.2	5.3	0.7
	Year of birth....	..	1924	1923	1922	1921	1920	1919	..

(year class of 1924) predominates considerably, and again the IV group are more plentiful than the III group. If the graph for this station is compared with that of Dr. BÜCKMANN for the Norderney section for September 1926 (Fig. 3) it will be seen that the two graphs are remarkably similar.

At all the five stations to the north of Heligoland the year class of 1922 as the IV group is by far the most important, the II group accounting for only a very insignificant percentage, considerably below that of the III group which again was about half as numerous as the IV group. The 1921 class as the V group is conspicuous only near Heligoland but the number of fish of this age on the coastal grounds would have been effected by offshore migration and capture. Fig. 5 and the graph for station 7 in Fig. 4 should be compared with Dr. BÜCKMANN's graph for 1926 in Fig. 1 for the Heligoland investigations in September where considerable resemblance will be seen.

We have then two distinct phenomena which may affect the marketable stock during the next few years. To the north of our area we have a large stock of the 1922 year class and a comparative scarcity of the 1923 and 1924 classes, while south of Heligoland the 1924 class was very rich, the 1923 class poor and that of 1922 very rich in early summer and moderately plentiful in November. The reasons for these differences are yet to be discovered but it is possible that light may be thrown on

the subject by a study of the hydrographical conditions which prevailed at the times of spawning; it is hoped that it will be possible to investigate this shortly.

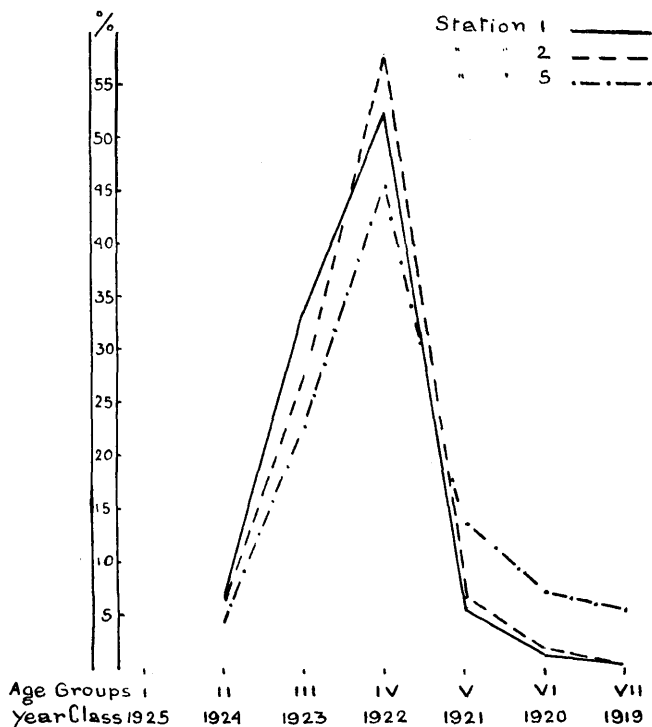


Fig. 3. Percentage of each age group of Plaice taken at stations off the German and Danish Coasts in June 1926.

The investigations carried out on the Market Categories were instituted mainly for the purposes of finding out the ages at which plaice enter the various categories. It was not possible at the time to sample the Category "Large"; it was assumed, however, that since the Category "Best Medium" consisted of plaice of the VI group and over, no plaice of a lesser age would be in this Category which consisted of still larger

Table 4. Catch per hour and proportion per cent of each Age group of Plaice taken at certain stations off the Dutch, German and Danish Coasts in November 1926.

Position	Depth in fms.		Age Groups							
			I	II	III	IV	V	VI	VII	VIII
Station 1										
Off Ymuiden	13—	Catch per hour ..	27	25	8	12	4	1	0	0
52°33' N.×4°10' E.	13½	Proportion percent	34.9	33.0	10.6	14.8	5.1	0.8	0.3	0.3
Station 3										
Skiermonikoog ...	14—	Catch per hour ..	95	293	171	201	68	20	4	..
53°42' N.×5°48' E.	15	Proportion percent	11.2	34.4	20.1	23.6	8.0	2.3	0.4	..
Station 5										
Heligoland	15½	Catch per hour ..	..	3	11	39	31	19	8	1
54°18,5×N.7°29' E.	—23	Proportion percent	..	2.4	10.0	34.9	27.6	17.1	6.7	1.3
Station 7										
Off Sylt	13	Catch per hour ..	1	7	104	303	104	53	9	1
54°58' N.×7°40' E.		Proportion percent	0.2	1.2	17.9	52.1	17.9	9.0	1.6	0.1
Station 8										
Near Sylt	12—	Catch per hour ..	..	4	14	36	10	6	2	..
54°58' N.×7°57' E.	8½	Proportion percent	..	5.6	18.8	50.2	14.3	8.0	3.1	..
Station 9										
Horn Reef	15—	Catch per hour ..	0	4	28	59	9	5	..	..
55°25' N.×7°28' E.	16	Proportion percent	0.5	3.8	26.3	55.8	8.8	4.8	..	..
Station 10										
Graa Dyb	8½	Catch per hour ..	3	2	22	46	13	9	1	..
55°20' N.×7°53' E.	—13	Proportion percent	3.7	2.3	22.7	47.4	13.5	9.6	0.8	..
		Year of birth ...	1925	1924	1923	1922	1921	1920	1919	

fish. The samples obtained were raised to the total landings of each Category for the month of October at Lowestoft and the number of fish from the II to the V groups computed as given in Table 5.

The table shows that the year class of 1922 was by far more important by number than any other year class. By weight the predominance inevitably is not great as the plaice increase rapidly in weight with age. The 1923 year class, which according to its average length, should have been very plentiful in the Category "Dead Small", was less numerous in this Category than the 1922 and 1921 year groups. The landings of this Category probably include a greater number of fish than all the other Categories added together. The investigations while not throwing much light on the general age composition of the plaice stock of the Southern North Sea certainly appear to demonstrate that the 1922 year class was exceptionally plentiful. Further investigations which are being

carried out on the Trade Categories will show whether this statement is correct. It may be possible that in every year the age group most

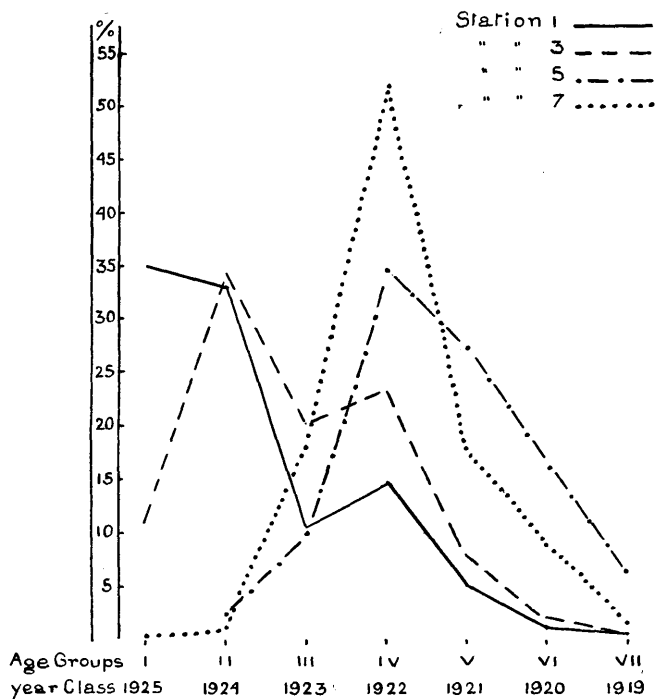


Fig. 4. Percentage of Plaice of each age group of Plaice taken at stations off the Dutch, German and Danish coasts in November 1926.

fished commercially is always the IV group, but should it be found that in the present year, when it will consist of the 1923 year class, that the IV group has decreased in importance compared with the III and V groups the hypothesis will be established.

Further details on the English Investigations of 1925 and 1926 will appear shortly in a Report in the Ministry's Scientific Series.

Table 5. Estimated number, weight and percentage by weight in each Age Group of Plaice landed by Steam Otter Trawlers at Lowestoft in October 1926.

	Age Groups				
	II	III	IV	V	VI
No. of Fish.....	14,573	155,059	404,501	275,704	..
Weight in cwts....	36	491	1,617	1,479	1,468
Percentage Wt.....	0.7	9.6	31.8	29.1	28.8

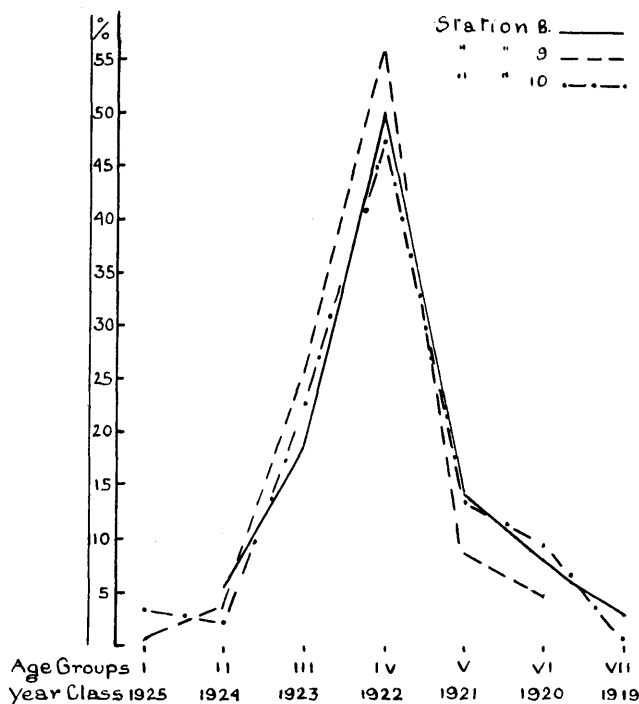


Fig. 5. Percentage of Plaice taken at stations off the Danish coast in November 1926.

Summary.

The English investigations confirm Dr. BÜCKMANN's conclusions to a very considerable extent.

1. The year class of 1922 predominated in 1925 and 1926 as the III and IV year groups in the otoliths taken in May from the most easterly station of the Leman-Haaks line; for the whole line it predominated in 1926, and was only very slightly below the dominant (IV) group in 1925, and so approximates closely to Dr. BÜCKMANN's samples taken in July to August 1925 and 1926.

2. In all samples whether collected from the Leman-Haaks line in May 1925 and 1926, the German and Danish coastal grounds in June or the Dutch, German and Danish grounds in November 1926, the year class of 1923 was scarce proportionately to the year class of 1922, as Dr. BÜCKMANN found in his Heligoland and Norderney samples.

3. In the stations off the Dutch coast in November 1926 the year class of 1924 was more plentiful than that of 1922, as in Dr. BÜCKMANN's investigations off Norderney in September 1926. Similarly the English investigations to the north of Heligoland showed no such predominance of the 1924 year class, which again was not evident in the German Heligoland investigations.

4. The Leman-Haaks material indicated that the year class of 1921 had been very abundant in 1923, 1924 and 1925 as the II, III and IV groups respectively and indeed seems to have been even richer than the 1922 year class. Dr. BÜCKMANN's July-August figures for 1924 and 1925 show that while the year class of 1921 was extremely plentiful in 1925 it was exceeded by the year class of 1922. The difference, however, between the English and German results is not very great.

5. Examination of Market Categories of Plaice at Lowestoft showed that in the landings for 1926 by steam trawlers the year class of 1922 (as the IV group) predominated greatly over the landings of all other year classes.