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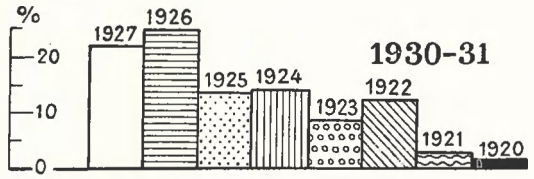
15.

Nine Years of Continuous Survey of an Annual Shoal of Spent Herring on the French-Belgian Coast, 1930—39.

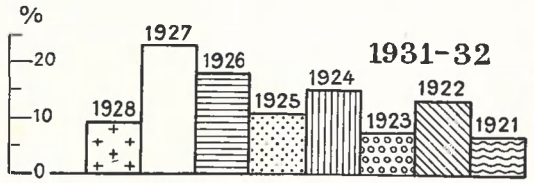
By

G. Gilson.



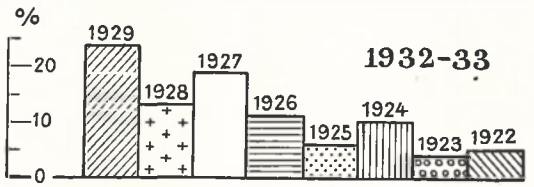
1930—31

Number of herrings examined	1,167	
Mean weight of a day's capture	8,338	kg.
Total weight landed in the season	18,360,596	kg.
Mean value of 100 kg	71	fr.
Total value of the season	13,008,930	fr.
Number of individuals destroyed	217,002,545	



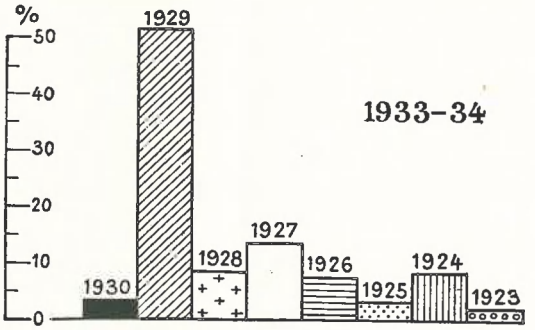
1931—32

Number of herrings examined	783	
Mean weight of a day's capture	5,225	kg.
Total weight landed in the season	3,383,750	kg.
Mean value of 100 kg	108	fr.
Total value of the season	3,642,806	fr.
Number of individuals destroyed	34,992,241	



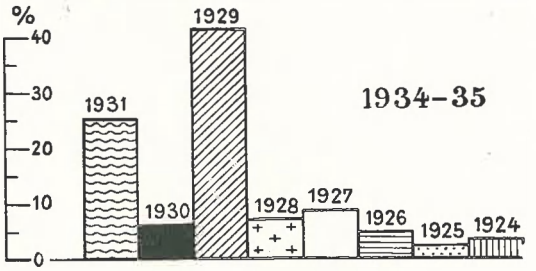
1932—33

Number of herrings examined	1,000	
Mean weight of a day's capture	4,514	kg.
Total weight landed in the season	2,673,185	kg.
Mean value of 100 kg	91,50	fr.
Total value of the season	2,446,867	fr.
Number of individuals destroyed	29,405,035	



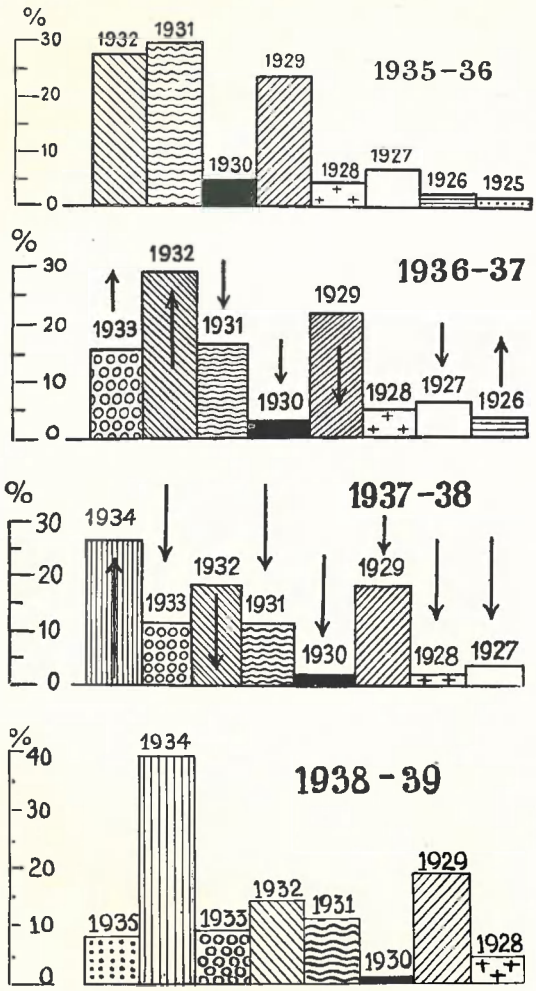
1933—34

Number of herrings examined	1,479	
Mean weight of a day's capture	7,600	kg.
Total weight landed in the season	7,455,800	kg.
Mean value of 100 kg	75	fr.
Total value of the season	5,577,441	fr.
Number of individuals destroyed	76,861,050	



1934—35

Number of herrings examined	1,200	
Mean weight of a day's capture	14,632	kg.
Total weight landed in the season	12,322,990	kg.
Mean value of 100 kg	31.52	fr.
Total value of the season	3,856,044	fr.
Number of individuals destroyed	123,553,199	



Balancing of percentages: number of individuals of each year-class in 100 fishes.

Fig. 1. Biological scale. Percentage number of individuals in each year-class.

1935—36

Number of herrings examined	1,300
Mean weight of a day's capture	11,120 kg.
Total weight landed in the season	8,595,895 kg.
Mean value of 100 kg	62 fr.
Total value of the season	5,328,754 fr.
Number of individuals destroyed	81,965,880

1936—37

Number of herrings examined	625
Mean weight of a day's capture	7,319 kg.
Total weight landed in the season	3,132,460 kg.
Mean value of 100 kg	72 fr.
Total value of the season	2,258,225 fr.
Number of individuals destroyed	31,211,269

1937—38

Number of herrings examined	575
Mean weight of a day's capture	5,568 kg.
Total weight landed in the season	807,425 kg.
Mean value of 100 kg	96 fr.
Total value of the season	774,629 fr.
Number of individuals destroyed	6,892,754

Number of herrings examined in 8 years 8,129

1938—39

Number of herrings examined	600
Mean weight of a day's capture	7,238 kg.
Total weight landed in the season	1,845,820 kg.
Mean value of 100 kg	81 fr.
Total value of the season	1,149,170 fr.
Number of individuals destroyed	16,045,013

Number of herrings examined in 9 years 8,729

It has been a habit of mine, since 1930, to present every year to the Combined North Sea and Eastern Channel Committee a series of diagrams showing the progress of the results obtained at Ostend, during all previous seasons, on the curious shoals of pure spent herring that concentrate every winter along the French-Belgian coast. Our work has been uninterrupted, always consisting of detailed analyses of daily samples of 30 herrings, bearing on the eight classical points: length, weight, sex, state of gonads, quantity of mesenteric fat, scalimetry, number of vertebrae, content of stomach.

This succession of annual diagrams has been named: The Biological scale of the herring. — A new step is regularly added after the closure of the fishing season each winter.

1. The last step of the scale, season 1938—39, is not materially different from that of previous years. As a whole it is rather low except the column of age-group IV, which is remarkably high: 40%.

2. Interesting as it may be for those engaged in similar studies, this last diagram is, after all, only one step in the course of life of the eight generations considered in the shoals of 1938—39. Let us now consider some of the variations revealed by nine years of continuous observations.

A. Fluctuation.

In this paper fluctuation means the variation of the proportion of one particular year-class in a succession of years. For instance, the fluctuation of the youngest class, the III-Group, is the variation of percentages shown in the left-hand columns of all the superposed diagrams of Fig. 1. Fig. 3 shows in a more intuitive way the fluctuation of the III-Group.

It shows also that there is no regularity or periodicity in fluctuations,—changes in the numeric composition of the classes being submitted to many internal or external agencies, including irregularities in the sampling and the balancing of percentages.

B. Balancing of Percentages.

This effect is very noticeable in certain steps in the biological scale. It is quite clear from some of the diagrams that the lowering of the older columns to the right, as compared with those of the previous year, is not merely the effect of mortality but also of a marked rise of the columns of the younger classes to the left. It may be opportune to remember

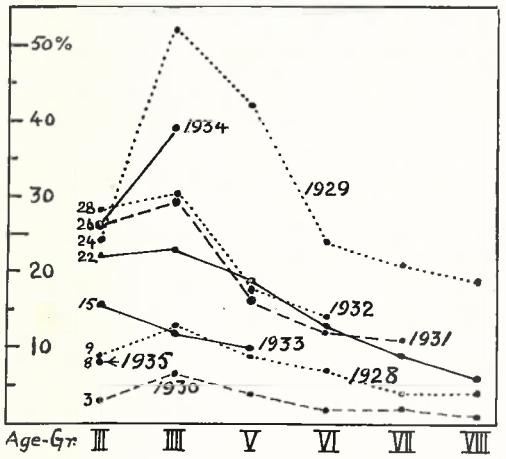


Fig. 2. Oscillation of the year-classes 1928 to 1935 from 1930—1939.

that changes in the percentage of any class must influence all other columns proportionately and inversely.

3. Oscillation. This means the variation of the proportion of *one particular generation*, not a year-class, considered during a succession of years.

The most interesting feature in the oscillation of our spent herring is the fact that *the percentage is always higher in the fourth year than in the third.* Young herrings are *more numerous* in the shoal at their second appearence on the coast than at that of their first. After that age a constant decline appears and from the third *appearance* (when 5 years old) the line in the linear diagram takes a general downwards trend, down to extinction. See Fig. 2.

It is this phenomenon that in 1935 led me to propose the term Oscillation. I consider that a great interest attaches to it, and the more so since we learned that the same oscillation is also noticeable in other concentrations of herrings and even of other fishes. We have tried to find an *explanation* of this peculiarity in the evolution of a generation of fishes[1]),

[1]) See G. Gilson. Fluctuations and Oscillation in a Community of Pure Spent Herring. Rapp. et Proc.-Verb. Vol. No. 105, III, 12, Copenhagen 1937.

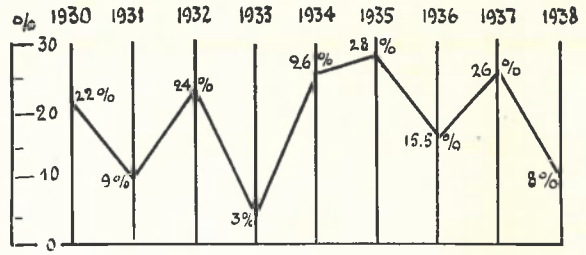


Fig. 3. Fluctuation at first appearance of 3-year-old recruits.

but without obtaining an entirely satisfactory one and I would be obliged for any suggestion as to this matter.

A remarkable exception to the rule of oscillation has been mentioned in my paper of 1938: the young generation born in 1933 and attaining, in 1937—1938, its 4th year of age, ought to have shown a higher percentage than in the previous season.—In fact it *decreased* to a lower figure—see Fig. 2.—The next season we rather expected that it would regain a higher figure by a belated arrival of young recruits, but it did *not* and fell still lower. This prognosticates that the class will remain a bad one until its total extinction. The next *generation*,—that of 1935,—attaining this last season the very high percentage of 39%, shows that the rule of oscillation was broken only for the one year and is now again in force.

4. Variation of the Density of the Shoal of

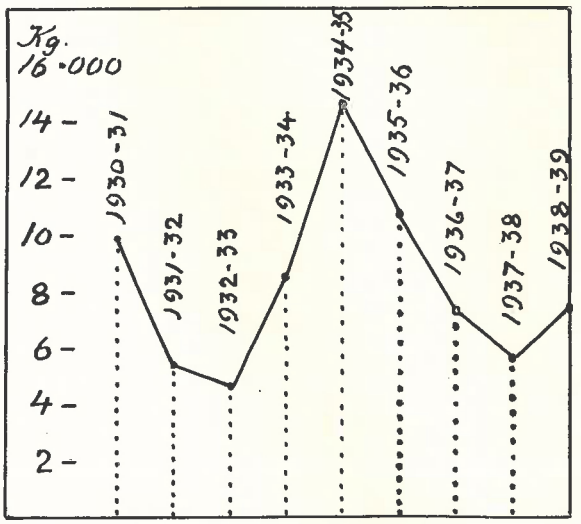


Fig. 4. Average daily catch in kg. of spent herring by Ostend fishermen, 1930—1939.

Spent Herring. This is a very desirable notion, as being the only way to obtain an approximation of the importance of the shoal visiting the coastal waters. It is also the most difficult to determine with some degree of accuracy. The question has been treated

in my first memoire on the spent herring in 1930—31 and the conclusion was that the *mean-weight* of a fishing day is, at the present time, the only obtainable base for an evaluation of the abundance of the spent herring in the duration of a fishing period.

Using the figures supplied by the Fishmarket Office we have drawn the diagram, Fig. 3, in which appears a remarkable periodicity in the variation of the quantity, obtained by calculation, as the mean weight in kilos of one day's fishing in each of the years from 1931 to 1939. This *periodicity* seems to suggest the existence of a correlation between the density of the shoal of spent herrings and some physical conditions periodically prevailing in the sea. Our English colleagues HODGSON and CARRUTHERS have paid attention to the matter and pointed out a remarkable relation between certain *winds acting* on the movement of the *water* and the abundance of *haddock and herring*, in the East Anglian region, and CARRUTHERS[1]) has insisted on the evident parallelism between the graphs of the wind at the Sandettié lightship and that of the variation of the abundance of our spent herrings of Ostend for a series of years.

This is a good example of what may be expected from the establishment of a regular circuit of lightship stations carrying out continuous observations, especially if completed by a system of international quarterly cruises in the intermediate region.

[1]) J. N. CARRUTHERS: Fluctuations in the Herrings of the East Anglian Autumn Fishery, the Yield of the Ostend Spent Herring Fishery, and the Haddock of the North Sea, in the light of relevant Wind conditions. Rapp. et Proc.-Verb., Vol. No. 107, III, p. 10, 1938.

My aim in presenting to the Committee this sketch of the present state of our work on the coastal spent herring was not only to make known certain particular features in the biology of clupeid fishes, but, mainly, to insist upon the efficiency, necessity and difficulty of continuous observation in this as in many other departments of biology. We all know that ordinarily the value of isolated observations in biological studies is very small: repetition in long series is absolutely required for control, detection of errors and the opening of new ways to investigation and synthetical views.

If we, in Belgium, have succeeded, with scanty means, to obtain some little positive data on fluctuation, oscillation, density of shoals, etc. it was owing to the continuous character of the work we have been able to carry out during many years.

On the other hand we know also that continuous observations in certain departments of biology are generally very laborious and that, as time goes on, they grow tedious. It is hardly to be expected that young scientific people, engaged on personal research and, perhaps, not realizing the importance of collecting positive data for synthetical work, should be willing to take up day by day the monotonous labour of plotting figures, tabulating data, calculating percentages, etc. etc. Continuous investigation is the work for first class technical agents, not for individual scientists, and it must be the task of Governmental Institutions automatically to recruit their technical staff to work under the direction of scientific pioneers of the sea.