THE USEFULNESS OF THE ECHO-SOUNDER AS THE DETECTOR FOR SARDINE SCHOOLS FROM THE STATISTICAL POINT OF VIEW. *

By

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In this paper sardine catches by a group of the boats equipped with the echo-sounders as the detectors for the schools of sardine are compared with those of another group without echo-sounders. Thereby, the author comes to the conclusion that the usefulness of the echo-sounder as the detector can not be denied at 0.005 level of significance.

(1)

In February 1950, in order to certify the usefulness of the echo-sounder noised about suddenly as the detector for the schools of sardine, the author examined statistically on the records of sardine obtained from the Fisheries Cooperations of Narao and Iwase-no-Ura in Goto Islands. The result of the investigation was published in a report by the prefectural authorities in Nagasaki at that time. In this present report the same data were examined in a different way from the former.

Since 1948 the several boats have equipped with the echo-sounders for detecting schools of sardine, but unfortunately these devices were scarcely effective. However, since November 1949 some boats gained repeatedly big catches not attained till then. Since then enthusiastically boats were equipped with echo-sounders.

At the time of author's investigation, the number of boats equipped with echo-sounders was not so big that by random sampling records of catches of only twenty boats were chosen, a half of them was equipped with the echo-sounders and the rest of them was not. Moreover not all twenty boats sailed fishing frequently during two examined months, December 1949 and January 1950. Therefore, from the records, the author could choose only ten days at random.

Both mean values of sardine catch a day and standard deviations are shown in Fig. 1. The mean value of mean catches a day per boat equipped with a echo-sounder amounts to 1.8 ton., and that the non-equipped 1.4 ton. Without due
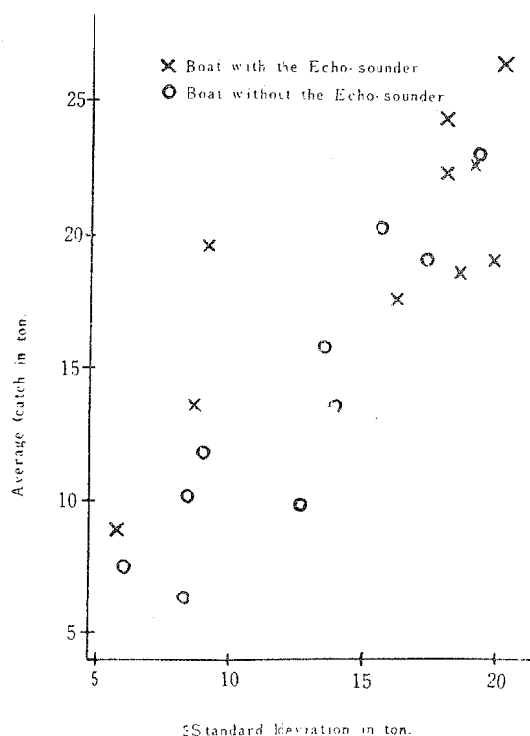

Fig. 1. The relation between average catch
and standard deviation.

consideration, we must not conclude that this difference between two mean values is significant, because their standard deviations are too big, amountng to 1.7 ton. and 1.4 ton. respectively.

Fig. 1 shows that means and standard deviations tend roughly to be proportional. Therefore transforming the values of recorded catches into square roots, the author made an analysis by means of the method of analysis of variance. The result of the computation is as follows.

Table 1.

Factor	Degree of freedom	· Unbiased estimate
Grouping of boats	1	2079
Between days	9	1533
Interaction	9	411
Error	180	233

From this computation, as to the echo-sounder we may conclude that the usefulness of it cannot be denied statistically at the 0.005 level of significance.

(2)

Due to the statistical analysis above-mentioned, the echo-sounder would be very effective for detecting sardine schools. Though the difference of the catches between

two groups of boats owes presumably, of its greater part, to whether echo-sounders are equipped with or not, such boats that were equipped with echo-sounders by enterprising owners taking the lead of the new application would have gained more catches than others, if they had nad no echo-sounders. Therefore to make this question clear, it is necessary to examine their records of catches when those boats were operated without echo-sounders.

Then the records during the period of autumn 1949 were examined for this purpose. In this period only eight boats had not yet been equipped with which were equipped with echo-sounders later. Among ten non-equipped boats examined in the preceding section, the author chose eight boats at random for comparison. The mean values of catches and standard deviations during this period are shown in Fig. 2. The mean value of catches by the group of boats which were equipped
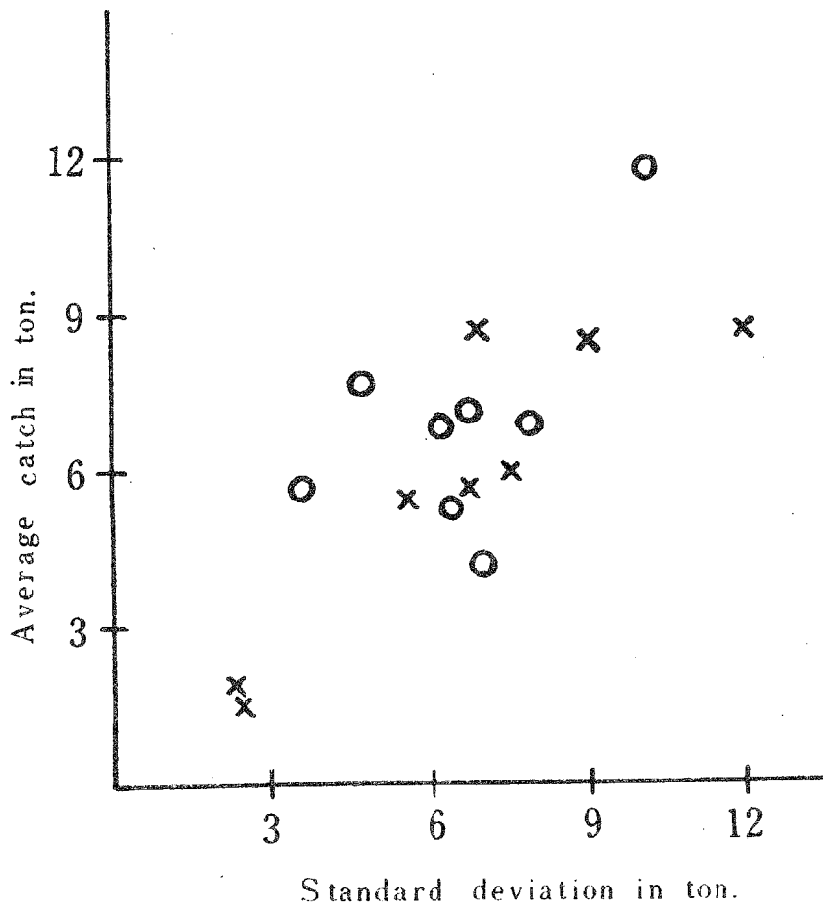

Fig. 2.   The relation between average and standard deviations of catch.

later with echo-sounders amounts to 7.3 ton, while that of the another group 8.8 ton. The difference between two mean values would be insignificant because of their big values of standard deviation. From Fig. 2 we may assume that mean catches and standard deviations during this period tend, alike to the preceding section, to be proportional. To test the significance of the difference between these two mean values, the data transformed into square roots are analysed by the

method of analysis of variance.

The result of the analysis is as follows.

Table 2.

Factor	Degree of freedom	Unbiased variance
Grouping of boats	1	268.1
Between days	7	191.8
Interaction	7	49.2
Error	112	148.7

Due to the relatively low value of unbiased estimate of variance, the difference of catches between two groups is almost insignificant even at the 0.2 level of significance. Thus according to this additional examination, the usefulness of the echo-sounder as the detector of sardine schools is confirmed strongly.

Acknowledgement