

## The performance of a Square Mesh Panel in the Bay of Biscay Nephrops trawl fishery.

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Warning : This note presents the conclusion of an analysis performed by Ifremer in 2008 on the experimental data collected by the French fishermen organisation in 2003-2004. This could be considered as a scientific review of the conclusions of preliminary reports (d'Hardivillé C. and T. Guigue in CNPMM report)

A cooperative program between French fishermen and technologists from Ifremer was conducted in 2003-2004 to test on a large scale devices designed to reduce by-catch of undersized hakes. Three kind of selective devices were tested: square mesh panel (SMP), diamond mesh panel and large mesh (150mm) in the wings and back). Some (but very few) trials using a 100mm mesh size in the cod-end were also conducted.

116 trips were realized using commercial vessels from various ports of the Bay of Biscay. This represents 540 days at sea and 1557 hauls for the whole program. Only the results of the SMP experiments are presented here.

### Methodology of the experiment

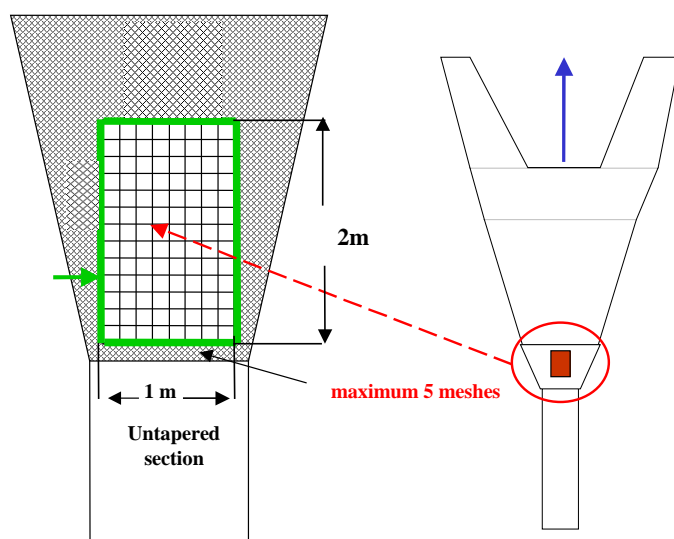


Figure 1: Dimensions and position of the square mesh panel

All the 30 commercial vessels used for these experiments were equipped with twin nets. One of the nets was modified with the selective device while the other remained standard. Observers on board collected information on the catch of hake in term of quantity and length frequency for both nets.

The SMP was tested during 69 trips (using 22 vessels) and 901 hauls.

It should be kept in mind that these experiments have been conducted during commercial trips. Therefore there has been a constant compromise between the need to carry out the experiments under scientific standards and the operational constraints due to the commercial activity. It may have occurred that the two trawls were not exactly the same, but when

substantial differences appeared, either the experiment was not conducted or has been rejected afterward.

785 hauls were considered as valid and kept for the analysis (Figure 2).

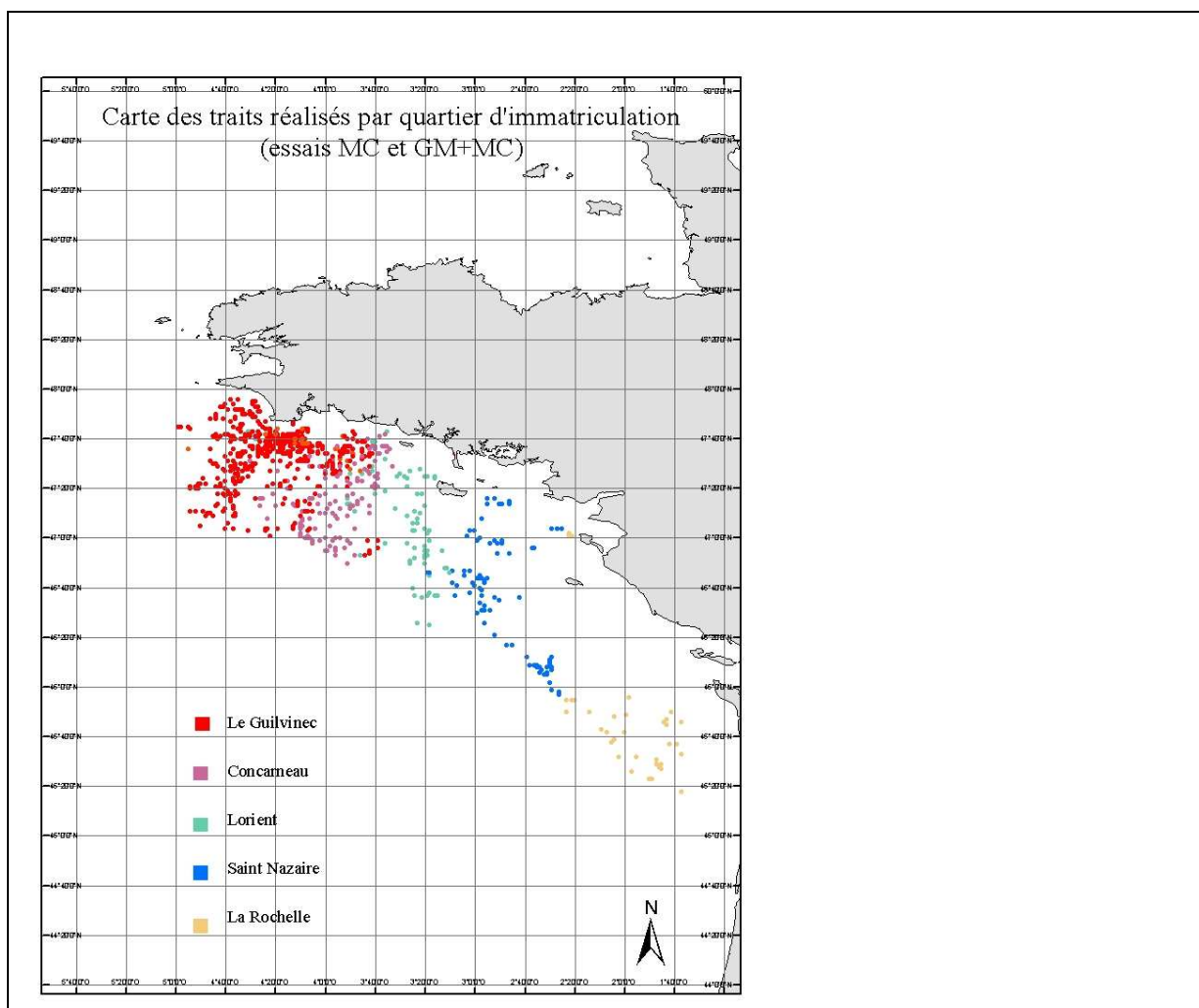


Figure 2. Spatial distribution of the fishing operation with SMP

### Data analysis

Among the valid hauls, a first analysis was carried out to investigate any relationship between the observed escapement and the number of undersized hakes in the haul. The second step was to set a threshold (number of undersized hakes in the standard trawl) above which the haul was considered in the final calculation of the mean escapement.

The escapement rate is defined as followed:

$$\% \text{ escapement} = \frac{\text{sum of undersized hakes in the standard trawl} - \text{sum of undersized hakes in the trawl with SMP}}{\text{sum of undersized hakes in the standard trawl}}$$

### *Selection of the hauls retained for analysis*

Among the valid hauls, the number of under-sized hakes in the standard haul varies from 0 to 3085 (Figure 3), with a mean of 166 undersized hakes per haul and a standard deviation of 228. It should be kept in mind that because the hauls had variable duration, no comparison could be made among the hauls.

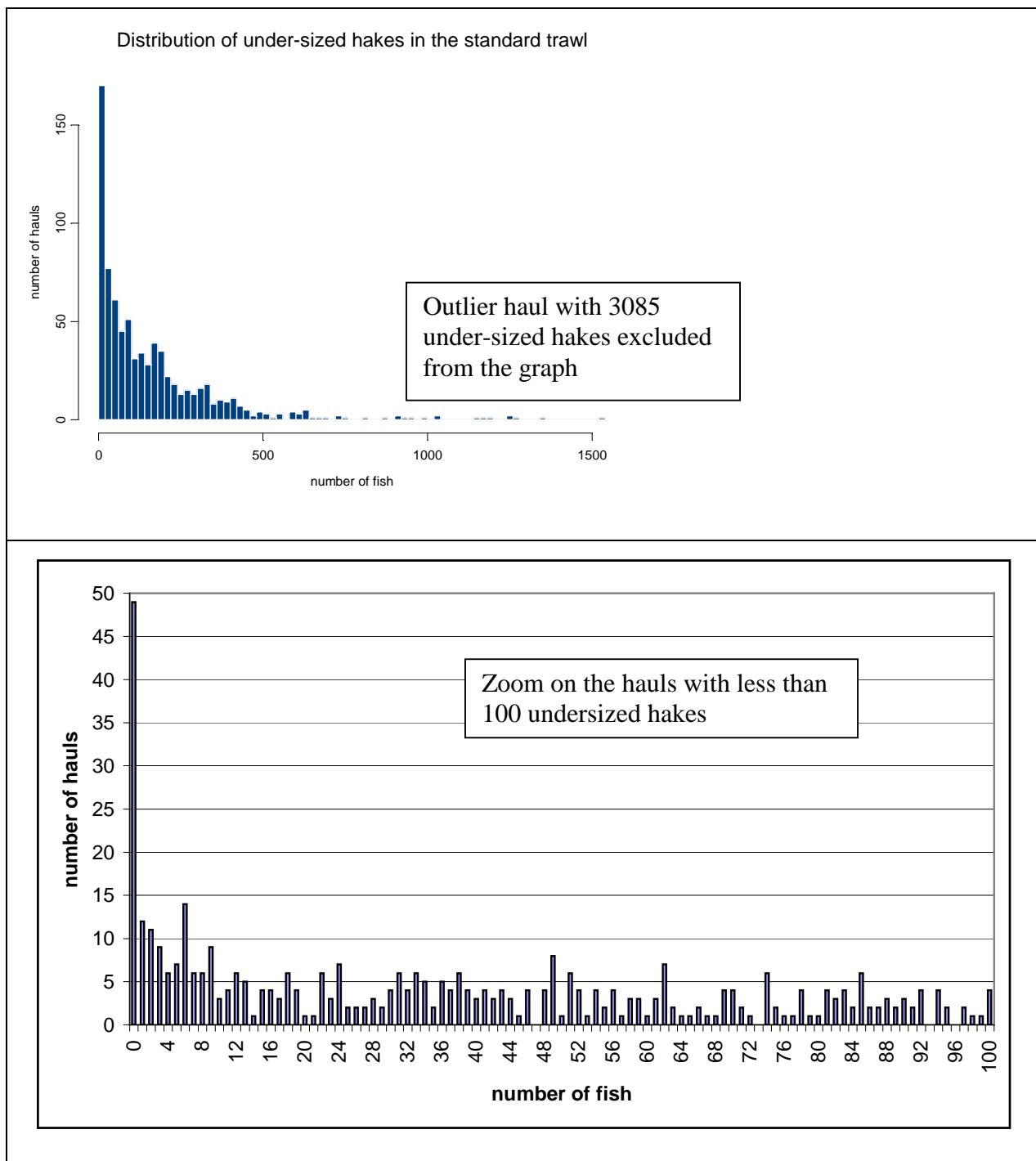


Figure 3. Frequency of under-sized hakes in the standard trawl

In order to see if there is any correlation between the level of escapement and the number of undersized hakes in the standard trawl, and to prevent any increase in variability when

including low-significant data in the analysis, Figure 4 shows the distribution of the level of escapement depending of the number of undersized hakes in the standard haul.

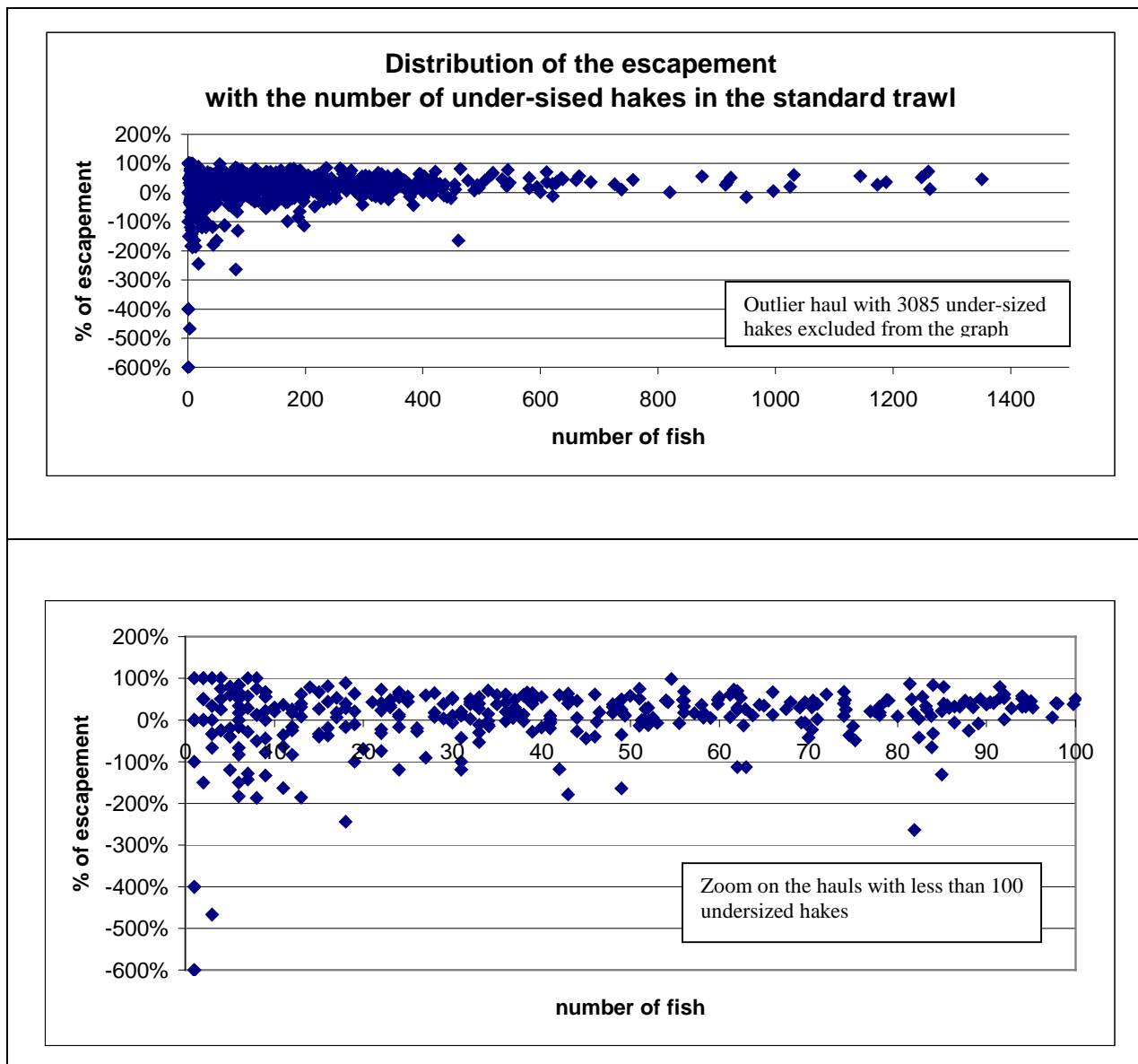


Figure 4: Distribution of escapement values versus the number of under-sized hakes in the standard haul.

The escapement of these under-sized hakes varies from  $-600\%$  (with an outlier at  $-3100\%$ ) to  $+100\%$ . The ‘negative’ escapement means that there were more undersized hakes in the trawl with the SMP than in the standard trawl.

It is quite clear from this figure that there is no significant relationship between the escapement and the number of fish. However the figure show that very high negative level of escapement have occurred for the hauls with the smallest number of under-sized hakes in the standard trawl.

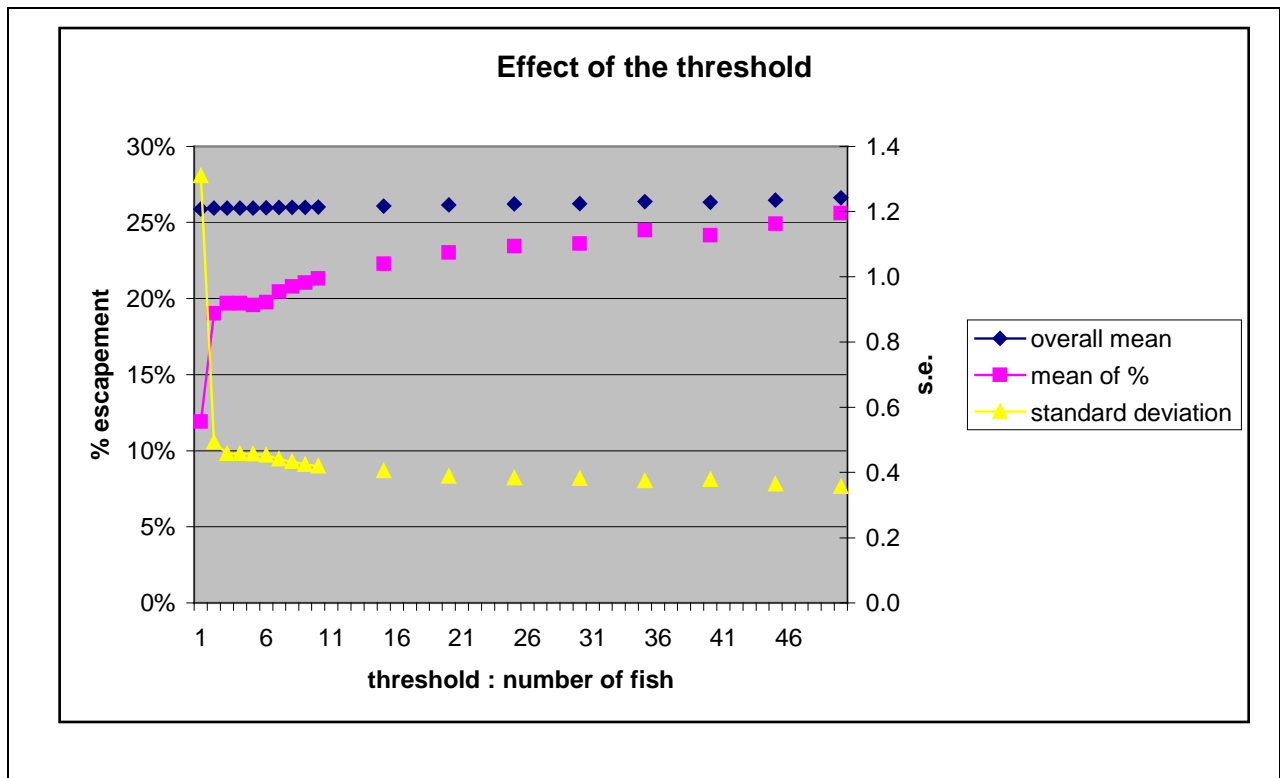


Figure 5.: Effect of the threshold on the number of undersized hake in the standard trawl to keep the haul information, on the results.

It is clear from Figure 5 that the mean of the escapement values for each haul tends to increase when the threshold is set higher towards the ‘overall mean’ (ratio of the sums over the considered hauls). Looking at the standard deviation plot and given the relative stability of the values, there is no clear indication to fix the level of the threshold. Therefore a threshold was set, arbitrarily, at 10 under-sized hakes in the standard trawl, and 656 hauls were kept for the final analysis.

***Final escapement estimates***

It has already been said that it happens that the number of undersized hakes is higher in the selective trawl than in the standard one. This is the case in 23% of the hauls when considering all the valid hauls with undersized hakes in the standard trawl. This percentage is 21% when applying the threshold at 10 to select the hauls used in the analysis.

The escapement varies largely from one haul to another. The way to incorporate this variability in the results is to average the escapement for each (valid) hauls and to calculate the associated coefficient of variation. The average escapement is 21.3% with a coefficient of variation of 197%.

A way of smoothing the results is to consider the sum of all the experimental (valid) hauls. The overall mean (escapement calculated on the sum of the hauls) gives an overall escapement of 26.0% for hakes under the MLS. An overall escapement of 19% is also found for the commercial hakes (mostly for lengths between 27 and 33 cm).

### Length distributions

The length distribution of the hakes for the standard trawl and the one with the SMP are given in Figure 6. It shows that more than an improvement of the selectivity towards hake, the SMP acts like a decrease in the efficiency of the gear over the smallest lengths. The modes in the length distributions of the catch of hakes are roughly the same (18cm) with and without SMP.

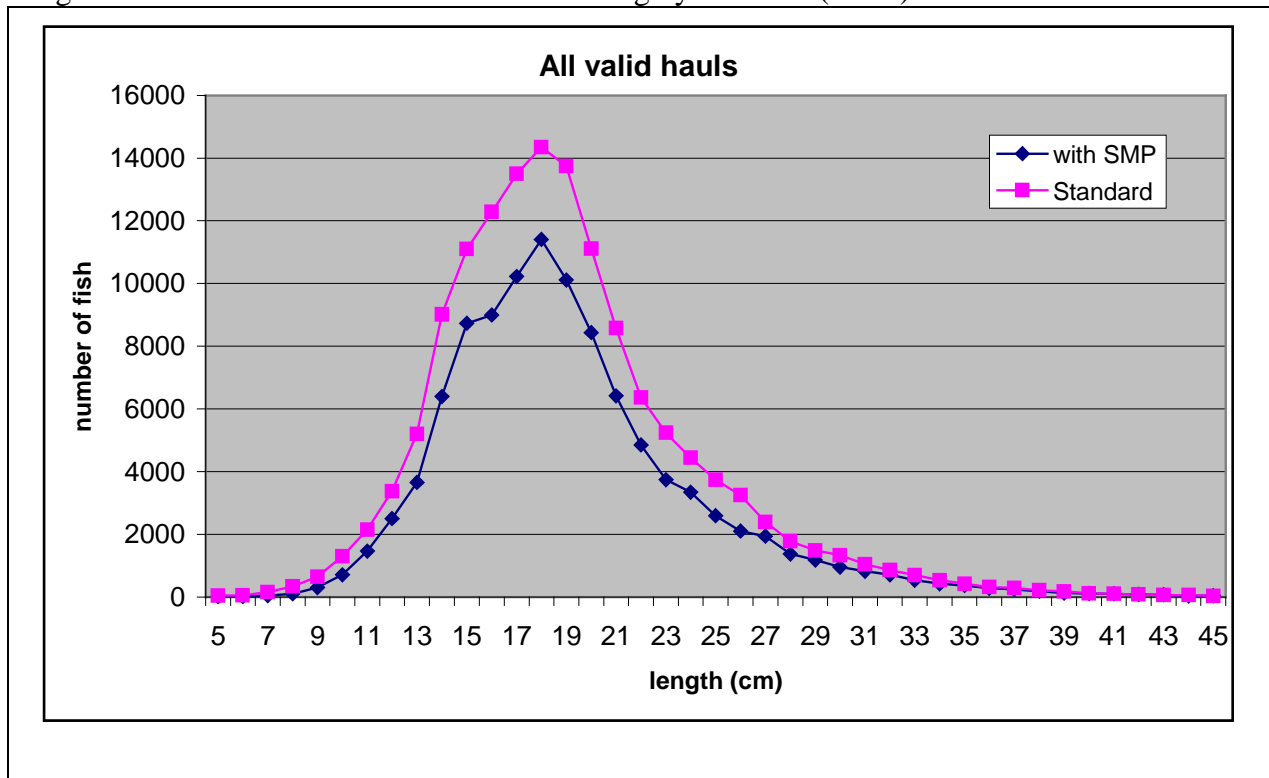


Figure 6: Length distribution of hake in the catch from the standard and with SMP trawls.

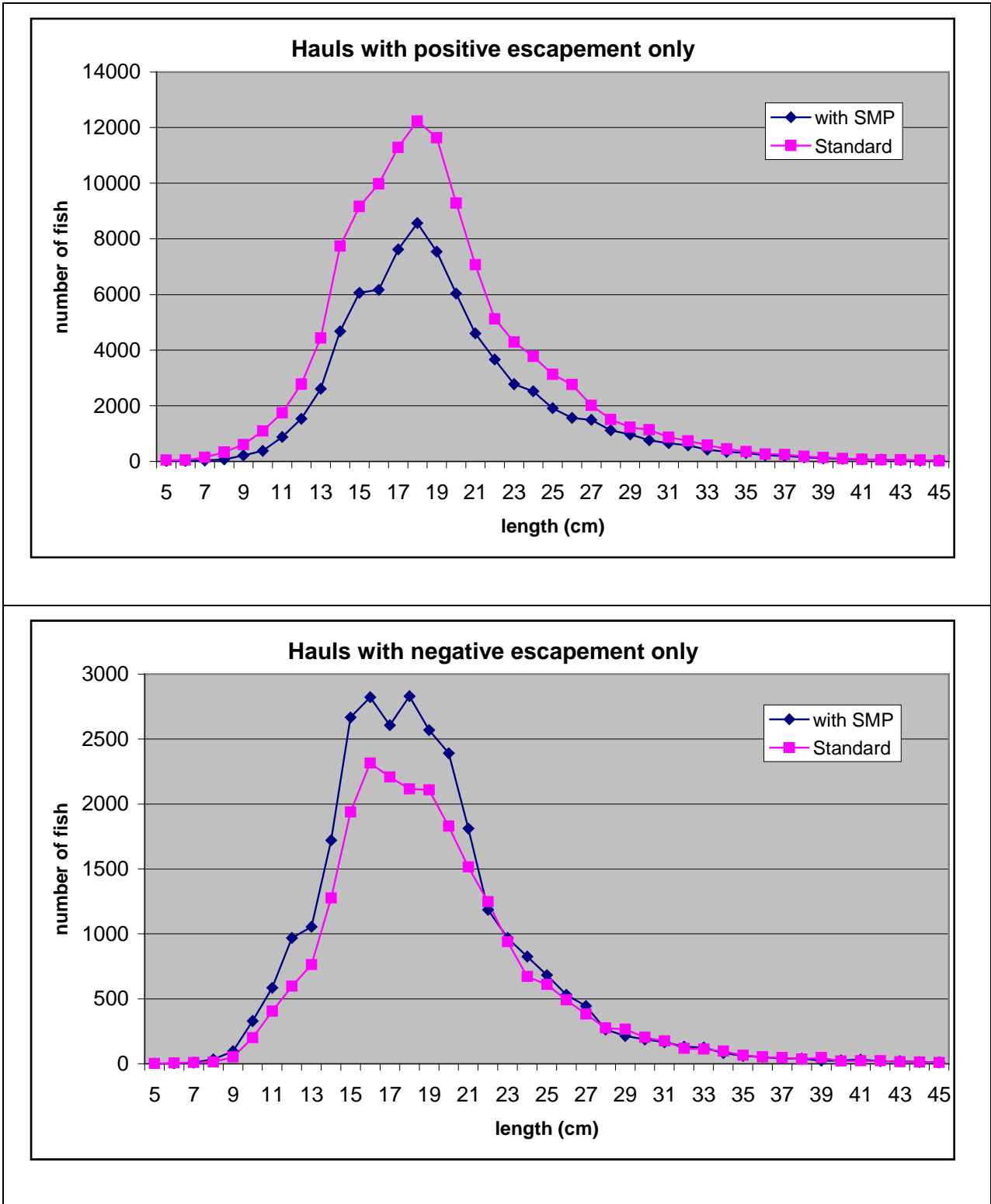


Figure 7: Length distribution for the hauls for which there is an escapement (top) and for the ones for which there are more undersized hakes in the 'selective' trawl than in the standard one.

These two figures show that, when there is an increase in efficiency due to the SMP, this mostly apply on length from 10 to 21 cm.

On the other hand, when it works as expected, the SMP leads to an escapement more or less constant on all sizes smaller than 30cm. This is probably because this escapement through a SMP at the top of the baiting is based on a dynamic behaviour of the fish.

**As a matter of conclusion, it could be said that the use of a Square Mesh Panel decrease the efficiency of the gear on the smaller sizes (roughly less than 30cm), leading to an overall reduction of the catch of undersized hakes by 26%.**

**However, there is a high variability from one haul to another (average of the escapement for each haul of 21%, with a coefficient of variation of 200%).**