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LONGLINE: FULL SCALE TRIALS WITH NEW HOOK DESIGNS  
AND REDUCED SIZE OF BAIT

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ABSTRACT

Experimental longline trials have shown that new certain hook designs give increased catch efficiency and that the size of bait might be reduced without corresponding reduction of catch rates. Full scale trials have been conducted in commercial longlining to evaluate the long run effect of the experimental results.

The average catch increase of cod using the Wide Gap hook was 17%. The superiority of this hook design decreased with increasing fish density. The Double hook gave a total increase of 58% in a mixed species fishery (tusk, ling, haddock), and showed a size selective effect compared to the standard hook.

Reduced bait size (average 40-50%), gave no significant reduction of catch rates for cod. Similar results were obtained in the mixed species fishery for tusk, ling and haddock.

## 1. HOOK DESIGN

Different new hook designs have given improved catch rates in experimental long line fishing. However, the magnitude of the improvement seem to be influenced by the experimental design. To establish a realistic figure for the catch-efficiency of a certain hook type in commercial longlining, long term fish trials have been conducted.

### 1.1 Wide Gap-hook

The Wide Gap hook was tried out in the cod fishery with monofilament longline on the coast of Finnmark, from April 28th to May 19th, 1981.

The experimental hook, Mustad Wide Gap Qual.: 72940, No. 5/0 (Fig. 1a) was tested against the standard hook, Mustad Norway Qual.: 7255, No. 6. An average of 5000 hooks (15 tubs of line) was hauled every trip. Most of the tubs (11) were rigged with the Wide Gap hook, and the rest of the tubs with the standard hook. These tubs were randomly distributed into the fleet between the "Wide Gap-tubs".

The number of fish caught on each tub of gear was recorded.

In 16 of 18 fishing trips, the Wide Gap hook gave better catch rates. A total of 65 600 Wide Gap hooks were hauled giving a catch of 22 980 cod (average catch rate: 35.0 fish pr. 100 hooks), while 22 720 Standard hooks gave 6802 cod (average catch rate: 29.9 fish per 100 hooks), giving an average catch increase for the Wide Gap hook of 17.1 %.

Fig. 2 gives the relation between the catch rate (of the Standard hook) and the ratio between the catch rates for the two hook types for every fishing trip. The relative effectiveness of the Wide Gap hook decreases with increasing catch rates (fish density). This effect is supposed to be caused by gear saturation.

Average fish size during the trial period was 1.9 kgs (gutted fish, head off). Based on the average catch rates for the two hook types, the estimated total catch on Standard hook would be 50.2 tons against 58.7 tons on the Wide Gap hook.

### 1.2 Double hook

The trials were conducted on the coastal banks off Ålesund (W. Norway) from November, 5th to December, 20th, 1982. Mustad Double loose hooks, qual.: 7825 T, No. 4/0 (Fig. 1b), were tested in comparative fishing trials against the standard hook: Mustad Kirby Sea, Qual.: 7330, No. 7/kirbed. Tubs of 200 hooks rigged with either Standard or Double hooks, were set alternately in every fleet of gear (normally 8-10 tubs). The number of fish and total weight for each species were recorded for each tub.

A total of 8355 standard hooks and 8380 Double hooks were hauled, and 37 pairs of tubs were used for paired comparison. The double hook gave improved catch rates for all species (Table 1).

Table 1. Relative increased catch rates on Double hook.

Species	Total number of fish	Increased catch rate on Double hook			
		Number of fish %	p-value	Weight %	p-value
Tusk	945	73.2	0.0002	83.8	0.0001
Ling	226	90.2	0.0430	111.1	0.0600
Haddock	989	18.5	0.1740	23.7	0.0240
Others	160	38.5	0.0720	47.0	0.015
Total	2 020	45.5	0.0000	58.1	0.0000

The following major factors are assumed to cause the increased catch-efficiency of the Double hook:

- Less bait loss
- Increased hooking probability
- Decreased escapement of hooked fish

It should be noted that the increase in weight is higher than the increase in numbers of fish, which shows that the Double hook has selective properties towards bigger fish.

## 2. BAIT SIZE

Annually, 15 - 20 000 metric tons of bait are used in Norwegian longlining. Experiments based on paired comparison between standard- and half bait size have shown that reduced size of bait give no significant reduction, and in some cases even an increase of catch rate.

Full scale trials were conducted to establish the effect of reduced bait size in regular longlining.

### 2.1 Coastal longlining for cod in N. Norway

The fishing trials were done from November 11th to December 9th, 1982, and includes the catch data from 10 fishing trips by 2 separate vessels (fishing at the same grounds at the same time). The vessels used reduced and standard bait size alternately.

Reduced bait size gave better catch rate than standard bait size in 4 of the 10 comparisons. Table 2 gives the summarized results.

Table 2. Longlining for cod. Bait consumption and catch results for standard - and reduced size of bait.

	BAIT SIZE	
	REDUCED	STANDARD
Number of hooks	320 000	335 000
Total amount of bait	7 460 kgs	12 520 kgs
Cut off (head + tentacles)	2 360 kgs	4 006 kgs
Net bait consumption	5 090 kgs	8 514 kgs
Average bait size	15.2 grams	26.6 grams
Total catch	49 159 kgs	49 771 kgs
Catch per 100 hooks	14.7 kgs	15.6 kgs

Gutted fish, head off.

In these trials a relative great reduction in bait size (43%), only gave a slight, non-significant reduction in catch rate (5-6%). The average size of the fish caught on small baits was slightly lower (7%), compared to the catch on standard bait size.

This indicates that reduced bait size may give equal and even better hooking probability than standard bait size, but the selective properties of small baits give a reduction in average fish size.

2.2 Mixed species - longlining - W. Norway

Full scale trials were conducted from September 30th to December 20th, 1982, on the coastal banks off Alesund (W. Norway). The material includes 35 fleets of longline (6 - 10 tubs each), where tubs baited with standard or half bait size were set alternately in every second position in each fleet.

One pair of tubs were used as unit in a paired comparison between catch rates on the different sizes of bait.

Average standard and reduced bait size was 31.8 grams and 16.0 grams, respectively. A total of 31 600 hooks were hauled, giving 75 paired comparisons (a few tubs were rejected). The summarized results are given in table 3.

Table 3. Mixed species longlining. Differences in catch rates for standard- and reduced size of bait.

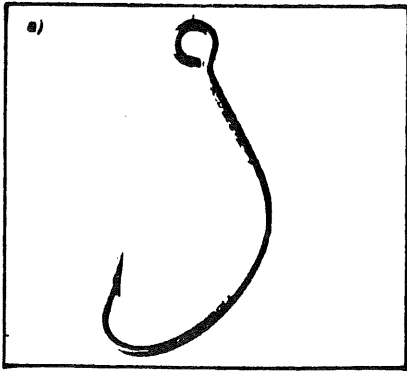
	Total number of fish	Difference in catch rate (+ indicate better catch rate on small bait size)			
		Number of fish %	Weight (kg) p-value	Weight (kg) %	p-value
Tusk	1 774	+ 7.4	0.476	+ 1.1	0.716
Ling	272	+ 25.0	0.056	+ 25.6	0.120
Haddock	1 513	- 4.1	0.259	- 5.6	0.680
Other	190	0	0.577	+ 2.5	0.567
Total	3 749	+ 3.4	0.753	+ 2.5	0.368

There was no significant difference between the total catch rates of standard and half bait size, which indicates that the bait consumption can be reduced without effects on the total catch rates. Among the different species, ling show the most dramatic effect, with a catch increase of 25 per cent. The increase in weight is not significant, but

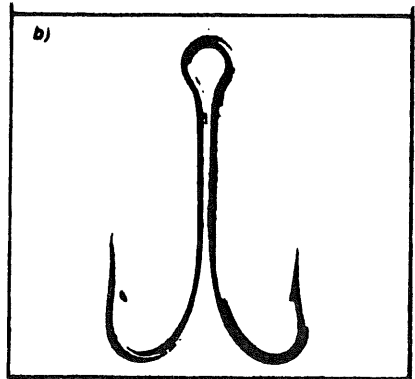
indicates that reduced bait size give a species selective effect for ling.

Figure 3 show the relation between fishing time and catch rate ratio (small-/large baits). One should expect that a large bait will last longer and therefore be favourable with increased fishing time. However, this material does not give a clear trend of this relation.

Figure 1.



a) Wide Gap-hook



b) Double-hook

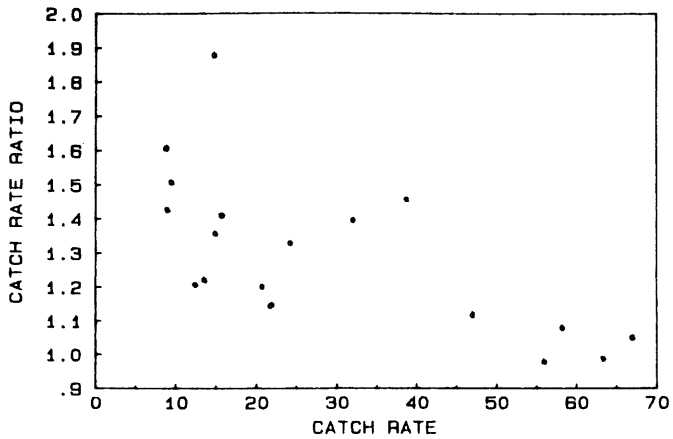


Figure 2. Relation between the catch rate of standard hook and the catch rate ratio: Wide Gap/Standard.  
 (Catch rate = number of fish per 100 hooks.)

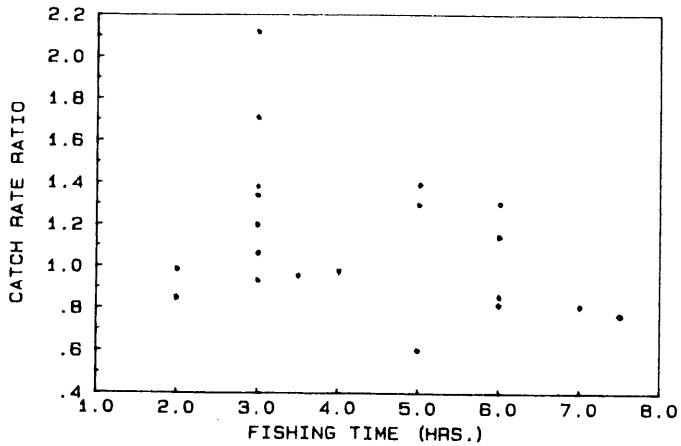


Figure 3. Relation between fishing time and the catch rate ratio: Small baits/large baits.