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Baltic Fish Committee

Working Group on
Assessment of Pelagic
Stocks in the Baltic

Selectivity of trawl cod ends in fishing for herring in the Baltic Sea

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Introduction

Investigations by BaltNIIRH and VNIRO in traumatism and mortality rate of Baltic herring after passing through the meshes of a trawl cod end have shown that dead fish on the average do not exceed 3%. This is evidence of the possibility of conserving their stock by setting appropriate mesh sizes for fishing gear.

In I972 on the basis of such studies of selectivity of trawls (CM I972/B:I0) for the Gulf of Riga the mesh size of herring trawl cod ends was increased from 24 to 28 mm. In the first year of application of the increased mesh the industry sustained losses. Trawl catches decreased by 6.900 tons against I97I despite the high yielding generation of I970 was subject to fishing.

In I973 undersized fish sifted by trawls in I972 began to be caught and the total catch of herring amounted to the fixed limit.

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The number of fishing boats operating in the Gulf and their capacity even dropped to a certain degree.

In commercial catches the share of 2-4 year olds increased while the share of one year olds decreased. According to calculations the introduction of a higher level of selectivity allows catches of herring in the Gulf to be increased by about 10% provided their stock is in a satisfactory state.

Methods

The experimental work to determine the selective properties of trawl cod ends in fishing for Baltic herring was done from small refrigerator trawlers, capacity 300 hp. Experimental trawlings were performed in the usual fishing regime on fish concentrations of different density and size composition. Fish that passed through trawl meshes were caught by small mesh netting coverings (fish catchers). These coverings were 1.5 times wider than the cod end and 1.5-2.0 m longer than the covered area. They were made from knotted caprone netting with a mesh of 16 mm (for cod ends with a 32-36 mm mesh) and with a mesh of 28 mm (for cod ends with a 40 mm mesh). When operating the covering did not touch the cod end which allowed smallfish unobsructedly to pass through its meshes. For small catches commercial length of all fish from the covering and cod end was measured. For big catches samples numbering not less than 270 sp. were taken from the cod end and the covering. The results were converted for the total catch. The length of fish was measured with an accuracy of the nearest half-centimeter.

Experiments were made with caprone cod ends (polyamide A) with different thickness of twines and the following mesh sizes: 32, 36, and 40 mm.

Results of investigations

The main data obtained as a result of experimental fishing are cited in Table I. Cod ends Nos I,2,3 and 4 were tested in the eastern areas of the Sea(off Klaipeda,Liepaja,Ventspils), cod end No 5 was testedeast of Bornholm. Size compositions of herring fished for by a series of trawlings are given in Fig.I.

Fig.2 gives charts of selectivity of the tested trawl cod ends.

Selectivity of trawls depends on a number of factors.The authors have made an attempt to study the effect of the size composition (modes of length $L_{n\ max}$ and number of undersized fish in the population under fishing) on the share in catches of fish of non-commercial size(p). Table 2 cites the summary data of the test of cod ends with mesh sizes 32 and 36 mm. Trawlings were grouped by similarity in size composition ($L_{n\ max}$).

Fig.3 shows the dependence of the share of non-commercial fish in catches (P) upon the varied size composition (modes $L_{n\ max}$) of the populations under fishing.

Proccessed by the least square method the experimental data gave the following empiric expressions of this dependence:

$P = 120.1 - 6.8\ L_{n\ max}$ with error $E = \pm 11.8\%$ for cod ends with 32 mm meshes and

$P = 119.0 - 8.7\ L_{n\ max}$ with error $E = \pm 12.3\%$ for cod ends with 36 mm meshes.

Depandence of the share of non-commercial fish (P) upon their abundance (N_n) in the population under fishing is given in Fig.4. The empiric expression of this dependence in the same way leads to the following expressions:

$P = 0.66\ N_m - 0.33$ with $E = \pm 2.3\%$ for cod ends with 32mm meshes

and

$P = 0.58\ N_m - 12.62$ with $E = \pm 2.4$ for cod ends with 36 mm meshes.

This study of the selective properties of trawls in fishing for Baltic herring allows the following conclusions to be made:

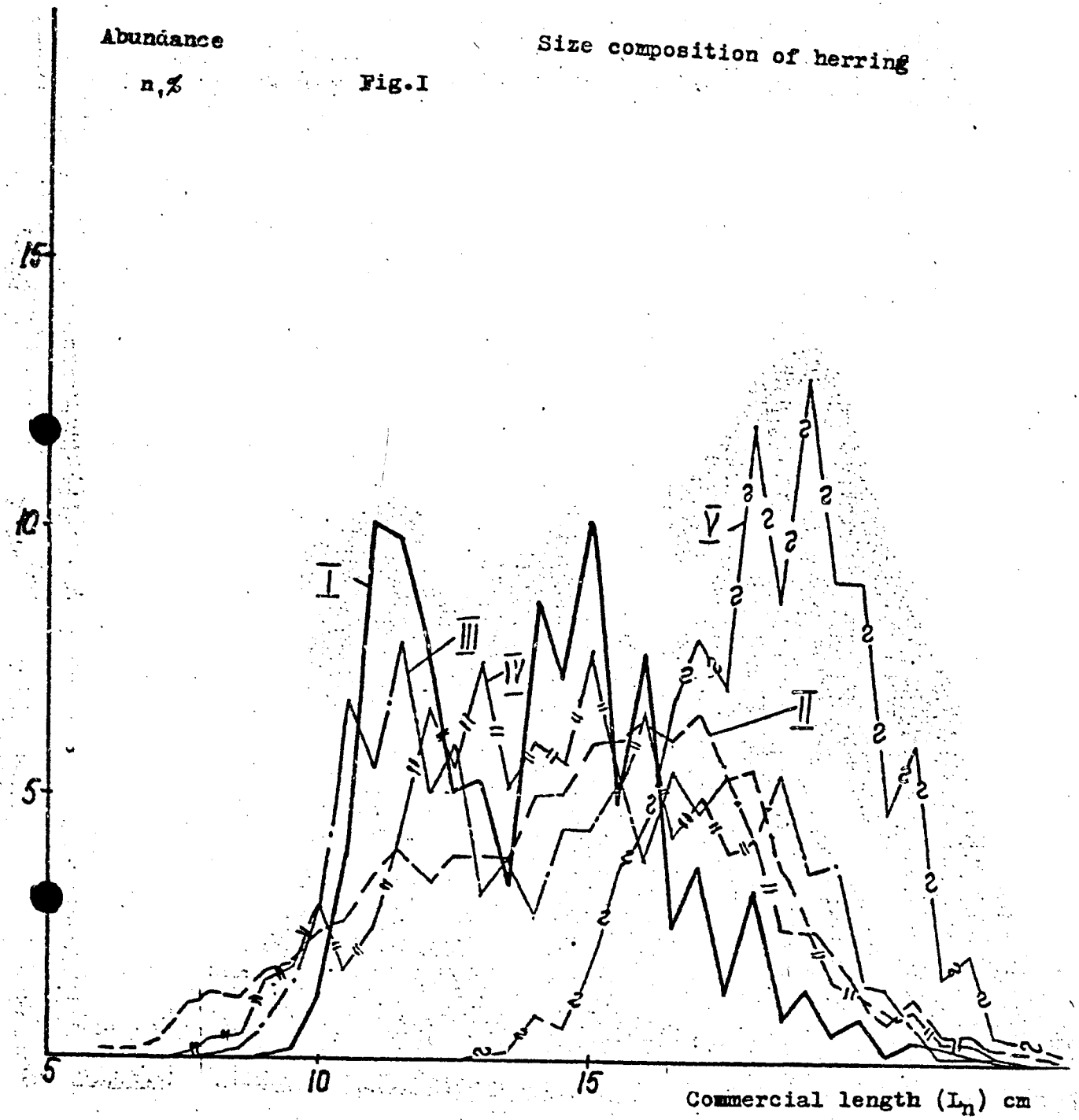
1. Increase in mesh sizes of tral cod ends from 32 to 40 mm considerably improves selectivity of trawls in fishing for herring in the Baltic Sea.
2. The selective properties of cod ends made of polyamide filament, Type A, decline with increasing thickness of twine (cod end No 1 compared with No 2 and cod end No 3 compared with No 4).
3. The selectivity factors of the tested cod ends made of twisted twines 93.5 tex x 2 x 2 up to 93.5 tex x 4 x 3 varied within the limits from 4.6 to 3.84.
4. The range of selectivity for herring in the Baltic Sea was within the limits from 1.3 to 3.0 cm.
5. The selective properties of trawls depend on the size composition of herring stocks under fishing. The revealation of connections between the share of non-commercial fish in catches (P), size composition (modes $L_{m\ max}$) and the abundance of non-commercial fish N_m makes it possible to calculate for different areas of the Baltic Sea minimum mesh sizes for cod ends meeting the requirements of international fishing regulations.
6. Traumatic mortality of herring after passing through the cod end is insignificant. It is possible and expedient to regulate fishing for herring by mesh sizes of trawl cod ends.

Abundance

n,%

Fig.I

Size composition of herring



I cod end 32 mm twine 93.5 tex x 2 x 3

II cod end 32 mm twine 93.5 tex x 2 x 2

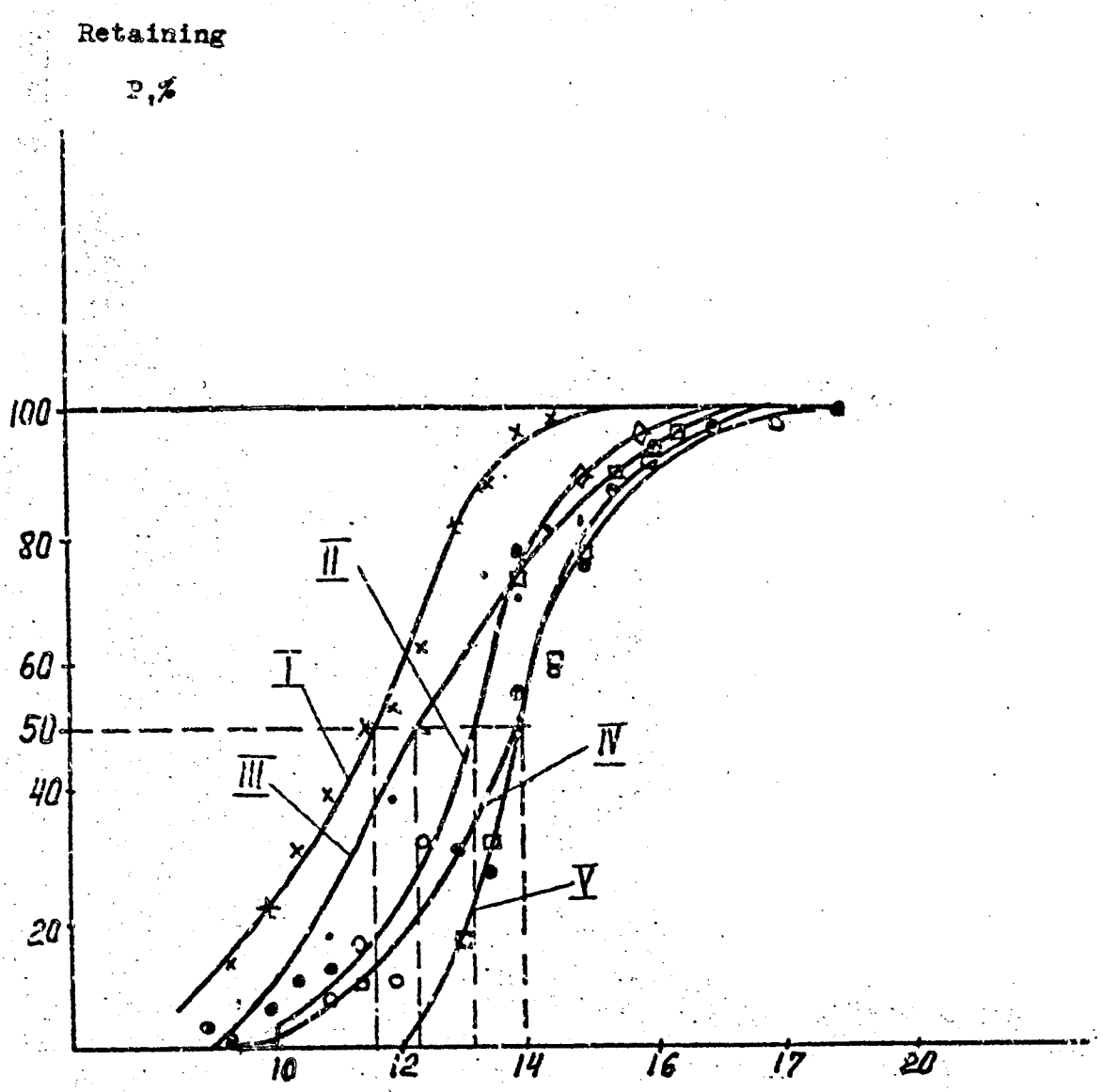
III cod end 36 mm twine 93.5 tex x 4 x 3

IV cod end 36 mm twine 93.5 tex x 2 x 3

V cod end 40 mm twine 93.5 tex x 2 x 3

Fig.2

Selectivity charts



I cod end 32 mm twine 93.5 tex x 2 x 3

II cod end 32 mm twine 93.5 tex x 2 x 2

III cod end 36 mm twine 93.5 tex x4 x 3

IV cod end 36 mm twine 93.5 tex x 2 x 3

V cod end 40 mm twine 93.5 tex x 2 x 3

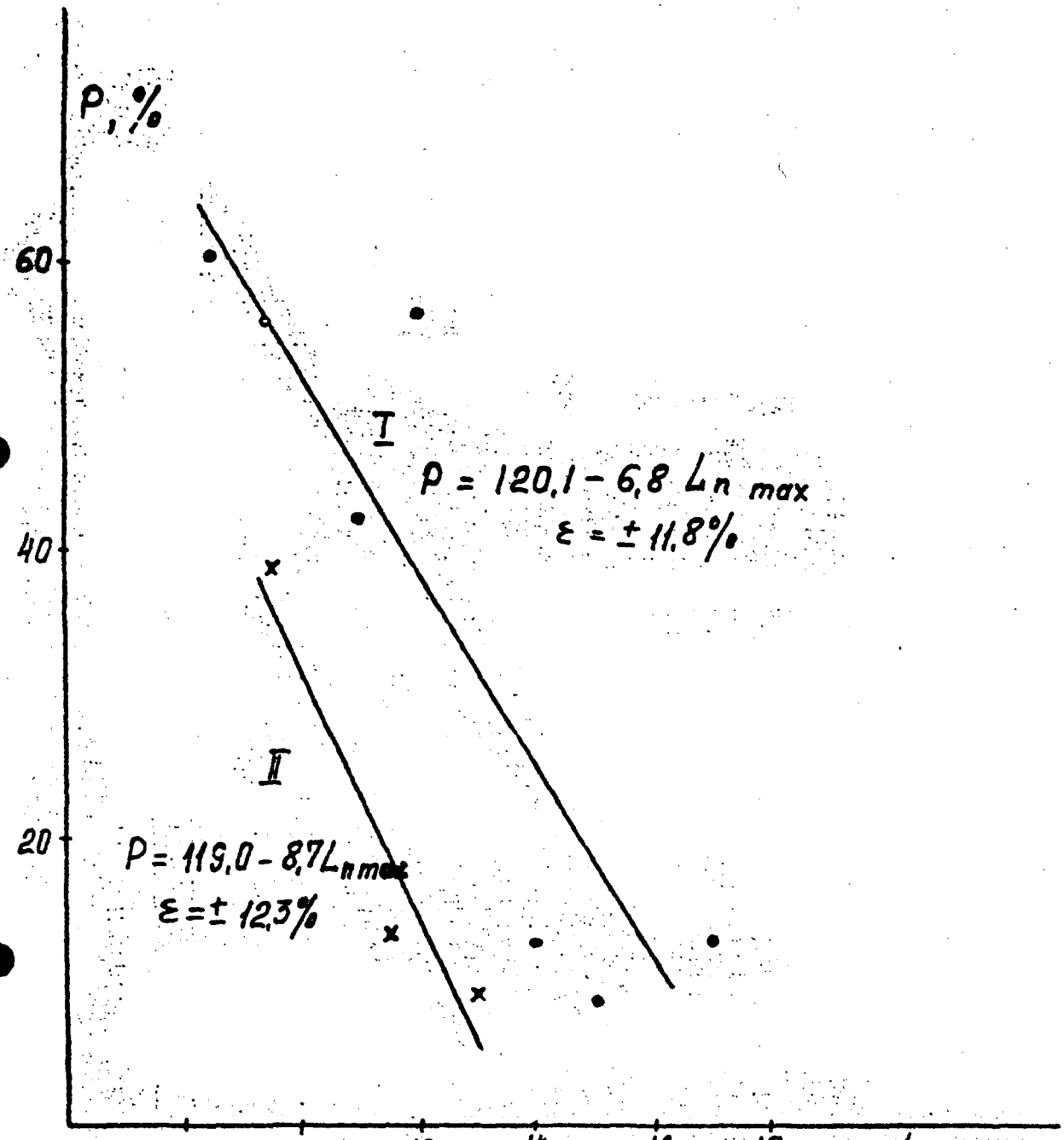


Fig.3

Catch of non-commercial fish (P) depending on varying size composition of herring (Ln max)

I cod end, 32 mm meshes

II cod end, 36 mm meshes

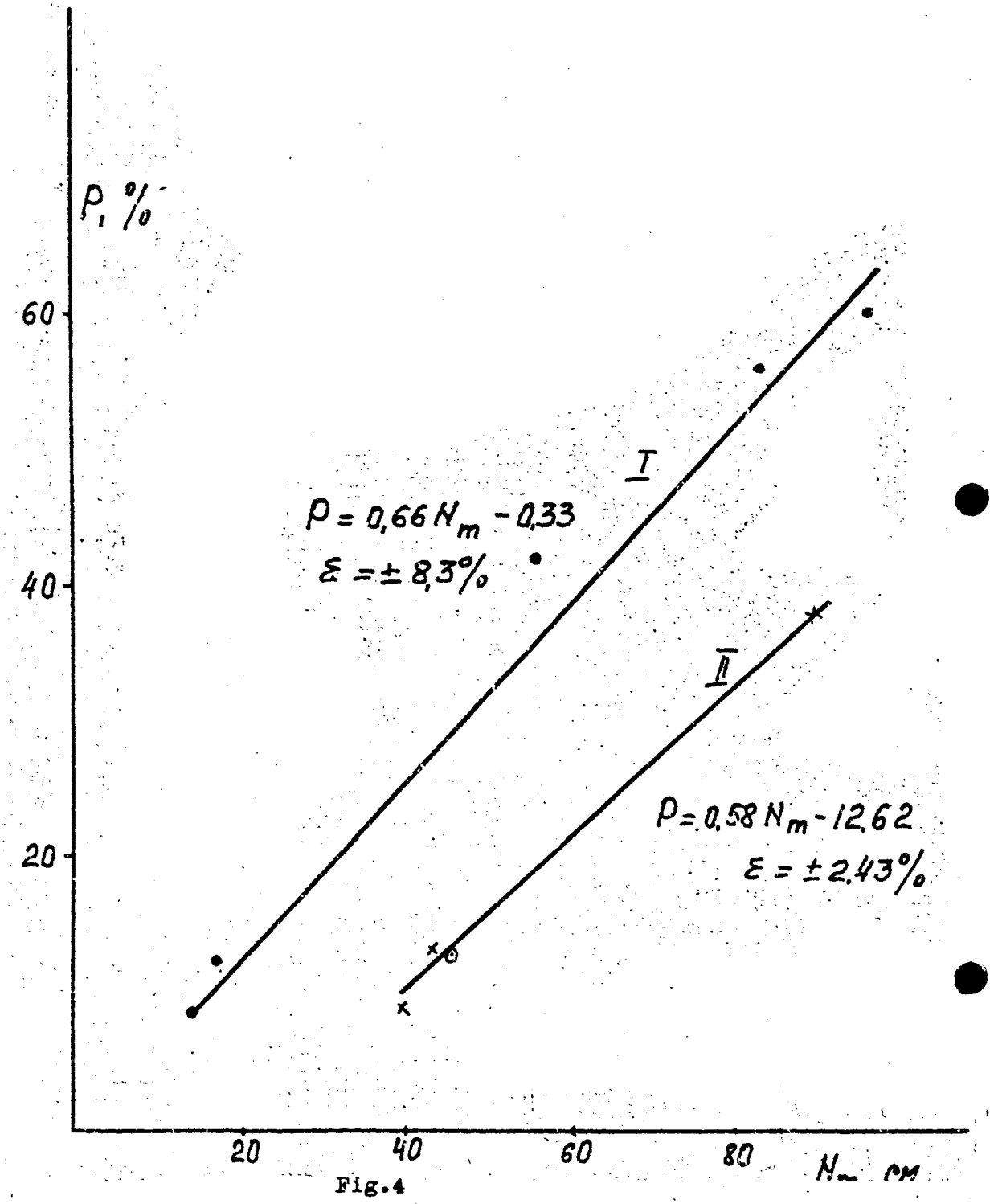


Fig.4

Catch of non-commercial fish (P)
depending on their abundance (N_m)

I cod end, 32 mm meshes
II cod end, 36 mm meshes

Ship: 300 hp

Date: I973-I974

Area: Baltic Sea

Depth: I0-70 m

Method: Outside small meshed covering

RESULTS OF EX

No of cod end	Mesh size and tex	Number of trawlings	Meam time of trawling (min.)	Number of in cod end	Number of in covering
I	32; 93.5 tex x 2 x 3	20	60.0	I45,555	40,828
2	32; 93.5 tex x 2 x 2	2I	53.0	I2,I73	5,6I3
3	36; 93.5 tex x 4 x 3	8	56.0	7,402	3,494
4	36; 93.5 tex x 2 x 3	II	68.0	I0,I49	7,364
5	40; 93.5 tex x 2 x 3	II	228.0	I45,443	3,8I6

Note: I. In experiments with cod end No I 64% of the weight of catches was accounted for by small fish.

2. The inner mesh size (B) was calculated by multiplying factory mesh size by coefficient 2.I3.

Table I

Species; Baltic herring

Trawl Type: bottom and twin mid-water (cod end No5)

Material: caprone (polyamide A)

Semi-cod end: on cod end No 5 only

RIMENTS

specimens in range of selectivity	L_0 - 50% (cm)	Selectivity factor K_s	Selectivity range $L_{75\%}$-$L_{25\%}$ (cm)	Non-commer. fish caught in cod end $L_0 \leq$ I6.0 cm (% by counting)	Sifted fish $L_0 \leq$ I6.0 cm (% by count.)	Number of fish $L_0 <$ I6 cm (% by counting)
66,439	I3.8	4.05	2.5	22.0	I.4	42.4
2,942	I5.7	4.6	I.7	II.5	8.I	30.6
3.08I	I4.7	3.84	3.0	I0.8	7.2	39.4
4,244	I6.4	4.28	2.I	7.6	I8.7	35.I
2,363	I6.4	3.85	I.3	0.06	4.I	0.2

SUMMARY PARAM
of selectivity of bottom trawl cod

No of series	Mesh size (mm) Cod end twine (tex)	Number of trawlings	Commercial length of fish of max. abundance L_n max (cm)	Selective 50% commercial length L_n 50% (cm)	Selectivity factor K_s	Selectivity range L_n 75% – L_n 25%
I	32; 93.5 tex x 2 x 2	8	8.5	I3.4	4.64	2.5
2	32; 93.5 tex x 2 x 3	I0	II.0	II.5	4.0	2.6
3	32; 93.5 tex x 2 x 2	II	I2.0	I3.5	4.68	3.0
4	32; 93.5 tex x 2 x 3	I0	I4.0	II.8	4.I	I.4
5	32; 93.5 tex x 2 x 2	I2	I5.0	I2.8	4.43	3.0
6	32; 93.5 tex x 2 x 2	I2	I7.0	I2.7	4.40	I.5
7	36; 93.5 tex x 4 x 3	I0	9.5	I4.6	4.50	2.2
8	36; 93.5 tex x 4 x 3	8	II.5	I2.5	3.85	2.8
9	36; 93.5 tex x 2 x 3	II	I3.0	I3.9	4.28	I.8

Table 2

TERS
ends when fishing for Baltic herring

Number of specimens			Total	Fish caught with L_n up to I4 cm (% by counting)	Sifted fish of L_n I4 cm and more (% by counting)
in cod end	in covering	in selectivity range			
I2,263	88,26I	I0,392	I00,524	60.3	7.9
99,932	37,482	62,6I5	I37,4I4	42.2	0.9
49,I83	99,07I	47,I03	I48,254	56.3	20.8
45,623	3,346	3,26I	48,969	I2.5	0.4
20,268	2,I90	2,593	22,458	8.7	2.4
5,I0I	I,809	267	4,9I0	I2.8	0.3
9,304	70,82I	9,657	80,I25	38.9	34.4
7,402	3,494	3,08I	I0,896	I3.4	5.9
I49	7,364	4,244	I7,5I3	9.3	I4.I

Подп. в печ. 14/УП 1975 г. Зак. 673 Тир. 205 Объем 2,0 п.л. ЦНИИТЭИРХ