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ON THE INFLUENCE OF MESHSIZE AND HANGING RATIO ON THE ESCAPE OF PANDALUS BOREALIS THROUGH THE SIDE PANELS OF A 4 - SEAM BOTTOM TRAWL.

by

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ABSTRACT

In this paper an experiment with different meshsize and different hanging ratio of the side panels of a prawn bottom trawl is described. The purpose of this experiment was to analyze the influence of these factors on the escape of prawns through the side panels. An increaced slack of the netting of the side panels relative to the upper and lower panels proved to be almost as effective as an increased meshsize from 40 to 50 mm.

EXTRAIT

Dans ce document on trouve la description d'expérimentations faites avec différentes longueurs de maille et différents taux d'armement sur des faces des chaluts de fond de crevettes. Ces expériment-ations étaient effectuées dans l'intention d'analyser l'influence de ces facteurs sur l'évasion des crevettes par les faces. L'augmentation du non-battant (slack) des filets sur les cotés, par rapport a des faces supérieures et inférieures, a éprouvé d'etre presque aussi efficace que l'élargissement de la maille de 40 a 50 mm.

INTRODUCTION

Pandalus borealis is caught in some fjords in Iceland. This fishery is strictly regulated. Thus, each fishing area has a total quota, each vessel has its own quota, the fishing season is regulated, the fishery may not been carried out without a permission from the ministry of fisheries and the vessels are penalized for landing undersized prawns in the form of fishery ban for some days. The minimum size which may be landed is regulated by a counting system. Not more than 300-340 (different by areas) individuals may be counted from a representative sample of 1 kg. All these regulations shall prevent overfishing and aim at the maximum sustainable yield for this species.

It is especially in Ísafjarðardjúp at the NW-coast that small and big prawns are more or less mixed together on the same grounds. This makes it difficult for the skippers to keep prawn size within the count limit. As the catch of small prawn will prevent rational utilization of the stock this is a problem which all concerned are very interested in solveing. Two methods of approach have been tried, i.e. to increase the meshsize and to use grading machines. The results of these methods can be outlined briefly as follows.

Trials have been carried out by the Marine Research Institute to examine the influence of an increased meshsize in the codend. The results obtained were not very consistent but indicated that 40 mm was the maximum possible meshsize which could be used commercially. In view of this, minimum meshsize was increased from 32 to 36 mm as measured with a plate. Actually a meshsize of 38 mm would have been more appropriate but due to the fact that the PE-netting frequently shrinks because of mud going into the knots a meshsize of 36 mm was chosen as the minimum codend meshsize. The minimum meshsize of the netting in front of the tip of the lower panel is 45 mm. This choice is based on commercial experience. Usually, fishermen will use exactly the minimum meshsize but Icelandic prawn fishermen very often use a larger meshsize. Figure 1 shows meshsizes frequently used in the different parts of commercial trawls, but sometimes mesh sizes are even larger. In spite of all the efforts to avoid capture of small prawns it is sometimes very difficult to keep the count within the limits.

Another method, which offers promise in getting rid of small prawns, is to use grading machines on board. Experiments on its efficiency carried out by the Marine Research Institute, showed that the grading machines were capable of sorting the prawns properly. There was a high survival rate of the released prawns if sorted shortly after coming on deck. Sorting machines became popular in Húnaflói on the north coast but now their use has been forbidden since the sorting procedure very often first starts when the prawns are already dead.

The idea to increase the selectivity of 4 seam prawn trawls by using more slack in the netting of the side panels was considered at a Pandalus conference in Kodiak, Alaska, in February 1979 in a verbal contribution by J.E. Jurkovic, Seattle. To the authors knowledge, no paper exists on this. Encouraged by this information the Marine Research Institute carried out some experiments in March 1980 in Ísafjarðardjúp to examine the influence of increased slack in the panels with two different meshsizes.

MATERIAL AND METHODS

The bottom trawl used in the experiment is shown in Figure 1. This design is descriptive for the fjord fishery on Pandalus in Icelandic waters. Some different sizes of trawls are used depending upon the size of the vessels. The trawlsize illustrated is used by the biggest vessels (20-30 BRT).

Cover bags with knotless netting of 19.6 mm were used in different positions on the trawl, marked A to E. The bags A to C, mounted on one of the side panels, were always used whereas bags D and E were only used on a few occasions for comparative purposes.

To analyze the escape through the side panels 4 different pairs of side panels were used (Figure 2). Panel 1A is the standard design as used by the commercial fishermen with 40 mm meshsize without slack in the netting relative to the upper and lower panel. Panel 1B was designed with 20% more slack but with the same meshsize. Panel 2A was designed with 50 mm meshsize without slack but panel 2B with 50 mm meshsize and 20% slack. Mesh measurements with the ICES gauge during the experiment showed the 40 mm netting to be 39.2 mm and the 50 mm netting to be 49.9 mm. The meshsize of the wing near cover bag D was measured 83.6 mm whereas the codend meshsize near cover bag E was measured 38.3 mm.

Cover bags A to C were used to check on the prawn released through the side panels. Each bag was considered as representing 1/3 of the side panels. To get the total release of each third of both side panels the catch in each cover bag was multiplied in accordance with the covered area. No comparative experiments with different placements of the bags on the side panels took place.

Before considering the results it should be mentioned that these experiments were combined with biological check experiments where no two tows were made in the same spot. Catch and size distribution are therefore different from haul to haul.

RESULTS

The escape of prawns through each third of the side panels relative to carapace length is shown by numbers and weight for all panel versions in Tables 1-4. The tables also show the catch by numbers and weight as well as the relative loss of prawns for each carapace mm-group. The loss of prawns with less than 17 mm and 17^{+} mm carapace length is shown seperately since prawns with less than 17 mm carapace length are, as previously mentioned, considered undesirable in large quantities.

The above tables show some evident pecularities which should be underlined. The low retention of the smallest prawns with less than 10 mm carapace length is obvious. This can been explained by the meshsize of the cover bags beeing too large to retain these tiny specimen properly.

Figure 3 depicts the prawn losses shown in the last column of Tables 1-4. Obviously the panel version 2B is unacceptable in the commercial fishery because of the big loss of the largest prawns. It should, however, be borne in mind that only relatively few prawns with more than 20 mm carapace length were caught. Consequently the curves become rather inaccurate towards the upper end.

Judging from these results it should be possible to increase the release of small prawns by 3-4 times by using side panel versions 1B or 2A instead of the standard version 1A. The price in both cases was 18% loss of big prawns. Probably the loss in catch will usually be lower since the prawns were very small during the experiments and the great majority of the big prawns measured 17-19 mm in carapace length. The prawn loss for each length group by changing from the standard panel version 1A into the 3 other versions is shown in Table 5.

The relative low prawn loss through the lowest third of the side panels is obvious but not surprising. Usually the highest escape rate is through the upper third of the side panels, but during experiments with panel version 2A a larger proportion went through the middle part of the side panels.

In 3 hauls wing cover D was used. The total catch in these hauls was 505 kg but only one single prawn was collected by the cover.

In 3 hauls the codend cover E was attached to the upper panel of the codend in front of the splitting strop. The total catch in these hauls was 405 kg and the calculated prawn weight released through the upper panel of the codend was 10.8 kg. About 80% of this was released in one haul with a catch of 175 kg of extremely small prawn (578 to the kilogram).

It should also be mentioned that the only fish species of commercial value present in the catches was juvenile herring (8-17 cm in length). With standard panels no herring was found in the covers. In case of panel 1B the number of herring escaping through the side panels was 9.7% of the herring in the codend. For panel 2A the rate of escape was 1.9% and 25.5% for panel 2B. These figures are by no means accurate but could nevertheless indicate that small fish are not completely retained by a codend cover when experimenting with codend selectivity.

It should be kept in mind that these experiments were not carried out in the same place nor under parallel conditions. Thus, the results should be viwed with caution. Further experiments in this field are urgently needed.

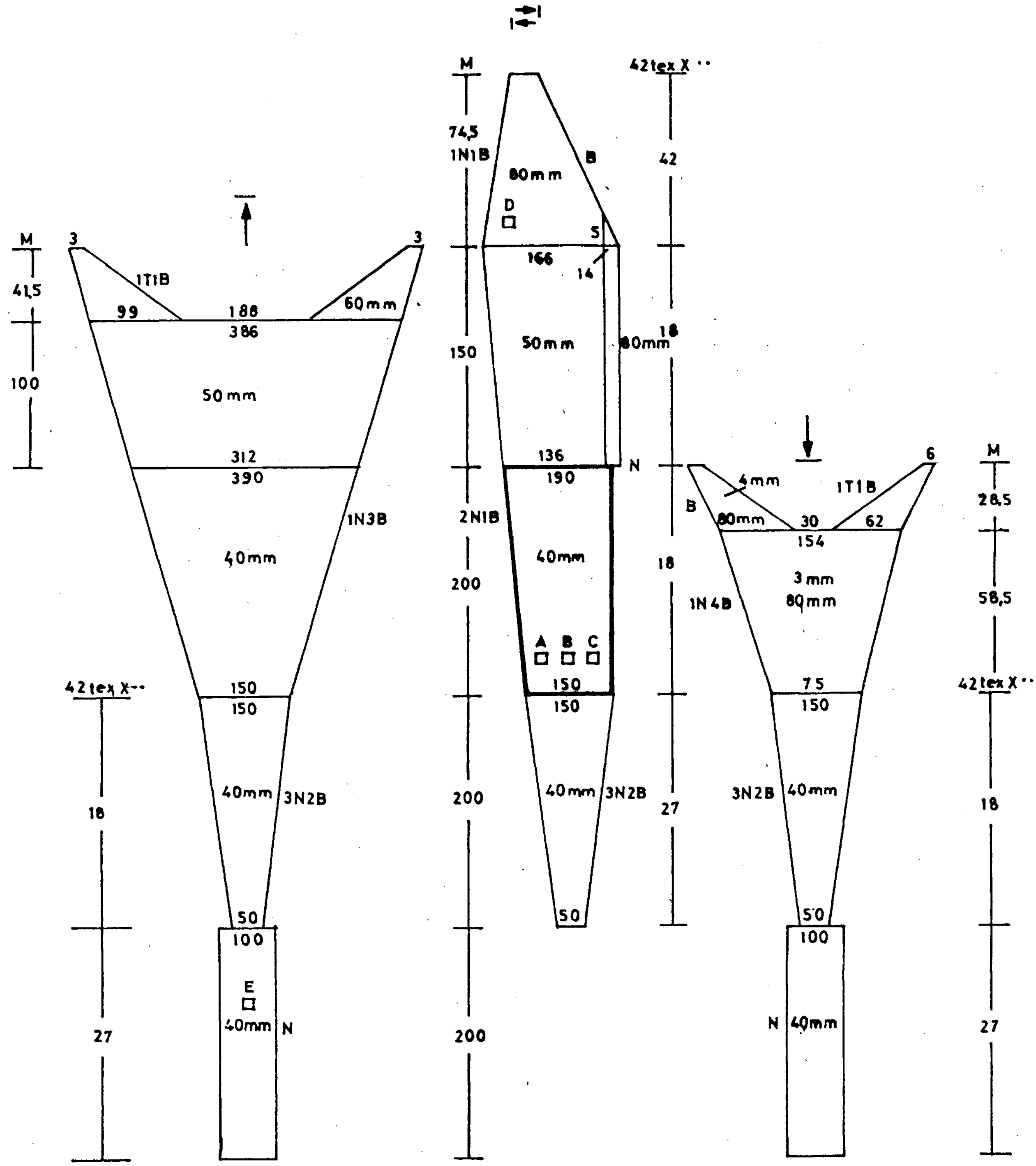

Figure 1.: Net drawing of the prawn trawl used in the experiments. The side panel is drawn with broader lines. A to E: positions of cover bags.

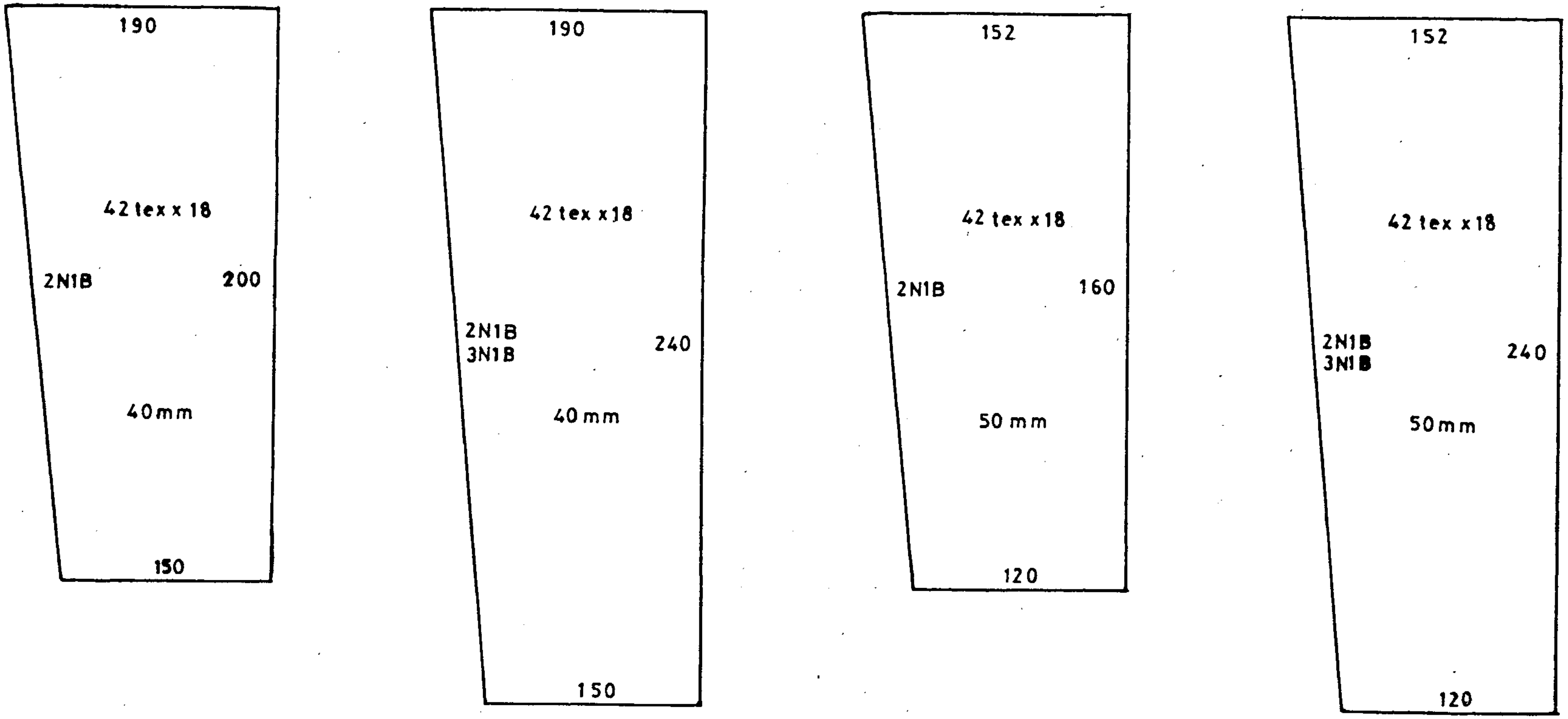

Figure 2.: Net drawings of the panel versions used during the experiment.

TABLE 1

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PANEL 1A

CARAPACE LENGTH(MM)	UPPER PANEL NRS	UPPER PANEL KG	MIDDLE PANEL NRS	MIDDLE PANEL KG	LOWER PANEL NRS	LOWER PANEL KG	PANELS TOTAL NRS	PANELS TOTAL KG	CODEND NRS	CODEND KG	LOSS % BY WT
6	0.053	0.0	0.053	0.0	0.000	0.0	0.105	0.0	9.654	1.0	1.08
7	0.053	0.0	0.000	0.0	0.000	0.0	0.053	0.0	11.309	2.0	0.46
8	0.053	0.0	0.000	0.0	0.000	0.0	0.053	0.0	12.213	3.3	0.43
9	0.316	0.1	0.000	0.0	0.000	0.0	0.316	0.1	0.154	0.1	67.25
10	0.580	0.3	0.053	0.0	0.053	0.0	0.685	0.4	6.085	3.4	10.12
11	2.898	2.2	0.632	0.5	0.211	0.2	3.741	2.8	17.799	13.5	17.37
12	10.485	10.5	1.791	1.8	1.159	1.2	13.435	13.5	77.553	77.9	14.77
13	11.433	14.9	1.317	1.7	1.317	1.7	14.068	18.3	88.941	115.9	13.66
14	4.373	7.3	0.263	0.4	0.422	0.7	5.058	8.4	41.400	68.7	10.89
15	2.792	5.8	0.211	0.4	0.474	1.0	3.477	7.2	55.270	114.9	5.92
16	2.687	6.9	0.369	0.9	0.580	1.5	3.635	9.3	90.855	233.1	3.85
17	2.582	8.1	0.158	0.5	0.422	1.3	3.161	9.9	103.378	323.3	2.97
18	0.527	2.0	0.263	1.0	0.263	1.0	1.054	4.0	64.108	241.6	1.62
19	0.105	0.5	0.105	0.5	0.000	0.0	0.211	0.9	31.235	140.4	0.67
20	0.105	0.6	0.000	0.0	0.000	0.0	0.105	0.6	12.202	64.8	0.86
21	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	5.577	34.7	0.00
22	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	4.880	35.4	0.00
23	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.668	5.6	0.00
24	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.00
25	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.00
26	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.048	0.6	0.00
<17	35.722	48.0	4.689	5.8	4.215	6.2	44.627	60.1	411.235	633.6	8.67
17+	3.319	11.1	0.527	2.0	0.685	2.3	4.531	15.4	222.097	846.4	1.78
TOT	39.042	59.1	5.216	7.8	4.900	8.6	49.158	75.5	633.332	1480.0	4.85

TABLE 2

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PANEL 1B

CARAPACE LENGTH(MM)	UPPER PANEL NRS	UPPER PANEL KG	MIDDLE PANEL NRS	MIDDLE PANEL KG	LOWER PANEL NRS	LOWER PANEL KG	PANELS TOTAL NRS	PANELS TOTAL KG	CODEND NRS	CODEND KG	LOSS % BY WT
6	0.000	0.0	0.000	0.0	0.063	0.0	0.063	0.0	3.414	0.4	1.82
7	0.379	0.1	0.000	0.0	0.063	0.0	0.443	0.1	10.378	1.8	4.09
8	1.012	0.3	0.000	0.0	0.000	0.0	1.012	0.3	14.899	4.0	6.36
9	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.00
10	3.732	2.1	0.316	0.2	0.190	0.1	4.238	2.3	6.122	3.4	40.91
11	9.171	6.9	1.328	1.0	0.316	0.2	10.816	8.2	22.255	16.8	32.70
12	33.079	33.2	4.238	4.3	1.202	1.2	38.519	38.7	78.380	78.7	32.95
13	38.582	50.3	6.578	8.6	1.138	1.5	46.298	60.3	75.432	98.3	38.03
14	15.053	25.0	2.846	4.7	0.822	1.4	18.722	31.1	44.767	74.3	29.49
15	16.761	34.8	2.909	6.0	1.391	2.9	21.062	43.8	77.454	161.0	21.38
16	27.260	69.9	4.427	11.4	0.822	2.1	32.510	83.4	131.394	337.1	19.83
17	24.414	76.3	5.060	15.8	1.391	4.4	30.866	96.5	95.568	298.8	24.41
18	12.966	48.9	3.795	14.3	0.253	1.0	17.014	64.1	56.570	213.2	23.12
19	4.554	20.5	0.696	3.1	0.316	1.4	5.566	25.0	39.149	176.0	12.45
20	1.265	6.7	0.063	0.3	0.126	0.7	1.455	7.7	20.037	106.5	6.77
21	0.000	0.0	0.126	0.8	0.000	0.0	0.126	0.8	5.335	33.2	2.32
22	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	4.536	32.9	0.00
23	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.681	5.7	0.00
24	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.306	2.9	0.00
25	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.00
26	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.00
<17	145.030	222.6	22.643	36.1	6.009	9.4	173.682	268.2	464.495	775.8	25.69
17+	43.199	152.4	9.740	34.4	2.087	7.4	55.027	194.2	222.182	869.2	18.26
TOT	188.229	375.0	32.383	70.5	8.096	16.8	228.708	462.3	686.678	1645.0	21.94

TABLE 3

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PANEL 2A

CARAPACE LENGTH(MM)	UPPER PANEL NRS	UPPER PANEL KG	MIDDLE PANEL NRS	MIDDLE PANEL KG	LOWER PANEL NRS	LOWER PANEL KG	PANELS TOTAL NRS	PANELS TOTAL KG	CODEND NRS	CODEND KG	LOSS % BY WT
6	0.173	0.0	0.000	0.0	0.086	0.0	0.259	0.0	2.159	0.2	10.71
7	0.173	0.0	0.000	0.0	0.259	0.0	0.432	0.1	6.835	1.2	5.94
8	0.432	0.1	0.345	0.1	0.000	0.0	0.777	0.2	7.215	1.9	9.72
9	0.259	0.1	0.000	0.0	0.173	0.1	0.432	0.2	0.000	0.0	100.00
10	1.295	0.7	0.345	0.2	0.086	0.0	1.726	1.0	1.651	0.9	51.11
11	3.107	2.3	2.589	2.0	0.432	0.3	6.128	4.6	12.007	9.1	33.79
12	7.681	7.7	9.408	9.4	1.208	1.2	18.297	18.4	27.918	28.0	39.59
13	11.911	15.5	12.860	16.8	3.625	4.7	28.395	37.0	51.152	66.7	35.70
14	3.539	5.9	8.286	13.8	1.381	2.3	13.205	21.9	20.635	34.2	39.02
15	5.955	12.4	9.321	19.4	2.934	6.1	18.211	37.9	36.712	76.3	33.16
16	8.458	21.7	10.789	27.7	2.676	6.9	21.922	56.2	54.831	140.7	28.56
17	7.595	23.7	11.393	35.6	2.244	7.0	21.232	66.4	57.393	179.5	27.00
18	5.610	21.1	4.920	18.5	0.949	3.6	11.479	43.3	50.275	189.4	18.59
19	2.417	10.9	2.762	12.4	0.777	3.5	5.955	26.8	27.410	123.2	17.85
20	1.036	5.5	0.777	4.1	0.259	1.4	2.071	11.0	12.781	67.9	13.95
21	0.173	1.1	0.345	2.2	0.000	0.0	0.518	3.2	4.570	28.5	10.18
22	0.086	0.6	0.000	0.0	0.000	0.0	0.086	0.6	6.223	45.1	1.37
23	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	1.495	12.5	0.00
24	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.995	9.6	0.00
25	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.00
26	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.00
<17	42.981	66.5	53.943	89.3	12.860	21.7	109.784	177.5	221.114	359.3	33.06
17+	16.916	63.0	20.196	72.9	4.229	15.5	41.342	151.3	161.142	655.7	18.74
TOT	59.898	129.5	74.139	162.1	17.089	37.2	151.125	328.7	382.256	1015.0	24.46

TABLE 4

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PANEL 2B

CARAPACE	UPPER PANEL		MIDDLE PANEL		LOWER PANEL		PANELS TOTAL		CODEND		LOSS
LENGTH(MM)	NRS	KG	NRS	KG	NRS	KG	NRS	KG	NRS	KG	% BY WT
6	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.00
7	0.448	0.1	0.000	0.0	0.000	0.0	0.448	0.1	0.000	0.0	100.00
8	1.279	0.3	0.192	0.1	0.064	0.0	1.535	0.4	0.449	0.1	77.37
9	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.449	0.2	0.00
10	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.00
11	0.896	0.7	0.192	0.1	0.000	0.0	1.088	0.8	1.388	1.0	43.93
12	3.966	4.0	2.431	2.4	0.320	0.3	6.717	6.7	6.857	6.9	49.48
13	3.518	4.6	6.077	7.9	0.640	0.8	10.236	13.3	22.631	29.5	31.14
14	4.862	8.1	4.478	7.4	0.512	0.8	9.852	16.4	16.374	27.2	37.56
15	8.316	17.3	5.182	10.8	0.640	1.3	14.138	29.4	13.380	27.8	51.38
16	11.387	29.2	6.653	17.1	1.088	2.8	19.128	49.1	24.051	61.7	44.30
17	28.659	89.6	7.677	24.0	2.111	6.6	38.447	120.2	40.512	126.7	48.69
18	38.895	146.6	11.387	42.9	1.471	5.5	51.753	195.0	46.619	175.7	52.61
19	23.798	107.0	5.438	24.4	0.960	4.3	30.195	135.7	26.983	121.3	52.81
20	22.006	116.9	4.350	23.1	0.576	3.1	26.932	143.1	15.455	82.1	63.54
21	8.252	51.4	1.919	12.0	0.448	2.8	10.619	66.2	6.046	37.7	63.72
22	6.205	45.0	1.151	8.3	0.128	0.9	7.485	54.3	3.406	24.7	68.73
23	3.582	30.0	0.512	4.3	0.000	0.0	4.094	34.3	0.898	7.5	82.01
24	1.279	12.3	0.192	1.8	0.000	0.0	1.471	14.2	0.000	0.0	100.00
25	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.449	4.9	0.00
26	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.000	0.0	0.00
<17	34.673	64.2	25.205	45.8	3.263	6.1	63.140	116.2	85.579	154.4	42.94
17+	132.678	598.8	32.626	140.9	5.694	23.2	170.997	763.0	140.368	580.6	56.79
TOT	167.351	663.1	57.831	186.7	8.956	29.4	234.138	879.2	225.948	735.0	54.47

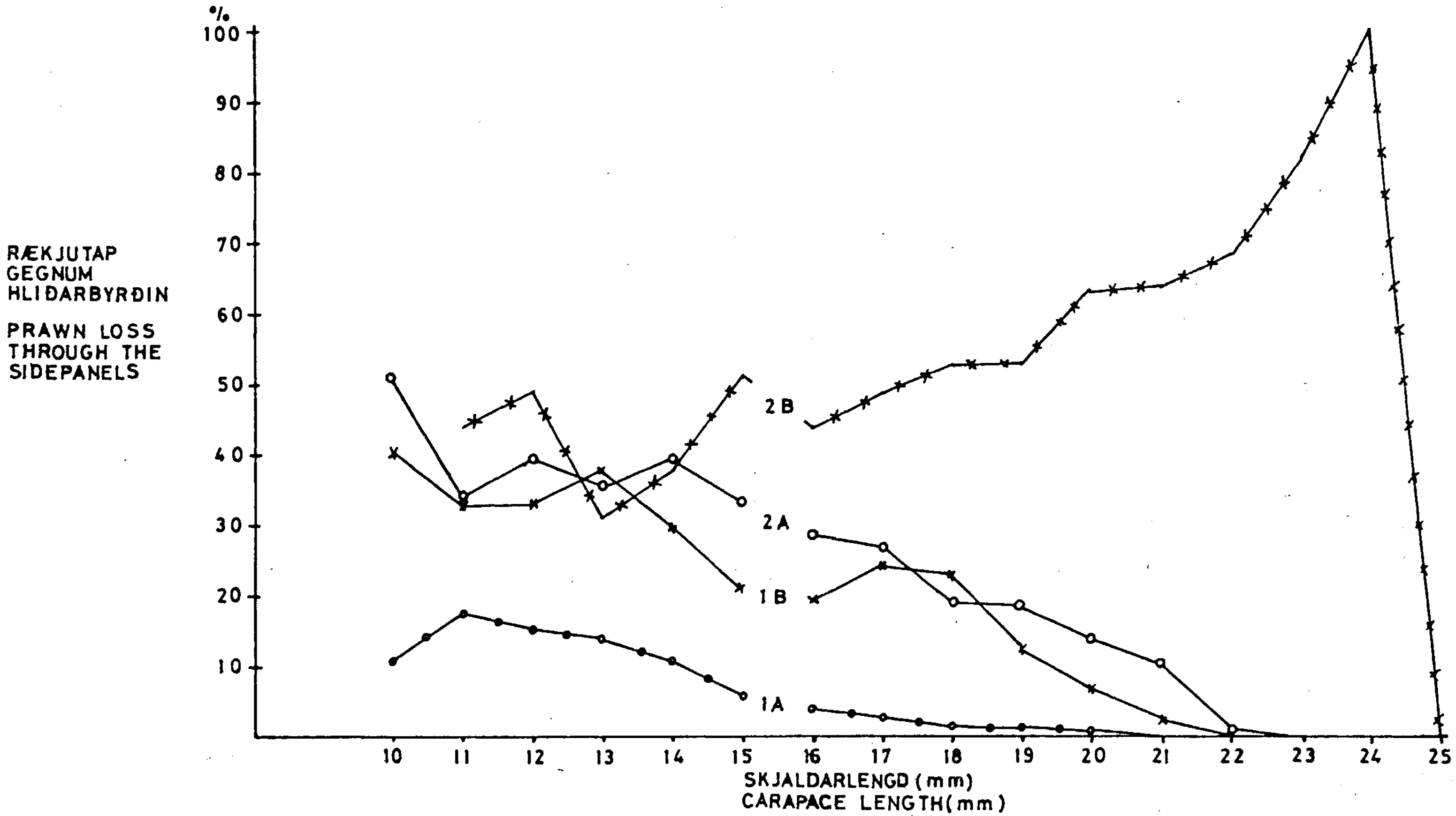

Figure 3.: Relative loss of prawn through all panel versions in relation to prawn size.

TABLE 5

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COMPARISON OF LOSSES BETWEEN PANEL VERSIONS, %

CARAPACE LENGTH(MM)	PANEL 1A	PANEL 1B	PANEL 2A	PANEL 2B
6	0.00	0.74	9.63	-1.08
7	0.00	3.63	5.48	99.54
8	0.00	5.93	9.29	76.94
9	0.00	-67.25	32.75	-67.25
10	0.00	30.79	40.99	-10.12
11	0.00	15.34	16.42	26.57
12	0.00	18.18	24.83	34.72
13	0.00	24.38	22.04	17.49
14	0.00	18.60	28.14	26.68
15	0.00	15.46	27.24	45.46
16	0.00	15.99	24.71	40.45
17	0.00	21.45	24.04	45.73
18	0.00	21.50	16.97	50.99
19	0.00	11.78	17.18	52.14
20	0.00	5.91	13.09	62.68
21	0.00	2.32	10.18	63.72
22	0.00	0.00	1.37	68.73
23	0.00	0.00	0.00	82.01
24	0.00	0.00	0.00	100.00
25	0.00	0.00	0.00	0.00
26	0.00	0.00	0.00	0.00
<17	0.00	17.02	24.40	34.27
17+	0.00	16.48	16.96	55.01
TOT	0.00	17.08	19.61	49.61