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International Council for the
Exploration of the Sea

CM1979/H:4
Pelagic Fish Committee

Report of the Working Group on Herring Larval Surveys South of 62°N

26-27 April 1979, Charlottenlund

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<u>Contents</u>	<u>Page</u>
1. Introduction	1
2. Conduct of Future Surveys	1
2.1 Survey Planning	1
2.2 Sampling Gear and Treatment of Samples	3
3. Estimates of Larval Abundance in 1978 and of Spawning Stock Size Derived From Them	3
3.1 North Sea	3
3.2 Division VIa	6
4. Other Surveys	7
4.1 Early Larval Surveys in Kattegat and Skagerrak	7
4.2 Early Larval Surveys in the Celtic Sea	7
4.3 Surveys of Late Herring Larvae in the North Sea and Skagerrak	7

REPORT OF THE WORKING GROUP ON HERRING LARVAL SURVEYS SOUTH OF 62°N

1. INTRODUCTION

In accordance with the recommendation of the Statutory Meeting of ICES (C. Res. 1978/2:13), the Working Group on Herring Larval Surveys South of 62°N met at Charlottenlund from 6-27 April 1979 with the following terms of reference:

1. A better balance of sampling effort should be obtained between the North Sea and Division VIa.
2. Should meet in 1979 in close connection with the Herring Assessment Working Group for the Area South of 62°N in order to assess the methods of using larval abundance estimates for spawning stock assessment.

The following participants attended the meeting:

A Saville (Chairman)	UK (Scotland)
J Beyer	Denmark
H Bjørke	Norway
A Corten	Netherlands
O Hagstrom	Sweden
G Joakimsson	Federal Republic of Germany
A Maucorps	France
D Schnack	Federal Republic of Germany
R J Wood	UK (England)

2. CONDUCT OF FUTURE SURVEYS

2.1 Survey Planning

The Working Group was asked to consider whether it was possible to achieve a better balance of sampling effort between larval surveys conducted in the North Sea (Region IV) and to the west of Scotland (Division VIa). The following surveys are planned for the autumn and winter of 1979/80.

<u>Area</u>	<u>September</u>	<u>October</u>
<u>VIa</u>	Scotland (first & second halves)	Scotland (first half)
<u>Northern North Sea</u>		
<u>Orkney/Shetland</u>	Germany (FRG) (27 Aug-07 Sept) Netherlands (first & second halves)	Scotland (first half)
<u>Buchan</u>	Scotland (first & second halves)	
<u>Central North Sea</u>	England (24 Aug-06 Sept) Netherlands (first & second halves)	England (27 Sept-09 Oct) Norway (08-25 Oct)
	<u>December</u>	<u>January</u>
<u>Southern North Sea/ English Channel</u>	Netherlands (second half)	Netherlands (first half) England (second half)*

* Provisional

It was clear that no diversion of effort would be possible during 1979 from the North Sea to Division VIa without reducing the coverage in the North Sea below the level necessary to produce acceptable estimates of spawning stock size (Anon, 1977). The Group agreed that sampling in Division VIa during 1979 was likely to be barely adequate but no way of improving the situation could be envisaged without the participation of additional sampling effort in these surveys.

The provisional sampling scheme for 1980, given in the text-table below, was planned by the Working Group on the basis of the sampling effort which it was thought might possibly be available in that year. It must be stressed, however that the members present could make no firm commitment regarding the availability of their countries research vessels for this project so far in advance, and that, in particular, the bracketed inputs by Norway, Germany and France are highly speculative.

Area	September		October	
	First Half	Second Half	First Half	Second Half
VIa	Scotland	(Germany (FRG)) (Norway)	Scotland (France)	(France)
Orkney/Shetland IVa	Germany (FRG) Netherlands	Netherlands	Scotland	
Buchan	Scotland	Scotland	England	
IVb	England Netherlands	Netherlands	England	Norway
IVc		December Netherlands	January Netherlands	England

The advisability of reducing the standard station interval of 10 miles in areas of exceptionally high larval abundance was considered. It was decided to recommend that during future surveys an attempt should be made to identify stations having a very high density (approx 10^2 per sample) of small herring larvae immediately after each station, so that additional stations could then be worked at 5-mile intervals both north/south and east/west around such high density stations.

It was further recommended that, in order to ensure better coordination of sampling effort during future surveys, regular radio contact should be maintained by survey vessels with Mr A Saville (or deputy) by means, if possible, of radio-link (Telephone: Aberdeen 876544). As a result of discussion of this topic during the meeting of the Working Group on Larval Fish Distribution in April 1979 it was agreed that some members of the Working Group on Herring Larval Surveys South of 62° N should re-examine the data collected on past surveys with a view to assessing whether estimates of abundance could be obtained with a more acceptable degree of precision whilst maintaining the same sampling effort, or with the same degree of precision but with smaller sampling effort by a more efficient sampling design.

2.2 Sampling Gear and Treatment of Samples

Doubts were expressed whether the standard sampling gear had been specified in sufficient detail, particularly in respect of the length and mouth aperture and twine thickness of the material of which it is constructed, and the angle of the nose cone. Accordingly a full specification of the Dutch Gulf III (Zilstra, 1970), in the slightly modified form which is used by the majority of participating countries, is given in Appendix 1.

There also appeared to have been some confusion as to the maximum depth to which the sampler should be fished in deeper water. It was agreed that, although it would in some cases involve slightly more time being spent in taking samples, at all stations the sampler should be fished to within 5 metres of the bottom irrespective of the depth at the station.

After discussing the examination and identification of herring larvae in the samples, the Working Group decided to recommend that particular care should be paid to the handling of the samples once the sampler has been recovered, particularly with regard to the washing down process, in order to minimise both possible damage and loss of the smallest sizes of herring larvae. At a previous meeting of the Working Group (Anon, 1971) it had been recommended that, in future estimates of abundance of small larvae, yolk sac larvae should be omitted. This recommendation, which was introduced because it was thought that participating countries caught yolk sac larvae with very differing efficiencies because of their differing abilities to fish sufficiently close to the bottom, has subsequently been followed. Accordingly to include yolk sac larvae in these estimates now would introduce a bias between past and future data which would in turn bias estimates of spawning stock size derived from the smaller larval abundances. However the initial reason for omitting yolk sac larvae is no longer valid now that all countries are using depth monitoring systems which allow them to sample close to the bottom. Accordingly it was decided that in future yolk sac larvae should not be included in the estimates of abundance of larvae less than 10mm which are used in estimating spawning stock size; but they should be reported, as a separate category, in the exchange of data between participating countries.

3. ESTIMATES OF LARVAL ABUNDANCE IN 1978 AND OF SPAWNING STOCK SIZE DERIVED FROM THEM

3.1 North Sea

3.1.1 Larval abundances

In the Orkney-Shetland area, four surveys were carried out in 1978, but of these two were done in the second half of August and one, predominantly in the first half of October. In former years, very little sampling had been done in this area except in September and accordingly regressions of stock size on early herring larval abundance can be done only for abundance of larvae in September surveys. As a result of the distribution of sampling in time in

1978, there is only one survey which can be used to calculate larval abundance as an input to the existing stock size regression equations. This survey was carried out in the first half of September. In previous years the index of larval abundance, the mean of all September surveys, was in all years based on at least one survey from each of the first and second halves of that month. To correct for the lack of sampling in the second half of September in 1978, the Working Group looked at the mean abundances of larvae in the two parts of the month of the years 1971-1977. These were:

	<u>1st half September</u>	<u>2nd half September</u>
1971	17.42 x 10 ¹¹	3.61 x 10 ¹¹
1972	14.37 x 10 ¹¹	7.95 x 10 ¹¹
1973	19.77 x 10 ¹¹	7.55 x 10 ¹¹
1974	12.23 x 10 ¹¹	2.24 x 10 ¹¹
1975	4.55 x 10 ¹¹	0.66 x 10 ¹¹
1976	7.32 x 10 ¹¹	0.63 x 10 ¹¹
1977	11.73 x 10 ¹¹	2.77 x 10 ¹¹

Based on these values it is clear that, over this period of years, the abundance of early larvae was very much higher in the first than in the second half of September. On this basis, the Working Group decided that, to calculate an abundance index for 1978, it should take the mean ratios of the values (0.26) to estimate from the survey in the first half of September 1978 a mean abundance index for the month as a whole. This gave a value for the Orkney-Shetland area in 1978 of 33.8 x 10¹¹.

The Orkney-Shetland survey in the first half of September 1978 was carried out partly by a Netherlands chartered vessel and partly by a Scottish research vessel with an appreciable number of stations being sampled by both vessels within a fairly short time period. A combined survey estimate was made by taking the mean at all stations sampled by both vessels. The problem with this survey is that, of the value of 53.9 x 10¹¹ small larvae derived from it, 24.2 x 10¹¹ is contributed by a single station at which a mean value of 6 900 early larvae per square meter was found. The values at adjacent stations were all much lower and the Working Group felt there were major dangers in placing so much emphasis in the total estimate on a single station value and one at which repeated sampling, only a few days apart, gave such disparate values as 13 594 and 250. Accordingly in calculating spawning stock size two values were used, one including this mean station value and another in which it was omitted and substituted by the mean of all adjacent station values. The index of early larval abundance in the Buchan area in 1978, which has been added in the past to that of the Shetland-Orkney area to get that for IVa, gave a value for September of 1.69 x 10¹¹. As a result, the two alternative estimates of abundance of early larvae in Division IVa are: 35.64 x 10¹¹, and 23.63 x 10¹¹ (Table 1).

In Division IVb, four surveys were carried out in September-October 1978. From these, a mean abundance index was calculated of 4.70×10^{11} early larvae (Table 1).

3.1.2 Spawning stock estimates

In the past, estimates of spawning stock size from indices of abundance of early larvae have been based on regressions of these larval indices on spawning stock sizes, estimated from separate VPAs on catches per age group in Division IVa and Division IVb. The functional regression equations used were:

$$\begin{aligned} \text{IVa} \quad Y &= 4.171 x + 49.393 \\ \text{IVb} \quad Y &= 7.365 x + 30.044 \end{aligned}$$

where Y is the spawning stock sizes ($\times 10^{-3}$ tonnes) and X is the larval abundance indices ($\times 10^{-11}$) (Anon, 1978).

Using these equations and the abundance indices given above, the following estimates of spawning stock are obtained for 1978:

IVa 198 000 tonnes or 148 000 tonnes depending on which of the alternative larval abundance indices given above is used.

IVb 64 600 tonnes

Saville (1979) has re-examined the data on which these regressions are based. He made only relatively minor adjustments to the larval abundance indices but recalculated the VPA spawning stock estimates by making, in Division IVa, a correction for the immigration of fish from that Division to VIa, and in IVb, by eliminating from the VPA catches of 2-ringed fish taken in the industrial fishery. The latter was based on the argument that there was no reason to assume that these 2-ringed herring taken in industrial catches were exclusively fish which would have spawned in that division. As a result, he produced rather different functional regressions:

$$\begin{aligned} \text{IVa} \quad Y &= 7.18 x - 16.31 \\ \text{IVb} \quad Y &= 7.15 x + 25.05 \end{aligned}$$

where X are the larval abundance indices expressed as larvae $\times 10^{-11}$. He pointed out that with these new regression equations the slopes are almost identical, which seems more logical than the very different slopes in the previous equations, and that for Division IVa the intercept in this new regression is not significantly different from zero. Using these equations, the estimates of spawning stock in 1978 are:

IVa 239 000 tonnes and 153 000 tonnes
IVb 58 700 tonnes

It should be appreciated that although the estimates for IVa using the different regression equations do not differ appreciably with the larval abundance indices which pertained in 1978, they would do so at very different levels of larval abundance, and secondly that they are not strictly estimating the same thing. Because of the way they were calculated, the previous regressions estimated the total population of fish of 2-rings and older in Division IVa at the spawning time, those calculated using Saville's regression exclude any component of VIa fish in this division, which are assumed not to spawn there.

3.2 Division VIa

Larval surveys have now been conducted in Division VIa since 1971, but McKay (1978) was not able to obtain a significant regression between these and estimates of the spawning stock size in that area taken from the VPA carried out by the Herring Assessment Working Group for the Area South of 62°N (Anon, 1978).

Saville (1979) has re-estimated both McKay's larval abundance indices over this period, and the estimates of stock size by taking into account the emigration of fish to Division VIa from the North Sea (Saville and Bailey - in press). As a result, he obtained a highly significant regression with an intercept which was not significantly different from zero. It should also be noted that this regression has a slope almost identical to those for IVa and IVb, which would seem logically necessary in view of the very close fecundity-weight relationships of these stocks. This functional regression is:

$$Y = 58.07 x + 6\ 418$$

where X is expressed as larvae $\times 10^{-9}$ and Y is the spawning stock in tons.

In 1978, two surveys were carried out in VIa, one in the period 1-11 September and the second in the period 23 September-10 October. Saville's regression was based on the mean abundances of September and October surveys, but unfortunately in 1978 very little sampling was done in October and the index of abundance appropriate to this regression equation hinges very much on whether one treats the second survey as a September or October one. The corresponding larval abundance index is $1\ 129 \times 10^9$ or 590×10^9 . Inserting these in the regression equation given above, the corresponding spawning stock estimates are 72 000 tonnes and 41 000 tonnes. Of these, because of the relative distribution of sampling on the second survey between September and October, the first would seem the more likely.

In relation to these estimates, it should be stressed that: (a) because of the method used by Saville these are estimates of the spawning stock size, which must be less than the population of fish of 3-years old and older; and (b) that this regression equation for Division VIa is closely linked to that of Saville for the spawning stock in IVa; it would be logically absurd to accept this equation for VIa whilst continuing to use the Working Group regression for IVa.

4. Other Surveys

4.1 Early Larval Surveys in Kattegat and Skagerrak

The participant from Sweden gave a brief account of work he had been doing in sampling spring-spawning herring larvae and was anxious, in the light of the unsatisfactory data base for assessment of the herring stocks in these areas to see more effort being applied to obtaining, systematically, indices of herring larval abundance as an index of spawning stock size. The Working Group on Herring Larval Surveys South of 62°N would support the inauguration of such surveys in that area and would request the support of the appropriate assessment working groups in achieving this.

4.2 Early Larval Surveys in the Celtic Sea

Mr John Molloy briefly joined the Working Group, in the absence of Mr R Grainger the Irish representative, to report on the surveys carried out in the Celtic Sea in 1978/79. The results of this work showed considerable promise, although the Working Group has some reservations about the procedure used by Mr Grainger to convert the larval abundances to spawning stock biomass. The Working Group expressed its interest in seeing these surveys continued.

4.3 Surveys of Late Herring Larval in the North Sea and Skagerrak

In the previous report of the Working Group results of sampling late herring larvae in the Skagerrak and Waddensea were reported which showed promise of being capable of giving earlier forecasts of the strengths of North Sea year-classes than are currently available (Anon, 1977). On the basis of these data the Working Group then decided that, in conjunction with the International Young Herring Surveys in the North Sea, surveys should be made of late larvae, using Isaac-Kidd mid-water trawls. The results of this programme to date were reviewed and the problems which some countries have had in handling this gear were discussed. It was decided that this programme should be continued, with the area sampled being extended to cover all squares fished during the International Young Fish Surveys, instead of only the area south of 57°30'N.

It was agreed that during the next meeting of the Herring Larval Survey Group for the Area South of 62°N time should be made available for a complete review of all the data collected in relation to this project, with a view to assessing its significance not only in relation to forecasting year-class strength but also in relating nursery sites to spawning areas. In the interim Mr Hagstrom reported the results of his sampling of these stages in the Skagerrak since the last meeting of the Working Group. These continued to show a reasonable relationship to the known estimates of year-class strength in the North Sea.

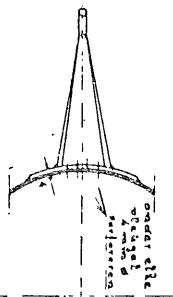
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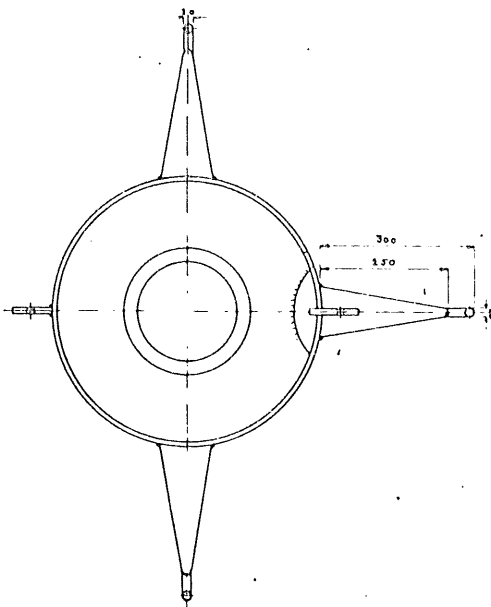
Table 1 Larval Abundance Indices in Divisions IVa and IVb Used in Spawning Stock Size Regressions ($\times 10^{-9}$).

	Division IVa			Division IVb	
	Shetland	Buchan	Total		
1967	-	-	-	03-08/09	1003
				10-13/10	194
				Mean	599
1968	-	-	-	03-05/09	141
				15-23/10	133
				Mean	137
1969	-	-	-	09-11/09	9
				06-14/10	19
				Mean	14
1970	-	-	-	26/08-11/09	199
				08-16/09	554
				06-12/10	171
				Mean	308
1971					
31/08-09/09	1742	214		07-15/09	108
16-27/09	361	138		15-23/09	148
20-30/09	-	76		02-07/10	374
Mean	1051	143	1193	12-20/10	47
				Mean	169
1972					
06-11/09	1437	70		03-13/09	159
22-27/09	795	5		19-27/09	105
				30/09-06/10	160
				17-26/10	23
Mean	1116	37	1153	Mean	112
1973					
28/08-03/09	1055	1		04-12/09	526
07-14/09	1977	4		18-26/09	1008
18-25/09	755	4		27/09-06/10	1220
				16-24/10	158
Mean	1262	3	1265	Mean	726
1974					
07-19/09	1223	97		27/08-01/09	64
23/09-02/10	224	480		02-09/10	1271
Mean	724	289	1013	Mean	668
1975					
03-19/09	445	231		15-23/09	91
10-24/09	116	1		08-14/10	79
20-25/09	66			21-29/10	8
Mean	212	116	328	Mean	59
1976					
04-11/09	732	1		03-14/09	86
13-23/09	63	1		16-24/09	137
				28/09-10/10	4
Mean	398	1	399	18-23/10	12
1977					
31/08-12/09	1128	102			
05-10/09	1629	25			
05-15/09	763				
18-24/09	258				
20/09-06/10	295				
Mean	815	63	878		

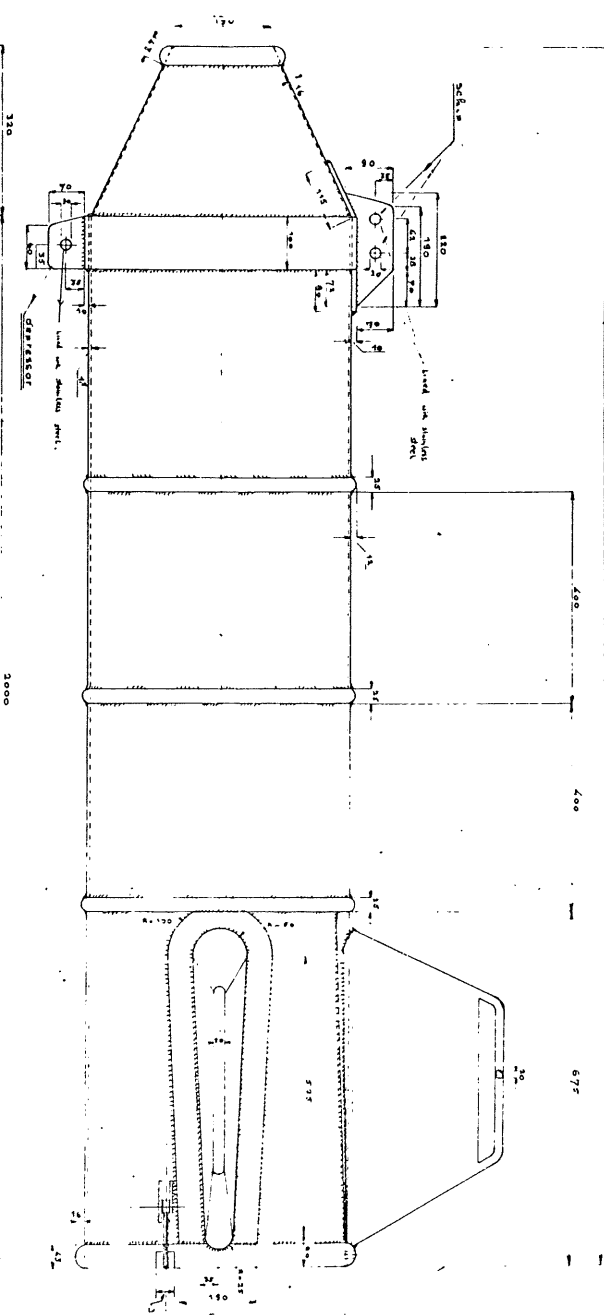
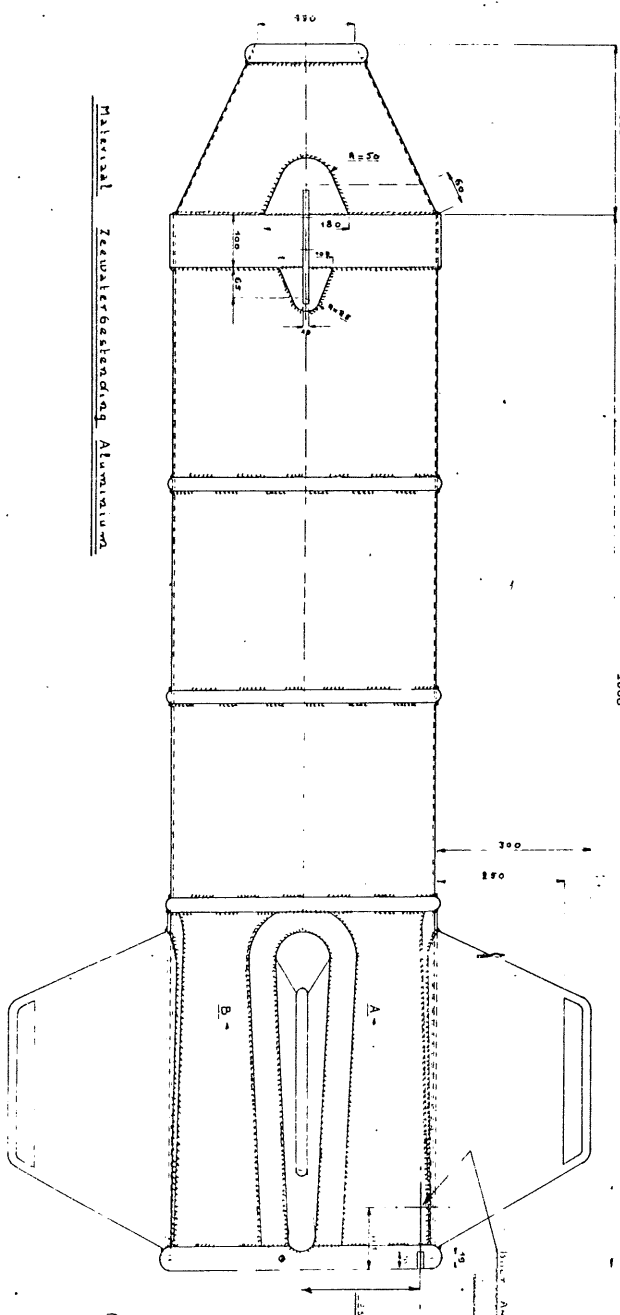
APPENDIX 1



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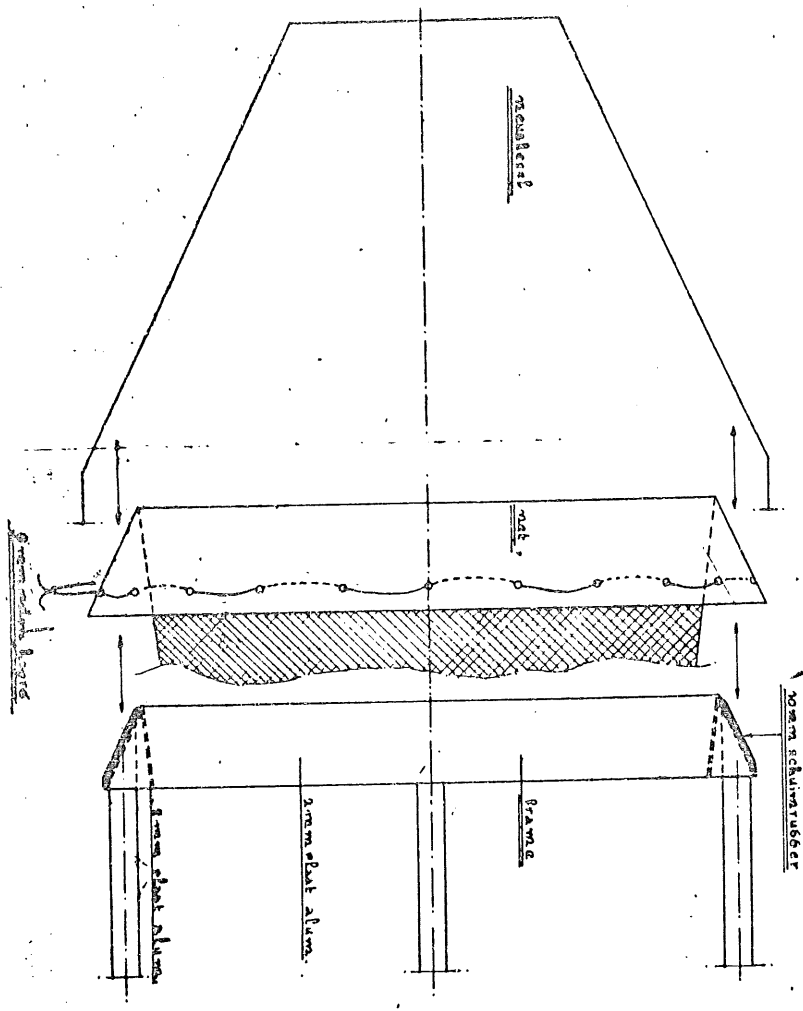
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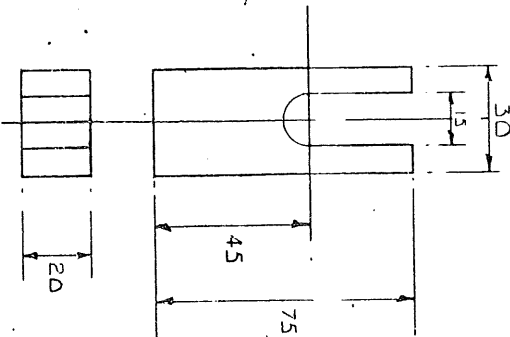
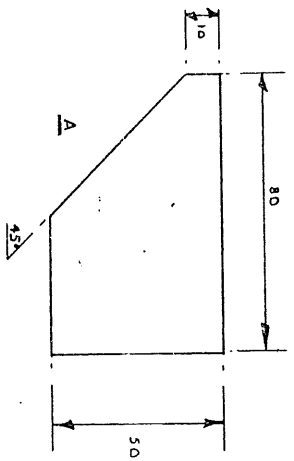
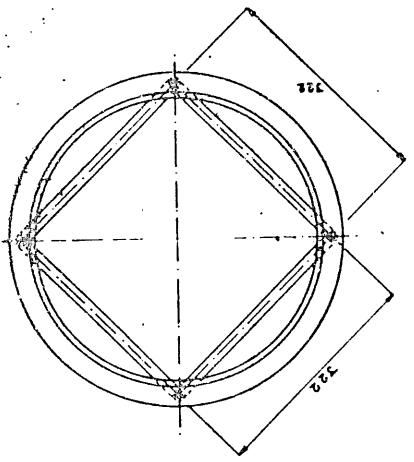
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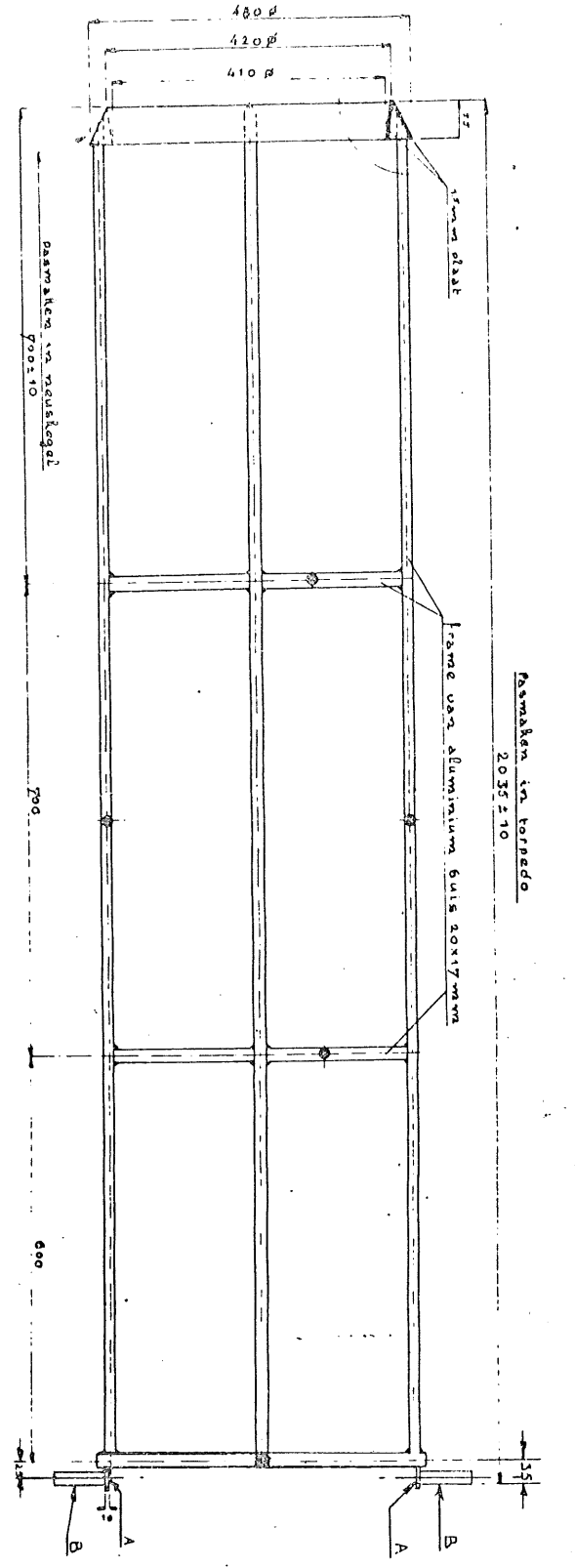
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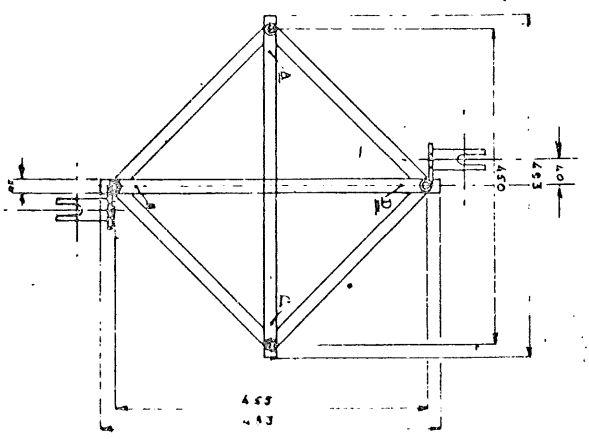
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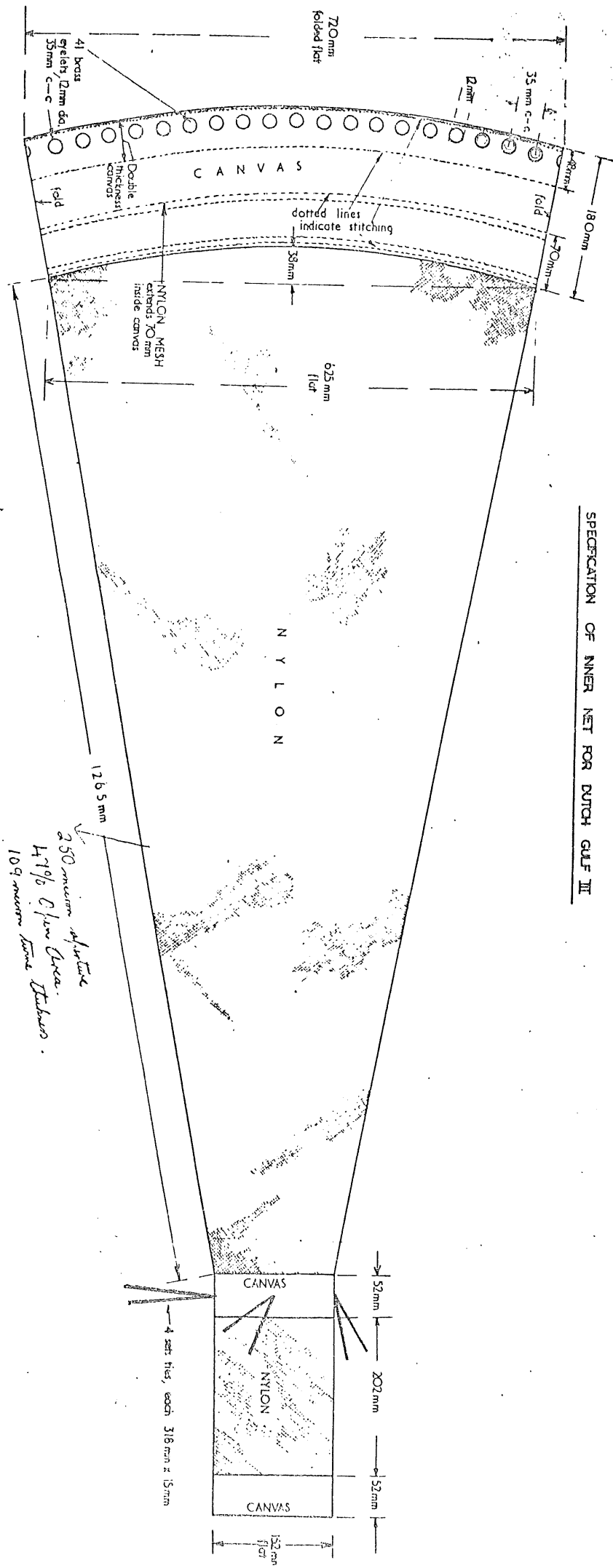


Welded in Position



Normen in torpede 2035 ± 10





SPECIFICATION OF INNER NET FOR DUTCH GULF III