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REPORT OF THE NORTH SEA ROUNDFISH WORKING GROUP
SPECIAL MEETING ON DATA BASE PROBLEMS

Aberdeen, 11-17 February 1981

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x) General Secretary,
ICES,
Palægade 2-4,
DK-1261 Copenhagen K,
Denmark.

TABLE OF CONTENTS

	<u>Page</u>
1. Terms of Reference	1
2. Participants	1
3. Background	1
4. The Data Bases	1
5. Documentation	5
6. West of Scotland (Division VIa) Stocks	5
Tables 1 - 9	6-12

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REPORT OF THE NORTH SEA ROUNDFISH WORKING GROUP
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1. Terms of Reference

It was recommended (C.Res.1980/2:6) that "appropriate members of the North Sea Roundfish Working Group should meet in Aberdeen from 11 to 17 February 1981, to complete the revision of their data bases started at the 1980 meeting of the Working Group. The results of this revision should be reported to the assessment meeting of this Working Group scheduled for 24 March to 2 April".

2. Participants

D W Armstrong	United Kingdom (Scotland)
H B Becker	Netherlands
T Jakobsen	Norway
B W Jones (Chairman)	United Kingdom (England & Wales)
C J Kuiter	Netherlands
F Lamp	Federal Republic of Germany
C T Macer	United Kingdom (England & Wales)
P Sparre	Denmark
G Wagner	Federal Republic of Germany.

3. Background

The data, on which all the analytical assessments are based, are the age compositions of the catches. Where appropriate, national age compositions are summed for each component of the fishery (human consumption, industrial and discards), these sub-totals, which may be raised to take account of catches by countries for which age compositions are unknown, are then summed to give age compositions as total numbers caught by all countries combined for each stock. These data bases for most stocks extend back to 1960. However, detailed examination of the historic data series has shown that they were not consistent over the whole time period. In particular, improvements in data collection in recent years have resulted in more extensive data becoming available for the industrial fisheries and for discards. Thus, whereas in recent years the age compositions included industrial by-catches and discards, these were not included for all countries in the earlier years, when such data were not available. In addition, it appears that there have been variations in the method of processing the age composition data from year to year.

A start was made last year to revise the catch age composition data for the main stocks. However because of the magnitude of the job and because of the need for consultation between members of the Working Group a special meeting was arranged to complete the job.

4. The Data Bases

Catches of cod, haddock and whiting are divided into three categories: human consumption landings, discards from the human consumption fisheries, and industrial (small mesh) fishery by-catches. The basic data are of numbers caught at each age in each

category by each country. The availability of original data varies for the different species/category/country groupings. The earliest data considered by the Group were those for 1960 and, as would be expected, the quantity of data increases with time and the data sets for the more recent years are the most comprehensive.

For the Special Meeting computer facilities and programmes for data handling were kindly made available by Mr D W Armstrong and the Marine Laboratory. The processing of the data consisted of three stages:-

- (i) Original national annual age composition data were input into the computer together with the nominal weight of catch. Each age composition was accompanied by a set of weight-at-age data. The derivations of the original data are indicated in Tables 1-3. In some cases age compositions have been derived from national length compositions converted to age using another country's age/length keys. The computer program required all age compositions to be accompanied by weight-at-age data. These were generally derived from mean length-at-age data converted to weight, but where no original data were available suitable substitute data were input.
- (ii) A listing of the completed sets of original data was made and checked. The sums of products (SOPs) of numbers x average weight calculated during the processing of the data were compared with nominal weights of catches. Either the numbers at age (Scottish data only) or weight-at-age data were adjusted by the ratio SOPs to nominal weight.
- (iii) Within each category annual data were summed and raised to provide estimated total international age compositions for catches of all countries combined. The procedures adopted to allow for catches by countries for which no original age compositions were available are described below.

Raising Procedures

(a) North Sea human consumption landings

The same procedure was adopted for all three species. The available age compositions for sampled countries in each year were summed. The resultant age composition was prorated by the ratio of weight landed by 'other' countries to weight landed by sampled countries. This gave an age composition for 'other' countries which when added to that for all sampled countries gave the total international age composition for human consumption landings.

Alternative ways of making allowance for unsampled countries were discussed by the Group, but the Group was not convinced that any more elaborate procedure would have been more valid than the one described above.

(b) North Sea discards

Sampling of fish discarded can be undertaken only by scientific observers who go to sea and record quantities discarded and measure samples of the discarded fish. Only two countries, Netherlands and Scotland have data from such sampling programmes for years up to 1979, Netherlands from 1968 and Scotland from 1975.

In the absence of any other data, and after inspection of the age compositions of the human consumption landings, the Group considered a number of options but concluded that the best approach would be to assume that countries with human consumption fisheries which could not provide discard data were discarding fish with age compositions similar to the reported age compositions and that the quantities discarded would be in the same proportion to human consumption landings as those for countries reporting discards. This procedure was adopted for all three species.

For cod there was no information on discarding during the period 1963-67. Age compositions were therefore estimated from those of consumption landings by assuming that, in each age group, the ratio of numbers discarded to those landed was the same as the mean ratio for years in which samples were available (Table 4). The total weight discarded in each year was estimated by multiplying the estimated numbers by mean weights, the latter being the average values for 1978 and 1979 (the only years for which both Scottish and Netherlands data are available).

(c) North Sea industrial fishery by-catch

Also included in this category for cod and whiting are by-catches taken in the crangonid shrimp fisheries. For cod it was assumed that countries other than the Federal Republic of Germany which have shrimp fisheries (Netherlands excluded) would have by-catches of cod similar to those of the Federal Republic of Germany. The age compositions reported by the Federal Republic of Germany were therefore raised by the factor:

$$\frac{\text{Weight of shrimp landed by all countries except Netherlands}}{\text{Weight of shrimp landed by Federal Republic of Germany}}$$

To give an estimate of the total numbers at each age landed in the international shrimp fishery Netherlands was excluded because estimates for by-catches in the shrimp fishery have been included in their discard data.

By-catch data for cod in the industrial fisheries were available for Norway for 1975-79 and for Denmark for 1974-79. Samples taken from Danish industrial landings contained only small numbers of cod and consequently the weights of the cod by-catches and the age compositions are not very reliably estimated. As the quantities of cod taken as by-catches are relatively small and because of the limited amount of data for this species the Group considered it inadvisable to attempt to reconstruct age compositions of cod by-catches in the industrial fisheries for the earlier years in the manner that is described below for haddock.

For haddock, age compositions of by-catches in the industrial fisheries were available for Denmark for 1972-79 and for Norway for 1974-79. To have a consistent data series it is necessary to include estimated age compositions of by-catches for all years. Accordingly estimates for the years 1960-71 were prepared as follows.

- (1) For the period 1972 to 1979 the ratio of the number per tonne in the Danish industrial catch to the number per tonne in the total human consumption landings was computed for ages 1 to 7. A mean of the ratios was derived from this data set (Table 5).

- (2) Using these values the estimated number per tonne for ages 1 to 7 in the Danish industrial catch for the period 1960 to 1971 were derived from corresponding values of numbers per tonne in the total human consumption landings. The total estimated number of haddock landed as industrial by-catch was then obtained by multiplying by the appropriate weight landed.
- (3) Using data for the period 1972 to 1979 the ratio of the number per tonne in the Danish industrial landings at age 0 in year t to the corresponding value at age 1 in year $t + 1$ was evaluated. A mean value was then obtained (Table 6).
- (4) These values were then used to estimate the number at age 0 in the Danish industrial catch from the number at age 1 as estimated in paragraph (3) above.
- (5) The numbers at age in the Danish industrial landings were then adjusted by SOP to agree with the nominal weight of Danish landings. The mean weights at age used to evaluate SOPs are shown in Table 7.
- (6) For the years 1965-67 total landings of industrial by-catches were estimated because the national statistics for Denmark do not give separately the landings for human consumption and industrial purposes. For the years 1960-63 no data of total landings were available and a value of 10 000 tonnes was estimated for Danish industrial landings.

It should be added that the procedure described above is far from satisfactory, especially since very large SOP corrections were required to make the landed weight estimated from Danish age compositions agree with the nominal landed weight. However, the method does at least produce Danish age compositions which are more realistic than those used in assessments prior to 1980. In addition, the method also ensures that relative year class abundances are preserved in the estimated Danish age composition.

Having thus obtained estimates of Danish age compositions for 1960-71 these were then raised by the ratio:

Total weight of industrial by-catch all countries

Weight of industrial by-catch of Denmark

For years when age compositions were reported by both Denmark and Norway these were first summed before raising to the total international landings.

Estimates of by-catches in industrial fisheries of the Federal Republic of Germany were available. For Norway (1960-71) and the Faroe Islands (1969-78), by-catches had to be estimated using the landings of Norway pout as a basis. These figures were available from the report of the Working Group on Norway Pout and Sandeels in the North Sea 1978 and, for Faroe for 1977-78, from the Bulletin Statistique. It was assumed that the by-catch of haddock amounted to the same percentage of Norway pout landings as in the Danish industrial fishery. However, for Norway, in the years for which Norwegian estimates exist, the estimates derived from this method were consistently higher and therefore the estimates for the earlier years were reduced accordingly.

For whiting, age compositions of industrial by-catches were available for Denmark (1960-66 and 1970-79) and Norway (1975-79). In addition there were estimated age compositions for Danish by-catches for 1967-69. Either Danish or Danish plus Norwegian age compositions were raised to represent age compositions from the total international industrial fishery. Where necessary the weight landed as industrial catch was estimated as described for haddock. Age compositions of whiting by-catches in shrimp fisheries of the Federal Republic of Germany were available for 1960-67.

5. Documentation

Two sets of documents produced by the Working Group have been deposited with the ICES Statistician. For each species and each category these consist of:

- (i) Computer listings of the original age composition data and the corresponding nominal weight of the catch, together with the accompanying weight-at-age data.
- (ii) Computer listings of the above data after Sums of Products adjustment. The nominal weight of catch and the Sums of Products calculated from the data in (i) are also printed. In addition, the summations and raising to allow for unsampled countries is also printed. This listing is annotated with the quantities caught by each country for which age compositions were not available.

The weight-at-age data printed in the columns of summed or raised age compositions are weighted average values.

Examples of documents (i) and (ii) are given as Tables 8 and 9.

6. West of Scotland (Division VIa) Stocks

In the time available it was not possible to make a full revision of the data bases for the West of Scotland stocks. Furthermore, not all the data required for this were available at the meeting. It is hoped that some progress will be made with these data before the March meeting of the Working Group but it may not be possible to complete the work, and further revision may be necessary before the 1982 Working Group meeting.

TABLE 1. COD. NORTH SEA. KEY TO BASIC DATA

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
<u>HUMAN CONSUMPTION LANDINGS</u>																				
BELGIUM	1. LENGTH COMPOSITION																			
	2. ALK																			
	3. WEIGHT AT AGE																			
DENMARK	1. LENGTH COMPOSITION																			
	2. ALK																			
	3. WEIGHT AT AGE																			
ENGLAND	1. LENGTH COMPOSITION																			
	2. ALK																			
	3. WEIGHT AT AGE																			
FRANCE	1. LENGTH COMPOSITION																			
	2. ALK																			
	3. WEIGHT AT AGE																			
NETHERLANDS	1. LENGTH COMPOSITION																			
	2. ALK																			
	3. WEIGHT AT AGE																			
SCOTLAND	1. LENGTH COMPOSITION																			
	2. ALK																			
	3. WEIGHT AT AGE																			
<u>DISCARDS</u>																				
NETHERLANDS	1. LENGTH COMPOSITION																			
	2. ALK																			
	3. WEIGHT AT AGE																			
SCOTLAND	1. LENGTH COMPOSITION																			
	2. ALK																			
	3. WEIGHT AT AGE																			
<u>INDUSTRIAL / SMALL MESH FISHERIES</u>																				
DENMARK	1. LENGTH COMPOSITION																			
	2. ALK																			
	3. WEIGHT AT AGE																			
GERMANY FED. REP.	1. LENGTH COMPOSITION																			
	2. ALK																			
	3. WEIGHT AT AGE																			
NORWAY	1. LENGTH COMPOSITION																			
	2. ALK																			
	3. WEIGHT AT AGE																			

TABLE 2. HADDOCK. NORTH SEA. KEY TO BASIC DATA

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
<u>HUMAN CONSUMPTION LANDINGS</u>																				
BELGIUM	1. LENGTH COMPOSITION																			← BELGIAN DATA
	2. ALK																			← BELGIAN ALK
	3. WEIGHT AT AGE																			← ENGLISH DATA
ENGLAND	1. LENGTH COMPOSITION	← ENGLISH DATA TRAWL AND "OTHER" GEARS SEPARATELY →														← ENGLISH DATA ALL GEARS →				
	2. ALK	← SCOTTISH ALK →														← ENGLISH ALK →				
	3. WEIGHT AT AGE	← 1 = 3 = 0.00000962 →																		
FRANCE	1. LENGTH COMPOSITION																			← FRENCH DATA
	2. ALK																			← FRENCH ALK
	3. WEIGHT AT AGE																			← 1979 DATA
NETHERLANDS	1. LENGTH COMPOSITION	← NETHERLANDS DATA →																		
	2. ALK	← SCOTTISH ALK →														← NETHERLANDS ALK →				
	3. WEIGHT AT AGE	← 1 = 3 = 0.00000962 →																		
POLAND	1. LENGTH COMPOSITION																			← POLISH DATA
	2. ALK																			← POLISH ALK
	3. WEIGHT AT AGE																			← SCOTTISH DATA
SCOTLAND	1. LENGTH COMPOSITION	← SCOTTISH DATA →																		
	2. ALK	← SCOTTISH ALK →																		
	3. WEIGHT AT AGE																			
<u>DISCARDS</u>																				
NETHERLANDS	1. LENGTH COMPOSITION	← NETHERLANDS DATA →																		
	2. ALK	← SCOTTISH ALK →														← NETHERLANDS ALK →				
	3. WEIGHT AT AGE	← 1 = 3 = 0.00000962 →																		
SCOTLAND	1. LENGTH COMPOSITION																			← SCOTTISH DATA
	2. ALK																			← SCOTTISH ALK
	3. WEIGHT AT AGE																			
<u>INDUSTRIAL BY- CATCH</u>																				
DENMARK	1. LENGTH COMPOSITION																			← DANISH DATA
	2. ALK																			← DANISH ALK
	3. WEIGHT AT AGE																			← DANISH DATA
NORWAY	1. LENGTH COMPOSITION																			← NORWEGIAN DATA
	2. ALK																			← SCOTTISH RV ALK
	3. WEIGHT AT AGE																			← 1 = 3 = 0.00000962

TABLE 3. WHITING. NORTH SEA. KEY TO BASIC DATA.

		1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
<u>HUMAN CONSUMPTION LANDINGS</u>																					
BELGIUM	1. LENGTH COMPOSITION																			← BELGIAN DATA →	
	2. ALK																			← BELGIAN ALKs →	
	3. WEIGHT AT AGE																			← ENGLISH DATA →	
ENGLAND	1. LENGTH COMPOSITION	ENGLISH DATA																			
	2. ALK	SCOTTISH ALKs										ENGLISH ALKs									
	3. WEIGHT AT AGE	1 = 3 = 0.00000808																			
FRANCE	1. LENGTH COMPOSITION																			← FRENCH DATA →	
	2. ALK																			← DUTCH/BELGIAN/FRENCH ALK →	
	3. WEIGHT AT AGE																			← 1979 DATA →	← FRENCH DATA →
NETHERLANDS	1. LENGTH COMPOSITION	NETHERLANDS DATA																			
	2. ALK	NETHERLANDS ALKs																			
	3. WEIGHT AT AGE	AVERAGE OF 1968-1970										1 = 3 = 0.00000808									
SCOTLAND	1. LENGTH COMPOSITION	SCOTTISH TRAWL AND 'OTHER' GEARS SEPARATELY																			
	2. ALK	SCOTTISH ALKs																			
	3. WEIGHT AT AGE																				
USSR	1. LENGTH COMPOSITION																				
	2. ALK																				
	3. WEIGHT AT AGE																				
<u>DISCARDS</u>																					
NETHERLANDS	1. LENGTH COMPOSITION	NETHERLANDS DATA																			
	2. ALK	NETHERLANDS ALKs																			
	3. WEIGHT AT AGE	AVERAGE OF 1968-1970										1 = 3 = 0.00000808									
SCOTLAND	1. LENGTH COMPOSITION																			← SCOTTISH DATA →	
	2. ALK																			← SCOTTISH ALKs →	
	3. WEIGHT AT AGE																				
<u>INDUSTRIAL/SMALL MESH FISHERIES</u>																					
DENMARK	1. LENGTH COMPOSITION	DANISH DATA										DANISH DATA									
	2. ALK	SCOTTISH RESEARCH VESSEL ALKs										SCOTTISH R.V. ALKs									
	3. WEIGHT AT AGE	1 = 2.9988 = 0.000007586										1 = 2.9988 = 0.000007586									
GERMANY	1. LENGTH COMPOSITION	BY-CATCHES IN SHRIMP FISHERIES																			
	2. ALK	LENGTH FREQUENCY ANALYSIS																			
	3. WEIGHT AT AGE	GERMAN ESTIMATES																			
NORWAY	1. LENGTH COMPOSITION																			← NORWEGIAN DATA →	
	2. ALK																			← SCOTTISH R.V. ALKs →	
	3. WEIGHT AT AGE																			1 = 3 = 0.00000808	

Table 4. North Sea COD. Ratios of numbers discarded to numbers landed from human consumption fisheries in sampled years. Values with asterisks were not included in the mean.

Year	Age group		
	I	II	III
1968	.533	.038	.006
1969	1.610	.133	
1970	1.177	.065	
1971	.866	.110	
1972	1.032	.098	.007
1973	1.848	.045	.004
1974	.264	.013	
1975	1.136	.020	
1976	.911	.027	
1977	1.630	.026	
1978	1.200	.424*	.012
1979	5.539*	.293*	.043
Mean	1.110	.057	.014

Table 5 HADDOCK North Sea 1972-1979
Estimated no./tonne in Danish industrial landings:
No./tonne in total human consumption landings

Age	1972	1973	1974	1975	1976	1977	1978	1979	Mean 1972-1979
0									
1	13.0	314.1	37.4	17.2	104.3	72.1	102.8	49.0	88.7
2	1.8	1.0	2.16	1.49	3.23	3.96	2.0	.67	2.0
3	.2	0	.68	.36	.79	1.14	.23	.08	.5
4	.05	.03	.32	.04	-	.24	.04	-	.1
5	.02	.74	-	-	.42	.25	-	-	.16
6	-	0	.34	-	-	.16	-	-	.06
7	-	0	.08	-	-	-	-	-	.01
8	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-
10+	-	-	-	-	-	-	-	-	-

Table 6 HADDOCK North Sea 1972-1979
No./tonne at age 0 in year t: No./tonne at age 1 in year t + 1
in Danish industrial landings

1972/73	1973/74	1974/75	1975/76	1976/77	1977/78	1978/79	Mean
.77	.62	.69	.39	.83	.20	3.8	1.0

Table 7 HADDOCK North Sea. Mean weight at age in Danish
industrial landings

Age	Mean weight
0	.01
1	.04
2	.18
3	.30
4	.40
5	.42
6	.44
7	.50

Human Consumption Landings COD North Sea 1977

	Col no 1		Col no 2		Col no 3		Col no 4		Col no 5		
	TRAWL	SCD	TRAWL	SCD	OTHER	REL	ALL	BEN	ALL		
	Data		Data		Data		Data		Data		
Age	Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight	
0				0.190							
1	1976	0.520	440	0.621	6209	0.591	327	0.540	4735	0.480	
2	6250	0.580	604	1.267	7962	0.993	6661	1.370	9832	0.840	
3	572	1.830	890	2.938	5041	2.269	655	3.040	6615	1.750	
4	357	3.510	239	5.311	1088	4.906	84	5.670	593	4.050	
5	83	5.350	73	7.139	629	7.158	47	7.260	535	6.310	
6	12	6.330	32	8.558	100	9.634	11	10.620	272	8.660	
7	3	6.760	33	10.277	66	10.206	6	9.370	435	9.950	
8	1	8.230	6	10.946	42	11.387			130	10.780	
9			3	10.984	10	13.727			158	12.390	
10			2	12.063	2	13.377				12.640	
11										13.900	
12										28	14.000
13										28	14.000
14											
15											
Wt.	7511		5784		28622		9855		39076		
SoP	7501		6063		35133		12284		38714		

	Col no 6		Col no 7	
	ENG	ALL	NET	ALL
	Data		Data	

Age	Number	Weight	Number	Weight
0				
1	9231	0.520	30219	0.544
2	8391	0.840	3435	1.371
3	5392	1.930	1723	3.045
4	1238	3.990	327	5.672
5	544	6.550	97	7.258
6	152	8.310	23	10.620
7	232	9.960	37	9.848
8	87	10.940	7	9.375
9	18	7.910	5	9.375
10	10	12.630	4	13.655
11	5	14.360	2	12.669
12	3	15.670	1	13.655
13	1	14.710	2	14.494
14		15.000		
15		15.000		
Wt.	35424		29903	
SoP	35686		29798	

Table 8 Sample print-out of Document Set (i) containing input data

Human Consumption Landings Cod North Sea 1977

Col no 1			Col no 2		Col no 3		Col no 4		Col no 5	
FRA	TRAWL		SCO	TRAWL	SCO	OTHER	REL	ALL	TEN	ALL
Data			Data		Data		Data		Data	
Wts adj by SoP			Nos adj by SoP		Nos adj by SoP		Wts adj by SoP		Wts adj by SoP	
Asc	Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight
0				0.190						
1	1976	0.521	420	0.621	5058	0.591	327	0.433	4735	0.484
2	6250	0.581	576	1.267	6486	0.993	6661	1.099	9832	0.848
3	572	1.832	840	2.838	4107	2.269	655	2.439	6615	1.766
4	357	3.515	228	5.311	886	4.906	84	4.549	593	4.088
5	83	5.357	70	7.139	512	7.158	47	5.824	535	6.369
6	12	6.339	31	8.558	81	9.634	11	8.520	272	8.741
7	3	6.769	31	10.297	54	10.206	6	7.517	435	10.043
8	1	8.241	6	10.946	34	11.387			130	10.891
9			3	10.984	8	13.727			158	10.06
10			2	12.063	2	13.377			12	10.58
11										14.030
12									28	14.131
13									28	14.131
14										
15										
Wt.	7511		5784		28622		9855		39076	
SoP	7501		6063		35133		12284		38714	
Col no 6			Col no 7		Col no 8		Col no 9		Col no 10	
ENG	ALL		NET	ALL	FSDEN ALL		OTHERS ALL	ALL	ALL	
Data			Data		Sum of col		Raised col	Sum of col		
Wts adj by SoP			Wts adj by SoP		01 02 03 04 05:08					08 09
					06 07					
Asc	Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight
0										
1	9231	0.516	30219	0.546	51966	0.538	8301	0.538	60267	0.538
2	8391	0.834	3435	1.376	41632	0.917	6650	0.917	48281	0.917
3	5392	1.916	1723	3.056	19903	2.091	3179	2.091	23082	2.091
4	1238	3.961	327	5.692	3713	4.412	593	4.412	4307	4.412
5	544	6.502	97	7.284	1888	6.639	302	6.639	2190	6.639
6	152	8.249	23	10.658	582	8.750	93	8.750	675	8.750
7	232	9.887	37	9.883	798	9.980	128	9.980	926	9.980
8	87	10.860	7	9.408	265	10.897	42	10.897	307	10.897
9	18	7.852	5	9.408	192	12.018	31	12.018	223	12.018
10	10	12.537	4	13.703	18	12.830	3	12.830	20	12.830
11	5	14.255	2	12.714	7	13.814	1	13.814	8	13.814
12	3	15.555	1	13.703	32	14.251	5	14.251	37	14.251
13	1	14.602	2	14.545	31	14.173	5	14.173	36	14.173
14		14.890								
15		14.890								
Wt.	35424		29903		156175		24946		181121	
SoP	35686		29798		156175		24946		181121	

Table 9 Sample of print-out of Document Set (ii) containing input data after SOPs adjustment raised and summed