International Council for the
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Scombriform Fish Committee

No. 67 K

First Report of the Bluefin Tuna Working Group

by

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I. Terms of reference and representations.

This working group was set up, following a recommendation of the Scombriform Fish Committee of ICES at its annual meeting in Copenhagen in 1961. Its main task is to uniformly compile all bluefin tuna catch composition data of the ICES area in order to study the relationship between the tuna catches of the different areas and the timing of arrival of tunas within their whole range of distribution.

Following the recommendation of the Committee the undersigned met from the 14th to the 17th of April for their first meeting in Hamburg at the invitation of the German Federal Republic Board for Fisheries.

II. Proceedings.

1. General

Prior to the meeting the single member countries in the Committee were requested to make available all existing material to the working group in this respect. The following data were obtained:

a) Information of the annual landings of bluefin tuna were given by Portugal, Spain, France, Norway, Denmark and Germany, i.e. from all member countries of ICES participating in tuna fishery.

b) Data of the size composition of catches for recent years could be given only by Portugal, Norway and Germany. While Norway and Germany were able to do such catch assessment work throughout their fishing season 1960 and 1961 and to compile their data on a weekly basis, Portugal submitted only few samples of measurements from trolling catches on its west coast.

From the material obtained it is obvious that there is no direct relationship between the Norwegian and German catches and the Portugal trolling catches which consist of immature fish only (Figure 1). Therefore, during this meeting, the detailed comparison of catches had to be restricted to the Norwegian and German fisheries only. However, on the basis of several publications it was possible to give a general picture on the size composition of tuna catches in the various countries (see Figure 1), i.e. Turkey (1), Morocco (5), Spain (6), Portugal (8), France (2), Norway (3), and Germany (7). Also the best mean of compilation of research data was discussed in principle during the meeting.

2. General size composition of tuna catch in the various countries.

As shown in Figure 1, it can be concluded that great differences between the various regions occur in the size composition of tuna. On the other hand there are also similarities in the size range between different areas.

Thus the Norwegian and German catches show a considerable similarity among themselves and also to the madrague catches of tuna in the south, although it is apparant that only the older age groups migrate so far north as to the Norwegian coast and the North Sea.

However, this general picture is far from being complete, since detailed size compositional data are lacking from Tunesia, Italy, Jugoslavia and Greece and since only few data refer to the same year. Yet, it is obvious how helpful the repeated analysis of catch compositions may be if detailed knowledge on the migration habits of bluefin tuna shall be obtained.

5. Compilation of Norwegian and German catch composition data.

With respect to the best way of data collection and compilation the following conclusions were reached:

a) In order to find the most practical way in carrying out the desired programme of systematic compilation of catch data the question was raised if the compilation should be done on a monthly or a weekly basis. The comparison of Norwegian and German data showed clearly that certain runs of tuna are so short that they can be recognised only if data are represented on a weekly basis. Therefore, a weekly sampling of data is indispensable.

b) The changes of the size composition of the Norwegian tuna catches can be easily followed up by weight records of individual fish. These weight data refer to gutted fish without head. The conversion of these weight data to weight data referring to ungutted fish is given by the following equation: $w_N = w'_N \cdot 1.285$, wherein w_N is the weight of ungutted fish and w'_N the weight of gutted fish without head (Tables 1-4).

Until now it has not been possible to collect length data of the Norwegian tuna catch, because they are more difficult to obtain since usually the head of the fish is removed before the fish is landed. In addition there are numerous landing places along the coast.

Contrary it is rather easy to collect length data in Germany. 90% of the whole landings are made on two fishing ports. Without doubt, length measurements (fork length) represent the most ideal way of describing the size composition of tuna catch. Germany has also taken the weight of individual fish. Since these weight measurements are made at the market on gutted fish with heads and gills, the following equation must be applied to calculate the weight of ungutted fish: $w_G = w'_G \cdot 1.026$, wherein w_G is the weight of ungutted fish and w'_G the weight of gutted fish with head and gills. The correlation factor was calculated according to data given by Krummholz.

Since length measurements are lacking for the Norwegian catches, it was decided to compile the catches of both countries on the weight basis. In Table 1-8 the Norwegian weight data and the German data on the weight and length composition of tuna catch of 1960 and 1961 have been compiled. In Figures 2 and 3 a direct comparison of the Norwegian and German weight data is made.

c) Although detailed catch localities are known for all the Norwegian and German tuna catches, it was found to be practical to subdivide the area in three sub-areas only:

1. North Norwegian coast (N of 63°N)
2. South Norwegian coast (S of 62°N)
3. North Sea

4. Conclusion.

From Figures 2 and 3 an interesting relationship existing between the Norwegian and German tuna catches can be concluded. The major tuna run to the North Norwegian coast corresponds in its size composition exactly with that caught some weeks later by German fishermen in the middle part of the western North Sea. These tuna consist of large fish only which had in both years peaks between 230 and 270 kg in their weight frequency curves. This run of tuna was found to arrive on the Norwegian coast north of 63°N during the 29th week in both of the years under observations, and had its peak of fishing season from the 30th to the 33rd week. After this time the catch decreased considerably and was reduced to nothing two to three weeks later (1961 and 1960). Instead, in 1960, the fish appeared during the 34th week (20th to 26th August) in the western part of the middle North Sea on the German fishing grounds and in 1961 during the 35th week. Main catches were made there from the 37th to 38th weeks in 1960 and from the 36th to 37th weeks in 1961. The last catches were made by German fishermen in the 42nd week (17th to 23rd October 1960) and in the 40th week (1961).

Although there is no direct proof of the theory that the tuna observed on the North Norwegian coast and later in the North Sea represent the same school of fish, there is much evidence for the existence of such a direct relationship. This finding, although being considered as preliminary, may have brought some light into the mysterious migration habits of giant tuna on the North Norwegian coast, which are known to disappear suddenly from there, after a few weeks stay only, at a time when younger tuna, which are south of 62°N, stay several weeks longer in Norwegian waters.

However, the figures show apparently that not all giant tuna have left the Norwegian coast, but that many, especially in 1961, have remained in Norwegian waters south of 62°N. This may explain that German catches of 1961 were so extremely poor.

The figures show furthermore that the very rich tuna runs of medium sized fish were only observed on the South Norwegian coast and were not found in the North Sea catches.

The above interpretation of results demonstrate how valuable this catch assessment work is in revealing the finer structure of tuna migrations. If possible, it is the aim of this Working Group to compile also the existing catch composition data from previous years - especially those from Norway and Germany - in the same way as has been done for 1960 and 1961 in this report.

III. Recommendations.

The Working Group realises the difficulties which some member countries have in collecting data of the size composition of tuna catches. However, it is felt that not every possibility, which exists to collect this information without employing a great staff, has been exhausted. This is especially true in the case of the madrague catches and the life bait catches where almost all fish are brought to a few firms or fish markets. Data of these catches are indispensable for the understanding of the population dynamics of the tuna stocks. It is therefore recommended:

1. to start immediately collection of weekly catch composition data

Although fork length measurements are being considered to represent the ideal form of describing the size composition of tuna stocks, the weight composition may well serve the same purpose as stated above (3,b). If only one kind of data (either length or weight) can be collected, a key for the transformation from one type of data into the other will be necessary. In working out this key, it must be born in mind that the feeding condition of bluefin fluctuates in and between fishing seasons.

In the present procedure of data presentation through Annales Biologiques it takes generally about two years to make the data available for the interested parties. In order to ensure a quicker release of the data, it is recommended that:

2. data on the catch composition collected within the ICES area should be made available to the Working Group for their quick compilation immediately after the close of each fishing season

It would be greatly desirable if a close collaboration in this kind of stock assessment work could be established between ICES and the General Fisheries Council for the Mediterranean. To start with, it is therefore recommended that:

3. the reports of the ICES Tuna Working Group should be made available to the interested member countries of G.F.C.M.

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Table 1. Size composition of Norwegian tuna catch north of 63°N by weight frequencies (‰) in 1960.

Group w_N	Means w'_N	Week numbers 29	30	31	32	33	34	35	36	37
105	82			3						
131	102									
138	107									
144	112									
150	117		4	8		3				
157	122		4	5	2	7				
163	127		11							
170	132			11	12	10	25			
176	137		11	22	15	3				
183	142		25	11	29	17				
189	147	15	14	24	15	28	25	18		
195	152	15	43	38	19	35	25			
202	157	15	46	54	44	24	25			
208	162	45	57	49	36	56	50	18	22	91
215	167	90	61	73	46	38	25	53	43	
221	172	15	57	68	82	38	25	18	65	
227	177	90	125	76	87	73	25		65	
234	182	164	86	92	85	73	25	70	43	
240	187	90	75	59	61	70	50	123	130	91
247	192	60	89	78	80	80	50	70	87	91
253	197	119	43	70	80	63	25	53	65	
260	202	90	54	51	68	80	50	88	43	
266	207	45	39	49	61	63	75	70	43	182
272	212	45	50	51	31	49	50	18	65	182
279	217		21	19	29	56	50	53	22	
285	222	15	32	41	24	35	50	88	22	
292	227	45	14	11	24	24		18	65	91
298	232	30	14	8	24	31	75	35	43	
305	237	15	7	11	19	14		88	87	91
311	242		4	5	5	7	50	35	65	91
317	247		7	5	7	10	75	35		91
324	252				12	7	50			
330	257		4	5				35	22	
337	262				2					
343	267					3		18		
350	272		4							
n =		67	280	370	413	287	40	57	46	11

Table 2. Size composition of Norwegian tuna catch south of 62°N by weight frequencies (‰) in 1960

Group w_N	Means w'_N	Week numbers												
		30	31	32	33	34	35	36	37	38	39	40	41	42
54	42									0	1			
60	47									1	1			
67	52							0	1	0	1			
73	57								1	0	1			
80	62		1				0	0	1	0	1			18
86	67		1		1	1	1	1	4	1	1			
93	72		3	1	4	3	2	6	12	5	6	1		
99	77		12	5	9	11	5	13	29	12	12	4	4	
105	82		12	11	20	18	16	23	55	32	28	11	11	
112	87		12	14	15	21	13	32	88	51	55	23	12	18
119	92		12	5	16	30	21	41	69	49	70	19	16	18
125	97		11	6	15	20	20	35	65	47	66	25	47	18
131	102		10	9	15	18	21	33	50	43	50	19	50	18
138	107		9	14	9	15	22	30	50	38	45	26	23	18
144	112		23	9	14	14	31	34	46	37	39	19	25	18
150	117		30	28	27	28	35	41	46	45	50	39	26	18
157	122		46	27	25	40	46	49	55	48	55	38	20	55
163	127	51	49	25	47	56	50	60	74	50	65	40	14	73
170	132	51	69	33	67	54	70	60	57	56	60	59	17	55
176	137	102	60	54	53	70	54	65	44	53	50	43	46	18
183	142	68	58	67	63	63	60	63	56	51	69	52	30	109
189	147	34	77	57	65	69	51	61	31	47	47	65	45	55
195	152	85	73	61	67	67	59	49	29	43	39	55	61	91
202	157	34	71	65	56	61	51	46	22	37	31	55	40	18
208	162	119	57	72	62	79	50	42	17	35	35	65	67	55
215	167	51	57	63	60	42	55	42	24	35	26	43	69	55
221	172	102	46	60	62	39	43	31	26	32	22	61	62	36
227	177	68	41	50	47	29	36	31	12	22	21	43	42	91
234	182	17	39	49	41	37	41	28	10	21	11	49	54	55
240	187	34	26	33	27	33	30	23	9	21	10	30	37	18
247	192	34	30	41	50	26	27	16	4	16	9	29	39	36
253	197	17	15	33	18	13	20	12	5	10	10	20	39	18
260	202	34	17	30	13	15	18	9	1	10	5	16	19	
266	207	34	10	28	10	6	14	7	2	9	3	10	27	
272	212	17	7	9	8	5	9	3	1	8	2	10	16	13
279	217	17	6	15	1	4	5	5	3	7		3	12	
285	222	17	2	3	9	4	6	2	1	4	1	13	7	
292	227	17	3	3	2	3	3	1		4	1	4	4	
298	232		1	6	1		2	2		5		3	9	
305	237		1	4			2	1	1	2		4	1	
311	242		1	2		1	2	0		2	1		1	
317	247		1	2		1	1	0		2			3	
324	252		1		1	1	1	0		0			1	
330	257			1								3	1	
337	262			2		0	0			1				
343	267													
n =		59	1626	952	1201	1368	3476	2651	1531	4227	1411	692	801	55

Table 3. Size composition of Norwegian tuna catch north of 63°N by weight frequencies (‰) in 1961.

Group w_N	Means w'_N	Week numbers							
		29	30	31	32	33	34	35	36
105	82				1				
112	87		0						
119	92		0	0	2				
125	97		0	1	0				
131	102		4	2	5	1			
138	107		3	5	4	1	1		
144	112		4	3	6	7	1		
150	117	5	5	3	12	2			
157	122		6	6	10	4			
163	127	1	10	6	15	3			
170	132	5	13	14	14	9	1	2	
176	137	15	20	23	22	11	10	5	59
183	142	21	31	25	32	25	4		
189	147	56	33	41	42	23	14	7	
195	152	26	47	47	53	40	17	25	
202	157	36	50	42	60	62	27	5	59
208	162	56	60	64	65	67	21	20	
215	167	103	64	61	69	73	45	37	
221	172	92	63	70	69	76	50	29	
227	177	82	77	67	67	60	59	42	59
234	182	77	70	67	64	68	64	42	176
240	187	62	72	75	55	84	66	76	
247	192	92	76	63	50	69	90	74	
253	197	51	59	57	57	47	72	31	
260	202	41	59	57	46	45	64	88	118
266	207	51	45	42	36	41	76	69	59
272	212	31	38	42	39	53	59	88	59
279	217	36	28	32	24	28	48	56	118
285	222	26	17	28	22	27	41	44	176
292	227	5	18	18	17	16	41	49	
298	232	15	11	11	9	19	32	56	
305	237	5	6	7	12	13	22	29	
311	242		2	8	7	9	25	20	
317	247		3	4	4	4	21	10	
324	252		2	2	3	4	11	25	59
330	257		2	2	4	2	2	15	
337	262		1	1	1	4	10	15	
343	267			1	1	2	2	2	
350	272			0	0				
356	277			0		1	2	2	59
362	282			0				2	
369	287			0			1		
375	292							2	
382	297							2	
n =		195	2510	2358	2226	987	814	408	17

Table 4. Size composition of Norwegian tuna catch south of 62°N by weight frequencies (‰) in 1961.

Group	Means	Week numbers													
w_N	w'_N	28	29	3o	31	32	33	34	35	36	37	38	39	4o	41
67	52														
73	57								1						
8o	62			o			o		1		2			1	
86	67					1			o		1			1	
93	72	o			o	1	o	3	1		1				
99	77			1		2	o	1	1		2				
1o5	82	o	o	1	1	1	1	1	4	2	2			1	
112	87	1	o	1	4	2	2	3	8	4	2	4		1	
119	92	4	2	6	4	7	7	12	19	6	8	4	5	3	
125	97	5	4	12	7	7	14	17	27	12	8	8	3	6	
131	1o2	8	6	22	19	16	22	27	38	27	9	12	7	11	
138	1o7	7	9	19	24	26	29	42	45	43	14	16	13	17	18
144	112	1o	11	22	2o	26	34	35	5o	36	18	28	15	2o	53
15o	117	15	13	21	25	21	38	59	55	49	15	28	2o	28	7o
157	122	27	17	35	32	53	35	38	45	49	16	2o	12	23	
163	127	39	31	39	41	35	44	5o	48	46	21	28	17	28	35
17o	132	57	38	51	48	52	45	44	46	45	17	2o	15	22	35
176	137	71	54	64	61	58	61	42	51	52	19	36	23	34	53
183	142	78	75	82	74	65	72	64	59	52	25	4o	33	4o	1o5
189	147	93	79	83	82	72	7o	8o	59	62	29	44	48	4o	88
195	152	96	95	76	1o1	96	71	65	54	47	35	68	55	43	53
2o2	157	85	85	81	79	81	69	65	55	61	42	84	5o	64	53
2o8	162	74	79	73	76	74	63	45	54	46	51	48	73	6o	1o5
215	167	72	68	65	57	65	57	39	53	45	62	72	69	54	53
221	172	6o	73	53	63	63	53	43	42	52	64	8o	79	58	35
227	177	49	56	37	4o	45	4o	46	37	49	58	68	75	66	35
234	182	39	47	4o	43	36	37	31	34	38	55	52	66	59	18
24o	187	27	37	27	25	37	27	22	21	34	54	44	55	62	
247	192	21	36	22	2o	26	23	25	16	24	53	52	45	47	35
253	197	19	21	19	17	16	18	26	14	19	44	24	43	48	1o5
26o	2o2	2o	16	15	12	11	16	17	16	21	46	32	39	38	
266	2o7	7	16	11	11	6	14	18	12	18	36	12	29	26	18
272	212	4	8	7	3	8	9	16	9	11	37	16	23	2o	18
279	217	3	7	4	3	3	6	8	8	1o	29		15	21	
285	222	3	7	4	3	3	5	3	5	6	3o	8	16	15	
292	227	3	4	4	3	1	5	3	4	7	27	8	16	11	
298	232	1	3	2	1	2	4	1	1	9	25		12	8	18
3o5	237	1	1	2	o	2	1	3	3	7	14	12	7	7	
311	242	o	2	1	1		2	4	2	4	14	12	6	7	
317	247		1			1	1	1		0	9	12	8	1	
324	252					1	1		1	4	7	4	2	2	
33o	257							1	1	2	5		1	1	
337	262										4		2	1	
343	267							1			1	4	2	2	
35o	272										3		1		
356	277										1			1	
362	282										2				
369	287										1				
n =		3318	4439	3o67	2392	1285	3429	1o84	3395	822	1988	25o	1153	1179	57

Table 5. Size composition of German tuna catch by smoothed weight frequencies (‰) in 1960.

(Total catch in 1960 = 1,623 fish)

Group w_G	Means w'_G	Week numbers										
		32	34	35	36	37	38	39	40	41	42	Total
171	167.5					3				5		1
177	172.5					1				5		1
182	177.5			3		1	1			2		1
187	182.5		1	6	7	3	4			2		1
192	187.5		4	3	13	5	7	5		5		4
197	192.5		4	-	7	6	6	10		9		5
202	197.5		4	6	-	9	7	5		10		7
207	202.5		10	18	-	14	10	16	3	12		10
212	207.5		17	21	-	18	13	37	8	19	15	15
217	212.5		23	36	21	21	13	37	12	25	30	21
223	217.5		36	48	54	27	23	48	16	27	39	29
228	222.5		48	45	54	33	30	59	28	32	54	35
233	227.5		39	36	40	33	36	43	37	45	44	36
238	232.5		37	24	40	36	40	32	35	51	30	39
243	237.5		48	21	33	36	48	32	39	48	30	42
248	242.5	1000	48	24	27	38	57	53	42	50	44	44
253	247.5		48	39	20	46	59	85	37	55	58	48
259	252.5		45	63	47	48	57	90	42	57	49	51
264	257.5		49	66	95	37	47	69	44	63	44	50
269	262.5		54	63	81	48	41	43	40	54	64	51
274	267.5		52	69	48	48	48	43	35	32	78	49
279	272.5		56	61	47	52	52	43	31	22	69	48
284	277.5		59	39	54	60	48	27	41	34	54	49
289	282.5		53	33	54	55	43	27	60	55	58	50
295	287.5		39	42	47	46	44	26	64	60	68	48
300	292.5		29	42	41	50	34	32	64	45	44	42
305	297.5		34	30	48	50	30	37	55	31	19	39
310	302.5		39	27	41	39	37	21	42	21	24	35
315	307.5		27	24	20	28	33	16	37	20	25	29
320	312.5		14	15	7	23	24	16	37	20	20	22
325	317.5		25	18	7	18	21	16	28	19	15	19
330	322.5		15	21	13	13	17	21	12	18	5	15
336	327.5		12	12	7	9	14	11	3	12	5	11
341	332.5		7	6	-	6	10		3	7	10	7
346	337.5		4	6	7	4	6		8	3	5	5
351	342.4		1	6	13	5	10		10	-		6
356	347.5		2	3	7	5	12		17	2		9
361	352.5		3	-		4	7		28	3		8
366	357.5		2	3		4	1		14	2		5
371	362.5		-	9		7	1		10	-		3
377	367.5		-	9		4	2		5	-		3
382	372.5		2	3		3	2		3	2		2
387	377.5		3			3	1		-	3		2
392	382.5		2			1	1		-	3		1
397	387.5		-				1		3	3		1
402	392.5		-				1		5	2		1
407	397.5		-				1		2	2		
413	402.5		-							3		
418	407.5		2									
423	412.5		3									
n 1 =		1	172	84	37	392	394	47	108	150	51	1,436
n 2 =		1	185	100	45	425	419	60	114	189	85	1,623

n 1 = number of tuna measured

n 2 = number of tuna caught in total

Table 6. Size composition of German tuna catch by smoothed length frequencies (‰) in 196o

(Total catch in 196o = 1,623 fish)

Group (cm)	Week numbers										Total
	32	34	35	36	37	38	39	4o	41	42	
2o5					1						
21o		1			2	1					2
215		4		7	5	5		7	5		4
22o		13	18	27	17	23	5	16	25	19	19
225		45	62	81	48	65	32	51	79	1o8	58
23o		94	122	135	98	128	1o6	128	157	226	122
235		152	191	142	172	185	2o3	2o4	2o9	275	186
24o	1ooo	184	2o5	149	226	198	235	212	2o6	215	2o5
245		185	146	169	196	169	2o2	153	164	1o3	174
25o		15o	98	155	125	126	143	99	91	39	12o
255		94	71	94	65	7o	63	74	35	15	67
26o		48	36	34	29	22	11	44	16		28
265		19	18	7	11	6		12	1o		1o
27o		6	18		3	2			3		3
275		3	12		1						1
28o		1	3		1						1
285		1									
n 1 =	1	172	84	37	392	394	47	1o8	15o	51	1,436
n 2 =	1	185	1oo	45	425	419	6o	114	189	85	1,623

n 1 = number of tuna measured; n 2 = number of tuna caught in total.

Table 7. ..... see page 1o, please.

Table 8. Size composition of German tuna catch by smoothed length frequencies (‰) in 1961

(Total catch in 1961 = 1,o92 fish)

Group (cm)	Week numbers							Total
	34	35	36	37	38	39	4o	
19o								
195								
2oo								
2o5								
21o					2			
215	21		4		5			2
22o	42	8	21	4	9	9	19	12
225	83	31	45	22	26	36	48	34
23o	167	6o	78	66	63	62	67	69
235	167	116	131	129	115	116	154	127
24o	1o4	197	195	19o	18o	25o	289	195
245	83	214	214	215	2o7	3o4	279	216
25o	1o4	167	164	185	176	16o	125	171
255	1o4	118	89	115	132	27	19	1o3
26o	42	56	41	5o	63	9		47
265	21	17	15	15	13	18		15
27o	41	1o	3	4	7	9		6
275	21	6		2	2			2
28o				2				1
285				1				
n 1 =	12	121	313	277	115	28	26	892
n 2 =	12	134	332	399	144	43	28	1,o92

n 1 = number of tuna measured; n 2 = number of tuna caught.

Table 7. Size composition of German tuna catch by smoothed weight frequencies (‰) in 1961

(Total catch in 1961 = 1,092 fish)

Group w_G	Means w'_G	Week numbers 34	35	36	37	38	39	40	Total
187	182.5			1	2	4			2
192	187.5		2	1	1	8			2
197	192.5	21	4	1	-	4			2
202	197.5	41	4	7	3	-			5
207	202.5	21	6	20	8	9			12
212	207.5	-	6	27	10	20	10		16
217	212.5	21	8	24	19	20	27		19
223	217.5	62	21	27	26	30	36	9	27
228	222.5	104	29	42	21	37	27	29	33
233	227.5	125	31	47	25	28	18	57	36
238	232.5	83	37	47	42	35	36	77	43
243	237.5	21	45	55	55	48	61	57	53
248	242.5	21	52	60	61	55	61	48	58
253	247.5	42	69	58	67	58	52	58	62
259	252.5	21	81	62	69	61	52	58	66
264	257.5	-	68	58	59	54	61	58	58
269	262.5	21	67	49	55	46	71	87	54
274	267.5	41	67	50	52	48	36	126	55
279	272.5	21	50	52	49	55	27	88	51
284	277.5	42	42	47	50	46	70	39	47
289	282.5	125	38	37	49	26	80	48	42
295	287.5	125	35	30	50	20	56	48	38
300	292.5	42	35	30	44	39	36	38	37
305	297.5		35	35	31	54	36	28	35
310	302.5		33	31	22	39	36	19	29
315	307.5		35	26	20	24	36	19	24
320	312.5		33	26	18	22	27	9	23
325	317.5		23	18	12	24	10		16
330	322.5		10	9	9	20	-		10
336	327.5		4	6	9	9	-		7
341	332.5		6	2	10	9	-		6
346	337.5		8	2	14	13	-		8
351	342.5		6	2	12	11	10		7
356	347.5		2	2	6	7	18		5
361	352.5		-	2	5	4	10		3
366	357.5		2	2	3	4			2
371	362.5		4	1	1	2			1
377	367.5		2	1	1	2			1
382	372.5			2	1	5			1
387	377.5			1	2				1
392	382.5				2				1
397	387.5				3				1
428	417.5				2				1
n 1 =		12	121	313	277	115	28	26	892
n 2 =		12	134	332	399	144	43	28	1.092

n 1 = number of tuna measured; n 2 = number of tuna caught in total.

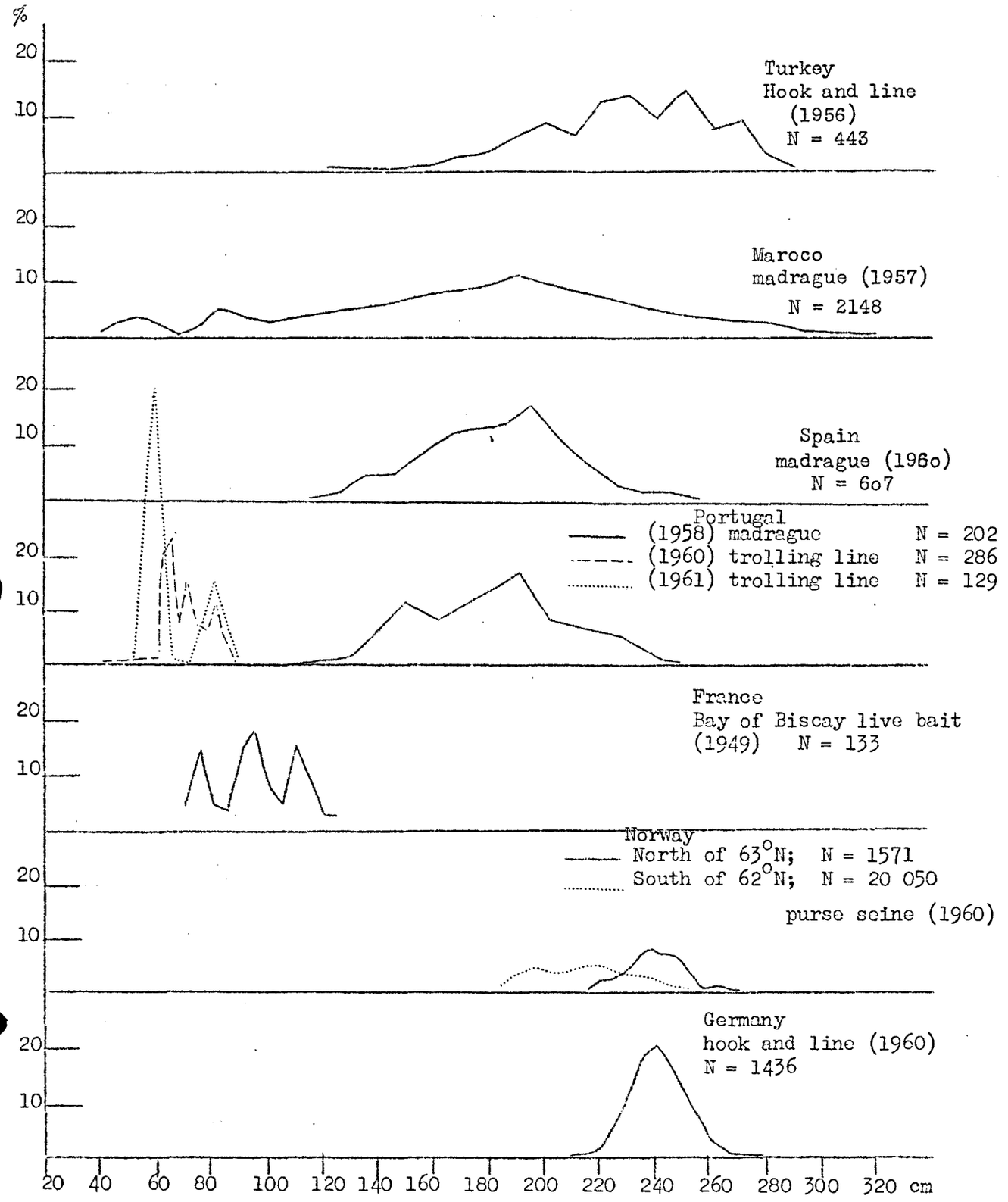

Figure 1. Size composition of bluefin tuna catch of different countries (length frequencies).

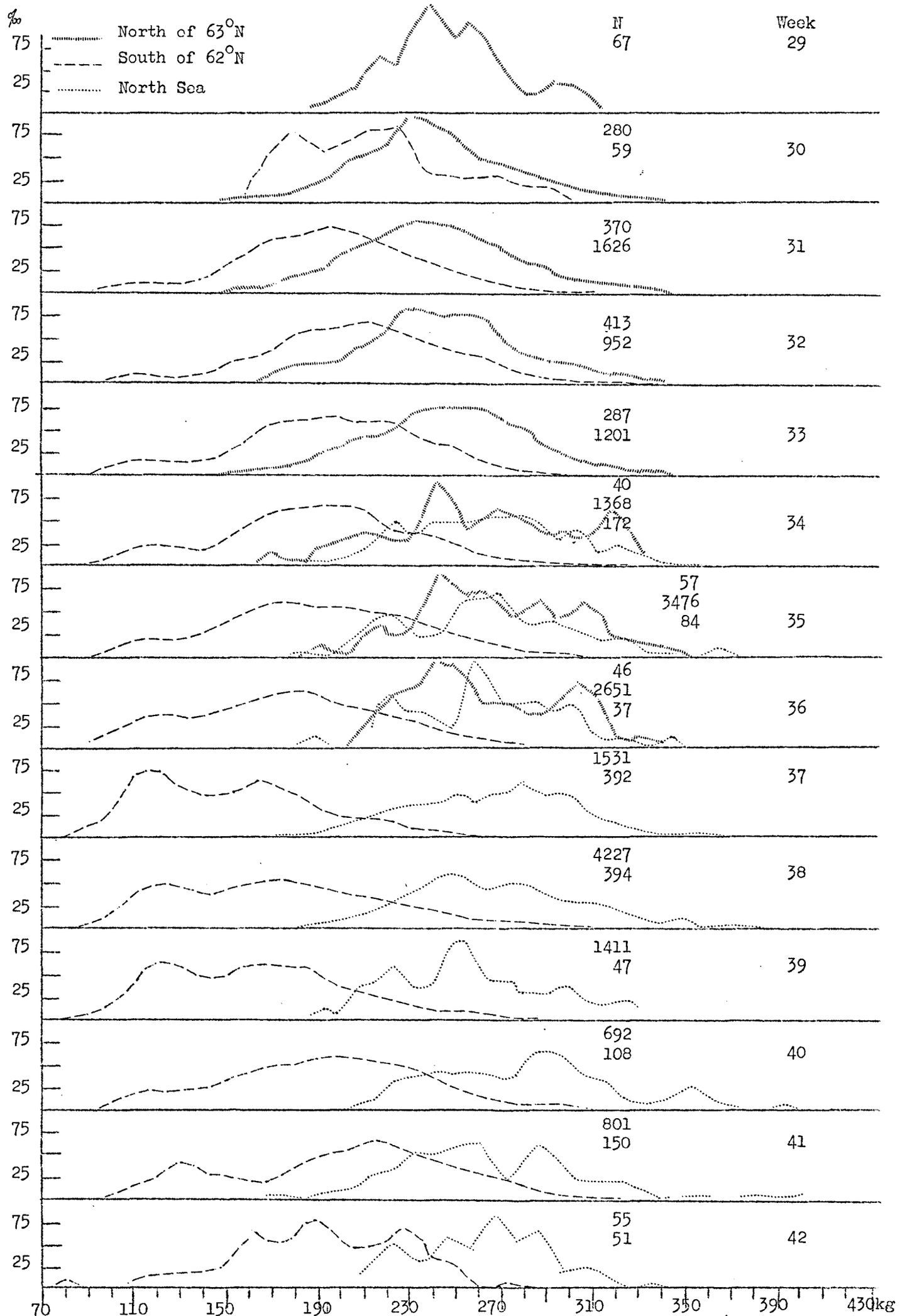

Figure 2. Size composition of Norwegian and German bluefin tuna catch (weight frequencies) by areas and weeks in 1960.

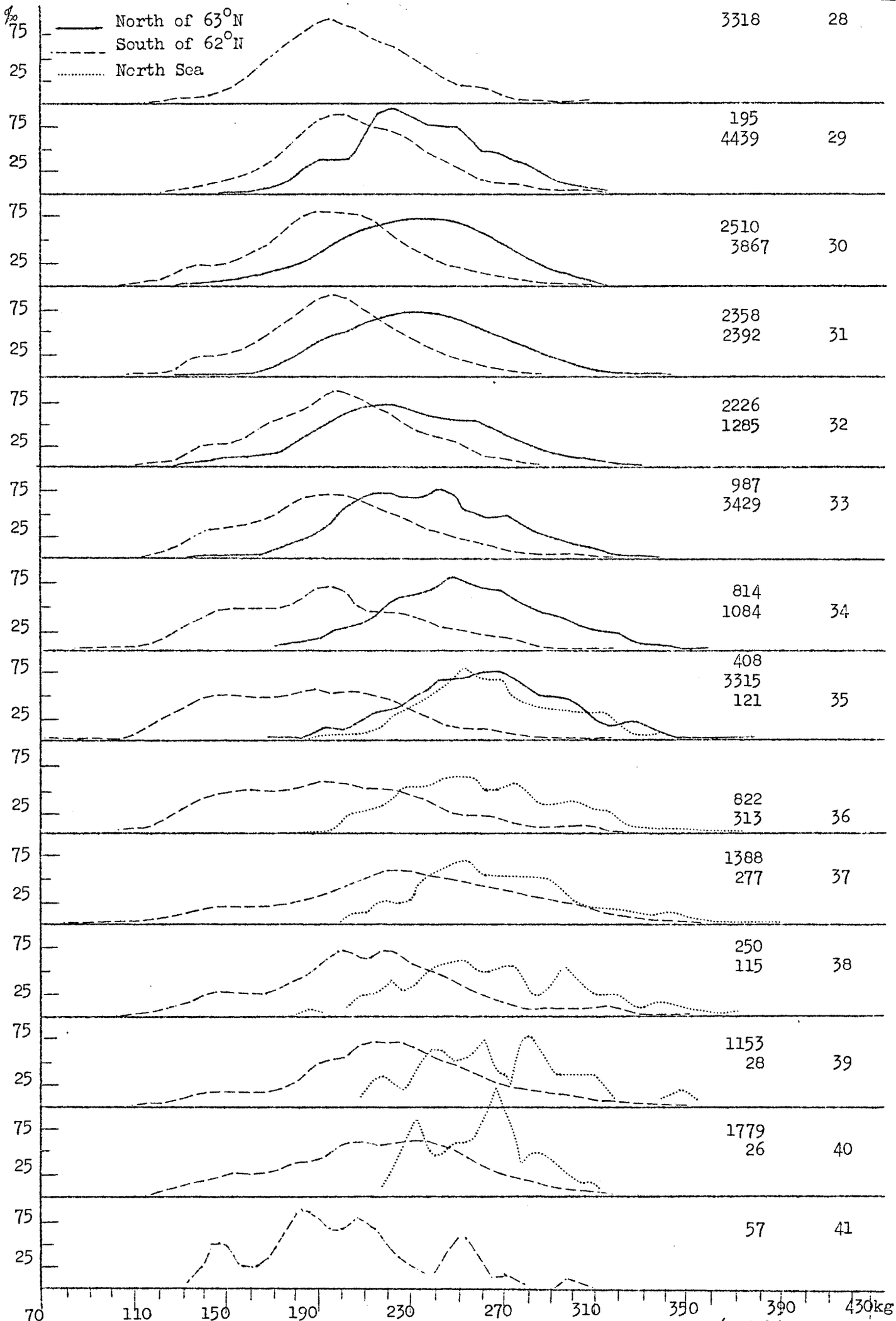

Figure 3. Size composition of Norwegian and German bluefin tuna catch (weight frequencies) by areas and weeks in 1961.