

**PRELIMINARY REPORT ON SIZE COMPOSITION OF GIANT BLUEFIN TUNA CAUGHT
IN THE GIBRALTAR STRAIT BY MOROCCAN HANDLINE FISHERY***

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**PATR Contribution No. 2*

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SUMMARY

In July, 1994, some Moroccan handline fishermen caught giant bluefin tuna in the Strait of Gibraltar by chance. After that, about 100 small fishing boats are engaged in fishing giant bluefin tuna and in early November, fishing operations are continued. Morocco is now continuing to measure size and body weight and to collect samples for mtDNA analysis. This preliminary report was prepared in order to make a statement about the size composition of giant bluefin tuna caught in the Strait of Gibraltar from late July to September. The relationship between fork length in cm (FL) and total body weight in kg (TW) is summarized as $TW = 7.6416 \times 10^{-6} FL^{3.1316}$. Mean body weight is 163.3 kg (49-298), estimated mean fork length is 216.7 cm (149-290). From 298 samples, fork length frequency distribution is determined. Body weight of these giant bluefin is less than fish caught by the Barbate trap in spring.

RESUME

En juillet 1994, des pêcheurs marocains à la ligne à main ont capturé par hasard des thons rouges géants dans le Déroit de Gibraltar. Par la suite, une centaine de petits bateaux de pêche se sont engagés dans la pêche aux thons rouges géants et au début du mois de novembre, la pêche continuait. Nous continuons à prendre les mesures de longueur et de poids et à échantillonner pour l'analyse de l'ADNmt. Nous avons préparé ce rapport provisoire afin de donner la composition par taille des thons rouges géants capturés dans le Déroit de Gibraltar entre la fin du mois de juillet et le mois de septembre. Le rapport entre la longueur fourche en cm (FL) et le poids total en kg (TW) se résume ainsi : $TW = 7,6416 \times 10^{-6} FL^{3,1316}$. Le poids moyen est de 163,3 kg (49-298) et la longueur fourche moyenne a été évaluée à 216,7 cm (149-290). A partir de 298 échantillons, la distribution de fréquence longueur a été déterminée. Le poids de ces thons rouges géants est moins élevé que les poissons pris dans les madragues de Barbate au printemps.

INTRODUCTION

Moroccan handline fishermen who located three villages in front of the Gibraltar strait (Fig. 1), are well known that some big fishes are living in the Gibraltar strait, because their fishing gear are cut off by strong power in sometimes. In near end of July 1994, some fisherman succeeded in fishing Giant bluefin tuna by chance. Soon after, many fishermen began to catch Giant bluefin tuna. Most of landing fishes were collected by fish exporters in Tanger in order to export to Spain. From August, we began to measure that fishes in order to make clear size composition and relationship between body length and body weight. In this paper, we want to report about that in the period from July to September 1994, but handline fishing operation are continuing in this time, November 1994.

It is very interesting to make clear the changes of size composition and condition factor, so we are continuing to measure Giant bluefin tuna caught by handline fishing in the Gibraltar strait. In near future, we have to prepare the report about that.

RESUMEN

En julio de 1994, algunos pescadores marroquíes de línea de mano capturaron casualmente atún rojo gigante en el Estrecho de Gibraltar. Desde entonces, hay unos 100 pequeños pesqueros comprometidos en la pesca de atún rojo gigante, y a comienzos de noviembre prosiguen las operaciones de pesca. En la actualidad se continúa midiendo la talla y peso del cuerpo y se obtienen muestras para análisis de ADNmt. Se prepara este informe preliminar con el propósito de hacer una declaración acerca de la composición por tallas del atún rojo gigante capturado en el estrecho de Gibraltar desde finales de julio a septiembre. La relación entre la longitud a la horquilla en cm (FL) y el peso total del cuerpo en kg (TW) se resume como $TW = 7.6416 \times 10^{-6} FL^{3.1316}$. El peso medio del cuerpo es de 163,3 kg (49-298), siendo la media estimada de la longitud a la horquilla de 216,7 cm (149-290). De 298 muestras, se determina la distribución de la frecuencia de la longitud a la horquilla. El peso del cuerpo de estos atunes rojos gigantes es inferior al de los peces capturados por la almadraba de Barbate en primavera.

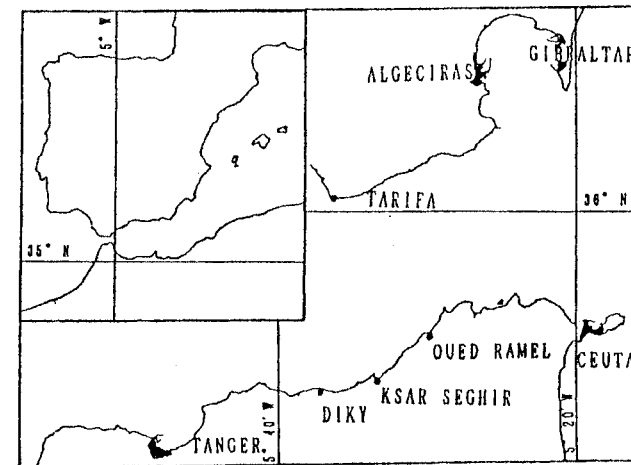


Fig. 1 Geographic explanation of three Moroccan Fishing villages in front of the strait of Gibraltar.

MATERIALS AND METHODS

Folk length and body weight of Giant bluefin tuna caught by Moroccan handline fishermen were measured at one of factory of fish exporters in Tanger port. Measurement of body weight was done by exporter, and we get data of body weight of giant bluefin tuna collected by same exporter from 31 July to 5 October 1994.

Relationship between folk length and body weight was determined by least square method. Folk length was calculated from body weight data by using this relationship, so then folk length frequency distribution was determined.

RESULTS

1. Relationship between folk length and body weight

From 27 September to 5 October, 24 samples of giant bluefin tuna caught by handline in the Gibraltar strait were measured at Tanger. Range of folk length is 185.0-276.5cm and body weight range is attained 112-366kg. Relationship between folk length in cm (FL) and body weight in kg (BW) is as follows:

$$TW = 7.6416 \times 10^{-6} FL^{3.1316}, r^2 = 0.9278$$

and shows in Fig. 2.

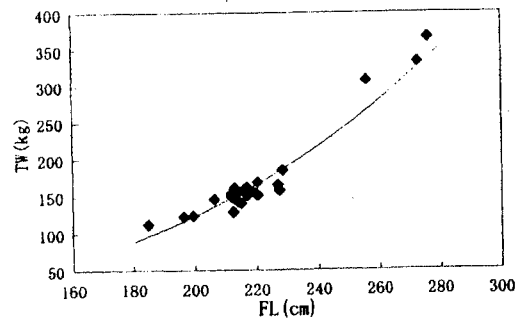


Fig. 2 Relationship between folk length(cm) and total weight(kg) in giant bluefin tuna caught in the strait of Gibraltar. (Sep. '94~Oct.'94)

$$TW = 7.6416 \times 10^{-6} FL^{3.1316} \quad r^2 = 0.9278$$

2. Folk length frequency distribution

One of fish exporter were send out 298 giant bluefin tuna caught by handline in the Gibraltar strait to Spain, including 2 fishes caught by gill

net, from 31 July to 27 September. This exporter have record of individual body weight by landing site and day. Folk length of this 298 fishes are calculated by folk length-body weight regression equation, result shows in Tab. 1.

Total weight of 298 giant bluefin tuna is 48 670kg, mean body weight is 163.3kg and its maximum and minimum weight are 298kg and 49kg respectively. Mean folk length is 216.7cm and its range is 149-290cm (Tab.2).

Folk length distribution is shown in Fig. 3.

Tab. 2 Mean body weight (TW) and mean estimated folk length (FL') of giant bluefin tuna caught by Hand-line in the strait of Gibraltar. (31 Jul. '94~5 Oct.'94)

	TW(kg)	FL'(cm)
AVG	163.3	216.7
S.D.	55.2	21.8
MIN	49	149
MAX	393	290
N	298	298

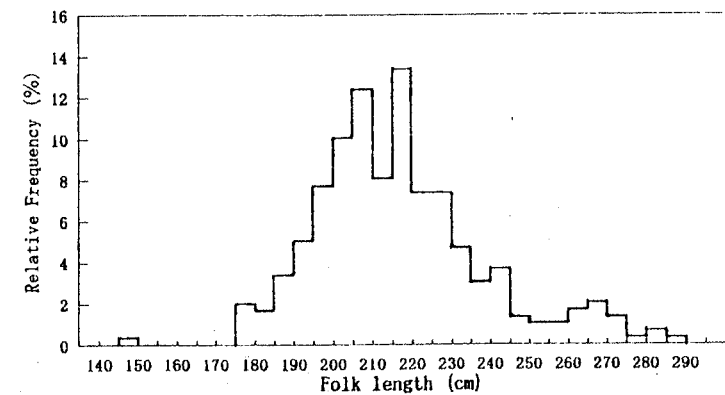


Fig. 3 Folk length frequency distribution of giant bluefin tuna caught in the strait of Gibraltar. (31 Jul. '94~5 Oct.'94)

3. Landing quantity and mean size in three Moroccan villages

Data of 298 giant bluefin tuna is separated to three villages, landing quantity of three villages are summarized in Tab. 3. Landing quantity of Diky is most greatest than that of another two villages, 73.2 % in individuals number and 74.3 % in weight. Landing quantity of Ksar Seghir and Oued Remel are similar, 12.4 % and 13.1 % in individual numbers, 11.3 % and 13.0 % in weight respectively.

Mean body weight and folk length of giant bluefin tuna landed by three villages are shown in Tab. 4. There are no difference in size of giant bluefin tuna landed.

Table 3 Landing quantity in three sites.

Landing site	Ind. No.	TOTAL WEIGHT		
		(%)	(kg)	(%)
Oued Remel	37	12.4	5522	11.3
Ksar Seghir	39	13.1	6347	13.0
Diky	218	73.2	36145	74.3
Tanger	4	1.3	656	1.3
total	298	100.0	48670	100.0

Table 4 Mean body weight and mean estimated folk length in three sites.

Landing site	Oued Remel	Ksar Seghir	Diky	Tanger
Ind. No.	37	39	218	4
TW (kg)				
avg	149.2	162.7	165.8	164.0
S. D.	46.7	43.9	58.5	39.3
MIN	49	95	82	132
MAX	310	272	393	218
FL (cm)				
avg	210.8	217.2	217.6	218.4
S. D.	20.7	18.5	22.5	16.2
MIN	149	184	176	205
MAX	269	258	290	240

DISCUSSION

Folk length-body weight relationship of giant bluefin tuna caught by Barbate trap (Spain) in 18 May 1992 are shown in Fig. 4 (FUSHIMI et al. Unpublished data). Comparing Fig. 2 with Fig. 4, it is apparently clear that giant bluefin tuna caught by Moroccan handline in Autumn are lighter than fish caught by trap in May, for example difference of body weight in 220cm and 260cm are ca. 50kg and 70kg respectively.

Giant bluefintuna caught by Moroccan handline in the Gibraltar strait in this Autumn are after spawned, because proportion of these giant bluefin tuna are similar to fish caught by Mediterranean trap in Summer after spawning season, and cloaca is still opening.

There are 4 fish exporters in this region, but we can get data of fish from one exporter. 4 fish exporters has cooperational relationship to collect giant bluefin tuna landed at three villages, there are no difference in fish size. So, estimated folk length frequency distribution in Fig 3 has no variance from total landings.

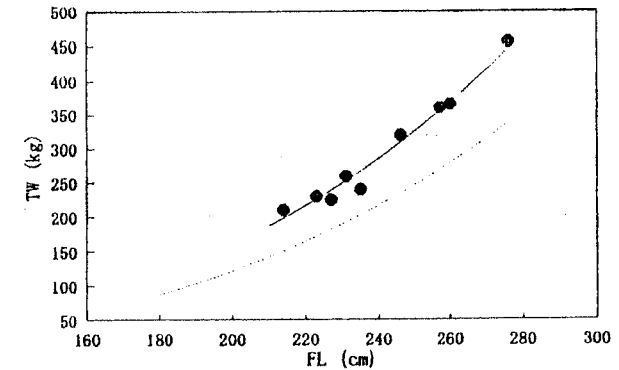


Fig. 4 Relationship between folk length (cm) and total weight (kg) in giant bluefin tuna caught by Barbate trap (Spain) in 18 May '92 (FUSHIMI et al. Unpublished data). Dotted line shows folk length-body weight relationship of giant bluefin tuna caught by Handline showed in Fig. 2.

Tab. 1 Body weight and estimated fork length of giant bluefin tuna caught by Hand-line in the strait of Gibraltar.

	DATE	PORT	TW(kg)	FL'(cm)		DATE	PORT	TW(kg)	FL'(cm)
1	31.07.94	DIKY	167	221	51	28.08.94	OUED RMEL	122	200
2	01.08.94	DIKY	148	212	52	28.08.94	OUED RMEL	130	204
3	01.08.94	DIKY	134	206	53	28.08.94	OUED RMEL	164	219
4	01.08.94	DIKY	163	219	54	28.08.94	OUED RMEL	218	240
5	08.08.94	DIKY	140	209	55	28.08.94	KSAR SEGHIR	145	211
6	08.08.94	KSAR SEGHIR	154	215	56	30.08.94	KSAR SEGHIR	224	242
7	09.08.94	DIKY	232	245	57	30.08.94	DIKY	92	182
8	09.08.94	DIKY	326	273	58	30.08.94	DIKY	200	234
9	09.08.94	DIKY	393	290	59	30.08.94	DIKY	243	249
10	09.08.94	KSAR SEGHIR	141	209	60	30.08.94	DIKY	141	209
11	10.08.94	KSAR SEGHIR	159	217	61	31.08.94	TANGER	132	205
12	10.08.94	DIKY	131	204	62	31.08.94	KSAR SEGHIR	197	233
13	11.08.94	DIKY	147	212	63	31.08.94	OUED RMEL	100	187
14	11.08.94	DIKY	167	221	64	31.08.94	OUED RMEL	118	197
15	11.08.94	DIKY	104	190	65	31.08.94	OUED RMEL	133	205
16	11.08.94	DIKY	139	208	66	31.08.94	OUED RMEL	159	217
17	11.08.94	DIKY	98	186	67	31.08.94	DIKY	148	212
18	11.08.94	KSAR SEGHIR	193	231	68	31.08.94	DIKY	155	215
19	11.08.94	KSAR SEGHIR	147	212	69	31.08.94	DIKY	161	218
20	12.08.94	KSAR SEGHIR	177	225	70	31.08.94	DIKY	187	229
21	12.08.94	DIKY	93	183	71	31.08.94	DIKY	95	184
22	17.08.94	KSAR SEGHIR	194	231	72	01.09.94	OUED RMEL	95	184
23	17.08.94	KSAR SEGHIR	117	197	73	01.09.94	KSAR SEGHIR	200	234
24	18.08.94	KSAR SEGHIR	158	217	74	01.09.94	KSAR SEGHIR	272	258
25	20.08.94	TANGER	138	208	75	01.09.94	DIKY	109	193
26	20.08.94	KSAR SEGHIR	182	227	76	01.09.94	DIKY	126	202
27	22.08.94	DIKY	142	210	77	01.09.94	DIKY	142	210
28	22.08.94	DIKY	107	191	78	01.09.94	DIKY	146	211
29	22.08.94	OUED RMEL	114	195	79	02.09.94	DIKY	82	176
30	22.08.94	TANGER	218	240	80	02.09.94	DIKY	120	199
31	23.08.94	OUED RMEL	121	199	81	02.09.94	DIKY	140	209
32	23.08.94	OUED RMEL	175	224	82	02.09.94	DIKY	130	204
33	23.08.94	OUED RMEL	198	233	83	02.09.94	DIKY	219	241
34	23.08.94	KSAR SEGHIR	220	241	84	02.09.94	OUED RMEL	310	269
35	23.08.94	KSAR SEGHIR	124	201	85	02.09.94	OUED RMEL	97	185
36	23.08.94	KSAR SEGHIR	132	205	86	02.09.94	OUED RMEL	109	193
37	23.08.94	DIKY	308	268	87	02.09.94	OUED RMEL	258	254
38	23.08.94	DIKY	100	187	88	02.09.94	OUED RMEL	140	209
39	23.08.94	DIKY	109	193	89	02.09.94	OUED RMEL	102	188
40	23.08.94	TANGER	168	221	90	02.09.94	OUED RMEL	190	230
41	24.08.94	DIKY	190	230	91	02.09.94	OUED RMEL	165	220
42	24.08.94	DIKY	332	275	92	03.09.94	DIKY	123	200
43	24.08.94	DIKY	108	192	93	04.09.94	DIKY	213	238
44	24.08.94	KSAR SEGHIR	205	236	94	04.09.94	DIKY	190	230
45	24.08.94	OUED RMEL	154	215	95	04.09.94	DIKY	115	196
46	25.08.94	DIKY	133	205	96	04.09.94	DIKY	115	196
47	25.08.94	DIKY	147	212	97	04.09.94	DIKY	86	179
48	25.08.94	DIKY	86	179	98	04.09.94	DIKY	117	197
49	28.08.94	DIKY	209	237	99	04.09.94	DIKY	86	179
50	28.08.94	DIKY	117	197	100	04.09.94	DIKY	100	187

Tab. 1 (continued)

	DATE	PORT	TW(kg)	FL'(cm)		DATE	PORT	TW(kg)	FL'(cm)
101	04.09.94	DIKY	265	256	151	10.09.94	DIKY	155	215
102	04.09.94	OUED RMEL	125	201	152	10.09.94	DIKY	137	207
103	04.09.94	OUED RMEL	162	219	153	10.09.94	DIKY	183	227
104	04.09.94	OUED RMEL	162	219	154	10.09.94	DIKY	140	209
105	04.09.94	KSAR SEGHIR	127	202	155	10.09.94	DIKY	165	220
106	04.09.94	KSAR SEGHIR	105	190	156	10.09.94	DIKY	233	245
107	04.09.94	KSAR SEGHIR	95	184	157	10.09.94	DIKY	117	197
108	04.09.94	KSAR SEGHIR	130	204	158	10.09.94	DIKY	175	224
109	05.09.94	KSAR SEGHIR	167	221	159	10.09.94	DIKY	119	198
110	05.09.94	KSAR SEGHIR	111	194	160	10.09.94	DIKY	276	259
111	05.09.94	DIKY	174	224	161	10.09.94	OUED RMEL	49	149
112	05.09.94	DIKY	220	241	162	10.09.94	OUED RMEL	135	206
113	05.09.94	DIKY	120	199	163	10.09.94	OUED RMEL	138	208
114	05.09.94	DIKY	160	218	164	10.09.94	OUED RMEL	162	219
115	05.09.94	DIKY	167	221	165	10.09.94	OUED RMEL	155	215
116	05.09.94	DIKY	192	231	166	11.09.94	KSAR SEGHIR	143	210
117	05.09.94	DIKY	169	221	167	11.09.94	DIKY	153	215
118	07.09.94	DIKY	130	204	168	11.09.94	DIKY	189	230
119	07.09.94	DIKY	180	226	169	11.09.94	DIKY	168	221
120	07.09.94	DIKY	199	233	170	12.09.94	KSAR SEGHIR	145	211
121	07.09.94	DIKY	147	212	171	12.09.94	DIKY	193	231
122	08.09.94	DIKY	228	244	172	12.09.94	DIKY	138	208
123	08.09.94	DIKY	292	264	173	12.09.94	DIKY	140	209
124	08.09.94	DIKY	117	197	174	12.09.94	DIKY	124	201
125	08.09.94	DIKY	300	266	175	12.09.94	DIKY	206	236
126	08.09.94	DIKY	141	209	176	13.09.94	DIKY	102	188
127	08.09.94	DIKY	183	227	177	13.09.94	DIKY	210	237
128	08.09.94	DIKY	174	224	178	14.09.94	DIKY	111	194
129	08.09.94	DIKY	204	235	179	14.09.94	DIKY	115	196
130	08.09.94	DIKY	128	203	180	14.09.94	DIKY	193	231
131	08.09.94	DIKY	144	210	181	14.09.94	DIKY	123	200
132	08.09.94	DIKY	178	225	182	14.09.94	DIKY	241	248
133	08.09.94	DIKY	154	215	183	14.09.94	DIKY	137	207
134	08.09.94	DIKY	121	199	184	14.09.94	DIKY	174	224
135	08.09.94	DIKY	295	265	185	14.09.94	KSAR SEGHIR	135	206
136	08.09.94	DIKY	131	204	186	15.09.94	OUED RMEL	182	227
137	08.09.94	DIKY	122	200	187	15.09.94	OUED RMEL	134	206
138	08.09.94	DIKY	179	226	188	15.09.94	DIKY	142	210
139	08.09.94	KSAR SEGHIR	116	196	189	15.09.94	DIKY	162	219
140	08.09.94	KSAR SEGHIR	198	233	190	15.09.94	DIKY	231	245
141	08.09.94	KSAR SEGHIR	223	242	191	15.09.94	DIKY	143	210
142	08.09.94	KSAR SEGHIR	108	192	192	15.09.94	DIKY	121	199
143	09.09.94	OUED RMEL	144	210	193	15.09.94	DIKY	98	186
144	09.09.94	DIKY	127	202	194	15.09.94	DIKY	154	215
145	09.09.94	DIKY	172	223	195	15.09.94	KSAR SEGHIR	257	253
146	09.09.94	DIKY	132	205	196	16.09.94	DIKY	151	214
147	09.09.94	DIKY	185	228	197	16.09.94	DIKY	286	262
148	10.09.94	KSAR SEGHIR	135	206	198	16.09.94	DIKY	196	232
149	10.09.94	KSAR SEGHIR	222	242	199	16.09.94	DIKY	117	197
150	10.09.94	KSAR SEGHIR	117	197	200	16.09.94	DIKY	127	202

Tab. 1 (continued)

	DATE	PORT	TW(kg)	FL'(cm)		DATE	PORT	TW(kg)	FL'(cm)
201	17.09.94	DIKY	179	226	251	01.10.94	DIKY	138	208
202	17.09.94	DIKY	169	221	252	01.10.94	DIKY	121	199
203	17.09.94	DIKY	297	265	253	01.10.94	DIKY	157	216
204	17.09.94	DIKY	180	226	254	01.10.94	DIKY	142	210
205	17.09.94	DIKY	247	250	255	01.10.94	DIKY	125	201
206	17.09.94	DIKY	146	211	256	01.10.94	DIKY	155	215
207	20.09.94	DIKY	110	193	257	01.10.94	DIKY	202	234
208	21.09.94	DIKY	139	208	258	01.10.94	DIKY	171	222
209	21.09.94	DIKY	168	221	259	01.10.94	DIKY	165	220
210	21.09.94	DIKY	159	217	260	01.10.94	DIKY	149	213
211	21.09.94	DIKY	292	264	261	02.10.94	DIKY	145	211
212	22.09.94	OUEB RMEL	140	209	262	02.10.94	DIKY	88	180
213	22.09.94	DIKY	158	217	263	02.10.94	DIKY	137	207
214	24.09.94	DIKY	206	236	264	02.10.94	DIKY	129	203
215	24.09.94	DIKY	105	190	265	02.10.94	DIKY	198	233
216	24.09.94	DIKY	140	209	266	02.10.94	DIKY	156	216
217	24.09.94	DIKY	126	202	267	02.10.94	DIKY	166	220
218	24.09.94	DIKY	354	280	268	02.10.94	DIKY	180	226
219	24.09.94	KSAR SEGHIR	187	229	269	02.10.94	DIKY	172	223
220	25.09.94	KSAR SEGHIR	127	202	270	02.10.94	DIKY	131	204
221	25.09.94	DIKY	212	238	271	02.10.94	KSAR SEGHIR	158	217
222	25.09.94	DIKY	311	269	272	03.10.94	DIKY	121	199
223	25.09.94	DIKY	152	214	273	03.10.94	DIKY	155	215
224	25.09.94	DIKY	152	214	274	03.10.94	DIKY	173	223
225	25.09.94	DIKY	113	195	275	03.10.94	DIKY	99	187
226	25.09.94	DIKY	85	178	276	03.10.94	DIKY	146	211
227	25.09.94	DIKY	110	193	277	03.10.94	DIKY	307	268
228	25.09.94	DIKY	155	215	278	03.10.94	DIKY	152	214
229	25.09.94	DIKY	335	276	279	03.10.94	DIKY	123	200
230	25.09.94	DIKY	159	217	280	03.10.94	DIKY	136	207
231	25.09.94	DIKY	317	271	281	03.10.94	DIKY	161	218
232	26.09.94	DIKY	127	202	282	03.10.94	DIKY	366	283
233	26.09.94	DIKY	180	226	283	04.10.94	DIKY	158	217
234	26.09.94	DIKY	144	210	284	04.10.94	DIKY	154	215
235	26.09.94	DIKY	113	195	285	04.10.94	DIKY	162	219
236	26.09.94	DIKY	143	210	286	04.10.94	DIKY	124	201
237	26.09.94	DIKY	105	190	287	04.10.94	DIKY	153	215
238	26.09.94	DIKY	181	226	288	04.10.94	DIKY	141	209
239	26.09.94	DIKY	132	205	289	04.10.94	DIKY	159	217
240	26.09.94	DIKY	165	220	290	04.10.94	DIKY	156	216
241	26.09.94	DIKY	281	261	291	04.10.94	DIKY	169	221
242	26.09.94	DIKY	231	245	292	04.10.94	DIKY	143	210
243	27.09.94	DIKY	208	237	293	05.10.94	DIKY	123	200
244	27.09.94	DIKY	160	218	294	05.10.94	DIKY	129	203
245	27.09.94	DIKY	180	226	295	05.10.94	DIKY	332	275
246	28.09.94	OUEB RMEL	133	205	296	05.10.94	DIKY	165	220
247	28.09.94	OUEB RMEL	147	212	297	05.10.94	DIKY	185	228
248	29.09.94	OUEB RMEL	182	227	298	05.10.94	DIKY	159	217
249	30.09.94	DIKY	145	211					
250	30.09.94	DIKY	170	222					

FL' : Estimated fork length calculated by the relationship between fork length and body weight. (Show Fig. 2)

Appendix tab. Fork length frequency distribution of bluefin tuna caught in the stait of Gibraltar. (31 Jul. '94~ 5 Oct. '94)

Class of fork length		Frequency	
	(cm)	Ind.	(%)
140	≤ < 145	0	0.0
145	150	1	0.3
150	155	0	0.0
155	160	0	0.0
160	165	0	0.0
165	170	0	0.0
170	175	0	0.0
175	180	6	2.0
180	185	5	1.7
185	190	10	3.4
190	195	15	5.0
195	200	23	7.7
200	205	30	10.1
205	210	37	12.4
210	215	24	8.1
215	220	40	13.4
220	225	22	7.4
225	230	22	7.4
230	235	14	4.7
235	240	9	3.0
240	245	11	3.7
245	250	4	1.3
250	255	3	1.0
255	260	3	1.0
260	265	5	1.7
265	270	6	2.0
270	275	4	1.3
275	280	1	0.3
280	285	2	0.7
285	290	1	0.3
290	295	0	0.0
295	≤ < 300	0	0.0
		298	100.0