MALTA FINAL REPORT 2000

Aims

Elaboration of Scientific Documents for submission to the Scientific Committee of CGPM and ICCAT's SCRS:

1. Fisheries: updated description. General view taking into consideration the fisheries description from projects supported by the European Community.

2. Spatial and temporal distribution of data on catch and fishing effort as well as length distributions by species and fishing gear. General view of the exploitation pattern taking into consideration the results from EU projects currently being developed.

3. Sex- ratio by length class, by species, fishing gear and spatial- temporal strata. Analysis of likely variability among fishing gears by fishing season and areas, taking into consideration the results reached during year 1999.

4. Length- weight relationships: to improve those worked out during year 1999.

5. Reproduction: spawning area and season (environmental description and variability). Sexual maturity by means of Gonadosomatic Index and Histological Analysis.

6. Growth and length- age keys: catch distribution into ages. Comparative analysis for bluefin tuna from traps.

7. Stock structure:

    7.1. Results for genetic analyses carried out during 1999 and those that will be implemented during year 2000 (bluefin tuna from traps).

    7.2. Analysis of the results from electronical tagging activities in collaboration with project FAIR- 97/3975 UE: improvement in our knowledge on bluefin tuna migration patterns in the Mediterranean Sea and Strait of Gibraltar.

8. Standardized abundance indices for bluefin tuna caught by traps: GLM analysis of historical series on catch and fishing effort (data for years 1999 and 2000).

9. Environment: oceanographic and environmental characterization of trap fishing areas and bluefin tuna reproduction areas during spawning season.

10. Associated species: to enhance the current data base by the inclusion of data on catch, length distributions and sex- ratio for associated species (sharks) closely linked to swordfish fishing activities by surface longliners. Incidence of several fishing gears on commercial shark species.

Objective 1

Fisheries Description

1.1 Bluefin Tuna

Bluefin tuna (*Thunnus thynnus*) fishing season in Malta starts during the month of May and extends until the month of July.

The upsurge in bluefin tuna landings came about as a result of the tapping of the Japanese market in1989 and in fact one will find that from a mere 48,669 kilos in1990 landings shot up to 353,014 in 1995 as a result of diversification of the fishing effort by the larger vessels. The decrease in landings during the last 3 seasons may be attributed to the large presence of tuna purse seiners off the Maltese Islands.

In 1998 tuna were targeted by 52 multi-purpose vessels ranging from 10 to 20 metres, 150 full-time fishermen and part-time fishermen. The total landings were 244,749 kg of which 108,768 kg (45 %) was exported.

The decrease in landings from 1995 onwards may be mainly attributed to the large presence of foreign tuna purse seiners just off the Maltese Islands, which carry out a very efficient operation.

The gear used is drifting surface longline and is baited with Atlantic mackerel and/or Japanese squid. The maximum number of hooks set in a longline is 2,500 and this depends mostly on the size of the boat. The lines are set during the afternoon and the operation goes on till around 8.00 p.m. since fishermen reckon that this is the prime time for the fish to bite. The lines start being retrieved from around 10.30 p.m. onwards.

Fishing is undertaken to the West, South and South East of the Maltese Islands between the 35^{th} and 36^{th} parallels with the following parameters: on the Western limit Latitude 35:52:00 Longitude 13:30:00 (50 miles from Marsaxlokk harbour) to the southern extremity Latitude 35:21:58 Longitude 12:25:24 (30 miles from Marsaxlokk harbour) to the south east Latitude 35:22:74 Longitude 15:03:14 (37 miles from Marsaxlokk harbour) which covers approximately 2,000 square miles (Busuttil, C 1999, *pers. comm*.).

At the beginning of the season, i.e. in May, the effort is undertaken mainly in the South West area of the region and consequently further to the east according to the normal movement of the bluefin tuna. The season ends in July.

The main landing zones are Marsaxlokk, St. Paul's Bay and Marsascala harbours in Malta, whilst those in Gozo are Mgarr and Marsalforn harbours. Marsaxlokk is the harbour where most of the tuna is landed.

The tuna is usually gutted (removal of internal organs and gills) on board and is unloaded at the fish market in Malta. The tuna for export is the prepared (removal of head and bones) and exported directly either by plane or by boat in freezer containers.

The potential catch size per boat per season for the Maltese fishermen amounts to approximately 80 bluefin tuna and ranges between 50 and 100 according to the year.

The long-line ('konz') (Fig. 1) is the most popular method for tuna fishing in our islands. In August 1953, the British Government decided to invite Mr. T.W. Burdon, then the deputy Director of Fisheries in Singapore, to prepare a report on the fishing industry in our islands. Mr. Burdon suggested that tuna fishing should be carried out by the long-line, as this was a less expensive implement than the 'tonnara' and did not require such a large number of fishermen working together concurrently. It was however only in the sixties that this fishing system became widely used.

The long-line, which is of a surface drift type, can vary from 20 kilometers to 120 kilometers in length; hence its name. It is usually kept afloat ('konz tal-wicc'). The main line is usually monofilament with a diameter ranging between 1.8 – 2.0 mm. Along the main line, there are the side lines / snood ('brazzol') which are about 6 m long. The snoods are also made of monofilament but with a smaller diameter of around 1.6 mm. The distance between two consecutive snoods is usually around 54 m. The snoods are alternatively fitted with a small white buoy. Floating flags tied to long bamboo rods are used along the line and these begin to vibrate vigorously when a fish is caught. At the end of each side line, there is a hook to which the bait is attached. The hooks used are of the Japanese round type. The number of hooks used by each fishermen is usually in the region between 1500 and 2500. The length of long-line and number of hooks used depend on the vessel and the crew. The bait used for fishing for bluefin tuna includes Atlantic mackerel and squid, which are alternatively attached to the hooks. The squid provides a better bait for the bluefin tuna but is in turn much more expensive.

Early in the afternoon, casting of the long-line starts with a speed of about 7 knots. It begins at a distance of about 15 kilometers from the coast and may take till about 8:30 in the evening, i.e. just before sunset.

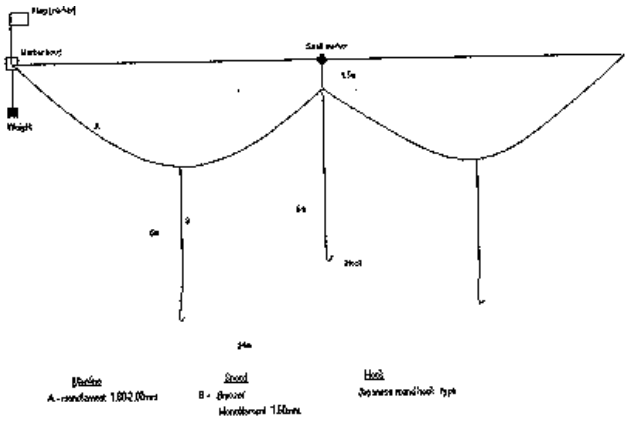

Fig. 1 Typical Maltese Surface Longlines - BFT

Hauling starts at around 10:30 and is done with special belt hydraulic winches. The master of the boat uses a strong light fixed to the bow of the boat to spot the small marker buoys. Hauling is done at a speed of about 6 to 7 knots. The time spent on hauling depends on the amount and type of fish caught because if for example the fish caught are still alive, it would take much longer to haul the fish on board.

Since the long-line is very long and consists of many hooks, it is very liable to get entangled. It is therefore wound up in a circular basket and the hooks are attached to straps of cork which are fixed around the rim of the basket. The long-line is then ready to be used again without any problems.

1.2 Swordfish

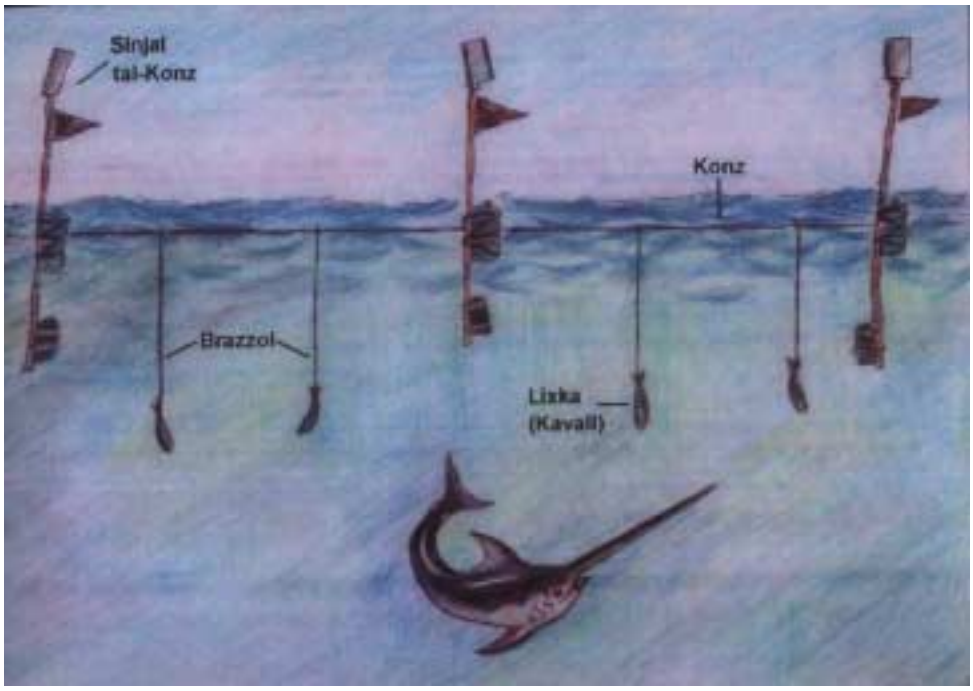

Fig. 2 Typical Maltese Surface Longlines - SWO

Objective 2

2.1 Collection of Data from the Fishmarket

The first part of the project involved the collection of information regarding the vessels which go fishing for tuna. In this respect, the data collected gave a brief overview of the vessels involved in the tuna season. Fishing effort data are very important in studying current fisheries activities as well as the status of stocks and in forecasting future trends.

The fishery craft statistics enabled us to decide how to conduct the sampling for this project.

Since in Malta registration of all boats is required by law, with the help of Fisheries Officers, the boats which are yearly engaged in tuna fishing were identified and for each fishing craft, the following information was collected from the respective owners:

Craft Registration Number	
Port	
Crew	
Number of Hooks	
Type of Vessel	
Length of Vessel (m)	
Width of Vessel (m)	
Draught of Vessel (m)	
Propulsion (hp)	

Table 1 Fishing Vessels Data Forms

2.2.1 Craft Registration Number

The craft registration number of each vessel was obtained from the Fisheries Department since in Malta registration of fishing boats is required by law.

Fig. 3 Main Fishing Ports

The owners of the three fishing vessels were contacted and asked to help with this project by allowing an observer on board to stay on the fishing vessel during fishing. The observers on board were taught how to collect the necessary information by the procedures described below.

2.1.2 Port

There are various ports scattered around the Maltese Islands as shown in Figure 2.3, where tuna fishing vessels can be anchored but the main ones include: Mgarr in Gozo and Marsaxlokk in Malta.

During the data collection exercise, the port from where each fishing vessel operates was recorded.

2.1.3 Number of Hooks

In Malta, tuna is caught by means of the surface drift long-line. This is usually made up of a main line along which are the side lines. At the end of each side line, there is a hook (Fig. 4) to which the bait is attached.

The number of hooks used for each fishing trip is very important for Fishery Statistics in order to calculate the Catch per Unit Effort.

Fig. 4 Hook used in catching BFT

2.2 Fishing Vessels used During the Bluefin Tuna Season

2.3.1 The 'Luzzu'

The 'luzzu' is a typical Maltese fishing boat. It is fusiform in shape (tapering at both ends) and carvel-built with a vertical stem pot at the prow which s slightly higher than the stern. Both the bow and the stern rise above the rest of the vessel in order to protect the crew from the spray of the sea when the boat is moving against the waves.

The luzzu-type boat was introduced in Malta in the beginning of this century when some men from Mosta brought a design of an English fishing boat to Marsaxlokk and boats started being built according to this new design. Initially, as all other fishing boats, the luzzu was propelled by sails and oars, but, as motor engines were increasingly applied to the vessels the number of 'luzzijiet' increased considerably. Today, many of them have a cabin installed, and a store for fish.

The name 'luzzu' possibly originates from 'lozzu' which is the Maltese name given to the Mediterranean barracuda. Like this fish, the 'luzzu' is fusiform in shape; the original name of this fishing boat was indeed 'lozzu' and not 'luzzu'. The length of this fishing boat usually reaches 15 m. Registered 'luzzijiet' belonging to full time and part time fishermen, as on 31 December 1998, amounted to 270 in Malta and 78 in Gozo.

2.3.2 Multi Purpose Vessel

The other fishing vessels used for bluefin tuna fishing are the launch or multi purpose vessels. On 31 December 1998, there were 59 of them registered in Malta and 20 in Gozo. These launches are all equipped with a cabin and are also widely decked. They are moderately fast vessels, with plenty of comforts for the crew and ample space for storing and handling all the various fishing implements and the captured fish.

2.4 Results

The data collected is summarized in Fig. 5, 6, 7 and 8 below.

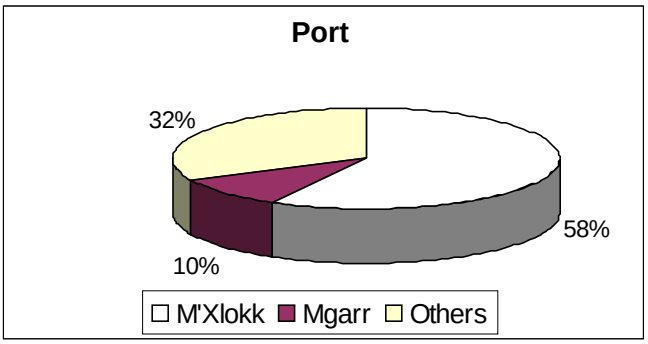

Fig.5 Number of Fishing Vessels per Port

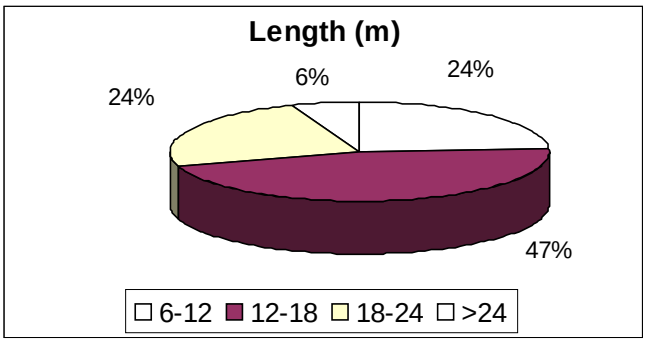

Fig.6 Length Range of Fishing Vessels in Marsaxlokk

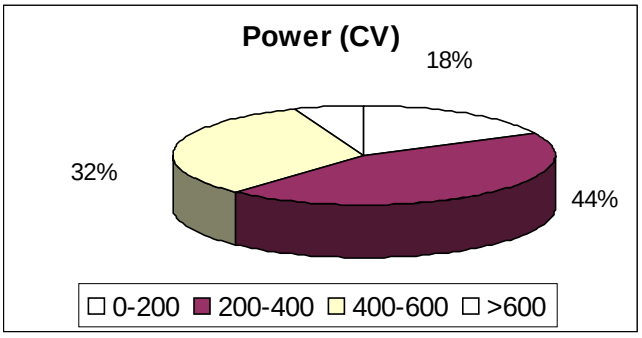

Fig.7 Power Range of Fishing Vessels in Marsaxlokk

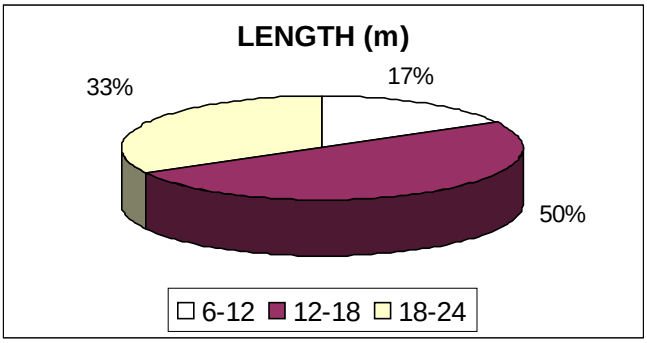

Fig.8 Length Range of Fishing Vessels in Mgarr

3.6 Collection of Data from Fish Market

Important data was collected daily from the fish market. This included all the individual weights of the bluefin tuna caught during May and June

Date	
Quantity (number)	
Fish Species	
Weight (kg)	

Table 2 Fish Market Data Forms

3.7 Results

Table 2 shows the number of BFT caught during each month and their respective weight. The average weight for BFT for each month is also calculated. Fig. 9 and 10 are graphical distributions of the results obtained in Table 3.

Month	Number	Catch/kg	Average Weight/kg
4	10	1525,5	152,6
5	1062	156712,99	147,6
6	904	133485,75	147,7
7	183	29332,75	160,3
Total	2159	321056,99	148,7

Table 3 Tuna Catches for 2000

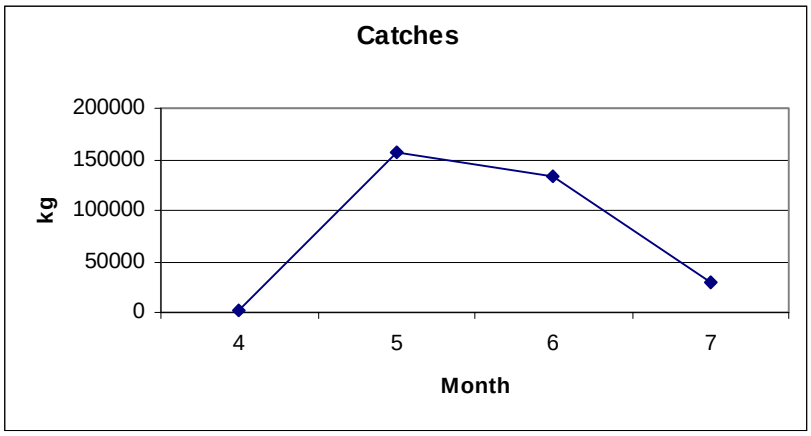

Fig. 9 Weight (kg) of BFT caught by LLHB during the Year 2000

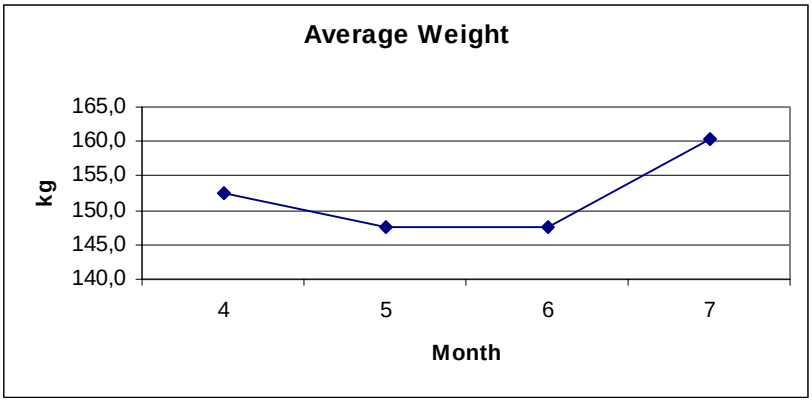

Fig. 10 Average Weight of BFT caught by LLHB during the year 2000

3.7.1 Size Distribution

The lengths of tuna were grouped in 5 cm intervals and Table 4 shows the number of bluefin tuna caught at each appropriate length range during the months of May and June. It also indicates the total of bluefin tuna in each class range. Fig. 11, 12, 13, 14 and 15 are graphical distributions of data collected in Table 4.

GEAR: LLHB BFT-200

Size	4	5	6	7	Total
50	0	0	0	0	0
55	0	0	0	0	0
60	0	0	0	0	0
65	0	0	0	0	0
70	0	0	0	0	0
75	0	0	0	0	0
80	0	2	0	0	2
85	0	0	0	0	0
90	0	0	0	0	0
95	0	0	1	0	1
100	0	8	1	1	10
105	0	7	1	0	8
110	0	34	14	3	51
115	0	20	9	2	31
120	0	23	6	2	31
125	1	25	15	3	44
130	0	20	9	1	30
135	0	14	8	1	23
140	0	17	5	1	23
145	0	10	5	0	15
150	0	18	10	0	28
155	0	15	3	1	19
160	0	20	14	6	40
165	2	32	27	5	66
170	0	36	31	5	72
175	0	50	32	6	88
180	3	39	28	7	77
185	0	16	32	8	56
190	2	19	47	8	76
195	0	32	57	11	100
200	0	56	90	13	159
205	0	92	117	15	224
210	1	98	106	11	216
215	1	96	76	8	181
220	1	77	48	18	144
225	1	67	43	10	121
230	0	38	31	11	80
235	0	29	15	12	56
240	0	25	14	7	46
245	0	18	4	2	24
250	0	10	5	2	17
255	0	8	2	4	14
260	0	6	1	0	7
265	0	3	1	0	4
270	0	1	1	0	2
275	0	4	0	0	4
280	0	0	0	0	0
285	0	0	0	0	0
290	0	0	0	0	0
295	0	0	0	0	0
300	0	0	0	0	0
305	0	0	0	0	0
310	0	0	0	0	0
315	0	0	0	0	0
320	0	0	0	0	0
325	0	0	0	0	0
330	0	0	0	0	0
335	0	0	0	0	0
340	0	0	0	0	0
345	0	0	0	0	0
350	0	0	0	0	0
Total	12	1085	909	184	2190

Table 4 No. of Bluefin Tuna Caught at each Size range

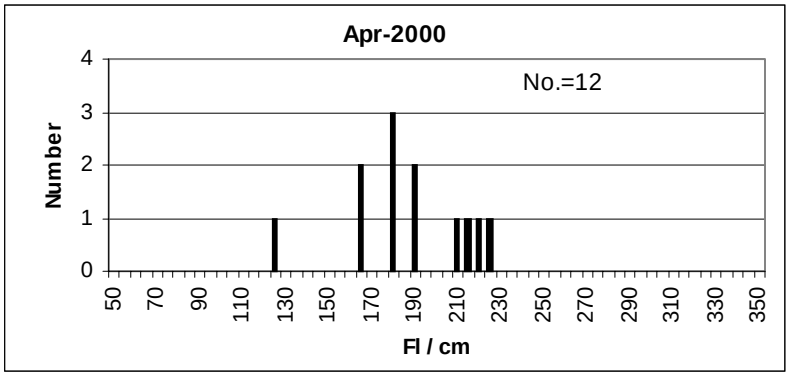

Fig.11 Distribution of Length of BFT caught by LLHB inApril 2000

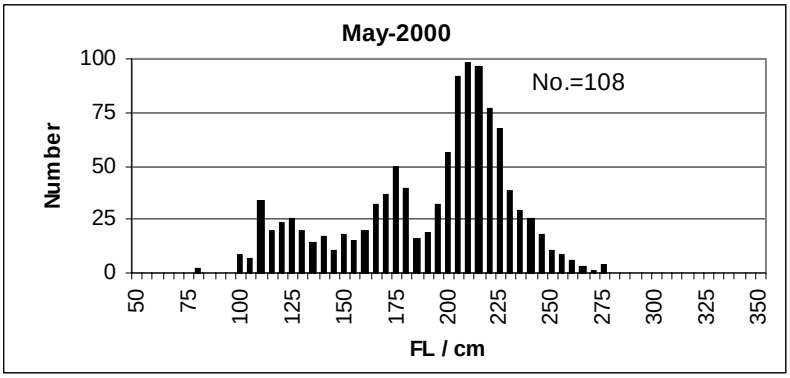

Fig. 12 Distribution of Length of BFT caught by LLHB in May 2000

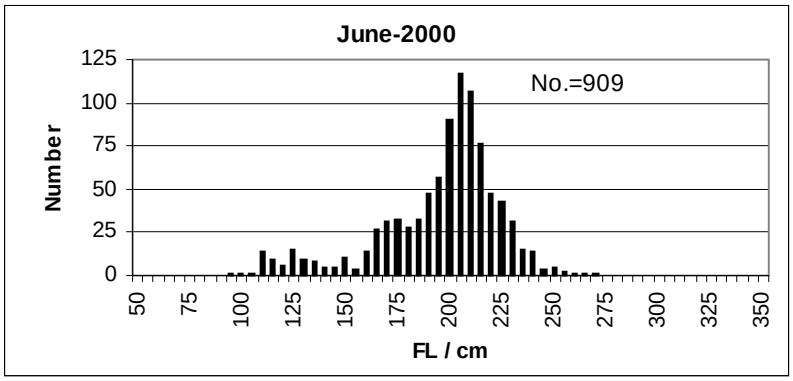

Fig.13 Distribution of Length of BFT caught by LLHB in June 2000

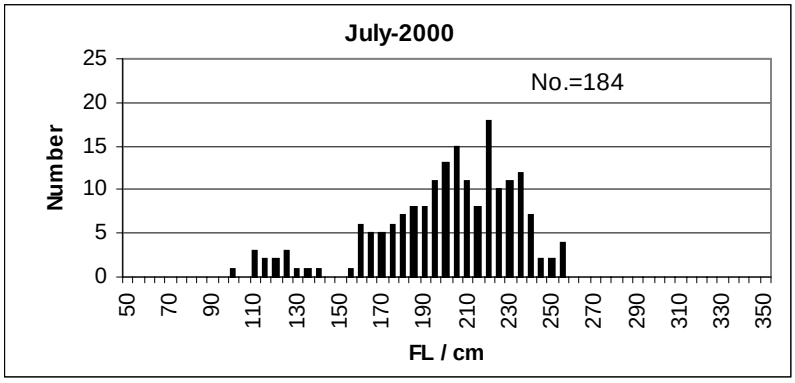

Fig. 14 Distribution of Length of BFT caught by LLHB in July 2000

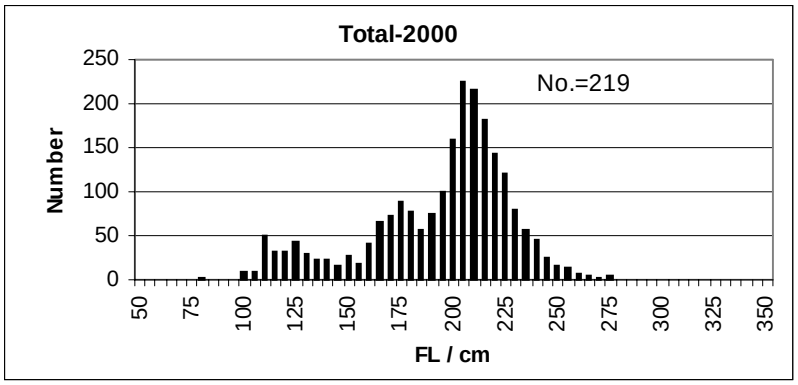

Fig. 15 Distribution of Length of all BFT caught by LLHB 2000

3.8 Data Collected for SWO

As regards swordfish, the only data that could be collected was the total weight of SWO for each month. No individual readings were collected since there were no observers on board SWO fishing vessels or at the fishmarket. Data collected is shown in Table 5 and Fig. 16 is a graphical representation of the data collected.

MONTH	WEIGHT (Kg)
1	4630
2	4326
3	3424
4	1521
5	12714
6	27098
7	28158
8	24548
9	6913
10	12773
11	12596
12	1454
Total	140155

Table 5 SWO Catches per Month for 2000

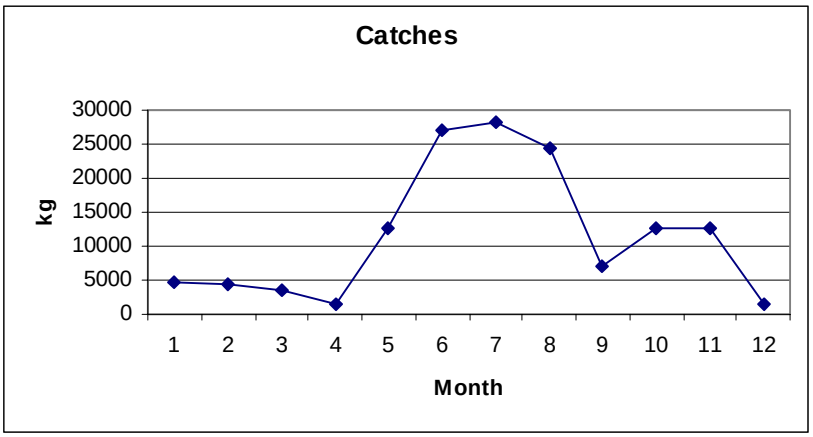

Fig. 16 Swordfish Catches per Month for 2000

Objective 3

Sex Ratio

Identification of Sex

Sex determination of tuna can only be done by examining internal organs. Thus, information on sex could only be obtained from carcasses which had not been eviscerated. The observers on board were asked to identify the sex of the individual tuna and record the information on the forms indicated above since the tuna are gutted out at sea.

Table 6 gives the number of male and female bluefin tuna observed by the observers on board the fishing vessels. Fig. 17 gives the female percentage by size class of BFT caught by LLHB during the year 2000.

BFT-LLHB				2000
Size	No.	M	F	%
80	1	1	0	0%
85	1	1	0	0%
90	0	0	0	-
95	0	0	0	-
100	1	1	0	0%
105	3	2	1	33%
110	0	0	0	-
115	2	2	0	0%
120	3	2	1	33%
125	3	2	1	33%
130	1	1	0	0%
135	2	1	1	50%
140	3	1	2	67%
145	3	1	2	67%
150	6	1	5	83%
155	2	1	1	50%
160	1	0	1	100%
165	4	2	2	50%
170	2	1	1	50%
175	0	0	0	-
180	4	2	2	50%
185	6	2	4	67%
190	4	2	2	50%
195	5	1	4	80%
200	1	1	0	0%
205	4	2	2	50%
210	11	3	8	73%
215	3	2	1	33%
220	7	2	5	71%
225	3	1	2	67%
230	10	4	6	60%
235	13	8	5	38%
240	10	4	6	60%
245	6	3	3	50%
250	4	3	1	25%
255	6	3	3	50%
260	6	4	2	33%
265	1	1	0	0%
270	4	3	1	25%
275	1	1	0	0%
280	0	0	0	-
285	0	0	0	-
290	0	0	0	-
295	1	1	0	0%
300	0	0	0	-
Total	148	73	75	51%

Table 6 No. of Male and Female BFT observed for Each Size Range

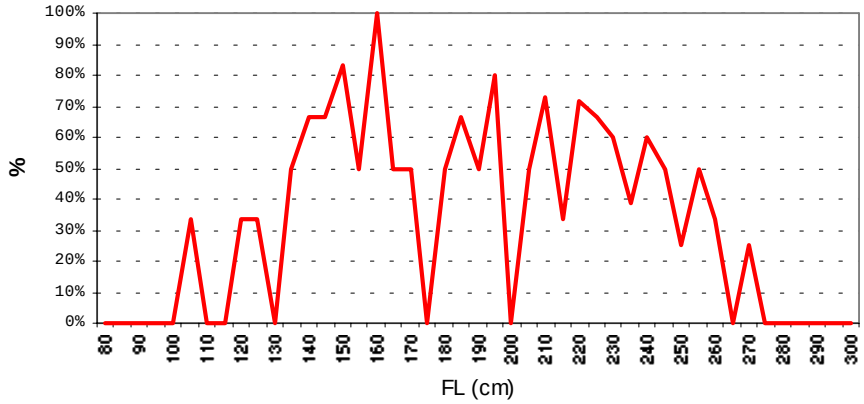

Fig. 17 Female Percentage by Size Class

Objective 4

Lenght – Weight Relationships

The data was collected as explained in Objective 4 and Figure 18 indicates the individual lenghts and weights of all the tuna sampled by the observer on board.

Fork Length	Weight (Kg)	Fork Length	Weight (Kg)	Fork Length	Weight (Kg)
255	258,1	249	235,48	155	163,56
256	256,36	251	232	125	129,92
236	212,28	235	168,2	224	218,08
270	358,44	255	233,16	180	106,72
260	276,08	210	147,32	204	168,2
181	95,12	210	171,68	193	174
240	200,68	185	97,44	215	190,24
252	241,28	180	85,84	188	143,84
240	213,44	240	226,2	102	42,34
236	222,72	195	98,6	137	102,08
259	269,12	232	178,64	167	150,8
225	199,52	230	196,04	210	206,48
279	327,12	270	150,8	198	201,84
230	191,4	270	172,84	213	271,44
259	288,84	220	154,28	195	192,56
210	148,48	245	232	172	150,8
213	154,28	239	261	108	29
230	197,2	242	199,52	208	198,36
250	249,4	260	238,96	250	264,48
248	249,4	260	257,52	210	206,48
235	247,08	266	290	185	174
238	212,28	230	249,4	238	263,32
242	213,44	295	429,2	216	185,6
230	208,8	165	73,08	127	133,4
230	214,6	214	191,4	225	278,4

228	201,84	239	229,68	198	204,16
260	187,92	180	105,56	148	170,52
185	110,2	216	228,52	159	179,8
272	287,68	206	203	109	53,94
230	161,24	239	277,24	82	26,68
235	207,64	224	218,08	88	44,08
120	46,4	115	37,12	128	75,98
235	175,16	153	92,8	208	233,16
235	164,72	117	42,92	188	187,92
190	95,12	221	267,96	221	251,72
210	160,08	208	190,24	213	250,56
255	228,52	145	74,24	165	187,92
150	112,52	249	177,48	138	131,08
220	142,68	211	262,16	152	164,72
236	179,8	130	61,48	192	214,6
190	112,52	120	41,76	151	172,84
245	192,56	107	33,06	142	141,52
240	204,16	188	167,04	163	179,8
230	150,8	122	47,56	89	13,34
140	45,24	151	109,04	97	15,66
145	61,48	168	170,52	92	15,37
151	48,72	198	36,54	76	10,73

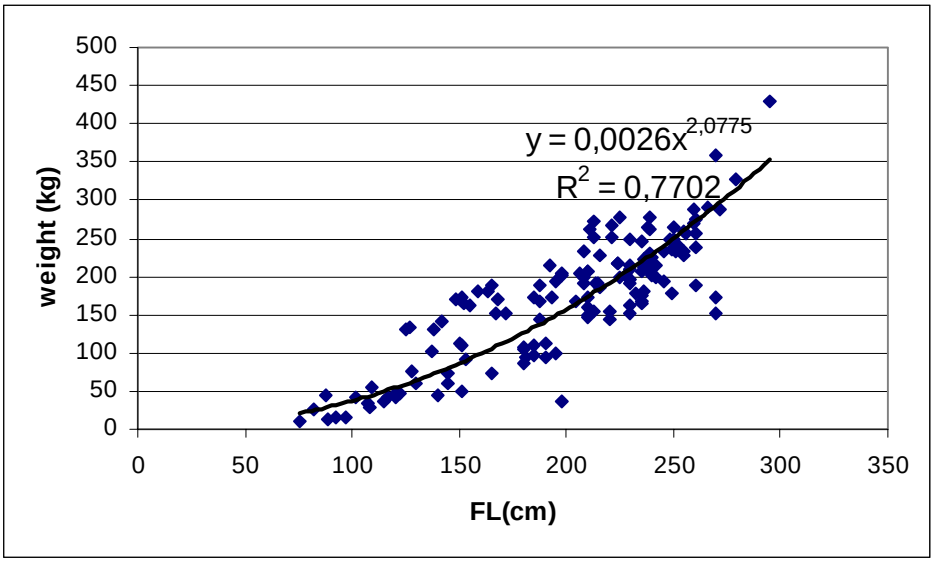

Fig. 18 Length-weight relationship for BFT sampled during the year 2000.

Objective 5

Reproductive Studies

The female gonads that were identified were weighed using the small balance available on board. 30 samples from the gonad were collected.

Histological analysis will be carried out and a document will be represented on the sampling meturity of BFT caught.

Objective 6

Growth Studies

The first dorsal fin of each tagged tuna landed in the fish market was spread and the membrane between the two first dorsal rays was cut. Then the first dorsal ray was bent forward until the ligaments were broken. The ray was then turned round to the right and to the left alternatively until it came out. Each ray was kept in an envelope labeled with the tag number. The spiny rays were kept in a cool place until laboratory analysis.

53 spines were collected by the 3 observers onboard. Samples were collected from each size range. At the moment they are being kept in Malta until it is decided where the sectioning will be carried out. Finally a key can be presented for BFT caught from around the Maltese Islands.

These spines will be sectiond and read and will be used to improve the legth-age key prepared during the year 1999.

Objective 7

96 samples have been collected from the muscle tissue of BFT. Genetic analysis will be carried out in order to elavorate on stock structure.

No tagged bluefin tuna have been recaptured around the Maltese Island.

Objective 8

The necessary information regarding BFT and SWO have been collected from the statistics section of the fishamarket. These will be used to analyze the historical series on catch and prepare a document of standardized abundance indices.

Objective 9

Objective 10

ByCatch

Important data was collected daily from the fish market. This included the number and weight of other species caught by the longline of bluefin tuna.

The data collected is summarized in Table 7.

	May		June	
	No.	Weight / kg	No.	Weight / kg
ALB	3	31,25	116	546,75
hutakahla	6	124	13	265,25
gurdien	4	376,5	1	128,5
kelb	1	49	0	0
lamp	1	15,25	35	370,5
pastar	10	180,75	6	75,25
pplamptu	1	108,5	0	0
raspa	10	66,75	20	184,5

Table 7 No. and Weight of other Species caught by BFT LLHB

Annex 1

SCRS/108/00

PRELIMINARY STUDY ON THE AGE ESTIMATION OF BLUEFIN TUNA (*Thunnus thynnus*, L.) AROUND THE MALTESE ISLANDS

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ABSTRACT

A preliminary age-length key is presented based on 84 bluefin tuna (*Thunnus thynnus*, L.) samples caught around the Maltese Islands by longline fishing between May and June 1999. The length of the bluefin tuna ranged from 106 cm to 290 cm while the weight ranged from 65 kg to 295 kg. Spine analysis of the sampled tuna revealed that the age ranged from 8 to 14 years. An extension of the age-length key made by Cort (1990) has been prepared to include larger fish. The age of all the other tuna caught in this period of time was calculated using the prepared key.

INTRODUCTION

The bluefin tuna fishing season in Malta starts during the month of May and extends until the month of July. The fishing of bluefin tuna has been undertaken by Maltese fisherman for a very long time. Statistics kept at the Department of Fisheries show that as early as 1920 a substantial amount of tuna was already being landed regularly during the season. The upsurge in bluefin tuna landings came about as a result of the tapping of the Japanese market in 1989 and in fact one will find that from a mere 48,669 kg in 1990, landings shot up to 353,014 kg in 1995 as a result of the diversification of the fishing effort by the larger vessels. The decrease in landings during the last three seasons may be attributed to the large presence of tuna purse seiners off the Maltese Islands. In 1998 150 full-time and part-time fishermen targeted tuna using 52 multi-purpose vessels ranging from 10 to 20 m. The total landings were 244,749 kg of which 108,768 kg (45%) was exported. The surface long-line is the most popular method for tuna fishing in the Maltese Islands. It can vary from 20 km to 120 km in length and the number of hooks used by each fisherman ranges from 1500 to 2500.

A wide variety of ageing techniques have been applied to bluefin tuna, including length-frequency analysis, tagging studies and examination of hardparts (vertebrae, spines, otoliths). Many of these techniques provide good results in ageing younger fish but age estimation of adult bluefin is more complicated. Reading interpretation of bluefin tuna

spines in adult fish is rather difficult since most of the first rings would have been reabsorbed. One must then back calculate body size at age based on the relationship that exists between the growth of the spine and the fish.

No previous studies have been made about the age structure of bluefin tuna caught around the Maltese Islands. The objective of this paper is to give a preliminary estimation of the age composition of adult bluefin tuna caught in the Maltese longline fishery.

This document has been carried out with the help of COPEMED Project, under the coordination of D. Jose Miguel de la Serna (Instituto Español de Oceanografía, Malaga).

MATERIALS AND METHODS

A total of 84 bluefin tuna spines (46 males, 38 females) were collected around the Maltese Islands (Fig. 1) during May and June 1999. The fish length ranged from 106 cm to 290 cm. From the individual weights of the total catch, the individual lengths have been calculated using the length-weight conversion for bluefin tuna for the Mediterranean (Arena; unpubl). The method of extraction, preparation and sectioning of spines used was the one described by Compean-Jimenez & Bard (1980). The samples were cut with a low speed saw (ISOMET) in sections ranged from 0.5 mm to 0.7 mm. The sections were then mounted on slides covered with a transparent resin (EUKITT) that was useful to fix the samples as well as to clarify the possible bands or annuli. The measuring and reading of the spinal sections was carried out with a profile projector using a zoom of 10. A binocular lens was also used together with a micrometer to determine ring diameter.

Most of the samples belonged to large fish older than 4 years old, which means that it was impossible to find all the rings since normally the nucleus or center of the spine would have been reabsorbed and consequently the first rings have disappeared. For this reason, the table prepared by Cort (1990) which provides the parameters (mean, standard deviation, and confidence interval) of the ring diameters for ages 1 to 7 years old has been used. Based on these parameters, the first visible ring was identified and assigned its respective age according to the table. Then all the successive rings were counted and measures of their respective diameters (mm) taken when possible.

RESULTS AND DISCUSSION

The parameters obtained from measuring the diameter of the corresponding rings are given (Table 1). These values are in good agreement with those obtained by Cort (1990) and Rey *et al*., (1984) although they only reach up to 8 years old fish. In this paper values obtained from measuring samples up to 15 years old are given.

The study of 72 spines allowed us to build up a preliminary age-length key prepared for large bluefin tuna (Table 2). Bluefin tuna spines were collected between May and June and most of them presented the last visible ring near the border.

The bluefin tuna longline fishery was mostly composed of large fish ranging from 86 to 275 cm (Fig. 2). The demographic composition of the catch in 1999 applying the before mentioned age-length key is presented in Table 3. Individuals from some length classes are missing since it has not been possible to assign and age (due to the low number of spines in some length groups) but in general terms most fish belong to the 8 to 10 years old age group.

As noted by other authors in the western stock (Butler *et al*., 1977, Hurley *et al*., 1981), differences in age and growth between adult males and females exist. Although sex data has been recorded, analysis of the spinal sections by sex has not been possible to perform due to the wide range of lengths and the low number of samples in each length class. However collection of new data will continue and further studies will be made.

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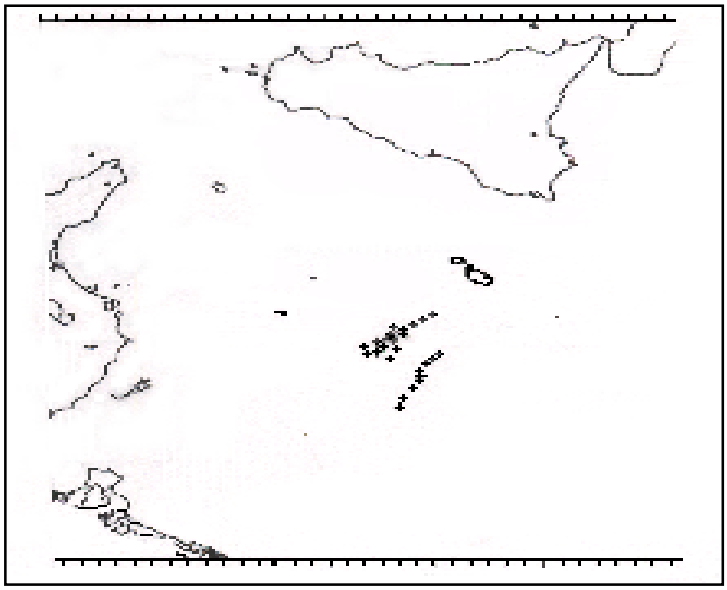

Fig. 1 Map indicating area from where bluefin tuna used in the study was caught

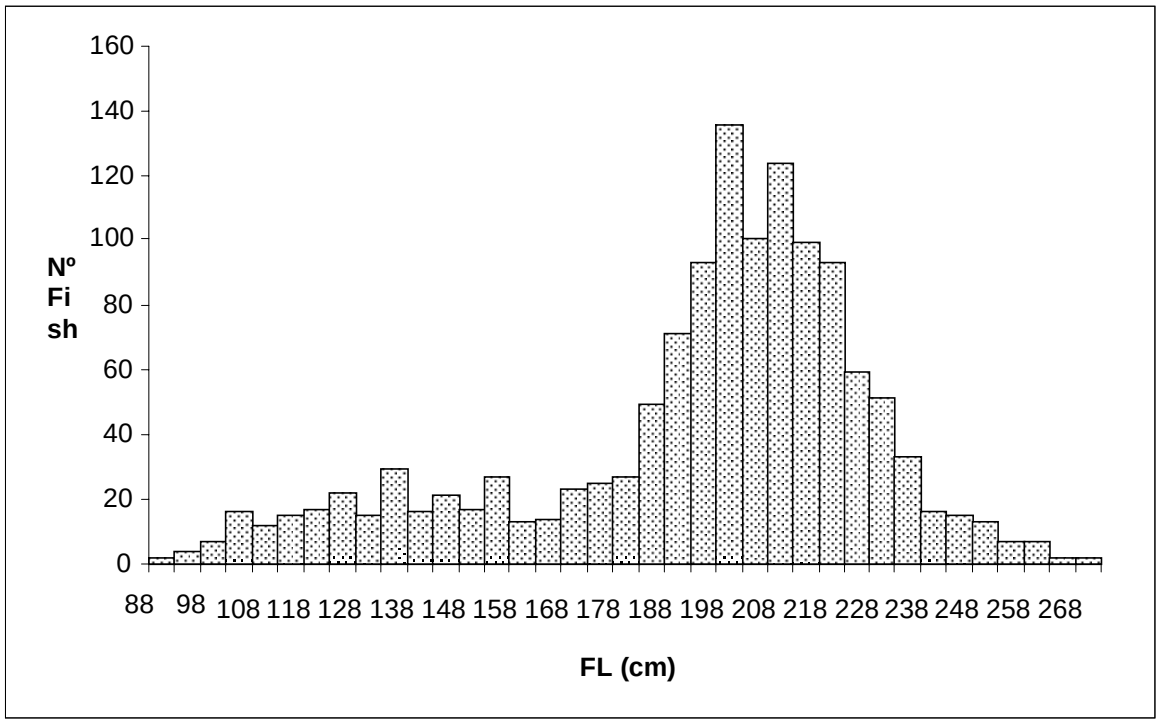

Fig. 2. Length-frequency distribution of bluefin tuna caught by longline fishery around the Maltese Islands in 1999.

Age	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
N	3	6	14	24	48	50	42	46	43	38	34	18	12	3	1
Mean	2.23	3.43	5.14	6.30	7.48	8.59	9.58	10.44	11.26	12.09	12.68	13.58	14.36	15.10	16.41
s.d.	0.21	0.25	0.45	0.32	0.30	0.29	0.29	0.37	0.46	0.52	0.74	0.82	0.88	1.10	
Sy	2.18	3.38	5.03	6.25	7.46	8.57	9.56	10.40	11.20	12.00	12.50	13.27	13.93	13.72	
Sx	2.28	3.48	5.24	6.34	7.51	8.62	9.61	10.48	11.33	12.18	12.86	13.89	14.80	16.48	

Table 1. Values and parameters (N= number of samples, Mean, s.d.= standard deviation, Sy = Inferior limit of confidence interval, Sx = superior limit of confidence interval) obtained from measuring the rings diameter of bluefin tuna spinal sections.

Length/Age	4	5	6	7	8	9	10	11	12	13	14	15	N
106-110	1.00												1
111-115													0
116-120			1.00										1
121-125													0
126-130		1.00											1
131-135													0
136-140		1.00											1
141-145													0
146-150				1.00									1
151-155			1.00										1
156-160			1.00										1
161-165													0
166-170			1.00										1
171-175													0
176-180													0
181-185						1.00							1
186-190					1.00								1
191-195						1.00							1
196-200					1.00								3
201-205								1.00					2
206-210							1.00						3
211-215					0.20			0.60		0.20			5
216-220							0.50			0.50			4
221-225					0.25		0.38		0.13	0.25			8
226-230						0.20	0.40	0.40					5
231-235								0.50	0.25	0.25			4
236-240						0.44		0.33	0.11	0.11			9
241-245								0.67		0.33			3
246-250									1.00				2
251-255								0.25		0.50	0.25		4
256-260								0.33	0.33			0.33	3
261-265									0.50		0.50		2
266-270										1.00			1
271-275								1.00					1
276-280								1.00					1
281-285													0
286-290												1.00	1
N	1	2	4	1	7	7	10	18	7	11	2	2	72

Table 2. A preliminary age-length key prepared for large bluefin tuna.

Age	4	5	6	7	8	9	10	11	12	13	14	15
Nº fish	12	31	80	17	242	159	213	216	34	102	3	2
%	1.1	2.8	7.2	1.5	21.8	14.4	19.2	19.4	3.0	9.2	0.2	0.2

Table 3. Demographic composition of bluefin tuna catch for 1999 in Maltese Islands.

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