

## BLUEFIN TUNA (*THUNNUS THYNNUS* L.) CATCH COMPOSITION IN THE TYRRHENIAN SEA AND IN THE STRAIT OF SICILY IN 2004

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### SUMMARY

*The more efficient system putted in place with the enforcement of the EC Reg. 1543/00, called "EC Data Collection Programme" and the new ICCAT Recommendations are slowly contributing to overcome the difficulties in obtaining reliable size data from the bluefin tuna fishery that, after the adoption of the quota system and the development of tuna caging, had showed several problems in the more recent years. The data presented in this report include the available size data, providing an updated overview of the 2004 fishery activity in the Tyrrhenian Sea and in the Strait of Sicily. For the second time, it was possible to obtain data also from some fattening plants, improving the data bank for the purse-seine fishery. It is important to underline that relevant percentages of giant bluefin tuna (over 3 m or >300 kg have been measured again this year, in the two area, confirming the previous comments made in 2004. Differences in catch composition among the various gear used are quite remarkable.*

### RÉSUMÉ

*L'efficacité améliorée du système mis en place avec l'exécution de la Rég. CE 1543/00, intitulé « Programme de collecte des données de la CE » et les nouvelles recommandations de l'ICCAT contribuent lentement à surmonter les difficultés à obtenir des données de taille fiables auprès de la pêcherie de thon rouge qui, après l'adoption du système de quotas et l'essor de la mise en cages des thons, avait connu plusieurs problèmes ces dernières années. Les données présentées dans ce rapport incluent les données de taille disponibles et fournissent une actualisation des activités halieutiques en 2004 réalisées dans la mer Tyrrhénienne et dans le Déroit de Sicile. Pour la deuxième fois, il a été possible d'obtenir également des données de certaines installations d'engraissement, ce qui a amélioré les bases de données de la pêcherie de senneurs. Il est important de noter qu'un nombre considérable de thons rouges géants (plus de 3 m ou >300 kg) ont été mesurés une fois de plus cette année, dans les deux zones, ce qui confirme les commentaires formulés en 2004. Il existe de grandes différences dans la composition de la capture en fonction des divers engins utilisés.*

### RESUMEN

*El sistema más eficaz establecido con la implementación del Reglamento CE 1543/00, denominado Programa CE de recopilación de datos, y las nuevas Recomendaciones de ICCAT están contribuyendo lentamente a que se superen las dificultades en la obtención de datos fiables de talla de la pesquería de atún rojo que, tras la adopción del sistema de cuotas y el desarrollo de la cría de atún rojo, había planteado numerosos problemas en los años más recientes. Los datos presentados en este informe incluyen los datos de talla disponibles, lo que supone una visión actualizada de la actividad de la pesquería en el mar Tirreno y en el Estrecho de Sicilia en 2004. Por segunda vez también fue posible obtener datos de algunas plantas de engorde, mejorando la base de datos para la pesquería de cerco. Cabe destacar que se han vuelto a calcular este año los porcentajes relacionados con atún rojo gigante (más de 3 m o >300 kg) para las dos zonas, confirmando los comentarios anteriores realizados en 2004. Las diferencias en la composición de la captura entre los diferentes artes utilizados son muy notables.*

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## KEYWORDS

*Large pelagic species; bluefin tuna; Mediterranean Sea; Size frequency analysis; Long-line fishing; Hand-line fishing; Purse-seine fishing; Catch composition; Data collection.*

### 1 Introduction

The bluefin tuna fishery is an historical and traditional fishing activity in Italy, but particularly in the southern part and the islands (Cau *et al.*, 1999), since ancient times. Besides of the last remaining tuna trap in the eastern Sicily (the first industrial fishery in the Mediterranean), the most important production source is again the purse-seine activity, while other fisheries are targeting this species in the area: the long-line fishery, the harpoon fishery and the hand-line fishery. Gillnets provide a very low amount of bluefin tuna as a by-catch.

The most important fishing grounds are located in the southern Tyrrhenian Sea (off the coasts of Campania, Calabria and northern Sicily, near the Aeolian Archipelago and the isle of Ustica) and in the Strait of Sicily, including some parts of the southern Mediterranean Sea and the area around Malta. The latter area had increased its importance since 1998, while the spawning concentration of bluefin tuna in the southern Tyrrhenian Sea had apparently decreased.

The importance of the bluefin tuna fishery for the local economy is very important, as well as for the social side, and some small coastal villages (like the small village of Cetara in Campania) are depending upon this fishing activity for most part of the year.

As a matter of fact, the bluefin tuna fishing is carried out now from March to July in the Strait of Sicily waters, while it covers a shorter number of months in the southern Tyrrhenian. The hand-line fishing has two major fishing seasons, in March-April and in August-October, with variations from year to year. Since several years, a part of the purse-seiners resident in the area usually moves to the Adriatic Sea at the end of winter, for a short fishing season there. The sport fishing activity is carried out mostly in summer and fall.

Catches are landed everywhere, in every harbour and sometimes also along beaches. In some case, particularly in the long-line fishing, catches could be trans-bordered at sea from various vessels into one single vessel and then landed all together, causing confusion in landing reports. At the same time, the huge development of tuna caging activity all over the Mediterranean had a certain impact on the previous usual behaviour of the purse-seine fleet, which now trans-board most of the tuna from the purse-seine nets to floating cages directly at sea. Then, the floating cages are slowly moved from the fishing ground to the final destination by tug vessels. This activity had created several difficulties in getting at least size data from the fishery (Miyake *et al.*, 2002).

Data from these fisheries are collected since several years and included in several previous reports (Di Natale, 1990, 1999; 2004), Di Natale *et al.*, 1987; 1988; 1995; 1998; 2000; 2002, 2004).

### 2 Methods

The EC Data Collection programme (EC Reg. 1543) had set up a mandatory sampling scheme for many species exploited by the EU fleets, including the large pelagic species. Data on size are collected every year, while biological data (sex, sexual maturity, age composition) are collected every three years. Data that are mandatory according to ICCAT rules must be collected with the same methodology requested by ICCAT. This part of the programme is conventionally called CAMPBIOL in Italy. Data from cages have been collected in the last two years by Aquastudio, trying to improve the number of samples from the purse-seine fleet, while even this part of data collection is mandatory since the ICCAT Recommendation entered into force in 2005.

The data from the bluefin tuna fisheries have been collected in several landing places, partially the same used in previous studies, with the purpose to continue the historical series obtained till now. The harbours where landing controls were carried out are Ponza (central Tyrrhenian Sea), Lipari, Milazzo and Messina (southern Tyrrhenian Sea), Favignana, Trapani, Mazara del Vallo and Marsala (Strait of Sicily). Data related to the purse-seine catches

transferred into floating cages in Sicily, Calabria and Malta have been collected as well<sup>3</sup>. Usually, landing controls cover two weeks per month. Due to the well-known problems for collecting all the necessary information at landings, several data have been collected directly at sea or at the fattening plants, using scientific observers.

Sometimes, due to the practice of the handling procedures or to local difficulties, only one single size parameter was collected (length or weight).

No data on sex or other biological parameters have been collected in 2004, according to the EC programme and also because almost all the specimens are landed already gutted.

Data have been regularly transmitted to the national co-ordination of CAMPBIOL that, after checking the data coherence, produced the mid-time and the yearly report for the Italian Direction General for Fishery and Aquaculture. The Ministry, after checking the quality of the data, transmitted the report to the EC Direction General for Fisheries for the final evaluation and to ICCAT Secretariat according to Task II format.

### 3 Discussion

Even if the data collection begun very late in 2004, it was possible to obtain 3386 length data, 26.4% from the central and southern Tyrrhenian Sea and 73.6% from the Strait of Sicily. In the same year, the total number of weight samples was of 5455; among these, 25.2% from the Central and Southern Tyrrhenian Sea and 74.8% is from the Straits of Sicily.

The factors causing this different proportion in the sample were still the difficulties created by some fattening plants to have access to the tuna, the lack of any longline fishery in several Tyrrhenian areas and possibly the different proportion in catches and the absence of tuna trap fishery. On the opposite, it was possible to increase the data collection from cages in the Strait of Sicily, thanks to the good co-operation with the Direction General for Fisheries in Malta, where some Italian catches were caged.

In the central and southern Tyrrhenian Sea the collection included a total of 893 length data, showing a mean FL of 172.9 cm, with a decrease of 2.4% on the previous year; among these, 123 specimens were from the hand-line fishery (62.7 cm mean FL, -63.2 compared to 2003), 453 specimens from the purse-seine fishery (200.4 cm mean FL, +13.5% compared to 2003), 189 specimens were fished by purse-seines but sized at the tuna cages (219.4 cm mean FL, -7.9% compared to 2003), 117 specimens were by-catch from gillnet fishery (111.7 91.1 cm mean FL, +91.6% compared to 2003) and 11 samples from the few longline fishery activity (121.4 cm mean FL). Detailed data are reported on **Table 1**, while **Figure 1** shows the length frequencies of these catches, by 5 cm classes for the various gears and in total.

In the same Tyrrhenian area the collection included a total of other 1373 weight data (non necessarily all from the same fishes used for the length sampling), showing a mean weight of 141.48 kg, with an increase of 35.6% on the previous year; among these, 127 specimens were from the hand-line fishery (24.86 kg mean RW, -68.8% compared to 2003), 881 specimens from the purse-seine fishery (168.15 kg mean RW, +66.3% compared to 2003), 189 specimens were fished by purse-seines but collected at the tuna cages (189.64 kg mean RW, -54.5% compared to 2003), 154 specimens were by-catch from gillnet fishery (41.8 kg mean RW, -61.2% compared to 2003) and 22 specimens were fished by longlines (31.09 kg mean RW). Detailed data are reported on **Table 2**, while **Figure 2** shows the weight frequencies of these catches, by 5 kg classes for the various gears and in total.

The 2004 collection in the Strait of Sicily included a total of 2493 length data, showing a mean FL of 175.9 cm, showing an increase of 8.8% on the previous year; among these, 893 specimens were from the longline fishery (174.8 cm mean FL, +10.2% compared to 2003) and 1600 specimens were fished by purse-seines but sized at the tuna cages (176.8 cm mean FL, +4.2% compared to 2003). Detailed data are reported on **Table 3**, while **Figure 3** shows the length frequencies of these catches, by 5 cm classes for the two gears and in total.

In the same Strait of Sicily area the collection included a total of 4082 weight data (non necessarily all from the same fishes used for the length sampling), showing a mean weight of 138.33 66.98 kg, showing an increase of 106.5% on the previous year; among these, 2396 specimens were from the longline fishery (133.29 kg mean RW, +71% compared to 2003) and 1686 specimens were fished by purse-seines but collected at the tuna cages

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(145.50 mean RW, +53.2% compared to 2003). Detailed data are reported on **Table 4**, while **Figure 4** shows the weight frequencies of these catches, by 5 kg classes for the two gears and in total.

The length-weight correlation curves have been plotted separately for all the fisheries and areas concerned (**Figures 5 to 6**). The curve appears quite different one from the other, particularly those obtained from samples collected at cages after fattening.

#### **4 Conclusion**

Taking into account the conclusion reported in previous papers (Di Natale *et al.*, 2002 and 2004), it appears quite clear that the EC Data Collection programme (EC Reg. 1543/2000) had resulted in a remarkable increasing of data availability for all the species concerned, including bluefin tuna.

Looking at the first three years of the new CE Data Collection Programme in the Tyrrhenian Sea and in the Strait of Sicily (limited to bluefin tuna, in this case), it is confirmed that the information provided is quite useful, either for feeding the already existing ICCAT data bank or for better focus the sampling or the analysis in the future.

Confirming the remarks made in a previous paper (Di Natale *et al.*, 2004), some problems are still existing and require a particular attention to be properly faced and solved, sometimes by adjusting the strategies, some others by a more strict regulation. The factors still affecting the sampling in these areas are effect of the driftnet ban, the relevant reduction of the purse-seine landings, the tuna farming transshipments and fattening activities, the high migratory behaviour of the long-line fleet and the landings in foreign harbours.

At the same time, the atypical climate situation recorded the last three years (high temperatures for long period, abnormal stratification of the water column, long period of calm weather in 2003, the good presence and catchability of bluefin tuna in 2004etc.) had clearly influenced the behaviour, the distribution and the biology of the bluefin tuna.

Again, according to the several observations made at sea and to the fishermen's reports, the presence of the bluefin tuna in the Central Mediterranean Sea continues to appear quite relevant in the last eight years while, according to the eastern Atlantic (including the Mediterranean) population model outputs, this fact was not expected, even if the model was not geographically oriented.

The long spawning season in the last three years should results in some important changes in the next recruitment of bluefin tuna.

The remarkable catch of several giant specimens in the last three years is a confirmed relevant information that increases our knowledge of the current composition of the stock.

Examining the last seven years data we can confirm that the bluefin tuna length composition of the stock in the area is almost stable, with a high variability from sample to sample and a more limited variation from year to year, due to the various types of gear used and the origin and number of samples.

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**Table 1.** Length frequency (FL) of bluefin tuna (*Thunnus thynnus*) caught by various gears in 2004 in central and southern Tyrrhenian Sea.

LENGTH CLASSES (cm)	HAND		PS		CAGES		GILL		LL		TOTAL 2004	
	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%
0-4,9	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00
5-9,9	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00
10-14,9	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00
15-19,9	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00
20-24,9	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00
25-29,9	44	35,77	0	0,00	0	0,00	0	0,00	0	0,00	44	4,93
30-34,9	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00
35-39,9	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00
40-44,9	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00
45-49,9	5	4,07	0	0,00	0	0,00	0	0,00	0	0,00	5	0,56
50-54,9	38	30,89	0	0,00	0	0,00	5	4,27	0	0,00	43	4,82
55-59,9	5	4,07	0	0,00	0	0,00	4	3,42	0	0,00	9	1,01
60-64,9	0	0,00	0	0,00	0	0,00	2	1,71	0	0,00	2	0,22
65-69,9	0	0,00	0	0,00	0	0,00	2	1,71	0	0,00	2	0,22
70-74,9	0	0,00	0	0,00	0	0,00	7	5,98	0	0,00	7	0,78
75-79,9	0	0,00	0	0,00	0	0,00	6	5,13	0	0,00	6	0,67
80-84,9	0	0,00	0	0,00	0	0,00	6	5,13	0	0,00	6	0,67
85-89,9	13	10,57	0	0,00	0	0,00	7	5,98	3	2,27	23	2,58
90-94,9	1	0,81	0	0,00	0	0,00	2	1,71	3	2,27	6	0,67
95-99,9	0	0,00	0	0,00	0	0,00	2	1,71	0	0,00	2	0,22
100-104,9	0	0,00	0	0,00	0	0,00	4	3,42	0	0,00	4	0,45
105-109,9	1	0,81	0	0,00	0	0,00	10	8,55	0	0,00	11	1,23
110-114,9	0	0,00	0	0,00	0	0,00	14	11,97	2	1,81	16	1,79
115-119,9	0	0,00	0	0,00	0	0,00	13	11,11	0	0,00	13	1,46
120-124,9	0	0,00	4	0,88	0	0,00	6	5,13	0	0,00	10	1,12
125-129,9	0	0,00	2	0,44	1	0,53	5	4,27	0	0,00	8	0,90
130-134,9	2	1,63	7	1,55	2	1,06	6	5,13	0	0,00	17	1,90
135-139,9	0	0,00	8	1,77	4	2,12	1	0,85	0	0,00	13	1,46
140-144,9	0	0,00	13	2,87	4	2,12	1	0,85	0	0,00	18	2,02
145-149,9	0	0,00	27	5,96	7	3,70	2	1,71	0	0,00	36	4,03
150-154,9	3	2,44	25	5,52	6	3,17	0	0,00	0	0,00	34	3,81
155-159,9	1	0,81	27	5,96	4	2,12	1	0,85	0	0,00	33	3,70
160-164,9	2	1,63	21	4,64	6	3,17	0	0,00	0	0,00	29	3,25
165-169,9	1	0,81	15	3,31	1	0,53	0	0,00	0	0,00	17	1,90
170-174,9	1	0,81	15	3,31	7	3,70	0	0,00	0	0,00	23	2,58
175-179,9	2	1,63	9	1,99	5	2,65	0	0,00	1	0,90	17	1,90
180-184,9	2	1,63	15	3,31	4	2,12	0	0,00	0	0,00	21	2,35
185-189,9	0	0,00	4	0,88	4	2,12	0	0,00	0	0,00	8	0,90
190-194,9	1	0,81	13	2,87	1	0,53	0	0,00	1	0,90	16	1,79
195-199,9	0	0,00	10	2,21	4	2,12	0	0,00	0	0,00	14	1,57
200-204,9	0	0,00	12	2,65	5	2,65	0	0,00	0	0,00	17	1,90
205-209,9	0	0,00	8	1,77	2	1,06	1	0,85	1	0,90	12	1,34
210-214,9	1	0,81	11	2,43	5	2,65	3	2,56	0	0,00	20	2,24
215-219,9	0	0,00	10	2,21	1	0,53	2	1,71	0	0,00	13	1,46
220-224,9	0	0,00	30	6,62	5	2,65	0	0,00	0	0,00	35	3,92
225-229,9	0	0,00	18	3,97	11	5,82	3	2,56	0	0,00	32	3,58
230-234,9	0	0,00	26	5,74	8	4,23	1	0,85	0	0,00	35	3,92
235-239,9	0	0,00	19	4,19	9	4,76	1	0,85	0	0,00	29	3,25
240-244,9	0	0,00	24	5,30	8	4,23	0	0,00	0	0,00	32	3,58
245-249,9	0	0,00	21	4,64	8	4,23	0	0,00	0	0,00	29	3,25
250-254,9	0	0,00	18	3,97	25	13,23	0	0,00	0	0,00	43	4,82
255-259,9	0	0,00	7	1,55	11	5,82	0	0,00	0	0,00	18	2,02
260-264,9	0	0,00	11	2,43	10	5,29	0	0,00	0	0,00	21	2,35
265-269,9	0	0,00	4	0,88	4	2,12	0	0,00	0	0,00	8	0,90
270-274,9	0	0,00	9	1,99	6	3,17	0	0,00	0	0,00	15	1,68
275-279,9	0	0,00	2	0,44	2	1,06	0	0,00	0	0,00	4	0,45
280-284,9	0	0,00	3	0,66	2	1,06	0	0,00	0	0,00	5	0,56
285-289,9	0	0,00	4	0,88	0	0,00	0	0,00	0	0,00	4	0,45
290-294,9	0	0,00	1	0,22	3	1,59	0	0,00	0	0,00	4	0,45
295-299,9	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00	0	0,00
?300	0	0,00	0	0,00	4	2,12	0	0,00	0	0,00	4	0,45
<b>TOTAL</b>	<b>123</b>		<b>453</b>		<b>189</b>		<b>117</b>		<b>11</b>		<b>893</b>	
mean FL (cm)	62,65		200,42		219,43		111,74		121,36		172,87	

**Table 2.** Weight frequency (RW) of bluefin tuna (*Thunnus thynnus*) caught by various gears in 2004 in central and southern Tyrrhenian Sea.

WEIGHT CLASSES (kg)	HAND		PS		CAGES		GILL		LL		TOTAL 2004	
	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%
0-4,9	91	71,65	0	0,00	0	0,00	16	10,39	0,00	0,00	107	7,79
5-9,9	1	0,79	0	0,00	0	0,00	12	7,79	0,00	0,00	13	0,95
10-14,9	0	0,00	0	0,00	0	0,00	11	7,14	7,00	31,82	18	1,31
15-19,9	0	0,00	0	0,00	0	0,00	6	3,90	3,00	13,64	9	0,66
20-24,9	1	0,79	0	0,00	0	0,00	29	18,83	4,00	18,18	34	2,48
25-29,9	2	1,57	4	0,45	0	0,00	31	20,13	1,00	4,55	38	2,77
30-34,9	0	0,00	7	0,79	0	0,00	10	6,49	3,00	13,64	20	1,46
35-39,9	1	0,79	12	1,36	0	0,00	8	5,19	0,00	0,00	21	1,53
40-44,9	1	0,79	3	0,34	1	0,53	4	2,60	0,00	0,00	9	0,66
45-49,9	3	2,36	12	1,36	2	1,06	2	1,30	0,00	0,00	19	1,38
50-54,9	1	0,79	28	3,18	5	2,65	1	0,65	0,00	0,00	35	2,55
55-59,9	4	3,15	23	2,61	3	1,59	1	0,65	0,00	0,00	31	2,26
60-64,9	3	2,36	23	2,61	8	4,23	2	1,30	0,00	0,00	36	2,62
65-69,9	2	1,57	22	2,50	7	3,70	0	0,00	1,00	4,55	32	2,33
70-74,9	0	0,00	17	1,93	1	0,53	1	0,65	1,00	4,55	20	1,46
75-79,9	2	1,57	16	1,82	4	2,12	0	0,00	0,00	0,00	22	1,60
80-84,9	2	1,57	14	1,59	9	4,76	1	0,65	0,00	0,00	26	1,89
85-89,9	1	0,79	9	1,02	4	2,12	0	0,00	1,00	4,55	15	1,09
90-94,9	1	0,79	9	1,02	2	1,06	0	0,00	0,00	0,00	12	0,87
95-99,9	1	0,79	14	1,59	3	1,59	0	0,00	0,00	0,00	18	1,31
100-104,9	0	0,00	15	1,70	0	0,00	1	0,65	0,00	0,00	16	1,17
105-109,9	2	1,57	16	1,82	1	0,53	0	0,00	0,00	0,00	19	1,38
110-114,9	0	0,00	3	0,34	1	0,53	1	0,65	1,00	4,55	6	0,44
115-119,9	1	0,79	4	0,45	1	0,53	0	0,00	0,00	0,00	6	0,44
120-124,9	0	0,00	2	0,23	6	3,17	0	0,00	0,00	0,00	8	0,58
125-129,9	0	0,00	1	0,11	0	0,00	0	0,00	0,00	0,00	1	0,07
130-134,9	0	0,00	6	0,68	0	0,00	0	0,00	0,00	0,00	6	0,44
135-139,9	0	0,00	4	0,45	1	0,53	0	0,00	0,00	0,00	5	0,36
140-144,9	0	0,00	3	0,34	6	3,17	0	0,00	0,00	0,00	9	0,66
145-149,9	2	1,57	5	0,57	1	0,53	0	0,00	0,00	0,00	8	0,58
150-154,9	0	0,00	61	6,92	0	0,00	5	3,25	0,00	0,00	66	4,81
155-159,9	0	0,00	36	4,09	0	0,00	0	0,00	0,00	0,00	36	2,62
160-164,9	1	0,79	23	2,61	0	0,00	2	1,30	0,00	0,00	26	1,89
165-169,9	0	0,00	21	2,38	0	0,00	1	0,65	0,00	0,00	22	1,60
170-174,9	1	0,79	21	2,38	1	0,53	0	0,00	0,00	0,00	23	1,68
175-179,9	0	0,00	19	2,16	1	0,53	2	1,30	0,00	0,00	22	1,60
180-184,9	1	0,79	34	3,86	4	2,12	0	0,00	0,00	0,00	39	2,84
185-189,9	0	0,00	22	2,50	1	0,53	2	1,30	0,00	0,00	25	1,82
190-194,9	0	0,00	32	3,63	6	3,17	1	0,65	0,00	0,00	39	2,84
195-199,9	1	0,79	25	2,84	4	2,12	1	0,65	0,00	0,00	31	2,26
200-204,9	0	0,00	34	3,86	7	3,70	0	0,00	0,00	0,00	41	2,99
205-209,9	1	0,79	50	5,68	3	1,59	0	0,00	0,00	0,00	54	3,93
210-214,9	0	0,00	47	5,33	3	1,59	0	0,00	0,00	0,00	50	3,64
215-219,9	0	0,00	40	4,54	7	3,70	0	0,00	0,00	0,00	47	3,42
220-224,9	0	0,00	37	4,20	6	3,17	0	0,00	0,00	0,00	43	3,13
225-229,9	0	0,00	4	0,45	4	2,12	0	0,00	0,00	0,00	8	0,58
230-234,9	0	0,00	2	0,23	6	3,17	0	0,00	0,00	0,00	8	0,58
235-239,9	0	0,00	1	0,11	4	2,12	1	0,65	0,00	0,00	6	0,44
240-244,9	0	0,00	4	0,45	7	3,70	0	0,00	0,00	0,00	11	0,80
245-249,9	0	0,00	1	0,11	8	4,23	0	0,00	0,00	0,00	9	0,66
250-254,9	0	0,00	9	1,02	12	6,35	1	0,65	0,00	0,00	22	1,60
255-259,9	0	0,00	3	0,34	4	2,12	0	0,00	0,00	0,00	7	0,51
260-264,9	0	0,00	4	0,45	2	1,06	0	0,00	0,00	0,00	6	0,44
265-269,9	0	0,00	1	0,11	2	1,06	0	0,00	0,00	0,00	3	0,22
270-274,9	0	0,00	3	0,34	2	1,06	0	0,00	0,00	0,00	5	0,36
275-279,9	0	0,00	2	0,23	2	1,06	0	0,00	0,00	0,00	4	0,29
280-284,9	0	0,00	5	0,57	7	3,70	0	0,00	0,00	0,00	12	0,87
285-289,9	0	0,00	2	0,23	4	2,12	0	0,00	0,00	0,00	6	0,44
290-294,9	0	0,00	3	0,34	2	1,06	1	0,65	0,00	0,00	6	0,44
295-299,9	0	0,00	2	0,23	1	0,53	0	0,00	0,00	0,00	3	0,22
?300	0	0,00	61	6,92	13	6,88	0	0,00	0,00	0,00	74	5,39
<b>TOTAL</b>	<b>127</b>		<b>881</b>		<b>189</b>		<b>154</b>		<b>22</b>		<b>1373</b>	
mean RW Kg	24,86		168,15		189,64		41,8		31,09		141,48	

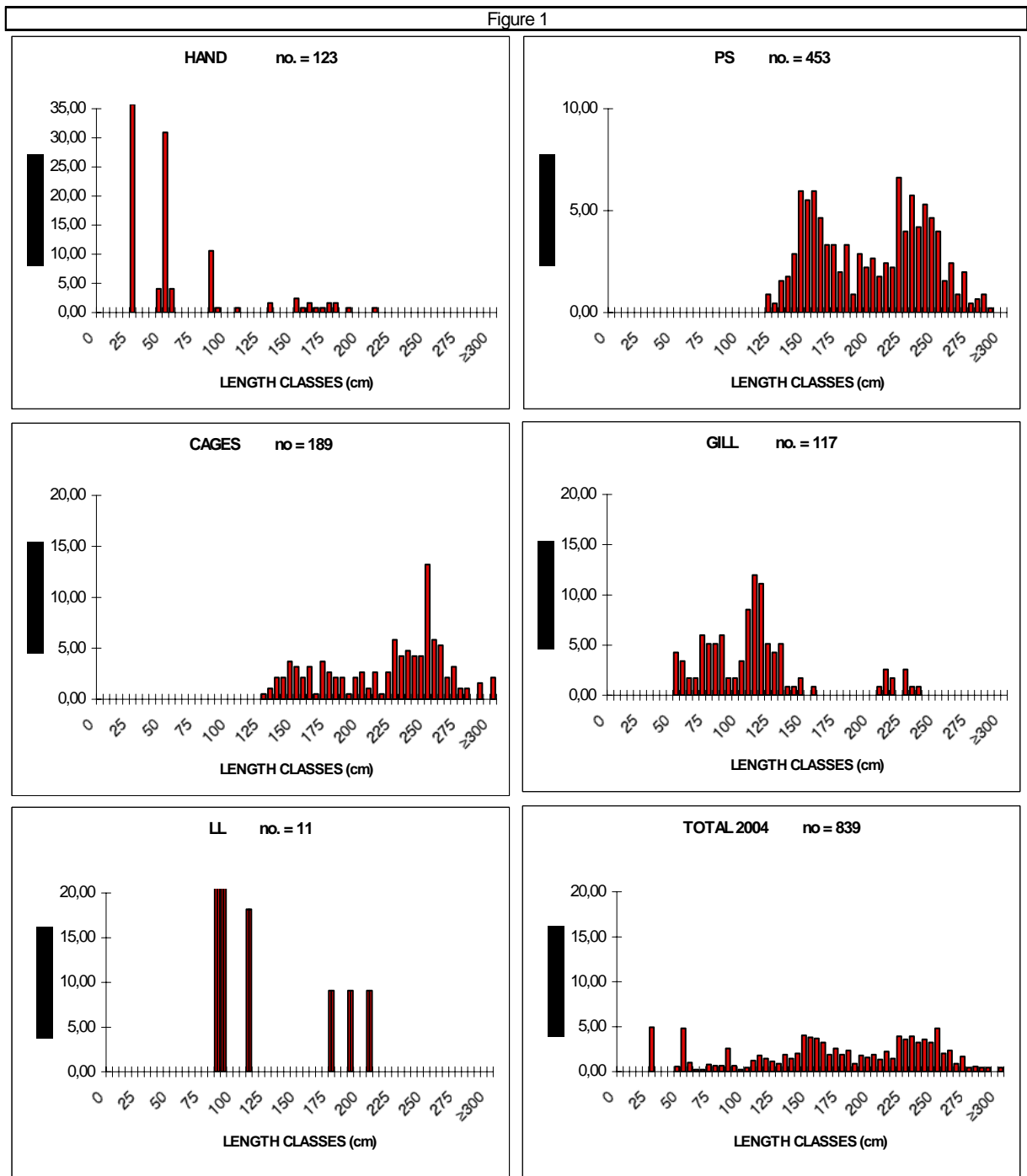
**Table 3.** Length frequency (FL) of bluefin tuna (*Thunnus thynnus*) caught by various gears in 2004 in the Strait of Sicily.

LENGTH CLASSES (cm)	LL		PS		TOTAL 2004	
	no.	%	no.	%	no.	%
0-4,9	0	0,00	0	0,00	0	0,00
5-9,9	0	0,00	0	0,00	0	0,00
10-14,9	0	0,00	0	0,00	0	0,00
15-19,9	0	0,00	0	0,00	0	0,00
20-24,9	0	0,00	0	0,00	0	0,00
25-29,9	0	0,00	0	0,00	0	0,00
30-34,9	0	0,00	0	0,00	0	0,00
35-39,9	0	0,00	0	0,00	0	0,00
40-44,9	0	0,00	0	0,00	0	0,00
45-49,9	0	0,00	0	0,00	0	0,00
50-54,9	0	0,00	0	0,00	0	0,00
55-59,9	2	0,22	0	0,00	2	0,08
60-64,9	2	0,22	0	0,00	2	0,08
65-69,9	0	0,00	0	0,00	0	0,00
70-74,9	0	0,00	0	0,00	0	0,00
75-79,9	0	0,00	0	0,00	0	0,00
80-84,9	0	0,00	0	0,00	0	0,00
85-89,9	4	0,45	35	2,19	39	1,56
90-94,9	1	0,11	105	6,56	106	4,25
95-99,9	2	0,22	59	3,69	61	2,45
100-104,9	6	0,67	39	2,44	45	1,81
105-109,9	20	2,24	16	1,00	36	1,44
110-114,9	5	0,56	4	0,25	9	0,36
115-119,9	18	2,02	42	2,63	60	2,41
120-124,9	35	3,92	50	3,13	85	3,41
125-129,9	39	4,37	50	3,13	89	3,57
130-134,9	50	5,60	36	2,25	86	3,45
135-139,9	25	2,80	15	0,94	40	1,60
140-144,9	22	2,46	27	1,69	49	1,97
145-149,9	47	5,26	3	0,19	50	2,01
150-154,9	50	5,60	36	2,25	86	3,45
155-159,9	53	5,94	11	0,69	64	2,57
160-164,9	51	5,71	35	2,19	86	3,45
165-169,9	44	4,93	23	1,44	67	2,69
170-174,9	30	3,36	49	3,06	79	3,17
175-179,9	24	2,69	22	1,38	46	1,85
180-184,9	25	2,80	43	2,69	68	2,73
185-189,9	37	4,14	97	6,06	134	5,38
190-194,9	21	2,35	79	4,94	100	4,01
195-199,9	12	1,34	97	6,06	109	4,37
200-204,9	22	2,46	117	7,31	139	5,58
205-209,9	21	2,35	56	3,50	77	3,09
210-214,9	26	2,91	17	1,06	43	1,72
215-219,9	35	3,92	123	7,69	158	6,34
220-224,9	25	2,80	44	2,75	69	2,77
225-229,9	24	2,69	50	3,13	74	2,97
230-234,9	12	1,34	78	4,88	90	3,61
235-239,9	28	3,14	3	0,19	31	1,24
240-244,9	14	1,57	28	1,75	42	1,68
245-249,9	10	1,12	21	1,31	31	1,24
250-254,9	14	1,57	2	0,13	16	0,64
255-259,9	15	1,68	16	1,00	31	1,24
260-264,9	4	0,45	14	0,88	18	0,72
265-269,9	5	0,56	22	1,38	27	1,08
270-274,9	3	0,34	9	0,56	12	0,48
275-279,9	4	0,45	6	0,38	10	0,40
280-284,9	2	0,22	0	0,00	2	0,08
285-289,9	2	0,22	5	0,31	7	0,28
290-294,9	0	0,00	5	0,31	5	0,20
295-299,9	1	0,11	1	0,06	2	0,08
?300	1	0,11	10	0,63	11	0,44
<b>TOTAL</b>	893		1600		2493	
mean FL	174,60		176,66		175,92	

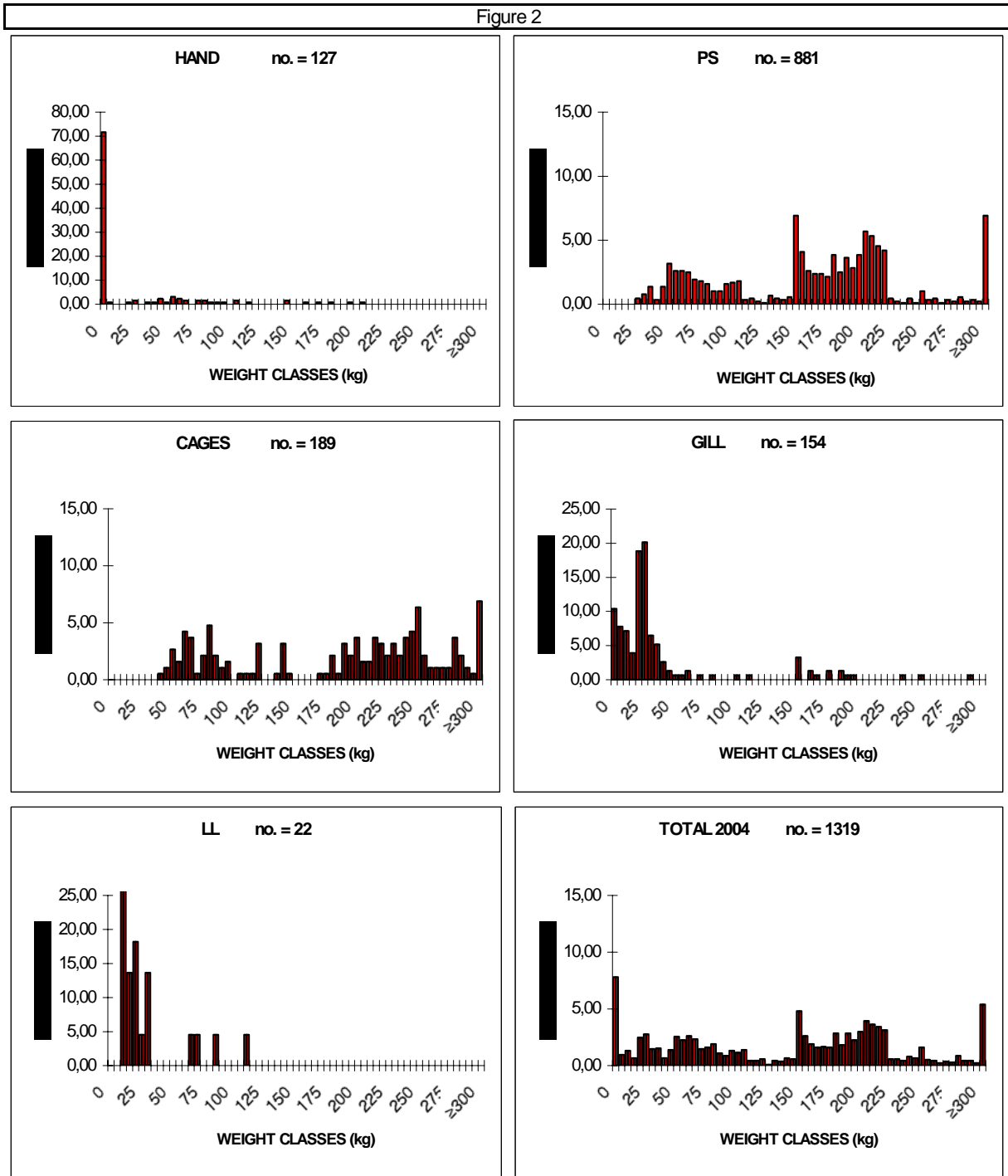


**Table 4.** Weight frequency (RW) of bluefin tuna (*Thunnus thynnus*) caught by various gears in 2004 in the Strait of Sicily.

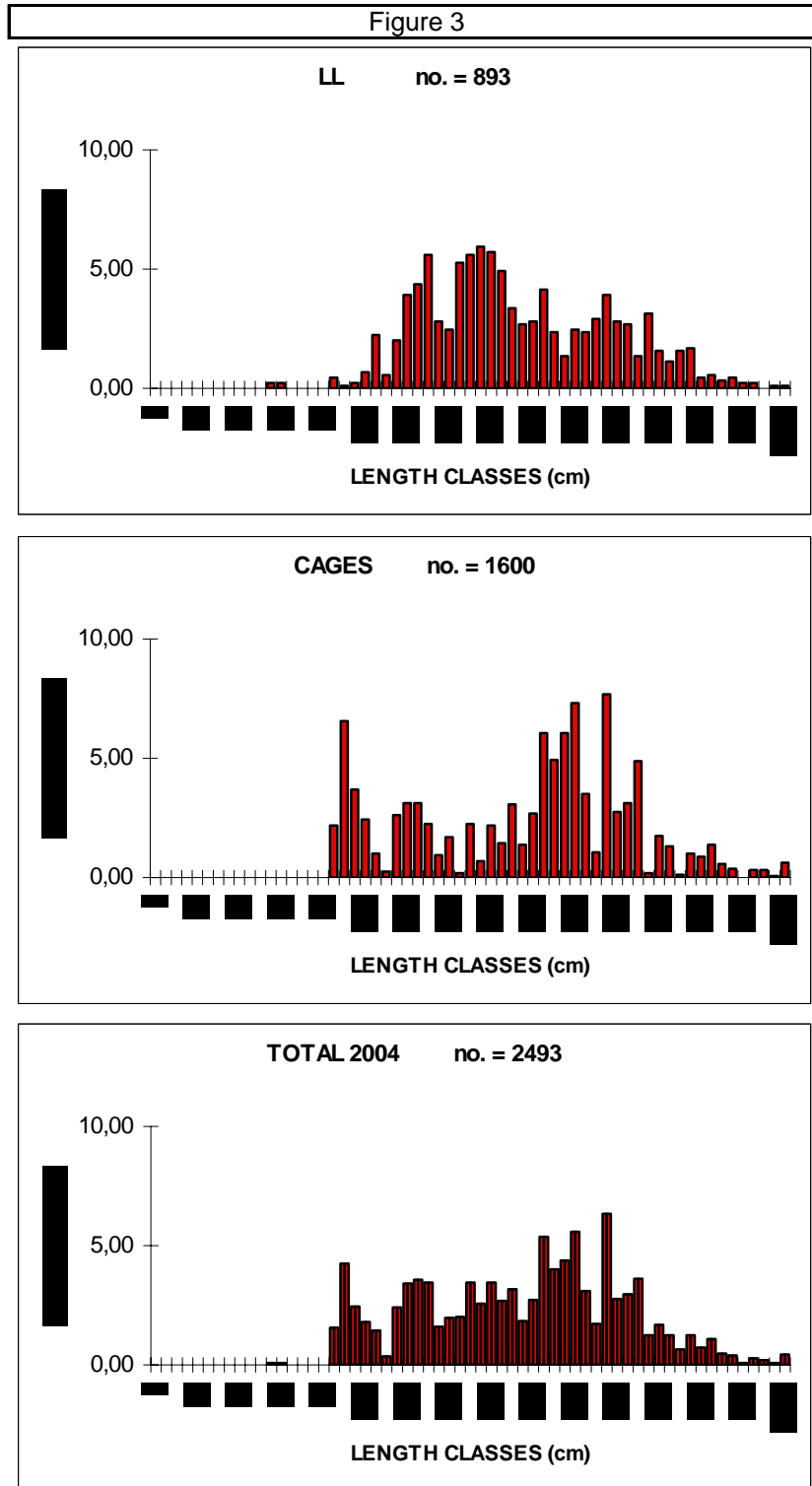
WEIGHT CLASSES (kg)	LL		CAGES		TOTAL 2004	
	no.	%	no.	%	no.	%
0-4,9	3	0,13	0	0,00	3	0,07
5-9,9	3	0,13	0	0,00	3	0,07
10-14,9	9	0,38	0	0,00	9	0,22
15-19,9	20	0,83	0	0,00	20	0,49
20-24,9	44	1,84	1	0,06	45	1,10
25-29,9	25	1,04	1	0,06	26	0,64
30-34,9	51	2,13	1	0,06	52	1,27
35-39,9	64	2,67	3	0,18	67	1,64
40-44,9	48	2,00	42	2,49	90	2,20
45-49,9	38	1,59	83	4,92	121	2,96
50-54,9	71	2,96	91	5,40	162	3,97
55-59,9	54	2,25	87	5,16	141	3,45
60-64,9	67	2,80	46	2,73	113	2,77
65-69,9	62	2,59	69	4,09	131	3,21
70-74,9	63	2,63	95	5,63	158	3,87
75-79,9	50	2,09	66	3,91	116	2,84
80-84,9	38	1,59	54	3,20	92	2,25
85-89,9	27	1,13	44	2,61	71	1,74
90-94,9	31	1,29	91	5,40	122	2,99
95-99,9	18	0,75	59	3,50	77	1,89
100-104,9	21	0,88	66	3,91	87	2,13
105-109,9	26	1,09	7	0,42	33	0,81
110-114,9	27	1,13	6	0,36	33	0,81
115-119,9	33	1,38	58	3,44	91	2,23
120-124,9	31	1,29	39	2,31	70	1,71
125-129,9	40	1,67	1	0,06	41	1,00
130-134,9	60	2,50	1	0,06	61	1,49
135-139,9	59	2,46	4	0,24	63	1,54
140-144,9	73	3,05	56	3,32	129	3,16
145-149,9	82	3,42	8	0,47	90	2,20
150-154,9	119	4,97	47	2,79	166	4,07
155-159,9	103	4,30	7	0,42	110	2,69
160-164,9	127	5,30	55	3,26	182	4,46
165-169,9	109	4,55	4	0,24	113	2,77
170-174,9	104	4,34	0	0,00	104	2,55
175-179,9	59	2,46	3	0,18	62	1,52
180-184,9	63	2,63	14	0,83	77	1,89
185-189,9	51	2,13	0	0,00	51	1,25
190-194,9	60	2,50	1	0,06	61	1,49
195-199,9	33	1,38	43	2,55	76	1,86
200-204,9	46	1,92	11	0,65	57	1,40
205-209,9	36	1,50	49	2,91	85	2,08
210-214,9	32	1,34	5	0,30	37	0,91
215-219,9	29	1,21	17	1,01	46	1,13
220-224,9	23	0,96	3	0,18	26	0,64
225-229,9	30	1,25	4	0,24	34	0,83
230-234,9	12	0,50	32	1,90	44	1,08
235-239,9	20	0,83	12	0,71	32	0,78
240-244,9	13	0,54	2	0,12	15	0,37
245-249,9	8	0,33	0	0,00	8	0,20
250-254,9	16	0,67	2	0,12	18	0,44
255-259,9	14	0,58	2	0,12	16	0,39
260-264,9	11	0,46	44	2,61	55	1,35
265-269,9	3	0,13	3	0,18	6	0,15
270-274,9	4	0,17	0	0,00	4	0,10
275-279,9	6	0,25	7	0,42	13	0,32
280-284,9	6	0,25	36	2,14	42	1,03
285-289,9	2	0,08	1	0,06	3	0,07
290-294,9	3	0,13	2	0,12	5	0,12
295-299,9	5	0,21	40	2,37	45	1,10
?300	11	0,46	161	9,55	172	4,21
<b>TOTAL</b>	2396		1686		4082	
mean RW	133,29		145,50		138,33	



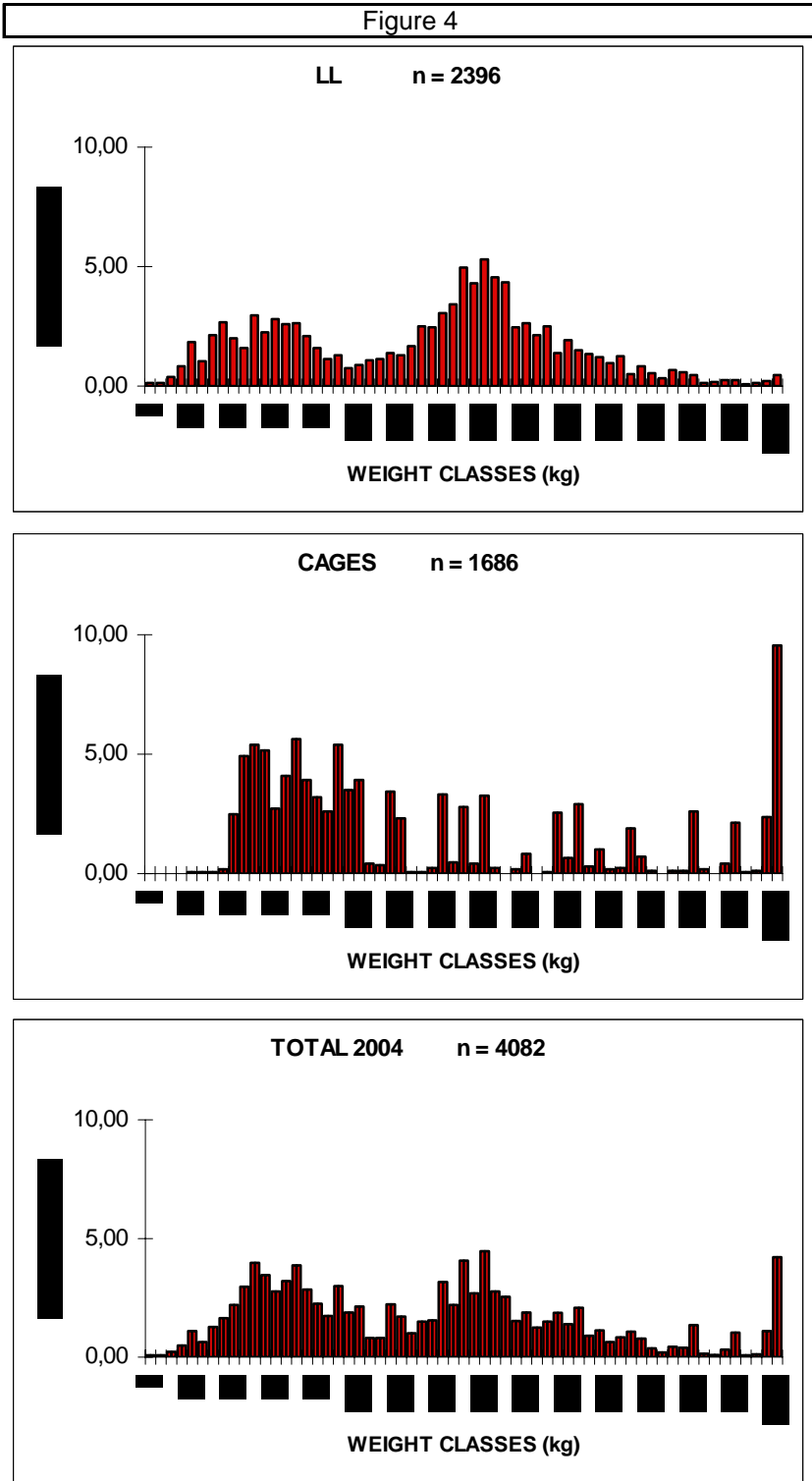
**Figure 1.** Length classes of Bluefin tuna (*Thunnus thynnus*) caught by various gears in central and southern Tyrrhenian Sea in 2004.



**Figure 2.** Weight classes of Bluefin tuna (*Thunnus thynnus*) caught by various gears in central and southern Tyrrhenian Sea in 2004.

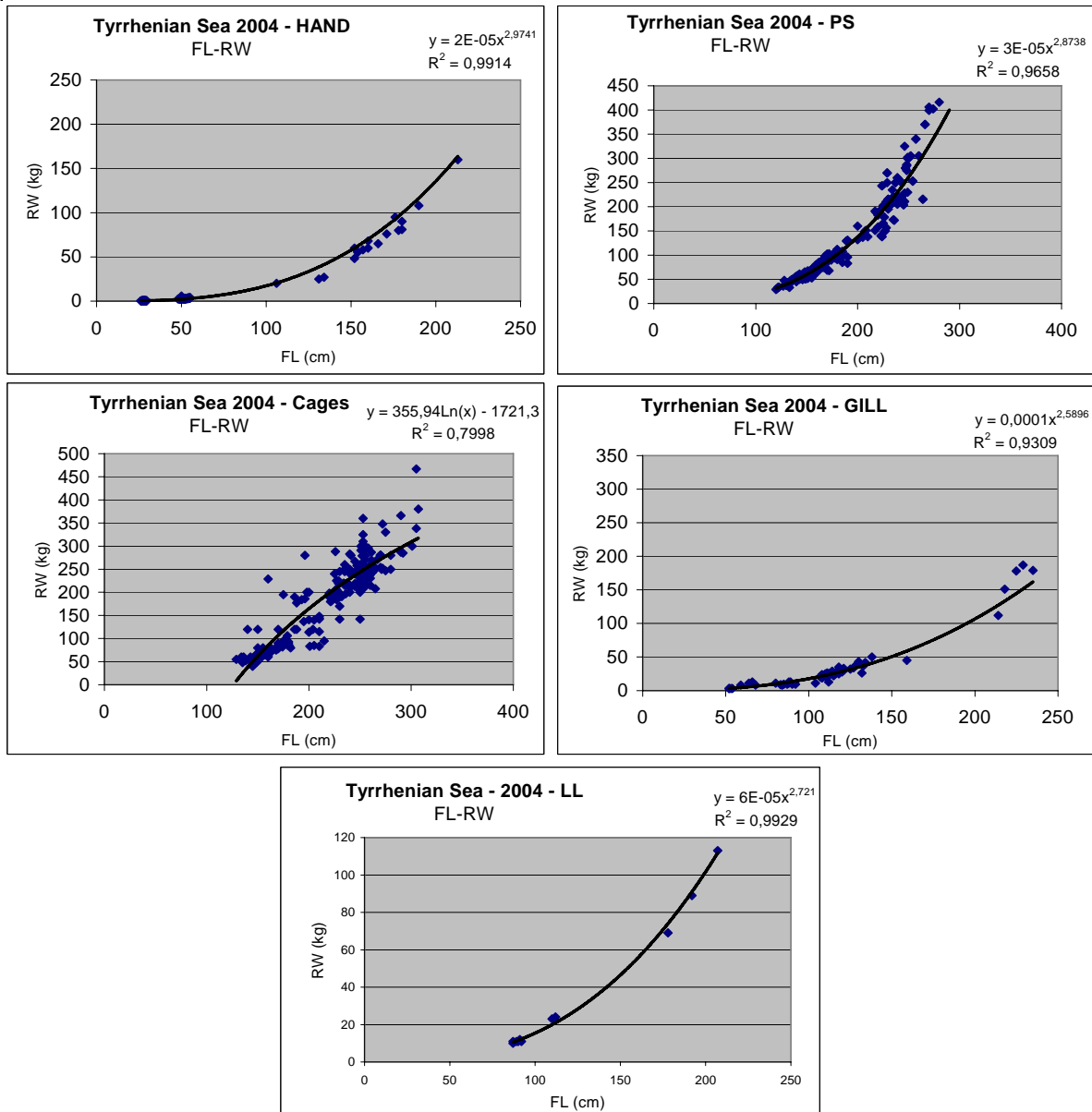


**Figure 3.** Length classes (FL) of Bluefin tuna (*Thunnus thynnus*) caught by various gears in the Strait of Sicily in 2004.



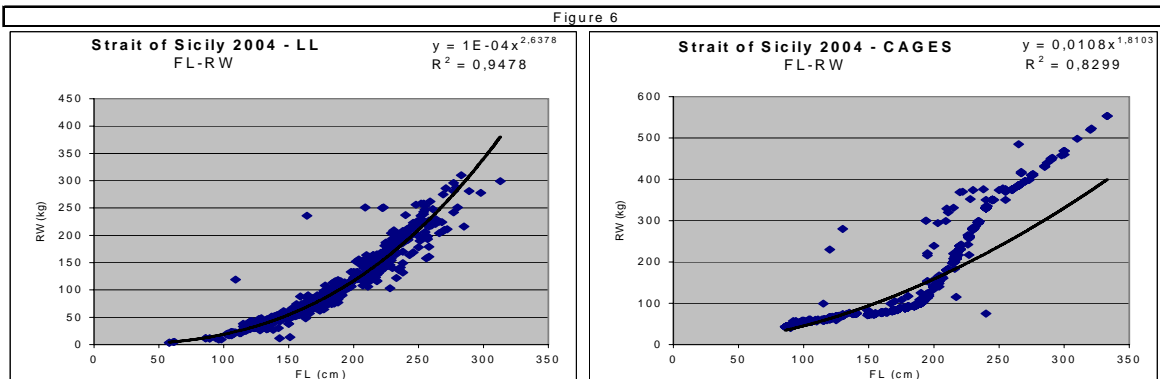
**Figure 4.** Weight classes of Bluefin tuna (*Thunnus thynnus*) caught by various gears in the Strait of Sicily in 2004.

Figure 5



**Figure 5.** Length-weight (FL/RW) correlations of Bluefin tuna caught by various gear in the central and southern Tyrrhenian Sea in 2004.

Figure 6



**Figure 6.** Length-weight correlation of Bluefin tuna (*Thunnus thynnus*) caught by various gears in the Strait of Sicily in 2004.