THE 2002 SIZE COMPOSITION OF BLUEFIN TUNA CATCHES OF THE FRENCH PURSE SEINE COMPARED TO THOSE OF THE EARLY 1990s AND 2001

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SUMMARY

In 2002, about 40% of the yield of the French purse seine fleet targeting bluefin tuna came from the Gulf of Lions, 38% from the Balearic Islands and about 22% from the Malta-Lybia area (a new area for this fleet). The fleet caught, in the Gulf of Lions, mostly juvenile bluefin (mainly 2 and 3 years old), whereas both juveniles and adults were targeted and caught in the Balearic and Maltese areas. As in 2001, the 2002 size composition of bluefin catches have been estimated from the EU log-books and both years looked very similar. Calculating Kolmogorov-Smirnov two sample tests between the yearly size compositions of 1990-1995 and those of 2001 and 2002, indicated significant differences between these two pools of data. Finally, we confirm that if the information provided by the EU log-books allows calculation of a rough estimate of the size composition of the catches, it remains too imprecise and lacks validation to allow the computation of a size frequency table that would fulfil the ICCAT requirements for Task II.

RESUME

Près de 40% des captures des senneurs français visant le thon rouge atlantique provenait du golfe du lion, 38% de la zone Baléares et environ 22% de la zone sud-Malte (une nouvelle aire de pêche pour cette flottille). Une grande majorité de juvéniles (principalement des poissons d'âge 2 et 3) est capturée lors de la campagne dans le golfe du lion, alors que juvéniles et adultes se retrouvent dans les captures des zones Baléares et Malte. Comme en 2001, la composition en taille des captures 2002 des senneurs français a été estimée à partir des données des livres de bord européens et les distributions de ces 2 années sont apparues très similaires. En utilisant des tests à deux échantillons de Kolmogorov-Smirnov entre les distributions des taille de captures des années 1990-1995 et 2001-2002, nous avons dégagé des fortes différences entre ces deux pools d'années. Finalement nous confirmons que si les informations issues des livres de bord européens permettent d'établir une composition en taille des captures approximative, elles restent cependant trop imprécises et manquent de validation pour permettre de calculer une composition en taille des captures qui répondrait au cahier des charges de la CICTA pour la tâche II.

RESUMEN

En 2002, cerca del 40% de las capturas de los cerqueros franceses que se dirigen al atún rojo procedía del Golfo de León, el 38% de las Islas Baleares y cerca del 22% de la zona de Libia-Malta (una nueva zona para esta flota). En el Golfo de León la flota capturó fundamentalmente atunes rojos juveniles (principalmente de 2 a 3 años de edad), mientras que en las zonas de Baleares y Malta capturó y se dirigió principalmente a juveniles y adultos. Como en 2001, la composición por tallas de 2002 de las capturas de atún rojo se ha estimado a partir de cuadernos de pesca de la CE y ambos años parecen muy similares. Utilizando un test Kolmogorov-Smirnov de dos muestras entre las distribuciones de talla de las capturas de los años 1990-1995 y 2001-2002, hemos advertido que existen grandes diferencias entre estos dos grupos de datos. Por último, confirmamos que aunque la información facilitada por los cuadernos de pesca de la CE permite el cálculo de una estimación aproximativa de la composición por tallas de las capturas, sigue siendo muy imprecisa y falta de validación para permitir el cálculo de una tabla de frecuencia de tallas que cumpla los requisitos de la Tarea II de ICCAT.

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Computation of size composition from EU log-books

The size composition of the catches of the French purse seiners (PS) targeting bluefin tuna (BFT) in the Mediterranean Sea, used to be estimated through the sale records of the French local seafood traders, which allowed to recover the size composition of most of the French catches from the late 1970s to the mid-1990s (Liorzou and Bigot 1999). Although this procedure estimated fork length from pooled data, the EU program BFTMED investigated and validated this method to estimate size frequencies (Liorzou 2001). However, this procedure became inoperative since the mid-1990s because of : (i) the rapid expansion of the fishing area, so that the French fleet lands a substantial part abroad (mainly in Spain and Malta) and (ii) the development of caging (a technique that does not permit the measurement of the catches as they are not landed anymore).

Without an observer on board program, the main source of information for 2002 comes from the European log-books (as in 2001). The log-books of the 38 active boats were recovered. The size frequency of the catches is computed just as for the local seafood traders data. To do so, we selected all the data that provided, for a given boat and a given day and/or positive set, the information on the total yield with the corresponding mean weight (MW). Each daily MW is converted into a corresponding fork length, using the ICCAT weight-length relationship for the Mediterranean (ICCAT 1997) and the number of fish is estimated by dividing each daily yield by the corresponding daily MW. Note that the main difference with the seafood traders data comes from the fact that the MW of the EU log-books are rough estimates made by fishermen, whereas these of the seafood traders were obtained from weighting.

The 2002 size composition

The 2002 log-books data includes 772 positive fishing days/sets for which the daily MW is available. This sample corresponds to 216347 fish for a total weight of 5297.514 tonnes, i.e., a sample size comparable to this of 2001 (see Fromentin 2003). The monthly distribution is also close to this of 2001 (**Figure 1**). In March and April, catches were dominated by juveniles from 70-120cm (fish of 2, 3 and 4 years old). In May, small BFT of about 70-80 cm (2 and 3 years old) largely dominated the catches, with only a few adults in comparison to 2001. June and July remained, however, typical of the fishing season around the BFT spawning grounds and included both juveniles of 70-120 cm and adults of various sizes/ages (but mainly at around 210 cm, **Figure 1**). From August to the end of the fishing season, catches were again largely dominated by juveniles of about 70-100cm.

Among this sample, about 40% of the catches came from the most traditional fishing area of this fleet, i.e., the Gulf of Lions, where PS mainly caught juveniles BFT in spring and autumn (mainly from 70 to 100 cm, **Table 1**, **Figure 2**). Approximately, the same amount (37.7%) of yields came from the Balearic Islands area, where both juveniles (about 70-110 cm) and adults (around 200 cm) were caught from mid-May to mid-July. The remaining 22.5% was caught at the same period in the central Mediterranean Sea, around Malta, and mainly included small and large adults BFT (140-170 cm and 200-230 cm) as well as a smaller amount of large juveniles BFT (110-120 cm, **Table 1, Figure 2**).

Comparison of the size frequencies since 1990

Fromentin (2003) concluded that *"the 2001 size composition computed from the EU log-books did not displayed any doubtful patterns and appeared, on the whole, in agreement with the 1982-1998 size compositions estimated from the local seafood traders"*. However, this was not really tested using quantitative methods. To do so, we performed the Kolmogorov-Smirnov two samples test (ks test, Sokal and Rohlf 1995) between the yearly size composition of early 1990s and those of 2001 and 2002, using S-Plus 6.1 (S-Plus6.1 2002). The size composition of 1990 to 1995 came from the local seafood traders data. These six years were retained as the samples were large enough (which was not the case afterwards).

At a first sight, the 1990 to 1995 size frequencies displayed rather similar patterns, but a further examination indicated a greater proportion of big BFT (> 200 cm) in the 1994 and 1995 distributions (**Figure 3**). This difference is confirmed by the ks tests (**Table 2**). The size compositions of 1990 and 1992 and 1993, as those of 1992 and 1993 appeared significantly similar, but these 4 years are always significantly different from the 1994 and 1995 ones (**Table 2**). Note that the 1994 and 1995 size compositions cannot be distinguished at the 5% level (p=0.07, **Table 2**). However, the greatest difference appeared to be between the size compositions of the early 1990s and those of 2001 and 2002. In contrast to the early 1990s, the 2001 and 2002 size frequencies appeared less continuous and included a smaller number of size classes (**Figure 3**). The ks tests indicated strong and

significant differences between these two pools of years (p being always < 0.01), whereas 2001 and 2002 appeared highly similar (p= 0.99, **Table 2**). Note that our results of the ks tests are potentially biased by the multiple testing problem (e.g.Peres-Neto 1999), i.e. the probability of the type I error becomes larger than the nominal value α (in other words, we reject H_0 more than we should). However, this statistical bias is unlikely to modify the overall conclusion as many probabilities were < 0.000001.

Conclusion

The 2002 size frequencies of the French PS fleet was very close to this of 2001. In 2002, about 40% of the yields came from the Gulf of Lions, 38% from the Balearic Islands and 22% from Malta area (which is a new area for this fleet). The French fleet caught mostly juveniles (mainly 2 and 3 years old) in the Gulf of Lions, whereas both juveniles and adults were targeted and caught in the 2 latter areas.

The Kolmogorov-Smirnov tests indicated two sets of differences. Firstly, between 1990-1993 and 1994-1995, which was due to a greater proportion of big fish in the latter years. This is likely to reflect changes in fishing strategies of the French PS fleet, which started to target spawners BFT in the Balearic area since the late 1980s, but did not catch significantly in this area before 1994. The second main difference occurred between the size compositions of the early 1990s and these of 2001-2002. In contrast to the previous case, this difference is unlikely to result from changes in the fishing strategy. The main changes, that occurred in the French PS fleet since the mid-1990s, are related to the development of caging and the exploration of a new fishing area in 2002, i.e., the Malta-Lybia zone. However, these two changes probably did not affect the size composition of the catches, as indicated by the strong similarity between 2001 and 2002 distributions. Therefore, this late difference is more likely to reflect the biases in the daily mean weight available in the EU log-books, as discussed above (i.e., this information being imprecise and furthermore not validated).

We thus confirm that information provided by the EU log-books allows to calculate a rough estimate of the size composition of the catches (which is still better than nothing), but this remains too imprecise and lacks of validation to allow the computation of a size frequency table that would fulfil the ICCAT requirements for task II. In 2003, IFREMER will implement a program of observers on board, so that we could collect precise and validated information on the size composition of the catches of a few French PS boats. This information gathered with this of the EU log-books should permit to recover a better idea of the size frequencies of this fleet in 2003.

References

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**Table 1.** Distribution of the yields (in tonnes) and number of fish by fishing areas (MW: mean weight).

	Yields	Percentage	Number	MW
Mediterranean	5297.514	100%	216347	24
Gulf of Lions	2108.564	39.8%	137212	15
Balearic Islands	1997.193	37.7%	66525	30
Malta area	1191.757	22.5%	12609	95

Table 2. Results of the Kolmogorv-Smirnov two-samples tests between the size compositions (Ho: the two sets of observations (i.e. the size compositions) come from the same distribution).
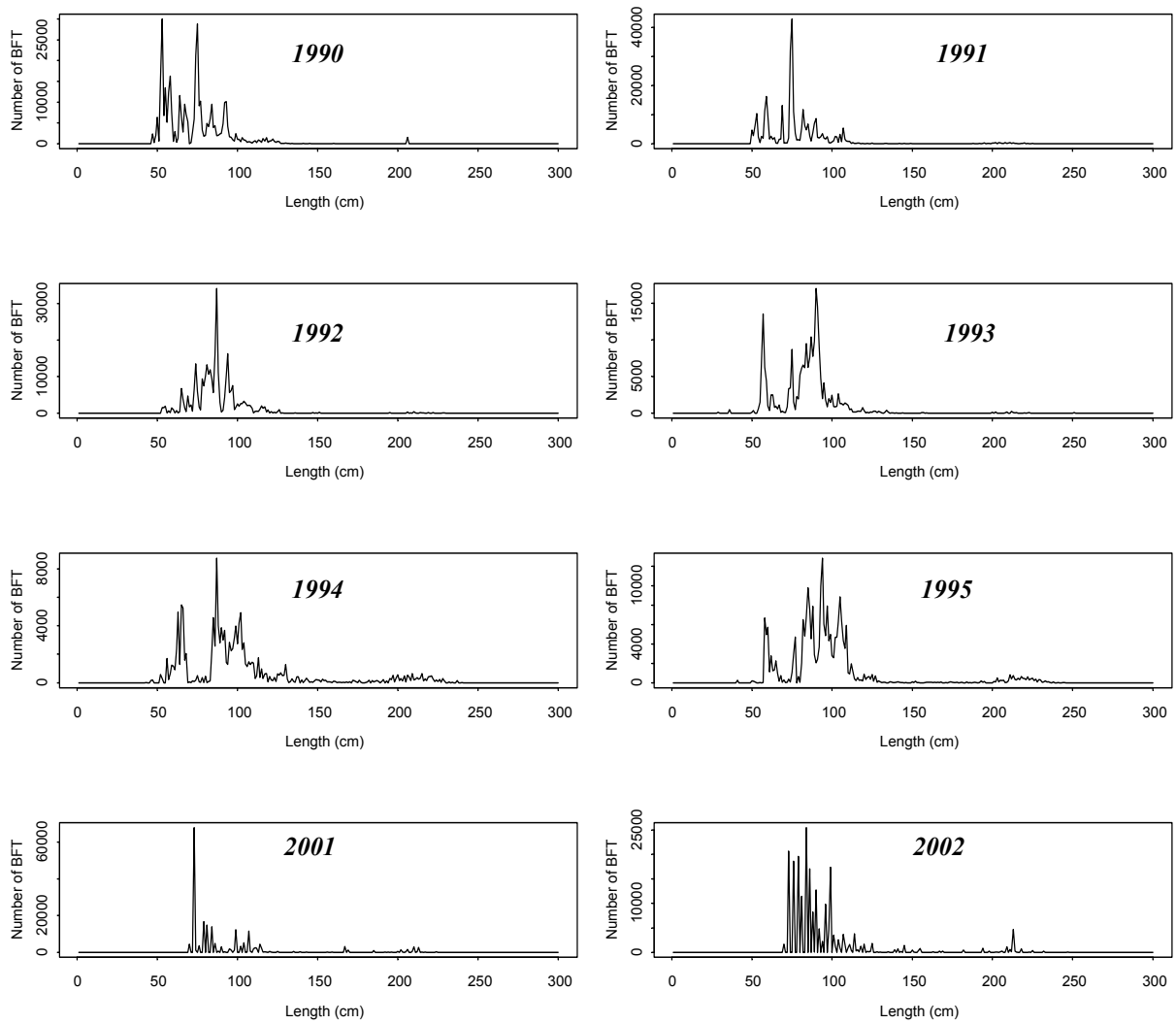
	1991	1992	1993	1994	1995	2001	2002
1990	< 0.001	0.951	0.604	< 0.001	< 0.001	< 0.001	0.006
1991	-	< 0.001	< 0.001	< 0.001	0.018	< 0.001	< 0.001
1992	-	-	0.976	< 0.001	< 0.001	< 0.001	0.01
1993	-	-	-	< 0.001	< 0.001	< 0.001	< 0.001
1994	-	-	-	-	0.07	< 0.001	< 0.001
1995	-	-	-	-	-	< 0.001	< 0.001
2001	-	-	-	-	-	-	0.997
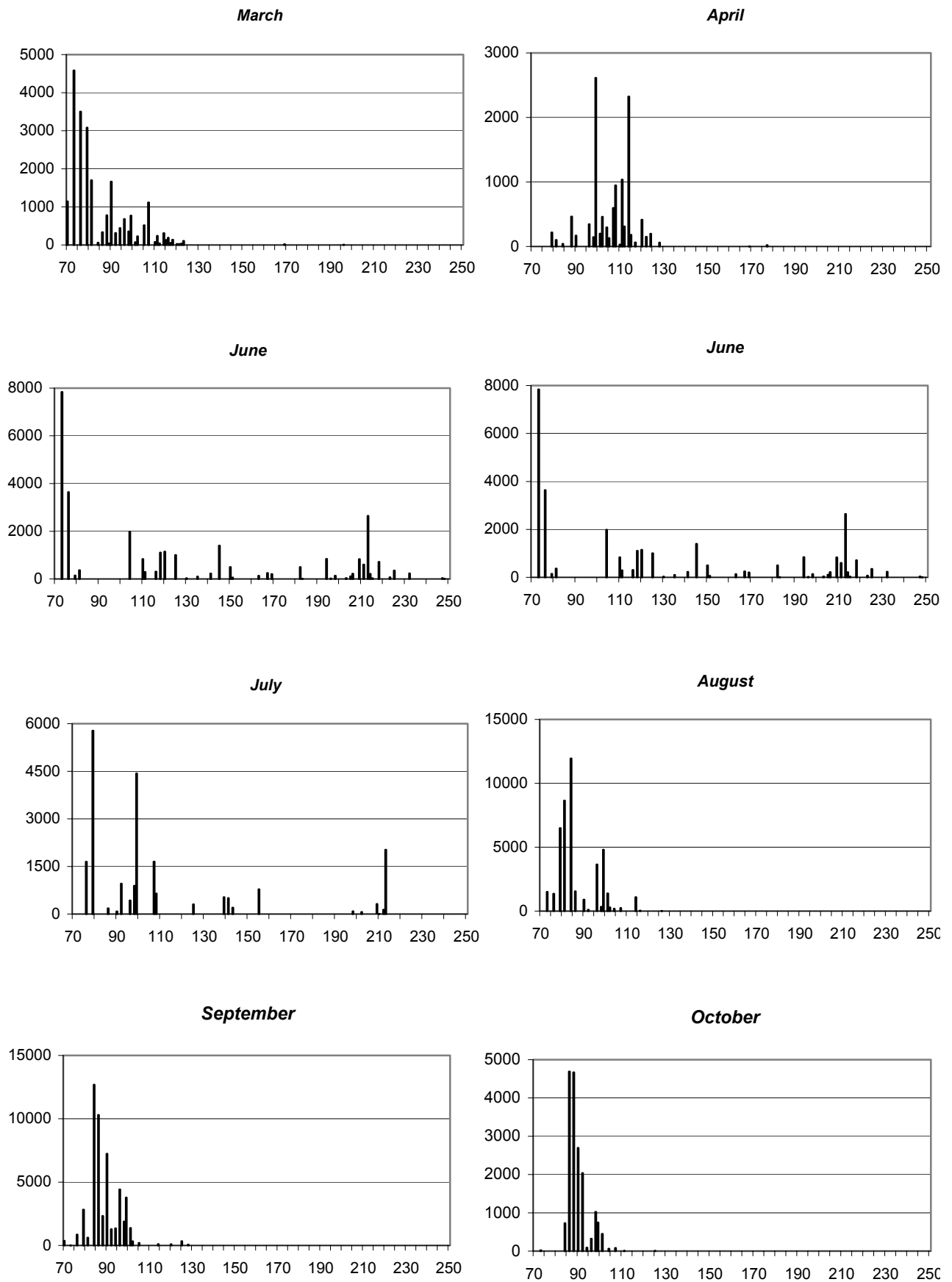
Figure 1. Monthly size composition of the French PS catches of BFT in 2002.

Gulf of Lions 2002

Baléares 2002

Malte 2002
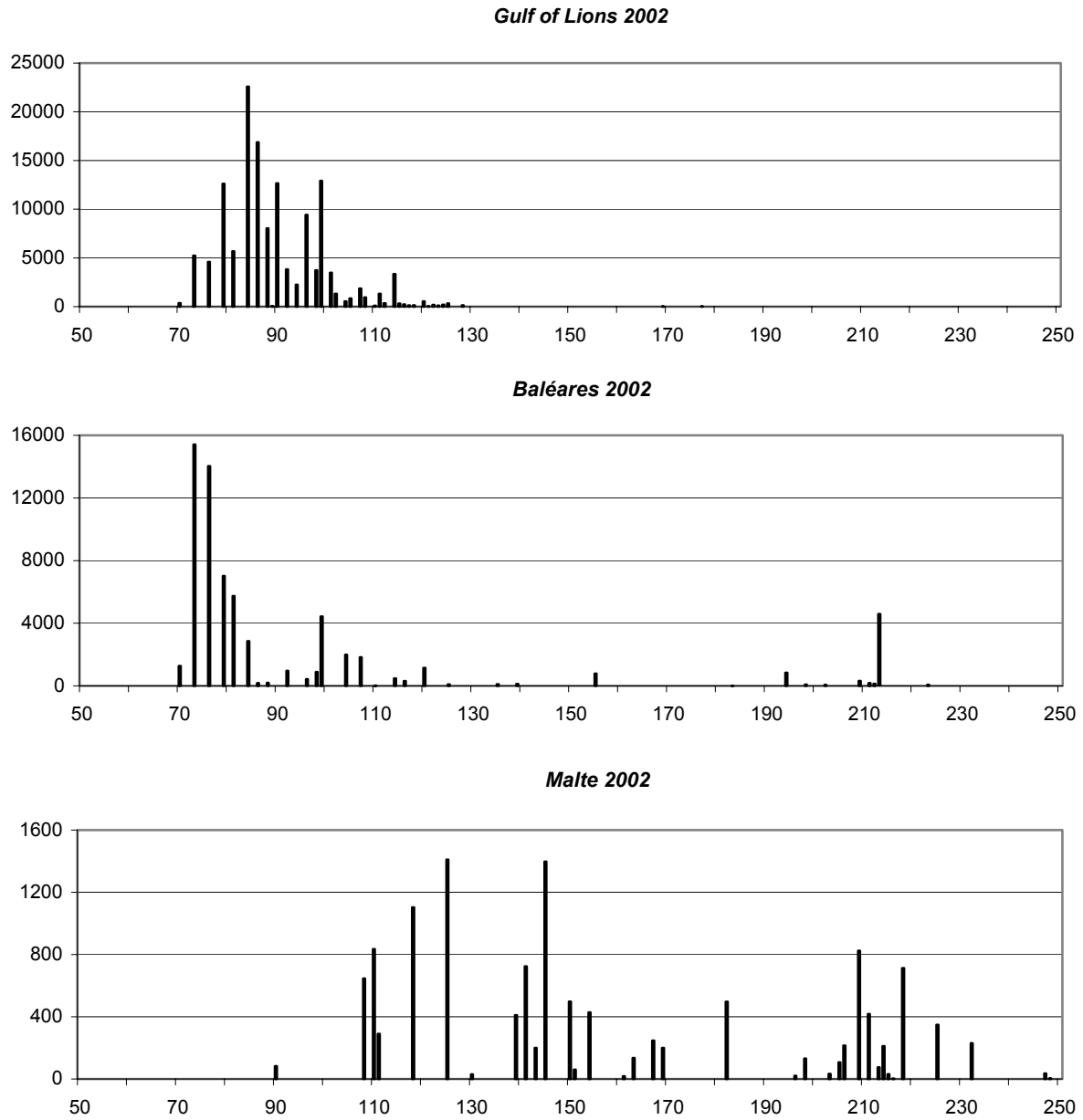
Figure 2. Size composition of the French PS catches by main fishing areas.

Figure 3. Size composition of the catches of the French purse seiners operating in the Mediterranean in 1990, 1991, 1992, 1993, 1994, 1995, 2001 and 2002.