PRELIMINARY RELATIONSHIPS BETWEEN THE WET FIN WEIGHT AND THE BODY WEIGHT OF SOME LARGE PELAGIC SHARKS CAUGHT BY THE SPANISH SURFACE LONGLINE FLEET

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SUMMARY

In this paper we present preliminary results based on raw data obtained on board Spanish surface longliners regarding the relationships between the body weight of some most prevalent large pelagic shark species and their wet fin weight. The mean percentage of fin weight as related to body weight in Prionace glauca was estimated to be around 14% when dressed, or if carcass body weight was used then the mean percentage was roughly 6.5% when compared to the round body weight. This mean percentage was estimated to be 5.8-6.8 % of the dressed weight in Isurus oxyrhinchus. The results highlight the need to establish ratios for each species and fleet because the different criteria for dressing the fish, and the different fins or parts of fins used.

RÉSUMÉ

Le présent document fournit des résultats préliminaires basés sur les données brutes obtenues à bord de palangriers de surface espagnols concernant les rapports entre le poids corporel des requins pélagiques les plus répandus et le poids de leurs nageoires mouillés. Le pourcentage moyen du poids de la nageoire par rapport au poids corporel chez le Prionace glauca a été estimé è environ 14% lorsqu'il est manipulé, ou si le poids de la carcasse est utilisé, le pourcentage moyen est d'environ 6,5% comparé au poids vif. Ce pourcentage moyen a été estimé à 5,8-6,8% du poids manipulé chez les Isurus oxyrhinchus. Les résultats soulignent la nécessité d'établir des ratios pour chaque espèce et flottille en raison des différents critères utilisés pour manipuler le poisson et des différentes nageoires ou parties de nageoires.

RESUMEN

En este documento se presentan resultados preliminares, basados en datos sin procesar obtenidos a bordo de los palangreros de superficie españoles, sobre las relaciones entre el peso corporal de algunas de las especies de grandes tiburones pelágicos predominantes y el peso húmedo de las aletas. El porcentaje medio del peso de la aleta en relación con el peso corporal en el Prionace glauca *se estimó en cerca del 14% en canal, o si se utiliza el peso del cuerpo en canal entonces el porcentaje medio era más o menos el 6,5% en comparación con el peso vivo. Este porcentaje medio se estimó en 5,8-6,8% del peso canal en* Isurus Oxyrinchus. *Los resultados destacan la necesidad de establecer ratios para cada especie y flota a causa de los diferentes criterios para manipular el pez, y de las diferentes aletas o partes de las aletas utilizadas.*

KEYWORDS

Large pelagic sharks, Fins, Body weight, Ratios

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1 Introduction

The word 'finning' has been recently introduced in the literature with different interpretations among countries. However, the 'finning' term was frequently interpreted as the cut of sharks fins and non-retention of the rest of the body or trunks which are discarded. The finning was a common practice in several fleets all over the world for decades, if not centuries. However, the increase of the global demand of fins began around the 1980s and 1990s, generally with a final destination of the fins in Asian markets. The mid-20th century marked the beginning of an intense fishing effort targeting tuna and tuna-like species by the long distance fleets operating under many different flags in all the oceans of the world. Some of these fleets would discard a portion of their catches of pelagic sharks, or they would use only a small part of the captured weight, discarding the rest (MEJUTO, 1985; MEJUTO & GONZÁLEZ-GARCÉS, 1984) although for most fleets this information is poorly documented. Therefore, it should not be generally assumed that the historic catch and landings levels of these shark species are equivalent concepts. In recent years, however, some fleets have reduced or abandoned this practice owing to changing markets, substantial improvements in onboard preservation, a greater amount of space available on the vessels to hold the catch and an increased awareness of responsible fishing practices. As a result, nowadays the catches of these shark species are generally employed more profitably (CUNNINGHAM-DAY, 2001), with less waste-discards than in the previous decades, and new ways being found to make profitable use of the different parts of the body (GRUBER, 1990, cited by CUNNINGHAM-DAY, 2001), leading to a more productive result than in most of the teleost species caught traditionally in a wide range of fisheries all over the world. This full utilization of the catch is to be encouraged and is consistent with FAO recommendations. Yet, the undesirable practice of finning still seems to linger on in some of the fleets of both developed and developing nations, particularly affecting fleets that are limited in terms of operational ability, or with space problems onboard, those having inadequate means of conservation, aimed at specific markets such as those only dealing in fins, etc.

A number of national or regional regulations have been laid down in recent years to ban or limit finning practices (in which the rest of the body is discarded), for the purpose of promoting the use of as much of the whole body as possible of the specimens landed, according to FAO initiatives. In keeping with this, several countries like Spain in may 2002, the EU in 2003, the USA (with some exceptions on a regional level) among other countries around the world, have either established or are in the process of establishing specific regulations to reduce finning practices with whole body discard, requiring the necessary equivalences between the fin weight and respective body weight in the landings. However, owing to the different species of sharks that may be caught or targeted by the different fisheries of the world, considering, in addition, the different biometric relationships depending on the species, and the varying criteria in terms of preparation-use of fish on board the different fleets, it would not appear to be advisable to establish criteria or ratios in general terms. Consequently, to be effective, this regulations must take the specific aspects and fleets behavior into account.

Moreover, accurate conversion factors between fins weight and body weight, or equivalent factors such as the percentage of fins related to the landed body weights, could be very useful in future scientific works to estimate the levels of catches of some of these species from fin landings and fin markets. So the accuracy of such factors could be vital in eliciting a scientific point of view to be able to estimate international catches made by the international fleets, including the catches obtained by national or multinational fleets, which should be accurately reported to the International Fisheries Bodies, or to estimate catches landed by important foreign fleets into national ports and markets which are normally transfer places to the final destination in Asian markets.

One of the main aims of the project recently initiated by the I.E.O. (Spain) on large pelagic sharks is to obtain records at sea or during landings to evaluate these equivalences between fin weight and landed body weight, among other biological tasks. The project is just starting but some thousand of records are already available and are summarized on a preliminary basis in this paper. Additional records are expected to be included in our data base over the coming years and more accurate equivalences between fin weight and body weight are planned to be achieved and provided to the SCRS.

2 Methods

Data by species, body weight and fin weight, among other variables, are recorded mostly by observers during some of the commercial trips of the Spanish surface longline fishery, taking advantage of the commercial routine protocol on board.

The body weight (in kilograms) of some individuals and the type of weight (round-RW-, gutted-GW-, dressed or trunks –DW-) are recorded when possible (or predicted from size using L-W relationships) jointly with their wet fin weight (in grams) following the commercial criterion used by the crew members on the boat under observation. The selection of cutting points, selection of useful fins, selection of part of fins, etc., is done only by the crew members of the boat using the same protocol as in a regular commercial trip, without any bias from the criteria of the observer. The general criteria for cutting the fins in the Spanish fleet is trying to obtain the maximal profitable use of the body as fins meat. The caudal, first dorsal and pectoral fins are a least used but , in some cases other fins are also taken, as pelvic fins (see annex 2 for details). However the cutting points of the fins show some variability, especially in the caudal fin, which should be detected by the variability of the ratios obtained per boat sampled.

The ratios, conversion factor (FACTOR) and the percentage of fins (PCT_FIN), were calculated by species for different types of body weights when available, where: Body weight = Fin weight * FACTOR, and the PCT_FIN = (Fins weight / (body weight *1000)) * 100.

Preliminary ANOVA were done in order to evaluate the statistical significance of some of the factors which could affect the rates obtained. Around 8,500 raw records were available but only the results for some of the most important species are presented, in the event that they might be useful on a preliminary basis.

3 Results And Dicussion

The ratios obtained (**Table 1, Figure 1**) might be useful on a preliminary basis for some of the most important species caught by the surface longline fleets of the E.U. The ratios obtained suggest important differences among species. It should be taken into account that each national fleet may have different criteria for dressing or gutting the fish onboard. Because of this, the factors by species could be especially different among fleets or, to a lesser extent, among boats. A general recommendation of the Regional Fisheries Bodies is for conversion factors to be developed by species and fleet.

As expected, the largest mean percentage was obtained for the long fin *Carcharhinus longimanus* with around 16 % of the body dressed weight when the largest sample size of 529 fish is used, and around 10% for its body round weight. The mean percentage of fins for *Prionace glauca* was around 14% for body dressed weight and 6.5 % for body round weight. This high percentage is due to the slender body and larger fins of this species in relation to other *Carcharhinidae* or *Lamnidae* species. A preliminary ANOVA for *Prionace glauca* points to a statistically significant relationship between the ratios obtained (fin / body weights) and the boat variable (**Figure 2**).

The variables (factor and pct_fin), when representing a mixture of species, would, by necessity, be very close to the values obtained for the blue shark (*Prionace glauca*) because this species is clearly one of the most prevalent species in the large pelagic system -taking advantage of the mean value of 37 embryos per female (CASTRO & MEJUTO, 1995)- and represents the most important amount of the so-called by-catch species (CASTRO *et al*., 2000; MEJUTO *et al*., 2002; ROSE & MCLOUGHLIN, 2001) and one of the most prevalent species in the international fin markets from long distance pelagic fleets (ANONYMOUS, 1999).

The relationship between the body weight of the fish and the weight of its fins has been seen to be quite consistent for a wide spectrum of sizes, both in *Prionace glauca* and in *Isurus oxyrhinchus*. For this reason, the resulting ratios are generally compatible for these wide size ranges, which would suggest that it is very appropriate to use mean overall ratios by species for all the sizes combined (figures 3 and 4) or to use threshold values by species or groups of species defined by means of their respective upper confidence intervals for compliance purpose.

We were unable to find large amount of documentation with the necessary detailed information on dressing protocols to draw comparisons between our results and those reported by other authors. Moreover the different criteria for dressing the fish and drying the fins onboard presented in the different papers make it difficult to be able to apply simple numerical comparisons of the results without having an in-depth knowledge of their respective methodological aspects, particularly when these ratios are defined in terms of weights that have already been processed (dressed, gutted, etc.), or fins in varying stages of drying, or only part of fins are included in some calculations. This lack of precaution in making these comparisons has, on occasion, led to incorrect conclusions or inferred apparent numerical discrepancies among authors that might not exist. It seems that the weight of shark fins has generally been defined as only accounting for 1 to 5 percent of the total body weight

(ANONYMOUS, 1999), but this range would probably not fit some of the most prevalent species in the epipelagic system. Nevertheless, this range might be a realistic reflection of some of the fisheries or other shark species commonly captured in bottom fisheries or for some national large pelagic fisheries with specific dressing criteria or different fins (or parts) used in the calculations.

In this sense, recent papers pointed out this problem and suggest that the percentage of fins obtained from *Prionace glauca* would represent around 6.0% of its round weight (GORDIEVSKAYA, 1973, cited in ROSE & MCLOUGHLIN, 2001). However, the same study also pointed out the value of 2.06 % from the same species and type of body weight (ANON., 1993, cited in ROSE & MCLOUGHLIN, 2001). The last authors also report a value of 3.74% between fins and carcass or dressed weight. A part of the possible different methodologies used among authors, this apparent numerical inconsistencies among results, as the % of fins related to dressed weight been lower than the % fins related to round weight for the same species, is probably an indication that the different authors-fleets are not using the same fins, or the same parts of the fins, or the same dressing criteria, etc.

Studies conducted in the NW Atlantic (CASEY, 1992, from E. Cortés pers. com.) based on a sample of 64 fishes made up of different species found percentages that were different from those obtained in our study for some of the species, especially *Prionace glauca*. However only 8 specimens of blue shark *Prionace glauca* and 5 short fin makos *Isurus oxyrhinchus* were used in this study, and the finning criteria were apparently different in number of fins and the part of fins used because only the lower lobe of the caudal fin was included in the calculations, which is a minor part of the total weight of this large fin. Additional information available of around 27,000 observations obtained by observers in years 1994, 1997, 1999 y 2002 in the NW Atlantic suggest mean percentages of wet fins related to the dressed weight between 4.4% and 5.3%. However any observation of *Prionace glauca* was included in these data, the number of fins used was apparent lower than normally used in the Spanish fleet and only the lower lobe of the caudal fin could be considered in the calculations. All this elements can explain the different numerical results obtained between this study done in the Spanish fleet with those done in the NW Atlantic.

Previous studies done by the IEO that we carried out on the basis of a very limited number of specimens obtained from scientific expeditions aimed at tagging swordfish and large pelagic sharks in the North Atlantic on board a Spanish longliner, showed mean percentages of fins weight as compared to body weight in *Prionace glauca* of 13.91%, 7.36% and 5.63% as related to body dressed weight, gutted weight and round weight respectively. In *Isurus oxyrhinchus* these mean percentages were tentatively estimated as being roughly 6.57%, 4.90% and 4.27%, respectively, although the sampling size was relatively small. Despite this limited number of observations, these values do not differ much from those found in this study, which has used a much larger sampling size and observations from samplings conducted on several different commercial vessels.

The results would suggest that it is advisable to continue with this type of study, in an attempt to cover a broad spectrum of species and all the variables that might affect the ratios obtained between the fin weight and body weight. The raw data must be clean-up of possible out-layers, although mean values obtained after cleaning are expected to be similar to those obtained in this paper. As these ratios are liable to present inter-annual variations due to changes in the markets and/or in the habits of the fleets, it would be helpful to carry on with this type of observational work for periods of several years and to include tests on the above-mentioned annual variable in future analyses. In any case, conversion factors among fins and body weights should be developed by species and fleet.

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Table 1. Number of fish sampled, mean, minimum and maximum values of the variables FACTOR and PCT_FIN using raw data, for the main species and type of body weight (see meaning of CO_ESP and type of weight in annex 1).

CO_ESP	Data	Obs. DW	Pred. DW	Obs.RW	Pred. RW
CFO	Samples	11	155	2	
	Mean FACTOR	9,07	12,39	15,90	
	Mín FACTOR	7,86	4,62	13,04	
	Máx FACTOR	10,00	40,00	18,75	
	Mean PCT_FIN	**11,09**	**8,96**	**6,50**	
	Mín PCT_FIN	10,00	2,50	5,33	
	Máx PCT_FIN	12,73	21,67	7,67	
CLO	Samples	39	529	7	
	Mean FACTOR	4,97	6,38	10,54	
	Mín FACTOR	3,18	2,86	8,57	
	Máx FACTOR	10,75	14,00	12,62	
	Mean PCT_FIN	**21,55**	**16,19**	**9,60**	
	Mín PCT_FIN	9,30	7,14	7,92	
	Máx PCT_FIN	31,43	35,00	11,67	
COO	Samples		4		
	Mean FACTOR		11,32		
	Mín FACTOR		8,86		
	Máx FACTOR		13,50		
	Mean PCT_FIN		**9,04**		
	Mín PCT_FIN		7,41		
	Máx PCT_FIN		11,29		
CPO	Samples		2		
	Mean FACTOR		10,60		
	Mín FACTOR		9,29		
	Máx FACTOR		11,92		
	Mean PCT_FIN		**9,58**		
	Mín PCT_FIN		8,39		
	Máx PCT_FIN		10,77		
GCO	Samples	1	8		
	Mean FACTOR	12,00	15,65		
	Mín FACTOR	12,00	7,14		
	Máx FACTOR	12,00	36,15		
	Mean PCT_FIN	**8,33**	**8,20**		
	Mín PCT_FIN	8,33	2,77		
	Máx PCT_FIN	8,33	14,00		
IOO	Samples	101	381		
	Mean FACTOR	17,56	15,17		
	Mín FACTOR	12,67	8,67		
	Máx FACTOR	33,33	31,50		
	Mean PCT_FIN	**5,81**	**6,80**		
	Mín PCT_FIN	3,00	3,17		
	Máx PCT_FIN	7,89	11,54		
IPO	Samples	3	67		
	Mean FACTOR	13,92	15,84		
	Mín FACTOR	13,13	11,84		
	Máx FACTOR	15,29	23,96		
	Mean PCT_FIN	**7,22**	**6,46**		
	Mín PCT_FIN	6,54	4,17		
	Máx PCT_FIN	7,62	8,45		
PGO	Samples	736	6040	184	
	Mean FACTOR	6,99	7,63	15,59	
	Mín FACTOR	3,33	3,57	10,00	
	Máx FACTOR	17,27	74,47	21,58	
	Mean PCT_FIN	**14,72**	**13,58**	**6,53**	
	Mín PCT_FIN	5,79	1,34	4,63	
	Máx PCT_FIN	30,00	28,00	10,00	
SLO	Samples		1		
	Mean FACTOR		10,48		
	Mín FACTOR		10,48		
	Máx FACTOR		10,48		
	Mean PCT_FIN		**9,55**		
	Mín PCT_FIN		9,55		
	Máx PCT_FIN		9,55		
SZO	Samples	4	212		1
	Mean FACTOR	12,17	10,30		18,07
	Mín FACTOR	10,00	5,56		18,07
	Máx FACTOR	14,47	16,83		18,07
	Mean PCT_FIN	**8,38**	**10,02**		**5,53**
	Mín PCT_FIN	6,91	5,94		5,53
	Máx PCT_FIN	10,00	18,00		5,53

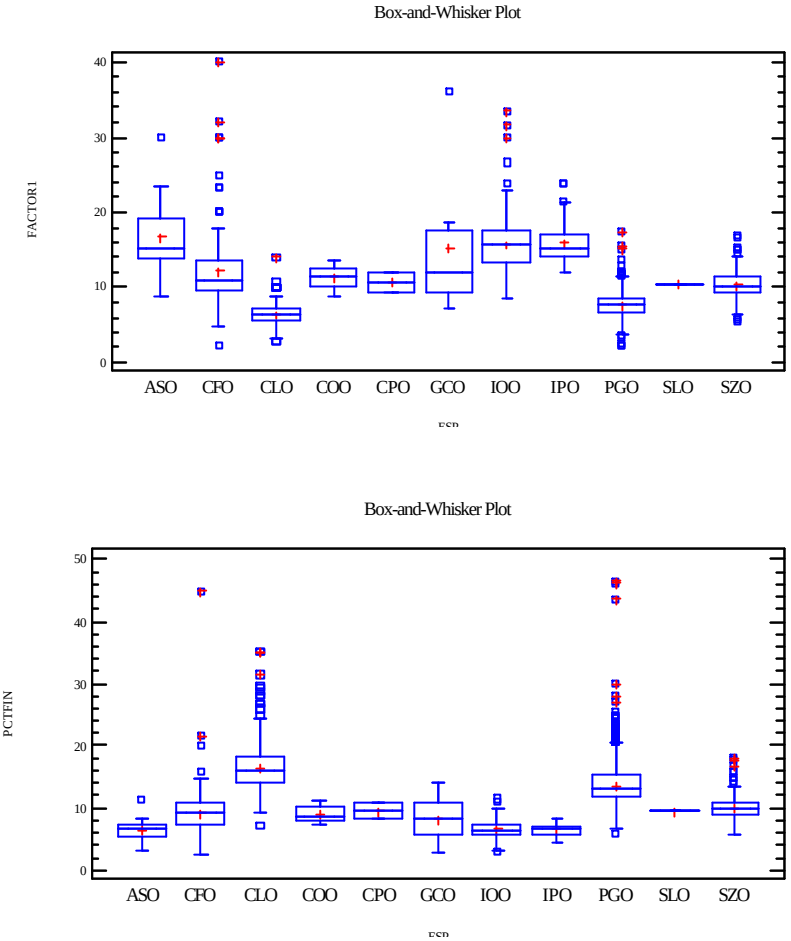

Figure 1. Box-and-Whisker plot of FACTOR and PCT_FIN obtained by each pelagic sharks species (ESP), for the available observations of body dressed weight DW (observed and predicted body dressed weight records combined).

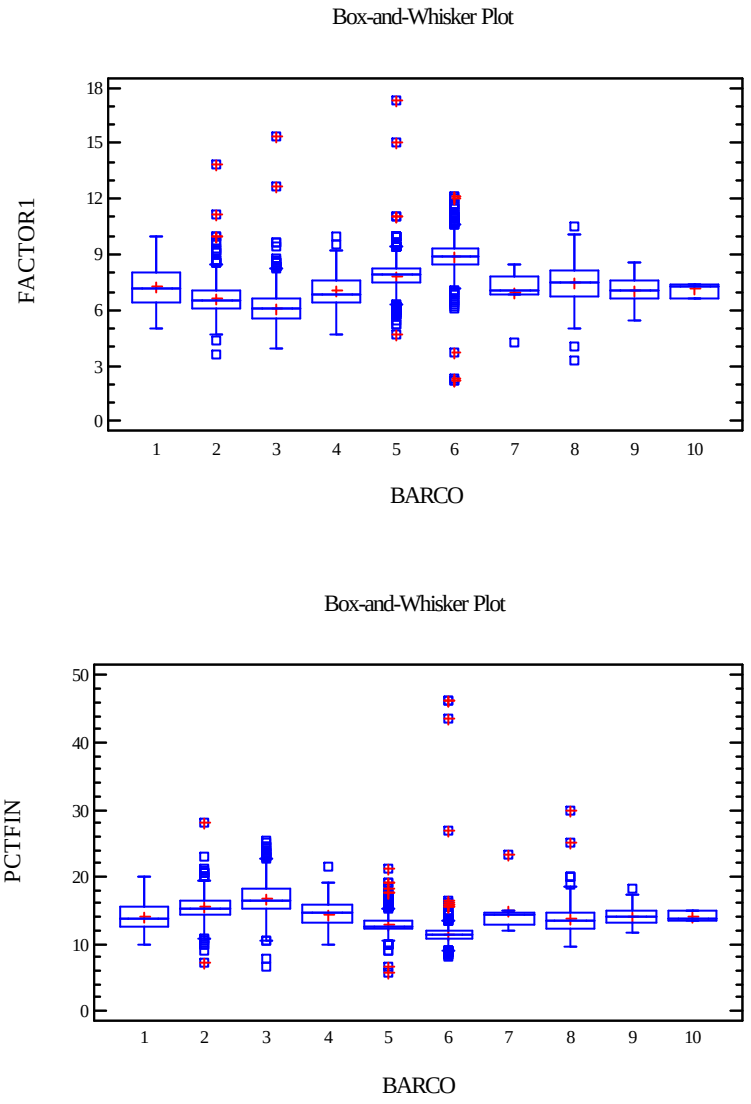

Figure 2. Box-and-Whisker plot of FACTOR and PCT_FIN obtained for the blue shark *Prionace glauca*, using observations of body dressed weight DW (observed and predicted body dressed weight records combined), by observed boats (BARCO).

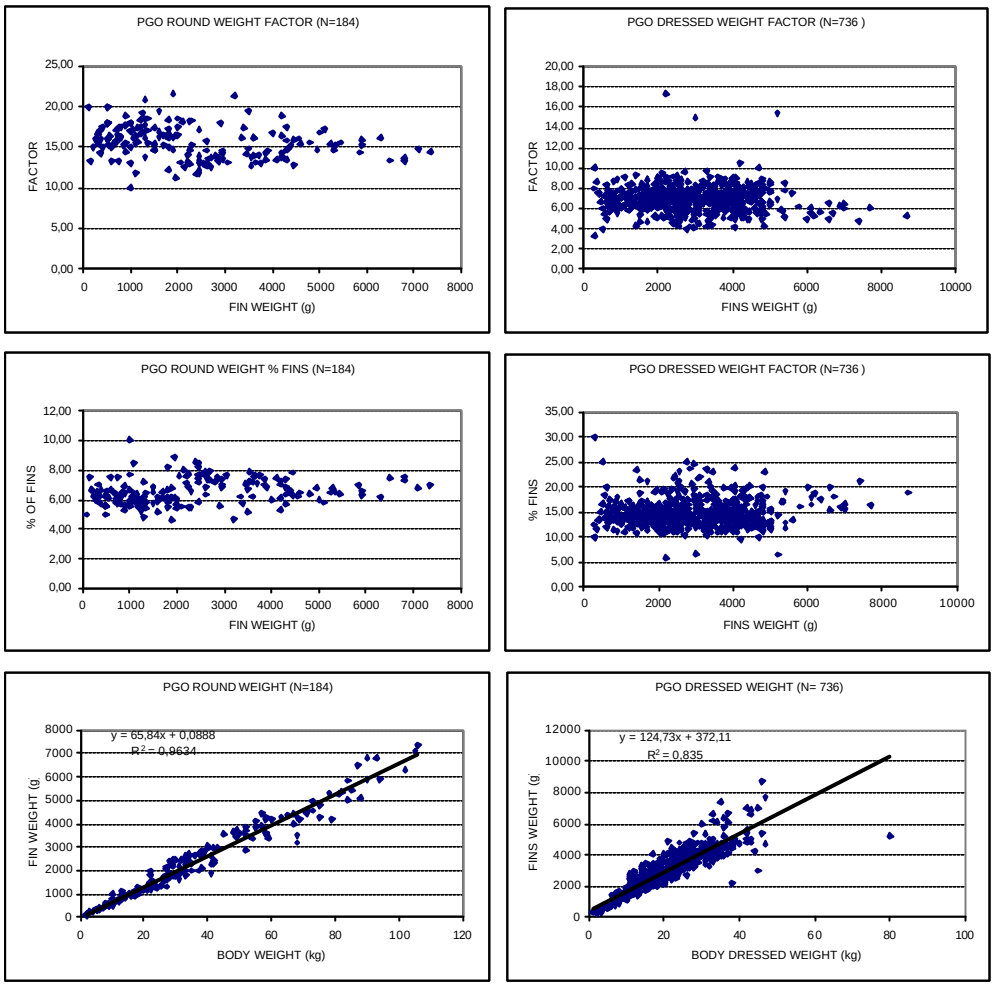

Figure 3. Conversion factors, percentage of fins and correlations between fin weight and body weight (body round weight: left, body dressed weight: right) for the blue shark *Prionace glauca*.

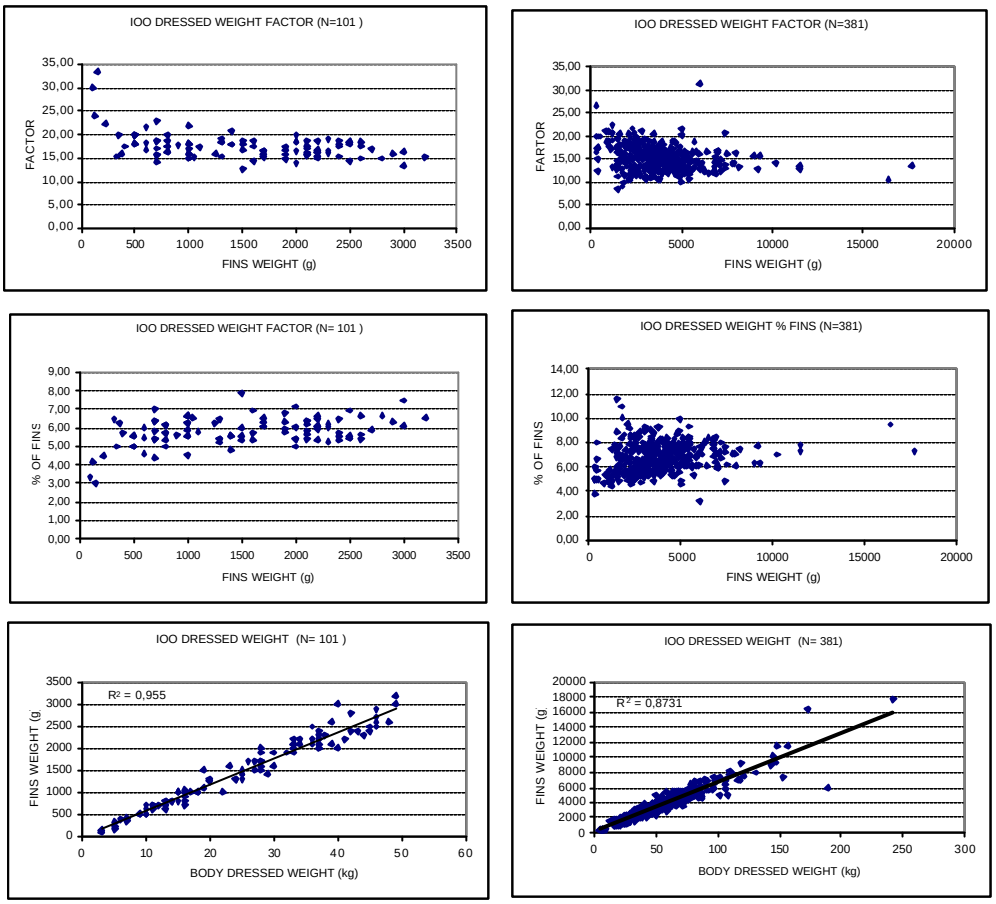

Figure 4. Conversion factors, percentage of fins and correlations between fin weight and body weight (observed body dressed weight: left, predicted body dressed weight from L-W relationship: right) for the short fin mako shark *Isurus oxyrhinchus.*

ANNEX 1

List of species and codes:

CODE	FAO SCIENTIFIC NAMES	COMMON NAMES (Eng. / Spa.)
ASO	*Alopias superciliosus*	Bigeye thresher / Tiburón zorro ojón, zorro de ojo grande
CFO	*Carcharhinus falciformis*	Silky shark / Tiburón jaquetón sedoso
CLO	*Carcharhinus longimanus*	Oceanic whitetip shrark / Tib. Oceánico puntas blancas, jaquetón de ley, jaquetón de aletas largas
COO	*Carcharhinus obscurus*	Dusky shark / Tiburón arenero, Jaqueton lobo.
CPO	*Carcharhinus plumbeus*	Sandbar shark / Tiburón trozo, Tiburón gris
GCO	*Galeocerdo cuvieri*	Tiger shark / Tiburón tigre, Tiburón rayado
IOO	*Isurus oxyrhinchus*	Shortfin mako / Marrajo dientuso
IPO	*Isurus paucus*	Longfin mako / Marrajo carite, Marrajo negro, ..
PGO	*Prionace glauca*	Blue shark / Tintorera, tiburón azul…
SLO	*Sphyrna lewiini*	Scalloped hammerhead / Cornuda común, cornuda negra o manchada
SZO	*Sphyrna zygaena*	Smooth hammerhead / Cornuda cruz

DW = dressed weight or carcass weight (ICCAT).
RW = round weight or live weight. (ICCAT).
GW = gutted weight or eviscerated (ICCAT).
Obs. = body weight obtained onboard or during landings.
Pred.= body weight obtained from size data using length-weight relationships.

ANNEX 2