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OBSERVATIONS ON THE RATIO BETWEEN FIN AND BODY WEIGHTS FOR THE BLUE SHARK CAUGHT BY THE PORTUGUESE LONGLINE FLEET IN THE INDIAN OCEAN

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SUMMARY

During the last decade there has been a debate regarding the ratios between fin and body weight for sharks. This debate has been particularly important in Europe, where a 5% value was implemented by EC in 2003. Herein we report ratios and factors for the conversion of fins weight into round and dressed weight for the blue shark (BSH - Blue shark, *Prionace glauca*) caught by the Portuguese longline fishery targeting swordfish in the SW Indian Ocean. A total of 447 specimens were measured and weighted by onboard observers between May and September 2011. The fin:body weight ratios observed were 6.02% and 14.78%, for the round and dressed weight, respectively. Moreover, a comparison is made with results found for the Atlantic Ocean. Weight-length relationships for the blue shark are also presented.

KEYWORDS: *Ratio fins weight vs. body weight, Blue shark (Prionace glauca), pelagic sharks, Equatorial area Atlantic Ocean*

1 Introduction

The most valuable parts of the majority of shark species are their fins, which are considered a delicacy in Asian cuisine. Shark meat is less profitable, which have resulted in a strong economic incentive to an undesirable practice named shark finning - cut off the fins and discard the carcass back into the sea. Finning has been commonly practiced by many fleets all over the world for many decades. Such practice is still carried out in many fisheries. However, an increase in the global demand for bodies and fins began progressively to take hold around the end of the 1980s and especially during the 1990s. The final destination of the fins was generally the Asian markets (Clarke et al., 2004; Clarke, 2008).

Portuguese catches of pelagic sharks are mostly due to the surface longline fishery primarily targeting swordfish, where the blue shark is largely the most important by-catch species. At the beginning of the Portuguese swordfish fishery (late 1980's) pelagic sharks were not properly discriminated in the logbooks and/or in the catch statistics, but their fins were collected to be exported to Asian markets, while the remain body parts were usually discarded back to the sea. However, this practice was left about 20 years ago, as a result of the increase in the global demand for shark products. Thus, landings and reports in the logbooks of pelagic sharks have increased, reflecting a change in marketing conditions of these species and the increasing interest of the international markets by shark products.

The finning practice has caused considerable discussion worldwide, leading to the adoption of shark finning regulations in several fisheries. This is also the case in Europe, that in June 2003 adopted a Regulation (Council of the European Union) on the removal of shark fins on-board vessels, which was intended to prevent the practice of shark finning within the European fleet (one of the world's largest shark fishing entities). Such Regulation established that "in no case shall the theoretical weight of the fins exceed 5% of the live weight of shark catch" (Article 4.5(EC) No. 1185/2003). As reported by Hareide et al. (2007), most finning regulations mandate a simple conversion factor between the weight of shark fins and the weight of the remainder of the body brought to the dock, verifying that all fins have a body to match, in an attempt to ensure that finning does not take place. Difficulties arise when conversion factors vary between fisheries, often because of different processing techniques, and the highest ratios drive the regulations. Discrepancies arise from keeping different numbers of fins from each carcass and/or cutting sharks differently when removing the fins so that more or less shark meat is left attached.

As mentioned by Cortés and Neer (2006), from a management perspective, banning shark finning required establishing conversion factors between fin weight and dressed carcass weight to ensure that the landed fins correspond to the carcasses being landed and not to those of discarded sharks if fins are not landed still attached to the body. In recent years a number of authors have studied this issue (Mejuto & García-Cortés, 2004, 2009; Santos & Garcia, 2005, 2008; Cortés & Neer, 2006; Ariz et al., 2008; Espino et al., 2010; Lorenzo et al., 2010) and reviewed it (Anon., 2006; Hareide *et al.*, 2007). However, to the author's best knowledge studies specifically devoted to the Indian Ocean were restricted to Ariz et al. (2006, 2008) and Espino et al. (2010). Some of these studies revealed different ratios figures between species, but also within fleets for the same species. The present study represents a first contribution to the knowledge on the ratios between fin weight and body weights for the blue shark (BSH - Blue shark, *Prionace glauca*) caught by the Portuguese longline fleet operating in the Indian Ocean. Additional information on the round and dressed weight to fork length relationships were also reported.

2 Materials and methods

The data reported in the present study was collected within the Portuguese observer program for the mainland based longline fleet targeting swordfish in the Indian Ocean. Between May and September 2011 a total of 447 (207 females and 240 males) blue sharks were sampled onboard a commercial vessel. Sampled specimens were caught in the SW area of the Indian Ocean, most precisely between 25-33ºS and 40-65ºE (corresponding to FAO fishing area 51.7). All specimens were measured (FL - fork length) to the nearest cm. Individual round and dressed wet weight was determined with a top loading digital spring scale with an accuracy of 0.5 kg. All fins (which included: 1st and 2nd dorsal, pectorals, annal, pelvics and caudal) from each specimen were weighted (wet weight), by means of a digital scale with an accuracy of 0.01 kg. Fin extraction was done with a knife, following Portuguese fishermen current practice, near the base of each fin (see Figure 1).

Figure 1. Example of the cutting practice onboard Portuguese longliners: blue shark dressed trunk and respective fins (© IPIMAR, 2007).

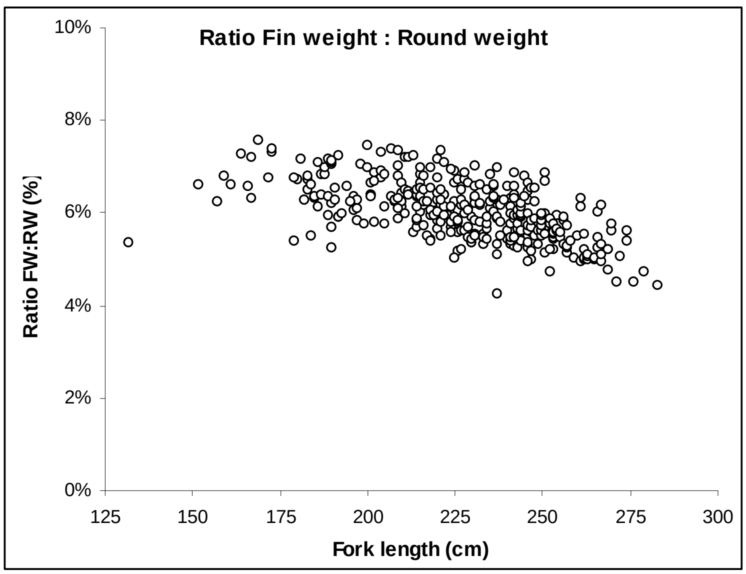
The acronyms and definitions used in this document are as follows:

- RW: Round weight or live weight, corresponding to fish not processed;
- DW: Dressed weight, corresponding to the trunk or carcass weight (see Figure 1);
- FW: Fins weight, corresponding to the wet weight of the fin set (all fins, see Figure 1).

3 Results and discussion

The results obtained in the estimation of weight-length relationships for blue shark, along with several sample descriptive statistics, are given in Table 1. The present results were very similar to those reported by García-Cortés & Mejuto (2002) and Espino et al. (2010).

The results obtained in the estimation of different body:fins weights relationships for the blue shark, along with several sample descriptive statistics, are given in Table 2. The obtained plots are shown in Figure 2. The mean FW/RW ratio found was 6.02%, while the FW/DW ratio the mean value was 14.78%. No significant differences were observed between the two ratios found for females and males (t test: $p < 0.0001$). For the blue shark the FW:RW result was slightly lower than those previously reported for the North Atlantic by Santos & Garcia (2005) and Mejuto & García-Cortés (2004), 6.56 and 6.53, respectively. Recently Mejuto et al. (2009) reported ratios for combined data for the Atlantic, Indian and Pacific Oceans with narrow ranges of 6.26%-6.31% and 6.47%-6.56%, depending on the type of datum and method used to calculate the averages. However, the present results were in the same range of those reported by Ariz et al. (2006, 2008) and Espino et al. (2010) for the Indian Ocean. In any case, all these ratios are higher than the maximum allowed limit in the EU regulation (of 5%).



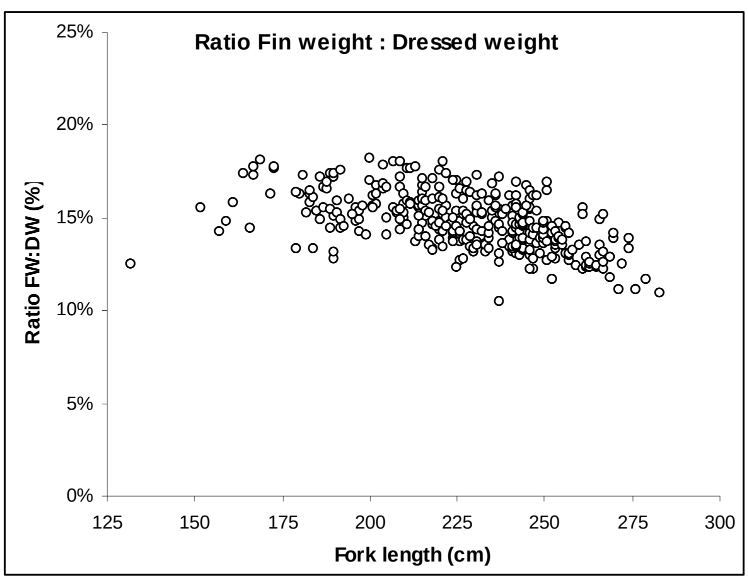


Figure 2. Plots of the individual fin:round body weight (above) and fin:dressed body weight (below) ratios for the blue shark (*Prionace glauca*) caught in the SW Indian Ocean.

As regards to the FW/DW ratio the result obtained of 14.78% was similar to that reported by Santos et al. (2008) for the Atlantic and in the same range of those reported by Mejuto et al. (2009) and Espino et al. (2010. However, all these authors reported considerably higher ratios than in US fisheries, where a fin to carcass ratio of below 4% has been reported (in Hareide *et al*., 2007). The ratio of fin to body weight is not constant among the shark size range. On the other hand, one of the reasons for such variations can be fishermen procedures, as variation has been reported between fishing vessels. In fact, some crew members trimmed slightly more off of the fins than others do and/or do not retain all fins (‘primary’ vs. ‘secondary’ fin set retained).

The ratio most widely referred to in fisheries literature and used as the basis for several shark finning regulations is about 2% of fin to whole weight or 5% of fin to dressed and round weight (see review by Hareide *et al*., 2007). This has been the basis for the finning legislation in the USA and Canadian Regulations. Other figures are, however, quoted that give in a much higher fin ratio than the above, as is the case of studies regarding the Portuguese and Spanish pelagic longline fleets. As there is no reason to believe that the morphology of the same shark species differs between the areas in the same Ocean, neither between Oceans, discrepancies in fin:body weight ratios can only arise from differences in the practices among the different fleets. This means that the different fleets are not using the same fins, the same parts of the fins, and/or the same dressing criteria. In fact, it is relatively common practice for EU fleets to leave quantities of flesh attached to the base of the fins, as they wish to maximize fin weight. On the other hand, it is increasingly common the use of shark belly as bait. These contribute for heavier fins and a lighter carcass. Therefore, much higher fin:carcass ratios. According to Hareide *et al*. (2007), fin buyers subsequently trim excess flesh from the fins during preparation prior to export or sale to processors. The drawback of this practice for the fishermen is that fin quality and unit price is significantly reduced; tainting from the excess meat may even damage the valuable part of the fin. Merchants and importers in East Asia also pay lower prices for such fins (the value/kg of fins imported to Hong Kong, as reported by Hong Kong Customs, are lower for imports from Europe than elsewhere, including the USA).

The results presented herein, together with other studies on EU pelagic shark fisheries, reinforce the fact that the current EU regulation on fin ratio is not adjusted to the fleet practice and should be changed in accordance to scientific evidence. In fact, in order to comply with the current EU regulation, as shark carcasses are retained onboard, shark fins (the most valuable shark product) have to be discarded. In the case of the European fisheries, as previously suggested by the SCRS (Anon., 2005), if a combination of shark species were to be considered, the percentage would necessarily be very close to the values obtained for the blue shark because it is clearly the most prevalent species in the landings of the EU surface longline fleet. However, for compliance purposes, it could be more appropriate to use threshold values by species as blue shark, or groups of species, defined by means of their respective upper confidence limit values or other metrics.

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Table 1. Descriptive statistics weight:length relationship parameters for the blue shark (*Prionace glauca*) caught in the SW area of the Indian Ocean (for sexes combined). N - sample size; min - minimum; max - maximum; RW– round weight (kg); DW – dressed weight (kg); SD - standard deviation; SE - standard error; CI confidence interval.

Species	**N**	**Mean FL (cm) (min-max)**	**Mean weight (kg) ± SD (min - max)**	**Equation**	**Determination coefficient (r^2)**	**SE of *b* (95% C.I. of *b*)**
Prionace glauca (Sexes combined)	447	227.8 ± 25.78 (132 – 283)	RW: 83.1 ± 28.52 (15.0 – 166.9)	$FW=2.66E\text{-}06FL^{3.1681}$	0.9971 (P<0.0001)	0.050 (3.0600 - 3.2763)
			DW: 33.8 ± 11.44 (6.4 – 67.4)	$DW=9.016E\text{-}07FL^{3.2048}$	0.9926 (P<0.0001)	0.0132 (3.1790 - 3.2307)

Table 2. Descriptive statistics and fin wet weight (FW) – round (RW) and dressed (DW) weight relationships parameters for the blue shark (*Prionace glauca*) caught in the SW area of the Indian Ocean (for sexes combined, females and males). N - sample size; min - minimum; max - maximum; SD - standard deviation; SE - standard error; Equation refer to the linear regression: $FW = a + b$W, where a is the obtained constant, b is the slope, FW is the overall fins wet weight. CI - confidence interval.

Species	**N**	**Mean FL (cm) (min-max)**	**Mean weight (kg) ± SD (min - max)**	**Mean Fin weight ± SD (min - max)**	**Equation**	**Determination coefficient (r^2)**	**SE of *b* (95% C.I. of *b*)**	**Mean % of fin weight ± SD (min - max)**
Prionace glauca (Sexes combined)	447	227.8 ± 25.78 (132 – 283)	RW: 83.1 ± 28.52 (15.0 – 166.9)	4.87 ± 1.447 (0.80 - 8.25)	FW= 0.653 + 0.049RW	0.9144 (P<0.0001)	0.001 (0.047 - 0.050)	6.02 ± 0.671 (4.25 – 6.24)
			DW: 33.8 ± 11.44 (6.4 – 67.4)		FW= 0.856 + 0.119DW	0.9093 (P<0.0001)	0.0020 (0.1154 - 0.1233)	14.78 ± 1.482 (10.48 – 18.18)
Prionace glauca (Females)	207	225.5 ± 20.50 (178 - 280)	RW: 79.1 ± 22.72 (36.5.0 – 154.6)	4.66 ± 1.141 (2.45 – 7.70)	FW= 0.569 + 0.051RW	0.8956 (P<0.0001)	0.001 (0.048 - 0.054)	6.19 ± 0.575 (4.72 – 7.34)
			DW: 32.2 ± 9.11 (15.1 – 62.3)		FW= 0.709 + 0.127DW	0.8925 (P<0.0001)	0.0036 (0.1198 - 0.1341)	15.18 ± 1.361 (11.66 – 18.01)
Prionace glauca (Males)	240	230.8 ± 28.04 (132 – 283)	RW: 87.6 ± 31.36 (15.0 – 166.9)	5.08 ± 1.572 (0.80 – 8.25)	FW= 0.597 + 0.049RW	0.9225 (P<0.0001)	0.001 (0.047 - 0.051)	5.88 ± 0.606 (4.25 – 7.66)
			DW: 35.6 ± 12.57 (6.4 – 67.4)		FW= 0.820 + 0.119DW	0.9175 (P<0.0001)	0.0025 (0.1137 - 0.1236)	14.44 ± 1.451 (10.48 – 18.18)