Round-weight and fin-weight ratios for several species of sharks from data gathered by scientific observers on board Spanish surface longliners in the Indian Ocean during a pilot action

by

Ariz, J, A. Delgado de Molina, Mª. L. Ramos and J.C. Santana [1]

Summary

We report the results of ratios between wet fin weight (FW), and the round (RW) and dressed weight (DW) of several shark species habitually caught by the Spanish long-line fleet targeting swordfish. Values from scientific observer data are different to those obtained for the various species studied. For the most commonly caught species—the blue shark (Prionace glauca)—values for FW/RW and FW/DW, using samples of 1360 and 466 specimens, were 5.7% and 14.9%, respectively. The FW/RW ratios found varied between 4.07% for Isurus oxyrinchus and 6.60% for Carcharhinus longimanus, while the extreme values for the FW/DW ratio were 6.26% for Isurus oxyrinchus and 16.05% for Carcharhinus longimanus. These values confirm the need to establish a per-species ratio or a mean value according to the most frequently caught species in each fishery. Simultaneously, in order to restrict fin removal and the non utilization of sharks, we propose that resolutions are based on the manner in which sharks are preserved on board, since, in most cases, carcasses are dressed and rarely preserved whole.

Keywords*: Large pelagic sharks, blue shark, fin ratios, round weight, dressed weight, ratios*

Introduction

Spanish surface longliners catch pelagic sharks in great amounts, mainly blue shark and shortfin mako. Both species are processed on board: gutted, beheaded and all fins removed. Accordingly, these vessels land both dressed carcasses and fins.

While the fins landed by many fleets generally consist of the lower caudal fin lobe, two pectoral fins and the first dorsal, Spanish fleets usually include all the fins (the whole caudal fin, both pectoral fins, dorsal fins, pelvic and anal fins) (Hareide *et al*. 2007), though the latter two are usually packed apart. Spanish fleets also leave significant weights of meat attached to the fins that are later removed and discarded. All these factors should be taken into account in order to estimate an appropriate conversion factor.

In 2004, the International Commission for the Conservation of Atlantic Tunas (ICCAT) approved a measure requiring full utilization of shark catches, so that fins retained on board

[1] Instituto Español de Oceanografía
Centro Oceanográfico de Canarias
P.O. Box 1373
38080 Santa Cruz de Tenerife
España.

total no more than 5% of the total weight of sharks landed—the same value adopted by the Indian Ocean Tuna Commission (IOTC) in 2005 (5% of the weight of sharks on board). In 2005, the Northwest Atlantic Fisheries Organization (NAFO) Commission adopted a ban on shark finning. The same year, the Inter American Tropical Tuna Commission (IATTC) adopted a resolution to ban finning in the Eastern Pacific Ocean, and Section 4 of this resolution indicates that fins on board must not exceed 5% of the weight of sharks on board. The United States of America shark finning regulations establish that 5% of total wet fin weight to 95% total dressed carcass weight, or 2% of wet fin weight to 98% whole shark ("round" or "live") weight should not be exceeded at the first point of landing in the Atlantic Ocean (Anon. 1993, Dos Santos and García 2005).

The European Union (EU) has also enacted shark finning regulations, but with one significant difference: fins landed separately from carcasses must weigh no more than 5% of the whole weight of the shark. This difference is very important because a shark's head and, in particular, its liver, are very heavy in relation to the rest of its body. It means that boat crews can fin many more sharks while still being able to conform to the 5% rule.

Setting a universal fin-body weight ratio appears to be inadvisable, owing to the different species of sharks that may either be caught or targeted by different fisheries around the world—probably with different fin-body weight ratios—and also owing to the varied criteria concerning the use and preparation of fish on board the different fleets. Consequently, if these regulations are to be efficient, they must consider different species of sharks and different fleet practices.

Aside from completion issues, accurate conversion factors between landed fin weight and whole body weight could be very useful for scientific efforts to calculate the catch levels of these species, based on landings and the shark fin trade.

Therefore, the accuracy of the conversion factors is vital for calculating catches made by shark-fishing fleets. Fin-body weight ratios may significantly affect catch estimations and, in the final analysis, may influence assessment results.

Material and methods

During 2005 (January to December), two Spanish surface longliners carried out an experimental fishing action in the waters of the south-western Indian Ocean designed to analyse the selection of different types of hook and bait (AP-08-2004), particularly where sea turtles were concerned. Scientific observers were permanently on board, enabling the gathering of copious and important biological and fishing information about the different species caught.

Surface longliners operating under the Spanish flag in the Indian Ocean process catches of large pelagic sharks and freeze them on board, conserving the dressed carcasses in cold storage. Observers on board vessels participating in the aforementioned pilot action gathered data about live (weight of specimen hoisted on board after expulsion of water content) and dressed weight (weight of the processed specimen before freezing: minus fins, viscera and head).

Commercial fins are defined as the combination of fins that fishermen retain for commercial purposes in each vessel or fleet. For European fleets, this consists of all fins, including the whole tail. However, this criterion is not followed by all fleets trading in shark fins. The fins exported from South Africa, where the ships involved in this pilot action offload, include the dorsal fin, pectoral fins, ventral flaps and the caudal fin.

Cutting techniques differ from fleet to fleet and even within a fleet. This will have a substantial impact on the fin to trunk weight ratio. Each national fleet might follow different criteria when presenting the fish on board. As a result, there could be different fin-body weight ratios per

species, particularly between fleets or, to a lesser extent, between boats. Evidently, a detailed description is required of the way fins are obtained per vessel, fleet and species.

In this respect, fin processing on these boats has been carried out in the following manner: fins are removed by means of a straight or "L" cut, tending towards a moon or half-moon cut for the pectoral and dorsal fins. Small fins are usually discarded. Processing the rest of the body may vary according to species.

Large specimens weighing between 15 and 20 kg of round weight or length to the furca (LF) of over 150 cm are usually processed on board. Catches of *Prionace*, *Carcharhinus* and *Sphyrna* are gutted by making two cuts parallel to the specimen's side, and then discarding the viscera and the belly meat. The head is removed by making a cut at the fifth branchial arch. For the *Isurus*, only one cut is made from the anus to the pectoral fins to extract the viscera, leaving the belly meat intact. The head is removed at the same time as all the viscera.

The scientific observer weighed the fins from these shark specimens either together or separately, depending on conditions on board. A clean cut was used to remove all fins from all sharks.

Eslamobranch fins were usually weighed using a 25-kg (with 100 g accuracy) or 5-kg dynamometer (with 5 g accuracy) according to weight. Fins were always removed by the same crew members on each vessel resulting in cuts being made in the same way, thereby minimising error.

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

RW: Round weight or live weight (Kg). Fish not processed.
DW: Dressed weight, trunk weight or carcass weight (Kg).
FW: Fins weight (Kg).
AF: All fins.

Observers on board the two boats participating in the pilot action gathered data on fin utilization for each shark specimen caught. For each specimen, they noted the length to the furca to the lowest centimetre, the weight (round, dressed or estimated) and the weight of the fins taken from the animal (together or by type: anal, pectoral, pelvic, caudal and dorsal). The weight of the specimens and the fins were both taken in kg and were accurate to 100 g.

This work only analyses specimens whose fins were removed.

Fins were wet weighed immediately after removal, since it was impossible to identify their origin when dry.

Data analysis was based on specimens that were actually weighed (round weight (RW) and dressed or trunk weight (DW)) and was never based on estimated weight.

1,360 specimens of both sexes of blue shark (BSH), *Prionace glauca* (Linnaeus, 1758), were analysed. They gave a total round weight of 85,139 kg (between 5.5. and 225 kg) and most specimens reported an individual weight above 15 kg, and a wet fin weight of 4,728 kg (between 200 g and 10 kg). All fins (dorsal, pectoral, caudal, pelvic and anal) were utilized from each specimen.

150 specimens of both sexes of shortfin mako (SMA), *Isurus oxyrhinchus Rafinesque, 1810*, were analysed: a total of 9,514 kg RW (between 7 and 149 kg) and 382 kg FW (between 350 g and 6 kg).

120 specimens of both sexes of silky shark (FAL), *Carcharhinus falciformis (Bibron, 1839)*, and 61 of oceanic whitetip shark (OCS), *Carcharhinus longimanus (Poey, 1861)*, were weighed, giving a total of 3,281 kg RW (between 4 and 183 kg), and 333 kg FW (between 200 g and 8 kg).

Information was only obtained from 14 specimens of scalloped hammerhead (SPL), *Sphyrna lewini (Griffith & Smith, 1834)*, resulting in 476 kg RW (range between 13 and 85 kg) and 22 kg FW (range between 600 g and 4 kg).

Results

Table 1 shows the percentages of fin weight (FW) compared with the round (RW) and dressed weight (DW) of the shark species studied, as well as the number of samples used for this calculation.

We observed differences per species in the fin weight (FW) and round weight (RW) ratio. Values ranged between 4.07% for short-fin mako (SMA) and 6.60% for silky shark (OCS).

The blue shark (BSH) was the most common in these long-line fisheries. In this work, the FW/RW ratio obtained has a value of 5.7%. This value is higher than the 5% established in several resolutions that regulate fin removal from sharks and similar species; though it is slightly lower than the values of 6.26%-6.31% recently obtained by Mejuto *et al.*, in press, for the same fleet. In previous works, Mejuto *et al.* (2004) and Dos Santos *et al.* (2005) obtained values of 6.53% and 6.56%, respectively, though the sampling size was considerably smaller.

Percentages for the fin weight (FW) and dressed weight (DW) ratio vary between 6.26% for short-fin mako (SMA) and 16.05% for silky shark (OCS).

The value obtained for blue shark was 14.9%. Mejuto *et al* (2004) and Dos Santos *et al* (2005) found values of 13.58% and 14.72%, respectively, for the FW/DW ratio. Mejuto *et al*., in press, have recently obtained values ranging between 14.05% and 14.76% between the weight of the fins and the weight of the carcass they came from.

Table 2 shows the values that correspond to the mean “factor” obtained per species and type of weight—based on fin weight—in order to establish the weight of the fish from which they were removed.

The “factors” found varied between 16.12 and 25.29 for silky shark (OCS) and short-fin mako (SMA), respectively, and for RW. The same species give the most extreme values for DW: 6.51 for OCS and 16.24 for SMA.

Figures 1 to 5 show fin weight (FW) in relation to round weight (RW) and dressed weight (DW), the percentage that fins suppose (%FW) over these weights and the conversion factor (FACTOR) found between fin weight and round or dressed weight for the five species of sharks studied: blue shark (BSH), short-fin mako (SMA), silky shark (FAL), whitetip shark (OCS) and scalloped hammerhead (SPL).

Annex 1 gives the scientific names and common names in Spanish and English, and the codes of the different species studied in this document.

Annex 2 shows images of different types of cut and fins from the shark species mentioned in this work.

Discussion

If we consider a combination of shark species, it is evident that the percentage to be retained would be close to the values obtained for the blue shark. This species is clearly predominant among large pelagic sharks and in catches made by the Spanish long-line fleet. Similarly, it is one of the predominant species on the international fin markets of long-distance pelagic fleets (Mejuto & Garcia-Cortés, 2004, Ariz *et al*, 2006).

Fin-body weight ratios did not vary for a wide spectrum of sizes in blue shark or short-fin mako. This suggests that it is advisable to use specific mean ratios of species for all the sizes combined or, for compliance purposes, threshold values per species or groups of species defined through their respective upper confidence limits.

The different criteria used by the various fleets for removing fins, presenting the fish, drying fins on board, and retaining fins or parts of fins explain the considerable differences in ratios obtained for the same species when comparing fleets. They also make it very difficult and inaccurate to apply a universal and unique numerical ratio without full knowledge of the methods used by each fleet, particularly when this percentage is based on weights that have been processed (dressed, trunk etc.) or are at different stages of the fin-drying process, or when only some fins or parts of fins are included in the calculations (Ariz *et al*, 2006).

It would be advisable to develop and implement conversion factors for fin and body weight specifically based on the fleet and/or the species. However, this would seriously complicate control tasks. Consequently, it would seem simpler and more efficient to consider one single factor that would logically encompass all factors calculable per species.

The regulatory measures adopted by the various RFOs concerning the full usage of sharks and their fins are essentially for monitoring purposes. This suggests that the fin-body weight ratio depends on the weight retained on board, which is effectively the weight that can be monitored on offloading or landing. We believe that unnecessary errors arise from applying a fin utilization control factor that relates fin weight and round weight, particularly when gutted sharks are landed. An alternative would be a factor that relates fin weight and the ready-for-market dressed weight.

References

ANON. 1993. Fishery Management Plan for sharks of the Atlantic Ocean. National Marine Fisheries Service, National Oceanic and Atmospheric Administration United States Department of Commerce. Washington DC

ARIZ J., A. DELGADO DE MOLINA, Mª L. RAMOS and J.C. SANTANA. 2006. Body weight (dressed weight) and fin-weight ratios of several species of shark caught by Spanish longliners in the Indian Ocean. IATTC, Document SAR-7-09

CLARKE S.C., J.E. MAGNUSSEN, D. ABERCROMBIE, M. Mc ALLISTER and M. SHIVJI. 2006. Identification of shark species composition and proportion in the Hong Kong shark fin Market based on molecular genetics trade records. Conserv Biol 20:201-211

CORTÉS, E. and J. A. NEER. 2006. Preliminary reassessment of the validity of the validity of the 5% fin to carcass weight ratio for sharks. Col. Vol. Sci. Pap. ICCAT, 59(3).

DOS SANTOS, M.N. and A. GARCIA. 2005. Factors for conversion of fin weight into round weight for the blue shark (*Prionace glauca*). Col. Vol. Sci. Pap. ICCAT, 58(3):935-941.

HAREIDE, N.R., J. CARLSON, M. CLARKE, S. CLARKE, J. ELLIS, S. FORDHAM, S. FOWLER, M. PINHO, C. RAYMAKERS, F. SERENA, B. SERET, and S. POLTI. 2007. European Shark Fisheries: a preliminary investigation into fisheries, conversion factors, trade Products, markets and management measures. European Elasmobranches Association.

MEJUTO, J. and B. GARCÍA-CORTÉS. 2004. Preliminary relationships between the wet fin weight and the body weight of some large pelagic sharks caught by the Spanish surface Longline fleet. Col. Vol. Sci. Pap. ICCAT, 56(1): 243-253.

MEJUTO, J., B.GARCÍA-CORTÉS and J. Ortiz de Urbina. (In press). Ratios between the wet fin weight and body weights of blue shark (*Prionace glauca*) in the Spanish surface Longline fleet during the period 1993-2006. Col.Vol.Sci.Pap.ICCAT, in press, ref. SCRS/2008/128.

Table 1. Number of fish sampled (n) per species and mean values of percentage of fins (% FW/RW or %FW/DW) for the main species of sharks from AP-08/2004 raw data. Values are calculated over round weight (RW) and dressed weight (DW)

Species	FAO Code	n	%FW/RW	n	%FW/DW
Prionace glauca	BSH	1360	**5.70**	466	**14.90**
Isurus oxyrinchus	SMA	150	**4.07**	113	**6.26**
Carcharhinus falciformis	FAL	120	**4.65**	8	**11.16**
Carcharhinus longimanus	OCS	61	**6.60**	20	**16.05**
Sphyrna lewini	**SPL**	**14**	**4.49**	**-**	**-**

Table 2. Number of fish sampled (n) per species and factor applicable to fin weight (FW) to obtain round (RW) and dressed weight (DW)

Species	FAO Code	n	Factor=(RW/FW)	n	Factor=(DW/FW)
Prionace glauca	BSH	1360	**18.03**	466	**6.92**
Isurus oxyrinchus	SMA	150	**25.29**	113	**16.24**
Carcharhinus falciformis	FAL	120	**21.73**	8	**9.23**
Carcharhinus longimanus	OCS	61	**16.12**	20	**6.51**
Sphyrna lewini	**SPL**	**14**	**23.24**	**-**	**-**

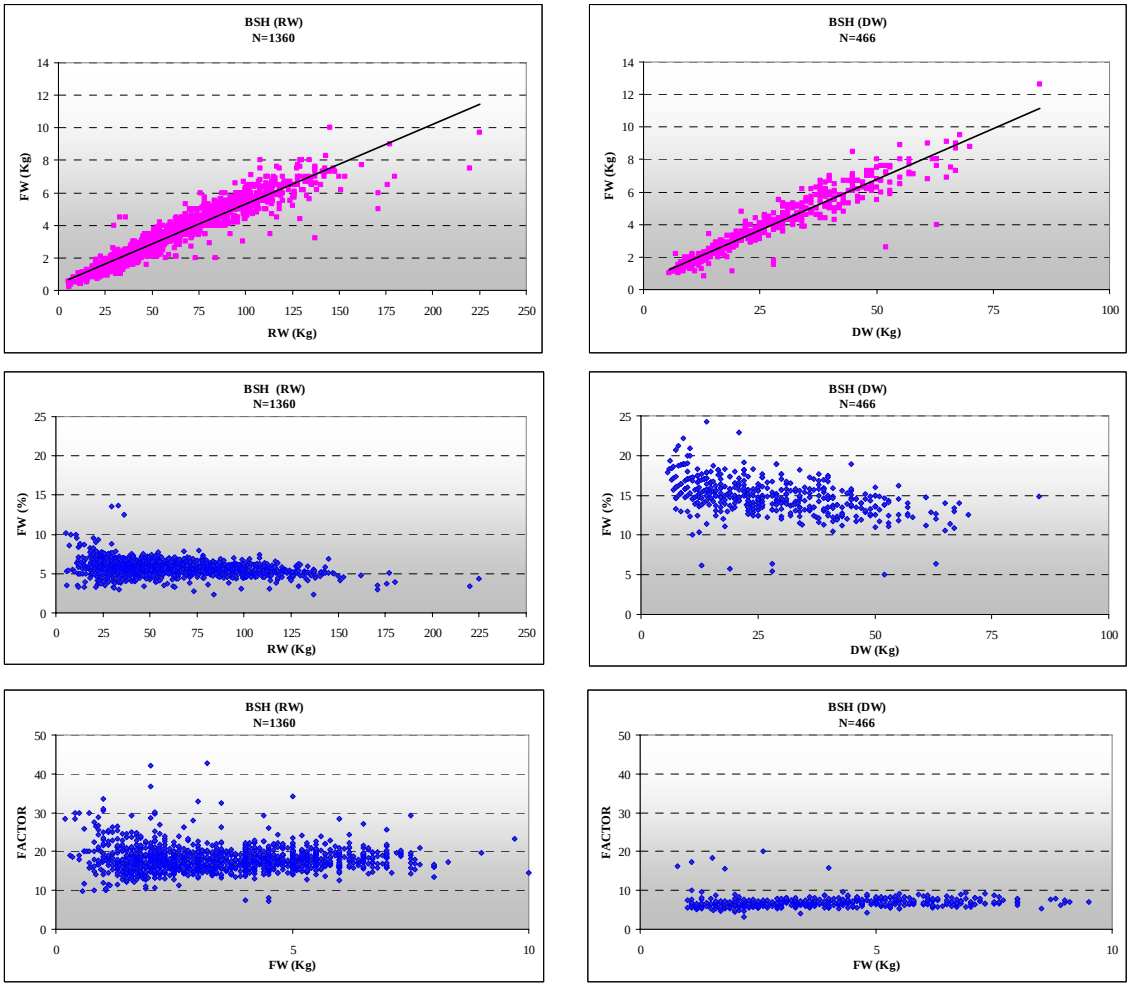


Figure 1. Percentage of fins, conversion factors and correlations between fin weight (FW) and body round weight (RW) and carcass weight (DW) for blue shark (BSH) from Pilot Action RAI-AP-08/2004 data in the South Western Indian Ocean

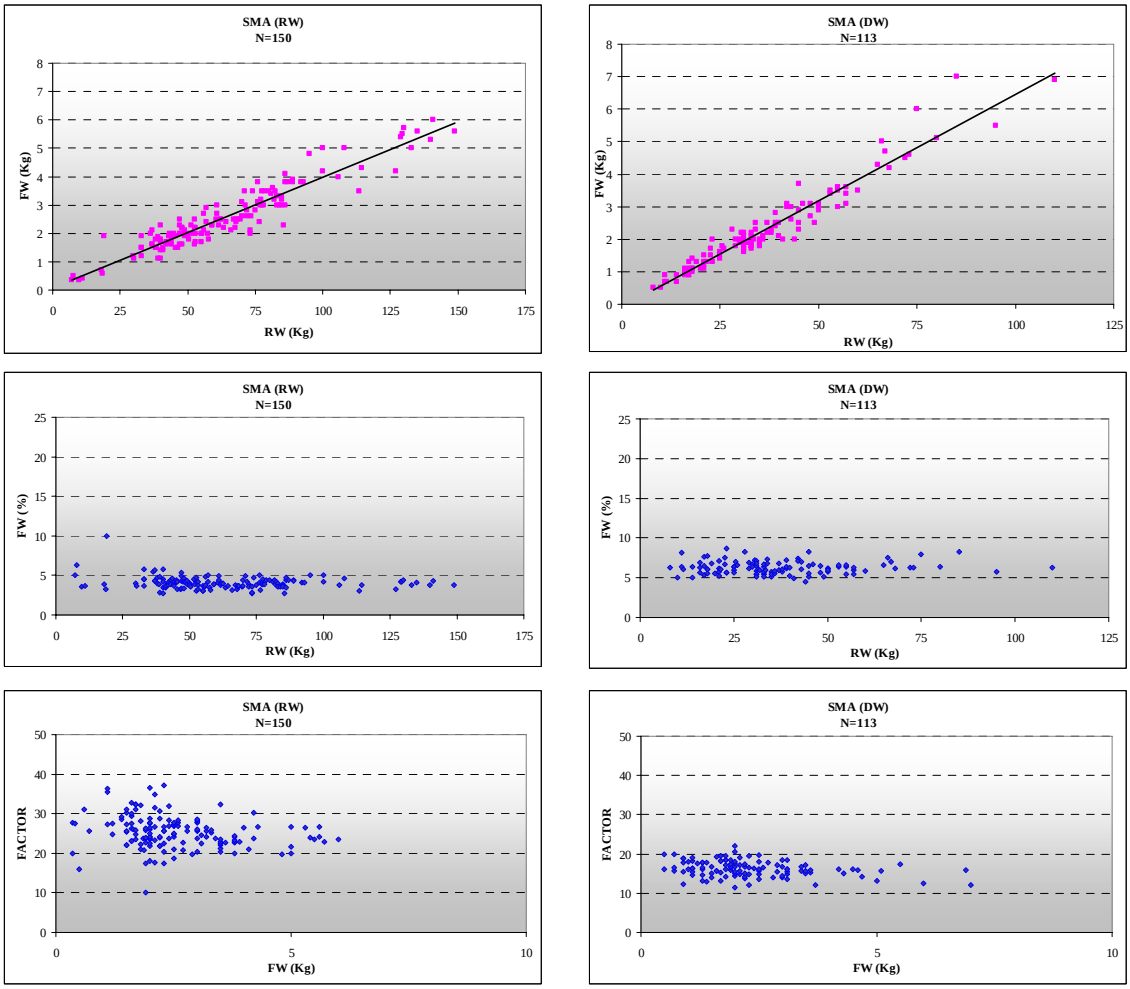


Figure 2. Percentage of fins, conversion factors and correlations between fin weight (FW) and body round weight (RW) and carcass weight (DW) for short-fin mako (SMA) from Pilot Action RAI-AP-08/2004 data in the South Western Indian Ocean

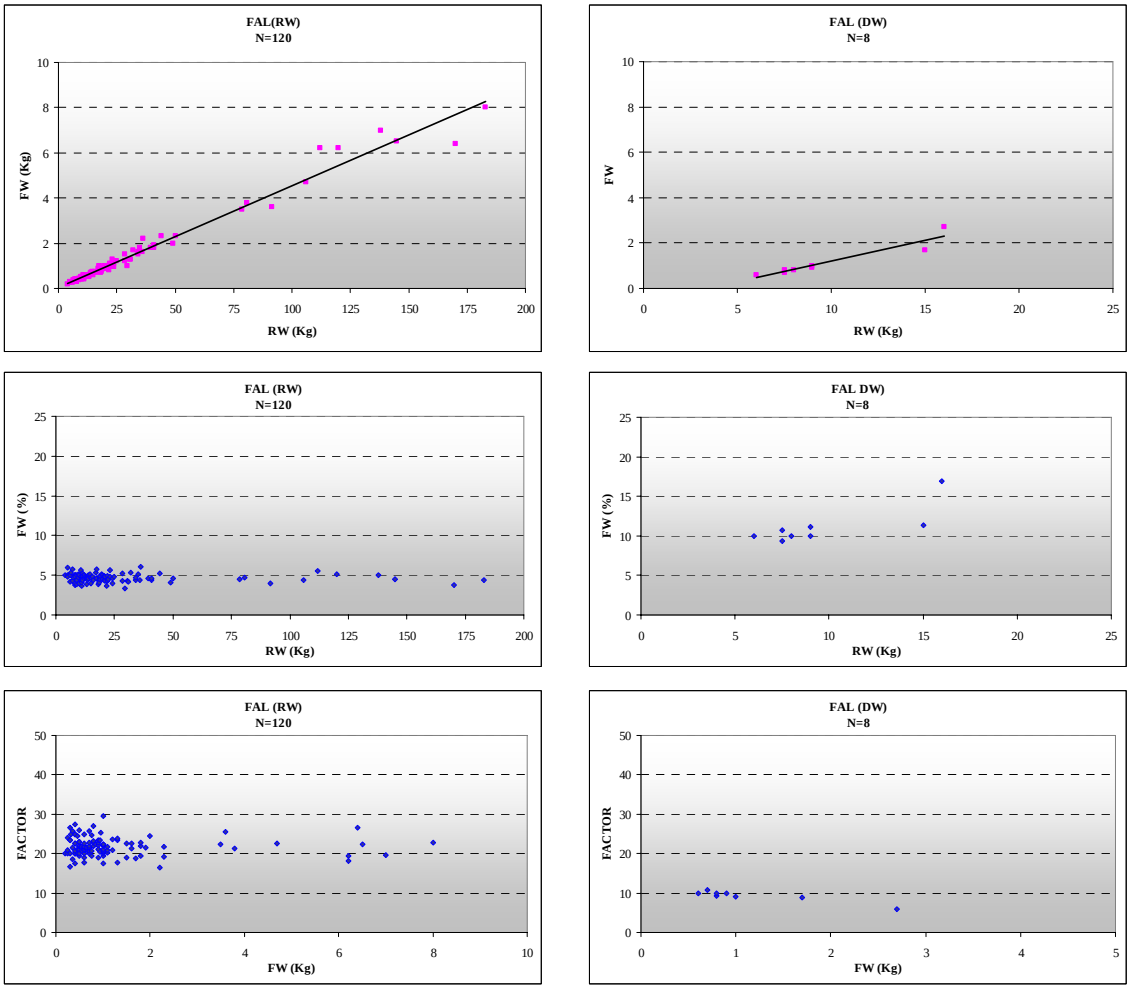


Figure 3. Percentage of fins, conversion factors and correlations between fin weight (FW) and body round weight (RW) and carcass weight (DW) for silky shark (FAL) from Pilot Action RAI-AP-08/2004 data in the South Western Indian Ocean

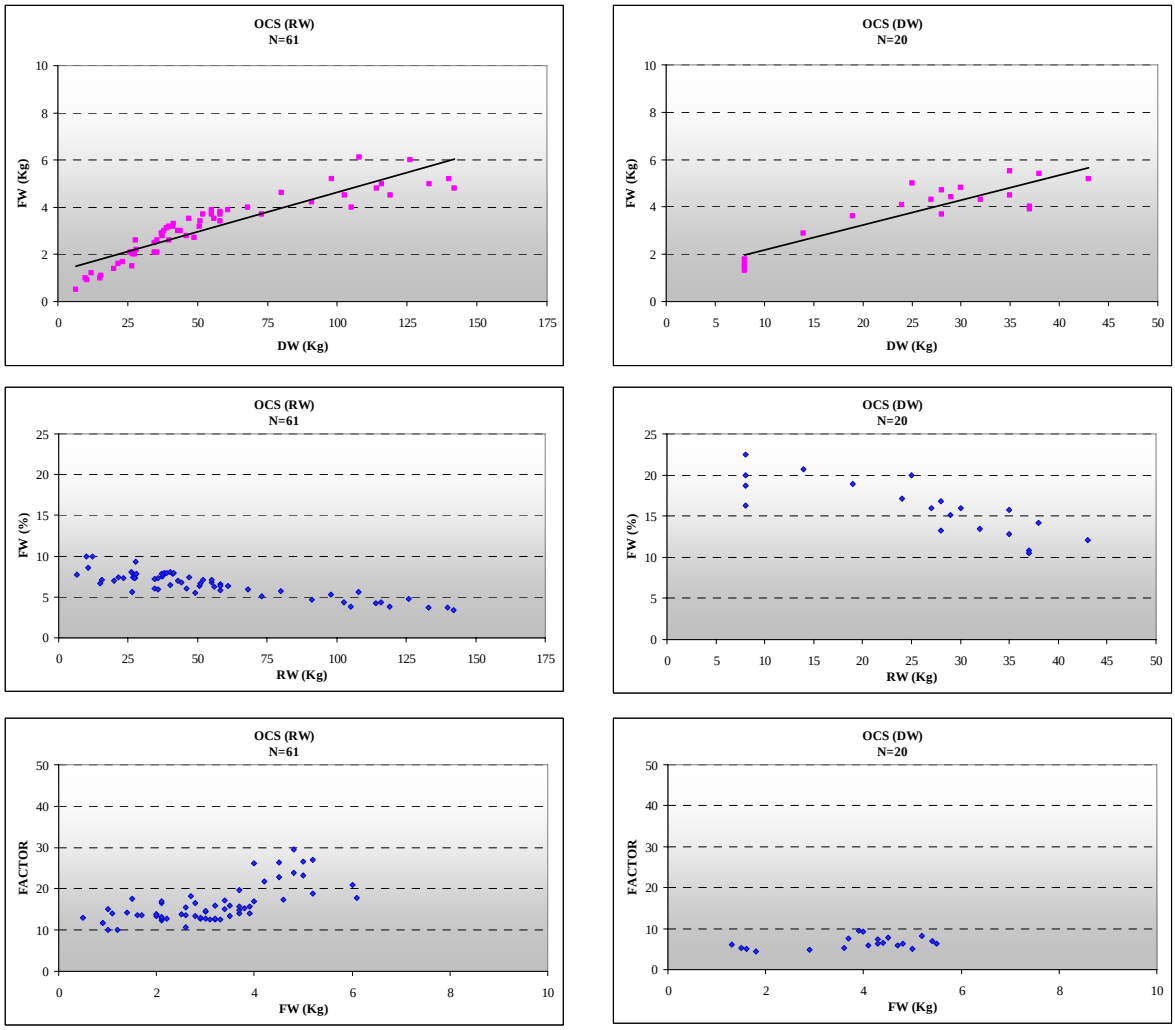
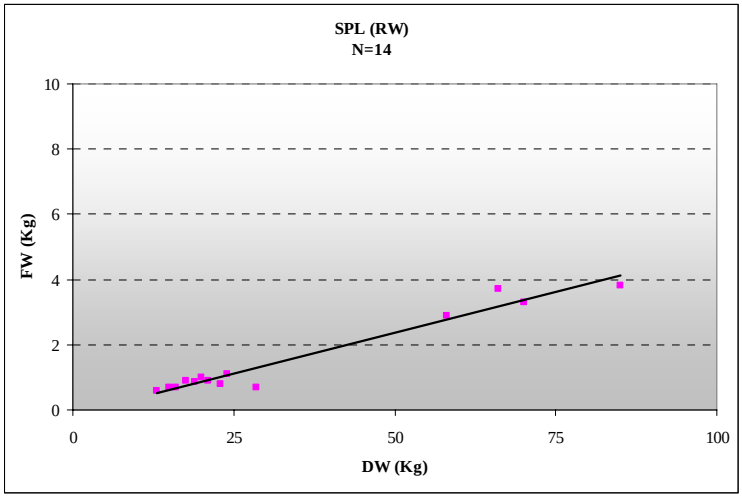
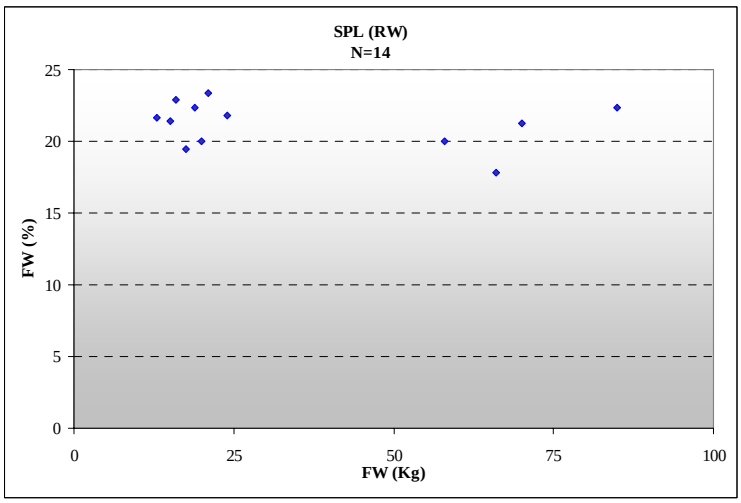


Figure 4. Percentage of fins, conversion factors and correlations between fin weight (FW) and body round weight (RW) and carcass weight (DW) for oceanic whitetip shark (OCS) from Pilot Action RAI-AP-08/2004 data in the South Western Indian Ocean





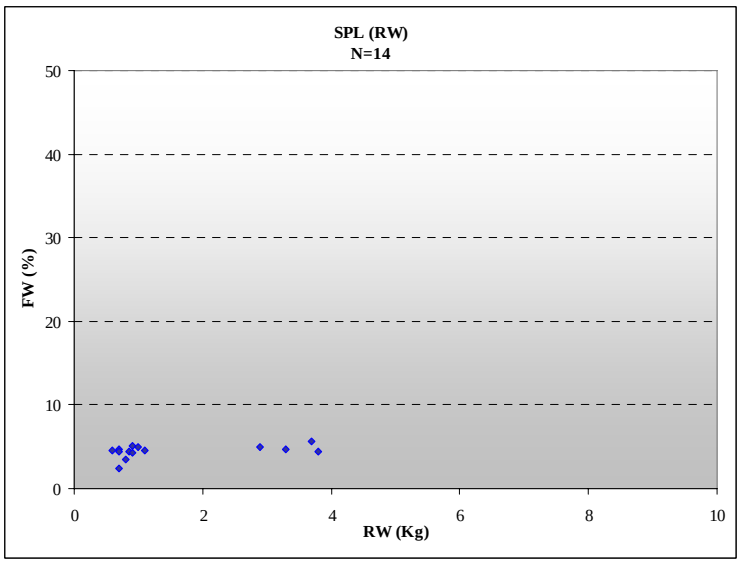
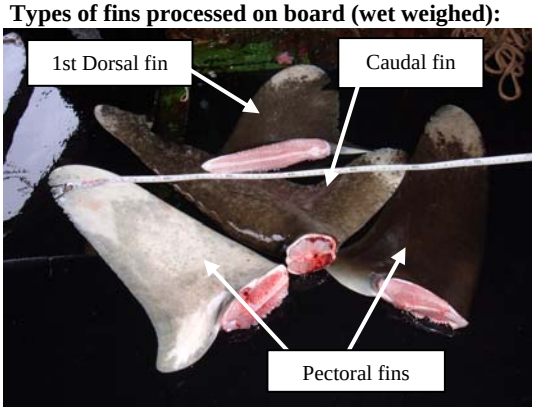


Figure 5. Percentage of fins, conversion factors and correlations between fin weight (FW) and body round weight (RW) for scalloped hammerhead (SPL) from Pilot Action RAI-AP-08/2004 data in the South Western Indian Ocean

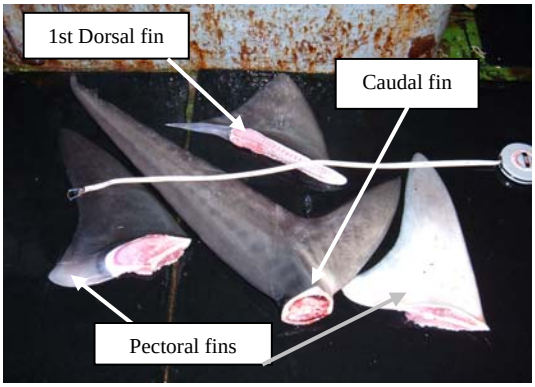
ANNEX 1
List of species and codes:

CODE FAO	FAO SCIENTIFIC NAMES	COMMON NAMES (English / Spanish)
FAL	*Carcharhinus falciformis (Bibron, 1839)*	Silky shark / Tiburón jaquetón
OCS	*Carcharhinus longimanus (Poey, 1861)*	Oceanic whitetip shark / Cazón, jaquetón de ley
SMA	*Isurus oxyrhinchus Rafinesque, 1810*	Shortfin mako / Marrajo dientuso
BSH	*Prionace glauca (Linnaeus, 1758)*	Blue shark / Quella, tiburón azul
SPL	*Sphyrna lewini (Griffith & Smith, 1834)*	Scalloped hammerhead / Cornuda común

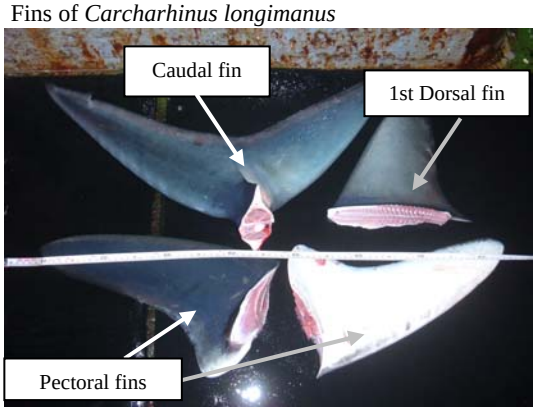
ANNEX 2
Types of fins processed on board (wet weighed):



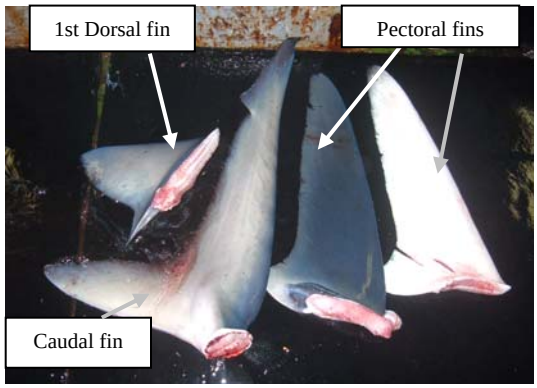
Fins of *Carcharhinus longimanus*



Fins of *Galeocerdo cuvieri*



Fins of *Isurus oxirhynchus*



Fins of *Prionace glauca*