Food and Agriculture Organization
of the United Nations

SharkFin Guide

IDENTIFYING SHARKS FROM THEIR FINS

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Cover photo:
May 2014, Su-ao, Yinlan County, Taiwan Province of China - Lindsay J. Marshall and Jenny Giles photographing the fins of a mako shark at the Su-ao fisheries landing site. ©FAO/Monica Barone.

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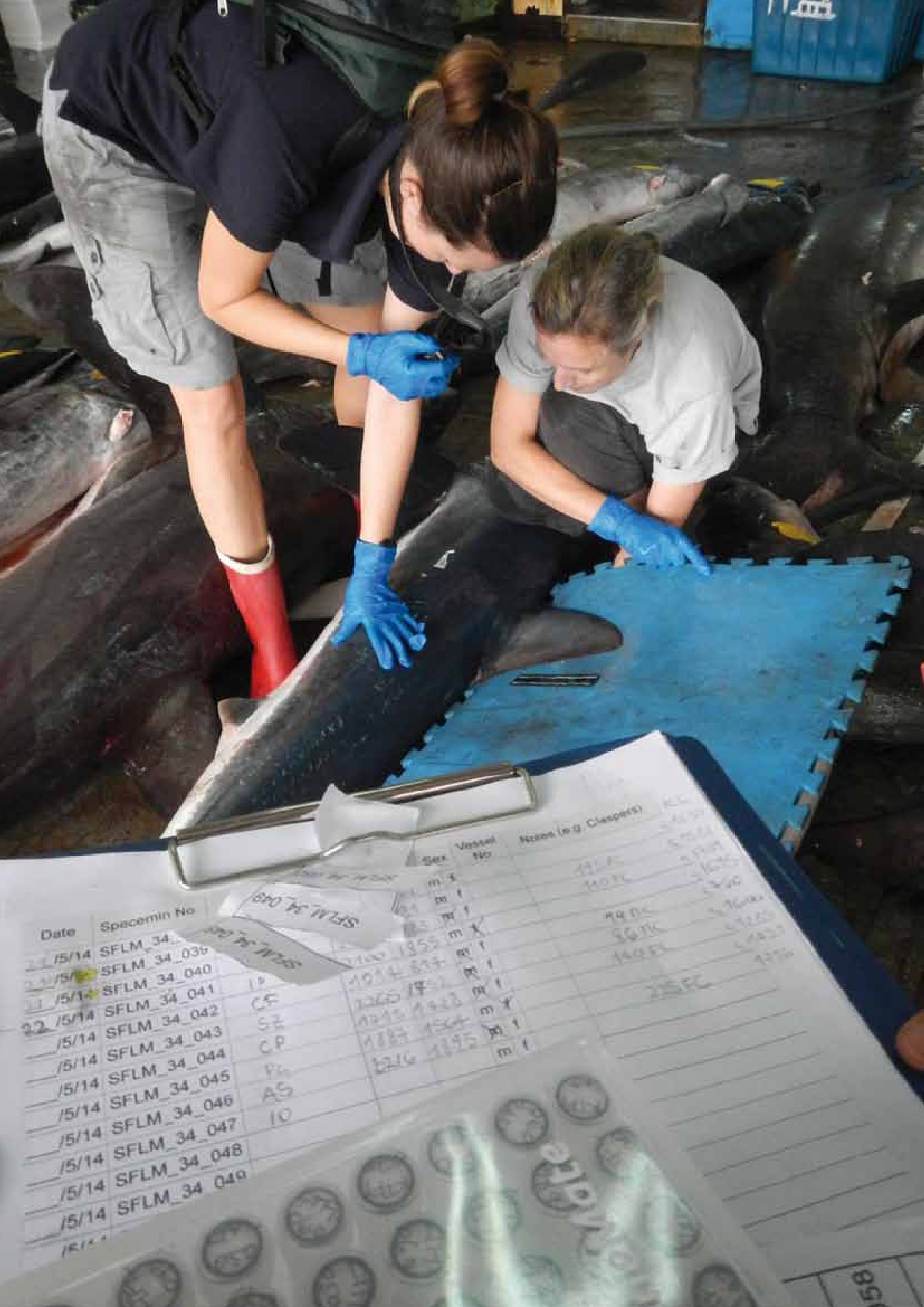
IDENTIFYING SHARKS FROM THEIR FINS

by
Lindsay J. Marshall
and
Monica Barone
Rome, Italy

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 2016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Summary

This publication covers 16 shark species that are globally distributed and are of major importance owing to either their conservation status or because they are a main target for the international trade in the fins.

This guide focuses on fresh to partially dried first dorsal fins, pectoral fins and whole caudal fins. The species are arranged in taxonomic order. For each species, a fact sheet instructs the user on the relevant diagnostic features and measurements of the dorsal, pectoral and caudal fins, showing a colour illustration of the whole shark, a distribution map and a photographic set of fins. For some species, photographs of pelvic, second dorsal and anal fins are also provided where available.

A practical and methodological section is included, guiding the users step by step through the identification of shark fins in different scenarios. It contains the user manual of the software iSharkFin and a practical protocol for the collection of the photographs as well as how to take the main technical measurements and the genetic samples.

Preparation of this document

This document was prepared under the coordination of the Japanese Trust Fund Project "CITES and Commercially-exploited Aquatic Species Including the Evaluation of Listing Proposals (Phase 2)" with financial support from the Government of Japan, and the European Union through the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). This guide was developed in close collaboration with the University of Vigo, Pontevedra, Spain, and the FAO FishFinder Programme of the Marine and Inland Fisheries Branch, Fisheries Department, Food and Agriculture Organization of the United Nations (FAO).

The global demand for shark fins (a primary driver of shark mortality) and the inclusion of new shark species in the Appendix II of CITES in 2013 have been key considerations in promoting the preparation of this guide.

This guide is a complementary tool to the software iSharkFin, developed in close collaboration with the University of Vigo, Pontevedra, Spain, and available at www.fao.org/fishery/ipoa-sharks/iSharkFin/en.

Photo:
Jorge Cervera Hauser

Acknowledgements

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Photo: Rodrigo Friscione

INTRODUCTION

Two of the basic guidelines of the International Plan of Action for the Conservation and Management of Sharks (IPOA-Sharks) are reiterated in most shark management recommendations, policies and programmes, and remain as relevant today as they were in 1999:

1. “facilitate improved species-specific catch and landings data and monitoring of shark catches”;
2. “facilitate the identification and reporting of species-specific biological and trade data”.

Over the last 15 years, there has been an increasing willingness to manage shark[1] species, and many of the management measures recently adopted for sharks are intended to limit the practice of finning. Regardless of the type of finning regulation in place (e.g. “fin to bodyweight ratio” or “fins naturally attached”), after the first point of landing, sharks are processed and the fins can become a separate trade product, which can be subject to further verification.

The present SharkFin Guide is a traditional field guide and is coupled with an innovative system, iSharkFin (FAO and University of Vigo, 2014). The idea for developing this set of tools came in response to the need of port inspectors, customs officers and any other enforcement agent facing the technical difficulty of assigning detached fins to the correct shark species. Indeed, this need has become more evident after the inclusion of new shark species in the Appendices of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

This publication covers 16 shark species that are globally distributed and are of major importance owing to either their conservation status or the fact that they are main target species for the international trade in fins. For each of these species, a fact sheet instructs the user on the relevant diagnostic features and measurements for the dorsal, pectoral and caudal fins, showing a photographic set of fins, a colour illustration of the whole shark, and a distribution map.
This guide also contains a methodological section, guiding the users step by step to the identification of shark fins in several scenarios. It includes the user manual for the iSharkFin software and a practical guide for the collection of useful shark fin photographs, as well as guidance on how to take the main technical measurements and genetic samples.

The improvement of a taxonomically specific data recording system for both shark fisheries and shark products in trade is of primary importance for the sustainable management and conservation of shark species, in every future development for shark management and conservation. The current challenge is the identification of shark products in trade, and this guide aims to improve the identification and traceability of shark fins, improving not only the enforcement of the management measures related to finning but more largely the global statistics on chondrichthyan resources.

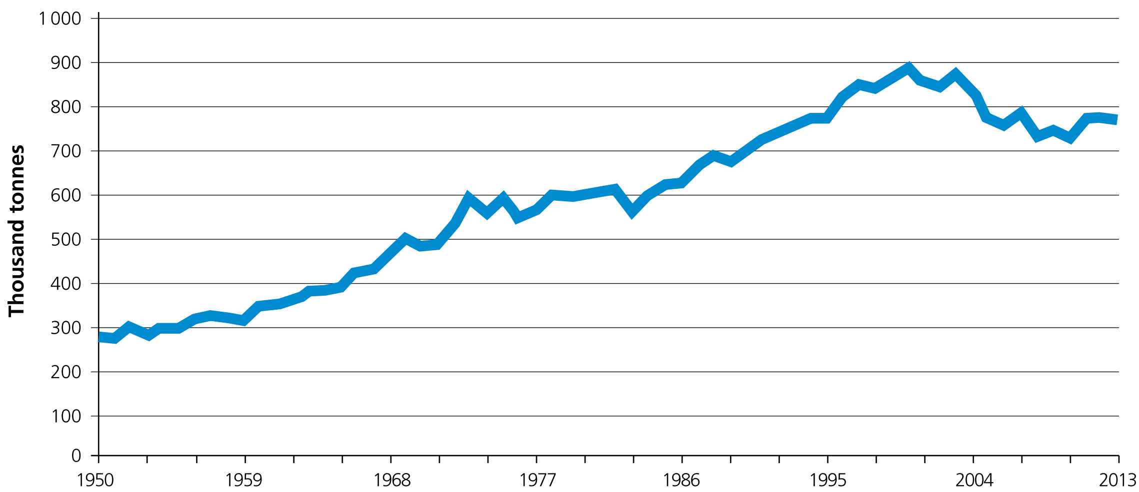
[1] For the purposes of this document, the term “shark” is taken to include all species of sharks, skates, rays and chimaeras (Class Chondrichthyes).

Shark fisheries

Cartilaginous fishes are caught in industrial and small-scale fisheries by a variety of fishing gear types, including trawl nets, gillnets, purse seine and longlines (Lack, 2014). Exploited in commercial fisheries targeting more valuable bony fishes (ICCAT, 2005), sharks have historically been targeted only at local scale (Ferretti *et al.*, 2008). However, fishers have increasingly been considering sharks as commercial species (rather than species landed unintentionally) owing to the demand for highly priced shark fins coupled with the expansion of the market for shark meat (Rose and McLoughlin, 2001; Stevens *et al.*, 2005; Dent and Clarke, 2015).

In the past few decades, many vulnerable and fished shark species have experienced a global decline. Capture production of chondrichthyan fishes reported to FAO tripled from 1950 to about 888 000 tonnes in 2000, an all-time high (Figure 1). Since then, it has continuously decreased to values of about 15 percent lower (FAO, 2014). The greatest decline in landings is reported in the FAO fishing areas of the Western Central Pacific and Western Indian Ocean (Davidson, Krawchuk and Dulvy, 2015).

Figure 1
Capture production of chondrichthyan fishes reported to FAO



Source: Updated from FAO (2014).

Although several factors may have contributed to this development (FAO, 2014), many studies explicitly relate the decline in shark landings to an increase in fishing pressure that is associated to the rise in demand for sharks products and to the continous increase in fishing effort as whole (Bonfil, 1994; Aires-da-Silva, Hoey and Gallucci, 2008; Dulvy *et al.*, 2014; Davidson, Krawchuk and Dulvy, 2015). Moreover, when habitat degradation (Jennings *et al.*, 2008; Ferretti *et al.*, 2010), pollution (Gelsleichter *et al.*, 2005), climate change (Chin *et al.*, 2010) and the extent to which shark fishing is adequately managed (Lack *et al.*, 2014) is combined with the intrinsic vulnerability of sharks (Oldfield *et. al.* 2012, García *et al.* 2008; Dulvy and Forrest, 2010), the risk of sharks being overexploited is high and perhaps increasing too.

Data on mortality rates in shark fisheries remains uncertain. The fishery statistical systems continue to be slow in recording sharks at species level, many shark catches are processed at sea and never reported (Chen, Phipps and Asia 2002), this is in addition to the many sharks caught by illegal, unregulated and unreported (IUU) fisheries (Pramod *et al.*, 2008). Even if there has been an improvement in the taxonomic detail of shark and ray catches reported to FAO (FAO, 2014), species specific catch data for sharks continues to be a challenge.

Photo:
Jorge Cervera Hauser

Trade in shark commodities

Consumption of shark products has been recorded in literature as early as the fourth century (Vannuccini, 1999; Clarke, Milner-Gulland and Bjørndal, 2007), but a truly global market in shark commodities appeared only in recent decades (Dent and Clarke, 2015).

The shark products that are most often distinguished and recorded in international trade are shark fins and shark meat. According to data reported to FAO and analysed by Dent and Clarke (2015), the market for fins and for meat are largely distinct from each other. As a general rule, the major shark producers export both commodity types, while importers do not overlap. Industrial and artisanal fleets from all over the world supply traditional Asian markets for shark fins, while the meat of the same captured sharks is diverted along separate supply channels. Thus, the supply chain of shark products is complex. These products pass through multiple countries as they move along regional trading routes or undergo various processing stages before consumption (Dent and Clarke, 2015).

Trade in shark fins

The majority of shark fins are destined for consumption in relatively few countries and territories in East and Southeast Asia such as China, Hong Kong SAR, Taiwan Province of China, Singapore, Malaysia and Viet Nam. From 2000 to 2011, China, Hong Kong SAR has been the most important trader of shark fins (Figures 2 and 3), surpassed by Thailand from 2007 to 2011 as the world's largest exporter of shark fins (Dent and Clarke, 2015; FAO, 2015). The role of countries in the world market for shark fins may be different. For example, China, Hong Kong SAR is not a producer, and the entirety of its outgoing trade consists of shark fins imported from shark-catching countries, which are then re-exported. Singapore's role is similar, it is an importer and re-exporter with minimal domestic shark production. China and Taiwan Province of China produce shark domestically in addition to consuming, importing, processing and trading fins. With regard to the exporters, the world's major shark-fin exporting producers are Spain, Indonesia, Taiwan Province of China and Japan. The main exporters can be considered primary producers (such as Spain and Indonesia) and re-exporters, further divided into pure traders, such as the United Arab Emirates, and processing traders, such as China (Dent and Clarke, 2015). It is worth mentioning here that the available data cover only a proportion of what is actually caught and traded (Clarke, 2015).

Figure 2
World export of shark fins. Average 2000–2011 (includes re-export)
(Dent and Clarke, 2015, modified)

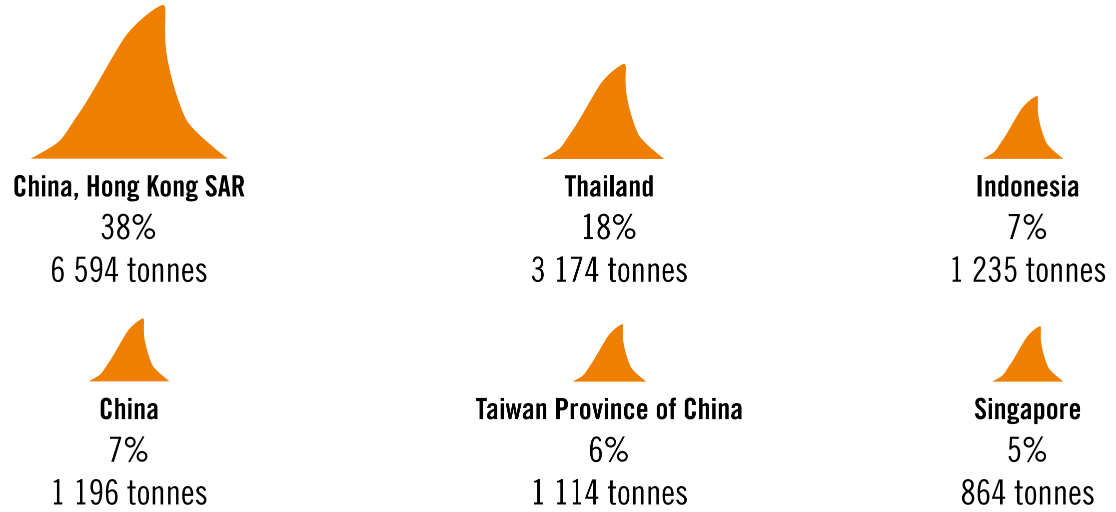
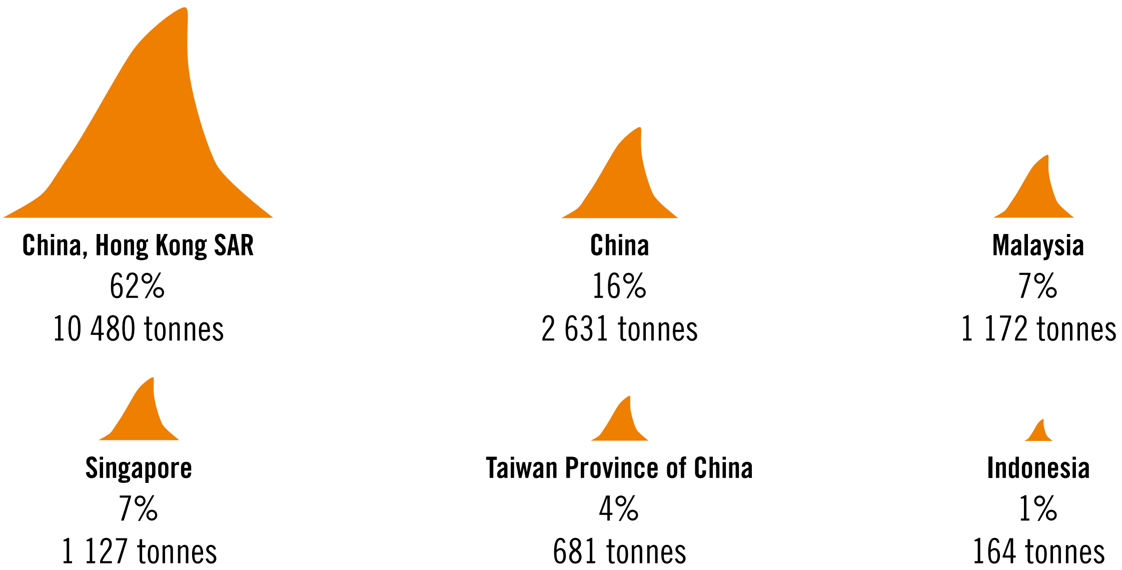


Figure 3
World import of shark fins. Average 2000–2011
(Dent and Clarke, 2015, modified)



The total imported and exported quantities of shark fins reached a maximum around 2004 and subsequently dropped to lower levels in 2008–2011, showing a pattern almost parallel to the chondrichthyan capture production (Dent and Clarke, 2015). In addition, several indications show that the shark fin trade through China and China, Hong Kong SAR has been diminishing since 2012. It is probable that several factors have had at least some influence in this development, appearing limited by capture production or due to either changing consumer attitudes, trade bans or growing conservation awareness (Eriksson and Clarke, 2015). However, current data are insufficient to determine which of these factors have been most important, probably a combination, given the difficulties of validating the reliability of global statistics data.

Trade statistics provide an important information source for assessing trends in exploitation and evaluating conservation strategies. One of the main constraints in the trade records is to some extent the inability to identify shark species from the fins, followed by the difficulties encountered in the classification in the commodity codes and thus in recording the info (Dent and Clarke, 2015). Certain species, such as hammerheads, oceanic whitetip and blue sharks are the preferred target of the international fin trade. The fins of sawfishes (Pristidae), guitarfishes (Rhinobatidae) and wedgefishes (Rhynchobatidae) are also highly prized by shark fin traders, and this is recognized as a key factor in the overfishing of these species (Dulvy *et al.*, 2014; Dent and Clarke, 2015). Therefore, better species-specific trade statistics are essential in order to detect trends in species composition and discover any potential substitution of low-value species as the high-value species are depleted.

With regard to the product form classification, the Harmonized System (HS) classification of the World Customs Organizations (WCO), used as a basis for the collection of customs duties and international trade statistics by more than 200 countries, has recently been improved with the addition of new specific codes for shark fins. In particular, the HS now has a specific code for shark fins in cured form (i.e. dried, salted or in brine). Moreover, from 1 January 2017, the coverage for sharks and shark fins (and also of rays and skates) will be further improved, with new subheading codes for shark fillets and shark meat in fresh or chilled and frozen forms, and for shark fins in fresh or chilled, frozen and prepared and preserved forms (WCO, 2015).

The improvement in the trade monitoring systems through the implementation of species-level identification, as well as traceability schemes, will greatly assist in guiding appropriate management responses (Eriksson and Clarke, 2015; Mundy and Sant, 2015).

Conservation and management of sharks

Until recently, target and non-target shark and ray fisheries were subjected to little management and were of low management priority (UNGA, 2010; Fischer *et al.*, 2012).
In the past few decades, the increasing demand for some shark species and the increasing international fishing effort directed at sharks has led to increasing concern about the status of shark stocks and the sustainability of their exploitation in world fisheries. The changing societal perception of sharks has played an important role (Dell'Apa, Smith and Kaneshiro-Pineiro, 2014), from one of needing to protect humans from sharks, to that of needing to protect sharks from humans (Simpfendorfer *et al.*, 2011). This situation has resulted in several international initiatives to promote greater understanding of sharks in the ecosystem and efforts to conserve the many shark species in world fisheries.

Photo:
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When considering the international instruments for fisheries governance, the 1982 United Nations Convention on the Law of the Sea (UNCLOS) establishes a comprehensive legal regime covering all aspects of the seas and the oceans. This is relevant for some oceanic sharks listed as highly migratory species under Annex I. The agreement to facilitate the implementation of certain provisions of UNCLOS, the 1995 UN Fish Stocks Agreement (UNFSA), obliges contracting parties to cooperate through the regional fisheries management organizations (RFMOs) to conserve and manage straddling and highly migratory fish stocks and, in Article 5, to minimize the catch of non-target species, such as sharks.

The starting point for the conservation and management of the sharks is the IPOA-Sharks, adopted by FAO in 1999 under the auspices of the FAO Code of Conduct for Responsible Fisheries. The IPOA-Sharks is considered the only specific global framework for sharks; it provides guidelines and encourages shark fishing nations to develop national plans of action to manage and conserve sharks. As of 2012, the majority of the top shark fishing nations had adopted their own national plans of action (Fischer *et al.*, 2012). However, their effectiveness in achieving the main goals of the IPOA-Sharks remains difficult to evaluate (Lack and Sant, 2011; Lack, 2014).

CITES and the Convention on the Conservation of Migratory Species of Wild Animals (CMS), which are both operating through the listing of species on the respective appendices, provide important tools for improving shark protection at the international level (Techera and Klein, 2011). CITES regulates international trade in listed species of wild animals and plants through a system of permits and certificates in order to ensure that such trade is legal, sustainable and traceable.

Sharks were first included in CITES appendices in 2003. As of 2015, eight species of sharks and all manta rays are included in Appendix II (species not necessarily threatened with extinction, but whose international trade must be controlled in order to avoid utilization incompatible with their survival); and all species of sawfishes are in Appendix I (species threatened with extinction, whose international trade is permitted only in exceptional circumstances) (CITES, 2015).

The CMS is aimed at conserving species that cross national boundaries and/or are in areas beyond national jurisdiction (ABNJ). Endangered migratory species are listed in Appendix I of the CMS. Migratory species that have an unfavourable conservation status, or would significantly benefit from international cooperation, are listed in Appendix II. A non-binding memorandum of understanding on the conservation of migratory sharks was agreed under the CMS in 2010, applying to the species already listed in Appendices I and II. As of 2015, 18 species of elasmobranchs are listed in Appendix I and 29 species in Appendix II (CMS, 2015).

The FAO Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing adopted in 2009 (FAO, 2009) is considered relevant for sharks as it reflects the role that port States could potentially play in monitoring shark catches, especially in relation to finning practices (Fischer *et al.*, 2012; Klein, 2014).

The Shark Specialist Group of the International Union for Conservation of Nature (IUCN), according to its vision for "a world where sharks, rays, skates, and chimaeras are valued and managed for sustainability", is continuously improving the information on the status of shark populations, by updating the Red List of Threatened species. The results of their assessments are commonly used by governments around the world to help prioritize conservation efforts (Hepp and Wilson, 2014). Worldwide, of the 1 041 assessed chondrichthyan species, 181 (17.4 percent) are classified as threatened, of which 25 (2.4 percent) are assessed as critically endangered, 43 (4.1 percent) endangered, and 113 (10.9 percent) vulnerable (Dulvy *et al.*, 2014).

At the regional and national level, since the adoption of the IPOA-Sharks, the initiatives in chondrichthyan conservation and management have been stimulated by the intention of limiting the practice of "finning". The term "finning" is defined as the practice of removing and retaining shark fins and discarding the remainder of the carcass at sea (Clarke *et al.*, 2006a; Hareide *et al.*, 2007; Fowler and Séret 2010; Biery and Pauly, 2012).

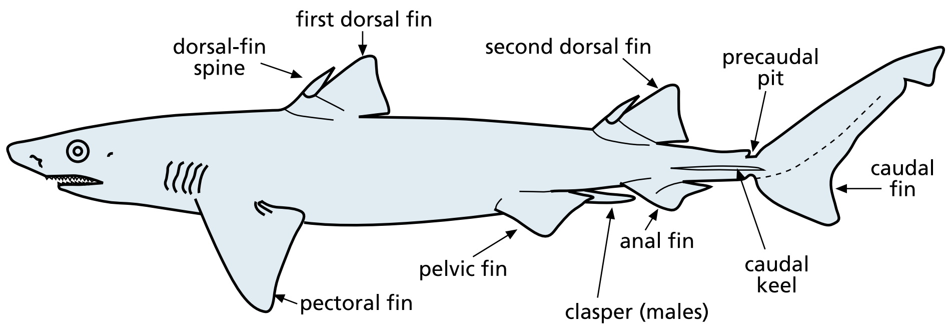
Some RFMOs have improved their management of highly migratory and straddling stocks of sharks through the adoption of several binding or non-binding regulations and/or recommendations. Since 2004, one of the most common management measures, adopted by almost all RFMOs, has been the prohibition of the practice of "finning". Members require their vessels not to have fins that total more than 5 percent of the weight of sharks on board, up to the first point of landing (ICCAT, 2004; IATTC, 2005; SEAFO, 2006; WCPCFC, 2010; NAFO, 2015). To date, only the North East Atlantic Fisheries Commission (NEAFC) has adopted the fins naturally attached regulation, prohibiting the removal of shark fins at sea (NEAFC, 2015). Other frequent management measures adopted by several RFMOs focus on the reduction of shark mortality by prohibiting retention on board, transshipping, landing, storing, etc. These are species-specific regulations applying to species such as the oceanic whitetip shark (*Carcharhinus longimanus*), silky shark (*Carcharhinus falciformis*), basking shark (*Cetorhinus maximus*), hammerhead (family Sphyrnidae) and thresher sharks (family

Alopiidae). Finally, reporting requirements aiming at monitoring catches have been adopted for certain species such as the shortfin mako (*Isurus oxyrinchus*) and the porbeagle (*Lamna nasus*).
At the national level, many countries have adopted measure prohibiting finning, but other regulations have also been introduced, such as time-area closures, catch limits, effort control, bycatch/discard regulations, protective measures for the most vulnerable species, special reporting requirements, shark sanctuaries and others (Fischer *et al.*, 2012; Worm *et al.*, 2013).

Shark fins and management measures to regulate finning

Shark fins predominantly consist of soft collagen and elastin fibres called ceratotrichia, commonly referred to as fin rays or fin needles, which are used to prepare shark fin soup and other shark fin dishes (Musick 2005; Rose, 1996; Vannuccini, 1999). There are typically six types of fin on a shark, the first and second dorsal, caudal, anal, pelvic (paired), and pectoral (paired) fins (Figure 4).

Figure 4
Shark fins



The quality and contents of fin needles determine the value of the fins. Moreover, fins are graded according to species, size, fin type, colour (black, white or brown), moisture content, smell and cut. Fins are usually auctioned by position, corresponding to the market value. The most valuable are the first dorsal, pectorals and lower caudal. The other fins, smaller anal, pelvic, second dorsal and upper caudal are also traded, but are less valuable (Vannuccini, 1999; Clarke *et al.*, 2005; 2006a,b; 2007; Fowler and Séret, 2010).

To use the valuable fin needles, fins must be processed to give an end product of dried fin. Drying methods vary from traditional methods of sun drying or salting (either on the fishing vessel or after landing), or by drying fins mechanically. Mechanical drying of the fins is usually carried out by large-scale fin processors, which buy large volumes of wet fins and process these before export or subsequent sale (Vannuccini, 1999). Shark fin product can be purchased at many stages of processing, including wet fins, raw fins, semi-prepared, fully prepared, frozen-prepared, in brine, fin net, and ready-to-eat or cook (Musick, 2005; Vannuccini, 1999).

Different fin cuts are used to prepare shark fins for export. Minimizing flesh and basal cartilage at the base of the fins is important in order to avoid spoilage of the fins that will be air-dried. The more valuable cuts are the half moon cut and the full moon cut, which retain less meat.

However, a larger quantity of meat can be left on frozen fins, without risk of tainting. Thus, frozen fins can be removed with crude cuts, but the value will be reduced given the subsequent costs of processing. Knowledge of the cutting techniques is important as it influences the fin-to-bodyweight ratio requested by most finning regulations.

The high value of shark fins, among the most expensive seafood items in the world, has often seen fishers adopting the controversial practice of finning, the act of removing and retaining shark fins and discarding the remainder of the carcass at sea. The practice of finning is considered to lead to a particularly high and unsustainable exploitation rate of sharks, because vessels that retain only fins have fewer constraints upon hold space for storage of their catch than do vessels that retain the carcass. These considerations, along with the IPOA-Sharks demands that waste and discards from shark catches be minimized, have led to the adoption of management measures intended to limit the practice of finning in a number of shark fishing countries and in several RFMOs.

The shark fin measures most commonly adopted require that the whole shark carcass be retained until the first point of landing, with fins removed but respecting a "fin to bodyweight ratio" or with fin "naturally attached" (Fischer *et al.*, 2012). To verify the compliance with the fin to bodyweight ratio, inspectors have to compare the total weight of landed shark carcasses with the total weight of landed fins (Passantino, 2013). This system is considered more difficult to implement as it creates some controversial enforcement issues (different species of sharks have different fin-to-carcass ratios, fin to bodyweight may vary between fisheries, often – because of different processing techniques – freezing and/or drying of fins before inspection may change the weight of the fins). The requirement that fins stay naturally attached is considered easier to control, and it is currently considered by many countries the target standard for how to enforce bans on shark finning.

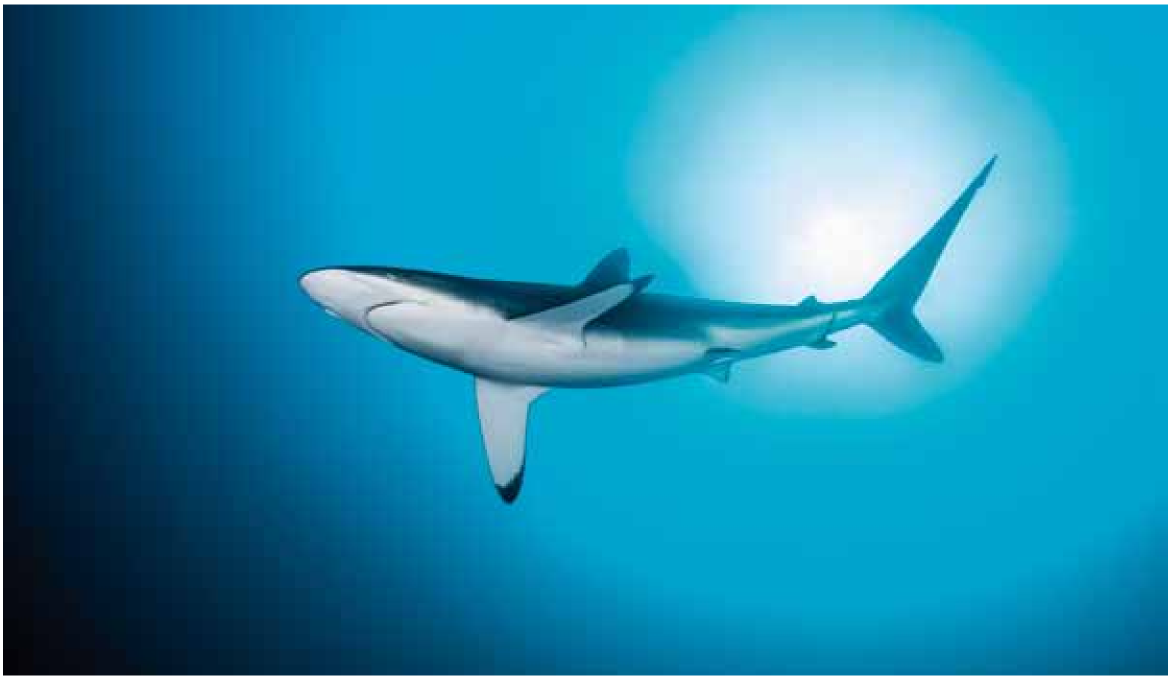


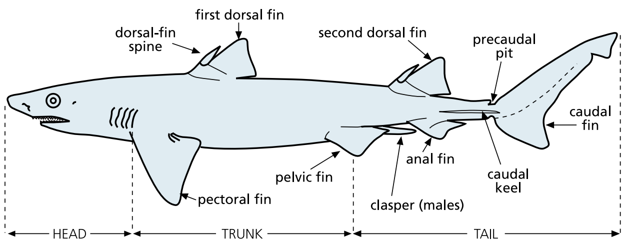
Photo:
Rodrigo Friscione

Although it is recognized that measures prohibiting finning have been a significant means for improving shark management and conservation measures, there is growing concern that management focusing on shark handling and utilization practices is diverting attention away from assessing whether current catch levels are sustainable. Moreover, the effectiveness of finning regulations in reducing the mortality of sharks has been questioned (Clarke *et al.*, 2013; Worm *et al.*, 2013; Clarke, 2015). Several factors can mean these regulations have little or no impact in reducing shark mortality. The management measures prohibiting finning are generic measures that do not apply to specific species and do not regulate the number of sharks caught, but only the way they should be landed (Lack, 2014). Only the fisheries that strictly target shark fins are influenced. Valuable shark species – such as oceanic whitetip, silky sharks and mako sharks – are more likely to be retained than finned, as was demonstrated in the Pacific where this happened even before the finning ban (Clarke *et al.*, 2013). Moreover, in countries where fisheries that catch sharks habitually land the whole carcass, such as India (Dent and Clarke, 2015), a policy requiring that both fins and carcass be landed would not affect fin production and trade. Furthermore, the increasing imports of shark meat observed recently indicate how the shark meat trade is becoming more prevalent, another important factor influencing shark mortality (Dent and Clarke, 2015).

Even if the prohibitions on finning and/or the demand for shark meat are increasingly causing sharks to be landed with their fins, the improvement of a data recording system to record specific-specific catches and trade flows, for both shark fisheries and shark products in trade, remains of primary importance for the sustainable management and conservation of chondrichthyan resources.

Photo:
Rodrigo Friscione

Photo: Monica Barone



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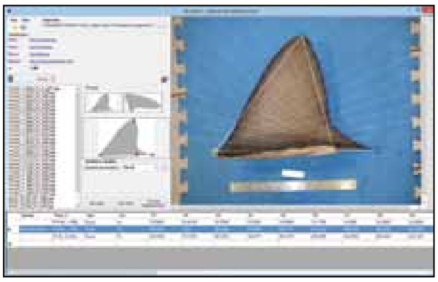

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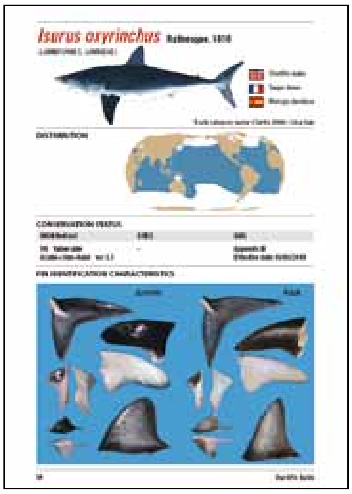

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I need genetic samples, what do I do?
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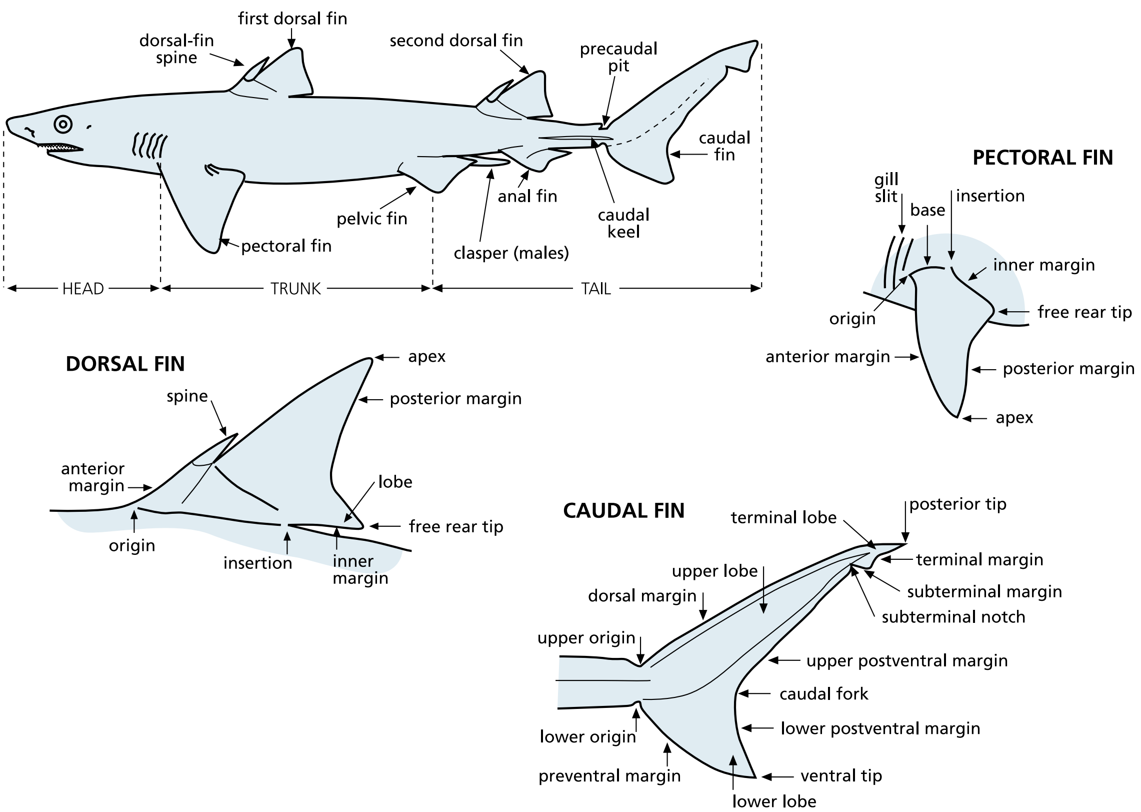
HOW TO USE THIS GUIDE

Readers are advised to follow these simple instructions in order to identify successfully the shark species to which the fin belongs.

- Refer to the technical terms and to the glossary to understand the terminology associated with the description of the shark fins.
- In order to differentiate between dorsal, pectoral, caudal and pelvic fins, use the key to the identification of fin type, observing the photographs associated with the information. Identifying the fin type is a first step.
- Read the description of the measurements and ratios to understand the detailed morphological descriptions of the fins in the fact sheets.
- Read carefully the information provided in the fact sheets of the single species, observing the illustration and the key characters of the fins of the species of interest as well as of the similar species. Bear in mind that not all species are included in this guide.
- Refer to the brief list of guidelines and methodological instructions on how to identify fins and on how to take standard photographs of fins, provided in the last section of the guide.
- Use the iSharkFin software (Manual available at p. 111 and software dowload at http://www.fao.org/fishery/ipoa-sharks/iSharkFin/en), as a complementary tool for a further verification of the identification.

Shark fins technical terms

The fins on a shark are the first dorsal fin, the pectoral fins (paired), the second dorsal fin, the pelvic fins (paired) and the caudal fin. Not all shark species possess the second dorsal or the anal fin.



Key to fin types (dorsal, pectoral, caudal, etc.)

1	Fin the same colour on each side (Fig 1a and 1b, Fig 3a and 3b)	go to step 2
	Fin darker on the top than the bottom or a different colour on either side (may be subtle) (Fig 2a and 2b)	go to step 4
2	Fin is made up of only one lobe (Fig 1a and 1b, Fig 3a and 3b)	go to step 3
	Fin is made up of more than one lobes (Fig 3c)	Whole Caudal Fin
3	Fin has a free rear tip (Fig 1c, Fig 1d) and/or the cross section of the severed end has continuous row of closely spaced cartilaginous blocks running along almost the entire fin base (Fig 1c, Fig 1d)	Dorsal Fin (1st or 2nd*)
	Fin has no free rear tip and the cross section of the severed end is typically only yellow spongy material (ceratotrichia) (Fig 3e) or, when cartilaginous blocks are present they are widely spaced (Fig 3d)	Lower caudal fin
4	Fins have claspers attached.	Pelvic fin(s) from male shark
	Fins do not have claspers attached.	Pectoral fin(s) (or pelvic fins**)

* Second dorsal fins are usually much smaller than first dorsal fins. The morphology of second dorsal fins will not be addressed in this guide other than photographs for individual species in the fact sheet fin plates, where specimens are available.
** The morphology of pelvic fins will not be addressed in this guide other than photographs for individual species in the fact sheet fin plates, where specimens are available. Pelvic fins are generally smaller in size and shorter across than pectoral fins.

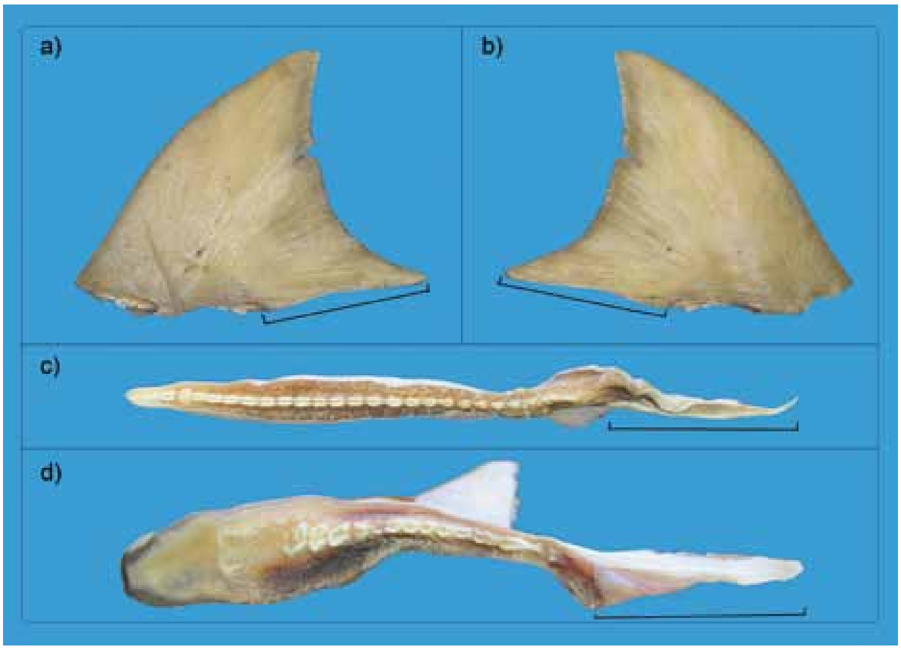


Photo:
Lindsay J. Marshall,
Jenny Giles

Figure 1: Example of a first dorsal fin, a) left side of first dorsal fin, lateral view; bar indicates the free rear tip; b) right side of first dorsal fin, lateral view; bar indicates the free rear tip; c) cross-section of the distal end of the first dorsal fin where the fin has been cut along the fin base, ventral view, bar indicates free rear tip; d) another example of a cross-section of the distal end of the first dorsal fin where the fin has been cut along the fin base, ventral view, bar indicates free rear tip.

Photo:
Lindsay J. Marshall,
Jenny Giles

Figure 2: Example of a pectoral fins, a) a left pectoral fin,dorsal view, bar indicates free rear tip; b) ventral view of the same left pectoral fin, bar indicates the free rear tip; c) and d) an example of a left pectoral fin that is quite similar in colouring on the dorsal surface (c) to the ventral surface (d), however a subtle difference can still be seen; e) cross-section of the distal side of the pectoral fin where the fin has been cut along the fin base, bar indicates free rear tip.

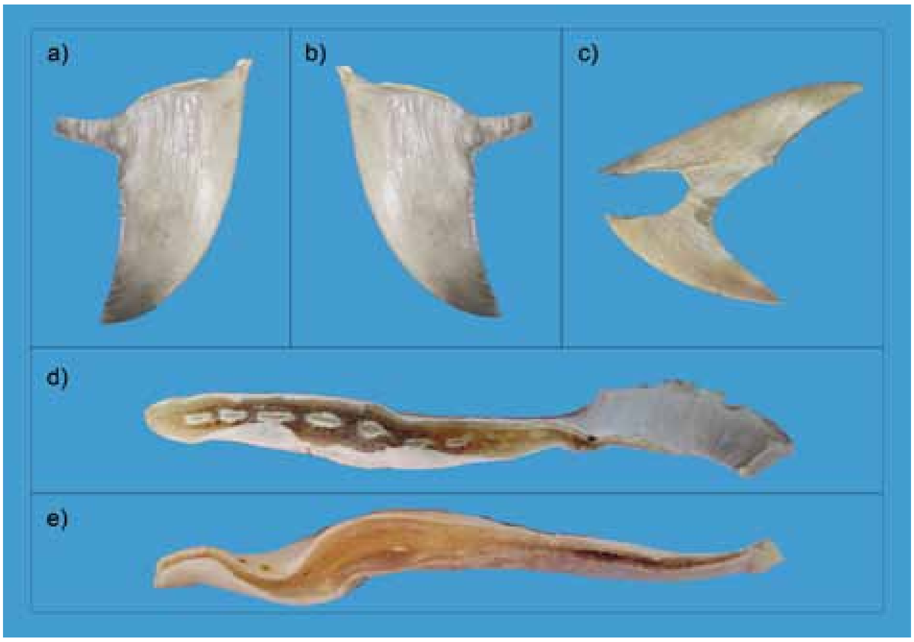


Photo:
Lindsay J. Marshall,
Jenny Giles

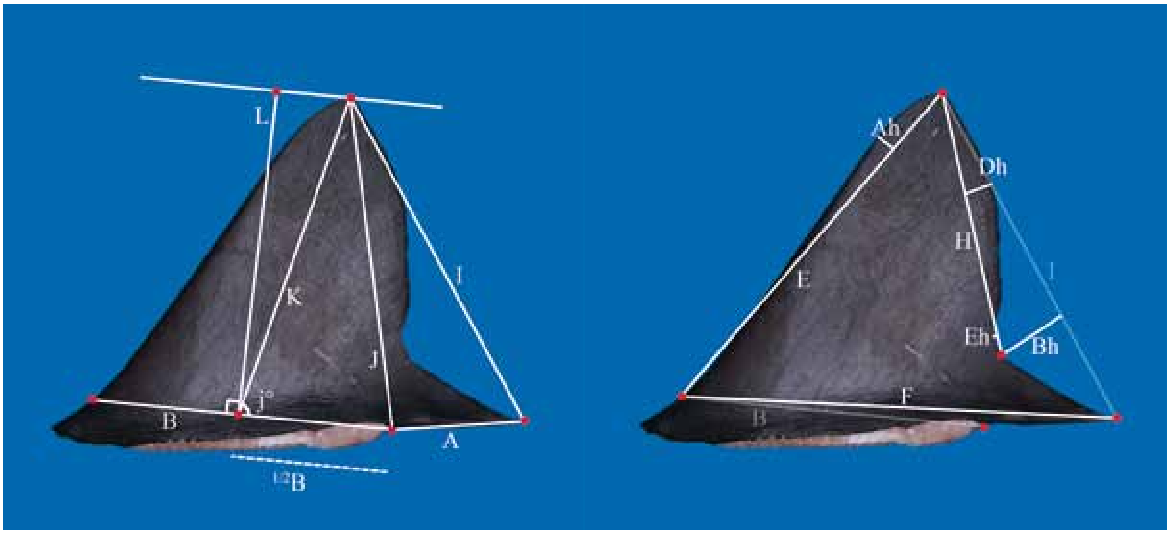
Figure 3: Example of caudal fins, a) right side of a lower caudal fin lobe that has been removed from the upper caudal fin lobe, lateral view; b) left side of a lower caudal fin lobe that has been removed from the upper caudal fin lobe, lateral view; c) a whole caudal fin that has been cut from the shark body (caudal peduncle and most of the vertebrae have been removed), both the upper and lower lobes are present; d) cross-section of a lower caudal lobe showing widely spaced cartilaginous blocks, dorsal view; e) cross-section of a lower caudal lobe showing yellow spongy material (ceratotrichia), dorsal view.

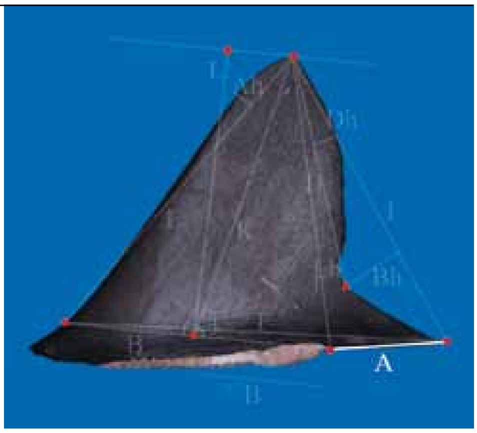
Shark fins measurements

The morphological descriptions of fins in the fact sheets include measurements and ratios, which are described as follows:

First Dorsal Fin

Photos: Lindsay J. Marshall



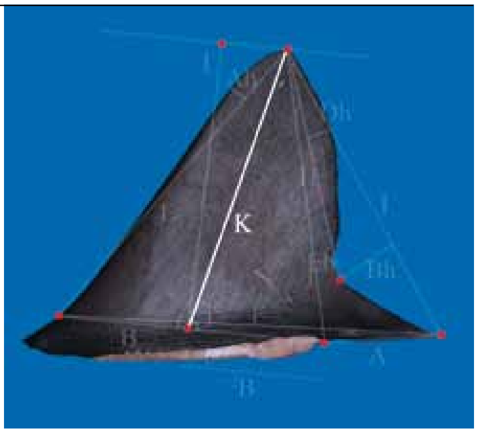
A	**Free rear tip**	The distance from the fin insertion to the end of the free rear tip.	
B	**Fin base**	The distance from the fin origin to the fin insertion, i.e. the length of the dorsal fin base, or “fin base length”. This is where the fin cut is made when fins are removed.	

E **Anterior margin** The distance between the dorsal fin origin and the fin tip.

F **Total Fin Width** The distance from the fin origin to the end of the free rear tip.

H **Upper posterior margin** The distance between the tip of the fin and the deepest point of the concave curve of the posterior margin.

I **Posterior margin** The distance between the fin tip and the posterior tip of the free rear tip.

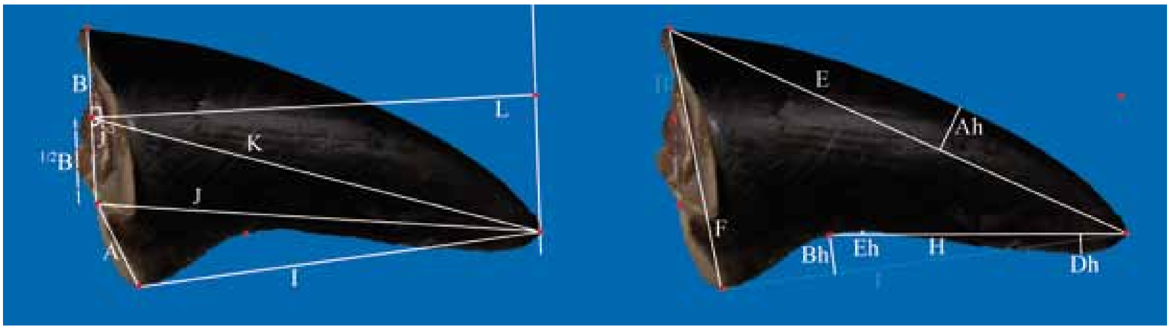
j°	**Fin angle**	The angle between the direct fin height (K) and the he mid-fin base (1⁄2 B).	
K	**Fin height (direct)**	Distance from the mid-fin base (½ B) to the tip of the fin.	
L	**Fin height (absolute)**	Perpendicular distance from the fin baseline (B) to the tip of the fin.	
Ah	**Anterior margin height**	The greatest distance (perpendicular) between line E and the anterior margin of the fin, anterior to line E.	

Bh	**Posterior margin depth**	The greatest distance (perpendicular) between line I and the posterior margin of the fin, anterior to line I.	
Dh	**Upper posterior margin convex depth**	The greatest distance (perpendicular) between the line H and the posterior margin of the fin, posterior to line H.	
Eh	**Upper posterior margin concave depth**	The greatest distance (perpendicular) between the line H and the posterior margin of the fin, anterior to line H.	

Photo:
Rodrigo Friscione

Pectoral Fin

Photos: Lindsay J. Marshall



A **Free rear tip** — The distance from the fin insertion to the tip of the free rear tip.

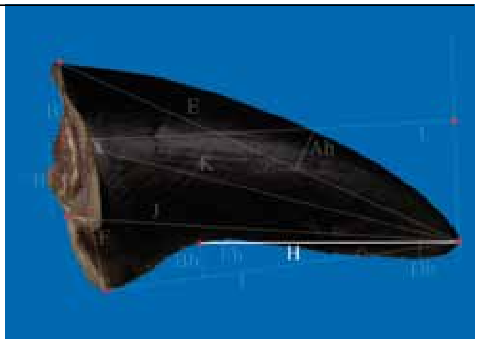
B **Fin base** — The distance from the pectoral fin origin to the fin insertion, i.e. the length of the dorsal fin base, or “fin base length”. This is where the fin cut is made when fins are removed.

E **Anterior margin** — The distance between the pectoral fin origin and the fin tip.

F **Total fin width** — The distance between the pectoral fin origin and the tip of the free rear tip.

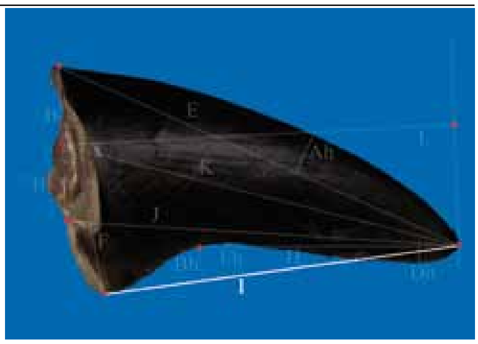
H **Upper posterior margin**

The distance between the pectoral fin tip and the deepest point of the concave curve of the posterior margin. The deepest point of the curve is where there is the greatest perpendicular distance between the line I and the posterior margin of the fin (see Bh).



I **Posterior Margin**

The distance between the pectoral fin tip and the tip of the free rear tip.



j° Fin angle

The angle between the direct fin height (K) and the he mid-fin base (1⁄2 B).

K **Fin height (direct)**

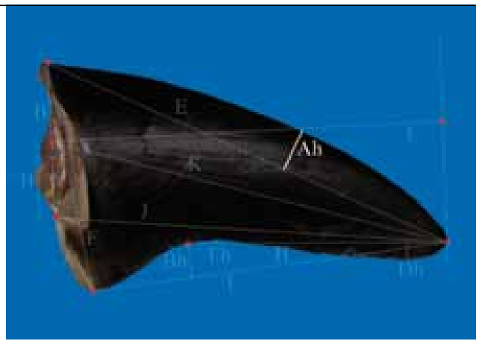
Distance from the mid-fin base (½ B) to the tip of the fin.

L **Fin height (absolute)**

Perpendicular distance from the fin base (½ B) to the tip of the fin.

Ah **Anterior margin height**

The greatest distance (perpendicular) between line E and the anterior margin of the fin, anterior to line E.

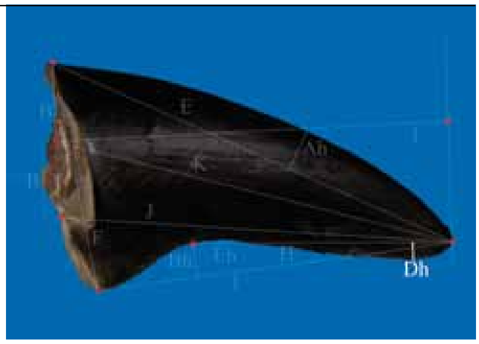


Bh **Posterior margin depth**

The greatest distance (perpendicular) between line I and the posterior margin of the fin, anterior to line I.

Dh **Upper posterior margin convex depth**

The greatest distance (perpendicular) between the line H and the posterior margin of the fin, posterior to line H.

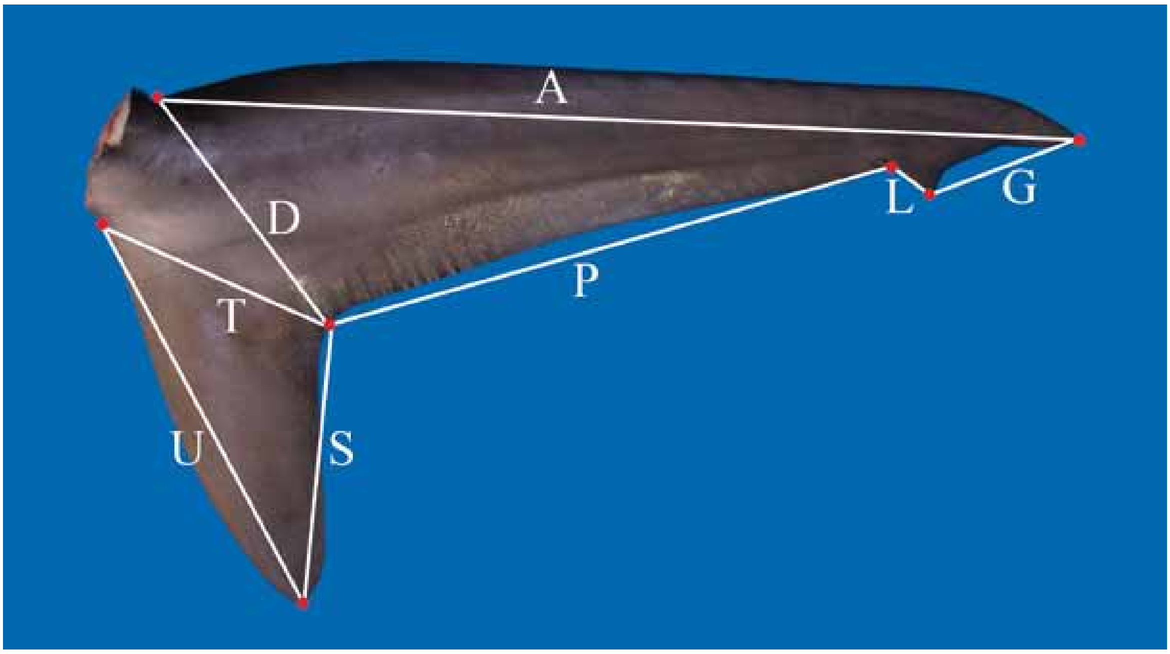


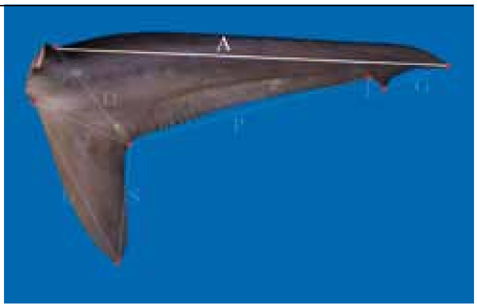
Eh **Upper posterior margin concave depth**

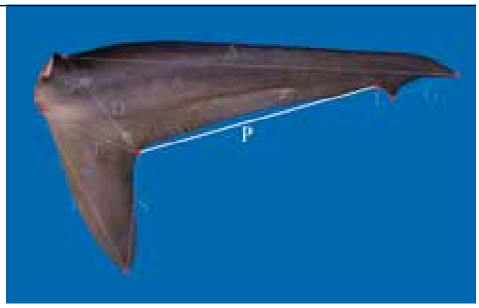
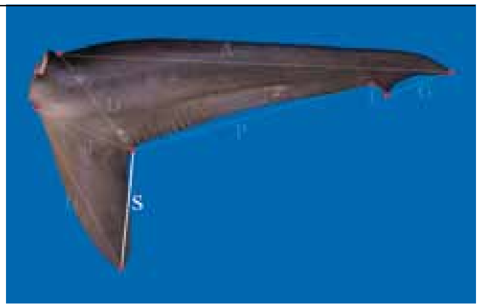
The greatest distance (perpendicular) between the line H and the posterior margin of the fin, anterior to line H.

Caudal Fin

Photos: Lindsay J. Marshall



A	**Upper caudal lobe**	Distance from the caudal fin upper origin to the posterior tip.	
G	**Terminal margin**	Distance from the caudal fin posterior tip to the posterior tip of the subterminal margin. Note: the terminal margin is not present in all species of sharks.	
D	**Upper caudal lobe base**	Distance from the caudal fin upper origin to the deepest point of the caudal fork.	

L	**Lower caudal lobe base**	Distance from the caudal fin lower origin to the deepest point of the caudal fork.	
P	**Upper postventral margin**	The distance from the subterminal notch to the deepest point of the caudal fork. Note: the terminal margin and subterminal notch are not present in all species of sharks. When the terminal margin is absent, this measurement is the distance between the caudal fin posterior tip and the deepest point of the caudal fork	
S	**Lower postventral margin**	The distance from the deepest point of the caudal fork to the ventral tip.	
T	**Lower caudal lobe base**	Distance from the caudal fin lower origin to the deepest point of the caudal fork.	
U	**Preventral margin**	Distance from the caudal fin lower origin to the ventral tip.	

Note that the lower lobe of the caudal fin, which has been severed, is common in trade. However, this guide does not describe the morphology and measurements for these severed lower caudal fins. This is because landmarks for morphometric measurements cannot be reliably located because of the manner in which these fins are cut.

Glossary

Anterior	(adv. anteriorly), relating to the front of or head end of an object (opposite of posterior)
Caudal fin	The tail fin
Caudal keel	A longitudinal fleshy ridge along the side of the caudal peduncle
Caudal peduncle	The posterior part of the body supporting the caudal fin; measured from the insertion of the anal fin to the lower lobe of the caudal fin.
Concave	Hollowed out, curved inwards (opposite of convex).
Convex	Arched, curved outwards (opposite of concave).
Demarcated (colour)	Sharply differentiated from the adjacent colour (unlike diffuse)
Diffuse (colour)	Blending in to adjacent colour (unlike demarcated)
Distal	Region, border or point remote from the site of attachment (opposite of proximal).
Dorsal	Pertaining to the upper part or surface of back (opposite of ventral)
Dusky	Slightly dark or greyish in colour
Falcate	Curved like a sickle
Free rear tip (of fin)	Posterior tip of a fin closest to the fin insertion, rear tip of the loose flap behind the fin attachment.
Posterior	(adv. posteriorly), relating to the hind or rear portion; situated farther back than something else (opposite of anterior)
Proximal	Region, border or point adjacent to the place of attachment of a projection or appendage (opposite of distal).
Subterminal notch	A notch in the caudal fin created by the subterminal lobe
Terminal lobe	Posterior upper lobe of the caudal fin of some cartilaginous fishes
Ventral	Pertaining to the lower part or surface (opposite of dorsal)

FACT SHEETS

A fact sheet for each species instructs the reader on the relevant diagnostic features and measurements of the dorsal, pectoral and caudal fins, showing a photographic set of fins, a colour illustration of the whole shark and a distribution map. The CITES and CMS Appendices as well as the status of conservation in the IUCN Red List for Threatened Species are indicated.

Wherever possible, a trade category name is presented following the Pinyin (Putonghua) system proposed by Clarke *et al.* (2006a), with the aim of encouraging users to compile their own list of trade category names for their specific country and region. The main diagnostic characteristics as well as the morphological measurements for the dorsal, pectoral and caudal fins, and the main differences among fins of similar species, are described. The photographs of the set of fins for juvenile and adults is presented in a standard format.

Furthermore, the estimate of the correlation between total length of the shark and the baseline of the fin is provided. This information can be associated with the length/ weight relationship, obtained from the literature, for a back calculation of the original biomass of the shark. Moreover, using size at maturity from the literature, the estimate of total length of the original shark can provide information on the probable maturity status of the animal.

The list of the species included in this guide is not intended to be complete. It includes 16 shark species that are globally distributed and are of major importance owing to either their conservation status or the fact that they are main target species for the international trade in fins. The description of similar species should not be considered extensive, and is limited by the species and specimens that were available for comparison.

Standard arrangement of the fin sets in each fact sheet showing the type of fin for both juveniles and adults. When the photographs were not available, the layout of the fins were left in black meaning that the images are still sought.

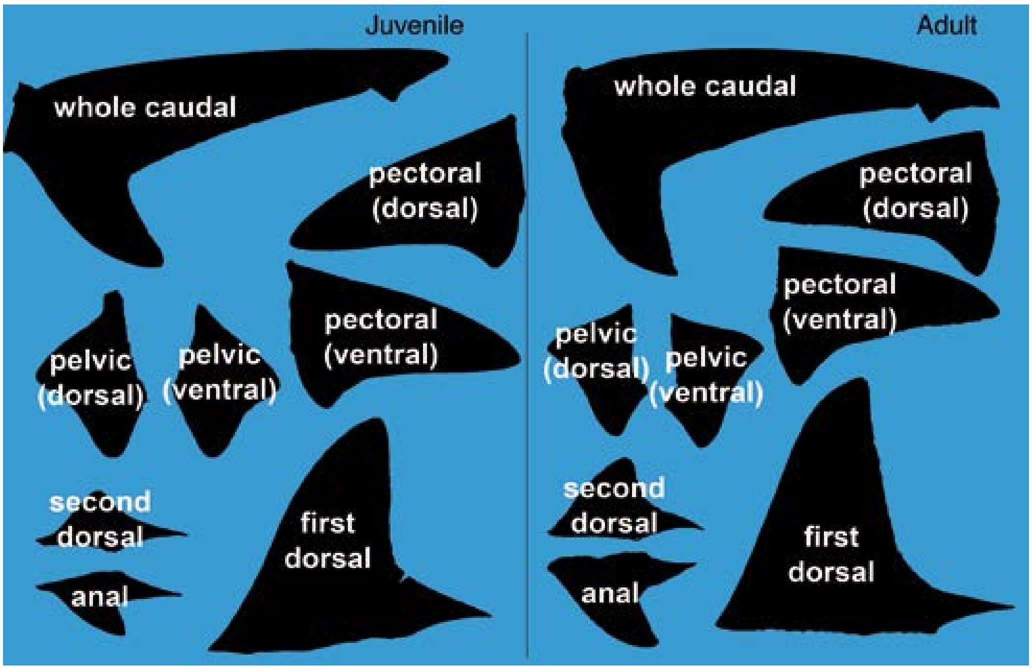


Photo: Jorge Cervera Hauser

List of orders, families and species included in this guide

Order ORECTOLOBIFORMES

Family RHINCODONTIDAE
Rhincodon typus Smith, 1828

Order LAMNIFORMES

Family ODONTASPIDIDAE
Carcharias taurus Rafinesque, 1810

Family ALOPIIDAE
Alopias superciliosus Lowe, 1841

Family LAMNIDAE
Carcharodon carcharias (Linnaeus, 1758)
Isurus oxyrinchus Rafinesque, 1810
Isurus paucus Guitart Manday, 1966
Lamna nasus (Bonnaterre, 1788)

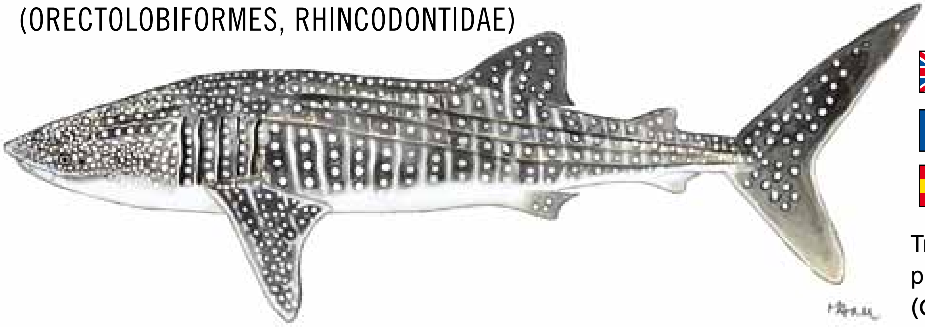
Order CARCHARHINIFORMES

Family CARCHARHINIDAE
Carcharhinus falciformis (Müller and Henle, 1839)
Carcharhinus longimanus (Poey, 1861)
Carcharhinus obscurus (Lesueur, 1818)
Carcharhinus plumbeus (Nardo, 1827)
Galeocerdo cuvier (Péron and Lesueur, 1822)
Prionace glauca (Linnaeus, 1758)

Family SPHYRNIDAE
Sphyrna lewini (Griffith and Smith, 1834)
Sphyrna mokarran (Rüppell, 1837)
Sphyrna zygaena (Linnaeus, 1758)

Rhincodon typus Smith, 1828

(ORECTOLOBIFORMES, RHINCODONTIDAE)



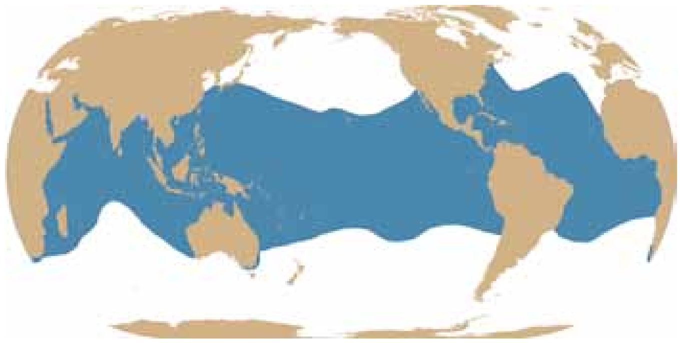
Whale shark

Requin baleine

Tiburón ballena

Trade category name:
pí tiān jiŭ chì; 牛皮天九翅
(Clarke, 2006a;b)

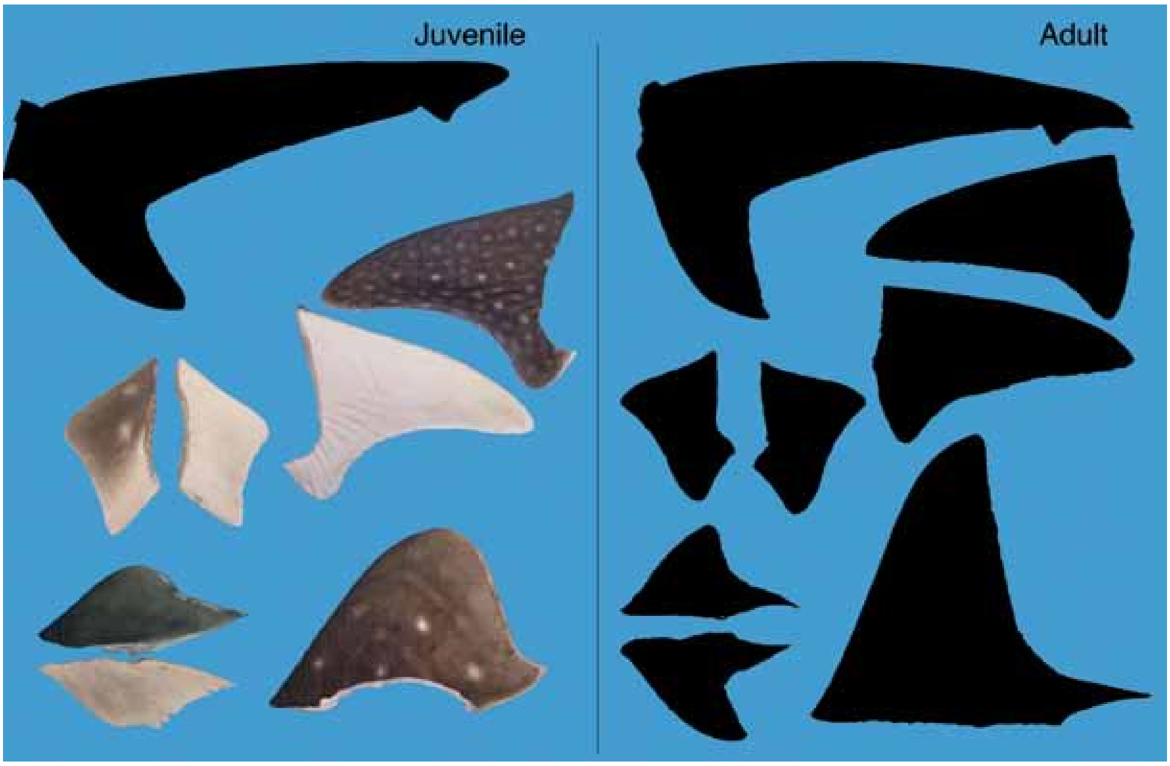
DISTRIBUTION



CONSERVATION STATUS

IUCN Red List	CITES	CMS
VU Vulnerable A2bd+3d ver 3.1	Appendix II Effective date 13/02/2003	Appendix II Effective date 14/02/2000

FIN IDENTIFICATION CHARACTERISTICS



All fins	**Greyish, bluish or brownish above, stark white ventrally; upper surface pattern of creamy white spots between pale, vertical and horizontal stripes. Dull (not shiny when dry).**

Dorsal fin (*n* = 1)	Fin size very large (size of the juvenile specimen investigated was B = 288 mm, L = 254 mm). Fin short (L/F = 0.65). Upright (L/E = 0.72). Tip shape broadly rounded. Free rear tip moderate size (A/B = 0.41). Posterior margin convex, but shallow (Bh/I = 0.9). Upper posterior margin slightly convex (Dh/H = 0.14, Eh/H = 0.00). No tip colour. White spots (and sometimes pale stripes) evident on the dorsal fins with skin.
Total length estimate equation	Not enough specimens.

Similar species:

Bowmouth guitarfish (*Rhina ancylostoma*) (*n* = 6)	Both species have white spots on the skin of the fin. However the dorsal fins of *R. ancylostoma* are much taller (L/F = 1.07–1.27) compared with *R. typus* (L/F = 0.65). The free rear tip of *R. ancylostoma* is much larger (A/B = 0.67–0.79) compared with *R. typus* (A/B = 0.41) The fins of *R. typus* are generally much larger than *R. ancylostoma.*   Images show the first (first image) and second (second image) dorsal fins of *R. ancylostoma* Photos: Lindsay J. Marshall, Jenny Giles
Basking shark (*Cetorhinus maximus*)	Both species are very large bodied sharks that have very large fins. However, the white markings on the skin of *R. typus* are not present on the skin of *C. maximus* (which is dull brown). No specimens of *C. maximus* were available, therefore no measurements are available for comparison.

Pectoral fins (*n* = 1)	Fin size very large (size of the juvenile specimen investigated was B = 326 mm, L = 571 mm). Falcate. Short (L/F = 1.27). Upright (j°= 87°, L/K = 1.00). Tip shape narrowly rounded. Free rear tip medium (A/B = 0.50), rounded. Posterior margin deeply concave (Bh/I = 0.20). Upper posterior margin showing a slight reverse sigmoid shape that is convex distally to very slightly concave proximally (Dh/H = 0.06, Eh/H = 0.07). No dorsal tip markings. Dorsal surface of free rear tip has a small white marking with diffuse edge. Ventral fin colour stark white. No ventral tip colour. White spots (and sometimes pale stripes) evident on the dorsal surface of pectoral fins with skin.
Total length estimate equation	Not enough specimens.

Similar species: The size of the fin (large), the dorsal spot makings and the starkly white ventral colour separate *R. typus* from most other pectoral fin specimens.

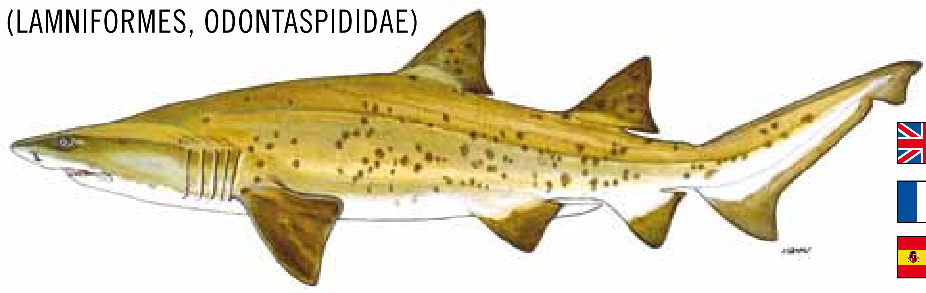
Tiger shark (*Galeocerdo cuvier*) (p. 66)	The pectoral fins of *R. typus* and *G. cuvier* are both short (L/F < 1.60) with a deep posterior margin (Bh/I > 0.09). However, *R. typus* has a shorter free rear tip (A/B = 0.50) than *G. cuvier* (A/B = 0.63–1.14). *G. cuvier* often has dusky grey markings on the ventral tip, whereas *R. typus* does not have any markings on the ventral fin tip.
Shortfin mako (*Isurus oxyrinchus*) (*n* = 47) (p. 42)	The pectoral fins of *R. typus* and *I. oxyrinchus* are both starkly white on the ventral surface with no ventral tip markings. However, *R. typus* is generally shorter (L/F = 1.27) than *I. oxyrinchus* (L/F= 1.49–1.83). The posterior margin in *R. typus* (Bh/I = 0.20) is deeper than for *I. oxyrinchus* (Bh/I = 0.06–0.14).
Basking shark (*Cetorhinus maximus*)	Both species are very large bodied sharks that have very large fins. However, the white markings on the skin of *R. typus* are not present on the skin of *C. maximus* (which is dull brown). No specimens of *C. maximus* were available, therefore no measurements are available for comparison.

Caudal fin (*n* = 0)	No specimens were available.

Photo:
Jorge Cervera Hauser

Carcharias taurus Rafinesque, 1810

(LAMNIFORMES, ODONTASPIDIDAE)



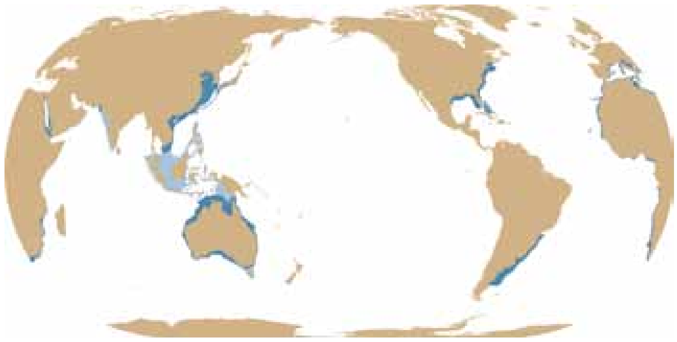
Sand tiger shark

Requin taureau

Toro bacota

Trade category name: -

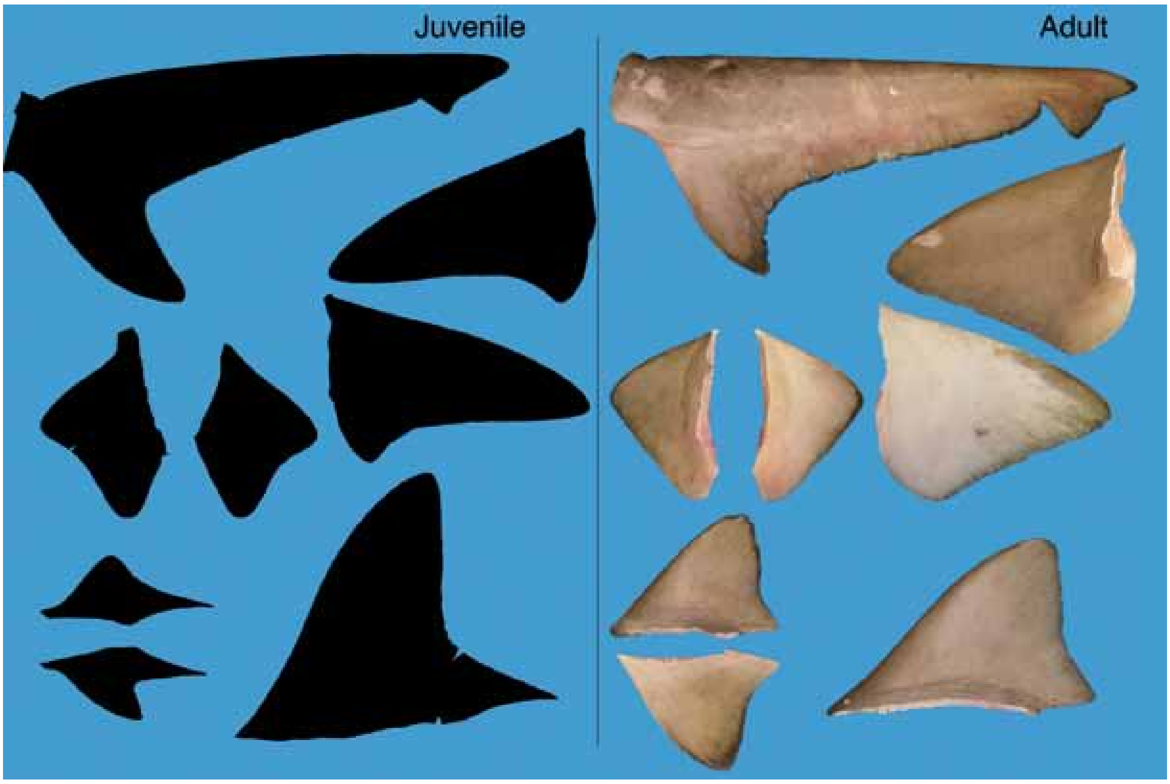
DISTRIBUTION



CONSERVATION STATUS

IUCN Red List	CITES	CMS
VU Vulnerable A2ab+3d ver 3.1	–	–

FIN IDENTIFICATION CHARACTERISTICS



All fins	**Dorsal surfaces bronzy; paler ventrally. Yellow/brown after death. Brown spots sometimes visible on skin, especially in smaller individuals. Dull when dry (not shiny). Wet fins are quite floppy in structure (not very rigid). Posterior edges of fins often "ragged" looking.**

Dorsal fin (*n* = 7)	Fin size medium-large (B = 50–273 mm*). Fin relatively short (L/F = 0.64–0.85). Raked back (L/E = 0.61–0.85). Tip shape broadly pointed. Free rear tip fairly short (0.25–0.42). Posterior margin concave but shallow (Bh/I = 0.07–0.13). Upper posterior margin straight to very slightly convex (Dh/H = 0.02–0.16, Eh/H = 0.00–0.05). No obvious tip colour. Slight dusky markings along the trailing margin, but not very dark.
Total length estimate equation	Total length (cm) = 1.01 B (mm) + 62.52 (± 6.45 SE, r^2 = 0.95, *n* = 6)

Similar species:

Sand tiger shark (*Odontaspis ferox*) (*n* = 1)	Not enough specimens were available for morphological comparison. A photograph of the dorsal fin of one specimen of *O. ferox* (B = 313 mm) is provided. Photo: Lindsay J. Marshall 

Pectoral fins (*n* = 5)	Fin size medium-large (B = 30–211 mm, L = 230–387 mm). Straight. Short (L/F = 1.11–1.30). Upright (j°= 71–95°, L/K = 0.95–1.00). Tip shape very broadly pointed. Free rear tip long (A/B = 0.75–0.97), very broadly pointed. Posterior margin straight, to only very slightly concave (Bh/I = 0.00–0.04). Upper posterior margin straight, showing a very slight reverse sigmoid shape that is slightly convex distally to slightly concave proximally (Dh/H = 0.8–0.20, Eh/H = 0.01–0.11). Sometimes slightly dusky on the dorsal tip and posterior margin, but not very obvious. Dorsal surface of free rear tip is diffusely lighter than rest of dorsal surface, but not obvious. Ventral fin colour creamy white. Ventral tip colour is slightly dusky (diffuse grey). Some specimens with dusky black margin along the anterior (from the fin tip to halfway along the edge) and posterior (from the fin tip to the free rear tip) edges of the fin. Ventral surface sometimes with light brown/grey, demarcated patches.
Total length estimate equation	Total length (cm) = 1.06L(mm) – 108.9 (± 15.57 SE, r^2 = 0.74, *n* = 4)

* Minimum fin size for all species was estimated by calculating the Base Length (B) at the minimum size at birth using the TL estimate regression equation calculated for the species. The maximum fin size for all species was estimated by calculating the Base Length (B) at the maximum recorded size for the species. Minimum size at birth and maximum recorded size for each species were obtained from Last and Stevens (2009).

Similar species:

Sicklefin lemon shark (*Negaprion acutidens*) (n = 7)	The pectorals of *C. taurus* and *N. acutidens* both have yellow/brown dorsal colouring and are short (L/F < 1.35) with large free rear tips (A/B > 0.58). However, the pectoral fins of *N. acutidens* have a very concave posterior margin, i.e. are profoundly sickle shaped (Bh/I = 0.11–0.18), whereas the posterior margin of *C. taurus* is straight (Bh/H = 0.03–0.04).   Photo: Lindsay J. Marshall These images show the dorsal (first image) and ventral (second image) sides of the left pectoral fin of a specimen of *N. acutiens* (B = 166 mm).
Sand tiger shark (*Odontaspis ferox*) (n = 1)	Not enough specimens were available for morphological comparison. Photographs of the left pectoral fin, dorsal (first photograph) and ventral (second photograph) view, of one specimen of *O. ferox* (B = 332 mm) are provided below.   Photo: Lindsay J. Marshall

Caudal fin (n = 5)	Fin size (A = 606–1205 mm, U = 215–440 mm). Upper to lower ratio small (U/A = 0.36–0.42, S/P = 0.26–0.42), heterocercal. Subterminal notch present, very large (L/G = 0.62–0.96). Terminal margin present, size medium; falcate with deep, wedge-shaped notch; tip pointed (G/P = 0.22–0.31). Lower caudal lobe tip shape broadly pointed. Most specimens have randomly placed brown spots on the caudal fin. Small dusky black mark on the lower lobe tip. Dark dusky border along the entire postventral and terminal margins, from the posterior tip to the ventral tip. No caudal keels.
Total length estimate equation	Total length (cm) = -0.16U(mm) + 309.49 (±7.36 SE, r^2 = 0.93, n = 3)

Similar species: None available for comparison.

Alopias superciliosus Lowe, 1841

(LAMNIFORMES, ALOPIIDAE)

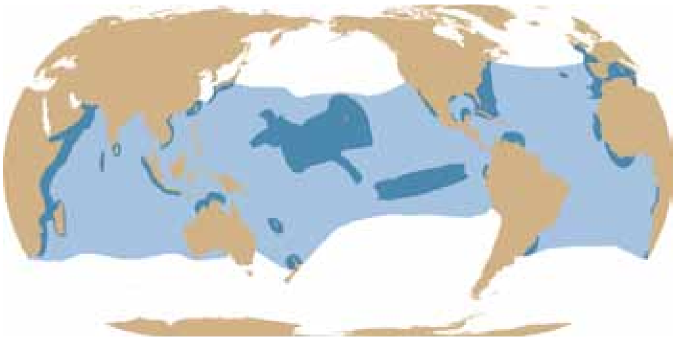
Bigeye thresher

Renard à gros yeux

Zorro ojón

Trade category name: wù gú; 勿 骨 (Clarke, 2006a;b)

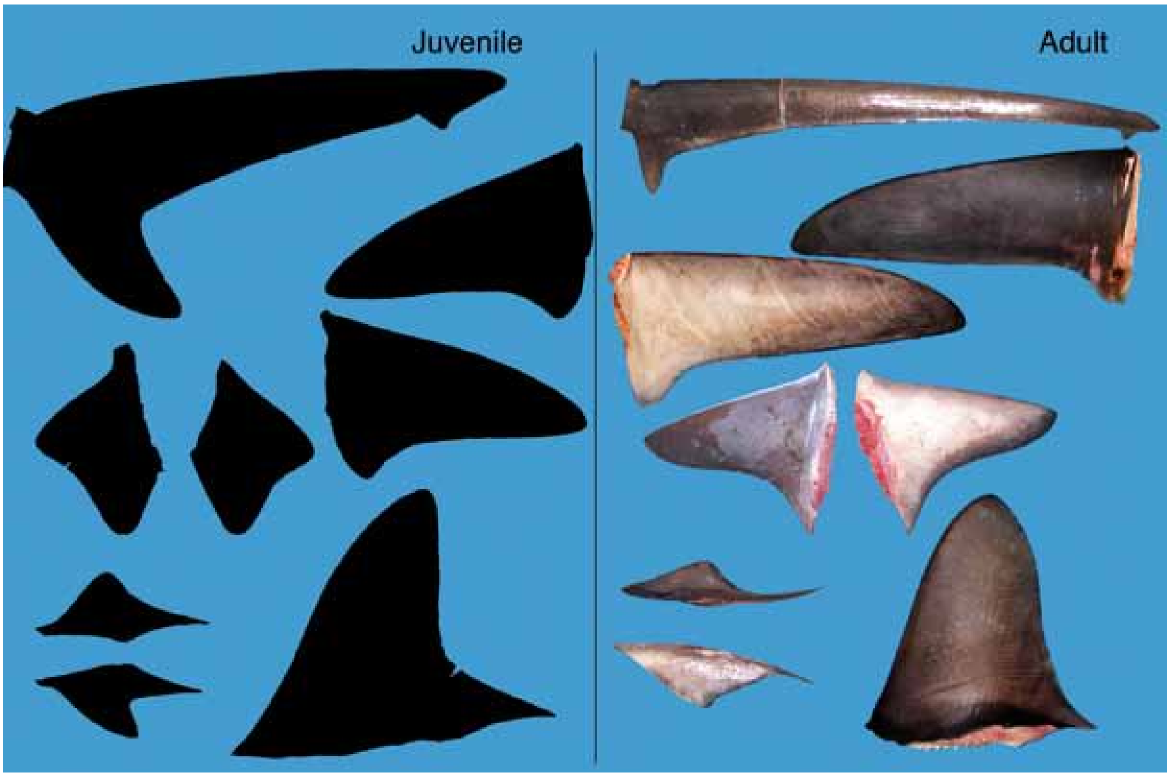
DISTRIBUTION



CONSERVATION STATUS

IUCN Red List	CITES	CMS
VU Vulnerable A2bd ver 3.1	-	Appendix II Effective date 08/02/2015

FIN IDENTIFICATION CHARACTERISTICS



All fins	**Skin on dorsal surfaces is dark purple-brown to violet-grey in colour, with anteroposterior striations ~1–2 mm thick (see photograph below). Creamy white ventrally. Skin dull when dry (not shiny) (denticles small).**
Dorsal fin (*n* = 38)	Fin size medium (B = 79–290 mm) Tall (L/F = 0.89–1.09). Upright (L/E = 0.80–0.90). Free rear tip very small (A/B = 0.13–0.28). Posterior margin fairly straight to slightly concave (Bh/I = 0.03–0.13). Upper posterior margin straight to convex (Dh/H = 0.02–0.11, Eh/H = 0.00–0.08).  Photo: Lindsay J. Marshall
Total length estimate equation	Total length (cm) = 0.94B + 130.47 (±20.42SE, r2 = 0.51, n = 18) Pre-caudal length (cm) = 0.61B(mm) + 43.61 (±8.72SE, r2 = 0.66, n = 18)
Similar species:	
Shortfin mako (*Isurus oxyrinchus*) (*n* = 20) (p. 42)	Skin colour is dark metallic blue/black for *I. oxyrinchus*, dark brown for *A. superciliosus*. *A. superciliosus* has anteroposterior striations which are not present in *I. oxyrinchus*). In fresh specimens of *I. oxyrinchus* the skin of is metallic/shiny; in *A. supercilious* it is matt/velvety. The posterior margin of *A. superciliosus* is more convex, while *I. oxyrinchus* is straight.
Pelagic thresher (*Alopias pelagicus*) (*n* = 6)	For *A. pelagicus* the skin colour is grey with no anteroposterior striations, while the skin colour of *A. superciliosus* is darker purple/brown with anteroposterior striations.
Porbeagle (*Lamna nasus*) (*n* = 2) (p. 50)	*L. nasus* has a longer free rear tip (A/B = 0.34–0.45) than that of *A. superciliosus* (A/B = 0.13–0.28). Obvious, demarcated, white patch covering free rear tip and lower half of posterior margin in *L. nasus*, which is not present in *A. superciliosus*.
Pectoral fins (*n* = 35)	Fin size large (B = 69–292mm, L = 250–905mm). Straight. Very tall (L/F = 1.95–2.49). Upright (j°= 82–99°, L/K = 0.99–1.00). Tip shape broadly pointed. Free rear tip very short (A/B = 0.39–0.60), rounded. Posterior margin slightly convex (Bh/I = 0.06–0.12). Upper posterior margin straight to convex (Dh/H = 0.01–0.70, Eh/H = 0.00–0.02). No dorsal tip markings. Dorsal surface of free rear tip is usually the same colour as the rest of the fin, but in some specimens can be diffuse white. Ventral surface has large, dusky, black markings on both the anterior and posterior edge of the fin. More specifically, the entire anterior margin of the fin has a dusky edge, whereas only the distal half of the posterior margin of the fin is dusky.

Total length estimate equation	Total length (cm) = 0.23L(mm) + 172.9 (±23.43SE, r^2 = 0.39*, *n* = 17) Pre-caudal length (cm) = 0.07L(mm) + 119.62 (±14.81SE, r^2 = 0.10*, *n* = 17) * More data is needed, as the r^2 is low. This should be considered when using these equations to estimate TL and PCL for *A. superciliosus*.

Similar species:

Blue shark (*Prionace glauca*) (*n* = 28) (p. 69)	The pectorals of *P. glauca* and *A. superciliosus* are similar in that both are long (L/F > 2.00) and have dark dorsal skin colouring. The free rear tip in *P. glauca* (A/B = 0.62–0.94) is larger than in *A. superciliosus* (A/B = 0.39–0.60). Moreover, *A. superciliosus* has anteroposterior striations on the dorsal and ventral surface of the pectoral fin. *A. superciliosus* has extensive dusky markings on the anterior and posterior ventral margins, whereas *P. glauca* has a dusky ventral margin that is limited to tip and first third of the distal posterior margin. Fin apex more broadly rounded in *P. glauca*.
Pelagic thresher (*Alopias pelagicus*) (*n* = 5)	*A. superciliosus* has anteroposterior striations on the dorsal and ventral surface, whereas *A. pelagicus* does not.

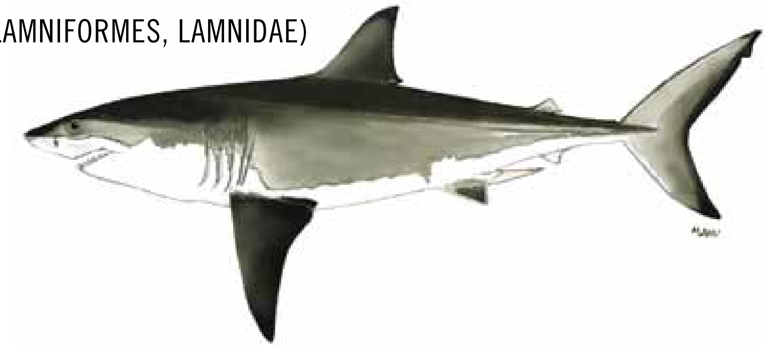
Caudal fin (*n* = 17)	Similar to all thresher sharks (Alopiidae), extremely long, scythe-like, upper caudal fin lobe. Because of this, caudal fins are often processed so that the upper caudal lobe is removed from the lower lobe. The upper lobe is often subsequently dissected into smaller pieces. Fin size medium for lower caudal (U = 39–326 mm), extremely large for upper caudal (A = 450–2 340 mm). Upper to lower ratio very small (U/A = 0.11–0.15, S/P = 0.08–0.11), heterocercal. Subterminal notch present; size moderate; falcate; tip pointed but broad (L/G = 0.36–0.52). Terminal margin size very small (G/P = 0.06–0.10). Caudal lobe tip shape broadly pointed. No obvious tip colour. No caudal keels.
Total length estimate equation	Total length (cm) = 0.72U(mm) + 171.65 (±18.52SE, r^2 = 0.54, *n* = 17)

Similar species:

Pelagic thresher (*Alopias pelagicus*) (*n* = 5)	The terminal margin of *A. superciliosus* (G/P = 0.06–0.10) is larger than that of *A. pelagicus* (G/P = 0.02–0.02).

Carcharodon carcharias (Linnaeus, 1758)

(LAMNIFORMES, LAMNIDAE)



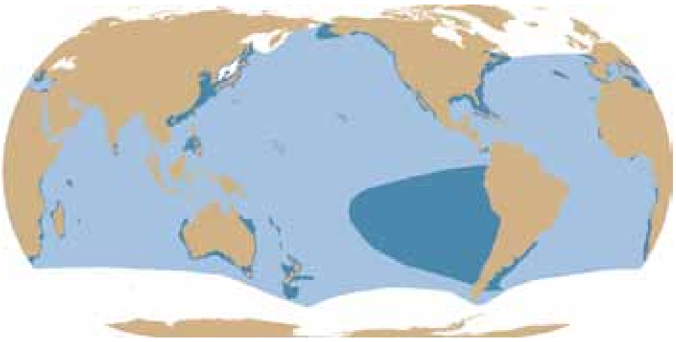
Great white shark

Grand requin blanc

Jaquetón blanco

Trade category name: -

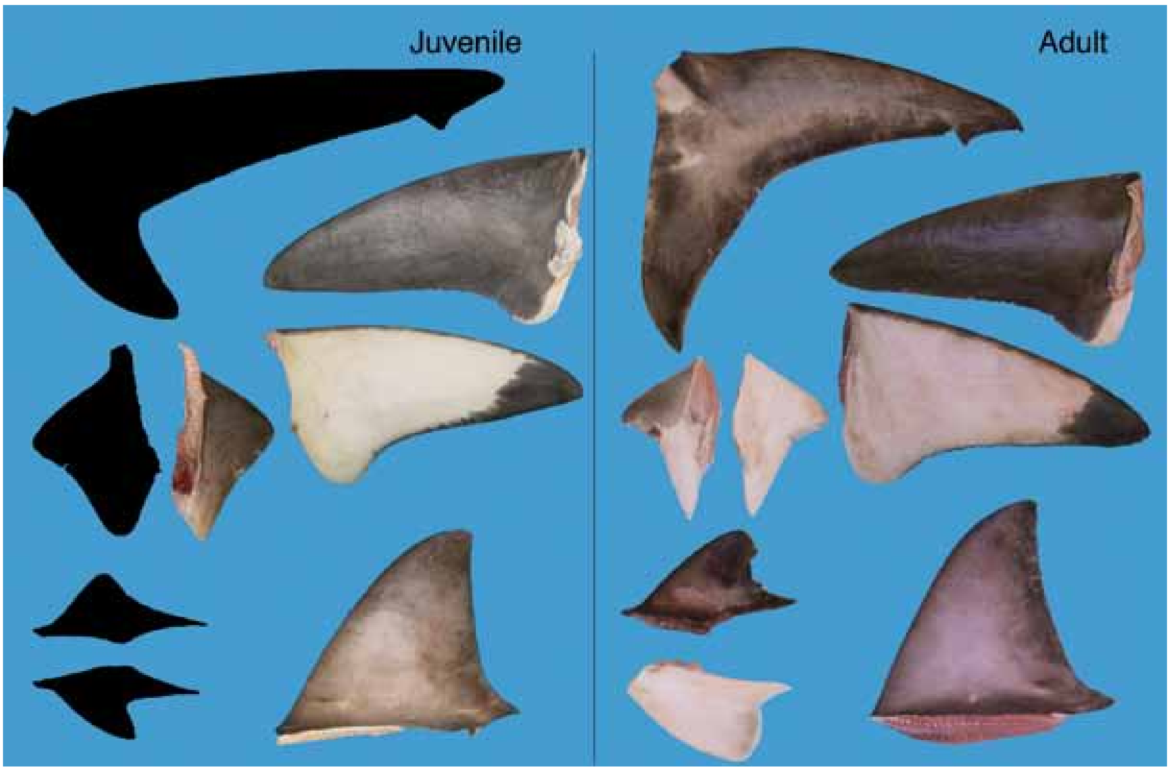
DISTRIBUTION



CONSERVATION STATUS

IUCN Red List	CITES	CMS
VU Vulnerable A2cd+3cd ver 3.1	Appendix II Effective date 12/01/2005	Appendix I and II Effective date 23/12/2002

FIN IDENTIFICATION CHARACTERISTICS



All fins	**Dorsal surface blue-grey to grey-brown, often bronzy when fresh; white ventrally; boundary between these tones is mostly abrupt. Skin colour fades to brown-black after death. Ventral colour stark white. Skin dull when dry (not shiny) (denticles small).**

Dorsal fin (n = 7)	Fin size medium to large (B = 118–668 mm). Fin moderately tall (L/F = 0.76–0.91). Fin upright to slightly raked back (L/E = 0.73–0.79). Tip shape sharply pointed. Free rear tip very short (A/B = 0.21–0.28). Posterior margin very slightly concave (Bh/I = 0.14–0.19). Upper posterior margin straight to slightly concave (Dh/H = 0.01–0.02 Eh/H = 0.03–0.12). No fin tip colour.
Total length estimate equation	Total length (cm) = 0.76B (mm) + 50.22 (± 12.07 SE, r^2 = 0.88, *n* = 6)

Similar species:

Bull shark (*Carcharhinus leucas*) (n = 22)	The dorsal fins of *C. carcharias* are very similar in shape to that of *C. leucas*. Look for geographical information or associated pectoral fins (see pectoral fin comparison section for this species) when genetic testing is not available.

Pectoral fins (*n* = 9)	Fin size large (B = 78–491 mm, L = 232–1 241 mm). Straight. Medium to long (L/F = 1.60–1.77). Upright (j°= 68–84°, L/K = 0.93–0.99). Tip shape broadly pointed. Free rear tip medium to short (A/B = 0.48–0.81), broadly rounded. Posterior margin concave but shallow (Bh/I = 0.07–0.12). Upper posterior margin straight (Dh/H = 0.02–0.06, E/H = 0.00–0.06). No obvious dorsal tip markings. Dorsal surface of free rear tip is white with a starkly demarcated border. Ventral colour is stark white. Ventral tip colour is pronounced, demarcated and black, concentrated at the distal end and sometimes tapering, proximally, along the posterior margin.
Total length estimate equation	Total length (cm) = 0.38L (mm) + 56.83 (± 13.94 SE, r^2 = 0.82, *n* = 5)

Similar species: The most obvious difference between the pectoral fins of *C. carcharias* and other pectoral fins that have a black tip on the ventral side is that the dorsal surface of the free rear tip of *C. carcharias* has a sharply demarcated white patch. Most other species that are the same size with a ventral black tip have a free rear tip that is white, but diffuse.

Silky shark (*Carcharhinus falciformis*) (*n* = 18) (p. 54)	Both fins have a black tip on the ventral side of the pectoral fin; however, in *C. falciformis* it is dusty compared with *C. carcharias*, which is inky black and starkly demarcated. *C. carcharias* has a sharply demarcated white patch on the dorsal side of the free rear tip.

Bull shark (*Carcharhinus leucas*) (*n* = 19)	The pectoral fin is generally longer in *C. carcharias* (L/F = 1.60–1.77) than in *C. leucas* (L/F = 1.36–1.60). Both fins have a black tip on the ventral side of the pectoral fin; however, it is dusky in *C. leucas* compared with *C. carcharias*, which is inky black and starkly demarcated. *C. carcharias* has a sharply demarcated white patch on the dorsal side of the free rear tip. The dorsal surface of the free rear tip of *C. leucas* can be white, but it is diffuse and not starkly demarcated.
Pigeye shark (*Carcharhinus amboinensis*) (*n* = 14)	The pectoral fin is generally longer in *C. carcharias* (L/F = 1.60–1.77) than in *C. amboinensis* (L/F = 1.46–1.60). Both fins have a black tip on the ventral side of the pectoral fin; however, it is dusky in *C. amboinensis* compared with *C. carcharias*, which is inky black and starkly demarcated. *C. carcharias* has a sharply demarcated white patch on the dorsal side of the free rear tip. The dorsal surface of the free rear tip of *C. amboinensis* can be white, but it is diffuse and not starkly demarcated.
Dusky shark (*Carcharhinus obscurus*) (*n* = 8) (p. 60)	The posterior margin of the pectoral fin is generally shallower in *C. carcharias* (Bh/I = 0.07–0.12) than in *C. obscurus* (Bh/I = 0.10–0.15). Both fins have a black tip on the ventral side of the pectoral fin; however, it is dusky in *C. obscurus* compared with *C. carcharias*, which is inky black and starkly demarcated. *C. carcharias* has a sharply demarcated white patch on the dorsal side of the free rear tip. The dorsal surface of the free rear tip of *C. obscurus* can be white, but it is diffuse and not starkly demarcated.
Shortfin mako (*Isurus oxyrinchus*) (*n* = 47) (p. 42)	The pectorals of *I. oxyrinchus* and *C. carcharias* are similar in that both have dark dorsal skin colouring and stark white ventral colouring. Both species have a starkly demarcated free rear tip on the dorsal surface of the pectoral fin. However, on the ventral surface of the pectoral fin, *C. carcharias* has an inky black and starkly demarcated marking at the fin tip, whereas *I. oxyrinchus* has no obvious ventral tip markings.
Porbeagle (*Lamna nasus*) (*n* = 2) (p. 50)	The pectorals of *L. nasus* and *C. carcharias* are similar in that both have dark dorsal skin colouring and stark white ventral colouring with dark ventral fin tips. Both species have a starkly demarcated free rear tip on the dorsal surface of the pectoral fin. However, on the ventral surface of the pectoral fin, *C. carcharias* has an inky black and starkly demarcated patch at the fin tip, whereas *L. nasus* has a large, diffuse grey/black dusky ventral tip patch. The upper posterior margin of *L. nasus* is more convex (Dh/H = 0.08–0.10) than that of *C. carcharias* (Dh/H = 0.00–0.06).

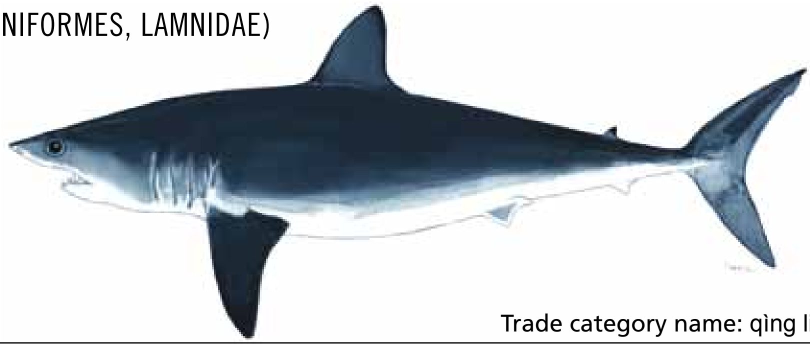
Caudal fin (*n* = 4)	Fin size (A = 223–1 356 mm, U = 97–1 285 mm). Upper to lower ratio very large (U/A = 0.67–0.77, S/P = 0.97–1.11), heterocercal. Subterminal notch present, size moderate (L/G = 0.31–0.54). Terminal margin present; size medium; straight to falcate; tip sharply pointed (G/P = 0.80–0.99). Lower caudal lobe tip sharply pointed. Sharply demarcated white blotch at lower origin. Smaller demarcated white blotches near the preventral margin. No obvious tip colours. Distinct caudal keels present.
Total length estimate equation	Total length (cm) = 0.40U(mm) + 91.81 (±1.40 SE, r^2 = 0.997, n = 3)

Similar species:

Shortfin mako (*Isurus oxyrinchus*) (*n* = 39) (p. 42)	Both *C. carcharias* and *I. oxyrinchus* have heterocercal caudal fins (U/A > 0.60) and a sharply demarcated white blotch at lower origin. The skin of *C. carcharias* is grey to dark-grey while *I. oxyrinchus* is blue-black to black. There are often small demarcated white blotches near the preventral margin of the caudal fins of *C. carcharias*, while the preventral margin of the caudal fin of *I. oxyrinchus* is solid in colour. The subterminal notch is larger in *C. carcharias* (L/G = 0.31–0.54) than *I. oxyrinchus* (L/G = 0.10–0.30).
Longfin mako (*Isurus paucus*) (*n* = 5) (p. 46)	Both *C. carcharias* and *I. paucus* have heterocercal caudal fins (U/A > 0.60) and a sharply demarcated white blotch at lower origin. The skin of *C. carcharias* is grey to dark-grey while *I. oxyrinchus* is blue-black to black. There are often small demarcated white blotches near the preventral margin of the caudal fins of *C. carcharias*, while the preventral margin of the caudal fin of *I. paucus* is solid in colour. The sharply demarcated white blotch at lower origin is often mottled with black spots in *I. paucus*, whereas this is not present in *C. carcharias*.
Porbeagle (*Lamna nasus*) (*n* = 2) (p. 50)	Both *C. carcharias* and *L. nasus* have heterocercal caudal fins (U/A > 0.60) and a sharply demarcated white blotch at lower origin. Both species have large caudal keels; however, *L. nasus* has a secondary keel below the extension of the primary keel, whereas *C. carcharias* does not. There are often small demarcated white blotches near the preventral margin of the caudal fins of *C. carcharias*, while the preventral margin of the caudal fin of *L. nasus* is solid in colour. The subterminal notch is larger in *C. carcharias* (L/G = 0.31–0.54) than in *L. nasus* (L/G = 0.13–0.29).

Isurus oxyrinchus Rafinesque, 1810

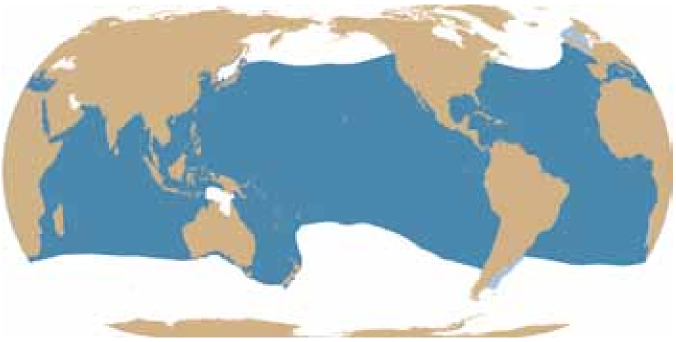
(LAMNIFORMES, LAMNIDAE)



Shortfin mako
Taupe bleue
Marrajo dientuso

Trade category name: qìng lián; 青 蓮 (Clarke, 2006a;b)

DISTRIBUTION



CONSERVATION STATUS

IUCN Red List	CITES	CMS
VU Vulnerable A2abd+3bd+4abd ver 3.1	-	Appendix II Effective date 05/03/2009

FIN IDENTIFICATION CHARACTERISTICS

All fins	**Dorsal surfaces indigo-blue, bright white ventrally. Dorsal surfaces becoming dark grey / black after preservation. Dull when dry (small denticles).**

Dorsal fin (*n* = 37)	Fin size fairly large (B = 69–329 mm). Tall fin (L/F = 0.70–1.07) and upright (L/E = 0.71–0.91). Tip shape bluntly pointed. Free rear tip very short (A/B = 0.13–0.24). Posterior margin very slightly concave (Bh/I = 0.06–0.17). Upper posterior margin shows a slight reverse sigmoid shape that is straight to slightly convex (dorsally) moving to slightly concave (ventrally) (Dh/H = 0.03–0.12, Eh/H = 0.00–0.09). No dorsal fin tip colour.
Total length estimate equation	Total length (cm) = 1.17B(mm)–9.02 (± 15.99 SE, r^2 = 0.91, *n* = 10)
Similar species:	
Longfin mako (*Isurus paucus*) (*n* = 6) (p. 46)	*I. paucus* has a longer free rear tip (A/B = 0.24–0.35) than *I. oxyrinchus* (A/B = 0.13–0.24).
Blue shark (*Prionace glauca*) (*n* = 75) (p. 69)	*I. oxyrinchus* dorsal fin is generally taller (L/F = 0.70–1.07) than that of *P. glauca* (L/F = 0.53–0.87). *I. oxyrinchus* has a shorter free rear tip (A/B = 0.13–0.24) than *P. glauca* (A/B = 0.34–0.65).

Pectoral fins (*n* = 47)	Fin size medium-large (B = 36–258 mm, L = 77–695 mm). Straight. Medium length (L/F = 1.49–1.83). Upright (j°= 70–91°, L/K = 0.94–0.11). Tip shape bluntly pointed to narrowly rounded. Free rear tip fairly short (A/B = 0.41–0.69), rounded. Posterior margin moderately concave (Bh/I = 0.6–0.14). Upper posterior margin convex (Dh/H = 0.04 -0.16, Eh/H = 0.00–0.03). No obvious dorsal tip markings. Dorsal surface of free rear tip is white with a starkly demarcated border. Ventral fin colour stark white, sometimes with small, sparse grey mottle/spots. No obvious ventral tip markings.
Total length estimate equation	Total length (cm) = 0.51L(mm) + 27.98 (± 12.25 SE, r^2 = 0.94, *n* = 11)
Similar species:	
Blue shark (*Prionace glauca*) (*n* = 28) (p. 69)	The pectorals of *P. glauca* and *I. oxyrinchus* are similar in that both have dark blue-black dorsal skin colouring and stark white ventral colouring. The pectoral fin of *P. glauca* (L/F = 2.24–2.62) is longer than that of I. oxyrinchus (L/F = 1.49–1.83). The free rear tip in *P. glauca* (A/B = 0.62–0.94) is generally larger than in *I. oxyrinchus* (A/B = 0.41–0.69). Moreover, the colour of the dorsal surface of the free rear tip of *P. glauca* is the same colour as the rest of the fin; however, in *I. oxyrinchus* the free rear tip is white and is starkly demarcated. The ventral surface of *I. oxyrinchus* does not have obvious tip colouring, while *P. glauca* often has dusky fin tips.

Longfin mako (*Isurus paucus*) (*n* = 7) (p. 46)	The pectorals of *I. oxyrinchus* and *I. paucus* are similar in that both have dark blue-black dorsal skin colouring and stark white ventral colouring. Both species have a starkly demarcated free rear tip on the dorsal surface of the pectoral fin. The pectoral fin of *I. paucus* (L/F = 2.14–2.48) is longer than that of *I. oxyrinchus* (L/F = 1.49–1.83). The free rear tip in I. *paucus* (A/B = 0.67–0.87) is generally larger than *I. oxyrinchus* (A/B = 0.41–0.69). Moreover, on the ventral side of the fin, *I. paucus* generally has a dark, dusky margin along the posterior margin, from the fin tip almost to the apex of the free rear tip, whereas *I. oxyrinchus* has no obvious ventral tip markings.
Great white shark (*Carcharodon carcharias*) (*n* = 9) (p. 38)	The pectorals of *I. oxyrinchus* and *I. paucus* are similar in that both have dark dorsal skin colouring and stark white ventral colouring. Both species have a starkly demarcated free rear tip on the dorsal surface of the pectoral fin. However, on the ventral surface of the pectoral fin, *C. carcharias* has an inky black and starkly demarcated marking at the fin tip, whereas *I. oxyrinchus* has no obvious ventral tip markings.
Porbeagle (*Lamna nasus*) (*n* = 2) (p. 50)	The pectorals of *I. oxyrinchus* and *L. nasus* are similar in that both have dark blue-black dorsal skin colouring and stark white ventral colouring. Both species have a starkly demarcated free rear tip on the dorsal surface of the pectoral fin. However, the ventral fin tip of *L. nasus* has a large, diffuse grey/black patch, whereas *I. oxyrinchus* does not have any ventral fin tip patches (ventral fin is entirely white). The free rear tip in *L. nasus* (A/B = 0.78–0.81) is larger than in *I. oxyrinchus* (A/B = 0.41–0.69).

Photo:
Jorge Cervera Hauser

Caudal fin (n = 39)	Fin size (A = 149–775 mm, U = 84–620 mm). Upper to lower ratio large (U/A = 0.67–0.83, S/P = 0.82–1.18), homocercal. Subterminal notch present, very small (L/G = 0.10–0.27). Terminal margin present; size medium; straight; tip pointed but fairly broad (G/P = 0.25–0.43). Lower caudal lobe tip pointed. Sharply demarcated white blotch at lower origin. No obvious tip colours. Distinct caudal keels present.
Total length estimate equation	Total length (cm) = 0.54U(mm) + 33.16 (±16.7 SE, r^2 = 0.87, *n* = 10)

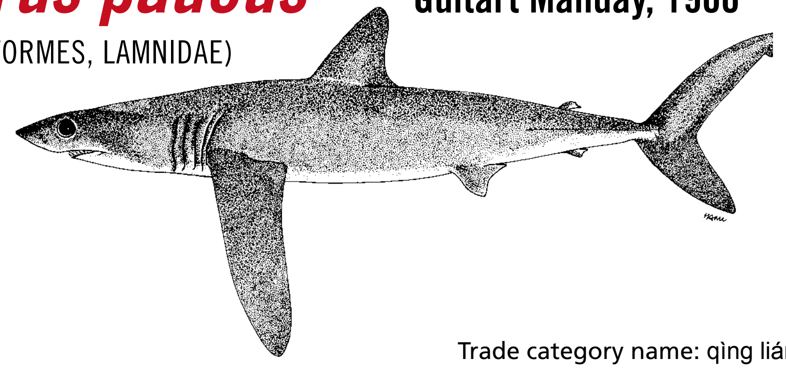
Similar species:

Great white shark (*Carcharodon carcharias*) (*n* = 4) (p. 38)	Both *I. oxyrinchus and C. carcharias* have heterocercal caudal fins (U/A > 0.60) and a sharply demarcated white blotch at lower origin. The skin of *C. carcharias* is grey to dark-grey while *I. oxyrinchus* is blue-black to black. There are often small demarcated white blotches near the preventral margin of the caudal fins of *C. carcharias*, while the preventral margin of the caudal fin of *I. oxyrinchus* is solid in colour. The subterminal notch is larger in *C. carcharias* (L/G = 0.31–0.54) than in *I. oxyrinchus* (L/G = 0.10–0.27).
Longfin mako (*Isurus paucus*) (*n* = 5) (p. 46)	Both *I. oxyrinchus* and *I. paucus* have heterocercal caudal fins (U/A > 0.60) and a sharply demarcated white blotch at lower origin. The sharply demarcated white blotch at lower origin is often mottled with black spots in *I. paucus*, whereas this is not present in *I. oxyrinchus*. The posterior upper to lower caudal ratio is larger in *I. paucus* (L/G = 0.29–0.41) than in *I. oxyrinchus* (L/G = 0.10–0.27). Terminal margin more falcate in *I. paucus* than in *I. oxyrinchus*.
Porbeagle (*Lamna nasus*) (*n* = 2) (p. 50)	Both *I. oxyrinchus* and *L. nasus* have heterocercal caudal fins (U/A > 0.60) and a sharply demarcated white blotch at lower origin. Both species have large caudal keels; however, *L. nasus* has a secondary keel below the extension of the primary keel, whereas *I. oxyrinchus* does not. The subterminal notch is smaller in *L. nasus* (S/P = 0.77–0.85) than in *I. oxyrinchus* (S/P = 0.82–1.18).

Isurus paucus

Guitart Manday, 1966

(LAMNIFORMES, LAMNIDAE)



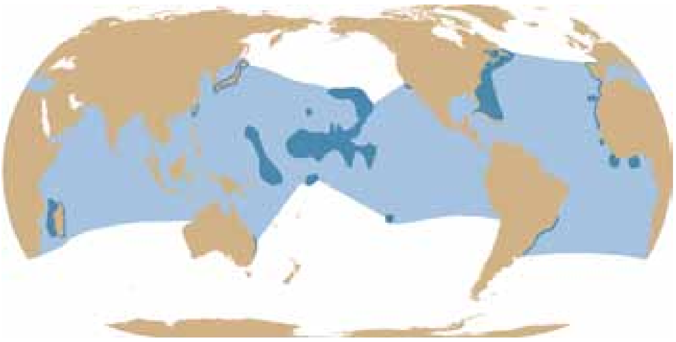
Longfin mako

Petite taupe

Marrajo carite

Trade category name: qìng lián; 青 漣 (Clarke, 2006a;b)

DISTRIBUTION



CONSERVATION STATUS

IUCN Red List	CITES	CMS
VU Vulnerable A2bd+3d+4bd ver 3.1	-	Appendix II Effective date 05/03/2009

FIN IDENTIFICATION CHARACTERISTICS

All fins	Dorsal surfaces grey-blue to grey-black. Dorsal surfaces becoming dark grey to black after drying. Dull when dry (not shiny) denticles small.

Dorsal fin (*n* = 6)	Fin size medium (B = 10–503 mm). Tall fin (L/F = 0.83–0.97). Upright (L/E = 0.78–087). Tip shape broadly pointed. Free rear tip short (A/B = 0.24–0.35). Posterior margin slightly concave (Bh/I = 0.10–0.16). Upper posterior margin straight to slightly convex (Dh/H = 0.05–0.11, Eh/H = 0.00–0.04). No tip markings. No obvious fin markings.
Total length estimate equation	Total length (cm) = 0.21B (mm) + 175.68 (± 16.84 SE, r^2 = 0.34, *n* = 3)
Similar species:	
Shortfin mako (*Isurus oxyrinchus*) (*n* = 37) (p. 42)	*I. paucus* has a longer free rear tip (A/B = 0.24–0.35) than *I. oxyrinchus* (A/B = 0.13–0.24).
Blue shark (*Prionace glauca*) (*n* = 75) (p. 69)	*I. paucus* dorsal fin is generally taller (L/F = 0.83–0.97) than in *P. glauca* (L/F = 0.53–0.87). *I. paucus* has a shorter free rear tip (A/B = 0.24–0.35) than *P. glauca* (A/B = 0.34–0.65).
Porbeagle (*Lamna nasus*) (*n* = 2) (p. 50)	*I. paucus* has a shorter free rear tip (A/B = 0.24–0.35) than *L. nasus* (A/B = 0.34–0.45). Obvious, demarcated, white patch covering free rear tip and lower half of posterior margin in *L. nasus*, which is not present in *I. paucus*.

Pectoral fins (n = 6)	Fin size medium-large (B = 36–378 mm, L = 163–1 093 mm). Straight to falcate. Long (L/F = 2.14–2.48). Upright (j°= 78–89°, L/K = 0.98–1.00). Tip shape pointed but broad. Free rear tip medium (A/B = 0.67–0.87), rounded. Posterior margin concave (Bh/I = 0.06–0.11). Upper posterior margin convex (Dh/H = 0.07–0.10, Eh/H = 0.00–0.02). No obvious dorsal tip markings. Dorsal surface of free rear tip is white with a starkly demarcated border. Ventral fin colour stark white. Ventral tips with a dark, dusky border along the posterior margin, from the fin tip almost to the apex of the free rear tip.
Total length estimate equation	Total length (cm) = 0.34L(mm) + 42.58 (± 2.25 SE, r^2 = 0.99, *n* = 3)
Similar species:	
Blue shark (*Prionace glauca*) (*n* = 28) (p. 69)	The pectorals of *I. paucus and P. glauca*are similar in that both are long and have dark blue-black dorsal skin colouring and stark white ventral colouring. The free rear tip in *P. glauca* (A/B = 0.62–0.94) is generally larger than *I. paucus* (A/B = 0.67–0.87). Moreover, the colour of the dorsal surface of the free rear tip of *P. glauca* is the same colour as the rest of the fin; however, in *I. paucus* the free rear tip is white and is starkly demarcated.

Shortfin mako (*Isurus oxyrinchus*) (*n* = 47) (p. 42)	The pectorals of *I. paucus and I. oxyrinchus* are similar in that both have dark blue-black dorsal skin colouring and stark white ventral colouring. Both species have a starkly demarcated free rear tip on the dorsal surface of the pectoral fin. The pectoral fin of *I. paucus* (L/F = 2.14–2.48) is longer than that of *I. oxyrinchus* (L/F = 1.49–1.83). The free rear tip in *I. paucus* (A/B = 0.67–0.87) is generally larger than in *I. oxyrinchus* (A/B = 0.41–0.69). Moreover, on the ventral side of the fin, I. paucus generally has a dark, dusky border along the posterior margin, from the fin tip almost to the apex of the free rear tip, whereas *I. oxyrinchus* has no obvious ventral tip markings.
Porbeagle (*Lamna nasus*) (*n* = 2) (p. 50)	The pectorals of *I. paucus and L. nasus* are similar in that both have dark blue-black dorsal skin colouring and stark white ventral colouring with dusky ventral tips. Both species have a starkly demarcated free rear tip on the dorsal surface of the pectoral fin. The pectoral fin of *I. paucus* (L/F = 2.14–2.48) is longer than that of *L. nasus* (L/F = 1.61–1.70).

Caudal fin (*n* = 5)	Fin size (A = 149–776 mm, U = 98–773 mm). Upper to lower ratio large (U/A = 0.69–0.77, S/P = 0.86–1.26), homocercal. Subterminal notch present, fairly small (L/G = 0.29–0.41). Terminal margin present; size medium; straight; falcate; tip pointed (G/P = 0.29–0.41). Lower caudal lobe tip shape broadly pointed, lobe narrow. Sharply demarcated white blotch at lower origin, often mottled with black spots. No obvious tip colours. Distinct caudal keels present.
Total length estimate equation	Total length (cm) = 0.47U(mm) + 50.92 (±1.35 SE, r^2 = 0.99, *n* = 3)

Similar species:

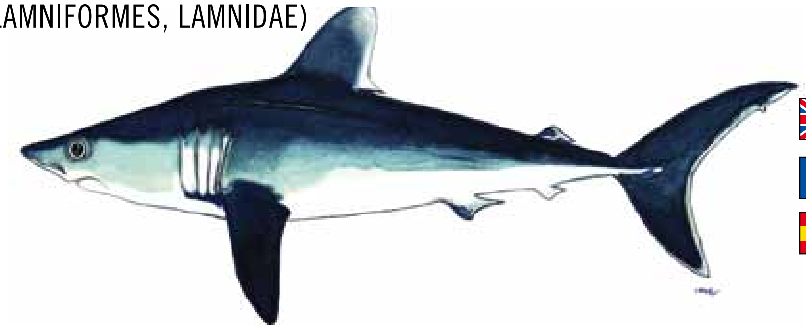
Great white shark (*Carcharodon carcharias*) (*n* = 4) (p. 38)	Both *I. paucus and C. carcharias* have heterocercal caudal fins (U/A > 0.60) and a sharply demarcated white blotch at lower origin. The skin of *C. carcharias* is grey to dark-grey while *I. oxyrinchus* is blue-black to black. There are often small demarcated white blotches near the preventral margin of the caudal fins of *C. carcharias*, while the preventral margin of the caudal fin of *I. paucus* is solid in colour. The sharply demarcated white blotch at lower origin is often mottled with black spots in *I. paucus*, whereas this is not present in *C. carcharias*.

Porbeagle (*Lamna nasus*) (*n* = 2) (p. 50)	Both *I. paucus* and *L. nasus* have heterocercal caudal fins (U/A > 0.60) and a sharply demarcated white blotch at lower origin. The sharply demarcated white blotch at lower origin is often mottled with black spots in *I. paucus*, whereas this is not present in *L. nasus*. Both species have large caudal keels; however, *L. nasus* has a secondary keel below the extension of the primary keel, whereas *I. paucus* does not. The subterminal notch is larger in *I. paucus* (L/G = 0.29–0.41) than in *L. nasus* (L/G = 0.13–0.29). Terminal margin more falcate in *I. paucus* than *L. nasus*.
Shortfin mako (*Isurus oxyrinchus*) (*n* = 39) (p. 42)	Both *I. paucus and I. oxyrinchus* have heterocercal caudal fins (U/A > 0.60) and a sharply demarcated white blotch at lower origin. The sharply demarcated white blotch at lower origin is often mottled with black spots in *I. paucus*, whereas this is not present in *I. oxyrinchus*. The posterior upper to lower caudal ratio is larger in *I. paucus* (L/G = 0.29–0.41) than in *I. oxyrinchus* (L/G = 0.10–0.27). Terminal margin more falcate in *I. paucus* than in *I. oxyrinchus*.

Photo:
Rodrigo Friscione

Lamna nasus (Bonnaterre, 1788)

(LAMNIFORMES, LAMNIDAE)



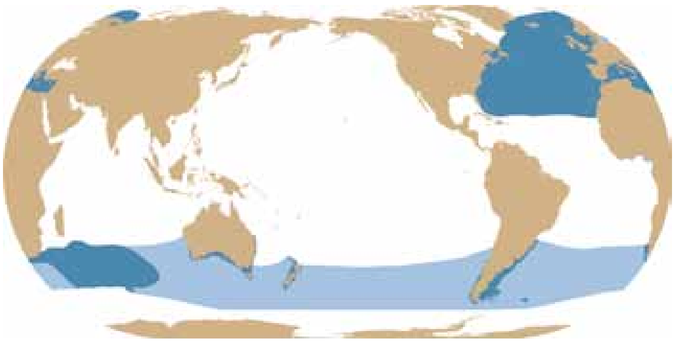
Porbeagle

Requin-taupe commun

Marrajo sardinero

Trade category name: -

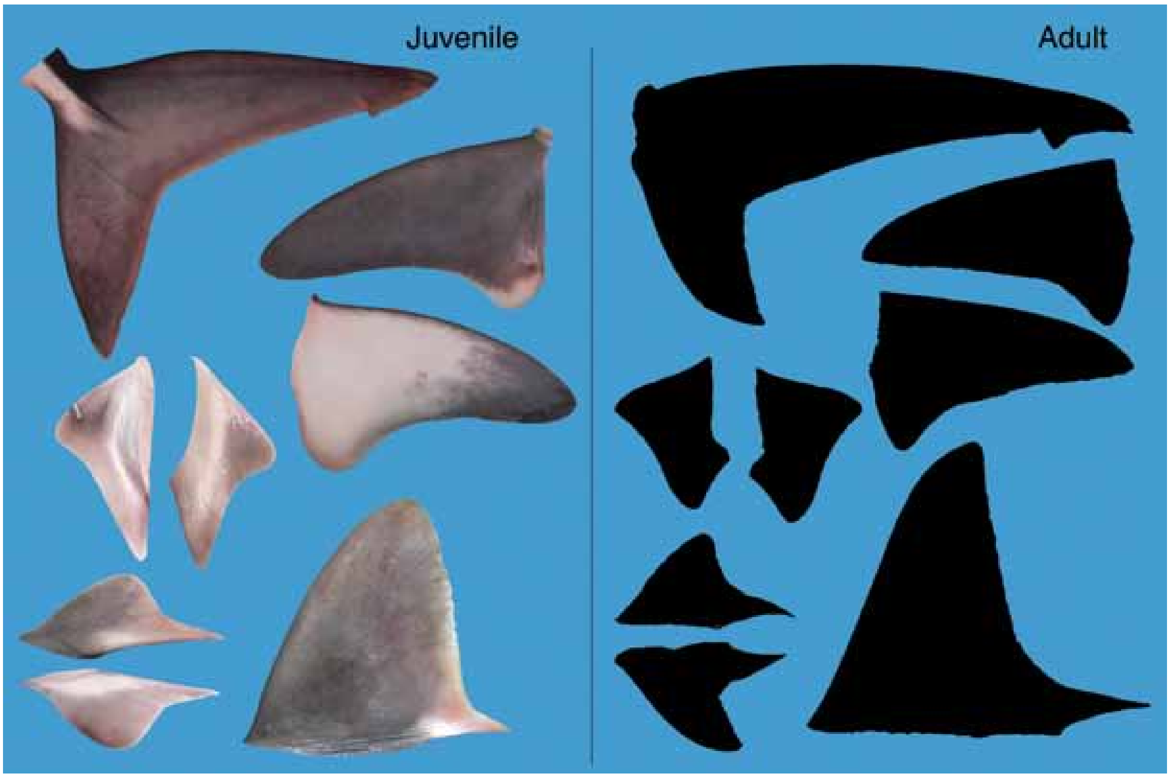
DISTRIBUTION



CONSERVATION STATUS

UCN Red List	CITES	CMS
VU Vulnerable A2bd+3d+4bd ver 3.1	Appendix II Effective date 14/09/2014	Appendix II Effective date 05/03/2009

FIN IDENTIFICATION CHARACTERISTICS



All fins	**Dorsal surfaces light grey to bluish -grey. No striations. Dull when dry (not shiny). Note: Only two juvenile specimens were examined for this version of the guide. Adult specimens may display different characteristics.**

Dorsal fin (*n* = 2)	Fin size medium (B = 69–329 mm*). Fairly tall fin (L/F = 0.83–0.91). Fairly upright (L/E = 0.77–084). Tip shape broadly pointed. Free rear tip medium (A/B = 0.34–0.45). Posterior margin slightly concave (Bh/I = 0.11–0.12). Upper posterior margin straight to slightly convex (Dh/H = 0.03–0.07, Eh/H = 0.01–0.01). No tip markings. Obvious, demarcated, white patch covering free rear tip and lower half of posterior margin. * As there were not enough specimens to generate linear regression to estimate minimum and maximum fin size, the estimated fin size for *I. oxyrinchus* has been substituted.
Total length estimate equation	Not enough specimens.

Similar species: The dorsal fin of *L. nasus* has an obvious, demarcated, white patch covering free rear tip and lower half of posterior margin, that was not present in the dorsal fin of any other species investigated.

Shortfin mako (*Isurus oxyrinchus*) (*n* = 37) (p. 42)	*L. nasus* has a longer free rear tip (A/B = 0.34–0.45) than *I. oxyrinchus* (A/B = 0.13–0.24). Obvious, demarcated, white patch covering free rear tip and lower half of posterior margin in *L. nasus*, which is not present in *I. oxyrinchus*.
Blue shark (*Prionace glauca*) (*n* = 75) (p. 69)	*L. nasus* dorsal fin is generally taller (L/F = 0.83–0.91) than that of *P. glauca* (L/F = 0.53–0.87). Obvious, demarcated, white patch covering free rear tip and lower half of posterior margin in *L. nasus*, which is not present in *P. glauca*.
Longfin mako (*Isurus paucus*) (*n* = 6) (p. 46)	*L. nasus* has a longer free rear tip (A/B=0.34–0.45) than that of *I. paucus* (A/B=0.24–0.35). Obvious, demarcated, white patch covering free rear tip and lower half of posterior margin in *L. nasus*, which is not present in *I. paucus*.
Bigeye thresher (*Alopias superciliosus*) (*n* = 38) (p. 35)	*L. nasus* has a longer free rear tip (A/B = 0.34–0.45) than that of *A. superciliosus* (A/B = 0.13–0.28). Obvious, demarcated, white patch covering free rear tip and lower half of posterior margin in *L. nasus*, which is not present in *A. superciliosus*.

Pectoral fins (n = 2)	Fin size medium-large (B = 36–258 mm*, L = 77–695 mm*). Falcate. Medium to long (L/F = 1.61–1.70). Somewhat raked back (j°= 86–87°, L/K = 1.00–1.00). Tip shape narrowly rounded. Free rear tip medium (A/B = 0.78–0.81), rounded. Posterior margin concave (Bh/I = 0.08–0.12). Upper posterior margin convex (Dh/H = 0.08–0.10, Eh/H = 0.00–0.01). No obvious dorsal tip markings. Dorsal surface of free rear tip is white with a starkly demarcated border. Ventral fin colour stark white. Ventral tip with large, diffuse grey/black patch. Border of the ventral tip patch is somewhat demarcated but mottled, appearing dusky. * As there were not enough specimens to generate linear regression to estimate minimum and maximum fin size, the estimated fin size for *Isurus oxyrinchus* has been substituted.
Total length estimate equation	Not enough specimens.

Similar species:

Blue shark (*Prionace glauca*) (*n* = 28) (p. 69)	The pectorals of *L. nasus* and *P. glauca* are similar in that both have dark blue-black dorsal skin colouring and stark white ventral colouring with dusky grey ventral fin tips. The pectoral fins of *P. glauca* are much longer (L/F = 2.24–2.62) than those of *L. nasus* (L/F = 1.61–1.70). Moreover, the colour of the dorsal surface of the free rear tip of *P. glauca* is the same colour as the rest of the fin; however, in *L. nasus* the free rear tip is white and is starkly demarcated.
Shortfin mako (*Isurus oxyrinchus*) (*n* = 47) (p. 42)	The pectorals of *L. nasus and I. oxyrinchus* are similar in that both have dark blue-black dorsal skin colouring and stark white ventral colouring. Both species have a starkly demarcated free rear tip on the dorsal surface of the pectoral fin. However, the ventral fin tip of *L. nasus* has a large, diffuse grey/black patch, whereas *I. oxyrinchus* does not have any ventral fin tip patches (ventral fin is entirely white). The free rear tip in *L. nasus* (A/B = 0.78–0.81) is larger than that of *I. oxyrinchus* (A/B = 0.41–0.69).
Great white shark (*Carcharodon carcharias*) (*n* = 9) (p. 38)	The pectorals of *L. nasus* and *I. paucus* are similar in that both have dark dorsal skin colouring and stark white ventral colouring with dark ventral fin tips. Both species have a starkly demarcated free rear tip on the dorsal surface of the pectoral fin. However, on the ventral surface of the pectoral fin, *C. carcharias* has an inky black and starkly demarcated patch at the fin tip, whereas *L. nasus* has a large, diffuse grey/black dusky ventral tip patch. The upper posterior margin of *L. nasus* is more convex (Dh/H = 0.08–0.10) than that of *C. carcharias* (Dh/H = 0.02–0.06).
Longfin mako (*Isurus paucus*) (*n* = 7) (p. 46)	The pectorals of *L. nasus* and *I. paucus* are similar in that both have dark blue-black dorsal skin colouring and stark white ventral colouring with dusky ventral tips. Both species have a starkly demarcated free rear tip on the dorsal surface of the pectoral fin. The pectoral fin of *I. paucus* (L/F = 2.14–2.48) is longer than that of *L. nasus* (L/F = 1.61–1.70).

Caudal fin (*n* = 2)	Fin size (A = 149–775 mm*, U = 84–620 mm*). Upper to lower ratio large (U/A = 0.72–0.72, S/P = 0.77–.85), homocercal. Subterminal notch present, very small (L/G = 0.13–0.29). Terminal margin present; size medium to large; straight; tip pointed but fairly broad (G/P = 0.32–0.36). Lower caudal lobe tip pointed. Sharply demarcated white blotch at lower origin. No obvious tip colours. Distinct caudal keels present. Secondary keel present below the extension of the primary keel. * As there were not enough specimens to generate linear regression to estimate minimum and maximum fin size, the estimated fin size for Isurus oxyrinchus has been substituted.
Total length estimate equation	Not enough specimens.

Similar species:

Longfin mako (*Isurus paucus*) (*n* = 5) (p. 46)	Both *L. nasus and I. paucus* have heterocercal caudal fins (U/A > 0.60) and a sharply demarcated white blotch at lower origin. The sharply demarcated white blotch at lower origin is often mottled with black spots in *I. paucus*, whereas this is not present in *L. nasus*. Both species have large caudal keels; however, *L. nasus* has a secondary keel below the extension of the primary keel, whereas *I. paucus* does not. The subterminal notch is larger in *I. paucus* (L/G = 0.29–0.41) than in *L. nasus* (L/G = 0.13–0.29). Terminal margin more falcate in *I. paucus* than *L nasus*.
Great white shark (*Carcharodon carcharias*) (*n* = 4) (p. 38)	Both *L. nasus and C. carcharias* have heterocercal caudal fins (U/A > 0.60) and a sharply demarcated white blotch at lower origin. Both species have large caudal keels; however, *L. nasus* has a secondary keel below the extension of the primary keel, whereas *C. carcharias* does not. There are often small, demarcated white blotches near the preventral margin of the caudal fins of *C. carcharias*, while the preventral margin of the caudal fin of *L. nasus* is solid in colour. The subterminal notch is larger in *C. carcharias* (L/G = 0.31–0.54) than in *L. nasus* (L/G = 0.13–0.29).
Shortfin mako (*Isurus oxyrinchus*) (*n* = 39) (p. 42)	Both *L. nasus and I. oxyrinchus* have heterocercal caudal fins (U/A > 0.60) and a sharply demarcated white blotch at lower origin. Both species have large caudal keels; however, *L. nasus* has a secondary keel below the extension of the primary keel, whereas *I. oxyrinchus* does not. The subterminal notch is smaller in *L. nasus* (S/P = 0.77–0.85) than in *I. oxyrinchus* (S/P = 0.82–1.18).

Carcharhinus falciformis (Müller and Henle, 1839)

(CARCHARHINIFORMES, CARCHARHINIDAE)

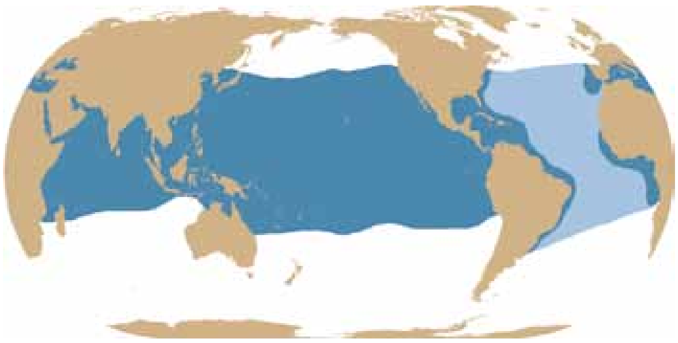
Silky shark

Requin soyeux

Tiburón jaquetón

Trade category name: wǔ yáng; 五 羊 (Clarke, 2006a;b)

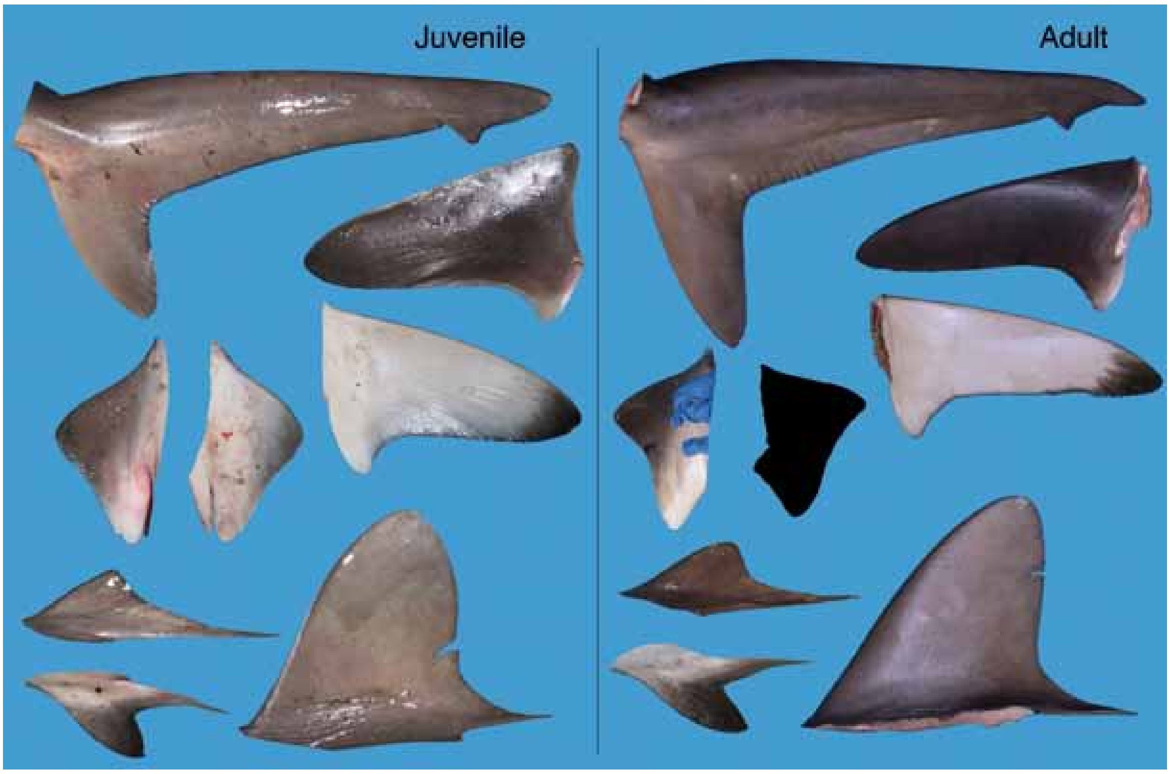
DISTRIBUTION



CONSERVATION STATUS

IUCN Red List	CITES	CMS
NT Near threatened ver 3.1	-	Appendix II Effective date 08/02/2015

FIN IDENTIFICATION CHARACTERISTICS



All fins	Skin colour dark grey-mauve-brown. Dull when dry with smooth texture and small denticles. All primary fins have a rigid structure when wet (i.e. are not "floppy").

Dorsal fin (n = 114)	Fin size (B = 49–289mm). Medium height (L/F = 0.58–0.75). Raked back (L/E = 0.68–0.84). Tip shape broadly pointed. Free rear tip long (A/B = 0.24–0.59). Posterior margin concave (Bh/I 0.10–0.35). Upper posterior margin typically convex (Dh/H = 0.01–0.17, Eh/H = 0.00–0.07). No tip colour. No distinct markings.
Total length estimate equation	Total length (cm) = 1.02 B (mm) + 26.54 (±17.99SE, r^2 = 0.937, *n* = 18)
Similar species:	
Blue shark (*Prionace glauca*) (*n* = 75) (p. 69)	The skin of *P. glauca* is a dark blue/black, whereas the skin of *C. falciformis* is dark purple-brown. When wet, *P. glauca* fins are much more "floppy" than *C. falciformis* dorsal fins, which are quite rigid.
Silvertip shark (*Carcharhinus albimarginatus*) (*n* = 45)	The dorsal fins of *C. albimarginatus* are similar in shape and colour to those of *C. falciformis*; however, *C. albimarginatus* has a distinct white tip on the dorsal fin.

Pectoral fins (n = 18)	Fin size medium (B = 30–195 mm, L = 24–550 mm). Straight. Fairly long (L/F = 1.45–1.99). Upright (j= 70–89°, L/K = 0.95–1.00). Tip shape broadly pointed. Free rear tip medium (A/B = 0.55–0.93), pointed. Posterior margin fairly concave (Bh/I = 0.10–0.15). Upper posterior margin convex (Dh/H = 0.04–0.11, Eh/H = 0.00–0.06). No obvious dorsal tip markings. Dorsal surface of free rear tip is diffuse white. Ventral fin colour stark white. Ventral tip colour is dusky (diffuse black) but dark, concentrated at the distal end and tapering, proximally, along the posterior margin.
Total length estimate equation	Total length (cm) = 0.44L + 42.26 (±11.64SE, r^2 = 0.97, *n* = 18)
Similar species:	
Spot-tail shark (*Carcharhinus sorrah*) (n = 37)	Fins of *C. falciformis* are generally larger (L ≈ 24–550 mm) compared with *C. sorrah* (L ≈ 24–223 mm). The skin colour of *C. sorrah* is generally lighter grey, compared with *C. falciformis*, which is darker grey/brown. Both species have a dusky black tip on the ventral side of the fin; however, in *C. sorrah* the tip colour appears concentrated around the fin apex, whereas in *C. falciformis* it appears to taper distally from the fin tip along the posterior margin.

Dusky shark (*Carcharhinus obscurus*) (*n* = 8) (p. 60)	Both fins have a dusky tip on the ventral side of the pectoral fin; however, the dusky patch is larger and more pronounced in *C. falciformis* compared with *C. obscurus*. The tip of the pectoral fin is more sharply pointed in *C. obscurus* compared with *C. falciformis*, which is broader.

Caudal fin (*n* = 78)	Fin size (A = 43–541 mm, U= 19–270 mm). Upper to lower ratio medium (U/A = 0.36–0.54, S/P = 0.42–0.61), heterocercal. Subterminal notch present, small (L/G = 0.22–0.56). Terminal margin present; size medium to small; falcate, sometimes with a rectangular notch; tip pointed (G/P = 0.23–0.33). Caudal lobe tip shape broadly pointed. Coloration uniformly dark grey-mauve-brown, faint, diffuse lighter patch near the lower origin. No tip coloration. No caudal keels.
Total length estimate equation	Total length (cm) = 0.79U(mm) + 21.46 (±10.64 SE, r^2 = 0.98, *n* = 12)

Similar species:

Dusky shark (*Carcharhinus obscurus*) (*n* = 9) (p. 60)	The caudal fins of *C. falciformis* and *C. obscurus* are very similar in shape. The caudal fins of *C. falciformis* have a slightly larger posterior upper to lower lobe ratio (S/P = 0.42–0.61) compared with *C. obscurus* (0.33–0.46). In smaller specimens, *C. obscurus* has a slight dusky margin on the lower caudal tip, whereas *C. falciformis* does not. In larger specimens of *C. obscurus* the posterior margin of the lower caudal lobe becomes more falcate, whereas the posterior margin of the lower caudal lobe of *C. falciformis* tends to be rounder, or more convex.
Sandbar shark (*Carcharhinus plumbeus*) (*n* = 12) (p. 63)	Denticles larger and skin much harder in *C. plumbeus* than *C. falciformis* (i.e. in fresh specimens, the skin of *C. falciformis* can be cut with a sharp knife, whereas the skin of *C. plumbeus* is extremely hard to cut). The skin colour of *C. plumbeus* is usually much lighter than that of *C. falciformis*. Terminal margin larger in *C. plumbeus* (G/P = 0.33–0.46) compared with *C. falciformis* (G/P = 0.23–0.33).
Blue shark (*Prionace glauca*) (*n* = 137) (p. 69)	The skin colour of the caudal fin of *P. glauca* is indigo blue to dark grey/black, while the skin colour of *C. falciformis* is dark purple-brown to dark grey. The terminal margin is much larger in *P. glauca* (G/P = 0.45–0.68) than in *C. falciformis* (G/P = 0.23–0.33).

Carcharhinus longimanus (Poey, 1861)

(CARCHARHINIFORMES, CARCHARHINIDAE)

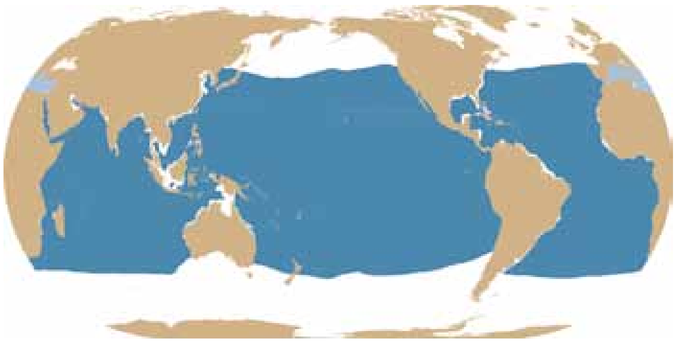
Oceanic whitetip shark

Requin océanique

Tiburón oceánico

Trade category name: liú qiú; 流 球 (Clarke, 2006a;b)

DISTRIBUTION



CONSERVATION STATUS

IUCN Red List	CITES	CMS
VU Vulnerable A2ad+3d+4ad ver 3.1	Appendix II Effective date 14/09/2014	-

FIN IDENTIFICATION CHARACTERISTICS

All fins	**Skin colour is dark brown-grey to olive. New-born and small juvenile specimens with mottled black tips on most fins (particularly the pelvic, second dorsal, anal and lower caudal fins). Black markings fade in adult specimens (> 130 cm TL) developing into mottled white tips on the first dorsal, pectoral, pelvic and caudal fins. Not shiny when dry. Skin has smooth texture.**

Dorsal fin (*n* = 30)	Fin size medium to large (B = 65–410 mm). Moderately tall (L/F = 0.68–0.99). Fin slightly upright (L/E = 0.68–0.83). Tip shape broadly rounded. Free rear tip medium length (A/B = 0.28–0.41). Posterior margin slightly concave (Bh/I = 0.08–0.20). Upper posterior margin moderate to deeply convex (Dh = 0.07–0.17, Eh/H = 0.00–0.03). Dorsal fins have white markings on the distal end that are demarcated and mottled. (Small specimens (B >150 mm) have mottled black fin tips, which fade as specimen size increases)
Total length estimate equation	Total length (cm) = 0.82B (mm) + 6.09 (±10.5 SE, r^2 = 0.96, *n* = 5)

Similar species: When skin is present, *C. longimanus* dorsal fins are very distinct and are not easily confused with other species; however, the following species also have white tipped dorsal fins:

Silvertip shark (*Carcharhinus albimarginatus*) (*n* = 45)	The dorsal fin tip of *C. albimarginatus* is pointed, whereas in *C. longimanus* the dorsal fin tip is broadly rounded. The border of the white tips of *C. albimarginatus* is sharply demarcated, whereas the border of the white tips of *C. longimanus* is mottled.
Grey reef shark (*Carcharhinus amblyrhynchos*) (*n* = 15)	The dorsal fin tip of *C. amblyrhynchos* is pointed, whereas in *C. longimanus* the dorsal fin tip is broadly rounded.
Whitetip reef shark (*Triaenodon obesus*) (*n* = 6)	The dorsal fin tip of *T. obesus* is bluntly pointed, whereas in *C. longimanus* the dorsal fin tip is broadly rounded.

Pectoral fins (*n* = 17)	Fin size large (B = 118–149 mm observed*, L = 389 = 459 mm observed). Straight. Fairly long (L/F = 1.72–1.99). Fairly upright (j°= 74–85°, L/K = 0.97–1.00). Tip shape broadly rounded. Free rear tip medium (A/B = 0.66–0.86), broadly pointed. Posterior margin slightly concave (Bh/I = 0.06–0.12). Upper posterior margin convex (Dh/H = 0.05–0.10, Eh/H = 0.00–0.00). Dorsal tip colour mottled white. Ventral side of the fin is yellow-white, usually with light, dusky mottled markings toward the proximal half of the fin, usually with a white patch in the middle of the fin close to the fin base. No ventral tip markings.
Total length estimate equation	Not enough specimens.

Similar species: When skin is present, *C. longimanus* pectoral fins are very distinct and are not easily confused with other species; however, the following species also have white tipped pectoral fins:

Silvertip shark (*Carcharhinus albimarginatus*) (*n* = 24)	The pectoral fin tip of *C. albimarginatus* is pointed, whereas in *C. longimanus* the pectoral fin tip is broadly rounded. The border of the white tips of *C. albimarginatus* is sharply demarcated, whereas the border of the white tips of *C. longimanus* is mottled.

Caudal fin (*n* = 31)	Fin size (A = 470–618*, U = 209–293 mm*). Upper to lower ratio medium (U/A = 0.39–0.53, S/P = 0.37–0.65), heterocercal. Subterminal notch present; small (L/G = 0.27–0.49). Terminal margin present; size moderate; falcate with deep, wedge-shaped notch; tip pointed but broad (G/P = 0.27–0.41). Lower caudal lobe tip shape broadly rounded. Demarcated, mottled, white tips on lower and upper caudal lobes, and along postventral margin. No caudal keels.
Total length estimate equation	Not enough specimens.

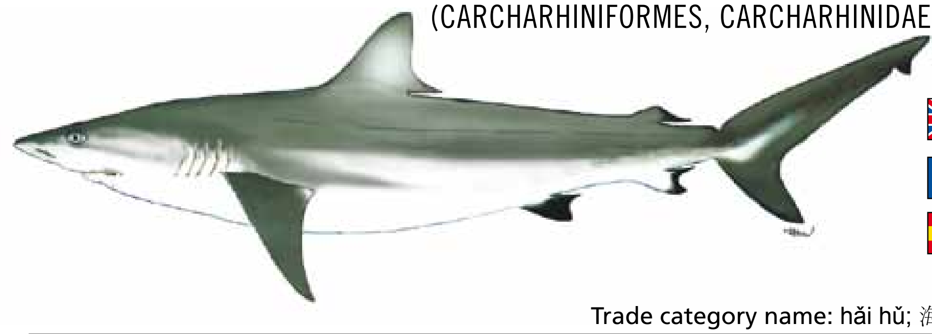
Similar species: When skin is present, *C. longimanus* caudal fins are very distinct and are not easily confused with other species; however, the following species also have white tipped caudal fins:

Silvertip shark (*Carcharhinus albimarginatus*) (*n* = 14)	The tip of the lower caudal lobe of *C. albimarginatus* is pointed, whereas in *C. longimanus* the tip of the lower caudal lobe is broadly rounded. The border of the white tips of *C. albimarginatus* is sharply demarcated, whereas the border of the white tips of *C. longimanus* is mottled.

* As there were not enough specimens to generate linear regression to estimate minimum and maximum fin size, the observed fin size for this species has been used.

Carcharhinus obscurus (Lesueur, 1818)

(CARCHARHINIFORMES, CARCHARHINIDAE)



Dusky shark

Requin de sable

Tiburon arenero

Trade category name: hăi hŭ; 海 虎 (Clarke, 2006a;b)

DISTRIBUTION

CONSERVATION STATUS

IUCN Red List	CITES	CMS
VU Vulnerable A2bd ver 3.1	–	-

FIN IDENTIFICATION CHARACTERISTICS

All fins	Dorsal surfaces bronzy grey to dark grey, pale ventrally. Small denticles. Skin generally shiny when dry.

Dorsal fin (*n* = 49)	Fin size moderately large (B = 75–293 mm). Moderately tall fin (L/F = 0.67–0.89). Moderately upright (L/E = 0.73–0.86). Tip shape pointed. Medium-sized free rear tip (A/B = 0.25–0.47). Posterior margin slightly concave (Bh/I = 0.09–0.35). Upper posterior margin straight to slightly convex (Dh/H = 0.00–0.18, Eh/H = 0.00–0.07). No distinct tip colour or markings.
Total length estimate equation	Total length (cm) = 1.23B(mm) – 8.26 (± 32.02 SE, r^2 = 0.91, *n* = 8)
Similar species:	
Sandbar shark (*Carcharhinus plumbeus*) (*n* = 20) (p. 63)	Denticles larger and skin much harder in *C. plumbeus* than *C. obscurus* (i.e. in fresh specimens, the skin of *C. obscurus* can be cut with a shark knife, whereas the skin of *C. plumbeus* is extremely hard to cut). Total fin height tends to be taller in *C. plumbeus* (L/F = 0.78–1.02) than in *C. obscurus* (L/F = 0.67–0.89).
Pigeye shark (*Carcharhinus amboinensis*) (*n* = 14)	The dorsal fins of *C. obscurus* are very similar in shape to that of *C. amboinensis*. Look for geographical information or associated pectoral fins (see pectoral fin comparison section for this species) when genetic testing is not available.
Great white shark (*Carcharodon carcharias*) (*n* = 7) (p. 38)	Free rear tip generally shorter in *C. carcharias* (A/B = 0.21–0.28) compared with *C. obscurus* (A/B = 0.25–0.47).

Pectoral fins (*n* = 8)	Fin size large (B = 71–201 mm, L = 139–638 mm). Straight. Long (L/F = 1.59–1.85). Upright (j° = 77–90°, L/K = 0.98–1.00). Tip shape sharply pointed. Free rear tip medium (A/B = 0.59 – 0.93), fairly pointed. Posterior margin convex, fairly deep (Bh/I = 0.11 – 0.17). Upper posterior margin straight (Dh/H = 0.00–0.15). No obvious dorsal markings; may be slightly dusky on smaller individuals. Ventral tip colour is dusky (diffuse black), concentrated at the distal end. Ventral fin colour white.
Total length estimate equation	Total length (cm) = 0.52L(mm) + 18.61 (± 37.21 SE, r^2 = 0.88, *n* = 6)
Similar species:	
Silky shark (*Carcharhinus falciformis*) (*n* = 18) (p. 54)	Both fins have a dusky tip on the ventral side of the pectoral fin; however, the dusky patch is larger and more pronounced in *C. falciformis* compared with *C. obscurus*; and tapers proximally along the posterior margin in *C. falciformis*, while being concentrated around the tip in *C. obscurus*. The tip of the pectoral fin is more sharply pointed in *C. obscurus* compared with *C. falciformis*, which is broader.

Bull shark (*Carcharhinus leucas*) (*n* = 19)	Both fins have a dusky tip on the ventral side of the pectoral fin; however, the dusky patch is larger, darker and more pronounced in *C. leucas* compared with *C. obscurus*. The pectoral fin is shorter in *C. leucas* (L/F = 1.36–1.60) compared with *C. obscurus* (1.59–1.85).
Pigeye shark (*Carcharhinus amboinensis*) (*n* = 14)	Both fins have a dusky tip on the ventral side of the pectoral fin; however, the dusky patch is larger, darker and more pronounced in *C. amboinensis* compared with *C. obscurus*. The pectoral fin is shorter in *C. amboinensis* (L/F = 1.46–1.60) compared with *C. obscurus* (1.59–1.85).
Grey reef shark (*Carcharhinus amblyrhynchos*) (*n* = 15)	Both fins have a dusky tip on the ventral side of the pectoral fin; however, the dusky patch is larger in *C. obscurus* (generally covers from one-quarter to one-third of the ventral fin surface) compared with *C. amblyrhynchos* (generally covers less than one-quarter of the ventral surface).

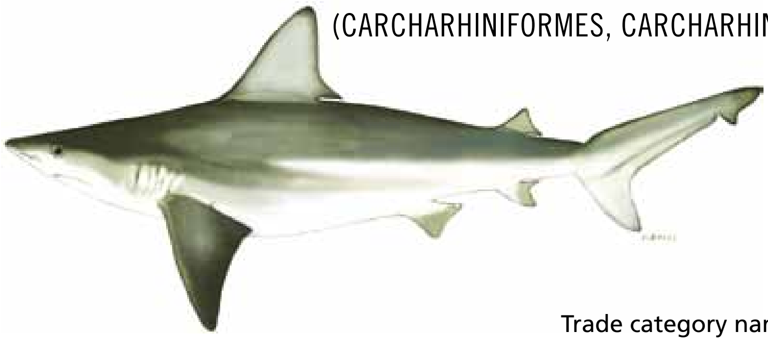
Caudal fin (*n* = 9)	Fin size (A = 227–817 mm, U = 64–127 mm). Upper to lower ratio medium (U/A = 0.41–0.50, S/P = 0.33–0.46), heterocercal. Subterminal notch present. Terminal margin size small (G/P = 0.20–0.31), concave. Lower caudal lobe tip shape sharply pointed, especially in larger individuals. Dusky margin on posterior margin of caudal fin, becoming thicker at the lower lobe tip, but not obvious (more pronounced in juveniles and less distinct in adults). No caudal keels.
Total length estimate equation	Total length (cm) = 0.79U(mm) + 22.95 (±39.15 SE, r^2 = 0.82, *n* = 7)

Similar species:

Bull shark (*Carcharhinus leucas*) (*n* = 10)	Base of the upper and lower caudal lobes tends to be thicker in *C. leucas* (D/A = 0.31–0.36, T/U = 0.61–0.71) than in *C. obscurus* (D/A = 0.29–0.34, T/U = 0.53–0.65). Terminal margin tends to be larger in *C. leucas* (G/P = 0.26–0.39) compared with *C. obscurus*(G/P = 0.20–0.31).
Pigeye shark (*Carcharhinus amboinensis*) (*n* = 7)	Base of the lower caudal lobe tends to be thicker in *C. amboinensis* (T/U = 0.61–0.68) than in *C. obscurus* (T/U = 0.53–0.65). Terminal margin tends to be larger in *C. amboinensis* (G/P = 0.26–0.33) compared with *C. obscurus* (G/P = 0.20–0.31).
Sandbar shark (*Carcharhinus plumbeus*) (*n* = 12) (p. 63)	Denticles larger and skin much harder in *C. plumbeus* than *C. obscurus* (i.e. in fresh specimens, the skin of *C. obscurus* can be cut with a shark knife, whereas the skin of *C. plumbeus* is extremely hard to cut). Terminal margin larger in *C. plumbeus* (G/P = 0.33–0.46) compared with *C. obscurus* (G/P = 0.20–0.31). Lower caudal lobe generally shorter (compared with upper lobe) in *C. plumbeus* (U/A = 0.38–0.47) compared with *C. obscurus* (U/A = 0.41–0.50). *C. plumbeus* does not have dusky.

Carcharhinus plumbeus (Nardo, 1827)

(CARCHARHINIFORMES, CARCHARHINIDAE)



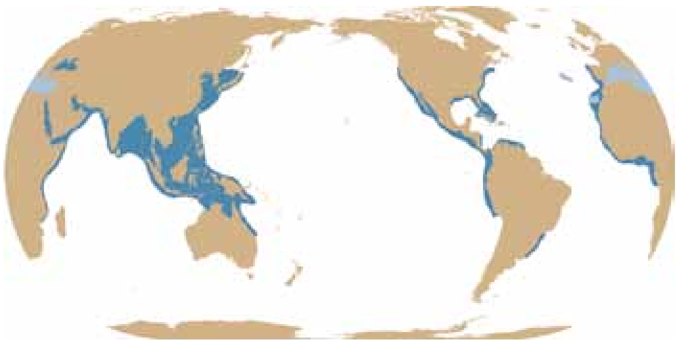
Sandbar shark

Requin gris

Tiburòn trozo

Trade category name: bái qìng; 白 青 (Clarke, 2006a;b)

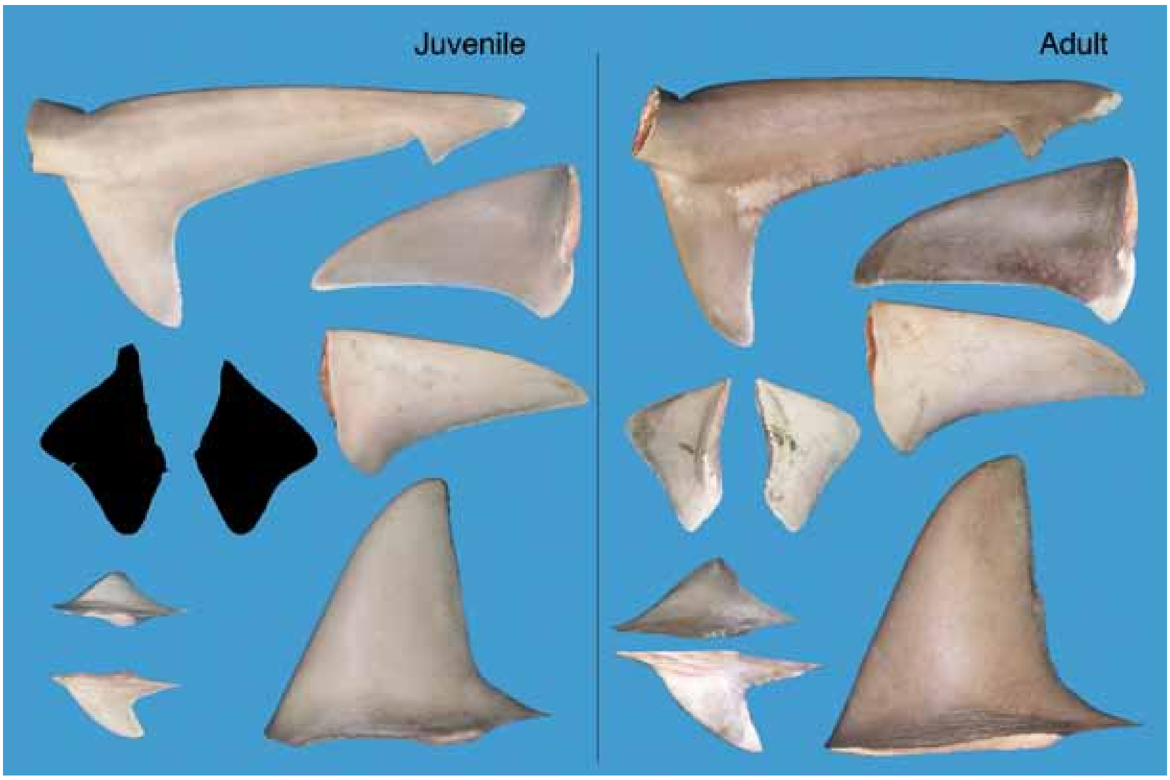
DISTRIBUTION



CONSERVATION STATUS

IUCN Red List	CITES	IUCN Red List
VU Vulnerable A2bd+4bd ver 3.1	–	–

FIN IDENTIFICATION CHARACTERISTICS



All fins	**Skin colour: dorsal surfaces pale bronze to pale greyish brown; ventral surfaces pale. Shiny when dry. Skin covered in large, very hard, denticles. This makes the skin feel smoother and harder compared with most other Carcharhinids. Skin noticeably tough (i.e. very hard to cut with a knife compared with most other species).**

Dorsal fin (*n* = 20)	Fin size quite large (B = 104–284 mm). Fin tall (L/F = 0.78–0.97). Upright (L/E = 0.77–0.91). Tip shape bluntly pointed. Free rear tip relatively short (A/B = 0.24–0.41). Posterior margin slightly concave (Bh/I = 0.09–0.20). Upper posterior margin straight (Dh/H = 0.00–0.07, Eh/H = 0.00–0.06). No dorsal tip colour. No distinct markings.
Total length estimate equation	Total length (cm) = 0.58B(mm) + 29.17 (± 21.59 SE, r^2 = 0.81, n = 4)

Similar species:

Scalloped hammerhead (*Sphyrna lewini*) (*n* = 20) (p. 72)	Denticles much larger and skin much harder in *C. plumbeus* than in *S. lewini*. Dry specimens with skin on will appear shiny for *C. plumbeus* (image on left), whereas *S. lewini* will look matt when dry (image on right).
Pigeye shark (*Carcharhinus amboinensis*) (*n* = 14)	Denticles much larger and skin much harder in *C. plumbeus* than in *C. amboinensis*. Total fin height tends to be taller in *C. plumbeus* (L/F = 0.78–0.97) than in *C. amboinensis* (L/F = 0.71–0.84). Fin tends to be more upright in *C. plumbeus* (L/E = 0.77–0.91) and more raked back in *C. amboinensis* (L/E = 0.65–0.82).
Blacktip shark (*Carcharhinus limbatus*) (*n* = 41)	Dorsal fin tip black in *C. limbatus* (especially smaller specimens B < 100 mm), whereas there is generally no tip colour for dorsal fins of *C. plumbeus* (some may have a slightly dusky margin at the tip but this is not obvious). Denticles much larger and skin much harder in *C. plumbeus* than in *C. limbatus*. Total fin height tends to be taller in *C. plumbeus* (L/F = 0.78–0.97) than in *C. limbatus* (L/F = 0.49–0.86). Fin tends to be more upright in C. plumbeus (L/E = 0.77–0.91) and more raked back in *C. limbatus* (L/E = 0.63–0.86). Posterior margin is deeper in *C. limbatus* (Bh/I = 0.16–0.34) compared with *C. plumbeus* (Bh/I = 0.09–0.20).

Photo: Lindsay J. Marshall, Jenny Giles

Dusky shark (*Carcharhinus obscurus*) (*n* = 49) (p. 60)	Denticles larger and skin much harder in *C. plumbeus* than in *C. obscurus* (i.e. in fresh specimens, the skin of *C. obscurus* can be cut with a sharp knife, whereas the skin of *C. plumbeus* is extremely hard to cut). Total fin height tends to be taller in *C. plumbeus* (L/F = 0.78–1.02) than in *C. obscurus* (L/F = 0.67–0.89).

Pectoral fins (*n* = 13)	Fin size (B = 40–168 mm, L = 102–476 mm). Straight, to slightly falcate. Long (L/F = 1.45–1.74). Upright (j = 74–88, L/K = 0.97–1.00). Tip shape sharply pointed. Free rear tip medium (A/B = 0.63–0.83), rounded. Posterior margin slightly convex (Bh/I = 0.06–0.12). Upper posterior margin straight (Dh/H = 0.00–0.04, Bh/H = 0.00–0.07). Generally no tip markings on the dorsal fin, but sometimes white-edged. Sometimes there is a demarcated white border on the dorsal surface of the free rear tip. Ventral fin colour white (no tip colour), sometimes very faintly dusky.
Total length estimate equation	Total length (cm) = 0.41L(mm) + 28.61 (± 21.95 SE, r^2 = 0.81, *n* = 5)

Similar species:

Shortfin mako (*Isurus oxyrinchus*) (*n* = 47) (p. 42)	Dorsal colour of *I. oxyrinchus* is much darker (black/blue). The fin tip is less sharply pointed than in *C. plumbeus*. The free rear tip is much longer in *C. plumbeus* (A/B = 0.63–0.83) compared with *I. oxyrinchus* (A/B = 0.41–0.69). The upper posterior margin is more convex in *I. oxyrinchus* (Dh/H = 0.04–0.16) compared with *C. plumbeus* (Dh/H = 0.00–0.04).

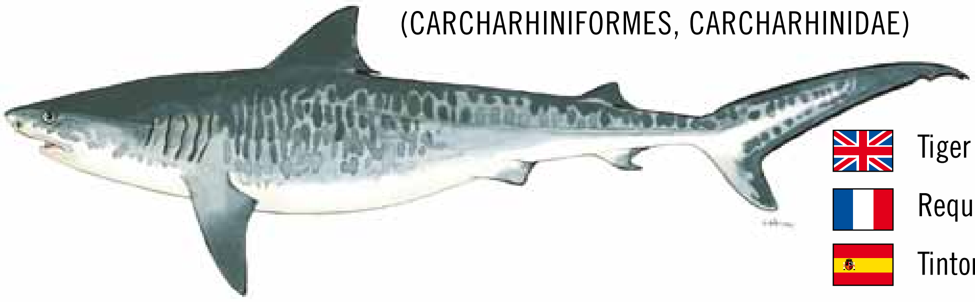
Caudal fin (n = 12)	Fin size (A = 157–606mm, U = 57–274mm). Upper to lower ratio (U/A = 0.38–0.47, S/P = 0.37–0.52), heterocercal. Subterminal notch present. Terminal margin size fairly large (G/P = 0.33–0.46). Lower caudal lobe tip shape broadly pointed. In most specimens, there is a small white blotch at the posterior tip. Often, the lower caudal lobe tip and the lower postventral margin have a faint white edge. No caudal keels.
Total length estimate equation	Total length (cm) = 0.74U(mm) + 21.71 (±17.34 SE, r^2 = 0.85, *n* = 8)

Similar species:

Dusky shark (*Carcharhinus obscurus*) (*n* = 9) (p. 60)	Denticles larger and skin much harder in *C. plumbeus* than in *C. obscurus* (i.e. in fresh specimens, the skin of *C. obscurus* can be cut with a sharp knife, whereas the skin of *C. plumbeus* is extremely hard to cut). Terminal margin larger in *C. plumbeus* (G/P = 0.33–0.46) compared with *C. obscurus* (G/P = 0.20–0.31). Lower caudal lobe generally shorter (compared with upper lobe) in *C. plumbeus* (U/A = 0.38–0.47) compared with *C. obscurus* (U/A = 0.41–0.50). *C. plumbeus* does not have dusky margins on the lower caudal fin.

Galeocerdo cuvier (Péron and Lesueur, 1822)

(CARCHARHINIFORMES, CARCHARHINIDAE)



Tiger shark

Requin tigre commun

Tintorera tigre

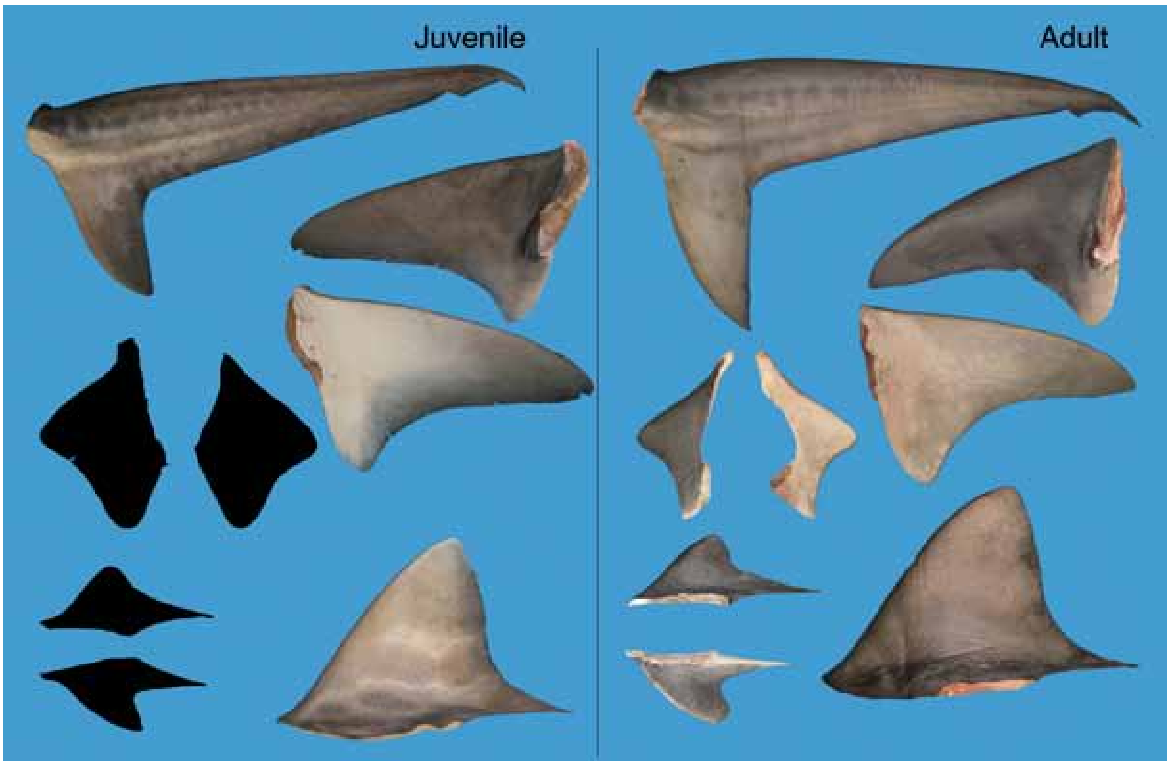
Trade category name: ruǎn shā; 軟 沙 (Clarke, 2006a;b)

DISTRIBUTION

CONSERVATION STATUS

IUCN Red List	CITES	CMS
NT Near Threatened ver 3.1	–	–

FIN IDENTIFICATION CHARACTERISTICS



All fins	**Skin colour light grey to light purple-grey. Dorsal surface grey with bold, dark reticulations in newly born young; reticulations becoming vertical bars in specimens up to 300 cm; bars faint or absent in larger adults. Ventral surfaces white. No striations on skin. Velvety appearance (never shiny when dry).**

Dorsal fin (*n* = 93)	Fin generally large, but the size varies significantly from small (juveniles) to large (adults) (B = 16–615 mm). Fin relatively short (L/F = 0.44–0.65). Moderately raked back (L/E = 0.58–0.82). Tip shape broadly pointed. Free rear tip very large (A/B = 0.39–0.85). Posterior margin slightly concave (Bh/I = 0.10–0.30). Upper posterior margin straight to slightly convex, showing a slight reverse sigmoid shape that is straight to slightly convex (dorsally) moving to slightly concave (ventrally) (Dh/H = 0.00–0.14, Eh/H = 0.00–0.25). No tip colour. Bold reticulations in smaller individuals B > 120 mm, which appear less distinct with increasing fin size.
Total length estimate equation	Total length (cm) = 0.92B (mm) + 34.97 (± 5.77 SE, r^2 = 0.996, *n* = 16)
Similar species:	
Bull shark (*Carcharhinus leucas)* (*n* = 22)	*G. cuvier* has a longer free rear tip (A/B = 0.39–0.85) than *C. leucas* (A/B = 0.19–0.40).

Pectoral fins (*n* = 40)	Fin size (B = 13–392mm, L = 47–836 mm). Falcate. Medium to short length (L/F = 1.22–1.60). Slightly raked back (j°= 68–89°, L/K = 0.94–1.00). Tip shape pointed, sharper in larger specimens. Free rear tip fairly long (A/B = 0.63–1.14), broadly pointed. Posterior margin deeply convex (Bh/I = 0.09–0.21). Upper posterior margin slightly convex, showing a slight reverse sigmoid shape that is slightly convex (distally) moving to slightly concave (proximally) (Dh/H = 0.02–0.10, Bh/H = 0.00–0.07). No dorsal tip markings. Dorsal surface of free rear tip is diffuse white to grey. Ventral fin colour white, sometimes with very light grey, demarcated, patches. Ventral tip colour is dusky but very light (diffuse grey), concentrated at the distal end and tapering, proximally, along the posterior margin.
Total length estimate equation	Total length (cm) = 0.69L (mm) + 18.24 (± 9.19 SE, r^2 = 0.99, n = 15)

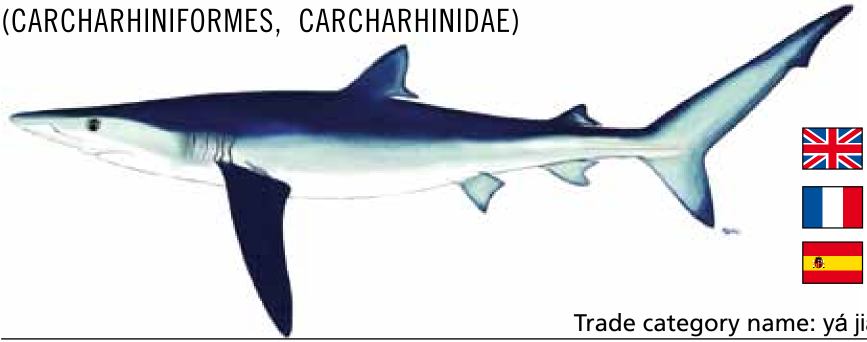
Similar species:	
Sicklefin lemon shark (*Negaprion acutidens*) (*n* = 7)	The dorsal skin colour of *G. cuvier* is usually light grey, whereas *N. acutidens* is usually yellowish brown. The upper posterior margin of *N. acutidens* is more concave (Eh/H = 0.06–0.10) than that of *G. cuvier* (Eh/H = 0.01–0.07).

Caudal fin (n = 62)	Fin size (A = 253–886 mm, U = 48–548 mm). Upper to lower ratio fairly large (U/A = 0.28–0.54, S/P = 0.20–0.48), heterocercal. Subterminal notch present, small (L/G = 0.16–0.49). Terminal margin present; very small; falcate; tip very sharply pointed (G/P = 0.10–0.31). Upper caudal lobe usually has an anterior–posterior line of spots (more evident in smaller specimens). Lower caudal lobe tip sharply pointed. No obvious tip colour. Caudal keels present, but small.
Total length estimate equation	Total length (cm) = 1.08U(mm) - 1.54 (±9.47 SE, r^2 = 0.98, *n* = 10)

Similar species:	
Scalloped hammerhead (*Sphyrna lewini*) (*n* = 7) (p. 72)	The ratio between the terminal margin and the upper postventral margin is larger in *S. lewini* (L/P = 0.10–0.13) compared with *G. cuvier* (L/P = 0.04–0.08). The subterminal notch is also somewhat smaller in *G. cuvier* (L/G = 0.16–0.49) compared with *S. lewini* (0.39–0.62). The upper caudal lobe of *G. cuvier* usually has an anterior–posterior line of spots (more evident in smaller specimens), whereas *S. lewini* does not. The lower caudal lobe of *S. lewini* has a small inky black mark (dusky in smaller specimens), whereas *G. cuvier* has no obvious lower caudal lobe tip markings.
Great hammerhead (*Sphyrna mokarran*) (*n* = 6) (p. 76)	The ratio between the terminal margin and the upper postventral margin is somewhat larger in *S. mokarran* (L/P = 0.07–0.09) compared with *G. cuvier* (L/P = 0.04–0.08). The subterminal notch is somewhat smaller in *G. cuvier* (L/G = 0.16–0.49) compared with *S. mokarran* (0.35–0.54). The upper caudal lobe of *G. cuvier* usually has an anterior–posterior line of spots (more evident in smaller specimens), whereas *S. mokarran* does not. The skin colour of *S. mokarran* is bronzy to dark greyish brown, while the skin colour of *G. cuvier* is usually light grey to light purple-grey.
Smooth hammerhead (*Sphyrna zygaena*) (*n* = 26) (p. 79)	The ratio between the terminal margin and the upper postventral margin is somewhat larger in *S. zygaena* (L/P = 0.07–0.09) compared with *G. cuvier* (L/P = 0.04–0.08). The upper caudal lobe of *G. cuvier* usually has an anterior–posterior line of spots (more evident in smaller specimens), whereas *S. zygaena* does not. The skin colour of *S. zygaena* is an olive to dark greyish brown, while the skin colour of *G. cuvier* is usually light grey to light purple-grey.

Prionace glauca (Linnaeus, 1758)

(CARCHARHINIFORMES, CARCHARHINIDAE)



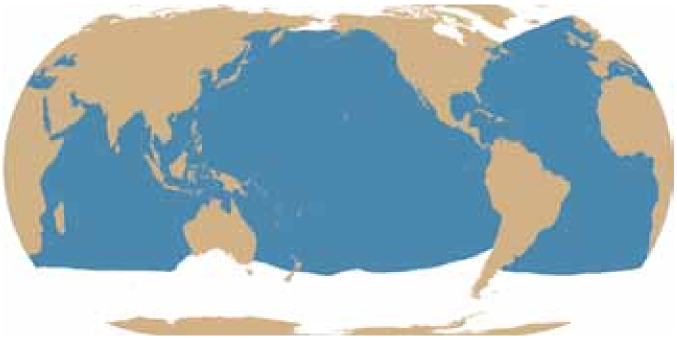
Blue shark

Peau bleue

Tiburón azul

Trade category name: yá jiăn; 牙 揀 (Clarke, 2006a;b)

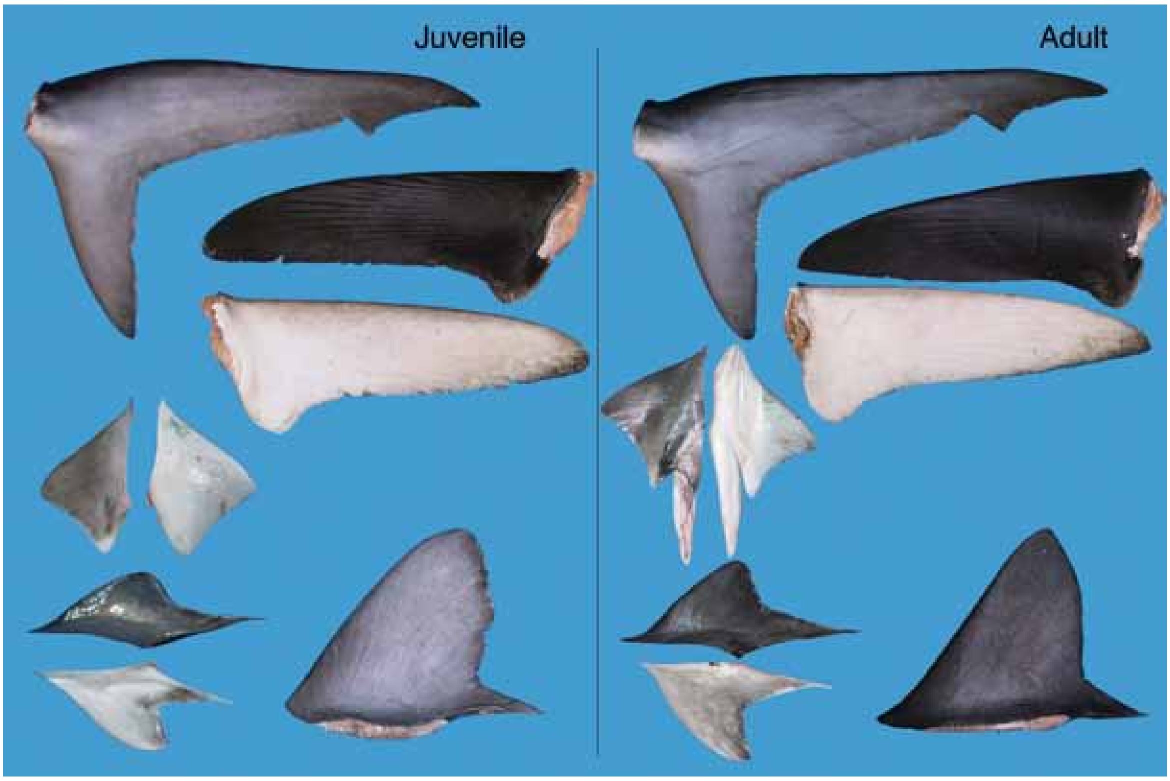
DISTRIBUTION



CONSERVATION STATUS

IUCN Red List	CITES	CMS
NT Near Threatened ver 3.1	–	–

FIN IDENTIFICATION CHARACTERISTICS



All fins	**Skin colour indigo blue when fresh, blue to dark grey/black otherwise. No obvious skin markings. No striations. Dull when dry (small denticles). Posterior margins of fins often with "ragged edges". When wet fins are quite pliable and "floppy", not rigid in structure.**

Dorsal fin (*n* = 75)	Fin size medium (B = 34–253mm). Medium height (L/F = 0.53–0.87). Raked back (L/E = 0.61–0.86). Tip shape broadly pointed. Free rear tip moderately long (A/B = 0.34–0.65). Posterior margin convex (Bh/I = 0.7–0.29). Upper posterior margin moderately convex (Dh/H = 0.05–0.18, Eh/H = 0.00–0.09). No tip markings. No distinct markings.
Total length estimate equation	Total length (cm) = 1.32B(mm) + 24.62 (± 20.76 SE, r^2 = 0.82, *n* = 15)
Similar species:	
Silky shark (*Carcharhinus falciformis*) (*n* = 115) (p. 54)	The skin of *P. glauca* is a dark blue/black, whereas the skin of *C. falciformis* is dark purple-brown. When wet, *P. glauca* fins are much more "floppy" than *C. falciformis* dorsal fins, which are quite rigid.

Pectoral fins (*n* = 28)	Fin size (B = 42–178mm, L = 22–852 mm). Straight. Long (L/F = 2.24–2.62). Upright (j°= 65–91°, L/K = 0.92–1.00). Tip shape is commonly rounded, however can be pointed in some larger specimens. Free rear tip moderately large (A/B = 0.62–0.94), rounded. Posterior margin generally concave but shallow (Bh/I = 0.04–0.09). Upper posterior margin quite variable but generally straight to very slightly convex (Dh/H = 0.00–0.08, 0.00–0.07). No obvious dorsal tip markings. The dorsal surface of the free rear tip is the same colour as the rest of the fin. Ventral colour pure white. Ventral tips often with dusky markings that are usually quite small, however can be more pronounced in some specimens. Ventral tip markings are usually concentrated around the fin tip, and taper along the posterior margin, distally.
Total length estimate equation	Total length (cm) = 0.31L(mm) + 85.12 (± 21.23 SE, r^2 = 0.74, *n* = 4)
Similar species:	
Longfin mako (*Isurus paucus*) (*n* = 7) (p. 46)	The pectorals of *P. glauca* and *I. paucus* are similar in that both are long (L/F > 2.00) and have dark blue-black dorsal skin colouring and stark white ventral colouring. The free rear tip in *P. glauca* (A/B = 0.62–0.94) is generally larger than *I. paucus* (A/B = 0.67–0.87). Moreover, the colour of the dorsal surface of the free rear tip of *P. glauca* is the same colour as the rest of the fin; however, in *I. paucus* the free rear tip is white and is starkly demarcated.

Porbeagle (*Lamna nasus*) (n = 2) (p. 50)	The pectorals of *L. nasus* and *P. glauca* are similar in that both have dark blue-black dorsal skin colouring and stark white ventral colouring with dusky grey ventral fin tips. The pectoral fins of *P. glauca* are much longer (L/F = 2.24–2.62) than those of *L. nasus* (L/F = 1.61–1.70). Moreover, the colour of the dorsal surface of the free rear tip of *P. glauca* is the same colour as the rest of the fin; however, in *L. nasus* the free rear tip is white and is starkly demarcated.
Bigeye thresher (*Alopias superciliosus*) (n = 35) (p. 35)	The pectorals of *P. glauca* and *A. superciliosus* are similar in that both are long (L/F > 2.00) and have dark dorsal skin colouring. The free rear tip in *P. glauca* (A/B = 0.62–0.94) is larger than in *A. superciliosus* (A/B = 0.39–0.60). Anteroposterior striations on the dorsal and ventral surface of the pectoral fin are present for *A. superciliosus*, and not present for *P. glauca*. On the ventral side of the fin *A. superciliosus* has extensive dusky markings on the anterior and posterior margins, whereas in *P. glauca* only the tip and first third of the distal posterior margin is dusky. Fin apex more broadly rounded for *P. glauca*.

Caudal fin (n = 137)	Fin size (A = 132–933 mm, U = 59–447 mm). Upper to lower ratio fairly large (U/A = 0.39–0.55, S/P = 0.55–0.85), heterocercal. Subterminal notch present, fairly small (L/G = 0.19–0.46) Terminal margin present; size large; falcate; tip sharply pointed (G/P = 0.45–0.68). Caudal lobe tip narrow and pointed. No obvious tip colour. No caudal keels.
Total length estimate equation	Total length (cm) = 0.69U(mm) + 39.01 (±24.10 SE, r^2 = 0.77, *n* = 14)

Similar species:

Silky shark (*Carcharhinus falciformis*) (n = 78) (p. 54)	The skin colour of the caudal fin of *P. glauca* is indigo blue to dark grey/black, while the skin colour of *C. falciformis* is dark purple-brown to dark grey. The terminal margin is much larger in *P. glauca* (G/P = 0.45–0.68) than in *C. falciformis* (G/P = 0.23–0.33).

Photo: Jorge Cervara Hauser

Sphyrna lewini (Griffith and Smith, 1834)

(CARCHARHINIFORMES, SPHYRNIDAE)

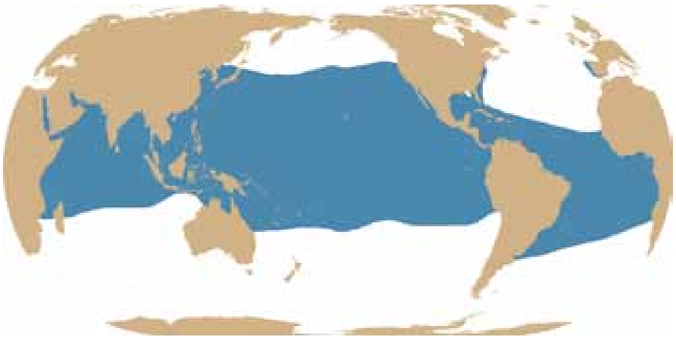
Scalloped hammerhead

Requin-marteau halicorne

Cornuda común

Trade category name: chūn chǐ; 春 翅 (Clarke, 2006a;b)

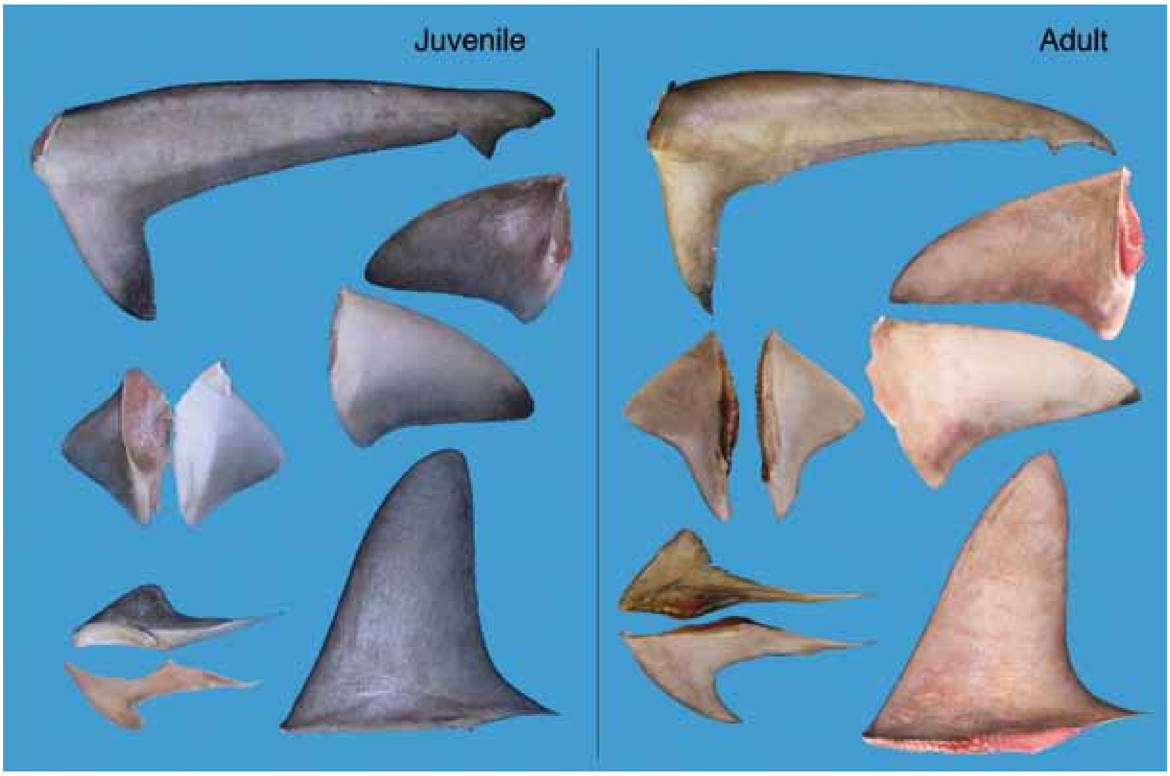
DISTRIBUTION



CONSERVATION STATUS

IUCN Red List	CITES	CMS
EN Endangered A2bd+4bd ver 3.1	Appendix II Effective date 14/09/2014	Appendix II 08/02/2015

FIN IDENTIFICATION CHARACTERISTICS



All fins	**Olive, bronze or brownish grey dorsally, pale ventrally. Dull when dry (small denticles).**

Dorsal fin (*n* = 20)	Fin size medium (B = 43–370 mm). Tall (L/F = 0.88–1.08). Upright fin (L/E = 0.77–089). Tip shape broadly pointed. Free rear tip fairly short (A/B = 0.25–0.40). Posterior margin concave (Bh/I = 0.11–0.25). Upper posterior margin shows a reverse sigmoid shape that is straight to slightly convex (dorsally) moving to slightly concave (ventrally) (Dh/H = 0.00–0.08, Eh/H = 0.01–0.09). No tip colour.
Total length estimate equation	Total length (cm) = 0.93B(mm) + 4.57 (± 5.22 SE, r^2 = 0.99, *n* = 13)

Similar species:

Smooth hammerhead (*Sphyrna zygaena*) (*n* = 41) (p. 79)	In *S. zygaena*, typically, the underside of free rear tip is stark white in contrast to dorsal skin (left image), compared with *S. lewini* where, typically, the underside of free rear tip is not as markedly different from dorsal side (right image). Overall skin colour more olive-brown in *S. zygaena*, and skin more grey in *S. lewini*.   Photos: Lindsay J. Marshall
Blacktip shark (*Carcharhinus limbatus*) (*n* = 42)	Dorsal fin tip black in *C. limbatus* (no tip colour in *S. lewini*); however, tip colour less noticeable in larger specimens of *C. limbatus* (B > 200 mm). Fin taller in *S. lewini* (L/F = 0.88–1.08) than *C. limbatus* (L/F = 0.41–0.86).
Sandbar shark (*Carcharhinus plumbeus*) (*n* = 20) (p. 63)	Denticles much larger and skin much harder in *C. plumbeus* than *S. lewini* (i.e. in fresh specimens, the skin of *S. lewini* can be cut with a sharp knife, whereas the skin of *C. plumbeus* is extremely hard to cut). *C. plumbeus* will appear very shiny when dry; however *S. lewini* will appear "velvety", or less shiny, due to smaller denticles on the skin.

Pectoral fins (*n* = 19)	Fin size small to medium (B = 27–168 mm, L = 45–438 mm). Straight. Short (L/F = 1.21–1.56). Upright (j°= 70–87°, L/K = 0.95–1.00). Tip shape broadly pointed. Free rear tip short-medium (A/B = 0.54–0.83), narrowly rounded. Posterior margin concave but shallow (Bh/I = 0.04–0.14). Upper posterior margin shows a reverse sigmoid shape which is straight to slightly convex (distally) moving to slightly concave (proximally) (Dh/H = 0.00–0.10, Eh/H = 0.00–0.07). Slightly dusky dorsal tip markings, but not obvious. Dorsal surface of free rear tip is diffuse white. Ventral fin colour white. Ventral tip colour is inky black (demarcated), concentrated at the tip (i.e. does not taper distally along posterior margin), covering a small area.
Total length estimate equation	Total length (cm) = 0.78L(mm) + 9.68 (± 4.34 SE, r^2 = 0.99, *n* = 14)

Similar species:

Smooth hammerhead (*Sphyrna zygaena*) (*n* = 40) (p. 79)	The ventral tip of the pectoral fin is lighter and more dusky in *S. zygaena*, compared with the inky black, demarcated tip of *S. lewini*. The ventral tip colour tapers distally along the posterior margin in *S. zygaena*, whereas in *S. lewini* it is concentrated around the fin tip. The pectoral fin of *S. zygaena* is slightly more raked back (j°= 70–80°) compared with *S. lewini* (j°= 70–87°).
Great hammerhead (*Sphyrna mokarran*) (*n* = 12) (p. 76)	The pectoral fins of *S. mokarran* (Bh/I = 0.11–0.18) are more falcate than those of *S. lewini* (Bh/I = 0.04–0.14), especially at the upper posterior margin (*S. mokarran* Eh/H = 0.02–0.11, *S. lewini* Eh/H = 0.00–0.07). The tip of the pectoral fin is much narrower and sharply pointed in *S. mokarran*.

Photo: Jorge Cervara Hauser

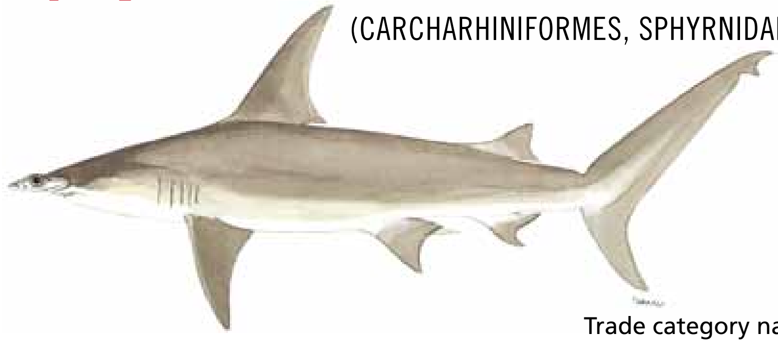
Caudal fin (*n* = 7)	Fin size (A = 131–1171 mm, U = 45–439 mm). Upper to lower ratio small (U/A = 0.33–0.39, S/P = 0.28–0.34), heterocercal. Subterminal notch present, moderately large (L/G = 0.39–0.62). Terminal margin present; small; falcate; broadly pointed in smaller specimens becoming sharply pointed in larger specimens (G/P = 0.21–0.24). Lower caudal lobe tip sharply pointed (more broadly pointed in smaller specimens). Small, inky, black mark on the lower lobe tip (this mark is larger and less demarcated in smaller individuals). No caudal keels.
Total length estimate equation	Total length (cm) = 0.77U(mm) + 10.14 (±3.88 SE, r^2 = 0.996, *n* = 7)

Similar species:

Great hammerhead (*Sphyrna mokarran*) (*n* = 6) (p. 76)	Both species have a black tip mark on the lower caudal lobe. The subterminal margin to upper postventral margin ratio is larger in *S. lewini* (L/P = 0.10–0.13) compared with *S. mokarran* (L/P = 0.07–0.09). The upper to lower caudal ratio is somewhat larger in *S. mokarran* (U/A = 0.36–0.46) than in *S. lewini* (U/A = 0.33–0.39). The upper to lower postventral margin ratio is somewhat larger in *S. mokarran* (S/P = 0.31–0.41) than in *S. lewini* (S/P = 0.28–0.34).
Smooth hammerhead (*Sphyrna zygaena*) (*n* = 26) (p. 79)	The tip of the lower lobe of *S. lewini* has a small inky black mark, whereas the tip of the lower caudal lobe does not have any obvious markings in *S. zygaena*. The upper to lower caudal ratio is larger in *S. zygaena* (U/A = 0.39–0.50) than in *S. lewini* (U/A = 0.33–0.39). The upper to lower postventral margin ratio is larger in *S. zygaena* (S/P = 0.39–0.53) than in *S. lewini* (S/P = 0.28–0.34). The subterminal margin to upper postventral margin ratio is larger in *S. lewini* (L/P = 0.10–0.13) compared with *S. zygaena* (L/P = 0.07–0.09).
Tiger shark (*Galeocerdo cuvier*) (*n* = 62) (p. 66)	The ratio between the terminal margin and the upper postventral margin is larger in *S. lewini* (L/P = 0.10–0.13) compared with *G. cuvier* (L/P = 0.04–0.08). The subterminal notch is also somewhat smaller in *G. cuvier* (L/G = 0.16–0.49) compared with *S. lewini* (0.39–0.62). The upper caudal lobe of *G. cuvier* usually has an anterior–posterior line of spots (more evident in smaller specimens), whereas *S. lewini* does not. The lower caudal lobe of *S. lewini* has a small inky black mark (dusky in smaller specimens), whereas *G. cuvier* has no obvious lower caudal lobe tip markings.

Sphyrna mokarran (Rüppell, 1837)

(CARCHARHINIFORMES, SPHYRNIDAE)



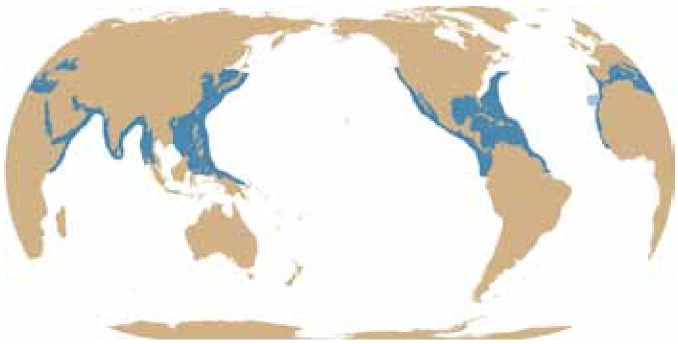
Great hammerhead

Grand requin marteau

Cornuda gigante

Trade category name: gú piàn; 骨 片 (Clarke, 2006a;b)

DISTRIBUTION



CONSERVATION STATUS

IUCN Red List	CITES	CMS
EN Endangered A2bd+4bd ver 3.1	Appendix II Effective date 14/09/2014	Appendix II Effective date 08/02/2015

FIN IDENTIFICATION CHARACTERISTICS

All fins	Bronzy to greyish brown dorsally, pale ventrally. No striations. Dull when dry (small denticles). Fins quite rigid in structure when wet, i.e. not pliable or “floppy”.

Dorsal fin (*n* = 13)	Fin size large (B = 75–567 mm). Extremely tall fin (one of the tallest L/F ratios) (L/F = 1.14–1.31). Somewhat raked back, more so in smaller specimens (L/E = 0.74–0.86). Tip shape pointed, more sharply pointed in larger specimens. Free rear tip short (A/B = 0.18–0.39). Posterior margin concave (Bh/I = 0.13–0.25). Upper posterior margin concave (Dh/H = 0.00–0.02, Eh/H = 0.01–0.09). No tip colour. Slightly darker along the anterior and posterior margins in smaller specimens (B < 250 mm).
Total length estimate equation	Total length (cm) = 0.83B(mm) + 30.57 (± 21.92 SE, r^2 = 0.76, *n* = 9)
Similar species:	
Winghead shark (*Eusphyra blochii*) (*n* = 2)	The dorsal fins of *E. blochii* and *S. mokarran* look very similar in shape and colour. The skin on the dorsal fins of *E. blochii* tends to be lighter grey than that of *S. mokarran*, and the anterior margin of the fin is usually slightly darker (more contrasting) in *E. blochii*; however, this can be hard to discern if the fins are dried or stained.

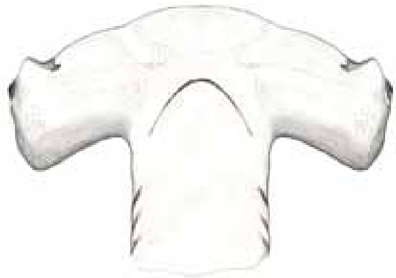
Pectoral fins (*n* = 12)	Fin size (B = 23–401 mm, L = 80–850 mm). Falcate. Moderately short (L/F = 1.38–1.53). Slightly raked back (j° = 76–86° , L/K = 0.98–1.00). Tip shape sharply pointed and narrow. Free rear tip short (A/B = 0.49–0.84), rounded but narrow. Posterior margin concave (Bh/I = 0.11–0.18). Upper posterior margin concave (Dh/H = 0.00–0.04, Eh/H = 0.02–0.11). Some specimens with a dusky dorsal tip marking, concentrated around the tip. Ventral colour white to creamy white. Ventral tip with dark markings with dusky edge, concentrated around the fin tip (i.e. not tapering distally along the posterior margin).
Total length estimate equation	Total length (cm) = 0.54L(mm) + 44.89 (± 17.73 SE, r^2 = 0.78, *n* = 8)
Similar species:	
Smooth hammerhead (*Sphyrna zygaena*) (*n* = 40) (p. 79)	The ventral tip of the pectoral fin is lighter and more dusky in *S. zygaena* compared with the dark black tip of *S. mokarran*. The ventral tip colour tapers distally along the posterior margin in *S. zygaena*, whereas in *S. mokarran* it is concentrated around the fin tip. The pectoral fin of *S. mokarran* (Bh/I = 0.11–0.18, Dh/H = 0.00–0.04, Eh/H = 0.02–0.11) is much more falcate than that of *S. zygaena* (Bh/I = 0.08–0.13, Dh/H = 0.03–0.09, Eh/H = 0.00–0.04). The pectoral fin is less raked back in *S. mokarran* (j°= 76–86°) than in *S. zygaena* (j°= 69–79°).

Scalloped hammerhead (*Sphyrna lewini*) (*n* = 19) (p. 72)	The pectoral fins of *S. mokarran* (Bh/I = 0.11–0.18) are more falcate than those of *S. lewini* (Bh/I = 0.04–0.14), especially at the upper posterior margin (*S. mokarran* Eh/H = 0.02–0.11, *S. lewini* Eh/H = 0.00–0.07). The tip of the pectoral fin is much narrower and sharply pointed in *S. mokarran*.

Caudal fin (*n* = 6)	Fin size (A = 314 –1368 mm, U = 64–756 mm). Upper to lower ratio small (U/A = 0.36–0.46, S/P = 0.31–0.41), heterocercal. Subterminal notch present, moderate (L/G = 0.35–0.54). Terminal margin present; very small; falcate; tip sharply pointed (G/P = 0.16–0.23). Lower caudal lobe tip sharply pointed (more broadly pointed in smaller specimens). Dusky black mark on the lower lobe tip. No caudal keels.
Total length estimate equation	Total length (cm) = 0.69U(mm) + 32.49 (±14.94 SE, r^2 = 0.89, *n* = 6)

Similar species:

Smooth hammerhead (*Sphyrna zygaena*) (*n* = 26) (p. 79)	The tip of the lower lobe of *S. mokarran* has a small dusky black mark, whereas the tip of the lower caudal lobe does not have any obvious markings in *S. zygaena*.
Scalloped hammerhead (*Sphyrna lewini*) (*n* = 7) (p. 72)	Both species have a black tip mark on the lower caudal lobe. The subterminal margin to upper postventral margin ratio is larger in *S. lewini* (L/P = 0.10–0.13) compared with *S. mokarran* (L/P = 0.07–0.09). The upper to lower caudal ratio is somewhat larger in *S. mokarran* (U/A = 0.36–0.46) than in *S. lewini* (U/A = 0.33–0.39). The upper to lower postventral margin ratio is somewhat larger in *S. mokarran* (S/P = 0.31–0.41) than in *S. lewini* (S/P = 0.28–0.34).
Tiger shark (*Galeocerdo cuvier*) (*n* = 62) (p. 66)	The ratio between the terminal margin and the upper postventral margin is somewhat larger in *S. mokarran* (L/P = 0.07–0.09) compared with *G. cuvier* (L/P = 0.04–0.08). The subterminal notch is somewhat smaller in *G. cuvier* (L/G = 0.16–0.49) compared with *S. mokarran* (0.35–0.54). The upper caudal lobe of *G. cuvier* usually has an anterior–posterior line of spots (more evident in smaller specimens), whereas *S. mokarran* does not. The skin colour of *S. mokarran* is bronzy to dark greyish brown, while the skin colour of *G. cuvier* is usually light grey to light purple-grey.



Sphyrna zygaena (Linnaeus, 1758)

(CARCHARHINIFORMES, SPHYRNIDAE)

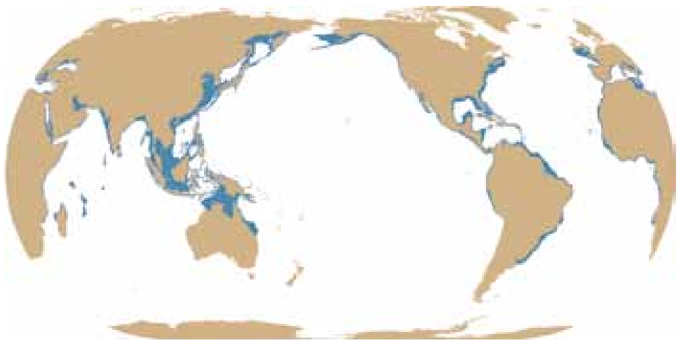
Smooth hammerhead

Requin-marteau commun

Cornuda cruz(=Pez martillo)

Trade category name: chūn chǐ; 春 翅 (Clarke, 2006a;b)

DISTRIBUTION



CONSERVATION STATUS

IUCN Red List	CITES	CMS
VU Vulnerable A2bd+3bd+4bd ver 3.1	Appendix II Effective date 14/09/2014	–

FIN IDENTIFICATION CHARACTERISTICS

Note: mottled white colour on juvenile caudal, pelvic and anal fins is due to degraded condition of the specimen and is not indicative of skin patterns for *S. zygaena*.

All fins	Olive to dark greyish brown dorsally, creamy white ventrally. No striations. Dull, "velvety" when dry (small denticles).

Dorsal fin (*n* = 41)	Fin size medium to large (B = 96–277 mm). Tall (L/F = 0.94–1.13). Upright (L/E = 0.78–0.88). Tip shape broadly pointed. Free rear tip very short (A/B = 0.15–0.34). Posterior margin concave (Bh/I = 0.10–0.25). Upper posterior margin shows a reverse sigmoid shape that is straight to slightly convex (dorsally) moving to slightly concave (ventrally) (Dh/H = 0.01–0.07, Eh/H 0.00–0.12). No tip markings. Ventral edge (underside) of free rear tip stark white compared with the dorsal fin colour (see image).  Photo: Lindsay J. Marshall
Total length estimate equation	Total length (cm) = 1.14 B (mm) – 4.47 (± 55.27 SE, r^2 = 0.69, *n* = 5)

Similar species:

Scalloped hammerhead (*Sphyrna lewini*) (*n* = 20) (p. 72)	In *S. zygaena*, typically, the underside of free rear tip is stark white in contrast to dorsal skin (left image), compared with *S. lewini* where, typically, the underside of free rear tip is not as markedly different from dorsal side (right image). Overall skin colour more olive-brown in *S. zygaena*, and skin more grey in *S. lewini*.   Photos: Lindsay J. Marshall
Blacktip shark (*Carcharhinus limbatus*) (*n* = 42)	Dorsal fin tip black in *C. limbatus* (no tip colour in *S. zygaena*); however, tip colour less noticeable in larger specimens of *C. limbatus* (B > 200 mm). Fin taller in *S. zygaena* (L/F = 0.94–1.13) than *C. limbatus* (L/F = 0.41–0.86).
Sandbar shark (*Carcharhinus plumbeus*) (*n* = 20) (p. 63)	Denticles much larger and skin much harder in *C. plumbeus* than *S. zygaena*. (i.e. in fresh specimens, the skin of *S. zygaena* can be cut with a sharp knife, whereas the skin of *C. plumbeus* is extremely hard to cut). *C. plumbeus* will appear very shiny when dry; however, *S. zygaena* will appear "velvety", or less shiny, due to smaller denticles on the skin.

Pectoral fins (*n* = 40)	Fin size (B = 51–157 mm, L = 93–371 mm). Slightly falcate. Moderately short (L/F = 1.29–1.63). Raked back (j°= 69–80°), L/K = 0.98-1.00. Tip shape broadly pointed. Free rear tip short (A/B = 0.34–0.61), rounded but narrow. Posterior margin concave (Bh/I = 0.08–0.13). Upper posterior margin convex (Dh/H = 0.03–0.09, Eh/H = 0.00–0.04). No obvious dorsal tip markings. Ventral fin colour creamy white. Dusky grey ventral tip markings, tapering distally from the tip along 1/3 of the posterior margin.
Total length estimate equation	Total length (cm) = 0.74L + 35.8 (± 55.42 SE, r^2 = 0.68, *n* = 5)

Similar species:

Great hammerhead (*Sphyrna mokarran*) (*n* = 12) (p. 76)	The ventral tip of the pectoral fin is lighter and more dusky in *S. zygaena* compared with the dark black tip of *S. mokarran*. The ventral tip colour tapers distally along the posterior margin in *S. zygaena*, whereas in *S. mokarran* it is concentrated around the fin tip. The pectoral fin of *S. mokarran* (Bh/I = 0.11–0.18, Dh/H = 0.00–0.04, Eh/H = 0.02–0.11) is much more falcate than that of *S. zygaena* (Bh/I = 0.08–0.13, Dh/H = 0.03–0.09, Eh/H = 0.00–0.04). The pectoral fin is less raked back in *S. mokarran* (j°= 76–86°) than in *S. zygaena* (j°= 69–79°)
Scalloped hammerhead (*Sphyrna lewini*) (*n* = 19) (p. 72)	The ventral tip of the pectoral fin is lighter and more dusky in *S. zygaena*, compared with the inky black, demarcated tip of *S. lewini*. The ventral tip colour tapers distally along the posterior margin in *S. zygaena*, whereas in *S. lewini* it is concentrated around the fin tip. The pectoral fin of *S. zygaena* is slightly more raked back (j°= 70–80°) compared with *S. lewini* (j°= 70–87°).

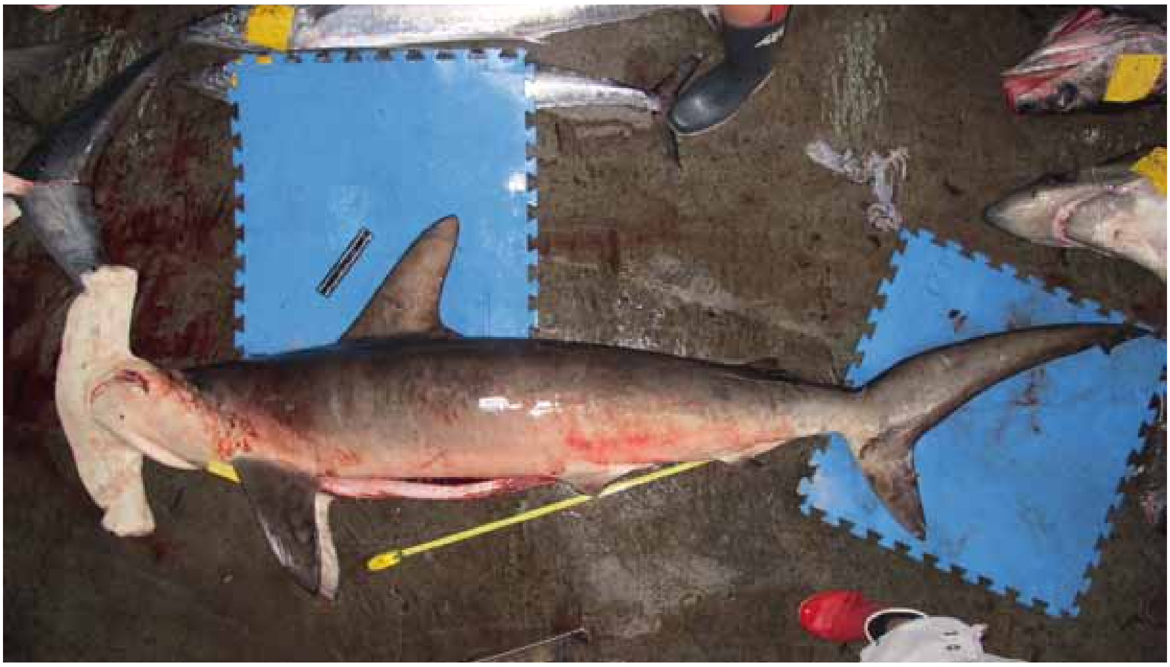


Photo: Lindsay J. Marshall

Caudal fin (*n* = 26)	Fin size (A = 216–799 mm, U = 67–361 mm). Upper to lower ratio moderate (U/A = 0.39–0.50, S/P = 0.39–0.53), heterocercal. Subterminal notch present, small (L/G = 0.30–0.45). Terminal margin present; small; falcate; tip sharply pointed (G/P = 0.18–0.26). Lower caudal lobe tip sharply pointed (more broadly pointed in smaller specimens). Lower lobe tip slightly dusky but not obvious. Slightly lighter colouring near the lower origin and preventral margin. Caudal fin shows sparse light grey mottling/blotches, especially in lighter areas. No caudal keels.
Total length estimate equation	Total length (cm) = 0.55U(mm) + 107.93 (±59.43 SE, r^2 = 0.53, *n* = 4)

Similar species:

Great hammerhead (*Sphyrna mokarran*) (*n* = 6) (p. 76)	The tip of the lower lobe of *S. mokarran* has a small dusky black mark, whereas the tip of the lower caudal lobe does not have any obvious markings in *S. zygaena*.
Scalloped hammerhead (*Sphyrna lewini*) (*n* = 7) (p. 72)	The tip of the lower lobe of *S. lewini* has a small inky black mark, whereas the tip of the lower caudal lobe does not have any obvious markings in *S. zygaena*. The upper to lower caudal ratio is larger in *S. zygaena* (U/A = 0.39–0.50) than in *S. lewini* (U/A = 0.33–0.39). The upper to lower postventral margin ratio is larger in *S. zygaena* (S/P = 0.39–0.53) than *S. lewini* (S/P = 0.28–0.34). The subterminal margin to upper postventral margin ratio is larger in *S. lewini* (L/P = 0.10–0.13) compared with *S. zygaena* (L/P = 0.07–0.09).
Tiger shark (*Galeocerdo cuvier*) (*n* = 62) (p. 66)	The ratio between the terminal margin and the upper postventral margin is somewhat larger in *S. zygaena* (L/P = 0.07–0.09) compared with *G. cuvier* (L/P = 0.04–0.08). The upper caudal lobe of *G. cuvier* usually has an anterior–posterior line of spots (more evident in smaller specimens), whereas *S. zygaena* does not. The skin colour of *S. zygaena* is an olive to dark greyish brown, while the skin colour of *G. cuvier* is usually light grey to light purple-grey.

PRACTICAL PROTOCOL TO THE IDENTIFICATION OF FINS

The identification of a shark fin will depend on the particular questions of the investigator and the availability of extra data associated with the fin (such data might be: geographical origin of the fin; date of capture and landing; vessel; gear; etc.). If prosecution is part of your aim, be aware of any chain of custody procedure that you will need to adhere to for your evidence to be admissible in a court of law.

Examples of questions/aims:

- I would like to to identify the species to which the fin belongs;
- I would like to identify regulated/protected species only;
- I would like to quantify the catch composition. For example, the user wishes to estimate the original size of individuals and the species composition from a particular vessel or fishery, represented by the fins seized.

Guidelines for the identification of one shark fin

- Scenario: the investigator has one single fin and would like to know the shark species to which it belongs. No associated data are available.

STEP	INSTRUCTION	GUIDE SECTION	PAGE
1.	Identify the type of fin (dorsal, pectoral, caudal, etc.)	Key to identification of fin types.	14
2.	Take a photograph (photographs) of the fin.	How to take standard photographs of shark fins.	91
3.	Have a preliminary look at pictures and description of the characteristics of the different species. Make a hypothesis on the species identification and consider the other information available, e.g. status of conservation, geographic region.	Fact sheets.	27
4.	Use iSharkfin software to cross-reference the identification. Follow the link http://www.fao.org/fishery/ipoa-sharks/iSharkFin/en to install the software and refer to the manual for its use.	iSharkfin manual.	111

Photo: Jorge Cervera Hauser

- If some doubts remain and/or a further verification of the identification is needed, continue with steps 5, 6 and 7.

5.	Take the measurements of the fins on the photographs. This can be done using a software for image and analysis processing (examples: ImageJ [Rasband, 2015], tpsDIG2 [Rohlf, 2015]), Adobe Photoshop [Adobe System Software, 2015]).	Shark fins measurements.	16
6.	Compare the set of measurements obtained at step 5 with the measurements described for that species and fin type.	Fact Sheets.	27
7.	If genetic proof of the identification is required, take a genetic sample. (Particularly important for cases involving prosecution and protected species).	How to take tissue sampling for genetic analysis.	100

- If information on the original size and biomass of the individual is required

8.	Once the fin is identified to species, use the total length estimate equation (specific for that species and fin type) to estimate the size of the shark from the base length of the fin. Then, from the length/weight relationship of the species available in the bibliography of this manual, estimate the weight of the individual. Consult the literature for size at maturity information (e.g. Last and Stevens, 2009).	Fact Sheets.	27

Photo:
©FAO/Monica Barone

Guidelines for the identification of a bag of fins from a known fishing trip

Scenario: the investigator is presented with a bag of fins from a known source (from a boat, a single fishing trip, etc.). In this case, we can be confident that the fins have been removed from a set of whole sharks (i.e. the number of first dorsals, left [or right] pectorals and caudal fins should be roughly similar, and one can assume they can match as a set to whole animals). In this scenario, a lot of extra information that is relevant for fisheries management can be obtained. Note: this scenario does not apply to bags of fins that are confiscated from further along in the trade supply chain, i.e. there the fins may have been sorted and graded and would not represent the composition of a given fishing trip. Fins such as these should be considered 'single fins' for identification purposes (see section " Guidelines for the identification of one shark fin" p. 95).

STEP	INSTRUCTION	GUIDE SECTION	PAGE
1.	Record as much associated data as possible (i.e. date, vessel name, vessel type, fishing gear, location of vessel, location where fishing occurred, date when fishing occurred, name of investigator).	Data Sheet 1	88
2.	Identify the type of fins. Separate manually into piles of fin types (i.e. first dorsals, left pectorals, right pectorals, lower caudals and whole caudals, secondary fins [second dorsals, anal fins, pelvic fins]).	Key to identification of fin types	14
3.	Within each pile (e.g. first dorsals), sort further into groups of visually similar fins (e.g. Visually Similar Group 1 [VSG1]). See if the number of fins within each VSG for dorsal fins corresponds to the number of of fins within each VSG for left pectoral fins, then right pectorals, caudals, and so on. This will indicate if the fins can be matched to a whole animal and will facilitate identification of the fins.	Data Sheet 2	89
4.	Identify each fin to species	Guidelines for the identification of one shark fin	85
5.	Once each fin is identified to species, use the total length estimate equation (specific for that species and fin type) to estimate the size of the shark from the base length of the fin. If you suspect that your catch includes the whole fin set for each animal (i.e. a dorsal, two pectorals and a caudal fin), you will only need to do this for one fin type (e.g. first dorsal fins, or left pectoral fins only). This will avoid overestimating the number of individuals in the catch.	Fact sheets	27

DATA SHEET 1

Date:	Investigator Name:		
Batch Identifier (e.g. Batch001)			
Vessel Name:			
Vessel Type:			
Vessel Nationality:			
Location of Vessel:			
Location of fishing:			
Days At Sea:			
Port of arrival:			
Gear type:	Longline	Gill Net	Trawl
	Handline	Other:	
Gear Specifications:	e.g. longline length, number of hooks etc.		
Total Shark fin Located:	e.g. kg		
Pictures of Vessel and fins?			
Location of Fins for investigation:			

Other information:

DATA SHEET 2

Date:	Investigator Name:

Specimen Number/ Label Number	Fin Type	Unconfirmed ID	Batch Identifier	Genetic Sample Taken?	Vial number

How to take standard photographs of shark fins

What you need:

- A camera, smartphone or tablet.
- Background, possibly light blue (e.g. a yoga carpet or a plastic blue sheet, opaque to avoid the reflections).
- A rolling ruler (tape measure) to take length measurements.
- A ruler to be included in the photo as scale reference.
- Labels to include the code of the specimens in the photograph (species, place captured [GPS location or description], sex, total length, date).

1) If you have a whole shark

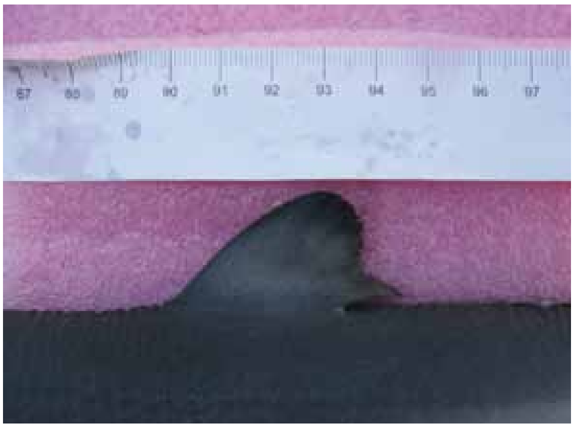
EXAMPLE IN LABORATORY

1) Photograph of the whole animal with the code label and the ruler on it.

2) Photograph of the ventral side (head and pectoral fins included).

Photo: Jorge Cervera Hauser

3) Photograph of the first dorsal fin.

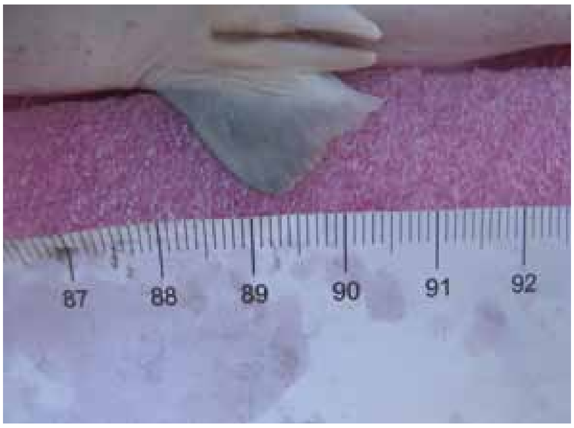


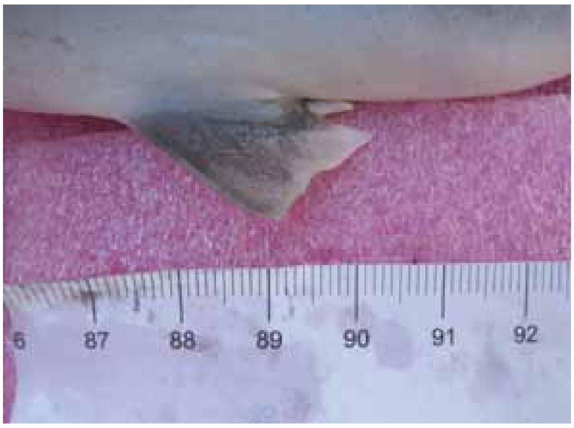
4) Photograph of the second dorsal fin.

5) and 6) Photographs of both sides of the pectoral fin.

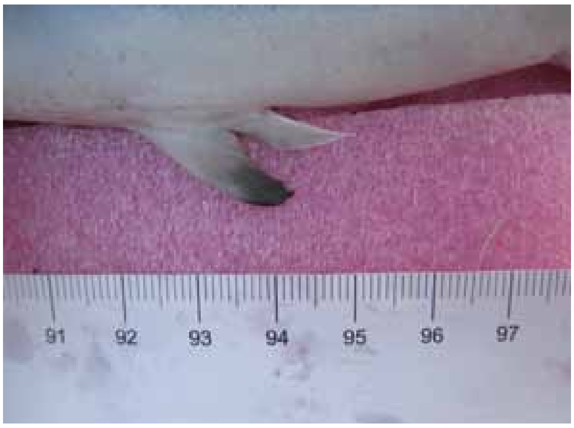
7) Photograph of the caudal fin.

8) and 9) Photographs of both (dorsal and ventral) sides of the pelvic fin.





10) Photograph of the anal fin.



Photos:
Monica Barone

EXAMPLE AT THE LANDING SITE

1) Photograph of the specimen.

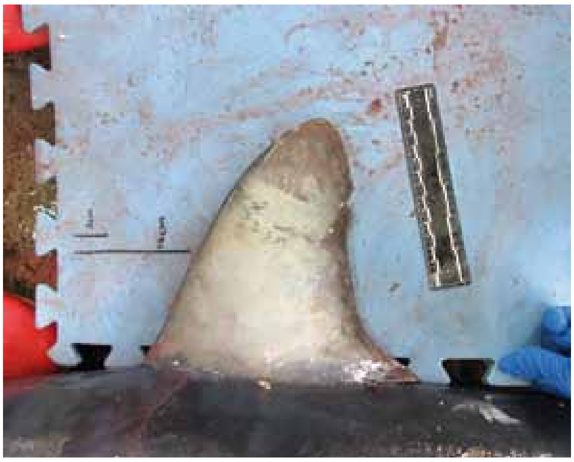
Photos: Monica Barone

2) Photograph of diagnostic characters (underside of head, teeth, caudal peduncle).

NOTES

- Take the photograph perpendicular to the plane of the fin (to avoid large distortions).
- The position of the individual fin should be as natural as possible.
- If the position of the shark, or the time available, does not allow you to take photographs the complete set of fins, give priority to the **first dorsal**, both sides of the **pectoral** and the **caudal**.

3) Photograph of the first dorsal fin. On the left, how to take the photograph; on the right, the resultant photograph.



4) Photograph of the second dorsal fin.

5) and 6) Photographs of both sides of the pectoral fin.

Photos:
Monica Barone, Lindsay J. Marshall

7) Photograph of the caudal fin.

8) Photographs of both sides of the pelvic fin.

Photos:
Monica Barone, Lindsay J. Marshall

9) Photographs of the anal fin.

Photos:
Monica Barone, Lindsay J. Marshall

2) Examples of photographs of fins removed

Take pictures of the fin on a homogenous background with a ruler and possibly a label with the specimen code in the photograph.
Make sure the specimen is in the most natural position possible, e.g.:

Photos:
Lindsay J. Marshall

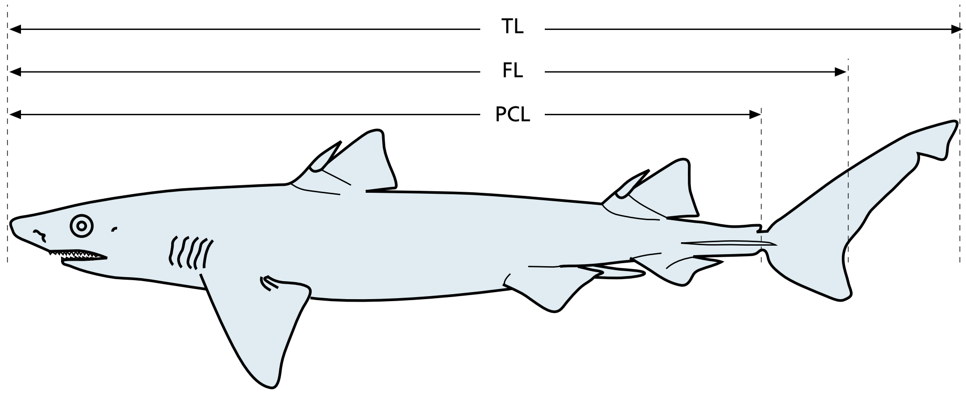
For pectoral and pelvic fins (or if you are unsure of which fin type it is), please take a photograph of both sides.

Photos:
Lindsay J. Marshall

Photos:
Lindsay J. Marshall, Jenny Giles

3) Minimum standard measurements

If you have the possibility to measure the shark, obtain at least the following data:



Total Length (TL): tip of the snout to the posterior tip of the tail.
Fork Length (FL): tip of the snout to the fork of the tail.
Pre-Caudal Length (PCL): tip of the snout to the beginning of the tail.

Date	Specimen code	Species	Total Length (cm)	Fork Length (cm)	Pre Caudal Length (cm)	Mass (kg)	Sex (F/M)	Genetic sample (Yes/No)
19/05/2014	KTF_1_008	*Isurus oxyrhinchus*	192.5	178.1	160.5	…	M	Yes

How to take tissue samples for genetic analysis

What you need:

- Tools to cut and transfer the tissue, e.g. scalpel and blades / surgical scissors and forceps.
- Vials containing preservative (such as 70 percent ethanol or a dimethyl sulphoxide [DMSO solution]) to store the sample, each to be assigned with a unique identifier. A volume of 1.5–2 ml per vial is sufficient. If no preservative is available, use sample bags and freeze the samples as soon as possible.
- A naming scheme to reliably link the data collected for each specimen to its corresponding tissue sample.

Photo:
Monica Barone

Instructions:

Cut a small piece of skin and/or muscle tissue, a ~0.5 cm cube or more is recommended, or not more than one-third of the volume of the preservative in the vial (to ensure adequate preservation). The tissue can come from anywhere on the specimen, but an easy method is to cut a V-shape from the edge of a gill slit (as pictured) using scissors, or through the softer skin under the pelvic fins using a scalpel blade.

Importantly, take the samples in a way that minimizes or prevents cross-contamination among samples. This is of particular importance where samples are intended for forensics. In most cases, taking a sample with skin and some internal tissue is suitable. Best practice would be to use a new scalpel blade for each specimen or to sterilize tools between specimens, and to sample internal parts of the specimen, avoiding exposed surfaces. (Pocket sharps disposal containers and bleach wipes are a useful way to achieve this under field conditions). In any case, it is worth quickly noting the collection protocol used for the genetic analyst. If you feel there is high potential for contamination among specimens under your conditions, cut larger samples to allow the analyst to sample away from the exposed edges of the tissue sample when conducting the DNA extraction.

Include with your collected samples a datasheet linking unique sample identifiers with specimens, and detailing the preservative and dilution. If shipping your samples, ensure they are adequately preserved (do not post frozen material at ambient temperature). Consider the shipping implications before choosing a preservative; for example, many air freighters will not allow ethanol solutions stronger than 70 percent. Including a Material Safety Data Sheet (MSDS) for the preservative can prevent potential delays with some carriers.

Note that CITES-listed species cannot be shipped internationally without a permit.

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Appendix 1

Manual of iSharkFin

iSharkFin is an expert system that uses machine learning techniques to identify shark species from shark fin shapes. The software was developed by FAO in collaboration with the University of Vigo with financial support from the Government of Japan and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Aimed at port inspectors, custom agents, fish traders and other users without formal taxonomic training, iSharkFin allows the identification of shark species from a picture of the fin. The iSharkFin takes an interactive process, the users only need to take a standard photo, select some characteristics of a fin and choose a few points on the fin shape, in few minutes iSharkFin will automatically analyze the information and tell you the shark specie from which the fin comes.

iSharkFin
SOFTWARE

1. Installation and language settings

To install iSharkFin, download it from the web page (http://www.fao.org/fishery/ipoa-sharks/iSharkFin/en) and execute the installer. Accept the end user licence agreement and choose where you want the program to be installed. After finishing the installation process, launch the program by executing "iSharkFin.exe".
At the first start, you will be asked to choose your language.

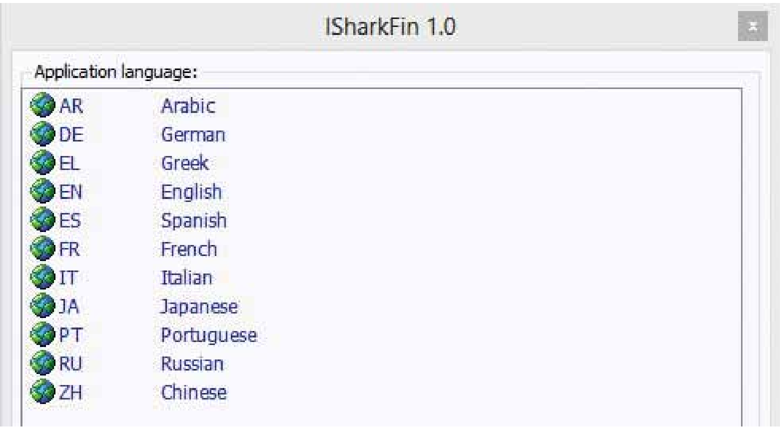
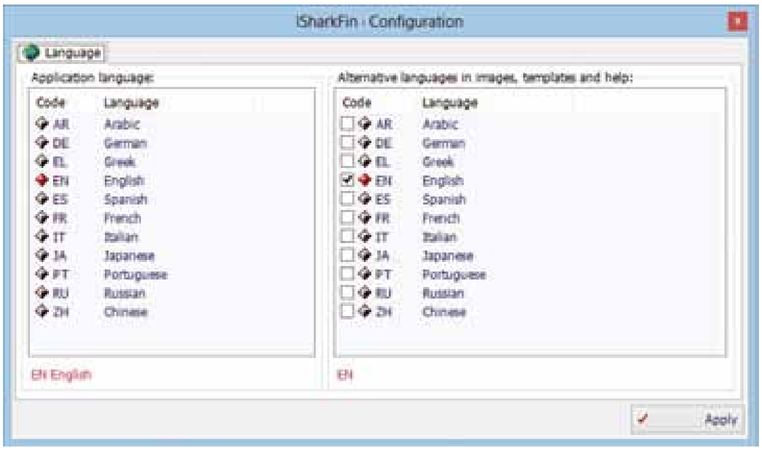


Image 1:
This language dialogue will appear at the first start. Choose the program language you wish to use.

You can change the program language afterwards in the menu "Configuration->language". In the language dialogue of the configuration menu, you can also select alternative languages for downloading pictures and help files, where they are not available in your preferred language.

Image 2:
You can change the program language afterwards in the menu. Here, you can also specify alternative languages for images, help files, etc.



2. Identifying sharks fins

To identify a shark fin, you need to first take a photograph of the fin and store it on your computer. Follow the "Practical method for taking standard photographs of shark fins" included in the Annex of this manual.
Once you have saved one or more photographs in a dedicated folder, you can proceed in one of two ways:

1) For batch identification: prepare the photographs and save the measurements of several fins before using the "Interactive identification" or the "Identification from file" tools. If you are willing to participate in data collection and help in the development of this software, this is the proper procedure that allows the inclusion of new samples and measurements of fins for which the species is already known.
2) For identification of a single fin: the second way to identify a fin is to use the "Interactive identification" tool. This tool is immediate and quick. Choose this way when you want to identify just one fin.

2.1 Preparing photographs

For both procedures, "Interactive identification" as well as for the "Identification from file", you need to prepare the photographs for creating the measurements that will be used by the identification algorithm.
Perform the following steps.

Step 1: Load photograph and choose fin type

First, you need to load a photograph and specify the fin type. To create a new isharkfin file use the menu "File->New" or, if you want to continue a project that was saved before, use "File->Open" instead. To load fin photographs, press the button "…" to search and choose the data folder that contains at least one photograph of a shark fin. The file names of the photographs found in your selected folder are then displayed in the list box on the left part of the screen. Now, select the file name for the photograph of the fin you want to identify. Choose the fin type (dorsal or pectoral fin) by clicking on the example pictures.

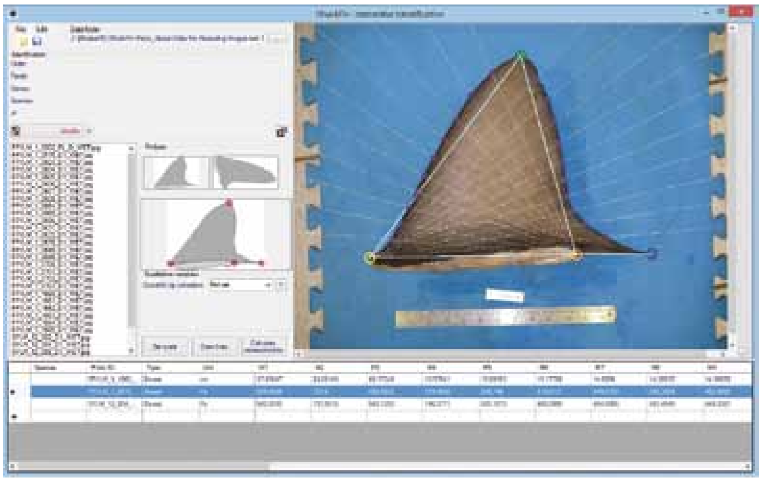


Image 3:
Selecting a folder with fin photographs, choosing a photograph in the list and specifying the fin type.

Step 2: Set the four basic points

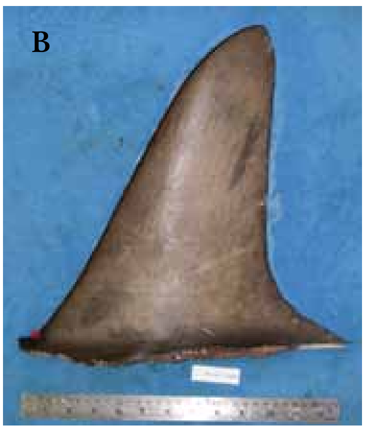
Set the four basic points on the photograph by clicking four times on the picture at the corresponding four locations. The points can be moved after, but not before, setting all four points. See the help picture for knowing where to put the points, and follow the descriptions below:

POINT 1. DORSAL FIN ORIGIN

In theory, this is the anterior-most point where the dorsal fin joins the dorsal body surface on the shark. Depending on where the fin is cut, you may face different situations:

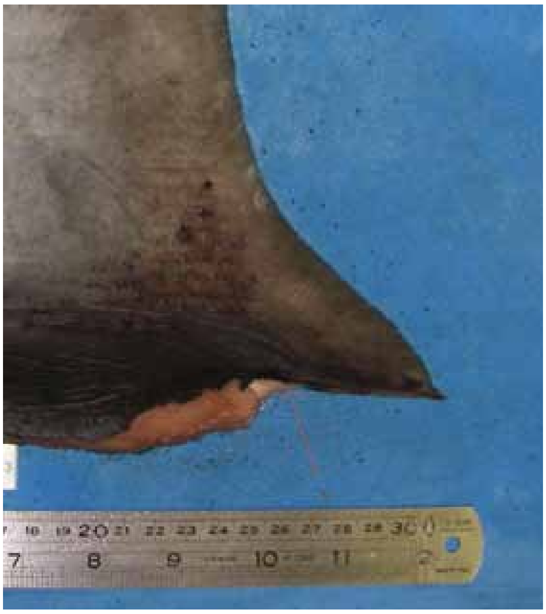
A: This may correspond to the first part of the fin.

B: If the fin has been cut lower, and it includes some skin from the dorsal surface of the shark body, the "Point 1" will be the most concave portion of the lower anterior portion of the fin.



Photos:
Lindsay J. Marshall

POINT 2. FIN INSERTION
Theoretically, this is the posterior point of attachment of a fin to its base. Considering that the vast majority of fins will be removed from their fin bases (i.e. removed from the animal), this is considered to be the junction between the skin of the inner margin of the free rear tip, the exterior of the animal, and the severed part of the fin.



POINT 3. FREE REAR TIP
This point should be placed at the tip of the free rear tip of the dorsal fin – theoretically, at the junction between the posterior margin and the inner margin of the free rear tip.

Photos:
Lindsay J. Marshall

POINT 4. DORSAL FIN TIP

In theory, this is the apex of the fin tip, i.e. the “point” of the fin where the anterior margin of the fin (leading edge) meets the posterior margin of the fin (trailing edge). This is not the uppermost point of the fin. This is usually the “pointiest” part of the fin, but not always (see examples below). You can look for a change between the “smooth” denticles on the anterior surface of the fin changing to the anterior margin, which is often “feathered”.

Below, you can see several fins of different shape and the position of the point.

Photos:
Lindsay J. Marshall

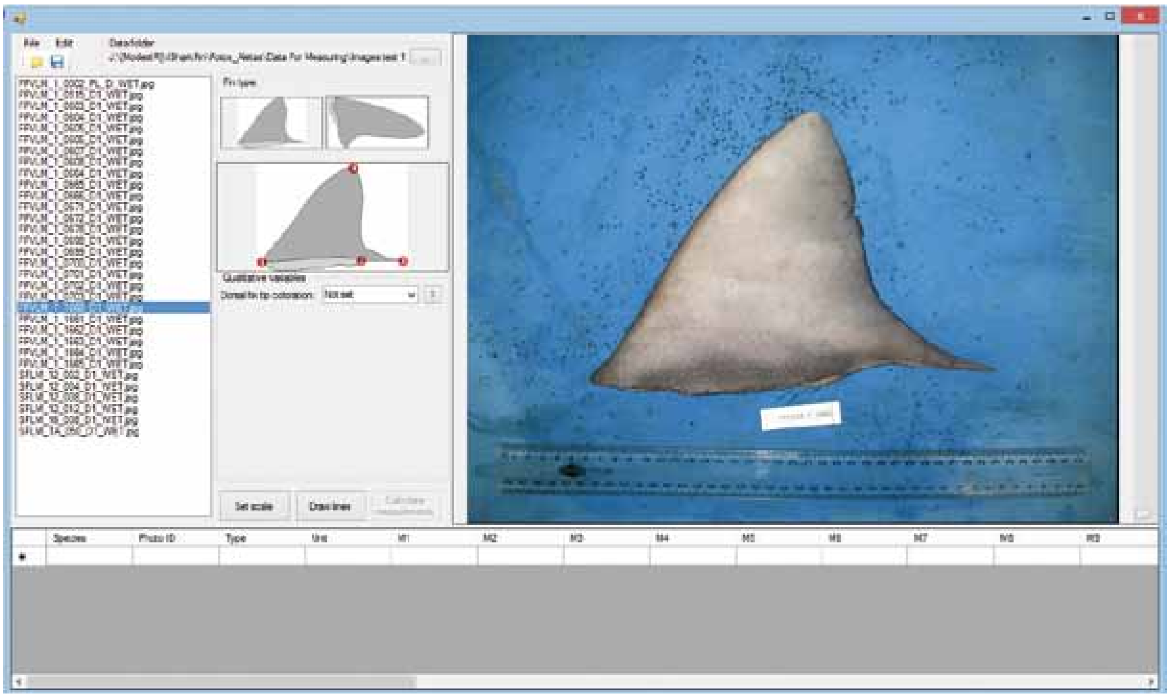


Image 4:
Setting of the four basic points.

Note that for taking the four points on pectoral fins, you can follow the analogous method.

Photo:
Lindsay J. Marshall

Step 3: Define the shape of the fin by setting the remaining points on the auxiliary lines

When the four basic points are set, click the "Draw lines" button. As a result, 20 auxiliary lines will appear with a purple point on each of them, which needs to be positioned exactly on the edge of the fin. Correct the purple points by dragging and dropping them until they are in exactly the right position. Use the zoom scroll bar on the right to place the points more precisely. In order to obtain a reliable identification, the points must be exactly on the edge. In the case of missing skin parts, place the points where you expect the edge should be.

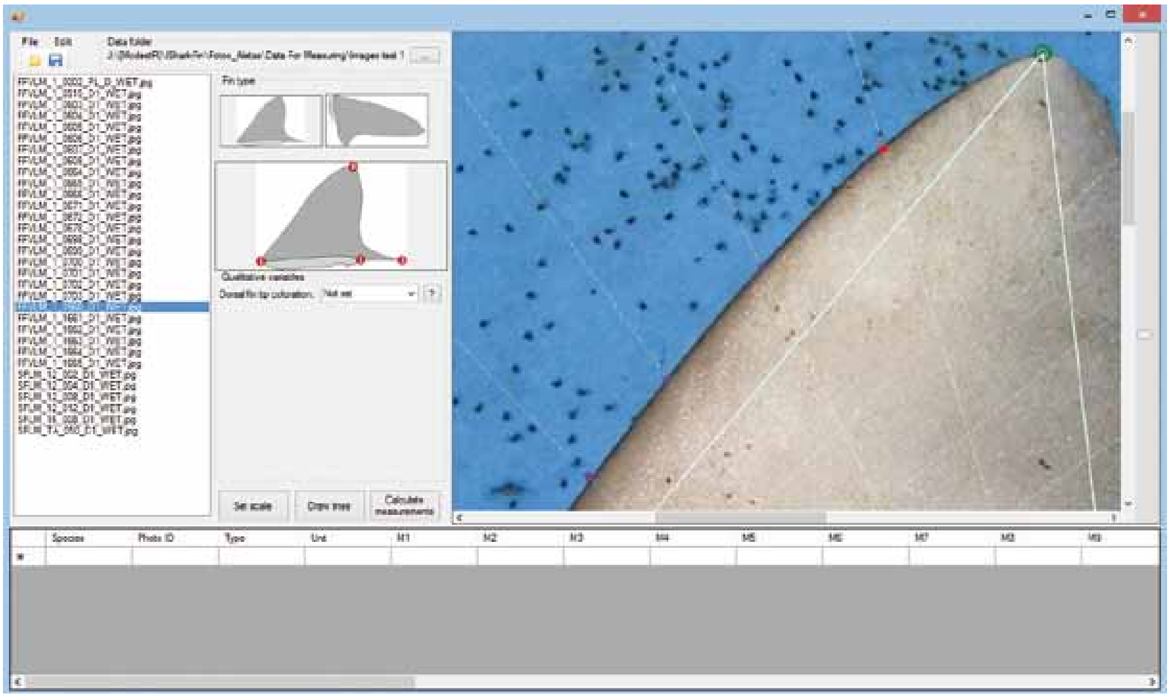


Image 5:
After clicking "Draw lines", use the zoom bar on the right to move the purple points precisely to the fin edge.

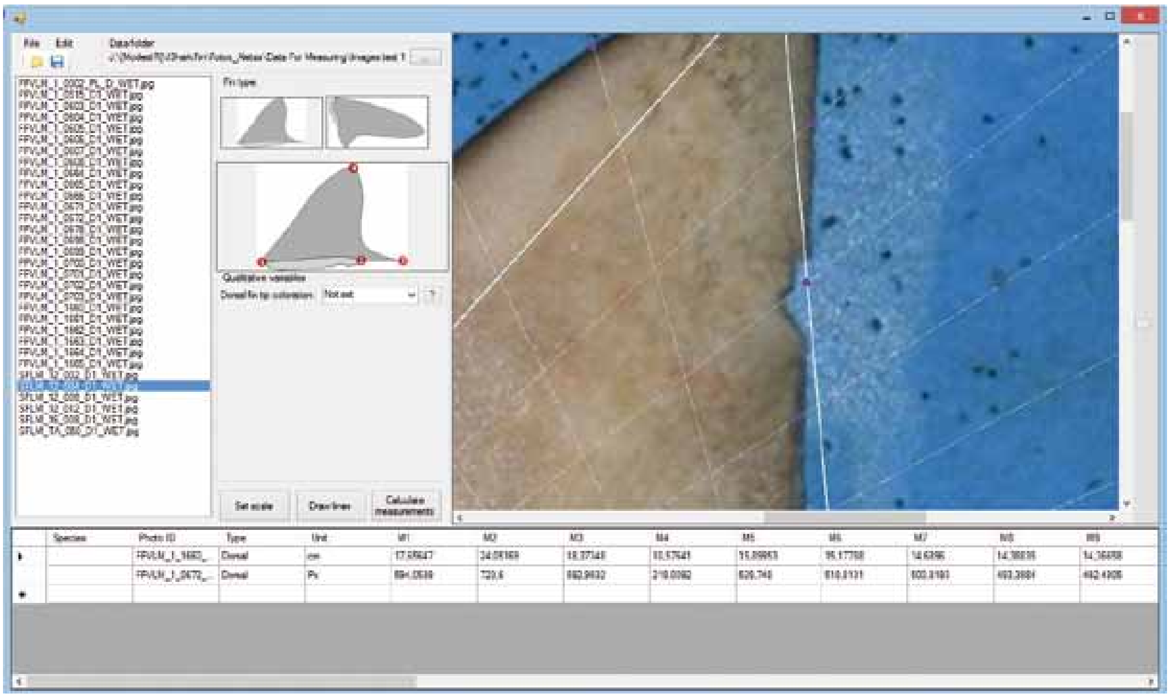


Image 6:
In the case of missing skin parts, move the point to the position where the edge is expected to be.

Step 4 (Optional): Set scale

To define a scale, first hit the "Set scale" button. Next, click on the photographs twice, to select the beginning and end points of a known distance (for example, by a ruler that is visible on the photograph). A dialogue will show up, where you can select the unit (centimetres or inches) and insert the measure corresponding to the selected distance on the photographs. If you define a scale, the measures will be converted into that unit.

This function allows the system to memorize the real measurements of the fins, data that can be useful for estimating the total length and the weight of the individual to which the fin belonged.

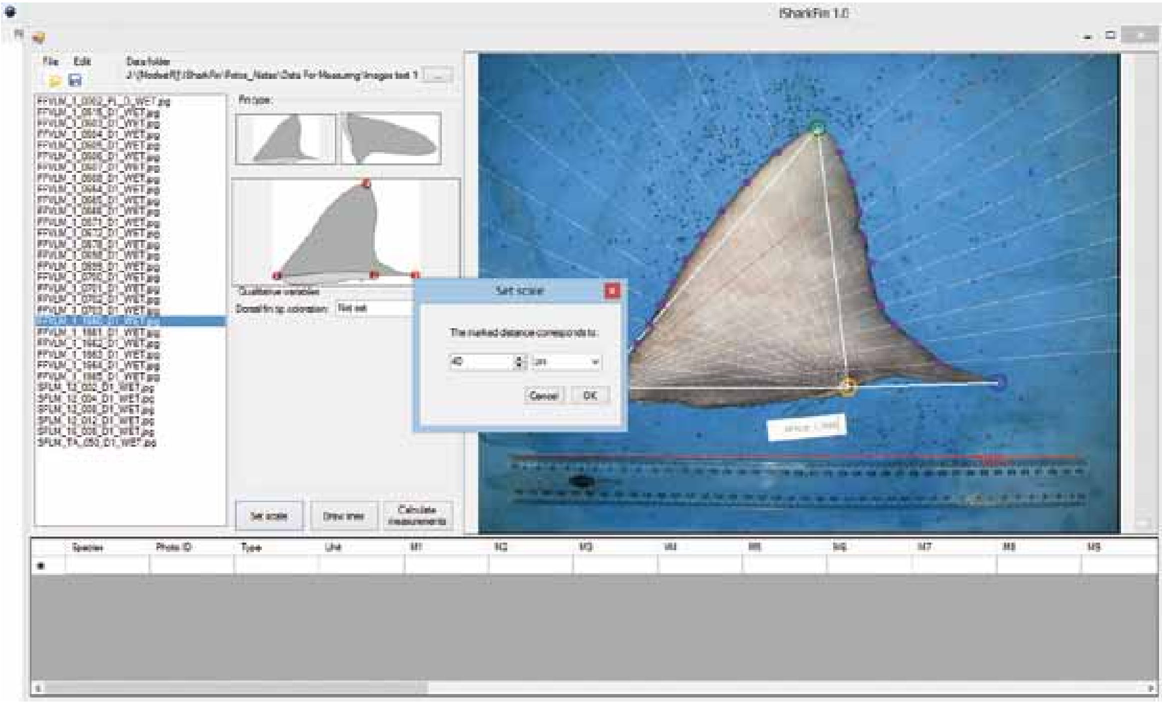


Image 7:
If the photograph contains a ruler as reference for the size, you can define a scale for working with measurements in centimetres or inches instead of pixels.

Step 5: Choose qualitative variables

To date, the only qualitative variable used by the identification algorithm is the "Dorsal fin tip coloration". Use the combo box to select one of the four possibilities: no tip color; decolored fin; white tip or black tip. Click the "?" button to see a description and example photographs of the selected character.

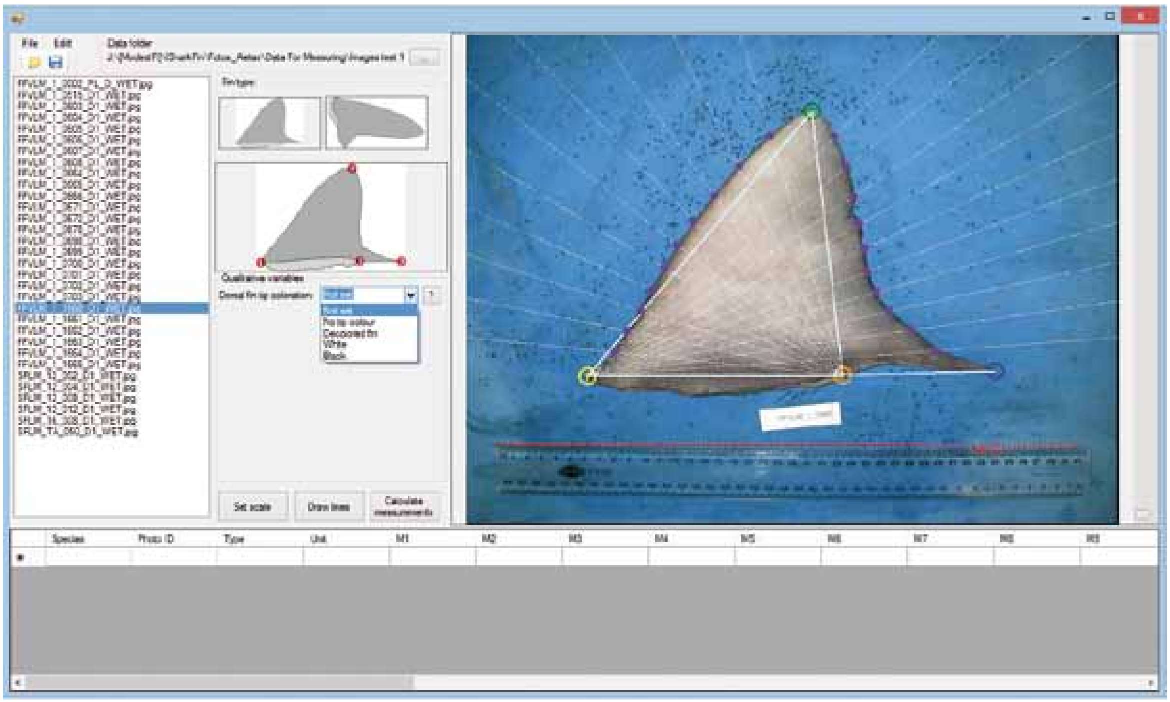


Image 8:
Choose a value for the qualitative variables.of pixels.

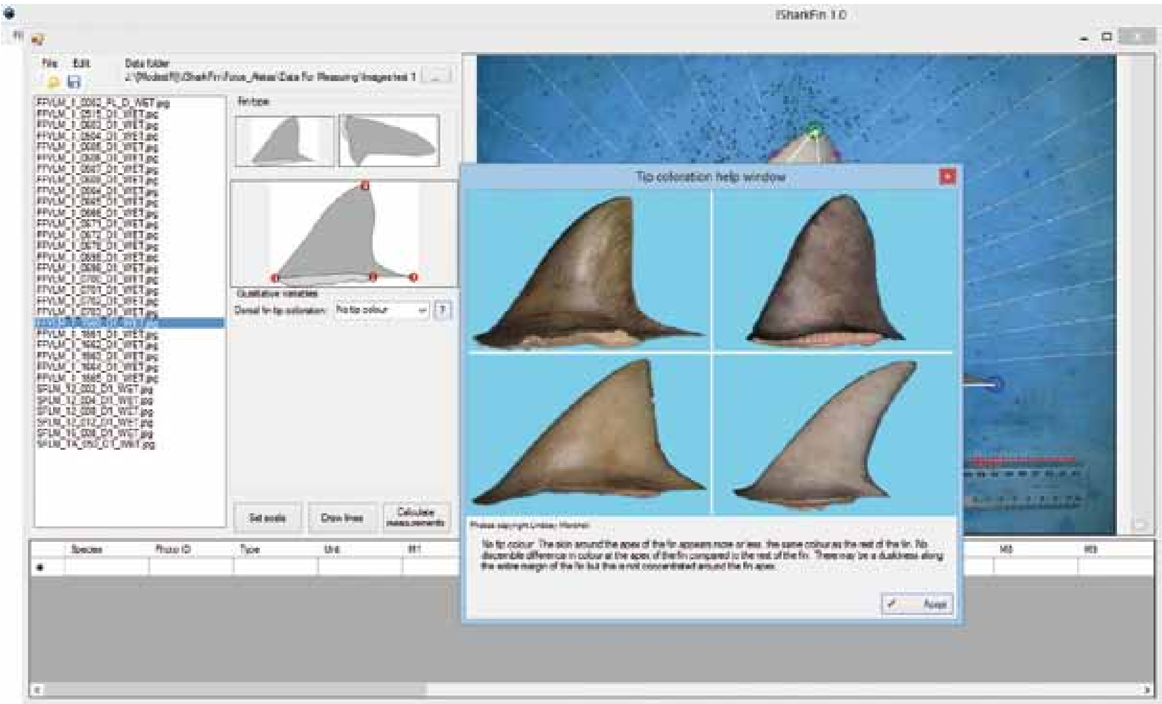


Image 9:
Use the help button “?” to see example images for the chosen qualitative variable value.

Step 6: Create measures

Create the measurement values using the button “Calculate measurements”. The measurements will appear in the table in the lower part of the screen. You can copy and paste lines, or edit and delete them manually. If you want to correct measurements that have already been made, click in the leftmost column to select the row and change the position of the points on the photograph. If you click again on “Create measures” while a row is selected in the table, the old values will be overwritten.

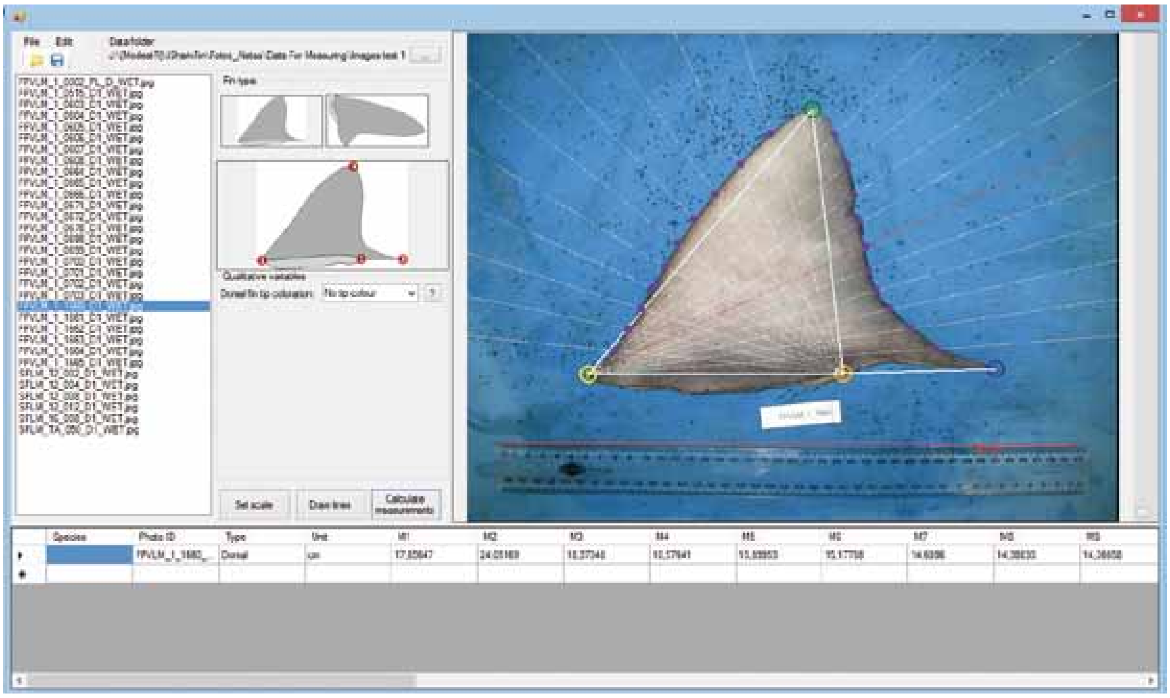


Image 10:
Finally create the measurements by hitting the “Calculate measurements” button. The measurements will appear as a new line in the table on the bottom of the window.

Step 7: Save file

Finally save your work as either a “.sfin” or “.txt” file. The “.sfin” files are binary iSharkFin project files that contain all information to restore the state of the project in the moment of saving. To be sure the file preserves the information on the position, do not move the file “.sfin” and the folder containing the photographs from the original position. The .txt files are readable text files that contain only the created measurements, but not the location of the points that have been placed on the pictures, thus the text files contain only the information you can see in the table at the bottom of the screen.

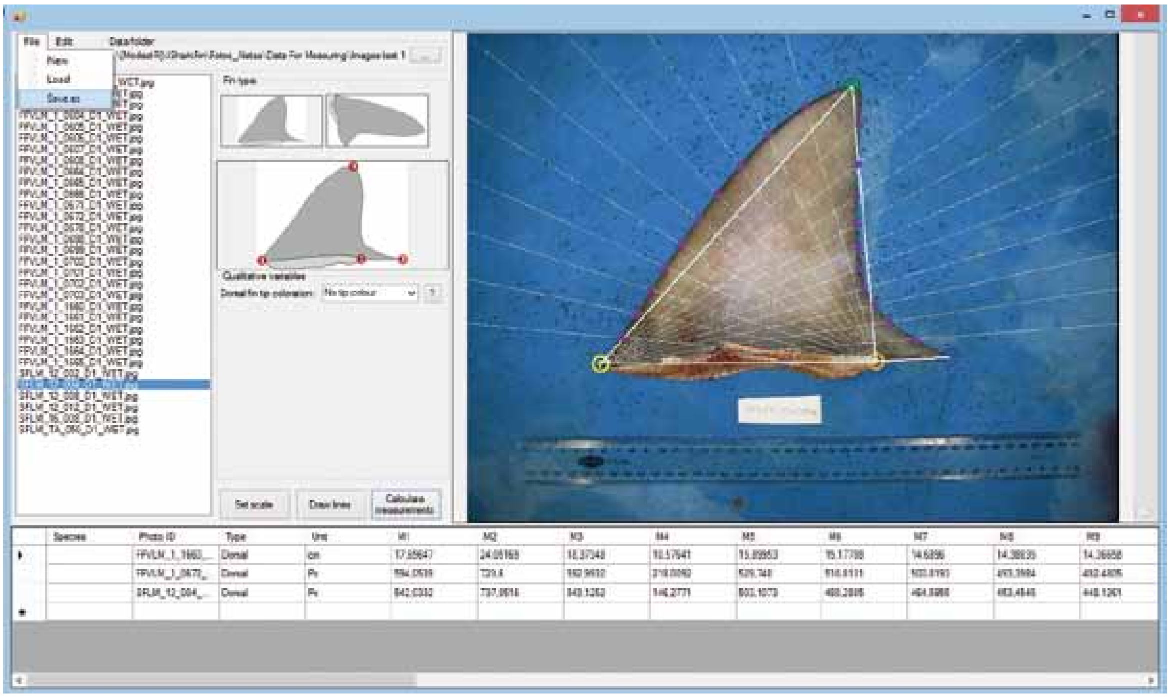


Image 11:
Do not forget to save the measurements for use in the identification module.

2.2 Interactive identification

If you would like to identify one fin and you have saved the photograph on your PC, go to “Identification -> Interactive identification” for the identification procedure. Open the “Interactive identification” window and perform all the steps (Steps 1–7) described in the previous section, beginning from the button “…” and searching for the folder where you have saved the photograph. Once you have completed the procedure for taking the measurements, click on the “Identify” button.
From the window “Interactive identification”, you can also load one of the files generated in the previous section. This allows you to identify one by one the fins already measured, selecting the row with the measurements in the table of the fin and then clicking on the “Identify” button.

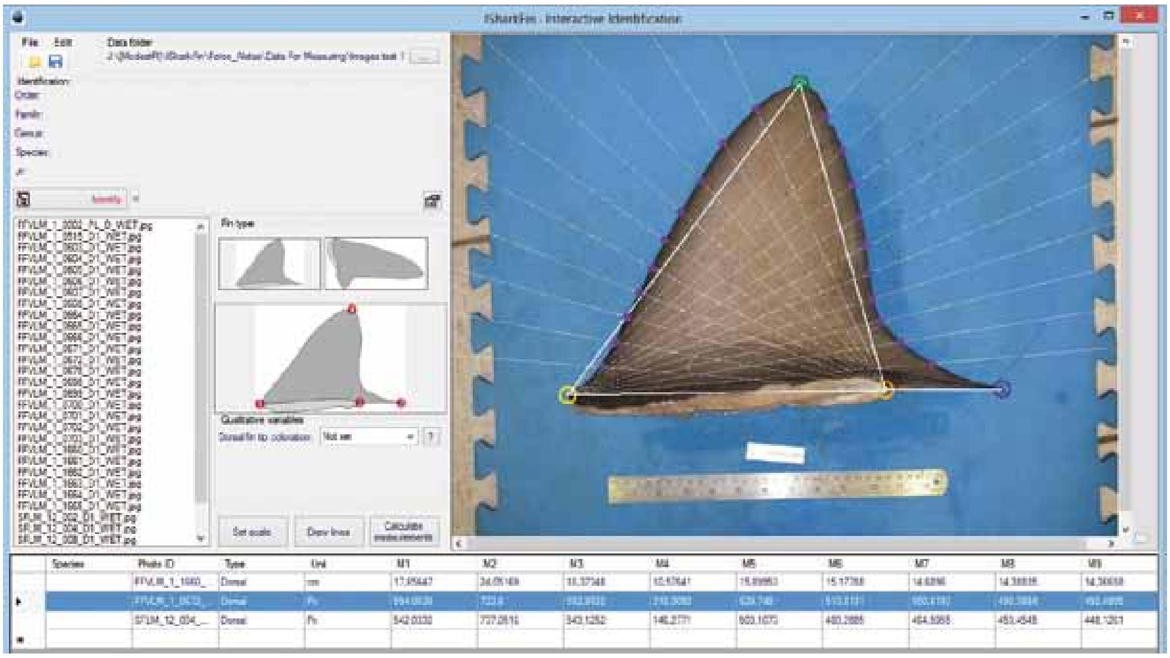


Image 12:
Load one of the previously generated files in the "Interactive identification" window and select the row of the fin you wish to identify in the table by clicking in the leftmost column of the table (see picture).

If the program is able to identify the photograph, the order, genus, family and species of the shark will appear on the screen, together with a probability value indicating the level of uncertainty about the identity of the specimen (probability, abbreviated with p, varies from 0 to 1; a p value close to 1 indicates strong evidence that the fin belongs to the taxon

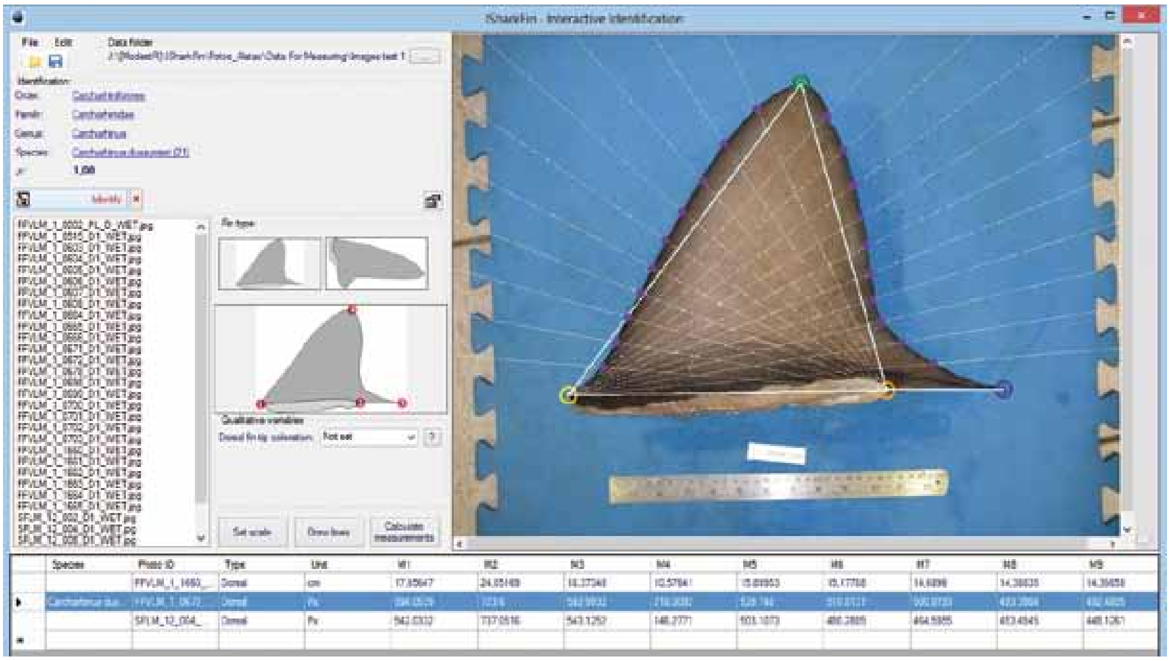


Image 13:
Trigger the identification process by hitting the "Identify" button.

identified). If it is not possible to identify the photograph, a message indicating that the photograph is "unidentified" will appear. In this latter case, the system could be able to give some indication about the taxonomic group to which the fin belongs.

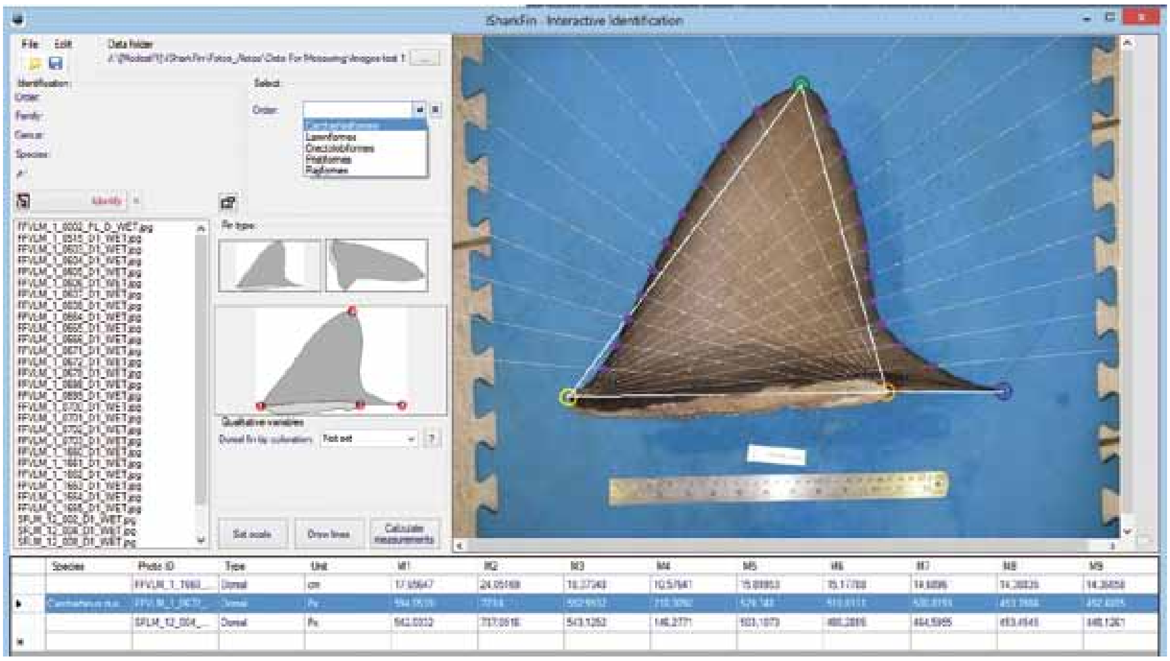


Image 14:
You may give hints if you have information about the order, family or genus of the fin on the photograph.

if you already have some information about the order, family or genus of the species, it is possible to give hints to the expert system. To do, click the small button "Direct selection" at the bottom right within the identification area. This makes a combo box appear where you can select the known order, genus or family, before triggering the identification process by hitting the "Identify" button.

2.3 Identification from file

To follow this procedure, you need to have first created a file with data of the measurements, as explained in the "Preparing photographs" section. If you have already created such files, go to "Identification -> Identification from file" in the menu. Select the input file by using the "Load" button. The input file may be either in the .sfin or .txt format. You can check the data table in an external editor by clicking the buttons with the notepad or Excel icons. Finally, click the button "Identify" and see the result in the table. You can save the results by using the save button.

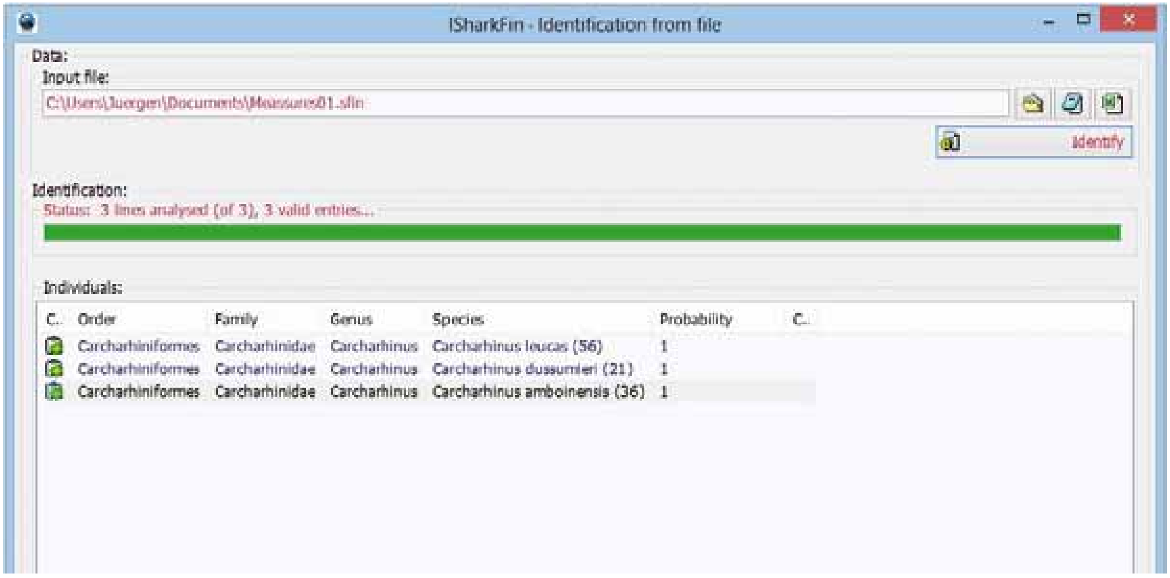


Image 15:
The result after identification from file.

You also have the possibility to access further information of the identified species by clicking with the right mouse button on the row of the identified species in the table and selecting "Images", "Common names" or "Map", which will open another window with the respective information. The windows that open are identical to those used in the "List of species" window, so see the following section on how to use them.

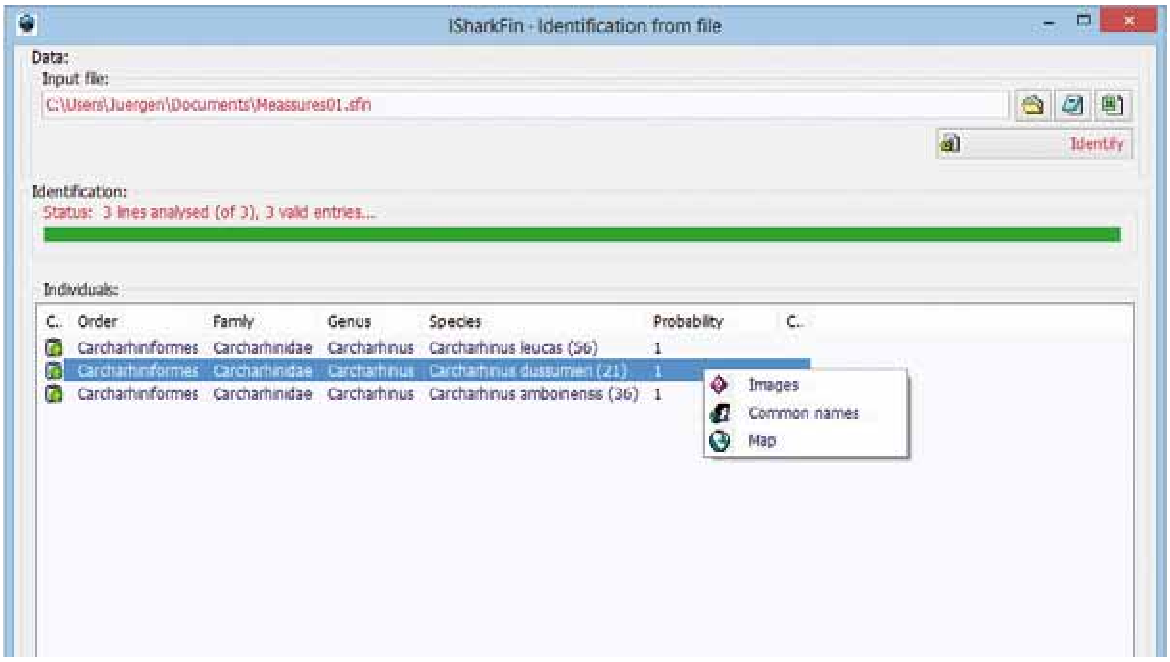


Image 16:
Access further information on the identified species by right clicking on the result in the table.

3. Further functionality

Besides identifying sharks, you can browse the database and taxonomy tree used by iSharkFin. It contains pictures, distribution maps and Internet links to further information on the different orders, genus, families and shark species.

3.1 List of species

To see the taxonomy tree, go to "Species->List of species" in the main menu. The list of species is not limited to the shark species for which the identification of fins is possible, but contains a complete checklist of sharks (www.ipez.es). A window will show up where you can browse the tree and see further information, pictures and Internet links. Small icons "C", "O", "G", "F" and "E" used in the tree stand for "class", "order", "genus", "family" and "species" (last one appears in red while the rest of them are in blue). At species level, a parenthesis with extra information, for example "(6D,7P)" may appear. This means that for the selected species measures from 6 dorsal and 7 pectoral fins are available in the database and used in the identification algorithm.

The taxonomy tree window also has a search function, and it is possible to search by scientific name, common name and synonym. Use the different search options "Name starts with search term" (B), "Name ends with search term" (E), "Name contains search term" (M) or limit the search to only order, family, genus or species level.

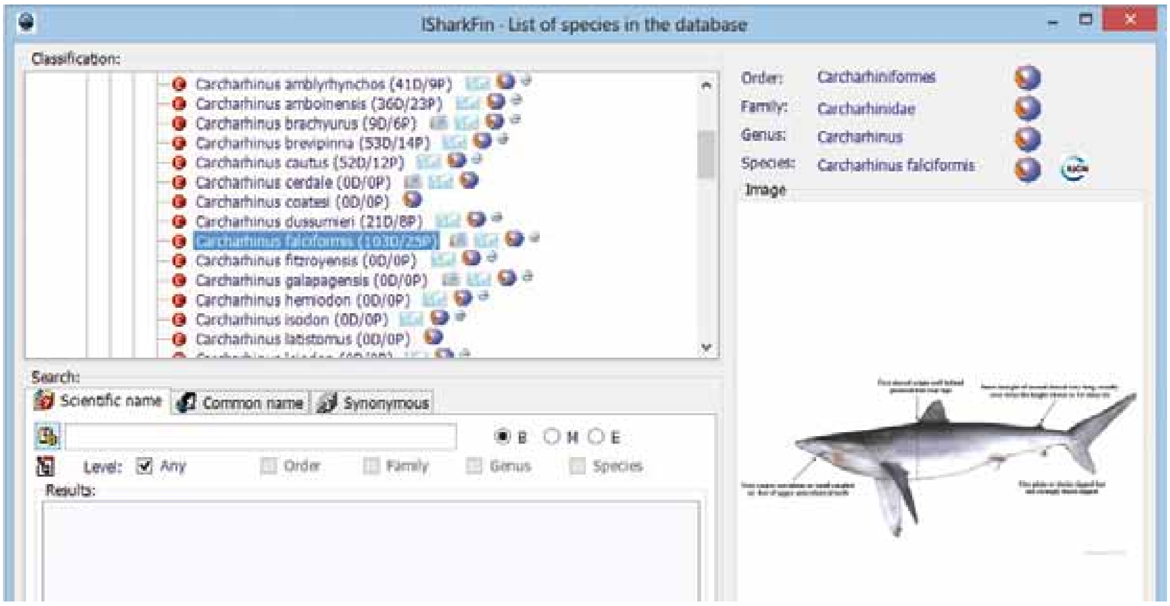


Image 17:
The taxonomy tree used by iSharkFin with the possibility to search entries and additional information such as photographs, common names, distribution maps and links.

If no picture of the species is shown in the picture box, this means that there is no picture available on your local hard disk. However, there may be a picture available on the iSharkFin server. To search for pictures on the iSharkFin server, proceed as follows:

1) Right click on the picture box and select "Multi language".

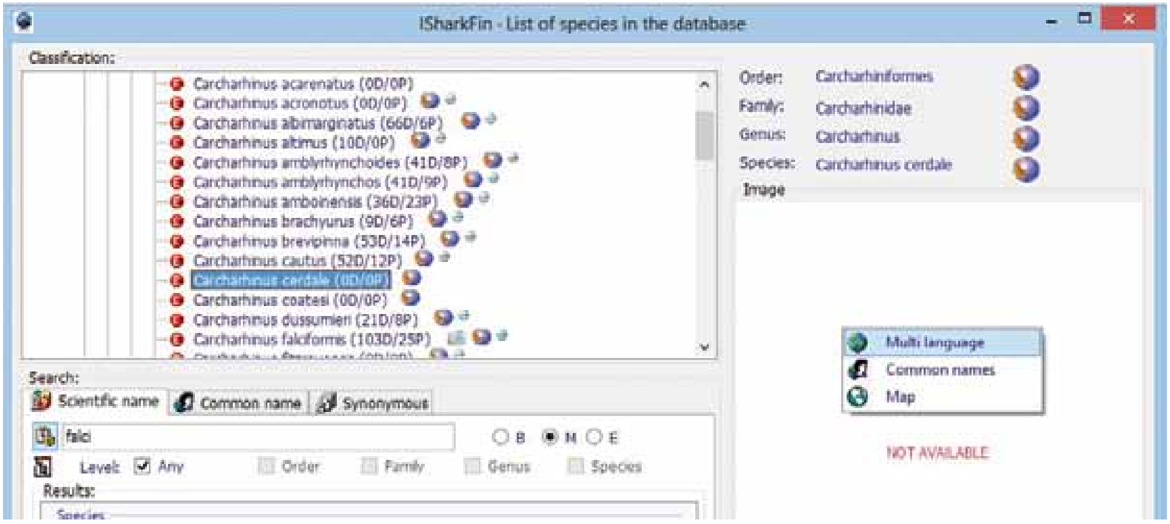


Image 18:
Right click on the (empty) picture box to look for pictures on the iSharkFin server or to access further information such as distribution maps or common names.

2) A dialogue will appear where you will see a list with information on the availability of the pictures in the different languages. To download one of them, select it and click "Download from iSharkFin server" on the bottom of the window.

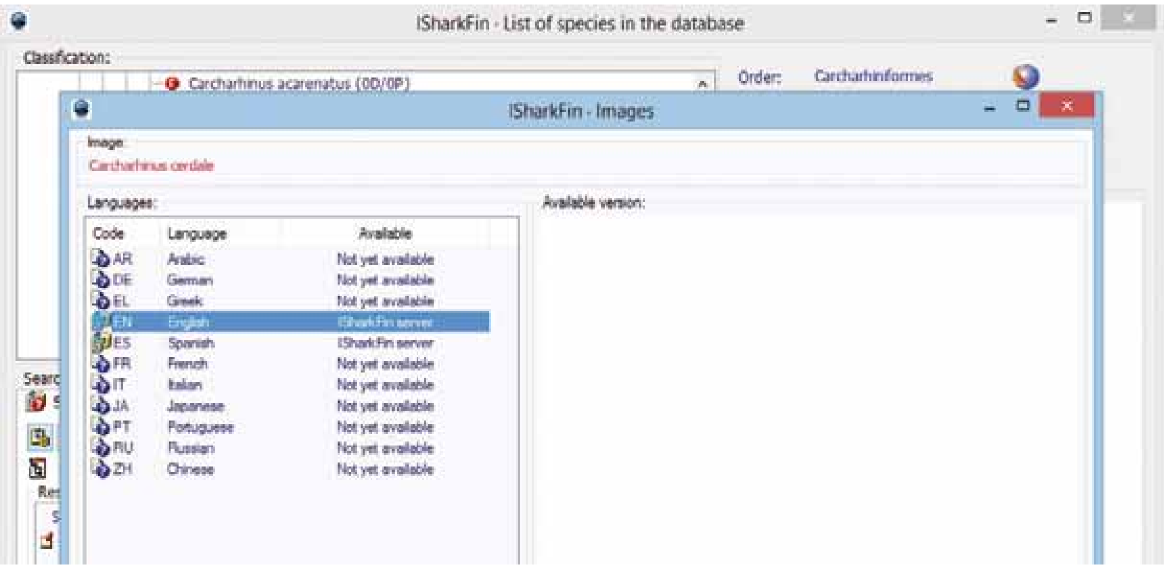


Image 19:
Select the picture you want to download and click "Download from ISharkFin server".

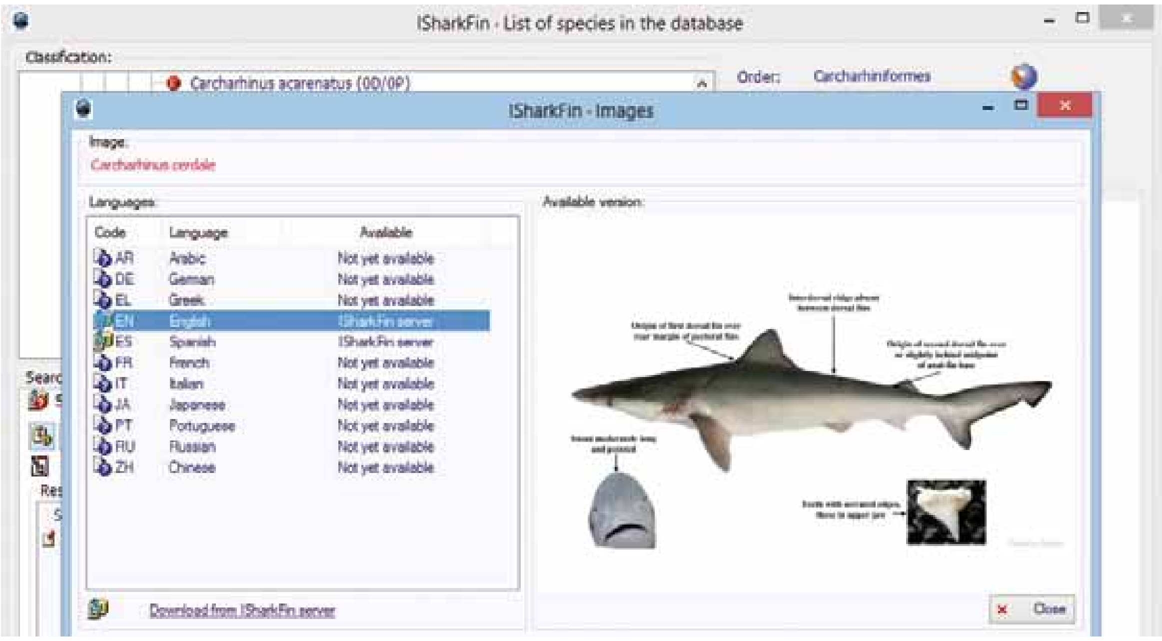


Image 20:
Example of picture downloaded from the server.

In addition to downloading pictures, you can use the context menu of the picture box, opening it with a click of the right mouse button, to open a window with information about common names of the species in local languages of the different countries and to see a distribution map of the species, where available. The names can be ordered by common name, by the countries where the name is used, and by language.

Image 21:
Different names of the species used in different countries and in different languages.

The distribution maps work exactly the same way as the species pictures. If available on the local hard disk, it will show up immediately on request; if not, you may look for it on the iSharkFin server and download it with the "Download from ISharkFin server" button.

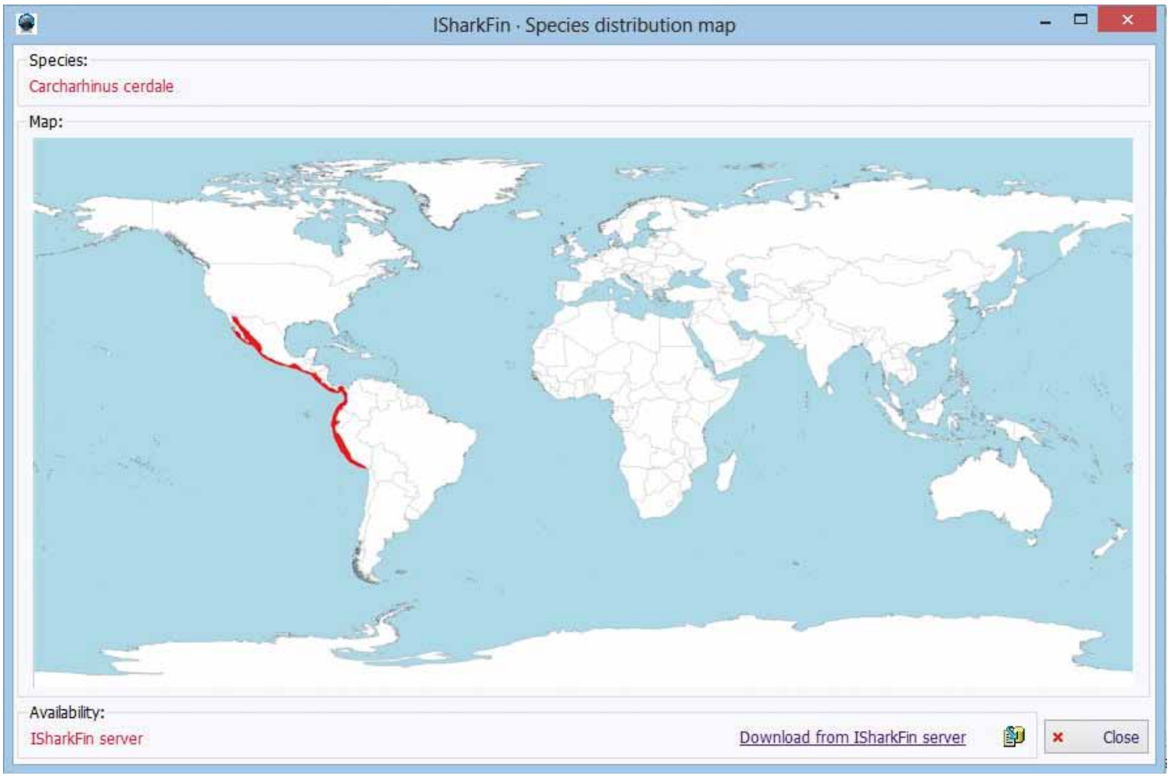


Image 22:
Example of distribution map of the species.

3.2 Export taxonomy

The program allows users to export a full taxonomy tree of the database. There are two ways of exporting the data. “Structured” and “Unstructured”. See the following images for examples of both.

	A	B	C	D	E
1	Subclass	Order	Family	Genus	Species
2	Elasmobranchii	Rajiformes	Anacanthobatidae	Anacanthobatis	Anacanthobatis americanus
3	Elasmobranchii	Rajiformes	Anacanthobatidae	Anacanthobatis	Anacanthobatis donghaiensis
4	Elasmobranchii	Rajiformes	Anacanthobatidae	Anacanthobatis	Anacanthobatis folirostris
5	Elasmobranchii	Rajiformes	Anacanthobatidae	Anacanthobatis	Anacanthobatis longirostris
6	Elasmobranchii	Rajiformes	Anacanthobatidae	Anacanthobatis	Anacanthobatis marmoratus
7	Elasmobranchii	Rajiformes	Anacanthobatidae	Anacanthobatis	Anacanthobatis nanhaiensis
8	Elasmobranchii	Rajiformes	Anacanthobatidae	Anacanthobatis	Anacanthobatis ori
9	Elasmobranchii	Rajiformes	Anacanthobatidae	Anacanthobatis	Anacanthobatis stenosoma
10	Elasmobranchii	Rajiformes	Anacanthobatidae	Sinobatis	Sinobatis borneensis
11	Elasmobranchii	Rajiformes	Anacanthobatidae	Sinobatis	Sinobatis bulbicauda
12	Elasmobranchii	Rajiformes	Anacanthobatidae	Sinobatis	Sinobatis caerulea
13	Elasmobranchii	Rajiformes	Anacanthobatidae	Sinobatis	Sinobatis filicauda
14	Elasmobranchii	Rajiformes	Anacanthobatidae	Sinobatis	Sinobatis melanosoma
15	Elasmobranchii	Rajiformes	Arhynchobatidae	Arhynchobatis	Arhynchobatis asperrimus
16	Elasmobranchii	Rajiformes	Arhynchobatidae	Atlantoraja	Atlantoraja castelnaui
17	Elasmobranchii	Rajiformes	Arhynchobatidae	Atlantoraja	Atlantoraja cyclophora
18	Elasmobranchii	Rajiformes	Arhynchobatidae	Atlantoraja	Atlantoraja platana
19	Elasmobranchii	Rajiformes	Arhynchobatidae	Bathyraja	Bathyraja abyssicola
20	Elasmobranchii	Rajiformes	Arhynchobatidae	Bathyraja	Bathyraja aguja
21	Elasmobranchii	Rajiformes	Arhynchobatidae	Bathyraja	Bathyraja albomaculata
22	Elasmobranchii	Rajiformes	Arhynchobatidae	Bathyraja	Bathyraja aleutica
23	Elasmobranchii	Rajiformes	Arhynchobatidae	Bathyraja	Bathyraja andriashevi
24	Elasmobranchii	Rajiformes	Arhynchobatidae	Bathyraja	Bathyraja bergi
25	Elasmobranchii	Rajiformes	Arhynchobatidae	Bathyraja	Bathyraja brachyurops
26	Elasmobranchii	Rajiformes	Arhynchobatidae	Bathyraja	Bathyraja caeluronigricans
27	Elasmobranchii	Rajiformes	Arhynchobatidae	Bathyraja	Bathyraja cousseauae
28	Elasmobranchii	Rajiformes	Arhynchobatidae	Bathyraja	Bathyraja diplotaenia
29	Elasmobranchii	Rajiformes	Arhynchobatidae	Bathyraja	Bathyraja eatonii
30	Elasmobranchii	Rajiformes	Arhynchobatidae	Bathyraja	Bathyraja fedorovi
31	Elasmobranchii	Rajiformes	Arhynchobatidae	Bathyraja	Bathyraja griseocauda
32	Elasmobranchii	Rajiformes	Arhynchobatidae	Bathyraja	Bathyraja hesperafricana
33	Elasmobranchii	Rajiformes	Arhynchobatidae	Bathyraja	Bathyraja interrupta
34	Elasmobranchii	Rajiformes	Arhynchobatidae	Bathyraja	Bathyraja irrasa

Taxonomy

Image 23:
The result of the “Unstructured” taxonomy export.

	A	B	C	D	E	F
1	Subclass	Order	Family	Genus	Species	Total Species
2	Elasmobranchii					1154
3		Rajiformes				356
4			Anacanthobatidae			13
5				Anacanthobatis		8
6					Anacanthobatis americanus	
7					Anacanthobatis donghaiensis	
8					Anacanthobatis folirostris	
9					Anacanthobatis longirostris	
10					Anacanthobatis marmoratus	
11					Anacanthobatis nanhaiensis	
12					Anacanthobatis ori	
13					Anacanthobatis stenosoma	
14				Sinobatis		5
15					Sinobatis borneensis	
16					Sinobatis bulbicauda	
17					Sinobatis caerulea	
18					Sinobatis filicauda	
19					Sinobatis melanosoma	
20			Arhynchobatidae			96
21				Arhynchobatis		1
22					Arhynchobatis asperrimus	
23				Atlantoraja		3
24					Atlantoraja castelnaui	
25					Atlantoraja cyclophora	
26					Atlantoraja platana	
27				Bathyraja		51
28					Bathyraja abyssicola	
29					Bathyraja aguja	
30					Bathyraja albomaculata	
31					Bathyraja aleutica	
32					Bathyraja andriashevi	
33					Bathyraja bergi	
34					Bathyraja brachyurops	

Image 24:
The result of the “Structured” taxonomy export.

4. Updates

Auto update

By default, the program is configured to search automatically for updates at each program start. You can change this configuration by using the menu “Configuration->Remote update->Automatic update”. It is possible to define the number of “Downloaded files” for each update. This option is particularly useful when installing iSharkFin for the first time. The program downloaded from the web page does not have the photographs that are in the database. Therefore, if the Internet connection is not very fast, the update process could take a long time, and it is possible to spread the downloading over several days.

Manual update

If you deactivated the automatic update, you can update the program at any time manually by using the menu “Configuration->Remote update ->Update management”. A window will appear where you can see a list of updateable files. You can apply filters for only updating certain file types of certain languages. To update, either hit the “Update all” button, for updating all files in the list, or make a selection of the files you wish to update and use the “Update selection” button instead.

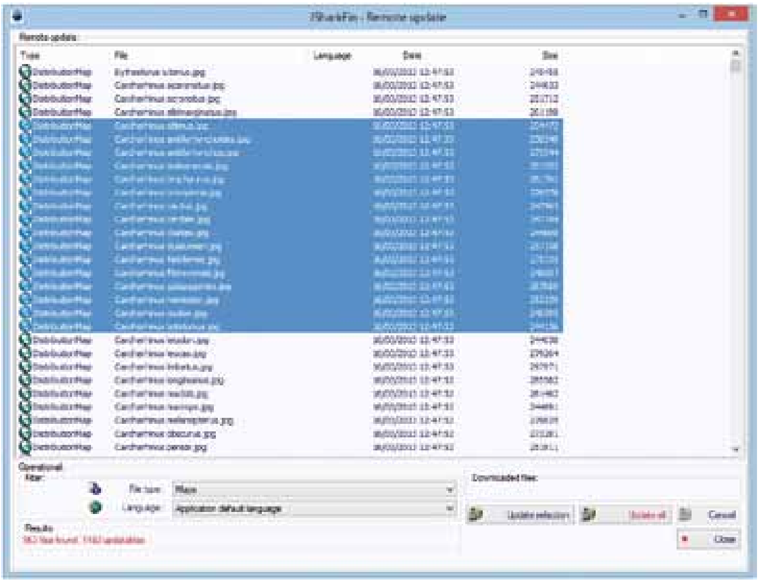


Image 25: The manual update window with a selection of distribution maps that can be downloaded from the iSharkFin server.

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The global demand for shark fins (a primary driver of shark mortality) and the inclusion of new shark species in the Appendix II of CITES in 2013 have been key considerations in promoting the preparation of this guide.

This guide is a complementary tool to the software iSharkFin, developed in close collaboration with the University of Vigo, Pontevedra, Spain, and available at www.fao.org/fishery/ipoa-sharks/iSharkFin/en.

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