Traceability study in shark products

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(Photo: © Francisco Blaha, 2015)

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1 Summary

The 27th Animals Committee (2014, Veracruz) requested the Standing Committee, at its 65th meeting in Geneva in 2014, to consider relevant matters relating to the implementation of shark listings, including the following:

i. *New legislative issues that might arise in exporting, transit and consumer countries;*

ii. <u>*Issues pertaining to chain of custody, including where in the trade chain it is considered essential to be able to identify the products in trade;*</u>

iii. *Issues pertaining to legality of acquisition and introduction from the sea;*

iv. *Existing catch documentation and product certification schemes that could assist in the implementation of Appendix II shark listings; and*

v. *The role of Regional Fisheries Management Organisations.*

It was also suggested that "Both the Standing Committee and the Animals Committee should review the requirements that have been developed for the trade in processed product types of Appendix II species such as crocodile skins, caviar etc. and consider their applicability to shark products containing Appendix II species" (CITES, 2014).

This report looks at the market chains of products derived from CITES-listed shark species and the use of traceability to identify the products in trade.

Sharks – and among them most CITES-listed species - have substantial commercial value. The highest valued product are shark fins. Shark meat, cartilage, liver oil, skin and bones are among other shark products. Market study and trade volumes show that while shark liver oil and skin are also traded, these quantities are minimal in comparison with meat and fins.

Official FAO statistics between 2011 and 2014 conservatively put the average declared value of total world shark fin imports at USD377.9 million per year from 2000 to 2011, with an average annual volume imported of 16,815 tons. In 2011, the last year for which full global data are available, the total declared value of world exports was USD438.6 million for 17,154 tons imported. The corresponding 2000–2011 annual average figures for shark meat were 107,145 tons imported, worth USD239.9 million; while in 2011 only, the reported figures for total world imports of shark meat were USD379.8 million and 121,641 tons for value and volume, respectively. This gives a total declared value of traded shark commodities (meat and fin) in 2011 of USD818.4 million (Dent & Clarke, 2015). However, a good part of the trade in shark products is informal and it is generally assumed that the actual trade is significantly larger.

Markets for meat and fins are essentially different. The vast majority of shark fins are consumed in China, Hong Kong (SAR), Taiwan Province of China, Singapore, Malaysia and Viet Nam, whereas the world's largest consumers of shark meat are found in South America and Europe, with the most important importers being Italy, Brazil, Uruguay and Spain. The Republic of Korea is largest importer for skate and ray meat.

Normally, trade statistics used by most seafood market sectors are not species-specific for meats and fins and it is therefore not possible to deduce what portion of those volumes are from CITES-listed species. Landing data often is not much more specific. However, given that species like the Oceanic Whitetip are caught in large numbers as a bycatch in pelagic fisheries[1], it can be assumed that a part of the estimated 1.4-1.7 million tons of shark caught for finning alone is from CITES-listed species.

Driven by the high prices of USD200-400/kg of whole fins, sharks represent a commercially very interesting catch. Most often, they are by-catch (e.g. in tuna fisheries) and kept by fishermen as additional income. Unsurprisingly, the shark trade is often informal, unregulated, unreported and in cases even illegal. As a result, the shark trade is not well controlled and management measures are jeopardised. Western Oceania has the highest numbers of threatened species assessed to date with 100. This region also has a high number of data deficient species with between 35 and 50 species listed as data deficient in New Caledonia, Vanuatu and Fiji (Polidoro, et al., 2011). Approximately one-fourth of all sharks and batoids found in Oceania are considered threatened. Clearly, sharks are under great stress and robust measures need to be taken to improve their management.

Traceability has been used in the area of food production for a number of purposes. In the context of strengthening CITES processes, compliance management, statistics and sustainability are the most relevant uses. While the implementation of large scale traceability systems must be considered a challenge, examples of good practice are emerging and first successes can be celebrated.

In the more specific area of traceability for aquatic products, a number of international efforts are looking currently at traceability or related systems, usually in the context of combating Illegal, Unreported and Unregulated (IUU) fishing. First attempts, e.g. by the European Union have shown that such schemes need to be robust enough to have any effect. It is becoming clearer and clearer that an effective catch documentation system (CDS) needs to be electronic to allow for cross-referencing (FAO, 2015).

Nevertheless, the implementation of traceability systems to strengthen CITES processes will need to address general challenges in implementation of large scale traceability systems, such as the inclusion of small fishermen, the lack of standardisation and the governance of the system.

When examining the specific uses of traceability, the report argues that the main focus should be on strengthening trade with legal specimens, supporting thus the Legal Acquisition Finding and the Introduction from the Sea (IFS) certificate issuance processes. While certainly the implementation of traceability can also contribute to data collection and therefore strengthen the sustainability assessment of the trade, supporting Non-Detriment Findings, it is the link of the permit to a legal origin process (such as a landing permit or a catch certificate) that will provide most value from traceability for CITES processes. A traceability system is developed in the report that links the CITES export permit or certificate process to a legal origination process via either a so-called mass balance process or through more specific systems on batch or unit levels. Such a traceability system should be combined with a risk management system that requires further documentary check in doubtful cases, with one risk dimension being the specificity of the traceability system employed.

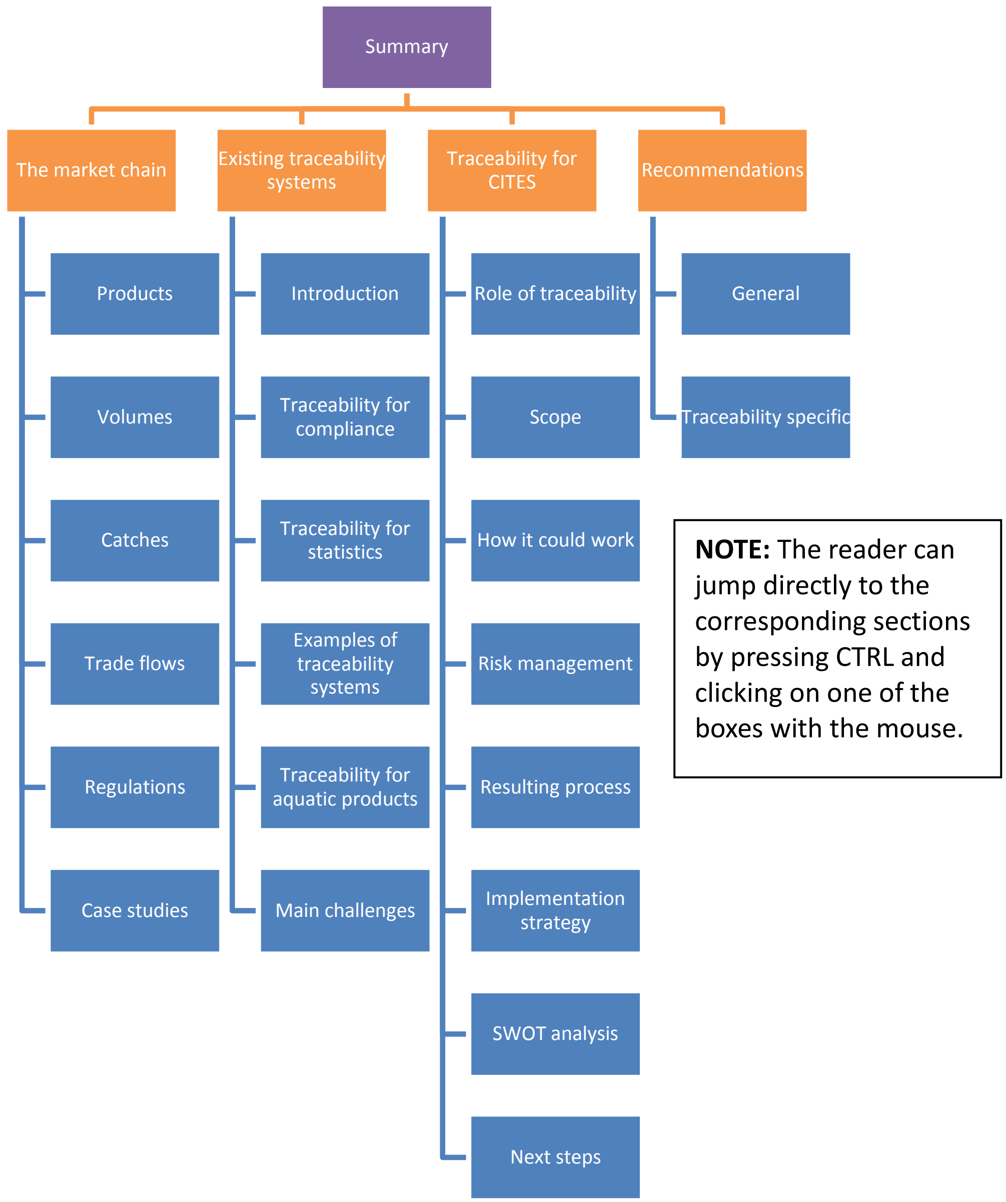
The report concludes with 9 recommendations regarding the use of traceability to strengthen CITES processes. However, it needs to be understood that while this study is based on years of

[1] http://www.iucnredlist.org/details/39374/1

experience in the implementation of traceability systems and through use of a network of relevant experts and scientific literature, the devil is in the detail. It is therefore suggested that a relevant pilot study be undertaken and suggestions for such a pilot are given.

1.1 Structure of the remaining document

This document is structured in the following way:



In addition, Annex I to this document provides a short characterisation of all CITES-listed shark species with products derived from them. Annex II collects basic information on Catch Documentation Schemes which are prime candidates for legal origination processes used in the proposed traceability system of Section 4.3.

1.2 Acknowledgements

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List of abbreviations

B&C. Book and claim, a system of tradable certficates
B2G. *Business to government*
CA. *Competent Authority*
CC. *Catch Certificate*
CD. *Catch document*
CDS. *Catch Documentation Scheme*
CoP. *Conference of Parties*
EEZ. *Exclusive Economic Zone*
EPCIS. *Electronic Product Code Information System, a set of data exchange standards managed by GS1*
FAO. *Food and Agriculture Organisation, a UN body*
FLUX. *Fisheries Language for Universal eXchange*
FOC. *Flag of Convenience*
G2G. *Government to government*
GHG. *Greenhouse Gas*
GlobalGAP. *A standardisation body called EurepGAP earlier*
GS1. *Global Standard One, a standardisation agency*
GTIN. *Global Trade Item Number*
HACCP. *Hazard Analysis and Critical Control Points, a food safety risk management methodology*
HMS. *Highly Migratory Species*
ICES. *The International Council for the Exploration of the Sea*
IFS. *Introduction from the Sea*
IT. *Information Technology*
LAF. *Legal Acquisition Finding*
LCS. *Large Coastal Shark*
MCS. *Monitoring Control and Surveillance*
MPA. *Marine Protected Area*
MSC. *Marine Stewardship Council*
NGO. *Non-governmental organisation*
NOAA. *National Oceanic and Atmospheric Administration, a US governmental body*
OUOD. *One up, one down method, a particular way to structure traceability systems*
RFB. *Regional fishery body*
RSPO. *Roundtable for Sustainable Palm Oil*
SCS. *Small Coastal Shark*
SME. *Small and medium enterprises*
TAC. *Total Allowable Catch*
UI. *Unique indentification*
UN/CEFACT. *A standardisation body of electronic business documents*
US. *United States of America*
USD. *United States Dollars*

2 The market chain

2.1 Shark Products

The carcass of a shark has substantial commercial value. Its most valuable parts are the fins, which are sold at prices as high as USD1,000 per set (Oceana, 2008). Shark cartilage serves as an ingredient for pills and powders in alternative medicine, while liver oil, called squalene, is a common ingredient in high price cosmetics. The meat is either cut as filet or steak for human consumption or fabricated into pet nutrition and fishmeal depending on the species. A more exhaustive list of shark uses is listed in the following table.

Table 2-1: More common uses for shark, adapted from (Shark Angels, 2011)

Part of the Shark or manta ray	Products thereof
Fin	a) Shark Fin Soup b) Dumplings
Cartilage (chondroitin) [2]	a. Shark Cartilage/ chondroitin pills and powder (alternative medicine) b. Energy drinks & supplements c. Dried/powdered manta and mobula gill rakers (Chinese medicine)
Liver (squalene/squalane, Liver Oil) [3]	a) Squalene pills (alternative medicine) b) Cosmetics (lip balms, face creams, cleaning agents and other) c) Vaccines d) Lubricant
Meat (mostly Porbeagle)	a) Steaks/ Filet (in some countries), with sometimes misleading names such as Swordfish, Thon blanc, Tuna flounder (Jacquet & Pauly, 2008)
Skin/Leather (Shagreen) (mostly Porbeagle/ Scalloped Hammerhead)	a) Wallets, Purses b) Shoes c) Furniture d) Other (Luxury) Leather Products e) Sandpaper
Shark teeth, jaws, snouts	a) Jewellery b) Souvenirs c) Trophies
Pet products	d) Food e) Fishmeal

[2] http://www.gnc.com/Natural-Brand-Shark-Cartilage/product.jsp?productId=3076015

[3] http://www.ewg.org/skindeep/browse.php?containing=706266&showproducts=1&notold=1

2.1.1 Shark fins

Fins are the most valuable part of sharks and also rank among the most expensive fish products in the world. The commercial value of the fin depends on various factors such as the percentage yield of fin rays or fin needles, type of fin (dorsal, caudal, etc.), the species, the general appearance (Vannuccini, Shark Utilization, Marketing and Trade, 1999). While most of the shark fins are used as ingredient in the traditional Chinese dish “shark fin soup”, the most expensive fins, usually from the larger shark species like whale sharks (*Cethorhinus maximus*), are used as displays in shark fin shops and shark fin soup restaurants (Oceana, 2008).

Shark fins soup is a traditional Chinese dish that is served at important events such as New Year’s Eve or weddings. It is used as a symbol of status as shark fins are relatively expensive and therefore only affordable by the upper-middle and upper class. Whole shark fins are also consumed braised or steamed.

Shark fins have little muscle tissue. Under the skin lie a number of collagen fibres, called fin needles (Vannuccini, 2002). These needles are used either separately or jointly as a bundle in soup making. The golden coloured collagen fibres are boiled in chicken stock to produce the distinctive flavour (Clarke, 2004). Fin needle type, size and length determine the quality and the price of the needles (Fong & Anderson, 2000).

Fin needles are sometimes replaced by “artificial shark fin”, reportedly from mung bean extract. According to Vannuccini, in Japan it is allowed to mix as long as 10% of any product labelled as shark fin really is shark fin (Vannuccini, 1999).

Fins are processed and marketed in a number of forms, of which the most important are (Vannuccini, 1999):

- Wet fins (fresh, chilled and unprocessed)
- Whole raw fins in dried form
- Semi-prepared skin-off
- Fully prepared
- Frozen prepared
- In brine
- As fin nests, i.e. with separated needles
- Canned or otherwise fully prepared

2.1.2 Shark meat

Sharks have traditionally been used as food, especially in coastal areas. Consumption of shark meat has been recorded in the literature as early as the fourth century. The Cretans and Persians caught and sold sharks 5,000 years ago in the Persian Gulf and the Mediterranean (Vannuccini, 1999; Vannuccini, 2002). Until the beginning of the twentieth century, shark meat consumption was rather limited and was not in high estimate as a food in many countries. Since the late 1950s, there has been a greater use of shark meat, thanks to better handling of shark meat, the use of ice and freezing, widespread malnutrition and the need for protein in the diet, the contemporaneous shortage of highly preferred bony fish in some areas and marketing efforts to promote shark meat as a substitute or alternative. However, in many countries it has been necessary to camouflage the name shark under euphemisms to overcome consumer resistance.

2.1.3 Shark liver oil

Sharks have no swim bladder and their buoyancy in sea water is made possible by their large livers which are saturated with oil. Deep sea sharks such as basking sharks are the major species targeted, as they contain a high yield of the oil and are therefore the largest natural reserves of shark-based squalene. They live in oceans with depth of 300 to 1,500 meters. Their livers may represent up to 25% of the weight of the entire animal, compared with around 5% in mammals. Even though these sharks are heavily targeted by fisheries, none of them is listed currently under the CITES Appendices (Oceana, 2008).

Squalene and squalane[4] are the main products derived from shark liver oil. While its historic use ranges from machine oil to the production of Vitamin A, it is currently used mainly as emollient and moisturizer in expensive cosmetics, such as anti-aging creams. Furthermore, it is used as a bactericide and as ingredient in some pharmaceuticals such as haemorrhoidal creams (Oceana, 2008).

Squalane is "naturally present in the skin lipid barrier of plants, animals and humans, preventing moisture loss while restoring skin's suppleness and flexibility" (Yeomans, 2014). In contrast to squalene, squalane is not subject to auto-oxidation and is colourless as well as odourless.[5] Furthermore, squalane can be derived from plants such as olives, as well. The plant-based squalene has the same qualities as animal-based squalene making it a natural substitute for the shark-based product.

However, consumers cannot be entirely sure of the ingredient's origin, as the current EU legislation on ingredient listing for cosmetics states that the origin of squalene does not have to be made explicit. Furthermore, the producers of squalene-based product might unintentionally mislabel the product, as there are instances where shark-based squalene is sometimes marketed as plant-based (Chabrol, 2012).

2.1.4 Shark cartilage

Shark cartilage is commonly used to derive chondroitin, a common ingredient in supplements and alternative medicine. Chondroitin is believed to help a variety of conditions, including arthritis, shingles, rheumatism, haemorrhoids, psoriasis, inflammatory disorders and cancer treatment. Even though there is no clinical evidence to support the claims that shark cartilage has any beneficial medicinal effect, companies continue to market it as such (Shark Angels, 2011; Shark Angels, 2011).

Shark cartilage is especially advertised as alternative treatment of cancer. However, numerous research studies have shown that it does not have a positive effect on life expectancy and on the quality of life of cancer patients (Cancer Research UK, 2015; U.S. National Library of Medicine, 2014; Shark Angels, 2011; American Cancer Society, 2008). Commercial Products include GNC's Natural Brand™ Shark Cartilage[6], Swanson Premium Shark Cartilage[7] and numerous other white label[8] products[9]. Other suppliers market shark cartilage as a supplement to improve the

[4] Fully hydrogenated or hardened squalene
[5] http://www.annmariegianni.com/difference-between-squalane-and-squalene/
[6] http://www.gnc.com/Natural-Brand-Shark-Cartilage/product.jsp?productId=2133186
[7] http://www.swansonvitamins.com/swanson-premium-shark-cartilage-750-mg-250-caps
[8] White label products are non-branded products, which are usually branded by the buyer
[9] http://www.ebay.com/bhp/shark-cartilage

condition of joints of humans and animals. Companies include Waitaki BioSciences[10], which markets the powder in high volumes (20kg bags), Aroma New Zealand Limited[11], UNNZ[12] and Summit Nutritional International[13], which claims to be the leading manufacturer in the United States. A more extensive list including suppliers in Indonesia, Mexico and the United Kingdom can be found on http://search.gmdu.net/b/Shark%20Cartilage.html.

In Japan, supplement makers also use shark cartilage. Some beverages even contain chondroitin, for example https://www.morinagamilk.co.jp/products/drink/rakuraku/1666.html.

2.1.5 Shark skin

The greatest use for shark skin is as leather products. Shark leather can be used to make a variety of products including furniture, book binding, shoes and handbags. Skin from frozen or chilled shark carcasses caught for their meat is usually so damaged that it is unsuitable for producing leather. Shark skin can also be consumed as food. Skin from dusky, thresher and whale sharks (*Rhincodon typus*), and from the giant guitarfish (*Rhynchobatus djiddensis*) is eaten in Taiwan, Province of China. Shark skin, as other fish parts rich in gelatine, is also processed into gelatinous food products. In a small mountainous part of Northern Japan there seems be a tradition to eat shark aspic ("Nikogori") for new year celebration[14]. In Singapore and Malaysia, processed and cooked shark skin is marketed as "shark lips" or "fish lips".

2.1.6 Other products

In addition to the products mentioned above, other parts of sharks are also used but within a very limited market. According to (Oceana, 2008)., shark stomachs are eaten in Asia, eyes are used in the cosmetic and pharmaceutical industries and jaws and teeth are traded for decoration and jewelleries. Fishmeal and pet food are among other products from sharks.

2.2 Relative market volumes of shark products

2.2.1 Shark fins

Clarke et al. estimate the global trade volume of shark fins to be 11,602mt in 2000, where 59% were traded through Hong Kong, SAR (Clarke, et al., 2006). However, the study considers a time span of 1996-2000 where volumes and market shares have fluctuated significantly (see Figure 2-1).

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[10] http://www.waitakibio.com/manufacturer/shark-cartilage
[11] http://www.thefoodworld.com/company/aroma-new-zealand-limited
[12] http://www.unnz.co.nz/products-shark.html
[13] http://summitnutritionals.com/our-products/
[14] http://www.fao.org/3/a-x2098e/X2098E05.htm

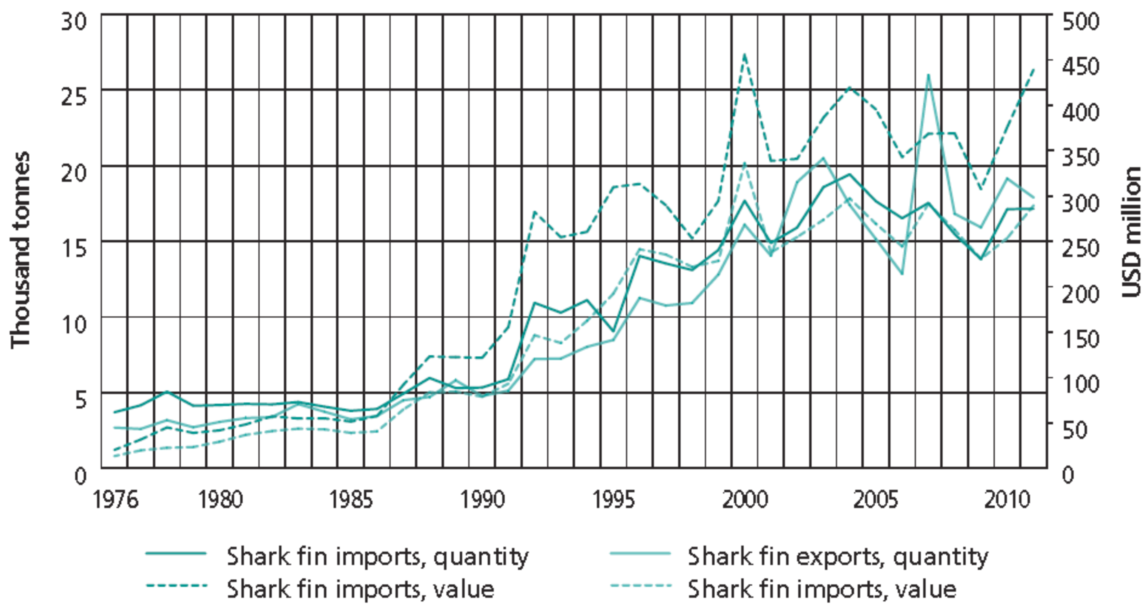

Figure 2-1 World trade in shark fins (Dent & Clarke, 2015)

Extrapolating to 2015, the current market volume would be about 14,600 t. However, this number is highly speculative, e.g. because recent developments in China are likely to have had a significant impact on global demand. Other sources of information estimate that the total volume of shark catches has slightly decreased from 1.44 million tons in 2000 to 1.41 million tons in 2010 (Worm, et al., 2013). Such a decrease up to 2010 would situate the total trade volume in shark fins still around 11,602 t.

Total market value is unclear due to the lack of public information on current market volumes and prices for shark fins. However, there are some anecdotal data by Whitcraft, who surveyed a small sample of traders in Hong Kong in December 2013 (Whitcraft, et al., 2014). According to this data, the average wholesale price is USD267 per kg (USD168.8 per kg when excluding the highest and lowest observation). All sampled traders reported steep price decreases from the year before with an average price decrease of 48.8%.

Assuming the Hong Kong, SAR price is a good proxy for the global market price, this would mean that the estimated total market value in 2013 was either $14116.9\ t * 168.8\ USD/t = USD\ 2.38\ m€$ or $11602\ mt * 168.8\ USD/t = USD\ 1.96\ m€$ for the new price and $USD4.66\ m€$ or $USD3.83\ m€$ at the old price ($330\ USD/t$).

Interestingly, most traders stated that the supply of shark fins was relatively steady, while the decline in prices was primarily due to a sharp decrease in demand in the Chinese market.

Table 2-2: Different scenarios for volume and prices

Volume/Price	Estimate "trimmed average"		Estimate "simple average"	
	USD168.8 per Kg	USD330 per Kg	USD 267 per Kg	USD521.5 per Kg
Steady (11602 t)	USD1.96 m	USD3.83 m	USD3.10 m	USD6.05 m

Extrapolated (14117 t)	USD2.38 m	USD4.66 m	USD3.77 m	USD7.36 m
Category Average	USD3.21 m		USD 5.07 m	
Scenario	Price Decrease	USD2.80 m	Price Rebound	USD5.475
Overall average	USD4.14 m			

2.2.2 Shark meat

Shark meat prices depend greatly on the species and thus the value of shark meat is difficult to assess on a global scale. A report by the Food and Agriculture Organization (FAO) has shark meat prices ranging from USD0.49/kg to USD9.91/kg (Vannuccini, 1999).

To estimate the volume of meat using the biomass estimation by Clarke et al. (Clarke, et al., 2006) or Worm et al. (Worm, et al., 2013) it is necessary to first the percentage of the shark that can be processed as meat. A report (Hareide, et al., 2007) by the European Elasmobranch Association (EEA) estimates that a beheaded and gutted shark weighs about 75% of the initial body mass. Assuming that about 5% of the shark weight is fins and that about 50% of the remaining biomass can be processed as shark meat, this leaves 35% of the biomass to be shark meat. This leads to a market volume of 0.49 million t to 0.6125 million t per year. Combining this with the estimated price per kg, this gives a market volume of USD0.74m to USD0.93m for the case without dogfish and USD0.88m to USD1.10m for the case with dogfish.

According to Clarke and Dent, global trends suggest that shark fin supplies are limited by the existing levels of shark capture production, but shark meat is under-utilized by international markets and the import-export trade may thus continue to expand (Dent & Clarke, 2015). The latest official figure of 121,641 tons (USD379.8 million) of shark (sharks, skates, rays and chimaera) meat imported in 2011 represents an increase of 42% by volume compared with 2000. To some extent the increasing amounts of shark meat observed in international trade may be the result of a wider application of restrictions on shark finning which, if complied with, may encourage landings of sharks whose fins are intended to be utilized. In this case, larger quantities of shark meat in international trade will not necessarily signal higher shark catches. Nevertheless, there are likely to be areas where increasing demand for seafood, and the decreasing proportion of under-utilized stocks of other fish species, will see demand for shark meat remain sufficiently high that even if demand for shark fins declines, existing fishing pressures will not.

2.2.3 Shark liver oil

According to Chabrol, shark liver oil sells at USD12 to USD15 per kg (Chabrol, 2012). Estimates of shark liver per shark and liver oil per liver are rare and vary dramatically dependent on the species of shark studied. Possible values include 10%[15], 16%[16] and 40%[17]. However, some studies (Kreuzer & Ahmed, 1978) argue that the relative size of the liver tends to increase with

[15] http://www.gma.org/fogm/Cetorhinus_maximus.htm
http://content.cdlib.org/view?docId=kt1q2n9851;NAAN=13030&doc.view=frames&chunk.id=d0e1939&toc.id=d0e97&brand=calisphere

[16] http://www.gma.org/fogm/Cetorhinus_maximus.htm

[17] http://www.fishwell.com.au/app_cmslib/media/lib/0908/m333_v1_report%20on%20industry%20deepwater%20shark%20information%20-%20final.pdf , might not be as relevant since it concerns a non CITES listed shark

the total body mass and gives estimates for 5 different types of sharks (Kitefin 19.2%, Tiger, 17.5% Salmon, 12.0%, Thresher 10.0%, Soupfin 2.9%) with an average of 12.32%.

Clarke et al. (Clarke, et al., 2006) estimate the average shark carcass caught to range from 1.21 and 2.29 million tons year in 2000 (1.75 mt on average). Extrapolating this estimate as in the shark fin example yield an estimate of 2.2 mt in 2015. On the other hand, Worm, et al. (Worm, et al., 2013) estimate that the total volume of shark catches remained unchanged from 2000 to 2010 at a volume of 1.41 mt. Using this estimate together with the average liver weight per biomass, the total landings of shark liver can be estimated to be either 0.271 million t or 0.174 million t. Assuming that the liver consists of 60% oil this yields an estimate of 0.104 million t to 0.163 million t of liver oil. Selling at an average price of (12-15USD)/2=13.5USD gives an estimated global market value of USD1.4m to USD 2.2m , with an average of USD1.8m. This is approximately equivalent to 43% of the value of the market in fins (using the average estimate). Using the estimate of Chabrol (Chabrol, 2012), who states that the estimated demand for shark liver oil was 2,000 to 2,200 tons per year, the total market size would range from USD27,000 to USD29,700. This would imply that the value of shark livers would be negligible by any standard and is somewhat astonishing given that many environmental groups report serious overfishing of deep-sea sharks, which are targeted for their livers. This puts doubts on the volume estimates of Chabrol (Chabrol, 2012).

Among the CITES-listed sharks, only the basking shark is explicitely mentioned by the FAO as target for their liver (Vannuccini, 1999; Vannuccini, 2002).

2.2.4 Squalane/Squalene (derived from shark liver oil)

Shark liver oil commonly sells at USD12-15/kg, while the derived squalene is priced at USD15-25/kg. The processed squalane is marketed at USD20-USD/kg. However, the prices depend on the origin of the squalane as some sources are seen as purer than others (Chabrol, 2012). Due to recent technological advances in the extraction of plant-based squalane coupled with the over exploitation of the relevant shark species and the resulting decline in shark catches, Oceana reported that shark-based squalene is now 20-30% more expensive than plant-based squalene (Oceana, 2008). However, this report was challenged by Chabrol, who claims that the plant-based product is up to 30% more expensive depending on the seasonal supply of olives (Chabrol, 2012). Nonetheless, numerous cosmetic companies, such as Unilever (Pond's and Dove) and L'Oreal have abandoned the use of the shark-based[18] squalene (Oceana, 2008)..

The 2012 global demand for squalene from shark liver oil was estimated at 2,000-2,200 tons, of which 90% comes from the cosmetics industry and 9% by the nutraceutical industry. Even though the European market seems to have moved predominantly towards plant-based squalane, the global market is still largely supplied with the shark-based product. The Japanese market is an important client as it accounts for approximately 40% of the global demand, while a demand for the plant-based product is almost non-existent (Chabrol, 2012).

According to MarketsandMarkets, a business intelligence company, the main players in the squalane market are Sophim (France), Croda International (U.K.), Amyris Inc. (U.S.), Empressa Figueirrense de Pesca, LDA (Portugal), SeaDragon Marine Oil Ltd. (New Zealand), and Kishimoto Special Liver Oil Co. (Japan) (MarketsandMarkets, 2015). The raw material, shark liver oil, is mainly extracted in the Indian Ocean, the South-East Atlantic and the West Pacific by companies

[18] The report explicitly mentions Unilever, L'Oreal, Beiersdorf, LVMH, Henkel, Clarins, Sisley and La Mer.

based in the Philippines, Indonesia, India, Australia, New Zealand and Spain, whose fisheries use Partnership Agreements and Joint Ventures to fish outside of European waters (Chabrol, 2012). However, market size estimates should be taken into account carefully, as there exists no standard code specifically for shark liver oil or shark-based squalane and squalene (except for South Korea) and countries generally do not declare trade to the FAO (Chabrol, 2012).

Besides its cosmetic use, squalene is sometimes used in alternative medicine. Well-known companies using shark-based squalene include Mayumi[19], MariClear[20], Jedwards[21], Okinawa[22], HABA[23] and Sigma-Aldrich[24]. However, there are numerous suppliers of capsules and oils[25].

2.3 Shark catches

Unfortunately, the trade and landing of sharks is not well documented. A key problem is the incomplete reporting of shark catches to the FAO, which tracks the status of fisheries worldwide. Caught sharks are often not landed and are instead discarded at sea (Stevens, et al., 2000; Clarke, et al., 2006), with such discards not usually reported to national or international management agencies unless there are trained observers on board. Compounding this problem is the practice of shark finning, where the animal's fins are removed prior to the body being discarded at sea (Clarke, et al., 2006). Therefore, it is very likely that reported catches represent only a fraction of total shark mortality. For example, (Clarke, et al., 2006) used trade auction records from Hong Kong to estimate that the total mass of sharks caught for the fin trade. Estimates ranged between 1.21 and 2.29 million metric tons per year with a median estimate of 1.70 million metric tons per year in the year 2000. This amounted to more than four times the reported shark catch from FAO at that time. The study points to Hong Kong SAR being the main trade hub for shark fins with an average of about 50% of the world trade. Other main traders of shark fins are China, Taiwan, Province of China, Singapore and Japan. Another recent study (Worm, et al., 2013) also provide an estimate of shark catches, discards and mortality worldwide. According to this study it is estimated that at least 1.4 million tons, or 100 million shark individuals are killed per year. They highlighted that exploitation rates of sharks calculated from these data, or from stock assessments, are unsustainable.

2.3.1 Common supply chains

The supply chain starts at the time of catching, i.e. on the fishing vessel. Commonly fishing vessels have significant storage capacity and operate for an extended time on the sea. Sharks are usually beheaded at sea, while the fins stay naturally attached or are separated according to the regulation in the target port.

The second step in the supply chain will be either transhipment or landing at the initial landing port. At the landing port, the carcasses will typically be weighted and separated into different product categories such as meat, livers, fins etc. Commonly these products are then shipped to international trade hubs.

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[19] https://www.momentum98.com/squalane.html
[20] http://tri-k.com/mariclear-shark-squalane
[21] http://www.bulknaturaloils.com/Category/557-bulk-shark-liver-oil.aspx
[22] http://www.okinawab2b.jp/misc5.html
[23] http://www.habaus.com/products/squalane
[24] http://www.sigmaaldrich.com/catalog/product/aldrich/234311?lang=de&region=DE
[25] http://www.ebay.com/bhp/shark-liver-oil

In the third step of the most common supply chain, the products arrive at international trade hubs where they are auctioned or sold. From these hubs, the products are either sold to big corporations or traders that supply local markets.

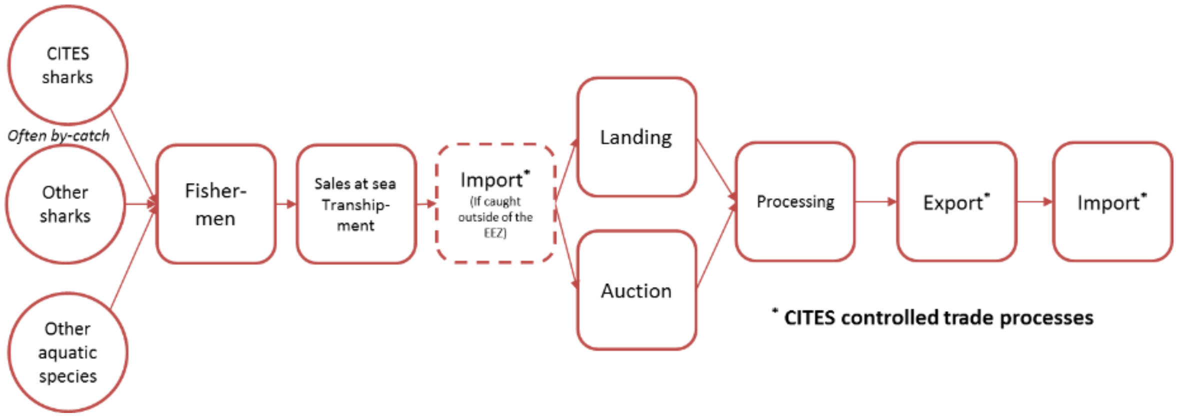


Figure 2-2 Simplified shark supply chain. For a more complete version see (Vannuccini, 1999; Vannuccini, 2002)

2.3.2 Illegal fishing activities

Researcher and environmentalist groups suspect that a large share of shark fishing occurs illegally and/or unreported. Developing countries struggle to protect their marine reserves due to the difficulty and expense of patrolling large areas of ocean (WildAid, 2007).

For example, the Galapagos are victim of a large amount of illegal fishing activities by close neighbours. Until recently, Ecuador was a major exporter of shark fins to East Asian markets, a large share of which were suspected to result from IUU fishing. Despite a prohibition on the export of shark fins since October 2004, illegal export continued after the ban (Watts & Wu, 2005; Jacquet, et al., 2008; Fietz, et al., 2013; Guardian, 2015). According to the prohibition directed fishing of sharks is banned in all Ecuadorian waters, but sharks caught in “continental” (i.e. not Galapagos) fisheries may be landed if bycaught. Sharks must be landed with fins attached in all fisheries. As of October 2014, a previous ban (in Ecuador) on trade in shark fins was lifted in 2007 (*ibid*). Shark fins are smuggled out of the Galapagos in a variety of ways. Some companies use large “mother ships”, which are stationed just outside the Marine Reserve and are regularly supplied with fins by small, fast moving boats, usually at night. In other cases, fins are packed into suitcases and smuggled from the Galapagos by plane. Shark fins have been found hidden in fuel-transport vessels and also on board cargo ships, concealed in coffee sacks and petrol containers. Pirate fishing is a great problem in Costa Rican waters as well. To work around the Costa Rican law, which requires fins to arrive naturally attached to the shark bodies, the slice-and dice finning (spinning) method was devised. A famous case was “Tseng’s case” in 2011 in which Costa Rican customs officials unloaded 332 shark carcasses from a Taiwanese ship’s hold. With flesh carved away and the fins clinging to spines by narrow strips of skin. The gruesome “spinning” technique attempted to exploit a legal loophole. On October 2012, a presidential decree was signed that banned the practice of shark finning, as well as the importation and transportation of shark fins. However according to second article of this decree, fins can be transported across the border with a certificate signed by the origin countries officials stating the sharks were landed with fins attached (Procraduria general de la Republica de Costa Rica, 2012) and this might still be used as a loophole from neighbouring countries on their illegal finning trades.

In Australia, increasing numbers of Indonesian fishermen are encroaching into the country's tropical northern waters as overfishing has depleted shark populations in many other parts of Southeast Asia. With shark fin worth up to USD700 per kilogram on the Chinese market, Indonesian fishers are prepared to take huge risks, including hefty fines and jail terms, to pursue these lucrative catches. If they are not caught, a single trip can provide the same economic return as a year of fishing in Indonesian waters (WildAid, 2007).

One common way in which fishermen circumvent management and conservation measures and avoid penalties for illegal fishing is by registering under a "Flag of Convenience" (FOC). Although international law specifies that the country whose flag a vessel flies is responsible for controlling its activities, certain countries allow vessels of any nationality to fly their flag for a small fee and then ignore any offences committed. These countries often lack the institution to regulate vessels under their flag (EJF, 2009). A report by Oceana on EU shark fishing points out that some fisheries misuse "Fisheries Partnership Agreements" (FPA's)[26] to catch sharks outside the EU's regulatory power. Instead of targeting the species under the contract, e.g. tuna, these vessels target sharks and end up with a "by-catch" of up 90% of the weight landed (Oceana, 2007). The new European Common Fisheries Policy of 2014, introduces a discard ban and landing obligation. In the region covered by this regulation, when a fishery falls under the landing obligation, all species in that fishery subject to catch limits should be landed. For years, certain total allowable catches (TACs) for stocks of elasmobranchs (skates, sharks, rays) have been set at zero, with a linked provision establishing an obligation to immediately release accidental catches. The reason for this specific treatment is that those stocks are in a poor conservation status and, because of their high survival rates, discards will not raise fishing mortality rates for them; discards are deemed as beneficial for the conservation of these species. As of 1 January 2015, however, catches of these species in pelagic fisheries will have to be landed, unless they are covered by any of the derogations from the landing obligation foreseen in Article 15 of Regulation (EU) No 1380/2013. Article 15(4)(a) of that Regulation allows such derogations for species in respect of which fishing is prohibited and which are identified as such in a Union legal act adopted in the area of the Common Fisheries Policy. Therefore, it is appropriate to prohibit the fishing of these species in the areas concerned (European Commission, 2015; European Commission, 2013). This obligation may close the loophole of "by-catch" statement of fisheries misusing the FPA. The by-catch or incidental catches' volumes could not be a high volume in these cases.

2.4 Regional distribution of shark trade and consumption

According to FAO statistics, the top five shark producers from 2000 to 2011, were Indonesia, India, Spain, Taiwan, Province of China and Argentina (FAO, 2013). The major part of shark fins is exported to a number of destinations in East and Southeast Asia. However the largest consumers of shark meat are European and South American countries (Dent & Clarke, 2015).

[26] Fisheries Partnership Agreement set a price for fishing by foreign vessels of the partner country in the home countries waters. E.g. Spain may agree with the Solomon Islands to pay 3000 Euro per year per vessel to be able to fish in their waters (Oceana, 2007).

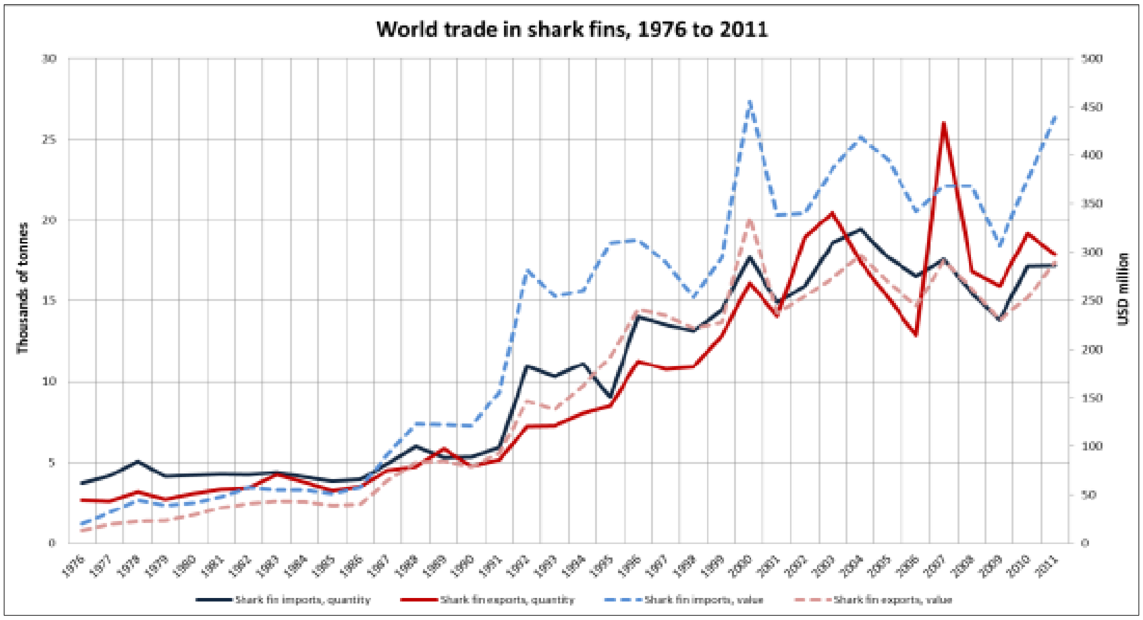


Figure 2-3: World trade in shark fins from 1976 to 2011 (Dent & Clarke, 2015)

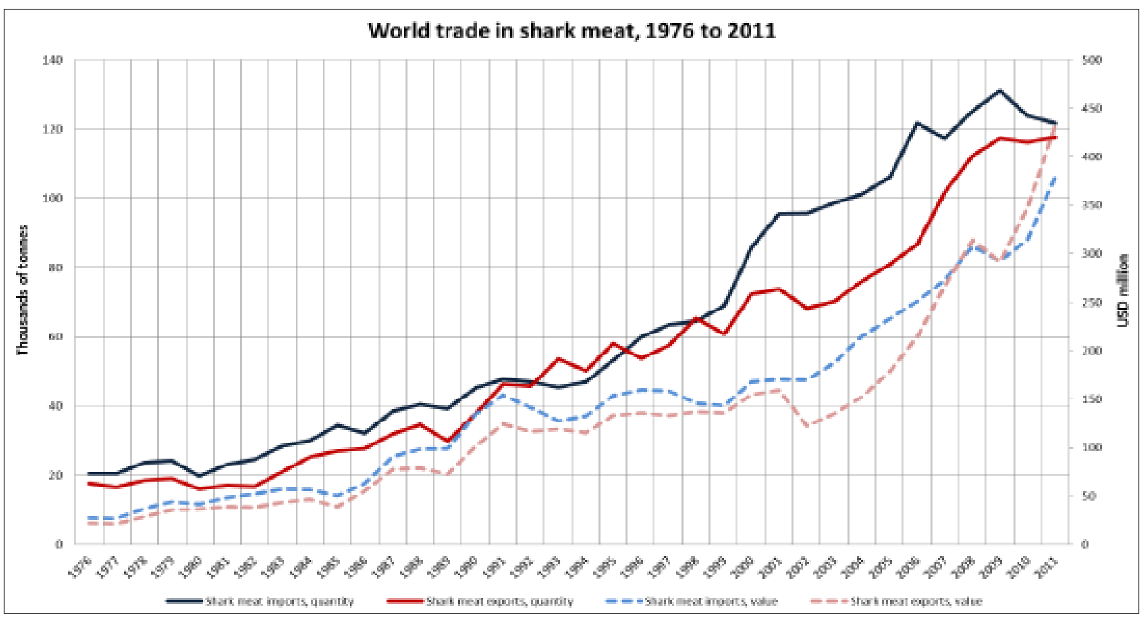


Figure 2-4: World trade in shark meat from 1976 to 2011. *Source:* (Dent & Clarke, 2015)

Figures below map the common trade hubs and routes for shark meat and fins.

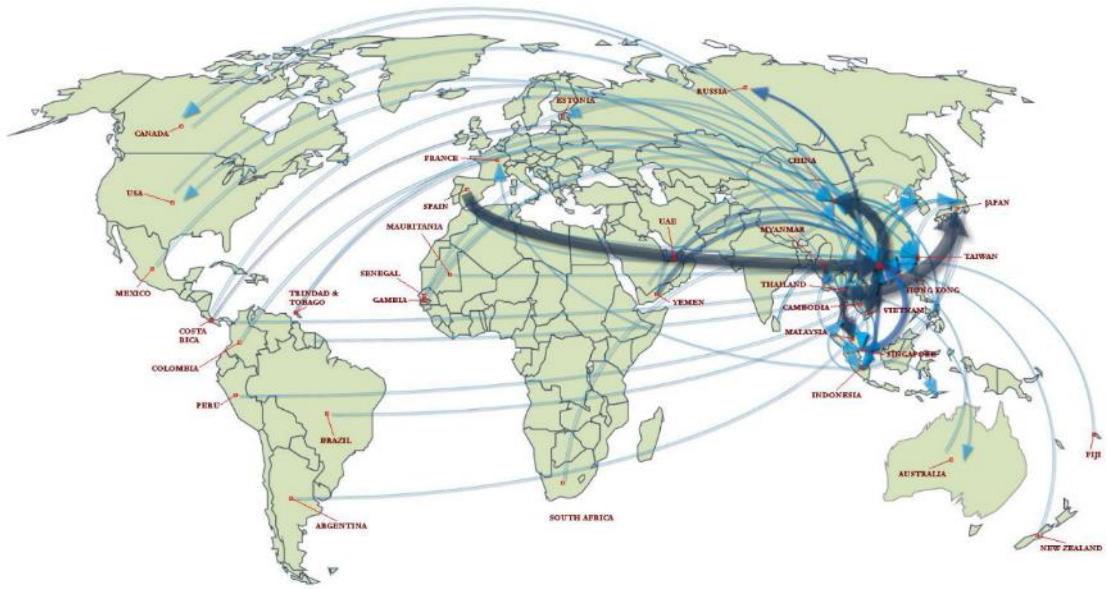


Figure 2-5 World trade in shark fins, trade flow map, average annual quantity, 2008 to 2011 inclusive (thicker/darker .lines indicate higher volume, excludes flows < 50 tonnes annually); Source: (Dent & Clarke, 2015)

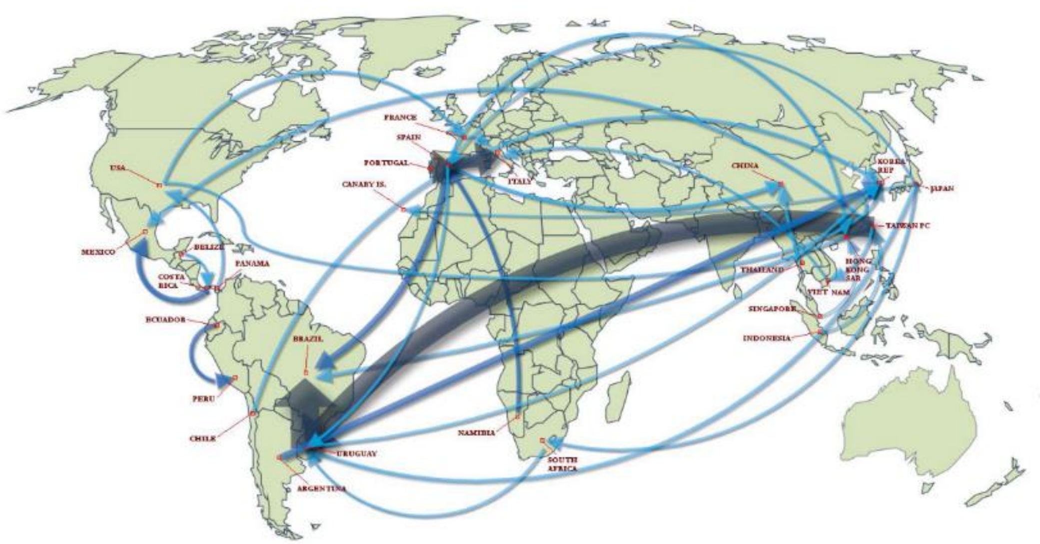


Figure 2-6 World trade in shark meat, trade flow map, average annual quantity, 2008 to 2011 inclusive (thicker/darker lines indicate higher volume, excludes flows < 1000 tonnes annually) ; from (Dent & Clarke, 2015)

2.4.1 European Union

Member countries of the European Union are involved in all parts of the shark trade. Even though the European Union has a share of 12% of the global shark meat production in 2005, it was responsible for 56% of the global imports and 32% of global exports. Furthermore, three European countries, namely the Netherlands, France and Spain, were found to participate in the global shark fin trade. Spain's average annual exports of shark fins, from 2000 to 2011, were about 3 490 tons, worth USD57.9 million. The major destination for Spain's shark fin exports, based on comparison of the official statistics as published by the various customs authorities, is China, Hong Kong SAR. From 2000 to 2012, exports to China, Hong Kong SAR accounted for, on average, 80 percent of the total volume (2,648 tons) and 86 percent of total value (USD47.6 million) (Dent & Clarke, 2015).

With regard to shark meat, Italy is the largest consumer of imported shark meat within Europe, accounting for more than 30% of all European Union imports. It ranks as the third-largest importer of shark meat in the world by volume. From 2000 to 2011, It recorded average annual shark meat imports of11 526 tons, worth USD34.8 million (Dent & Clarke, 2015). In Italy, frozen blue shark steaks are sold side by side with frozen swordfish steaks and often used as a cheap replacement (Oceana, 2008; Jacquet & Pauly, 2008). Traditionally, sharks eaten in Italy were caught in the Mediterranean, but since shark populations are dwindling due to overfishing, most of the shark meat eaten today is imported as frozen carcasses, processed within the country and sold as frozen steaks or fillets. It is predominantly eaten in northern Italy, and in general smaller shark species are preferred to larger ones. Major imported species include the porbeagle (*Lamna nasus*) that is listed in CITES Appendix II.

Spain, on the other hand, is the biggest trader of shark meat in Europe and is responsible for importing and exporting most of shark fins and shark meat in Europe. The Galician port of Vigo and the port of Las Palmas in the Canary Islands are the European centres for the shark fin trade. In Las Palmas, Spanish vessels and the Japanese Atlantic longliners land shark fins.

Shark is consumed in Spain as well. Frozen and fresh shark fillets can be found next to tuna and swordfish steaks in supermarkets and fish shops in Spain. However, the name of the product may not always indicate shark meat. Furthermore, depending on the region, producers and supermarkets may give different names to shark meat.

Besides Italy and Spain, France, Portugal, the United Kingdom, Greece, Denmark, Belgium and Germany are the other European Union importers of shark meat and are among the top 20 importers worldwide. In France shark meat is sold under various, somewhat misleading names, such as veau de mer ("sea veal") for porbeagle (Oceana, 2008).

According to Oceana's findings, "there are mainly three industrial and rather destructive fishing fleets involved: the deep- sea gillnet fishery, carried out mainly by French and English flagged vessels; the Spanish deep-sea longline fishery; and the French and English bottom trawl fishery." (Oceana, 2008).

2.4.2 China

The change in economic policy in the late 1980s lead to an increase in the demand for shark fins by the emerging Chinese middle and upper class. This increase in demand was followed by a significant increase in supply of shark fins by the fishing industry as prices soared. However, the new supply was often criticized by environmental groups because many fisheries engaged in "finning" and had little regard for the consequences of overfishing. "Finning" is the practice of cutting off the shark fins aboard and throwing the remaining carcass back into the sea. This technique was often used as the price of fins was far above the value of the remaining carcass and thus finning allowed the fisheries to increase their profit significantly (Watts & Wu, 2005; Oceana, 2008). As a result, many countries such as the United States and the European Union member states have anti-finning regulations that require the fins to be naturally attached to the shark carcasses when landed. While this policy was generally welcomed, it was also pointed out that this regulation may have a major effect on distant long-liner operation and may cause an increase in discards of sharks caught as by-catch (many of which can be dead upon haul), in particular since the remaining carcass is often of low value (Miyake, et al., 2010; Oceana, 2011; Watts & Wu, 2005).

In recent years, consumer-awareness media campaigns by environmental groups seem to have changed the public perception on shark fin soups. As many Chinese consumers were not aware of the shark fin in shark fins soup[27], the practice of finning and the severe consequences of overfishing, awareness campaigns were successful in convincing many Chinese consumers to refrain their consumption. Among the success factors of these media campaigns is the participation of Chinese celebrities such as the former NBA player and Chinese idol Yao Ming (Denyer, 2013).

In addition, in December 2013, the Chinese authorities published a regulation that explicitly ruled out dishes containing shark fins, bird nests and wild animal products in official reception dinners (Xinhuanet news agency, 2013).

As a result, traders in Hong Kong and Mainland China report that demand has dropped significantly over the recent years (Whitcraft, et al., 2014). The decline in demand also had a declining effect on prices, which, at the time of writing are down up to 40% compared to 2010. However, this assertion is based on information gained in interviews with Chinese traders and may not accurately reflect current prices, i.e., the trade centres may have shifted.

Imports into China excluding Hong Kong, SAR in 2004 were estimated at 4,776t, representing 36% of global imports. However, Clarke reports that a significant portion of frozen fins have been reclassified within an aggregated commodity category (Dent & Clarke, 2015) which makes it more difficult to determine China's exact share of the world demand for shark fins.

Note: other than in the literature, more recent data seems to indicate that since 2006 the Chinese Custom code are separated for different types of fins or even for specific species. The table below shows the codes related to shark fins (China Trade Data Service, 2012).

HS Codes used in Chinese custom related to sharks

- **03** Fish and crustaceans, molluscs and other aquatic invertebrates
    - **0302 Fish, fresh or chilled, excluding fish fillets and other fish meat**
        - **030281** Other fish, excluding livers and roes:
            - **03028100** Dogfish and other sharks
                - **0302810010** Whale shark (*Rhincodon*), man-eating shark (*Cachardon*), basking shark (*Cetorhinus*), (Excluding livers and roes), fresh or chilled
                - **0302810090** Other
            - **03028**200 Rays and Skates
            - **03028**300 Toothfish
    - **0303 Fish, frozen, excluding fish filet and other fish meat**

[27] The direct translation from Chinese is "fish wing soup" (Whitcraft, Hofford, Hilton, O'Malley, Jaiteh, & Knights, 2014)

- 030381 Other fish
  - 03038100 Dogfish and other sharks
    - 0303810010 Whale shark (*Rhincodon*), man-eating shark (*Carcharodon*), basking shark (*Cetorhinus*)
    - 0303810090 Other
    - 0303820000 Rays and Skates

- **0305 Fish, dried, salted or in brine, smoked fish whether or not cooked before or during the smoking process; flours, meals and pellets of fish fit for human consumption**
  - 03057100 Shark fins
    - 0305710010 Whale shark (*Rhincodon*), man-eating shark(Cachardon), basking shark (*Cetorhinus*)
    - 0305710090 Other

- **1604 Prepared or preserved fish**
  - 1604.2011 Shark fin in airtight container
  - 1604.201110 Shark fin of Whale shark (*Rhincodon*), man-eating shark (*Cachardon*), basking shark (*Cetorhinus*)
  - 1604.201190 Other
- 1604.201910 Fish in imminent danger

2.4.3 Hong Kong, SAR

As well as being one of the largest consumer markets for shark fins, Hong Kong SAR has historically been the most important trader of shark fins in the world, accounting for the majority of recorded import volume and value since data first became available, and also establishing itself as the world's largest exporter from the late 80s onwards (Dent & Clarke, 2015). It posts only minimal domestic production volumes. Hong Kong SAR is also notable for being the only customs territory that has consistently distinguished between four different types of shark fin in its trade database, maintaining separate commodity codes for frozen, dried, processed and unprocessed shark fins (Dent & Clarke, 2015).

From 2000 to 2011, China, Hong Kong SAR maintained its position as by far the world's largest trader of shark fins, controlling the majority of global trade. In this period, China, Hong Kong SAR imported shark fins worth an average of USD378 million (10,480 tons) per year, representing about 80 percent of the global total in value terms (62 percent of total volume). The dominant position of China, Hong Kong SAR in the international market is based on its role as a mass importer and re-exporter, acting as a supplier to a number of other, mainly Asian countries (such as China) in addition to its own domestic market. Its contribution to shark fin production is minimal. From 2000 to 2011, China, Hong Kong SAR reported average chondrichthyan captures of 333 tons, an insignificant quantity in practical terms when compared with the world's top three producers in 2011: Indonesia (106,034 tons), India (73,842 tons) and Spain (61,293 tons). Indeed, of the total 70,697 tons of shark fins exported by China, Hong Kong SAR from 2000 to 2009, only 3 tons were domestically produced exports (Hong Kong Census and statistics department, 2011; Dent & Clarke, 2015).

2.4.4 Singapore

Apart from Hong Kong, SAR, Singapore seems to be the second largest trade hub for shark fins worldwide. While Singapore's share of the international trade in shark meat is negligible, its trade in shark fins dominates reported ASEAN imports (60-80%) and exports (45-65%) and covers a significant portion of global trade volumes in shark fins (7-17%). Furthermore, national trade statistics indicate that Singapore also acts as entrepôt for the trade in shark fins. While Singapore's reported capture of shark fins is less than 100t per annum, Singapore's reported exports of about 700t shark fin indicate production of processed fins from imported raw product

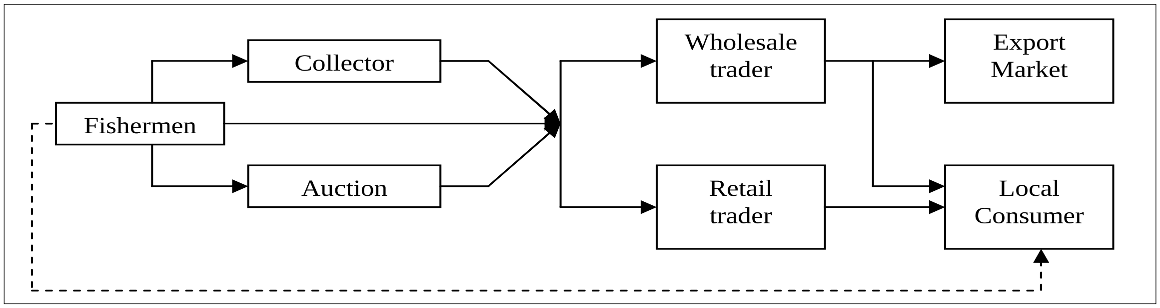


Figure 2-7: General pattern of shark trade in Southeast Asia (SEAFDEC, 2006)

(SEAFDEC, 2006).

Singapore functions as an international and regional trade hub, supplying China's market as well as countries in Southeast Asia with shark meat and fins. Singapore is supplied with the raw material for production by a large number of countries. The processed high quality shark fins are then shipped to China, while the Southeast Asian market is mainly supplied with lower grade fins due to market conditions. Prices are relatively consistent between ASEAN (including Singapore) markets with dried loose fin needles in 'nests' commanding USD150-250/kg, small (<10cm) whole fins at USD200-400/kg (dried) or USD40-100/kg (wet), and small loose fin needles (wet) at USD3-40/kg (as subject to mixing with artificial fins). However, reliable information regarding the species used in the shark fin trade is difficult to come by. Hence, any attempt to better regulate the use of CITES-listed sharks would require creating or expanding an existing catch documentation scheme to include species-specific information, at least for the CITES-listed sharks in Singapore (SEAFDEC, 2006; Dent & Clarke, 2015).

2.4.5 Recent changes in market trends

Recently market trends have slightly changed, in particular for meat. Large shark producers such as Spain and Taiwan, Province of China, in addition to their roles as suppliers to the shark fin markets, also export large volumes of shark meat to their respective major market partners, i.e. Italy and Brazil. Uruguay has also emerged as an important importer of unprocessed shark meat from major shark fishing nations (such as Taiwan, Province of China and Spain) and re-exporter of processed shark meat supplying the rapidly expanding Brazilian market. Together, Uruguayan imports of raw material and Brazilian imports of processed shark meat from Uruguay account for the major proportion of the increase in shark meat volumes traded (Dent & Clarke, 2015).

United Arab Emirates is becoming increasingly important as a supplier of raw material to Hong Kong SAR, consisting almost entirely of unprocessed dried fins, although a comparison of export volumes with reported capture volumes strongly suggests that underreporting of captures and/or imports from other regional producers is occurring. According to Clark and Dent, and despite what appears to be declining trends in shark fin trade volumes in Hong Kong, SAR and China, Thailand has surpassed Hong Kong, SAR as the world's largest exporter of fins, and estimates suggest that its main trading partners Japan and Malaysia may be among the world's top four importers of shark fins – particularly small, low-value fins – with no indications of decline (Dent & Clarke, 2015).

2.5 A short overview of relevant regulations

This section is meant to provide the reader with a stand-alone reference to relevant types of legislation governing the catch, sale and trade of CITES-listed shark species. The section is meant to exemplify different types of legislations that will be relevant when discussing the existing legal origination process in Section 4.3. The section provides with Table 2-3 on page 37 a summary of different types of legislations.

2.5.1 CITES regulations[28]

CITES works by subjecting international trade in specimens of selected species to certain controls. All import, export, re-export and introduction from the sea of species covered by the Convention has to be authorized through a licensing system. Each Party to the Convention must designate one or more Management Authorities in charge of administering that licensing system and one or more Scientific Authorities to advise them on the effects of trade on the status of the species.

The species covered by CITES are listed in three Appendices, according to the degree of protection they need.

Appendices I and II

Appendix I includes species threatened with extinction. Trade in specimens of these species is permitted only in exceptional circumstances.

Appendix II includes species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival.

The Conference of the Parties (CoP), which is the supreme decision-making body of the Convention and comprises all its member States, has agreed in Resolution Conf. 9.24 on a set of biological and trade criteria to help determine whether a species should be included in Appendices I or II. At each regular meeting of the CoP, Parties submit proposals based on those criteria to amend these two Appendices. Those amendment proposals are discussed and then submitted to a vote. The Convention also allows for amendments by a postal procedure between meetings of the CoP (see Article XV, paragraph 2, of the Convention), but this procedure is rarely used.

Appendix III

This Appendix contains species that are protected in at least one country, which has asked other CITES Parties for assistance in controlling the trade. Changes to Appendix III follow a distinct procedure from changes to Appendices I and II, as each Party's is entitled to make unilateral amendments to it.

[28] This text is presented for the purpose of a stand-alone report only; the contents is mainly drawn directly from the CITES website.

A specimen of a CITES-listed species may be imported into or exported (or re-exported) from a State party to the Convention only if the appropriate document has been obtained and presented for clearance at the port of entry or exit. There is some variation of the requirements from one country to another and it is always necessary to check on the national laws that may be stricter, but the basic conditions that apply for Appendices I and II are described below.

Appendix-I specimens

1. An import permit issued by the Management Authority of the State of import is required. This may be issued only if the specimen is not to be used for primarily commercial purposes and if the import will be for purposes that are not detrimental to the survival of the species. In the case of a live animal or plant, the Scientific Authority must be satisfied that the proposed recipient is suitably equipped to house and care for it.
2. An export permit or re-export certificate issued by the Management Authority of the State of export or re-export is also required.

   An export permit may be issued only if the specimen was legally obtained; the trade will not be detrimental to the survival of the species; and an import permit has already been issued.

   A re-export certificate may be issued only if the specimen was imported in accordance with the provisions of the Convention and, in the case of a live animal or plant, if an import permit has been issued.

   In the case of a live animal or plant, it must be prepared and shipped to minimize any risk of injury, damage to health or cruel treatment.

Appendix-II specimens

1. An export permit or re-export certificate issued by the Management Authority of the State of export or re-export is required.

   An export permit may be issued only if the specimen was legally obtained and if the export will not be detrimental to the survival of the species.

   A re-export certificate may be issued only if the specimen was imported in accordance with the Convention.

2. In the case of a live animal or plant, it must be prepared and shipped to minimize any risk of injury, damage to health or cruel treatment.
3. No import permit is needed unless required by national law.

In the case of specimens introduced from the sea, a certificate has to be issued by the Management Authority of the State into which the specimens are being brought, for species listed in Appendix I or II. For further information, see the text of the Convention, Article III, paragraph 5 and Article IV, paragraph 6 and below in section 2.5.1.2.

Appendix-III specimens

1. In the case of trade from a State that included the species in Appendix III, an export permit issued by the Management Authority of that State is required. This may be issued only if the specimen was legally obtained and, in the case of a live animal or plant, if it

will be prepared and shipped to minimize any risk of injury, damage to health or cruel treatment.
2. In the case of export from any other State, a certificate of origin issued by its Management Authority is required.
3. In the case of re-export, a re-export certificate issued by the State of re-export is required.

In its Article VII, the Convention allows or requires Parties to make certain exceptions to the general principles described above, notably in the following cases:

- for specimens in transit or being transhipped [see Resolution Conf. 9.7 (Rev. CoP15)];
- for specimens that were acquired before CITES provisions applied to them (known as pre-Convention specimens, see Resolution Conf. 13.6 (Rev. CoP16);
- for specimens that are personal or household effects [see Resolution Conf. 13.7 (Rev. CoP16)];
- for animals that were 'bred in captivity' [see also Resolution Conf. 10.16 (Rev.)];
- for plants that were 'artificially propagated' [see also Resolution Conf. 11.11 (Rev. CoP15)];
- for specimens that are destined for scientific research;
- for animals or plants forming part of a travelling collection or exhibition, such as a circus [see also Resolution Conf. 12.3 (Rev. CoP16)].

There are special rules in these cases and a permit or certificate will generally still be required. Anyone planning to import or export/re-export specimens of a CITES species should contact the national CITES Management Authorities of the countries of import and export/re-export for information on the rules that apply.

When a specimen of a CITES-listed species is transferred between a country that is a Party to CITES and a country that is not, the country that is a Party may accept documentation equivalent to the permits and certificates described above.

2.5.1.1 Legal Acquisition Finding (LAF)

For a Party to issue a permit authorizing an export 'A Management Authority of the State of export is satisfied that the specimen was not obtained in contravention of the laws of that State for the protection of fauna and flora.' [Convention Article IV 2(b)]; see also (CITES, 2015).

LAF is a confirmation/conclusion that a specimen was obtained in accordance with relevant national laws. There are other provisions for Introduction From the Sea (IFS); see below.

The word 'obtained' refers to the series of steps – and not only to the last of these - by which a specimen its brought from its source (place of origin) and becomes the possession of the exporter.

Specimens of shark species may be obtained in contravention of applicable laws if they are, for example, (Mundy-Taylor & Crook, 2013):

- Derived from illegal fishing activities (e.g. use of prohibited fishing gears or methods, or where fins and carcasses were landed in contravention of finning regulations, or where there is zero quota, or the quota has been exceeded)
- Sourced from within areas closed to fishing activities, (e.g. inside "no-take" marine protected areas (MPAs) or reserves)

- Caught during closed fishing seasons.
- Taken in violation of binding Regional Fisheries Bodies (RFB) management measures.
- The species listed as export prohibited.

2.5.1.2 Introduction From the Sea (IFS)

Introduction From the Sea (IFS) is one of 4 types of trade regulated by CITES. According to the Convention Article III 5 and Article IV 6 and 7, a prior grant of an IFS certificate is required for "specimens taken in the marine environment not under the jurisdiction of any State" [Convention Article I(c)]; see also (CITES, 2015). The latter are commonly known as High Seas and defined in CITES as: "those marine areas beyond the areas subject to the sovereignty or sovereign rights of a State, consistent with international law, as reflected in the United Nations Convention on the Law of the Sea" [Resolution Conf. 14.6 (Rev. CoP16)].
IFS is a one-state transaction where (a) the same State takes the specimens from the high seas, (b) serves as the State of introduction and (c) Issues an IFS certificate. Under normal circumstances, if two or more states are involved, a normal import/export procedures is used.

Issuance of an IFS certificate for Appendix-I specimens requires

- An NDF from the Scientific Authority
- Assurance from the Management Authority that the specimen is not to be used for primarily commercial purposes and that the recipient of a living specimen is suitably equipped to house and care for it

Issuance of an IFS certificate for Appendix-II specimens requires

- An NDF from the Scientific Authority
- Assurance from the Management Authority that living specimen are handled so as to minimize the risk of injury, damage to health or cruel treatment

There is no IFS for Appendix-III specimens.

Parties are also to take into account whether or not the specimen is acquired and landed [Resolution Conf. 14.6 (Rev. CoP16)]:

- In a manner consistent with applicable measures under international law, e.g. other treaty, convention, agreement; and
- through any illegal, unreported or unregulated (IUU) fishing activity

Special rules exist for chartered vessels, see [Decisions 16.48 – 16.51].

Figure 2-8 shows three scenarios. **Scenario 1** describes the situation when a vessel catches a CITES-listed specimens on the high seas and lands them in the same state to which the vessel is flagged, the Management Authority of the "State of introduction" must grant an IFS certificate. **Scenario 2** describes the situation when a vessel catches CITES-listed specimens in the High Seas but lands them in a different country than its flag state. This is considered an export and the corresponding certificates need to be issued. The Management Authority of the flag state must issue an export permit, requiring an NDF and a LAF (Mundy, et al., 2014). **Scenario 3** describes the situation when a th chartering state and vessel registration state of a vessel are different states. If specimens are transported in the chartering state and both countries have a written agreement consistent with the framework on chartering operations of a relevant RFMO/A, the CITES secretariat is informed of such agreement and has made it available to all Parties and to any relevant RFMO/A, an IFS must be issued [Resolution Conf. 14.6 (Rev. CoP16)]. In all other cases, the rules for export/import are followed.

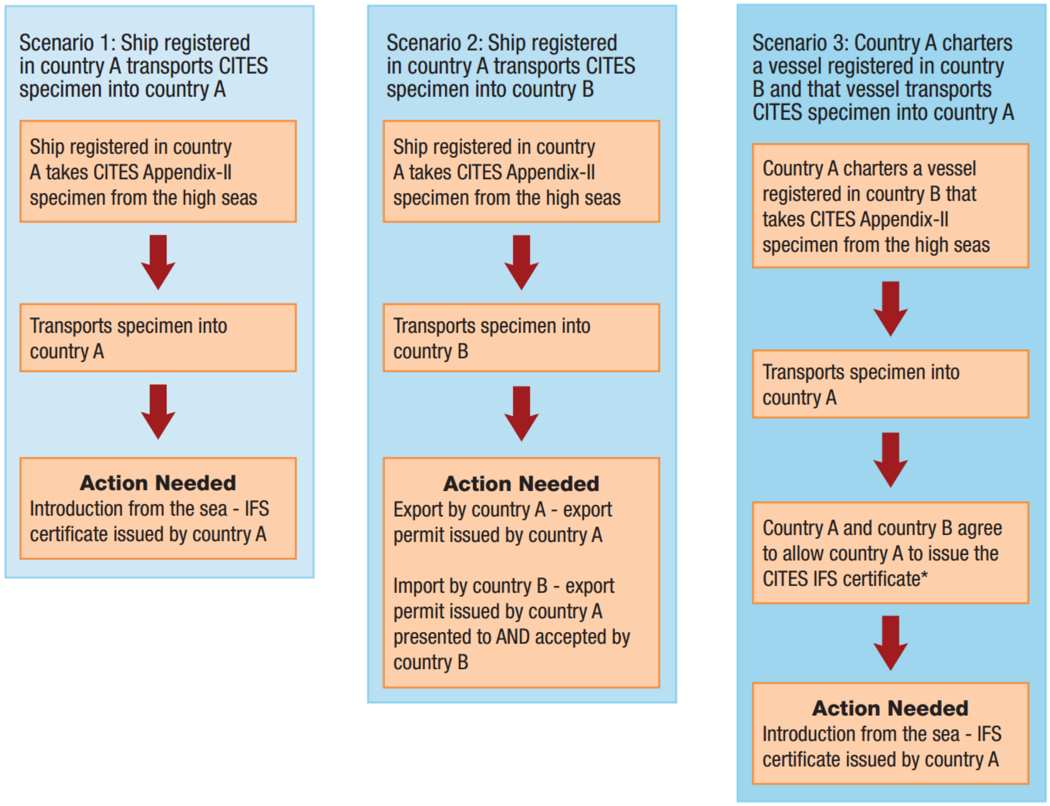


Figure 2-8 Issuance of IFS certificates in different situations (NOAA, 2015)

2.5.1.3 Transshipment

According to "Article VII" (*Exemptions and Other Special Provisions Relating to Trade*); "The provisions of Articles III, IV and V shall not apply to the transit or transhipment of specimens through or in the territory of a Party while the specimens remain in Customs control."

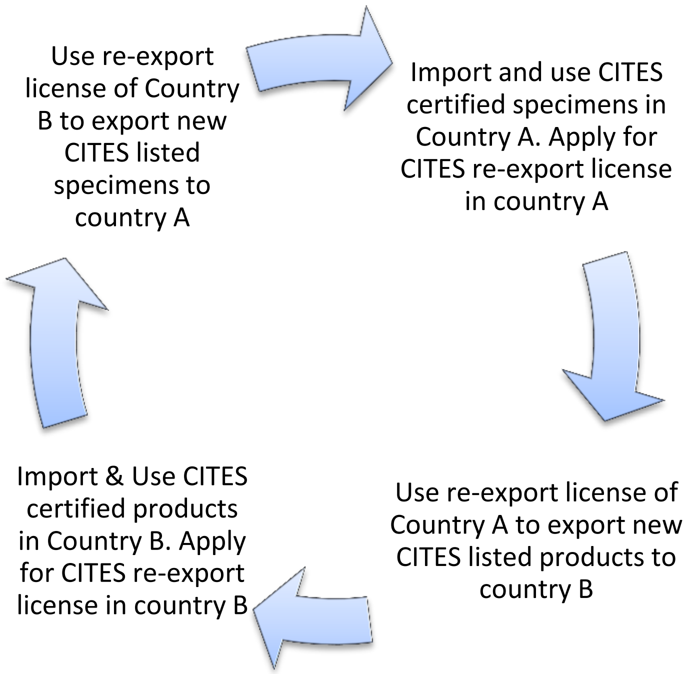
2.5.1.4 Technical trade issues

CITES import/export and IFS certificates rely on Non-Detriment Findings. Guidance for CITES-listed shark species makes reference to management activities (e.g. stock assessments) of relevant RFMOs or states as a basis for assessing the sustainability of the species (Mundy, et al., 2014).

In the case where at a landing port the relevant NDF or LAF is subject to the origin of the species, the landing vessel could misreport the catch area to avoid denial of the corresponding certificate.

For this purpose, it could e.g. mix carcasses of non CITES-listed sharks with fins of CITES-listed shark or other products of CITES-listed sharks. Since products of CITES-listed sharks might be rarer than the same product from another shark, this might be a profitable strategy. Species identification, in particular of heads-off sharks, is not always easy and requires training and capacitation.

At a trade hub, a trader could sell the catch locally after having applied for a re-export certificate. With that certificate, other specimens could be traded which have not undergone the CITES licensing process. Theoretically, this could be used to create a circle of certification:



2.5.2 United States of America

The catching of shark in the Atlantic is regulated under §635 of the electronic Code of Federal Regulations (e-CFR). The regulation lays out specific rules regarding catching and trading in sharks that are binding for the territory of the United States. and its Exclusive Economic Zone (EEZ). Regulations are binding for all federal states except when federal law is more restrictive. The law prohibits any catching of Basking, White and Whale sharks. Furthermore, Hammerhead and Oceanic Whitetips sharks "cannot be retained, transhipped, landed, stored, or sold by vessels with pelagic longline gear on board or on vessels issued both an HMS Charter/Headboat permit and a commercial shark permit when tuna, swordfish, or billfish are on board the vessel or being offloaded from the vessel." (NOAA Fisheries, 2014).

2.5.2.1 Shark Finning

Shark finning is prohibited in the United States owing to the "Shark Finning Prohibition Act" (2000). While the initial act used a 5% fins to landed carcass ratio, the law was amended to a "fins-naturally-attached" ruling. Consequently, all shark fins landed must be attached to the carcass "with at least a small flap of uncut skin". Once landed, fins may be removed and shipped separately. Furthermore, only the heads of the sharks may be removed at sea (Office of Sustainable Fisheries Highly Migratory Species, 2014).

2.5.2.2 Quotas and Fishing Seasons

To manage catches in the Atlantic Ocean and Gulf of Mexico, the NOAA defines landing quotas for some shark species, including Hammerheads, Oceanic Whitetips and Porbeagle sharks. These quotas can be defined separately for both regions, as in the case of Hammerheads, or jointly, as in the case of Oceanic Whitetips and Porbeagle sharks. The quotas are determined for each year (from 1st of January to 31st of December) and work in tandem with the fishing seasons (Office of

Sustainable Fisheries Highly Migratory Species, 2014). Every year, the NOAA announces the beginning of the fishing in the Federal Register (contingent on available quotas). From then on, commercial fisheries are allowed to catch and land the specified shark species in accordance with the remaining regulations, which are detailed in the following sections.

Once NOAA Fisheries estimates that 80 percent of the quota of any management group, e.g. pelagic sharks, has been caught, the fishing season for that species/management group closes no fewer than five days after publication of filing a closure notice in the Federal Register. When the season is closed, commercial fisheries are not allowed to possess or sell any sharks of the specified species and certified dealers are not allowed to buy any sharks of the specified species. Management groups of sharks are sometimes grouped, e.g. Atlantic hammerhead sharks and Atlantic aggregated LCS, meaning that if the season for either one is closed, then the season for the other one is closed automatically as well. All fishing seasons are automatically closed on the 31st of December if not closed earlier (Office of Sustainable Fisheries Highly Migratory Species, 2014).

2.5.2.3 Regulation for Commercial Fishermen

Commercial fishing of sharks is regulated through a license system. Vessel owner landing sharks in United States ports have to possess either a Federal Atlantic Directed or Incidental shark limited access permit (hereafter called Directed and Incidental license). These permits are vessel specific and are no longer issued by the NOAA. However, ownership may be transferred and hence the owner of a license may sell it. Licenses may be transferred among vessels, however, there are limitations discussed in a later section. The **Directed license** permits allow the attached vessel to engage in targeted shark fishing. Owner of a Directed license may land up to 36 Large Coastal Sharks[29] (LCS), Small Coastal Sharks[30] (SCS) or pelagic sharks[31]. None of the following species may be retained: Atlantic angel, basking, bigeye sand tiger, bigeye sixgill, bigeye thresher, bignose, Caribbean reef, Caribbean sharpnose, dusky, Galapagos, longfin mako, narrowtooth, night, sandbar, sand tiger, sevengill, sixgill, smalltail, whale, and white sharks.

Furthermore, the **Directed license** may be transferred to another vessel or the belonging vessel may be upgraded “if the upgrade or transfer does not result in an increase in horsepower of more than 20 percent or an increase of more than 10 percent in length overall, gross registered tonnage, or net tonnage from the original qualifying vessel’s specifications.” The **Incidental license** does not permit to engage in targeted shark fishing, but allows the owner to retain shark by-catch up to a limit. Specifically, owners may retain up to 3 LCS and 16 SCS or pelagic sharks (combined) per trip. Again, no prohibited species may be retained. There is not vessel upgrade restriction for the Incidental license (Office of Sustainable Fisheries Highly Migratory Species, 2014).

Selected fisherman with a commercial shark permit must report fishing activities in an approved logbook within 48 hours of completing that day’s fishing activities, or before offloading, or whichever is sooner. The logbooks must be species-specific and must include weigh out slips that have all fin and carcass weights recorded and that show the dealer to whom the fish were transferred, the date of transfer, and the carcass weight of each fish for which individual weights

[29] LCSs include e.g. all Hammerheads.
[30] SCSs do not include any CITES listed sharks
[31] Pelagic sharks include among others Oceanic Whitetips and Porbeagle sharks.

are normally recorded. For fish that are not individually weighed, a weigh out slip must record total weights by species and market category (Office of Sustainable Fisheries Highly Migratory Species, 2014).

2.5.2.4 NOAA Regulation (Vessel Regulation)

Owners of vessels landing shark in a United States port have to have either a Federal Atlantic Directed or Incidental shark limited access permit. In all other cases, sharks must be released immediately with minimal injury, without removing from the water and in a manner that maximizes its chances of survival (Atlantic HMS Management Division, 2012).

Permits limit the legal amount of shark carcasses landed per vessel per landing. Licenses are no longer issued, but can be obtained from fishermen leaving the business. Each licence applies to only one vessel. Transfer of vessel licences and upgrade of vessels is restricted by a maximum increase in horsepower by 20% or 10% in length overall, gross registered tonnage, or net tonnage from the original qualifying vessel's specifications (Atlantic HMS Management Division, 2012).

2.5.2.5 Dealer Requirements

Since January 2013, Atlantic sharks and legally landed shark fins from vessels with a federal shark limited access permit maybe sold only to federally-permitted shark dealers and only when the fishery for that species/management group is open. To become a licensed dealer, one has to apply at the NOAA for an annual licence to deal in Atlantic sharks. The system applies to all Atlantic dealers in Highly Migratory Species (HMS).

The licensed dealers are required to report any purchases of shark on a weekly basis via an online system with personal login data provided by the NOAA. In addition to quantities, the dealers have to report e.g. information regarding the seller including identification and logbook ID, information on the gear type used by the seller, catch area, date of purchase including price and whether shark fins were naturally attached at the time of landing. Furthermore, dealers have to hand in a negative report if they did not engage in any shark related trade.

Dealer reports have to species specific and have to include the weight of the fins separately from the weight of the carcass. If a dealer fails to provide the weekly reports his license may be revoked leaving him unable to engage in Atlantic HMS trade legally.

2.5.3 European Union

2.5.3.1 Finning ban

In 2003, the EU enacted a prohibition of shark finning with (EC) 1185/2003. It is prohibited to remove shark fins on board vessels, and to retain on board, tranship or land shark fins (article 1). However, it may be allowed to remove shark fins from dead sharks on board and retain on board, tranship or land shark fins with regard to vessels which hold a special fishing permit (article 4). Fishermen with a licence issued by the vessel's home country are allowed to cut the shark fins on board and store carcass and fins separately. When landed, the weight of the fins cannot exceed 5% of the theoretical weight of the shark carcasses on board. This 5% rule -to many experts- leaves rooms for cheating the system. For instance, fisheries could circumvent the rule by retaining high-value fins and high value carcasses and discarding the low-value ones. It allows the fishers to land the fins and carcasses from different species in the correct ratio, while finning large numbers of sharks. As most sharks are beheaded on board and the carcasses do not have to be landed simultaneously with the fins, the law proved to be inefficient in fighting illegal shark finning. To address these issues, the EU enacted an amendment of regulation (EC) 1185/2003 in 2013 that ruled that all sharks have to be landed with their fins “naturally attached”. All EU member countries except for Spain and Portugal supported the amendment.

2.5.3.2 Council Regulation (EU) 2015/104

The European Union uses two tools to manage fishing stocks in the EU EEZ and vessels with EU flag: Total allowable catches (TACs) or fishing opportunities, are catch limits (expressed in tons or numbers) that are set for most commercial fish stocks. TACs are set annually for most stocks (every two years for deep-sea stocks) by the Council of fisheries ministers. For stocks that are shared and jointly managed with non-EU countries, the TACs are agreed with those (groups of) non-EU countries. TACs are shared between EU countries in the form of national quotas. For each stock a different allocation percentage per EU country is applied for the sharing out of the quotas. This fixed percentage is known as the relative stability key. EU countries can exchange quotas with other EU countries (European Commission, 2015).

The current TACs do not include any CITES-listed sharks. However, under the Council Regulation (EU) 2015/104 most of the CITES-listed sharks may not be fished, retained on board, transhipped or landed by any EU vessels. The regulation lists Sawfish, Basking sharks, White sharks, Porbeagles or Mantas (both Giant and Reef Manta Ray) (Article 12). Interestingly, whale sharks are not included in this list. However, for vessels fishing in the WCPFC[32] convention area in the high seas and located between 20° N and 20° S, “it shall be prohibited to set a purse seine on a school of tuna associated with a whale shark (*Rhincodon typus*) if the animal is sighted prior to the commencement of the set.” (Article 35)

Article 23 amends this list by (among others) including all Hammerheads on the CITES Appendix II in association with fisheries in the ICCAT[33] convention area and Oceanic whitetip sharks taken in any fishery.

However, environmental groups criticise that some EU fisheries evade the regulation by either using Flags of Convenience or land at foreign ports that do not require official documentation. Allegedly, some even use private ports to ensure that environmental groups cannot monitor their activities[34] (Oceana, 2007).

2.5.4 Regulation outside of National EEZs

Outside a nation’s EEZs, shark catching, targeted or as by-catch, is mainly covered by international treaties. The United Nations Convention on the Law of the Sea (UNCLOS) sets out the legal framework within which all activities in the oceans and seas must be carried out. In Article 64 it establishes that fishing nations must cooperate to ensure the conservation of highly migratory species both within and beyond their exclusive economic zones, through appropriate international organizations. (UN General Assembly, 1982)

To meet the obligations under the treaty, the signing nations have established Regional Fisheries Management Organizations (RFMO) for the relevant species with the goal of long-term sustainability.

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[32] Western & Central Pacific Fisheries Commission
[33] International Commission for the Conservation of Atlantic Tunas
[34] The relevant report points especially to Spanish vessels that engage in IUU fishing, targeting of endangered species and finning.

The most relevant RFMO for the Atlantic Ocean concerned with shark catches is the International Commission for the Conservation of Atlantic Tunas (ICCAT) that requires contracting parties to annually report catch data for each shark species caught in association with the fisheries ICCAT manages. However, underreporting to the ICCAT Secretariat remains an acknowledged problem. However, it is unclear whether misreports are intentional or due to confusion as some ICCAT parties have expressed such confusion over shark catch reporting requirements.

A prime example reflecting the misreporting of shark catches is the FAO database. In the timespan of 2007-09 annual reported landings of Porbeagle ranged between 600 – 800 tons globally; however, the EU reported imports of Porbeagle in 2010 of about 2,600 tons (FAO, 2013). Even though the timing is slightly different, it is unlikely that global catches, which had been relatively stable, exploded within one year by up to 333% (Oceana, 2011). However, this can be also due to the issue of reporting porbeagle in the FAO database under aggregated species group like “sharks, rays, skates etc, nei” and “Mackerel sharks, porbeagles nei”.

The ICCAT was the first RFMO to establish a legally binding shark finning measure, which requires that the weight of the fins does not exceed 5% of the weight of the carcasses on-board at the first point of landing (ICCAT Secretariat, 2014). However, this rule leaves plenty of loopholes for finning as the 5% ratio is a flawed approximation for many species and Contracting Parties are not required to land shark fins and bodies simultaneously (Oceana, 2011). Furthermore, the ICCAT Contracting Parties are prohibited to retain, land or sell Hammerheads (excluding Bonnetheads) and Oceanic Whitetips (ICCAT Secretariat, 2014).

Other RFMOs like Indian Ocean Tuna Commision (IOTC) and Western & Central Pacific Fisheries Commission (WCPFC) are also active in management and conservation of fish stocks.

Although sharks are not part of 16 species directly under IOTC mandate, they are frequently caught in association with fisheries targeting IOTC species. As such, the contracting parties and cooperating non-contracting parties are required to report the information at the same level of details as for the 16 species directly under IOTC mandate (IOTC, 2015). The main species caught in IOTC fisheries, are Blue sharks, Oceanic whitetip sharks, shortfin mako sharks, scalloped hammerhead sharks, silky sharks, igeye thresher sharks and Pelagic thresher sharks. An example of misreporting here could be the Oceanic whitetip capture production. FAO shows a total of 176 tons of capture production in the Indian ocean in 2013 and an average of 240t for 2009-2013 (FAO, 2013) while the IOTC status report states a 230t of reported catch with an average of 317t for the same period. However, it could be again due to reporting under aggregated species (e.g. nei sharks).

2.5.5 Summary of regulations affecting catch, sale and trade of sharks

More information about regulations affecting the conservation of sharks is available, e.g. in a recent book edited by E.J. Techera and N. Klein (Techera & Klein, 2014) or in a report by TRAFFIC (Lack & Sant, 2011). Note should also be made of the International Plan Of Action For The Conservation And Management Of Sharks (IPOA-Sharks); see for example the FAO report (Fischer, et al., 2012).

Other, less formal overviews are available (HSI, 2014).

Legislation can perhaps be grouped as follows:

Table 2-3 Different types of legislations affecting catch, sale and trade of sharks.

Type of restriction	What	Example countries
Shark fishing	Fishing and possession of sharks within a designated area prohibited; alternatively moratorium on (commercial) shark fishing. Exception are often made for incidental catches or scientific purposes	American Samoa (2012), Bahamas (2011), Cook Islands (2012), Congo-Brazzaville (2001), Egypt (2005), Fiji (2011), French Polynesia 2006), Israel (1980), Maldives (2010), Marshall Islands (2011), Palau (2009), Indonesia in Raja Ampat (2010), Tokelau (2011) In addition, all signatories to CCAMLR
Specific on shark fins	Possession, sale and trade of shark fins and ray parts, often with exceptions for small-scale fishers	Commonwealth of the Northern Mariana Islands (2011), Guam (2011), Hawaii (2011), USA (2011-2012)
Limitations on shark finning	Typically disallow landing of sharks without the corresponding carcasses – either by direct attachment or equivalent weight; beheading, gutting and skinng are usually allowed.	Argentia (2009), Australia (various), Brazil (1998), Canada (1994), Cape Verde (2005), Chile (2011), Colombia (2007), Costa Rica (2006), Ecuador (2004), El Salvador (2006), United Kingdom (2009), European Union (2009), Mexico (2007), Namibia (2000), Nicaragua (2004), Panama (2006), Seychelles (2006), South Africa (1998), Taiwan Province of China (2012) In addition, all signatories to ICCAT, GFCM, IATTC, IOTC, SEAFO, NAFO, WCPFC, NEAFC

2.6 Challenges to shark legislation as a tool for conservation

Clarke reports the following (Clarke, 2015):

> *In tuna and billfish fisheries, sharks are caught alongside these target species in large numbers. Methods to reduce unwanted shark catches are a topic of active research but solutions appear to vary by fishery and may have economic or operational consequences […]*
>
> *Under two forms of catch prohibition — no-retention measures for certain species and area-specific prohibitions for all species (sometimes referred to as "sanctuaries") — sharks, if caught, must be released with minimal harm. However, studies in the Indian*

and Pacific Oceans have shown that 81–84% of sharks do not survive their encounter with purse-seine gear. […]

In longline fisheries it is estimated that 12–59% of commonly caught shark species will die before reaching the vessel, 10–30% of those that survive haul back will die through handling, and 5–19% of those that survive handling will die after release). With such high potential mortality rates for released sharks, it is not clear whether no-retention and "sanctuary" measures can reduce overfishing to sustainable levels.

Whenever discarding sharks is seen by fishermen to come at a cost — for example loss of saleable products or increasing the likelihood that the next set will catch the same unwanted shark — enforcement must be strong. Small Island Developing States often struggle to find the resources to conduct intensive patrols at sea. Even if catch prohibitions in "sanctuaries" are strongly enforced, vessels that want to continue to catch and retain sharks, or to kill unwanted ones, may move to other jurisdictions with fewer rules and less monitoring (such as the high seas) and continue to fish the same stocks.

Trade data can help to highlight areas where existing fisheries controls may need to be strengthened. For example, the Marshall Islands declared itself a shark "sanctuary" in 2011 by prohibiting both catch and trade. Nevertheless, Hong Kong government records show imports of 7.2 t of dried unprocessed Marshallese shark fins in 2012 and 2.5 t in 2013 […]. Similarly, United States trade records show 16 t of frozen shark exported to Palau in 2012 and 15 t in 2013 […]. While Palau may not have banned the trade in sharks, these exports suggest that the demand exists, either nationally or for onward trade, and this demand could undermine Palau's designation as a shark "sanctuary" in 2009. These examples provide further impetus for integrating fishery and trade monitoring programmes.

This analysis shows that trade monitoring might be a better tool than outright prohibition of catches. However, it also clearly shows that measures – like traceability – are needed to improve rules and regulations aiming at the conservation of shark species.

3 Existing traceability systems

3.1 Introduction to traceability systems

Traceability is most commonly defined as “the ability to trace history, application or location of an entity, by means of recorded identifications”, following ISO 9000:2015. In other words, traceability is a system identifying and connecting all entities in the supply chain of a product unit and thereby making it traceable at every point in time.

While the ISO definition is flexible towards different applications, e.g. different methods of “recorded identifications” such as paper records or electronic records, all traceability systems depend on Unique Identification (UI), Critical Tracking Events (CTEs) and Key Data Elements (KDEs). Thus, the key questions to be answered when establishing a traceability system are

- What to trace?
- When to record?
- What to record?

Note: Traceability is a general concept that can be applied to any industry. However, as this report focuses mainly on the food industry, we will denote every entity that is part of the supply chain as Food Business Operator (FBO).

Table 3-1: The basic ingredients of traceability

Element of traceability	**Unique identification**	**Key data element**	**Critical tracking point**
Examples	• Single Units • Batches • Barrels • Boxes	• Unique identifier • Supplier ID • Quantity • Date	• Reception • Processing • Mixing/ Grading • Dispatch
Performance dimensions	*Precision*	*Breadth*	*Depth*

3.1.1 What to trace: The principles of unique identification

Traceability aims to establish links between FBOs in the supply chain of a particular product unit and therefore requires that both the product unit and the FBO - most commonly a combination of the two - be identified uniquely.

	SSCC (Serial Shipping Container Code)		
Application Identifier	Extension Digit	GS1 Company Prefix → ← Serial Reference	Check Digit
0 0	N_1	N_2 N_3 N_4 N_5 N_6 N_7 N_8 N_9 N_{10} N_{11} N_{12} N_{13} N_{14} N_{15} N_{16} N_{17}	N_{18}

Figure 3-1 Example of a unique identification code combining FBO identification with product unit identification

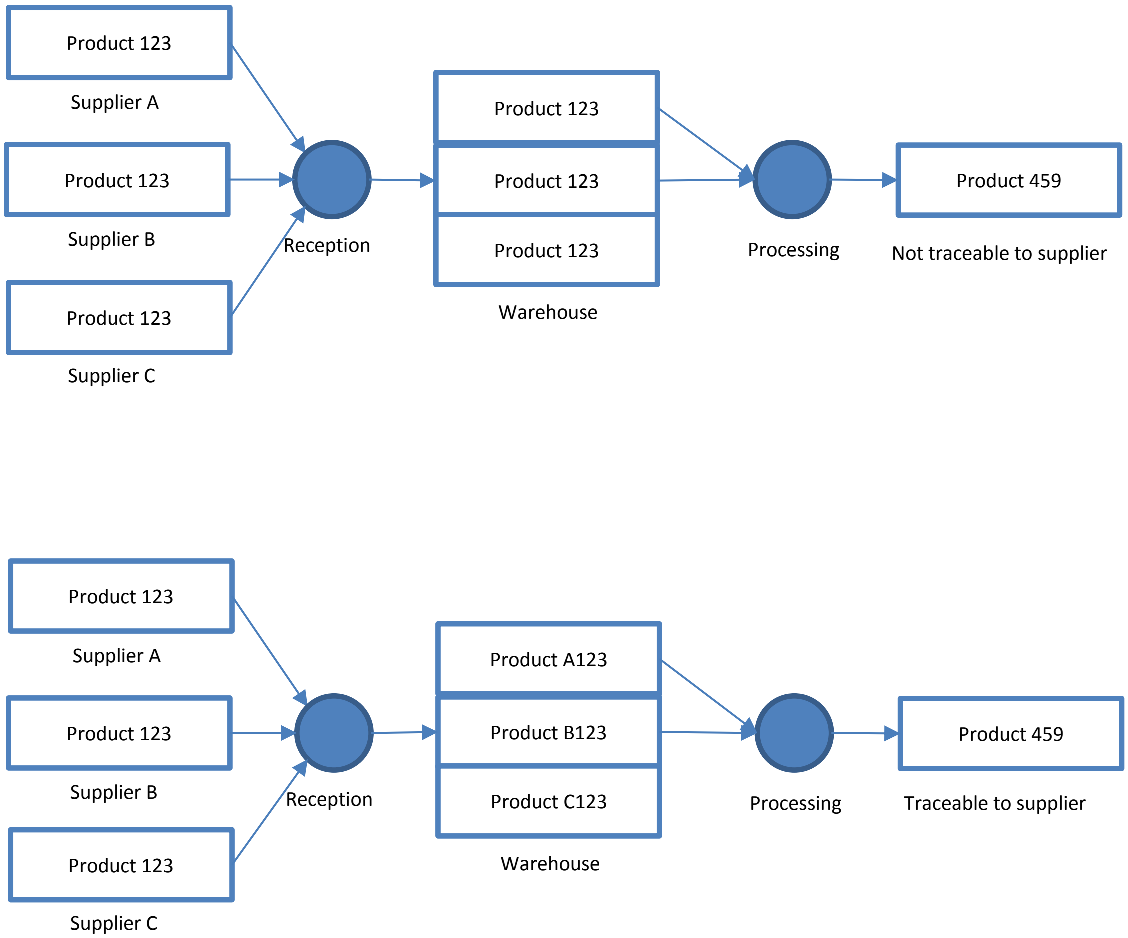

Figure 3-2 Example of loss of traceability (upper part) and correct recordkeeping to allow traceability (lower part)

Without unique identification, traceability systems will not be able to supply specific information. For example, if a trader were to buy an identical raw material 123 from three suppliers (A, B, C), store that indiscriminately in the raw material storage and then produce a product 459 from it, the knowledge which supplier's raw material was used would be lost; see Figure 3-2 (upper part). If, on the other hand, the supplier is identified together with the raw material, traceability back to the supplier is possible.

Since unique identification is such an important ingredient to traceability, multiple coding systems have been proposed and multiple organisations founded to supply the market with unique identifiers.

Ideally, companies employ international standards in identifying suppliers, products, trade and logistics units. Global Standards One, or GS1, is a prominent supplier of identity products (Lehr, 2013). In the context of GS1's products, a Global Trade Item Number (GTIN) is used to identify a product of a particular FBO. Different batches of that product can be identified by adding a serial number to the GTIN, forming a so-called SGTIN. The production location is identified by a Global Location Number (GLN). Logistic units, such as pallets are identified by a Serial Shipping Container Code (SSCC). The traceable unit is typically a batch and identified by a SGTIN or a combination of a GTIN with a production/best before date. Higher value items are sometimes identified uniquely by an SGTIN.

Access to unique identification is one of the key issues of global traceability (Lehr, 2013). This is particularly true for small operators early in the chain, i.e. farmers and fishermen. Until recently, identification products were not generally available to them due to a lack of understanding, but also access obstacles to leading identity providers (and the lack of support and training).

A promising initiative by UN Global Compact, ITC and GS1 should be mentioned, which is currently at a pilot stage (Bracken, 2015). The Blue number initiative (Blue Number, 2015), is a concrete contribution to the second global goals for sustainable development to end hunger, achieve food security and improve nutrition, and promote sustainable agriculture. The Blue Number is a unique ID for any individual, entity or asset contributing to the food system. It is a specific Global Location Number, or "GLN", which identifies a farm or Small Medium Enterprise in any part of a food and agriculture value chain. It provides the holder with a universal identifier appended with additional information for use in international registries, databases and other information storage infrastructures. The Blue Number is issued by GS1 (GS1, 2015), and obtained via a dedicated global online system where:

- farmers and agribusinesses can register and volunteer information about themselves;
- farmers and agribusinesses can create a sustainability profile on their products, services and capacity, including for trade or export;
- information can be shared with stakeholders, trading partners and regulators;
- farmers and agribusinesses can declare they are ready for capacity-building support from national stakeholders, governments and various UN agencies.

How big or small the traceable units are, is called the *precision* of a traceability system and depends on the available resources as well as practicability.

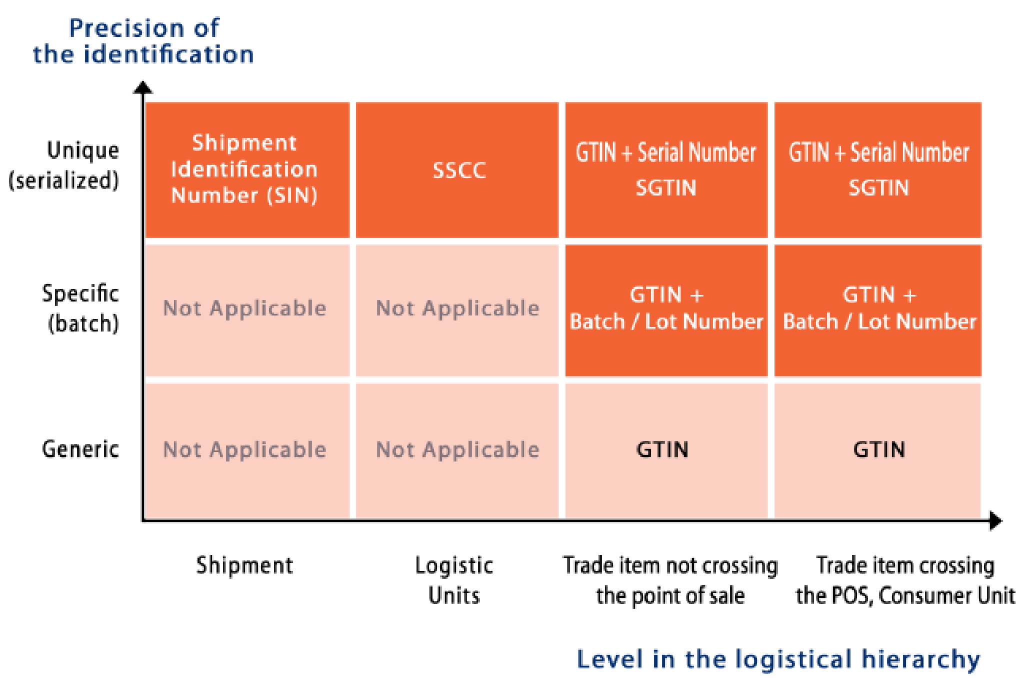

Figure 3-3 Precision of traceability vs identification system

Most commonly, unique identification is provided in the form of alphanumeric codes, which can then be encoded into barcodes and RFID tags – the so-called Automated Identification and Data Capture (AIDC) technologies. Special mechanisms have been provided to encode additional information for faster data transmission, such as weight, lot number, expiration date, destination and many other elements.

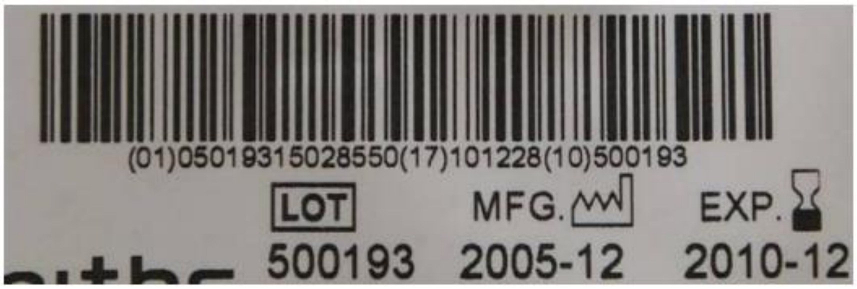

Figure 3-4 Example of a GTIN with additional barcoded information, such as expiration date and lot number

3.1.2 When to record: The principle of recording Critical Tracking Events

Traceability aims to identify the path of a product throughout its production process and supply chain. To achieve this goal, it is essential that every FBO records its actions and makes the information available. The principle of recording transformations says that any transformation of the product has to be recorded such that the traceability system is able to trace and track a product unit throughout the process. Examples for such transformations are mixing, processing or splitting. For example, when a trader grades shark fins from a finite number of boxes bought at an auction and sorts them into different baskets, he has to record which shark fins were sorted into which basket, i.e. which boxes served as input for a given basket of shark fins.

3.1.3 What to record: the principle of Key Data Elements

Critical Tracking Events (CTEs) define the actions that trigger data recording. Typically there are three main categories of CTEs per entity: Reception, Processing and Dispatch, as depicted in Figure 3-5. A traceability system has to define the Key Data Elements to be recorded at each of these CTEs as well as the degree of differentiation between the CTEs. For example, a trader in shark fins might define separate processing CTEs for mixing and drying, as the former process changes the composition of the good and the latter does not. To achieve traceability, it is essential that KDEs recorded at the beginning and end of a transformation process link inputs to outputs. For example, if a factory of frozen shark meat receives a batch of shark carcasses and processes them, it has to record which batch of carcasses were used as an input for a specific batch of shark filet.

The length of the supply chain covered by a traceability system covers is called its *depth* and depends on its purpose. In some cases, certain supply chain steps, such as distribution are excluded from traceability systems.

Key Data Elements (KDEs) consist of the most important information from a traceability perspective at each CTE. KDEs have to be defined such that tracking and tracing through their assigned event is possible. Furthermore, they have to include information that is necessary to achieve the purpose of the traceability system. For example, KDEs for sharks landed at a harbour might be the species, the total weight, the vessel ID and the UI code assigned to the carcass or batch of carcasses.

KDEs will differ along the supply chain as the product is transformed and different information becomes relevant. In general, KDEs might include basic description elements, origin and destination, processes applied to the product or legal status. A traceability system has to define specific KDEs for every CTE. The amount of information recorded at each KDE is commonly called the *breadth* of a traceability system.

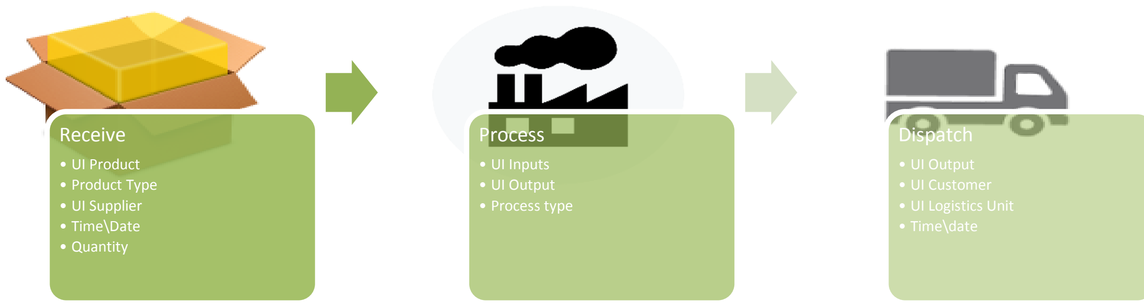

Figure 3-5 Typical CTEs with their most common KDEs

3.1.4 Information management

When designing a traceability system, it has to be defined where the recorded data will be stored. The two options in this regard are: Individual Data Storage Systems and Cumulative Data Storage Systems.

3.1.4.1 Individual data storage systems

The individual data storage approach is typically called the One-Up-One-Down (OUOD) method and requires that every FBO in the supply chain records its predecessor and successor. Thus every FBO will be able to point out the supplier of a specific input unit and the customer for a specific output unit. In this way, many small traceability steps achieve overall traceability as one can hop from one FBO to another along the supply chain to trace or track a product unit and its ingredients.

The main advantages of the OUOD method are its simplicity and its cost-effectiveness. Every FBO is only responsible for its own data and data storage can be done on paper as well as electronically depending only on the FBO itself. Hence, initial investment can be arbitrarily small and basically any FBO can be included in the traceability system. However, the information chain in this system is easy to break and it also suffers from slow response times and leaves more space for human errors, as data entries will only be checked when a traceability request is made.

3.1.4.2 Cumulative data storage systems

In Cumulative Data Storage Systems, the data is gathered along the supply chain. This can be done either in a central database or by accumulating traceability records along the supply chain.

Accumulating records along the supply chain is very similar to the One-Up-One-Down method as every FBO stores data at its own facility. However, accumulating the records along the supply chain enhances the information available to every but the initial FBO in the supply chain and is better suited for customer information and certification purposes as all traceability records are accessible at the last stage of the supply chain. Furthermore, carrying the information along the supply chain increases data consistency and response times, as information becomes readily

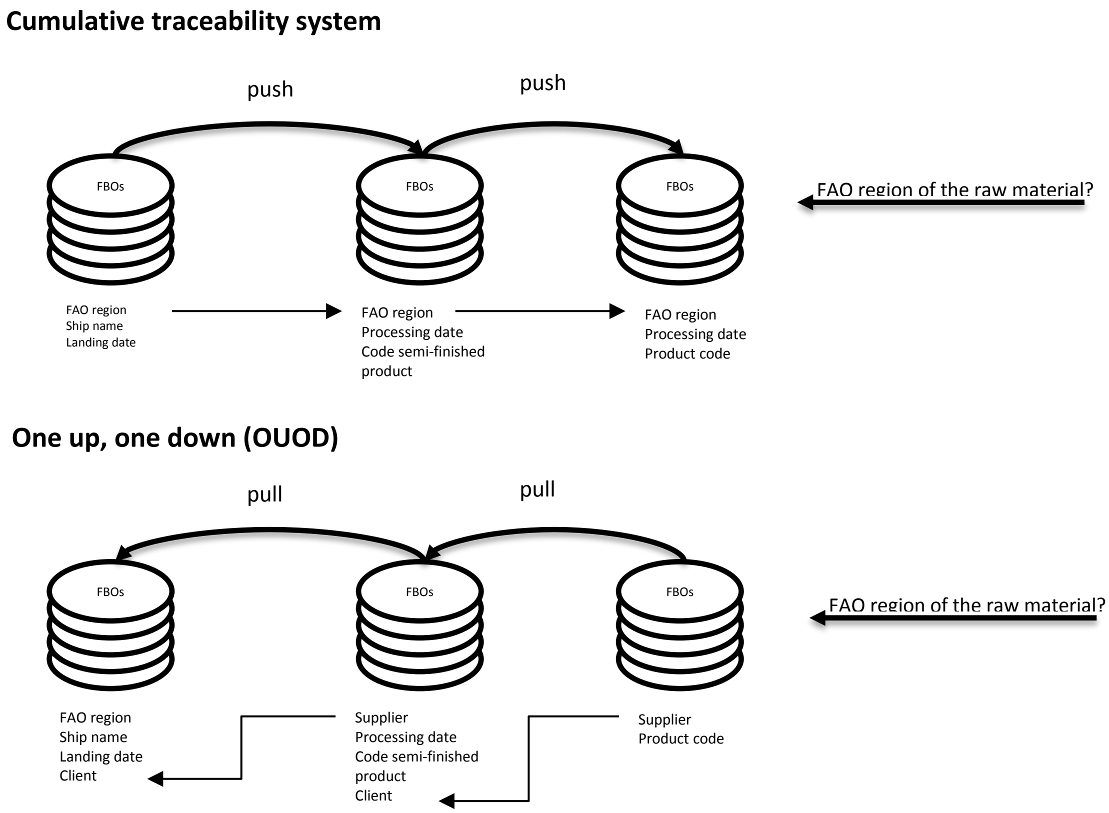

Figure 3-6 Cumulative traceability systems (upper part) versus one up, one down systems (lower part). Cumulative traceability transport defined data elements together with the goods. One up, one down (OUOD) systems only transport links between FBOs, but no data. Lookup in cumulative systems can be down only of pre-defined data elements, but without involving the chain. Lookup in OUOD systems can contain any data element stored at some step, but requires the supply chain to cooperate (Lehr, 2013).

available.

On the other hand, record accumulation increases information storage requirements disproportionally for FBOs at the later stages of the production process and therefore requires increasing investment along the supply chain. Nonetheless, the cumulative approach is sometimes worth considering, especially when downstream operators are disconnected from upstream operators.

The second approach to Cumulative Data Storage Systems is based on centralized traceability databases, where all FBOs in the supply chain enter recorded data into a single database. The database stores the information entered and makes it available in the case of a traceability request.

Besides faster response times, central databases also allow for automated consistency checks and supply chain improvements through data mining. On the other hand, they require larger initial investment, higher maintenance costs, either due to service fees to the provider or due to maintenance of the infrastructure, and extensive collaboration along the supply chain as all FBOs have to agree on the system, data security regulations and a cost sharing schedule. Primarily due to initial investments and technical infrastructure requirements, central database systems are often considered a market entry barrier for smallholders.

Central database systems are typically hard to achieve in long, fragmented and diffuse supply chains with misaligned economic interests. However, they can be very successful when organized through a central organ such as a trade association or governmental organizations, which is documented in case studies presented later in this section.

Following the implementation of the General Food Law in Europe, all European FBOs have an obligation to be able to identify their suppliers and clients. In the best of cases, this establishes a OUOD system (although not batch-specific and therefore it is debated that this really is a traceability system). At the same time, European labelling regulations in some sectors such as fish, require that the production method and the origin be made available to consumers (Lehr, 2013). This is achieved using a cumulative traceability system.

3.1.4.3 Individual vs. cumulative data storage system

While Individual and Cumulative Data Storage Systems both have their advantages and disadvantages (as highlighted in Table 3-2), it is essential to fit the data management system to the purpose of the traceability system and the resources of its FBOs. Traceability systems with the purpose of identifying the origin of hazardous products in the case of food scandals will require quick analysis of massive data volumes and thus Cumulative Traceability systems might be necessary and adequate. On the other hand, traceability systems with the purpose of certification and identification of origin might not require excessive data and fast response times, but rather integration of numerous, economically very different FBOs. Hence, an Individual Data Storage system might be more fitting in this case.

Table 3-2 Individual vs. cumulative traceability systems

	One-Up-One-Down	Cumulative Traceability
Advantages	– Easy to Implement – Compatible with paper-based approaches – Cost effective – Data security	– Fast response times – High data consistency – Data mining possible – Sustainable in a world of increasing technologic advances
Disadvantages	– Slow response times – Prone to human errors – Data consistency not guaranteed	– More expensive to implement – Maintenance Costs – Collaboration necessary

3.1.5 Traceability models for certification

Traceability is often used as a tool to differentiate product through certification, or to verify the legality of a product when its sources are in doubt. For these purposes several types of traceability systems have been proposed: Product segregation, Mass Balance and Book and Claim.

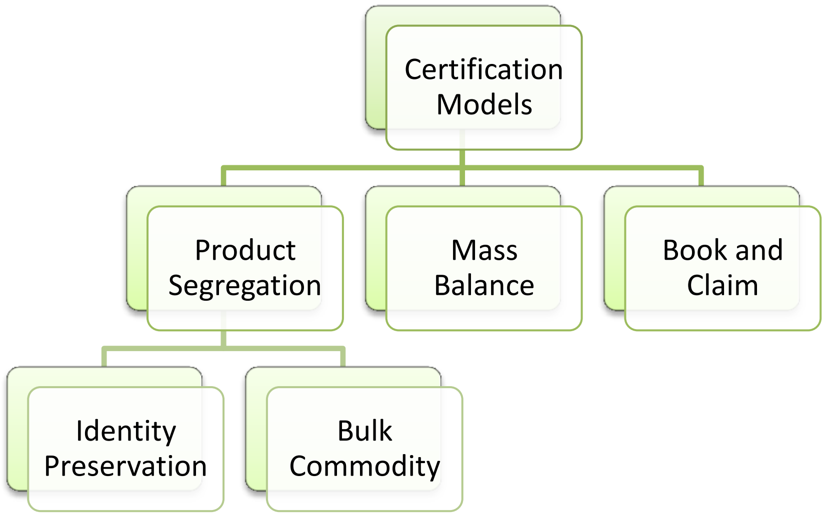

Figure 3-7 Traceability models for certification

3.1.5.1 Product segregation

The aim of product segregation is to verify certification claims by physically separating certified and non-certified commodities throughout the supply chain. This approach ensures that 100% of the product is derived from certified sources and is used in food production where the claim to be verified is highly valued by customers such as organic food or fair trade food. Product segregation can be further split up into identity preservation and bulk commodity.

In the identity preservation approach, mixing of certified commodities from different sources is strictly forbidden. This ensures that the product can be traced back to its origin without any uncertainty. However, identity preservation is often highly unpractical and costly and as a result is only used when consumers are explicitly interested in the specific origin of the food.

Where mixing is a natural process (due to grading for example), the segregated approach is more practical, where certified commodities can be mixed, but only between certified sources.

3.1.5.2 Mass balance

The Mass Balance approach is less strict than the Segregation approach as it allows for mixing of certified and non-certified commodities. Every FBO records the proportion of certified and non-certified input, either for every production facility or for the company as a whole, and labels the output accordingly. Hence, the FBOs are able to calculate which percentage of their output was sourced from a certified entity. Customers cannot know exactly how much of their product is sourced from a certified source, but know that on average the product contains a given percentage of certified ingredients. This is commonly used in the commodity business where segregation is considered to be too costly. Section 3.3.4 presents a case study of a mass-balance system.

3.1.5.3 Book and Claim

In the Book and Claim (B&C) approach, certificates are issued whenever certified product is produced/landed and are distributed to the producer or fisherman. These certificates relate to a quantity of certified product produced and can be sold independently of the flow of the product giving the certified producer an additional source of income. Buyers of certificates can use them to communicate to the public that they support the cause of certification, e.g. by labelling their products. This makes claims such as “product supports the sustainable sourcing and production of essential commodities” possible. Section 3.3.5 presents a case study of a Book and Claim system.

3.2 Uses of traceability

Traceability can be used for quite a number of purposes. Table 3-3 shows a list of common uses of chain traceability (i.e. traceability involving more than one supplier chain partner).

Table 3-3: Common areas of use of chain traceability

Sanitary and phytosanitary information • Hygiene, food safety and related export procedures • Disease control • Food safety information for recall purposes Food nature and history • Origin (linked to compliance, consumer health and choice, food safety) • Certification and practices (e.g., Halal, fair trade, labour conditions) • Consumer information, in particular related to correct labelling Control of illegal activities • Import/export bans • Lack of trade permits • Illegal, unreported and unregulated fishing	Customs and regulatory control • Information for efficient trade • Avoidance of illegal activities • Exporter blacklists Statistics • Continuous improvement • Mass balance • Avoidance of illegal activities Sustainability • Calculation of environmental, economic and social impact along supply chains Food security • Production prediction models based on history information • Avoidance of waste

The following sections focus on the uses that are most relevant to trade in CITES-listed specimens.

3.2.1 Traceability for regulatory compliance

Traceability systems are built on data compiled from every product unit and FBO in a supply chain. As this information provides deep insights into the supply chain, it could be and is used by standard setting organisations and legal authorities to verify claims of legality or standard compliance. For example, an organisation concerned with organic food can use the information provided by a traceability system to link a product to its origin and thereby verify whether the product was derived from certified organic inputs only. Furthermore, legal authorities could use the information traceability provides to identify products of questionable or illegal origin as well as entry levels for these products.

In **white markets**, where customers and producers trade only in legal goods, traceability may act as assurance of legality claims. As traceability identifies every FBO in the supply chain, it supports the claim that the good was sourced legally. This might be especially valuable when there is a risk for the illegally sourced product entering the legal market, and customers demand assurance that the product was sourced and fabricated in accordance to legal standards. For example, customers of products from reptile skins might be worried that the skin was sourced illegally. The information provided through the traceability system provides may verify the claim that the skin was indeed sourced legally. Consumer might not even need access to the data; knowing that officials have access could be sufficient for assurance.

This feature is equally valuable in **grey markets**, where illegal products are laundered into legal business chains and where the illegal origin of goods is deliberately kept from clients. In these markets, traceability can provide evidence whether a good was sourced legally. This can also be used in law enforcement as it points towards products with questionable sourcing. For example, lawmakers could define different customs standards depending on whether the product is traceable or not, thereby ensuring that investment in traceability is supported by the regulation.

In **black markets**, where both the customers and producers are aware of trading in illegally, traceability can support law enforcement as a lack of traceability can highlight products of questionable origin. Furthermore, if traceability were mandatory for a product category, a lack of or forged traceability will give law enforcement officers a legal basis for confiscation of questionable products. Hence, traceability can function as a gatekeeper and deny illegally sourced products market entry or at least increase the risk of participating in black markets. Having said this, if both sellers and buyers agree on illegal transactions, traceability is not likely to help very much.

3.2.2 Traceability for statistics

Traceability systems gather significant volumes of information on supply chain transactions. If made accessible through electronic systems, this information is valuable for reliable statistics of the supply chain. Paper-based traceability systems carry the same amount of data, but the data is not accessible and is therefore much less valuable for statistics purposes. In addition, manual data aggregation and reporting introduce data quality issues that affect the use of statistical data.

The statistics can serve both internal and external functions as they may function as a controlling or marketing tool for the FBOs and as an information disclosure tool for the general public.

The ability to provide data for meaningful industry statistics will be limited by the uptake of the traceability system by all relevant supply chain partners.

Statistics based on traceability systems could reveal production and trade volumes, regional and international trade flows in terms of volumes as well as other volume-based measures. In general, traceability systems will be able to identify volumes, locations as well as the stage of the supply chain. This can be especially valuable when statistics on the industry are not available yet or very unreliable such as in the case of trade in shark products. Such statistics can be used in Non-Detriment Findings (NDF).

3.3 Examples of traceability systems

3.3.1 EPCIS: Generic traceability system standard

The Electronic Product Code Information Services (EPCIS[35]) is created and promoted by GS1. GS1 cites as goal of EPCIS to "enable disparate applications to leverage Electronic Product Code (EPC) data via EPC-related data sharing, both within and across enterprises. Ultimately, this sharing is

[35] http://www.gs1.org/gsmp/kc/epcglobal/epcis

aimed at enabling participants in the EPCglobal Network to gain a shared view of the disposition of EPC-bearing objects within a relevant business context."

EPCIS has, however, outgrown its EPC-centric beginnings. In particular, the set of standards work with any globally unique identifier, a strong advantage. Version 2.0 of the standard which was presented in November 2014 in Lisbon, addresses limitations that required a (non-standardised) extension of the standard for food traceability.

Electronic Product Code Information Services (EPCIS)

- Standard for sharing Electronic Product Code (EPC) related information between trading partners.
- Defines standard set of messages for both data capture and data exchange
- The what, where, when, and why of events occurring in any supply chain is exchanged
- Stores important business information such as time, location, disposition and business step of each event that occurs during the life of an item in the supply chain.
- Not originally created for food
- Two main areas: Event Capture and Query Interface

Norway: eSporing
Unique effort to implement electronic food traceability country-wide. eSporing is based on EPCIS V1.0 and therefore had to extend the standard for food. A workshop in Oslo in 2011 reviewed the status of EPCIS as a basis for a globally acceptable food information exchange standard. More information on www.tracefood.org.

Not all standards are yet completed. There is also a lack of international governance of EPCIS repositories, so that currently businesses looking for information about a particular item have to know where to start their search. (This would be equivalent to a non-networked Domain Name Server (DNS) that would only know the IP addresses of such websites that it has in its own tables. The strength of DNS is precisely the global network of such servers that allows any user to resolve the IP address of a domain within fractions of a second.)

EPCIS is backed by larger companies in the food sector (mostly downstream). It does have, however, a larger and growing following. The standard is in itself limited. Much of the information required for more specific information services e.g. with respect to sustainability and trade will have to be incorporated via extensions or via specific dictionaries.

3.3.2 VeriLabel: Traceability for authenticity

Traceability can be used as a basis for product authentication; this is sometimes called food integrity. Currently, the European research project FoodIntegrity[36] demonstrates the use of traceability in this context.

A concrete implementation example of a high-value food product for the Asian market – similar to shark fins - is the authentication of bird nest origin. Bird nests are a luxury health food item consumed in China. Due to its high price and import restrictions from major producing countries,

[36] https://secure.fera.defra.gov.uk/foodintegrity/index.cfm

the Chinese market is flooded with fraudulent bird nests. Producers of genuine bird nests face the challenge of decreasing consumer confidence in product authenticity and as a result decreasing prices.

The main idea is to use a code that consumers could check with their mobile phones when purchasing the bird nests. Consumers will be given a green, yellow or red light, depending on whether the nest could be authenticated, there are doubts or the nest could not be authenticated at all. The result of the verification process will not only be shown to consumers, but also to the producers, effectively using consumers as "auditors".

Additionally, the tool provides information about the producer and the product. To the producers, the application provides information on the location of consumers, the status of the verification and potentially other data elements. This enables producers to identify geographic region where fraudulent practices occur more frequently.

The statistical approach of this tool relies on several factors such as (a) the history of scans, e.g. whether the code has already been scanned and where, (b) on the activation date of code and (c) whether the code is actually issued by the system.

Furthermore, consumers may indicate that they bought the specific bird nests. Any bird nest attached with an identical code can then be identified as fraudulent.

The data generated by the codes and consumers is stored centrally. Producers access only the data on their own bird nests, so that the confidentiality is conserved.

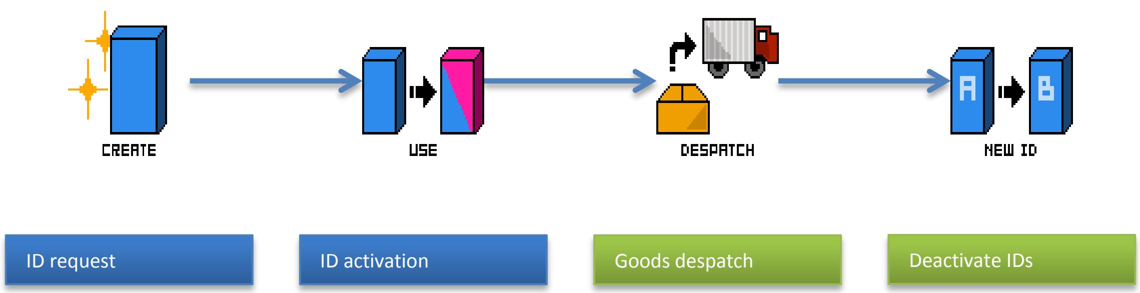

Figure 3-8 Critical tracking events (CTEs) of the VeriLabel bird nest authentication system

Such a system was attempted to implement under the name of VeriLabel in Malaysia. Due to difficulties with the supply chain partners, it found no uptake.

3.3.3 TraceVerified: traceability for transparency

Vietnam has long been exporting *pangasius* to the EU and the United States, mainly as a cheap source of fish protein. However, due to negative NGO reports regarding the safety of consumption, the environmental impact and dislocation of the domestic whitefish industry, consumption in high-end markets has either stagnated or reduced significantly.

In order to remedy this situation, a private company founded by a former minister of Fishery of Vietnam decided to invest in traceability in order to overcome consumer's mistrust in the product. The idea was to counter suspicion with absolute transparency, demonstrating with concrete data to buyers and consumers alike that international food safety standards are met.

The consumer information tool of TraceVerified is based on a tracking code, for convenience provided as a QR code on the packaging. The code is linked to a web portal, where sourcing information is made available. The information includes a map locating the originating farm and processing facilities, sustainability measures such as carbon and water footprint as well as which standards the product fulfils such as Halal or HACCP standards. This fullness of information is meant to increase trust in the product and create a personal link as the clients can locate the farm and can use the information provided as a starting point for risk management.

Similarly, TraceVerified provides information to existing and potential importers of Pangasius from Vietnam. Registered importers can access more detailed data on the farm and processing sites than consumers. This increases their trust in the product and enables them to create marketing campaigns based on origin and supply chain. For example, knowing that the farms at the beginning of the supply chain are smallholders may allow importers to market their product as supporting smallholders in developing countries.

In addition to standard information gathering, TraceVerified also engages in verification of that information. For this purpose, TraceVerified has established a fully equipped testing laboratory in different places of the country. The company effectuates unannounced spot checks to ensure that the data kept on the system is reliable.

TraceVerified is run as a pay-as-you-go scheme. Suppliers pay for the service whenever they demand labels from TraceVerified and enter the information in the web portal. This ensures that they remain flexible in using the system and is a key selling point for undecided suppliers as they can always leave the scheme whenever they want.

3.3.4 KnownSources: traceability for sustainability

Palm oil is the most efficient source of vegetable oil in terms of output per hectare and currently covers about 35% of the global demand for vegetable oil. It is an ingredient in a large array of products such as food, cosmetics, biofuel and pharmaceuticals. However, palm oil production has been heavily criticized by environmental activists as it is often preceded by deforestation of tropical forests. The deforestation brought by palm oil plantations threatens the survival of species and leads to high Greenhouse Gas (GHG) emissions.

These adverse effects have led to demands for sustainable palm oil production by supranational organisations, environmental activists and consumers alike, especially in developed countries. KnownSources is an industry platform owned and operated by the private company FoodReg that monitors palm oil traceability and sustainability via mass balance and segregation systems covering the entire supply chain from the palm oil mills to the final manufacturer. Its purpose is increase supply chain transparency for customers and suppliers alike.

KnownSources operates as a web-based platform relying on regular data entry by FBOs. FBOs register their facilities and whether they are certified against a recognized sustainability standard. FBOs enter reception of oil palm based raw materials on a monthly basis, primarily identifying the supplier of the raw materials. The system then establishes when possible the link to the originating palm oil mill and calculates the percentages for which this is possible as a key performance indicator (% traceable). In addition, the system measures % of segregated raw

By recording reception and dispatches on a regular basis, KnownSources establishes traceability using a mass balance type of algorithm by linking outputs of a particular reporting period to inputs of the same reporting period. Traceability is then used to arrive to the palm oil mills and plantations.

The primary goal of KnownSources is to support the industry in monitoring the process towards zero deforestation, no peat land degradation and positive impacts on local communities. Furthermore, the system calculates sustainability measures such a GHG emission per ton of product, sustainable volumes and other relevant socio-ecological policies. This information can be used by the FBOs to monitor their socio-economic impact and by potential clients to select their source.

To ensure that confidentiality concerns of companies are met and that no anti-trust laws are broken, KnownSources has a very detailed and explicit confidentiality policy that assumes that data is confidential, unless explicitly stated otherwise. Confidential data is grouped into three categories where the most confidential data simply cannot be accessed by anybody but the reporter, whereas sharing of other data elements is subject to explicit permission by the data owner.

KnownSources currently does not publish information directly, but it is envisioned that regular reporting on industry level will be added in the future.

3.3.5 GreenPalm: supporting actions for farmers

GreenPalm[37] is the operator of the Book and Claim (B&C)[38]certification scheme for sustainable palm oil, covering about 40% of all palm oil producers. for sustainable palm oil, covering about 40% of all palm oil producers.

A significant issue in increasing the sustainable supply of palm oil is the adoption rate of sustainable production standards, in particular by small farmers and operators. Some of these farmers and operators are not connected to sustainable supply chains, because no sustainable downstream operations are at a suitable distance of their operations (palm oil, especially unrefined palm oil, degrades rather quickly, much like fish).

To incentivise local farmers to adopt sustainable practices, the RSPO founded GreenPalm, a Book and Claim system for sustainable palm oil production.

Certified farmers can claim GreenPalm certificates for their production, one per ton of produced material. The farmers can then sell the certificates to manufacturers and retailers of palm oil based products, either directly or through a centralized brokering system[39]. The revenue from selling certificates goes exclusively and directly to the farmer.

Subsequently, palm oil and palm oil certificates are traded separately, so there is no physical link between certificates and traded oil.

Manufacturers having bought the certificates can claim to support sustainable production and are usually counted as "sustainable" in supplier score cards or other NGO publications. Manufacturers and retailers are allowed to print the GreenPalm logo onto their products as long as they hold sufficient certificates for 100% of the palm oil inputs. This enables them to communicate their support of sustainable production without the need to purchase physically

[37] www.greenpalm.org
[38] www.rspo.org
[39] In the brokering system, farmers offer certificates at a certain price. Potential buyers respectively record their bids and the system then matches offers and bids based on a first comes-first-served basis.

sustainable raw materials. This is especially valuable in complex supply chains with mixing occurring at multiple stages.

From the producers' perspective, this scheme creates a direct financial return for the investment in sustainable practices[40], even if their direct supply chain does not value the supply of sustainably produced raw material.

However, GreenPalm has been criticised for greenwashing as it does not contribute to converting the whole industry to sustainable practices. Manufacturers relying solely on GreenPalm have been criticised and are now moving towards full traceability of their production origins using KnownSources (see section 3.3.4) or other solutions.

3.4 Traceability for aquatic products

Traceability has been used in aquatic products for a relatively long time as a means to combat Illegal, Unregulated and Unreported (IUU) fishing and fishery management in general. Authorities and consumers alike are concerned with the status of the fishery resource and are actively searching for means to ensure aquatic products are sourced sustainably.

3.4.1 Current Obstacles to Traceability in Aquatic Products

Implementation of supply chain traceability is not trivial, and the systematic analysis of the current status in a number of countries shows that there is a lot of confusion and inconsistencies in the meaning, scope, legal status, implementation capacity and control of traceability systems (Blaha, et al., 2015). Blaha states that "it seems that efforts towards the implementation of traceability systems in the analysed countries and across countries have not been supported in an interdisciplinary and standardised way. Ensuring traceability through the seafood production chain can be only accomplished by careful planning, taking the time to gain consensus among the operators and authorities."

There are many reasons that the aquatic and seafood industry faces challenges in having 100% traceable supply chain: (Boyle, 2012)

- Seafood is a globally traded commodity, and language and technological barriers hinder the use of standardized electronic systems for full traceability within supply chains. Also, scale greatly varies in supply chains – from a single vessel or farm to a processor or importer that handles millions of pounds of seafood per year. Because of these varying scales, one solution may not work best for all companies within one supply chain.
- Technical systems (databases, barcode scanners, etc.) need to be functional and up to date to meet traceability needs. Limitations in resources, database expertise, and IT staff often allow for IT systems to become antiquated and not effective for comprehensive traceability. For smaller companies, significant technology costs may also hinder progress. For companies that sell more than seafood, the seafood portion of the business is often not the most profitable; therefore, other business areas may drive traceability or database decisions.
- The seafood industry has traditionally operated based on relationships and trust, and supply chain information is often closely guarded. The idea that full traceability allows

[40] At current market prices and yields, GreenPalm give the farmers economic benefits from the B&C scheme of about USD30 per hectare.

for more transparency up and down the supply chain (to differing degrees) has some concerned about confidentiality and the use of information for competitor advantage.

- Many companies are reluctant to invest in costly systems now, as the authorities may mandate new regulations. Companies are also concerned that a majority of the industry will adopt the same standardized system, which would pose a problem for the companies already invested in different traceability programs.

3.4.2 Landing Certificates in the European Union

As a response to concerns over IUU fishing, the European Union has introduced several legal measures to combat market entry of product derived from IUU fishing. On September 2008, the EU adopted council regulation (EC) No 1005/2008 establishing a community system to prevent, deter and eliminate IUU fishing, commonly referred to as the EU IUU fishing regulation. One of the main objectives of the EU IUU Regulation is to control the movement of fisheries products entering the EU Market[41]. Based on this Regulation, the ability for a non-Member State to export fisheries products into the EU depends on how the state addresses IUU fishing in its area, or the region where the fisheries product originated. This restriction of imports is accomplished through the implementation of port state control of third country vessels, the establishment of a Community IUU vessel list, the establishment of a non-cooperating third countries list and the implementation of catch certification requirements for all fisheries products.

According to the regulation, fishery products can only be imported into the EU market with a validated catch certificate (Article 12). This certificate follows a pre-approved format by each flag state (Article 20), or the country, and/or RFMO of origin of the fish product, and is completed by the master of the vessel. Also accepted as catch certificates are the documentation schemes and catch certificates used by RFMOs (Article 13). The importation and exportation of the fish product is dependent on the validation of the certificate by both the flag state of the vessel (Article 15) and the competent authority of the port state (Article 16).

The mandatory landing certificates must contain a unique landing certificate number, vessel and vessel owner identification, specification of the species landed and weight landed as well as identification of the issuing agency. The certificates must be issued by the vessel's flag state and follow the product throughout the supply chain. This is meant to ensure that the source of the fishery product can be verified throughout the whole supply chain and hence products from IUU fishing can be detected even at later stages, even when they manage to enter the market initially.

In the nomenclature of Section 3.1.4.2, this constitutes a cumulative traceability system.

Exporters of fisheries products to the EU must present their landing certificates to the importing country's Customs authority prior to the export. The responsible Customs authority of the importing country then verifies the documentation and decides whether it deems the information to be credible. This typically involves coordination with the Competent Authority of the exporting nation, and hence imposes consistency requirements strengthening the legality claim. Issuing agencies in non-EU countries must be registered with the EU and must prove that

[41] http://ec.europa.eu/fisheries/cfp/illegal_fishing/info/handbook_original_en.pdf

they have the means to verify the information provided on the landing certificates as well as institution to prove the claim in case of doubt.

Even though the EU landing certificate scheme uses traceability to combat IUU fishing and market entry of illegally sourced fisheries products, it suffers from challenges as most agencies use paper instead of electronic certificates. Paper-based traceability systems are less efficient as the information is only available to the holder of the certificate, more prone to human errors such as misspelling and much easier to falsify.

3.4.3 A Global Framework to Ensure the Legality and Traceability of Wild-Caught Seafood

Recently, a panel of experts in legality and electronic traceability of seafood with the aim to create a blue print to combat IUU fishing globally, presented a comprehensive document called "Recommendations for a Global Framework to Ensure the Legality and Traceability of Wild-Caught Fish Products" as a result of their work between 2013 and 2015 (Expert Panel on Legal and Traceable Wild Fish Products, 2015). In this document the experts call for eight measures to be taken by the competent authorities.

1. *Set minimum information standards for wild-caught fish products*
2. *Create authoritative data sources, including a global record of fishing vessels, to be established or identified as soon as possible*
3. *Establish a harmonized system of "landing authorizations" to provide primary assurances of the legal origin of fish products*
4. *Multiple points of verification throughout seafood supply chains*
5. *A transition to fully electronic traceability systems for all commercial wild fish products within the next five years*
6. *Support and capacity building to those producers who will need help with the transition to electronic traceability systems, particularly SMEs and commercial fishers in developing countries*
7. *Create a global architecture for interoperability systems*
8. *Where applicable, establish non-discriminatory border measures setting minimum standards for seafood traceability and proof of legal origin to combat trade in IUU products while facilitating legitimate commerce through a "risk-based, tiered, and targeted" approach.*

The final recommendation of the panel aims to pressure less concerned countries to join the effort of combating trade in IUU products by establishing the necessary authorities and traceability systems. If countries were to face adverse economic effects by excluding their FBOs from the world market for seafood, then the correct incentives will the reinforced even if they profited from IUU fishing in the past or in general are less concerned about conserving global fishing grounds.

According to the panel, establishing common standards will level the international playing field and ensure that competition for landings will not drive down traceability and legality standards (Expert Panel on Legal and Traceable Wild Fish Products, 2015). The panel recommends to use a risk-based approach in setting minimum standards.

3.5 Main challenges to Traceability in CITES-listed shark commodities

3.5.1 Bringing traceability to small-scale fisheries

Including smallholders in a traceability system will be one of the main challenges in combating IUU fishing in general or for specific species. Smallholders, or more specifically small-scale fishermen, perform a vital role in the global seafood supply chain as suppliers of raw material. However, their engagement in a specific fishery depends greatly on the equipment and investment necessary, hence they will be less present in high-sea fishing, which is dominated by large vessels with high-tech equipment. Nonetheless, their inclusion in a traceability system will be necessary in an effort to stop IUU fishing globally and important to ensure engagement by developing countries, whose agricultural sector may be comprised of smallholders.

Small-scale fishermen often have access only to limited and/or outdated equipment and a lack of formal education. This leads to very unique obstacles to overcome when establishing traceability systems as documented by reports of development aid organisations (George Karoppacheril, et al., 2011).

Firstly, small fishermen may face a very steep learning curve with respect to traceability. Some may never have engaged in documenting their commercial activities. In these cases, the formalities of traceability constitute a change in business practice and require extensive training in process and transaction documentation as well as an introduction into reporting collected data to regulatory authorities or business partners.

Secondly, some fishermen might not have the facilities to store extensive documentation. Using personal computers commercially is still rare for smallholders and a lack of appropriate storage room for paper documentation might be an issue.

Thirdly, investing in traceability and traceability technology might be difficult for small fishermen due to a lack of access to finance. To make things worse, the lack of standardisation in traceability systems increases the risk to make bad investments in traceability systems and/or technology. Hence, small fishermen require extensive support in choosing the right traceability system.

Experience from South America and other regions shows that these obstacles are major issues for smallholders, as they tend to leave supply chains that require high standards in food security and traceability. However, some case studies have shown that smallholders can be integrated successfully when supported throughout the implementation process required by a traceability system (George Karoppacheril, et al., 2011).

In addition to these obstacles, the sheer number of smallholders makes adoption of traceability difficult in a given country. An initial challenge is the identification of such a large number of players (typically in the area of hundreds of thousands or millions). Recently, an initiative by UN Global Compact (UNGC), the International Trade Centre (ITC) and GS1 have initiated a five-year pilot in which they plan to provide 500,000 farmers world-wide with a unique identity through the Global Farm Registry; see e.g. (Bracken, 2015). This is a welcome step forward in resolving this important bottleneck, although it must be pointed out that the total number of smallholders is likely to be several orders of magnitude larger than the scope of the five-year pilot project.

3.5.2 Global standardisation of traceability systems

As already mentioned, standardisation is one of the main challenges in the implementation of traceability systems (Lehr, 2015; Lehr, 2013). Standardisation is needed on a number of levels: in general, for the establishment of traceability, but also specifically for fishery products and even more specifically for shark products.

Standardisation will be necessary in many regards, including:

- What information to store/transport (procedural standards),
- How to transport information (information exchange standards),
- How to name information elements (semantic standards),
- How to store information (Syntactic standard), and
- How to identify product units and FBOs uniquely (identification standards).

Fortunately, the need for standardisation has already been identified and several organisations, private and public, have started to develop standardized coding schemes. However, the challenge will be to either agree on unique standards or to make them interoperable. The UN has already started to address these problems, but a global solution is not yet available.

For unique identification, GS1 is the most established source globally. GS1 is a global non-profit organisation with two relevant products: The Global Trade Item Number (GTIN) and the Global Location Number (GLN). The GTIN can be used as unique identification for products and trade units. However, for some products and production processes, the serial GTIN or SGTIN might be more suitable. The GLN is commonly used to identify companies and their facilities. Companies are assigned a code prefix and then have to assign full codes to each of their facilities, uniquely identifying them. The GLN codes are registered in combination with the geographic coordinates of the facilities. GS1 offers more coding schemes, but they are less important for a general traceability scheme.

In the case of semantic standards, the United Nations has developed the Standard Products and Services Code (UNSPSC) classification scheme, which is managed by GS1. The UNSPSC aims to create a globally unique classification scheme for products and services in order to simplify communication and help businesses to categorize their expenditures effectively. The UNSPSC might serve as a basis for naming KDEs regarding product or service/ transformation description. However, further efforts to establish semantic standards for KDEs will be necessary when establishing a global traceability system.

One of the attempts to create a data management standard is the Fisheries Language for Universal Exchange (FLUX), a UN/CEFACT standard, which will be made mandatory for the EU. FLUX is a standard that aims to simplify B2G and G2G data exchange by defining a generic data model and a series of electronic messages for communication from sender to destination. FLUX is designed as a modular standard, where the modules are designed to serve specific purposes within fishery management. Thus, countries will only use the modules designed for the fisheries they are actually engaged in (Callewaert, 2014; Callewaert, 2012; Lehr, 2015).

3.5.3 Governance

Traceability systems typically contain a significant amount of detailed information about a participating business. Some of these information elements (like suppliers or raw materials) are highly confidential and might even be business-critical.

Traceability might also lead to legal proceedings against companies. This might be because the company has provided inconsistent information to different government bodies (e.g. the tax authority and the department of agriculture) or because they are part of a compromised chain (as e.g. in food incidents) or because part of their supply is informal.

All this makes traceability information typically very sensitive. In response, three approaches have been chosen as an implementation strategy:

1) "Hands-off" approach. For example, the General Food Law 178/2002 or the Food Safety Modernisation Act of the United States mandate the use of traceability without making any reference to how it should be implemented and how data shall be made available. Traceability is used on a per-need basis in reactive mode, usually to resolve food safety incidents. Government agencies do not generally have access to data, other than through specific requests.
2) Top down collection of data by governments. In some cases, governments have mandated collection of traceability data (e.g. for livestock management and general food safety in countries such as India, Malaysia, Vietnam and Indonesia). In specific cases (e.g. livestock) this has been successful, in other cases it hasn't. Many traceability pilots never evolved into national traceability systems.
3) Sector-managed systems. Attempts have been made, for example the Norwegian eSporing system where data is generally kept within the companies, but made exchangeable through linkages stored on a central server that is managed by the particular sector (Foras, et al., 2015).

In general, there is value in governmental agencies having access to traceability information in (near) real-time to reduce fraud, disease and illegal traffic. However, this value needs to be balanced with the right of food business operators to confidentiality with regard to certain categories of business information.

To solve this conundrum, a layered model was proposed (Lehr, 2009; Lehr, 2010; Lehr, 2013; Lehr, 2013; Lehr, 2015). The layered model differentiates between the public sector or regulatory layer (layer 1), the private sector or operational layer (layer 2) and the certification or verification layer (layer 3). It recommends clear legislation or regulation on what information should be stored in layer 1, who gets access to it and under which circumstances, and how that information may be used by government agencies. This information might be anonymised and/or aggregated if that does not compromise the mandate of the corresponding agency.

Information kept in layer 1 would be stand-alone, so that it can be accessed at any time and without the need for the private sector to collaborate.

Its backbone is a private sector traceability system in layer 2 where private parties agree on a contract basis regarding the information to exchange.

Finally, the verification layer might consist of private entities (e.g., auditor for standard schemes like MSC, GlobalGAP or others) or public agencies. The purpose of private entities is to verify, usually on a sample basis, information kept on the private sector layer and/or the regulatory layer. Verifiers would ideally have access to online information (at least if contracted privately), but access can also be established on a case-by-case basis.

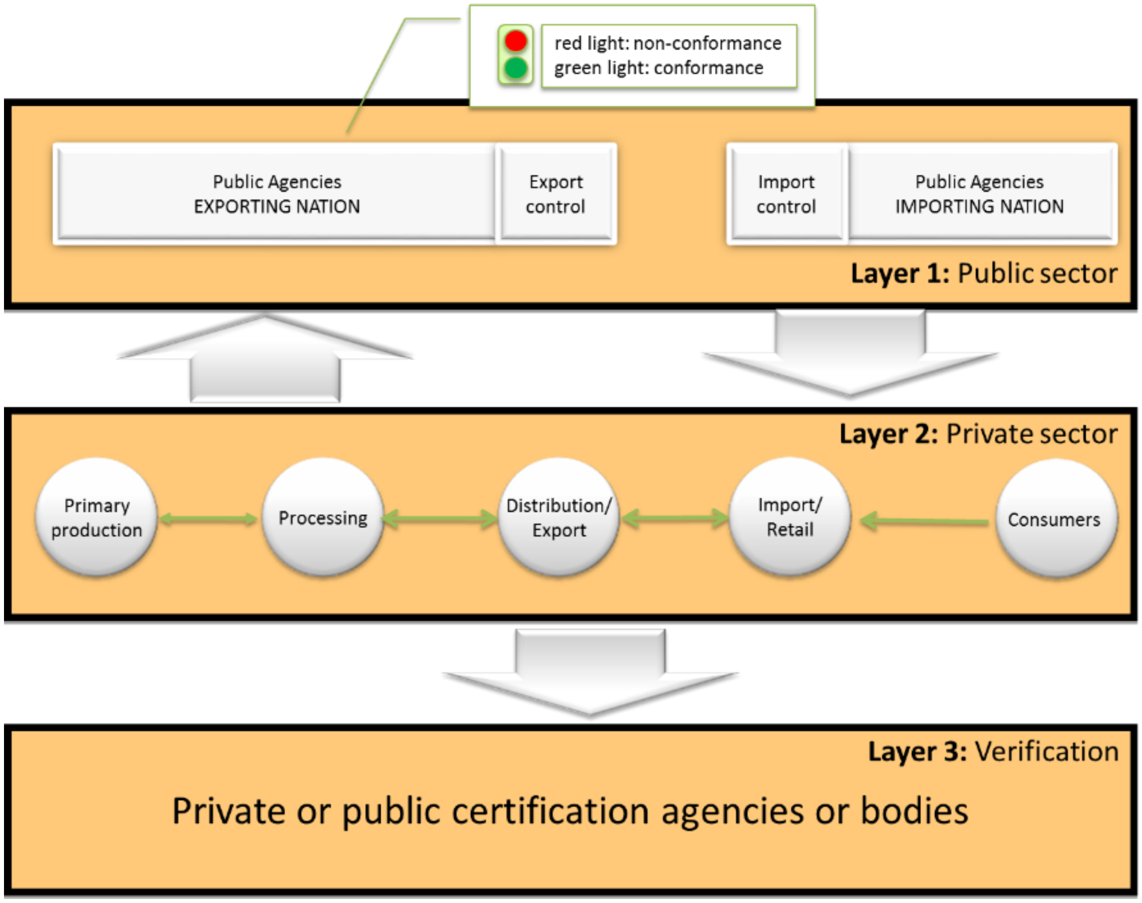

Figure 3-9 The layered approach to large scale traceability systems

4 Traceability as a tool to strengthen CITES processes

Traceability as defined in section 3.1 refers to the means to store and then access information about an item, such as a food product. Traceability can link products for export to their origin, to any process that the product might have undergone or to any regulatory document it may be linked to. In addition, it can provide additional information about the FBO, the product, its origin or all of the above. Traceability has also been used to prove the authenticity of a food item or its compliance to legal or standard requirements. Traceability for these reasons is clearly relevant as a measure to support CITES processes.

For the purpose of this section, we will concentrate on shark fins and meat as a relevant, but also relatively simple cases of application of traceability in international trade in CITES-listed species.

4.1 The potential role of traceability in CITES processes

As elaborated in section 2.5.1, CITES uses permits and certificates as the main tool to regulate international trade in products of species listed in Appendix I, II or III; see also Section 7. Trade of listed species is controlled on a *specimen* level.

All Parties to the Convention must designate a Management Authority that issues permits/certificates for exports and imports of specimens of CITES-listed species. In order to obtain such a permit, entities have to apply for it with the Management Authority. The Authority must consider in its process to grant or not such permit/certificate:

- The legality of the trade process
- The sustainability, or the "non-detriment" of the trade for the survival of the species in the wild (determined by the Scientific Authority of the same country)

Information about origin, supply chain steps and process may certainly help determine whether the material was indeed acquired legally in the sense of the Legal Acquisition Finding (LAF). In addition, traceability can link trade statistics to production origin, i.e. the FAO or ICES catch areas (if that information is reported correctly).

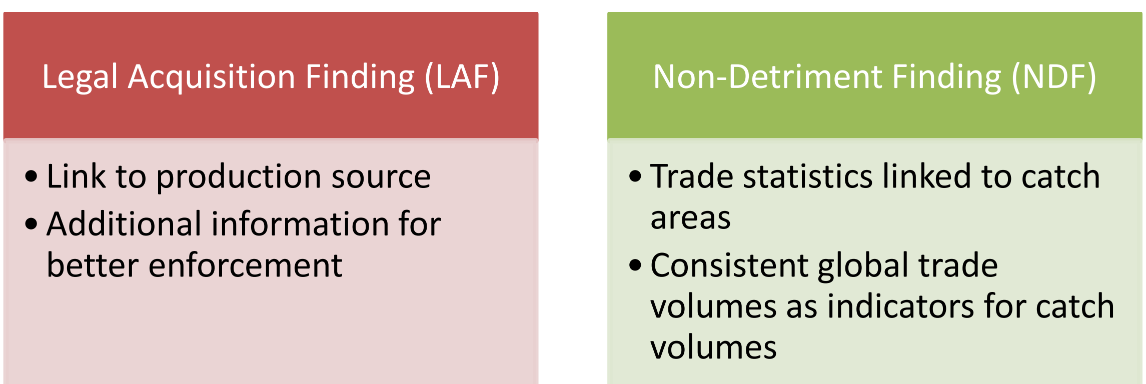

Figure 4-1 Potential roles of traceability in stengthening CITES processes

This information can be used by nations in their efforts to make Non-Detriment Findings. This is particularly true where shark products are reported in a collective manner in normal trade processes.

While there clearly is a use of traceability for the purpose of statistics that are subsequently used as input into Non-Detriment Findings and for the review of significant trade under CITES, perhaps the most immediate use of traceability is in the support of the Legal Acquisition Finding, in particular, to document the relationship of the goods to be exported with a legal origination process (see section 4.3).

4.2 Limitations of the use of traceability systems in the trade of shark products

There are a number of limitations for the use of traceability systems in the trade of specimens of CITES-listed shark species.

A good portion of the shark trade is illegal, unregulated and unreported; for these black market activities, traceability is not an ideal tool (see also Section 3.2). If both buyer and seller act knowingly outside of the law, they are very unlikely to document transactions and make that information available in some form or other. Traceability can help law enforcement activities to some extent because (a) the analysis of product flows may provide hints of illegal activity and (b) companies can be held accountable based on the data they have previously submitted. However, the impact of traceability on reducing black market transactions should not be overestimated.

The main benefit of a traceability system to CITES trade therefore would be the avoidance of entry of illegal material into legal chains.

This can have two effects: it can raise awareness of supply chains and push semi-legal chains into legality. However, additional data requirements and the additional burden of complying with traceability requirements can also convert (semi-)legal chains into illegal chains. This might be the case for example if (a) current business models are interrupted (e.g. fishermen not being able to use shark bycatch as direct income), (b) the additional documentation requirements exceed the capacity of the supply chain or (c) the transaction costs associated with the additional requirements reduce the profit margin.

Arguably, the success of a future traceability system will depend on the determination of the Parties of implementing it, but also on value created for the supply chain, particularly in the early stages.

It is therefore of importance to consider measures of positive discrimination for those who deal legally in sharks and shark products. For fishermen, this might be tradable shark credits to support conversion from illegal, unreported catches to legal and reported catches; similar to Book & Claim systems (see Section 3.3.5). Fishermen would receive credits upon legally landing sharks and can sell credits in addition to sharks. Buyers – especially those removed from the originating source – can purchase credits to support sustainable shark trade. Ideally, this would result in the ability to issue a marketing claim e.g. in the form of some logo or recognised statement (such as “Supporting local fishermen”, “Supporting sustainable shark trade” etc).

The second limitation is the assumption that a legal origination process exists. In countries that have implemented a Catch Documentation Scheme (CDS) (see Annex II for discussion of different types of schemes) or in those that plan to do so, such a process may exist. However, the extent to which developing nations may have the necessary resources to implement and monitor such schemes may be limited and the requirement of a legal origination process may then represent an unreasonable burden for trade.

Thirdly, the quality of data captured in the legal origination process must be monitored by implementing nations. Traceability is a system of claims[42] and requires verification to make sure that data held in a traceability system is valid. If the traceability system is not sufficiently robust, its introduction may create a smokescreen of legality that will fail to address the actual problem, i.e. the pressure on the population of some shark species.

4.3 Linking to a legal origination process

The traceability system that is suggested for use by Parties to CITES links the export/import permit or certificate process to a legal origination process and combines it with a risk-based control method.

A *legal origination process* would be defined as a legal procedure, such as a landing certificate, that creates a document trail to prove the legal origin of the raw material.

Table 4-1 Examples of legal origination processes for different shark products

Product	Raw material	Legal origination process
Unprocessed shark fins	Shark carcass	Landing, Introduction from the Sea
Shark meat	Shark carcass	Landing, Introduction from the Sea
Processed shark fins	Unprocessed fins	Landing, Introduction from the Sea or import

This concept can easily be extended to other CITES species. In the case of farmed species, for example, farm operation permits can be considered a legal origination process using the above definition.

Legal origination processes would have to fulfil the following criteria:

- Be supported by a document or certificate or other form of document that allows determining the legal status of the process
- Be uniquely identified – preferably globally, but at least within a clearly identified context
- Contain information related to the landed species and quantity or weight[43]
- It is highly desirable to record also the FAO/ICES catch area, the vessel ID and the landing port and should in general follow the recommendations listed in Section 3.4.3

Relevant identification standards

- GDTI for certificates
- SGTIN for unique identification
- GTIN for species + Application identifier
- GLN for vessel ID, landing port, exporter

Figure 4-2 Examples for identification standards that are relevant in the context

4.4 Robustness of the legal origination process

The certificate of legal origination would need to be sufficiently robust in order to add value to the process. A number of catch documentation schemes are currently under consideration and/or being implemented world-wide. In general, it has shown that additional measures should be adopted to verify the contents of the catch/landing certificate.

Table 4-2 Some measures to strengthen validity of catch information

[42] i.e. it records claims. Claims turn into facts only after verification.

[43] This means that the legal origination process must be output-based. Input-based processes (e.g. limiting Days at Sea) are not sufficient for the purpose of this traceability system.

Measure	Advantages	Disadvantages
Fishery observers	Human intelligence	Potential issues between observers and crew
Video surveillance	Neutral observer	Little industry buy-in
Electronic logbooks	Simple and cost effective to implement	No assurance of correctness of information entered

Collectively, such measures are often called Monitoring Control and Surveillance (MCS) schemes and as such are part of fisheries management.

Another challenge where the originating information quality might be compromised is the differentiation among species, which is essential for CITES purposes. Fishermen might

- Not be knowledgeable about the precise listings of shark species
- Not be able to distinguish sharks at the taxonomic level required by CITES

The legal origination process must consider the possibility of errors in the species description and provide counter measures. Such measures may include:

(i) A requirement to land sharks fins-on[44]
(ii) Training in and dissemination of CITES listings
(iii) Taking photos of the catch[45]
(iv) Raising the awareness of CITES-listed species with fishery officers
(v) A requirement for officers to check the species in the landing/import process

See also the FAO Port State Measures Agreement[46].

Other than remarking that the quality of data recorded on the legal origination process will determine the usefulness of the traceability system for the legal acquisition finding, the robustness of the legal origination process goes beyond the scope of the report.

4.5 Conversion between raw materials and products

Since shark fins and meat are traded in parts, most likely in either frozen or dried forms, there is a need to convert the original raw material quantities into product quantities in order to commence the traceability process down the market chain.

Table 4-3 Examples of conversion factors

Raw material	Product	Factor	Conversion risk
Shark carcass	Fins (quantity)	4	Not all fins might be used

[44] Disallowing fins-only landings will greatly increase the ability of the authority to check the self-declared species and quantities, however at the expense of reducing the profit margin of fishermen. Shark carcasses if not sold for meat will occupy the limited space on board and reduce the available space for the commercial catch. A fins-on requirement might therefore be a disincentive to convert to legal and reported fishing and drive more fishermen into IUU fishing

[45] For later (automated) processing, as evidence for a documentary check or for species identification; see e.g. http://www.fao.org/fishery/ipoa-sharks/iSharkFin/en

[46] http://www.fao.org/fishery/topic/166283/en

Shark carcass	Wet fins (weight)	5% of body weight	Actual fin weight is at least species-dependent; the 5% figure might be overestimated
Wet fins	Dried fins	0.25	-
…			

For shark meat, the conversion factor would have to include normal shrinkage due to processing (i.e. processing yield).

Conversion factors would need to be established by the CITES Scientific Authorities, ideally in coordination with other Parties. The Secretariat could facilitate such coordination efforts.

The conversion factors will be used in the CITES permit/certificate process to link an export permit/certificate to a number of identified landing/catch certificates.

4.6 Linking the export certificate to a legal origination process

In a traceability supported permitting process, the application for a CITES permit or certificate should also include the recording of certificates of origination for an equivalent quantity.

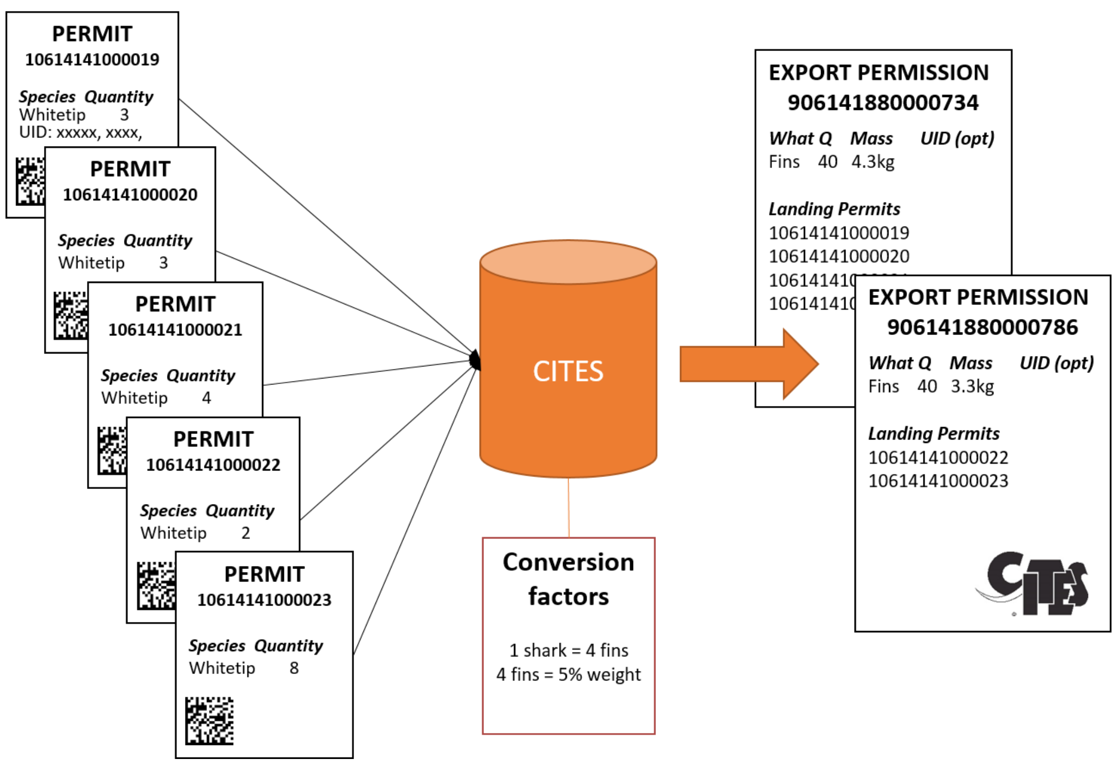

Figure 4-3 Conceptual link between the export permit/certificate and the legal origination processes, here shown for the "batch" modality of the traceability system

The equivalent quantity is calculated from (a) the quantity information on the landing permit/catch certificate and (b) the conversion factors.

Different traceability system options are possible. In particular, three levels of traceability can be used (i) a mass balance system, (ii) a batch traceability system where products are linked to raw material batches using internal traceability and (iii) unique identification where products are linked to individual shark carcasses.

Mass balance
Risk: higher

- All landing certificates are recorded in an electronic system
- Processors record incoming certificates together with the source of the certificate
- If a certificate has been entered already and the quantity exceeded, all users of that certificate are requested to provide evidence of legal acquisition
- Incoming certificates are converted into *allowances* for products via agreed conversion factors using a stock mechanism
- Export permits are subject to having sufficient allowances

Batch/Unique identification
Risk: medium/low

- All landing certificates are recorded in an electronic system
- Processors record incoming certificates
- If a certificate has been entered already and the quantity exceeded, all users of that certificate are requested to provide evidence of legal acquisition
- When applying for an export certificate, the corresponding origination certificates are detailed (pre-requisite: internal traceability)
- Export permits are subject to having the quantity matching the listed certificates of origination x agreed conversion factors

Figure 4-4 Process description for the three traceability system types proposed

For the **mass balance** type of traceability system, certificates of legal origination contribute to a stock of available material per raw material and per species. A successful application for an export permit/certificate will deduct from the stock the equivalent quantities as calculated by the conversion factors.

For the **batch** type[47] of traceability system, certificates of origination are directly related to the CITES permit, i.e. an export permit will be directly linked to an equivalent number of incoming certificates.

The **individual identification** type of traceability system is a variation of the identity preserved type of traceability system, i.e., each individual specimen will be linked to a permit. Both the batch and the individual identification system require the presence of internal traceability between the legal origination process and the final product.

Comparatively speaking, a batch type traceability system is more robust than a mass balance system and a system based on individual identification is more robust than one based on batches. All three cases, however, are potentially subject to substitution fraud of the incoming certificates. If exporters falsely claim to own the rights to such certificates, traceability will be compromised. In order to mitigate this risk, two measures are suggested.

Certificates of origination should be recorded electronically. Cross-referencing certificates between different trade processes is the only way that allows the detection of reuse or misuse of a certificate of origination. Ideally, certificates are generated electronically when adopting traceability as a tool to strengthen the CITES processes and cover more than CITES-listed species. Electronic copies of the certificates can be held in a 3rd party system, as long as there it can be integrated with the CITES e-permiting toolkit.

Certification of origination should be recorded as early as possible. Ideally the certificate is recorded at the point and time of origination, e.g. as part of the landing process. It will add to the robustness if the recording is part of the certificate issuance process and therefore the data is already trustworthy. If that is not possible, certificates of origination can be recorded based on self-declaration. CITES may consider providing a recording toolkit; in particular, a mobile-phone

[47] A batch type of traceability system is equivalent to the earlier introduced segregated type of traceability systems.

based toolkit would seem valuable. There are already commercial and semi-commercial packages for simplified mobile phone integration into EPCIS available.

In particular, the electronic recording of base information from the certificate, such as

- Unique identification number (in the context)
- Species
- Quantity or weight

is essential. Failure to record this information electronically will significantly reduce the robustness of the traceability system.

4.7 Combination with risk management

Traceability in general relies on verification of data for robustness; the processes proposed above are no exception. For aquatic species in trade, such as the ones under consideration here, it is reasonable to attempt to go one step further than using a self-declaratory relationship between a legal origination process and an export permit/certificate.

The ideal option would be to employ traceability in the context of a risk management system. The risk management system will make a basic decision of whether or not to require a documentary check, i.e. additional supporting information.

It will make that decision based on a series of risk factors, such as the commodity, the applicant's history, the chosen traceability system. Risk factors will determine the frequency of checks[48].

Table 4-4 Example risk factors

Factor	Inspection	Control frequency	
		Higher	Lower
Unique identification	No		X
Weight-based landing certificate	No	X	
Landing certificate is older than expected for product	No		
Landing certificate quantity exceeded	Yes		
Any quantity excesses last 12 months	No		
Last control favourable	No		
Catch certificate recorded at landing	No		
…			

Table 4-4 collects a few potential risk factors without being too exhaustive. It also differentiates between a physical inspection, which occurs when the certificate is used more than once, and a control, typically in the form of a documentary check, in all other cases.

[48] Often in trade-related risk management systems, risk factors are combined into risk groups and inspection/documentary check frequencies are designed for such groups.

Risk factors should be coordinated between Parties ideally, so that an importing Party can rely on the risk management process of an exporting Party. However, Parties might have different views on the details of the risk weighing and it would probably be necessary to account for some flexibility in this area.

Some of the risk factors might also be raw material and/or product dependent. To limit certificate fraud, the timespan between the issuance of the certificate of origination and its use in a CITES application might be considered another risk factor. However, products have very different shelf life; a dried, processed fin will for example have a much longer shelf life than a wet fin or fresh shark meat. This needs to be taken into consideration.

4.8 The resulting process

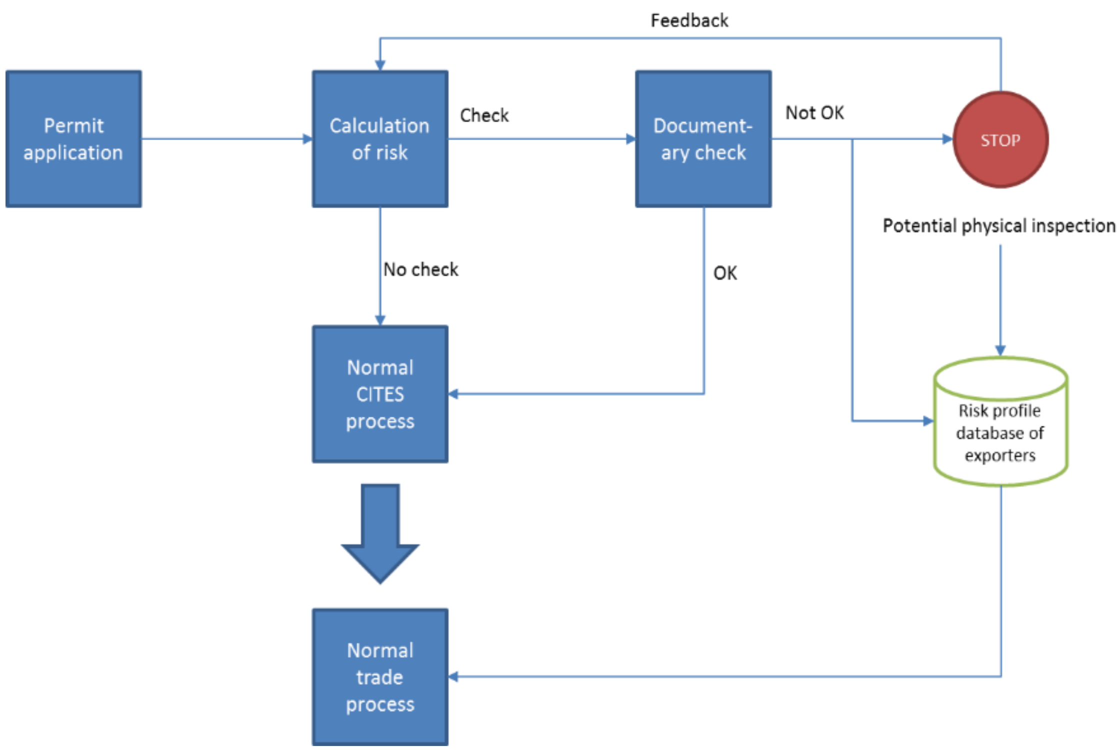

Figure 4-5 The process resulting from the integration of traceability into normal CITES processes

Considering the elements described in the preceding sections, the suggested traceability process for shark fins and meat would be executed in the following way:

1. The applicant submits an application for a CITES export permit which links the permit process to a legal origination process, either through *allowances* resulting from a mass-balance process or through a direct link to a number of certificates of origination
2. The permit issuance process then calculates a risk for the permit process, taking into consideration the applicant and the applicant's history of compliance, the consistency of information and in particular if the weights or quantities tally, in which Appendices the species is listed, the age of the certificates of origination or other information
3. As a result of the risk assessment, a decision is made by the Managing Authority whether to request more in-depth information for a documentary check (or even physically inspect the operator/alert law enforcement)

4. If the risk assessment is positive, the current CITES process continues. If it is negative officers evaluate the submitted information. If that check has a positive result, the normal CITES process continues. If not, the CITES export permit process stops. In both cases, the Risk profile database of exporters is updated.

CITES Parties may wish to consider providing access to the risk profiles of exporters to other trade process owners, such as Customs officers, for their own risk management.

4.9 Implementation strategy

Table 4-5 Advantages and disadvantages of paper-based, mixed and electronic traceability systems

	PAPER-BASED SYSTEMS	MIXED PAPER-ELECTRONIC SYSTEMS	ELECTRONIC SYSTEMS
WHAT	Traceability system based on forms filled at the different stages and available for inspection	Traceability system where data is captured initially on paper (at some of the stages), but then entered into an electronic system	Fully electronic system with full electronic data capture at every step of the chain involved
ADVANTAGES	Paper is resilient Paper forms are common Low initial investment cost Very difficult to change over time	Investment cost low Apt for smallholder integration Easier to on-board low-tech parties Very difficult to change over time Data available can be used for more than one purpose Can be integrated into risk management processes	Most robust system Reliable cross-check of data Apt for fast processes Increased data quality Easier to improve over time Cheap to operate Data available can be used for more than one purpose Can cope with any amount of information Faster for operators
DISADVANTAGES	Inspection/verification very costly if possible at all Transportation of paper takes time No backup possibilities Paper can be falsified (also after the fact) Prone to fatigue by operators and resulting errors or omissions Cannot be easily integrated into risk-management systems	Not apt for fast processes More vulnerable to errors and fraud Repudiation is questionable Legal prevalence unclear (what is the original?)	Higher investment cost Requires technical capacity Lack of coverage of mobile and data networks requires "offline-mode" which increases the cost of the system No clear off-the-shelf electronic standards

The system described above relies on authentication of the export goods with the legal origination process at the moment of processing the application. This is not possible with a paper-based system in a reliable fashion, because paper-based systems are prone to certificate fraud.

Also, the integration into a risk management system as described in Section 4.7 requires data to be electronic.

On the other hand, one has to accommodate the fact that in many places around the world the use of electronic tools is still a challenge. Partly this is due to the lack of electricity or connectivity and partly this is due to experience in the use of electronic systems. Any global traceability system needs to accommodate offline data capture via paper forms that are later converted into electronic information. Traceability systems should also allow mobile data capture, given the proliferation of smartphones all over the planet.

The electronic part of the proposed system can be implemented in different ways.

Implementation in coordination with an electronic catch documentation scheme

Where electronic catch documentation schemes are already implemented or in the process of implementation, the best solution would be to integrate the traceability system with the catch documentation scheme. This integration will depend on the particular nature of the catch documentation scheme. The United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) offers for example the FLUX message standard for exchanging fishing activity information between systems (Honoré, 2015; Callewaert, 2012; Callewaert, 2014).

Disadvantages

Integration of IT systems operated by different entities, potentially even under different jurisdictions, is typically not straightforward. If the existing system does not allow integration, data will have to be entered multiple times.

Advantages

An integration methodology already exists through the standardisation of relevant messages such as the FLUX framework. Full integration of CITES processes in existing processes will reduce the obstacle to initial implementation.

Implementation together with an electronic catch documentation scheme

When implementing both traceability and electronic catch documentation schemes (CDS) at the same time, there is the opportunity to ensure that the implemented CDS is based on international standards, in particular on unique identification standards and standards like FLUX.

Disadvantages

The timing of implementation of the CDS and the traceability system might be very different and this can easily lead to a slowdown of the implementation of traceability for CITES processes.

Advantages

It is considerably less work to build a traceability system with all requirements clear from the beginning. If a CITES system is built together with an electronic CDS system, the total resulting implementation cost will be lower than if implementing them sequentially. The implementation of traceability for CITES might also be used as an additional argument for the need of an electronic CDS.

Implementation within the e-permitting toolkit

Implementation of a traceability system in accordance with the e-permitting toolkit is also a possible option. To optimize this solution, two additional elements are suggested: (a) certain data fields and forms to the toolkit, and (b) a risk management module. Adding such functionality to the toolkit would probably be the cleanest solution, as it could also provide an easy way to introduce relevant data exchange standards between countries, such as EPCIS; see e.g. (Lehr H. , Information management in agrifood chains: towards an integrated paperless framework for agrifood trade, 2015).

Disadvantages

The extension of the e-permitting toolkit requires considerable coordination with the respective committees within CITES. Moreover, the standards recommended in the Toolkit have been integrated with the World Customs Organization (WCO) Data Model, and any new extensions to the Data Model by CITES must therefore be approved by the WCO Data Model Project Team.

Advantages

Inclusion of standards related to a CITES traceability system for shark fins in the e-permitting toolkit may be seen as good balance to provide functionality to implementing Parties while optimising the associated workflows.

Implementation independently of any other scheme

At least for the purposes of a proof of concept and of comparison with the other options, this section considers the option of creating an additional, standalone system that deals with the risk management and the relationship between the export/import permit/certificate and the certificate of origination independently.

Upon landing, all CITES-listed specimens would be registered in an electronic system issuing a certificate of origination with a unique ID.

Applicants would be required to submit the standard CITES export permit application as well as traceability form using the landing IDs; this could be integrated into electronic forms[49]. If an online form is used, this would need to be amended.

The CITES Management Authority must (i) connect to the risk management system and enter information extracted from the form, in particular the certificate of origination, the associated species and quantities, (ii) take note of the result of the risk analysis, (iii) conduct a documentary check if requested and annotate the results in both the risk management and the certificate management system.

Disadvantages

Using a stand-alone system will require some double data entry for either officers or business operators. Double entry of data is a loss of time and also a potential source of inaccuracies and errors.

Advantages

The lack of dependence on other systems and processes means that this strategy is probably the

[49] e.g. the form provided at http://www
ES/informaciondeutilidad/Documents/

Figure 4-6 Implementing traceability globally

fastest route to implementation for traceability. Particularly for trial purposes, this is certainly a very reasonable strategy.

Global roll-out

Traceability is a global issue and governance of a traceability system is not a simple issue; see section 3.5.3.

It is desirable that any traceability system possesses the inherent capability to be distributed or networked. In this way, local requirements, regulations and laws can be respected as well as the cost of operation distributed. Some countries may also have views with respect to what data can be held and accessed under what circumstances.

Nevertheless, initially it might be easier to use a centralized or cloud architecture during the implementation of such a system. Central implementation operated by a suitable entity will help (a) verify the benefits of such a system, (b) allow to remedy any shortcomings with limited impact on the Parties, (c) remove some of the burden especially on developing countries in the implementation and operation of such a system.

The technical design of the traceability system should take into consideration the possibility of a future network of traceability system nodes where a number of such systems are operated globally by different countries or organisations and have the need to exchange information. If sharks are landed e.g. in one country that has a free trade agreement with another country and both countries operate their own CITES traceability system, these systems would need to be able to exchange information.

If the systems were to be based on international standards, such as EPCIS, or use relevant information exchange standards such as FLUX, this point would be addressed.

4.10 SWOT analysis of the traceability system proposal

Strengths

- Relatively simple to apply
- Limited amount of data recording and effort
- No physical link between product and raw material necessary
- Step-wise improvement possible
- Allows for diverse systems depending of capacity
- Applicable to other CITES-listed species

Weaknesses

- No assurance on physical level [I don't understand what this means]
- Like other documentation systems, addresses only white and grey market
- Unless the system is electronic, easy to break
- Without verification probably not robust enough

Traceability as a tool for strengthening CITES

Opportunities

- Strengthens both the legal acquisition and the non-detriment requirement
- Can re-use catch certificates or other legal origination certificates

Threats

- Implementation of electronic system necessary
- Lack of capacity, especially in developing nations
- Does not address the black market, which is a sizeable portion of the shark product trade

4.11 Next steps

General experience in implementing traceability in the food, fishery, livestock and other sectors shows that implementation of traceability is a very detailed process. Some implementations are quite straightforward, and with the right motivation of the private sectors, have been quite successful. Other implementations have proven to be lengthy and complicated, with mixed results at best. A combination of public and private sector support seems absolutely essential for success.

In this sense, the implementation of a traceability system to strengthen CITES processes needs to be tested more in-depth before it can be considered proven that traceability has a positive impact on the final end goal, namely the conservation and sustainable use of CITES-listed species.

A number of elements are critical for success:

- The ability to convert illegal, unregulated and unreported shark fishing, including bycatch, into legal and reported originations, in particular also for small-scale fisheries
- Designing the right mix of positive and negative incentives for the private industry to participate
- Obtaining the buy-in from Parties that there is indeed a need to strengthen CITES processes through the use of traceability systems for sharks
- Provision of a traceability toolkit (or integration into the e-permitting toolkit), so that traceability that is easy to implement, yet meaningful to CITES Management Authorities

- Feasibility of the recommended processes in the technical sense, economic sense and conservational sense that must be demonstrated e.g. by conducting a socio-economic impact analysis

All these could be checked by a pilot project. A pilot project should have the following criteria without attempting to be complete:

- It shall be large enough to have a measurable impact; ideally it would cover one to three Management Authorities for a period of time (e.g. 6 months)
- Parties participating in the pilot shall already have a legal origination process; ideally they would also support electronic recording of certificates of origination (e.g. landing/catch certificates)
- It should involve at least one developing country in the technical feasibility assessment. Ideally – if enough budget is available – this would include a country with low technological capacity to gain practical experience how such a process can be implemented under difficult circumstances
- A socio-economic impact assessment should be made that compares implementation and operation cost with the likely impact on CITES-listed species
- It should attempt to quantify the amount of illegal and unreported landings using indicator markets/ports and local expert knowledge
- It should involve a trading partner with a history of strong interest in sustainable use of sharks and their products to provide better motivation to food business operators
- It should concentrate on one product only to start with. Fins would likely make a larger impact on conservation issues, while meat is a less politically contentious product.
- It may consider Parties first that already use risk management in export related procedures

5 Recommendations for consideration of the Parties

5.1 General, non-traceability specific recommendations

In order to strengthen the conservation and sustainable use of CITES-listed species of shark in trade, recommendations have been made to the Animals Committee of CITES in 2015 that have continued relevance (Dent & Clarke, 2015).

In particular, the following recommendations seem particularly relevant in the context of this report:

1. Separate commodity codes should be implemented for unprocessed dried, processed dried, unprocessed frozen and processed frozen shark fins as a matter of urgency in order to continue meaningful trade monitoring.
2. National authorities should consider amending their national commodity coding systems to include these categories as a gesture of support for shark conservation and management while advocating for a World Customs Organization (WCO) directive.
3. National authorities should ensure that there are appropriate taxonomically specific data recording systems for both fisheries and trade concerning species pertinent to both the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and fisheries management authorities.
4. National authorities should ensure that such taxonomically specific data are shared between relevant national systems, and use national plans of action (NPOAs) for the conservation and management of sharks to consider further opportunities for trade monitoring to contribute to improved management.
5. Intergovernmental organizations such as CITES, Convention on the Conservation of Migratory Species of Wild Animals (CMS) and regional fisheries management organizations should consider establishing formal liaison and data-sharing protocols on species of shared interest.
6. National authorities should maintain integrated trade and fishery datasets for chondrichthyan products to allow prompt and efficient participation in enforcement actions against illegal, unreported and unregulated (IUU) fishing.
7. Fishers, traders, distributors and retailers interested in offering certified-sustainable chondrichthyan products should actively participate in constructing trade monitoring systems that support traceability and effective management.

5.2 Specific recommendations concerning traceability

1. Traceability is a tool that can help avoid the entry of illegal, unregulated and unreported material into the legal supply chain. As such, traceability is a viable option to strengthen the Legal Acquisition Finding.
2. Traceability and in particular linking trade data to the origin of the raw materials can be used by Parties in the process of making more robust Non-Detriment and Legal Acquisition Findings.
3. Traceability should link the export/import permit (such as a CITES permit) or certificate to a suitable legal origination process. This legal origination process must include issuance of a uniquely identified certificate that lists the species and the quantity/mass.

4. It is highly recommended that such certificates of origination are recorded electronically as early as possible; they can, however, also be recorded in the export permit issuance process.
5. An attempt should be made not to place undue burden on food business operators that would discourage their buy-in. It is therefore recommended to allow exporters to use a mass balance traceability system, especially if the business operators commit, as part of their continuous improvement programs, to switch over time to a batch system or one relying on individual identification. The effort invested into the more robust traceability systems should be rewarded, e.g. by allowing marketing claims or by incentivising them otherwise (less controls, pre-approved exports, reduced export tax etc.).
6. It is highly recommended to link the traceability system with a risk management system. As a result, exporters/importers shall undergo a documentary check if doubts regarding the origination arise. Results of such checks should be recorded in an exporter profile database and made available to other relevant stakeholders.
7. Traceability will help very little when buyers and sellers operate in the black market. It is recommended to design incentives to convert illegal and unreported landings into legal and reported landings, e.g. by implementing tradable certificates. At the same time, it is recommended to implement a consistent Monitoring Control and Surveillance system to strengthen the traceability system. Requiring fins-on landings will also strengthen the proper identification of the raw material subject to CITES regulations.
8. It is recommended that a neutral intergovernmental body operate a traceability system centrally. It is also recommended that such a system be implemented with the possibility in the mind that Parties (or other institutions, like RFMOs) might want to operate a node in the future. The system should be prepared to run in a distributed fashion; EPCIS is a standard that should be considered in this context.
9. Finally, it is highly recommended to study the implementation of traceability as a tool for strengthening CITES process in practical detail through a pilot project involving at least also one developing country.

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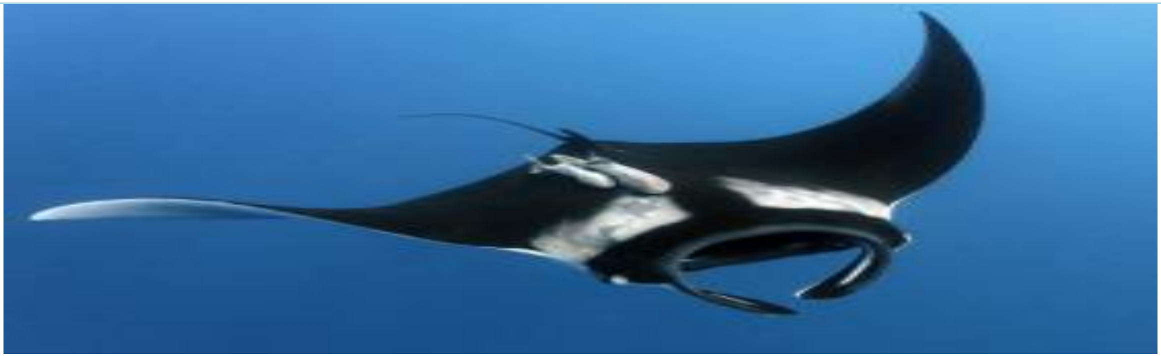
7 Annex I: CITES-listed species

7.1 Appendix I Species

7.1.1 Mobulid rays

Table 7-1: Giant Manta Ray *Sources:* (FAO, 2013)*,* (IUCN and TRAFFIC, 2012) *and* (Mundy-Taylor & Crook, 2013)



Species	*Manta birostris*
Common Name	Giant Manta Ray
Family	*Mobulidae*
Order	*Rajiformes*
Size	Up to 7m
Weight	Up to 2 tons
Regions	The Giant Manta Ray is widely distributed, inhabiting tropical, subtropical and temperate waters and undergoing significant seasonal migrations (>1000 km).
Catching	Mantas are taken in targeted fisheries throughout their range and as by-catch in coastal and offshore fisheries.
Catching Nation	Manta catches are insufficiently documented and reported. Indonesia, Sri Lanka and India have the largest documented fisheries, accounting for around 90% of recorded Giant Manta Ray mortality, with annual landings of over 3 000 animals. Among the top reporters of broader categories including Mantas were Indonesia, Liberia, Ecuador, Argentina, Indonesia, Malaysia, Thailand, South Korea, USA and Pakistan. However, it is unclear what percentage actually were Mantas. Targeted fisheries have also been reported in Peru, Mexico, China, Mozambique and Ghana. Indonesia and mainland China are considered likely to be the main catchers of Mantas in waters beyond national jurisdiction.
Catching Gear	Targeted catching: Harpoons, gillnets and trawl nets. By-catch: Gillnets, longline and purse seine fisheries
Product Value	Mantas are primarily caught for their gill rakers, which are supplied to international markets such as Hong Kong and Singapore. The skins and cartilage are also traded internationally.

Table 7-2: Reef Manta Ray *Sources:* (FAO, 2013), (IUCN and TRAFFIC, 2012) *and* (Mundy-Taylor & Crook, 2013)

Species	*Manta alfredi*
Common Name	Reef Manta Ray
Family	*Morbulidae*
Order	*Rajiformes*
Size	Up to 5.5m
Weight	Up to 1.4 tons
Regions	The Reef Manta Ray is more resident to coastal waters, inhabiting tropical and subtropical waters with shorter seasonal migrations than the Giant Manta ray.
Catching	Targeted catching, by-catch
Catching Nations	Manta catches are insufficiently documented and reported. Among the top reporters of broader categories including Mantas were Indonesia, Liberia, Ecuador, Argentina, Indonesia, Malaysia, Thailand, South Korea, USA and Pakistan. However, it is unclear what percentage actually were Mantas. Targeted fisheries have also been reported in Peru, Mexico, China, Mozambique and Ghana. Indonesia and mainland China are considered likely to be the main catchers of Mantas in waters beyond national jurisdiction.
Catching Gear	Targeted catching: Harpoons, gillnets and trawl nets. By-catch: Gillnets, longline and purse seine fisheries
Product Value	Mantas are primarily caught for their gill rakers, which are supplied to international markets such as Hong Kong and Singapore. The skins and cartilage are also traded internationally.

7.2 Appendix II Species

7.2.1 Requiem sharks

Table 7-3: Oceanic Whitetip shark. *c*

Species	*Carcharhinus longimanus*
Common Name	Oceanic whitetip shark
Family	*Carcharhinidae*
Order	*Carcharhiniformes*
Size	Up to 4m
Weight	Up to 167 kg
Regions	The Oceanic Whitetip is distributed worldwide in tropical and subtropical open ocean surface (epipelagic) waters between 42°N and 35°S.
Catching	Oceanic Whitetip is taken primarily as by-catch in oceanic longline fisheries targeting large pelagic species (tunas, swordfishes and others). Levels of Oceanic Whitetip catch in directed fisheries are likely to be minor compared with by-catch in tuna fisheries.
Catching Nations	Key catchers of the Oceanic Whitetip according to FAO data are Sri Lanka, China, Brazil, Taiwan, Fiji and Tanzania. Other countries that are known to take Oceanic Whitetip as by-catch are France, Japan, Spain, Uruguay and the US.
Catching Gear	Long-liner (Atlantic, Pacific and Indian Ocean), Purse-seine (Pacific and Indian Ocean).
Product Value	The Oceanic Whitetip is primarily retained for his large fins, which are highly demanded in markets such as Hong Kong. Furthermore, there is some evidence that the meat might be of sufficient value in some markets such as the US and Mexico. When retained on board, the liver can be used to harvest liver oil and the skin to fabricate leather.

7.2.2 Hammerhead sharks

Table 7-4: Scalloped Hammerhead *Sources:* (FAO, 2013), (IUCN and TRAFFIC, 2012) *and* (Mundy-Taylor & Crook, 2013)

Species	*Sphyrna lewini*
Common Name	Scalloped hammerhead
Family	*Sphyrnidae*
Order	*Carcharhiniformes*
Size	3.7m to 4.3m
Weight	Up to 152 kg
Regions	The Scalloped Hammerhead Sphyrna lewini is a circumglobal shark species found in coastal warm temperate and tropical seas between 46°N and 36°S to depths of 1000m. The species is primarily found on continental shelves and in adjacent deep water but rarely found in open ocean areas.
Catching	The three Hammerhead species are taken in targeted fisheries and as by-catch. Their coastal distribution suggests they are more vulnerable to fisheries on the continental shelf rather than the open ocean and they are reportedly relatively less vulnerable to high seas pelagic long-line fisheries than other pelagic sharks.
Catching Nation	Hammerheads are exploited along continental shelves and adjacent oceanic areas in a vast number of countries, in both tropical and warm temperate seas. However, most countries do not report catching of hammerheads down to the species level. The main catching nations that reported by species were Brazil, Spain and Mauritania. Key catchers of Hammerhead in general include Indonesia, Senegal, Republic of Congo, Sri Lanka, Mexico, Liberia, Spain, Ecuador and Benin.
Catching Gear	Gillnets (Madagascar, West Africa, Brazil, Colombia and India), long-line (East Africa, Brazil, Colombia, Costa Rica, Mexico, India and Indonesia) and driftnets (West Africa).
Product Value	The fins of the Scalloped Hammerhead are highly valued in international trade because of their large size and high fin ray count. The meat is also traded.

Table 7-5: Great Hammerhead *Sources:* (FAO, 2013), (IUCN and TRAFFIC, 2012) *and* (Mundy-Taylor & Crook, 2013)

Species	*Sphyrna mokarran*
Common Name	Great Hammerhead
Family	*Sphyrnidae*
Order	*Carcharhiniformes*
Size	Up to 6.1 m
Weight	Avg. 230, up to 500kg
Regions	The Great Hammerhead Sphyrna mokarran is also a circumglobal species, occurring between 46°N and 36°S to depths of 300m.
Catching	Targeted directly, by-catch
Catching Nations	Hammerheads are exploited along continental shelves and adjacent oceanic areas in a vast number of countries, in both tropical and warm temperate seas. Key Hammerhead catchers include Indonesia, Senegal, Republic of Congo, Sri Lanka, Mexico, Liberia, Spain, Ecuador and Benin.
Catching Gear	Gillnets (Madagascar, West Africa, Brazil, Colombia and India), long-line (East Africa, Brazil, Colombia, Costa Rica, Mexico, India and Indonesia) and driftnets (West Africa).
Product Value	The main product value of the Great Hammerhead is its fins. Its meat is also traded internationally, however, the value is insignificant compared to the value of the fins.

Table 7-6: Smooth Hammerhead *Sources:* (FAO, 2013), (IUCN and TRAFFIC, 2012) *and* (Mundy-Taylor & Crook, 2013)

Species	*Sphyrna zygaena*
Common Name	Smooth hammerhead
Family	*Sphyrnidae*
Order	*Carcharhiniformes*
Size	2.5 to 3.5 m, up to 5m
Weight	Up to 400kg
Regions	The Smooth Hammerhead Sphyrna zygaena has a wider range, being a circumglobal coastal-pelagic and semi-oceanic species that occurs in temperate and tropical seas between 59°N and 55°S.
Catching	Rarely fished intentionally, but rarely released alive when caught.
Catching Nations	Hammerheads are exploited along continental shelves and adjacent oceanic areas in a vast number of countries, in both tropical and warm temperate seas. Key Hammerhead catchers include Indonesia, Senegal, Republic of Congo, Sri Lanka, Mexico, Liberia, Spain, Ecuador and Benin.
Catching Gear	Gillnets (Madagascar, West Africa, Brazil, Colombia and India), long-line (East Africa, Brazil, Colombia, Costa Rica, Mexico, India and Indonesia) and driftnets (West Africa).
Product Value	As in the case of the Scalloped Hammerhead, the Smooth hammerheads fins are highly valuable. Its meat is also traded internationally, however, the value is insignificant compared to the value of the fins.

7.2.3 Basking shark

Table 7-7: Baskin sharks *Sources:* (FAO, 2013)*,* (IUCN and TRAFFIC, 2012) *and* (Mundy-Taylor & Crook, 2013)

Species	***Cetorhinus maximus***
Common Name	Basking shark
Family	*Cetorhinidae*
Group	*Lamniformes*
Size	6.7 - 8.8 m, up to 10m
Weight	About 4 tons
Regions	The basking shark is found throughout the world mainly in cool and temperate waters, although some sharks have recently been tagged, and found in tropical waters.
Catching	Mostly caught for fins or as by-catch.
Product Value	Liver (aphrodisiac in Japan), liver oil (cosmetics), Fins (Soup)

7.2.4 Mackerel sharks

Table 7-8: Baskin sharks *Sources:* (FAO, 2013)*,* (IUCN and TRAFFIC, 2012) *and* (Mundy-Taylor & Crook, 2013)

Species	***Carcharodon carcharias***
Common Name	Great white shark
Family	*Lamnidae*
Group	*Lamnisformes*
Size	Up to 6 m
Weight	Up to 3.4 tons
Regions	Great white sharks are found throughout the world's oceans, mostly in temperate and sometimes warm waters but occasionally in cold environments.
Catching	Targeted and as by-catch
Product Value	Fins (Soup), liver oil, skin (leather), flesh, teeth and jaws (up to 50000 USD)

Table 7-9: Porbeagle *Sources:* (IUCN and TRAFFIC, 2012), (Mundy-Taylor & Crook, 2013)

Species	*Lamna nasus*
Common Name	Porbeagle
Family	*Lamnidae*
Order	*Lamnisformes*
Size	Um to 3.5 m
Weight	230 kg
Regions	Porbeagle is found in a circumglobal band of ~30-60°S in the Southern Hemisphere and mostly between 30-70°N in the North Atlantic Ocean and Mediterranean.
Catching	The Porbeagle is both targeted and caught as by-catch, mainly by long-line fisheries. Many countries and unions such as the US, EU and Canada have strict catching quotas or prohibit boarding and landing of Porbeagle.
Catching Nations	Key catchers for Porbeagle include Japan, New Zealand, Republic of Korea, Spain, Taiwan and Uruguay. However, recent changes in EU regulations should erase Spain from the list, as no EU vessel is allowed to land Porbeagle anymore (See Section 2.5.3.2.)
Catching Gear	Long-line (Atlantic, Southern Hemisphere), trawler (Southern Hemisphere)
Product Value	The main value of the Porbeagle is derived from its meat that is mainly consumed and traded in Europe, fresh or frozen. The fins of Porbeagle are considered to be of lower value as they have a low needle count. However, fins are still exported to Hong Kong by catching.

7.2.5 Whale shark

Table 7-10: Whale sharks *Sources:* (FAO, 2013), (IUCN and TRAFFIC, 2012) *and* (Mundy-Taylor & Crook, 2013)

Species	***Rhincodon typus***
Common Name	Whale shark
Family	*Rhincodontidae*
Group	*Orectolobiformes*
Size	14 - 20m
Weight	Up to 34 tons
Regions	Found throughout the world's oceans in temperate and tropical waters, the whale shark most commonly occurs in a global band around the equator between 30° to 40° latitude. The whale shark inhabits shallow coastal areas as well as the open ocean.
Catching	Targeted by fisheries.
Product Value	Meat (some Asian markets), Fins (Soup),

7.2.6 Sawfishes

Table 7-11: Dwarf Sawfish *Sources:* (FAO, 2013), (IUCN and TRAFFIC, 2012) *and* (Mundy-Taylor & Crook, 2013)

Species	***Pristis clavata***
Common Name	Dwarf Sawfish
Family	*Pristidae*
Group	*Pristiformes*
Size	Up to 1.4 m
Weight	
Regions	Restricted to tropical northern Australia in the Western Central Pacific and Eastern Indian Ocean. The species is known to occur from the Pilbara coast of north western Australia through the Kimberley region and the Northern Territory to at least the Gulf of Carpentaria, Queensland.
Catching	Mostly and commonly caught as by-catch
Product Value	Meat, fins, oil and rostrums (souvenirs)

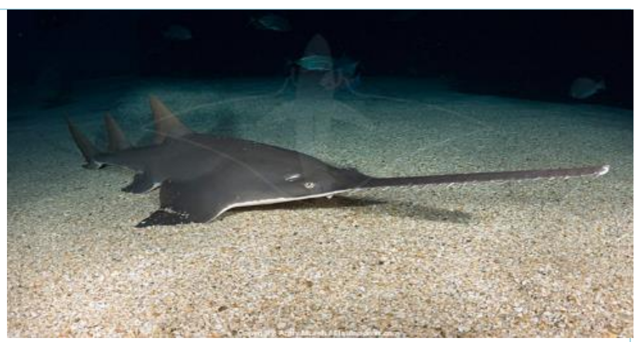
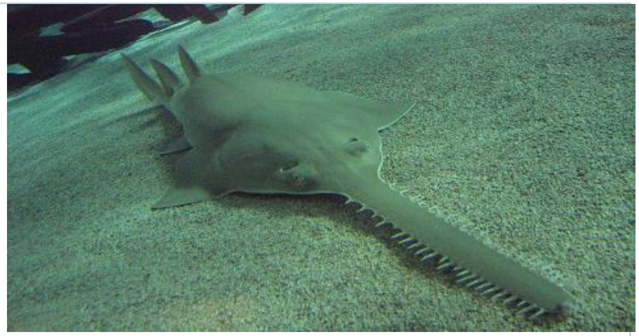


Table 7-12: Green Sawfish *Sources:* (FAO, 2013), (IUCN and TRAFFIC, 2012) *and* (Mundy-Taylor & Crook, 2013)



Species	***Pristis zijsron***
Common Name	Green Sawfish
Family	*Pristidae*
Group	*Pristiformes*
Size	About 4.3 m
Weight	
Regions	This once common sawfish has a wide distribution in the northern Indian Ocean, reaching east to South Africa, and is also found off Indonesia and Australia as well as in the western Pacific. Throughout this range, the populations of this species have been severely depleted and sightings have been rare in the last 40 years.[50]
Catching	By-catch by prawn fisheries, fish trawling, gillnetting and other fishing activities.
Product Value	Fins (Soup), saw/snout (souvenir), meat

Table 7-13: Smalltooth Sawfish *Sources:* (FAO, 2013), (IUCN and TRAFFIC, 2012) *and* (Mundy-Taylor & Crook, 2013)

Species	***Pristis pectinata***
Common Name	Smalltooth Sawfish
Family	*Pristidae*
Group	*Pristiformes*
Size	Avg. 5.5 m, up to 7.6 m
Weight	350 kg
Regions	The historical distribution of this species was worldwide, although recent declines in number mean that the smalltooth sawfish is now absent from many sites. In American waters, the smalltooth sawfish used to be prevalent in coastal areas from New York, around the Floridian peninsula and along as far as Texas.[51]
Catching	Has been over-fished both intentionally and as by-catch. By-catch seldom returns to water alive as they are difficult to disentangle from nets and dangerous to fishermen.
Product Value	Liver oil (soap, medicine, leather polish), saw/snout (souvenirs), meat (food),

[50] http://www.arkive.org/green-sawfish/pristis-zijsron/
[51] http://www.arkive.org/smalltooth-sawfish/pristis-pectinata/

	fins (soup)

Table 7-14: Largetooth Sawfish *Sources:* (FAO, 2013), (IUCN and TRAFFIC, 2012) *and* (Mundy-Taylor & Crook, 2013)

Species	***Pristis***	
Common Name	Largetooth Sawfish	
Family	*Pristidae*	
Group	*Pristiformes*	
Size	Up to 5m	
Weight	About 500 kg	
Regions	The largetooth sawfish occurs in the tropical eastern Pacific, from the Gulf of California to Ecuador; the western Atlantic, from Florida to Brazil; and the eastern Atlantic, from Portugal to Angola. The largetooth sawfish used to also occur in the Mediterranean.	
Catching	Overfished due to targeted fishing	
Product Value	Saw/snout, fins, meat	

Table 7-15: Knifetooth Sawfish *Sources:* (FAO, 2013), (IUCN and TRAFFIC, 2012) *and* (Mundy-Taylor & Crook, 2013)

Species	***Anoxypristis cuspidate***	
Common Name	Knifetooth sawfish	
Family	*Pristidae*	
Group	*Pristiformes*	
Size	Up to 4.7m	
Weight		
Regions	The knifetooth sawfish has a relatively wide distribution across the Indo-West Pacific, from the Red Sea and Arabian Gulf, east to Japan and South East Asia, and south to northern Australia.[52]	
Catching	Targeted fishing as well as by-catch	
Product Value	Meat, fins, liver oil, saw/snout (curio and Chinese medicine)	

[52] http://www.arkive.org/knifetooth-sawfish/anoxypristis-cuspidata/

8 Annex II: Catch Certification Schemes

8.1 Fisheries Led Schemes

Forward facing fisheries led schemes start from a requirement to document all catches and transhipments. It is most likely that such schemes will be under the authority of a regional fisheries management body, so the initiating Catch Documents (CDs) and subsequent trade focused Catch Certificates (CCs) should use simple, clear formats agreed among the parties.

In order to be effective, fisheries led schemes are likely to require the most potentially trade restrictive mechanisms to be available to them – including the capacity to prevent consignments of fish that do not comply to proceed across border – both outwards and inwards.

Initiation of Catch Document:

The CD is initiated by the Master of the fishing vessel, and signed by him/her, certifying that he/she harvested the products in compliance with national and regional fisheries regulations (or any further or other required certifiable attributes).

A CD is initiated at sea, and contains all information relative to the batch of products that are about to leave the fishing vessel. Initiation at this point in time is of essence in order for MCS-related controls to be triggered, so that legality of the fishing operation (and catch) may be established at a point in time when relevant checks may be carried out.

The issuing of a CD is triggered when a batch of fish product(s) is leaving a fishing vessel (or its nets) as a transhipment, a transfer into tow cages, or a landing. The unit of "recording" is hence the act of transferring catch off the fishing vessel, regardless of the full or partial nature of such transfer with respect to the totality of catch aboard the fishing vessel at any given point in time over the course of one or more fishing trips.

A CD should be initiated for all landings, transhipments or transfers into tow cages regardless whether the landing takes place inside or outside of the coastal waters of the flag State of the fishing vessel.

Validation:

A CD should be validated by the flag State Competent Authority (CA) of the vessel and may be counter validated by other CAs along the chain of custody up to, and including the point of landing. The flag State of a reefer vessel, in the case of transhipment and the port State receiving and verifying a landing should counter-validate the CD.

A CA should be a central or federal government authority, although delegated authority may be appropriate in some circumstances. Where the fish is being transhipped or landed at a port State that is not also the flag State, counter-signing by appropriate authorities increases the verifiability (and hence reliability) of the data contained in certificates.

A Catch Certificate is validated first on the basis of estimated weights (at sea), and may be adjusted for verified weights when counter-validated by a port State CA.

Only Catch Information on a Catch Document:

A CD only covers the catching and landing/transhipment/ transfer dimension of the supply chain. It shall contain no trade-related data. The issuing and certification of the CD must occur as soon as practically feasible.

Catch Document Finalisation:

Once counter-signed/validated by the last CA, the CD is fixed. No more sections or other data/information can/may be added to it. Once complete, it embodies the fixed and formal starting point of the supply chain, to which all traceability elements lead back to.

Where electronic, secured Catch Document Systems are used, that electronic recording and final validation of the CD should be by the flag state CA after other counter validations have taken place. The final validation by the flag state should lock the CD.

Catch Certificate Coverage:

The Catch Certificate (CC) covers a full consignment of fisheries products that is subject to a CDS system, and makes the link between the products in the consignment and the CD(s) from which products were sourced.

Restriction of trade to certified fish:

In order for a fisheries-led CDS system to be effective, no export of fish originating from a fishery with a CDS in operation should be permitted without a CC, regardless of whether the importing market state requires them. Positive checking of CCs should be required by the Customs procedures of exporting countries. Failure to supply a validated CC for a consignment at point of export should lead to stoppage of the consignment. This may require specific legislation or regulation to implement – such as a Customs Prohibition Order.

Trade Certificate Initiation:

The TC is initiated by the Fisheries Business Operator (FBO) exporting the products, who is liable for the truth of the information contained in the Certificate.

Catch Certificate Validation:

Validation of CCs can only be done by the same CA which is in charge of receiving, validating and locking CDs. The CC and the products it lists will be linked to original CD data within the CDS system. Therefore, it has to be pooled with the existing CD data in the system, in order for meaningful product accounting to take place, and to ensure that anomalies are detected by the CA at the time when a FBO requests validation of a CC.

Validated CCs should be logged with the RFMO and be available to the exporting country Customs Authority. It should not be possible to export the fish from a CDS controlled fishery

Catch Certificate Traceability Standard:

The CC should contain a Table which lists the various products in the consignment. The Table should link the product batch(es) in the consignment to their original CD on a line-by-line basis. For each lot of products obtained from a specific line from a CD there should be one line in the table listing the original CD number, the original weight acquired by the FBO, the weight used in processing, and the weight obtained through processing (final product weight per batch in the consignment).

The CC must maintain a hard link between original weight acquired from any specific CD, and product weight obtained after processing, in order to allow for reconciliation of mass balance through trade to be assessed. No grouping of original CDs for resulting product weights can occur, as it will make reconciliation back to original catch unachievable.

The same traceability standard should apply to CCs for re-exports. Traceability along the supply chain applies only to inter-country traceability. In-country traceability is out of scope and is governed by minimum standards established in national food safety and traceability legislation.

Catch Certificate at point of import:

Where an export is to a cooperating market state, the CC data should be logged by the FBO at the time of importation with the Customs Authority of the importing State. In paper-based systems, logging can occur by sending copies of the Certificates to the RFMO Secretariat (or other third party chosen to manage the system) – through the CA. In an e-CDS, this is could be done via an electronic interface, with the FBO or CA logging the data directly, and the importing CA validating the entry. Note that under an e-CDS, the data for any particular trade will already exist in the system (due to CC logging at the time of exportation), so the CA merely needs to select and validate the existing trade transaction.

In the absence of logging of imported Certificates with a cooperating market State, no import should take place, because FBOs would not be "credited" with supplying certified products. This may require specific legislative or regulatory authorisation – such as a Customs Prohibition Order.

Logging of imported Certificates should be requested by FBOs and required by cooperating market States where the FBO intends to re-export some, or all, of the fish product. Re-exports should require a repeat of the export/import certification, logging and reconciliation process.

In the case of exports to market States that are not cooperating with the CDS, the system should automatically establish the inevitable absence of logging as exports to end-market State destinations. Re-exports from non-cooperating States to CDS cooperating States should immediately establish the need for a validated re-export CC to be logged by the FBO or lead to the consignment being refused entry.

8.2 Cooperative Schemes

Cooperative CDS schemes arise from a request from a State seeking cooperation from one or more other States to help it manage specific challenges of illegal or unauthorised fishing within its coastal fishery or fraudulent trade, for example from passing off lower valued species as higher valued species. The cooperation takes the form of either of importing market states cooperating to verify that only certified (authorised) exports of fish from the country seeking cooperation are permitted entry. Alternatively, the State seeking cooperation requests that exporting country authorities verify that the fish that is being exported is from an authorised fishery and/or is the species that it is asserted to be.

In both scenarios, the State seeking cooperation restricts that cooperation to requesting agreement to specific Catch Certification which is akin to the model of a CITES Appendix III Certificate of Origin. The State seeking cooperation accepts that the catch documentation systems of the States that it is seeking to cooperate with are fit for purpose and at least equivalent to its own.

The arrangements between the States concerned would be ad hoc and negotiated to fit the specific circumstances. They would not be registered as CITES Appendix III registrations as they would be unlikely to meet their specific requirements, but the mechanism proposed is modelled after CITES Appendix III.

Catch Certificate Coverage:

The Catch Certificate (CC) covers those fish species and products in a consignment of fisheries products that are the subject to the Cooperation Arrangement. It requires an official assurance that the fish in the consignment originates from an authorised fishery operation and (where appropriate) are the species stated on the Certificate.

Restriction of trade to certified fish:

In order for a fisheries cooperation scheme to be effective no export or import (as appropriate) of fish originating from the fishery concerned should be permitted without a CC. Positive checking of CCs should be required by the Customs procedures of exporting countries. Failure to supply a validated CC for a consignment at point of export should lead to stoppage of the consignment. This may require specific legislation or regulation to implement – such as a Customs Prohibition Order.

Catch Certificate Initiation:

The CC is initiated by the Fisheries Business Operator (FBO) exporting the products, who is liable for the truth of the information contained in the Certificate.

Catch Certificate Validation:

Validation of CCs should be done by the same CA which is in charge of the system that issues authorities to fish. The CC and the products it lists should be linked to the original fisheries authorisation for the fisher(s) supplying the fish.

Validated CCs should be logged and be available to the exporting country's Customs Authority. It should not be possible to export the fish to the cooperating state(s) without a positive check by Customs or equivalent border control agency.

Validation and the information required could be supplied as additional information to other official assurances, such as the Sanitary Certificate. Validation of the CC information in such situations could be done under delegated authority.

Catch Certificate Traceability Standard:

The CC should contain a Table which lists the various products in the consignment relevant to the cooperation agreement. The Table may link the product batch(es) in the consignment to their original authorisation to fish or the CA may provide an official assurance that the fish originates from authorised fishing.

In-country traceability is out of scope and is governed by minimum standards established in national fisheries management and traceability legislation.

Catch Certificate at point of import:

The CC data should be logged by the FBO at the time of importation with the Customs Authority of the importing State. In paper-based systems, logging occurs by supplying copies of the Certificates to the CA. In an e-CDS, this is could be done via an electronic interface, with the FBO or CA logging the data directly, and the importing CA validating the entry. Note that under an e-CDS, the data for any particular trade will already exist in the system (due to CC logging at the time of exportation), so the CA merely needs to select and validate the existing trade transaction.

In the absence of logging of imported Certificates with a cooperating market State, no import should take place, because FBOs would not be "credited" with supplying certified products. This may require specific legislative or regulatory authorisation – such as a Customs Prohibition Order.

8.3 Market Led Schemes

Market led CDS schemes are unilateral requirements established by importing market States that seek verification from exporting flag States that the fish that is being supplied has originated from legal, authorised fishing activities. The certification requirements are likely to be comprehensive rather than specific and require that all captured fish and fish products supplied from the flag States are certified.

The information requirements of such market led schemes are likely to be based on the fisheries reporting requirements the importing market state has imposed on its own fishers and justified on grounds of equal treatment and therefore no more restrictive on market access than the regulatory obligations it has in place for domestic suppliers.

In making such demands however, market states should be conscious of the potential regulatory, information and other related impacts the CDS requirements may have for supplying flag States and their fisheries, fish processing and trading businesses. Market led schemes should recognise that they are fundamentally reliant on the catch authorisation, documentation and recording arrangements of flag and coastal States to provide the information they may require on consignment-based CCs. Market States should be prepared to cooperate and negotiate on alternative documentation and assurances from Flag States where the market State has confidence that the outcome of flag States' MCS and compliance systems are at least equivalent to the outcome of the market State's in regard to restricting the opportunity for illegal or unauthorised fish to enter into international trade.

In practice it is only appropriate to seek information and assurance about the fish in consignments leaving the flag state for the market State (either directly or indirectly) rather than to seek information about the totality of the fish landed in the fishing events that have supplied consignments to the market State.

Catch Certificate Coverage:

The Catch Certificate (CC) covers a full consignment of fisheries products and makes the link between the products in the consignment and the fishery from which products were sourced. It requires an official validation that the fish in the consignment originates from an authorised fishery operation

Restriction of trade to certified fish:

Access to the market for fish from capture fisheries is restricted by regulation to the provision of a validated CC from the flag State for the fish in a consignment attesting that the fish in the consignment originated from a fishery and fishing activity authorised by the flag State. Failure to supply a validated CC for a consignment at point of export can lead to stoppage of the consignment.

Catch Certificate Initiation:

The CC is initiated by the Fisheries Business Operator (FBO) exporting the products, who is liable for the truth of the information contained in the Certificate.

Catch Certificate Validation:

Validation of CCs should be done by the same CA which is in charge of authorising fishing and can validate the fishing related information supplied in the CC. The CC and the products it lists should be linked to the authorised fishing event(s) supplying fish in the consignment.

Validated CCs should be logged and be available to the exporting country Customs Authority. The flag State CA should take appropriate steps to ensure that no fish are exported to the market State directly or indirectly without validated CCs required by the CC.

Market States should give favourable consideration to accepting validation and the information required being supplied as additional information to other official assurances, such as the Sanitary Certificate. Validation of the CC information in such situations could be done by another CA under delegated authority from the flag State CA.

Catch Certificate Traceability Standard:

The CC should contain a Table which lists the various products in the consignment. The Table should link the product batch(es) in the consignment to their original authorised fishing event on a line-by-line basis. For each lot of products there should be one line in the table listing the original the weight of fish product in the consignment.

If the product is being re-exported from a third country the products in the consignment should be linked on a line by line basis to the original CC for the consignment(s) of fish product imported into the third country that are supplying the re-export consignment stating the original product weight acquired by the FBO, and the weight obtained through processing (final product weight per batch in the consignment).

The same traceability standard should apply to CCs for re-exports. Traceability along the supply chain applies only to inter-country traceability. In-country traceability is out of scope and is governed by minimum standards established in national fisheries management, food safety and traceability legislation.

Catch Certificate at point of import:

The CC data should be logged by the FBO at the time of importation with the Customs Authority of the importing State. In paper-based systems, logging occurs by sending copies of the Certificates through the CA. In an e-CDS, this is could be done via an electronic interface, with the FBO or CA logging the data directly, and the importing CA validating the entry. Note that under an e-CDS, the data for any particular trade will already exist in the system (due to CC logging at the time of exportation), so the CA merely needs to select and validate the existing trade transaction.

In the absence of logging of imported Certificates with the market State, the market State may refuse import. This may require specific legislative or regulatory authorisation.