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TRACEABILITY SYSTEMS IN THE CITES CONTEXT

A review of experiences, best practices and lessons learned for the traceability of commodities of CITES-listed shark species

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Acronyms and abbreviations

AC	Animals Committee (CITES)
ACP	African, Caribbean and Pacific
CDS	Catch documentation scheme
CFMC	Caribbean Fisheries Management Council
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
COFI	Committee on Fisheries (FAO)
COFI FT	Committee on Fisheries Sub-Committee on Fish Trade (FAO)
CONAP	Consejo Nacional de Areas Protegidas/National Council of Protected Areas (Guatemala)
CoP	Conference of the Parties
CPUE	Catch Per Unit Effort
CRFM	Caribbean Regional Fisheries Mechanism
CSG	Crocodile Specialist Group
CTE	Critical Tracking Event

[1] Fishwell Consulting
[2] TRAFFIC
[3] Fishwell Consulting

EA	Enforcement Authority (CITES)
EEZ	Exclusive Economic Zone
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FDPM	Forestry Department Peninsular Malaysia
FLEGT	Forest Law Enforcement, Governance and Trade
FOD	Forest Origin Document (Brazil)
HACCP	Hazard Analysis and Critical Control Point
IBAMA	Brazilian Institute for Environment and Renewable Natural Resources
ICCAT	International Commission for the Conservation of Atlantic Tunas
IFS	Introduction from the sea
IGO	Intergovernmental organization
ISO	International Organization for Standardization
ITTO	International Tropical Timber Organization
IUCN	International Union for Conservation of Nature
IUCN SSC	IUCN Species Survival Commission
IUU	Illegal, unreported and unregulated
IWG-RS	International Working Group on Reptile Skins
KDE	Key Data Elements
MA	Management Authority (CITES)
MCS	Monitoring, control and surveillance
NDF	Non-Detriment Finding
NGO	Non-Governmental Organization
OSPESCA	Organizacion del Sector Pesquero y Acuicola del Istmo Centroamericano (Central America Fisheries and Aquaculture Organization)
PC	Plants Committee (CITES)
QCEW	Queen Conch Expert Workshop
QCWG	Queen Conch Working Group
RESP	Responsible Ecosystems Sourcing Platform

RFID	Radio frequency identification
RST	Review of Significant Trade
SA	Scientific Authority (CITES)
SC	Standing Committee (CITES)
SPAW	Specially Protected Areas and Wildlife
TDS	Trade documentation scheme
UK	United Kingdom
UN	United Nations
UN/CEFACT	United Nations Centre for Trade Facilitation and Electronic Business
UNCTAD	United Nations Conference on Trade and Development
UNEP-WCMC	United Nations Environment Programme World Conservation Monitoring Centre
US	United States
USD	US Dollars
US FWS	United States Fish and Wildlife Service
VMS	Vessel Monitoring Systems
VPA	Voluntary Partnership Agreement
WECAFC	Western Central Atlantic Fishery Commission
WWF	World Wide Fund for Nature

1. Project objectives

At its 27th meeting (AC27, Veracruz, 2014), the CITES[4] Animals Committee agreed on a number of recommendations relevant to addressing the implementation challenges posed by the inclusion of five species of sharks and both species of manta ray *Manta* spp. in CITES Appendix II at the 16th meeting of the Conference of the Parties (CoP16, Bangkok, 2013). These recommendations, which support implementation of CITES *Resolution Conf. 12.6 (Rev. CoP16)* on the Conservation and management of sharks, were considered at the 65th meeting of the CITES Standing Committee (SC65, Geneva) in July 2014[5] and an intersessional working group was established with a mandate to consider these recommendations[6].

The current project contributes to the fulfillment of the following recommendations agreed at AC27 (paragraph numbers refer to SC65 Doc. 46 on sharks and rays) and will support the deliberations of the Standing Committee intersessional working group on sharks:

- *Paragraph o) The Animals Committee requests the Standing Committee, at its 65th meeting, to consider relevant matters relating to the implementation of shark listings, including the following:*
    - *ii. 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;*

- *Paragraph p) 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.*

Specifically, this report presents the findings of a review of traceability systems that have been developed in the CITES context for the trade in processed product types of Appendix II-listed species. The report considers the experiences, lessons learned and best practices from these case studies for ensuring the traceability of products of shark species listed in CITES Appendix II, and analyses the potential for establishing an effective traceability system – along the lines of those already developed in the CITES context – for shark commodities.

For a review of the market chain and other traceability systems developed for commercially exploited aquatic species, see Andre (2013) and the following report produced for the CITES Secretariat: *Traceability study in shark products* (Lehr *et al.*, 2015).

The case studies of focus in this report are traceability systems developed for sturgeon caviar, crocodile skins, Queen Conch *Strombus gigas*, and timber, and/or related developments, as appropriate. These examples were selected as case studies, in light of experience and recent progress on issues relating to traceability and the potential to provide relevant guidance for the traceability of CITES-listed shark products.

The remainder of this report is structured as follows:

- **Section 2** provides an overview of the methods used to gather information for this report.
- **Section 3** provides a brief explanation of traceability and how this operates in the CITES context.
- **Section 4** presents the results of the review of traceability systems developed for sturgeon caviar, crocodile skins, Queen Conch and timber in the CITES context.
- **Section 5** assesses the use of traceability measures for commodities of CITES Appendix II-listed shark species, based on the experiences, lessons learned and best practices identified in the review of CITES systems.

[4] Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
[5] SC65 Doc. 46: http://www.cites.org/sites/default/files/eng/com/sc/65/E-SC65-46.pdf
[6] SC65 Summary Record

2. Methods

The review of CITES traceability systems is based on a literature review and contact with selected CITES authorities, industry representatives and experts with experience of the operation and implementation of the respective systems. Feedback was obtained via questionnaires and through email and telephone discussions. Published sources of information reviewed for this report include: CITES documents, non-governmental organization (NGO), industry and other expert reports and meeting/workshop proceedings.

3. Traceability

3.1. Definitions

Traceability is: "… the ability to trace the history, application and location of that which is under consideration, and for products this can include the origin of materials and parts, the processing history and the distribution and location of the product after delivery" (ISO, 2011). Traceability systems provide for the storage and transfer of product information within and between actors in a supply chain, enabling a product to be traced back along a supply chain, through any processes or transformations it may have undergone. As such, traceability systems provide a mechanism by which to verify the integrity of "chains of custody" (FAO, 2014), defined as "the chronology of the ownership, custody or location of product from the time it is obtained to the time it is presented" (Expert Panel on Legal and Traceable Wild Fish Products, 2015).

Originally, the concept of traceability developed in response to food safety concerns, providing a mechanism by which contaminated products could be traced back to source and isolated, and enabling the implementation of targeted withdrawals (Knuckey *et al.*, 2014). More recently, with the upsurge in controls over the origin of products, traceability systems have been used increasingly to establish compliance with legality requirements (e.g. contained in the US Lacey Act or the European Union's Timber Regulation[7]) or sustainability standards (e.g. the Marine Stewardship Council's Fisheries Standard). In the context of the seafood industry, traceability systems are included in measures to ensure the quality and safety of fish and fish products, and are used as a tool to demonstrate legality and origin from a sustainably managed fishery (FAO, 2012).

3.2. Traceability in the CITES context

CITES sets out conditions for international trade in specimens of species listed in its three Appendices. The bulk of international trade in CITES specimens, is in Appendix II-listed species. With an export permit, the exporting State declares that specimens were lawfully acquired (legality), and that trade is not detrimental to the survival of the species in the wild (sustainability). Exporting States also need to ensure that living specimens are shipped so as to minimize the risk of injury, damage to health or cruel treatment[8]. International trade in species listed in the Appendices to CITES operates by way of a system of permits and certificates. Parties are also required to maintain records of international trade in listed species and submit annual trade reports to the CITES Secretariat.

Traceability is central to the effective operation of CITES. In order to determine whether a specimen has been legally acquired, a national CITES Management Authority (MA) will generally require information about the origin of the specimen and any processing stages it may have undergone. Traceability can also assist a Scientific Authority (SA) in the non-detriment finding (NDF) process, linking a specimen to its geographical origin so that the impact of international trade on the wild population can be ascertained. An effective traceability system should therefore assist national CITES authorities in assessing whether trade is within sustainable limits, on the basis of which an export permit for international trade will be issued or refused.

Under the provisions of the Convention, traceability of trade from countries of (re-)export to countries of import is maintained through (CITES Secretariat, 2013):

- issuance of appropriate permits and certificates;

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[7] *Regulation (EU) No 995/2010 of the European Parliament and of the Council of 20 October 2010 laying down the obligations of operators who place timber and timber products on the market*

[8] CITES convention text Article IV.

- submission of relevant permit trade data in national annual reports (published via the UNEP-WCMC CITES Trade Database);
- identification/verification of transactions and specimens when entering/leaving countries;
- compulsory marking of certain specimens in trade; and
- collaboration between national CITES authorities and other agencies and enforcement authorities.

The issuance of permits and certificates is the primary mechanism used by CITES to regulate and trace international trade falling within the scope of the Convention. However, for certain species listed in the CITES Appendices, additional measures (usually in the form of CoP resolutions[9]) have been implemented to improve the traceability of parts and products in trade. These measures are designed to facilitate identification of source/origin as well as trade monitoring and control, and include:

- the universal labelling requirements for sturgeon (order: Acipenseriformes) caviar, which prescribes standardized labels for caviar containers in trade, whether for import, export, re-export of domestic trade - see *CITES Resolution Conf. 12.7 (Rev. CoP16)*;
- the universal tagging system for the identification of crocodilian skins and parts, which recommends the use of non-reusable tags for all crocodilian skins entering international trade and tagging of transparent containers containing crocodilian parts – see *CITES Resolution Conf. 11.12 (Rev. CoP15)*;
- the recommended marking of whole elephant (Elephantidae spp.) tusks and cut pieces of ivory that are both 20 cm or more in length and one kilogramme or more in weight – see *CITES Resolution 10.10 (Rev. CoP16)*;
- the recommended tagging of hunting trophies of leopard *Panthera pardus* and Markhor *Capra falconeri* – see *CITES Resolution Conf. 10.14 (Rev. CoP16)* and *CITES Resolution Conf. 10.15 (Rev. CoP14)*, respectively.

In addition to these established systems, options are also being explored for enhancing traceability of international trade in other CITES-listed taxa. At CITES CoP16, for example, it was agreed that Queen Conch range States[10] "should collaborate in exploring ways to enhance the traceability of specimens in international trade, including, but not limited to, catch certificates, labelling systems and the application of genetic techniques" (*CITES Decision 16.144*). This decision reflects the Recommendations of the October 2012 meeting of the Queen Conch Working Group[11] (QCWG, Panama City) on implementation of an auditable chain of custody procedure so that catches can be traced back to their catch location (including through enhanced catch documentation and CITES permitting procedures to track international trade), and research into practical technology to improve Queen Conch traceability, such as labelling, marking and DNA stock identification (Expert Workshop Recommendations 28b and c; see also QCWG Workplan for 2015-2018[12] and an overview of progress as of mid 2015[13]).

Recent developments in traceability solutions, including software, devices and technologies such as forensics, have presented opportunities for improved tracking and identification of CITES specimens in international trade. In 2012, a Workshop on Timber Marking and Tracking

[9] Resolutions are agreements between the CITES Parties regarding the interpretation of the Convention or the application of its provisions. They include recommendations on how to interpret the provisions of the Convention and rules for controlling trade (such as issuing permits and marking specimens in trade). Resolutions are typically intended to remain in effect for a long period (https://www.cites.org/eng/resources/terms/glossary.php#r).

[10] A State whose territory is within the natural range of distribution of a species (https://www.cites.org/eng/resources/terms/glossary.php#r)

[11] Of the Caribbean Fisheries Management Council (CFMC), the Central American Fisheries and Aquaculture Organization (Organización del Sector Pesquero y Acuícola del Istmo Centroamericano – OSPESCA), the Western Central Atlantic Fishery Commission (WECAFC) and the Caribbean Regional Fisheries Mechanism (CRFM).

[12] http://www.strombusgigas.com/qcgroup%202ndmeeting%20nov2014/20%20QCWG%20Work%20Plan%20TORs%20(Nov%202014).pdf

[13] https://cites.org/sites/default/files/eng/com/ac/28/E-AC28-19.pdf

Technologies was held within the framework of the ITTO-CITES joint timber programme and a Compendium on available timber tracking technologies was produced to support the efforts of CITES Parties in making use of such technologies to more effectively implement CITES for listed tree species and their products[14]. In addition, several CITES Parties have implemented or are piloting timber tracking systems for CITES-listed species, including under the ITTO-CITES timber programme and in the context of Voluntary Partnership Agreement (VPA) implementation/negotiations under the EU Forest Law Enforcement, Governance and Trade (FLEGT) Action Plan. These countries include Brazil, Cameroon, Democratic Republic of the Congo (DRC), Guatemala, Indonesia, Malaysia, Peru and the Republic of Congo.

In recognition of developments in tracking and species identification, the CITES Secretariat reported on the formation of an internal task team to address various identification and traceability issues at the joint meeting of the Animals and Plants Committees in May 2014 (AC27/PC21, Veracruz). The Secretariat also noted that a multidisciplinary approach would be required in order to meet the objectives under the different CITES Decisions and Resolutions on the identification of specimens of CITES-listed species (AC27/PC21 Doc. 14[15]). At AC28 in Tel Aviv in 2015, following discussions of traceability relevant to snakes and reflecting on the consideration of traceability for sharks, the committee recommended:

"The Animals Committee invites the Standing Committee to consider the drafting of a decision on traceability based on the different decisions related to traceability adopted at CoP16 with a view to increasing coherence, reducing duplication of effort and providing guidance to Parties implementing traceability systems."

Details of the Draft Decision which would establish a working group on traceability with terms of reference that include the drafting of a Resolution for consideration at CoP18 can be found in Annex II of AC28 Com. 6 (Rev. by Sec.)[16]

A number of the measures/initiatives outlined in the section above have been selected for further discussion and analysis in **Section 4** below.

[14] http://cites.org/eng/news/sundry/2012/20120606_tracking_technologies.php

[15] For mandate of intersessional working group, see: https://cites.org/sites/default/files/common/com/ac-pc/ac27-pc21/sum/E-AC27-PC21-ExSum02%20.pdf

[16] https://cites.org/sites/default/files/eng/com/ac/28/Com/E-AC28-Com-06-Rev.%20by%20Sec.pdf

4. Review of CITES traceability systems

Traceability systems for sturgeon caviar, crocodile skins, Queen Conch and timber are at various stages of development and requirements have not been codified under CITES (e.g. through CoP Resolutions) in all cases. Therefore, each of the four sections below follows a slightly different structure, as considered most appropriate to present relevant requirements, issues, best practices and lessons learned for each case study.

4.1. Caviar

4.1.1. Overview of caviar trade

Caviar is the unfertilized roe of sturgeon and paddlefish of the order Acipenseriformes. There are 27 species of Acipenseriformes, divided into two families: Acipenseridae (sturgeon) and Polyondontidae (paddlefish). They occur in the coastal and inland waters of around 25 countries in Europe, Asia and North America (Knapp *et al.*, 2006).

All species of Acipenseriformes have been listed in the CITES Appendices since 1998. Of these, two species, the Common or Baltic Sturgeon *Acipenser sturio* and the Shortnose Sturgeon *Acipenser brevirostrum* are listed in Appendix I. The remaining species are listed in Appendix II. The CITES listings cover all live specimens, as well as any readily recognizable parts and products derived from these species (such as caviar, meat, leather, fertilized eggs, cartilage, etc.).

Caviar is a gourmet delicacy, and one of the most expensive fisheries products in the world. It is traded under different names depending on the species. Beluga caviar, from the Beluga *Huso huso*, is considered the finest quality and is most expensive. Other traditional varieties include osietra, which comes from the Russian Sturgeon *Acipenser gueldenstaedtii* and Persian Sturgeon *Acipenser persicus*; and sevruga, which comes from the Stellate Sturgeon *Acipenser stellatus* (Knapp *et al.*, 2006). Caviar may be stored fresh, or may be pasteurized to extend its shelf-life (by up to two years). However, all caviar is perishable and must be stored in cool temperatures at between –4º and –2ºC (CITES Secretariat, 2001).

Over the past decade, countries bordering the Caspian Sea (Azerbaijan, Iran, Kazakhstan and Russia) have dominated global wild caviar exports (Knapp *et al.*, 2006). Other important source regions for wild caviar have included the Amur and Danube river basins, the Black Sea, the Sea of Azov and the Great Lakes of North America. However, in recent years, zero export quotas have been established for caviar and meat derived from shared stocks of these species, as no export quotas were submitted by the range states according to the provisions in *CITES Resolution Conf. 12.7 (Rev. CoP16))*. This effectively means that no international trade in wild-sourced caviar from shared stocks has been allowed, and legal supply has shifted to caviar produced from aquaculture operations (Engler and Knapp, 2008).

4.1.2. Labelling requirements

Illegal trade in caviar has flourished over the years, perpetuated by high product values and relatively low risks of detection (Knapp *et al.*, 2006). In spite of zero export quotas, the illegal fishing of wild sturgeons has continued to supply the caviar trade, posing a threat to populations of these species (Jahrl, 2013).

A key difficulty for effective regulation of the caviar trade has been in distinguishing caviar from illegal and legal sources. As a means of addressing this issue, and ensuring that all caviar entering the market is from legal sources, the CITES Parties have established a caviar labelling and registration system, to facilitate identification/tracing of source and origin.

The universal labelling system for the identification of caviar was established in April 2000 at CoP11 through *CITES Resolution Conf. 11.13*. Initially, the system applied only to exports of caviar from countries of origin, due to complexities associated with the labelling of re-packaged caviar in countries of re-export. All caviar containers over 250 grams were required to be labelled, whether containing caviar sourced from the wild or aquaculture.

In the lead up to CoP12, the Animals Committee and its Working Group on the universal labelling system agreed that, in order to be fully effective in combatting illegal trade, the labelling system also needed to cover re-exports of caviar (AC17 Summary Record). Inadequate controls in domestic markets were also a concern (AC18 Doc. 15.2.). Therefore, in November 2002 (CoP12), the system was extended to require labelling of all caviar containers, including re-exported and re-packaged caviar, whether destined for international trade or domestic markets.

The system has since been revised to further improve the traceability of caviar (in October 2004 at CITES CoP13; in June 2007 at CITES CoP14; and in March 2013 at CITES CoP16), and is currently set out in *CITES Resolution Conf. 12.7 (Rev. CoP16)*. It applies to caviar from all sturgeon species (including hybrids) of wild or farmed origin, and for commercial and non-commercial purposes for both domestic and international trade. The main components of the universal labelling system are described further below.

(a) Labels and information requirements

CITES Resolution Conf. 12.7 (Rev. CoP16) provides that all primary containers (i.e. tin, jar or other receptacle) into which caviar is packed directly, must be marked with a non-reusable label by the processing plant concerned. A non-reusable label is one that cannot be removed undamaged or transferred to another container. It must either seal the primary container, or the caviar should be packaged in a manner that permits visual evidence of any opening of the container.

The label must contain details regarding the source and country of origin of the caviar, using the codes set out in the Resolution as follows:

1. Standard species code as provided in Annex 2 to the Resolution (e.g. "HUS" is the standard species code for Beluga Sturgeon *Huso huso*)
2. Source code of the caviar (e.g. "W" for sturgeon harvested from the wild; "C" for captive-bred origin)[17]
3. ISO two-letter code for the country of origin;
4. Year of harvest;
5. Official registration code of the processing plant (see xxxx in example below, also under **(b) Registration**); and
6. Lot identification number for the caviar (caviar tracking system used by the processing or (re-)packaging plant – see yyyy in example below), for instance:

HUS/W/RU/2000/xxxx/yyyy

See examples in **Figures 1** and **2.**

[17] Aquaculture plants may use sturgeon specimens from the wild as well as specimens born or bred in captivity. Therefore source codes C, F or W may apply (AC27 Doc. 21.3).

Figure 1: Example of a CITES label with CITES code

Source: Jahrl (2013)

Figure 2: Example of method used to enable visual evidence of opening of caviar containers

Method used by one plant in Bulgaria to enable visual evidence of opening of caviar containers. The caviar is packaged with a seal around the sides of the container and the CITES label includes flaps which also seal the container. Opening of the container would result in tearing of the CITES label (Knapp, 2008)

Source: V. Georgiev, Management Authority of Bulgaria, May 2008 (in Knapp, 2008)

Containers into which caviar is repackaged must also be affixed with a label that meets the above criteria. Repackaging occurs where caviar is transferred into new primary containers[18]. Labels on repackaged caviar should allow authorities to trace the origin of the caviar and therefore include:

1. Standard species code;
2. Source code of the caviar;
3. ISO two-letter code of the country of origin;
4. Year of repackaging;
5. Official registration code of the repackaging plant, which incorporates the ISO two-letter code of the country of repackaging if different from the country of origin (see IT-wwww in example below, also under **(b) Registration**); and
6. Lot identification number, or CITES export permit or re-export certificate number (see zzzz in example below), for instance:

HUS/W/RU/2001/IT-wwww/zzzz

The same information that is on the label affixed to the container must be given on the export permit or re-export certificate, or in an annex attached to the CITES permit or certificate. Parties should not accept caviar shipments unless they are accompanied by relevant documents containing this information.

(b) Registration

In support of the labelling system, *CITES Resolution Conf. 12.7 (Rev. CoP16)* recommends that Parties establish a registration system for caviar processing and (re-)packaging plants, including aquaculture operations. Parties should allocate unique registration codes to these plants, and provide a list of facilities, and their official registration codes, to the Secretariat. This information is distributed by the Secretariat via Notifications to the Parties, and included in a Register on the CITES website (https://www.cites.org/eng/common/reg/ce/AR).

(c) Caviar trade database

The caviar trade database was established in 2007 and is managed by UNEP-WCMC. The database records information relating to exports, re-exports and imports of caviar, helping Parties to monitor the legal origin of caviar in international trade, check export quota compliance, track shipments of caviar and identify any potential illegitimate use of CITES permits (UNEP-WCMC, 2008).

CITES Resolution Conf. 12.7 (Rev. CoP16) recommends that Parties submit copies of all export permits and re-export certificates issued to authorize trade in caviar, no longer than one month after they have been issued, for inclusion in the caviar trade database. Parties are recommended to consult the database prior to issuing a re-export certificate, in order to verify the origin of a shipment for re-export. Specific uses of the database include:

- linking permits electronically from countries of origin to subsequent re-export permits (and if previously re-exported, to the re-export permit from a third Party), allowing consignments to be tracked from the country of origin, via any other exporter, to the latest country of export; and
- verification of quantities to be re-exported (to ensure the quantity to be re-exported by any country does not exceed the quantity previously imported, as indicated on the previous (re-)export permit) (UNEP-WCMC, 2008).

[18] In contrast, a "secondary container" refers to a receptacle into which primary containers are placed: *CITES Resolution Conf. 12.7 (Rev. CoP16)*

(d) Additional provisions

Caviar from different Acipenseriformes species should not be mixed into a primary container (except in the case of pressed caviar[19]). *CITES Resolution Conf. 12.7 (Rev. CoP16)* also recommends that: "where available, Parties use the full eight-digit Customs code for caviar, instead of the less precise six-digit code (which includes roe from other fish species)".

4.1.3. Implementation of the labelling system

(a) Implementation

CITES Resolution Conf. 12.7 (Rev. CoP16) establishes universal standards for caviar labelling and the registration of processing/repackaging facilities. However, the Resolution provides scope for Parties to determine the exact type of labels used, and flexibility to establish systems for tracking and monitoring of trade. This section provides some examples of how the guidelines have been interpreted and implemented at the national level.

- *Security features, design and positioning of labels:* CITES caviar labels may include a variety of security features, including holograms, unique security numbers, security prints, security cuttings (to ensure damage to the label in case of opening), and thermal transfer printing (Knapp, 2008; Scales *et al.*, 2010). Some Parties may require labels to seal the caviar container; in others, different mechanisms may be used (e.g. individual packaging of tins in nets and closed using metal seals) (Scales *et al.*, 2010). Security features/mechanisms may be used individually or in combination, and are not necessarily prescribed in national legislation.

- *Issuance of labels:* CITES caviar labels may be produced centrally (e.g. by the CITES MA or State printing company) and issued to traders, or the CITES MA may approve a number of different labels for use. In other cases, traders may issue their own labels provided they are licensed, registered or otherwise authorized by the CITES MA (Jahrl, 2013).

- *Record-keeping requirements:* some Parties have implemented requirements for caviar processing/(re-)packaging facilities to maintain records of caviar imported, exported, produced or stored etc., which must be available for inspection by authorities (e.g. the EU in Article 66(7) of *Commission Regulation (EC) No 865/2006*). This provides an essential tool for verification of legal origin, allowing authorities to trace caviar back to the point of production.

- *Allocation of processing plant and lot identification numbers:* In the early stages of implementing the guidelines, there were differences in how processing plant and lot identification numbers were applied by Parties (e.g. in some cases, to exporting companies and procedures only; in other cases, already during the prior processing phase). The Secretariat provided clarification on the issue in AC17 Inf. 9, namely that processing plant and lot identification numbers should take account of the production process and not simply the identification of caviar submitted for export and international trade. This would help to confirm that the caviar is of legal origin by linking directly to the production process.

  Monitoring and enforcement of requirements: a number of approaches have been used to monitor and enforce the labelling system, and ensure the legal origin of labelled caviar. Monitoring and enforcement approaches have included: (i) the provision of information materials and training to enforcement authorities; (ii) consultations with processing/(re-)packaging plants to inform them of CITES labelling requirements; (iii) inspections of caviar processing and

[19] Caviar composed of unfertilized eggs (roe) of one or more sturgeon or paddlefish species, remaining after the processing and preparation of higher quality caviar - *CITES Resolution Conf. 12.7 (Rev. CoP16).*

(re-)packaging plants and verification of production records; and (iv) testing of samples using DNA and isotope analysis (Knapp, 2008; Kecse-Nagy, 2011).

(b) Issues

A number of issues have been encountered during implementation of the caviar labelling system, which may potentially undermine its effectiveness in regulating caviar trade. These are summarized below:

Regulatory framework

- *Difficulties associated with verifying the authenticity of labels*. Caviar labels are extremely diverse in design and quality (including the positioning of the CITES code), causing difficulties for authorities when attempting to verify the authenticity of labels during inspections/controls (Knapp, 2008; J. Jahrl, WWF Austria, *in litt*., 2015).

- *Lack of control over the production of labels*. Where the production or issuance of labels is not centralized, this may result in the use of labels with inadequate security features, or of otherwise poor quality/design, facilitating misuse and fraud (see below).

Compliance and enforcement

- *Inadequate security features, design or positioning of labels*. Often the security features, design or positioning of labels do not meet the requirements of the Resolution (i.e. that labels are non-reusable, and either seal the container or allow visual evidence of any opening or tampering). For example:
    - Labels lacking security features and of poor quality, meaning that fraudulent labels can be easily produced and authorities, retailers and consumers are unable to distinguish fraudulent from valid labels (J. Jahrl, WWF Austria, *in litt*., 2015).
    - Design of label inadequate to prevent reuse, e.g. label can be removed undamaged (J. Jahrl, WWF Austria, *in litt*., 2015).
    - Insufficient mechanisms to prevent tampering with contents, e.g. codes printed on the lids of containers, making it impossible to determine whether the container has been (illegally) opened and refilled (Knapp, 2008; Kecse-Nagy, 2011).

- *Forged/counterfeit CITES labels in circulation*. Investigations in the EU have, for example, detected smuggling of caviar and use of forged CITES labels and falsified or duplicate CITES documents in order to commercialize illegally sourced products within the EU (Knapp *et al*., 2006; Kecse-Nagy, 2011).

- *Information requirements for labels not met*. This may include incomplete codes, lack of source code (e.g. W or C) or codes referring to exporting companies rather than processing plants (see under **(a) Implementation** above) (J. Jahrl, WWF Austria, *in litt*., 2015; Scales *et al*., 2010). In some cases, the code is difficult to read or locate (e.g. printed in very small or poor quality print, or included as part of a block of text), or becomes unreadable when exposed to water and therefore easily falsified (J. Jahrl, WWF Austria, *in litt*., 2015).

- *Mislabelling of caviar*. Caviar mislabelling has been detected through application of DNA testing to samples available for purchase (e.g. Doukakis *et al*., 2012; Jahrl, 2013). Examples include tins containing caviar from a mixture of different sturgeon species (in contravention of the CITES Resolution), or containing caviar from a species other than the species identified on the label (Jahrl, 2013; Knapp *et al*., 2006). Research has found that illegal fishing of sturgeons is an ongoing and substantial problem in some range States and that caviar from wild-caught sturgeons may be "laundered" to appear legal through labelling as farmed caviar

(Jahrl, 2013; Kecse-Nagy, 2011). A key issue is determining at what point in the supply chain mislabelling occurred.

- *Other contraventions of the labelling requirements*. These include inconsistencies between information on labels and permits/certificates (Knapp, 2008), or caviar sold without CITES labels, for example, in glass jars or plastic tubs to avoid detection (Jahrl, 2013; G. Clarke, UK Border Force, pers. comm., 2015)

Registration and licensing

- *Issues with information contained in the CITES Register of caviar facilities/plants*. Although recognized as a useful resource for CITES authorities, there is evidence to suggest that information on caviar facilities/plants in the CITES Register may be out of date, incomplete or inaccurate (Jahrl, 2013). A number of improvements have also been proposed; for example, the inclusion of information on the species of sturgeon used by each aquaculture facility and the source of the caviar produced, to assist in determining legality/detecting instances of fraud particularly if international trade in wild sturgeons re-commences (AC27 Doc. 21.3; A. Petrossian, Petrossian, pers. comm, 2015). It has also been suggested that registration numbers of caviar processing and re-packaging plants should show whether the plant is processing or only re-packaging, due to significant differences in production methods used (AC27 Doc. 21.3).

- *Issues associated with registration of caviar facilities/plants*. For example, the involvement of unregistered or unlicensed companies in producing, processing, (re-)packaging and/or exporting caviar (Jahrl, 2013; Scales *et al.*, 2010).

Traceability/other

- *Loss of traceability/break in chain of custody as a result of re-packaging of caviar*. Concerns have been raised regarding the re-packaging process and loss of traceability during this stage. Re-packaging can also make it difficult to detect at which point in the supply chain mislabelling may have occurred (J. Jahrl, WWF Austria, *in litt.*, 2015).

- *Difficulties of tracking caviar permit information*. Tracking of CITES permits for caviar can be challenging due to complex and unpredictable trade routes (UNEP-WCMC, 2008). Furthermore, the effectiveness of the UNEP-WCMC caviar trade database may be compromised by cancelled and unused permits, which cause trade to be over-estimated, as well as a lack of reporting, delays in reporting and inconsistencies in the terms/units used (UNEP-WCMC, 2008). In addition, while Parties are recommended to consult the database prior to issuing a re-export certificate, it is unclear whether this happens on a routine basis.[20]

- *Other issues*. These include the continued lack of knowledge of the caviar labelling system among retailers, consumers and enforcement agencies; a lack of implementation of the system in key domestic markets (J. Jahrl, WWF Austria, *in litt.*, 2015); administrative burden (UK CITES MA, *in litt.*, 2015); and lack of staff/financial means for controls (Hubenova *et al.*, 2009).

[20] It is noted that the requirement for Parties "to supply to UNEP-WCMC copies of all export permits and re-export certificates issued to authorize trade in caviar, no longer than one month after they have been issued, for inclusion in the UNEP-WCMC caviar trade database" is currently under review, as it is unclear whether the database is still needed/useful – see SC65 Doc. 24.2 Annex 1.

4.1.4. Lessons learned

The universal caviar labelling and registration requirements have made an important contribution to improving the traceability of caviar in trade and facilitating enforcement of CITES provisions. A key strength of the system is the application of unique and globally standardized serial identification numbers to all containers of caviar, regardless of size, source and origin. This is combined with the registration of processing and re-packaging plants and through making these unique registration numbers publically available, this enables authorities, traders and even informed consumers to check which plant produced or re-packaged the caviar concerned (German CITES MA, *in litt.*, 2015).

However, as outlined in **Section 4.1.3.** above, a number of issues appear to compromise the implementation and effectiveness of the system. These relate to the design and application of labels, the implementation of registration/licensing requirements, and the oversight and verification of the system, including inspections and controls. This section considers examples of how the system could be strengthened and best practices, which provide lessons learned for implementation of other similar systems (see also the examples in **Boxes 1** and **2**).

To facilitate enforcement controls and reduce the potential for fraud, it has been suggested that labels should be standardized and quality security features (such as holograms) should be required. Centralizing the production and issuance of labels with CITES MAs or State printing companies could further address issues of forgery/counterfeit labels, as already implemented in a number CITES Parties (Jahrl, 2013).

Accurate, up to date and detailed book-keeping systems are essential to allow for the tracing of caviar along the entire chain of custody in order to confirm legality (Knapp *et al.*, 2006). This is particularly important where re-packaging makes tracing the origin and source of caviar more difficult, opening up the potential for fraud (Knapp *et al.*, 2006). In Germany, for example, a stringent book-keeping system is established in every plant that applies for a registration number, which must provide information about the caviar processed or re-packaged in the plant, including species, source codes, quantity, legality, origin and any existing CITES documents, in the case of importation. In particular, the system must ensure that the quantities of outgoing and incoming caviar are equal, and that no illegal quantities can enter the plant and be legalized (German CITES MA, *in litt.*, 2015).

In addition to strict book-keeping requirements, the robustness of the labelling system depends on regular monitoring and verification of trade records by enforcement authorities, and the regular inspection of facilities/plants (Knapp *et al.*, 2006). Controls using various laboratory techniques can also assist in the effective monitoring of caviar trade and enforcement of regulations, including verifying that species and origin are consistent with information on CITES labels, and preventing the mixing of caviar from various species[21] (Jahrl, 2013; Doukakis *et al.*, 2012; FAO, 2010).

[21] For an overview of current challenges relating to the *Identification of sturgeons and paddlefish specimens in trade,* see https://cites.org/sites/default/files/eng/com/ac/28/Inf/E-AC28-Inf-18.pdf.

Box 1: Example of national systems for regulation of caviar trade

Romanian database of sturgeon captures

To control illegal fishing and trade in sturgeon, the Romanian Ministry of Agriculture issued the Ministerial Ordinance No. 350/Oct. 2001 introducing the compulsory tagging and reporting within 48 hours of every legally captured and landed specimen of sturgeon.

To make the process of issuing CITES permits for the export of products derived from sturgeons transparent to the public and national/international authorities, on 3 July 2003, the CITES MA and SA of Romania launched their web page "Sturgeons of Romania and CITES".

Since September 2003*, all CITES export permits were issued by the CITES MA only for caviar specimens reported and posted on the web page in the database of captures. The database of captures was regularly used by the Romanian Customs Service to check the validity of CITES permits and labelling of caviar exported.

**Note: In 2006, Romania suspended fishing of sturgeons for 10 years (Jahrl, 2013)*

Source: Presentation by the Romanian CITES Scientific Authority for Sturgeons (in Knapp *et al.*, 2006)

Box 2: Example of national systems for regulation of caviar trade

Iranian traceability system for sturgeons

In the Islamic Republic of Iran, control of the whole cycle of sturgeon and caviar utilization, processing and production of different products, trading and research is carried out through the Iranian Fisheries Organization (IFO).

A traceability system controls all activities related to sturgeon. Necessary information about each fish is recorded in digital format and distributed via a special network. A lithographic code number relating to the processing station and the type and grade of caviar is printed on the cans*. Documentation is also provided which meets the requirements of CITES, the European Union, Customs and other national level standards. Together, these measures allow for all caviar cans to be traced back to their source after any period of time.

In addition, a monitoring system has been established to control markets and gather information about the quantity of illegal catch. Fishery guards control the sea, shore lines, roads and markets, and have the authority to arrest shop keepers and close shops if illegal sturgeons or sturgeon products are found. In 2008, the guards made 28 000 inspections, seized 1948 kg sturgeon and 28.6 kg caviar, and thousands of immature and undersized sturgeons (caught as by-catch) were released back into the sea. In addition, around 320 juridical cases were filed and the perpetrators brought to court. Fines were imposed and fishing gears and vessels were confiscated.

**Note: The labels used are non-reusable and attempts to remove the label will damage it. Tins are also enclosed in netting with a seal which matches the label and will split if tampered with (Engler and Knapp, 2008).*

Source: Presentation by Iran at the FAO and CITES Technical Workshop on Combating Illegal Sturgeon Fishing and Trade (Antalya, Turkey, 28–30 September 2009) (in FAO, 2010)

4.2. Crocodile skins

4.2.1. Supply chains

All species of Crocodylia (alligators, caimans and crocodiles) are listed in either Appendix I or Appendix II of CITES. Over the past few decades, ranching and captive-breeding operations have come to dominate the production of crocodilian skins for international trade, with a corresponding decline in the proportion of skins supplied from wild-harvesting (Macgregor, 2002; Macgregor, 2006).

Skins are produced from wild-harvesting, ranching or captive-breeding, and producers sell skins to intermediaries, tanneries or exporters. Tanning is a crucial stage in the supply chain (processing of dried skins to produce leather), traditionally carried out in France and Italy, although has more recently developed in other countries including the US, Mexico, Colombia, Italy, South Korea and Japan (Macgregor, 2006). Manufacturing has also diversified and developed technologically, with manufacturers increasingly found in range States and operating on a larger scale (Macgregor, 2006). Crocodilian leather products are not limited to the luxury sector, but available globally at a range of prices in a wide range of markets, which are continually diversifying, changing emphasis and possibly also expanding (Macgregor, 2006).

The number of tanneries, despite having increased in recent years, is relatively small compared to the number of other entities in the chain, such as exporters and manufacturers (Macgregor, 2002). This provides what has been termed a "Tannery Bottleneck" (Ashley, 2013), which, it has been suggested makes for relatively easy control of the vast bulk of trade (Hutton and Webb, 2002).

4.2.2. Elements of the CITES crocodilian skin tagging system

The universal system for the tagging of crocodile skins was first introduced in 1992 through *CITES Resolution Conf. 8.14* in response to concerns regarding the resurgence of illegal trade in crocodilian skins and difficulties associated with identifying and monitoring skins in trade (IUCN, 2002; CoP8 Doc. 8.26). The system has since been revised to take into account experiences of the various implementing countries (at CoP9 and CoP11; IUCN, 2002) and is currently implemented through *CITES Resolution Conf. 11.12 (Rev. CoP15)*. The system applies only to raw, tanned and finished skins. Finished products, such as handbags, belts and shoes, are not covered.

(a) Tagging requirements

CITES Resolution Conf. 11.12 (Rev. CoP15) recommends that all raw, tanned and/or finished crocodilian skins, flanks and chalecos[22], be tagged individually before entering international trade from their countries of origin, using non-reusable tags. The non-reusable tags are to include, as a minimum: (i) the ISO two-letter code for the country of origin; (ii) a unique serial identification number; (iii) a standard species code; and (iv) where appropriate, the year of skin production or harvest. The tags must also have, as a minimum, the following characteristics: (i) a tamper-resistant, self-locking mechanism; (ii) heat resistance; (iii) inertia to chemical and mechanical processing; and (iv) alphanumeric information, which may include bar-coding, applied by permanent stamping. The Resolution recommends that tails, throats, feet, backstrips and other parts should be exported in transparent, sealed containers, clearly marked with a non-reusable tag or label, together with a description of the content and total weight (in addition to the information required above).

Specific provisions apply to re-exports of raw, tanned and/or finished skins. Parties re-exporting such items are recommended to ensure that they are re-exported with original tags intact (unless

[22] The lateral sides of the belly portion of the skin (flanks) sometimes joined as a "waistcoat" cut (chaleco).

the pieces originally imported have been further processed and cut into smaller pieces). Where original tags have been lost, damaged, or removed from raw, tanned, and/or finished skins, flanks and chalecos, the country of re-export should tag such items prior to re-export with a "re-export tag". Re-export tags should meet the requirements mentioned above, except that country of origin, standard species code and years of skin production and/or harvest need not be included.

(b) Monitoring and control of trade

According to *CITES Resolution Conf. 11.12 (Rev. CoP15)*, Parties should accept export permits or re-export certificates for the international trade in crocodilian skins, only if they contain the relevant tag information noted above and if the related skins and parts are tagged in accordance with the provisions of the Resolution. In the case of re-exports, details of the original permit under which the skins, flanks and chalecos were imported should also be included in the re-export certificate. Parties involved in the re-export of raw, tanned and/or finished skins are recommended to implement an administrative system for the effective matching of imports and re-exports.

CITES Resolution Conf. 11.12 (Rev. CoP15) recommends that Parties establish, where legally possible, a system of registration or licensing (or both) for producers, tanners, importers and exporters of crocodilian skins. Parties are also recommended to implement a management and tracing system for tags used in trade, the details of which are set out in Annex 2 to the Resolution. As part of such a system:

- The Secretariat regularly publishes a list of approved manufacturers capable of manufacturing tags that meet the minimum requirements of the Resolution (currently contained in CITES Notification 2013/029), and Parties are recommended to only obtain tags from these approved sources.
- When issuing export permits or re-export certificates for crocodilian skins, Parties should record the numbers of tags associated with each document and make this information available to the Secretariat on request.
- Management Authorities of exporting, re-exporting and importing Parties should provide to the Secretariat (when directed by the Standing Committee or agreed between the range State and the CITES Secretariat), copies of CITES documents issued for crocodilian skins, flanks or chalecos, immediately after issuance or receipt (as appropriate).
- Parties that require or intend to require the use of tags or labels for containers should send at least one sample tag or label for reference to the Secretariat.

4.2.3. Implementation and effectiveness of the crocodilian skin tagging system

While recognized as an important and successful tool for the monitoring and regulation of crocodilian skin trade, at CoP14 (Hague, 2007) the Parties agreed on a Decision[23] to review the implementation and effectiveness of the universal tagging system (contained then in *CITES Resolution 11.12 (Rev. CoP14)*), in order to determine whether any improvements or streamlining of the Resolution were necessary to better contribute to the objectives of the Convention (see CoP14 Doc. 43 & 46; AC24 Doc.11).

[23] *14.62 The Standing Committee shall, at its 57th meeting, initiate a process to review the implementation and effectiveness of the universal tagging system [...], including [its[impact on the effectiveness of the Convention. For that purpose, it shall establish a working group with representatives from exporting and importing countries, the Animals Committee, the Secretariat and other interested parties.*
The tasks of the working group, which might work electronically, shall be:
a) to examine the implementation and effectiveness of the universal tagging system;
b) […]
c) […]
d) to report to the Standing Committee on the results of its work at its 58th meeting.
14.63 The Standing Committee shall, at its 58th meeting, consider the report of the working group established under Decision 14.62 and shall submit recommendations, as appropriate, to the Conference of the Parties for consideration at its 15th meeting.

At the 57th meeting of the Standing Committee (SC57), a Working Group was established comprising representatives from Parties, NGOs, private sector companies (with experience in tag production and tag application through different processing stages), inter-governmental organizations (IGOs) such as IUCN, a representative of the Animals Committee and the CITES Secretariat. The Working Group agreed to compile and assess the experiences of CITES Parties in using the uniform tagging system to regulate large numbers of enterprises engaged in crocodilian skin production and related activities (e.g. tanners, skin traders and other industry groups) and, in particular, how Parties had developed procedures to streamline and facilitate compliance with the provisions of *Resolution Conf. 11.12*. A questionnaire was drafted and distributed to major crocodilian importing and exporting countries, industry representatives and IGOs/NGOs, to which 13 responses were received (CITES authorities of Bolivia, Bulgaria, Colombia, France, Germany, Mexico, Singapore, Switzerland, Thailand, US and Zambia, also H Trading Co. (Japan) and Ashley Associates (US alligator industry)).

The key findings derived from the questionnaires, and compilation of individual responses, were submitted to the Standing Committee for consideration at its 58th meeting in July 2009 (SC58 Doc. 27). Overall, the review found widespread support among Working Group members for the continued use of a tagging system as a means of ensuring a legal and sustainable trade in crocodilian skins (SC58 Summary Record). However, a number of recommendations were proposed to align the system with developments in knowledge of crocodilian taxonomy, conservation and trade practice, and to streamline the system while maintaining a robust and secure trade control regime (SC58 Summary Record) (see under **(d) Effectiveness** below).

An overview of implementation and effectiveness of the crocodilian skin tagging system, based on the 2009 review, is provided below. Where indicated, information from 2009 is supplemented by updated information from relevant literature and provided by selected CITES authorities and experts to TRAFFIC for purposes of the present report.

(a) General

The Resolution is implemented widely, but only partially in some Parties (e.g. for imported skins, but not for re-exports). Implementation is generally overseen by CITES MAs, although responsibility may be shared with trade associations (e.g. with regard to the purchase, recording and issuance of tags to members) and administration of tagging requirements/systems may take place at sub-national level (Australian CITES MA, *in litt.*, 2015; US Fish and Wildlife Service (FWS), *in litt.*, 2015). In at least one Party, difficulties have been caused by the use of tags for export but not for harvest and internal movement of skins, which hinders determination of legality and sustainability of skins for export.

The administrative burden for companies, CITES MAs and enforcement agencies has been reported as an issue (French CITES MA, *in litt.*, 2015), although may be considered acceptable in view of improvements in traceability and legality of skins (Italian CITES Enforcement Agency (EA), *in litt.*, 2015; US FWS, *in litt.*, 2015). In addition, computerization has reduced the administrative burden of managing tagging data for relevant authorities (German CITES MA, *in litt.*, 2015), with some Parties switching to bar codes which can further assist data management.

(b) Tagging requirements

Information on tags
Tags in use in CITES Parties generally contain the minimum information set out in the Resolution, applied by permanent stamping, although the information sequence is not always precisely followed.

Physical characteristics of tags

Crocodilian skins are tagged using loop or button style tags (Ashley, 2013). In terms of security characteristics, tags are mostly self-locking and designed to prevent reuse, however, cases of manipulation and re-use of tags have occurred where security features were insufficient to prevent misuse. It is thought that this may be occurring less often as more secure tags become available, for example, the tag used in Colombia which requires a special tool to be affixed to the skin (German CITES MA, *in litt.*, 2015). For examples of tags in use, see Ashley (2013): http://unctad.org/en/PublicationsLibrary/ditcted2013d6_en.pdf.

Problems may occur during processing (tanning), where tags are not resistant to mechanical/chemical processes and become detached from skins, damaged or destroyed; or the nature of the process requires the systematic removal of the original tags (French CITES MA, *in litt.*, 2015; Australian CITES MA *in litt.*, 2015). It has been suggested that the removal of tags before tanning (and subsequent replacement with an export tag) leaves scope for abuse, in particular to launder illegal skins through tanneries (AC24 Doc. 11; AC27 Doc 19.4 Annex 1). Some tags have been developed to withstand the skin tanning processes (e.g. loop style tags made of nylon-based material with laser-etched bar code, used to mark American Alligator skins) (Ashley, 2013).

Reproduction of counterfeit tags has also been reported (Italian CITES EA, *in litt.*, 2015); however the list of CITES approved tag manufacturing companies and reporting of tag numbers used should assist in addressing this issue (Ashley, 2013).

Tagging of re-exports
In the 2009 review, most respondents indicated that, in cases where the original tag is lost or removed, a re-export tag meeting all requirements of the Resolution is used.

Use of technology
There is interest among CITES Parties and industry stakeholders in the use of innovative technologies, such as bar coding on tags, to reduce fraud and administrative burden associated with implementing the tagging system (French CITES MA *in litt.*, 2015; Australian CITES MA *in litt.*, 2015). Some Parties, such as the US, have already incorporated such systems into their tags (Ashley, 2013); however, some problems with bar coding have been encountered (e.g. technical issues associated with the tanning process impacting readability of the coding) (Australian CITES MA, *in litt.*, 2015).

In Australia, there is continued interest amongst the Australian crocodile industry to implement bar coding to facilitate data transfer from the tag to a database. The Australian CITES MA is currently investigating new technologies that might address problems encountered previously, thereby enabling application of bar coding and introduction of automated processes by industry and/or State/territory governments (Australian CITES MA *in litt.*, 2015).

(c) Monitoring and control of trade

Registration/licensing
Registration and/or licensing of producers, tanners, importers and exporters is not required in all CITES Parties. Some countries do not implement this requirement, while others only require registration or licensing of crocodile farms, or importers/exporters. Registration/licensing may be undertaken at the sub-national (e.g. State, territory) level (Australian CITES MA, *in litt.*, 2015).

Tag manufacture and issuance
Companies may obtain tags directly from licensed/registered manufacturers (or possibly via a designated trade association). In some CITES Parties, the CITES MA oversees tag orders, issuance, distribution and possibly also the tagging itself (see below). Although provided for in Annex 2 to the Resolution, no respondent in the 2009 review reported requesting that the Secretariat purchase and distribute tags on their behalf. CITES MAs may also maintain records of tags issued.

Examples of systems currently in use include:

- Australia: the Australian CITES MA purchases crocodile tags and distributes them to relevant State/territory governments for issuance to individual operators/exporters and keeps a national record. State/territory governments are responsible for maintaining records of tags, including replacement tags, issued to individual operators/exporters (Australian CITES MA, *in litt.*, 2015).

  For re-tagging of skins for re-export, where tags have been removed or lost (e.g. during processing):
- France: orders for replacement tags are submitted by companies to the Centre Technique du Cuir (CTC). CTC then prepares a bulk order specifying tag numbers corresponding to each company and submits this for endorsement by the national CITES MA. The national MA keeps a copy of all CTC tag orders, which relate tag numbers to the companies. Once a year, the CTC provides the national CITES MA with an overview of all tags that have been sent to companies (French CITES MA, *in litt.*, 2015).
- Germany: the owner of the skins orders and pays for any replacement tags and these are sent by the tag manufacturing company directly to the Government authority, which undertakes the re-tagging. Depending on the amount of skins, re-tagging is either directly undertaken by a Government authority, or is supervised and checked during the re-tagging process. (German CITES MA, *in litt.*, 2015).
- Italy: replacement tags must be requested by companies from the CITES Enforcement Agency, Corpo Forestale Dello Stato, which provides tags and maintains a register of all tags provided to companies at the local level (Italian CITES EA, *in litt.*, 2015).

Recording of tag numbers on export/re-export documents
The recording of tag numbers associated with export permits/re-export certificates appears to be implemented in most, if not all, CITES Parties. Some Parties make use of electronic permitting systems to store information on permits, including details of tags, which can provide for rapid retrieval of information on permits and associated tags (French CITES MA, *in litt.*, 2015; German CITES MA, *in litt.*, 2015).

Administrative systems to match imports and re-exports
In the 2009 review, most respondents reported implementing an administrative system to match imports and re-exports. Examples of systems currently in use include:

- France: companies that have carried out re-tagging of skins must update a Register to include details of the import permit, the old and new tag numbers, and the date of re-tagging. The effective matching of imports and re-exports is verified by enforcement officers during random inspections, and by the CITES MA when processing applications for re-export certificates (French CITES MA, *in litt.*, 2015).
- Germany: where tags have been removed, the owner must provide proof of legal origin to the relevant CITES authority, including the source of the skins (imported or purchased within the EU). Proof could include invoices, copies of CITES import documents or the original tags which were removed during processing. A government certified expert in skin identification could also be asked to verify the species of the skins or the age of the skins before a re-export certificate is issued (German CITES MA, *in litt.*, 2015).
- Italy: companies are obliged to maintain a Register of skins that have been received, sold and transformed. Fiscal documentation must be integrated with a declaration of the origin of the skin and details of the relevant import permit (Italian CITES EA, *in litt.*, 2015).

(d) Effectiveness

General
All respondents in the 2009 review regarded the universal crocodilian skin tagging system as either very necessary or somewhat necessary for the effective control of trade in crocodilian skins (see also **Box 3:** *US case study*). Examples of blatant abuses of the system have been reported (e.g. shipments of skins with tags unattached, multiple skins on a tag), but this appears to be the exception rather than the rule (G. Webb, IUCN CSG, *in litt.*, 2015). In the 2009 review, no respondent reported more than 25 commercial shipments with CITES violations (including Colombia and the US, which each reported using more than 500 000 tags annually), with most reporting 0–10 cases (data for 2007).

Following the 2009 review, a number of changes were made to the Resolution with a view to streamlining the tagging system and reducing the administrative burden on authorities. These included removing the requirement for tag manufacturers and CITES MAs to report tag orders to the Secretariat (previously contained in Annex 2), and reducing the tagging requirement for chalecos to a single tag[24] due to little or no fraud associated with this commodity over the years (SC58 Doc. 27; AC24 Doc.11).

Costs
Four respondents in the 2009 review reported using 20 0001–50 000 tags annually; one reported 100 001–500 000; and two reported using over 500 000 tags. Costs of tags vary and unit costs decline with increasing volumes ordered. Crocodilian loop tags in Indonesia cost US$0.30 each for relatively small quantities (ca. 5000 units); alligator loop tags (with bar codes) used in Louisiana in large quantities (> 300 000 per year) cost US$0.17 per tag (Ashley, 2013).

Costs associated with administering the system exceeded US$75 000 annually in two Parties. Some Parties recovered the costs of the tagging programme from the private sector (cost of tags).

Strengths
As mentioned above, the tagging system is widely recognized as an effective mechanism for curtailing the illegal trade in crocodilian skins. Some strengths of the system have been cited as:

- Improved assurance of origin and legality of skins in trade (Australian CITES MA, *in litt.*, 2015; Italian EA, *in litt.*, 2015; US FWS, *in litt.*, 2015).
- Establishment of universal standards for tagging of crocodilian skins, but with sufficient flexibility as to their implementation (German CITES MA, *in litt.*, 2015; US FWS, *in litt.*, 2015).
- Provision of an index of volumes produced in source countries, which can be confirmed by import statistics for importing countries (G. Webb, IUCN CSG, *in litt.*, 2015).
- Potential for integration with CITES electronic permit systems, and incorporation of new technologies onto tags.
- Requirements for tags to remain on skins during processing (and, if lost, for re-tagging to be undertaken if skins are re-exported), and also for the tagging of smaller parts of skins, which help to control illegal trade[25].

[24] Previously, each flank (side) of the chaleco was required to be tagged.
[25] Although some problems in implementing these provisions remain (German CITES MA, *in litt.*, 2015)

Box 3: US case study

The US Fish and Wildlife Service (US FWS) has made legal acquisition and non-detriment findings (NDFs) on a State-by-State basis, as a way to address the large-scale export of American Alligator *Alligator mississippiensis* skins. States are required to report annually on applicable laws and regulations and mandatory tagging is based on US FWS approval of each State's management and legal regime. Tagging by approved States is considered to provide sufficient evidence of legal acquisition, and US FWS can refuse to provide tags to States that do not comply with the implementation requirements.

Properly tagged specimens accompanied by a Service 3-177 Declaration for export and a US FWS import/export licence, are routinely granted CITES export permits at designated US ports. Tags are an indication that legal acquisition and NDFs have been made and the process provides a uniform approach to presentation of American Alligator skins at ports.

In the US, the tagging regime is augmented by enforcement regimes at the national and local level, such as State wildlife agency regimes to ensure lawful harvest or production. Shipment declarations and presentation of specimens for inspections allow authorities to ensure that tags are legitimate and match the documentation association with the specimens.

The past three decades of implementing the tagging of American Alligator skins have demonstrated that the system is effective, and has contributed not only to improved implementation of CITES but also to the recovery of the American Alligator.

Source: US FWS, *in litt.* (2015)

Limitations
Nevertheless, a number of limitations/weaknesses of the system have been identified:

- Administrative burden and costs for stakeholders.
- Scope for fraud or abuse of the system, for example, resulting from or associated with:
    - the removal or loss of tags during processing;
    - insufficient security mechanisms on tags;
    - ease of reproducing counterfeit tags;
    - insufficient verification of tagging/oversight by authorities;
    - use of tags from previous years.
- Difficulties of selecting tag types that can withstand the tanning process, do not damage skins, are practical and do not fail, and include all necessary information required by CITES.
- Partial implementation of the system (e.g. tagging requirements for imports but not re-exports; registration/licensing provisions not implemented).
- Uncertainty in the application of the tagging requirements in certain production steps (e.g. where skins are cut transversely into two or three parts, but sent together).[26]
- Issues associated with information requirements on tags and loss of traceability (e.g. lack of requirement to keep original information about the country of origin, species code, year of skin production or harvest on replacement tags).

Suggested improvements
In order to improve the system further, it has been suggested that the application of electronic identification technologies to tags, such as bar coding, should be explored, which could be directly linked to relevant databases for automated transfer of data (SC58 Doc.27; AC27 Doc.

[26] It is unclear whether this practice is legitimate (i.e. part of the organization of work in the production chain), or a circumvention of requirements (French CITES MA, *in litt.*, 2015).

19.4 Annex). Combined with electronic management systems to assess and store data on tags, this could improve the accuracy and handling of skins, while reducing fraud and administrative burden. Bar coding is already employed by some Parties, and this possibility has been included in *Resolution Conf. 11.12* (paragraph c) since CoP15. The introduction of a database that catalogues all tags issued and is publically accessible could also reduce the possibility of misuse (Italian CITES EA, *in litt.*, 2015; see also AC27 Doc. 19.4 Annex).

4.2.4. Lessons learned

Experience of implementing the universal tagging system for the identification of crocodilian skins has highlighted the importance of ensuring tagging systems are simple, easy to apply, and leave sufficient scope and flexibility for Parties to determine how they should be implemented (AC14 Summary Record; German CITES MA, *in litt.*, 2015; US FWS, *in litt.*, 2015). Affording Parties and industry flexibility in the types of tags/technology to be used can help to drive technological improvements to cope with challenges as they arise.

Tagging systems are associated with significant administrative and cost burdens for Parties, which are not always recouped from industry. Administrative burdens may, however, decline as developments in technology, such as electronic data capture and management systems, become more widely available and cost-effective. Systems should be sufficiently flexible to allow for incorporation of technological developments, if considered appropriate/practicable for the implementing countries.

As is true for all tagging and traceability systems, the universal tagging system is only as strong as the legal/regulatory regimes and monitoring systems in place (US FWS, *in litt.*, 2015) and cannot overcome issues of weak governance (Ashley, 2013). Regardless of the type of tagging system implemented, assurance of legal acquisition is largely dependent on self-reporting by the producer/harvester, therefore the system must be supported by enforcement regimes at the local and national level (US FWS, *in litt.*, 2015; see **Box 3**: *US case study*).

Managing the re-tagging of skins and re-exports can present considerable challenges, particularly where processing results in the loss, damage or removal of tags, with the potential for abuse of the system at this stage. Before considering implementation of systems for re-tagging of skins/tagging of re-exports, it is important to evaluate whether tagging systems are being effectively implemented in countries of origin in support of legal and traceable trade.

4.2.5. Related developments

At CITES CoP16 (Bangkok, 2013), the Parties adopted a number of interconnected decisions concerning *Snake trade and conservation management (Serpentes spp.)*. These included decisions relating to the potential implementation of a traceability and marking system for snake skins[27], which

[27] CoP16 Decisions on *Snake trade and conservation management (Serpentes spp.)* include the following:
Directed to the Secretariat
16.102 The CITES Secretariat shall, where appropriate in consultation with the Standing Committee:
c) inform Parties of the results of the International Trade Centre (ITC) study on trade in python snakes in Asia, the UNCTAD Biotrade Initiative's Working Group on reptile skin sourcing, when these become available, and other relevant studies and information;
Directed to the Animals Committee
16.103 The Animals Committee shall:
b) examine the study undertaken by the UNCTAD Biotrade Initiative's Working Group on reptile skin sourcing mentioned in Decision 16.102, paragraph c), and any other relevant available information concerning:
i) existing marking and tracing systems and, where relevant, accompanying certification schemes of all kinds (and not necessarily limited to those currently in use for trade in wild species), which could provide best practices that might be applicable to snakes;
ii) a traceability system to confirm the legal origin of snake skins; and
iii) the economic feasibility of current technologies to implement such a traceability and marking system;
c) advise the Standing Committee on the feasibility of implementing such a traceability system for snakes; and
d) report on the status of this work at the 65th and 66th meetings of the Standing Committee.
Directed to the Standing Committee

were the subject of discussion at the 27th meeting of the Animals Committee (AC27, Veracruz, May 2014) and 65th meeting of the Standing Committee (SC65, July 2014). Research/activities undertaken to inform and contribute to implementation of these decisions have included:

(i) A study co-commissioned by the CITES and United Nations Conference on Trade and Development (UNCTAD) Secretariats entitled *Traceability Systems for a Sustainable International Trade in South-East Asian Python Skins* (Ashley, 2013)[28]. This study, which is referred to in Decision 16.103 paragraph b), incorporates inputs from a broad range of stakeholders and reviewers, and provides decision-makers with a number of options for strengthening the regulatory framework for trade in snake skins, and improve traceability (see AC27 Doc.19.2 for a further description of the study and related consultation processes).

(ii) A stakeholder consultation process initiated by the Responsible Ecosystems Sourcing Platform (RESP) through its International Working Group on Reptile Skins (IWG-RS), to develop the basis of a global traceability information system for reptile skins to complement and strengthen the current CITES permitting system related to this trade. The main findings of this consultation process were submitted for consideration at AC27 (see Annex to AC27 Doc. 19.4).

At AC27, the Animals Committee established a Working Group on snake trade and conservation management, with the mandate to examine the findings and recommendations concerning traceability of snake skins presented in the UNCTAD/CITES study and arising from the RESP/IWG-RS consultation process described above, as well as additional relevant information concerning, for example, existing marking and tracing systems for snakes, certification schemes and current technologies.

Based on the discussions of this Working Group, the Animals Committee at AC27 made the following initial recommendations on the feasibility, development and implementation of a traceability system for snakes, which were reported to the Standing Committee at SC65 (SC65 Doc. 44):

b) Concerning traceability, the Animals Committee suggested that the Standing Committee consider implementing a traceability system for snake skins comprising the following characteristics:

- *For the formulation of relevant provisions, the Standing Committee may draw upon Resolution Conf.11.12 (Rev. CoP15) on Universal tagging system for the identification of crocodilian skins as a template;*
- *In particular, the traceability systems should commence as close to the point of harvest of the animal or production of the skin as possible. It should be made mandatory up to and including finished skins. Any use of the tagging information further on in the trade chain is optional; and*
- *The identification of skins should make use of devices that are tamper proof, affordable, uniquely serially numbered and contain the following minimum information: species, country of origin (where relevant regional code), year of harvest or production, unique serial number, source code. In addition, Parties are encouraged to add other information they deem necessary.*

At SC65, the Standing Committee took note of these recommendations, acknowledging that its Working Group on snake trade and conservation management would further consider the matter

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16.105 The Standing Committee shall:
a) consider the reports and recommendations from the Animals Committee and the Secretariat provided in accordance with Decisions 16.102 and 16.103 and, as appropriate, the results of the ITC study on trade in python snakes in Asia, the UNCTAD Biotrade Initiative's Working Group on reptile skin sourcing, and any other relevant available information;
b) examine the study undertaken by the UNCTAD Biotrade Initiative's Working Group on reptile skin sourcing, and any other relevant available information concerning:
i) the socio-economic implications of such a traceability system; and
ii) the potential costs of the system at all levels along the supply chain, from producers to consumers;
c) make recommendations to the Parties, the Animals Committee and the Secretariat as appropriate; and
d) report on the implementation of Decisions 16.102, 16.104 and 16.105 at CoP17, with recommendations for consideration by the Parties, if deemed necessary.

[28] Available from http://unctad.org/en/PublicationsLibrary/ditcted2013d6_en.pdf

of snake skin traceability and sourcing intersessionally and report at SC66 (Geneva, January 2016). Further developments and activities relevant to the above are described in AC28 Doc. 14.2.1. and AC28 Doc. 14.2.2. and the outcomes of deliberations at AC28 are discussed under **Section 3.2** above.

Although discussions regarding a traceability system for snake skins are ongoing, research carried out so far has already provided valuable guidance and lessons learned for the traceability of reptile skins more generally, including for crocodiles. The UNCTAD/CITES study, for example, (described at point (i) above) was informed, to some extent, by the experience of implementing a tagging system for crocodilian skins. A comprehensive discussion of the findings of the UNCTAD/CITES study is beyond the scope of this report, however, some helpful traceability considerations that emerge from this initiative include the following:

- *Point of first tagging:* Tagging should take place in the range State or country of origin and at the earliest feasible point of the supply chain. The first point of tagging will vary by range State, and determination of the appropriate point will require consultation with range States/regional trade stakeholders. Entities authorized to receive tags must be licensed, required to report, subject to inspection and accountable for the system used. Consideration must be given to the limited resources of actors in the first stages of a supply chain and any negative impacts the tagging system could have on local participation and livelihoods.

- *Verification of legality:* Consideration should be given to the stages in the supply chain during which legal trade can be reasonably verified. For snake skins, this is at harvest, transport, processing or tanning level, and the "Tannery Bottleneck" can be used as the final point at which to verify legal trade. After this point, verification becomes much more difficult: marking/tagging could still be used (e.g. to help ensure chain-of-custody), however, verification of legality needs to be achieved between the dried skin and leather stage. A "tiered approach" to tagging could be considered (e.g. mandatory tier corresponding to early stages in the value chain, with a mandatory or optional second tier).

- *Marking options:* Marking options used should be specific to trade (in this case, Python skins), but draw on systems currently used; be low cost, easy to apply, simple to distribute, pragmatic, business-friendly, and fraud-proof; have real-time online registration (which could be compatible with mobile technology to register skins); provide revenues that can be used by range States to finance implementation of the traceability system; and be based on technical and scientific analysis, as well as population and trade data. Tags should only be allocated to private sector participants that are licensed, subject to inspection, responsible for regular reporting and required to return any unused tags to the issuing authority, or report those lost or stolen. A range State database detailing who received tags is the foundation of any traceability system, with subsequent verification of tag numbers exported, in inventory, lost, stolen or damaged.

- *Links to CITES permitting processes:* Due consideration should be given to the linking of tagging/traceability systems to the CITES permitting process, and ensuring that all information is standardized. Sharing of real-time information (e.g. when verifying shipments) will require development of new means for Parties to share data in an automated manner, for example, through use of mobile phone technology and linking with national databases/the UNEP-WCMC CITES Trade Database.

4.3. Queen Conch

4.3.1. Overview of fisheries and trade

Queen Conch *Strombus gigas* is an edible marine gastropod endemic to the Caribbean region, with a range spanning the territorial waters and Exclusive Economic Zones (EEZs) of at least 36 countries and dependent territories (Theile, 2001). It is one of the most important fishery resources in the Caribbean in terms of annual landings and socioeconomic importance (Theile, 2001; Aspra *et al.*, 2009). More than 20 000 fishers are thought to be engaged in Queen Conch fishing in the Caribbean region, ranging from small-scale, subsistence fishers to large scale, commercial activities. In spite of the difficulties in obtaining appropriate and updated estimations of total landings, regional annual conch production is believed to be around 7,600 MT (Prada and Appeldoorn, 2014).

Queen Conch has been listed in Appendix II of CITES since 1992, which controls international trade in all specimens (live animals, meat, shells, pearls and other parts and derivatives). The main commodity in trade is the white conch meat, which is mostly traded in frozen form, but may also be exported as fresh or dried product (Theile, 2001; Prada and Appeldoorn, 2014). Other commodities such as shells, carvings and pearls are also traded in considerable quantities (e.g. as curios, in jewellery, or as souvenirs) but are generally considered as secondary products of the fishery (Mulliken, 1996; Chakalall and Cochrane, 1996). The operculum is also utilised as a souvenir in the tourism industry in low numbers and, since relatively recently, has been exported to China where it is believed to be used in traditional Chinese medicine (Prada and Appeldoorn, 2014).

Queen Conch meat is consumed domestically and exported to major markets such as the US, the EU and the French overseas territories in the Caribbean (FAO, 2013). Prior to export, most Queen Conch meat undergoes some degree of processing, the extent of which depends, for example, on the marketing system, final destination and cultural preferences (Aspra *et al.*, 2009). In general, processing is relatively simple and entails the removal of the intestines and the removal of the darker portion of outer "skin" (Aspra *et al.*, 2009). Depending on the degree of processing, this may result in a reduction of up to 50% or more of the original tissue weight after extraction from the shell (Theile, 2001). One kilogram of clean Queen Conch meat costs typically around US$7-8 (Prada and Appeldoorn, 2014).

In the majority of countries, Queen Conch fishing remains an artisanal activity involving small canoes or dories of 7-10 m long, powered by outboard engines, or sail and oars, and carrying 1-4 divers. Artisanal fishing may also be carried out at distant fishing grounds, using mother ship vessels to transport small canoes and larger numbers of fishers (7-10 divers approx.), with trips lasting around 4-7 days. Queen Conch meat in artisanal fisheries is generally landed alive or fresh, with the shell or as unclean meat (i.e. with the majority of organs attached). Where a mother ship is used, meat is usually landed as refrigerated, clean product (i.e. trimmed meat with no organs) (Prada and Appeldoorn, 2014).

Industrial fishing for Queen Conch involves larger, steel-hulled boats (up to 35 m in length), powered by inboard engines, and carrying as many as 40 or even 60 divers, for several weeks or months at a time. In addition to free/scuba diving, industrial divers may use surface compressor (Hookah) diving techniques. Industrial fishing takes place around 40 to 160 nautical miles from landing sites in Jamaica, Honduras and Nicaragua (and up to 2012 also in Colombia). In industrial fisheries, the meat is generally extracted from conches using a hammer and knife underwater, before being pre-processed and stored on board the vessel and landed in bags as frozen, clean product (Prada and Appeldoorn, 2014).

It is noted that Queen Conch has been included in the Review of Significant Trade[29] and recommendations made to range States by the Animals Committee (see AC26/PC20 Doc. 7 and AC26/PC20 Doc. 7 Annex 5). Trade suspensions have also been recommended for some range States.

4.3.2. Recent developments

Since 2012, a number of recommendations and decisions of relevance to Queen Conch traceability have been agreed upon in various regional fora and by the CITES CoP. These are summarized in **Table 1** below.

4.3.3. Traceability options for Queen Conch

This section provides an overview of selected measures that are currently being implemented at the national level for traceability of Queen Conch and/or are being considered for implementation/harmonization at the regional level. As there is no specific traceability system for Queen Conch defined under CITES, this section provides examples of possible approaches, although not attempting to provide an exhaustive or complete list. More general mechanisms to combat illegal fishing, such as Vessel Monitoring Systems (VMS) and enforcement patrols, are also essential to improve confidence in traceability systems; however a discussion of these approaches is beyond the scope of this report.

Recent discussions have recognized that implementing any measures to improve the traceability of Queen Conch will require an understanding of the supply chain for all stages of processing (AC28 Doc. 19). This underlies the discussion of the following measures, but is not considered further here.

The information in this section is based on a review of relevant literature, as well as contact with CITES/fisheries officials from the region, where indicated. It is noted that experience from implementing management measures for other aquatic species such as abalone Haliotis midae *and sea cucumbers should also be considered, where approaches such as developing more inclusive fisheries policies and/or listing in CITES Appendix III have been largely unsuccessful at addressing IUU activity (e.g. due to a lack of adequate resources and international support to combat illegal trade). See, for example, De Greef and Raemaekers (2014); Sant (2004) in Bruckner (ed.) (2006).*

(a) Catch documentation schemes

A catch documentation scheme (CDS) is a system that combines both catch certification and trade documentation, i.e. it documents verifiable information on fish catch from the point of capture to final destination (FAO, 2008).

The introduction of a regional CDS has been suggested as a potential management option to improve traceability of Queen Conch and to reduce opportunities for illegal, unreported and unregulated (IUU) catch to enter trade (Caribbean Regional Fisheries Mechanism (CRFM), 2013). Possible features of a CDS were discussed at the EU ACP Fish II[30]/CRFM Queen Conch

[29] The Review of Significant Trade (RST) process involves a review of biological, trade and other relevant information on Appendix-II species subject to levels of trade that are significant in relation to the population of the species, in order to identify problems concerning the implementation of Article IV, paragraphs 2 (a), 3 and 6 (a) of CITES, and possible solutions. The species subject to the RST are selected by the Animals and Plants Committees. Non-compliance by any State with the solutions recommended by these Committees may ultimately lead to a recommendation by the Standing Committee to suspend trade with that State in specimens of the species concerned. See *CITES Resolution Conf. 12.8 (Rev. CoP13)* (https://www.cites.org/eng/resources/terms/glossary.php#s).

[30] The ACP FISH II Programme was a 4.5-year programme financed by the European Development Fund on behalf of ACP (African, Caribbean and Pacific Group of states) countries. See: http://www.acpfish2-eu.org/.

workshop in June 2013, although an expansion of the system beyond CRFM[31] is considered to greatly increase its utility (CRFM, 2013).

Features discussed at the June 2013 workshop include:

- Development of a single system compatible with the EU IUU Regulation and CITES documentation and which serves international reporting requirements.
- Use of unique codes for each shipment, which would link a shipment with the vessel trips that landed the conch.
- National responsibility for issuing and validating catch documentation and export/re-export documents and reporting.
- Regional responsibility for managing national data in a regional database, verifying/monitoring data, and reporting on regional Queen Conch trade annually (CRFM, 2013).

Requirements for an effective CDS include a functional database management system, which would operate across the region and allow importing and exporting countries to report trade in Queen Conch (CRFM, 2013). A technician would be needed to run the system, as well as long-term support and maintenance requiring funding commitment from the region. Risks identified include a lack of funding, training, demand for use and expertise within CRFM/countries, or a change of priorities, which might make the system difficult to maintain. A barrier to introduction of a CDS is also the willingness of countries to give up control over their fishery and international trade, as they would need to consult with the regional body on export and import.

It is noted that a number of Caribbean States are already familiar with the CDS used by the International Commission for the Conservation of Atlantic Tunas (ICCAT) and the EU IUU Regulation catch certification scheme for other fish products. In developing any new CDS, it would make sense to consider the requirements of the EU IUU Regulation system, which is used by States that export fish products to the EU (MRAG, 2013; see, for example, **Box 4** for details of the Bahamas EU Catch Certificate).

Box 4: The Bahamas EU Catch Certificate

Exporters from the Bahamas to the EU require a catch certificate, which is provided by the Department of Marine Resources. The certificate is currently compiled by hand, however to improve the provision of catch and effort data, the process has been partially automated. Spreadsheets are used for data entry and transmission, and a simple database is used to hold and report data. A catch certificate request can be automatically verified based on data previously provided, and automatically produced and printed both in paper and electronic form. A significant advantage of the system is that it works using office software and systems, with which processing company staff are already familiar.

Verification of the information can take place at various points in the chain of custody, where the quantity of conch can be measured and matched against the quantity recorded on the certificate. Critical points of verification include the landing site/delivery point to the processor, the point of export and the point of import. Verification in the Bahamas is not carried out at the landing site, and only superficially at point of export.

Source: MRAG (2013)

[31] Anguilla, Antigua and Barbuda, Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Haiti, Jamaica, Montserrat, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, Trinidad and Tobago, Turks and Caicos

Table 1: Progress of discussions regarding traceability of Queen Conch – outcomes of relevant meetings (2012-2015)

Abbreviations: HACCP - Hazard Analysis and Critical Control Point; CFMC - Caribbean Fisheries Management Council; OSPESCA - Organizacion del Sector Pesquero y Acuicola del Istmo Centroamericano (Central America Fisheries and Aquaculture Organization); WECAFC - the Western Central Atlantic Fishery Commission; CRFM - the Caribbean Regional Fisheries Mechanism; SPAW - Specially Protected Areas and Wildlife

Meeting	Outcomes
QCEW (United States, May 2012)	The Queen Conch Expert Workshop (QCEW) agreed on 29 recommendations, including the following: *28. The following recommendations represent a set of possible approaches to combat IUU and improve enforcement in the region. Given the on-going problems with enforcement, there are unlikely to be any simple solutions. However, there are a number of initiatives and procedures which could be enhanced and encouraged: […]* *b. Implement an auditable "chain of custody" procedure, so that catches can be traced back to their catch location, and not just their point of landing or point of export. Catch documentation procedures are already required by HACCP and the EU, and CITES permit and certificate system could track Queen Conch entering international trade;* *c. Research practical technology to enhance the traceability of queen conch, including labelling, marking, DNA stock identification, etc.*
First meeting of the QCWG (Panama, October 2012)	The members of the CFMC/OSPESCA/WECAFC/CRFM Queen Conch Working Group (QCWG) adopted a joint 'Declaration of Panama City' (with an annex containing the QCEW recommendations of May 2012), and a QCWG work plan for 2012-2013. The Declaration recommends that "*the Conference of the Parties [to CITES]....adopt recommendations as appropriate to support the sustainable utilization, conservation and international trade in Queen Conch*". A separate working group was established to develop a number of draft decisions for consideration at CoP16, to be based on the regional findings and actions agreed at the October 2012 QCWG meeting.
CITES CoP16 (Thailand, March 2013)	The Parties adopted a number of decisions of relevance to Queen Conch trade, management and conservation (Decisions 16.141-16.148). These included the following decision on traceability: *16.144 Range States of* S. gigas *should collaborate in exploring ways to enhance the traceability of specimens in international trade, including, but not limited to, catch certificates, labelling systems and the application of genetic techniques.* Decision 16.141 also encourages range States to adopt and, where applicable, move towards implementation of the recommendations of the QCEW. Decisions regarding the development of Queen Conch conversion factors at different stages of processing are also of relevance to traceability.
EU ACP Fish II / CRFM Queen Conch workshop (St Vincent & the Grenadines, June 2013)	The workshop developed a Regional Management Options Paper for Queen Conch, based on the results of five field missions to The Bahamas, Belize, Dominican Republic, Grenada and Haiti, and a regional review of Queen Conch management and science in the region. The recommendations of the QCEW in 2012 were also considered to provide a broad outline of options available, allowing the workshop to propose how the recommendations might be implemented in practice. It was agreed that the options should be considered at the regional and national levels for implementation (CRFM, 2013).
WECAFC 15th session (Trinidad & Tobago, March 2014)	A number of recommendations on Queen Conch were adopted including the following: *WECAFC, in close coordination with OSPESCA, CRFM, CFMC, CITES and the SPAW Protocol Secretariat, develop a regional plan for the management and conservation of Queen Conch, in accordance with the best available scientific evidence to be presented to the 16th session of WECAFC for final review and regional adoption.*

Meeting	Outcomes
Second meeting of the QCWG (Panama, November 2014)	Meeting participants reviewed a draft Queen Conch management and conservation plan and determined which of the 26 potential measures contained in the plan would contribute most to the sustainability of stocks and livelihoods of those involved in Queen Conch fisheries. Measures with implications for traceability include: *(i) the licensing of all Queen Conch fishers, processors and exporters; (ii) traceability of Queen Conch throughout the value chain; (iii) develop and progressively implement a certification program to promote legal conch consumption in the Wider Caribbean; (iv) develop and implement a digital catch and effort data entry and analysis system*. The experts recommended that 16 measures were suitable for regional level harmonization and should be discussed in 2015 with all relevant stakeholders at national level in the Queen Conch range States. It was noted that most measures identified were applied already by a majority of range States at the national level. Adoption of a final set of regionally harmonized management measures was foreseen to take place at the 16thsession of the WECAFC and the CITES CoP17 in 2016. The QCWG also agreed on a workplan for 2015-2018, including: *To begin a review of options for development of an auditable "chain of custody" procedure to track catches from their catch location to their eventual destination (implementation of Recommendation 28, b. Of the Expert Workshop).*
International Regional Cooperation Workshop for the Management and Trade of Queen Conch (Colombia, March 2015)	The main objective of the Workshop was to assess and define a regional workplan to incorporate relevant strategies to put in to practice the recommendations laid out in the Panama Declaration and relevant CoP16 decision, with an emphasis on NDFs and conversion factors. Specific objectives included: *(i) To develop a proposal for conversion factors at the different levels of transformation of the Queen Conch, which will enable the standardization of data and instruments for the presentation of reports on catches and trade in meat and other products.* *(ii) Definition of the Regional Management Plan for Queen Conch to guarantee conservation and traceability in international trade of this species* (AC28 Doc. 19).

(b) Electronic data collection and management systems

The draft Regional Queen Conch Fisheries Management and Conservation plan (considered at the second meeting of the QCWG, November, 2014) places emphasis on the gradual transition from paper-based to electronic data collection, reporting and management systems to underpin the establishment of an effective harvest strategy for the region. This has implications for traceability of Queen Conch, supporting implementation of CDS and facilitating verification of product legality (e.g. compliance with quotas, licences, etc.) and tracing back to point of capture.

In the shorter-term, improving data collection might involve enhancing mechanisms to facilitate and increase reporting by fishers, or cleaning/improving existing digital databases at the national and sub-regional level (Prada and Appeldoorn, 2014). In the longer-term, the draft Regional Queen Conch Fisheries Management and Conservation plan envisages the following:

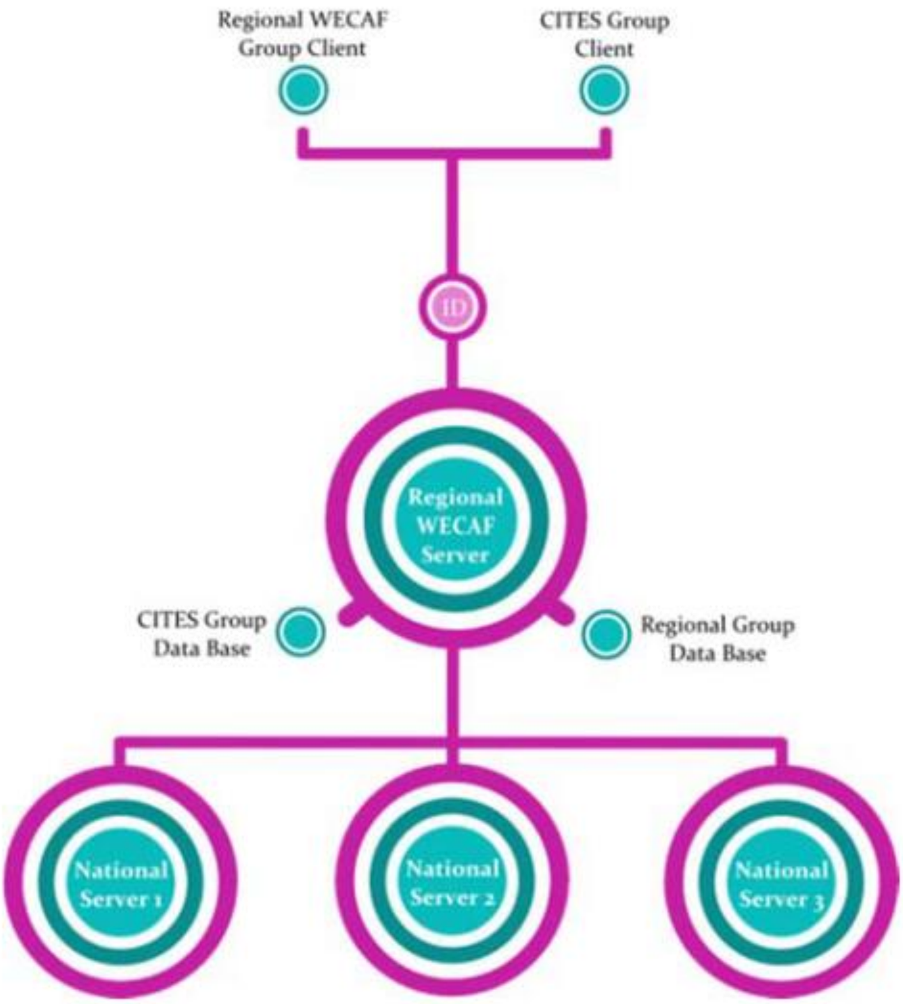
1. Establishing mandatory reporting of fishery-dependent[32] information, not only for industrial or processors, but also for all fishermen and processors.
2. Establishing a program to electronically report fishery-dependent data in real-time by structuring an online platform for sharing and storing Queen Conch information **(Figure 3).** Access to the database would be granted to registered users through a secure online platform. Fishers would access the online platform by sending information through a special application that works from a mobile phone or a tablet. They could also send a text message with the requested information.
3. Compiling data in national databases, incorporating conversion factors and mechanisms for quality control, for analysis at the national level.
4. Storing and sharing national databases in a WECAFC[33] server, for analysis on a regional level, and link with CITES Secretariat.

The use of software tools to increase efficiency in data management and improve accuracy of reporting (e.g. by industry) was also discussed at the EU ACP Fish II/CRFM Queen Conch workshop. Implementation would involve: (i) the identification of suitable tasks which can be automated; (ii) development of the appropriate software tools to complete the task; and (iii) dissemination of tools to users with appropriate training where necessary (CRFM, 2013). Software tools could be developed nationally for specific tasks (see, for example, **Box 5**), but should be made available throughout the region (CRFM, 2013). Risks identified at the workshop include a lack of training, which would prevent software tools from being used properly, and the need for standardized hardware through the chain for data collection and entry (CRFM, 2013). Widespread acceptance of any software tool that increases efficiency is considered likely, provided that users understand how it is operated (CRFM, 2013).

[32] Fishery-dependent information includes information derived from fishing activity/the fishing sector (e.g. reported landings, catches, etc.), in contrast to fishery-independent information which is obtained or undertaken independently of fishing sector activity. In cases where fishery-independent data, such as stock abundance indices from research surveys, are available, it is possible to use these as an independent check on catch per unit effort (CPUE) based on commercial fishery catch and effort data. In cases of suspected serious misreporting of catches, it is possible to use such fishery-independent data to obtain estimates of the commercial catches (FAO, 1998).

[33] Western Central Atlantic Fishery Commission.

Figure 3: Simplified diagram of the electronic centralized Queen Conch catch and effort data collection and storage system



Source: Prada and Appeldoorn (2014)

Box 5: The Bahamas Data Collection Initiative

Queen Conch processors in a number of Caribbean countries provide reports with catch and effort information based on their purchases, however these data are often incomplete and difficult to verify (Prada and Appeldoorn, 2014).

In 2012, The Bahamas introduced a new electronic data collection system to obtain catch and effort data from key processing facilities that export and supply larger local restaurants with Queen Conch and other species. The system was primarily set up to improve provision of accurate data for spiny lobster, but will cover all marine products purchased by the main processors. Implementation is not yet complete: data is not yet routinely processed by the Department of Marine Resources (DMR) and only one processor has consistently submitted records so far.

Processors submit catch and effort data of purchased landings using spreadsheet data entry forms. Forms are transmitted weekly from the processor to the DMR by email. At the DMR, the spreadsheets are loaded directly and automatically into an MS Access database with minimum staff intervention.

Although processors are required to collect additional data, this may already be required for EU catch certificates and the software tools provided by DMR facilitate data entry and preparation. As such, the additional work is not excessive.

Note: the only catches that are recorded are those purchased by processing facilities. Landings for subsistence, or those purchased by many small local restaurants and smaller commercial outlets, are not recorded. The scale of unrecorded total catch is not known.

Source: MRAG (2013)

(c) Licensing and cooperatives

Licensing of all fishers, processers and exporters is a means for fisheries managers to establish the number of individuals/entities involved in the Queen Conch fishery and related trade, and to secure compliance with reporting and management measures (Prada and Appeldoorn, 2014b). It is proposed as a management measure in the draft Regional Queen Conch Fisheries Management and Conservation plan, which suggests that provision/renewal of a licence (Prada and Appeldoorn, 2014b):

(i) should be on an annual basis;
(ii) should be linked to the provision of logbook, landing, processing, export/catch data, and other information; and
(iii) should depend on whether sustainable and legal practices are applied.

A licensing system can support traceability through improved data collection and reporting. In Belize, progress has been made with regard to the traceability of Queen Conch meat in international trade through establishment of catch quotas and licensing of fishing cooperatives (AC28 Doc. 19). Further information is provided in **Box 6.**

Box 6: Fishing cooperatives in Belize

In Belize, the export of Queen Conch meat is carried out exclusively by fishermen cooperatives. The Fisheries Department (FD) in Belize has developed a database to store records of Catch Per Unit Effort (CPUE) data (individual fisherman catch data) gathered from fishermen cooperatives, which are required to register and obtain an export licence every year. Data are processed and analysed by FD, as a result of which the FD is able to link catches to area and fishermen who traditionally use the fisheries.

Fishermen cooperatives are required to submit monthly production data, which helps to ensure compliance with agreed catch quotas by individual fishermen cooperatives. FD carries out inspections for each shipment of Queen Conch to ensure compliance with the minimum size limit regulation.

For Belize, the main challenge to developing a system for traceability in the Queen Conch commodity is primarily due to lack of field data to determine the origin of the product. This is being addressed at present through the implementation of a rights-based management system called Managed Access. This system allows fishermen the right to harvest fish in specific fishing zones through a special licensing system. When fully implemented in 2016 this system will allow for the collection of data that will indicate the origin of the product. Fishermen cooperatives will also be required to include area and date fished on product labels, in addition to other information.

Over the years, fishermen cooperatives have consistently and fully cooperated with the FD, and will immediately cease accepting conch meat from all fishermen once their quota is exhausted. Individual catch data is provided in digital format and FD personnel verify the data through cross-checking of catch receipts.

Source: M. Gongora, Belize Fisheries Department, *in litt.* (2015); also AC28 Doc. 19

(d) Conversion factors

For any CDS to operate effectively, it must be possible to link products at different levels of processing, in order to interpret quantities consistently and apply controls over exports (MRAG, 2013). However, for Queen Conch, conversion factors estimated by countries may not be standardized or necessarily rigorous, while for some countries conversion factors may not yet be available (MRAG, 2013; QCWG, 2014; Prada and Appeldoorn, 2014). Furthermore, although countries should report Queen Conch catch statistics to FAO as live weight (animal with shell), data is often provided as meat weight, with no information on the level of processing (QCWG, 2014; Catarci, 2004). The lack of standardized reporting confounds attempts to make comparisons between countries and undertake consistent studies on regional trends.

To address these issues, the following decision was adopted at CoP16:

16.143 Range States of S. gigas *should:*

a) in coordination with the Working Group on Queen Conch mentioned in Decision 16.141, develop conversion factors at different levels of processing of S. gigas *for standardization of data and reporting instruments on the catch and trade in meat and other products;*

b) adopt these conversion factors by the end of 2015 and report them to all range States of S. gigas*, FAO and the CITES Secretariat; and*
c) by the end of 2016, apply the agreed conversion factors in their S. gigas *fishery management and national, regional and international reporting, and include the degree of processing of* S. gigas *products in the description field of the export permit.*

The 15th session of the Western Central Atlantic Fishery Commission (WECAFC) (Port of Spain, Trinidad and Tobago, March 2014) also approved a recommendation, which stated that: "*Members of Western Central Atlantic Fishery Commission work towards determining and adopting national conversion factors based on regionally agreed processing grades and terminologies before the end of 2015 and communicate the adoption formally to the FAO and CITES Secretariats*."

Following various field studies, regional conversion factors have been suggested for three standard and most commonly used processing grades (dirty, 50% clean and 100% clean), to allow calculation of live weight of Queen Conch caught and to obtain harmonized and comparable statistics between countries (QCWG, 2014). It is recognized, however, that due to spatial variability and characteristics of the species, countries should also consider it a priority to establish their own conversion factors (AC28 Doc. 19). Conversion factors are currently being developed/refined by various Queen Conch range States (e.g. Jamaica and Belize), while discussions are continuing on related issues and complexities at a regional level (see AC28 Doc. 19).

(e) Genetic techniques

The application of genetic techniques is referred to in CoP16 Decision 16.144 as a possible approach to enhancing traceability of Queen Conch (see **Table 1**). An overview of progress on genetic techniques has been provided in AC28 Doc. 19, and is summarized briefly below.

- US: the US FWS has a forensic laboratory service, which has the capacity to identify Queen Conch meat.
- Jamaica: a project is ongoing to study the application of genetic techniques to characterize population structure of Queen Conch and the connectivity of populations in the region. Potential applications include managing IUU fishing of Queen Conch by foreign vessels.
- Colombia: genetic studies have been carried out, which can assist in product identification.

(f) Certification

An ecological certification stamp to encourage sustainable production and consumption of Queen Conch in the wider Caribbean region is being considered as an additional approach to demonstrate sustainable production, improve traceability and incentivize data capture by fishermen (AC28 Doc. 19). Certification could be linked with current chain of custody procedures and quality controls for exported products, such as HACCP (Hazard Analysis and Critical Control Points) (MRAG, 2013; Prada and Appeldoorn, 2014). The implementation of pilot projects with local communities/restaurants is being considered (AC28 Doc. 19).

4.4. Timber

This section is largely based on developments in timber tracking systems and discussions that have taken place within the framework of the ITTO-CITES timber programme. This is a collaboration between the International Tropical Timber Organization (ITTO) and CITES Secretariats, which aims to ensure that international trade in CITES-listed timber species is consistent with their sustainable management and conservation. The programme plays an important role in CITES implementation for tropical tree species such as Afromosia *Pericopsis elata*, mahogany *Swietenia* spp., and ramin *Gonystylus* spp., including recommendations of the CITES Plants Committee and Working Group on the Bigleaf Mahogany and other Neotropical Timber Species. This Working Group, at its fourth meeting in November 2011 (Petén, Guatemala), agreed on the following recommendation:

7. Exporting and importing countries should establish systems to ensure the legality of specimens of the species concerned that are in trade by using chain of custody and traceability systems and identify possible sources of funding to strengthen such mechanisms. Parties are urged to share their experiences in implementing chain of custody and traceability systems for timber (Recommendation 7, PC20 Doc. 19.1).

A key area of focus of the ITTO-CITES timber programme is the development of cooperative and cost-effective regulatory systems for product tracking and chain of custody (PC17 Doc. 16.2 Annex). Phase II (2012 -2015) of the programme has focused, amongst other things, on assisting range States in their efforts to demonstrate that robust chains of custody are in place for products derived from CITES-listed species, including through the use of tracking technologies. In 2012, the ITTO and CITES jointly published a report entitled "Tracking sustainability: a review of electronic and semi-electronic timber tracking technologies" (authored by Seidel *et al.*, 2012), which provides Parties with a compendium of existing timber tracking technologies and detailed information on the features of various systems. The report also incorporates information and recommendations from a Workshop on Tracking Technologies for Forest Governance (Kuala Lumpur, Malaysia, May 2012), which provided an opportunity for participants to share experiences about timber tracking technologies and to learn about the latest developments (ITTO, 2012).

*The following sections draw on information contained in the 2012 ITTO-CITES report and findings of the Workshop, as these provide a comprehensive overview of the status of timber tracking technologies in use (or being developed) in the CITES context, as well as lessons learned and best practices as regards implementation. This is supplemented by experiences from (pilot) projects implemented under the ITTO-CITES timber programme, and CITES Plants Committee discussions. The national case studies (**Section 4.4.4**) are based on a literature review, and information received from relevant authorities.*

4.4.1. Overview of timber traceability systems

A generic traceability system in the timber sector might begin with the application of unique numbers or codes to stumps and logs in a forest concession, through physical marking using paint, waterproof paper/plastic tags, bar codes or RFID tags (**Table 2**). Data may be recorded using a handheld device or on paper, which may be transferred to a database either automatically, or manually at a later stage. At each control point in the supply chain, for example, at the point of felling or removal from the forest, timber may be re-tagged/marked and product information (e.g. length, species and value) recorded and transferred to the database. Data may then be accessed by authorized departments (e.g. via a web-browser) and analysed to verify the number of logs from a single tree and location of the stump, detect non-conformities, verify the logical flow of timber products and/or volume, and ensure that the volume does not increase at any stage (Seidel *et al.,* 2012; **Figure 4**).

As an alternative to physical marking of timber, a mass balance system may be used (see **Figure 5**). Mass balance systems monitor whole batches of timber, based on a systematic understanding of inputs, outputs and accumulations of timber material, without physical marking. Whereas physical tracking is appropriate mainly for larger timber items, such as round wood, mass balance systems allow smaller products (such as smaller pieces of sawn wood, wood chips, etc.) to be tracked and are therefore commonly used for processed material. Mass balance systems are generally less costly than physical tracking systems; however, they may be inappropriate where it is necessary to track an individual product or lot back to its physical origin, particularly if there is a possibility that mixing with high-risk material could occur (Seidel *et al.*, 2012).

Table 2: Methods for the physical marking of timber and timber products

Method	Advantages	Disadvantages
Paint *Serial number hand-painted and stamped onto individual logs and timbers*	• Low cost • Easy to apply • Durable • Can be read at longer distances	• Labour-intensive • Prone to mis-reading and forgery
Plastic tags *Plastic tags printed with unique ID number*	• Low cost • Easy to apply • Increases legibility • Avoids duplication in ID numbers	• Prone to forgery • Less durable (can become damaged or detached from timber) • Inappropriate for roundwood used for pulp or paper processes • Need to be in proximity of the timber to be read
Bar codes *Bar codes fixed to timbers and scanned using reader*	• Automatic transfer of data to database • Relatively low cost • Difficult to forge	• Requires trained staff to operate readers • Connection to mobile phone/ internet network may be required • Bar codes may become detached from product • Need to be in relatively close proximity to the timber to be read
Radio Frequency Identification (RFID) *ID number and product data stored in tag and transmitted wirelessly to reader*	• Automatic transfer of data to database • Resistant to forgery • Dissolvable tags now available for use in pulp industry	• Relatively expensive • Requires trained staff to operate readers • Connection to mobile phone/ internet network may be required • Inappropriate for roundwood used for pulp or paper processes • Need to be in relatively close proximity to the timber to be read

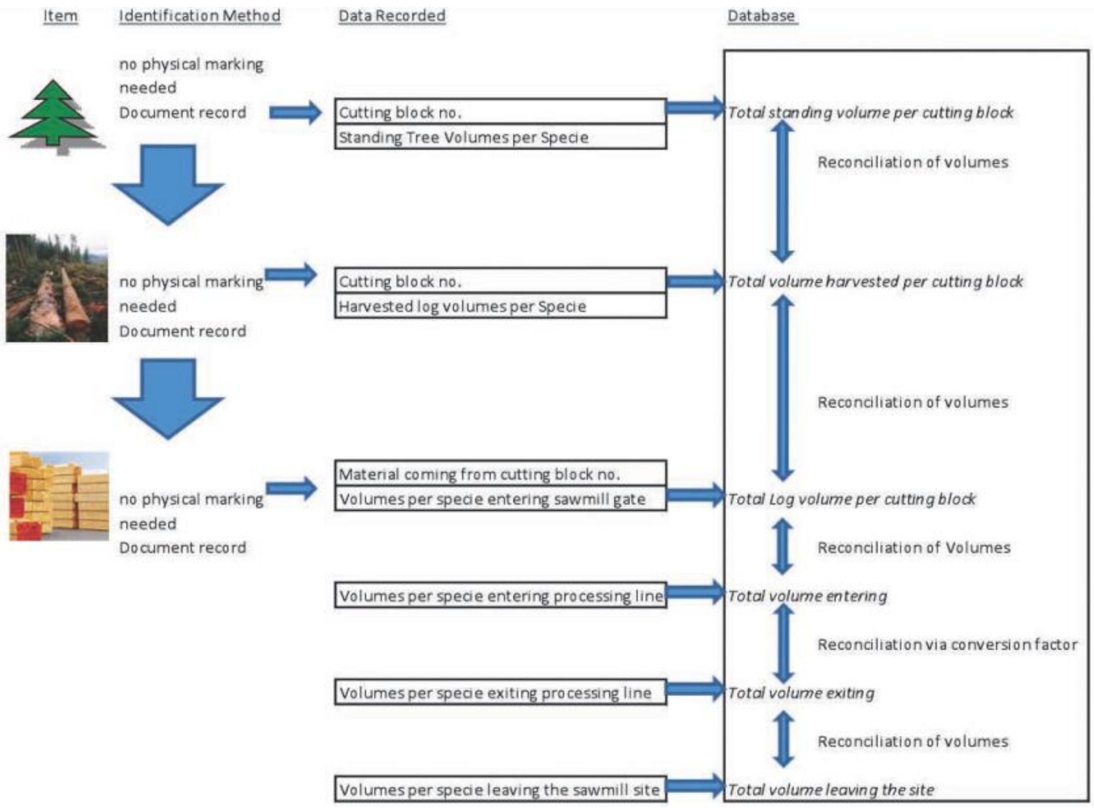
Source: after Seidel *et al.* (2012), ITTO (2012), H.K. Chen, TRAFFIC, *in litt.* (2015)

Figure 4: Core elements of an electronic timber and timber products tracking system

Steps	Description
1. Data collection	The product information is collected at each stage of the supply chain.
2. Data transfer	The data is transferred into the database.
3. Data storage	Data storage in database in order to generate reports and reconcile the data.
4. Data Analysis	Non conformities are detected through reconciliation of the data.

Source: Seidel *et al.* (2012)

Figure 5: Illustrated concept of a mass balance system



Source: F. Seidel in Seidel *et al.* (2012)

4.4.2. Challenges

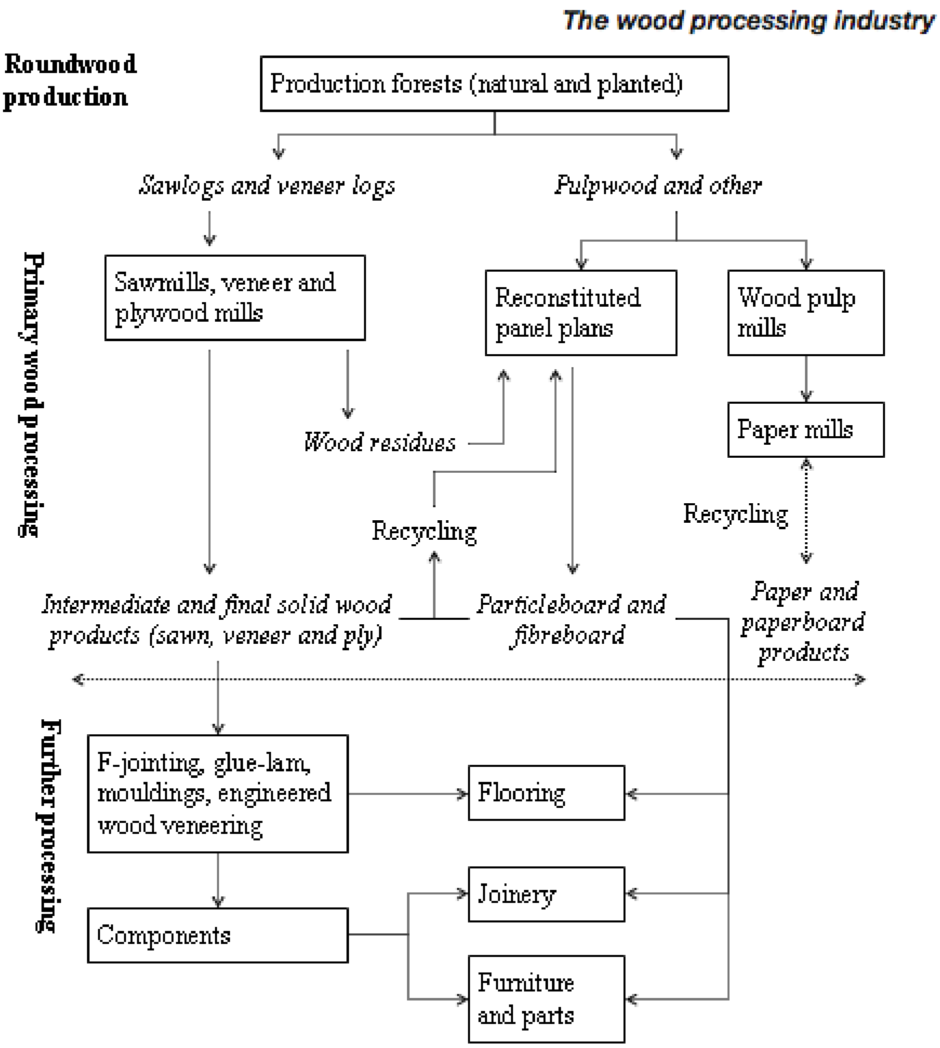
Tracking flows of CITES-listed timber and timber products, from areas of harvest to consumer countries, presents a significant challenge for reasons including:

- The range of products in trade. Tracking is more simple where the CITES-listing is restricted to products such as logs, sawn wood, veneer sheets and plywood (e.g. for Bigleaf Mahogany *Swietenia macrophylla*), but more complex where processed products are involved (e.g. the listing for ramin *Gonystylus spp.* extends to all products other than seed, seedlings or tissue cultures) (PC17 Doc 16.2 Annex)[34].
- The complexity of timber supply chains, for example, due to the mixing of wood from multiple concessions, regional transshipment and different stages of processing in different locations (FAO Forestry Department, 2012, in ITTO, 2012; H.K. Chen, TRAFFIC, *in litt.*, 2015). A generalized timber supply chain is depicted in **Figure 6**, with further detail provided in **Figure 7.**
- Challenging physical environments, especially for marking of tropical species in the tropical rainforest (Forestry Department Peninsular Malaysia, FDPM, 2010a)
- Weak infrastructures, e.g. roads, communications, network, internet connectivity, controls, etc. (Seidel *et al.*, 2012)
- Range of background and skills of forest operators (FDPM, 2010a), weak staff training (IT systems, literacy, etc.) (Seidel *et al.*, 2012)
- Variety of authorities involved in forest management and enforcement; low governance capacity/verification through government systems (Seidel *et al.*, 2012)
- Tracking systems can incur additional costs (e.g. hardware, software, training, labour costs etc.) without guarantee of higher revenues or price premiums, and require sustained funding to stay operational (Seidel *et al.*, 2012)

[34] Listings of species in the CITES Appendices may be annotated (i.e. a note attached) to indicate which parts or derivatives are concerned by the listing. This has been most widely used for listings of plants and timber.

- Insufficient incentives for a complete tracking system throughout the timber supply chain to be realized (Seidel *et al.*, 2012), for example, government revenues only accrue from forest to primary processing.

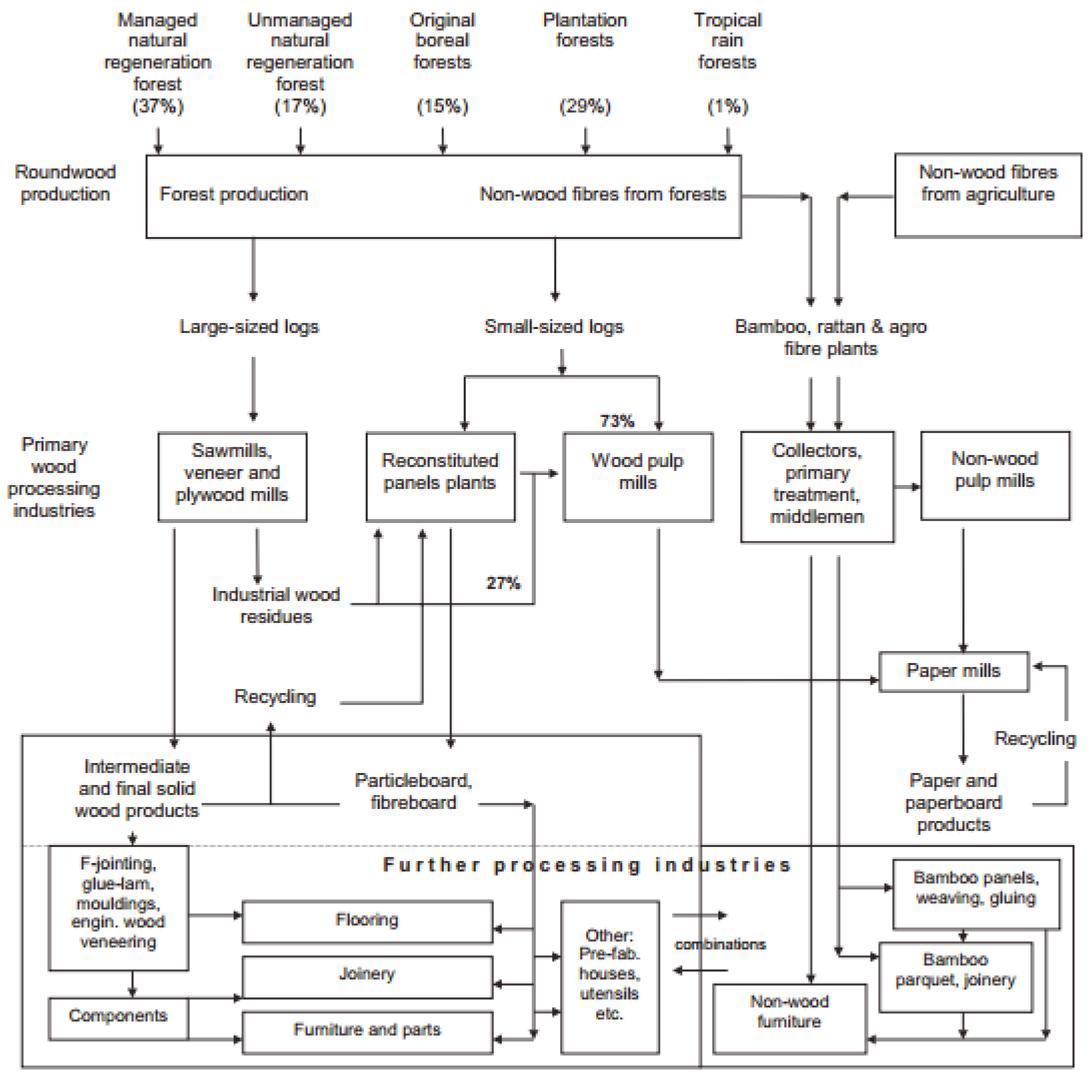
Figure 6: Generalized timber supply chain



Source: United Nations Conference on Environment and Development (UNCTAD), adapted from International Trade Centre/ITTO. *Tropical Timber Products: Development of Further processing in ITTO Producer Countries. Geneva: ITC/ITTO, 2002.* Available at: http://www.unctad.info/en/Infocomm/Agricultural_Products/Bois_tropicaux/Marketing-chain/

Figure 7: Detailed timber supply chain

Figure 1 Raw material and product flows in forest industries



Source: Based on ITTO PPD 11/92 (I), added to by ITC with ITTO permission, 2001.

Note: Percentage figures on raw material flows as reported by IIED (1996).

Source: Tropical Timber Products: Development of Further processing in ITTO Producer Countries. Geneva: ITC/ITTO, 2002

4.4.3. Progress of activities for CITES timber

Traceability systems implemented for CITES-listed timber vary widely across countries. As CITES does not prescribe specific traceability requirements for CITES-listed timber, Parties have considerable latitude to develop systems appropriate to their national contexts. These range from paper-based systems, to systems involving centralized web-platforms and/or integration of electronic tracking technologies such as RFIDs. DNA and isotope methods are also being explored as a means of strengthening compliance with existing systems.

(a) Electronic tracking systems

Recent discussions in CITES and under the ITTO-CITES programme have focused on the use of electronic timber tracking systems as a means of improving implementation of CITES for timber species and addressing the limitations of paper-based systems (ITTO, 2012). Progress towards more robust and reliable tracking systems has also been prompted by requirements to demonstrate legal origin of timber for access to key consumer markets, for example, under the EU Forest Law Enforcement, Governance and Trade (FLEGT) Action Plan and US Lacey Act (ITTO, 2012). Potential benefits of electronic tracking systems include improved transparency in trade chains, strengthened chain of custody and increased efficiency of exchange of enforcement intelligence information between agencies (CITES Secretariat, 2012, in ITTO, 2012).

Electronic tracking systems for CITES-listed timber can be developed at the individual operator level (i.e. by each company involved in production and trade) or a "new" system developed centrally, e.g. at the regional or national level by integrated timber businesses or government. While individual systems can cause issues for interoperability/linking of supply chains, developing a new, centralized system can require significant know-how and government investment (PC21 Inf. 9). An alternative is to use an existing, "off the shelf" system, with the addition of specific functionalities appropriate to the particular context. Such systems can often be integrated with existing infrastructure and may present a more efficient and cost-effective alternative for supply chain stakeholders, in terms of development and deployment (PC21 Inf. 9).

Examples of existing electronic tracking systems that may be used/adapted for CITES-listed timber include: the Timber Tracking Platform (RADIX Tree) developed by Global Traceability Solutions (GTS); CI World™ developed by Helveta Ltd; and Track Vision developed by Track Record Global Ltd. The features of these and other technological solutions are provided in detail in Seidel *et al.* (2012). Country case studies of electronic/semi-electronic systems in place for CITES-listed timber species are provided under **Section 4.4.4.** below.

(b) DNA and isotope methods

The past decade has seen significant advances in DNA analysis and isotope methods for verifying the declared origin of timber in trade. These methods are being used increasingly to verify the accuracy of documentation accompanying flows of timber, as a means of strengthening existing traceability and chain of custody systems (ITTO, 2012).

Advantages of DNA analysis and isotopic methods include (ITTO, 2012; Seidel *et al.*, 2012):

- resistance to forgery (manipulation of traits inherent to wood is not possible);
- ease of integration with and strengthening of existing tracking systems (e.g. focus on high-risk sections of supply chains);
- samples can be taken at any point in supply chains, including from processed products.

However, a key constraint is the need to establish very large reference databases for most methods (if individual samples of each specimen/product are not taken and preserved for reconciliation and verification of the supply chain back to the stump), the cost of which may be prohibitive for companies during the initial phases of development. However, some governments are providing funding and effort to build databases for selected timber species (ITTO, 2012).

An overview of these methods is provided below. For further discussion and analysis see the Annex to PC21 Doc. 15 and ITTO (2012)

DNA analysis

There are three main scientific approaches applicable to timber identification and tracking involving DNA analysis (Lowe and Cross (2011); Geach *et al.* (2011)):

- DNA barcoding (developing genetic markers for species identification)
- Population genetics/genographic mapping (country/area of origin)
- DNA fingerprinting (identification of individuals)

DNA barcoding is relatively fast and cheap to develop for new species, however genographic mapping is a slower and more costly process (J. Geach, DoubleHelix, pers, comm., 2014, cited in PC21 Doc. 15 Annex), requiring the establishment of comprehensive reference databases for all species of interest (Seidel *et al.*, 2012).

In the context of origin determination for timber tracking, a DNA sample is taken at any control point along a timber supply chain and compared with a genographic map to establish the material's area of origin. Alternatively, the sample is physically paired against samples taken from timber/timber products at previous control points in the chain (e.g. from the same tree prior to harvest). For this latter option, establishment of a reference database is not required (Seidel *et al.*, 2012).

An overview of recent developments in DNA techniques and their application in the tracking and identification of CITES-listed species is provided in the Annex to PC21 Doc. 15. These include an ITTO-CITES pilot project to implement DNA traceability systems for *Pericopsis elata* in forest concessions and sawmills in Congo and Cameroon, which was implemented in 2013-2014 jointly by ANAFOR (National Forestry Development Agency, Cameroon), CNIAF (National Centre for Forest and Fauna Inventory, Congo) and Double HELIX Tracking Technologies Pte Ltd. The project involved the development of genetic markers for *P. elata* suitable for DNA fingerprinting, as well as capacity-building and training of local teams in DNA sample collection and storage (Sosa Schmidt, 2013b; ITTO-CITES newsletter, February 2015).

Stable isotope method

Isotope methods for timber tracking involve the identification of an isotope profile for a particular geographic area based on isotopes found in the soil. Samples taken from timber or timber products can then be traced to their location by analysing the isotope profile against the profile for a particular area. The precondition is that the isotopes for a region are already known, defined and registered (Boner, 2013).

Stable isotope methods have been tested in several projects of relevance for CITES-listed timber. For example, a stable isotope database of teak and mahogany species has been developed by Agriosolab in Germany, and tested with samples from Southeast Asia, India and Latin America which confirmed the reliability of this technique (Agriosolab, 2012, in ITTO, 2012). An international reference database for teak and mahogany is expected to be completed by the end of 2015, which could be used routinely for tracing the origin of CITES timber (Agriosolab, 2012, in ITTO, 2012). Additional information on isotope analysis can be found in the Annex to PC21 Doc. 15, as well as ITTO (2012) and Seidel *et al.* (2012).

4.4.4. National case studies

This section provides an overview of timber traceability systems that have been implemented (or the subject of pilot projects) for CITES-listed timber in selected national contexts. These case studies were considered to provide a range of potentially relevant experience for the development of electronic or semi-electronic traceability systems for other CITES commodities. It is noted, however, that similar developments are being seen across a number of other CITES Parties, including in Indonesia (introduction of an online tracking system, SIPIHH[35], in 2009, and national timber legality verification system, SVLK, in 2013) (Hoare and Wellesley, 2014) and Cameroon (development of a computer-based tracking system under Cameroon's FLEGT initiative with the EU) (ITTO-CITES Newsletter, June 2013).

(a) Malaysia

Ramin *Gonystylus* spp. is a tropical hardwood found in peat swamp forest habitats. It is one of the most valuable timber species harvested in Malaysia, being widely used for furniture, picture frames and indoor crafting (FDPM, 2010b).

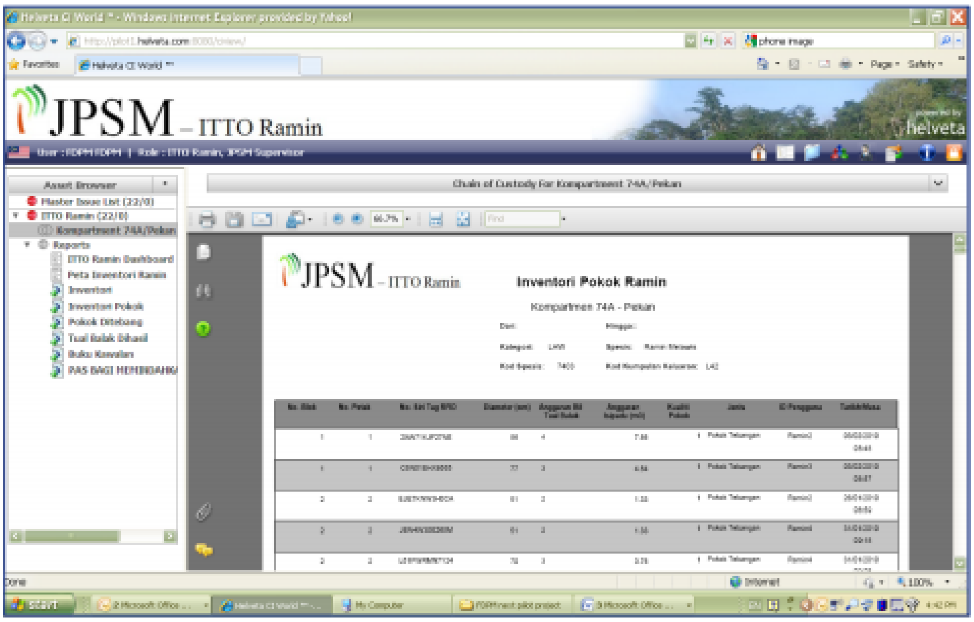
A timber tagging system based on plastic tags and bar codes has been used for many years in Peninsular Malaysia, with considerable merit (FDPM, 2010b). However, large components of the system are manual and paper-based, as a result of which monitoring can be cumbersome and validation/verification cannot be undertaken effectively on a remote or volume basis (FDPM, 2010b). In addition, bar code technology has had several limitations such as: prone to damage, reader operations affected by moisture, requirement of clear line of sight, and inability to read/write information or to add information to a printed bar code (FDPM, 2010b).

To address these concerns, a project to develop a Ramin timber monitoring system using RFID technology was implemented in Peninsular Malaysia between 2008 and 2010, under Phase I of the ITTO-CITES Programme. The project aimed to develop a customized, cost-effective monitoring system based on RFID technology, and an automated detection and notification mechanism for tracing non-compliance using hand-held computers with an RFID scanner system (FDPM, 2010b). RFID scanners were considered more accurate than other methods (e.g. when scanning all logs on a truck), more able to withstand harsh environments, and provided the opportunity to include additional load specific data to strengthen the chain of custody. Other benefits of RFID technology were considered to include: the ability to read over a longer range (no line of sight requirement), provision of greater storage capacity and real-time tracking capability (FDPM, 2010b).

FDPM opted for a commercial, off the shelf, RFID software solution (CI World™) as the platform for the RFID Ramin Monitoring System. The system was deployed by a nominated concessionaire in Pekan Forest Reserve, Pahang, during tree inventory operations, felling, scaling and log transportation from log yards to the forestry checking station. At each control point, data were captured by or entered into the RFID handheld application and sent wirelessly to the central server system. The data could then be accessed via an online interface (with a User ID and password), through which reports could be viewed for different control points across the supply chain. Alarms were set to automatically detect non-conformities, e.g. duplicate RFID numbers, changes in species or diameters (FDPM, 2010a). **Table 3** provides an overview of the procedures at each control point, the data captured, the contents of the reports generated and any comments/issues regarding implementation at each stage. Screen captures of the reports generated at the Tree Inventory and Removal Pass stages are included at **Figure 8**.

[35] The full name is the Information System for Forest Products Administration. See Ministry of Forestry Regulation No. P.8/Menhut-II/2009.

Figure 8: Tree Marking (Inventory) Report and Removal Pass Report



RFID Ramin Monitoring System – Tree Marking (Inventory) Report

RFID Ramin Monitoring System – Removal Pass Report

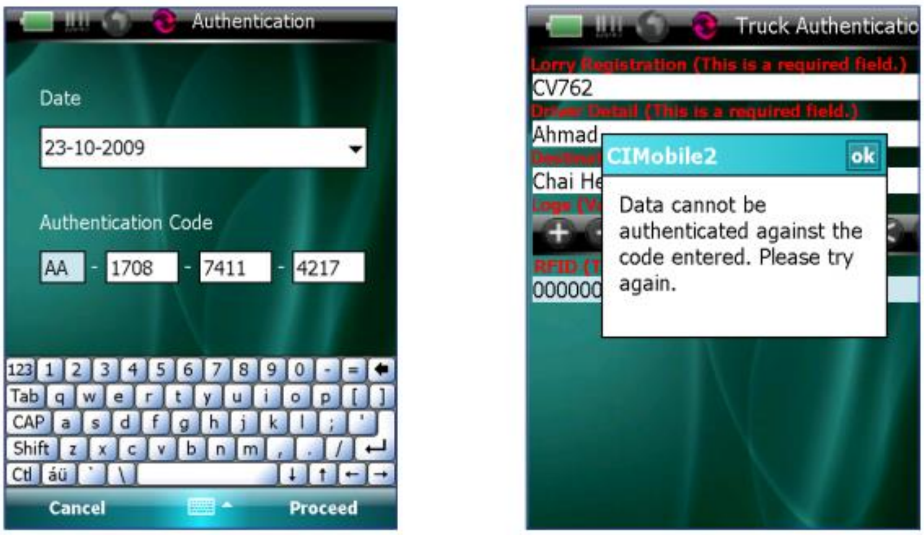
Source: FDPM (2010b)

Table 3: RFID Ramin Timber Monitoring System Control Points (after FDPM, 2010a)

Control point	Procedure	Report	Content of report	Comments/issues
Forest inventory	Boundary demarcation; RFID tagging of Ramin trees; details of each tagged tree recorded using handheld devices.	ramin inventory report	RFID tag number, tree species, diameter, estimated logs produced, log quality, block and box location	*No issues in applying handheld RFID application. Contractor tagged trees and collected data without much assistance.*
Tree felling	Log licence issued; trees designated for removal felled; data captured using handheld computer; another RFID tag fixed to long logs; logs excavated from forest.	ramin felling report	Information of the standing tree RFID label and fallen tree RFID label	*Chainsaw operators applied and scanned RFID tags effectively. However, tags prone to loss or damage during excavation.*
Temporary log yard	Cross cutting (logs divided into shortened, cross cut logs); RFID tags scanned; additional tags affixed to cross cut logs and scanned.	Log production report	Information on the number of logs being cross-cut: standing tree RFID label, RFID labels of logs, original estimated number of logs, actual number of logs produced.	*Staff carried out data collection effectively.*
Main log yard	Tags scanned again; data relating to timber entered again using handheld computer.	Log yard control book report	Lists all logs reaching main log yard. Information includes date, concession area, tree species, log RFID tag number, log length and diameter, estimated/actual number of logs produced.	
Forest checking station	Lorry stops at assigned forest checking station to declare logs being removed from concession: • Details of logs and truck information entered into handheld - provided no discrepancies, truck issued with Removal Pass, proceeds to mill. • Unique authentication code generated by handheld application, written on Removal Pass. • Forestry tax assessed based on log volume and species.	Removal Pass report	Information about log species, log RFID tag number, log length, diameter and volume, defects information, royalty rate, checking station details.	*System has expedited Removal Pass issuance (wireless mobile broadband and connection with PC via docking station, allows RFID handheld system to synchronise and send data directly to central database. Officer can log into system to produce and print Removal Pass physically at checking station). Authentication code functionality is available in "offline" mode and has significantly improved removal pass security.*

Monitoring and checking of Removal Passes and royalty invoicing was carried out by FDPM enforcement officers using the handheld verification system. To improve the security of the system, a unique authentication code was generated using the RFID handheld application and included on each Removal Pass. The combination of unique authentication code, Removal Pass identification number and RFID tag data could then be used by enforcement officers (in offline mode) to verify the legitimacy of the load at any point along the transport route (see **Figure 9**; FDPM, 2010b).

Figure 9: Use of authentication code to verify legitimacy of load



Authentication Code Verification (1) Authentication Code Verification (2)

Source: FDPM (2010b)

The project found RFID technology to be a useful instrument to provide fully documented and effective timber tracking from forest to mill. Key successes of the project have included the automated verification of chain of custody data and legality compliance, accessibility of digitized paper documentation for validation by a range of stakeholders, offline enforcement functionalities and scalability to handle the volume of marking and legality assurance data required (FDPM, 2010b).

In terms of findings/lessons learned from this project (FDPM, 2010a, 2010b):

- The project demonstrated the value of an off the shelf, configurable application, which is cost-effective and can be rapidly deployed and customized to meet varying requirements and improve existing paper-based processes. The CI World™ system was configured over four weeks to match FDPM harvesting processes and Removal Pass procedures.
- One of the most important aspects when deploying a RFID ramin timber monitoring system is to comprehensively study the user requirements in order to make sure the system's specifications are appropriate to the processes and challenges of a specific chain of custody.
- RFID monitoring systems can provide a tool to better share real-time information and documents between district, State and central offices, and facilitate field inspections.
- In order to be efficient, a RFID monitoring system must achieve wide acceptance within the forestry sector. Unless all stakeholders in the forest supply chain agree to participate and actively use the system, its impact will remain limited. The best incentive for stakeholders/industry to adopt a RFID timber monitoring system is to provide a flexible tool than can be easily adapted to internal processes.

- The long-term utilization of the RFID monitoring system will depend substantially on the capacity building, sustained and ongoing engagement of the various stakeholders in the process. Skills and knowledge must be transferred to the State and district levels, as well as to forest concession operators, as they will be performing RFID tagging and using handhelds to read and capture data in the field. Comprehensive training workshops and adequate user guides and manuals are crucial for effective implementation.
- There is a need for detailed analysis of the form of RFID tags best suited for marking and tracking processes in the peat swamp forest. While the price of an RFID tag is a concern, it is estimated that prices will quickly reduce as the tag is deployed in commercial applications and production volumes increase.

In addition, FDPM has made several recommendations for extension of the project and further work, including (FDPM, 2010b; Young, 2013):

- Continuous replication to other management units/states to bring down operational costs.
- Extension of scope of coverage to include transformation processes (i.e. sawmill, ply mill) to further extend traceability along the chain of custody.
- Analysis of RFID system integration with current computer systems, as well as State revenue collection to provide a wider range of monitoring.
- RFID tag management that includes the issuance of unique identifiers in a controlled and auditable manner.

(b) Brazil

Brazil's Forest Origin Document (FOD) system is a monitoring and control system operated by the Brazilian Institute for Environment and Renewable Natural Resources (IBAMA) since 2006. Under the system, an electronic document is required for the transportation and storage of products and by-products of Brazilian native ecosystems, including forest products from CITES-listed tree species. All processes of transformation and consumption of forest products[36] are controlled, for example the use of wood as a raw material in the furniture industry or in construction. However, finished goods, such as doors, windows, furniture or other goods characterized in the final stage of manufacturing, are exempt (Seidel *et al.*, 2012).

The DOF system is managed through a centralized, online database, which allows for integration with systems developed at the State level. Credits are generated when a State authority issues a logging authorization to a landowner or operator, and are transferred to a tracking system (either the DOF or other State system). The tracking system then generates the transport documents that must accompany the timber along the chain of custody (Wellesley, 2014). All transactions are recorded in real time (Seidel *et al.*, 2012).

The DOF system serves as a tool for the monitoring of timber production and trade, providing information on the volume of products and by-products throughout the supply chain (from transportation to conversion, including storage) and supporting law enforcement actions through the provision of information for real-time analysis and decision-making (Seidel *et al.*, 2012). The system is open to use by all federal environment agency (IBAMA) offices, as well as by State agencies, police and prosecuting counsel (Seidel *et al.*, 2012). Compared to the previous, paper-based licence system (ATPF – Forest Product Transport Authorization), the DOF system offers a more cost-effective, transparent and secure system for timber monitoring and control (Seidel *et al.*, 2012). The development cost of the system has been estimated by IBAMA at around USD261 000 (excluding hosting hardware and services) and transfer to other countries through Bilateral Cooperation Agreements is being explored (Seidel *et al.*, 2012).

[36] Such as wood in logs, bolts, posts, bracing, stump, sleepers, poles, fence posts, logs, chips, boards, blocks, firewood, charcoal, laminates, flooring, parquet decking (Seidel *et al.*, 2012)

According to a 2010 Chatham House assessment, Brazil was considered particularly strong in terms of the use of timber-tracking technology compared to the other producer countries under review (Wellesley, 2014). However, in recent years there has been a loss of confidence in the integrity of the DOF system and its ability to prevent illegal production and fraud, for example due to (Wellesley, 2014):

- reports of computer hacking and entry of false information into the system;
- concerns regarding the rate of conversion of logs to sawn timber employed by the system (the conversion rate of 45% is thought to be 10-20% higher than actual conversion rates, allowing additional timber volume credits to be traded or transported);
- weak implementation of CONAMA Resolution No. 406/2009 (requiring systems operating at the State level to be linked to the central DOF system), which has hampered the ability of the various systems to monitor trade effectively;
- inability of civil society and other stakeholders to verify official documents related to production and processing (only transportation documents are available online), which has limited the use of the system as a tool for independent monitoring of compliance with forest-sector regulations.

As a result of concerns about fraud and abuse of the system, a 2014 Chatham House assessment emphasized that improved monitoring and auditing of the system are urgently needed, including evaluations of the DOF/State systems themselves and carrying out spot checks on the ground (Wellesley, 2014).

(c) Guatemala

Information in this sub-section was provided to TRAFFIC by César Beltetón Chacón of CONAP (the Guatemalan National Council of Protected Areas) in June 2015, unless otherwise indicated.

Guatemala's Automated System on CITES Timber Flora management is managed jointly by CONAP (the Guatemalan CITES Management Authority and Scientific Authority) and was developed locally by CONAP using government funds.

The CONAP system applies only to CITES species and provides information to be considered for the granting of CITES permits/certificates, including on: (i) the origin of the product to be exported; (ii) the verification of the shipment prior to transfer to the port of departure; (iii) the transportation of the product to the port of departure; and (iv) volumetric and trade information. The system also contains a database of permits and certificates in downloadable form (C. Beltetón Chacón, 2013, cited in Chatham House, 2013). Information can be consulted via the CONAP website[37] by authorities in Guatemala (e.g. Customs when verifying the accuracy of CITES documents), by importing countries prior to a shipment's arrival, and by the general public.

All stages of the supply chain are covered by the system, from the authorized volume of standing trees, through transportation of logs to industry, and transformation of roundwood to sawn wood, veneer and plywood for export. However, as finished products are not included in the CITES listings for timber species of relevance to Guatemala, these are not covered by the system. For each stage of the supply chain, national legislation provides for the issuance of a document certifying the legality of the activity concerned, for example, decisions approving forest management plans and licences in the case of exploitation, or decisions approving yields for wood transformations. Timber/timber products are not marked, however must be accompanied by a packing list for verification. In addition, all authorized shipments of timber are inspected and labeled with a CONAP-CITES security label (C. Beltetón Chacón, 2013, cited in

[37] http://www.conap.gob.gt/index.php/servicios-en-linea/manejo-forestal/permisos-certificados-cites-flora-maderable.html

Chatham House, 2013). Currently, documents arising from the verifications of shipments are transferred through a scanner and uploaded to an online system. Training is provided on use of the system to relevant authorities/technical personnel.

Key strengths of the system include the ability to assess legal origin of products entering the market at each stage of the supply chain, as well as improved transparency at all stages of production and greater credibility for the forest sector. In developing the system it was considered essential to achieve consensus among the entire sector to make information publicly available, to ensure the system was as transparent as possible. Constraints to the system include the lack of technical infrastructure, as well as the high costs associated with implementation.

4.4.5. Lessons learned and best practices

This section provides a summary of a number of lessons learned and best practices for developing and implementing effective traceability systems for CITES-listed timber species. For further analysis and more detailed discussion, it is recommended to consult the 2012 ITTO-CITES report (Seidel *et al.*, 2012) and Workshop findings (ITTO, 2012).

System development/design

1. Controlling raw product is generally most efficient and straightforward; therefore controls should start and be focused at the early stages of the timber industry (Sosa Schmidt, 2013c).

2. The self-development of a system can require a long trial phase before it can become operational (Seidel *et al.*, 2012). Off-the-shelf solutions can offer a cost and time-efficient solution in terms of development and deployment for both large and small supply chain stakeholders. Such solutions are generally flexible (ITTO, 2012) and can be scalable to cover all types of supply chains (PC21, Inf. 9). However, harmonization of technical standards should be promoted as far as possible (ITTO, 2012).

3. Tracking systems can be relatively easily integrated within current chain of custody systems (ITTO, 2012) and should be incorporated into existing structures such as management, accounting and payment systems (Seidel *et al.*, 2012). If designed as standalone systems, there is the risk that work could be duplicated, resulting in additional costs (Seidel *et al.*, 2012).

4. Poorly designed timber tracking systems can lead to dysfunctional and ineffective systems. A carefully monitored and evaluated trial phase is essential for any tracking system, in order to evaluate that the design of a tracking system is able to cope with the field challenges (Seidel *et al.*, 2012). In the planning phase, developers must have a good understanding of on the ground conditions, such as the quality and availability of internet connections, and the system must be adapted accordingly (Seidel *et al.*, 2012).

5. Compatibility with upstream/downstream systems, including industry developed systems, and with other countries' systems, should be considered, where relevant (ITTO, 2012).

Transparency and security

6. Security measures required for systems and additional verification methods need to be chosen according to the local/national context. Additional verification methods may be necessary if instances of fraud encountered are high (Seidel *et al.*, 2012).

7. A certain level of confidentiality and data security needs to be maintained in timber tracking systems to maintain confidence and ensure that all suppliers participate (Seidel *et al.*, 2012).

8. Countries should ensure relevant information (transport authorisations, Customs clearances, etc.) from tracking systems is made available in a transparent manner (e.g. user-friendly web-based systems) (ITTO, 2012).

Technology

9. Timber tracking technologies must suit local communication infrastructure, be robust and abuse resistant, cheap, effective and user-friendly (Helveta, 2012, in ITTO, 2012).

10. The level of technology used must be appropriate to each individual country/industry and adequate capacity building needs to be undertaken to ensure sustainability and local ownership of the system after any pilot phase (ITTO, 2012). It is important to ensure that adequate capacity exists before adopting technologically advanced systems (ITTO, 2012).

11. Timber tracking systems using bar codes and handheld PCs for data capturing processes are well-developed and have reached the operational stage in forestry and many other sectors. This standard method should be considered before moving to more advanced methods (Seidel *et al.*, 2012).

12. New technologies such as DNA and isotope analysis can help to verify the accuracy of information in tracking systems (Johnson, 2013).

13. Whichever tracking system is employed, the system should be open to upgrading as improved technologies become available (ITTO, 2012). Electronic tracking systems need to stay up to date and incorporate new technologies in order to remain compatible with state of the art software and technological developments (Seidel *et al.*, 2012).

Costs and incentives

14. The costs and effectiveness of any tracking system to be deployed must be assessed closely. Electronic tracking systems are generally expensive and external funds are often required to establish infrastructure in tropical timber producing countries (ITTO, 2012).

15. Incentives could be considered for the establishment of tracking systems. These include tax incentives, legal requirement for tracking systems, support for smallholders, and priority recognition of companies with tracking systems in licensing processes (ITTO, 2012).

Stakeholders

16. Implementing a timber tracking system requires many stakeholders to accept changes in practices to incorporate a new way of handling timber and timber products (Seidel *et al.*, 2012). Prior to deploying a system, consultations must be held with relevant stakeholders in order to come out with a common workable system. Particular attention must be paid to challenges faced by smallholders in understanding and implementing such systems (ITTO, 2012).

Governance

17. Timber tracking systems cannot overcome weak governance. If legal systems are weak, timber tracking systems alone will not be able to reduce fraud and combat illegal logging (Seidel *et al.*, 2012)

5. Assessment of the use of traceability systems for commodities of CITES Appendix II-listed shark species

5.1. Traceability systems and sharks

5.1.1. Role of traceability in supporting CITES implementation for shark species listed in CITES Appendix II

At CoP16, the CITES Parties agreed to list the following seven species of shark and ray in CITES Appendix II: Oceanic Whitetip shark *Carcharhinus longimanus*; Porbeagle *Lamna nasus*; Scalloped Hammerhead shark *Sphyrna lewini*, Great Hammerhead shark *Sphyrna mokarran*, and Smooth Hammerhead shark *Sphyrna zygaena* (collectively, the "Hammerheads"); and the Manta rays *Manta birostris* and *Manta alfredi*. These listings came into force on 14 September 2014, joining the Basking Shark *Cetorhinus maximus* (listed in 2003), Whale Shark *Rhincodon typus* (listed in 2003) and Great White Shark *Carcharodon carcharias* (listed in 2005) in CITES Appendix II. It is noted that the Sawfish family, Pristidae, are all listed in CITES Appendix I, which prohibits commercial trade.

Under Article IV of CITES, an export permit must be issued by the Management Authority of the State of export for the international trade in products of the shark species listed in CITES Appendix II. As discussed above, an export permit cannot be issued until the Management Authority has advised that the specimens were legally acquired, and the Scientific Authority of the State of export has developed an NDF. In the case of specimens caught on the high seas (i.e. areas outside of the jurisdiction of any State), specific provisions ("Introduction from the Sea") are set out in Articles IV.6 and 7 of CITES and *Resolution Conf. 14.6 (Rev. CoP16)*:

- An NDF is required for specimens landed in the State to which the vessel is flagged (Flag State), in order for the Management Authority of the "State of introduction" (Flag State) to grant an Introduction from the Sea (IFS) certificate. Also the State of Introduction should take into account whether or not the specimen was or will be acquired and landed: i) in a manner consistent with applicable measures under international law for the conservation and management of living marine resources, including those of any other treaty, convention or agreement with conservation and management measures for the marine species in question; and ii) through any illegal, unreported or unregulated (IUU) fishing activity;
- For specimens landed in a different State to the Flag State, the provisions of Article III, paragraphs 2 and 3, or Article IV, paragraphs 2, 3 and 4, respectively, should be applied. This means, as in a "normal" import-export trade transaction, an NDF and a legal acquisition finding will be required in order for the Management Authority of the Flag State to issue an export permit (Mundy-Taylor *et al.*, 2014).

As described in **Section 3** above, traceability can assist national CITES authorities in determining the legal acquisition of a shark specimen intended for international trade and in the development of an NDF:

- In the context of a legal acquisition finding, a traceability system can link a specimen to be exported with a "legal origination process", defined as a legal procedure, such as a landing certificate, which creates a document trail to prove the legal origin of the raw material (Lehr *et al.*, 2015). A robust system of traceability reduces the likelihood of illegally harvested product entering legal trade (Willock, 2004).
- In the context of NDF development for shark commodities, a traceability system not only offers the possibility of linking a specimen to the area of production/harvest (e.g. FAO or ICES catch area, if reported correctly), but also for using trade statistics as a proxy for catch volumes per area (Lehr *et al.*, 2015), which may be useful where catch data (or fisheries

independent data) are not available to assess the severity of fishing pressure on the stock of the shark species concerned (Mundy-Taylor *et al.*, 2014).

In addition, traceability systems implemented for CITES species offer an opportunity to gather specific information that can be fed back for the purposes of adaptive management and to strengthen future NDFs for the species, in line with the recommendations of the 2008 International Expert Workshop on CITES NDFs in Mexico[38]. In some circumstances when an NDF is issued, conditions may be set to gather more information through the permitting process, for example, on catch quantities, location of catch, etc. The collection of samples during the tagging/labelling process (as part of a traceability system) can allow for more accurate information to be obtained on species, sex ratios and ocean from which the individual was caught, through application of new DNA and isotope techniques. Close-kin DNA techniques also allow for estimates of abundance to be determined (for many shark species there are no current estimates of abundance).[39]

While traceability has applications for both legal acquisition findings and NDFs, the main objective of a traceability system implemented in support of the CITES shark listings is to reduce the risk of illegal material entering into legal chains (Lehr *et al.*, 2015). Traceability can also support monitoring and control throughout the trade chain, for example, facilitating Customs verifications and inspections.

5.1.2. Traceability of wild-caught fish products

This section considers a number of principles that can guide the design of robust traceability systems for wild-caught fish (seafood) products. These will provide a framework for the analysis of application of CITES traceability schemes to shark products in **Section 5.2.2**.

In addition, recent initiatives have defined principles and (draft) best practice guidelines to be considered when establishing traceability systems for supply chains for wild-caught fish products and should be consulted for more detailed information:

- Lehr, H. *et al.* (2015). Traceability study in shark products. Report prepared for the CITES Secretariat.
- Draft best practice guidelines for traceability – presented at the Fourteenth Session of the FAO Committee on Fisheries (COFI) Sub-Committee on Fish Trade (COFI:FT) (Bergen, Norway, 24-28 February 2014). Available at: http://www.fao.org/cofi/29510-0d3ea0e690044579673debe9c27579459.pdf. The recommendations aim to assist operators in the creation of reliable, simple, clear and transparent traceability systems.
- Recommendations for a Global Framework to Ensure the Legality and Traceability of Wild-Caught Fish Products – Final Report, March 2015. Prepared by the Expert Panel on Legal and Traceable Wild Fish Products, a multi-disciplinary expert group convened by WWF. Available at: http://solutions-network.org/site-legaltraceablefish/
- Traceability Principles for Wild-caught Fish Products. WWF, April 2015. Available at: https://www.worldwildlife.org/publications/traceability-principles-for-wild-caught-fish-products

The design of a traceability system for wild-caught fish products will vary depending on the requirements of a particular product or context. However, three principles effectively summarise the core elements necessary for the efficient implementation of any traceability system: (i) unique identification; (ii) data capture and management; and (iii) data communication. These principles

[38] Fishes Working Group. See: http://www.conabio.gob.mx/institucion/cooperacion_internacional/TallerNDF/taller_ndf.html

[39] Kinship between individuals of the same species may be used as an indicator of stock abundance, which could particularly assist with the NDF process for shared stocks (C. Davies, CSIRO, pers. comm., 2015). See, for example: http://frdc.com.au/research/Documents/Final_reports/2007-034-DLD.pdf

provided the framework for a recent FAO analysis of traceability practices in the seafood sector (Andre, 2013), which informed the development of the above draft best practice guidelines (FAO, 2014). Further discussion is also provided in Lehr *et al.* (2015).

Principle 1: Unique identification

Traceability systems require that any unit in the supply chain be uniquely identified. The definition of a unit may vary between products. A unit may refer to an individual specimen or a lot or batch (defined quantity produced at a certain time and placed in a uniform manner – Peterson and Green, 2007). The identification format should be clearly defined, bear some meaning, be verifiable and should accompany the product at all times, for example, on the label, packaging, container or accompanying document. The size of the traceable unit (e.g. one shark or several sharks) is commonly called the precision of a traceability system (Lehr *et al.*, 2015).

Any actor (operator) in the supply chain that modifies the product or may have an impact on the product (e.g. by mixing or splitting the lots) must also be uniquely identified. The identification format should again be meaningful, and may take the form of a production licence or other form of authorization, which could be integrated into wider registration/licensing procedures.

Principle 2: Data capture and management

Reliable and comprehensive data must be captured and recorded along the supply chain, and throughout multiple product transformations, such as splitting and mixing of lots, or discarding of parts of lots (as is common in food supply chains). This includes data capture within an organization, e.g. during processing (*internal traceability system*), as well as data capture, management and communication between steps of a supply chain (*external traceability system*). A system of data capture and management may be established by an individual operator, by a group of uniform operators, or by operators along an entire supply chain.

Key Data Elements (KDEs) refer to the essential information from a traceability perspective that needs to be captured along a supply chain. The precision and amount of data to be captured will depend on the purpose of the traceability system and needs for documenting compliance with legal requirements (see UN/CEFACT FLUX Project[40]). Nevertheless, minimum information standards for wild-caught fish products have been recommended, which cover the "who, what, where, when and how" of fishing, including primary information about vessel registrations, fishing licences and catch documentation sufficient to provide strong evidence of legality (Expert Panel on Legal and Traceable Wild Fish Products, 2015).

Critical Tracking Events (CTEs) are the points along a seafood supply chain at which fish products change form, location or ownership, and identify the stages at which capture of KDEs is vital to a successful traceability process (Expert Panel on Legal and Traceable Wild Fish Products, 2015). Traceability requires that KDEs recorded at the beginning and end of a transformation process link inputs to outputs (Lehr *et al.*, 2015).

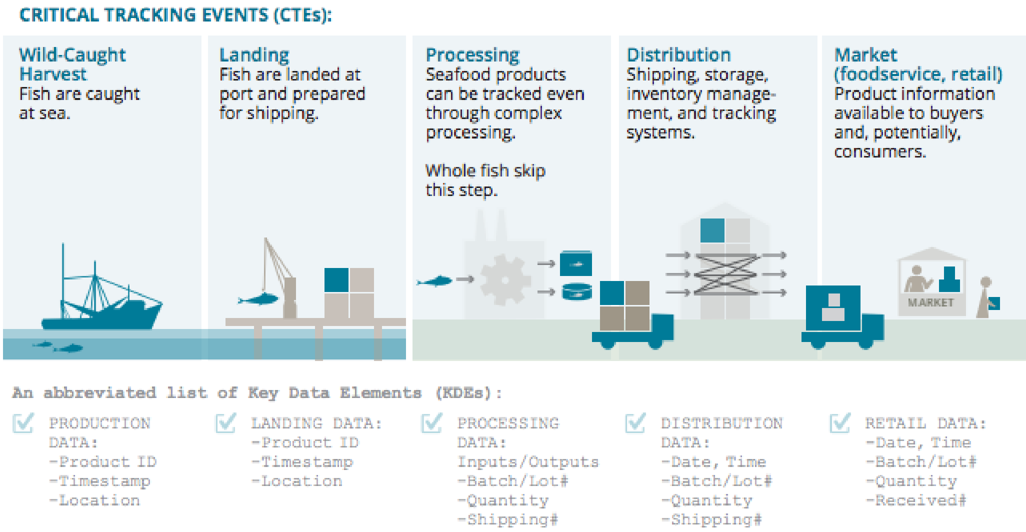
An overview of KDEs and CTEs for seafood traceability is provided in **Figure 10**.

Mechanisms for verifying the reliability of data captured at each CTE are also essential for ensuring the robustness of any traceability system. The type of traceability solution selected, e.g. paper-based, semi-electronic or fully electronic, will affect the degree of accuracy with which a product's movements or characteristics can be identified and the amount/frequency of verifications required to ensure the data captured and communicated are reliable. Paper records maintained at an individual operator level may be sufficient to comply with minimum requirements, however the data captured may be more difficult to verify and more prone to

[40] http://www1.unece.org/cefact/platform/display/CNP/Electronic+Interchange+of+fisheries+catch+data

error. In the case of more detailed/rigorous requirements, more sophisticated systems guaranteeing ease of verification and reliability of data may be needed (FAO, 2014).

Figure 10: Critical Tracking Events for Seafood Traceability



Source: Expert Panel on Legal and Traceable Wild Fish Products (2015), adapted from National Fisheries Institute (2011). *For more detailed information about CTEs and KDEs relevant for documenting legality of caught and landed fish see the Expert Panel's Recommendations for a Global Framework to Ensure the Legality and Traceability of Wild-Caught Fish Products, March 2015 (available for download at: http://solutions-network.org/site-legaltraceablefish/)*

There are three general approaches to seafood traceability: paper-based, basic electronic and integrated hardware traceability systems (Anon, 2015).

- Paper-based traceability: manual paper-based records of the source, transformation, aggregation, destination and other associated information related to seafood products for traceability purposes.
- Basic electronic traceability: computerized record keeping of the source, transformation, aggregation, destination, and other associated information related to seafood products for traceability purposes.
- Integrated hardware traceability: integrated hardware (e.g. bar codes and reader, radio-frequency identification (RFID) tags and scanners) implemented to capture the source, transformation, aggregation, destination and other associated information related to seafood products for traceability purposes. RFID tags are physical carriers of electronic data, which are scanned using radio waves to automatically identify individual items (Anon, 2005, cited in Knuckey *et al.*, 2014).

The advantages and disadvantages associated with each of these approaches are summarized in **Table 4**. For electronic approaches, it is noted that the ease of tracking and verifying the data captured will further depend on the type of database system used to process and store the data (i.e. whether a multi-database or single database system). Further details are provided under *Principle 3* below.

Principle 3: Data communication

Data captured by various actors in the supply chain must be transferred and accompany the physical flow of products. Data should be exchanged in a standardized format, which may be specified by a standard or regulation (e.g. labelling requirements, catch certificate).

There are two types of supply chain traceability information flow models.

- The *one step up-one step down information flow model* and requires that operators are able to trace one step before and one step after their own operation (FAO, 2014). It is the model most commonly used in food businesses (Folinas *et al.*, 2006); however, the final receiver of a product cannot easily or simply trace a product back to its source using this model. Operators in the supply chain are responsible for their own data, which may be stored on paper or electronically (Lehr *et al.*, 2015). Electronic storage of data takes place in individual databases throughout the supply chain – a *multi-database system* (**Figure 11**). Multi-database systems allow each operator to retain full control over their data; however, differences in standards of record keeping can present difficulties for communication between links in the chain (Peterson and Green, 2007).

- An *aggregated information flow model* is used in cases where it is necessary to have immediate access to information related to all stages of production, treatment and distribution. Data are stored either in a central (single) database or by accumulating traceability records along the supply chain (Lehr *et al.*, 2015). In a *single-database system*, all operators in a supply chain submit their data to a single database, which can accessed as and when required (**Figure 12**). The use of a common standard makes information retrieval easier and faster between various links in the supply chain; for example, stakeholders may access data via a web-based platform (Peterson and Green, 2007).

Table 4: Overview of advantages and disadvantages of approaches to seafood traceability

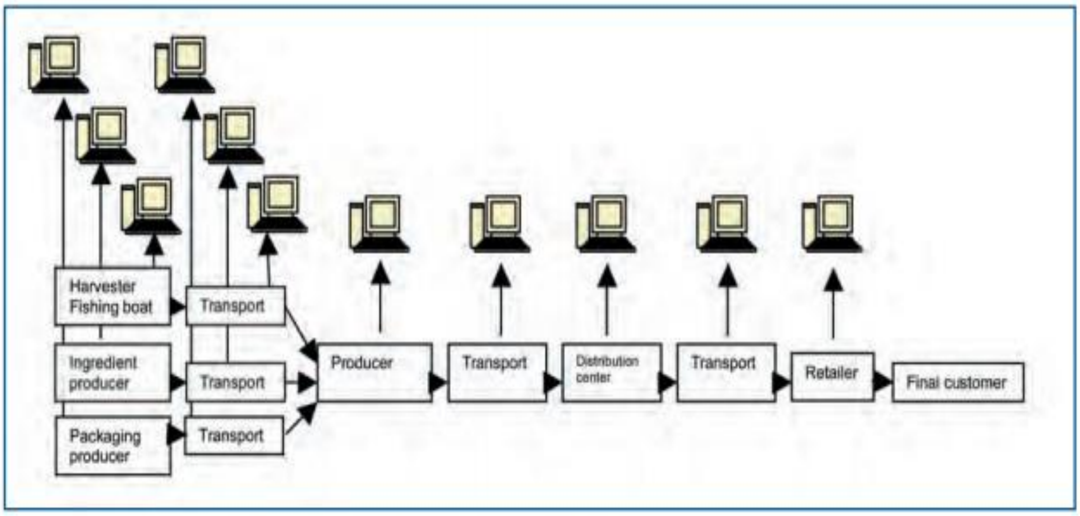
	Advantages	Disadvantages
Paper-based traceability	• Widespread and well-established in supply chains (know-how and systems may already exist for implementation) • Require lowest level of technology (little to none) • Inexpensive to implement • Flexible, easy to modify • Can be improved through tagging of products with unique identifiers (physical tamperproof tags) and inclusion of unique identification information in paper records	• Can be inefficient and require too much storage space for large quantities of product (viable for small quantities of product only) • Often no common identifier that is consistent throughout supply chain (e.g. product description, inconsistent terminology – lots, batches, pallets, etc.) • Manually intensive, data entry prone to errors • Delay in data entry makes systems prone to fraud • Trace-back, review and verification of data time-consuming/difficult • May not be appropriate for complex supply chains (e.g. involving multiple vessels, products, and outlets). • Consumers/retailers may lack confidence in system
Basic electronic traceability	• Efficient data storage • Enables easy transmission of data, including to other links in supply chain • Records, report and queries can be made quickly and adapted to the situation • Facilitates tracking of product throughout supply chain, including to consumer via web-based systems (if central database) • Facilitates verification of data • Can be improved through tagging of products with unique identifiers (physical tamperproof tags) and inclusion of identification information in electronic system	• Data entry prone to errors (not an automated system) • May not address issue of common identifiers through supply chain
Integrated hardware traceability	• Efficient data storage • Enables easy transmission of data, including to other links in supply chain • Records, report and queries can be made quickly and adapted to the situation • Facilitates tracking of product throughout supply chain, including to consumer via web-based systems (if central database) • Facilitates verification of data • Automated data capture faster and less prone to human error • Real-time availability of information • Systems are frequently interoperable[1] • RFID tags usually small, do not have to be in line of sight (multiple products can be scanned whilst passing through reader area)	• Data still needs to be standardized across supply chain (particularly product and location codes) • Need for relatively expensive equipment (readers, computer systems, software) *Bar codes* • Generally scanned by humans, therefore some room for error • External traceability can be hampered by use of proprietary numbers in bar codes (i.e. not meaningful to operators down-stream in supply chain) • Must be positioned "in line of sight" *RFID* • Generally more expensive than bar code systems[2]

Source: Knuckey *et al.* (2014), Peterson and Green (2007), Anon (2005) (cited in Knuckey et al), Anon (2015), Regattieri *et al.* (2007)

Notes:

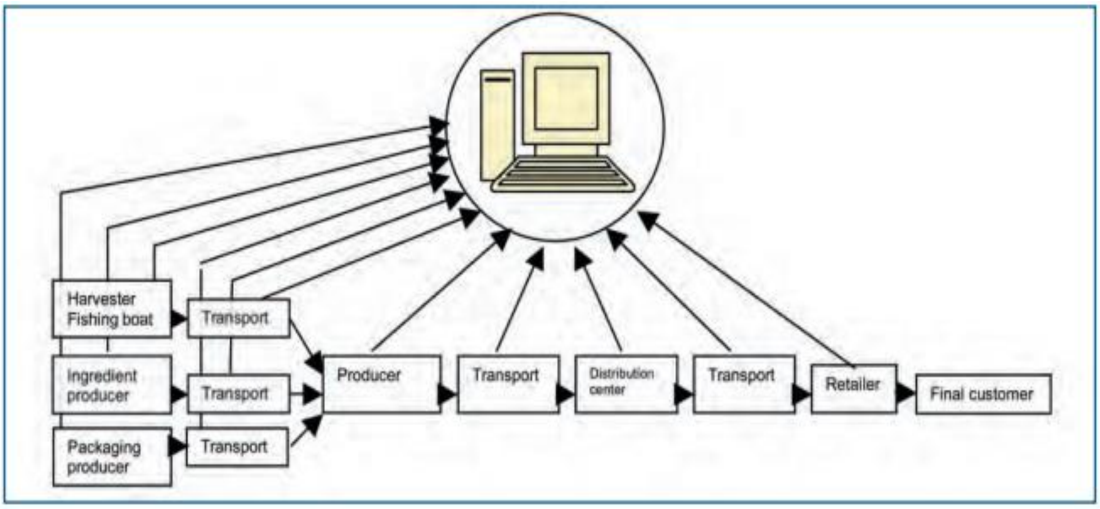
1. Meaning that "different information technology systems and software applications [can] communicate, exchange data, and use that information" (Global Food Traceability Centre, 2014, cited in Anon, 2015)
2. Although costs will decrease as technology advances (Peterson and Green, 2007)

Figure 11: A multi-database system



Each link in the food supply chain keeps the traceability information in a proprietary system.

Figure 12: A single database system



Each link in the food supply chain sends traceability information to a central database.

Source: Peterson and Green (2007)

5.1.3. CITES shark products and generalized supply chains

Sound knowledge of a product's supply chain is a prerequisite for implementing an effective traceability system. This requires identification of all physical entities (and locations) in the chain (Regattieri *et al.*, 2007), and processes taking place at each step.

A simple representation of a generic fresh fish supply chain begins with capture at sea, some degree of processing onboard the vessel, and storage in a refrigerated onboard hold or ice slurry. At the port of first landing, the catch is unloaded and transferred to a refrigerated vehicle where it is transported by road to a land-based wholesaler/processer for further processing, filleting and packaging. The product is then distributed by refrigerated vehicle to the final entity, being a retailer or restaurant (Knuckey *et al.*, 2014).

In reality, however, the supply chains for wild-capture fisheries are far more complex than described above. The chain begins with a fleet of different fishing vessels catching multiple products (species), which go onto unload at multiple ports from which catches are transported to different markets, wholesalers and processers. These entities convert the product into multiple forms, before distribution to a variety of restaurants, retail and food service outlets both nationally and internationally. The situation with shark fisheries is further compounded by the range of products that can be derived from a single shark, each with a potentially different supply chain (Knuckey *et al.*, 2014). Furthermore, products such as shark fins may be bought and sold multiple times, before being exported for the first time (Chen, 1996).

There are six major categories of products derived from sharks: meat, fins, liver oil, cartilage, skin and teeth (Knuckey *et al*, 2014). While shark fins and meat are the two most traded commodities (Dent and Clarke, 2015) quantities of liver oil, cartilage, skin and teeth are thought to be under-represented in trade statistics, which generally do not distinguish these products as deriving from sharks (Clarke, 2004). Manta rays are targeted and retained as valuable secondary catch to supply the international gill raker trade (Mundy-Taylor and Crook, 2013).

The shark products listed above are each associated with significantly different uses, processing techniques, supply chains and distributions (Knuckey *et al.*, 2014; see also **Figure 13**). These give rise to different challenges for traceability, and a variety of solutions may be needed depending on specific product requirements and contexts.

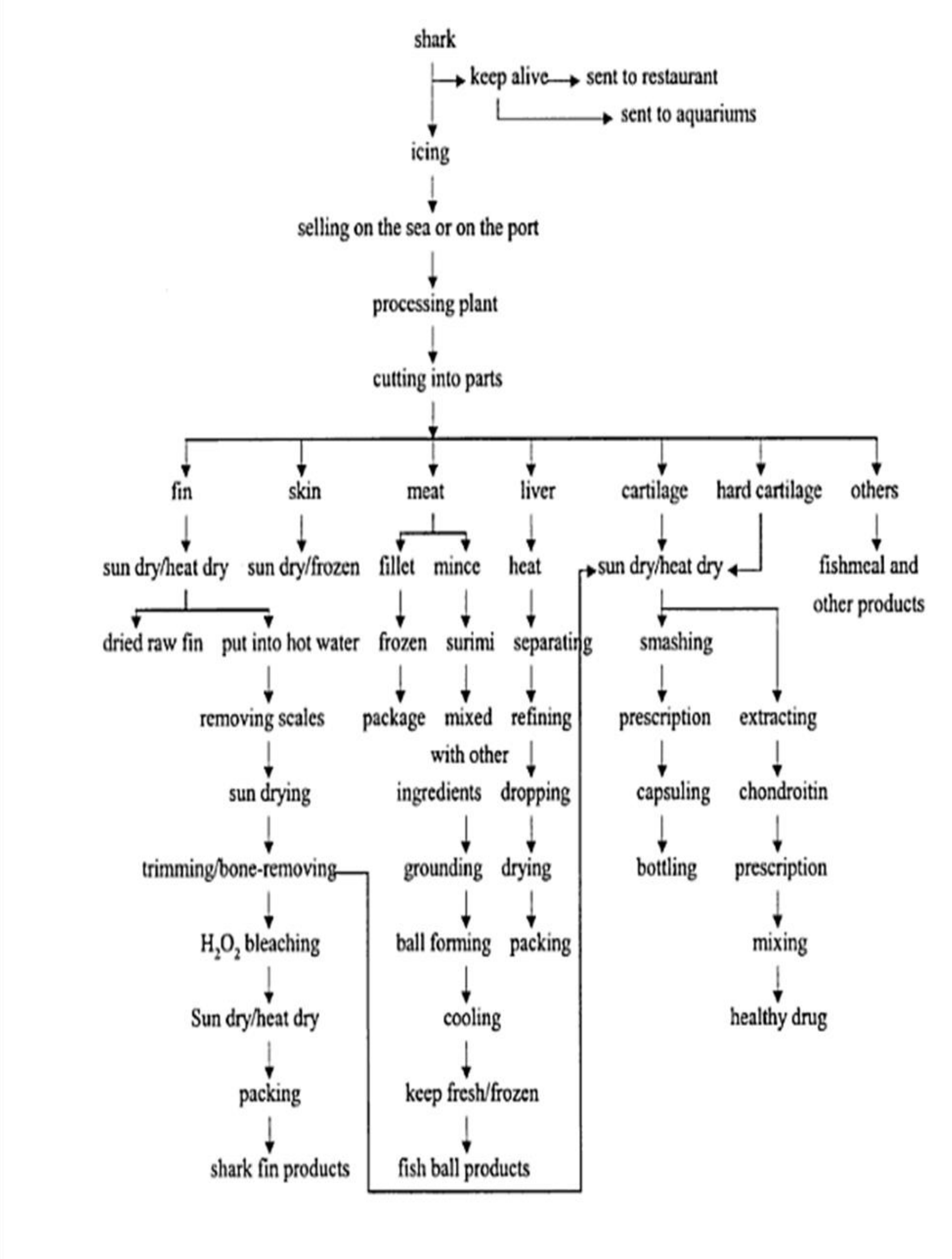
In view of the numerous permutations in the supply chains for shark products, the analysis and discussion in **Section 5.2** of this report focuses primarily on the traceability of meat and fins of the shark species listed in CITES Appendix II, as these represent the bulk of trade in these species. The report further focuses on the shark species listed in CITES Appendix II at CoP16, as they present some of the greatest challenges from a traceability perspective, owing in part to the commercial scale of international trade in their commodities[41].

It is, however, noted that shark product supply chains share some commonalities, particularly in the earlier stages, from capture to first landing (see **Figures 13 and 14**). Therefore, many of the lessons learned and best practices identified in this report for the initial stages of meat and fin supply chains may apply equally to other shark commodities. Future work may include an extension of this review to include other shark commodities/species, if considered useful/appropriate. For example, lessons learned from implementing the caviar labeling requirements may be relevant for the labeling of shark liver oil traded in capsule form.

Below is a brief overview of key trade routes and supply chains for meat and fins of CITES Appendix II-listed species based on a high-level review of relevant literature. For further details see Dent and Clarke (2015), Mundy-Taylor and Crook (2013), the CITES CoP16 listing proposals for Oceanic Whitetip, Porbeagle and Hammerheads (2013), the IUCN/TRAFFIC analyses of the CoP16 listing proposals (2013), Clarke (2004), Vannucini (1999) and Parry-Jones (1996).

[41] For example, information from traders indicates that fins of Basking Shark, Whale Shark and Great White Shark are traded more as trophies for display than for consumption due to the lower quality of the fin needles (Clarke, 2004).

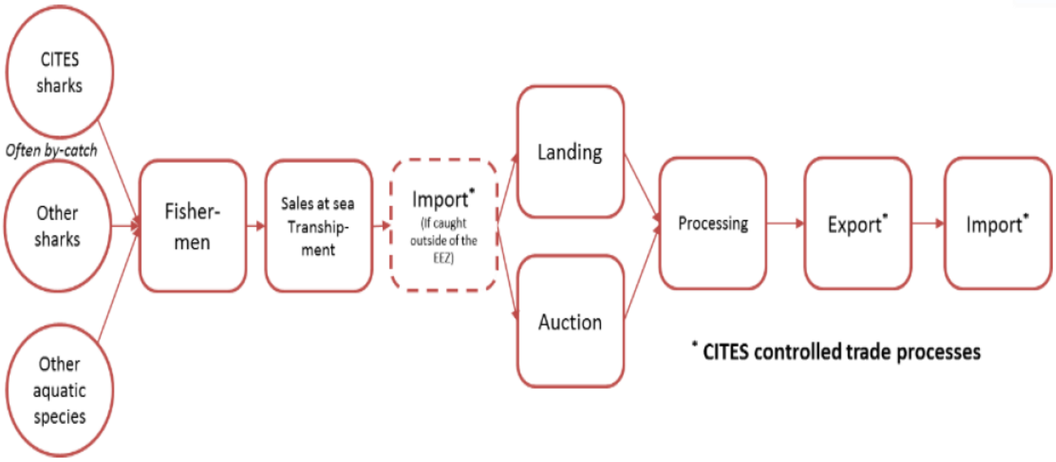
Figure 13: General shark processing flowchart (shark landed with fins attached)



Source: adapted from Vannuccini (1999).

Notes: * The skin of fins, like that of the rest of the body, is covered with large numbers of usually very small thorn-like structures called denticles.

Figure 14: Simplified shark supply chain



Source: from Lehr *et al.* (2015)

(a) Meat

Trade routes

Shark meat is traded in large quantities globally, with key markets in Europe (e.g. France, Italy and Spain), Brazil, Mexico and mainland China (and Republic of Korea for skates and rays) (Dent and Clarke, 2015; Mundy-Taylor and Crook, 2013). Uruguay has emerged as an important trader of shark meat in recent years, importing unprocessed meat from major shark catchers (such as Taiwan and Spain) and re-exporting processed shark meat to the rapidly expanding Brazilian market (Dent and Clarke, 2015).

As regards trade routes for meat of the CITES Appendix II-listed species:

<u>Porbeagle</u> meat is highly valued by consumers in Europe, where it is traded in fresh and frozen form (Mundy-Taylor and Crook, 2013). Porbeagle is taken in both targeted fisheries and as secondary catch, particularly in pelagic longline fisheries for tuna and swordfish, but also in gill nets, driftnets, trawls and handlines. Key catchers include Japan, New Zealand, Republic of Korea, Spain, Taiwan and Uruguay. In the Southern Hemisphere, Porbeagle is primarily taken on the high seas, therefore IFS provisions will apply. In the Northern Hemisphere, most Porbeagle is harvested within Exclusive Economic Zones (EEZs) (Mundy-Taylor and Crook, 2013).

<u>Oceanic Whitetip</u> meat is reportedly eaten in fresh and smoked forms in Mexico and the US; and in fresh, dried and salted forms in the Seychelles and Sri Lanka (CITES CoP16 Proposal). Oceanic Whitetip is taken in many parts of its range, primarily as secondary catch in oceanic longline fisheries targeting large pelagic species (tunas, swordfishes and others) (FAO, 2013). Key catchers of Oceanic Whitetip, according to FAO data, include Sri Lanka, mainland China, Brazil, Taiwan, Fiji and Tanzania (FAO FishStat, total capture 2002-2011, cited in Mundy-Taylor and Crook, 2013), while other countries/territories that are known to take Oceanic Whitetip as secondary catch in their fisheries include France, Japan, Spain, Uruguay and the US. Oceanic Whitetip is often taken on the high seas, therefore IFS provisions will apply (Mundy-Taylor and Crook, 2013).

<u>Hammerhead</u> meat is also traded internationally; however it is unlikely that the amount is significant when compared to the volume of fins in trade (CITES CoP16 Proposal). Hammerhead meat is reportedly consumed in Mexico and in many other parts of Latin America (Sosa-Nishizaki, *in litt.* to IUCN/TRAFFIC, 2012, cited in IUCN and TRAFFIC, 2012), and also in Europe, Japan and elsewhere (CITES CoP16 Proposal). Owing to their wide distributions and

coastal-dwelling nature, Hammerheads are exploited along continental shelves and adjacent oceanic areas in a vast number of countries, in both tropical and warm temperate seas. Hammerheads are taken in targeted fisheries and as secondary catch in fisheries for pelagic and demersal species (FAO, 2013). As Hammerheads are primarily taken in EEZs, IFS provisions will generally not apply, but will in some circumstances (Mundy-Taylor and Crook, 2013).

Supply chains

The generic stages of a shark meat supply chain are described in **Table 5** below (see also **Figure 13**).

Table 5: Stages of a generic shark meat supply chain

Location	Main activities/processes
Fishing vessel	Shark is trunked (head removed and gutted) and stored on ice or chilled brine (refrigerated sea water) or frozen on the vessel. Fins may be separated or remain naturally attached, depending on relevant requirements. The shark may also be filleted and stored onboard as dried product. Transshipment to another vessel (or vessels) may take place before landing.
Landing port/land-based processor	The carcass is typically weighted and separated into different product categories (e.g. meat, liver, fins, etc.). The trunk may be processed at this stage, whereby the meat is removed from the cartilage frame and skinned. Shark meat is usually prepared as whole frozen carcasses (headed and gutted) for storage and shipment, but also as fresh carcasses, and fresh/frozen split carcasses, fillets and blocks.
Production facility	The carcass is generally filleted, frozen or packaged at this stage, or minced and made into surimi and packaged. The products are then distributed and held in cold storage until dispatched to restaurants or retail stores.

Source: Vannuccini (1999); Knuckey *et al.* (2014)

(b) Fins

Trade routes

Shark fins are the most valuable shark commodity per unit weight. The commercial value of a fin is dependent on a number of factors, including the percentage yield of ceratotrichia (soft collagen and elastin fibres commonly known as fin needles), general appearance and texture (Chen in Vannuccini, 1999). Separately, or joined as a bundle, the fin needles are considered a delicacy in Chinese cuisine, used in soup-making and other dishes (Vannuccini, 1999).

The vast majority of fins are destined for consumption in a relatively small selection of countries/territories in East and Southeast Asia, including mainland China, Hong Kong Special Administrative Region (SAR), Taiwan, Singapore, Malaysia and Viet Nam (Dent and Clarke, 2015).

Hong Kong serves as an international trade hub for shark fins, importing large quantities from producing countries in (wet and dried) unprocessed forms, and exporting them to regional markets, where they are generally processed before consumption. Fins commonly arrive in Hong Kong by sea, and are transported onwards to processing facilities in Guangdong Province, mainland China, by river barge (Clarke, 2004). After processing, fins may be consumed in mainland China, or transported back to Hong Kong for consumption or re-export (Clarke, 2004). Taiwan is also involved in importing, processing and trading fins (as exports and re-exports) (Dent and Clarke, 2015).

Singapore plays a similar role to Hong Kong as a regional trading centre, although it is also believed to be involved in processing to some extent. Recent figures suggest that the shark fin markets in Thailand, Malaysia and Japan are also significant, primarily for small, low-value fins. Thailand has also surpassed Hong Kong as the world's largest exporter of shark fins in recent years (Dent and Clarke, 2015). These developments suggest a decline in dominance of mainland China and Hong Kong in the international shark fin trade.

As regards fins of the shark species listed in Appendix II of CITES (from Mundy-Taylor and Crook, 2013):

Oceanic Whitetip is a preferred species in many fin markets, including in Hong Kong (Vannuccini, 1999). See **(a) Meat** – ***Trade routes*** above for an overview of patterns of exploitation.

Porbeagle fins are generally less valued than fins of other species due to their low needle count (IUCN and TRAFFIC, 2012). Porbeagle is not one of the common species in the Hong Kong dried fin market, possibly as most fins in the market derive from areas other than those where Porbeagle is most abundant (Northeast and Northwest Atlantic) (Clarke *et al.*, 2006). However, Porbeagle fins are still exported from New Zealand to Hong Kong and also from Norway to Asian markets as secondary products of meat processing.

Hammerhead fins, and particularly those of the Scalloped Hammerhead, are highly valued in international trade because of their large size and high fin needle count (IUCN and TRAFFIC, 2012). See **(a) Meat** – ***Trade routes*** for an overview of patterns of exploitation.

Supply chains

Shark fins are processed and marketed in a variety of forms, the most important being (Vannuccini, 1999):

- Raw fins - in dried form only, with skin (most common). Dried fins from larger sharks are traditionally traded as fin sets comprising the two pectoral fins, the first dorsal fin, and the lower lobe of the caudal (tail) fin (Parry-Jones, 1996). A complete set from the same shark is preferred. Other fins are of lower commercial value and sold as mixed fins or fin nets after processing (Subasinghe, 1992).
- Wet fins - fresh, chilled and unprocessed
- Semi prepared fins - dried, skin removed, fin needles still intact as one dry mass
- Fully prepared fins - dried, with individual strands of fin needles, and packed in cardboard boxes or in a single or double layer of viscose film
- Frozen prepared fins
- In brine
- Fin nets – fin needles boiled, separated, redried and packaged in loose groupings
- Prepared ready to eat or cooked products – canned soups, prepared dishes in cans or pouches and instant soup powders.

The method of processing a shark fin generally depends on the level of infrastructure and post-harvest technology available in a fishery. Higher quality fins are those kept fresh, clean and unsalted before drying; however, where infrastructure is lacking, salt is used in preservation resulting in an inferior product with higher moisture content (Vannuccini, 1999).

Supply chains for shark fins are complex and global in nature, involving multiple countries between fishing vessel and end consumer (Dent and Clarke, 2015). Fins may be bought and sold numerous times prior to export and during later stages in the supply chain (e.g. by importers, retailers, wholesalers and restaurants).

The generic stages of a shark fin supply chain are described in **Table 6** (see also **Figure 13**). These stages are most characteristic of industrial and larger-scale artisanal fisheries, operating in deeper waters in EEZs and on the high seas. By contrast, shark fin supply chains for traditional and smaller-scale artisanal fisheries are relatively diverse, often with specific characteristics depending on country or region. These supply chains generally involve many operators at each level, may operate in remote locations and can be relatively fluid, as demonstrated by Cripps *et al.* (2015) in a recent value chain analysis of the shark fisheries of Madagascar (see **Figure 15**).

Table 6: Stages of a generic shark fin supply chain

Location	Main activities/processes
Fishing vessel	Once a shark is caught, the fins may be removed and stored separately from the carcass (or the carcass discarded) or left attached to the trunk and removed later during land-based processing. Freshly cut fins are cleaned well and: • kept on ice for several days with re-icing if necessary (fresh/wet fins) • hung or stored around the vessel to start the drying process (especially if fishing operations are long) or oven-dried if sun-drying is not possible (dried fins)
Landing port	Fins removed from carcass (if landed attached) and dried or frozen. Unprocessed fins are sold to dealers or intermediaries and may be graded (see next stage) before export.
Regional/ international trade hub	Importers/traders grade fins by type, size, as black or white[42] and other factors such as moisture content, smell and cut, according to market requirements. Fins may also be traded in lots. Fins may be processed by traders (e.g. restaurants) or re-exported for processing elsewhere.
Processing centre	• Fins are softened in water, denticles removed, skinned and the meat/cartilaginous base plate removed. Fins may be dried in this form, or the two layers of gelatinous fin rays may be separated into two bundles before drying. • Fins may also be further processed into fin needles or fin nets. Processed fins are softened, boiled and transferred to chilled water to separate fin needles from the gelatinous fin ray membrane. Washed, wet fin needles may be arranged into fin nets and sun-dried. • Products may be re-exported or distributed to local markets

Source: Parry-Jones (1996), Chen in Vannuccini (1999), Vannuccini (1999)

[42] Black group – deeper water sharks, such as *Carcharhinus* spp., mako, blue sharks. White group – shallow water sharks, such as sandbar and hammerheads (Vannuccini, 1999). Fins of the white group are associated with higher percentage yields of fin needles, and command higher prices.

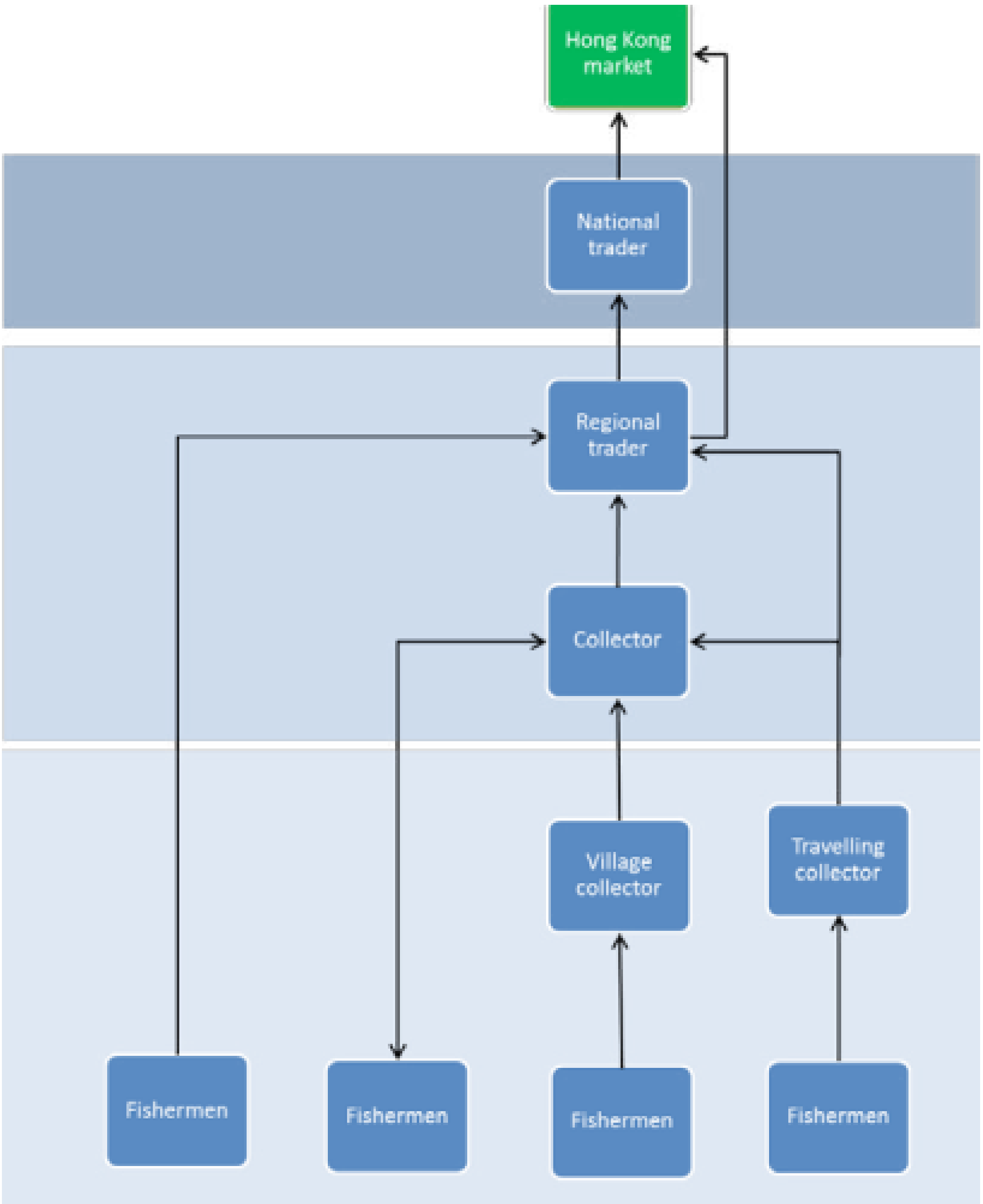


Figure 15: Shark fin supply chain for sharks caught in Madagascar's traditional fisheries (Cripps *et al.*, 2015). *For traditional shark fisheries, the trading routes and number of linkages within supply chains for fins can vary considerably depending on fisher location (proximity to urban centres), price, buyer availability, personal contacts or know-how of individual fisherman, demand and product condition. Most fishers sell salted, wet (undried) fins to local collectors (to obtain a higher price per kg), who then dry the fins to meet buyer specifications and sell them on to regional collectors/traders. However, some fishers with the means to travel, contacts and know-how sell dried fins directly to main buyers in larger towns, or occasionally to regional traders, increasing income by almost 40% for the highest quality fins. Dried fins are exported to overseas markets such as Hong Kong SAR (Cripps et al., 2015).*

5.1.4. Issues to be considered for the traceability of CITES shark commodities

Any traceability system implemented to support CITES implementation for shark commodities must consider the issues listed below.

Pre-landing

- Multiple species caught by vessels, including CITES-listed and non-listed species
- CITES-listed species taken from multiple catch areas on a single fishing trip
- Transshipments at sea of CITES-listed products (particularly complex if the vessels are owned by different operators)
- Methods of storage and processing onboard vessels, and possibility for product segregation (separation of CITES listed and non-listed species)
- Feasibility of physical marking individual/batches of CITES specimens
- Physical conditions that could impact a traceability system (e.g. tracking technology affected by moisture)
- Current recording practices onboard vessels (e.g. electronic vs. paper-based logbooks)
- Appropriate level of technology/technical infrastructure
- Hardware/software needed to meet defined traceability requirements
- Available financial resources
- Information necessary for assessing compliance with legal requirements (KDEs)

Post-landing

- Form and quantities in which CITES-listed species are landed and distributed
- Critical Tracking Events (CTEs)
- Processing/product transformations, including mixing and aggregation (species, multiple vessels etc.), and possibility for product segregation
- Ability of operators to confidently identify specimens
- Feasibility of physical marking individual/batches of CITES specimens
- Ability of physical marking to withstand processing
- Current recording practices of operators
- Existing port controls and CITES requirements upon landing in ports
- Appropriate level of technology/technical infrastructure
- Hardware/software needed to meet defined traceability requirements
- Available financial resources
- Information necessary for assessing compliance with legal requirements (KDEs)
- Opportunities/prospects for collaboration between operators along the supply chain

5.2. Application of CITES traceability measures to shark commodities

The aim of this section is to assess whether the measures considered in **Section 4** can be applied in whole or in part, whether individually or in combination, to the traceability of fins and meat of the shark species listed in CITES Appendix II at CoP16. The reasoning for focusing on these specific shark commodities was outlined in **Section 5.1.3.** above.

5.2.1. General observations

From the review of traceability measures carried out in **Section 4**, it would seem that none of the four case studies examined would offer an easily transferable solution for the traceability of meat or fins of Oceanic Whitetip, Porbeagle or the three Hammerhead species listed in CITES Appendix II at CoP16. However, there are many commonalities in the lessons learned from these case studies, which can provide useful guidance in developing traceability systems and measures for CITES shark commodities.

Table 7 compares the products, supply chains and traceability measures implemented or under consideration/development for sturgeon caviar, crocodile skins, Queen Conch and timber. Relevant information is included for sharks, where possible, to facilitate an assessment of the applicability of the various traceability measures considered in **Section 4** to the products and supply chains of CITES shark commodities.

The table highlights a number of specific aspects of shark meat and fin supply chains which would make the direct application of the traceability systems reviewed in **Section 4** either unfeasible or inappropriate. These include the mixing of CITES and non-CITES shark species onboard vessels and at points of landing, partial processing at sea, capture on the high seas, and exports of products in a range of different forms/stages of processing. The variety of possible supply chains, e.g. for artisanal vs. industrial fisheries, adds a further layer of complexity.

By comparison, in the case of caviar labelling, both product and packaging are relatively uniform, the operators are limited in number and easily defined, there is little variation in supply chains, and processing occurs on land, close to the point of harvest, at which stage a label is applied to the product and no further processing takes place. Likewise for crocodile skin tagging, the exported product is again relatively standard (whole skins) and amenable to being physically tagged, in contrast to the smaller fins and processed meat products of CITES shark species that are commonly exported. For further comparisons see **Table 7**.

Nevertheless, the four case studies considered in **Section 4** provide useful guidance for the design and implementation of effective traceability systems that are compatible with CITES requirements and processes. **Table 8** provides a summary of some of the main lessons learned and best practices arising from these case studies for the traceability of CITES shark commodities, with commonalities between the case studies listed under *Common issues*.

Queen Conch, as the only marine fisheries example, provides some particularly useful insights into regional cooperation on the conservation and management of a CITES marine species, including on traceability issues. Systems are also being implemented at the national level which could potentially be scaled-up or replicated elsewhere, for other marine species. Of particular relevance to sharks are the approaches being implemented/considered to improve traceability in artisanal fisheries and for processed meat products, such as electronic data collection and management systems, catch documentation schemes, standardization of processed meat conversion factors and incentives for data collection and reporting. While there are important differences between fisheries for Queen Conch and sharks (see **Table 7**), it would be useful to follow the progress of these developments for possible guidance for shark commodities.

A common theme emerging from across the four case studies, is the need to strike a balance between establishing minimum standards/universal guidelines for traceability systems (e.g. to ensure interoperability of systems, coherence and compliance with legal requirements) whilst affording operators and Parties flexibility to implement systems that are well-adapted to their specific contexts (e.g. in terms of level of technology, available resources and capacity of users). The lack of universal standards has allowed for the proliferation of different systems, which are not necessarily interoperable. As noted in **Table 8**, traceability systems and technologies should be appropriate to particular supply chains and take into account local communication infrastructures, technological capacities, physical conditions, internal systems and business practices. Above all, systems should be simple, user-friendly, cost-effective, inclusive, transparent and robust.

As in the case of timber, the complexity and variety of supply chains for shark meat and fins is particularly pronounced (see **Table 7**), and building flexibility into systems will be even more crucial. However, the experience of timber has also shown how "off the shelf" traceability solutions can provide readily deployed, flexible systems that may be scalable to cover all types of supply chain and customized to meet specific requirements. These are already used and available for a wide variety of commodities, including fisheries products, and further exploration of their application to commodities of CITES-listed shark species is warranted.

For a more comprehensive list of lessons learned and best practices emerging from the four case studies, see **Table 8**.

5.2.2. Possible elements of a traceability system for commodities of CITES-listed shark species

Before embarking on the design and implementation of a traceability system for supply chains of CITES shark commodities, there are a number of important steps that should be considered to ensure that the system is widely accepted and appropriate to the specific context(s) to which it is to be applied. These include

1. Considering at which scale a system should be established to achieve its objectives (e.g. national, regional, global).
2. Mapping key product supply chains from point of harvest to, as a minimum, point of first export.
3. Identifying the data input and control points (i.e. where data entry and verification are possible – e.g. "bottlenecks"), operators involved, and information to be collected at each stage.
4. Identifying and consulting with stakeholders along the supply chain to determine a workable solution. Issues to consider include barriers to participation, the need for incentives, integration with existing systems and processes, cost/administrative burden and technical/logistical challenges.
5. Determine what improvements may be necessary to the monitoring, control and surveillance (MCS) systems and regulatory/enforcement regime(s) to support the effective implementation of the traceability system.

The following sections draw on all four case studies reviewed in **Section 4** to provide examples of traceability options for the fins and meat of Oceanic Whitetip, Porbeagle and Hammerheads, based on the lessons learned/best practices set out in **Table 8** and the specific features of the fin and meat supply chains (described in **Section 5.1.3.** and **Table 7**). The information below is not intended to be exhaustive or cover every possible scenario, but is intended to provide an example of how a simple traceability system might work for shark meat and fins, as a basis for further research and discussion by the CITES Parties.

It is noted that the below options are more relevant to industrial fisheries or to more technologically advanced artisanal fisheries operating in deeper waters in EEZs/on the high seas.

Due to the diversity of supply chains and technological capacities for traditional and smaller-scale artisanal fisheries (which may operate in remote locations and involve numerous individual operators), further consideration of specific contexts would be required to determine workable traceability solutions. These fisheries may face particular challenges in achieving traceability objectives, and a stepwise approach to implementation may be required. Nevertheless, from the four case studies, and from the example of Queen Conch in particular, it is possible to identify a number of options that could be adapted for traditional/artisanal fisheries for CITES shark species (see also **Table 8** below):

1. Recording of basic information on shark catches by fishers using mobile phones, which could be sent to a central system either via an app or by text message.
2. Introduction of a paper-based or, ideally, an electronic catch documentation scheme to link catches to particular trips. Batches of fins may be allocated with a unique codes, linking them with the vessel trips that landed the fins.
3. Allocation of licences/quotas to operators or entities that handle aggregated fins from many vessels, e.g. processing plants, regional collectors, or fishing cooperatives, and requiring them to report information on purchased fins (training in the identification of fins of CITES species may be required). Data could be provided in spreadsheets and emailed on a regular basis to the fisheries authority for storage in a central database.
4. Provision of incentives to encourage data recording and reporting, e.g. preferential licences, certification schemes, provision of mobile phone technology and training.

Regarding the options for industrial fisheries, these are outlined below under the three traceability principles: (i) unique identification; (ii) data capture and management; and (iii) data communication (see **Section 5.1.2.**).

(a) Unique identification

A CITES-listed shark is caught and processed onboard the vessel into trunked form with fins on to allow identification to species level. Each trunk is marked with a tamper-proof tag (e.g. attached to the dorsal fin) which includes the vessel name and a unique identifier, preferably in bar code form. The tags are produced by authorized manufacturers and distributed only to licensed vessels.

The trunk is then chilled or frozen and stored in the onboard hold. Ideally, no further processing of the product would be allowed during the land-based unloading, transport, trading and cold-storage of the trunked shark. Therefore, the product that is received at the land-based processor is chilled or frozen shark trunks, each tagged with a unique identifier.

At the processor, the shark trunks would be processed into the component products (shark fin, shark meat etc.) and packaged. Each package would be labelled with a bar code or RFID that refers to the unique carcass tag information.

In situations where finning takes place onboard a vessel, fins should be grouped by CITES-listed species and catch area (or as appropriate to allow verification of legal compliance) and maintained as separate lots, e.g. in individual containers, and allocated a unique lot number (e.g. date, container and hatch number). Each lot should be uniquely marked, e.g. the container labelled with vessel name and the unique lot number (preferably in bar code form).

Optimally, each lot of fins would remain as a discrete entity up to the point of repackaging for export (e.g. as a batch of whole frozen or dried fins) and be accompanied by the unique identifier (bar code) affixed to the container onboard the vessel.

However, where this is not possible (e.g. a middleman receives many small batches of fins of the same CITES-listed species but from different vessels/catch areas), aggregation of lots may be allowed provided that the operator records information about what was mixed and how the new mixed lot is now identified. Each package of mixed fins for export would be labelled with a new unique identifier in the form of a bar code or RFID, which can be linked back to the original lots and catch information via a central database (see under **(b) Data capture and management** below).

(b) Data capture and management

Fishing vessels record catch information associated with each uniquely identified shark carcass or lot/batch of fins, preferably in an electronic logbook system[43]. Catch information should include, as a minimum, the species, date, catch location/area, gear used and vessel name/registration number. Where a bar code is used, a handheld device can be used to scan the bar code and to enter catch information, which can be transferred in real-time to a central database, or at the point of landing. This information, in turn, can be used to generate an electronic catch document confirming the legality of the catch, which is linked with the unique identifier. The catch document should also accompany the physical flow of product along the supply chain.

At each data entry and control point along the supply chain (CTE – see **Figure 10**), information about the uniquely identified carcass or lot can be recorded by scanning the bar code and entering data using a handheld device, or via a secure, online interface. Examples of KDEs to be recorded at the point of landing, processing and distribution are included in **Figure 10**. Where the carcass/lot undergoes processing, the KDE must be recorded at the beginning and end of the process so that inputs can be linked to outputs.

Verification of data entered at each control point could be achieved through physical inspections of shipments, genetic testing (e.g. identification of species, ocean-level geography), manual analysis/reconciliation of data stored in the central database, and the use of software to automatically detect non-conformities. Depending on product transformations between capture and export, this may require standardized conversion factors to be defined (e.g. frozen carcass to frozen meat fillets; frozen to dried fins). Conversion factors will also enable CITES MAs to verify that quantities of fins or meat on a CITES export permit application (i.e. post-processing) correspond to the reported catch (as contained in the catch certificate).

Consideration may be given to the licensing of processing plants/exporters to ensure their production processes are capable of effectively segregating CITES species, and to facilitate verification of the reliability of data captured and transferred to the central database. Licensed processing plants/exporters could be allocated a unique registration code for incorporation into the unique identifier (e.g. bar code) on the packaged product for export.

(c) Data communication

A single (central) database system would seem most appropriate for CITES shark commodities, due to the importance of rapid retrieval of information from all stages of the supply chain for verification and decision-making purposes. The database should contain all relevant information to allow the national CITES MA to determine legal acquisition of a shipment for the purposes of issuing an export permit. This may also include scanned copies of paper-based documents (e.g. relevant authorisations, licences), where these are not yet issued in digital format. Stakeholders could be provided access to information in the database via a secure, web-based platform (see **Sections 5.3.3(b)** and **5.4.4.**).

The central database could be maintained at the national level, but with links to a regional database, e.g. the existing database of a relevant Regional Fishery Body (RFB), for the purposes

[43] Alternatively, paper-based records can be manually entered into a computerized system after landing, if this is not possible at sea.

of regional monitoring and reporting of catches. The database should also link to the CITES e-permitting process.

Table 7: Overview of products, supply chains and traceability measures for the four case studies under review, including relevant considerations for the traceability of CITES Appendix II shark commodities (fins and meat) for comparison

	Caviar	Crocodile skins	Queen Conch	Timber	Sharks
CITES listings					
1. Are all species covered by the CITES listing?	*Yes – all Acipenseriformes listed in App. I or II*	*Yes – all Crocodylia species listed in App. I or II*	*Yes*	*No – not all timber-producing species listed*	*No – very small proportion of all sharks are CITES-listed in App. I or II*
2. Are all products covered by the CITES listing?	*Yes - all Acipenseriformes products*	*Yes - all Crocodylia products*	*Yes*	*Depends on species. Generally roundwood and semi-processed products (sawnwood, veneers, plywood). For some species, further processed products are covered.*	*Yes*
Products and traceability measures					
3. Have traceability measures been defined under CITES?	Yes – *Resolution Conf. 12.7 (Rev. CoP16)*	*Yes - Resolution Conf. 11.12 (Rev. CoP15)*	*No*	*No*	*No*
4. Which products are traded internationally?	*For Acipenseriformes species - mainly caviar and meat*	*For Crocodylia species – mainly skins, with meat a by-product of the industry*	*Meat is the main target of the fishery for international trade. However, the secondary products - shells, pearls, operculum – are also traded internationally.*	*Primary products (roundwood), semi-processed products (sawn wood, veneers, plywood), further processed products.*	*Meat, fins, liver oil, cartilage, skin, teeth*
5. Are all products in international trade covered by traceability measures? If not, which products are covered?	*No – labelling is only required for <u>caviar</u>*	*No – tagging requirements only apply to <u>raw, tanned and finished crocodilian skins</u> (and containers of parts such as tails, backstrips, etc.).*	*Measures not defined under CITES, however various measures under discussion/ already implemented, e.g. documentation schemes, licensing, labelling. <u>Meat</u> is the main commercial product and priority for traceability.*	*Depends on system – although traceability measures are more common for <u>primary and semi-processed products</u>*	
6. Which processing stages are covered by traceability measures?	*<u>Post-processing stage</u> - caviar is the first and final processed product. Re-packaging of caviar is also covered (transfer into new primary containers)*	*<u>Pre-processing and semi-processing stages</u> – from raw to finished skins*	*Meat is landed and exported in <u>various stages of processing</u> – this would need to be taken into consideration in the development of a traceability system*	*Depends on system – generally <u>primary wood processing stage</u>, but systems also in place for further processing.*	

	Caviar	Crocodile skins	Queen Conch	Timber	Sharks
7. How easy is product identification?	*Identifying species in caviar may be possible by visual identification but is generally achieved by DNA analysis.*	*Skins in raw, tanned or finished form generally easy to identify to species by distinctive features*	*Genetic techniques can assist in identification of meat, potentially also geographical origin.*	*Identification to genus level, possibly also species, may be possible using wood anatomy; however, chemical or DNA analysis may be needed to identify to species level. Identification of geographical origin through DNA and isotope analysis may also be possible.*	*Whole (or near whole) specimens and fins with skin attached – species identification based on morphological features possible. Processed/semi-processed product (e.g. meat, fins without skin, fin needles) - genetic testing necessary for species identification. Genetic testing is also becoming available for determining geographical origin*
Supply chains					
8. Is the supply chain well-defined/understood?	*Yes – the supply chain is well-defined, and relatively standard for all caviar*	*Yes – typical supply chains are well-defined for crocodile skins from harvest to tannery. However, the number of operators may vary. Also, tanning may take place either before or after first export.*	*Generally yes - although more information on specific (national) contexts required*	*Generally yes - from concessions to the end of primary wood processing, the supply chain is relatively well-defined. However there are complexities (see below).*	*Yes and no – basic/generalized supply chains understood, but more information on specific contexts required. Various possible supply chains for meat and fins of the App. II species, involving many different operators, countries and complexities (see below).*
9. Is the supply chain complex?	*No – uniform product (caviar in tins/containers), relatively few, well-defined operators (processors, (re-)packagers, exporters, importers, retailers) in a limited number of countries. Stages of supply chain are not numerous. For wild-sourced caviar, range States are known and restricted, providing a good initial situation for quota setting. Introduction from the sea does not apply.*	*Yes and no – numerous operators on the harvesting and exporting side and skins may change hands several times before export. However, product generally exported as whole skins. Also, all skin trade is channelled through a limited number of tanneries mid-way through the chain (generally in the country of first import, although tanneries are also now located in countries of origin).*	*No – processing of meat is relatively simple with few operators involved between capture and export. Queen Conch may be caught in multi-species fisheries (e.g. with Spiny Lobster), but mixing of products is not an issue due to distinct markets. Capture is in territorial waters and EEZs, therefore introduction from the sea does not apply.*	*Yes – due, for example, to:* • *mixing of wood from multiple concessions;* • *regional transshipment;* • *different stages of processing carried out in different locations;* • *imported material (e.g. logs) entering supply chains in countries of origin.* *After primary wood processing, products may be destined for both domestic use and international trade. Further processing is more*	*Yes – different supply chains for fins and meat, for high seas and EEZ catches, and for traditional, artisanal and industrial fisheries. Complexities include:* • *CITES and non-CITES shark species caught by vessels;* • *species from multiple catch areas on a single fishing trip;* • *transshipments at sea;* • *mixing of products (species,*

	Caviar	Crocodile skins	Queen Conch	Timber	Sharks
				complex, however for many species, the CITES listings do not cover this stage.	*vessels);* • *introduction from the sea;* • *finning/processing at sea;* • *products landed and sold in various forms.*
10. What operators/ activities are involved and where are these located/carried out?	*Country of origin: wild-harvest/aquaculture, caviar processing and packaging* *Country of import: re-packaging for domestic consumption or re-export*	*Country of origin: wild-harvest/ breeding facility, slaughterhouse, (domestic) tannery* *Country of import: tannery (production of finished skins and possible re-export)*	*Country of origin: fishers (capture), trader (buy/sell), processing facility (processing of meat)* *Country of import: traders, retailers*	*Country of origin: felling (concession/forest), primary processing (e.g. saw mill, veneer, plywood mill), possibly also further processing (although may not fall under CITES), traders, exporters, retailers* *Country of import: further processing (although generally not covered by CITES and traceability systems), traders, re-exporters, retailers*	*Traditional/artisanal fisheries (fins)*:* • *Country of origin: fishers, collectors, traders, exporters* • *Country of import: traders, processors, retailers, restaurants, re-exporters* • *Country of 2nd import: traders, processors, retailers, restaurants, re-exporters* *Industrial fisheries (meat and fins)*:* • *EEZs/high seas: fishers, multiple vessels (transshipment)* • *Country of landing: trader, processor, processing facility, distributor* • *Country of import: trader, processors, retailers, restaurants, re-exporters* • *Country of 2nd import: traders, processors, retailers, restaurants, re-exporters.* **destined for international trade.*

	Caviar	Crocodile skins	Queen Conch	Timber	Sharks
Unique identification					
11. How are products uniquely identified under current traceability systems?	*Label with unique alpha-numeric code. Code contains information on species, source, country of origin, year of harvest/repackaging, processing/repackaging plant, lot or CITES document number.*	*Tag with alpha-numeric code or bar code. Code contains information on species, country of origin, year of skin production or harvest and a unique serial identification number. Re-export tags only need to contain a unique serial identification number. Currently, loop or button-style tags are used.*	*Catch documentation, also use of labels for meat products. May include catch area and date fished, in addition to other information.*	*Paper/electronic documentation or physical marking with paint, waterproof paper/plastic tags, bar codes, RFID devices containing unique identification number.*	
12. How are actors in the supply chain uniquely identified under current systems?	*Registration of processing and re-packaging plants and allocation of unique registration codes is recommended - Resolution Conf. 12.7 (Rev. CoP16). Information is included in CITES Register.*	*Registration and/or licensing of producers, tanners, importers and exporters of crocodilian skins is recommended - Resolution Conf. 11.12 (Rev. CoP15). Registration/licensing may be undertaken by authorities at the national or sub-national level.*	*Examples include licensing of fishers, cooperatives, processors or exporters at the national level.*	*Examples include registration and licensing (for harvest, processing and export)*	
13. At what stage in the supply chain is the product first marked or uniquely identified under current systems?	*Close to harvest – label affixed at processing plant or aquaculture facility*	*Depends – tag may be affixed at any stage between harvest and export*	*Catch documentation may link product to fishing trip, and may be verified at point of landing or subsequently. Labels affixed after processing and packaging (meat)*	*Depends on system, but often at point of harvest (e.g. standing trees, stumps, logs)*	
14. Is there central control or oversight of physical marking methods used?	*Examples include production and issuance of labels by CITES MA; production by State printing company; or production by traders and approved by CITES MA*	*Tag manufacturers approved and list published on CITES website. Parties recommended to only obtain tags from approved manufacturers. In some Parties, the CITES authority may oversee tag orders, issuance, distribution and possibly the tagging itself.*	*Generally no*	*Generally yes at the forest department level (can vary depending on system), but not at the CITES MA level which is usually a separate agency or division.*	

	Caviar	Crocodile skins	Queen Conch	Timber	Sharks
15. Can products be easily marked?	*Yes – caviar tins easy to mark (although smaller sizes of tin are more difficult)*	*Yes – skins large and robust, can withstand tagging*	*Some products only - labelling of packaging possible for processed meat*	*Some products only – larger items such as roundwood can by physically marked. For smaller items (e.g. smaller pieces of sawn wood, wood chips) marking may be on package or batch.*	*Some products only. Possible options include:* • *Trunks/carcasses – individual tags (e.g. attached to dorsal fin)* • *Meat – label on package* • *Dried fins – tag on larger fins, or label on package of fins* • *Frozen fins – label on package*
16. Do marks need to withstand processing?	*No – label is affixed to primary container after processing. New label is then affixed to new primary container if re-packaging takes place. However, labels need to withstand storage in refrigerated conditions/on ice.*	*Preferably yes – to avoid removal of tags from skins during tanning process*	*No – any label would be applied to processed product ready for export*	*No - semi-processed and further processed products would need to be individually marked again, or as a lot/batch*	*No – semi-processed and further processed products would need to be individually marked again, or as a lot/batch. However, labels/tags need to withstand storage (e.g. in ice slurry or freezer)*
Data capture and management					
17. What types of systems are currently used to manage product data for traceability purposes?* *Note: see* ***Section 5.1.2.*** *for definitions.*	*Paper-based, basic electronic*	*Paper-based, basic electronic, integrated hardware*	*Paper-based, basic electronic*	*Paper-based, basic electronic, integrated hardware*	
18. How is data captured and stored by individual operators?	*Label and other information (quantities of caviar imported, exported, produced, stored, etc.) may be stored in computerized form by individual operators (e.g. spreadsheets).*	*Tag and other information (quantities of skins received, transformed, sold, re-tagged, etc.) may be stored in computerized form by individual operators (e.g. spreadsheets, database). Bar coding allows for automated*	*An example might be the manual entry of data into spreadsheets by processors or fishers, and transfer of spreadsheets to national authority for storage in a central database.*	*Examples of systems:* • *Data capture at various control points using RFID tags and handheld computers, and automated transfer of data to single online database.* • *Electronic or paper*	

	Caviar	Crocodile skins	Queen Conch	Timber	Sharks
		transfer to databases.		*documentation accompanying products along the supply chain, and automatic transfer (or scanning) for storage in central, online database.* • *Manual entry of data into spreadsheets/forms by harvesters and processers, and transfer of spreadsheet/forms to national authority for storage in central database.*	
19. How is the reliability of data captured by individual operators verified under current systems?	*CITES authorities may verify records held by individual operators and carry out inspections of plants/ facilities (e.g. processing, re-packaging). Spot checks of products using genetic testing may be carried out.*	*CITES authorities may verify records held by individual operators and carry out inspections*	*Data reported to and held in national databases can be verified by national authorities, with inspections at point of landing, processing, export, etc.*	*If data are held in a central database (e.g. managed by the forest department, CITES MA), these may be verified manually or software may allow for automatic detection of non-conformities between control points. Information from physical inspections of individual shipments may also be captured in database.*	
Data communication					
20. What information accompanies the physical flow of the product?	*Information contained in label accompanies physical flow of product. Up to point of re-packaging, caviar can be traced back to processing plant/facility in country of origin. After re-packaging, caviar can be traced back to country of origin.*	*Information contained on tag accompanies physical flow of product and allows tracing back to country of origin. However, re-export tags only need to include a unique serial identification number, therefore do not enable tracing back to country of origin.*	*Catch documentation may accompany physical flow of product and allow tracing back to point of capture (e.g. fishing trip)*	*Marking devices with unique number identifiers (plastic tags, bar codes, RFID devices) and electronic/paper documents accompany physical flow of product and allow tracing back to point of harvest.*	
21. Is there a central database to allow for retrieval of information by	*Operators maintain records of labels and other information, which are not integrated in*	*Operators maintain records of tags and other information, which are not integrated into centralized*	*Some countries have established national databases to store information captured by fishing*	*Some examples of central, online databases established at the national (or State/provincial) level*	

	Caviar	Crocodile skins	Queen Conch	Timber	Sharks
all stages in the supply chain?	*centralized databases.* *National authorities may maintain a database of labels issued for internal use.* *The CITES caviar trade database stores information on export permits and re-export certificates issued (which includes label information). This allows re-exporting countries to track shipments back to country of origin and to verify quantities of caviar previously imported for the purposes of issuing re-export certificates.*	*databases.* *National or sub-national authorities may maintain records of tags issued for internal use. Also, national e-permitting systems provide for storage of tag information on CITES documents, but are only accessible to the CITES authorities in-country.*	*cooperatives, processors, etc. These can be accessed by national authorities.* *Online platforms for sharing and storing of catch and effort data, accessible to registered users (e.g. fishers, processors), have also been proposed for longer-term development. National databases may be linked with a regional database under such a system.*	*to allow for tracking of timber throughout the chain of custody. Some information may be accessible to operators and wider civil society.*	

Table 8: Overview of lessons learned and best practices from the review of CITES traceability measures

<table>
<tr><th></th><th>Lessons learned/best practices for application to sharks</th></tr>
<tr><td>Common issues</td><td><u>Initial considerations:</u>
Universal standards for tracking systems are important but should leave sufficient scope and flexibility for Parties/operators to determine how they should be implemented.
An understanding of the supply chain is a prerequisite to the establishment of any traceability system and should include identifying the data entry and control points (where data entry and verification are possible), operators involved, and information to be collected at each stage.
Consultations must be held with relevant stakeholders prior to deploying a system to ensure widespread acceptance, with particular attention to challenges faced in traditional/artisanal fisheries and possible incentives for participation.
Establishing and maintaining a robust and effective traceability system can be an administrative and financial burden for authorities. Automation of some or all activities should be considered to reduce this burden, as well as recouping costs through licensing and requiring payment for tagging devices.
For CITES purposes, when designing a traceability system, it is important to first ensure that a system is robust and effective from harvest to the point of export, before considering subsequent stages.
Traceability measures should apply to products destined for domestic and international trade.
Traceability systems are only as strong as the legal/regulatory and monitoring regimes in place and cannot overcome issues of weak governance.
Mixing of product from different species compromises traceability.

<u>Level of technology</u>:
Systems should be sufficiently flexible to allow improvements/advances in technology (e.g. software developments) to be easily incorporated, and to encourage innovation.
Tracking technologies must suit local communication infrastructure, be robust and abuse resistant, be cheap, effective and user-friendly.
The level of technology must be appropriate to the context and adequate capacity must exist before considering more advanced technologies.
Integrated hardware technologies, such as bar codes, can assist in data management and reducing administrative burden, e.g. through automated, real-time transfer of data to relevant databases. Systems involving bar codes and handheld PCs for data capture are well-developed and operational for tracking products in a range of sectors.
Consideration should be given to the compatibility of tracking technology with smart phone applications.

<u>Data management, monitoring and verification:</u>
Consideration should be given to the use of electronic systems for data collection and management, in order to reduce administrative burden, facilitate monitoring and verification, and allow for rapid retrieval of information to determine legal origin.
Systems must be supported by monitoring and verification procedures to ensure reliability of data. Verification is particularly important for high-risk supply chains.
Stringent book-keeping requirements by operators are essential for a robust and effective traceability system.
Traceability systems should have a secure, central database (e.g. national, regional, global) which link directly with other databases and the CITES e-permitting system. Important considerations include auditing/verification of data, real-time sharing of information, transparency, and provision of universal access (e.g. to civil society stakeholders) via a user-friendly interface.
Genetic techniques can help to verify the accuracy of information in tracking systems.
</td></tr>
<tr><td>Caviar</td><td>
If labels are used, standardization and robust security features are essential. This can be assisted by centralized production of labels/issuance.
Inspections of operators and verifications of records are also important to ensure reliability of data.
</td></tr>
</table>

	Lessons learned/best practices for application to sharks
Crocodile skins	• Physical marking should take place as close to the point of harvest as possible but first point of tagging should be determined in consultation with stakeholders. • Removal of physical marks (such as tags) during processing provides a potential opening for abuse of the system but may be unavoidable. If marking cannot be maintained during processing, alternative mechanisms to ensure the integrity of the system will be necessary – e.g. strict book-keeping requirements to match products received to products sold, verifications and inspections. • Data control points may include bottlenecks in supply chains (where products come together for processing or handling by a limited number of stakeholders), which provide important opportunities for verification of legality. • Administrative burden should be considered when designing a system and streamlining may need to be considered to remove unnecessary elements.
Queen Conch	• A catch documentation scheme (CDS) is a key mechanism allowing for the tracking of fisheries products through the supply chain and tracing back to point of capture. Features to be considered include compatibility with regional/international requirements (e.g. RFMO, CITES, EU IUU Regulation systems), and the linking of national databases with regional databases for reporting/verification at the regional level. For artisanal fisheries, linking of documentation back to a particular fishing trip may be sufficient. • For the establishment of any CDS, long-term support and maintenance are essential, as well as training for users and widespread agreement among countries to ensure coverage is as comprehensive as possible. • Electronic data collection and management systems should be considered to support implementation of any CDS/tracking system and facilitate reporting, analysis and verification of data. • The allocation of catch quotas and export licences to fishing cooperatives has proven a useful mechanism for ensuring traceability and improving data collection and reporting. This can be combined with spatial restrictions and rights-based management approaches to allow products to be traced back to catch area. • Consideration should be given to establishing standardized/scientifically rigorous conversion factors to allow detection of discrepancies between processing stages in a supply chain. This can support implementation of a CDS.
Timber	• Controls should be focused on the early stages of the industry, where traceability is more efficient and straightforward. For example, physical markings should start at the stump at the time of felling. • Systems should be designed to integrate with existing chain of custody and other business systems, must be adapted to on the ground conditions, and should be tested during a trial/pilot phase. • Mass balance systems are an option for processed products, although are inappropriate where mixing with high risk material could occur or where individual products/lots need to be traced to origin • RFID monitoring systems have proven a useful tool to share real-time information and automate data transfer/identification of non-conformities. • Electronic tracking technologies are becoming more user-friendly, reliable, available, and prices are expected to decline further with increasing volumes produced. • "Off the shelf" tracking systems may present an efficient and cost-effective option, in terms of development and deployment. Systems are generally flexible and can be customized to meet varying user requirements. • Incentives could be considered for the establishment of tracking systems, e.g. tax incentives, legal requirements, support for smallholders.

References

Andre, V. (2013). *Review and analysis of current traceability practices*. FAO Committee on Fisheries, Sub-Committee on Fish Trade. Fourteenth Session, Bergen, Norway, 24-28 February 2014. COFI: FT/XIV/2014/Inf.6.

Anon (2015). *Seafood Traceability Definitions*. FishWise. Available at: http://fishwise.org/index.php/press/blog/287-seafood-traceability-definitions. Accessed 31 July 2015.

Ashley, D. (2013). *Traceability Systems for a Sustainable International Trade in South-East Asian Pythons.* United Nations, Geneva, Switzerland. UNCTAD/DITC/TED/2013/6. v

Aspra, B., Barnutty, R., Mateo, J., Marttin. F. and Scalisi, M. (2009). *Conversion factors for processed queen conch to nominal weight.* FAO Fisheries and Aquaculture Circular No. 1042. Rome, FAO. 97 pp.

Boner, M. (2013). *Applications of stable isotopes for timber tracking.* TÜV Rheinland Agroisolab.

Bruckner, A.W. (ed.) (2006). *Proceedings of the CITES workshop on the conservation of sea cucumbers in the families Holothuriidae and Stichopodidae*. NOAA Technical Memorandum NMFSOPR 34, Silver Spring, MD 244 pp.

Catarci, C. (2004). *World markets and industry of selected commercially-exploited aquatic species with an international conservation profile*. FAO Fisheries Circular No. 990, Rome, FAO.

Chakalall, B. and Cochrane, K.L. (1996): The Queen conch fisheries in the Caribbean – An approach to responsible fisheries management. In: Posada JM and Garcia-Moliner (eds.): *Proceedings of the First International Queen conch Conference, San Juan, Puerto Rico, 29-31 July 1996*. Caribbean Fisheries Management Council. 60-76 pp.

Chatham House (2013). *Meeting Summary: The EU Timber Regulation and CITES, 11-12 December 2013*. Energy, Environment and Resources summary, Chatham House, London.

Chen, H.K. (ed.) (1996). *An overview of shark trade in selected countries of Southeast Asia.* TRAFFIC Southeast Asia, Petaling Jaya, Malaysia.

CITES Secretariat (2013). *Importance of traceability for sustainability of flora and fauna species*. Presentation at the 2nd BioTrade Congress of the United Nations Conference on Trade and Development (UNCTAD). Palais des Nations, Geneva, Switzerland, 11-13 December 2013.

CITES Secretariat (2001). *CITES World Official Newsletter of the Parties Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).* Issue No. 8, December 2001.

Clarke, S.C., Magnussen, J.E., Abercrombie, D.L., Mcallister, M.K. and Shivji, M.S. (2006). Identification of shark species composition and proportion in the Hong Kong shark fin market based on molecular genetics and trade records. *Conservation Biology* 20: 201– 211 pp.

Clarke, S. (2004). *Shark Product Trade in Hong Kong and Mainland China and Implementation of the CITES Shark Listings.* TRAFFIC East Asia, Hong Kong, China.

CRFM (2013). *Regional Management Options for Queen Conch with improved scientific approaches considered.* CRFM Technical & Advisory Document, No. 2013/13. 24 pp.

Cripps, G., Harris, A., Humber, F., Hardin, S. and Thomas, T. (2015). *A preliminary value chain analysis of shark fisheries in Madagascar.* Indian Ocean Commission, Smart Fish, SF/ 2015/34.

De Greef, K. and Raemaekers, S. (2014). *South Africa's Illicit Abalone Trade: An Updated Overview And Knowledge Gap Analysis.* TRAFFIC International, Cambridge, UK.

Dent, F. and Clarke, S. (2015). *State of the global market for shark products*. FAO Fisheries and Aquaculture Technical Paper No. 590. Rome, FAO. 187 pp.

Doukakis P., Pikitch E.K., Rothschild A., DeSalle R., Amato G., and Kolokotronis S-O. (2012). Testing the Effectiveness of an International Conservation Agreement - Marketplace Forensics and CITES Caviar Trade Regulation. *PLoS ONE*, Volume 7, Issue 7, 1-9 pp.

Engler, M. and Knapp, A. (2008). *Briefing On the Evolution of the Caviar Trade and Range State Implementation of Resolution Conf. 12.7 (Rev. Cop 14).* A TRAFFIC Europe Report for the European Commission, Brussels, Belgium.

Expert Panel on Legal and Traceable Wild Fish Products (2015). *Recommendations for a Global Framework to Ensure the Legality and Traceability of Wild-Caught Fish Products*. Final Report. March 2015.

FAO (2014). *Best practice guidelines on traceability*. FAO Committee on Fisheries, Sub-Committee on Fish Trade. Fourteenth Session, Bergen, Norway, 24-28 February 2014. COFI:FT/XIV/2014/7.

FAO (2013). *Report of the fourth FAO Expert Advisory Panel for the Assessment of Proposals to Amend Appendices I and II of CITES Concerning Commercially-exploited Aquatic Species, Rome, 3–8 December 2012*. FAO Fisheries and Aquaculture Report No. R1032. Rome, FAO. 161 pp.

FAO (2012). *Traceability best practice guidelines*. FAO Committee on Fisheries, Sub-Committee on Fish Trade. Thirteenth Session, Hyderabad, India, 20-24 February 2012. COFI:FT/XIII/2012/5.

FAO (2010). *Report of the FAO and CITES Technical Workshop on Combating Illegal Sturgeon Fishing and Trade Antalya, Turkey, 28–30 September 2009*. Rome, FAO.

FAO (2008). *Harmonisation of catch documentation schemes.* FAO Committee on Fisheries, Sub-Committee on Fish Trade. Eleventh Session, Bremen, Germany, 2-6 June 2008. COFI:FT/XI/2008/5.

FAO (1998). *Guidelines for the routine collection of capture fishery data*. FAO Fisheries Technical Paper, 382: 113 pp.

FDPM (2010a) *Technical Report – the Development of* Gonystylus *spp. (Ramin) Timber Monitoring System Using Radio Frequency Identification (RFID) in Peninsular Malaysia*. Forestry Department Peninsula Malaysia, Kuala Lumpur, Malaysia.

FDPM (2010b) *Completion Report – the Development of* Gonystylus *spp. (Ramin) Timber Monitoring System Using Radio Frequency Identification (RFID) in Peninsular Malaysia*. Forestry Department Peninsula Malaysia, Kuala Lumpur, Malaysia.

Folinas, D., Manikas, I., and Manos, B. (2006). Traceability data management for food chains. *British Food Journal*, Volume 108, Issue 8, 622-633 pp.

Geach, J., Thomas, D. and Lowe, A. (2011). *Applied genetics for forest conservation and sustainable trade - the state of DNA technology for trees and wood products*. July 2011. Double Helix.

Hoare, A. and Wellesley, L. (2014). *Illegal Logging and Related Trade: The Response in Indonesia*. Chatham House Research Paper, Chatham House, London.

Hubenova T., Uzunova E. and Zaikov A. (2009). *Management strategies in protection and restoration of sturgeon biodiversity in Bulgaria*. Proceedings "IV INTERNATIONAL CONFERENCE FISHERY", Belgrade, 27-29 May 2009, 39-52 pp.

Hutton, J. and Webb, G. (2002). Legal Trade Snaps Back: Using the Experience of Crocodilians to Draw Lessons on Regulation of the Wildlife Trade. In *Proceedings of the 16th Working Meeting of the Crocodile Specialist Group of the Species Survival Commission of IUCN – The World Conservation Union convened at Gainesville, Florida, 7 – 10 October 2002*. IUCN, Gland, Switzerland.

ISO (2011) *ISO Standard 12875:2011 Traceability of finfish products — Specification on the information to be recorded in captured finfish distribution chains*.

ITTO (2012) *Report of workshop on tracking technologies for forest governance, Kuala Lumpur, Malaysia, 15-17 May 2012*. ITTO.

IUCN (2002). *Proceedings of the 16th Working Meeting of the Crocodile Specialist Group of the Species Survival Commission of IUCN – The World Conservation Union convened at Gainesville, Florida, 7 – 10 October 2002*. IUCN, Gland, Switzerland.

IUCN and TRAFFIC (2012). *IUCN/TRAFFIC Analyses of the Proposals to Amend the CITES Appendices.* Prepared by IUCN Global Species Programme and TRAFFIC for the Sixteenth Meeting of the Conference of the Parties to CITES. IUCN – International Union for Conservation of Nature, Gland, Switzerland.

Jahrl, J. (2013). *Illegal caviar trade in Bulgaria and Romania - Results of a market survey on trade in caviar from sturgeons (Acipenseridae)*. WWF Austria and TRAFFIC, Vienna, Austria.

Johnson, S. (2013) *Workshop on tracking technologies and forest governance, 15-17 May 2012, Kuala Lumpur, Malaysia.* Presentation at the International Meeting on Sustainable Forest Management in CITES, 8-10 January 2013, Bali, Indonesia.

Kecse-Nagy, K. (2011). *Trade in Sturgeon Caviar in Bulgaria and Romania - overview of reported trade in caviar, 1998-2008*. A TRAFFIC report for WWF Austria, Budapest, Hungary.

Knapp, A. (2008). *An Assessment of caviar labelling and licensing provisions in the European Union.* A TRAFFIC Europe Report for the European Commission, Brussels, Belgium.

Knapp. A., Kitschke, C. and von Meibom, S. (eds.) (2006). *Proceedings of the International Sturgeon Enforcement Workshop to Combat Illegal Trade in Caviar.* Prepared by TRAFFIC Europe for the European Commission, Brussels, Belgium.

Knuckey, I., Sant, G. and Koopman, M. (2014). *Options for traceability of shark products through the Cathay Pacific supply chain to prove sustainable and legal provenance*. Prepared by Fishwell Consulting and TRAFFIC for Cathay Pacific Airways Limited. Unpublished.

Lack, M. (2007). *Catching On? Trade-related Measures as a Fisheries Management Tool.* TRAFFIC International.

Lehr, H. *et al.* (2015). *Traceability study in shark products*. Report prepared for the CITES Secretariat.

Lowe, A.J. and H.B. Cross. (2011). The Application of DNA methods to timber tracking and origin verification. *IAWA Journal* Volume 32, Issue 2, 251-262 pp.

MacGregor, J. (2006). *The Call of the Wild: Captive Crocodilian Production and the Shaping of Conservation Incentives*. TRAFFIC International, Cambridge, UK.

Macgregor, J. (2002). *International Trade in Crocodilian Skins: Review and Analysis of the Trade and Industry Dynamics for Market-based Conservation.* Presentation at the 16th Meeting of the Crocodile Specialist Group, Gainesville, Florida.

MRAG (2013). *Support to improve and harmonize the scientific approaches required to inform sustainable management of queen conch (Strombus gigas).* Final Technical Report of the ACP Fish II Programme – Strengthening Fisheries Management in ACP Countries. 287 pp.

Mulliken T A (1996). Status of the Queen conch fishery in the Caribbean. *TRAFFIC Bulletin* Volume 16, Issue 1, 17-28 pp.

Mundy-Taylor V. and Crook V. (2013). *Into the deep: Implementing CITES measures for commercially-valuable sharks and manta rays*. Report prepared for the European Commission.

Mundy-Taylor, V., Crook. V., Foster, S., Fowler, S., Sant, G. and Rice, J. (2014). *CITES Non-detriment Findings Guidance for Shark Species (2nd, Revised Version). A Framework to assist Authorities in making Non-detriment Findings (NDFs) for species listed in CITES Appendix II.* Report prepared for the Germany Federal Agency for Nature Conservation (Bundesamt fuïr Naturschutz, BfN).

Olsen P. and Borit M. (2013). How to define traceability. *Trends in Food Science and Technology*, Volume 29, Issue 2, 142-150 pp.

Parry-Jones, R. (1996). TRAFFIC Report on Shark Fisheries and Trade in Hong Kong. In: Anon., 1996. *The World Trade in Sharks: A Compendium of TRAFFIC's Regional Studies, I.* TRAFFIC International, Cambridge, UK.

Peterson, A. and Green, D. (2007). *Seafood Traceability: A Practical Guide for the U.S. Industry.* North Carolina Sea Grant. UNC-SG-06-04.

Prada, M.C. and Appeldoorn, R.S. (2014). *Regional Queen Conch Fisheries Management and Conservation Plan.* CFMC/WECAFC/OSPESCA/CRFM/CITES, San Juan de Puerto Rico, November 2014.

QCWG (2014). *Proposal – Conversion Factors for Processed Queen Conch to Live Weight.* CFMC/WECAFC/OSPESCA/CRFM Working Group on Queen Conch, 2nd meeting, Panama City, Panama, November 2014.

Regattieri, A., Gamberi, M. and Manzini, R. (2007). Traceability of food products: General framework and experimental evidence. *Journal of Food Engineering*, Volume 81, Issue 2, 347-356 pp.

Sant, G.J. (2004). CITES and Sea Cucumbers. *Technical workshop on the conservation of sea cucumbers in the families Holothuridae and Stichopodidae*, Kuala Lumpur, Malaysia, 1-3 March 2004, Doc. 5.

Scales, H., Kecse-Nagy, K. and von Meibom, S. (2010). *An assessment of the implementation of the CITES caviar labelling and licensing provisions in three sturgeon range States in the Caspian region*. A TRAFFIC briefing paper for the European Commission, Brussels, Belgium.

Seidel, F., Fripp, E., Adams, A. and Denty, I. (2012). Tracking Sustainability - Review of Electronic and Semi-Electronic Timber Tracking Technologies and Case Studies. *ITTO Technical Series #40*. ITTO and CITES.

Sosa Schmidt, M. (2013a). ITTO-CITES Programme for Implementing CITES Listings of Tropical Tree Species – Phase II. *ITTO-CITES Newsletter*, Issue 2-2, March 2013.

Sosa Schmidt, M. (2013b). *Update on some CITES identification initiatives concerning tree listed species*. Presentation at Expert Meeting on CITES-listed tree species, 5 December 2013, Brussels, Belgium.

Sosa Schmidt, M. (2013c). *Relevance of Tracking Technologies to CITES*. Presentation at the International Meeting on Sustainable Forest Management in CITES, 8-10 January 2013, Bali, Indonesia.

Subasinghe, S. (1992). *Shark fin, sea cucumber and jelly fish. A processor's guide*. Infofish Technical Handbook 6. Infofish, Kuala Lumpur.

Theile, S. (2001). *Queen Conch fisheries and their management in the Caribbean*. TRAFFIC Europe.

UNEP-WCMC (2008). *Analysis of EC Trade in Caviar by Species and Tracking of Caviar Permits within the UNEP-WCMC Caviar Database*. A Report to the European Commission. UNEP-WCMC, Cambridge.

Vannuccini, S. (1999). *Shark utilization, marketing and trade*. FAO Fisheries Technical Paper No. 389. Rome, FAO.

Wellesley, L. (2014). *Illegal Logging and Related Trade: The Response in Brazil*. Chatham House Research Paper, Chatham House, London.

Willock, A. (2004). *Administrative and Monitoring Implications of listing and down-listing of commercially-exploited aquatic species, including the implications of Annex 4 of Resolution Conf. 9.24*. TRAFFIC International, Cambridge, UK.

WWF (2015). *Traceability principles for wild-caught fish products*. WWF Smart Fishing Initiative.

Young, H. (2013). *Malaysia: The development of Gonystylus species. (Ramin) timber monitoring system using radio frequency identification (RFID) in Peninsular Malaysia*. Presentation at the International Meeting on Sustainable Forest Management in CITES, 8-10 January 2013, Bali, Indonesia.