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

1st of October 2014

Victoria Mundy-Taylor, Vicki Crook, Sarah Foster, Sarah Fowler, Glenn Sant and Jake Rice.

© Cat Holloway/WWF-Canon

© Doug Perrine / WWF-Canon

Federal Agency for Nature Conservation

TRAFFIC
the wildlife trade monitoring network

Report prepared for the German Federal Agency for Nature Conservation (Bundesamt für Naturschutz, BfN).

All material appearing in this publication is copyrighted and may be reproduced with permission. Any reproduction in full or in part of this publication must credit BfN as the copyright owner.

The views of the authors expressed in this publication do not necessarily reflect those of the BfN, the TRAFFIC network, WWF or IUCN.

The designation of geographical entities in this publication, and the presentation of the material, do not imply the expression of any opinion whatsoever on the part of BfN, TRAFFIC or its supporting organizations concerning the legal status of any country, territory, or area, or its authorities, or concerning the delimitation of its frontiers or boundaries.

The TRAFFIC symbol copyright and Registered Trademark ownership is held by WWF. TRAFFIC is a strategic alliance of WWF and IUCN.

Suggested citation: 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 für Naturschutz, BfN).

TABLE OF CONTENTS

Acknowledgements iv

Background iv

Introduction 1

What are CITES Non-detriment Findings? 1

Why is guidance for Non-detriment Findings needed? 1

The aim of this Guidance 2

How to use this Guidance 3

Step 1: Preliminary Considerations and Information Gathering 8

Section 1.1: Review origin and identification of specimen 11

Section 1.2: Review legality of acquisition and export 14

Section 1.3: Review available information on management context 16

Step 2: Intrinsic Biological Vulnerability and Conservation Concern 18

Section 2.1: Evaluate intrinsic biological vulnerability of species 20

Section 2.2: Evaluate conservation concern 23

Step 3: Pressures on Species 26

Section 3.1: Evaluate trade pressures 28

Section 3.2: Evaluate fishing pressures 31

Step 4: Existing Management Measures 35

Step 5: Non-Detriment Finding and Related Advice 49

Step 6: Further Measures 56

Bibliography 60

LIST OF FIGURES, TABLES AND TEXT BOXES

Figure 1. Four scenarios of catch, landing &/or export and CITES documentation required 5

Figure 2. Flow chart illustrating NDF process 6

Figure 3. Flow chart for Step 1: Preliminary considerations and information gathering 8

Figure 4. Flow chart for Step 2: Intrinsic biological vulnerability and conservation concern 18

Figure 5. Flow chart for Step 3: Pressures on species 26

Figure 6. Flow chart for Step 4: Existing management measures 35

Figure 7. Flow chart for Step 5: Non-detriment finding and related advice 49

Figure 8. Flow chart for Step 6: Further measures 56

Table 1. Structure of the Guidance 7

Text Box 1. Over-arching principles that will enhance development of robust shark NDFs 3

Text Box 2. Introduction from the sea (IFS) 4

Text Box 3. Setting catch and export quotas 51

ANNEXES.....63

Annex 1. Guidance Notes.....64

Annex 2. Useful Sources of Information ..... .102

Annex 3. Glossary, Acronyms & Abbreviations ..... .108

Annex 4. Default Species-specific Biological Data..... .113

Annex 5. Management measures and their appropriateness for mitigating pressures on shark stocks from fisheries and trade..... .134

Annex 6. Links to Management Risk Assessments Developed by Lack et al. (2014) ..... .144

ACKNOWLEDGEMENTS

This study benefited enormously from the participation of the authors and other contributors and reviewers at a workshop hosted by IUCN Headquarters (Gland, Switzerland) in December 2013. The authors are particularly grateful to Colman O Criodain (WWF), Susan Lieberman (WCS), Haruko Okusu (CITES Secretariat) and Ute Grimm (BfN) for their participation in that meeting, and to the following reviewers of drafts of this report: Thomasina Oldfield and Richard Thomas (TRAFFIC), and Vin Fleming (JNCC).

We also thank Mary Lack, Glenn Sant, Markus Burgener, Nicola Okes and the UK Department for Environment, Food and Rural Affairs for sharing information from their management risk assessment work and allowing this to be incorporated into the current guidance; Amanda Vincent for making the Project Seahorse Non-detriment Framework for Seahorses freely available to us; the authors of the CITES Non-detriment Findings guidance for perennial plants for allowing this document to form the basis for development of the current guidance; and Stephanie von Meibom and Julie Gray of TRAFFIC for their support in the preparation of this report.

This first major revision of the Shark NDF guidance followed an international Workshop hosted by the German Federal Agency for Nature Conservation (BfN) in August 2014, which evaluated the results of ten case studies undertaken by international experts to test the Shark NDF Guidance. It was attended by over 20 experts in CITES, shark[1] conservation biology and fisheries management issues, from 14 countries across Africa, Asia, Europe, Latin America, the Middle East, North America and Oceania. CITES Management and Scientific Authorities, national government fisheries departments, Regional Fishery Bodies and the European Commission were represented. The authors of this Guidance are extremely grateful for their time and advice.

BACKGROUND

This Guidance was produced for BfN under the project "Development of Non-detriment Findings for shark species listed in Appendix II of CITES: a review of existing management measures and the development of guidelines and practical recommendations" and presented to the 27th meeting of the CITES Animals Committee in 2014[2].

The NDF procedures set out in the report were then tested on selected stocks of the shark and ray species listed in Appendix II by the sixteenth meeting of the Conference of the Parties to CITES (CoP 16) in March 2013, and the results analysed during a small expert workshop hosted by the German government in Bonn during August 2014. The procedures and guidance notes were revised following discussions at, and the consensus agreement of, this workshop.

The aim is for the Guidance to be finalised and ready for practical implementation as the Appendix II listings adopted by CoP 16 come into force in September 2014. The revised guidance report is planned to be made available to Parties through the CITES homepage section for sharks and mantas (http://www.cites.org/eng/prog/shark/index.php).

[1] The term "shark" is used in this Guidance to refer to all sharks, rays and chimaeras (*Class Chondrichthyes*).
[2] http://cites.org/sites/default/files/common/com/ac/27/E-AC27-Inf-01.pdf

INTRODUCTION

What are CITES Non-detriment Findings?

Ensuring trade lies within sustainable limits is at the core of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (**CITES**). According to the Convention, Parties shall allow trade in specimens of species included in Appendix II, or non-commercial trade in species included in Appendix I, only if the Scientific Authority of the State of export has advised that "such export will not be detrimental to the survival of that species" (**Article IV.2(a)**). Referred to as "**non-detriment findings**" (**NDFs**), these are intended to ensure that exports of products from listed species covered by the NDF have not harmed wild populations[3] or ecosystems.

International trade of products derived from species listed in Appendix II[4] (the main focus of this document) is only permitted if the **Management Authority** of the exporting State has issued a **CITES Export Permit**[5]. An export permit cannot be issued until the Management Authority has advised that the specimens were **legally acquired**, and an **NDF** has been made by the **Scientific Authority**. Special provisions apply to Appendix II-listed species caught on the **high seas,** i.e. areas outside of the jurisdiction of any State (**Articles IV.6 & 7** and **Resolution Conf. 14.6 (Rev. CoP 16)**), see **Text Box 2** below.

The **development of an NDF should ideally take place before** any listed shark species destined to be exported or introduced from the sea **has been fished and landed**. This is particularly important because NDFs may come with conditions, such as improving management through restrictions on catch (e.g. an annual Total Allowable Catch (**TAC**) comprised of separate quotas for national fleets or individual vessels) or export quantities, or the requirement of monitoring and control systems to ensure compliance with such limits. Another condition may be the need for traceability from catch to consumer. Setting such conditions in advance of harvesting will help to discourage unsustainable mortality driven by trade demand.

Why is guidance for Non-detriment Findings needed?

Because the Scientific Authority of each CITES Party is responsible for making NDFs and determining how to do so, the Conference of the Parties (**CoP**) has not produced binding technical criteria for undertaking NDFs. Instead, considerable effort has been made by some CITES Parties, inter-governmental organisations (**IGOs**), non-governmental organisations (**NGOs**), the CITES Secretariat and the CoP to develop non-binding general and taxon-specific guidance for making NDFs (see **Annex 2**). This Guidance draws upon these resources, particularly the outputs of an International Expert Workshop in Mexico in 2008[6], a framework for making NDFs for seahorses[7], and NDF guidance for perennial plants[8], while incorporating specific issues and information that may need to be taken into account when making NDFs for shark species.

---

[3] Elsewhere in this Guidance, the term "stock" is generally used instead of "population".

[4] In 2014, the shark species listed in CITES Appendix II are: (i) Oceanic Whitetip Shark *Carcharhinus longimanus*; (ii) Porbeagle *Lamna nasus*; (iii) Scalloped Hammerhead Shark *Sphyrna lewini*; (iv) Great Hammerhead Shark *Sphyrna mokarran*; (v) Smooth Hammerhead Shark *Sphyrna zygaena*; (vi) Basking Shark *Cetorhinus maximus*; (vii) Whale Shark *Rhincodon typus;* (viii) Great White Shark *Carcharodon carcharias*, and (ix) the Manta rays *Manta birostris* and *Manta alfredi*. The Sawfish, Family Pristidae, are all listed in Appendix I, which prohibits commercial trade. Current shark species lists are available at http://www.cites.org/eng/prog/shark/index.php

[5] Or equivalent documentation, if one of the States involved is not a Party to CITES.

[6] http://www.conabio.gob.mx/institucion/cooperacion_internacional/TallerNDF/taller_ndf.html

[7] http://seahorse.fisheries.ubc.ca/ndf

The aim of this Guidance

Although this guidance may appear intimidatingly long and comprehensive, this is because it aims to cover every possible relevant point that might contribute to reaching an NDF. It is certainly not necessary to provide all the data listed at each step before making an NDF. However, where data are lacking, Scientific Authorities are encouraged to adopt a **precautionary approach** under Principle 15 of the Rio Declaration on Environment and Development and according to the conclusions of the FAO/CITES Genazzano workshop[9].

This document sets out to provide **practical NDF guidelines under Article IV.2(a) (Export) and Article IV.6(a) (Introduction from the sea)** for CITES Authorities dealing with the export of products from Appendix II-listed shark and ray species or their introduction from the sea.

The following pages cover the procedures needed for development of NDFs for international trade in CITES Appendix II-listed specimens caught in **a State's territorial waters and/or Exclusive Economic Zone (EEZ)** and for specimens caught on the **high seas** (see **Figure 1** and **Text Box 2**).

The Guidance takes into account the preparation of NDFs for **stocks that occur within the waters of more than one State and/or on the high seas**[10]. Under these scenarios, CITES allows an NDF to be developed and issued at a **regional level** with, for example, a Regional Fisheries Body (**RFB**) (such as a Regional Fisheries Management Organisation (**RFMO**)) acting as an international Scientific Authority for high seas stocks, as provided under **Article IV.7**. This facilitates collaboration between countries to ensure that all sources of mortality for the stock concerned are considered. An RFB that undertakes a stock assessment and/or establishes an NDF for a stock under its remit could, for example, set a TAC, with a view to allocating this in the form of quotas to its Contracting and Collaborating Parties (CCPs). These CCPs will, with very few exceptions, also be CITES Parties.

The Guidance recognises that CITES also encourages **consultation with the RFBs**[11] that have jurisdiction over the fisheries that take the species concerned, whether as directed or secondary catch. **Scientific Authorities should check with the relevant RFB to see if a Regional NDF has been agreed** – where one has not, they should seek scientific advice from that RFB in developing a State-based NDF. Where an RFB is not yet addressing shark management issues, Parties (in their capacity as RFB CCPs) may wish to consider requesting that they now do so.

Over-arching principles that will facilitate the development of robust NDFs for shark species, even where stock assessments are not yet available, are provided in **Text Box 1,** below.

---

[8] Leaman, D.J. and Oldfield, T.E.E. (2013) *CITES Non-Detriment Findings Guidance for Perennial Plants- A Nine-Step Process to Support CITES Scientific Authorities Making Science-Based Non-Detriment Findings (NDFs) for Species Listed in CITES Appendix II.* First Edition. BFN. http://www.cites.org/sites/default/files/common/com/pc/21/E-PC21-Inf-01.pdf

[9] *Report of the FAO/CITES Workshop to Review the Application and Effectiveness of International Regulatory Measures for the Conservation and Sustainable Use of Elasmobranchs*. Genazzano, Italy, 19–23 July 2010. FAO Fisheries and Aquaculture Report. No. 984. Rome, FAO. 2012. 31 pp. http://www.fao.org/docrep/015/i2445e/i2445e00.pdf

[10] Also called straddling stocks and high seas stocks. See http://www.fao.org/fishery/topic/14769/en

[11] A few Regional Fisheries Bodies (**RFB**) are solely scientific advisory bodies (e.g. the International Council for the Exploration of the Seas (ICES)), but most are Regional Fisheries Management Organizations (**RFMO**) with both a fisheries conservation and management remit. The latter may obtain scientific advice from other RFBs, or from internal scientific committees and working groups.

Text Box 1. Over-arching principles that will enhance development of robust shark NDFs

1. Good communication between Fisheries Authorities and CITES Authorities within and between Parties, especially where Fisheries Authorities are designated as the Scientific Authority for making NDFs for sharks and/or other aquatic species.
2. International coordination, including through the bilateral and multilateral development of joint NDFs for shared (straddling, high seas and highly migratory) stocks.
3. Collaborative development of stock assessments and NDFs for high seas shark stocks through membership of Regional Fisheries Bodies.
4. Parties adopting standard approaches that allow NDFs to be equivalent and comparable, regardless of provenance, enhanced by peer review and sharing of NDF methodologies.

How to Use this Guidance

This Guidance has been developed as a series of colour-coded steps, illustrated by the flow-chart in **Figure 2** and by **Table 1**. The Worksheets provided at each Step are supported by supplementary information and other sources in the Annexes. Authorities are advised, in particular, to consult the detailed Guidance Notes in **Annex 1** for further advice on completing the Worksheets as they make their way through the NDF process.

The primary intent of this document is to guide Scientific Authorities through the process of carrying out NDFs for shark species, considering the range of different scenarios that may be encountered, for example, species caught:

- in **target fisheries**;
- as **secondary catch (i.e. a secondary target, rather than an unwanted bycatch)**;
- from **stocks exploited by several States**; and/or
- in **data-poor situations**.

Steps 2–5, shown in colour in **Figure 2**, are directly related to the **role of Scientific Authorities** in preparing NDFs and receive particular attention in the following pages. Other related tasks (**Steps 1 and 6**) that are primarily the **responsibility of Management Authorities** are also described. This is because the data gathered and feedback provided at those stages will assist the work of the Scientific Authorities and aid the process by which existing NDFs are reviewed and new NDFs prepared. This approach also recognises that CITES Scientific and Management Authority roles may overlap considerably in some Parties.

Authorities are recommended to consider **Step 6** in <u>all</u> cases (and not only in relation to a Negative NDF) as part of an **adaptive management approach**. Although this Guidance is intended to guide a Scientific Authority through the process of gathering and analysing data relevant to an NDF, ultimately it is necessary for the Scientific Authority to **weigh up the risks and evidence to make its final NDF decision**.

Table 1 provides an overview of the **structure of this Guidance**, as follows (from left to right):

- the **Steps** in the decision-making process, as illustrated in **Figure 2**;
- the **Sections** under each Step (also shown in **Figure 2**); and
- the main **Question**(s) to be answered under each Section.

Text Box 2

Introduction from the sea (IFS)

When a CITES-listed species that was taken on the **high seas** (in an area not under the jurisdiction of any State) is landed, this is referred to as an "introduction from the sea" (**IFS**) and is included in CITES' definitions of "trade" and therefore requires an NDF.

Under the framework agreed at CITES CoP16 (contained in **Resolution 14.6 (Rev. CoP16)**), where a vessel catches an Appendix II listed species on the high seas **and**:

- lands the specimen(s) in the **same State** to which the vessel is flagged, the Management Authority of the "**State of introduction**" (i.e. the State to which the vessel is flagged – the Flag State) must grant an **IFS certificate**, requiring an NDF to be prepared before the catch can be landed;
- lands the specimen(s) in a **different State** to the State to which the vessel is flagged, the transaction will be **treated as an export**. The Management Authority of the Flag State must issue an **export permit**, requiring an NDF and a legal acquisition finding.

A narrow exception to this requirement has been agreed in cases where **chartering arrangements** are in place between two CITES Parties. In such cases, where a vessel chartered by one State (State A) from the Flag State (State B), catches a species on the high seas and wishes to land the specimens in State A, the two States **can agree** that the **chartering State (State A) will issue an IFS certificate** for the specimens concerned (rather than State B having to issue an export permit).

According to Resolution Conf. 14.6 (Rev. CoP16), for this exception to apply, the chartering arrangements should be consistent with the framework for chartering of a relevant Regional Fisheries Body (**RFB**) and the CITES Secretariat should be informed in advance of the arrangement, enabling CITES Authorities/RFBs to find out from the Secretariat what agreement is in force.

Note that, although an NDF is required for the purposes of an IFS certificate, **a legal acquisition finding** (**LAF**) in the strict sense is not necessary if the specimens are not going to be exported to another State (see below). Resolution Conf. 14.6 (Rev. CoP16) does, however, recommend that Parties, when issuing an IFS certificate, 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.

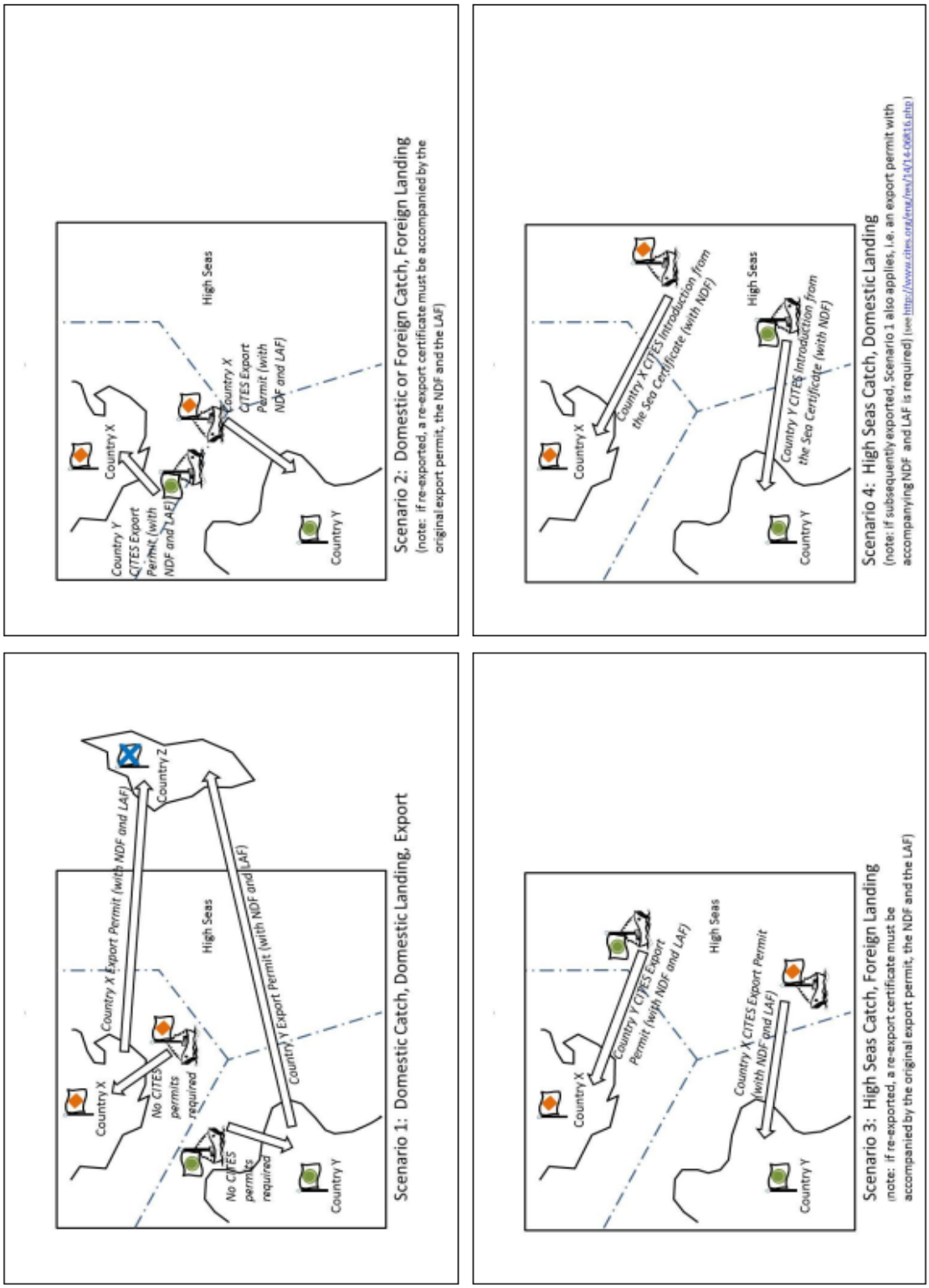
In cases where the specimens are **subsequently to be exported**, a legal acquisition finding will also be required for the issuing of the export permit.

Article IV.7 specifies that IFS certificates may be granted "in respect of periods not exceeding one year for total numbers of specimens to be introduced in such periods". In other words, just as with specimens landed in national waters, an NDF may be based on a total catch quota (agreed to be non-detrimental) for the year and issue individual permits to vessels until that quota has been met for the stock being fished (see also **Text Box 3** below).

Figure 1, reproduced with permission from Clarke *et al*. (2014), illustrates some of these issues.

See also: http://www.nmfs.noaa.gov/ia/agreements/global_agreements/cites_page/cites.pdf

Figure 1. Four scenarios of catch, landing and/or export and CITES documentation required



Reproduced with permission from Clarke *et al*. (2014)

Figure 2. Flow chart illustrating NDF process

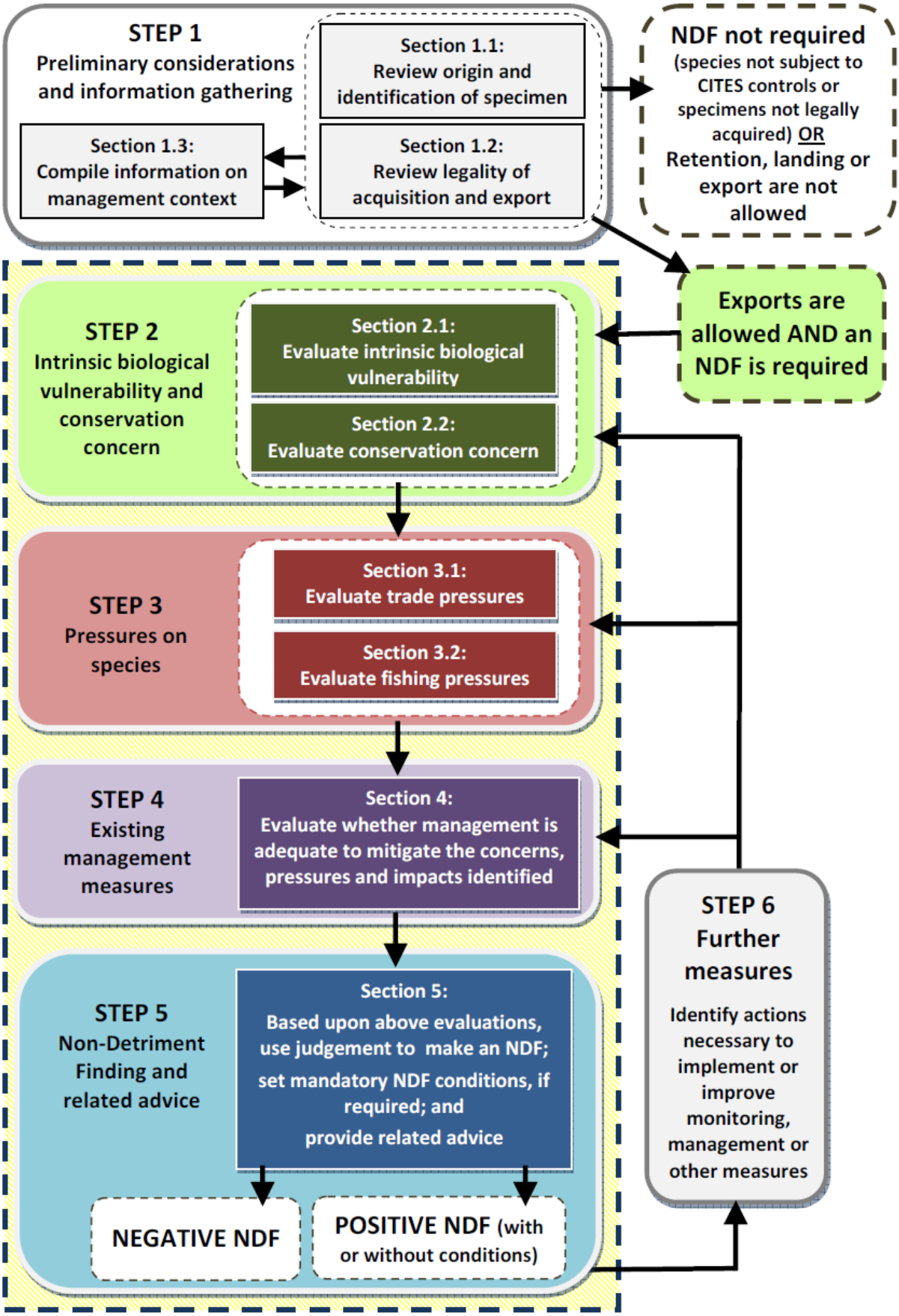
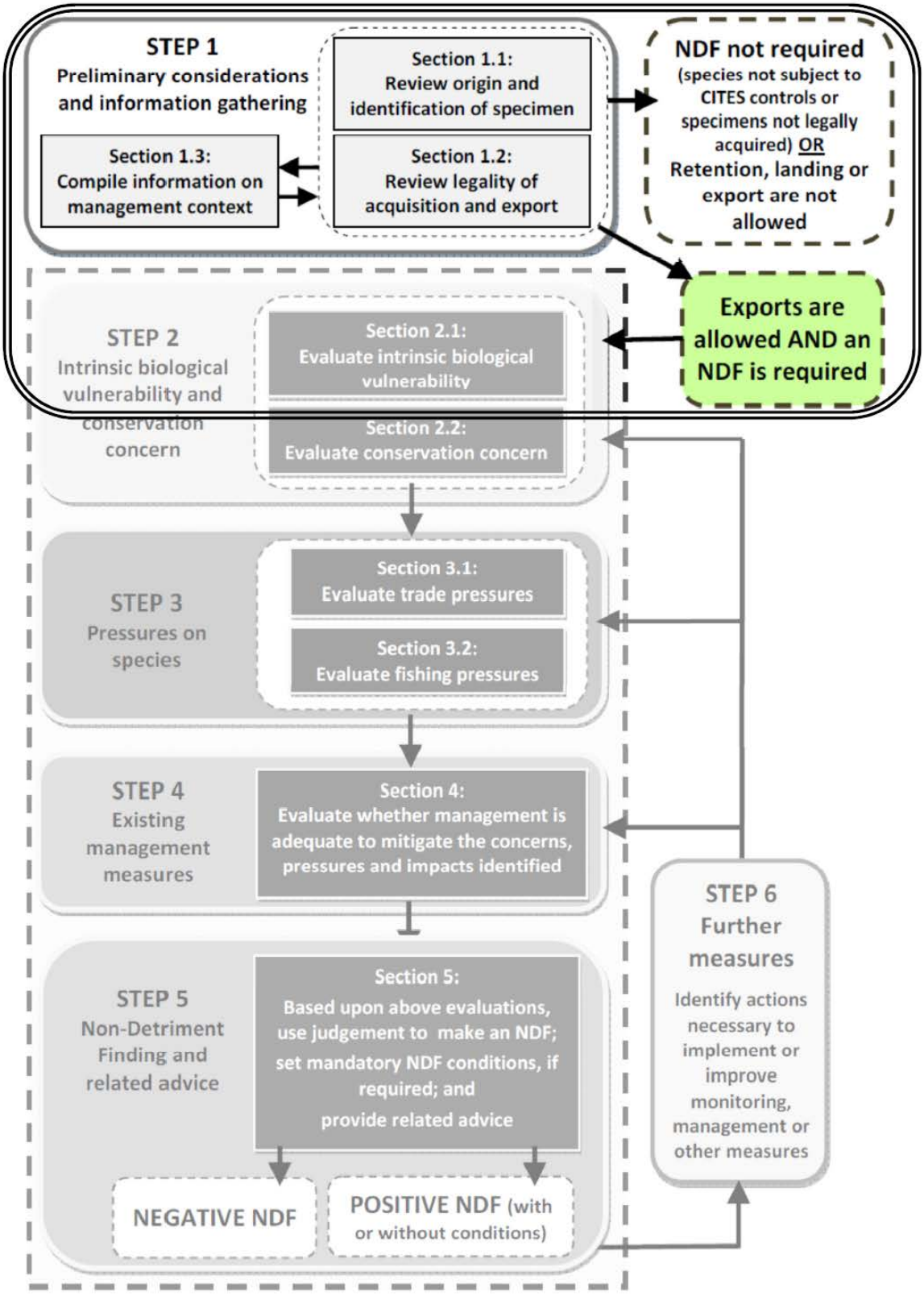


Table 1. Structure of the Guidance

Steps	Sections	Questions
Step 1 Preliminary considerations and information gathering (to be carried out prior to NDF process)	**Section 1.1** Review origin and identification of specimen	**1.1 (a)** Is the specimen subject to CITES controls?
		1.1 (b) Where, or from which stock of the species, was (will) the specimen (be) taken?
	Section 1.2 Review legality of acquisition and export	**1.2** Was (will) the specimen (be) legally obtained and is export allowed?
	Section 1.3 Compile information on management context	**1.3** What does the available management information tell us?
NDF starts here:		
Step 2 Intrinsic biological vulnerability & conservation concern	**Section 2.1** Evaluate intrinsic biological vulnerability	**2.1** What is the level of intrinsic biological vulnerability of the species?
	Section 2.2 Evaluate conservation concern	**2.2** What is the severity and geographic extent of conservation concern?
Step 3 Pressures on species	**Section 3.1** Evaluate trade pressures	**3.1** What is the severity of trade pressure on the stock of the species concerned?
	Section 3.2 Evaluate fishing pressures	**3.2** What is the severity of fishing pressure on the stock of the species concerned?
Step 4 Existing management measures	**Section 4** Evaluate whether management is adequate to mitigate the concerns, pressures and impacts identified	**4.1 (a)** Are existing management measures appropriately designed and implemented to mitigate the pressures affecting the stock/population of the species concerned?
		4.1 (b) Are existing management measures effective (or likely to be effective) in mitigating the pressures affecting the stock/population of the species concerned?
Step 5 Non-Detriment Finding and related advice	**Section 5** Based upon above evaluations, use judgement to make a Non-Detriment Finding; set mandatory NDF conditions, if required; and provide related advice	**5.1** What is the final outcome of the previous steps? Based on the outcomes of the previous steps, the Scientific Authority now has to use its judgement to decide: Is it possible to make a positive NDF (with or without associated conditions)? OR Is a negative NDF required?
NDF finishes here.		
Step 6 Further measures		Identify actions necessary to implement or improve monitoring, management, or other measures.

STEP 1:
PRELIMINARY CONSIDERATIONS AND INFORMATION GATHERING



Introduction

This first step has two important **objectives**:

1. **to confirm whether an NDF will be needed, and**
2. **to compile the information used to reach this decision.**

CITES assigns Management Authorities the task of reviewing the origin and identification of the specimens for which an export permit is needed, and confirming whether the specimens were legally obtained. The activities identified in this section are not, therefore, part of the Scientific Authority's NDF-development duties. Nonetheless, guidance for this preliminary step is included here because the same experts may be involved in both processes, and the information obtained at this stage is also important for making decisions during **Steps 2–5** in this NDF Guidance.

There are **two reasons why a Management Authority will initiate this step**:

1. A **request has been received** for an export permit and/or an introduction from the sea (**IFS**) certificate (for prospective catches or for catches that have already taken place).
2. For the purposes of **management planning of the shark stock concerned** (for example, setting a sustainable harvest and/or export quota), where future requests for IFS certificates or export permits are expected but have not yet been received.

Is an NDF necessary?

As discussed in the **Introduction** to this Guidance (see "**What are CITES Non-detriment Findings?**"), an NDF for CITES-listed Appendix II shark species must be issued by a Party if:

1. An **export permit is to be issued**, in cases where:

- Sharks are caught within the **national waters of a State** (territorial waters or Exclusive Economic Zone - **EEZ**) and then, **following landing in a Port of the same State, that State wishes to export the specimens.**
- Sharks are caught within the **national waters of a State** (territorial waters or EEZ) and the specimens are to be **landed in the Port of a different State** from the one in which they were caught.
- A **State's vessel** catches sharks on the **high seas** and **lands them in the Port of another State** (see **Text Box 2** and **Figure 1** for further information).

2. An **IFS certificate is required**, in cases where:

- A **State's vessel** catches sharks on the **high seas** and **lands the specimens in its own Port** (see **Text Box 2** and **Figure 1** for further information).

However, if any of the following circumstances apply, **an NDF will NOT be required**. (Further guidance to assist Authorities in their decision-making in such situations is provided in the Guidance Notes in **Annex 1**, and the Worksheets in **Sections 1.1** and **1.2** below.)

- The specimen has **not been correctly identified** on the export permit application and the actual species to be exported is **not subject to CITES controls** (see **Section 1.1**).
- The specimen was **obtained illegally** and, because it is in contravention of applicable national or sub-national laws, export is not allowed (see **Section 1.2**).
- **International export is banned** by national legislation (see **Section 1.2**).

In addition, Scientific Authorities **will NOT be required to make a new NDF if the export permit is consistent with an existing NDF** which, for example, used scientific advice to set a catch quota, Total Allowable Catch (**TAC**), and/or export quota for a one year period. In this case, individual export permits may continue to be issued throughout the year under that NDF, for as long as they are **consistent with the scientific advice** and **do not exceed** any specified limits or contravene other conditions. Under **Article IV.3** of CITES, a Scientific Authority is obliged to **monitor** both the **export permits granted** by that State for specimens of species included in Appendix II and the **actual exports** of such specimens.

International trade of **captive-bred** specimens of CITES Appendix II listed species requires that the Management Authority, with the advice of the Scientific Authority, be satisfied that the breeding stock meets the criteria in Resolution Conf. 10.16 (Rev.). However, while specimens of other CITES-listed fish species (e.g. sturgeon) may be derived from captive-bred sources, this issue will rarely apply to specimens of CITES-listed sharks. The NDF procedures applicable for specimens derived from captive-bred sources are not, therefore, considered further in this Guidance.

Once it has been determined that international export is permitted under national legislation and that a new NDF is required, it is useful to review available information on the management context for the shark stock concerned. This information will inform decision-making under **Steps 2 to 5** of this Guidance. The type of information required is described in **Section 1.3 below**, with further details in **Annex 1** (**Table A**). Some of this information will also be relevant to decisions made under **Sections 1.1 to 1.2** below; therefore, in practice, collation of information on the management context is likely to take place alongside consideration of these preliminary issues.

Section 1.1:
Review origin and identification of specimen

Is the specimen subject to CITES controls?

In order to know whether an NDF is required, it is first necessary to determine whether the product (specimen) [12] derives from a species subject to CITES controls (see **Introduction** for shark species currently listed on Appendix II of CITES). This requires consideration of the **effectiveness of specimen identification** and **traceability**.

See the Guidance Notes for Step 1 (Annex 1, p. 64) for more information on factors to consider when reviewing this issue, and for sources of identification guides and appropriate methodologies.

Where, or from what stock, was (will) the specimen (be) taken?

It is desirable to confirm the location of harvest, and hence the stock from which the specimen(s) is (are) derived, because **stock identity influences other decisions** such as **legality of acquisition** and **whether previous NDFs are still relevant**. It will also determine whether the specimens came from the **Convention area of a Regional Fisheries Body** (**RFB**), which is important if the State involved is a Member of that RFB, and if RFB management is in force for the listed species.

Certain situations can require more precise information with respect to geographic origin of harvest. For example, if a no-take marine protected area overlaps with part of the geographical distribution of a stock, the legality of harvest will depend upon whether the specimen was harvested within or outside the closed area. Stock boundaries are also important, as NDF decision-making will involve different considerations for stocks shared between States and/or occurring on the high seas, compared with stocks that are restricted in distribution to a single EEZ.

To assist in answering this question, CITES Authorities may wish to **consider whether more detailed information should be requested on the geographical location** of the harvest of marine fish species, including sharks, during the permit application process. It would become easier to determine origin if existing forms and permits were adapted to require more detailed harvest location data (see **Resolution Conf. 12.3 (Rev. CoP16)**), for example, to include data from vessel logbooks.

Determining the stock from which the specimen was derived will also affect assessments made under **Steps 2-5** of this Guidance. Conservation concerns, harvest/trade impacts, and applicable management measures may vary among and between stocks; ideally each stock should be considered separately when making an NDF.

[12] Under CITES definitions, "specimen" refers to any animal, whether alive or dead, or any readily recognizable part or derivative thereof.

<table>
<tr><th colspan="4">Worksheet for Step 1</th></tr>
<tr><th colspan="4">Question 1.1(a)
Is the specimen subject to CITES controls?
(How did you identify the species?)</th></tr>
<tr><td colspan="4">• See pages 64–65 of Annex 1 for additional Guidance Notes on completing this Worksheet.</td></tr>
<tr><td>Species name</td><td>Product form</td><td>CITES Appendix</td><td>Source of identification</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="4"><u>NEXT STEPS</u></td></tr>
<tr><td rowspan="3">In view of the above, is the specimen subject to CITES controls?
Consult “Decision and Next Steps” guidance in Annex 1.</td><td colspan="2">YES</td><td>GO TO Question 1.1(b)</td></tr>
<tr><td colspan="2">NOT CERTAIN</td><td>Describe concerns in more detail below, and GO TO Question 1.1(b)</td></tr>
<tr><td colspan="2">NO</td><td>NDF is not required</td></tr>
<tr><td>Concerns and uncertainties:</td><td colspan="3"></td></tr>
</table>

Worksheet for Step 1 (continued)		
Question 1.1(b) **From which stock will the specimen be taken/was the specimen taken?** **(Can origin and stock be confidently identified?)**		
• See pages 66–67 of **Annex 1** for additional Guidance Notes on completing this Worksheet**.**		
	Description/comments	**Sources of information**
Ocean basin		
Stock location/ distribution/ boundaries (attach a map)		
Is this a shared stock (i.e. occurring in more than one EEZ[13] and/or the high seas)?		
If the stock occurs in more than one EEZ, which other Parties share this stock?		
If a high seas stock, which other Parties fish this stock?		
Which, if any, RFB(s)[14] cover(s) the range of this stock?		
Are all Parties listed above (which fish or share the stock concerned) Members of the relevant RFB(s)?		
Are there geographical management gaps?		
How reliable is the information on origin?		
NEXT STEPS		
Is information on origin sufficiently detailed for Question 1.2 to be answered? Consult "Decision and Next Steps" guidance in **Annex 1**. **(Apply this answer at end of Question 1.2)**		**YES** **NO**

[13] Exclusive Economic Zone

[14] Regional Fisheries Body

Section 1.2:
Review legality of acquisition and export

If the Management Authority determines that a specimen was **obtained (or landed or retained) in contravention of applicable national or sub-national legislation**, or if **export is not permitted** under the relevant legal framework, then the specimen **should not be granted an export permit** under CITES. The **process stops here**, because an export permit cannot be granted and an NDF is not necessary.

Specimens of shark species may be obtained in contravention of applicable laws if, for example, they are:

- Derived from illegal fishing activities, such as through the use of prohibited fishing gears or methods, or where fins and carcasses were landed in contravention of finning regulations, or where there is a zero quota, or the quota has been exceeded.
- Sourced from within areas closed to fishing activities, for example, inside the boundaries of "no-take" marine protected areas (**MPAs**) or reserves.
- Caught during closed fishing seasons.
- Taken in violation of binding RFB management measures[15].
- Caught on the high seas, landed in the same State as the Flag State, but without an IFS certificate.

It is noted that the issuance of an IFS certificate does not require a legal acquisition finding in the strict sense (see **Text Box 2** above). Therefore, even if an IFS certificate is present, a legal acquisition finding will still need to be made before an export permit can be granted.

[15] While the catch of certain sharks may be legal, they may not be compliant with RFB conservation and management measures, particularly if those measures are not binding on RFB members, if the catching country is not a member of that RFB, or if an RFB member is not implementing the RFB measures. It is worth noting the CITES Standing Committee has convened a working group to discuss such implementation issues relevant to RFBs.

Worksheet for Step 1 (continued)

Question 1.2

Was (will) the specimen (be) legally obtained and is export allowed?

- See pages 67–68 of **Annex 1** for additional Guidance Notes on completing this Worksheet**.**

Is the species:	**Description/comments**	**Sources of information**
Protected under wildlife legislation, a regional biodiversity Agreement, or (for a CMS[16] Party) listed in CMS Appendix I?		
Sourced from illegal fishing activities (e.g. in contravention of finning regulations, or where a TAC[17] is zero or exceeded)?		
Taken from a no-take marine protected area or during a closed season?		
Taken in contravention of RFB recommendations, if any?		
Listed as a species whose export is prohibited?		
Of concern for any other reason?		

NEXT STEPS

In view of the above and the final section of the Worksheet for Question 1.1(b), was the specimen legally acquired and can exports be permitted? Consult "Decision and Next Steps" guidance in **Annex 1**.	**YES**	**GO TO Question 1.3**
	SOME DOUBT	Describe concerns in more detail below, and **GO TO Question 1.3**
	NO	Export cannot be permitted, **NDF is not required**
Concerns and uncertainties:		

[16] Convention on Migratory Species.
[17] Total Allowable Catch

Section 1.3:
Review available information on management context

Information on the relevant management context is very important for underpinning the assessments carried out under **Steps 2 to 5** of this Guidance. For example, in order to assess the adequacy of existing management measures (**Step 4**), it is valuable to know the number and nature of the relevant management units and management bodies for the stock concerned. This information is also useful to inform the preliminary considerations described under **Sections 1.1 and 1.2** above.

Worksheet for Step 1 (continued)		
Question 1.3 **What does the available management information tell us?**		
• See page 69 and Table A of **Annex 1** for additional Guidance Notes on completing this Worksheet**.**		
Part 1. Global-level information		
	Description/comments	**Sources of information**
Reported global catch		
Species distribution		
Known stocks/populations		
Main catching countries		
Main gear types by which the species is taken		
Global conservation status		
Multilateral Environmental Agreements		
Part 2. Stock/context-specific information		
Stock assessments		
Main management bodies		
Cooperative management arrangements		
Non-membership of RFBs		
Nature of harvest		
Fishery types		
Management units		
Products in trade		

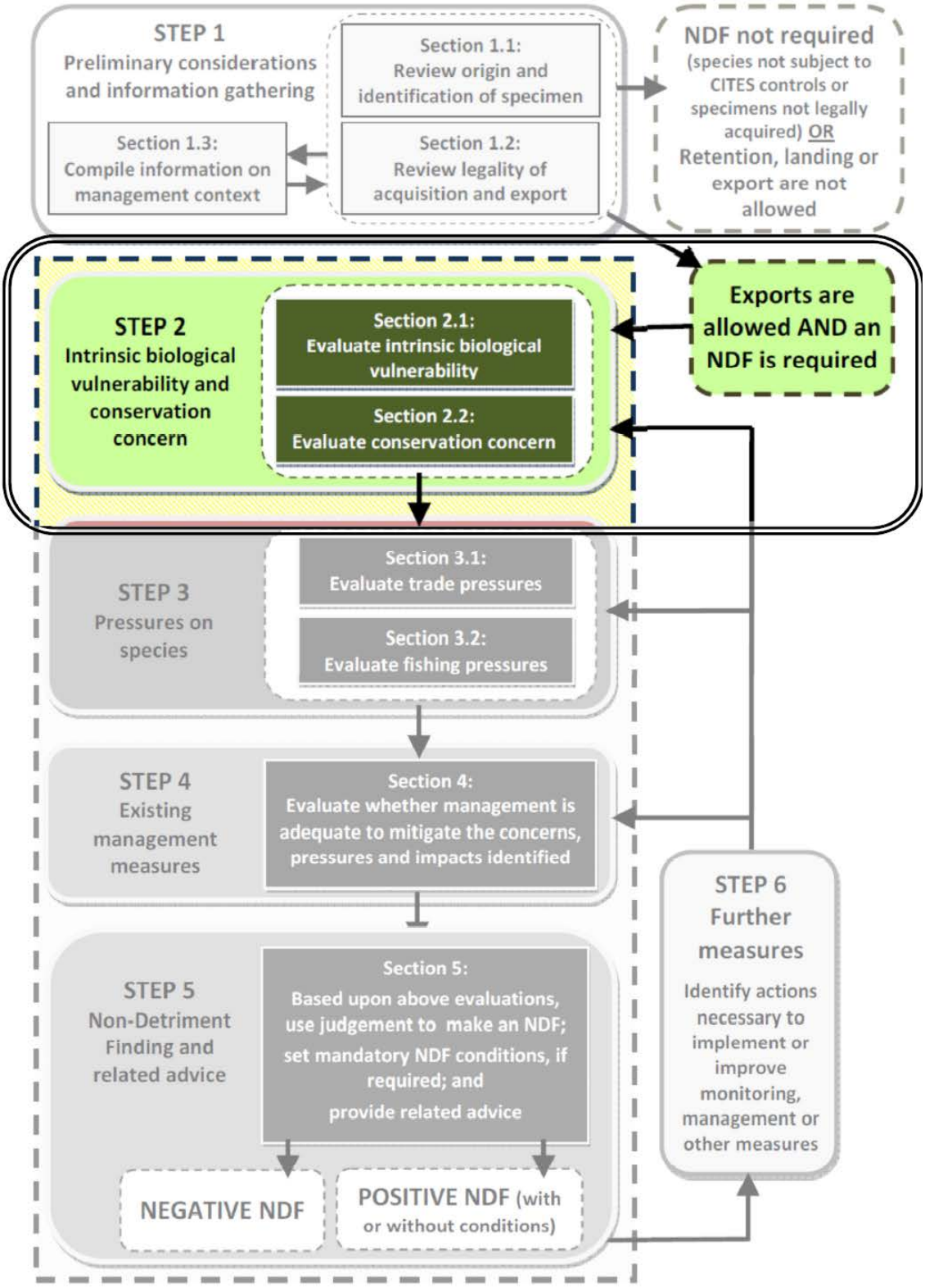
Part 3. Data and data sharing		
Reported national catch(es)		
Are catch and/or trade data available from other States fishing this stock?		
Reported catches by other States		
Catch trends and values		
Have RFBs and/or other States fishing this stock been consulted during or contributed data during this process?		

NEXT STEPS

The information collated in the above worksheets can now be passed to the Scientific Authority, so that the NDF process can begin with Step 2

STEP 2:

INTRINSIC BIOLOGICAL VULNERABILITY AND CONSERVATION CONCERN



Introduction

This second step measures:

1. the **intrinsic vulnerability** of a listed species to depletion (regardless of whether this is driven by accidental mortality, exploitation for domestic consumption, or to supply international trade demand), and
2. the current **conservation status** of the listed species as a result of exploitation and other pressures.

It is relatively easy to assess the intrinsic vulnerability of a CITES-listed species to over-exploitation and the severity of the conservation concern for the stock being considered. Sources of information on stock declines and other metrics are provided in **Annex 2**, and **Annex 4** provides standardised biological data for all shark and ray species listed in Appendix II. Authorities should note that biological characteristics can vary between stocks of any one species and, where available, the parameters of the local stock should be inserted.

This section may also be used (backed by other sources of information) to evaluate the intrinsic vulnerability of other commercially exploited aquatic species.

An NDF is, however, concerned with more than ensuring the survival of a listed species, or its relative short-term extinction risk (**Article IV.2(a)**). **Article IV.3** also considers whether limiting trade is necessary in order to "maintain that species throughout its range at a level consistent with its role in the ecosystems in which it occurs" as well as "above the level at which that species might become eligible for inclusion in Appendix I". Guidelines are not yet available for assessing the role of a shark species in its ecosystem and cannot be provided here, but several publications have described field research and model results that illustrate the potentially serious habitat and ecosystem impacts of removing large numbers of predatory sharks from the marine environment[18].

The Guidance Notes to **Steps 3, 4 and 5** (contained in **Annex 1**) provide advice on how the results of the analysis undertaken in **Step 2** may be taken into account in the NDF decision-making process. Essentially, the **greater the intrinsic vulnerability** of the species to over-exploitation, and the **higher the overall severity and extent of conservation concern**, the greater the requirements are for:

- good **quality of information**;
- the **rigour of fisheries management** to mitigate (reduce the severity of) the risks and pressures identified; and
- the **degree of precaution** that should be applied to making the NDF.

[18]See e.g, Ferretti *et al.* 2010; Friedlander and DeMartini, 2002; Heithaus *et al*., 2008, 2010; Ruppert *et al*., 2013; Stevens *et al*., 2000.

Section 2.1:
Evaluate intrinsic biological vulnerability of species

Some species are naturally more susceptible to the detrimental effects of over-exploitation than others, based on their intrinsic biological characteristics. **Sharks appear to be particularly vulnerable to the pressures of fishing** due to their "slow" **life-history characteristics**, although assessments are often complicated by the lack of comprehensive baseline data (e.g. Stevens *et al*., 2000). Additionally, the migratory nature of many shark species can make estimating stock size and devising management plans especially problematic. Any shark species listed in the CITES Appendices is, however, likely to be highly vulnerable.

Recent work by RFB Scientific Committees and government agencies has developed useful relative assessments of intrinsic biological vulnerability, using risk assessments conducted at the fishery level. For example, Hobday *et al*. (2007) used the following biological parameters in different fish species to assess and score their intrinsic vulnerability to exploitation pressure:

- average age at maturity; average maximum age;
- average size at maturity; average maximum size;
- fecundity; reproductive strategy;
- trophic level

The US National Oceanic and Atmospheric Administration (NOAA) has adapted and extended this approach with these additional parameters:

- population growth (*r*)
- growth coefficient (*k*)
- natural mortality (*M*)

This Guidance draws upon these examples by applying a range of parameters for evaluating species' "intrinsic biological vulnerability", on the understanding that certain biological characteristics contribute to the risk that harvest will be detrimental to their survival. Scientific Authorities are prompted in this section to note the particular biological factors that contribute to the vulnerability of the species under consideration here (i.e. the risk that harvest will be detrimental to this species' survival) from the species-specific data presented in **Annex 4**. The default figures in **Annex 4** are derived from international standardised data and may not reflect local stock characteristics. Wherever possible verified local data on stock characteristics should be utilised.

The rationale for this approach is described in Sant *et al*. (2012) and Oldfield *et al*. (2012). Many of the metrics for the different levels of vulnerability are taken from Sant *et al.* (2012), others from FAO (2001).

Worksheet for Step 2

Question 2.1

What is the level of intrinsic biological vulnerability of the species?

- See pages 73 to 75 of **Annex 1** for additional Guidance Notes on completing this Worksheet.
- In the Worksheet below, circle the **level of vulnerability** associated with each **Intrinsic Biological Factor**. Default Indicator/metric figures for listed shark and ray species are provided in **Annex 4** (pages 111–131). These may be inserted here, but they are derived from international standardised data and may not reflect local stock characteristics. Wherever possible, verified local data on stocks should be utilised.

Intrinsic biological factors *(see p. 73 of the Guidance Notes)*	**Level of vulnerability** *(circle as appropriate)*	**Indicator/metric** *(see p. 73 of the Guidance Notes)*
a) Median age at maturity	Low	
	Medium	
	High	
	Unknown	
b) Median size at maturity	Low	
	Medium	
	High	
	Unknown	
c) Maximum age/longevity in an unfished population	Low	
	Medium	
	High	
	Unknown	
d) Maximum size	Low	
	Medium	
	High	
	Unknown	
e) Natural mortality rate (M)	Low	
	Medium	
	High	
	Unknown	
f) Maximum annual pup production (per mature female)	Low	
	Medium	
	High	
	Unknown	

Intrinsic biological factors *(see p. 73 of the Guidance Notes)*	**Level of vulnerability** *(circle as appropriate)*	**Indicator/metric** *(see p. 73 of the Guidance Notes)*
g) Intrinsic rate of population increase (r)	Low	
	Medium	
	High	
	Unknown	
h) Geographic distribution of stock	Low	
	Medium	
	High	
	Unknown	
i) Current stock size relative to historic abundance	Low	
	Medium	
	High	
	Unknown	
j) Behavioural factors	Low	
	Medium	
	High	
	Unknown	
k) Trophic level	Low	
	Medium	
	High	
	Unknown	

SUMMARY for Question 2.1
Intrinsic biological vulnerability of species

Provide an assessment of the overall intrinsic biological vulnerability of the species (tick appropriate box below). Explain how these conclusions were reached and the main information sources used.

High	*Medium*	*Low*	*Unknown*

Explanation of conclusion and sources of information used:

NEXT STEPS

- Go to **Section 2.2**

Section 2.2:
Evaluate conservation concern

In this Step, Scientific Authorities are encouraged to draw on available information from **existing conservation status assessments** to document relevant threats and to support an evaluation of the severity of conservation concern associated with the stock(s) of the species concerned. The Scientific Authority is not required to undertake conservation status assessments as part of the NDF, where these are lacking, outdated, or incomplete, but may wish to do so.

Conservation and stock status assessment systems have a variety of forms (e.g. Red Lists[19], Red Data Books, threatened species listings, fish stock assessments) and a range of geographic scopes (sub-national, national, regional, or global).

For shark species, fish stock assessments, where these exist (which is not the case for many listed species), **are the most comprehensive and rigorous sources of information** available on the status of the stock concerned. Parties are therefore **encouraged to undertake stock assessments** for CITES-listed shark species: for high seas shark stocks, these may be developed through their membership of RFBs. Stock assessments provide:

- **estimates of stock size** at the time of assessment (breeding stock biomass relative to the level before exploitation);
- **forecasts of future stock size** and **growth rates** under different scenarios;
- and **advice on sustainable levels of harvest**.

However, **in the absence of stock assessments**, other sources (e.g. RFB risk and vulnerability assessments for sharks and IUCN Red Lists) may provide useful background information to inform management decisions. It is important to note, however, that the definition of assessment criteria and categories vary between different assessment systems. The NDF process for which this guidance has been developed is also designed to be a form of risk assessment.

Conservation status, in the IUCN Red List context, **is an assessment of the relative risk of extinction posed to a species (or stock of the species)**. Conservation status assessments may take many **factors into account to evaluate risk of extinction**. These factors may be relevant to other Steps in this Guidance. For example:

- **Number of individuals** (or biomass) remaining in the population being assessed, and **recent trends in population size** (**Section 2.1** and **Step 3**).
- **Known threats**, such as harvest and trade impacts, loss or degradation of habitat (**Step 3**).
- Existence and effectiveness of **management systems** in place (**Step 4**).

A detailed, well-documented, and up-to-date conservation status assessment may therefore provide information relevant to several of the remaining steps of this Guidance.

[19] Dulvy *et al*. (2014). *Extinction risk and conservation of the world's sharks and rays*. eLife.http://arxiv.org/abs/1312.3926

Worksheet for Step 2 (continued)

Question 2.2

What is the severity and geographic extent of the conservation concern?

- See pages 76 to 80 of **Annex 1** for additional Guidance Notes on completing this Worksheet.
- Based on existing stock assessments or conservation status assessments, evaluate the severity and geographic extent/scope of conservation concern, including reasons for the conclusions drawn and information on sources used.
- In the Worksheet below, circle the **level of severity/scope of concern** associated with each **Factor** using the descriptions in the indicator column in **Table B** in the Guidance Notes (**Annex 1**). In the column entitled **Indicator** in the Worksheet below, note briefly the reason for this assessment of level of severity/scope of concern. Further explanation (including information on sources used) can be provided in the boxes entitled "*Comments*".

Conservation concern factors *(see p.78 of the Guidance Notes)*	**Level of severity / scope of concern** *(circle as appropriate)*	**Indicator/metric** *(see p.78 of the Guidance Notes)*
Conservation or stock assessment status	Low	
	Medium	
	High	
	Unknown	
	Comments:	
Population trend	Low	
	Medium	
	High	
	Unknown	
	Comments:	

Conservation concern factors *(see p.78 of the Guidance Notes)*	**Level of severity / scope of concern** *(circle as appropriate)*	**Indicator/metric** *(see p.78 of the Guidance Notes)*
Geographic extent/ scope of conservation concern	None	
	Low	
	Medium	
	High	
	Unknown	
	Comments:	

SUMMARY for Question 2.2
Severity and geographic extent of conservation concern

Provide an assessment of the overall severity and geographic extent of the conservation concern for this species or stock (tick appropriate box below). Explain how these conclusions were reached and the main sources of information used.

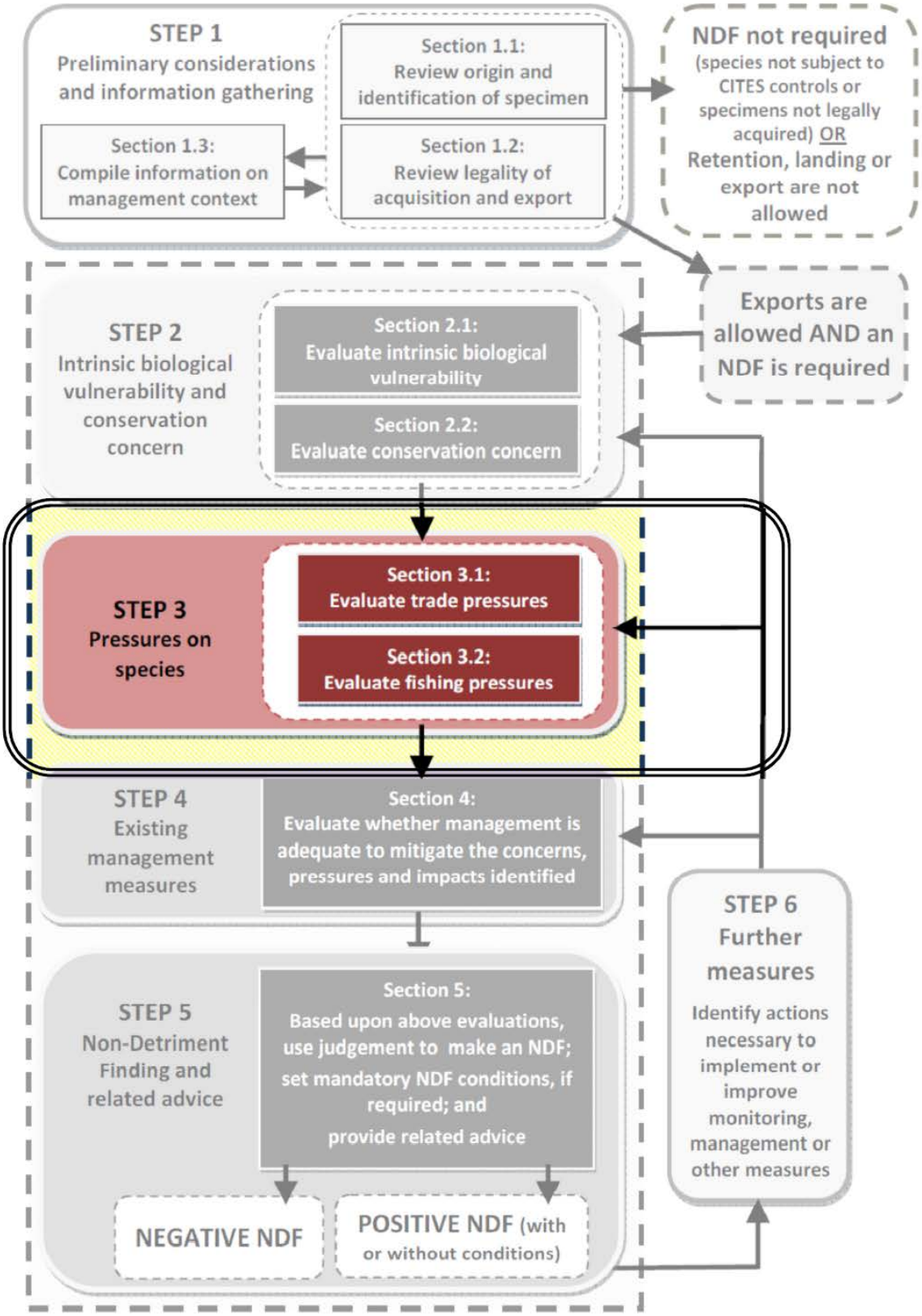
High	*Medium*	*Low*	*Unknown*

Explanation of conclusion and sources of information used:

NEXT STEPS

- Go to **Step 3**

STEP 3:
PRESSURES ON SPECIES



Introduction

Having described the intrinsic vulnerability of the species and its current conservation or stock assessment status in the previous step of this Guidance, the aim of **Step 3** is to consider the **external pressures** that are **continuing to affect its stocks**.

The IUCN Global Shark Red List Assessment[20] concluded that **fisheries mortality** (target and incidental) is by far the **single greatest cause of shark population depletion**, and that international trade drives a significant amount of that mortality. **Step 3 therefore focuses upon the impact on shark stocks of fisheries exploitation, because this is the major factor driving mortality that needs to be considered when developing CITES NDFs.** However, trade dynamics are also considered in the first part of this Step (in **Section 3.1**), as trade drives fisheries exploitation and provides a helpful backdrop to understanding the fishing pressures considered in the second part of the Step (**Section 3.2**). Trade data can also serve as a useful proxy where fisheries dependent/independent data are not available to assess the severity of fishing pressure on the stock of the shark species concerned.

In comparison to fisheries exploitation, other threats to sharks (such as **habitat loss and damage, pollution, depletion of food sources, and climate change**) generally have only a minor impact upon their status. They are therefore not discussed specifically in this step. However, where any of these threats are relevant for a particular stock, this should be kept in mind as potentially warranting a **greater degree of precaution** when a judgement is made as to whether a positive or a negative NDF is required.

In terms of the implications of this step for NDF decision-making:

- a **positive NDF is more likely** for a stock that is **not depleted** AND which is **not subject to a great deal of fishing mortality** than for,
- a **depleted stock**, which is of elevated conservation concern, AND which is **still subject to fishing pressure**.

In the latter case, permitting trade on a depleted stock could result in further declines, potentially driving the population down to a level where its survival is threatened and it qualifies for listing in Appendix I. There are, naturally, "grey areas" between these two extremes.

Completing the **Worksheets for Step 3** below with the aid of the Guidance Notes in **Sections 3.1 and 3.2** of **Annex 1**, will enable Scientific Authorities to make a **judgement** in **Step 5** as to whether:

- the **status of the stock** assessed in **Step 2**, combined with the **pressures on the stock** assessed in **Step 3**, are adequately mitigated by current **management measures** in place as assessed in **Step 4**, so as to allow a positive NDF (with or without conditions), or whether
- a negative NDF is required.

[20] Dulvy *et al*. (2014). *Extinction risk and conservation of the world's sharks and rays*. eLife.http://arxiv.org/abs/1312.3926

Section 3.1:
Evaluate trade pressures

The impacts of trade can be detrimental to the survival of the species concerned because trade may increase total mortality by driving fishing pressure and unsustainable harvest rates; this is the potential threat most relevant to CITES. Scientific Authorities can identify and evaluate these impacts by considering the available information about the scale and trend of legal and illegal trade – both international and domestic.

As noted above, an evaluation of trade dynamics can assist in understanding fishing pressures and patterns of exploitation. Trade data can also be used as a proxy where fisheries data are lacking. However, the key aim of this Step is to assess **overall fishing mortality** – this is undertaken in **Section 3.2** below.

Although **Section 3.2** considers the impact of all harvest, whether for domestic use or international trade, it is useful to consider the impact of international trade in relation to that of any domestic trade (both legal and illegal). Where products are associated with high values on international markets, international demand for the product is likely to drive increased catch, particularly of unmanaged stocks of the species concerned (Lack *et al*. 2014). High prices in international trade may also be associated with higher risks of laundering of products into trade in contravention of relevant laws and regulations.

Improving available **information on trade dynamics** for shark species would assist authorities in more accurately evaluating the pressures exerted by trade on shark stocks. This may be achieved through:

- the establishment of (regional) **databases** with information on exports and imports of shark products;
- carrying out analyses of **supply and distribution chains**;
- improving the use of **conversion factors** between live weight, landed dead weight and weight of traded products for CITES-listed shark species; and
- improving trade monitoring, facilitated by the introduction of **species-specific Customs codes**.

As similarly noted under **Step 2**, the **greater the severity of trade pressure** for the stock of the species concerned, the **greater are the requirements** of:

- **information quality;**
- **management rigour** required to mitigate (reduce the severity of) risks and pressures identified; and
- the **degree of precaution** that Scientific Authorities should apply to making the NDF.

NOTE:

In **Section 3.1** Scientific Authorities should make an effort to assess the severity of trade pressure **without taking into account** the impacts of existing management measures. The extent to which existing management is effectively mitigating the trade pressures identified in **Section 3.1** is considered in **Step 4**.

Worksheet for Step 3

Question 3.1

What is the severity of trade pressure on the stock of the species concerned?

- See pages 81 to 84 of **Annex 1** for additional Guidance Notes on completing this Worksheet.
- In the Worksheet below, circle the **level of severity** associated with each trade pressure **Factor** using the descriptions in the **Indicator** column in **Table C** in the Guidance Notes (**Annex 1**). In the column entitled **Indicator/metric** in the Worksheet below, note briefly the reason for this assessment of level of trade pressure severity. Consider **all products in both domestic and international trade**.
- For each Factor, circle the **level of confidence** associated with each assessment of trade pressure severity. This involves an assessment of the **quality of the information** used to evaluate the severity of trade pressure on the stock of the species concerned.
- In the box entitled *"Reasoning",* provide reasons to justify the evaluation of severity of trade pressure and assessment of confidence level (i.e. quality of information used). Here, comments/information should also be provided on:
  - the sources of information used to evaluate severity of trade pressure;
  - whether a precautionary approach was taken to the evaluation of trade pressure severity (e.g. due to a lack of robust trade information to inform the evaluation);
  - whether the evaluation of trade pressure was adjusted (i.e. severity increased to a higher level) to take into account high intrinsic biological vulnerability/conservation concern assessed in **Step 2**;
  - whether information is particularly lacking and, if so, how this data availability may be improved (see also **Section 6.1** of the Guidance Notes in **Annex 1** for further advice).

Factor *(see p. 84 of the Guidance Notes)*	**Level of severity of trade pressure** *(circle as appropriate)*	**Indicator/metric** *(see p.84 of the Guidance Notes)*
(a) Magnitude of legal trade	Low	
	Medium	
	High	
	Unknown	
	Level of confidence (*circle as appropriate*): *(see p.83 of Guidance Notes)* Low Medium High	
Reasoning (e.g. has this assessment involved the exercise of precaution, and/or has severity of trade pressure been increased in light of the assessment in Step 2?)		

Factor *(see p. 84 of the Guidance Notes)*	**Level of severity of trade pressure** *(circle as appropriate)*	**Indicator/metric** *(see p.84 of the Guidance Notes)*
(b) Magnitude of illegal trade	Low	
	Medium	
	High	
	Unknown	
	Level of confidence (*circle as appropriate*): *(see p. 83 of Guidance Notes)* Low Medium High	
Reasoning (e.g. has this assessment involved the exercise of precaution, and/or has severity of trade pressure been increased in light of the assessment in Step 2?)		

NEXT STEPS

- Add notes in the Worksheet for **Section 6.1** on improvements in trade data availability/monitoring required to evaluate trade pressure under **Section 3.1**.
- GO TO **Section 3.2** to evaluate fishing pressures.

Section 3.2:
Evaluate fishing pressures

Fishing can exert pressure on shark stocks by way of **targeted/directed catch** and **secondary catch/bycatch** (whether retained or discarded). The total level of mortality experienced by the stock is key to its past and future status, regardless of whether that mortality occurs as a result of targeted fishing or secondary catch as part of other target fisheries. The same is true whether that catch occurs within EEZs or on the high seas, and whether it is discarded, used domestically or exported. **In short, all mortality needs to be considered when making an NDF**.

The **potential impacts of harvest mortality** on **shark stocks** and **ecosystems** include:

- **Death** or **injury** of individuals, whether retained or discarded;
- Limitation of future population growth through the **removal of particular sizes/life stages** (e.g. juveniles at coastal nursery grounds, aggregations of mature adults);
- Reduction in reproduction by **catching more of one sex than the other** (e.g. targeting aggregations of pregnant females); and
- **Degradation of ecosystems and habitats**, when stock depletion means that the shark population can no longer maintain its role in the ecosystem.

Scientific Authorities can identify and evaluate these impacts by considering the **best available information on fishing practices** (methods, gears) and **fishing intensity** (e.g. fishing effort – number of boats, fishing trips; proportion of the overall stock affected). **Population trends** are almost always a **useful indicator of fishing impacts**, as stock declines for sharks are only occasionally due to impacts other than fishing (which may have been identified in existing conservation status assessments in **Step 2**). **Trends in effort and landings**, however, can be driven by market forces rather than reflecting trends in stock status, and so **should be evaluated with due caution**.

When assessing overall fishing pressure, as many different metrics and methods of assessment as possible should be considered. For example, if catch per unit effort (CPUE) is used, it is important not to overlook the possible impact of additional mortality from discards and illegal, unreported and regulated (IUU) fishing. **IUU fishing** exerts pressures of largely unknown magnitude on shark stocks. It not only **compromises the accuracy of data** used to undertake stock assessments (generally leading to an underestimate of fishing mortality), but also **undermines the effectiveness of existing conservation and management measures** (García Núñez, 2008).

Because many CITES Parties can exert fishing pressure on a single high seas shark stock, **it is important that all high seas captures of all States are considered when developing NDFs for introductions from the sea**. The same is true when **more than one State fishes a stock that occurs within the waters of more than one State**. In these cases, which are common to many shark species, it is not sufficient to consider just those fisheries operating inside the exporting State's EEZ, or only the harvests made by the flag vessels of that State.

In order to make robust evaluations of the pressures exerted by fishing on the stock of a shark species, in many cases there will be a need to **improve reporting** of catch, bycatch, discard and landings data by species and by weight, in order to determine contribution of bycatch and discards to overall shark mortality. Data should be both timely and standardised, to allow effective monitoring of the state of fisheries resources (see also **Step 6**) and to detect established and emerging trends.

As similarly noted under **Step 2**, the **greater the severity of fishing pressure** for the stock of the species concerned, the **greater are the requirements** of:

- **information quality**;
- **management rigour** required to mitigate (reduce the severity of) risks and pressures identified; and
- **degree of precaution** that Scientific Authorities should apply to making the NDF.

NOTE:

In **Section 3.2,** Scientific Authorities should make an effort to **assess the severity of fishing pressure, without taking into account the impacts of existing management measures**. While in some cases the risks posed by fishing may be reduced by existing management measures, the extent to which existing management is effectively mitigating the fishing pressures identified in **Section 3.2** is considered in **Step 4**.

Worksheet for Step 3 (continued)

Question 3.2

What is the severity of fishing pressure on the stock of the species concerned?

- See pages 85 to 90 of **Annex 1** for additional Guidance Notes on completing this Worksheet.
- In the Worksheet below, circle the **level of severity** associated with each fishing pressure **Factor** using the descriptions in the **Indicator** column in **Table D** in the Guidance Notes (**Annex 1**). In the column entitled **Indicator/metric** in the Worksheet below, note briefly the reason for this assessment of level of fishing pressure severity. Consider **all fishing methods and gears** that interact with the shark stock concerned.
- For each Factor, circle the **level of confidence** associated with each assessment of fishing pressure severity. This involves an assessment of the **quality of the information** used to evaluate the severity of fishing pressure on the stock of the species concerned.
- In the box entitled *"Reasoning",* provide reasons to justify the evaluation of severity of fishing pressure and assessment of confidence level (i.e. quality of information used). Here, comments/information should also be provided on:
  - the sources of information used to evaluate severity of fishing pressure;
  - whether a precautionary approach was taken to the evaluation of fishing pressure severity (e.g. due to a lack of robust information to inform the evaluation);
  - whether the evaluation of fishing pressure was adjusted (i.e. severity increased to a higher level) to take into account high intrinsic biological vulnerability/conservation concern assessed in **Step 2**;
  - whether information is particularly lacking and, if so, how this data availability may be improved (see also **Section 6.1** of the Guidance Notes in **Annex 1** for further advice).

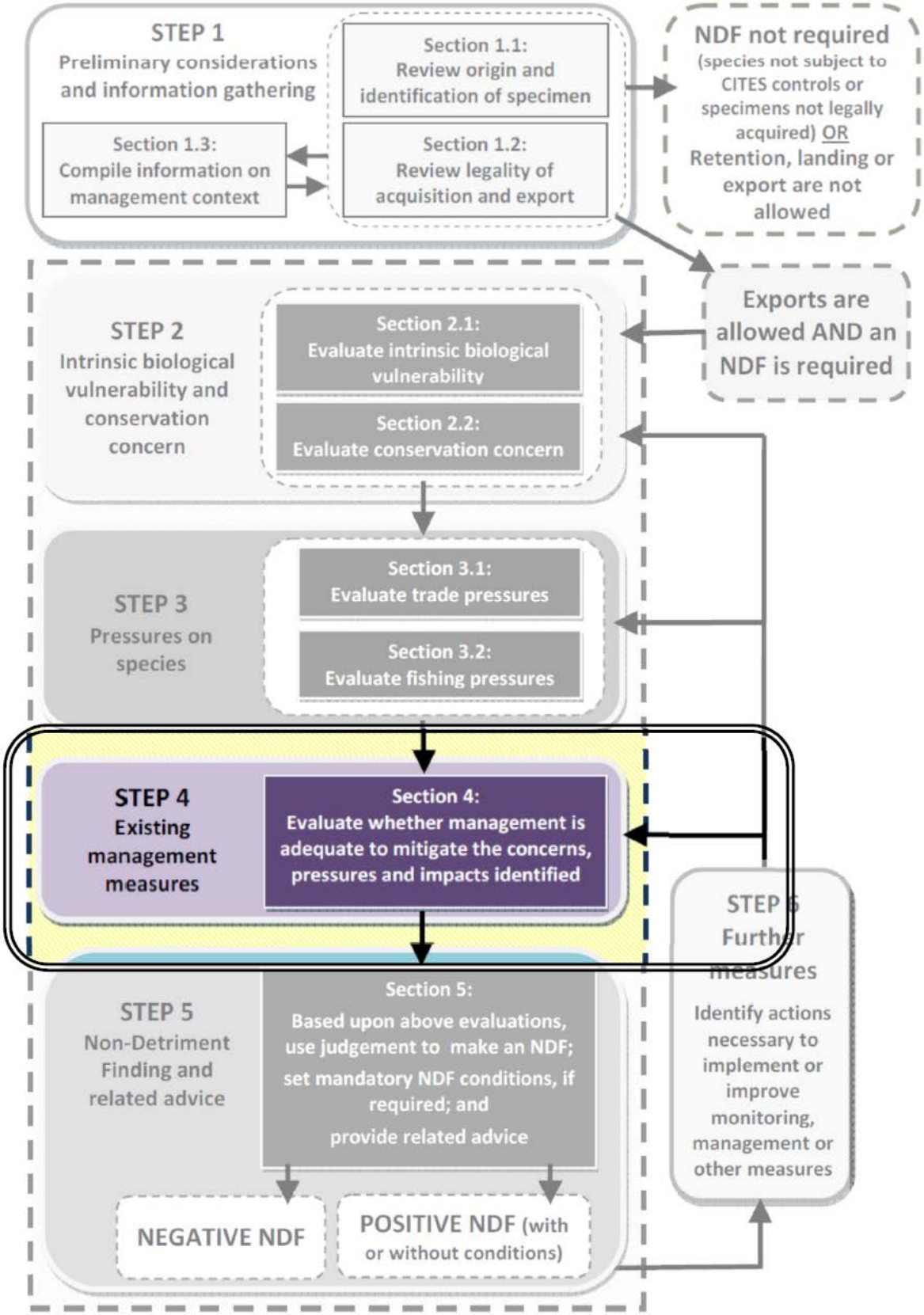
Factor *(see p. 89 of the Guidance Notes)*	**Level of severity of fishing pressure** *(circle as appropriate)*	**Indicator/metric** *(see p. 89 of the Guidance Notes)*
(a) Fishing mortality (retained catch)	Low	
	Medium	
	High	
	Unknown	
	Level of confidence (*circle as appropriate*): *(see p. 88 of Guidance Notes)* Low Medium High	
Reasoning (e.g. has this assessment involved the exercise of precaution, and/or has severity of fishing pressure been increased in light of the assessment in Step 2?)		
(b) Discard mortality	Low	
	Medium	
	High	
	Unknown	
	Level of confidence (*circle as appropriate*): *(see p. 88 of Guidance Notes)* Low Medium High	
Reasoning (e.g. has this assessment involved the exercise of precaution, and/or has severity of fishing pressure been increased in light of the assessment in Step 2?)		

Factor *(see p. 89 of the Guidance Notes)*	**Level of severity of fishing pressure** *(circle as appropriate)*	**Indicator/metric** *(see p. 89 of the Guidance Notes)*
(c) Size/age/ sex selectivity	Low	
	Medium	
	High	
	Unknown	
	Level of confidence (*circle as appropriate*): *(see p. 88 of Guidance Notes)* Low Medium High	
Reasoning (e.g. has this assessment involved the exercise of precaution, and/or has severity of fishing pressure been increased in light of the assessment in Step 2?)		
(d) Magnitude of illegal, unreported and unregulated (IUU) fishing	Low	
	Medium	
	High	
	Unknown	
	Level of confidence (*circle as appropriate*): *(see p. 88 of Guidance Notes)* Low Medium High	
Reasoning (e.g. has this assessment involved the exercise of precaution, and/or has severity of fishing pressure been increased in light of the assessment in Step 2?)		

NEXT STEPS

- Add notes in the Worksheet for **Section 6.1** on improvements in fisheries data availability/monitoring required to evaluate fishing pressure under **Section 3.2**.
- GO TO **Section 4** to evaluate the extent to which existing management measures are effective in mitigating the risks/pressures/concerns identified in **Steps 2 and 3**.

STEP 4:
EXISTING MANAGEMENT MEASURES



Introduction

For most harvested shark species listed in CITES Appendix II, non-detrimental trade requires the effective implementation of **management measures**.

Steps 2 and 3 of this Guidance have supported Scientific Authorities in the evaluation of the species concerned as "Low", "Medium", or "High" for intrinsic biological vulnerability, conservation concern, and fishing and trade pressures, and to identify the particular factors that contribute to the severity of concern, risk, and impact.

Step 4 guides Scientific Authorities in the use of available information to evaluate whether management measures are **adequate** to mitigate (reduce the severity of) the identified concerns, pressures and impacts, taking into account level of severity and state of knowledge. Specifically, the existing management measures in place are evaluated in terms of whether they are:

1. **Appropriately designed and implemented** in order to mitigate the fishing/trade pressures identified for the species concerned and its stocks (**Question 4.1 (a)**). "Designed" in this context is used to mean whether the **appropriate type(s) of measure(s)** is/are in place to mitigate the pressures identified. The extent to which existing management is consistent with scientific advice is considered in relation to "effectiveness of management" under **Question 4.1(b)** below. **AND**
2. **Effective** (i.e. positive results have been demonstrated through robust monitoring) or, where not yet proven/verified, likely to be effective in mitigating the fishing/trade pressures identified (**Question 4.1(b)**). **Question 4.1(b)** also considers whether management is **flexible and adaptive**, meaning that there is a system in place to monitor and review management outcomes and to adjust the measures in place as necessary.

These two questions in **Step 4** assist authorities in identifying where gaps in management exist; whether the design and/or implementation of management measures needs to be improved; and whether improved monitoring of the effectiveness of management is required. **Step 4** therefore allows for the provision of advice on what should be considered in the following **Steps 5 and 6**. Guidance on decision-making in the absence of management, and the measures that can be taken to improve monitoring and/or management, is provided in **Steps 5 and 6** respectively.

As similarly noted above under **Steps 2 and 3**, the **greater the severity of intrinsic biological vulnerability, conservation concern, and fishing/trade pressures** for the stock of the species concerned, the **greater are the requirements** of **information quality** with regard to the management measures in place and their impact and **management rigour** required to mitigate (reduce the severity of) risks and pressures identified.

Worksheet for Step 4

Preliminary stage

Compile information on existing management measures

In the table below, provide a list of existing generic and species-specific management measures in place for the stock or population of the species concerned. Consider measures implemented at the **(sub-)national, regional and international level** (i.e. including any measures implemented by relevant RFBs). Include a brief description of each measure, the sources of information used and any other comments if appropriate.

A table of commonly used generic and species-specific fisheries management measures is provided in **Annex 5** (page 132). **It is advisable to consult Annex 5 prior to completing the Worksheets in this section, in conjunction with context-specific fisheries management advice**.

Existing management measures *(see Annex 5 for examples)*	**Is the measure generic or species-specific?**	**Description/comments/sources of information**
(SUB-)NATIONAL		
REGIONAL/INTERNATIONAL		

NEXT STEPS

- GO TO **Question 4.1(a).**

Worksheet for Step 4 (continued)

Question 4.1(a)

Are existing management measures appropriately designed and implemented to mitigate the pressures affecting the stock/population of the species concerned?

- See pages 91 to 92 of **Annex 1** for additional Guidance Notes on completing this Worksheet.
- Firstly assess whether **appropriately designed** management measures are in place to mitigate the pressures affecting the stock/population of the species concerned:
  - From the **"Preliminary stage"** Worksheet above, transfer information on existing management measures into the Worksheet below, alongside the relevant fishing and trade pressure Factor(s) the measure(s) can help to mitigate (as evaluated in **Step 3**).
  - Use the information in the table of commonly used generic and species-specific fisheries management measures in **Annex 5** to determine which pressures the existing management measures in place can help to address/mitigate.
- Next, assess whether the existing management measures in place are being **implemented:**
  - In the column entitled "Relevant Monitoring, Control and Surveillance (MCS) measure(s)", include information on existing MCS measures that are relevant to the implementation of the existing management measures identified. **Annex 5** provides information on MCS measures that can help to secure compliance with commonly used fisheries management measures.
  - Second, based on the explanations provided in the column in the Worksheet below entitled "Overall assessment of compliance regime", make a judgement as to whether the existing management measure(s) identified is/are being implemented (i.e. adequately enforced/complied with).

NOTE: in some circumstances where the fishing/trade pressure severity was assessed as "Low" for any of the Factors in **Step 3**, mitigation may not be required (see also the Guidance Notes for Question 4(a) in **Annex 1**). In such cases, "Not applicable" can be noted under the "Existing management measure(s)" and "Relevant MCS measure(s)" columns in the Worksheet (for that trade/fishing pressure Factor).

- Provide reasons to justify the assessments made in this Worksheet in the box entitled *"Reasoning/comments*", including any sources used.
- Where certain management measures are being implemented but others are not, this information can also be included under *"Reasoning/comments*". Also note down any considerations, issues or shortcomings relating to any of the management measures identified that will need to be kept in mind when completing the **Worksheet for Question 4.1(b)** below

Factor	**Existing management measure(s)**	**Relevant monitoring, control and surveillance (MCS) measure(s)**	**Overall assessment of compliance regime** *(tick as appropriate)*	
TRADE PRESSURE				
(a) Magnitude of legal trade			Unknown (no information on compliance)	
			Poor (limited relevant compliance measures in place)	
			Moderate (some relevant compliance measures in place)	
			Good (comprehensive relevant compliance measures in place)	
	Reasoning/comments (e.g. Are management measures being implemented to varying degrees? Which compliance measures are lacking?)			
(b) Magnitude of illegal trade			Unknown (no information on compliance)	
			Poor (limited relevant compliance measures in place)	
			Moderate (some relevant compliance measures in place)	
			Good (comprehensive relevant compliance measures in place)	
	Reasoning/comments (e.g. Are management measures being implemented to varying degrees? Which compliance measures are lacking?)			

Factor	**Existing management measure(s)**	**Relevant monitoring, control and surveillance (MCS) measure(s)**	**Overall assessment of compliance regime** *(tick as appropriate)*	
FISHING PRESSURE				
(a) Fishing mortality (retained catch)			Unknown (no information on compliance)	
			Poor (limited relevant compliance measures in place)	
			Moderate (some relevant compliance measures in place)	
			Good (comprehensive relevant compliance measures in place)	
	Reasoning/comments (e.g. Are management measures being implemented to varying degrees? Which compliance measures are lacking?)			
(b) Discard mortality			Unknown (no information on compliance)	
			Poor (limited relevant compliance measures in place)	
			Moderate (some relevant compliance measures in place)	
			Good (comprehensive relevant compliance measures in place)	
	Reasoning/comments (e.g. Are management measures being implemented to varying degrees? Which compliance measures are lacking?)			

Factor	**Existing management measure(s)**	**Relevant monitoring, control and surveillance (MCS) measure(s)**	**Overall assessment of compliance regime** *(tick as appropriate)*	
(c) Size/age/ sex selectivity			Unknown (no information on compliance)	
			Poor (limited relevant compliance measures in place)	
			Moderate (some relevant compliance measures in place)	
			Good (comprehensive relevant compliance measures in place)	
	Reasoning/comments (e.g. Are management measures being implemented to varying degrees? Which compliance measures are lacking?)			
(d) Magnitude of IUU fishing			Unknown (no information on compliance)	
			Poor (limited relevant compliance measures in place)	
			Moderate (some relevant compliance measures in place)	
			Good (comprehensive relevant compliance measures in place)	
	Reasoning/comments (e.g. Are management measures being implemented to varying degrees? Which compliance measures are lacking?)			

NEXT STEPS

- Go to **Question 4.1(b)**.

Worksheet for Step 4 (continued)

Question 4.1(b)

Are existing management measures effective (or likely to be effective) in mitigating the pressures affecting the stock/population of the species concerned?

- See pages 93 to 94 of **Annex 1** for additional Guidance Notes on completing this Worksheet.
- From the **Worksheet for Question 4.1(a)** above, transfer information on existing management measures currently in place into the column in the table below entitled "Existing management measure(s)", alongside the relevant fishing/trade pressure Factor.

NOTE as above for **Question 4.1(a)**: in some circumstances where the fishing/trade pressure severity was assessed as "Low" for any of the Factors in **Step 3**, mitigation may not be required (see also the Guidance Notes for **Question 4(b)** in **Annex 1**). In such cases, "Not applicable" can be noted under the "Existing management measure(s)" and "Relevant MCS measure(s)" columns in the Worksheet (for that trade/fishing pressure Factor).

- In the relevant columns in the table below, for each management measure indicate with a tick in the appropriate box whether:
  1. Data are collected and analysed to inform management decisions?
  2. Management is consistent with expert advice?
- Based on the responses to these questions, make a judgement as to whether the management measures(s) identified is/are effective/likely to be effective. Provide reasons to justify this assessment. For example, is effectiveness being compromised by poor design of the management measures or by their inadequate implementation (see responses in the Worksheet for **Question 4.1(a)** above)? Include information on any sources used in the box entitled "*Reasoning/comments*".
- Note that for each fishing/trade pressure identified, there may be more than one management measure currently in place aimed at mitigating the pressure. When assessing whether the management of a particular fishing/trade pressure is effective/likely to be effective, the aim should be to consider the combined effect of all relevant measures in mitigating the pressure identified.

Factor	**Existing management measure(s)**	**Are relevant data collected and analysed to inform management decisions? (e.g. landings, effort, fisheries independent data)** *Tick as appropriate*		**Is management consistent with expert advice?** *Tick as appropriate*	
TRADE PRESSURE					
(a) Magnitude of legal trade		No data OR data are of poor quality OR data are not analysed (adequately) to inform management		No expert advice on management identified	
		Limited relevant data are collected AND analysed to inform management		Not consistent	
		Some relevant data are collected AND analysed to inform management		Expert advice partially implemented	
		Comprehensive data collected AND analysed to inform management		Consistent	
	Management measure(s) effective/likely to be effective? (circle as appropriate) Yes Partially No Insufficient information				
	Reasoning/comments (e.g. Is effectiveness compromised by poor design and/or implementation, or is a greater diversity or amount of management required? What data are required to better inform and evaluate management decisions? How is management inconsistent with expert advice?)				

Factor	**Existing management measure(s)**	**Are relevant data collected and analysed to inform management decisions? (e.g. landings, effort, fisheries independent data)** *Tick as appropriate*		**Is management consistent with expert advice?** *Tick as appropriate*	
TRADE PRESSURE					
(b) Magnitude of illegal trade		No data OR data are of poor quality OR data are not analysed (adequately) to inform management		No expert advice on management identified	
		Limited relevant data are collected AND analysed to inform management		Not consistent	
		Some relevant data are collected AND analysed to inform management		Expert advice partially implemented	
		Comprehensive data collected AND analysed to inform management		Consistent	
	Management measure(s) effective/likely to be effective? (circle as appropriate) Yes Partially No Insufficient information				
	Reasoning/comments (e.g. Is effectiveness compromised by poor design and/or implementation, or is a greater diversity or amount of management required? What data are required to better inform and evaluate management decisions? How is management inconsistent with expert advice?)				

<table>
<tr><th>Factor</th><th>Existing management measure(s)</th><th colspan="3">Are relevant data collected and analysed to inform management decisions? (e.g. landings, effort, fisheries independent data)
Tick as appropriate</th><th colspan="2">Is management consistent with expert advice?
Tick as appropriate</th></tr>
<tr><td colspan="7">FISHING PRESSURE</td></tr>
<tr><td rowspan="6">(a) Fishing mortality (retained catch)</td><td rowspan="4"></td><td colspan="2">No data OR data are of poor quality OR data are not analysed (adequately) to inform management</td><td></td><td>No expert advice on management identified</td><td></td></tr>
<tr><td colspan="2">Limited relevant data are collected AND analysed to inform management</td><td></td><td>Not consistent</td><td></td></tr>
<tr><td colspan="2">Some relevant data are collected AND analysed to inform management</td><td></td><td>Expert advice partially implemented</td><td></td></tr>
<tr><td colspan="2">Comprehensive data collected AND analysed to inform management</td><td></td><td>Consistent</td><td></td></tr>
<tr><td colspan="6">Management measure(s) effective/likely to be effective? (circle as appropriate)
Yes Partially No Insufficient information</td></tr>
<tr><td colspan="6">Reasoning/comments (e.g. Is effectiveness compromised by poor design and/or implementation, or is a greater diversity or amount of management required? What data are required to better inform and evaluate management decisions? How is management inconsistent with expert advice?)</td></tr>
</table>

<table>
<tr><th>Factor</th><th>Existing management measure(s)</th><th colspan="3">Are relevant data collected and analysed to inform management decisions? (e.g. landings, effort, fisheries independent data)
Tick as appropriate</th><th colspan="2">Is management consistent with expert advice?
Tick as appropriate</th></tr>
<tr><td colspan="7">FISHING PRESSURE</td></tr>
<tr><td rowspan="6">(b) Discard mortality</td><td rowspan="4"></td><td colspan="2">No data OR data are of poor quality OR data are not analysed (adequately) to inform management</td><td></td><td colspan="2">No expert advice on management identified</td><td></td></tr>
<tr><td colspan="2">Limited relevant data are collected AND analysed to inform management</td><td></td><td colspan="2">Not consistent</td><td></td></tr>
<tr><td colspan="2">Some relevant data are collected AND analysed to inform management</td><td></td><td colspan="2">Expert advice partially implemented</td><td></td></tr>
<tr><td colspan="2">Comprehensive data collected AND analysed to inform management</td><td></td><td colspan="2">Consistent</td><td></td></tr>
<tr><td colspan="6">Management measure(s) effective/likely to be effective? (circle as appropriate)
Yes Partially No Insufficient information</td></tr>
<tr><td colspan="6">Reasoning/comments (e.g. Is effectiveness compromised by poor design and/or implementation, or is a greater diversity or amount of management required? What data are required to better inform and evaluate management decisions? How is management inconsistent with expert advice?)</td></tr>
</table>

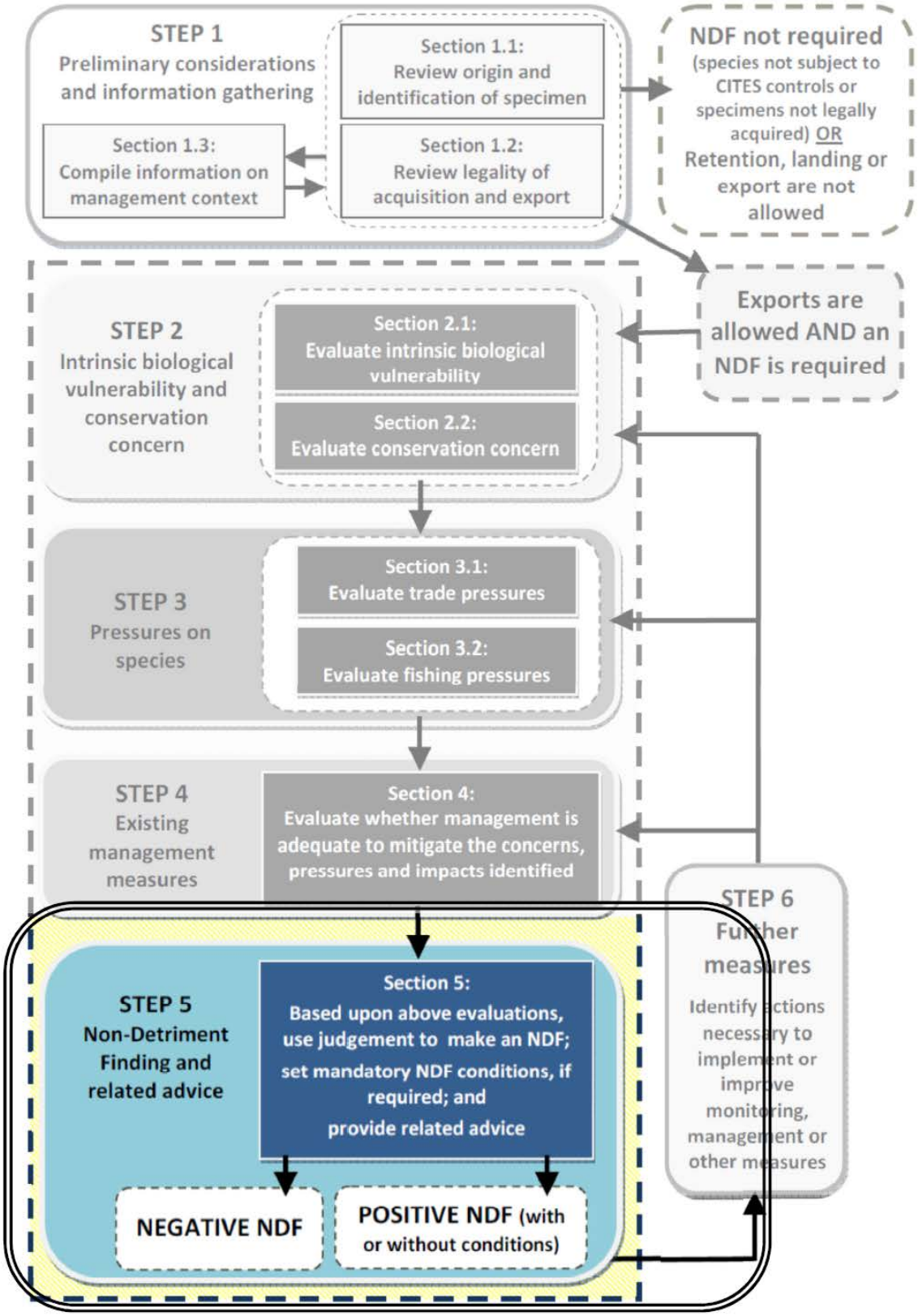
<table>
<tr><th>Factor</th><th>Existing management measure(s)</th><th colspan="3">Are relevant data collected and analysed to inform management decisions? (e.g. landings, effort, fisheries independent data)
Tick as appropriate</th><th colspan="2">Is management consistent with expert advice?
Tick as appropriate</th></tr>
<tr><td colspan="7">FISHING PRESSURE</td></tr>
<tr><td rowspan="6">(c) Size/age/ sex selectivity</td><td rowspan="4"></td><td colspan="3">No data OR data are of poor quality OR data are not analysed (adequately) to inform management</td><td colspan="2">No expert advice on management identified</td></tr>
<tr><td colspan="3">Limited relevant data are collected AND analysed to inform management</td><td colspan="2">Not consistent</td></tr>
<tr><td colspan="3">Some relevant data are collected AND analysed to inform management</td><td colspan="2">Expert advice partially implemented</td></tr>
<tr><td colspan="3">Comprehensive data collected AND analysed to inform management</td><td colspan="2">Consistent</td></tr>
<tr><td colspan="6">Management measure(s) effective/likely to be effective? (circle as appropriate)
Yes Partially No Insufficient information</td></tr>
<tr><td colspan="6">Reasoning/comments (e.g. Is effectiveness compromised by poor design and/or implementation, or is a greater diversity or amount of management required? What data are required to better inform and evaluate management decisions? How is management inconsistent with expert advice?)</td></tr>
</table>

<table>
<tr><th>Factor</th><th>Existing management measure(s)</th><th colspan="2">Are relevant data collected and analysed to inform management decisions? (e.g. landings, effort, fisheries independent data)
Tick as appropriate</th><th colspan="2">Is management consistent with expert advice?
Tick as appropriate</th></tr>
<tr><td colspan="6">FISHING PRESSURE</td></tr>
<tr><td rowspan="5">(d) Magnitude of IUU fishing</td><td rowspan="4"></td><td>No data OR data are of poor quality OR data are not analysed (adequately) to inform management</td><td></td><td>No expert advice on management identified</td><td></td></tr>
<tr><td>Limited relevant data are collected AND analysed to inform management</td><td></td><td>Not consistent</td><td></td></tr>
<tr><td>Some relevant data are collected AND analysed to inform management</td><td></td><td>Expert advice partially implemented</td><td></td></tr>
<tr><td>Comprehensive data collected AND analysed to inform management</td><td></td><td>Consistent</td><td></td></tr>
<tr><td colspan="5">Management measure(s) effective/likely to be effective? (circle as appropriate)
Yes Partially No Insufficient information</td></tr>
<tr><td colspan="5">Reasoning/comments (e.g. Is effectiveness compromised by poor design and/or implementation, or is a greater diversity or amount of management required? What data are required to better inform and evaluate management decisions? How is management inconsistent with expert advice?)</td></tr>
</table>

NEXT STEPS

- Add notes in the Worksheet for **Section 6.1** on improvements in data availability/monitoring required to evaluate the effectiveness/likely effectiveness of management under **Question 4.1(b)**.
- Add notes in the Worksheet for **Section 6.2** on improvements in management (including compliance systems) required to more fully mitigate the pressures impacting the stock/population of the shark species concerned.
- Go to **Step 5**

STEP 5:
NON-DETRIMENT FINDING AND RELATED ADVICE



Introduction

Steps 2 to 4 of this Guidance have been structured to guide Scientific Authorities through a series of Questions and decision paths to make "**a science-based assessment that verifies whether a proposed export or introduction from the sea (IFS) is detrimental to the survival of that species**".

This Guidance additionally supports Scientific Authorities to gather, evaluate, and document relevant information for which the **data quality** is "**proportionate to the vulnerability of the species concerned**" – in other words, based on a **risk assessment**.

The tasks remaining for the Scientific Authority in **Step 5** are to:

- make a **positive** or a **negative NDF**; and
- **provide advice** on any **mandatory conditions** that might need to be issued (for a positive NDF) or **recommendations as to further measures** to be taken to limit the grant of export permits for specimens of that species or to improve monitoring or management actions (relevant for both positive and negative NDFs; see **Article IV.3**[21] and **Text Box 3** below on the establishment of catch and export quotas). This may be particularly important in cases where pressures are considered high and therefore could threaten the role of the species in the ecosystem and/or reduce stocks to Appendix I levels[22].

In the case of a positive NDF, an authority may consider it appropriate to allow **exports to continue for a defined period** (in other words, the positive NDF is valid for a limited period only), with recommendations as to improvements in monitoring and/or management that should be carried out during this period (see **Step 6** for examples of such improvements). At the end of this period, the authority can make a decision as to whether to maintain a positive NDF in place, or to make a negative NDF.

In the case of a negative NDF, further measures (e.g. to improve monitoring or management) need to be implemented **before** any export takes place (see **Step 6** for examples of such further measures). The negative NDF can then be reviewed once these measures have been implemented, and may lead to a decision to make a positive NDF (and therefore allow exports to take place) at some future time.

In later years, when existing NDFs have been made, the Scientific Authority should undertake regular re-appraisals of these NDFs to ensure that they are still valid.

[21] According to **Article IV.3**, "a Scientific Authority in each Party shall monitor both the export permits granted by that State for specimens of species included in Appendix II and the actual exports of such specimens. Whenever a Scientific Authority determines that the export of specimens of any such species should be limited in order to maintain that species throughout its range at a level consistent with its role in the ecosystems in which it occurs and well above the level at which that species might become eligible for inclusion in Appendix I, the Scientific Authority shall advise the appropriate Management Authority of suitable measures to be taken to limit the grant of export permits for specimens of that species."

[22] See Resolution Conf. 9.24 (Rev. CoP16) (Criteria for amendment of Appendices I and II): http://www.cites.org/eng/res/09/09-24R16.php

Text Box 3

Setting catch and export quotas

- The **management aim of a catch and/or export quota** is to **limit fishing mortality (F)** by regulating the number of sharks being caught.
- It is important to consider that **export quotas will not limit catches where sharks are obtained as bycatch**. In such cases any use of quotas should be combined with other precautionary measures, given the uncertainty as to how export quotas influence catches.
- A **Party may establish IFS or catch and export quotas unilaterally**, but **quotas can also be set regionally, or by the CITES CoP** (www.cites.org/eng/resources/quotas/index.php). Any relevant fisheries body (including a RFB or national agency) could be appointed to act as a Scientific Authority and advise on international TACs and national and vessel quotas.
- Setting a quota that establishes the maximum number of specimens of a species that may be taken and/or exported over the course of a year without having a detrimental effect on the species' survival will contribute to meeting the CITES requirement for an NDF. However, Parties must ensure they take into account **the level of harvest for domestic use as well as for export**, **and other sources of mortality** (particularly when other fleets are harvesting the same stock).
- **Export quotas** can be a **useful tool for assisting in making NDFs**, providing they are established based on appropriate science and necessary precaution. Scientific Authorities should note that a given national export quota could still be detrimental to a stock if other sources of mortality and uses are unsustainable.
- See also:
  - Management of nationally established export quotas: Res. Conf. 14.7 (Rev. CoP15) (http://www.cites.org/eng/res/14/14-07R15.php)
  - Periodic reports of the national CITES Authority to the CITES Secretariat, including updates on national export quotas: (http://www.cites.org/eng/resources/quotas/index.shtml)

Worksheet for Step 5

Question 5.1

Based on the outcomes of the previous steps, is it possible to make a positive NDF (with or without associated conditions) or is a negative NDF required?

- See pages 95 to 97 of **Annex 1** for additional Guidance Notes on completing this Worksheet.
- Transfer all results from **Steps 2–4** to the Table below by circling the appropriate descriptors.
  - From the **Worksheets for Questions 2.1 and 2.2** above, transfer the **level of vulnerability** and **level of severity/scope of conservation concern** into the Worksheet below.
  - From the **Worksheets for Questions 3.1 and 3.2** above, transfer the **level of severity** for each trade and fishing pressure Factor into the second column in the Worksheet below and the **level of confidence** associated with each evaluation of severity into the third column in the Worksheet below.
  - Based on the information contained in the **Worksheets for Questions 4.1(a) and 4.1(b)**, state in the Worksheet below whether the **existing management measures are effective/likely to be effective** at mitigating each of the pressures identified (taking into account whether they are **appropriately designed** and **being implemented**), or whether there is insufficient information to make such an assessment.
- Based on the information generated and evaluations made in the previous **Steps**, the Scientific Authority now has to decide whether to make a positive NDF for the export (with or without mandatory conditions), or a negative NDF. A decision tree to assist in this decision-making process is provided in the Guidance Notes in **Annex 1**.
- The final decision regarding the NDF should be indicated in the relevant box at the end of this Worksheet. Under "*Reasoning/comments*" include justification for the decision made and describe any **mandatory conditions** (for a positive NDF) and/or **recommendations as to further measures** (e.g. improvements in monitoring and/or management required – relevant for both positive and negative NDFs).

Step 2: Intrinsic biological vulnerability and conservation concern			
Intrinsic biological vulnerability (Question 2.1) **Conservation concern (Question 2.2)**			High Medium Low Unknown High Medium Low Unknown
Step 3: Pressures on species			**Step 4: Existing management measures**
Pressure	**Level of severity (Questions 3.1 and 3.2)**	**Level of confidence (Questions 3.1 and 3.2)**	**Are the management measures effective* at addressing the concerns/pressures/impacts identified? (Question 4.1(b))** **taking into account the evaluation of management appropriateness and implementation under Question 4.1(a)*
Trade pressures			
(a) Magnitude of legal trade	High Medium Low Unknown	High Medium Low	Yes Partially No Insufficient information Not applicable**
(b) Magnitude of illegal trade	High Medium Low Unknown	High Medium Low	Yes Partially No Insufficient information Not applicable**
** Only to be used where the trade pressure severity was assessed as "Low" for any of the Factors in **Step 3** and a judgement is made that the impacts on the shark stock/population concerned are so low that mitigation is not required.			
Fishing pressures			
(a) Fishing mortality (retained catch)	High Medium Low Unknown	High Medium Low	Yes Partially No Insufficient information Not applicable**
(b) Discard mortality	High Medium Low Unknown	High Medium Low	Yes Partially No Insufficient information Not applicable**

Pressure	Level of severity (Questions 3.1 and 3.2)	Level of confidence (Questions 3.1 and 3.2)	Are the management measures effective* at addressing the concerns/pressures/impacts identified? (Question 4.1(b)) **taking into account the evaluation of management appropriateness and implementation under Question 4.1(a)*
(c) Size/age/sex selectivity of fishing	High Medium Low Unknown	High Medium Low	Yes Partially No Insufficient information Not applicable**
(d) Magnitude of IUU fishing	High Medium Low Unknown	High Medium Low	Yes Partially No Insufficient information Not applicable**

Only to be used where the fishing pressure severity was assessed as "Low" for any of the Factors in **Step 3 and a judgement is made that the impacts on the shark stock/population concerned are so low that mitigation is not required.

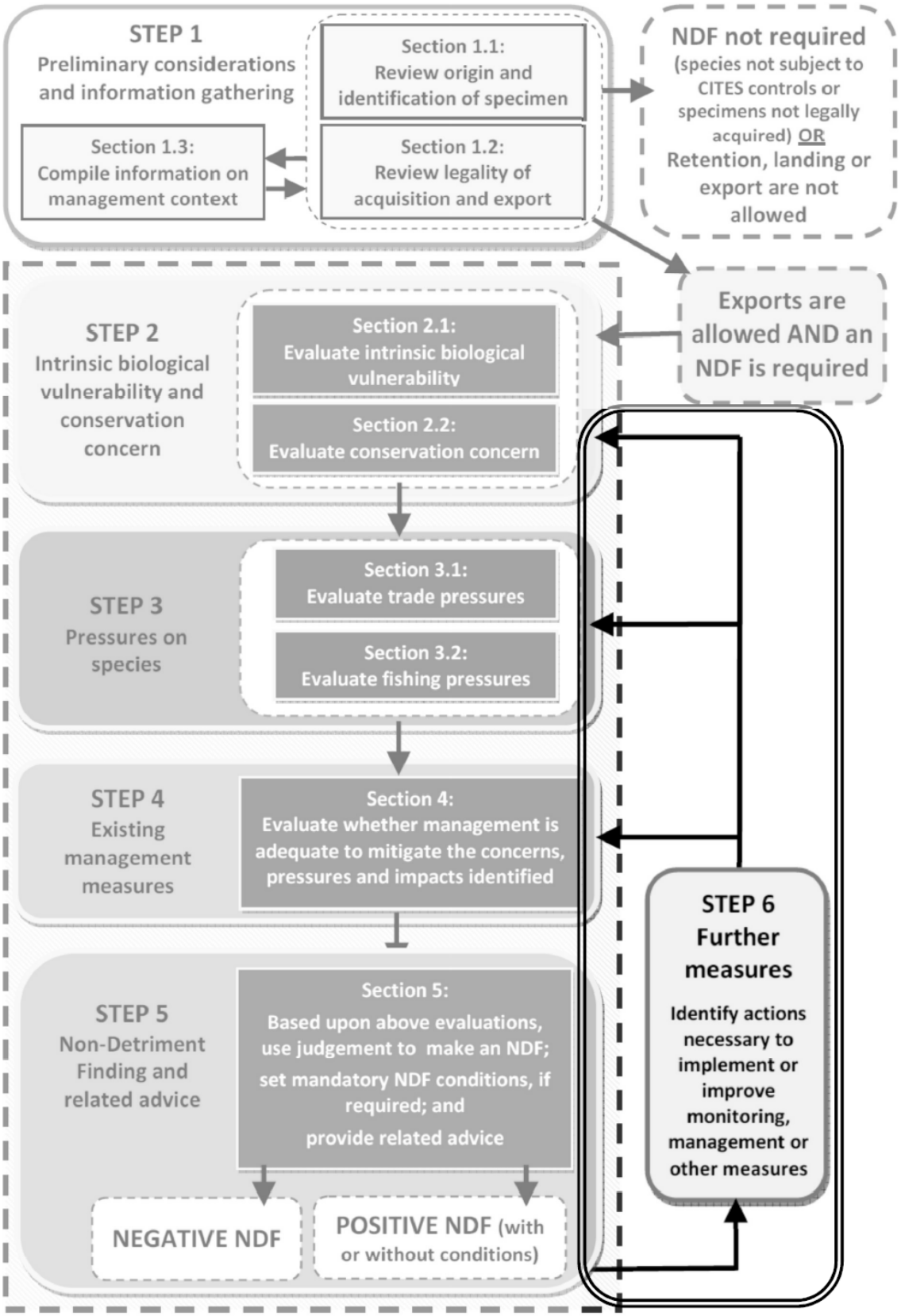
A) Can a positive NDF be made?	**YES** - *go to B*	**NO** - *go to **Step 6** and list recommendations for measures to improve monitoring/management under Reasoning/comments below*
B) Are there any mandatory conditions to the positive NDF?	**YES** - *list under Reasoning/comments below and go to C*	**NO** - *go to C*
C) Are there any other further recommendations? *(e.g. for improvements to monitoring/management)*	**YES** - *go to **Step 6** and list recommendations for measures to improve monitoring/management under Reasoning/comments below*	**NO**

Reasoning/comments *(include justification for decision made and information on mandatory conditions and/or further recommendations)*

NEXT STEPS

- OPTION 1: If improvements in monitoring or management are required (whether in the case of a **positive or negative NDF**) go to **Step 6**
- OPTION 2: If no improvements in monitoring or management are required, make a **positive NDF** and stipulate any **mandatory conditions**, if appropriate, to the Management Authority and any other relevant bodies.

STEP 6:
FURTHER MEASURES



Introduction

As already noted in **Step 4**, non-detrimental trade in the products of most harvested shark species listed in CITES Appendix II requires **adequate management** to be in place to mitigate the impact of exploitation upon stocks and to enable sustainable trade to take place.

In **Step 5**, Scientific Authorities were required to make a judgement on whether to issue a **positive or negative NDF**, and whether to provide **related advice** based on the assessments made in **Steps 1 to 4** of this Guidance.

The current step, **Step 6**, is intended to guide authorities in making the **necessary improvements to monitoring or management** (together, "Further Measures"), as appropriate, in order to address shortcomings in information availability or adequacy of management in mitigating the concerns, pressures and impacts identified. This step, which is primarily the responsibility of **Management Authorities** (and does not form part of the NDF process), is particularly relevant where Scientific Authorities have decided to issue **a negative NDF** as improvements in monitoring and/or management will be required if a positive NDF is to be made in the future.

The information below may, however, also be of wider interest to Parties as they develop and implement flexible and adaptive management of their shark fisheries.

Recommendations for further measures may not only be directed to national level fisheries management (and/or other relevant) authorities but, where shared stocks are involved, may necessarily be **directed to any relevant RFB** with responsibility for the stock concerned.

It is noted that, unless stocks are very healthy and fisheries closely managed and monitored, **shark NDFs for export permits and IFS certificates will generally be valid for a single year**, during which period a Total Allowable Catch (**TAC**) and quota system may operate (see **Text Box 3**, page 51, for further information on the setting of catch and export quotas). At the end of the year, during which any further measures may have been implemented (whether at the national or regional, e.g. RFB, level), it would be useful to work **through Steps 3, 4 and 5** of this Guidance again to see if the NDF needs to be revised.

Worksheet for Step 6

Further measures

Section 6.1

Improvement in monitoring or information is required

In the space below, authorities are encouraged to list the improvements in monitoring or information that are required to address cases where:

(i) The severity of trade/fishing pressures has been assessed as unknown.

(ii) The level of confidence in the evaluation of trade/fishing pressures is low.

(iii) There is insufficient information on the effectiveness of management.

Recommendations should be made in **consultation with the national fisheries management agency** and should be as **specific as possible** to address any gaps/shortcomings identified with **clearly defined objectives.** Time-frames for implementation should be specified where possible, including with regard to the review of progress on implementation.

See pages 98 to 99 of **Annex 1** for additional Guidance Notes on completing this Worksheet.

Section 6.2

Improvement in management is required

In the space below, authorities are encouraged to list the improvements in management that are required to address cases where management has been assessed as partially effective or ineffective at addressing any of the concerns/pressures/impacts identified, particularly where a fishing or trade pressure is assessed as medium or high (confidence levels: low, medium or high).

As noted above for **Section 6.1**, recommendations should be made in **consultation with the national fisheries management agency** and should be as **specific as possible** to address any gaps/shortcomings identified with **clearly defined objectives.** Time-frames for implementation should be specified where possible, including with regard to the review of progress on implementation.

See page 100 of **Annex 1** for additional Guidance Notes on completing this Worksheet.

BIBLIOGRAPHY

Chapman, D.D. and Abercrombie, D. (2010). Genetic Identification of Shark Body Parts in Trade: Rapid, Reliable, Inexpensive. A Summary of New Scientific Analysis. *Ocean Science Factsheet.* Pew Environment Group. Washington DC. http://www.pewtrusts.org/uploadedFiles/wwwpewtrustsorg/Fact_Sheets/Protecting_ocean_life/Pew%20OSS%20Genetic%20ID%20sharks%20final.pdf?n=7918

CITES (2008). Final Report of the Fish Working Group. *Results of the International Expert Workshop on CITES Non-Detriment Findings, 17-22 December 2008, Mexico.* http://www.conabio.gob.mx/institucion/cooperacion_internacional/TallerNDF/Links-Documentos/WG-CS/WG8-Fishes/WG8-FR.pdf

CITES (2013). Consideration of Proposals for Amendment of Appendices I and II. Proposal for inclusion of *Lamna nasus*. *CoP16 Prop.44*. http://www.cites.org/eng/cop/16/prop/index.php

CITES (2014). *CITES Virtual College module on making NDFs*. Available at: https://cites.unia.es/

Clarke, S., Manarangi-Trott, L. and Brouwer, S. (2014). *Issues for t-RFMOs in relation to the listing of shark and ray species by the Convention on International Trade in Endangered Species (CITES)*. WCPFC-SC10-2014/ EB-IP-05. https://wcpfc.int/node/18991

Cochrane, K. and Garcia S. (2009). *A Fishery Manager's Guidebook*. FAO. www.fao.org/docrep/015/i0053e/i0053e.pdf

Cosandey-Godin, A. and Morgan, A. (2011). *Fisheries Bycatch of Sharks: Options for Mitigation.* Ocean Science Division, Pew Environment Group, Washington, DC.

DFO. (2005). Stock assessment report on NAFO Subareas 3–6 porbeagle shark. *CSAS Science Advisory Report* 2005/044.

DFO. (2012). Guidance related to bycatch and discards in Canadian commercial fisheries. *DFO Can. Sci. Advis. Sec. Sci. Advis. Rep*. 2012/022.

Dulvy, N., Fowler, S., *et al*. (2014). Extinction risk and conservation of the world's sharks and rays. *eLIFE Decision*: 28-01-2013-RA-Elife-00590. http://arxiv.org/abs/1312.3926

FAO Marine Resources Service. (2000). Fisheries management. 1. Conservation and management of sharks. *FAO Technical Guidelines for Responsible Fisheries*. No. 4, Suppl. 1. ftp://ftp.fao.org/docrep/fao/003/x8692e/x8692e00.pdf

FAO. 2001. *A background analysis and framework for evaluating the status of commercially-exploited aquatic species in a CITES context*. Second Technical Consultation on the Suitability of the CITES Criteria for Listing Commercially-exploited Aquatic Species. 23 pp. (www.fao.org/DOCREP/MEETING/003/Y1455E.HTM).

FAO. (2012). *Report of the FAO/CITES Workshop to Review the Application and Effectiveness of International Regulatory Measures for the Conservation and Sustainable Use of Elasmobranchs*. Genazzano, Italy, 19–23 July 2010. FAO Fisheries and Aquaculture Report. No. 984. Rome, FAO. http://www.cites.org/common/disc/coop/CITES-FAO-Genazzano-workshop-report2010.pdf

FAO. (2013b). *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. http://www.fao.org/docrep/017/ap999e/ap999e.pdf

Ferretti, F., Worm, B., Britten, G.L., Heithaus, M.R., Lotze H.K. (2010). Patterns and ecosystem consequences of shark declines in the ocean. *Ecology Letters* 13: 1055–1071.

Fischer, J., Erikstein, K., D'Offay, B., Barone, M., Guggisberg, S. (2012). *Review of the Implementation of the International Plan of Action for the Conservation and Management of Sharks*. *FAO Fisheries and Aquaculture Circular* No. 1076. Rome, FAO. 120 pp. http://www.fao.org/docrep/017/i3036e/i3036e00.htm

Foster, S.J. and Vincent, A.C.J. (2013). *Making Non-Detriment Findings for seahorses – a framework,* Version 3.0. Project Seahorse, Fisheries Centre, The University of British Columbia. 65 pp. http://seahorse.fisheries.ubc.ca/ndf

Friedlander A.M., DeMartini E.E. (2002). Contrasts in density, size, and biomass of reef fishes between the northwestern and the main Hawaiian islands: The effects of fishing down apex predators. *Marine Ecology Progress Series* 230: 253–264.

GFCM Secretariat. (2010). *Focus on the status of GFCM-SAC Priority Species*. http://151.1.154.86/gfcmwebsite/SAC/2010/Elasmobranches/paper/ReviewStatus.pdf

García Núñez, N.E. (2008). *Sharks: Conservation, Fishing and International Trade.* Bilingual edition. Dirección. General para la Biodiversidad. Ministerio de Medio Ambiente, y Medio Rural y Marino, Madrid. 111 pp. www.cites.org/common/com/ac/24/EF24i-05.pdf

Godin, A.C., Worm B. (2010). Keeping the lead: How to strengthen shark conservation and management policies in Canada. *Marine Policy* 34 (5) pp. 995-1001.

Harley S. Rice J., Williams P. (2013). *A progress report on the Shark Research Plan*. WCPFC Scientific Committee, Ninth Regular Session, Pohnpei, Federated States of Micronesia, 6-14 August 2013. WCPFC-SC-9-2013/EB-WP-06

Heithaus M.R., Frid A., Vaudo J.J., Worm B., Wirsing A.J. (2010). Unravelling the Ecological Importance of Elasmobranchs. In: Carrier JC, Musick JA, Heithaus MR, editors. *Sharks and Their Relatives II: Biodiversity, Adaptive Physiology, and Conservation* CRC Press. 611–637.

Heithaus M.R., Frid A., Wirsing A.J., Worm B. (2008). Predicting ecological consequences of marine top predator declines. *Trends in Ecology and Evolution* 23: 202–210.

Hobday, A. J., Smith, A., Webb, H., Daley, R., Wayte, S., Bulman, C., Dowdney, J., Williams, A., Sporcic, M., Dambacher, J., Fuller, M., Walker, T. (2007). *Ecological Risk Assessment for the Effects of Fishing: Methodology*. Report R04/1072 for the Australian Fisheries Management Authority, Canberra.

ICCAT SCRS/ICES (2009). *Report of the 2009 Porbeagle stock assessment meeting*. Copenhagen, Denmark, June 22 to 27, 2009. SCRS/2009/014. 57 pp.

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. http://www.cites.org/sites/default/files/common/cop/16/inf/E-CoP16i-14.pdf

Lack, M. (2008). *The Case for a Catch Documentation Scheme in the Western and Central Pacific*. WWF South Pacific Programme and TRAFFIC International.

Lack, M., Sant, G., Burgener, M., Okes, N. (2014). *Development of a Rapid Management-risk Assessment Method for Fish Species Through its Application to Sharks*. Report to the Department of

Environment, Food and Rural Affairs. Defra Contract No. MB0123. http://cites.org/sites/default/files/common/com/ac/27/E-AC27-Inf-06.pdf

Leaman, D.J. and Oldfield, T.E.E. (2013). *CITES Non Detriment Findings Guidance for Perennial Plants- A Nine-Step Process to Support CITES Scientific Authorities Making Science-Based Non-Detriment Findings (NDFs) for Species Listed in CITES Appendix II*. First Edition. BFN. http://www.cites.org/sites/default/files/common/com/pc/21/E-PC21-Inf-01.pdf

Mundy-Taylor, V. and Crook, V. (2013). *Into the deep: Implementing CITES measures for commercially-valuable sharks and manta rays (2013)*. TRAFFIC. www.traffic.org/fisheries-reports/traffic_pub_fisheries15.pdf

Mundy-Taylor, V., Crook. V., Foster, S., Fowler, S., Sant, G. and Rice, J. (2014). *CITES Non-detriment Findings Guidance for Shark Species. A Framework to assist Authorities in making Non-detriment Findings (NDFs) for species listed in CITES Appendix II*. [FIRST VERSION] Report prepared for the Germany Federal Agency for Nature Conservation (Bundesamt für Naturschutz, BfN). http://cites.org/sites/default/files/common/com/ac/27/E-AC27-Inf-01.pdf

Musick, J.A. and Bonfil, R. (2005). *Manual of Techniques for the Management of Elasmobranch Fisheries.* FAO. http://www.fao.org/docrep/009/a0212e/a0212e00.htm

New Zealand Ministry for Primary Industries (2012). *Fisheries Assessment Plenary November 2012. Stock Assessment and Yield Estimates*. Compiled by the Fisheries Science Group. Available at: http://fs.fish.govt.nz/Doc/23102/November%202012%20Plenary%20Online.pdf.ashx

Oldfield, T.E.E., Outhwaite, W., Goodman, G. and Sant, G. (2012). *Assessing the intrinsic vulnerability of harvested sharks.* JNCC. http://www.cites.org/common/com/AC/26/E26-09i.pdf

Rosser, A.R. and Haywood, M.J. (Compilers). (2002). *Guidance for CITES Scientific Authorities: Checklist to assist in making non-detriment findings for Appendix II exports*. IUCN, Gland, Switzerland and Cambridge, UK. xi + 146pp.

Ruppert J.L.W., Travers M.J., Smith L.L., Fortin M.J., Meekan M.G. (2013). Caught in the Middle: Combined Impacts of Shark Removal and Coral Loss on the Fish Communities of Coral Reefs. *PLoS ONE* 8(9): e74648.

Sant, G., Goodman, G., Crook, V., Lack, M. and Oldfield, T.E.E. (2012). *Fish and Multilateral Environmental Agreements: developing a method to identify high risk commercially-exploited aquatic organisms in trade and an analysis of the potential application of MEAs*. *JNCC Report No. 453.* Joint Nature Conservation Committee, Peterborough. http://jncc.defra.gov.uk/page-6120.

Simpfendorfer, C. A., Bonfil, R. and Latour, R.J. (2005). Chapter 8: Mortality Estimation. In Musick and Bonfil (2005). *Manual of Techniques for the Management of Elasmobranch Fisheries.* FAO. http://www.fao.org/docrep/009/a0212e/a0212e00.htm

SSG (2007a). *Review of Migratory Chondrichthyan Fishes*. CMS Technical Series No. 15.

SSG (2007b). *Background paper on the Conservation status of Migratory sharks and possible options for international cooperation under the Convention on Migratory species*. UNEP/CMS/MS/4.

Stevens J.D., Bonfil R., Dulvy N.K. and Walker P.A. (2000). The effects of fishing on sharks, rays, and chimaeras (chondrichthyans), and the implications for marine ecosystems. *ICES Journal of Marine Science* 57: 476–494.

ANNEXES: CITES NON-DETRIMENT FINDINGS GUIDANCE

Annex 1. Guidance Notes **64**

Step 1: Preliminary Considerations and Information Gathering **64**

Step 2. Intrinsic Biological Vulnerability and Conservation Concern **73**

Step 3. Pressures on Species **81**

Step 4. Existing Management Measures **91**

Step 5. Non-detriment Finding and Related Advice **95**

Step 6. Further Measures **98**

Annex 2. Useful Sources of Information **101**

Annex 3. Glossary, Acronyms & Abbreviations **107**

Annex 4. Default Species-specific Biological Data **111**

Annex 4.1. Intrinsic biological characteristics of Oceanic whitetip shark *Carcharhinus longimanus* 112

Annex 4.2. Intrinsic biological characteristics of White Shark *Carcharodon carcharias* 114

Annex 4.3. Intrinsic biological characteristics of Basking Shark *Cetorhinus maximus* 116

Annex 4.4. Intrinsic biological characteristics of Porbeagle *Lamna nasus* 118

Annex 4.5. Intrinsic biological characteristics of Whale Shark *Rhincodon typus* 120

Annex 4.6. Intrinsic biological characteristics of Scalloped Hammerhead *Sphyrna lewini* 122

Annex 4.7. Intrinsic biological characteristics of Great Hammerhead *Sphyrna mokarran* 124

Annex 4.8. Intrinsic biological characteristics of Smooth Hammerhead *Sphyrna zygaena* 126

Annex 4.9. Intrinsic biological characteristics of Reef Manta Ray *Manta alfredi* 128

Annex 4.10. Intrinsic biological characteristics of Giant/Oceanic Manta Ray *Manta birostris* 130

Annex 5. Management measures and their appropriateness for mitigating pressures on shark stocks from fisheries and trade **132**

Annex 6. Links to Management Risk Assessments Developed by Lack *et al.* (2014) **141**

ANNEX 1. GUIDANCE NOTES

This Annex provides additional guidance and background information to Scientific Authorities completing the worksheets for each stage of the NDF process. Useful Sources of Information are listed in **Annex 2.**

Step 1: Preliminary Considerations and Information Gathering

Guidance Notes
Question 1.1(a). Is the specimen subject to CITES controls?

Because CITES Authorities do not normally see the specimens for which a permit is being sought, a judgement on the correct identification of the species must be made on the basis of the information supplied on the permit.

Factors to consider when addressing this question include:

- In what **form** are the specimens being traded? Are they (highly) **processed**?
- What **stage in the supply chain** does the export permit correspond to? (The potential for species substitution and confusion in identification increases further along the chain.)
- Are any **traceability measures** in place to ensure that the specimen (if it is a part or product) can be traced back to the original animal from which it derives?

Examples of how a CITES Authority can be confident that the specimen concerned has been correctly identified include the following:

a) The specimen(s) for export is/are **identified on the permit application** to the **level of species**; **AND** the specimen was or will be **recorded to the species level at the point of landing**; **AND** there is a **system of traceability/chain of custody** in place to ensure substitution with another specimen cannot take place in the interim (e.g. the specimen is/will be accompanied with catch or trade documentation, or tagged or bar-coded, and this information recorded).

b) The specimen was/will be **identified by an expert at a previous stage in the supply chain AND** there is a **system of traceability/chain of custody** in place to ensure that substitution with another specimen has not taken place in the interim (e.g. the specimen is accompanied with catch or trade documentation, or has been tagged or bar-coded and this information recorded).

c) The specimen has been **identified by an expert at this time** or at the **immediately preceding stage in the supply chain** (using morphological characteristics or through molecular testing).

Identification tools

There are many detailed **visual identification guides**[1] for sharks, for use at landing sites and when live animals are traded to aquaria, and for identifying some of the most common products of CITES-listed species in international trade to species level (e.g. unprocessed shark fins and dried manta gill rakers). It is also relatively easy to identify teeth and jaws traded as curios, trophies and souvenirs.

[1] See http://www.cites.org/eng/prog/shark/traceability.php; also list of identification guides in Appendix N of *Into the deep: Implementing CITES measures for commercially-valuable sharks and manta rays* (2013) (www.traffic.org/fisheries-reports/traffic_pub_fisheries15.pdf).

The rapid identification to species level of other shark parts, products and derivatives (e.g. meat, skin, oil, and cartilage supplements) is more challenging. This is particularly true of highly processed specimens, where there are several stages in the international supply chain (from fishery to end-market) – in these cases it is important to have in place **traceability measures** that allow products to be traced back to the original animal from which they were derived. A number of approaches have been implemented for other types of fish and fisheries products that could assist in the verification of shark products along the supply chain, including eco-labelling and catch/trade documentation schemes (Mundy-Taylor and Crook, 2013). **Genetic analyses** can also be used to confirm species identification and sometimes even geographic origin (Chapman and Abercrombie, 2010).

Species identification is also challenging in situations where fins are transported in **large quantities or as mixed shipments** (e.g. combining CITES listed and non-listed species) and without the labelling of individual species. A further challenge arises where fins of CITES-listed "look-alike" species are commonly being traded as those of other species on CITES permit applications – this is particularly likely where the look-alike species is subject to significant levels of illegal trade. The use of available rapid visual fin identification guides can assist in such circumstances.

DECISION AND NEXT STEPS

OPTION 1: YES, the specimen is subject to CITES controls (i.e. the species is listed in the CITES Appendices and is likely to be correctly identified)

- Example conditions a, b or c (above) or equivalent **are met**.
- There is a low risk that the specimen has been incorrectly identified (by intention or by error) and the species is listed in a CITES Appendix.
- Complete the **Worksheet for Step 1 Question 1.1(a)** and **GO TO Question 1.1(b)**

OPTION 2: It is NOT CERTAIN whether the specimen is subject to CITES controls (i.e. whether the specimen is of a species listed in the CITES Appendices)

- Example conditions a, b or c (or equivalent) **are not met** and identification is inconclusive.
- Use the **Worksheet for Step 1 Question 1.1(a)** to describe any concerns about the identification of the specimens or the species. Make recommendations that would improve the future identification of specimens. These might include:
  (i) improving chain of custody and traceability procedures, starting at the landing site;
  (ii) ensuring that specimens can readily be identified at landing sites by requiring them to be landed with fins attached;
  (iii) requiring fins to be transported in "fin sets" (all fins from one animal are kept together).
- The Management Authority may consider it necessary to investigate a concern about the intentional or unintentional substitution of another species for the one named in the permit application, particularly in cases where look-alike species have significant levels of illegal trade. If the Management Authority is unable to resolve these concerns, it should describe the problems in the **Worksheet for Step 1 Question 1.1(a)**, ensure that all recommendations for resolving these problems are communicated to the applicant, and **GO TO Question 1.1(b)**

OPTION 3: NO, the specimen is not subject to CITES controls

- Example conditions a, b or c are met and the specimen has been identified, but it is not from a CITES-listed species. **NO NDF IS NECESSARY.**

Question 1.1(b). From which stock will the specimen be taken/was the specimen taken?

In this Step, CITES Authorities will need to make a judgement on the origin of the specimen (i.e. the stock from which the specimen is, or will be, derived), on the basis of the information supplied on the permit.

Information on the management context for the species concerned will be relevant in determining the level of resolution of geographical origin that will be needed (see **Question 1.3 below**). This information is particularly important where no-take protected areas or fisheries management measures **affect only part of the stock concerned,** or where stocks **occurring in the waters of more than one State and/or on the high seas** are harvested within an RFB Convention area where relevant management measures have been adopted.

For shared stocks, it is important to find out whether other range States are also exploiting this stock and contributing catch data. Catch data may be shared directly to other range States or with the relevant RFBs.

Factors to consider when addressing this question include:

- Can **evidence** be provided in support of the origin stated on the export permit application, e.g. information from the vessel logbook? (See Useful Sources in **Annex 2**)
- Can the specimen be **traced** with the required level of certainty to the origin stated on the export permit application?
- Are any of the following **traceability mechanisms** in place: eco-labelling scheme, catch/trade documentation schemes, permitting, prior notification of catches, chain of custody measures, technological initiatives (e.g. tagging system)?
- Are the **traceability** mechanisms in place **adequate** to support the claim on the export permit application of the origin of the specimen?

Examples of how a CITES Authority can be confident that the specimen concerned is of the origin stated on the export permit include the following:

a) The **origin of the specimen(s)** for export is **identified to a sufficient level of detail on the permit application AND**

b) The origin of the specimen is **recorded at the point of landing**; the **system of monitoring, control and surveillance** (**MCS**) in place is **adequate** to ensure that the origin specified on the permit corresponds to the actual location of harvest of the specimen; **AND** there is a **system of traceability/chain of custody** in place to ensure substitution with another specimen has not taken place in the interim (e.g. the specimen is accompanied with catch or trade documentation, or has been tagged or bar-coded and this information recorded).

c) The **origin of the specimen** has been **confirmed by an expert at this time** or at the **immediately preceding stage** in the supply chain (through molecular testing).

d) The **origin of the specimen** was **confirmed by an expert at a previous stage** in the supply chain (through molecular testing) **AND** there is a **system of traceability/chain of custody** in place to ensure substitution with another specimen has not taken place in the interim (e.g. the specimen is accompanied with catch or trade documentation, or has been tagged or bar-coded and this information recorded).

DECISION AND NEXT STEPS

OPTION 1: YES, the origin of the specimen(s) has been identified

- Example conditions a **AND** b, or c, or d (or equivalent) are met.
- Use the **Worksheet for Step 1 Question 1.1(b)** to describe the traceability measures in place, or the evidence provided in support of the origin of the specimen stated on the export permit application, record the information sources used, and **GO TO Section 1.2**.

OPTION 2: NO, the origin of the specimen(s) has not been identified satisfactorily

- Example condition a **OR** b, or c, or d (or equivalent) are not met.
- Use the **Worksheet for Step 1 Question 1.1(b)** to describe why the traceability measures in place or evidence of origin of the specimen are inadequate. The Management Authority may wish to seek further advice on this issue. If the issue cannot be resolved, then describe any concerns about origin in the **Worksheet for Step 1 Question 1.1(b)**.
- **GO TO Section 1.2,** but note that if the origin of the specimen cannot be identified, it may be impossible for the Management Authority to determine conclusively whether the specimens were taken legally or illegally.

Question 1.2. Was (will) the specimen (be) legally obtained and is export allowed?

Factors to consider when addressing this question:

- For specimens caught in national waters (EEZs):
  - Is harvest and export of the specimen(s) permitted by **national or relevant sub-national legislation or regulation**, or under **RFB management measures**?
  - Is the **harvest method consistent** with this legislation?
  - Are **adequate MCS systems** in place to enable legality of harvest to be determined? (For example, where fisheries have been banned in specific protected areas in national waters and the location of harvest requires verification.)
  - If **doubts** regarding the **precise origin** of the specimen were identified in **Question 1.1(b),** can **legality of harvest still be determined**?
- For specimens caught in waters beyond national jurisdiction:
  - Was the specimen **acquired and landed in a manner consistent** with:
    - the provisions of Resolution Conf.14.6 (Rev. CoP16) regarding international law for the conservation and management of living marine resources and illegal, unreported or unregulated (**IUU**) fishing activity; and
    - with relevant RFB management measures covering the area of origin (regardless of whether the State issuing the permit is an RFB member)?
  - Are **adequate MCS systems** in place to ensure that the obligations set out in Resolution Conf. 14.6 (Rev. CoP16) and RFB measures are satisfied?

If **doubts** regarding the **precise origin** of the specimen were identified in **Question 1.1(b)**, can **legality of harvest still be determined**?

The relevant RFMO may be consulted to confirm whether there are any possible compliance violations regarding harvesting from the high seas or elsewhere in RFMO areas of jurisdiction.

DECISION AND NEXT STEPS

OPTION 1: YES, the specimens were legally acquired and export is permitted

- There is **high confidence** that the specimens were **legally acquired AND** that take and export are **permitted under national or sub-national law** and **relevant RFB regulations**.
- Use **Worksheet for Step 1 Question 1.2** to describe the legislation or regulation(s) and their relevance, note the MCS systems in place and their appropriateness/effectiveness in relation to the risks of IUU fishing activities, and record information sources used.
- Then **GO TO Section 1.3.**

OPTION 2: There is SOME DOUBT as to whether the specimens were legally acquired or that export is permitted

- It **cannot be said with confidence** that the specimens were **legally acquired OR that export is permitted** under national or sub-national law or relevant RFB regulations.
- Use **Worksheet for Step 1 Question 1.2** to describe the legislation or regulation(s) and their relevance, note the MCS systems in place and their appropriateness/effectiveness in relation to the risks of IUU fishing activities, and record information sources used.
- Consider the implications if **Question 1.1(b)** found that the origin of specimens is uncertain.
- Depending on the level of concern/doubt regarding legality of acquisition/export, the Management Authority may wish to refer this question to the responsible authority for fisheries and/or biodiversity enforcement.
- Then **GO TO Section 1.3.**

OPTION 3: NO, the specimens were not legally acquired and/or export is not permitted

- It **can be said with confidence** that the specimens were **not legally acquired AND/OR** that **take/export are not permitted** under national or sub-national law or relevant RFB regulations.
- Describe the evidence used to reach this decision in the **Worksheet for Step 1 Question 1.2**, including the legislation or regulation(s) and their relevance, noting the MCS systems in place and their appropriateness/effectiveness in relation to the risks of IUU fishing activities, and record information sources used.
- The Management Authority may wish to notify the responsible authorities for fisheries and/or biodiversity enforcement (in other countries, where relevant), and should consider taking such information to the relevant RFB level where breaches of RFB regulations are suspected.
- It is not possible to issue an NDF. The **PROCESS STOPS HERE**.

Question 1.3. What does the available management information tell us?

Examples of the types of information to be collated on the management context, with Guidance Notes and recommended Sources of Information, are provided in **Table A** below. Useful species-specific sources of information include the most recent CITES listing proposals for CoP16, the IUCN and TRAFFIC Analyses of the Proposals (IUCN and TRAFFIC, 2012), and the FAO Expert Panel reviews of those proposals (FAO, 2013). In addition, **Annex 6** of this Guidance provides a link to the management risk assessments available for a range of shark species (prepared by Lack *et al*., 2014) that may be used to populate the **Worksheet for Step 1 Question 1.3**.

Part 2 of the **Worksheet for Step 1 Question 1.3** on stock/context-specific information should be completed through further consideration of the sources set out in **Part 1** and any other more detailed reports/information available.

Table A. Key information to be considered in Question 1.3

Management Aspect	Guidance and Explanatory Notes	Sources of Information
Part 1. Global-level information		
1. Reported global catch	Average annual catch in tonnes for the previous 5-year period. N.B. FAO Capture Production data should only include species-specific data and exclude general categories that contain the species.	FAO Capture Production database; CITES proposals; IUCN and TRAFFIC (2012); Mundy-Taylor and Crook (2013).
2. Species distribution	Insert map if available or provide a description.	IUCN Red List Assessments, Fishbase, CITES proposals; FAO (2013); IUCN and TRAFFIC (2013); Mundy-Taylor and Crook (2013)
3. Known stocks / populations	Describe what is known about the stock structure of the species. Note that this may or may not be known, or may be partially known (i.e. some stock delineation may have been determined).	IUCN Red List Assessments, Fishbase, CITES proposals, national assessments, RFB assessments.
4. Main catching countries	Countries responsible for taking the bulk of the reported global catch based on FAO Capture Production data for the most recent 5 years.	FAO Capture Production database; CITES proposals; IUCN and TRAFFIC (2012); FAO (2013); Mundy-Taylor and Crook (2013)
5. Main gear types by which the species is taken	Use available information to identify main gear types by which species taken.	IUCN Red List Assessments, Fishbase, CITES proposals, RFB assessments, national assessments, and information at FAO (2013); Mundy-Taylor and Crook (2013); and www.cites.org/eng/prog/shark/legality.php
6. Global conservation status	Include information on IUCN Red List Status and year of assessment	IUCN Red List Assessments; CITES proposals; IUCN and TRAFFIC (2012)
7. Multilateral Environmental Agreements	• CITES: have any of the main catching countries taken out a reservation? • CMS: are the main catching countries signatories to the Memorandum of Understanding and Action Plan, if relevant to the species? • Regional Agreements (e.g. OSPAR, Barcelona): What are requirements for listed species, and have any Parties taken out reservations?	CITES reservations: http://www.cites.org/eng/app/reserve.php CMS: http://www.sharksmou.org/ http://www.cms.int/species/index.htm http://www.ospar.org/ http://www.rac-spa.org

Management Aspect	Guidance and Explanatory Notes	Sources of Information
Part 2. Stock/context-specific information		
1. Stock assessments	Include information on available stock assessments, and those currently in preparation or planned	RFB assessments, scientific publications, CITES proposals, FAO (2013), Mundy-Taylor and Crook (2013)
2. Main management bodies	Determine main management bodies based on distribution, stock structure, main catching countries, cooperative management arrangements and gaps in RFB membership. Identify any gaps in management.	See information provided for rows 2, 3, 4 in Part 1 of this table, and rows 3 and 4 below.
3. Cooperative management arrangements	3a. For non-highly migratory species shared across EEZs, include information on countries fishing shared stocks. Note that UNCLOS obliges countries fishing shared stocks to cooperate in stock management. 3b. For highly migratory or high seas species, identify relevant RFBs. These are: (i) those identified by FAO as having a management mandate; (ii) whose areas of competency overlap with the species distribution; and (iii) for which there is reliable information that the species is taken in fisheries managed by the RFB.	Highly migratory species are those listed in Annex I to UNCLOS. Migratory or possibly migratory if identified as such by SSG (2007 a, b). If neither applies, classify as "other". For 3a: See FAO Capture production database by sub-ocean for indication of likely relevant countries in the absence of more specific information. For 3b: See FAO RFBs: http://www.fao.org/fishery/rfb/search/en
4. Non-membership of RFBs	Identify main catching countries of the stock concerned that are not members of the relevant RFB(s) (if applicable). The management measures of these countries will be relevant to Management Aspect 2 above.	See RFB website addresses and membership at http://www.fao.org/fishery/rfb/search/en
5. Nature of harvest	Include whether the stock concerned is being harvested directly in target fisheries or as secondary catch in non-target fisheries. Is fishing effort spread evenly across stocks?	IUCN Red List Assessments, National conservation assessments, Fishbase, CITES proposals, IUCN and TRAFFIC (2012), RFB assessments, FAO (2013), Mundy-Taylor and Crook (2013)
6. Fishery types	Include information on the main fisheries responsible for catches of individuals from the stock concerned. Relevant information includes: 1. Target species (where species taken as secondary catch) 2. Main gear types by which species is taken 3. Scale of fishery (industrial or small-scale/artisanal)	IUCN Red List Assessments, National assessments, Fishbase, CITES proposals, IUCN and TRAFFIC (2012), RFB assessments, FAO (2013), Mundy-Taylor and Crook (2013)
7. Management units	Determine the main bodies responsible for the management of the stock concerned (at RFB or national level). Identify any gaps in management.	See information provided in Parts 1 and 2 of this table, and compare management structures with distribution of fisheries and species.

8. Products in trade	Information on main products from the species traded internationally.	Mundy-Taylor and Crook (2013). FAO Fisheries Commodities and Trade database. National online trade databases, including Eurostat. Other FAO publications, IUCN Red List Assessments etc.

Management Aspect	Guidance and Explanatory Notes	Sources of Information
Part 3. Data and data sharing		
1. Reported national catch(es)	Average annual catch in tonnes for the previous 5-year period.	Compare national, RFMO and FAO data records.
2. Are catch and/or trade data available from other States fishing this stock?	Note that FAO data may not provide species-specific information. National and regional fisheries bodies may have more accurate and recent information.	Data should be available online from FAO and RFMO databases. If not, RFMOs and other range States may still be able to provide some information.
3. Reported catches by other States	Average annual catch in tonnes for the previous 5-year period.	As above.
4. Catch trends and value	Catch trends may be an important indicator of stock status and market demand.	As above.
5. Have RFBs and/or other States fishing this stock been consulted or contributed data during this process?	It is important to be aware of all sources of mortality upon the stock when collating data for the development of an NDF. RFBs, in particular, may be able to take on responsibility for collating information and developing NDFs for shared or high seas stocks (see page 2).	RFBs and CITES Authorities in other range States.

Step 2. Intrinsic Biological Vulnerability and Conservation Concern

Guidance Notes

Question 2.1:
What is the level of intrinsic biological vulnerability of the species?

The biological factors listed below and the data provided in **Annex 4** can be used to assess the severity of the intrinsic vulnerability of the shark species to over-exploitation (harvest). As many factors as possible should be considered. Bear in mind that several methods may be used to calculate and interpret some stock assessment metrics. Furthermore, the default figures in Annex 4 are derived from international standardized data and may not reflect local stock characteristics. Wherever possible, verified local data on stock characteristics should be utilised.

It is noted that the Worksheet for this section may also be used (backed by other sources of information) to evaluate the intrinsic vulnerability of other commercially exploited aquatic species for which an NDF is required.

Biological factor	Level of vulnerability	Indicator/metric
a) Median age at maturity (age at which 50% of a cohort reaches maturity)	Low	<5 year
	Medium	5–15 years
	High	>15 years
	Unknown	
	Notes: *Later sexual maturation, higher vulnerability. Age at maturity can fall in a heavily fished stock; the metric used here should be for a lightly-fished or unfished stock and focus upon more slowly growing, later maturing females.*	
b) Median size at maturity (size at which 50% of a cohort reaches maturity)	Low	<40 cm (total length)
	Medium	40–200 cm (total length)
	High	>200 cm (total length)
	Unknown	
	Notes: *Larger size at maturity, higher vulnerability. Size at maturity can fall in a heavily fished stock; the metric used here should be for a lightly-fished or unfished stock and focus upon females (where the species exhibits sexual dimorphism).*	
c) Maximum age/ longevity in an unfished population	Low	<10 years
	Medium	10–25 years
	High	>25 years
	Unknown	
	Notes: *Longer lifespan, higher vulnerability. Calculate as age reached by 1% of a cohort.*	
d) Maximum size	Low	<100 cm (total length)
	Medium	100–300 cm (total length)
	High	>300 cm (total length)
	Unknown	
	Notes: *Larger size, higher vulnerability*	

Biological factor	Level of vulnerability	Indicator/metric
e) Natural mortality rate (M)	Low	>0.4
	Medium	0.17–0.4
	High	<0.17
	Unknown	
	Notes: *Lower natural mortality rate, higher vulnerability.* *See http://www.fao.org/docrep/009/a0212e/a0212e12.htm for methodologies for the calculation of M and other key life history parameters for sharks and rays.*	
f) Maximum annual pup production (per mature female)	**Low**	>15
	Medium	2–15
	High	<2
	Unknown	
	Notes: *Smaller litter size/fewer eggs, higher vulnerability.* *The above metrics are for use with sharks and rays. Change to assess other fish species.*	
g) Intrinsic rate of population increase (r)	Low	>0.35
	Medium	0.15–0.35
	High	<0.15
	Unknown	
	Notes: *Low rates of population increase, higher vulnerability.* *See ftp://ftp.fao.org/docrep/fao/008/a0212e/a0212E09.pdf* and Beddington, J.R. and Cooke, J.G. 1983. *The potential yield of fish stocks. FAO Fisheries Tech. Pap*. 242	
h) Geographic distribution of stock	Low	Ocean basin; unrestricted; limited fragmentation
	Medium	Regional; partially restricted; fairly fragmented
	High	National; severely restricted; highly fragmented
	Unknown	
	Notes: *Restricted distribution and/or highly fragmented, higher vulnerability* • *Assess known range and distribution of the stock* • *Consider whether distribution of the stock is broad and continuous, or to what degree it is restricted to certain areas and fragmented*	
i) Current stock size relative to historic abundance	Low	>50% of baseline abundance
	Medium	25–50% of baseline abundance
	High	<25% of baseline abundance
	Unknown	
	Notes: *Refer to the CITES criteria for commercially-exploited aquatic species.* • *Assess stock size, trend and distribution across the range subject to NDF* • *Consider whether stock is homogenous across its range or fragmented (and at what densities)*	

Biological factor	Level of vulnerability	Indicator/metric
j) Behavioural factors	Low	Few or no behavioural factors to increase vulnerability
	Medium	Some behavioural factors increase risk to stock
	High	High level of risk incurred through behavioural factors
	Unknown	
	Notes: • *Consider whether the species is associated with critical habitats during key life stages, e.g. coastal nursery grounds (gravid females, newborns and early juveniles easily targeted by fisheries), breeding areas/feeding grounds. Consider availability of habitats and threats to these habitats. How susceptible and vulnerable are these habitats to human and other impacts? (e.g. habitat loss and degradation through land claim of coastal nursery grounds, damage by fishing gears)* • *Does the species aggregate at particular sites? A (high) reliance on critical habitats or tendency to aggregate at key sites –> higher vulnerability* • *Does the species exhibit other behavioral characteristics (e.g. a particular vulnerability to fishing gears, poor survivorship of bycatch) that increases its vulnerability to anthropogenic factors?* • *Determine the relative scale to be assigned according to local circumstances.*	
k) Trophic level	Low	
	Medium	
	High	
	Unknown	
	Notes: *The trophic level of a shark species is a measure of its position within the wider fish community. Large predatory sharks have important marine ecosystem roles. Although filter-feeding species have a low trophic level, they are of high vulnerability in most other respects, including their large size and other intrinsic life-history characteristics. Trophic level is important under Article IV (3), which states: "*Whenever a Scientific Authority determines that the export of specimens of any such species should be limited in order to maintain that species throughout its range at a level consistent with its role in the ecosystems in which it occurs and well above the level at which that species might become eligible for inclusion in Appendix I, the Scientific Authority shall advise the appropriate Management Authority of suitable measures to be taken to limit the grant of export permits for specimens of that species."	

Guidance Notes

Question 2.2

What is the severity and geographic extent of conservation concern?

When consulting relevant conservation status assessments to evaluate the severity and geographic extent of conservation concern under this Question, it will be important to consider both the **criteria** and **scientific data** that were used to make these assessments.

Caution should be taken when considering the **national or regional implications of global conservation status**, particularly for a widespread or globally distributed species, as:

- A national or regional population may be considered threatened (e.g. by localised impacts on locally small populations) while the global population may not qualify as threatened.
- Alternatively, the global population of a species may be considered threatened, but particular national or regional populations may be more secure (due to the absence of threats or effective management in place).

Ideally, therefore, the **best conservation assessments** to consider are those **carried out at a geographical scope that includes the stock that is the subject of the NDF**. Where **stocks are not well-defined**, conservation concern should be evaluated at the **level of each relevant management unit** (these units may include an entire EEZ, or an RFB area).

When answering **Question 2.2**, the following **sources of information** can be consulted:

1. Where a **stock assessment** exists, this will generally represent the most comprehensive information available to assess the severity and geographic extent of conservation concern for the stock of the species concerned.
2. For stocks occurring in **more than one country's EEZ and/or on the high seas**, conservation or stock status assessments made at the **regional level** (e.g. through a relevant RFB) will be of most use in evaluating conservation concern. Alternatively, **joint stock assessments** may have been developed for stocks shared by more than one country.
3. Where there is **no stock assessment**, consider whether status has been assessed **under other conservation status assessment systems**, including national or regional Red List assessments (many of these are summarised at www.nationalredlist.org).
4. Where a **national or regional assessment is lacking or outdated**, a **global assessment** can provide useful information about threats and indicate the severity of concern (see www.iucnredlist.org) – but note the cautions above regarding extrapolating from a global to a regional assessment.
5. If the stock(s) of the species has been included in **more than one assessment system** or **geographic scope of assessment**, the Scientific Authority may **select one assessment** to evaluate the severity of conservation concern that **best combines the following qualities**:
   - Most **indicative of the threat of extinction** to the stock(s) of the species, and the **effective functioning** of the species in its ecosystem.
   - Most **recent/up to date**.
   - Most **transparent** and **informative criteria** for identifying threats and other factors on which the assessment is based.
6. **Current assessments** should be used wherever available; old (>5 years old) or out of date (>10 years old) assessments may contain useful information, but they should be treated with an understanding that the information on which they were based may no longer be accurate.

7. In addition to information contained in stock assessments, **other indicators of adverse fishing impacts** that can be revealed by shark population monitoring include:

- decline in the **spatial distribution** of the stock; decline in catch per unit effort (CPUE);
- decline in the **mean size/age of individuals**;
- changes in the **sex ratio;** and
- changes in **shark species composition**.

Where information on these parameters is available, this should be **taken into consideration** when assessing conservation status of the stock concerned.

The following **notes are provided to assist in interpretation of the results** of any available information on stock assessments / fisheries status:

- Information on **biomass or level of depletion** will provide information on **whether the stock is "overfished"**:
  - A stock is considered overfished when it is **exploited beyond a specified safe limit** at which its abundance is considered too low to ensure safe reproduction.
  - In many fisheries fora the term is used when biomass has been estimated to be below a **"limit biological reference point"** that is used as the signpost defining an "overfished condition".
  - The stock may remain overfished (i.e. with a biomass well below the agreed limit) for some time if recovery is slow, even though fishing pressure might be reduced or suppressed[2].
  - NOTE: where the stock is not overfished but there are **no fisheries mortality data available**, the severity of conservation concern should not be considered "low" because there is still a **risk that overfishing is occurring**.
- Information on **fishing mortality** will inform **whether "overfishing" is occurring**:
  - Overfishing is used to refer to the state of a stock subjected to a level of fishing effort or fishing mortality such that a **reduction of effort** would, in the medium term, **lead to an increase in the total catch**.
  - This is **often referred to as overexploitation** and **equated to biological overfishing**; it results from a combination of "**growth overfishing**" and "**recruitment overfishing**". These may occur together with "ecosystem overfishing" and "economic overfishing"[2].
  - NOTE: where the exploitation rate is not excessive but there are **no biomass data available**, the severity of conservation concern should not be considered "low" as there is still a **possibility that the stock is overfished**.

Scientific Authorities may consider it inappropriate for an NDF to be issued in cases where a stock of a species listed in Appendix II is overfished, and overfishing is still occurring.

Further Guidance to assist in answering this question is provided in **Table B** below.

For further explanation of mortality estimation in the context of shark fisheries, see Simpfendorfer *et al*. (2005), available at: http://www.fao.org/docrep/009/a0212e/a0212e12.htm

[2] FAO Fisheries Glossary: http://www.fao.org/fi/glossary/default.asp

Table B. Indicators of Conservation Concern

Factor	Level of severity / scope of concern	Indicator
Conservation or stock assessment status *(measured in terms of biomass and fishing mortality, or Red List Assessment or equivalent)*	Low	Where a stock assessment and reference points are available: • The stock is not overfished AND overfishing is not taking place. • The fishing mortality (*F)* ≤ 0.75 natural mortality (*M)*[3] • Breeding stock biomass above precautionary reference point (*B* > *B*pa*)* Where there is no stock assessment: • The species, population, or stock has been assessed and is **not threatened**. • The assessment or listing is based on defined criteria (e.g. IUCN Red List category Least Concern/LC or equivalent categories used in other systems).
	Medium	Where a stock assessment and reference points are available: • The stock is either overfished OR overfishing is taking place. • The fishing mortality (*F)* = 0.75–1.1 natural mortality (*M)* • Breeding stock biomass lies between the precautionary and the target or limit reference points (*B*lim < *B* < *B*pa*)* Where there is no stock assessment: • The species, population, or stock has been assessed and is considered to be **moderately threatened**. • The assessment or listing is based on defined IUCN criteria (e.g. IUCN Red List categories Near Threatened (NT), Vulnerable (VU), or equivalent categories used in other systems).
	High	Where a stock assessment and reference points are available: • The stock is overfished AND overfishing is taking place. • The fishing mortality (*F)* >1.1 natural mortality (*M)* • Breeding stock biomass is below the target reference point ($B < B\text{lim}$). Where there is no stock assessment: • The species, population, or stock has been assessed and qualifies as **seriously threatened.** • The assessment or listing is based on defined criteria (e.g. IUCN Red List Critically Endangered/CR, Endangered/EN, or equivalent categories used in other systems).
	Unknown	• There is no stock assessment, or an attempted stock assessment or best available scientific evidence has concluded that it is impossible to estimate either absolute or relative present status, or relative trend. • The conservation status of the species, population, or stock has not been assessed (e.g. IUCN Red List category Not Evaluated/NE, equivalent categories used in other systems); OR • There are insufficient data to evaluate the conservation status of the species, population, or stock against defined criteria (e.g. IUCN Red List

[3] DFO (2012). Guidance related to bycatch and discards in Canadian commercial fisheries. *DFO Can. Sci. Advis. Sec. Sci. Advis. Rep*. 2012/022.

Factor	Level of severity / scope of concern	Indicator
		category Data Deficient/DD or equivalent categories used in other systems); OR • The assessment is outdated or in doubt; OR • The severity of conservation concern cannot be determined for other reasons.
	Notes: • This factor considers any existing sub-national, national, regional, or global conservation status assessments for the population or stock(s) of the species that are the subject of the NDF. • Other indicators may also be used here, e.g. changes in sex ratio, decline in average size/age, decline in spatial distribution.	
Population trend	Low	• Population trend is stable and relevant abundance indicators suggest that the stock is above 60% of historic baseline/target levels • Population trend is decreasing, but relevant abundance indicators suggest that the stock is above 70% of historic baseline/target levels • The population trend is increasing and relevant indicators of abundance suggest that the stock is above 50% of historic baseline/target levels • Area of distribution and/or population density is stable or increasing.
	Medium	• The population trend is stable and relevant indicators of abundance suggest that the stock is above 40% of historic baseline • The population trend is unmanaged, decreasing, and relevant indicators of abundance suggest that the stock is 40–70% of historic baseline • The population trend is increasing under management and relevant indicators of abundance suggest that the stock is above 30% of historic baseline. • Area of distribution shows signs of contraction or fragmentation/ population density is decreasing.
	High	• The population trend is stable or increasing, but relevant indicators of abundance suggest that the stock is below 20% of historic baseline • The population trend is unmanaged, decreasing, and relevant indicators of abundance suggest that the stock is below 40% of historic baseline. • Area of distribution is shrinking and fragmented; former density "hot spots" are no longer present.
	Unknown	• There are no stock/population trend data, or an attempted stock assessment or best available scientific evidence has concluded that it is impossible to estimate either absolute or relative population trends. • An assessment of population trend and/or distribution is outdated or in doubt.
	Notes: • This takes into account the population size trend as well as the current abundance of the stock that is the subject of the NDF. • A contracting range or area of distribution is often one of the first signs of population decline. • Density may be measured by commercial or research vessels catch-per-unit-effort; if the "hot spots" are diminishing, this is usually indicative of a declining population.	

Factor	Level of severity / scope of concern	Indicator
Geographic extent/ scope of conservation concern	None	The species is not considered threatened and no threats have been identified.
	Low	Identified threats affect only one or a few local stocks of the species, but other stocks are not affected.
	Medium	Identified threats affect the national/regional stock of the species.
	High	Identified threats affect the entire global population of the species.
	Unknown	• The conservation status of the species has not been assessed (e.g. IUCN Red List category Not Evaluated/NE, equivalent categories used in other systems); OR • There are insufficient data to evaluate the conservation status of the species, population, or stock against defined criteria (e.g. IUCN Red List category Data Deficient/DD or equivalent categories used in other systems).
	Notes: *This factor considers the geographic extent of identified threats in relation to the distribution of the species, and hence its global severity.*	

Step 3. Pressures on Species

Guidance Notes

Question 3.1

What is the severity of trade pressure on the stock of the species concerned?

1. What does this step involve?

This step involves an evaluation of the severity of trade pressure for the stock of the shark species concerned on the basis of available qualitative and quantitative information as "Low", "Medium", "High", or "Unknown".

2. What information is relevant to answering this question?

Information relevant to answering this question is described under **Section 1.3** (**Review available information on management context**) and **Step 2 (Evaluation of intrinsic biological vulnerability and conservation concern)**.

In addition, when assessing severity of trade pressure, authorities should consider the results of the assessment of **intrinsic biological vulnerability and conservation concern** made under **Step 2.**

- For stocks or populations identified in **Step 2** as of **"Medium" or "High" intrinsic biological vulnerability or as having "Medium" or "High" conservation concern**, efforts should be made to use **higher-quality information** to fill any remaining information gaps for **Section 3.1.** For species lacking relevant conservation status assessments in **Step 2 (Section 2.2)**, Scientific Authorities will need to gather any available information about trade pressures for **Section 3.1**.
- In addition, the **impact of trade** on a species will **vary according to the intrinsic vulnerability of the species concerned** (see **Section 2.1** above). This should be taken into account when assessing trade pressure severity and authorities should **exercise judgement as to whether the severity of trade pressure should be adjusted** accordingly (i.e. whether trade pressure should be assessed at a higher level of severity where a stock can withstand only low levels of off take). Where such an adjustment to the severity of trade pressure is made, this should be noted under the relevant box entitled "*Reasoning*" in the Worksheet.

When considering the severity of the impact of trade on the relevant stock(s) of the shark species in question, it is necessary to take into account **all products in both domestic and international trade** (fins, meat, other products). The more products/markets, the more complex the networks of domestic and international trade, and the more difficult it can be to understand the impact, monitor and regulate trade.

The following **FACTORS** should be considered when evaluating the severity of trade pressure for the shark stock concerned (in terms of driving unsustainable levels of harvest). Useful indicators or metrics are provided in **Table C** (page 84)**.**

(a) Magnitude and trend of legal trade

This factor considers the magnitude of trade in relation to the harvest and trade volume trend (decreasing, stable, or increasing). Risks may be higher, for example, where trade volume/market demand is high in relation to information on the abundance of the species. Trade volumes and prices of products in trade might be increasing or decreasing, which could indicate changes in supply, demand, or management. For example:

Increasing prices might indicate that:

- demand is stable/continuing but there is reduced supply due to a declining resource (but note that stockpiling or release of stockpiles may be used to influence markets); or
- demand is increasing but supply is unable to increase to meet this demand because the resource is exploited to its limit; or
- improved fisheries or biodiversity management measures are restricting catches and reducing the availability of products in trade.

Falling prices might indicate that:

- demand is decreasing (e.g. because public awareness campaigns are changing consumption patterns); or
- economic problems are affecting consumer spending; or
- the market is being flooded with product (e.g. due to increased exploitation or the release of stockpiles).

(b) Magnitude and trend of illegal trade

This factor considers whether illegal trade is known to exist, whether the magnitude and trend in illegal trade is significant in proportion to the abundance of the species, whether illegal trade is significant in proportion to the overall volume of trade, and whether the substitution for a look-alike species in trade has a significant influence on the species of concern's survival (i.e. the species of concern is used as a substitute for other species, meaning that the overall magnitude of trade in the species of concern is likely to be higher than it appears).

Issues to take into account include:

- whether trade chains are **transparent**;
- the extent of **differences** between **fishing and trade records***; and
- whether fisheries and trade (domestic and international) are **well documented**.

The various issues should be taken into account together, and in light of available documentation/reports of illegal trade.

*NOTE: It is important to view such discrepancies in fishing and trade records with caution and in consultation with experts possessing knowledge of the fisheries-specific context. There may be various reasons for discrepancies between fishing and trade records (other than IUU trade), e.g. extensive processing of products for markets, domestic consumption (where export data are being considered) and gaps/errors in catch/trade data reporting, etc.

In terms of **INDICATORS** of adverse trade impact, changes in stock parameters over time may point to the adverse impacts of trade on the stock of the species concerned, where trade is driving harvest.

Indicators of potential adverse trade impacts include: (i) declines in certain population parameters (e.g. spatial distribution of the stock, relative abundance [stock size or catch per unit effort] and mean size/age of individuals); and (ii) changes in the sex ratio.

Declines in supply and **increases in demand/price** can also provide an indication of the adverse impact of trade on the shark stock concerned (unless it is clear that these are the direct result of improved harvest management), as can shifts in trade patterns (e.g. emergence of new markets/destinations) and the appearance of novel products in trade.

For further information on the monitoring of domestic and international trade volumes and characteristics (and potential uses of this information) see **Section 6.1** below.

3. What happens if data to evaluate trade pressures are unavailable or lacking?

Where robust information on trade is unavailable or lacking, authorities are advised to follow a **precautionary approach** when assessing the severity of trade pressure on the stock of the species concerned. For example, anecdotal evidence may indicate that market demand or trade volumes are increasing rapidly, however, there may be a lack of verified, quantitative data on this trade (e.g. where trade is not reported under species-specific Customs codes). In such a case, authorities should consider whether it is appropriate to circle "High" in the Worksheet under "Magnitude of Legal Trade". If such a judgement is made, this should be indicated in the box entitled *"Reasoning*" under the relevant factor.

Where, based on the information currently available, it is not possible to evaluate trade pressure severity for either of the two trade pressure factors in the Worksheet, circle "Unknown". **Section 6.1** of the Guidance document provides details of how monitoring of domestic and international trade can be improved to generate the information necessary to make such assessments in future. **It is important that a note is made in the box entitled *"Reasoning"* where information is particularly lacking.** This will help to guide the design and implementation of trade monitoring that may be considered necessary in light of findings from this NDF process (see **Section 6.1**).

4. How is the level of confidence in the evaluation of trade pressure severity (i.e. quality of information used in the evaluation) assessed?

The higher the quality of the information, and the greater the amount of corroborating information, the higher the level of confidence associated with the assessment of trade pressure severity.

The following general indicators can be used to assist in assessing level of confidence (quality of information):

- High: Information available from authoritative sources with little or no extrapolation or inference required
- Medium: Some reliable information available but inference and extrapolation required
- Low: Limited information available
- Unknown: No information available

Examples of higher quality information may include:

- export permit/CITES trade data;
- trends in national export volumes over time (national Customs statistics in FAO Fishstat, UN Comtrade, Eurostat);
- trends in volumes of domestic trade;
- quantitative data from market surveys; and
- seizure data in relevant databases (e.g. EU-TWIX, LEMIS) and in CITES Annual and Biennial Reports.

An indication of trade demand/volume may also be obtained through:

- Internet searches (for common and scientific names), including sales through business to business trade platforms and auction sites;
- reports/observations from traders, local communities, the fishing industry and fisheries managers; and
- NGO reports on legal and illegal trade.

However, the quality of this information may vary (e.g. depending on the reliability of the sources concerned) and authorities will need to use their judgement when assessing level of confidence. As noted above, level of confidence may be higher where information is corroborated from several different sources.

Table C. Indicators of Trade Pressure

Factor	Level of severity of trade pressure	Indicator
(a) Magnitude of legal trade	Low	• Number or volume of specimens in trade is small in relation to abundance of the species • Trade volume / market demand decreasing over time • No shortage of products in trade observed
	Medium	• Number or volume of specimens in trade neither small nor large in relation to abundance of the species • Trade volume / market demand stable or slowly increasing
	High	• Multiple uses in commercial trade (i.e. the species supplies several products to different types of markets) • Trade volume / market demand high in relation to abundance of species and part used • Trade volume / market demand increasing quickly, or decreasing in response to limited resource availability • High prices per unit product or rapid price increases; shortages of products in trade
	Unknown	• Information about this factor is unavailable
(b) Magnitude of illegal trade	Low	• Good documentation of domestic and international trade • Trade chain transparent • Little concern about substitution for a look-alike species • Estimated harvest and estimated volume in legal domestic and reported export trade are approximately equal
	Medium	• Moderate documentation of trade (domestic and international) • Trade chain difficult to follow • Some concern about substitution for a look-alike species • Some concerns about whether estimated harvest and volume in legal domestic and reported export trade are approximately equal
	High	• Documented illegal trade • Poor documentation of trade (domestic and international trade) • Trade chain not transparent • Great concern about substitution for a look-alike species • Quantities legally exported are significantly smaller than quantities reported by importing countries
	Unknown	• Information about this factor is unavailable

Question 3.2

What is the severity of fishing pressure on the stock of the species concerned?

1. What does this step involve?

This step involves an assessment of severity of fishing pressure for the stock of the shark species concerned on the basis of available qualitative and quantitative information as "Low", "Medium", "High", or "Unknown". Analytical stock assessments will provide answers to most of the questions posed, however these are not available for many of the species listed in CITES Appendices, therefore in such cases other data should be considered.

2. What information is relevant to answering this question?

Information relevant to answering this question is described under **Section 1.3** (**Review available information on management context**) and **Step 2 (Evaluation of intrinsic biological vulnerability and conservation concern)**.

In addition, when assessing severity of fishing pressure, authorities should consider the results of the assessment of **intrinsic biological vulnerability and conservation concern** made under **Step 2.**

- For stocks or populations identified in **Step 2** as of **"Medium" or "High" intrinsic biological vulnerability or as having "Medium" or "High" conservation concern**, efforts should be made to use **higher-quality information** to fill any remaining information gaps for **Section 3.2.** For species lacking relevant conservation status assessments in **Step 2 (Section 2.2)**, Scientific Authorities will need to gather any available information about fishing pressures for **Section 3.2**; AND
- In addition, the **impact of catch level** on a species will **vary according to the intrinsic vulnerability of the species concerned** (see **Section 2.1** above). This should be taken into account when assessing fishing pressure severity and authorities should **exercise judgement as to whether the severity of fishing pressure should be adjusted** accordingly. For example, a low level of fishing mortality (retained catch) may present a relatively high risk to a stock with characteristics that make it unable to withstand even low levels of harvest. Therefore, if intrinsic biological vulnerability is high but fishing mortality (retained catch) severity has been assessed as low, consider whether it would be appropriate to increase the fishing pressure severity to medium or high to account for this vulnerability. Where such an adjustment to the severity of fishing pressure is made, this should be noted under the relevant box entitled "*Reasoning*" in the Worksheet.

When considering the severity of the impact of fishing on the relevant stock(s) of the shark species in question, it is necessary to take into account **all fishing methods and gears that interact with the stock** (see **Section 1.3** above). The greater the number of fishing methods and gears, the more complex the assessment and management of fishing impacts.

Tools/indicators such as productivity-susceptibility assessments and risk assessment frameworks (e.g. see **Annex 6,** Hobday *et al*. (2007) and Ecological Risk Assessments considering productivity and susceptibility - Figure 3 of http://www.iccat.int/Documents/Meetings/Docs/SCRS/SCRS-08-138_Cortes_et_al.pdf) might also assist Parties in completing this section, particularly for low-information stocks.

The following **FACTORS** should be considered when evaluating the severity of fishing pressure for the shark stock concerned:

(a) Fishing mortality (retained catch)

This factor considers the **characteristics of the harvest** that determine the scope or extent of impact, and the **proportion of the total stock that is removed by fishing** (targeted and secondary catch). The relevant characteristics of the harvest to consider are:

- The **type** of impact (what fishing gears are used and how selective are they?)
- The **frequency** of the impact (is fishing of the stock continuous/regular, or occasional?)
- The **extent** of impact (i.e. is fishing limited to certain parts of the stock only?)

For shark species, an appropriately precautionary rate of total fishing mortality (F), including both retained and discard mortality, is less than half M (natural mortality rate): F ≤ 0.5 M, or a precautionary F ≤ 0.4 M in data-poor situations (DFO, 2012).

For further explanation of mortality estimation in the context of shark fisheries, see Simpfendorfer *et al*. (2005), available at: http://www.fao.org/docrep/009/a0212e/a0212e12.htm

(b) Discard mortality

This factor considers the **discard rate** (i.e. the proportion of the catch that is not retained on board the vessel but returned to the sea, compared to proportion that is landed) specific to the particular gears/fleets concerned.

The relevant consideration should be the **total level of mortality arising from discards**, which varies according to species, the fishing method, and the way in which catch is handled prior to release (García Núñez, 2008). If discard mortality is high, this has a significant impact upon total mortality levels even if only a small proportion of the catch is landed. If a large proportion of the total catch is thrown back, but survival rates following release are high, then the severity of impact on the harvested stock will be lower.

To estimate impact, it will ideally be necessary to know about the discard rates and the levels of post-release mortality for the species/fishery/gear combination concerned.

(c) Size/age/sex selectivity

This factor considers the **extent to which fishing** has the **potential to harm the breeding stock disproportionately and influence future recruitment** through the targeting of particular life history stages. For example, fisheries that are highly selective for a particular size class may result in greater long-term negative impacts on wild stocks than less selective fisheries that take small and large sharks (note, however, that size/age/sex selectivity can enhance sustainability in certain fisheries, for example by catching a small number of younger age classes).

It is important to find out whether the species is associated with critical habitats during certain periods of its life cycle (e.g. coastal nursery grounds) and the way in which fishing interacts with the stock of the species concerned during these periods. For example, if a fishery removes a significant proportion of juveniles, fewer individuals will reach maturity and contribute to the next generation, but the long-term impact upon recruitment rates may not become apparent for many years.

To estimate impact, compare natural length:age:sex frequency plots to those for sharks in catches.

(d) Magnitude of illegal, unreported and unregulated (IUU) fishing

This factor considers whether the magnitude and trend in legal fishing is significant in proportion to the abundance of the species, whether known illegal fishing exists, and whether illegal fishing comprises a significant proportion of the total harvest. Issues to take into account include whether the fishery is well-documented, and any mismatch between fishing and trade records.

Where the magnitude of IUU fishing appears to be high based on available information, a greater proportion of the shark stock concerned is likely being removed through fishing activities than would be apparent from fisheries-dependent data (e.g. reported landings, catches, etc.). This should be

reflected accordingly in the assessment of confidence level for Fishing mortality (retained catch), especially as the exact magnitude of IUU fishing is (owing to its very nature) extremely difficult to determine. Where the confidence level for the evaluation of Fishing mortality (retained catch) is adjusted in this way, this should be recorded in the box entitled "*Reasoning*" under this Factor.

In terms of **INDICATORS** of adverse fishing impact, changes in stock parameters over time may be caused by adverse impacts of fishing practices on the stock of the species concerned. **I**ndicators of adverse fishing impacts include:

- declines in **spatial distribution** of the stock
- declines in **relative abundance** (stock size or catch per unit effort)
- declines in **mean size/age** of individuals (unless caused by a strong year class entering the fishery)
- changes in the **sex ratio** (e.g. a reduction in mature females or juveniles)
- changes in the **species composition** of catches (e.g. declining relative abundance of the species of concern compared with that of other species).

Monitoring for indicators of adverse impacts from fishing activities can take the form of **population monitoring** (standardised **fishery-independent** surveys) or **monitoring of fisheries and/or markets** (catches and discards, where possible, or at least landings). Fisheries-dependent monitoring data are only useful and dependable if accompanied by data on fishing effort, because trends in landings can also be influenced by changing market demand and/or fisheries management measures. See **Section 6.1** below for further information.

3. What happens if data to evaluate fishing pressures are unavailable or lacking?

In some cases, **fisheries dependent/independent data will not be available** to assess the severity of fishing pressure on the population or stock of the shark species concerned. In these cases, it **may be possible to consult trade data as a proxy for stock information**. Such data may include **trends in trade volumes, values** (at different stages in the supply chain) and **patterns** (e.g. shifts in trade routes/markets/uses). However, it is **necessary to exercise care** when using trade data as a proxy for stock information as, for example, changes in trade volumes could indicate changes in either supply or demand. For further information, see **Section 3.1** above.

Where robust information on fishing pressures is unavailable or lacking, authorities are advised to follow a **precautionary approach** when assessing the severity of fishing pressure on the stock of the species concerned. For example, anecdotal evidence may indicate that discard rates are high (with moderate or low post-release survival rates) but levels of observer coverage may be insufficient to verify this information. In such a case, where intrinsic biological vulnerability/conservation concern have been assessed as "High" in **Step 2**, authorities should consider selecting "High" in the Worksheet below under Discard Mortality, indicating a "Low" level of confidence in this evaluation of Discard Mortality.

If a judgement is made based on a precautionary approach, this should be indicated in the box entitled *"Reasoning*" under the relevant factor. It is noted that an appropriate precautionary rate of fishing mortality (F) for shark species is described above under 2(a) - Fishing mortality (retained catch).

Where, based on the information currently available, it is not possible to evaluate fishing pressure severity for any of the four fishing pressure factors in the Worksheet, circle "Unknown". **Section 6.1** of the Guidance document provides details of how population and fisheries monitoring can be improved to generate the information necessary to make such assessments in future. **It is important that a note is made in the box entitled *"Reasoning"* where information is particularly lacking.** This will help to guide the design and implementation of population/fisheries monitoring that may be considered necessary in light of findings from this NDF process (see **Section 6.1**).

4. How is the level of confidence in the evaluation of fishing pressure severity (i.e. quality of information used in the evaluation) assessed?

The higher the quality of the information, and the greater the amount of corroborating information, the higher the level of confidence associated with the assessment of fishing pressure severity.

The following general indicators can be used to assist in assessing level of confidence (quality of information):

- High: Information available from authoritative sources with little or no extrapolation or inference required
- Medium: Some reliable information available but inference and extrapolation required
- Low: Limited information available
- Unknown: No information available

Examples of higher quality information may include:

- conservation status/stock assessments (for population trends and harvest impacts);
- population monitoring data, sampled and modelled stock parameters (e.g. changes in relative abundance, spatial distribution, age or size structure, sex ratio);
- scientific publications/reports describing fishing practices, population trends;
- surveys and inventories (e.g. surveys conducted at fishing locations and at no-take marine protected areas);
- records of catches (e.g. reported in FAO Capture Production database, regional (RFB) and national databases), including discards where possible (or at least landings) over time, derived from on-board observer data, on-board cameras, Vessel Monitoring System (**VMS**) information, catch documentation, databases, logbooks, landings at ports;
- species-specific vulnerability assessments undertaken by RFBs.

An indication of fishing pressures may also be obtained through:

- expert, fishing industry, local community, resource manager reports/observations of e.g. fishing practices used, occurrence of illegal fishing, changes in shark abundance and mean size of animals caught;
- information disseminated through NGO/other initiatives to combat IUU fishing (e.g. Stop Illegal Fishing: http://www.stopillegalfishing.com) and enforcement/NGO reports;
- trade data proxies e.g. trends in trade volumes, values (at different stages in the supply chain) and patterns (e.g. shifts in trade routes/markets/uses).

However, the quality of this information may vary (e.g. depending on the reliability of the sources concerned) and authorities will need to use their judgement when assessing level of confidence. It is noted that information on fishing mortality is often poorly documented, with generally a lack of reliable, species-based data on catch. Species-specific catch information in the FAO Capture Production database is known to significantly underestimate total fishing mortality due to: (i) underreporting; (ii) inclusion of species specific catch in general fish catch categories; (iii) exclusion of discards in the data; and (iv) exclusion of IUU catch (Lack *et al*., 2014). As noted above, level of confidence may be higher where information is corroborated from several different sources.

Table D. Indicators of fishing pressure

Factor	Level of severity of fishing pressure	Indicator/metric
(a) Fishing mortality (retained catch)	Low	• Small proportion of stock removed by all fishing activities • The fishing mortality (F) ≤ 0.5 natural mortality (M) and is not increasing, or is ≤ 0.4 in data-poor situations (DFO, 2012)
	Medium	• Moderate proportion of stock removed by all fishing activities • The fishing mortality (F) = 0.5–1.0 natural mortality (M) but is stable or falling
	High	• High proportion of stock removed by all fishing activities • The fishing mortality (F) = 0.5–1.0 natural mortality (M) and rising, or >1.0 natural mortality
	Unknown	• Unknown proportion of stock removed by all fishing activities
(b) Discard mortality	Low	• None or only a small proportion of total catch is thrown back • A moderate or large proportion of total catch is thrown back but survival rates of released individuals is high
	Medium	• A moderate proportion of total catch is thrown back and survival rates of released individuals is moderate or low
	High	• A large proportion of total catch is thrown back and survival rates of released individuals is low
	Unknown	• An unknown proportion of total catch is thrown back and/or survival rates of released individuals is unknown
(c) Size/age/ sex selectivity	Low	• Fisheries are not selective for any size-age classes, or for male/female individuals OR • Selectivity has a positive or neutral impact on sustainability
	Medium	• Fisheries are moderately selective for certain size-age classes, and/or for male/female individuals, AND selectivity has a negative impact on sustainability
	High	• Fisheries are highly selective for certain size-age classes, and/or for male/female individuals AND selectivity has a negative impact on sustainability
	Unknown	• Unknown size/age/sex selectivity
(d) Magnitude of illegal, unreported and unregulated (IUU) fishing	Low	• Good documentation of catches • Trade chain transparent • Estimated harvest and estimated volume in legal domestic and reported export trade are approximately equal
	Medium	• Poor documentation of catches • Trade chain difficult to follow • Some concerns about whether estimated harvest and volume in

Factor	Level of severity of fishing pressure	Indicator/metric
		legal domestic and reported export trade are approximately equal
	High	• Documented illegal fishing • Trade chain not transparent • Clear evidence showing mis-match between estimated harvest, and volume in legal domestic and reported export trade
	Unknown	• Information about this factor is unavailable

Step 4. Existing Management Measures

Guidance Notes

Preliminary stage

Compile information on existing management measures

1. What does this step involve?

This step identifies the **existing generic and species-specific management measures** that are in place for the stock of the species concerned. These include measures implemented at the national, regional and international level.

Generic fisheries management measures

These are the measures in place to manage overall effort or catch in a fishery that are not specific to the species concerned but may have some benefit to that species, e.g. limited entry or catch controls on other target species, controls on species groups such as shark finning controls and gear restrictions.

Species-specific management measures

These are measures that relate explicitly and directly to the species being assessed e.g. a catch quota for the species, an effort control in a target fishery for the species or an area closure specifically designed to protect life cycle stages of the species (Lack *et al*., 2014). Certain RFBs have also implemented measures to prohibit retention of certain non-target species (including sharks), often accompanied by a requirement to ensure that any incidental catch of the species is immediately returned to the sea without further harm in order to maximise chances of post-capture survival.

2. What information is relevant to answering this question?

Information relevant to answering this question is described under **Section 1.3 (Review available information on management context)** and may also be derived from the conservation status assessments consulted **for Step 2 (Evaluation of intrinsic biological vulnerability and conservation concern)**. A list and description of commonly used generic and species-specific fisheries management measures (harvest and trade) is provided in **Annex 5**, which should **be consulted prior to completing the Worksheets in Step 4 (in conjunction with context-specific fisheries management advice)**.

Question 4.1(a)

Are existing management measures appropriately designed and implemented to mitigate the pressures affecting the stock/population of the species concerned?

1. What does this step involve?

This step involves an assessment of both the **design** and the **implementation** of existing management measures aimed at mitigating the pressures affecting the stock/population of the species concerned. The extent to which those measures are proven to be effective at mitigating these pressures is assessed under **Question 4.1(b)** below.

(a) Management design

- To assess whether management measures are appropriately designed (of an appropriate type) to mitigate the pressures affecting the stock/population of the species concerned, the **generic** and **species-specific management measures** identified and compiled in the "Preliminary stage" of **Step 4** are compared with the severity of fishing and trade pressures identified in **Step 3**.
- For each existing management measure, ask the following question: which pressures can this measure help to mitigate? For example, is the measure aimed at mitigating the effects of fishing on bycatch species, including the species concerned? This is therefore an assessment of whether the **appropriate type of measure** is in place – the extent to which existing management is consistent with scientific advice is considered in relation to "effectiveness of management" under **Question 4.1(b)** below.
- Include the management measure next to the relevant fishing/trade pressure it can help to mitigate in the Worksheet.

(b) Management implementation

- This stage involves an evaluation of the monitoring, control and surveillance (MCS) measures in place to ensure enforcement of and compliance with fisheries management. MCS measures are mechanisms for implementing agreed policies, plans or strategies for oceans and fisheries management and are a key component of the fisheries management process.
- For each existing management measure identified under (**a) Management design** above, identify which MCS measures are in place that can help to ensure enforcement of and compliance with that measure. Include the MCS measure next to the relevant management measure in the Worksheet.

NOTE: Where the fishing/trade pressure severity was assessed as "Low" for any of the Factors in **Step 3**, and a judgement is made that the impacts on the shark stock/population concerned are so low that mitigation is not required, "Not applicable" can be noted under the "Existing management measure(s)" and "Relevant MCS measure(s)" columns in the Worksheet (for that trade/fishing pressure Factor). Include a comment to this effect in the box entitled "*Reasoning/comments*".

2. What information is relevant to answering this question?

Information relevant to answering this question is described under **Section 1.3 (Review available information on management context)** and may also be derived from the conservation status assessments consulted **for Step 2 (Evaluation of intrinsic biological vulnerability and conservation concern)**.

A list and description of commonly used generic and species-specific fisheries management measures (harvest and trade) is provided in **Annex 5**, which should **be consulted prior to completing the Worksheets in Step 4 (in conjunction with context-specific fisheries management advice)**. **Annex 5** also provides details of relevant MCS measures for commonly used fisheries management responses.

Annex 2, Useful Sources of Information, lists resources for fisheries management and compliance systems.

Question 4.1(b)

Are the existing management measures effective (or likely to be effective) in mitigating the pressures affecting the stock/population of the species concerned?

1. What does this step involve?

In this step, a judgement is made based on the information available as to the effectiveness of existing management measures in mitigating the fishing and trade pressures identified in **Step 3**. Where fisheries dependent/independent data are not available to prove/verify the effectiveness of existing management measures, "likely" effectiveness may be assessed based on whether management is appropriately designed (i.e. the right type of measure is in place to address the pressures identified – see **Question 4.1(a)** above); being implemented (i.e. a comprehensive compliance regime is in place – see **Question 4.1(b)** above); and is consistent with scientific/expert advice.

A lack of effectiveness of existing management may be due to any of the following factors (or a combination thereof):

- Appropriate management measures (relevant to the pressures negatively impacting a stock/ population) are not in place;
- Management measures are in place but are not being implemented adequately (e.g. due to a non-existent/ineffective compliance regime);
- Management measures are in place but are inconsistent with scientific advice;
- Management measures are in place and are adequate in terms of design and implementation. However, according to the available data (e.g. landings, effort, fisheries independent data), further management measures are still required to mitigate relevant trade/fishing pressures.

Where it is possible to determine the reason for a lack of effectiveness of existing management measures, **this information should be included in the box entitled *"Reasoning/comments*" for the relevant fishing/trade pressure.** This will help to guide recommendations with regard to improvements in management that may be considered necessary in light of findings from this NDF process (see **Section 6.2**).

NOTE: As above for **Question 4.1(a)**, where the fishing/trade pressure severity was assessed as "Low" for any of the Factors in **Step 3**, and a judgement is made that the impacts on the shark stock/population concerned are so low that mitigation is not required, "Not applicable" can be noted under the "Appropriate management measure(s)" columns in the Worksheet (for that trade/fishing pressure Factor). Include a note to this effect in the box entitled "*Reasoning/comments*".

2. What information is relevant to answering this question?

In assessing the effectiveness of management, it will be useful to consider any information gathered under **Step 2** (e.g. assessments of conservation status/stock assessments). Information relevant to answering this question may also have been compiled and/or considered under **Section 1.3 (review available information on management context)** and **Step 3 (evaluation of fishing and trade pressures)**. **Annex 2**, Useful Sources of Information, lists other relevant resources.

In addition, as noted above under point (1), the information gathered under **Question 4.1(a)** can provide an indication of the likelihood that measures are effective, i.e. if measures are appropriately designed (of an appropriate type) to mitigate the fishing/trade pressures identified, and the assessment of the compliance regime suggests they are being adequately implemented, the measures are more likely to be effective.

Where available data are insufficient to evaluate the effectiveness (or likely effectiveness) of existing management measures in mitigating the pressures identified, the option "Insufficient information" should be circled. The specific data gaps and where further data collection, monitoring and/or analysis is required **should be recorded in the box entitled "*Reasoning/comments*".** This will help to guide the design and implementation of population/fisheries monitoring that may be considered necessary in light of findings from this NDF process (see **Section 6.1**).

NOTE:

- The greater the severity of intrinsic biological vulnerability, conservation concern, fishing pressure and/or trade pressure identified under **Steps 2 and 3**, the greater the effort that should be made to utilise available **higher-quality information** to assess the effectiveness or likely effectiveness of management measures in mitigating the risks identified.
- **Higher-quality information** may include:
  - Results of stock assessments/conservation status assessments
  - Quantitative monitoring of fisheries dependent and/or fisheries independent data
  - Quantitative monitoring of domestic and export trade volumes
  - Quantitative off-take thresholds (e.g. estimates of maximum sustainable yield)

3. What are the indicators of management effectiveness? Are there any other considerations that should be taken into account when answering Question 4.1(b)?

Ideally, management effectiveness should be demonstrated through **robust monitoring** of the stock concerned. Where **stocks** are estimated to be **stable** or increasing in size over time, then **management can be considered effective**. If, however, stock numbers are declining or other indicators of adverse impacts are observed (such as changes in the sex ratio or average body size of the population), then improvements to existing management will be necessary. This is discussed further in **Section 6.2** below.

In the **absence of stock monitoring** over a sufficiently long time frame, other factors may provide an indication of the likely effectiveness of management. This includes whether the measures are **based on scientific advice** and whether a system of **adaptive management** is in place. Adaptive management, as defined in this Guidance, refers to the process of monitoring the effectiveness of management and making necessary adjustments where deficiencies are observed. Therefore, when answering this question, it may be useful to consider the following:

- Is there a **requirement for species-specific information to be collected** to inform the status of the stock (e.g. on landings or, if retention is prohibited, on discards)?
- Are these data analysed to inform management decisions?
- Are the **management measures in place consistent with scientific advice** (i.e. do the measures implemented respond appropriately to the needs identified by the available scientific advice, **OR** do they reflect the specific management advice provided by the scientific advisory body)? (Lack *et al*., 2014).

Step 5. Non-detriment Finding and Related Advice

Guidance Notes

Question 5.1

Based on the outcomes of the previous steps, is it possible to make a positive NDF (with or without associated conditions) or is a negative NDF required?

1. What does this step involve?

This question considers the evaluation of fishing/trade pressures and management measures made under **Steps 3 and 4** of this Guidance with a view to determining whether a positive NDF (with or without conditions) can be made, or whether an negative NDF is required.

When considering the assessments made in **Steps 3 and 4**, it is also essential to keep in mind (as over-arching considerations) the level of **conservation concern** and **intrinsic vulnerability** of the stock of the species concerned (from **Step 2**) and, in view of this, whether existing management is **sufficiently precautionary**.

It is important to note that there is no defined formula as to how to make an NDF. Rather, it is for authorities to **weigh up the available information** and use their **judgement** in deciding whether (in light of the vulnerability of the species and severity of conservation concern) existing management is sufficient to effectively mitigate the trade and fishing pressures on the stock/population concerned so as to allow a positive NDF to be made. As a degree of judgement will always be needed in the NDF decision-making process (especially for cases where data are limited and uncertain), this Guidance does not prescribe a process for the "weighting" of the various factors to be taken into consideration when making an NDF.

2. What information is relevant to answering this question?

In determining whether a positive NDF (with or without conditions) can be made, or whether a negative NDF is required, it will be necessary to draw on the information gathered and assessments made under **Steps 1 to 4**.

As noted in the previous Steps, where robust information on intrinsic vulnerability, conservation concern, trade/fishing pressures and/or impacts is unavailable or lacking, authorities are advised to follow a **precautionary approach** when making their NDF. For example, where fishing/trade pressures have been evaluated as low, medium or high BUT there is a low level of confidence associated with this evaluation (due to a lack of reliable information available), it may still be possible to issue a positive NDF if existing management in place is sufficiently precautionary.

If the decision regarding an NDF is made based on a precautionary approach, this **should be noted in the box entitled "*Reasoning/comments*"** at the end of the Worksheet for **Step 5**.

3. What are the possible NDF scenarios?

Three possible Scenarios may be identified under this step.

SCENARIO 1 - A POSITIVE NDF can be considered where:

- The existing **management measures** identified in **Step 4** are **ADEQUATE** to mitigate the concerns, pressures and impacts identified in **Steps 2 and 3**. For example:
  - Existing management is judged as effective/likely to be effective **to mitigate ALL fishing/trade pressures (whether low, medium or high)**.

- **Fishing/trade pressures are low** (confidence levels: medium or low**) AND** a judgement is made based on the available information that **management** is **adequate to mitigate these small pressures**.

- In addition, it is noted that**:**
  - Where fishing/trade pressures are low, medium or high and there is a low level of confidence in these evaluations (e.g. due to a lack of information available), it may still be possible to issue a positive NDF if existing management in place is sufficiently **precautionary**.
  - Where available information indicates that fishing/trade pressures are low (confidence level: high) and there is **no effective management** in place to address these pressures, a judgement should be made as to whether the implementation of management measures is necessary before a positive NDF can be issued.
  - Even where a decision is made to issue a positive NDF, the relevant authority may still wish to include recommendations with regard to improvements in monitoring and/or management (see **Step 6** for examples of such measures). However, when any recommendations as to further measures (e.g. improvements in monitoring or management) need to be implemented **before** the export takes place, this is a **negative NDF with advice** on further measures - see instead **Scenario 3** below.

SCENARIO 2 - A POSITIVE NDF WITH CONDITIONS can be considered where:

- The existing **management measures** identified in **Step 4** are **ADEQUATE** to mitigate the concerns, pressures and impacts identified in **Steps 2 and 3** (see above under **Scenario 1**); however, it is considered necessary to attach some **mandatory conditions** to the positive NDF to ensure that any shipment remains in line with existing management measures in place.
- Examples of possible **mandatory conditions** that may accompany a positive NDF include:
  - that the specimen is harvested in accordance with a specified quota or catch limit;
  - that the specimen is harvested in accordance with a specified size limit (e.g. as stipulated at the time the NDF decision is made);
  - that existing management is maintained in its current state;
  - that the specimen is marked or tagged in a specified manner.
- These mandatory conditions differ from recommendations as to further measures, which can be made with either a positive or a negative NDF. Recommendations as to further measures are aimed at bringing about improvements in, for example, data availability and the existing management regime, in response to any shortcomings in monitoring or management identified by authorities as they work through this NDF guidance.
- As noted under **Scenario 1** above, when any recommendations need to be implemented **before** the export takes place (e.g. for further measures to improve monitoring or management), this is a **negative NDF with recommendations as to further measures** - see instead **Scenario 3** below.
- It is also possible, that in some situations, an authority may consider it appropriate to allow **exports to continue for a defined period** (in other words, a positive NDF valid for a limited period only), with recommendations as to improvements in monitoring and/or management that should be carried out during this period. At the end of this period, the authority can make a decision as to whether to maintain a positive NDF in place, or to make a negative NDF.

SCENARIO 3 - A NEGATIVE NDF is made where:

- At least one of the major fishing and trade pressures is medium or high (confidence levels: low, medium or high) **AND** a judgement is made that **management** of this pressure is ineffective, only partially effective (e.g. due to poor design and/or implementation) or there is insufficient information on management effectiveness.
- Further measures (e.g. to improve monitoring or management) need to be implemented **before** the export takes place. The negative NDF can then be reviewed once these measures have been implemented, and may lead to a decision to make a positive NDF at some future time.

4. In what circumstances will further measures (e.g. to improve monitoring or management) be required?

As noted under the three Scenarios above, an authority may issue recommendations for improvements to monitoring and/or management in the case of a positive or a negative NDF. However, only in the case of a negative NDF will the implementation of such recommendations (as to further measures) be required in order to allow for a positive NDF to be made at some future time.

A. Improvements in monitoring and information will be required:

- Wherever the severity of trade/fishing pressures have been assessed as unknown.
- Wherever the level of confidence in the evaluation of trade/fishing pressures is low.
- Wherever there is insufficient information on the effectiveness of management.

NOTE: It is recommended that monitoring is also carried out in all other circumstances, however, a degree of judgement will be needed when determining the frequency and intensity of monitoring required based on the severity of concerns/pressures/impacts identified. For example, in cases where a fishing pressure has been assessed as low with a high level of confidence in this assessment, a judgement may be made that intensive/frequent monitoring is unnecessary. However, as pressures can change over time, some degree of monitoring will usually be required.

B. Improvements in management will be required:

- Wherever management has been assessed as partially effective or ineffective at addressing any of the concerns/pressures/impacts identified, particularly where a fishing or trade pressure is assessed as medium or high (confidence levels: low, medium or high).

NOTE: an exception may be considered where the severity of any trade or fishing pressure is assessed as "Low" in **Step 3** and the relevant authority makes a judgement that the impacts on the shark stock/population concerned are so low that mitigation is not required.

Step 6. Further Measures

Guidance Notes

Section 6.1:

Improvements in monitoring or information required

These Guidance Notes provide examples of how monitoring or information gathering could be improved in order to address cases where:

- the severity of any **fishing or trade pressures** were considered **unknown**;
- the **level of confidence** was **low** for any assessment; **AND/OR**
- there is insufficient information on the effectiveness of **existing management measures.**

Recommendations for improvements in monitoring or information gathering should be developed in consultation with the national fisheries management agency (where this differs from the authorities responsible for CITES issues). Advice should be sought on the management bodies to whom monitoring recommendations can/should be directed and how this may be achieved in practice (e.g. when the relevant management body is an RFB/RFMO).

Monitoring of adverse impacts from fishing/trade pressures on shark stocks may take the following forms:

(a) Population monitoring (fisheries-independent data)

- For example, longline, tag and release, baited remote underwater video (**BRUV**) or other underwater surveys.
- Data collected from such monitoring may include: species composition, presence/absence, densities/abundance indices, sex ratios (males, females, juveniles), fecundity, age distribution, reproductive cycle, intrinsic rates of population increase, natural mortality rates.

(b) Fisheries monitoring (fisheries-dependent data)

- Monitoring of catches, including discards where possible, for example through onboard observers, landings at port, onboard cameras, vessel monitoring systems (**VMS**), interviews, catch documentation schemes, databases and logbooks.
- Data collected from such monitoring may include: methods of harvest (e.g. target/secondary catch, fishing gear), fishing locations, spatial/temporal variability of catches, catch volumes (including discards), post-release survival, catch characteristics (sex ratios, size/age structure), fishing effort (number of boats, number of trips, duration of tows, etc.).
- Note that coordination among fleets and homogenisation of adopted procedures is essential for achieving desired quality of data on shark catches (García Núñez, 2008).

(c) Monitoring of domestic and international trade volumes and characteristics

- For example, through market sampling, interviews with fishermen/traders, genetic analysis, trade documentation schemes, Customs and other databases
- Data collected from such monitoring may include: volumes (at different points in market chain), values (at different points in market chain), uses (domestic and international) trade/market structure and dynamics, seasonality of trade, trade routes (including spatial and temporal trends).
- In addition, carrying out comparisons of trade and catch records can provide an indication of

levels of IUU fishing/trade (for further information, see for example http://www.fisheries-trade-data.org).

NOTE: Trade monitoring is often useful for supplementing information on stock status/levels of harvest and can be more available/straightforward to collect than stock/harvest data. For example, trade data and trend information can provide an indication of commercial demand for shark products and mortality when landings are under-reported. However, while analysis of international trade data can provide an additional tool for long-term assessment and monitoring, there is a need for species-specific commodity codes and identification guides to allow shark products (particularly those in highly-processed form) in international trade to be monitored (García Núñez, 2008). There is also a need for consistent Customs codes between countries to trace trade volumes along international supply chains.

Section 6.2:

Improvement of management is required

This section provides brief guidance to authorities when considering the types of improvements in management to address cases where:

- Management was considered only **partially effective** or **ineffective** at addressing any of the concerns/pressures/impacts identified, particularly in relation to a fishing or trade pressure that has been assessed as medium or high (confidence levels: low, medium or high).

As noted in the previous steps, above, in such cases management needs to be addressed before trade can be considered non-detrimental to wild stocks.

As a starting point for effective management of shark stocks, Parties are encouraged to implement the UN FAO International Plan of Action for the Conservation and Management of Sharks (**IPOA-Sharks**) at the national and regional levels (as previously recommended, for example, by the CITES CoP in **Decisions 14.115 and 14.116**).

Based on the assessments made in **Steps 4 and 5**, there are **three possible scenarios** with regard to the status of existing management (Foster and Vincent, 2013). These are described below. For each of these scenarios, the **national fisheries management authority should be consulted** for guidance on management recommendations, including to which management bodies such recommendations can/should be directed and how this may be achieved in practice (e.g. when the relevant management body is an RFB/RFMO). The three scenarios are as follows:

1. If management is **non-existent, inappropriate (of the wrong type) or insufficient** then **add appropriate management.** See **Annex 5** for a list of commonly used species-specific and generic shark management measures, and **Annex 2**, Useful Sources of Information, for more information on fisheries management.
2. If management is appropriate **but not being implemented** then **increase enforcement and/or incentives/other mechanisms for compliance**. See **Annex 5** to this Guidance for examples of MCS measures relevant to commonly used species-specific and generic shark management measures, and **Annex 2**, Useful Sources of Information, for other resources.
3. If management is in place and being implemented **but is not sufficiently effective** then **recommend improvements to that management**, depending on the shortcomings identified. For example, existing catch and/or export quotas may need to be altered (reduced) to address continued population declines; closed fishing seasons may need to be lengthened or moved to enhance protection of vulnerable life-history stages; or no-take zones may need to be increased in size to improve resilience of the population to fishing pressures or re-located to better match critical areas of habitat.

ANNEX 2. USEFUL SOURCES OF INFORMATION

This Annex aims to provide an initial selection of useful sources for consultation during the development of NDFs for shark and ray species listed in the CITES Appendices. It focuses primarily upon major regional and international resources, and has not attempted to compile all relevant national resources or the 'grey' literature from the wide variety of governmental and non-governmental organisations that may also be useful to CITES Authorities considering NDFs for regional or national stocks.

Additional background to the NDF decision-making process is available in the outputs from other initiatives to develop non-binding general and taxon-specific guidance for making NDFs. The following milestones, in particular, mark the achievements of CITES Parties, inter-governmental organisations (IGOs), non-governmental organisations (NGOs), the CITES Secretariat and the Conference of the Parties (CoP), and contributed to the development of the guidance for shark species.

- The publication (and supporting workshops) of the IUCN Species Survival Commission's ***Guidance for CITES Scientific Authorities: Checklist to assist in making non-detriment findings for Appendix II exports***[4] (Rosser and Haywood, 2002);
- The ***International expert workshop on CITES non-detriment findings*** (Cancun, Mexico, 17-22 November 2008[5]) considered case studies on NDF development for seahorses (*Hippocampus* spp.), Humphead Wrasse (*Cheilinus undulatus*), sturgeons, *Arapaima* spp. and European Eel (*Anguilla anguilla*) in order to formulate general guidelines on making NDFs for fish species;
- The information document submitted by Spain to the 24th Meeting of the CITES Animals Committee (**AC**), ***Sharks: Conservation, fishing and international trade*** (AC24 Inf. 5)[6], which proposed general guidelines for assessing the effect that exploitation due to commercial international trade may have on shark stocks;
- ***Resolution Conf. 16.7 on Non-detriment Findings***[7], which provides general guidelines on making NDFs based on the outcomes of the 2008 workshop;
- ***CITES Non-detriment Findings guidance for perennial plants: a nine-step process to support CITES Scientific Authorities making science-based non-detriment findings (NDFs) for species listed in CITES Appendix II***, under preparation by TRAFFIC on behalf of WWF Germany, with financial support from the German Federal Agency for Nature Conservation (BfN);
- ***Making Non-detriment Findings for seahorses – a framework,*** developed by Project Seahorse under a project to build in-country capacity to undertake NDFs for *Hippocampus* spp. in Indonesia, Thailand and Viet Nam[8];
- Electronic guide on the making of Non-detriment Findings, directed at Central American and Caribbean American Scientific Authorities, developed by TRAFFIC[9];
- The CITES Virtual College module on making NDFs[10].

[4] http://data.iucn.org/themes/ssc/our_work/wildlife_trade/citescop13/CITES/guidance.htm#guide
[5] http://www.conabio.gob.mx/institucion/cooperacion_internacional/TallerNDF/taller_ndf.html
[6] http://www.cites.org/common/com/ac/24/EF24i-05.pdf
[7] http://www.cites.org/eng/res/16/16-07.php Resolutions may be revised at each CoP, but the CITES website is updated accordingly.
[8] http://seahorse.fisheries.ubc.ca/ndf
[9] Mosig, P. and Reuter, A. (2011). *Guía para la elaboración de Dictámenes de Extracción No Perjudicial (DEnP) en el marco de la CITES, basada en los resultados del Taller Internacional de Expertos en la materia celebrado en Cancún, México, 2008*. TRAFFIC North America.
[10] https://cites.unia.es/

Major portals for shark NDF and fisheries management resources

- **CITES Shark portal**: http://www.cites.org/eng/prog/shark/index.php
- **United Nations (UN) Food and Agriculture Organization (FAO) shark portal**: http://www.fao.org/fishery/ipoa-sharks/en

  This UN FAO portal provides links to National and Regional Plans of Action for Sharks (**NPOA** and **RPOA-Sharks**) and Shark Assessment Reports (**SAR**) developed within the framework of the UN FAO International Plan of Action for the Conservation and Management of Sharks (**IPOA–Sharks**). However, it may not be complete or up to date: CITES Authorities should always consult their national fisheries management authorities and the relevant regional fisheries bodies listed in the FAO RFB portal, below.

  For summaries of international, RFB and national shark fisheries management measures, also see Lack *et al*. (2014); Mundy-Taylor and Crook (2013); FAO review of the implementation of the IPOA-Sharks (Fischer *et al*., 2012).

- **UN FAO Regional Fisheries Bodies (RFB) portal**: http://www.fao.org/fishery/rfb/en

  Many of the RFBs listed here do not include shark fisheries management within their remit. The five major tuna RFBs listed below have responsibility for managing the catch and bycatch of ecologically-related species, including sharks, within their geographic and fisheries management remit (particularly on the high seas). The sixth, the Mediterranean Sea RFB, has also adopted specific measures for shark and ray species.

  Indian Ocean Tuna Commission: http://www.iotc.org/

  Inter-American Tropical Tuna Commission: http://www.iattc.org/

  International Commission for the Conservation of Atlantic Tunas: http://www.iccat.org/

  Commission for the Conservation of Southern Bluefin Tuna: http://www.ccsbt.org/

  Western and Central Pacific Fisheries Commission: http://www.wcpfc.int/

  General Fisheries Commission for the Mediterranean: http://www.gfcm.org/

- *Into the deep: Implementing CITES measures for commercially-valuable sharks and manta rays* (2013). www.traffic.org/fisheries-reports/traffic_pub_fisheries15.pdf

Other shark fisheries management resources

- National legislation and sub-national legislation relevant to the catch, landing and/or export of species (see Party responses to CITES Decision 16.128 on domestic laws and regulations)
- A Fishery Manager's Guidebook (Cochrane and Garcia, 2009) http://www.fao.org/docrep/015/i0053e/i0053e.pdf
- *Manual of Techniques for the Management of Elasmobranch Fisheries* (Musick and Bonfil, 2005)
- *Fisheries management. 1. Conservation and management of sharks. FAO Technical Guidelines for Responsible Fisheries. No. 4, Suppl. 1* (FAO Marine Resources Service, 2000): ftp://ftp.fao.org/docrep/fao/003/x8692e/x8692e00.pdf
- *Report of the FAO/CITES Workshop to Review the Application and Effectiveness of International Regulatory Measures for the Conservation and Sustainable Use of Elasmobranchs* (FAO, 2012): http://www.cites.org/common/disc/coop/CITES-FAO-Genazzano-workshop-report2010.pdf

- For summaries of international, RFB and national shark fisheries management measures: Lack *et al*. (2014); Mundy-Taylor and Crook (2013); FAO review of the implementation of the IPOA-Sharks (Fischer *et al*., 2012).

Catch and trade data resources

- **FAO Capture Production database**: www.fao.org/fishery/statistics/global-capture-production/en
- **FishStat:** http://www.fao.org/fishery/statistics/software/fishstat/en

  The FishStat online database provides access to data submitted to FAO, by country, region, ocean basin and globally. More accurate data and regional stock assessments for listed species may be available on the Tuna RFB websites and/or can be obtained from national fisheries bodies. Ideally, catch records should include discards as well as landings. They may be derived from on-board observer/Vessel Monitoring System (**VMS**) data, on-board cameras, catch documentation, databases, logbooks, and landings at ports (the latter to assess or detect IUU fishing activities).
- FAO Fisheries Commodities and Trade database: www.fao.org/fishery/statistics/global-commodities-production/en
- UN Comtrade. (**Note:** The highest level of detail of trade reported in UN Comtrade is under the 6 digit Harmonised System. More detailed trade information may be reported in national Customs statistics, e.g. under the 8 digit Combined Nomenclature system of the EU).
- Eurostat epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database)
- National (online) trade databases
- http://www.fisheries-trade-data.org
- CITES Trade database: http://trade.cites.org

Introduction from the Sea

The interpretation of this complex issue is still under review, for example as regards the provision for chartering arrangements. However, these links provide helpful overviews:

- http://www.nmfs.noaa.gov/ia/agreements/global_agreements/cites_page/cites.pdf
- https://wcpfc.int/node/18991

Biodiversity/wildlife management information sources

- Review lists of species protected under national legislation and by the other regional and multilateral environmental agreements to which the State is a Party. See, for example, www.speciesplus.net/
- CITES Appendices: http://www.cites.org/eng/resources/pub/checklist11/index.html
- CITES Species Database: http://www.cites.org/eng/resources/species.html
- CITES Reservations: http://www.cites.org/eng/app/reserve.php
- For species listed in the Appendices to the Convention on the Conservation of Migratory Species of Wild Animals (CMS) see: http://www.cms.int/species/index.htm
- For species listed in the CMS Sharks Memorandum of Understanding: http://www.sharksmou.org/

- For species listed in regional seas conventions, see http://www.ospar.org/ (Northeast Atlantic) and http://www.rac-spa.org (Mediterranean)
- Catches taken from marine protected areas where fisheries are regulated, restricted or prohibited may not be legally obtained: www.protectplanetocean.org/

Species biology and status

- **Annex 4** to this document.
- Original CITES listing proposals and FAO Expert Panel evaluations
- Global (and sometimes regional/population level): www.iucnredlist.org
- National and regional conservation status assessments: www.nationalredlist.org; www.regionredlist.com
- Fishbase: http://www.fishbase.org
- Beddington, J.R. & Cooke, J.G. (1983). *The potential yield of fish stocks. FAO Fisheries Tech. Pap*. 242.
- García Núñez, N.E. (2008). www.cites.org/common/com/ac/24/EF24i-05.pdf
- Lack, M., Sant, G., Burgener, M. and Okes, N. (2014). *Development of a Rapid Management-Risk Assessment Method for Fish Species through its Application to Sharks: Framework and Results*. Report to the Department of Environment, Food and Rural Affairs. Defra Contract No. MB0123. http://cites.org/sites/default/files/common/com/ac/27/E-AC27-Inf-06.pdf
- Oldfield, T.E.E., Outhwaite, W., Goodman, G. and Sant, G. (2012). *Assessing the intrinsic vulnerability of harvested sharks.* JNCC. http://www.cites.org/common/com/AC/26/E26-09i.pdf
- Sant, G., Goodman, G., Crook, V., Lack, M. and Oldfield, T.E.E. (2012). Fish and Multilateral Environmental Agreements: developing a method to identify high risk commercially-exploited aquatic organisms in trade and an analysis of the potential application of MEAs*. JNCC Report No. 453*. Joint Nature Conservation Committee, Peterborough. http://jncc.defra.gov.uk/page-6120

Please note that the biology of some stocks/populations may vary from those summarised in **Annex 4** and in other global or ocean-basin level sources listed above. Where stock assessments or detailed population monitoring data (sampled and modelled stock parameters, such as changes in relative abundance, spatial distribution, age or size structure, sex ratio, from fisheries dependent and/or independent data) are not available, records of catches or at least landings at ports can be used. Where possible, catch records should include estimates of discards, derived from on-board observer/Vessel Monitoring System (**VMS**) data, on-board cameras, logbooks, and other catch documentation schemes. In addition to the sources listed above, relevant data may also be available from national and regional scientific publications, reports of fishing practices, population trends, surveys and inventories (e.g. at fishing locations and in marine protected areas).

When assessing population trends, additional useful data may be available from national experts, fisheries and natural resource managers and enforcement officers' reports of fishing practices used and the occurrence of illegal fishing, the fishing industry, traders, local communities and other stakeholders**.** These may rely upon qualitative indices (e.g. perceptions of local communities/fishing industry of changes in shark abundance, mean size of animals caught, decline in supply, increase in demand, changes in price).

Identification guides, traceability and chain of custody

- See list of identification guides on http://www.cites.org/eng/prog/shark/traceability.php and in Appendix N of *Into the deep: Implementing CITES measures for commercially-valuable sharks and manta rays* (2013): www.traffic.org/fisheries-reports/traffic_pub_fisheries15.pdf

Eco-labelling:

- Marine Stewardship Council (**MSC**) eco-label: http://www.msc.org/
- FAO Guidelines for the Ecolabelling of Fish and Fishery Products from Marine Capture Fisheries: http://www.fao.org/fishery/topic/13293/en

Catch and trade documentation (examples):

- CITES Resources for Implementation: http://www.cites.org/eng/prog/shark/traceability.php
- Lack (2008); catch documentation scheme implemented under the European Union (**EU**) IUU Regulation[11] http://ec.europa.eu/fisheries/cfp/illegal_fishing/info/index_en.htm
- Technological initiatives, such as using digital technology (e.g. smart phones) to facilitate traceability (e.g. Thisfish: http://thisfish.info/)
- *Into the deep: Implementing CITES measures for commercially-valuable sharks and manta rays (*2013): www.traffic.org/fisheries-reports/traffic_pub_fisheries15.pdf

Legality of capture:

- www.cites.org/eng/prog/shark/legality.php
- IUU vessel black lists established under relevant RFB (see RFB websites) or other legal instruments (e.g. http://ec.europa.eu/fisheries/cfp/illegal_fishing/info/index_en.htm)
- NGO reports of IUU fishing and vessel lists
- Information obtained from INTERPOL (e.g. under Project Scale: http://www.interpol.int/Crime-areas/Environmental-crime/Projects/Project-Scale)
- NGO reports on IUU fishing – e.g. Stop Illegal Fishing: http://www.stopillegalfishing.com
- CITES Annual and Biennial Reports (e.g. seizure data, enforcement information); illegal trade reported in US Fish and Wildlife Service (**US FWS**) LEMIS and EU-TWIX databases.

Export permits and quotas

- Management of nationally established export quotas: Res. Conf. 14.7 (Rev. CoP15): http://www.cites.org/eng/res/14/14-07R15.php
- Quantitative information on numbers of specimens exported (CITES trade database: http://www.cites.org/eng/resources/trade.shtml; see also guide to using the trade database: http://www.unep-wcmc-apps.org/citestrade/docs/CITESTradeDatabaseGuide_v7.pdf), including trends over time and additional information.
- Periodic reports of the national CITES Authorities to the CITES Secretariat, including updates on national export quotas: http://www.cites.org/eng/resources/quotas/index.shtml

[11] Council Regulation (EC) No 1005/2008 of 29 September 2008 establishing a Community system to prevent, deter and eliminate illegal, unreported and unregulated fishing (**EU IUU Regulation**).

- Permit applications (proposed or actual number or volume of specimens included in relation to other permits for specimens from the same stock in the current year)
- Reports of illegal trade contained in CITES Annual and Biennial Reports (e.g. seizure data, enforcement information); illegal trade reported in US FWS LEMIS and EU-TWIX databases

When assessing applications for export permits, it may be useful to consider the following:

- Trends in national export volumes over time (from sources identified under catch and trade data resources above),
- Trends in volume of domestic trade: market and field reports, surveys, information from traders, the fishing industry/local communities, fisheries managers;
- Internet searches for both common and scientific names to give an indication of demand, including sales through B2B (business to business) trade platforms;
- Enforcement and NGO reports on legal and illegal trade;
- Reports of illegal trade contained in CITES Annual and Biennial Reports (e.g. seizure data, enforcement information);
- Eurostat for regional information into and out of the EU;
- US **FWS** LEMIS and EU-TWIX databases (for illegal trade);
- Shark catch data (FAO Fishstat, RFB databases) to assist in assessing levels of illegal trade;
- Management Risk Assessments for information on IUU fishing activities affecting stocks of listed species (Lack *et al*. 2014).

ANNEX 3. GLOSSARY, ACRONYMS & ABBREVIATIONS

Glossary

Baited remote underwater video (BRUV). A non-extractive low-cost method to monitor changes in relative abundance and diversity, using bait to attract fish into the field of view of a remotely controlled camera.

Bycatch. The part of a catch taken incidentally in addition to the target species towards which fishing effort is directed. Includes secondary catch – the bycatch that is retained and utilised.

Catch Documentation Scheme. A trade-based recording and reporting measure, one of several monitoring, control and surveillance (MCS) tools developed by Regional Fisheries Management Organizations (RFMOs) to combat illegal, unreported and unregulated (IUU) fishing activities.

Catch per unit effort (CPUE). An indirect fishery-dependent measure of the abundance of a target species, in which changes in CPUE are inferred to reflect changes to the target species' true abundance. A decreasing CPUE indicates overexploitation, while a level CPUE indicates sustainable harvesting.

Chondrichthyan. Member of the Class Chondrichthyes, including the elasmobranchs (sharks and batoid fishes) and the holocephalans (chimaeras).

Circumglobal. Occurring around the world.

Circumtropical. Occurring around the tropical regions of the world.

Cohort. A group of fish born in the same year within a particular stock.

Eco-labelling. Eco-labelling schemes entitle a fishery product to bear a distinctive logo or statement certifying that the fish was harvested in compliance with conservation and sustainability standards. Eco-labels may be supported by chain of custody measures to verify that the product bearing the eco-label originates from the certified fishery concerned.

Elasmobranch. Member of the subclass Elasmobranchii: the sharks and batoid fishes (including sawfishes, skates and rays, characterised by 5–7 pairs of gill openings).

Exclusive Economic Zone (EEZ). A zone under national jurisdiction (up to 200-nautical miles wide) declared in line with the provisions of UNCLOS, within which the coastal State has the right to explore and exploit, and the responsibility to conserve and manage, living and non-living resources.

Demersal. Occurring or living near or on the bottom of the ocean (cf. pelagic).

Fishery-independent monitoring. A method to monitor stocks that is not dependent upon and therefore influenced by commercial fishing activity. Examples include scientific surveys using standard methodologies.

Fishing mortality (F). The removal of fish from a stock caused by all forms of fishing activities, whether the fish are retained, discarded, or lost (unrecorded) from fishing gear. This can be sub-divided into mortality due to retained catch and the mortality of the discarded catch.

Generation. Measured as the average age of parents of newborn individuals within a population. Usually lower in an exploited stock.

Genetic analyses. May be used to confirm species identification and sometimes even geographic origin (Chapman and Abercrombie, 2010).

High Seas. Areas outside of the jurisdiction of any State (also international waters, or trans-boundary waters). Fisheries on the high seas are managed by regional fisheries management bodies.

Highly migratory species. The agreed list of species listed in UNCLOS Annex I. These should be subject to cooperative management by the countries fishing the stocks.

Individual Transferable Quota (ITQ). A catch limit or quota (a part of the Total Allowable Catch) allocated to an individual fisher or vessel owner that can either be harvested or sold to others.

Illegal, unreported and unregulated (IUU). Illegal fishing takes place where vessels operate in violation of the fishing laws of a RFMO or a coastal State. Unreported fishing is unreported or misreported to relevant authorities, in contravention of applicable laws and regulations. Unregulated fishing generally refers to fishing by vessels without nationality, or flagged to a State not Party to the RFMO governing the species or fishing area. See FAO IPOA–IUU fishing. http://www.fao.org/docrep/003/y1224e/y1224e00.htm

International Plan of Action for the Conservation and Management of Sharks. A voluntary measure adopted to assist with the implementation of the FAO Code of Conduct for Responsible Fisheries. Encourages FAO Members that catch sharks to produce Shark Assessment Reports and adopt National Shark Plans, and RFMOs to develop regional management measures.

Introduction from the sea. See Text Box 2.

Longevity. The maximum expected age of individuals in the absence of fishing mortality.

Look-alike species. Species whose specimens in trade look like those of species listed for conservation reasons (see CITES Article II paragraph 2).

Management bodies. Authorities with responsibility for species or fisheries management. In the context of this report, these are likely to be national authorities or regional fisheries management bodies (RFB/RFMO).

Maximum sustainable yield (MSY). The largest theoretical average catch or yield that can continuously be taken from a fish stock under existing environmental conditions without causing it to become depleted (it assumes that removals and natural mortality are balanced by stable recruitment and growth).

Monitoring, control and surveillance (MCS). The mechanism for implementing agreed policies, plans or strategies for oceans and fisheries management; a key component of the fisheries management process.

Mortality. In the context of this document, total fish mortality is comprised of fisheries mortality (F) and natural mortality (M). F should be less than half of M, in a sustainable shark fishery ($F \leq 0.5\ M$).

National Plan of Action/National Shark Plan. See International Plan of Action for the Conservation and Management of Sharks.

Natural mortality (M). The removal of fish from a stock from causes not associated with fishing; such as predation, disease, pollution and old age.

Overfished. A stock is considered overfished when it is exploited beyond a limit (often expressed as a 'limit biological reference point') at which its abundance is considered too low to ensure safe reproduction.

Overfishing. A term used to refer to the level of fishing effort or fishing mortality upon a fish stock that would, if reduced, lead to an increase in the total catch. Overfishing may occur even if the stock is not overfished. Also termed over-exploitation.

Pelagic. Referring to organisms that live in the water column, not on the sea bottom.

Productivity. Relates to the birth, growth and mortality rates of a fish stock. Highly productive stocks are characterised by high birth, growth and mortality rates and can usually sustain higher exploitation rates and, if depleted, could recover more rapidly than comparatively less productive stocks.

Regional Fisheries Body (RFB). A group of States or organizations that are Parties to an international fishery arrangement and work together towards the conservation and management of fish stocks. Some RFBs only provide scientific advice. See also RFMO (below).

Regional Fisheries Management Organisation (RFMO). An RFB with a conservation and management remit.

Regional Plan of Action/Regional Shark Plan. See International Plan of Action for the Conservation and Management of Sharks.

Shark Assessment Report. See International Plan of Action for the Conservation and Management of Sharks.

Specimen. Under CITES definitions, "specimen" refers to any animal, whether alive or dead, or any readily recognizable part or derivative thereof.

Stock. A fish stock is a subpopulation of a particular fish species, often occupying a well-defined geographical range and regarded as an entity for management and assessment purposes, whose population dynamics are defined by its intrinsic parameters (extrinsic factors are considered to be insignificant).

Stock assessment. Scientific analyses that provide fisheries managers with the information needed to develop measures for the regulation of a fish stock.

Straddling stock. A fish stock which migrates between, or occurs in both a State's Exclusive Economic Zone (EEZ) and the high seas.

Total Allowable Catch (TAC). The total quantity of a species permitted to be caught in a certain area during a particular fishing season or year. The TAC is subdivided into quotas that may be assigned to each country participating in the fishery, and/or to each fleet, vessel or fisher.

Total length (TL). A standard morphometric measurement, from the tip of the snout or rostrum to the end of the upper lobe of the caudal fin.

Traceability measures. These allow products, particularly those that pass through several stages in the international supply chain (from fishery to end-market), to be traced back to the original animal from which they were derived. Approaches implemented for other types of fish and fisheries products that could assist in the verification of shark products along the supply chain, include eco-labelling and catch/trade documentation schemes (Mundy-Taylor and Crook, 2013) and genetic analyses.

Trade Documentation scheme. See Catch Documentation Scheme.

Vessel Monitoring System (VMS). Satellite position fixing system used by environmental and fisheries regulatory organizations to monitor position, course and speed of commercial fishing vessels.

Acronyms and Abbreviations

AC	Animals Committee (CITES)
BfN	Bundesamt für Naturschutz (German CITES Scientific Authority)
BRUV	Baited remote underwater video
CDS	Catch Documentation Scheme
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	Convention on Migratory Species
CoP	Conference of the Parties
CPUE	Catch per unit effort
DEFRA	Department for Environment, Food and Rural Affairs (UK)
EEZ	Exclusive Economic Zone
EU	European Union
EU-TWIX	Trade in Wildlife Information eXchange
FAO	Food and Agriculture Organization of the United Nations
IFS	Introduction from the sea
IGO	Inter-governmental organisation
IPOA	International Plan of Action
IUCN	International Union for Conservation of Nature
IUU	Illegal, unreported and unregulated
MCS	Monitoring, control and surveillance
MSC	Marine Stewardship Council
MPA	Marine Protected Area
NGO	Non-governmental organisation
NDF	Non-detriment finding
NPOA	National Plan of Action/National Shark Plan
OSPAR	Convention for the Protection of the Marine Environment of North-East Atlantic
RFB	Regional Fisheries Body
RFMO	Regional Fisheries Management Organisation
RPOA	Regional Plan of Action/Regional Shark Plan
SAR	Shark Assessment Report
TAC	Total Allowable Catch
TDS	Trade Documentation Scheme
UN	United Nations
UNCLOS	UN Convention on the Law of the Sea (1982)
US FWS	United States Fish and Wildlife Service
VMS	Vessel Monitoring System

ANNEX 4. DEFAULT SPECIES-SPECIFIC BIOLOGICAL DATA

The intrinsic biological characteristics provided in the following pages are derived from international standardised data on species listed in CITES Appendix II and from case study data provided to the 2014 Shark NDF workshop in Bonn. They may not reflect local stock characteristics. Wherever possible, verified biological data for local stocks should be utilised.

The online database at www.shark-references.com provides a comprehensive scientific bibliography on the chondrichthyan fishes: sharks, skates, rays and chimaeras and can be consulted by species. The following links , provided here by kind permission of Jürgen Pollerspöck, lead to descriptions of each species listed in the CITES Appendices, including further links to relevant species entries on Fishbase, the IUCN Red List of Threatened Species, Eschmeyer's Catalog of Fishes hosted by the California Academy of Sciences website, and a complete list of species-specific references.

http://shark-references.com/species/view/Carcharhinus-longimanus

http://shark-references.com/species/view/Sphyrna-lewini

http://shark-references.com/species/view/Sphyrna-mokarran

http://shark-references.com/species/view/Sphyrna-zygaena

http://shark-references.com/species/view/Carcharodon-carcharias

http://shark-references.com/species/view/Lamna-nasus

http://shark-references.com/species/view/Cetorhinus-maximus

http://shark-references.com/species/view/Rhincodon-typus

http://shark-references.com/species/view/Manta-alfredi

http://shark-references.com/species/view/Manta-birostris

http://shark-references.com/species/view/Pristis-clavata

http://shark-references.com/species/view/Pristis-pristis [including the synonym *Pristis microdon*]

http://shark-references.com/species/view/Pristis-pectinata

http://shark-references.com/species/view/Pristis-zijsron

http://shark-references.com/species/view/Anoxypristis-cuspidata

Annex 4.1. Intrinsic biological characteristics of Oceanic whitetip *Carcharhinus longimanus*

Intrinsic biological factors	Level of vulnerability	Indicator/metric
a) Median age at maturity	Low	4-5 years In the North Pacific (Seki *et al*., 1998)
	Medium	6-7 years for both sexes (Bonfil *et al*. 2008)
	High	
	Unknown	
b) Median size at maturity	Low	
	Medium	168-196 TL (Bonfil *et al*. 2008; Seki *et al*., 1998)
	High	
	Unknown	
c) Maximum age (longevity) of unfished population	Low	
	Medium	11 yrs (Bonfil *et al*. 2008); 13 yrs (Lessa et al. 1999)
	High	
	Unknown	
d) Maximum size	Low	
	Medium	285 cm TL (Bonfil *et al*. 2008)
	High	325 – 342 cm total length (TL) (Lessa *et al.*, 1999; Seki *et al.*, 1998).
	Unknown	
e) Natural mortality rate (M)	Low	
	Medium	0.18 (Fishbase 2014)
	High	
	Unknown	
f) Maximum annual pup production (per mature female)	Low	
	Medium	(Bonfil *et al*. 2008)
	High	
	Unknown	
g) Intrinsic rate of population increase (r)	Low	
	Medium	
	High	0.081 (Smith *et al*. 1998)
	Unknown	
h) Geographic distribution of stock	Low	
	Medium	Circumtropical (mainly) (Fishbase 2014)
	High	
	Unknown	
i) Current stock size relative to historic	Low	
	Medium	

abundance	High	Current West & Central Pacific biomass is 6.5% of original (estimated) biomass (Rice and Harley 2012)
	Unknown	
j) Behavioural factors	Low	
	Medium	
	High	Inquisitive and readily hooked on longlines
	Unknown	Critical habitats unknown
k) Trophic level	Low	
	Medium	
	High	4.2 (Fishbase 2014)
	Unknown	

SUMMARY for Question 2.1
Intrinsic biological vulnerability of species

High	*Medium*	*Low*	*Unknown*

Explanation of conclusion and sources of information used:

This species has inherently low productivity. Its current biomass in the WCPO and likely other oceans is severely depleted. This will exacerbate its poor reproductive resilience

Anon. (2012). Proposal for the inclusion of *Carcharhinus longimanus* in Appendix II of CITES. CoP16 Prop. 42.

Bonfil, R., S. Clarke and H. Nakano. (2008). The biology and ecology of the oceanic whitetip shark, *Carcharhinus longimanus*. pp. 128-139, IN: *Sharks of the Open Ocean*, M. Camhi, E. Pikitch and E.A. Babcock (eds). Blackwell Publishing, Oxford, UK.

Clarke, S. (2011). A Status Snapshot of Key Shark Species in the Western and Central Pacific and Potential Mitigation Options. SC7-EB-WP-04. Secretariat of the Pacific Community, Nouméa, New Caledonia (available at http://www.wcpfc.int/node/2768).

Clarke, S., S. Harley, S. Hoyle and J. Rice. (2011). An indicator-based analysis of key shark species based on data held by SPC-OFP. SC7-EB-WP-01. Secretariat of the Pacific Community, Nouméa, New Caledonia. (available at http://www.wcpfc.int/node/2766)

Clarke, S. and S. Hoyle. (2014). Development of limit reference points for elasmobranchs. SC10-MI-07. Western and Central Pacific Fisheries Commission, Pohnpei, Federated States of Micronesia. (available at http://www.wcpfc.int/node/19015)

Dulvy *et al*. (2008). You can swim but you can't hide: the global status and conservation of oceanic pelagic sharks and rays. *Aquat. Conserv. Mar. Freshw. Ecosyst.* 18, 459–482.

Gallagher, A.J., E.S. Orbesen, N. Hammerschlag and J.E. Serafy. (2014). Vulnerability of oceanic sharks as pelagic longline catch. *Global Ecology and Conservation*. http://dx.doi.org/10.1016/j.gecco.2014.06.003

Lessa, R., R. Paglerani, and F.M. Santana. (1999). Biology and morphometry of the oceanic whitetip shark, *Carcharhinus longimanus* (Carcharhinidae), off north-eastern Brazil. *Cybium*, 23: 353–368.

Lessa, R., Santana, F.M. and Paglerani, R. (1999). Age, growth and stock structure of the oceanic whitetip shark *Carcharhinus longimanus*, from the southwestern equatorial Atlantic. *Fisheries Research* 42: 21-30.

Rice, J. and S. Harley. (2012). Stock Assessment of Oceanic Whitetip Sharks in the Western and Central Pacific Ocean Rev 1 (3 August 2012). SC8-SA-WP-06. Secretariat of the Pacific Community, Nouméa, New Caledonia. (available at http://www.wcpfc.int/node/3235)

Seki, T., T. Taniuchi, H. Nakano, and M. Shimizu. (1998). Age, growth, and reproduction of the Oceanic Whitetip shark from the Pacific Ocean. *Fisheries science*. Tokyo. 64:14-20.

Smith, S., D.W. Au and C. Show. (1998). Intrinsic rebound potentials of 26 species of Pacific sharks. *Marine and Freshwater Research* 49: 663-678.

Annex 4.2. Intrinsic biological characteristics of White Shark *Carcharodon carcharias*

Intrinsic biological factors	Level of vulnerability	Indicator/metric
a) Median age at maturity	Low	
	Medium	
	High	18 years (females)
	Unknown	
b) Median size at maturity	Low	
	Medium	
	High	450 – 500 cm (females)
	Unknown	
c) Maximum age (longevity) of unfished population	Low	
	Medium	
	High	Over 70 years (NW Atlantic, Hamady *et al*. 2014), over 40 years elsewhere
	Unknown	
d) Maximum size	Low	
	Medium	
	High	700 cm (females)
	Unknown	
e) Natural mortality rate (M)	Low	
	Medium	
	High	0.08 (Fishbase).
	Unknown	
f) Maximum annual pup production (per mature female)	Low	
	Medium	
	High	Four (if a two year reproductive cycle)
	Unknown	
g) Intrinsic rate of population increase (r)	Low	
	Medium	
	High	0.051
	Unknown	
h) Geographic distribution of stock	Low	Very broadly distributed and wide-ranging species.
	Medium	
	High	
	Unknown	
i) Current stock size relative to historic abundance	Low	
	Medium	Stock declines reported in many areas, but some recovery is taking place following protection.

	High	
	Unknown	
j) Behavioural factors	Low	
	Medium	
	High	Very inquisitive shark, targeted for high value products and persecuted because of perceived danger to swimmers. Important for ecotourism.
	Unknown	
k) Trophic level	Low	
	Medium	
	High	4.5 (Fishbase)
	Unknown	

SUMMARY for Question 2.1
Intrinsic biological vulnerability of species

High	*Medium*	*Low*	*Unknown*

Explanation of conclusion and sources of information used:

No NDF case study prepared. This conclusion is derived primarily from the following sources:

Anonymous. 2004. Proposal to include the White Shark (*Carcharodon carcharias*) in Appendix II of CITES. Bangkok, Thailand. CoP 12, Prop 32. http://www.cites.org/eng/cop/13/prop/E13-P32.pdf

Dulvy *et al*. (2008). You can swim but you can't hide: the global status and conservation of oceanic pelagic sharks and rays. *Aquat. Conserv. Mar. Freshw. Ecosyst.* 18, 459–482.

Fergusson, I., Compagno, L.J.V. & Marks, M. 2009. *Carcharodon carcharias*. The IUCN Red List of Threatened Species. Version 2014.2. <www.iucnredlist.org>. Downloaded on **30 September 2014**.

Fishbase. http://www.fishbase.org/summary/751

Hamady LL, Natanson LJ, Skomal GB, Thorrold SR (2014) Vertebral Bomb Radiocarbon Suggests Extreme Longevity in White Sharks. PLoS ONE 9(1): e84006. doi:10.1371/journal.pone.008400

Annex 4.3. Intrinsic biological characteristics of Basking Shark *Cetorhinus maximus*

Intrinsic biological factors	Level of vulnerability	Indicator/metric
a) Median age at maturity	Low	
	Medium	
	High	5 – 18 years (Dulvy *et al*. 2008)
	Unknown	
b) Median size at maturity	Low	
	Medium	
	High	700 – 800 cm (females)
	Unknown	
c) Maximum age (longevity) of unfished population	Low	
	Medium	
	High	
	Unknown	Unknown, but likely very high.
d) Maximum size	Low	
	Medium	
	High	~1 000 cm
	Unknown	
e) Natural mortality rate (M)	Low	
	Medium	
	High	
	Unknown	Unknown
f) Maximum annual pup production (per mature female)	Low	
	Medium	Possibly 3, if litters of 6 are born every 2 years
	High	
	Unknown	
g) Intrinsic rate of population increase (r)	Low	
	Medium	
	High	
	Unknown	Unknown.
h) Geographic distribution of stock	Low	Widespread and highly migratory in temperate waters
	Medium	
	High	
	Unknown	
i) Current stock size relative to historic abundance	Low	Some stocks have never been targeted in fisheries and are healthy.
	Medium	

	High	Historical target fisheries depleted several Northern hemisphere stocks to less than 10% of baseline; some are now showing signs of recovery.
	Unknown	
j) Behavioural factors	Low	
	Medium	
	High	Surface feeding and courting aggregations are vulnerable to fisheries (now primarily historic), boat strike and tourism disturbance
	Unknown	
k) Trophic level	Low	Presumably low (filter-feeder)
	Medium	
	High	
	Unknown	

SUMMARY for Question 2.1
Intrinsic biological vulnerability of species

High	*Medium*	*Low*	*Unknown*

Explanation of conclusion and sources of information used:

No NDF case study prepared. This conclusion is derived primarily from the following sources:

Anonymous. 2002. Proposal to include the Basking Shark (*Cetorhinus maximus*) in Appendix II of CITES. Santiago, Chile. CoP 12, Prop 36. http://www.cites.org/eng/cop/12/prop/E12-P36.pdf

Dulvy *et al*. (2008). You can swim but you can't hide: the global status and conservation of oceanic pelagic sharks and rays. *Aquat. Conserv. Mar. Freshw. Ecosyst.* 18, 459–482.

Fishbase. http://www.fishbase.org/Summary/SpeciesSummary.php?ID=90&AT=basking+shark

Fowler, S.L. 2005. *Cetorhinus maximus*. The IUCN Red List of Threatened Species. Version 2014.2. <www.iucnredlist.org>. Downloaded on **30 September 2014**.

Annex 4.4. Intrinsic biological characteristics of Porbeagle *Lamna nasus*

Intrinsic biological factors	Level of vulnerability	Indicator/metric
a) Median age at maturity	Low	
	Medium	13 yrs (F, NWA: Campana *et al*. 2008; DFO 2005).
	High	15-18 years for females (NZ. Francis *et al*. 2007).
	Unknown	
b) Median size at maturity	Low	
	Medium	
	High	Females: 170–180 cm fork length (Southern Oceans, Francis & Duffy 2005); 230–260 cm TL (North Atlantic, Campana *et al*. 2008; Dulvy *et al*. 2008).
	Unknown	
c) Maximum age (longevity) of unfished population	Low	
	Medium	
	High	25–46 yrs (N Atl); 65 yrs **(**S Oceans, Francis *et al*. 2007)
	Unknown	
d) Maximum size	Low	
	Medium	Ca. 250 cm FL (Southern Oceans: Francis 2013)
	High	357 cm TL (N Atlantic: DFO 2005, Dulvy *et al*. 2008)
	Unknown	
e) Natural mortality rate (M)	Low	
	Medium	
	High	0.10 (immatures), 0.15 (mature M), 0.20 (mature F) (NW Atlantic, Campana *et al*. 2001). 0.07 (Southern Oceans) based on longevity of 65 years
	Unknown	
f) Maximum annual pup production (per mature female)	Low	
	Medium	
	High	4/litter (Francis & Stevens 2000, Jensen *et al*. 2002).
	Unknown	
g) Intrinsic rate of population increase (r)	Low	
	Medium	
	High	0.05–0.07 (N. Atlantic); 0.026 (from MSY, SW Pacific) (Campana *et al*. 2008; Smith *et al*. 2008)
	Unknown	
h) Geographic distribution of stock	Low	Continuous in Southern Hemisphere
	Medium	Two stocks (NE and NW in North Atlantic)
	High	

	Unknown	
i) Current stock size relative to historic abundance	Low	
	Medium	
	High	<10%; <20%; <20% (Atlantic: ICCAT SCRS/ICES 2009)
	Unknown	Unknown in Southern Oceans
j) Behavioural factors	Low	No targeting. Critical habitats unknown in S. Oceans
	Medium	
	High	Aggregation sites targeted opportunistically in NE Atl.
	Unknown	
k) Trophic level	Low	
	Medium	
	High	
	Unknown	Unknown

SUMMARY for Question 2.1
Intrinsic biological vulnerability of species

High	*Medium*	*Low*	*Unknown*

Explanation of conclusion and sources of information used:

Low productivity in Southern Oceans makes this species highly vulnerable. Stocks are severely depleted in the North Atlantic.

Anon. (2012). Proposal for the inclusion of *Lamna nasus* in Appendix II of CITES. CoP16 Prop. 44.

Campana, S., Marks, L., Joyce, W. and Harley, S. (2001). Analytical assessment of the NW Atlantic porbeagle (*Lamna nasus*) population, with estimates of long-term sustainable yield. *CSAS Res. Doc*. 2001/067. 17 pp.

Campana S. and J. Gibson. (2008). Catch and Stock Status of Porbeagle Shark (*Lamna nasus*) in the Northwest Atlantic to 2007, NAFO Doc. 08/36.

DFO. (2005). Stock assessment report on NAFO Subareas 3–6 porbeagle shark. *CSAS Science Advisory Report* 2005/044.

Dulvy *et al*. (2008). You can swim but you can't hide: the global status and conservation of oceanic pelagic sharks and rays. *Aquat. Conserv. Mar. Freshw. Ecosyst.* 18, 459–482.

Francis, M.P. (2013). *Commercial catch composition of highly migratory elasmobranchs. New Zealand Fisheries Assessment Report* 2013/68. 79 p.

Francis, M.P.; Campana, S.E.; Jones, C.M. (2007). Age under-estimation in New Zealand porbeagle sharks (*Lamna nasus*): is there an upper limit to ages that can be determined from shark vertebrae? *Marine and Freshwater Research 58*: 10-23.

Francis, M.P.; Duffy, C. (2005). Length at maturity in three pelagic sharks (*Lamna nasus*, *Isurus oxyrinchus*, and *Prionace glauca*) from New Zealand. *Fishery Bulletin 103*: 489-500.

Francis, M.P.; Stevens, J.D. (2000). Reproduction, embryonic development and growth of the porbeagle shark, *Lamna nasus*, in the south-west Pacific Ocean. *Fishery Bulletin 98*: 41-63.

ICCAT SCRS/ICES (2009). Report of the 2009 Porbeagle stock assessments meeting. Copenhagen, Denmark, June 22 to 27, 2009. SCRS/2009/014. 57 pp.

Jensen, C. F., L.J. Natanson, H.L. Pratt, N.E. Kohler, and S.E. Campana. (2002). The reproductive biology of the porbeagle shark, *Lamna nasus*, in the western North Atlantic Oce*an. Fish. Bull*. **100**:727–738.

Smith, S., D.W. Au and C. Show. (1998). Intrinsic rebound potentials of 26 species of Pacific sharks. *Marine and Freshwater Research* 49: 663-678.

Annex 4.5. Intrinsic biological characteristics of Whale Shark *Rhincodon typus*

Intrinsic biological factors	Level of vulnerability	Indicator/metric
a) Median age at maturity	Low	
	Medium	
	High	Female > 22, male <20 years
	Unknown	
b) Median size at maturity	Low	
	Medium	
	High	Female > 800 cm, male >600 cm
	Unknown	
c) Maximum age (longevity) of unfished population	Low	
	Medium	
	High	
	Unknown	Unknown
d) Maximum size	Low	
	Medium	
	High	~ 2 000 cm
	Unknown	
e) Natural mortality rate (M)	Low	
	Medium	
	High	
	Unknown	unknown
f) Maximum annual pup production (per mature female)	Low	
	Medium	
	High	
	Unknown	Unknown, one litter of ~300 pups recorded; perhaps 100 pups if reproduction not annual
g) Intrinsic rate of population increase (r)	Low	
	Medium	
	High	
	Unknown	unknown
h) Geographic distribution of stock	Low	Cosmopolitan tropical and warm temperature species, undertaking long-distance migrations
	Medium	
	High	
	Unknown	
i) Current stock size relative to historic	Low	
	Medium	Seriously depleted in some target fisheries, other

abundance		stocks unexploited.
	High	
	Unknown	
j) Behavioural factors	Low	
	Medium	
	High	Feeding aggregations vulnerable to fisheries, disturbance from unregulated tourism, and boat strikes
	Unknown	
k) Trophic level	Low	Filter feeder
	Medium	3.6 (Fishbase)
	High	
	Unknown	

SUMMARY for Question 2.1
Intrinsic biological vulnerability of species

High	*Medium*	*Low*	*Unknown*

Explanation of conclusion and sources of information used:

No NDF case study prepared.

Rapid depletion of stocks exploited by harpoon fisheries, large size and slow life history characteristics indicate that this species is of high intrinsic vulnerability, despite its broad distribution and relatively low tropic level.

This conclusion is derived primarily from the following sources:

Anonymous. 2002. Proposal to include the Whale Shark (*Rhincodon typus*) in Appendix II of the Convention on International Trade in Endangered Species (CITES). Santiago, Chile.

Dulvy *et al*. (2008). You can swim but you can't hide: the global status and conservation of oceanic pelagic sharks and rays. *Aquat. Conserv. Mar. Freshw. Ecosyst.* 18, 459–482.

Fishbase. http://www.fishbase.org/Summary/speciesSummary.php?ID=2081&AT=whale+shark

Joung, S.J., Chen, C.T., Clark, E., Uchida, S. and Huang, W.Y.P. 1996. The whale shark, *Rhincodon typus*, is a livebearer: 300 embryos found in one "megamamma" supreme. *Environmental Biology of Fishes* 46: 219-223.

Norman, B. 2005. *Rhincodon typus*. The IUCN Red List of Threatened Species. Version 2014.2. <www.iucnredlist.org>. Downloaded on **30 September 2014**.

Wintner, S.P. 2000. Preliminary study of vertebral growth rings in the whale shark, *Rhincodon typus*, from the east coast of South Africa. *Environmental Biology of Fishes* 59: 441–451.

Annex 4.6. Intrinsic biological characteristics of Scalloped Hammerhead *Sphyrna lewini*
(N.B. these vary considerably between stocks.)

Intrinsic biological factors	Level of vulnerability	Indicator/metric
a) Median age at maturity	Low	
	Medium	
	High	15-17 years (Females, NW Atlantic)
	Unknown	
b) Median size at maturity	Low	
	Medium	
	High	154–200 cm fork length, for females
	Unknown	
c) Maximum age (longevity) of unfished population	Low	
	Medium	
	High	15–30 years (observed)
	Unknown	
d) Maximum size	Low	
	Medium	
	High	296 – 346 cm TL (females)
	Unknown	
e) Natural mortality rate (M)	Low	
	Medium	
	High	0.13 (Fishbase)
	Unknown	
f) Maximum annual pup production (per mature female)	Low	
	Medium	6–20 pups (one litter every 2 years)
	High	
	Unknown	
g) Intrinsic rate of population increase (r)	Low	
	Medium	
	High	0.028 (Smith *et al*. 1998)
	Unknown	
h) Geographic distribution of stock	Low	Circumglobal, coastal pelagic to semi-oceanic in warm temperate to tropical seas
	Medium	
	High	
	Unknown	
i) Current stock size relative to historic	Low	
	Medium	

abundance	High	Reported declines in abundance of 60-99% during recent years in Atlantic and Indo-Pacific (Anon 2012)
	Unknown	
j) Behavioural factors	Low	
	Medium	
	High	Very high bycatch mortality, even when discarded
	Unknown	
k) Trophic level	Low	
	Medium	
	High	~ 4 (Fishbase)
	Unknown	

SUMMARY for Question 2.1
Intrinsic biological vulnerability of species

High	*Medium*	*Low*	*Unknown*

Explanation of conclusion and sources of information used:

Although all populations of scalloped hammerhead are of high intrinsic vulnerability, CITES Authorities are urged to consult national and regional experts to obtain biometric data relevant to local stocks.

Most of the data provided above represent ranges from many authors across a wide range of stocks. The first two citations below provide more information from different stocks and regions.

Anon. (2012). Proposal for the inclusion of *Sphyrna lewini* in Appendix II of CITES. CoP16 Prop. 43.

Baum, J., Clarke, S., Domingo, A., Ducrocq, M., Lamónaca, A.F., Gaibor, N., Graham, R., Jorgensen, S., Kotas, J.E., Medina, E., Martinez-Ortiz, J., Monzini Taccone di Sitizano, J., Morales, M.R., Navarro, S.S., Pérez-Jiménez, J.C., Ruiz, C., Smith, W., Valenti, S.V. & Vooren, C.M. (2007). *Sphyrna lewini*. The IUCN Red List of Threatened Species. Version 2014.2. <www.iucnredlist.org>. Downloaded on **30 September 2014**.

Dulvy *et al*. (2008). You can swim but you can't hide: the global status and conservation of oceanic pelagic sharks and rays. *Aquat. Conserv. Mar. Freshw. Ecosyst.* 18, 459–482.

Smith, S., D.W. Au and C. Show. (1998). Intrinsic rebound potentials of 26 species of Pacific sharks. *Marine and Freshwater Research* 49: 663-678.

Annex 4.7. Intrinsic biological characteristics of Great Hammerhead *Sphyrna mokarran*

Intrinsic biological factors	Level of vulnerability	Indicator/metric
l) Median age at maturity	Low	
	Medium	8 years
	High	
	Unknown	
m) Median size at maturity	Low	
	Medium	
	High	250–300 cm TL (females)
	Unknown	
n) Maximum age (longevity) of unfished population	Low	
	Medium	
	High	39 years (females)
	Unknown	
o) Maximum size	Low	
	Medium	
	High	480 – 550 cm (females)
	Unknown	
p) Natural mortality rate (M)	Low	
	Medium	
	High	0.08
	Unknown	
q) Maximum annual pup production (per mature female)	Low	
	Medium	6 – 20 pups/year (13-42 pups/litter)
	High	
	Unknown	
r) Intrinsic rate of population increase (r)	Low	
	Medium	
	High	
	Unknown	Assumed to be very low (hence high vulnerability), similar to *S. lewini*
s) Geographic distribution of stock	Low	Circumglobal in coastal warm temperate and tropical seas, coastal-pelagic, semi-oceanic. Often solitary.
	Medium	
	High	
	Unknown	
t) Current stock size	Low	

relative to historic abundance	Medium	
	High	
	Unknown	Very little species-specific catch or trend data. At least some stocks are likely to be similarly depleted to those of *S. lewini*
u) Behavioural factors	Low	
	Medium	
	High	Very high bycatch mortality, even if released
	Unknown	
v) Trophic level	Low	
	Medium	
	High	4.3 (Fishbase)
	Unknown	

SUMMARY for Question 2.1
Intrinsic biological vulnerability of species

High	*Medium*	*Low*	*Unknown*

Explanation of conclusion and sources of information used:

The biology of *Sphyrna mokarran* is not as well studied, but appears to be broadly similar to that of *S. lewini*.

Catch data are not generally collected to species-specific level; catches and trend data for the three large hammerhead species are often combined in a species complex

Although all populations of great hammerhead are of high intrinsic vulnerability, CITES Authorities are urged to consult national and regional experts to obtain biometric data relevant to local stocks.

Anon. (2012). Proposal for the inclusion of *Sphyrna lewini* in Appendix II of CITES. CoP16 Prop. 43. Annex 3 provides data on other large hammerhead species.

Denham, J., Stevens, J., Simpfendorfer, C.A., Heupel, M.R., Cliff, G., Morgan, A., Graham, R., Ducrocq, M., Dulvy, N.D, Seisay, M., Asber, M., Valenti, S.V., Litvinov, F., Martins, P., Lemine Ould Sidi, M. & Tous, P. and Bucal, D. 2007. *Sphyrna mokarran*. The IUCN Red List of Threatened Species. Version 2014.2. <www.iucnredlist.org>. Downloaded on **30 September 2014**.

Dulvy *et al*. (2008). You can swim but you can't hide: the global status and conservation of oceanic pelagic sharks and rays. *Aquat. Conserv. Mar. Freshw. Ecosyst.* 18, 459–482.

Fishbase. http://www.fishbase.org/summary/Sphyrna-mokarran.html

Annex 4.8. Intrinsic biological characteristics of Smooth Hammerhead *Sphyrna zygaena*

Intrinsic biological factors	Level of vulnerability	Indicator/metric
a) Median age at maturity	Low	
	Medium	~15 years for both sexes in the Eastern Atlantic (Coelho *et al.* 2011)
	High	
	Unknown	
b) Median size at maturity	Low	
	Medium	
	High	~220cm FL in Eastern Atlantic & Australia (Castro & Mejuto 1995 , Last & Stevens 2009)
	Unknown	
c) Maximum age (longevity) of unfished population	Low	
	Medium	
	High	>20 years (Coelho *et al.* 2011)
	Unknown	
d) Maximum size	Low	
	Medium	
	High	370-400cm TL (Last & Stevens 2009)
	Unknown	
e) Natural mortality rate (M)	Low	
	Medium	
	High	
	Unknown	Unknown.
f) Maximum annual pup production (per mature female)	Low	20-49 pups/litter (Stevens 1984)
	Medium	
	High	
	Unknown	
g) Intrinsic rate of population increase (r)	Low	
	Medium	
	High	
	Unknown	Unknown
h) Geographic distribution of stock	Low	Circum-temperate (Last & Stevens 2009)
	Medium	
	High	
	Unknown	
i) Current stock size relative to historic	Low	
	Medium	

abundance	High	
	Unknown	Very little species-specific catch or trend data. At least some stocks are likely to be similarly depleted to those of *S. lewini*
j) Behavioural factors	Low	
	Medium	
	High	Very high discard mortality
	Unknown	Critical habitats unknown
k) Trophic level	Low	
	Medium	
	High	4.5 (Fishbase)
	Unknown	

SUMMARY for Question 2.1
Intrinsic biological vulnerability of species

High	*Medium*	*Low*	*Unknown*

Explanation of conclusion and sources of information used:

The biology of *Sphyrna zygaena* is not well studied, but likely broadly similar to that of *S. lewini*, with inherently low productivity due to late maturity, limited reproduction, etc.

Catch data are not generally collected to species-specific level; catches and trend data for the three large hammerhead species are often combined in a species complex.

Although all populations of smooth hammerhead are of high intrinsic vulnerability, CITES Authorities are urged to consult national and regional experts to obtain biometric data relevant to local stocks.

Anon. (2012). Proposal for the inclusion of *Sphyrna lewini* in Appendix II of CITES. CoP16 Prop. 43. Annex 3 provides data on other large hammerhead species.

Castro JA, Mejuto J (1995) Reproductive parameters of blue shark, *Prionace glauca,* and other sharks in the Gulf of Guinea. Marine and Freshwater Research 46:967-973

Coelho R, Fernandez-Carvalho J, Amorim S, Santos MN (2011) Age and growth of the smooth hammerhead shark, *Sphyrna zygaena,* in the Eastern Equatorial Atlantic Ocean, using vertebral sections. *Aquatic Living Resources* 24:351-357

Denham, J., Stevens, J., Simpfendorfer, C.A., Heupel, M.R., Cliff, G., Morgan, A., Graham, R., Ducrocq, M., Dulvy, N.D, Seisay, M., Asber, M., Valenti, S.V., Litvinov, F., Martins, P., Lemine Ould Sidi, M. & Tous, P. and Bucal, D. 2007. *Sphyrna mokarran*. The IUCN Red List of Threatened Species. Version 2014.2. <www.iucnredlist.org>. Downloaded on **30 September 2014**.

Fishbase. http://www.fishbase.org/summary/Sphyrna-mokarran.html

Last PR, Stevens JD (2009) Sharks and Rays of Australia, Vol. CSIRO Publishing, Melbourne

Annex 4.9. Intrinsic biological characteristics of Reef Manta Ray *Manta alfredi*

Intrinsic biological factors	Level of vulnerability	Indicator/metric
a) Median age at maturity	Low	
	Medium	6-15 years (~3-6 yrs in males of Hawaii subpopulation; ~10 yrs in Mozambique; 15 years or more in Maldives).
	High	
	Unknown	
b) Median size at maturity	Low	
	Medium	
	High	300 cm for males, 390 cm for females
	Unknown	
c) Maximum age (longevity) of unfished population	Low	
	Medium	
	High	40 years
	Unknown	
d) Maximum size	Low	
	Medium	
	High	500 cm
	Unknown	
e) Natural mortality rate (M)	Low	
	Medium	
	High	
	Unknown	No data available *but thought to be low.*
f) Maximum annual pup production (per mature female)	Low	
	Medium	
	High	0.2–0.5 per annum (1 pup every 2-3 years in Mozambique; 1 pup every 5 years in Maldives)
	Unknown	
g) Intrinsic rate of population increase (r)	Low	
	Medium	
	High	0.050 (Ward-Paige *et al*., 2013)
	Unknown	
h) Geographic distribution of stock	Low	
	Medium	
	High	Found in tropical and subtropical waters. Populations are very restricted and isolated.
	Unknown	
i) Current stock size	Low	

relative to historic abundance	Medium	*Likely, based upon life history traits & fishing pressures*
	High	
	Unknown	No data available
j) Behavioural factors	Low	
	Medium	
	High	Often resident in or along productive near-shore areas. Populations appear to be restricted geographically, e.g. atolls, with smaller home ranges, philopatric movement patterns and shorter seasonal migrations than Oceanic Mantas. Vulnerable to offshore fisheries during evening and nighttime offshore migrations. Vulnerable to gillnet fisheries and (tourist) boat propellers.
	Unknown	
k) Trophic level	Low	~3; secondary consumer.
	Medium	
	High	
	Unknown	

SUMMARY for Question 2.1
Intrinsic biological vulnerability of species

High	*Medium*	*Low*	*Unknown*

Explanation of conclusion and sources of information used:

ADDITIONAL INFORMATION IS AVAILABLE FROM THE MANTA TRUST www.mantatrust.org

Couturier *et al.* (2012). Biology, ecology and conservation of the Mobulidae. *Journal of Fish Biology*, 80(5), 1075–1119. doi:10.1111/j.1095-8649.2012.03264.x

Couturier *et al.* (2013). Stable isotope and signature fatty acid analyses suggest reef manta rays feed on demersal zooplankton. *PloS One*, *8*(10), e77152. doi:10.1371/journal.pone.0077152

Couturier *et al.* (2014). Population dynamics of the reef manta ray *Manta alfredi* in eastern Australia. *Coral Reefs*, *33*(2), 329–342. doi:10.1007/s00338-014-1126-5

Deakos, M., Baker, J., & Bejder, L. (2011). Characteristics of a manta ray *Manta alfredi* population off Maui, Hawaii, and implications for management. *Marine Ecology Progress Series*, *429*, 245–260.

Deakos, M. H. (2011). The reproductive ecology of resident manta rays (*Manta alfredi*) off Maui, Hawaii, with an emphasis on body size. *Environmental Biology of Fishes*, *94*(2), 443–456.

Dulvy, N. K., Pardo, S. a., Simpfendorfer, C. a., & Carlson, J. K. (2014). Diagnosing the dangerous demography of manta rays using life history theory. *PeerJ*, *2*, e400. doi:10.7717/peerj.400

Heinrichs *et al.* (2011). The Global Threat to Manta and Mobula Rays. *A Manta Ray of Hope Report*. <http://www.mantarayofhope.com/downloads/The-Global-Threat-to-Manta-and-Mobula-Rays.pdf>.

Jaine *et al.* (2012). When Giants Turn Up: Sighting Trends, Environmental Influences and Habitat Use of the Manta Ray at a Coral Reef. *PLoS ONE*, *7*(10), e46170. doi:10.1371/journal.pone.0046170

Jaine *et al.* (2014). Movements and habitat use of reef manta rays off eastern Australia: offshore excursions, deep diving and eddy affinity revealed by satellite telemetry. *Marine Ecology Progress Series*, *510*, 73–86.

Kashiwagi, T., Ito, T., & Sato, F. (2010). Occurences of reef manta ray, *Manta alfredi*, and giant manta ray, *Manta birostris*, in Japan, examined by photographic records.

Marshall *et al.* (2011). *Manta alfredi*. *The IUCN Red List of Threatened Species*. <http://www.iucnredlist.org/details/195459/0>. [Accessed 10th September, 2014]

Annex 4.10. Intrinsic biological characteristics of Giant/Oceanic Manta Ray *Manta birostris*

Intrinsic biological factors	Level of vulnerability	Indicator/metric
a) Median age at maturity	Low	
	Medium	8-10 years
	High	
	Unknown	
b) Median size at maturity	Low	
	Medium	
	High	380 cm for males and 400 cm for females
	Unknown	
c) Maximum age (longevity) of unfished population	Low	
	Medium	
	High	Based on current data: >40 years
	Unknown	
d) Maximum size	Low	
	Medium	
	High	700 cm
	Unknown	
e) Natural mortality rate (M)	Low	
	Medium	
	High	
	Unknown	No data available, but thought to be low.
f) Maximum annual pup production (per mature female)	Low	
	Medium	
	High	0.2 – 0.3 per annum
	Unknown	
g) Intrinsic rate of population increase (r)	Low	
	Medium	
	High	0.042 (Ward-Paige *et al*., 2013)
	Unknown	
h) Geographic distribution of stock	Low	
	Medium	Found in tropics, subtropics and temperate waters. Populations likely fragmented and sparsely distributed.
	High	
	Unknown	
i) Current stock size relative to historic	Low	
	Medium	

abundance	High	
	Unknown	No data available. *Likely medium-high vulnerability based upon life history traits and fishing pressures.*
j) Behavioural factors	Low	
	Medium	Generally solitary but tend to aggregate at off-shore pinnacles and sea mounts. They also visit cleaning stations in shallow reefs, and are sighted feeding at the surface inshore and offshore. Possible nursery grounds near the continental shelf edge (e.g. Sri Lanka, Peru and Ecuador). Particularly vulnerable to gillnet fisheries.
	High	
	Unknown	
k) Trophic level	Low	
	Medium	
	High	
	Unknown	Data not available for *M. birostris*. Likely low-medium based on closely related *M. alfredi* and similar feeding ecology to *Rhincodon typus*.

SUMMARY for Question 2.1
Intrinsic biological vulnerability of species

High	*Medium*	*Low*	*Unknown*

Explanation of conclusion and sources of information used:

Most data is still unavailable or unknown but from the little known information, they appear to be highly vulnerable.

ADDITIONAL INFORMATION IS AVAILABLE FROM THE MANTA TRUST www.mantatrust.org

CITES (2013). Inclusion of the genus *Manta* in Appendix II of CITES. <http://www.cites.org/eng/cop/16/prop/E-CoP16-Prop-46.pdf>.

Couturier *et al.* (2012). Biology, ecology and conservation of the Mobulidae. *Journal of Fish Biology*, 80(5), 1075–1119. doi:10.1111/j.1095-8649.2012.03264.x

Dulvy, N. K., Pardo, S. a., Simpfendorfer, C. a., & Carlson, J. K. (2014). Diagnosing the dangerous demography of manta rays using life history theory. *PeerJ*, *2*, e400. doi:10.7717/peerj.400

Heinrichs S., O'Malley M., Medd H. & Hilton P. (2011). The Global Threat to Manta and Mobula Rays. *A Manta Ray of Hope Report*. <http://www.mantarayofhope.com/downloads/The-Global-Threat-to-Manta-and-Mobula-Rays.pdf>. [Accessed 10th September, 2014].

Marshall, A., Compagno, L. J. V., & Bennett, M. B. (2009). Redescription of the genus *Manta* with resurrection of *Manta alfredi* (Krefft, 1868) (Chondrichthyes; Myliobatoidei; Mobulidae). *Zootaxa*, 1 – 28.

Marshall, A. D. (2009). Biology and Population Ecology of *Manta birostris* in Southern Mozambique. *PhD thesis for the University of Queensland*.

Marshall, A., Bennett, M.B., Kodja, G., Hinojosa-Alvarez, S., Galvan-Magana, F., Harding, M., Stevens, G. & Kashiwagi, T. (2011). *Manta birostris*. *The IUCN Red List of Threatened Species*. <http://www.iucnredlist.org/details/198921/0>. [Accessed 10th September, 2014].

Ward-Paige, C. a., Davis, B., & Worm, B. (2013). Global Population Trends and Human Use Patterns of Manta and Mobula Rays. *PLoS ONE*, *8*(9), e74835. doi:10.1371/journal.pone.0074835

ANNEX 5. MANAGEMENT MEASURES AND THEIR APPROPRIATENESS FOR MITIGATING PRESSURES ON SHARK STOCKS FROM FISHERIES AND TRADE

*The tables below describe 14 potential harvest-related measures and 2 potential trade-related measures for the management of shark populations, a*dapted from Lack *et al*. (2014); Foster and Vincent (2013)*. This is intended as a non-exhaustive summary of the most common measures, but other management possibilities certainly exist.*

A. Harvest-related management measures

Aim(s)	Implementation	Appropriate for which pressures?	Relevant compliance measure (options)
1. LIMITED ENTRY			
To limit fishing mortality by restricting access to the fishery to a specific group or number of operators (as the first step in controlling fishing effort)	Typically through issue of fishing right e.g. permit or licence	**Fishing mortality (retained catch):** ✓ • Targeted catch – if used in combination with other effort controls such as a catch quota specific to the shark species concerned • Secondary catch – if used in combination with a catch quota (as above) and/or spatial restrictions on the use of fishing gears associated with bycatch of the shark species concerned **IUU fishing:** ✓ • Provides a basis for exerting further control over fishery (e.g. restricting access to vessels on IUU black lists) and the implementation of associated compliance measures • Supports collation of information on vessels fishing in a particular area	• Sound licensing system in place • At sea and in port inspections of vessels and authorisations to fish • Vessel lists used by RFMOs or other national/regional organisations (e.g. EU IUU vessel list established under the EU IUU Regulation): o White lists – identify vessels authorized to fish in (RFMO) area o Black lists – identify vessels considered or determined to have been fishing in breach of (RFMO) measures. Used as a basis for imposing restrictions on access of the listed vessels to ports through the introduction of port State measures.

Aim(s)	Implementation	Appropriate for which pressures?	Relevant compliance measure (options)
2. FISHING TIME RESTRICTIONS			
i. To limit fishing effort by restricting number of days that fishers can operate ii. To increase selectivity of fishing operations to minimize take of certain segments of target stock, or of non-target species	Adoption of fishing seasons (closed/open for certain months of year, e.g. to coincide with peak reproduction periods) or time restrictions (time of day, e.g. restrict night-setting of pelagic longlines to reduce interactions)	**Fishing mortality (retained catch): ✓– with caution** • Targeted catch – appropriate, although may need to be combined with a catch quota specific to the shark species concerned. • Secondary catch – appropriate, although may need to be combined with a catch quota specific to the shark species concerned. Degree to which appropriate for reducing fishing mortality (retained catch) may also depend on design of measures, e.g. whether seasonal restrictions are timed to coincide with peaks in reproduction. Consult available life history information for breeding/reproductive season. **Size/age/sex selectivity: ✓ - with caution** • If implemented based on seasonal patterns in behaviour of shark species concerned. Consult available life history information for breeding/reproductive season. • If life history information not available, implement temporal closures and monitor overall take from the area.	• Vessel monitoring system (monitor fishing activity in and around periods of closure) • On-board observers or E-monitoring (on board cameras) • Reporting requirements (where and when specimens caught)
3. FISHING GEAR RESTRICTIONS			
i. To limit fishing effort by controlling quantity of gear that can be deployed or type of gear that can be used ii. To improve selectivity of the gear so as to avoid catching particular size/life stages of	i. Controls on number of hooks, length of net or prohibition on use of drift nets, etc. ii. Restrictions on net mesh size, minimum hook size, etc.	**Fishing mortality (retained catch): ✓** • Targeted catch – appropriate, although may need to be combined with a catch quota specific to the shark species concerned (to guard against increased intensity of effort – e.g. increase in number of boats deployed to compensate for decreased CPUE) • Secondary catch – if restrictions are placed on the use of non-selective gears associated with higher levels of bycatch of the shark species concerned **Discard mortality: ✓** • If restrictions are placed on the use of non-selective gears associated with higher levels of bycatch of the shark species concerned • Certain fishing gears/gear characteristics may be associated with increased post-release survivorship in some shark species, e.g. use of circle	• In-port and at-sea inspections of gear

Aim(s)	Implementation	Appropriate for which pressures?	Relevant compliance measure (options)
target species or non-target species iii. To improve post-release survivorship	iii. Specifying gear characteristics and use (e.g. circle hooks/ corrodible hooks on pelagic longlines; limits on soak time)	hooks/corrodible hooks on pelagic longlines. Reducing soak time of pelagic longlines may also increase survivorship. **Size/age/sex selectivity: ✓** • Gear restrictions can be designed so as to reduce impact on certain life history stages of the population of the shark species concerned	
4. PERMANENT AREA CLOSURES			
To protect certain segment of the target species population (e.g. nursery area)	Through spatial closure of fishing grounds	**Fishing mortality (retained catch): ✓– with caution** Targeted and secondary catch: • Where enforced permanent area closures buffer against fishing pressures • Particularly if implemented so as to target specific area where individuals are abundant (e.g. through underwater surveys, catch landings analyses or discussions with fishers and traders) • However, it is important to note the possible displacement of fishing effort - may be necessary to combine with other measures **Discard mortality: ✓ - with caution** • Where enforced these buffer against fishing pressures • Particularly if implemented so as to target specific area where individuals are abundant (e.g. through underwater surveys, catch landings analyses or discussions with fishers and traders) • However, note possible displacement of fishing effort – may be necessary to combine with other measures **Size/age/sex selectivity: ✓** • If implemented so as to target particular life history period (e.g. nursery area). Consult available information on areas associated with particularly life stages.	• Vessel monitoring system (monitor fishing activity in and around closed area) • On-board observers or E-monitoring (on-board cameras) • Reporting requirements (where specimens caught)

Aim(s)	Implementation	Appropriate for which pressures?	Relevant compliance measure (options)
5. NO-TAKE MARINE PROTECTED AREA			
To minimize fishing mortality of one or more species or to protect certain habitat/ecosystem types	Through prohibitions on all fishing in an area (e.g. through declaration of a Marine Protected Area where no fishing is allowed) or the prohibition on the retention of certain species (e.g. via declaration of shark sanctuaries) – see also **Prohibited Retention** below	**Fishing mortality (retained catch): ✓– with caution** Targeted and secondary catch: • Where enforced sanctuaries buffer against all pressures • Particularly if implemented so as to target specific area where individuals are abundant • However, it is important to note the possible displacement of fishing effort – may be necessary to combine with other measures **Discard mortality: ✓ - with caution** • Where enforced these buffer against all pressures • However, note possible displacement of fishing effort – may be necessary to combine with other measures **Size/age/sex selectivity: ✓** • If implemented so as to target particular life history period (e.g. nursery area). Consult available information on areas associated with particularly life stages.	• Vessel monitoring system (monitor fishing activity in and around sanctuary) • On-board observers or E-monitoring (on-board cameras) • Reporting requirements (where specimens caught)
6. TOTAL ALLOWABLE CATCH (TAC)			
To limit fishing mortality on a species or a group of species	Through the establishment of a species/species group catch limit for the fishery as a whole in relation to a defined period (e.g. a fishing season or year)	**Fishing mortality (retained catch): ✓- with caution for secondary catch** • Targeted catch – appropriate, as fishers targeting the shark species concerned are able to limit their catch volumes and so fishing mortality • Secondary catch – appropriate only where a fishery is completely closed once the shark species bycatch quota is met **NOTE:** • If only landings are monitored, catch quotas must be set conservatively to allow for discarding at sea before landing. • Uncertainties in key variables (abundance, biomass and F) result in high risk of overfishing. In such circumstances, catch quotas should be combined with	• Catch documentation scheme • Real time or near real time catch reporting • Controls on transshipment at sea • Landings inspections

Aim(s)	Implementation	Appropriate for which pressures?	Relevant compliance measure (options)
		other precautionary measures. • An appropriately precautionary catch quota would be calculated as: **current abundance*biomass^{-1}*F** where F ≤ 0.5*M (M = natural mortality) • Abundance should be estimated conservatively, given the uneven distribution of individuals across shark populations.	
7. INDIVIDUAL QUOTA (IQ)			
To provide individual fishers or community groups with security of access to a specific portion of the TAC	Allocation of TAC across eligible fishers or countries, usually expressed as percentage of TAC (or as quantities of fish). Right to catch quantity of fish associated with IQ is often, especially under national schemes, tradeable, either seasonally (leased) or permanently (sold)	**Fishing mortality (retained catch): ✓– with caution for secondary catch** • Targeted catch – appropriate, as fishers targeting the shark species concerned are able to limit their catch volumes and so fishing mortality • Secondary catch – appropriate only where a fishery is completely closed once the shark species bycatch quota is met	• Appropriate level of observer coverage • Landings inspections • Catch documentation scheme or paper trail of documentation to track fish through catch, disposal, processing, etc. • Controls on transshipment at sea
8. FISHING TRIP LIMITS			
To control mortality of target or non-target species	A per vessel limit on the quantity of fish that can be landed at the end of a fishing trip	**Fishing mortality (retained catch): ✓– with caution for secondary catch** • Targeted catch – appropriate, as fishers targeting shark species concerned must limit their catch volumes per trip, so fishing mortality • Secondary catch: o If fishing trip limit relates to the shark species concerned, bycatch fishing mortality will depend on likelihood of survival once released. May encourage fishers to return more animals to the sea alive. o If fishing trip limit relates to the target species of the fishery (with which the shark species concerned is caught in association as bycatch), placing a limitation on target catch per trip should result in a corresponding	• In-port inspections • Real time or near real time catch reporting • Controls on trans-shipment at sea

Aim(s)	Implementation	Appropriate for which pressures?	Relevant compliance measure (options)
		reduction in bycatch of the shark species concerned. **Note** that for both targeted and secondary catches of the shark species concerned, other measures may be required to guard against possible increases in fishing effort (number of trips made). **Discard mortality: ✓– with caution** • See above for **Fishing mortality (retained catch): secondary catch.**	
9. PROHIBITED RETENTION			
To minimize fishing mortality of a certain species	Through prohibitions on the landing of a specified species and often a requirement to ensure that any incidental catch of the species is immediately returned to the sea without further harm in order to maximise chances of post-capture survival	**Fishing mortality (retained catch): ✓– with caution for secondary catch** • Targeted catch – appropriate, as shark species concerned can no longer be the subject of targeted capture, reducing fishing mortality to zero • Secondary catch – prohibiting retention may stimulate changes in fishing gear characteristics/method of use to reduce interactions with the shark species concerned (direct feedback loop). In the absence of such changes, bycatch fishing mortality will depend on likelihood of survival once released. **Discard mortality: ✓– with caution** • Handling requirements for secondary catch (e.g. immediate return to the sea without further harm) may reduce discard mortality. Will depend on likelihood of survival once released. **IUU fishing: ✓** • Such restrictions can provide the basis for improved recording/reporting of catches of shark species for which retention prohibited (e.g. logbook requirements, data collection by relevant RFMO). Can help to address IUU fishing. • Needs to be associated with requirement to land trunks of any retained sharks intact, including with fins attached, in order to provide for identification of any retained specimens of the prohibited species.	• Logbooks or other formal recording mechanisms to record discards and life status • At-sea inspections • Observer coverage of 20% or above to estimate post-release survival • E-monitoring systems (e.g. onboard cameras) to augment or replace observer coverage and at-sea inspections • Control of trans-shipments at sea (or ban on unobserved trans-shipments) • Random in-port inspection of trans-shipment and unloading
10. FISH SIZE LIMITS			
(i) To ensure each fish can reproduce	• Through imposing minimum legal	**Fishing mortality (retained catch): ✓– with caution** • Targeted catch - if fishers targeting the shark species concerned are able to	• In-port and at-sea inspections • Logbooks or other formal

Aim(s)	Implementation	Appropriate for which pressures?	Relevant compliance measure (options)
at least once prior to capture and that fish are not removed before reaching a size at which maximum growth and productivity would be obtained from the stock (ii) To maximise contribution of individuals to the stock	size limits on retained fish • Through maximum size limits that preclude the retention of mature individuals beyond a certain size (usually associated with age)	be selective, taking only those individuals larger and/or smaller than the agreed minimum/maximum size limit, such a measure can help to reduce overall take from the wild. If not, this might increase discard mortality, depending on the likelihood of survival post-release. • Secondary catch – non-selective fishing gears that catch the shark species concerned are unlikely to be selective for size of individuals. Likely that individuals not conforming to size limits will be discarded, the effect of which will depend on the likelihood of survival post-release. **Size/age/sex selectivity: ✓** • If fishers targeting the shark species concerned are able to be selective with regard to the size of individuals caught, then imposing size limits is appropriate to address size (and, likely, age) selectivity concerns associated with fishery. • To determine impact, monitor size of sharks in catch and/or landings. Compare with length/age frequency plots sharks in the wild.	recording mechanisms to record life status • On-board observers
11. PROTECTION OF BREEDING FEMALES			
To protect breeding females in order to minimize the impact of fishing on recruitment to the stock	Through prohibition on retention of females	**Size/age/sex selectivity: ✓** • If fishers targeting the shark species concerned are able to be selective with regard to the gender of individuals caught (e.g. avoiding nursery grounds), then imposing gender-based restrictions is appropriate to address sex selectivity concerns associated with fishery. • To determine impact, monitor sex/reproductive status of sharks in catch and/or landings.	• In-port and at-sea inspections • Logbooks or other formal recording mechanisms to record life status • On-board observers
12. PRODUCT-FORM RESTRICTIONS			
To reduce fishing mortality on a species	Through requirements that a species can be landed only in a certain form, on the assumption, or knowledge, that this	**Fishing mortality (retained catch): ✓– with caution for secondary catch** • Targeted catch – if appropriately designed, product-form restrictions can reduce fishing mortality arising from targeted catch (e.g. requiring sharks to be landed with fins attached – fewer specimens can be transported/stored) • Secondary catch – if product-form restrictions are designed to provide a disincentive to retention of the species then they can reduce fishing	• Observers required for trans-shipment • Landings inspections

Aim(s)	Implementation	Appropriate for which pressures?	Relevant compliance measure (options)
	will provide a disincentive to retention of the species (e.g. requirements for shark to be landed with fins attached or that shark fins can only be landed with the associated trunks)	mortality arising from secondary catch. However, unless this prompts changes to more selective fishing gears/methods of use to reduce interactions with the shark species concerned, bycatch fishing mortality will depend on the likelihood of survival once released. **IUU fishing: ✓** • Some requirements, such as for sharks to be landed with fins attached, can facilitate monitoring and reporting of shark catches to the species level, due to improved potential for identification • Product-form restrictions can assist authorities in detecting breaches of fisheries management measures, e.g. prohibited retention of certain species.	
13. MOVE-ON PROVISIONS			
To minimize fishing mortality of a certain species, usually a non-target species	Through requiring fishers to move a specified distance from a fishing ground when catch rates of a species reach a specified level	**Fishing mortality (retained catch): ✓** • Targeted and secondary catch – appropriate for targeted and secondary catch, although more generally used for reducing fishing mortality of a non-target species **Discard mortality: ✓** • If properly implemented, should result in reduced catch rates of non-target species and associated reduction in discard mortality.	• High level of observer coverage
14. BYCATCH REDUCTION DEVICES (BRDs)			
To reduce fishing impacts on a non-target species	Through the use of specified by-catch mitigation devices such as circle hooks, etc.	**Fishing mortality (retained catch): ✓ - for secondary catch** • Use of appropriate mitigation devices can result in reduced levels of bycatch of the shark species concerned **Discard mortality: ✓** • Use of appropriate mitigation devices can result in reduced levels of bycatch of the shark species concerned and/or improve survival of animals following release	• In-port and at-sea inspections to ensure BRDs are being used/used correctly

B. Trade-related management measures

Aim(s)	Implementation	Appropriate for which pressures?	Relevant compliance measures
1. DOCUMENTATION SCHEMES			
To assist in validating catch data and/or minimising opportunities for product taken by IUU fishing to reach markets	Through requiring documentation for products that enter international trade (trade documentation scheme – TDS) or for all catch and trade (catch documentation scheme – CDS)	**IUU fishing:** ✓ • If properly implemented, CDS and TDS can both assist in addressing IUU fishing **Illegal trade:** ✓ • If properly implemented, CDS and TDS can both assist in addressing illegal trade in fisheries products	**N/A** Used as part of a monitoring, control and surveillance regime
2. EXPORT QUOTAS			
To limit export volumes in the expectation that this will limit catches and hence fishing mortality	Through the establishment of a species/species group export limit in relation to a defined period (e.g. a year)	**Fishing mortality (retained catch): ✓ - with caution and for targeted catch only** • A precautionary export quota would result in total fishing mortality (F) at half estimated natural mortality (M) of the species: **F ≤ 0.5*M** • Any use of export quotas should be combined with other precautionary measures, given the uncertainty as to how export quotas will influence catches **Legal trade:** ✓	• Real time or near real time catch reporting • Controls on trans-shipment at sea • Landings inspections • Monitoring of trade volumes

ANNEX 6. LINKS TO MANAGEMENT RISK ASSESSMENTS DEVELOPED BY LACK *ET AL.* (2014)

Lack, M., Sant, G., Burgener, M. and Okes, N. (2014). *Development of a Rapid Management-Risk Assessment Method for Fish Species through its Application to Sharks: Framework and Results*. Report to the Department of Environment, Food and Rural Affairs. Defra Contract No. MB0123. Available at: http://bit.ly/1mDeLG7

The following species M-Risk assessments are available at the above link:

1	*Alopias pelagicus*	Pelagic Thresher
2	*Alopias superciliosus*	Bigeye Thresher Shark
3	*Alopias vulpinus*	Common Thresher Shark
4	*Carcharhinus brachyurus*	Bronze Whaler
5	*Carcharhinus falciformis*	Silky Shark
6	*Carcharhinus leucas*	Bull Shark
7	*Carcharhinus longimanus*	Oceanic Whitetip Shark
8	*Carcharhinus obscurus*	Dusky Shark
9	*Carcharhinus plumbeus*	Sandbar Shark
10	*Carcharhinus porosus*	Smalltail Shark
11	*Carcharias taurus*	Sand Tiger
12	*Carcharodon carcharias*	Great White Shark
13	*Centrophorus granulosus*	Gulper Shark
14	*Centrophorus lusitanicus*	Lowfin Gulper Shark
15	*Centrophorus squamosus*	Deepwater Spiny Dogfish
16	*Centroscyllium fabricii*	Black Dogfish
17	*Centroscymnus coelolepis*	Portuguese Dogfish
18	*Cetorhinus maximus*	Basking Shark
19	*Dalatias licha*	Kitefin Shark
20	*Deania calcea*	Shovelnose Spiny Dogfish
21	*Echinorhinus brucus*	Bramble Shark
22	*Galeocerdo cuvier*	Tiger Shark
23	*Ginglymostoma cirratum*	Nurse Shark
24	*Hexanchus griseus*	Bluntnose Sixgill Shark
25	*Isurus oxyrinchus*	Shortfin Mako
26	*Isurus paucus*	Longfin Mako
27	*Lamna nasus*	Porbeagle Shark

28	*Mustelus canis*	Dusky Smoothhound
29	*Mustelus lenticulatus*	Spotted Smoothhound
30	*Mustelus mustelus*	Common Smoothhound
31	*Negaprion brevirostris*	Lemon Shark
32	*Notorynchus cepedianus*	Broadnose Sevengill Shark
33	*Oxynotus centrina*	Angular Rough Shark
34	*Oxynotus paradoxus*	Sailfin Rough Shark
35	*Prionace glauca*	Blue Shark
36	*Pseudocarcharias kamoharai*	Crocodile Shark
37	*Scyliorhinus stellaris*	Nursehound
38	*Scymnodon ringens*	Knifetooth Dogfish
39	*Somniosus microcephalus*	Large Sleeper Shark
40	*Somniosus pacificus*	Pacific Sleeper Shark
41	*Somniosus rostratus*	Little Sleeper Shark
42	*Sphyrna lewini*	Scalloped Hammerhead
43	*Sphyrna zygaena*	Smooth Hammerhead
44	*Squalus acanthias*	Piked Dogfish
45	*Squatina californica*	South Pacific Angel Shark
46	*Squatina squatina*	Angel Shark