Making Non-Detriment Findings for seahorses – a framework

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PROJECT SEAHORSE
advancing marine conservation

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Dried seahorses photo credit: T. Stiem/Project Seahorse
Live seahorse photo credit: B. Balnis/SOTW

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PREFACE

This framework for making Non-Detriment Findings (NDFs) for seahorses (*Hippocampus* spp.) was developed to meet an obligation to The CITES Secretariat under a project entitled ***Building in-country capacity to undertake non-detriment findings with regard to Hippocampus species in Indonesia, Thailand and Viet Nam***. The overall goal of the project was to assist CITES Authorities to develop approaches for making NDFs for proposed CITES trade in seahorses.

Project Seahorse is uniquely poised to provide such assistance because of its unusual blend of expertise in seahorse research, management and policy. Project Seahorse is the recognised global authority on seahorse biology, trade, and fisheries management, as measured by its diverse seahorse-expertise roles, including: (i) IUCN SSC Specialist Group for Seahorses, Pipefishes and Sticklebacks (iucn-seahorse.org); (ii) Chair, CITES Working Group on syngnathids; (iii) FishBase Authority for syngnathids; (iv) authors of papers and definitive taxonomy, and more.

One activity under the project was to generate a step-by-step framework for the development of adaptive management programmes and production of sound NDFs for seahorses, in consultation with CITES Authorities, government agencies and national experts. Key inputs for the framework came from guidelines to support CITES Authorities in making NDFs for perennial plants[1], and the outcomes of the Fishes Working Group at the International Workshop on CITES Non-Detriment Findings, held in Cancun, Mexico in 2008[2].

A first draft of the NDF framework for seahorses was presented at a national consultative training workshop for CITES Authorities and national experts in Nha Trang, Viet Nam in May 2013. The workshop provided a platform to facilitate input into the design – and to generate ownership of – the framework. The framework was revised based on the excellent feedback we received from workshop participants, and subsequently presented at a similar training workshop in Thailand in June 2013. Version 2 incorporated yet more helpful amendments from participants at the Thai workshop, as well as feedback obtained from colleagues at the Fisheries Centre at The University of British Columbia. Version 3 was further amended to reflect ideas arising from a discussion with colleagues with respect to a similar framework for sharks[3]. This version (4) reflects changes made to address questions and confusions that arose when we applied the framework to Thailand's seahorse exports – particularly with respect to the types of data that can be used to evaluate pressures, determining the source of your seahorses, the section that evaluates fishing pressures, and the steps to be taken after management has been evaluated. Minor edits were also made based on feedback received during a scientific forum for CITES Authorities and national experts in Cebu, Philippines in March 2016.

We have made this framework available to all Parties at www.projectseahorse.org/NDF. This framework is a living document (continually updated) so please check for new versions regularly, and contact us with any suggestions for improvement. We want to hear from you. We

[1] http://www.bfn.de/0302_ndf+M52087573ab0.html
[2] http://www.conabio.gob.mx/institucion/cooperacion_internacional/TallerNDF/taller_ndf.html
[3] https://cites.unia.es/cites/file.php/1/files/shark-ndf-guidance.pdf

would be pleased to support Parties to translate the framework into their national languages for greater access.

ACKNOWLEDGEMENTS

This project was funded by the European Commission through the CITES Secretariat. Additional support came from: PTES – The People's Trust for Endangered Species (www.PTES.org); Guylian Chocolates Belgium (www.guylian.com/en/project-seahorse/project-seahorse); an anonymous donor through their partnerships for marine conservation with Project Seahorse; the John G. Shedd Aquarium (www.sheddaquarium.org); and SOS – Save Our Species (www.SaveOurSpecies.org).

Project Seahorse heartily thanks our Thai and Vietnamese colleagues, particularly those from the CITES Management and Scientific Authorities, for their welcome and positive engagement in the original development of this framework. We also thank the Conservation and Research Foundation whose seed money allowed for important first visits to Thailand and Viet Nam.

1. INTRODUCTION

1.1 Rationale

This framework is intended to help CITES Authorities in making "Non-Detriment Findings" (NDFs) for seahorses (see Section 1.3, below). We realise making NDFs for seahorses can seem challenging, especially where Parties feel they know little about their seahorse populations. But the truth is you already know enough to get going. Truly. **A lot can be done right away with the information you have.** Then – in the spirit of adaptive management – you can improve your NDFs as you learn more. The more your seahorse populations are exploited or under pressure from people, the more you will need to pay attention to fixing the NDFs.

This framework and the guidance we provide are intentionally generic. They need to apply to many Parties, each with different situations, limitations and opportunities. **It is for you to decide which parts are appropriate and practical for your Party's situation.**

1.2. What CITES means for seahorses

In November 2002, CITES Parties voted to list all seahorse species (*Hippocampus* spp.) on Appendix II, with implementation in May 2004.

This means the export of seahorses requires a permit from CITES Management Authorities (MAs).

Such an export permit should only be granted when all three of the following conditions have been met[4]:

1.2.1. Formal CITES text: a Scientific Authority of the State of export has advised that **such export will not be detrimental to the survival of that species (in the wild)**;

Informal explanation: The export of seahorses must not harm wild populations of seahorses. *We address this condition in Section 3.2 and Section 4.*

1.2.2. Formal CITES text: a Management Authority of the State of export is satisfied that **the specimen was not obtained in contravention of the laws of that State** for the protection of fauna and flora;

Informal explanation: Seahorses caught in a way that violated any laws must not be exported. *We address this condition in Sections 3.1.*

[4] http://www.cites.org/eng/disc/text.php#IV

1.2.3. Formal CITES text: a Management Authority of the State of export is satisfied that **any living specimen will be so prepared and shipped as to minimize the risk** of injury, damage to health or cruel treatment.

Informal explanation: Live seahorses have to be treated humanely when shipped from one country to another. *We address this condition in Section 8.1.*

1.3. What is an NDF?

An NDF – "Non-Detriment Finding" – is how Parties evaluate if condition 1.2.1 (*above*) **has been met** – whether exporting seahorses will or will not harm wild populations.

1.4. How can exports *harm* wild seahorse populations?

Most seahorses in trade are fished from the wild. Many of the same characteristics that make seahorses such interesting animals also make them vulnerable to heavy fishing and habitat damage. Indeed, we know that **wild seahorse populations usually do badly under heavy fishing pressure[5].**

- Seahorses are generally found in low numbers, and are patchy in distribution – this means even low rates of removal can significantly reduce population numbers.
- The male seahorse becomes pregnant and this means the babies depend on their father until they are born. If males are fished when they are pregnant, then none of their babies survive.
- Seahorses form long-term pair bonds. Many only mate with a single partner throughout the breeding season. If one of the seahorses is removed, the other stops reproducing unless it can find a new mate.
- Seahorses of most species have very small home ranges, and as mentioned are generally found in low numbers (low densities). This makes it hard for seahorses to find each other
- Seahorses are very slow swimmers, which prevents them from escaping fishing pressure, and means they can be slow finding other seahorses.
- Adult seahorses do not get eaten much by other marine life because of their good camouflage. This makes fishing a relatively new pressure on seahorses, and one they have not evolved to deal with.
- Seahorses are mostly found in coral reef, seagrass and mangrove habitats. All of these habitats are under pressure from human activities worldwide, putting seahorses under pressure too.

All that said, there are many ways Parties can reduce potential harm to wild populations, and as a result have both seahorse trade and healthy seahorse populations (*more on this in Section 5*).

Project Seahorse has summarised the life history and ecology of seahorses globally, as we know it – you can find this information online at www.projectseahorse.org/NDF[6]. You will see there

[5] See Vincent et al 2011 (Journal of Fish Biology 78(6): 1681–1724) for a comprehensive review of seahorse conservation and management.
[6] Be sure to check www.projectseahorse.org/NDF regularly for updates of this information.

are many gaps for many species. Indeed, compared to many commercially important fish species, we know very little about the life history and biology of seahorses. Section 7.2 suggests ways to fill those gaps – but we will get back to that later.

1.5. Why all this talk about fishing and habitats? Isn't CITES about trade?

Yes, CITES is about international trade. But **NDF assessments must consider ALL pressures facing your seahorses**. So even very small export volumes could pose a problem – and potentially need reduction – if your seahorses are threatened in other ways. For example, if your seahorse habitats are in bad shape, or there is a large domestic or illegal trade, then any export might be unsustainable. That is why we will consider fishing pressures in Section 4.3 and threats to seahorse habitats in Section 4.5. This is also why, when considering trade pressures in Section 4.4, we consider domestic consumption, and illegal, unregulated and unreported (IUU) fisheries and trades; if either of these is big, then even a small international trade can be too much for a population to handle.

1.6. Section summary

- CITES Appendix II listing for all seahorse species means seahorse exports require a permit issued by the exporting Party's CITES Management Authority.
- **Three conditions** must be met before that permit can be issued:
  The proposed export **will not harm wild** populations (Section 1.2.1).
  The proposed export is of **legally acquired** specimens (Section 1.2.2).
  When applicable, live seahorses are being **shipped humanely** (Section 1.2.3).
- **A Non-Detriment Finding (NDF) determines if the first of these conditions (1.2.1) is being met** – that the proposed export will not harm wild populations of seahorses.
- A preliminary NDF assessment can be made with very little information, and improved as knowledge improves.
- **NDFs need to consider ALL pressures** on a population – not just those imposed by international trade.

It's common to feel a bit lost at this stage, with so much to absorb. That's why the next section explains how this framework will guide you in making NDFs for your seahorse exports. Please go to Section 2.

2. HOW TO USE THE FRAMEWORK

This framework will guide you through the steps needed to make an NDF assessment for proposed seahorse exports.

2.1. How the framework is structured

Section 3 will help you first determine **if you even need to make an NDF** for the proposed export, and if so whether this framework is appropriate for your situation.

If you do, **Sections 4, 5 and 6 will guide you in making that NDF**. Sections 4 and 5 each consist of a series of steps. Each step is supported by **guiding text, a flowchart and a worksheet**. These three elements are all cross-referenced for ease of use.

In **Section 4 you evaluate the pressures** facing the seahorse species under consideration.

- Section 4.1 will help you determine the species in trade.
- In Section 4.2 you describe the pressures facing wild populations of that species in your Party's oceans.
- In Sections 4.3 through 4.5 you assess the risk to the species (low, medium, high or unknown) from fishing, trade and habitats pressures, respectively.

In **Section 5 you evaluate the ability of existing management to mitigate the risks** identified in Section 4. You will consider whether existing management is appropriate for the risks (Section 5.2.1), whether it is being implemented (Section 5.2.2), and whether it is indeed effective at reducing the identified pressures in support of sustainable seahorse populations and so sustainable trade (Section 5.2.3).

Completing Sections 4 and 5 should provide Scientific Authorities sufficient information to make a decision about the NDF, and **we consider the NDF options in Section 6.**

Where risks are not being managed with good results, or are unknown, then **Section 7 offers guidance and advice about how to improve management** action (Section 7.1) and/or **fill knowledge gaps** (Section 7.2), and **use the framework to inform a national action plan for seahorses** (Section 7.3), all in support of adaptive management.

If all risks are being managed appropriately and effectively, then you can turn to **Section 8, which considers the final steps to take before issuing a permit** in situations where an export has been considered non-detrimental to wild populations of seahorses.

Finally, **Section 9 lists some useful resources** you can consult for more information on seahorses and CITES/NDFs.

2.2. Sources of information for making NDFs

As mentioned in the previous section, a lot can be done right away with existing information – you just have to know where to find it. **So where can you find existing information on seahorse species** biology, ecology, threats, management and conservation? There are the usual places – such as the primary (published, peer-reviewed) literature. Project Seahorse maintains a database of seahorse publications that we would be happy to share with you. Project Seahorse has also summarised the life history and ecology of seahorses globally, as we know it – and you can find this information online at www.projectseahorse.org/NDF, along with links to other key seahorse resources (see also Section 9). Information critical to the NDF process can also be found in grey literature, unpublished data, information from citizen science initiatives (such as Project Seahorse's iSeahorse – www.iseahorse.org), and of course local ecological knowledge (LEK)/traditional environmental knowledge (TEK). **But there are other important places to look for information as well, and we touch on them here.**

NDFs should be scientifically sound and defensible. That means that regardless of where you get your information, it is important to consider its quality and reliability. The less confident you are about the quality of information, the more precautionary you must be when assessing risk to your species from pressures (Section 4), and when evaluating the ability of existing management measures to mitigate those risks (Section 5).

2.2.1. Conservation assessments

A species conservation assessment evaluates whether members of it are still alive, and how likely the species is to become extinct in the near future. Many factors are taken into account when assessing conservation status: not simply the number of individuals remaining, but the overall increase or decrease in the population size over time, breeding success rates, known threat, etc.

2.2.1.1. Global status, or, the IUCN Red List

The IUCN Red List of Threatened Species (www.iucnredlist.org) is the best-known worldwide conservation status listing and ranking system. Species are classified by experts into nine categories of risk reflecting criteria such as rate of decline, population size, area of geographic distribution, and degree of population fragmentation.

- Critically Endangered (CR), Endangered (EN), and Vulnerable (VU): These indicate that the species is threatened with extinction.
- Near Threatened (NT): This species does not currently qualify for threatened but may do so in the near future.
- Least Concern (LC): This species has little risk of becoming extinct.
- Data Deficient (DD): This species has been assessed, but we do not know enough to assess its status. Such a designation gives no information about the conservation status of the species, good or bad.
- Not Evaluated (NE): This species has never been assessed.

The species assessments found at www.iucnredlist.org include summaries of the information used to make the assessment – such as taxonomic notes, geographic range, population information and trends, habitat and ecology, threats, and conservation action. **The information is all cited and peer reviewed**, which is why IUCN Red List assessments make a good starting place for understanding what is known about a species globally.

2.2.1.2. National conservation status

The conservation status of a species globally may be different from the status regionally or nationally. Because of this some countries also have national assessment lists (http://www.nationalredlist.org/). Most of these lists use the same approach as the IUCN Red List, but consider the populations within a country. These are also often called Red Lists or Red Data Books. **Some, but not all, of these also include summaries of the information used to make the assessment**, which is why national assessments can make a good starting place for understanding what is known about a species nationally – although the information may be out of date and may not be peer reviewed.

Many seahorses on the Red List are listed as DD, and there are some NEs. If you discover that your species is without a global or national conservation status and would like to change that please contact Project Seahorse. Project Seahorse is the IUCN Species Specialist Group (SSG) for seahorses and their relatives, and so coordinates the conservation assessments for these species (iucn-seahorse.org). We will be pleased to guide you in assessing your species!

2.2.1.3. Which list should I use?

Since CITES is implemented at the national level, use the national assessment if there is one. If the national assessment is non-existent, out of date, or unreliable, then the global assessment can be used. However, **you should consider that the conservation status of the species globally could be very different from its status in your country.** A species that is threatened globally could be flourishing in any range state, or a species of Least Concern globally could be highly threatened locally.

2.2.1.4. IUCN Red List ≠ CITES

It is important to note that the IUCN Red List is not the same as CITES, although they are often confused. The confusion comes from the fact the IUCN Red List and CITES use similar sets of criteria to evaluate species for inclusion. But the criteria are not identical. And the lists differ in their regulator capacities.

The IUCN Red List is a flagging device. It is intended to draw attention to species that may be in need of conservation intervention, or to those we need to learn more about. The listing of a species on the Red List as threatened or otherwise has no legal consequences.

The listing of a species on CITES has legal consequences. When a species is listed on a CITES Appendix, its international trade MUST be regulated by signatory Parties or the Party could face review and eventual sanctions[7].

2.2.2. National experts

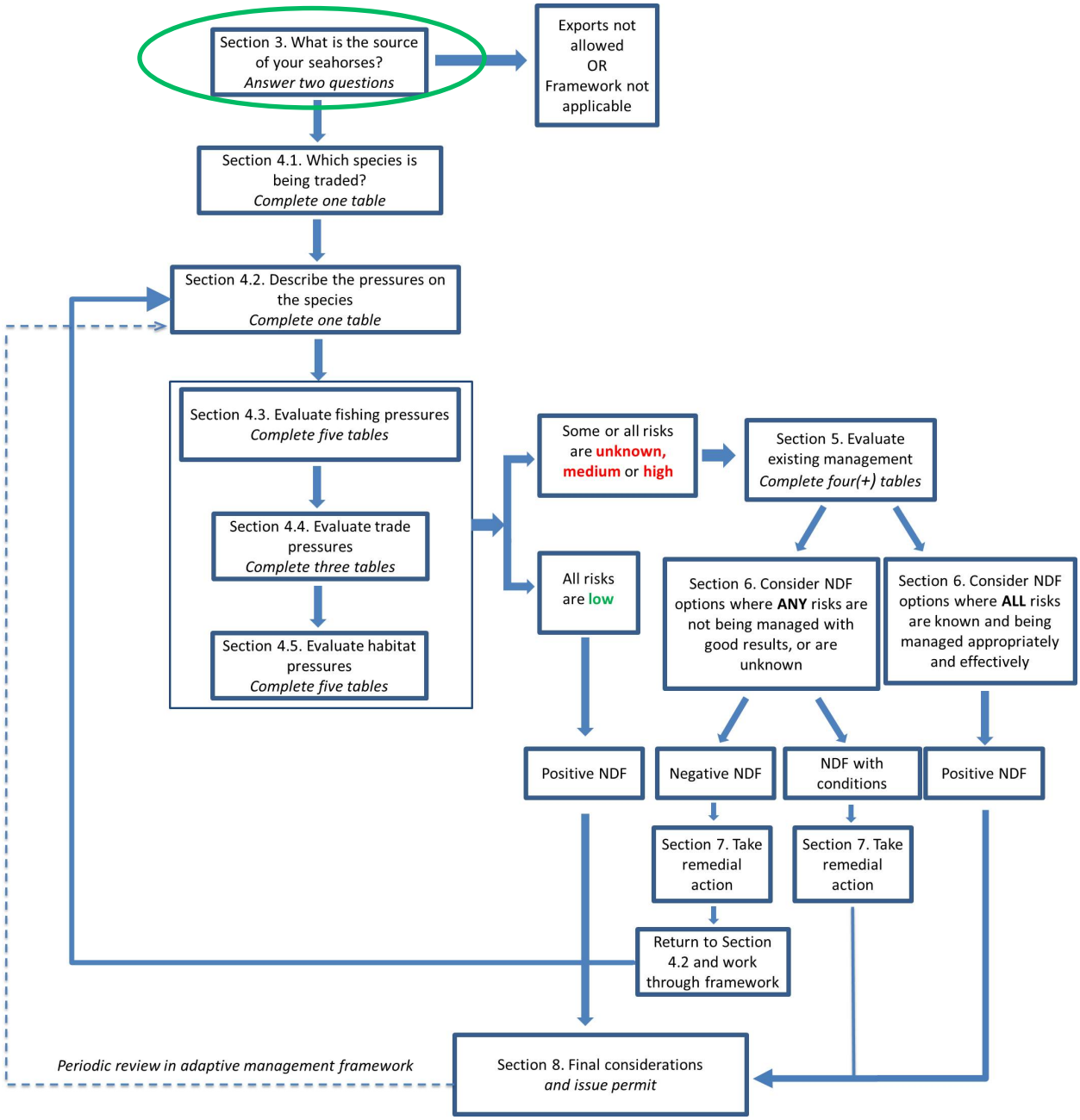
The other important sources of information for making NDF assessments for seahorse species are your regional experts. You can consult Project Seahorse to find out about your Party's seahorse experts. However important information can also come from people that know nothing about seahorses at all, but know a lot about the habitats they live in, the fisheries that catch them, the management that might affect them. **We suggest bringing these experts together to work through this framework** – doing so will reveal how much is already known, and what gaps need to be filled in understanding of seahorse populations and pressures.

Ok – let's get started. Please move to Section 3 to determine if you even need to make an NDF. You might not...

[7] https://cites.org/eng/res/12/12-08R13.php

Flow chart to support Section 2. How to use the framework

This chart represents all sections of the framework, starting with the next section (Section 3) in which you determine if you even need to make an NDF. **We will use this summary flowchart to guide us through the framework from this point forward.**



3. WHAT IS THE SOURCE OF THE SEAHORSES?

The source of the seahorses being considered for export will determine if you should consider their export at all, and if so, whether you should use this framework to make an NDF for the proposed exports.

3.1. Are the seahorses legally obtained?

Remember condition 1.2.2 for granting a CITES permit: that seahorses sourced from activities that **violate national laws cannot be traded**.

Examples of seahorses sourced in ways that violate national laws:

- Sourced from illegal fishing activities, such as from trawlers operating in areas closed to trawling;
- Taken from inside the boundaries of no-take marine protected areas (MPAs) or reserves;
- Caught during closed fishing seasons;
- Caught even though regional or national laws prohibit fishing seahorses.
- And, of course, if export is banned by national legislation.

If the seahorses were caught in a way that violates any national laws then stop here. You cannot grant an export permit for those seahorses.

If the seahorses were legally obtained then go to section 3.2.

3.2. Are the specimens wild caught, offspring of wild caught or captive bred?

Remember condition 1.2.1 for granting an export permit: the proposed export of seahorses should not harm **wild** populations. So you need to **start by asking about the source of the seahorses** for which the permit is being sought.

Sources of seahorses generally fall into one of three groups, all of which need NDFs[8].

This framework addresses making NDFs for these two groups:

3.2.1. Wild caught seahorses (seahorses taken from the wild). If the seahorses were taken from the wild you can use this framework to make an NDF. This includes those that were taken from the wild and then kept in captivity for some time before export (i.e. "ranched").

3.2.2. Offspring of wild caught seahorses. The offspring of wild caught seahorses are known as "F1" generation and the parents as "broodstock". If the parents were taken from the wild, then you can use this framework to an make NDFs for the parents. Export of their offspring (F1) can be a particular problem for wild populations where a lot of wild parents must be brought into captivity to maintain culture production.

[8] http://www.cites.org/common/com/ac/19/X-AC-19i-06.pdf

If the seahorses are from groups 3.2.1 (wild caught) or 3.2.2 (offspring of wild caught) then move to Section 4 and start your NDF. If not, keep reading.

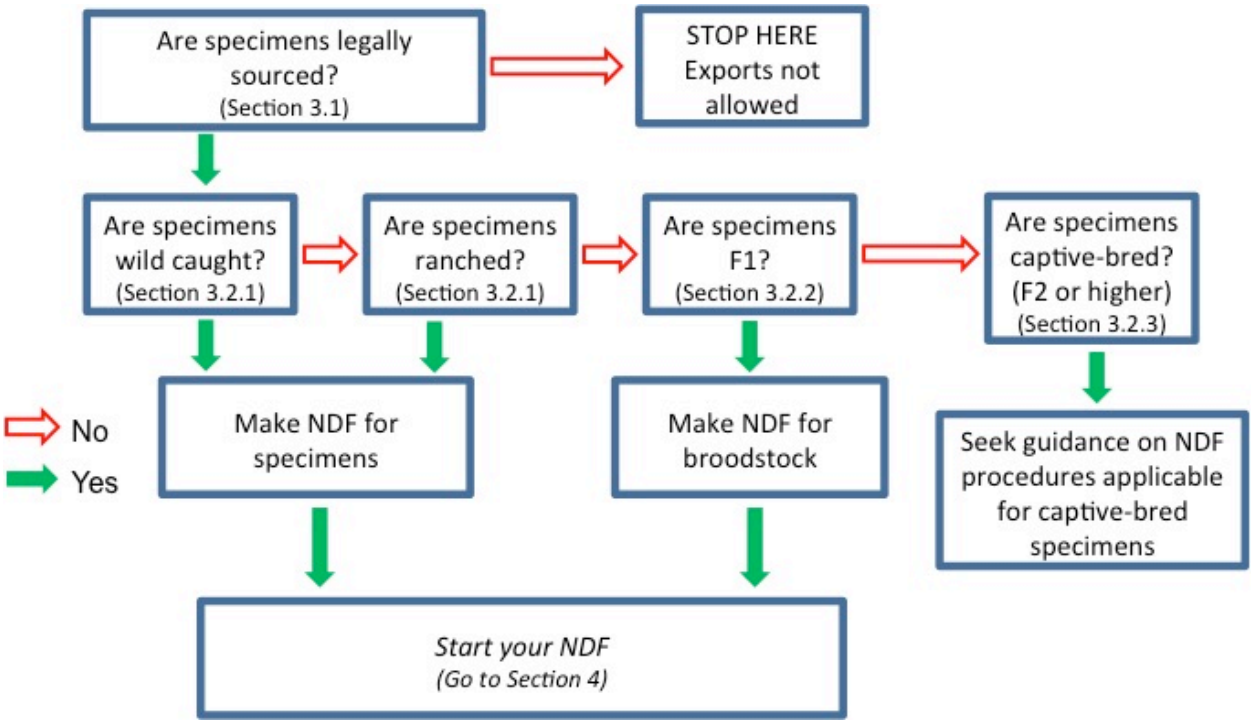
This framework does not address making NDFs for this group:

3.2.3. Offspring of captive born parents. The offspring of first generation captive born parents (F1) are known as "F2" generation. The offspring of F2 parents are known as "F3", and so on. In cases where offspring are born to captive born parents there is little or no reliance on wild seahorses – and little or no chance of harming wild populations. International trade of captive bred specimens of CITES Appendix II listed species requires that the Management Authority ensure that the specimens are indeed captive bred[9]. Where specimens are derived from well-regulated captive breeding there is a high probability that exports will not be detrimental to the survival of the species in the wild. While many Parties export captive bred seahorses, this framework is focused on evaluating sustainability of wild sourced exports (3.2.1 and 3.2.2) and NDF procedures for truly captive bred seahorses are not considered further.

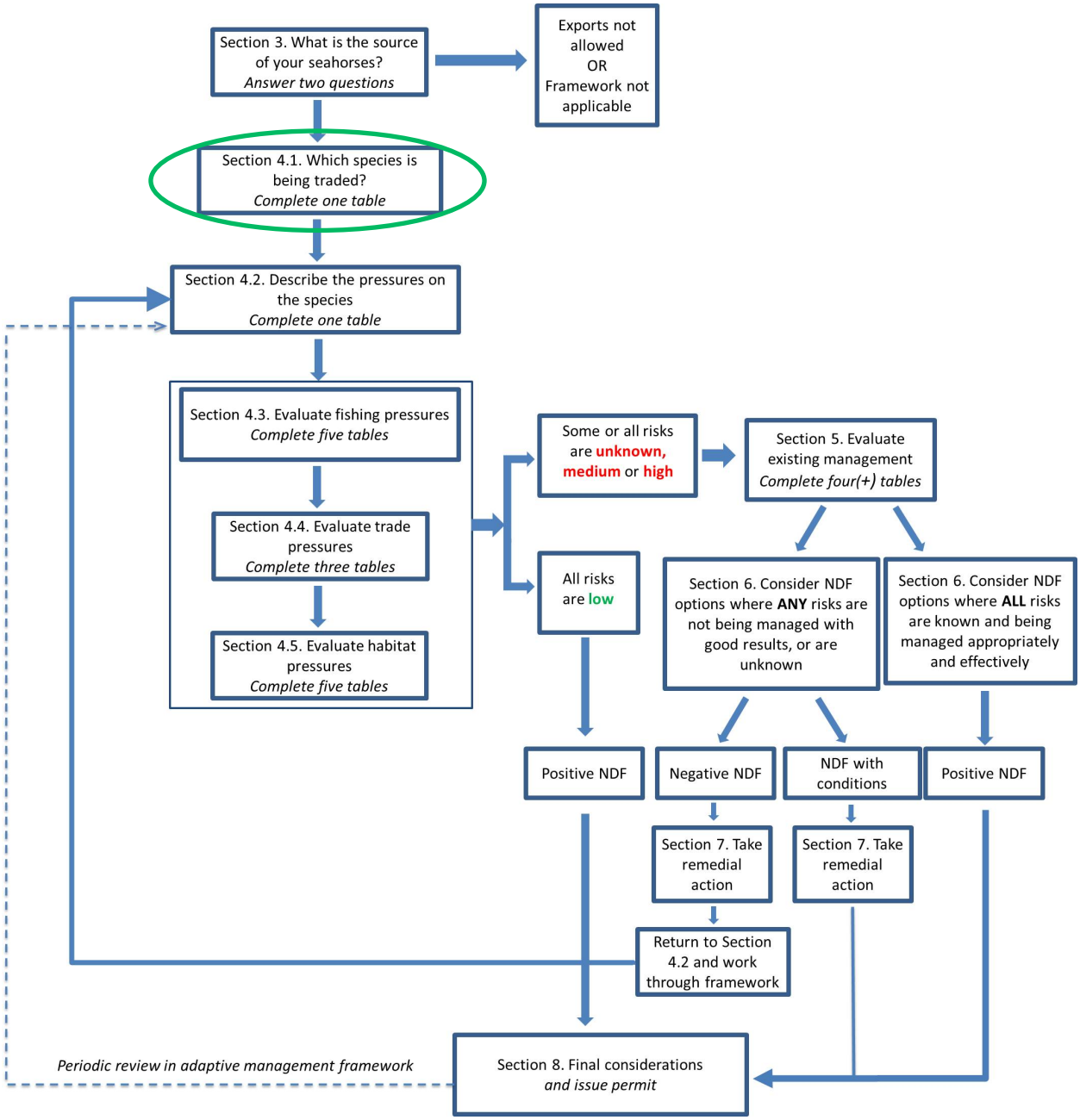
If the permit application is for group 3.2.3 (offspring of captive born parents) – and you have the documentation to prove it – then you can stop here and seek guidance on NDF procedures applicable to captive bred specimens.

[9] https://www.cites.org/eng/res/10/10-16C15.php

Flow chart to support Section 3. What is the source of the seahorses?



Where we are headed next



4. EVALUATE PRESSURES ON THE SPECIES

This section considers situations where exported specimens are legally obtained (from Section 3.1), and where export has the potential to harm wild populations (from Section 3.2), We will work through Sections 4.1-4.5:

- Section 4.1 will help you determine the species in trade.
- In Section 4.2 you will consider and summarise the pressures on your wild seahorse populations.
- Sections 4.3-4.5 will help you evaluate the risk to wild populations of your species associated with the pressures identified in Section 4.2.

4.1. Which seahorse species is being traded?

All NDFs should be made at the species level. CITES Management Authorities (MAs) are supposed to ensure the seahorse is correctly identified on the permit application. Correctly is when the name agrees with the nomenclature adopted by CITES[10]. Doing this will greatly improve the use and value of the CITES data (which come from Parties' permits) in tracking the international trade in seahorses (*more on this in Section 8*).

The challenges, of course, are that (a) seahorse species can all look much the same and (b) dried seahorses are commonly exported as mixed species shipments. But you can still move forward effectively.

4.1.1. What if I need help determining the species?

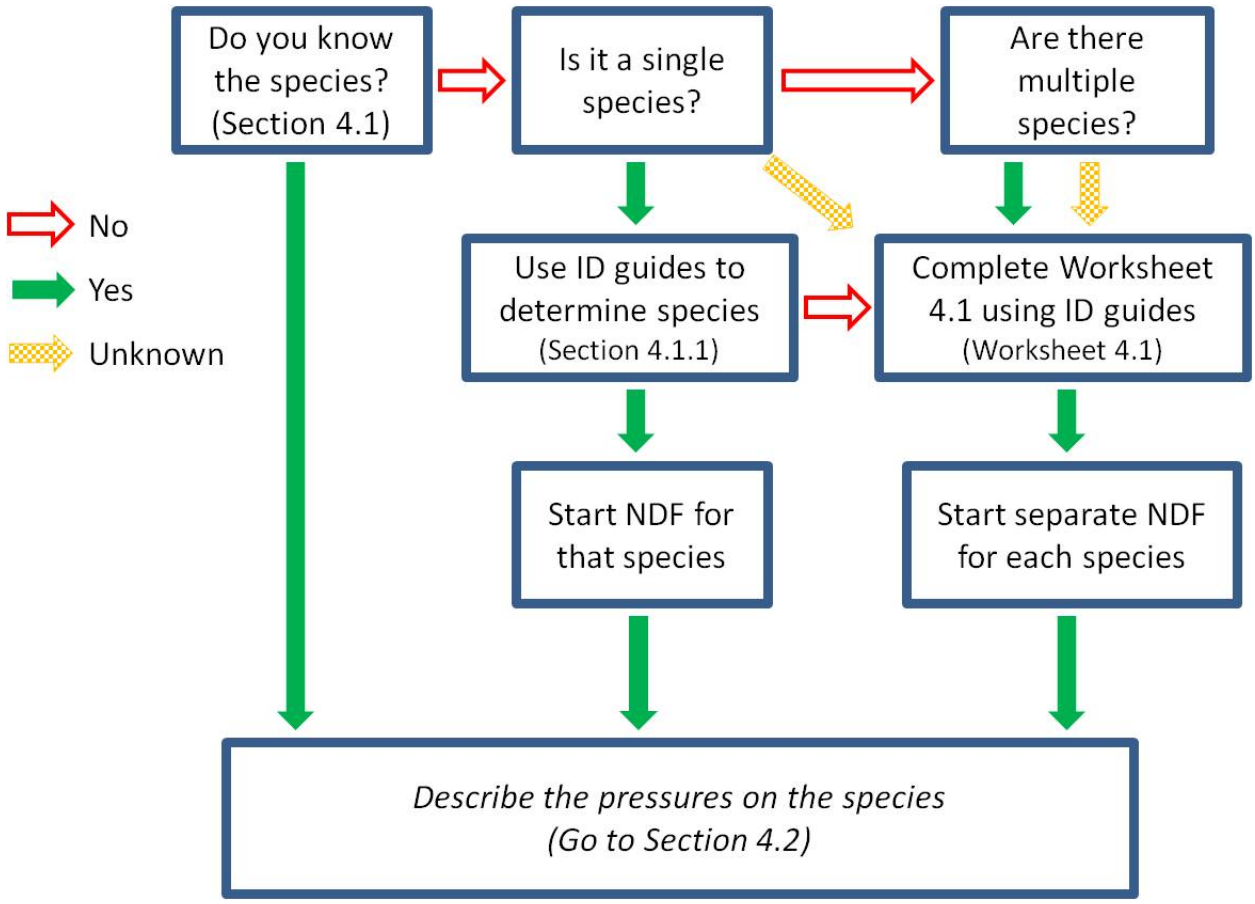
CITES Authorities should use the identification guides produced by Project Seahorse. The guides can be found online at www.projectseahorse.org/NDF.

You can take a sub-sampling approach where you suspect a shipment consists of more than one seahorse species. **Remember, you will need to make separate NDFs for each of those species.** Worksheet 4.1 will guide you in the process, but to summarise you take a random sample of any shipment with multiple species and identify all seahorse species in that sample. Then, you assume that each species comprises the same proportion in the full shipment as it did in the sample. You might miss some of the less commonly traded species, **but it is unrealistic to expect Authorities or enforcement agencies to identify every individual in a shipment of 1,000, 10,000 (or more!) seahorses.** Indeed to try might be very discouraging ---

If you know the species, move to Section 4.2. If you don't, then turn to Worksheet 4.1.

[10] see CITES Resolution 12.11 (Rev. COP15)

Flow chart to support Section 4.1. Which seahorse species is being traded?



Worksheet 4.1. Which seahorse species is being traded?

Instructions:

Using Table 4a:

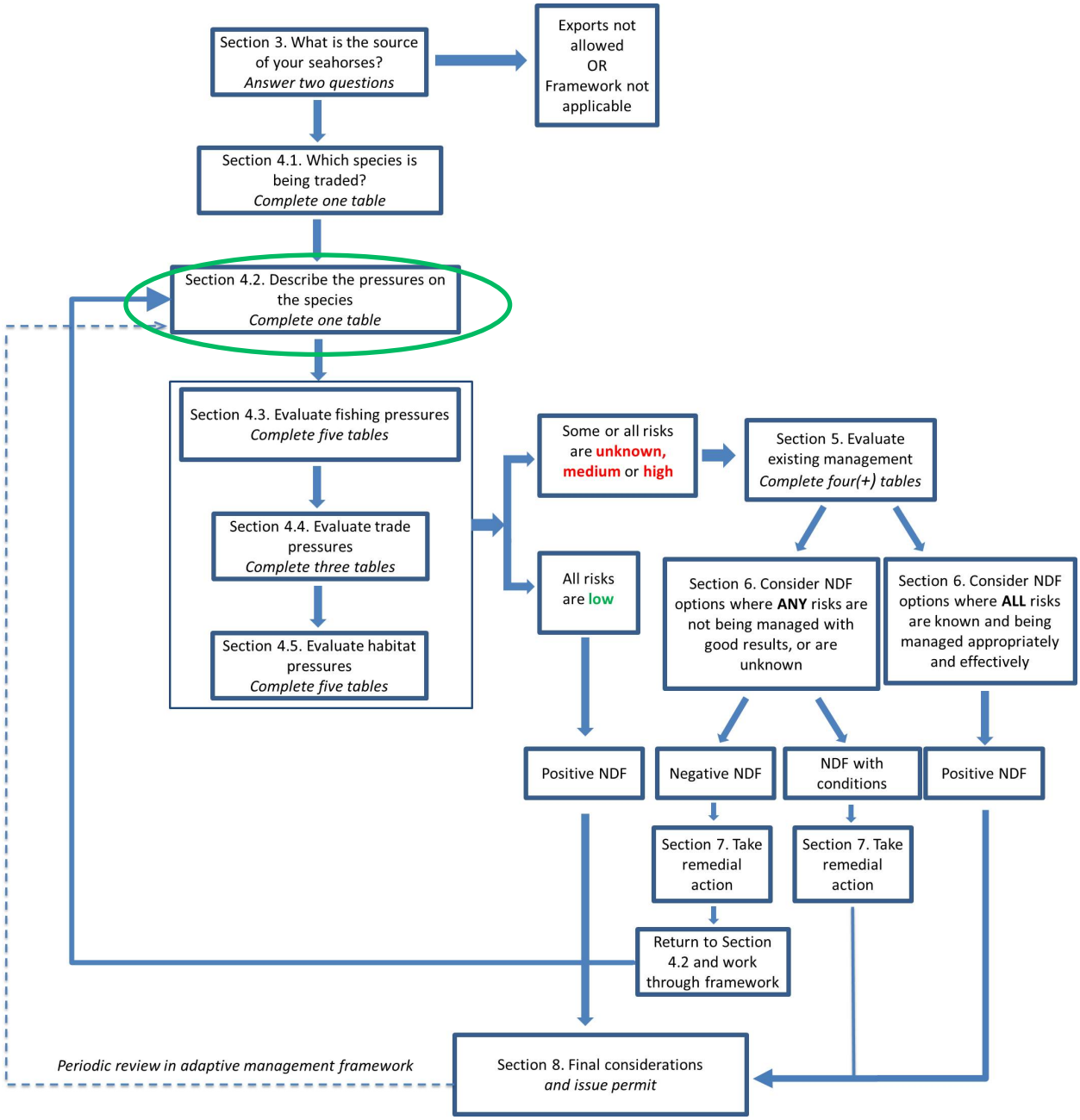
- Record the weight or total number of **all individuals in the proposed shipment** in **cell X.** For dried shipments, weight will almost always be easier.
- **Take a sample** of the shipment – make it as big as possible but also remember you will need to identify every individual in the sample. So be realistic.
- Record the weight or total number of **all sampled individuals** in **cell Y**.
- **Identify each seahorse in the sample**, using the identification materials at www.projectseahorse.org/NDF where needed, and sort the sample according to species.
- **Record each species** you found under column heading: ***Hippocampus sp.***
- Record the weight or total number of **individuals of each species** in the sample under column heading: **Weight or number of species in sample.**
- Finally, **extrapolate** from the sample up to the entire shipment, by doing the math under column heading: **Total weight or number of species in shipment.**
- *Hint: The sum of all entries under* **Total weight or number of species in shipment** *of Table 4a should be equal to the value recorded in cell X.*

Table 4a. Determining the species composition of proposed seahorse shipments.

Total weight or number of all individuals in the shipment		X
Weight or number of all individuals in the sample		Y
***Hippocampus* sp.**	**Weight or number of species in sample**	**Total weight or number of species in shipment**
species 1	a	=a*(X/Y)
species 2	b	=b*(X/Y)
species 3	c	=c*(X/Y)
species 4	d	=d*(X/Y)
species 5	e	=e*(X/Y)
species 6	f	=f*(X/Y)
species 7	g	=g*(X/Y)
species 8	h	=h*(X/Y)

Congratulations! Now that you have identified your species, move to Section 4.2.

Where we are headed next



4.2. Describe the pressures on the species

Seahorses are under pressure from many human activities. These activities in turn lead to population declines, destruction or damage of their habitats, or changes in their distribution. We now provide some examples of threats to seahorses, recognising that fisheries and trade are intimately linked.

4.2.1. Overfishing – bycatch

The vast majority of seahorses in trade (as much as 95%) are caught incidentally by non-selective fishing gears – such secondary, or non-targeted, catch is called bycatch. Bottom trawls are responsible for the majority of seahorse bycatch; many seahorses are likely to be particularly vulnerable to capture in bottom trawls because they are found in the same benthic habitats as desirable species such as shrimp, swim slowly and are the same size as many of the targeted species. But the main reason bottom trawls catch the most seahorses is because their fishing effort is so intense – the catch per unit effort of seahorses by trawlers is similar to that of other gears, but the global trawl effort is huge. Seahorses are also obtained in many other gear types including gillnets, pushnets, beach, shore and purse seines and crab pots – in some places, and for some species, these gears catch more seahorses than trawlers. Seahorses caught as bycatch mostly go into the dried trade, but can sometimes enter the live trade (although they usually die from injuries). *We re-visit bycatch in Section 4.3.*

4.2.2. Overfishing – target catch

Some Parties have a targeted seahorse fishery. Although these fisheries are usually small, **they can make big impacts where seahorse populations are small or depleted**. Most target seahorse fisheries occur in developing countries where fishers catch seahorses by hand or by using small hand-held nets. Seahorses caught this way can be sold into either the dry or live seahorse trade. *We re-visit target catch in Section 4.3.*

4.2.3. Overfishing – IUU

Illegal, unreported and unregulated (IUU) fishing practices occur worldwide; it is estimated that that IUU fishing occurs in most fisheries, and accounts for up to 30% of total catches in some important fisheries[11]. Much of our understanding of population trends and trade in seahorses comes from surveys of fishery landings; it is therefore important to understand the extent of IUU fishing as it could have considerable influence on population estimates. Also, proposed management solutions to control pressures on seahorses may not be effective if much of the fishing pressure is IUU. *We re-visit IUU for fisheries and trades in Section 4.4, and management practices in Section 5.*

4.2.4. Inadequately managed trade

The global trade in seahorses is vast, complex and diverse. Seahorses are traded dry for traditional medicines and for curios, and live for the aquarium trade. Many millions of animals are exchanged among at least 80 countries every year. Most of this trade is dried, and most of the seahorses are sourced from countries in Southeast Asia and West Africa and sold to East Asia. The majority of seahorses are sold whole, but they can also be ground up and included in prepared medicines. Any processing before first export makes tracking seahorse trade difficult.

[11] FAO 2010. The State of World Fisheries and Aquaculture (SOFIA).

Many countries also have a significant domestic demand for seahorses – for traditional medicines and souvenirs. *We re-visit trade in Section 4.4.*

4.2.5. Habitat loss and degradation

Knowing your species habitat preferences – its range within your Party's waters, preferred depths and habitat types – will be important when evaluating habitat pressures in Section 4.2, and when assessing the potential of existing management measures to mitigate risks to your species in Section 5.

Most species of seahorses are found in seagrasses, coral reefs or mangroves. Seahorses can also be found on sandy, muddy or rocky bottoms, or living on artificial habitats (like nets or cages). Many species live in two, three, or all of these habitats. Abiotic factors – such as temperature, pH, salinity, and water quality, are also important components of seahorse habitat.

Seahorse habitats are globally declining due to threats such as: coastal development, fishing (e.g. trawling), pollution, sedimentation, and climate change. There can be both habitat loss (i.e. reduced area covered by a critical habitat) and fragmentation (i.e. breaking apart of continuous habitat into small patches), or habitat degradation (when habitat quality declines).

***Seagrasses*:** A quarter of all seagrass species are threatened with extinction – this threat is centred on species found in the tropics[12], where many seahorse species are also found.

***Coral reefs*:** Over 60% of coral reefs in the ocean are threatened by direct human impacts such as too much fishing, destructive fishing, coastal development and pollution. This number increases to over 75% if thermal stress from global climate change is considered[13].

***Mangroves*:** The main threat to mangroves is coastal development, including aquaculture. Globally there has been a 20% decline in mangrove cover in the past 25 years and most of this has occurred in Asia[14], which is also the centre of seahorse diversity.

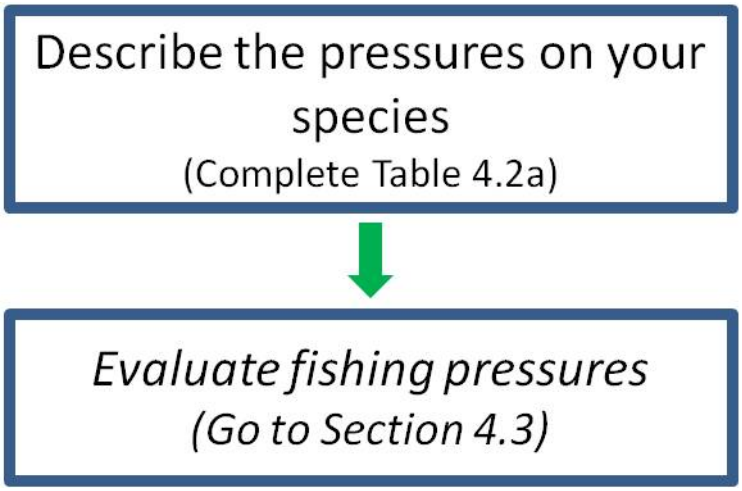
***Abiotic factors*:** Human activities can result in deleterious changes to abiotic components of marine habitats. For example: cause increased pollution – including that from noise, increased temperature, changes in salinity, decreased water clarity, excessive nutrients in runoff, increased sedimentation.

We re-visit habitats in Section 4.5.

It is now time to summarise the pressures on your seahorse species. Please complete Worksheet 4.2. It would be helpful to consult the species' global or national conservation assessment, if one exists (see Section 2.2.1). You may also want to bring your experts together in a workshop to complete the worksheet (see Section 2.2.2).

[12] Short *et al*. 2011. Biological Conservation. 144(7): 1961–1971
[13] Burke *et al.* 2011. Reefs at Risk Revisited.
[14] FAO 2007. The world's mangroves 1980-2005.

Flow chart to support Section 4.2. Describe the pressures on the species



Worksheet 4.2. Describe the pressures on the species

In this section you will consider and summarise what is known or unknown about the pressures facing wild populations of the seahorse species requiring the NDF in your Party's waters. You will need this information to complete the rest of the framework. Include as much detail and you can – do not be constrained by the size of Table 4.2a, it is here for guidance only.

Table 4.2a. Describe pressures on populations of the seahorse species being considered. Identify if each of the following is an extant pressure on populations of the seahorse species being considered, and describe its nature.

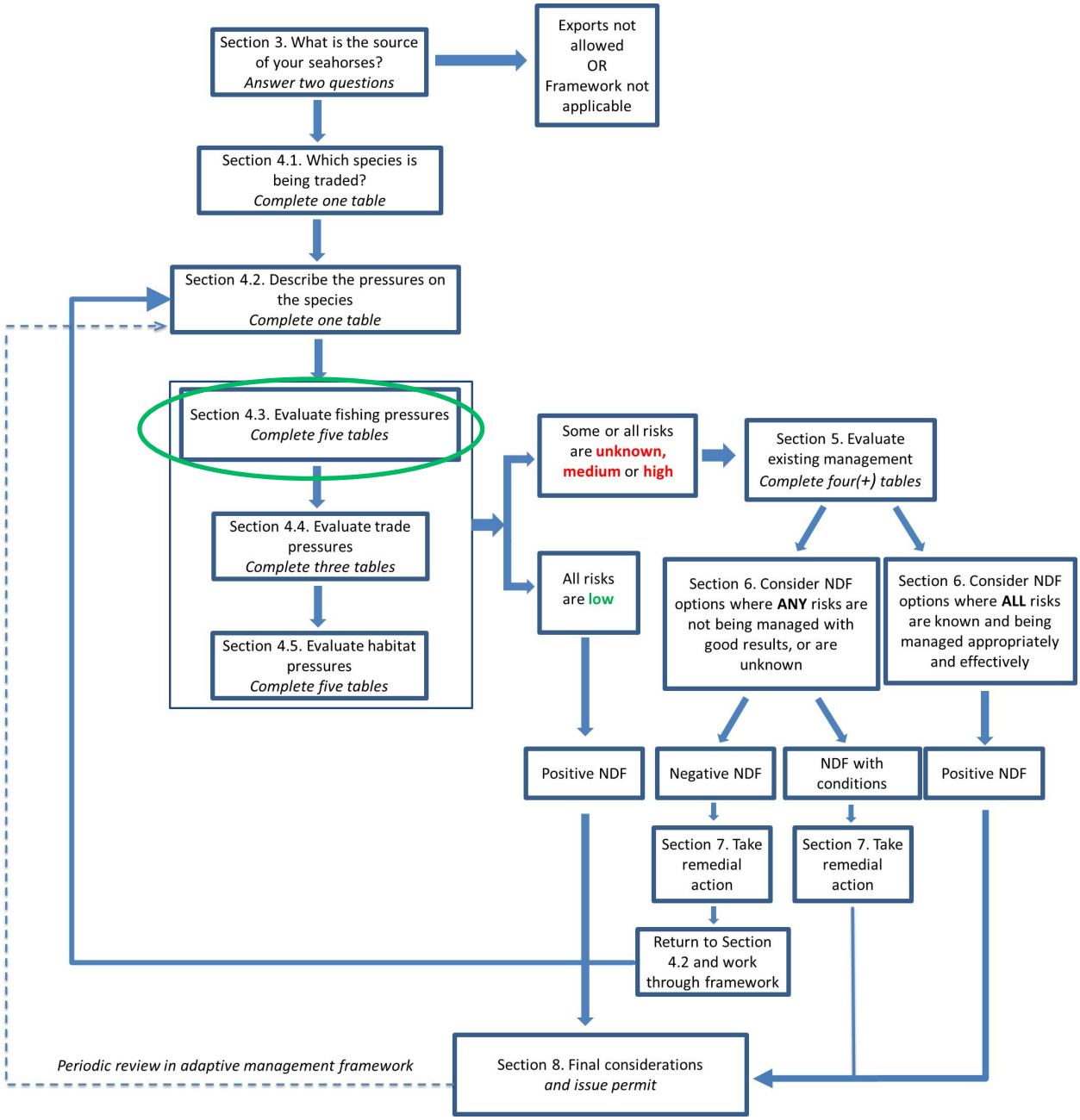
Seahorse species under consideration:		
Pressure	**Circle one**	**Describe**
FISHING – Consider all fishing methods and gears that interact with the seahorse species		
Bycatch	Yes No Unknown	
Target catch	Yes No Unknown	
IUU fishing	Yes No Unknown	
TRADE – Consider all trades (dried: whole, processed; live) that involve the seahorse species		
International trade	Yes No Unknown	
Domestic trade/consumption	Yes No Unknown	
IUU trade	Yes No Unknown	

Table 4.2a. Continued...

Seahorse species under consideration:		
HABITAT – Consider each of the seahorse species habitats		
Describe the species habitats in your nations waters	Geographic range:	
	Depth range:	
	Habitats:	
Pressure	**Circle one**	**Describe**
Habitat loss / fragmentation	Yes No Unknown	
Habitat degradation	Yes No Unknown	
Changes in abiotic habitat (e.g. temperature, salinity, pH, noise pollution, water quality)	Yes No Unknown	

Congratulations! Now that you have described the pressures on your species (if any), move to Section 4.3.

Where we are headed next



4.3. Evaluate fishing pressures

As mentioned in Section 4.2, **seahorses entering international trade are obtained as bycatch or from target fisheries**. Fishing pressure can pose many serious problems for seahorses. The more fisheries you have interacting with your seahorse populations, the more complicated your NDF assessment will be.

You may choose to complete this section considering all seahorse fisheries together, or by keeping the fisheries that catch seahorses separate. The latter would be useful for determining whether certain fisheries are having greater impacts on seahorses than others, and therefor require more management attention.

4.3.1. Seahorse fisheries

4.3.1.1. Bycatch

The vast majority of seahorses in trade (as much as 95%) are caught incidentally by non-selective fishing gears – called bycatch. Bottom trawls are responsible for the majority of seahorse bycatch because their fishing effort is so immense. Seahorses are also obtained in many other gear types including gillnets, pushnets, beach, shore and purse seines and crab pots – in some places, and for some species, these gears catch more seahorses than trawlers.

Sometimes fishers sort the seahorses from the bycatch. Many of these seahorses are destined for international trade. But sometimes the seahorses are thrown back (discarded), or are sent with the rest of the low-value catch to be processed into fishmeal or fertilizer.

***There are two important take home messages with respect to bycatch*:**

- **Many catches of just a few seahorses add up to a total take of many many seahorses**. There are a great many fishing gears, a great many fishers, and a great many fishing trips. If each boat or fisher catches only one or two seahorses a night, those tiny catches can total hundreds of thousand, even millions, of animals caught each year. This is well documented[15].

- **Although some gear types do land seahorses alive, you should assume any seahorse caught by any gear will be a dead seahorse.** Even when seahorses are thrown back alive, they are not likely to survive. There is effectively no chance that a discarded seahorse will survive injuries from gear and depth changes, escape predation, find its mate, and end up in suitable habitat.

4.3.1.2. Target catch

Most direct exploitation for syngnathids is by small-scale or subsistence fishers in developing countries, although some are taken by aquarium collectors in developed countries.

[15] e.g. Baum *et al*. 2003. Fishery Bulletin 101: 721–731; Giles *et al*. 2006. Biodiversity and Conservation 15: 2497-2513; Perry *et al*. 2010. Aquatic Conservation: Marine and Freshwater Ecosystems 20: 464–475.

4.3.2. Potential fishing impacts

Indirect or direct fishing can affect seahorse individuals, populations and species in a variety of ways. For example (also see Section 1.4):

- injure or kill individuals;
- reduce reproduction by catching more of one sex than the other;
- reduce reproduction by splitting mated pairs;
- limit future population growth by selecting for particular sizes/ages; and/or
- damage habitats (especially true of bottom trawls).

4.3.3. What determines fishing impacts?

Parties should **consider at least three factors when evaluating potential for fisheries impacts** on seahorses.

4.3.3.1. The number of fishing methods and/or gears that interact with the species. The greater the diversity of fishing methods and/or fishing gears that interact with your wild populations of seahorses, the more complex your assessment and management of fishing impacts will be. This in turn results in a seahorse trade that is very challenging to understand, monitor and regulate.
To estimate impact, you need to understand which fishing methods/gears interact with seahorses.

4.3.3.2. Fishing mortality – the proportion of the total population that is removed by fishing. This in turn depends on:

- type of impact (what gears are used, if any);
- frequency of impact (continuous / regular, as distinct from occasional); and
- extent of impact (relative catch by different gear types *cf* total fishing effort, whether there are non-fished parts of population).

For seahorses, an appropriately precautionary rate of fishing mortality would be: $F \leq 0.5*M$ (M = natural mortality). However it is unlikely you will know F for your seahorse populations. In this case you can consider the type, frequency and extent of impact in estimating fishing mortality.
To estimate impact, you ideally need to compare the number of seahorses in the wild to the number being caught. You should be conservative when estimating abundance, especially given the patchiness of seahorse populations. But realistically you will probably need to infer the risk from fishing mortality by considering the type, frequency and extent of impact.

4.3.3.3. Size/sex selectivity – which seahorse sizes/ages/sexes are caught and which are left. Different fisheries may catch different size/age classes. This factor considers if fishing has the potential to harm the breeding population and influence recruitment. **If a fishery takes all the small/immature individuals**, there are no fish left to mature and contribute to the next generation. **If a fishery takes all the large/mature individuals**, then over time the mature adult population is depleted to a level where it no longer has the reproductive capacity to replenish itself – there are not enough adults to produce offspring. Therefore, in the case of fisheries, being highly selective for only smaller or larger size classes can lead to greater negative impacts on wild populations. **Selectivity for sex can also be a problem** – any bias in the sex ratio would be

worrying as male pregnancy limits the male's reproductive rate, and most species are monogamous, at least within a breeding season.

To estimate impact, you ideally need to compare length frequency plots and/or sex ratios of seahorses in the wild and to those in the catch. However it is common to have only catch information, and know nothing about wild populations. In these cases you can infer the extent of size/sex selectivity by calculating the % catch that is under the species length at maturity (or comparing size at 50% maturity to size at 50% selectivity), or seeing if there is a statistically significant bias in the sex ratio of caught animals[16].

4.3.3.4. Discard rates – the proportion of the catch that is actually landed compared to that which is thrown back, or sent for processing with the rest of the low valued catch. What we know about seahorse fisheries comes largely from trade surveys and a few sets of landing data. These data do not account for the seahorses that are thrown back. **Fishing may be a big and unknown pressure where discard rates are high.** Remember – you should assume any seahorse caught by any gear will be a dead seahorse – even if thrown back alive (see take home messages in Section 4.3.1.1).
To estimate impact, you need to know something of discard rates so you can compare landed seahorses and caught seahorses. You can estimate discard rates directly, or ask fishers about their discarding practices for seahorses.

Illegal, unregulated and unreported fisheries (IUU) also pose a particular challenge – but we address this issue in Section 4.4 (4.4.1.2 in particular).

4.3.4. What are the indicators of adverse fishing impacts?

Authorities can find clues to the adverse impacts of fishing practices by monitoring their seahorse populations or catches over time for, or asking stakeholders about, **DECLINES** in any of the following parameters:

- Geographic distribution (presence/absence across space).
- Relative abundance [population size and/or catch per unit effort (CPUE)].
- Mean size of animals.
- Frequency of male pregnancy (indicates disruption of breeding activities).
- *Sex ratio* (*not a decline per se, but a change*).

4.3.5. Monitoring for indicators of adverse fishing impacts

Monitoring for indicators of adverse impacts from fishing activities (as outlined in Section 4.3.4) can occur on three levels:

4.3.5.1. Population monitoring – usually consists of underwater surveys of seahorse populations (using SCUBA or snorkel), but may also involve using pushnets or other gears to systematically survey seahorses in shallow waters. Project Seahorse has toolkits for underwater

[16] For an example see Lawson et al 2015. Journal of Fish Biology 86: 1–15.

seahorse monitoring, available at www.projectseahorse.org/ndf and www.iseahorse.org/trends-underwater, and can provide guidance for Parties wishing to try other means.

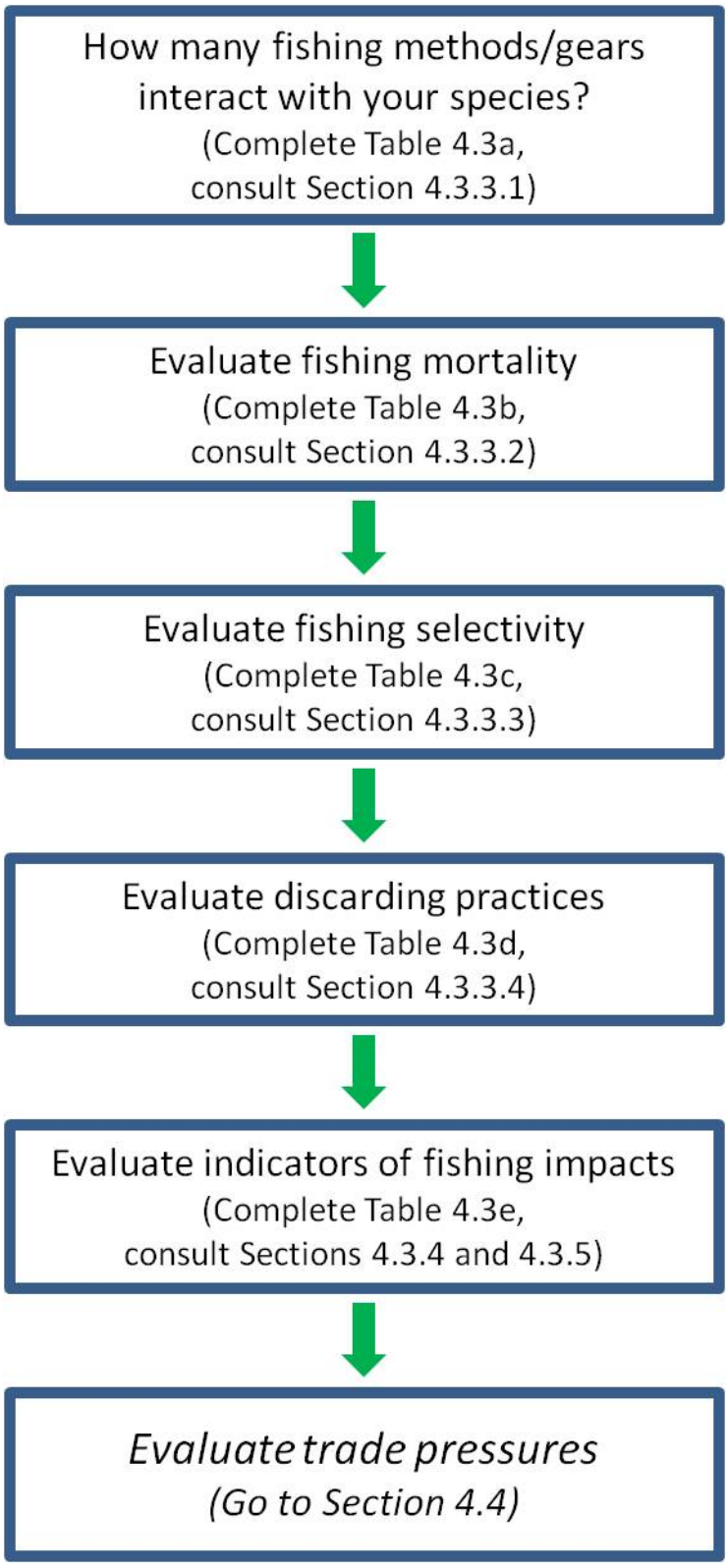
4.3.5.2. Fisheries monitoring – monitor catches, including discards where possible – or at least landings. The key to fisheries dependent monitoring is to **collect information on fishing effort** – the data are only truly useful and dependable if they are accompanied by a measure of effort. Project Seahorse has toolkits for monitoring seahorse landings at ports, available at www.projectseahorse.org/ndf and www.iseahorse.org/trends-landings. There are of course many other approaches to fisheries dependent monitoring, such as on-board observers, deployment of Vessel Monitoring Systems (VMS) and/or onboard cameras. As with the rest of this framework you need to consider which approaches are appropriate and practical for your situation.

4.3.5.3. Stakeholder interviews – although directly monitoring populations or catches for indicators of adverse impacts from fishing is ideal, it takes time to get results. For an immediate assessment, one can **ask stakeholders (e.g. fishers, buyers, exporters) about their perceived rates of decline (or change**) in any of the indicators in Section 4.3.4. As with fisheries monitoring, you should also ask questions to understand any changes in fishing effort. It is also prudent to use triangulation to cross-validate the information received by (i) asking the same questions in three different ways within an interview and (ii) comparing the answers within and among interviews. Project Seahorse would be happy to support Parties to design an interview protocol for understanding fisheries and trade impacts on seahorses.

We suggest that Parties set up specific "sentinel" or indicator populations and/or fisheries that can be monitored at regular intervals over time to evaluate fishing impacts on their wild seahorse populations. Parties need to evaluate the feasible frequency for sampling, seeking consistency in timing. We recommend repeating surveys annually at a minimum – recognising that more frequent monitoring will provide useful information more quickly. In the meantime, **stakeholder interviews are very useful** for obtaining immediate information on perceived rates of decline (or change) in any indicators of adverse fishing impacts.

Please complete Worksheet 4.3 to evaluate the fishing pressures faced by your species.

Flow chart to support Section 4.3. Evaluate fishing pressure



Worksheet 4.3. Evaluate fishing pressures

For each table, circle the level of risk that is associated with the row option that corresponds to the seahorse species needing the NDF.

You may choose to complete the worksheet (from Table 4.3b onward) considering each fishery you described in Worksheet 4.2 (Table 4.2a) individually or considering them all together. We suggest that at a minimum you consider target and bycatch fisheries separately, and have set the tables up as such – but you could also complete the tables for each fishery separately. Considering risk from each fishery individually would be useful for determining whether certain fishing activities are having greater impacts on seahorses than others, and therefore require more management attention.

Table 4.3a. Evaluate risk from the diversity of fishing methods/gears that interact with your species. Corresponds to Section 4.3.3.1 in text.

Seahorse species:		
Diversity of fishing methods/gears	**Risk – Target fisheries**	**Risk – Bycatch fisheries**
Caught by one method/gear	Low	Low
Caught by a few methods/gears	Medium	Medium
Caught by many methods/gears	High	High
Methods/gears unknown	Unknown	Unknown
Reasoning		

Table 4.3b. Evaluate risk from fishing mortality. Corresponds to Section 4.3.3.2 in text.

Seahorse species:		
Fishing mortality	**Risk – Target fisheries**	**Risk – Bycatch fisheries**
Small proportion of population removed by all fishing activities (low rate of fishing mortality)	Low	Low
Moderate proportion of population removed by all fishing activities (medium rate of fishing mortality)	Medium	Medium
High proportion of population removed by all fishing activities (high rate of fishing mortality)	High	High
Unknown proportion of population removed by all fishing activities (unknown rate of fishing mortality)	Unknown	Unknown
Reasoning		

Table 4.3c. Evaluate risk from fishing selectivity. Corresponds to Section 4.3.3.3 in text. Remember that in the case of fisheries, being highly selective for certain size classes or sexes can lead to greater negative impacts on wild populations – so in this evaluation of risk, fisheries that are more selective confer greater risk.

Seahorse species:		
Fishing selectivity	**Risk – Target fisheries**	**Risk – Bycatch fisheries**
Fisheries are not selective for any age-size classes/sex	Low	Low
Fisheries are moderately selective for certain age-size classes/sex	Medium	Medium
Fisheries are highly selectivity for certain age-size classes/sex	High	High
Unknown selectivity for age-size classes/sex	Unknown	Unknown
Reasoning		

Table 4.3d. Evaluate risk from discarding practices. Corresponds to Sections 4.3.1.1 and 4.3.3.4 in text.

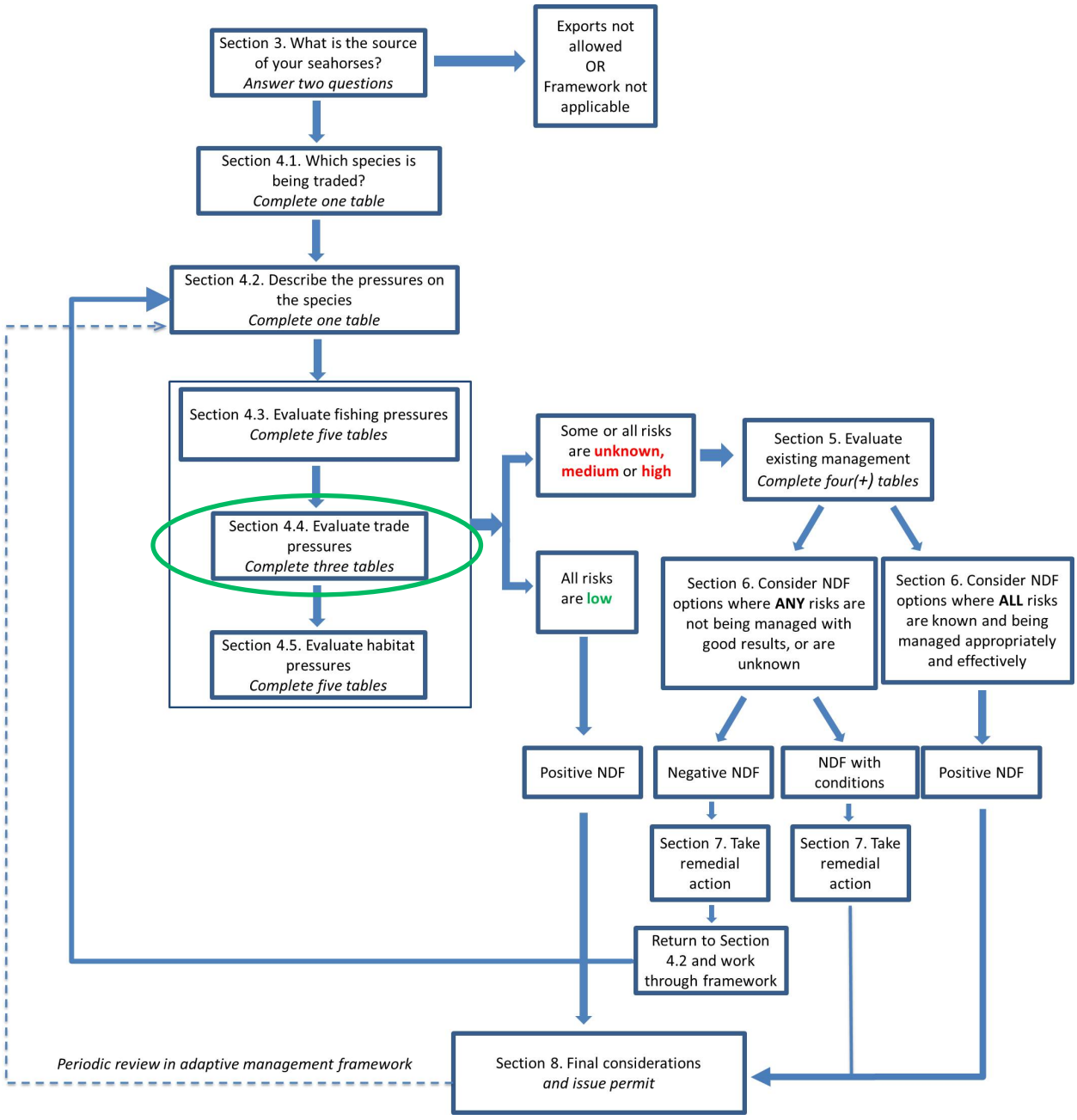
Seahorse species:		
Discarding practices	**Risk – Target fisheries**	**Risk – Bycatch fisheries**
None or only a small proportion of total catch is thrown back	Low	Low
A moderate proportion of total catch is thrown back	Medium	Medium
A large proportion of total catch is thrown back	High	High
An unknown proportion of total catch is thrown back	Unknown	Unknown
Reasoning		

Table 4.3e. Evaluate indicators of adverse fishing impacts. Corresponds to Sections 4.3.4 and 4.3.5 in text.

Seahorse species:		
Indicators of fishing impacts	**Risk – Target fisheries**	**Risk – Bycatch fisheries**
No observed or inferred declines in any of the indicators of adverse fishing impact	Low	Low
Moderate observed or inferred declines in any of the indicators of adverse fishing impact	Medium	Medium
Large observed or inferred declines in any of the indicators of fishing impact	High	High
Unknown change in any of the indicators of adverse fishing impact	Unknown	Unknown
Reasoning		

Congratulations! Now that you have evaluated the pressures your species faces from fishing (if any), move to Section 4.4.

Where we are headed next



4.4. Evaluate trade pressures

As we have mentioned in the introduction to this framework (Section 1), **NDFs must consider all pressures on a species**, not just that posed by export for international trade. That is why we had to consider fishing pressures in Section 4.3, and will consider threats to their habitats in Section 4.5. This is also why in this section we consider both domestic consumption, and illegal, unregulated and unreported (IUU) fisheries and trades; if either of these are big, then even a small international trade can be too much for a population to handle.

You may choose to complete this section considering all trades together, or for each trade individually (e.g. domestic, international; live, dried; traditional medicine, curios). The latter would be useful for determining whether certain trades are having greater impacts on seahorses than others, and therefor require more management attention.

4.4.1. Factors to consider when considering trade

Parties should **consider at least three factors** when evaluating potential trade pressures on seahorses.

4.4.1.1. How many ways is the species used?

The more uses for seahorses (e.g. dried whole and/or processed for traditional medicines, dried for souvenirs, live for public aquaria, live for home aquaria, etc.), the more markets for seahorses, and the more complex the networks of domestic and international trade for seahorses. This in turn results in a seahorse trade that is very challenging to understand, monitor and regulate.

4.4.1.2. Does illegal, unregulated or unreported (IUU) fishing and/or trade comprise a significant part of the total trade in the seahorse species?

This can be answered by asking:

- How different are fishing and trade records?
- Are fisheries and trades (both domestic and international) well documented?
- Is the trade chain transparent?

In the absence of information on IUU fishing and/or trade of seahorses, you could consider the extent to which IUU fishing takes place among the fisheries that catch seahorses, and/or the extent of IUU wildlife trade in general.

Remember condition 1.2.2 for issuing a CITES permit – that the specimens were legally sourced. Therefore, if you know that the specimens to be traded came from illegal fishing practices then you cannot issue an NDF (see Section 3.2).

4.4.2. What are indicators of adverse trade impacts?

Authorities can find clues to adverse impacts of trade practices by monitoring their seahorse trades over time for any of the following parameters:

Declines in:
- Supply.
- Relative abundance [trade per unit effort (TPUE)].
- Mean size of animals.
- Frequency of male pregnancy (indicates disruption of breeding activities).
- *Sex ratio* (*not a decline per se, but a change*).

Increases in:
- Demand.
- Price.

4.4.3. Monitoring for indicators of adverse trade impacts

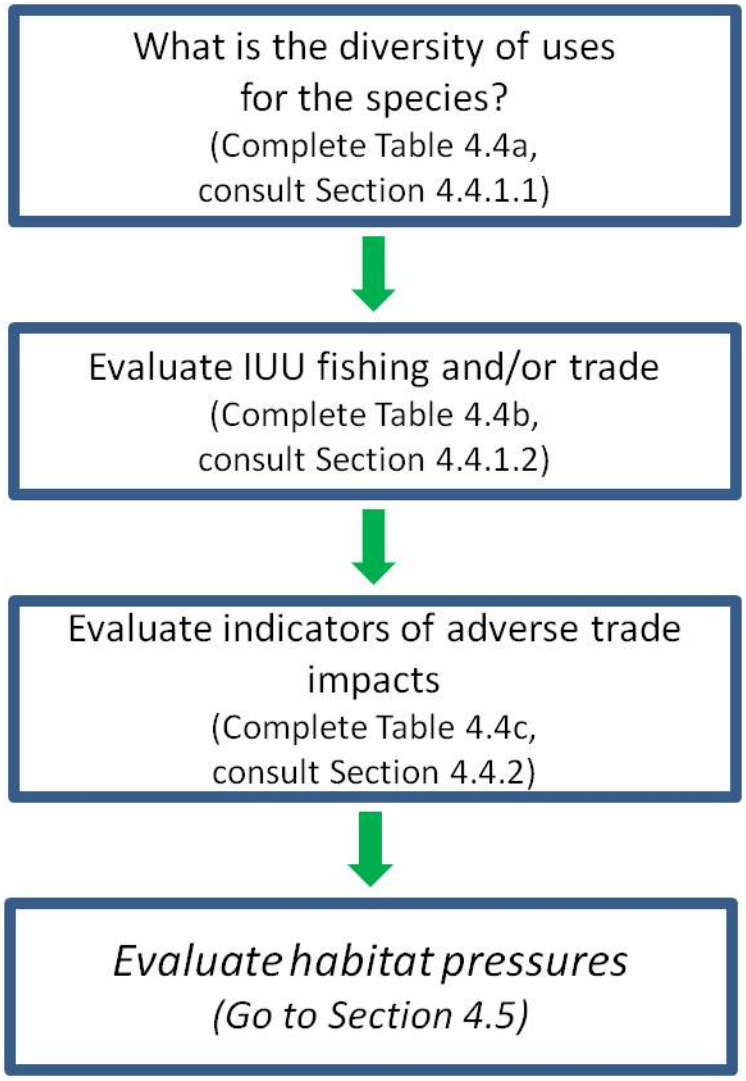
Monitoring for indicators of adverse impacts from trade activities **requires monitoring domestic and international trade volumes and characteristics.** The objective of trade research is to generate and share new knowledge about seahorse biology, fisheries and trade that might affect implementation of the CITES Appendix II listing for seahorse species. Trade research provides vital baseline data to identify fisheries of concern, determine the appropriate initial management options for a Party's particular situation, and identify gaps in information and management needs.

During trade research you gather information on seahorse biology, ecology, methods of extraction (e.g. target/incidental), catch/trade per unit effort, volumes, values (at different trade levels), uses (domestic and international), trade structure, trade routes, and seasonality of the trade. You can also probe temporal trends and geographic differences in these parameters. **Information comes from (a) accessing existing but overlooked data sets, (b) interviewing a wide array of participants in fisheries and trades, and (c) measuring seahorses in trade.**

Parties need to be careful when using trade data as a proxy for population information; changes in trade volumes could indicate changes either in supply or in demand. Price changes might help to explain whether a decreasing trade volume is due to declining resource, driving up the price.

Please complete Worksheet 4.4 to evaluate the trade pressures faced by your species.

Flow chart to support Section 4.4. Evaluate trade pressure



Worksheet 4.4. Evaluate trade pressures

For each table, circle the level of risk that is associated with the row option that corresponds to the species needing the NDF.

You may choose to complete the worksheet (from Table 4.4b onward) considering all trade pressures you described in Worksheet 4.2 (Table 4.2a) together, or complete them for each trade separately. The latter would be useful for determining whether certain trades are having greater impacts on seahorses than others, and therefore require more management attention.

Table 4.4a. Evaluate risk from the diversity of uses for your species. Corresponds to Section 4.4.1.1 in text.

Seahorse species:		
Diversity of use	**Risk – International**	**Risk – Domestic**
Used for one purpose	Low	Low
Used for a few purposes	Medium	Medium
Used for many purposes	High	High
Reasoning		

Table 4.4b. Evaluate risk from IUU fishing and/or trade. Corresponds to Section 4.4.1.2 in text.

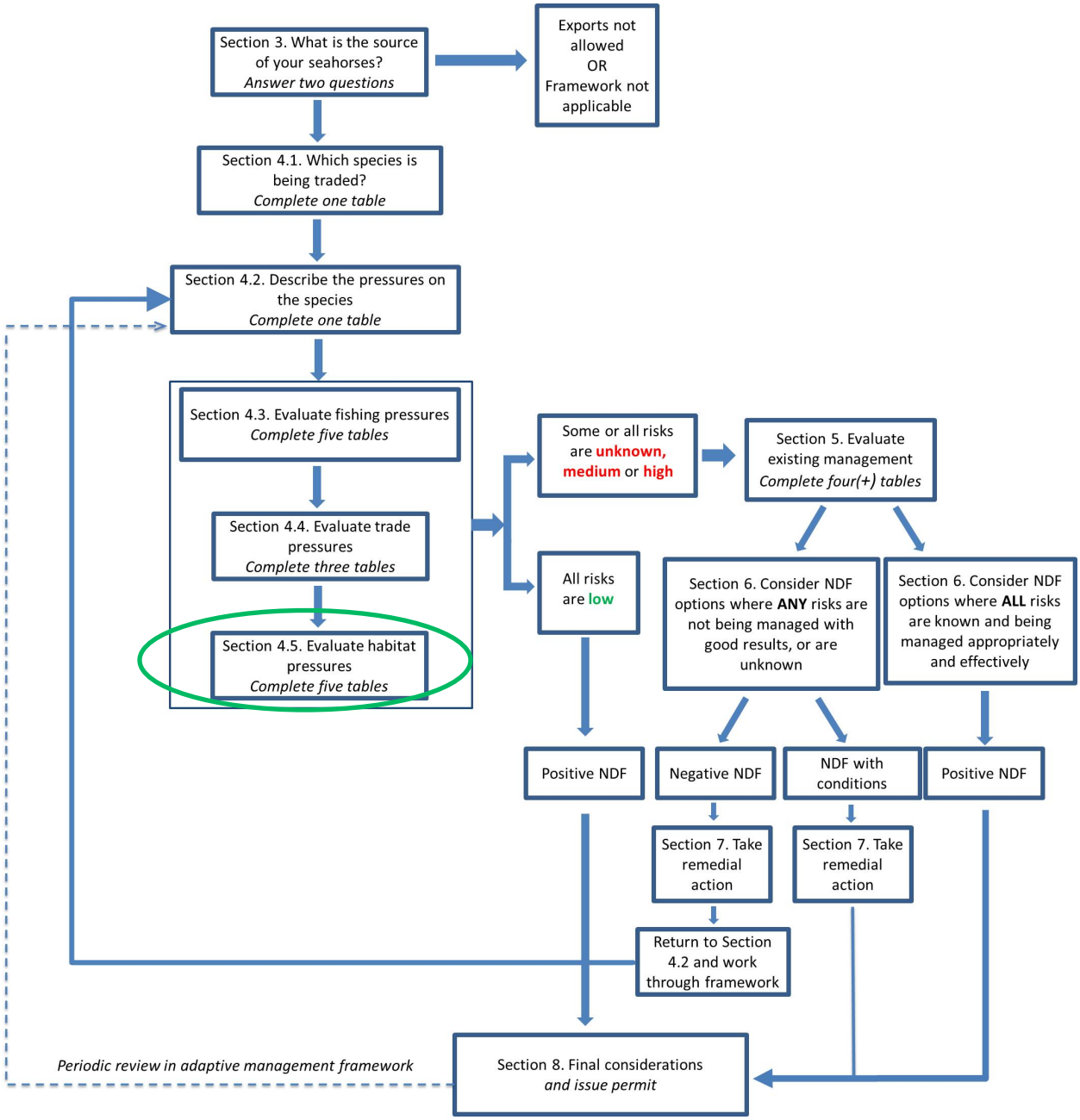
Seahorse species:			
Illegal fishing and/or trade (IUU)	**Risk – Fishing**	**Risk – International**	**Risk – Domestic**
Good documentation of catches/trade, trade chain transparent	Low	Low	Low
Some documentation of catches/trade, trade chain difficult to follow	Medium	Medium	Medium
Little to no documentation of catches/trade, trade chain not transparent	High	High	High
Reasoning			

Table 4.4c. Evaluate indicators of adverse trade impacts. Corresponds to Sections 4.4.2 and 4.4.3 in text.

Seahorse species:		
Indicators of trade impacts	**Risk – International**	**Risk – Domestic**
No observed changes in any indicators of adverse trade impact	Low	Low
Moderate changes observed in any indicators of adverse trade impact	Medium	Medium
Large changes observed in any indicators of adverse trade impact	High	High
Unknown changes in any indicators of adverse trade impact	Unknown	Unknown
Reasoning		

Congratulations! Now that you have evaluated the pressures your species faces from trade, move to Section 4.5.

Where we are headed next



4.5. EVALUATE HABITAT PRESSURES

Seahorses and other syngnathids live in some of the world's most threatened marine habitats: seagrasses, mangroves, coral reefs, estuaries and macroalgae. **Where there is a loss of seahorse habitat, there will be a loss of seahorses.**

Most areas of the world's oceans are experiencing habitat loss. But coastal areas, with their proximity to dense human population centers, have suffered disproportionately – mainly from anthropogenic stresses. Habitat loss here has far-reaching impacts on the entire ocean's biodiversity, including seahorses. Although natural causes, such as hurricanes, can cause massive habitat damage, it is usually temporary. Human activities, however, are significantly more impactful and persistent.

4.5.1. Is your species a habitat generalist or specialist?

Usually, populations of species that are widely distributed with diverse habitat associations (i.e. generalists, e.g. *H. kuda* which is found on seaweed/algae, seagrass, rocks, mangroves and artificial habitats) are more likely to be resilient to habitat damage and/or loss than populations of species with limited distributions and specific habitat needs (i.e. specialists, e.g. *H. bargibanti* which is only found on one species of gorgonian coral). Indeed, **habitat specialization is recorded as one of the central factors that make species vulnerable to extinction.** Most species fall somewhere on the continuum from highly specialized to broadly generalist when it comes to habitat.

Remember that while most species of seahorses are found in seagrasses, coral reefs and/or mangroves, they can also be found on sandy, muddy or rocky bottoms, in algae, or living on artificial habitats (like nets or cages). Seahorses may also live in different habitats at different life stages (i.e. juveniles versus adults). Some marine habitats (e.g. sand and mud) are more resilient to human activities than other habitats are (e.g. coral reefs and seagrass beds). So it is important to understand the condition of the habitats that your seahorses rely on and how they use those habitats during different parts of their lives.

4.5.2. Three main causes of damage and destruction to seahorse habitats:

4.5.2.1. Marine based activities including (but not limited to) destructive fishing practices such as bottom trawling and dynamiting; aquaculture (particularly for shrimp); tourism (boaters, snorkelers, and scuba divers come into direct contact with vulnerable marine habitats); dredging and filling (for shipping channels and coastal development); anchoring; and shipping (large ships can damage habitat with their hulls and anchors, and spill crude oil and other substances into the water). Seahorses themselves are vulnerable to the noise pollution that results from many of these activities.

4.5.2.2. Land based activities including (but not limited to) industrial and agricultural practices (which create chemical and nutrient runoff that pollutes the seas or covers benthic habitats); damming inland rivers (that increases the salinity of coastal waters, and/or can alter the temperature and lower the salinity if it is released in masse);

deforestation (causes erosion, sending silt into shallow waters); sewage (increases nutrients, can lead to toxic blooms and disease).

4.5.2.3. Climate change is expected to negatively affect inshore marine habitats and their fauna, including seahorses, through changes in, for example, temperature, rainfall patterns, atmospheric CO^2, community composition, oceanographic patterns, status of coastal habitats and storm action.

4.5.3. What are the indicators of seahorse habitat health?

Habitat indicators can track habitat conditions over time and identify seahorse habitats that are in trouble or in most risk of disturbance. Indicators can also improve understanding of linkages among habitat pressures, habitat status, and management responses (e.g. conservation and restoration actions).

Authorities can find clues to the impacts of marine and/or land based activities and/or climate change by monitoring their seahorse habitats over time for changes in any of the following parameters:

Declines in:

- Diversity of habitats that seahorses depend on[diversity of different habitat types, or of species (seagrass, mangrove, coral) within a habitat type].
- Distribution of habitats (total area covered by a habitat across a coastline).
- Percent live cover of a habitat type (e.g. coral, seagrass).
- Structural complexity (rugosity of a reef, or height of seagrass canopy).
- Oxygen.
- pH.
- Salinity.

Increases in:

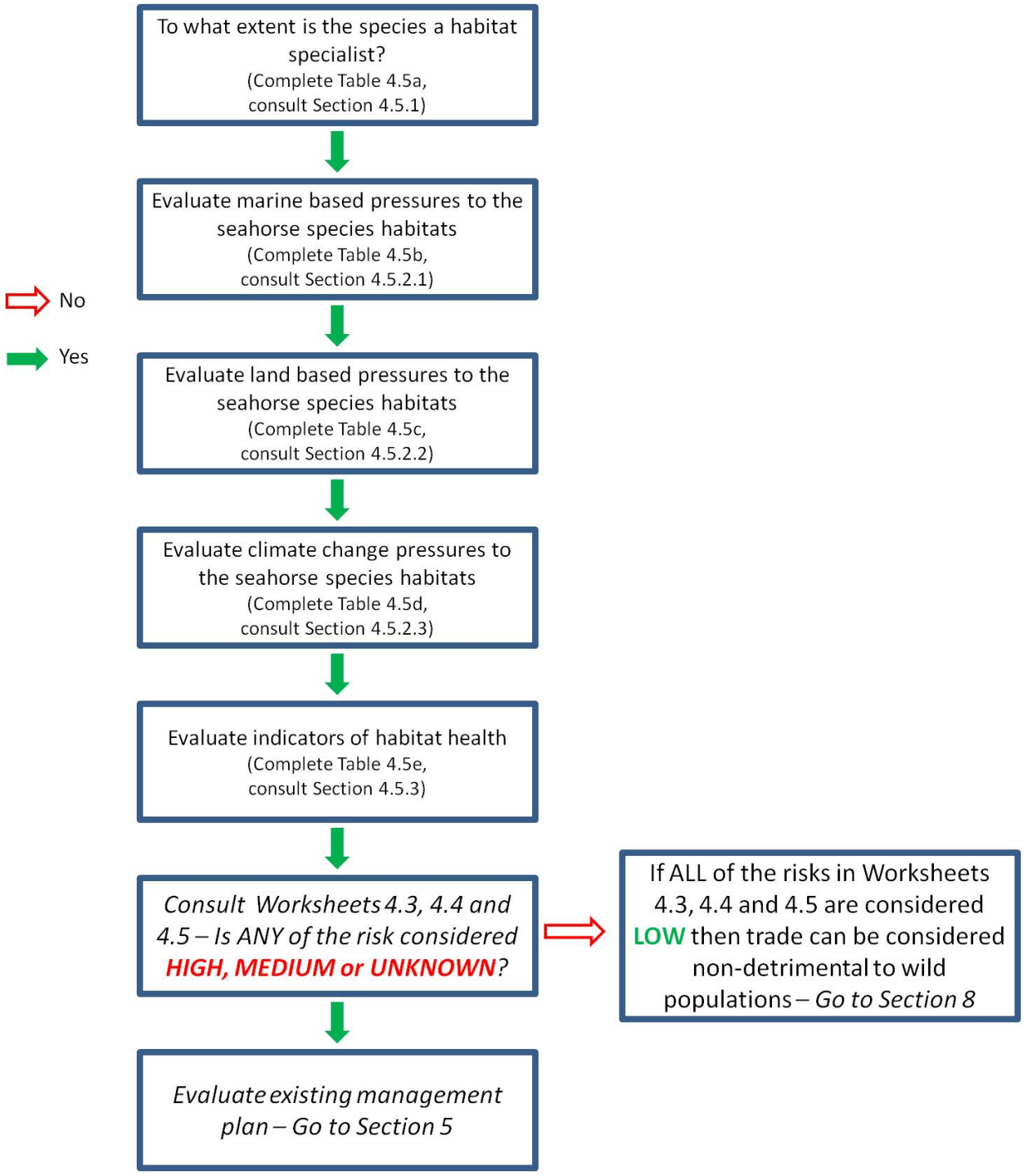
- Fragmentation of habitats (breaking apart of habitat areas into smaller patches).
- Water quality indicators (turbidity/sedimentation, nutrient levels, chemical pollution).
- Temperature.
- Salinity.
- Noise pollution.

4.5.4. Monitoring for indicators of habitat health

There are several approaches for monitoring marine habitats – ranging from complex and expensive (e.g. remote sensing), through to simple and affordable (e.g. manta tow). **You should decide which are appropriate to your situation and need.** Some of the most tractable approaches have been developed in support of "citizen science" programs that use a partnership between community volunteers and scientists to addressing both scientific and environmental management needs. For example, SeagrassWatch (seagrasswatch.org) and SeagrassNet (www.seagrassnet.org) provide detailed information on how to map and monitor seagrass resource status and condition. CoralWatch (www.coralwatch.org) provides a simple way to quantify bleaching and monitor coral health. Reef Check (www.reefcheck.org) offers another approach for regular monitoring and reporting on reef health. These and other global coral monitoring programs are addressed in *Methods For Ecological Monitoring Of Coral Reefs* (http://data.iucn.org/dbtw-wpd/edocs/2004-023.pdf). Similarly, MangroveWatch (www.mangrovewatch.org.au) is a new monitoring program that targets estuarine and coastal systems where there are mangroves, saltmarsh and saltpans.

Please complete Worksheet 4.5 to evaluate the habitat pressures faced by your species.

Flow chart to support Section 4.5. Evaluate habitat pressure



Worksheet 4.5. Evaluate habitat pressures

For each table, circle the level of risk that is associated with the row option that corresponds to the species needing the NDF.

You may choose to complete the worksheet (from Table 4.5b onward) considering all seahorse habitats you described in Worksheet 4.2 (Table 4.2a) together, or complete them for each habitat individually. The latter would be useful for determining whether certain habitats are more at risk and therefore require more management attention

Table 4.5a. Evaluate risk from degree of habitat specialization. Corresponds to Section 4.5.1. in text.

Seahorse species:	
Degree of habitat specialization	**Risk**
Species is found in more than three habitat types	Low
Species is found in two habitat types	Medium
Species is found in only one type of habitat	High
Species habitat is unknown	Unknown
Reasoning	

Table 4.5b. Evaluate marine based pressures on the seahorse species habitats. Corresponds to Section 4.5.2.1 in text.

Seahorse species:	
Marine based activities	**Risk**
Marine based activities cause no or little damage and/or loss to seahorse habitats	Low
Marine based activities cause moderate damage and/or loss to seahorse habitats	Medium
Marine based activities cause severe damage and/or loss to seahorse habitats	High
Marine based activities cause unknown damage and/or loss to seahorse habitats	Unknown
Reasoning	

Table 4.5c. Evaluate land based pressures on the seahorse species habitats. Corresponds to Section 4.5.2.2 in text.

Seahorse species:	
Land based activities	**Risk**
Land based activities cause no or little damage and/or loss to seahorse habitats	Low
Land based activities cause moderate damage and/or loss to seahorse habitats	Medium
Land based activities cause severe damage and/or loss to seahorse habitats	High
Land based activities cause unknown damage and/or loss to seahorse habitats	Unknown
Reasoning	

Table 4.5d. Evaluate climate change pressures on the seahorse species habitats. Corresponds to Section 4.5.2.3 in text.

Seahorse species:	
Climate change	Risk
Climate change cause no or little damage and/or loss to seahorse habitats	Low
Climate change cause moderate damage and/or loss to seahorse habitats	Medium
Climate change cause severe damage and/or loss to seahorse habitats	High
Climate change cause unknown damage and/or loss to seahorse habitats	Unknown
Reasoning	

Table 4.5e. Evaluate indicators of habitat health. Corresponds to Sections 4.5.3 and 4.5.4 in text.

Seahorse species:	
Indicators of seahorse habitat health	**Risk**
No observed change in any indicators of habitat health	Low
Moderate observed change in any indicators of habitat health	Medium
Large observed change in any indicators of habitat health	High
Unknown change in any indicators of habitat health	Unknown
Reasoning	

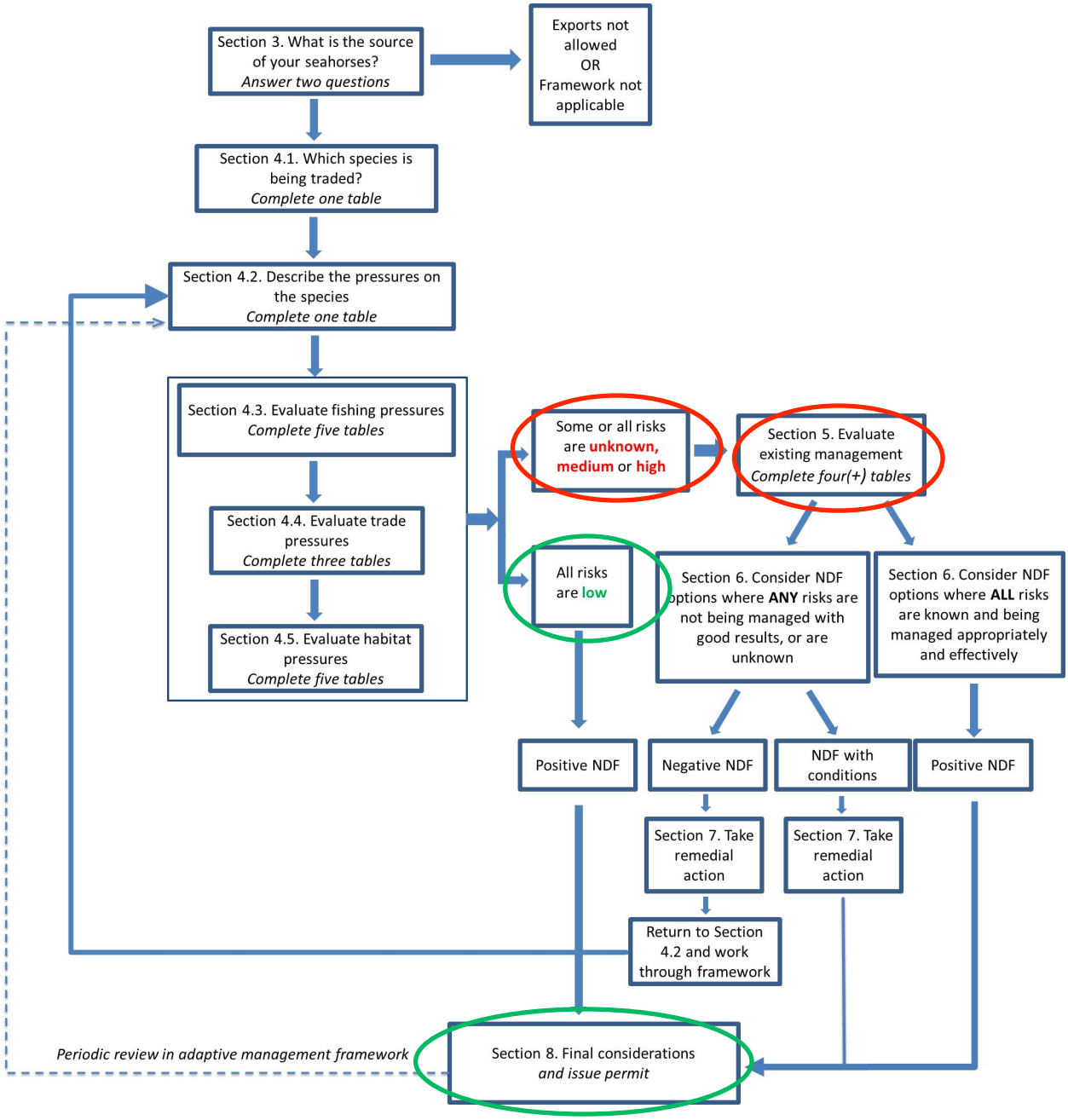
Congratulations! You have now evaluated the risk to your species from the pressures of habitat damage and/or loss (if any).

At this time please review Worksheets 4.3, 4.4 and 4.5.

If **ANY** of the risk inferred from fishing, trade and/or habitat pressures has been identified as **high, medium or unknown**, then move to Section 5 where you will consider how existing management (if any) might help reduce these pressures.

If **ALL OF** the risks inferred from fishing, trade and/or habitat pressures have been identified as **low** then trade can be considered non-detrimental to wild populations and you can issue a "positive NDF" (see Section 6 for more on NDF types). Go to Section 8.

Where we are headed next



5. EVALUATE EXISTING MANAGEMENT

This section will guide you as to **assess if existing management is sufficient to mitigate the risks** identified in Section 4, in support of sustainable seahorse populations and so sustainable trade. You will consider whether existing management is:

- **appropriate** for the pressures facing your seahorse species (Section 5.3.1);
- **implemented** (Section 5.3.2); and
- **effective** at mitigating the identified risks (Section 5.3.3).

5.1. Why consider management?

For most species included in CITES Appendix II, you will need management plans in order to grant an export permit. Condition 1.2.1 for granting an export permit (see Section 1.2, above) is to ensure that proposed export of the seahorses will not harm wild populations – and this usually relies on developing good management. **Pressures do not have to be a problem for seahorses where they are appropriately and effectively managed.**

5.2. Potential management responses for seahorses

Management measures that may benefit seahorses can be species-specific or they may be generic:

- **Species-specific** management measures are those directed at the seahorse species concerned (e.g. a minimum size limit).
- **Generic** management measures are those in place to manage the overall catch or effort of a fishery, and though not specific to seahorses they may confer on them some benefit (e.g. spatial restrictions on destructive fishing activities). You need to know the overlap of the general measure with the species in space and time to determine if it can mitigate risks (refer back to Table 4.2a for information on your species range, depth and habitat preferences).

The following are 12 potential management tactics for seahorses. Each has its own benefits and limitations, which we now sketch. All measures we present are proximate, and will require distal transitions to be realised; for example, shifts in socio-economic and/or governance structures. Also, **you should not feel restricted by this list of measures** – we have summarised the most common measures, but other management possibilities certainly exist.

For all tactics, it is important to realise that seahorses can be sold at sea or brought to land at many different locations, making it difficult to track total take (i.e. catch volumes).

5.2.1. Limited entry

- *What:* The aim is to limit the total number of seahorses taken in the fishery by restricting participation in the fishery (e.g. the number of fishers, boats and/or gears). This is usually regulated using a system of licenses or permits. BUT limiting the entry may not limit the catch, therefore this tactic is normally used together with other effort controls [such as fishing restrictions in space or time (5.2.2, 5.2.3 or 5.2.4), or catch quotas (5.2.5)].
- *How:* For seahorses, the ideal aim should be to use limited entry as a tool to reduce the total fishing mortality (F) to ≤ half estimated natural mortality (M) of the species (*see 5.2.5. Catch quota*).

5.2.2. Permanent, no-take Marine Protected Areas (MPAs) also known as Reserves

- *What:* The aim of MPAs is to eliminate some fishing pressure on the seahorses and to protect seahorse habitats. The hope is that some seahorse adults or young will spill out of the MPA to help repopulate adjacent areas. At the very least, the MPA will act as a reservoir for seahorses and an insurance policy against other mismanagement. The best approach is to protect areas with known seahorse populations. However, MPAs in seahorse habitats are a good idea even if you are not sure about the nature of the seahorse populations in the area.
- *How:* If you do not known where seahorses live, you can determine their locations with the use of underwater rapid assessments, catch landings analyses or discussions with fishers and traders (*more on this in Section 4.3.5 and 4.4.3*). Select areas with good seahorse numbers and sex/size ratios. If such work is impossible or you want to narrow your selections, then consult the IUCN Red List or national conservation assessments for known seahorse habitats by species (see Section 2.2). Many Parties have national guidelines on how much of the ocean should be included in MPAs. The recent global marine protection targets range from 10-30%[17]. So you would want to protect 10-30% of each seahorse habitat in order to make sound NDFs.

5.2.3. Gear restrictions (spatial)

- *What:* The aim is to reduce some problematic fishing pressure on the seahorses and to protect seahorse habitats. This approach may be particularly important when unsustainable numbers of seahorses are caught by destructive and non-selective gear such as trawlers.
- *How:* See 5.2.2 (MPAs).

5.2.4. Gear restrictions (temporal)

- *What:* The aim is to reduce (i) all fishing pressure or (ii) some problematic fishing pressure on the seahorses and to protect seahorse habitats during particular periods when it might offer the greatest benefit. For example, it may be useful to stop fishing – or stop using certain gears – during periods of peak seahorse reproduction, thereby increasing the chances that seahorses will be able to reproduce – and their young disperse – before being captured. Such temporal gear restrictions may also be useful as we learn more about the offshore migrations that some seahorse populations appear to make. Finally, temporal restrictions may just be a good way of reducing total fishing pressure, even without any seasonal variation in seahorse growth, reproduction or movement.
- *How:* Try to discern seasonal patterns in seahorse behaviour. Consult available information on seahorse breeding seasons by species, or carry out underwater or fisheries monitoring to

[17] http://iucn.org/about/work/programmes/marine/marine_our_work/marine_mpas/

deduce them (*more on this in Section 4.3.5 and 4.4.3*). Otherwise, just implement temporal closures and monitor overall take from the area.

5.2.5. Catch quota

- *What:* The aim is to limit how many seahorses are being caught by limiting fishing mortality (F) for the entire area and/or gear. It is usually only possible to monitor landings. In that case, catch quotas must be set conservatively to account for discarding at sea before landing. Uncertainties in key variables (abundance, biomass and F) result in a high risk of overfishing, so catch quotas should be combined with other precautionary measures.
- *How:* For seahorses, an appropriately precautionary catch quota would be calculated as follows: current abundance*biomass^{-1}*F, where $F \leq 0.5*M$ (M = natural mortality). Setting this quota therefore requires an estimate of F or M, and of current abundance/biomass. You should be conservative when estimating abundance, especially given the patchiness of seahorse populations. If you are uncertain about any of these variables, you could try setting a precautionary catch quota and then monitoring population trends to infer its effects (*see Section 5.5.3*) – in the spirit of adaptive management.

5.2.6. Minimum size limit

- *What:* The aim of a minimum size limit is to ensure seahorses can reproduce before being exploited, thereby increasing the chance that they will be replaced in the population. Such a measure can also sometimes help reduce overall take from the wild.
- *How:* The CITES Animals Committee has recommended a minimum height of 10 cm for all seahorses in trade[18], and the same limit could apply to seahorses in fisheries. This recommendation is under review and may well increase. You could also set a species-specific minimum size limit based on current understanding of the species size at maturity.
- *Note:* mesh size regulations on fishing nets are not likely to select for seahorses by size, as seahorses have body shapes that get them caught no matter what the mesh size is.

5.2.7 Maximum size limits

- *What:* The aim of a maximum size limit is to leave the larger seahorses in the sea as each larger seahorse contributes more than a smaller seahorse to the next generation. This is because larger seahorses produce more eggs (females) and carry more, and produce larger (and so presumably fitter), young (males).
- *How:* There is currently no recommended maximum height for seahorses, but Project Seahorse would be able to advise Parties on setting such a limit.
- *Note:* mesh size regulations on fishing nets are not likely to select for seahorses by size, as seahorses have body shapes that get them caught no matter what the mesh size is.

5.2.8 Slot size limits

- *What:* Slot limits means that you set both a minimum (5.2.6) and a maximum (5.2.7) size limit. The aim is to allow seahorses to reproduce before being exploited AND to leave the larger and so more fecund individuals in the sea.
- *How:* See 5.2.6 for a recommendation with respect to the lower end of the slot size, and 5.2.7 for the upper end of the slot size.

[18] CITES Decision 12.54: http://www.cites.org/eng/notif/2004/033.pdf

- *Note:* mesh size regulations on fishing nets are not likely to select for seahorses by size, as seahorses have body shapes that get them caught no matter what the mesh size is.

5.2.9 Leaving pregnant males

- *What:* The aim is to leave pregnant males in the water until they have released their young, hopefully to help secure wild populations.
- *How:* Ban capture of pregnant males in their natural habitat until they have given birth. This could be best achieved in target fisheries, but also by restricting nonselective fishing gears during period of peak reproduction (see 5.2.3).

5.2.10. Export quota

- *What:* The aim is to limit export volumes in the expectation that this will limit catches. *This will not happen where seahorses are obtained as bycatch*. Any use of quotas should be combined with other precautionary measures, given the uncertainty as to how export quotas influence catches.
- *How:* For seahorses, a necessarily precautionary export quota would result in total fishing mortality (F) at ≤ half estimated natural mortality (M) of the species (*see 5.2.5 re Catch quota*).

*5.2.*11. Reintroduction/supplementation

- *What:* The aim is to replace seahorse populations in areas where they have been extirpated (reintroduction) or – much more commonly – to increase seahorse densities in areas where they have been depleted (supplementation).
- *How:* The IUCN Reintroduction Specialist Group recommends against most releases of captive animals unless the wild population has disappeared AND the cause of the declines is known and has been removed AND the released animals will be very carefully monitored. In general, supplementation poses risks to wild populations (disease and genetic issues) with few likely benefits. Any releases need to be carried out with extreme caution and following best practices. Otherwise they will threaten the vital remnant wild populations. The IUCN 'Guidelines for Reintroductions and Other Conservation Translocations' can be found at http://ow.ly/mRgRG.

5.2.12. Habitat restoration

- *What:* The aim is to restore seahorse habitats in areas where they have been damaged or lost – in the hopes that this will in turn support seahorse populations (either return to areas where they have been lost, or increase in density in areas where they have been depleted). **It is much easier to protect habitats before they are lost than it is to restore them** – see 5.2.2, 5.2.3, 5.2.4**.**
- *How:* It depends on the habitat – but resources exist for restoring seagrasses and mangroves, and reviving coral reefs. However as with reintroduction/supplementation of seahorses (5.3.11), the threats that led to the original habitat declines need to have been eliminated before you proceed with any such activities.

5.3. Evaluating management responses

Parties should consider at least three factors when evaluating a management response in the context of seahorses.

- Are existing management measures **appropriate** to the pressures they need to address? (i.e. can they relieve the conservation threats, fishing and/or trade pressures?) (Section 5.3.1)
- Are the management procedures definitely being **implemented** (i.e. used/met with compliance and/or enforced)? (Section 5.3.2)
- Are the management procedures definitely effective (i.e. **monitored** with good results)? (Section 5.3.3).

5.3.1. Which measures are suitable for which pressures?

Please consult Table 5a to see which of the management responses outlined above (in Sections 5.2.1 through 5.2.12) may be most **appropriate to address pressures from target or bycatch fisheries for seahorses**. The management responses are mostly concerned with fishing, but we have indicated the appropriateness of the response for relieving pressures on seahorse habitats – so Parties may choose measures that can address multiple pressures at once.

5.3.2. Are the measures being implemented?

Please consult Table 5a to see how you can determine if the management measure is actually being used. **Implementation depends on adequate compliance and/or enforcement**.

5.3.3. Is the management effective?

You will need to track population trends over time in order to determine the effectiveness of any intervention. Population trends can be deduced from population surveys underwater, or by surveying fishery catches or landings or trade volumes over time, or stakeholder interviews. We discussed these monitoring options in more detail in Sections 4.3.5 and 4.4.3.

Where populations are estimated to be stable or increasing in size over time, then management can be considered effective.

If, however, population numbers are declining or you observe other indicators of adverse impacts (as described in Sections 4.3.4 and 4.4.2), then your existing management plan needs work. Is it either not the right management for the pressures (as per Section 5.3.1), it is not enough management (e.g. need more MPA coverage), or implementation is inadequate (i.e. not enough enforcement or compliance, as per Section 5.3.2). **If you management needs work you need to consider remedial action, which we cover in Section 7**.

Please complete Worksheet 5 to evaluate your existing management.

Table 5a. Potential management responses and their appropriateness for mitigating pressures on seahorse populations from fisheries and habitat pressures.

Text section	Potential management response	Appropriate for targeted capture	Explanation	Appropriate for incidental capture (including both active and static gear types)	Explanation	Appropriate for additional pressure from habitat loss	Explanation	Implementation
5.2.1	Limited entry	YES when combined	Only when used in combination with seahorse catch quotas**.**	YES when combined	Only when used in combination with seahorse catch quotas and/or spatial restrictions of gears that catch seahorses.	YES when combined	Only when used in combination with MPAs or spatial restrictions of gears that catch seahorses.	Determined by monitoring fishing activity.
5.2.2	Permanent, no-take Marine Protected Areas (i.e. reserves)	YES	Where enforced these buffer against all pressures.	YES	Where enforced these buffer against all pressures.	YES	Where enforced these buffer against all pressures.	Determined by monitoring fishing activity in and around the MPAs by probing where seahorses are being caught.
5.2.3	Gear restrictions - spatial	YES	Where enforced these buffer against fishing pressures.	YES	Where enforced these buffer against fishing pressures.	YES	Where enforced these buffer against gear pressures on habitats.	As for 5.2.2 (MPAs) for select gear.
5.2.4	Gear restrictions - temporal	Cautiously	Only when temporal gear restrictions coincide with peak seahorse reproduction periods.	Cautiously	Only when temporal gear restrictions coincide with peak seahorse reproduction periods.	NO, usually	Not appropriate where habitats are still subject to destructive fishing practices at other times of the year.	Determined by monitoring fishing activity in and around the periods of closure and by probing where and when seahorses are being caught.
5.2.5	Catch quota	YES	Fishers targeting seahorses are able to limit their catch volumes and so fishing mortality.	Cautiously	Appropriate only where a fishery is completely closed once seahorse bycatch quota is met.	Not applicable	Output controls do not protect habitats.	Determined by monitoring catch and/or landings.

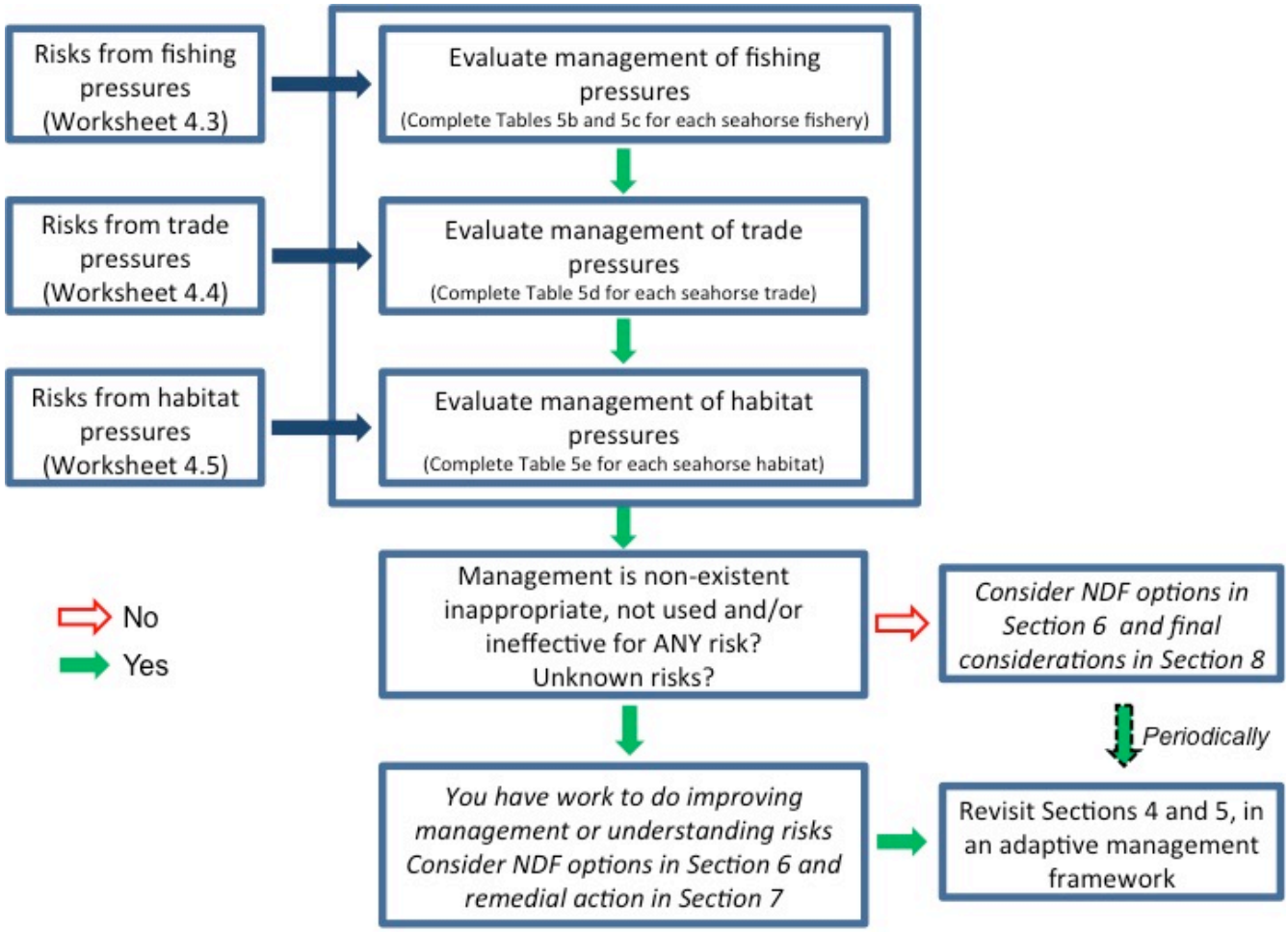
Table 5a. Continued...

Text section	Potential management response	Appropriate for targeted capture	Explanation	Appropriate for incidental capture (including both active and static gear types)	Explanation	Appropriate for additional pressure from habitat loss	Explanation	Implementation
5.2.6	Minimum size limit	YES	Fishers targeting seahorses are able to be selective, taking only those larger than the agreed minimum size, and leaving smaller individuals where they are found.	NO	Non-selective fishing gears that catch seahorses cannot be selective for seahorse size – mesh size does not matter.	Not applicable	Output controls do not protect habitats.	Determined by monitoring the size of seahorses in the catch and/or landings and/or trade.
5.2.7	Maximum size limits	YES	Fishers targeting seahorses are able to be selective, taking only those smaller than the agreed maximum size, and leaving larger individuals where they are found.	NO	Non-selective fishing gears that catch seahorses can not be selective for seahorse size – mesh size does not matter.	Not applicable	Output controls do not protect habitats.	As for 5.2.7 (Minimum size limits).
5.2.8	Slot size limits	YES	Fishers targeting seahorses are able to be selective, taking only those that fall between the agreed minimum and maximum size limits, leaving other individuals where they are found.	NO	Non-selective fishing gears that catch seahorses can not be selective for seahorse size – mesh size does not matter.	Not applicable	Output controls do not protect habitats.	As for 5.2.7 (Minimum size limits).
5.2.9	Leaving pregnant males	YES	Fishers targeting seahorses are able to be selective, leaving pregnant males where they are found.	NO	Non-selective fishing gears that catch seahorses can not be selective for seahorse reproductive state.	Not applicable	Output controls do not protect habitats.	Determined by monitoring the reproductive status of male seahorses in the catch and/or landings and/or trade.

Table 5a. Continued...

Text section	Potential management response	Appropriate for targeted capture	Explanation	Appropriate for incidental capture (including both active and static gear types)	Explanation	Appropriate for additional pressure from habitat loss	Explanation	Implementation
5.2.10	Export quota	NO, usually	Only where there is a direct feedback loop that generates a catch reduction of seahorses.	NO, usually	Only where there is a direct feedback loop that generates a catch reduction of seahorses.	Not applicable	Output controls do not protect habitats.	Determined by monitoring catches, landings or even trade volumes.
5.2.11	Reintroduction/ supplementation	Not if threat is ongoing	There is no evidence that seahorse releases can increase densities of wild seahorse populations.	Not if threat is ongoing	There is no evidence that seahorse releases can increase densities of wild seahorse populations.	Not applicable	-	Determined by monitoring the fate of the newly release seahorses in areas where there were no remaining wild seahorses. Again, the threats that led to original declines need to have been eliminated.
5.2.12	Habitat restoration	YES when combined	Only when combined with Permanent, no-take Marine Protected Areas. No sense increasing seahorse habitats if they are going to be targeted by fishers.	YES when combined	Only when combined with Permanent, no-take Marine Protected Areas. No sense increasing seahorse habitats if they are going to be fished.	Cautiously	Not if threat that caused habitat decline is ongoing	Determined by monitoring the restored habitats for increases in the number of seahorses.

Flow chart to support Section 5. Evaluate existing management



Worksheet 5. Evaluate existing management plan

This worksheet seeks to evaluate if your existing management is sufficient to mitigate the pressures you have described in Table 4.2a and evaluated in Sections 4.2 through 4.5. It is important you read through Section 5 before completing these tables.

First, transfer the risks *from the tables of Worksheets 4.3, 4.4 and 4.5 to Tables 5b, 5c, 5d and 5e, respectively. You can complete this section considering risks from all target fisheries together in Table 5b, all bycatch fisheries together in Table 5c, all trades together in Table 5c, and all habitats together in Table 5d – but* ***it is ideal if you repeat Tables 5b, 5c, 5d and 5e for every problem fishery, trade and habitat, respectively, as you described in Table 4.2a. This will allow you to be more specific in your evaluation of management to mitigate those risks (this section), and in planning the way forward (Sections 6 and 7).***

Second, describe existing management responses that are appropriate to the risks *– you can consult Table 5a to determine if a management response is appropriate for the risk, but you are not restricted by the list of measures in Table 5a –other management possibilities certainly exist.*

Third, indicate if the management response is implemented *(complied with and/or enforced, Section 5.3.2 and Table 5a)* ***and/or effective*** *(populations are observed to be stable, or increasing in numbers, over time, Section 5.3.3.).*

Table 5b. Evaluate existing management for **target** fishing pressures.

Seahorse species:				
Target fishing method/gear:				
Table	**Risk**	**Management response**	**Implemented?**	**Effective?**
	Transfer risks from *Worksheet 4.3*.	List existing management responses appropriate to the risk *(Consult Table 5a)*.	Indicate: Yes, No, Unknown *(Consult Table 5a)*.	Indicate: Yes, No, Unknown *(Consult Section 5.5)*.
Diversity of fishing methods/gears *(from Table 4.3a)*				
Fishing mortality *(from Table 4.3b)*				
Fishing selectivity *(from Table 4.3c)*				
Discarding practices *(from Table 4.3d)*				
Indicators of fishing impacts *(from Table 4.3e)*				

Table 5c. Evaluate existing management for **bycatch** fishing pressures.

Seahorse species:				
Bycatch fishing method/gear:				
Table	**Risk**	**Management response**	**Implemented?**	**Effective?**
	Transfer risks from *Worksheet 4.3*.	List existing management responses appropriate to the risk *(Consult Table 5a)*.	Indicate: Yes, No, Unknown *(Consult Table 5a)*.	Indicate: Yes, No, Unknown *(Consult Section 5.5)*.
Diversity of fishing methods/gears *(from Table 4.3a)*				
Fishing mortality *(from Table 4.3b)*				
Fishing selectivity *(from Table 4.3c)*				
Discarding practices *(from Table 4.3d)*				
Indicators of fishing impacts *(from Table 4.3e)*				

Table 5d. Evaluate existing management of trade pressures.

Seahorse species:					
Trade/use:					
Table		**Risk**	**Management response**	**Enforced?**	**Effective?**
		Transfer risks from *Worksheet 4.4.*	List existing management responses appropriate to the risk *(Consult Table 5a)*.	Indicate: Yes, No, Unknown *(Consult Table 5a)*.	Indicate: Yes, No, Unknown *(Consult Section 5.5)*.
Diversity of use *(from Table 4.4a)*	**international trade**				
	domestic trade				
IUU *(from Table 4.4b)*	**fishing**				
	international trade				
	domestic trade				
Indicators of trade impacts *(from Table 4.4c)*	**international trade**				
	domestic trade				

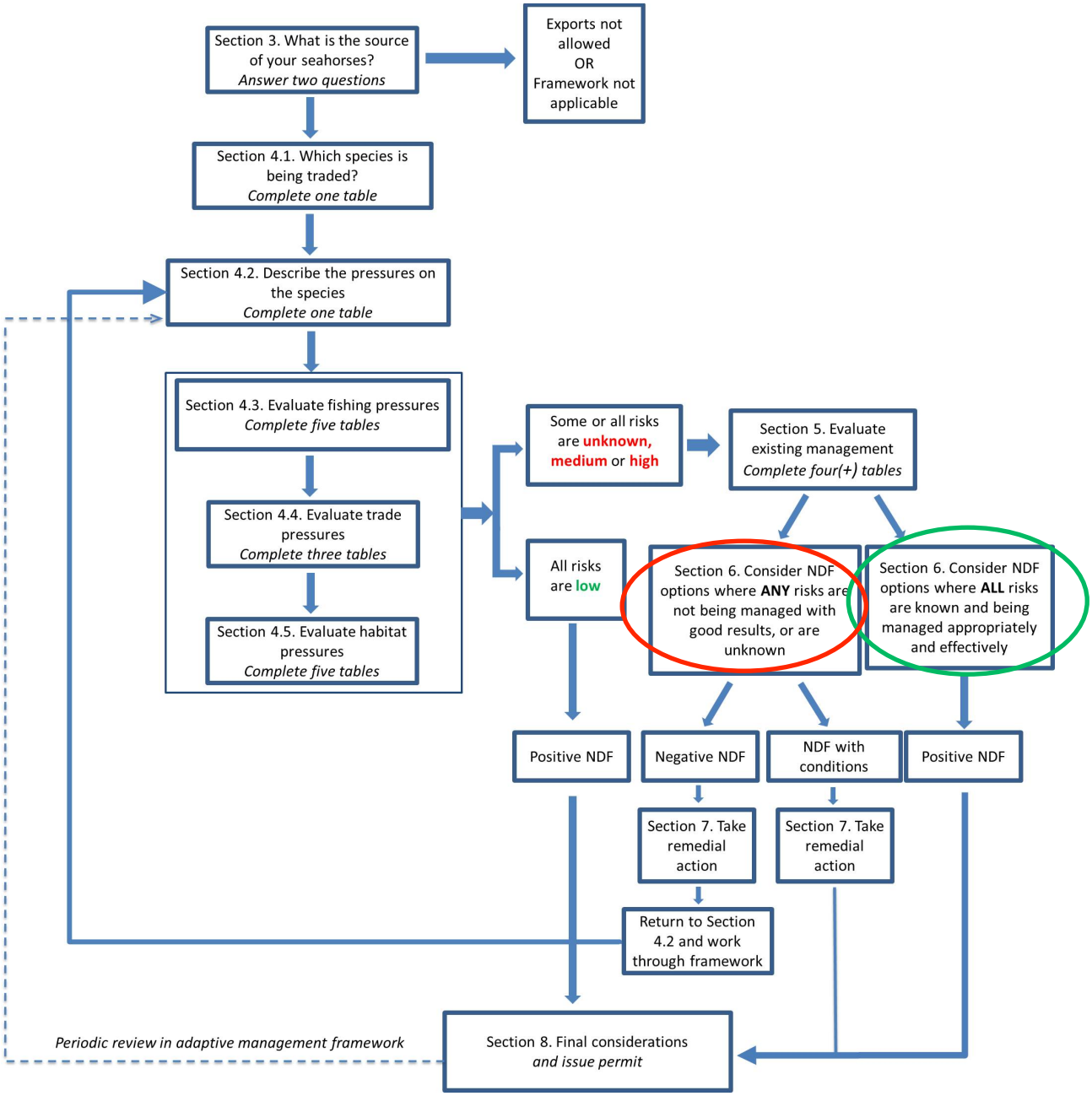
Table 5e. Evaluate management of pressures on seahorse habitats.

Seahorse species:				
Habitat type:				
Table	**Risk**	**Management response**	**Enforced?**	**Effective?**
	Transfer risks from *Worksheet 4.5.*	List existing management responses appropriate to the risk *(Consult Table 5a).*	Indicate: Yes, No, Unknown *(Consult Table 5a).*	Indicate: Yes, No, Unknown *(Consult Section 5.5).*
Habitat specialization *(from Table 4.5a)*				
Marine based activities *(from Table 4.5b)*				
Land based activities *(from Table 4.5c)*				
Climate change *(from Table 4.5d)*				
Indicators of habitat health *(from Table 4.5e)*				

If any of fishing, trade and/or habitat pressures are medium, high or unknown and/or management is non-existent, inappropriate, not used or ineffectual, then you have work to do before trade can be considered non-detrimental to wild populations.

Section 6 will guide you in making a decision about the NDF, based on your assessments of i) risk from pressures (Section 4) and ii) management (Section 5)

Where we are headed next



6. MAKING A DECISION ABOUT THE NDF

You now need to make a decision about the Non-detriment Finding (NDF). Remember that under CITES provisions, a Scientific Authority should only approve exports that will not be detrimental to survival of the species in the wild.

Remember also that NDFs need to be **scientifically sound and defensible**. This means that the more uncertain you are with respect to risks from pressures (from Section 4) and/or management effectiveness (from Section 5), the more precautionary you should be in your NDF decision.

For shorthand purposes, a finding of non-detriment is referred to as a **positive NDF**, while a finding of conservation detriment is referred to as a **negative NDF**.

A positive NDF can be considered in the very rare case that exports are considered, without a doubt, to be non-detrimental to wild populations. If all risks are known and being managed appropriately and effectively, then you can turn to Section 8 which considers the final steps to take before issuing a permit.

In most cases, however, working through this framework will reveal that the export of seahorses should be limited in order to ensure non-detriment. **Where risks are not being managed with good results, or are unknown, you could consider a negative NDF or an NDF with conditions.**

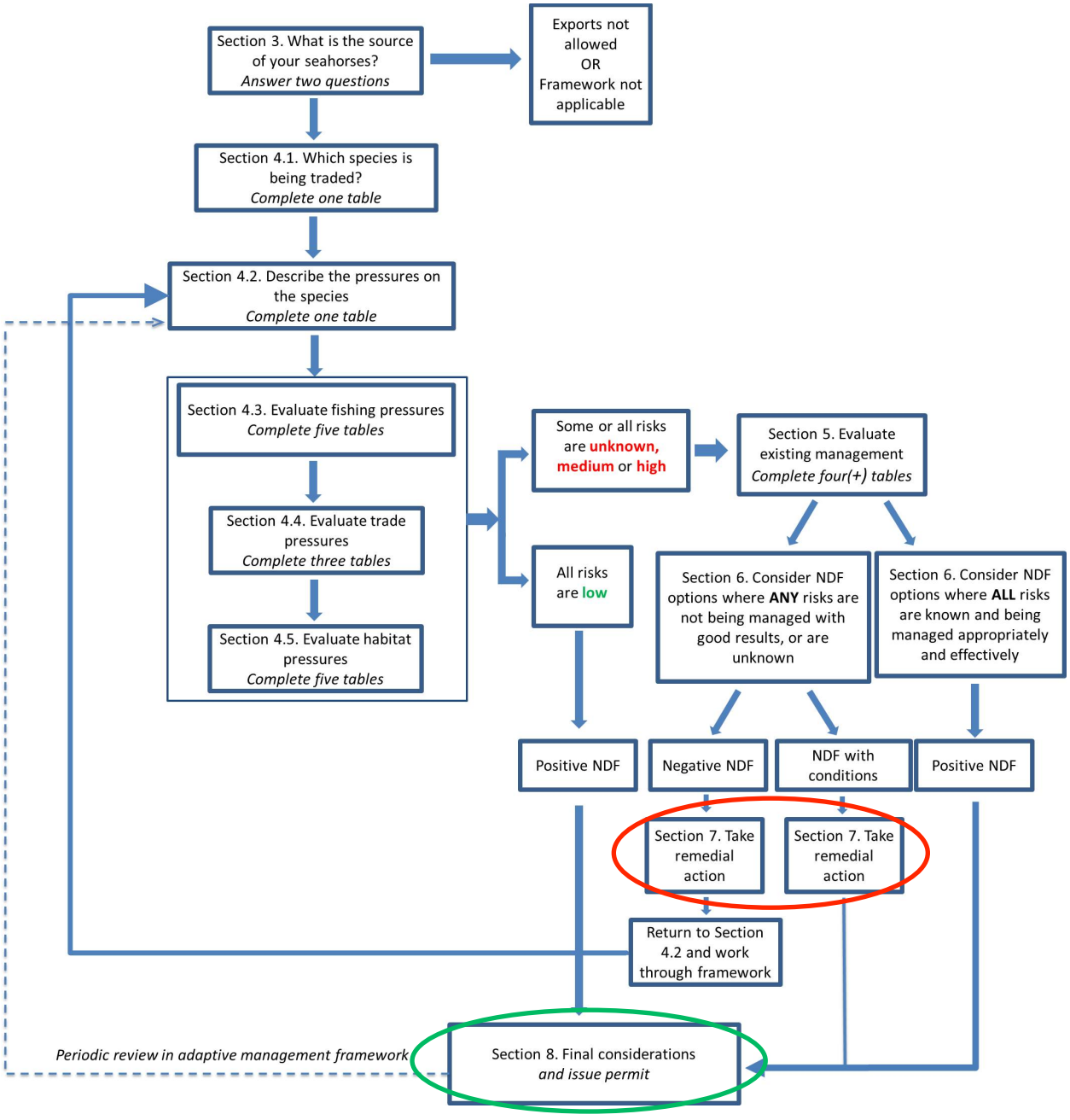
An NDF with conditions allows for precautionary levels of exports while risks are reduced, gaps in management are addressed, or quality of information is improved..

In the case that you have work to do before trade can be considered non-detrimental to wild seahorse populations, **Section 7 offers guidance and advice about how to improve management** action (Section 7.1) and/or **fill knowledge gaps** (Section 7.2), and **use the framework to inform a national action plan for seahorses** (Section 7.3), all in support of adaptive management.

Where any risks are not being managed with good results, or are unknown, turn to Section 7.

If all risks are being managed appropriately and effectively, then you can turn to Section 8.

Where we are headed next



7. REMEDIAL ACTION

7.1. You have unmanaged risks. Now what?

If you identified any risks from fishing, trade or habitat pressures as medium or high, and management is non-existent, unknown, inappropriate, not used or ineffectual **you need to develop an action plan to improve your management so exports can be allowed** (in the case of a negative NDF) **or NDF conditions adjusted** (in the case of an NDF with conditions)**.**

There are three main actions to consider:

- Where existing management is non-existent or inappropriate, you can **add appropriate management** (consult Table 5a).
- Where existing management is appropriate but not used, you can **increase enforcement** and/or **increase incentives for compliance**.
- Where existing management is appropriate and used, but ineffectual, you can **increase the amount or diversity of management** (e.g. increase MPA coverage).

7.2. You have unknown risks. Now what?

If you identified any risks from fishing, trade or habitat pressures as unknown you have research to do.

There are many gaps in our understanding of the life history and conservation status of many seahorse species. Still, a lot can be done with little information. This section offers guidelines for data collection priorities in the spirit of adaptive management – you can improve your NDFs as you learn more. The more your seahorse populations are exploited or under pressure from human actions, the more attention to you will need pay to improving your NDFs.

We must re-emphasise that any data are better than no data. Authorities should not feel overwhelmed by the length of these data "wish" lists, but rather use them as starting points for which to design pragmatic programs for monitoring their populations, fisheries and trades.

Three different types of data should be collected: **population, fisheries and trade data**. Project Seahorse has made available a number of Technical Reports for Research and Management, which will prove useful for Parties who want to develop and implement data collection and population monitoring programs (see www.projectseahorse.org/NDF and www.iseahorse.org/trends).

7.2.1. Population data (see also Section 4.3.5) **–** Population data can be collected via fishery-independent programs or by sub-sampling fishery catches or landings – and includes:

- Species composition
- Presence/absence
- Densities/abundance indices
- Sex ratio (males, females, juveniles)
- Size structure
- Reproductive status (males – pregnant/not pregnant)
- Habitats/depth of collection
- Variation in seahorse distribution in time and space

7.2.2. Fisheries data (see also Section 4.3.5) – In addition to these population data, the following types of fisheries data should be collected in order to understand the effects of fishing on wild populations:

- Methods of extraction (e.g. target/incidental, gear types)
- Fishing locations
- Seasonality of catches
- Seahorse catch volumes (including discards)
- Seahorse catch characteristics – species, sex ratios, size structure, reproductive status
- Fishing effort (number of boats, number of trips, duration of tows, etc)

The goal is to develop an index of CPUE (catch per unit effort) by location and species.

7.2.3. Trade data (see also Section 4.4.3) – Trade data should also be collected in order to understand the effects of trade on wild populations:

- Trade per unit effort (TPUE)
- Volumes (at different trade levels)
- Values (at different trade levels)
- Uses (domestic and international)
- Trade structure
- Trade routes
- Seasonality of the trade

7.3. Planning the way forward

The most important thing is to get going. Choose and initiate key actions, then add more as seems necessary and feasible. A lot can be achieved by changes in one fishery even if you can't address all exploitation. Much can be improved by better management of one habitat or region, even if others also need attention. Some helpful changes are better than none at all.

You can use Tables 5b through 5e to set your priorities for action – either for improving management of known risks (7.1) or filling gaps for unknown risks (7.2).

We suggest using three criteria to set priorities for action:

- **Take actions to address the most critical risks** – Pick out the top one or two pressures and implement actions to relieve those pressures. Use completed Tables 5b through 5e to identify which fisheries and/or trades are putting the most pressure on your seahorse species, and/or which seahorse habitats are at greatest risk. One example that will apply to many Parties is to **implement or enforce constraints on trawl fisheries.**

- **Take actions that are easier to implement** – Pick out one or two unmanaged or unknown risks that could be addressed with relatively little effort. This will allow you to make positive gains for seahorses right away. Use completed Tables 5b through 5e to identify risks that meet this criterion. The key example here, which will apply to most Parties, is to **implement a catch landings monitoring plan for seahorses** – to better understanding potential impacts from fishing (4.3.5), evaluate the effectiveness of any existing management (5.3.3), and also improve understanding of the species biology.

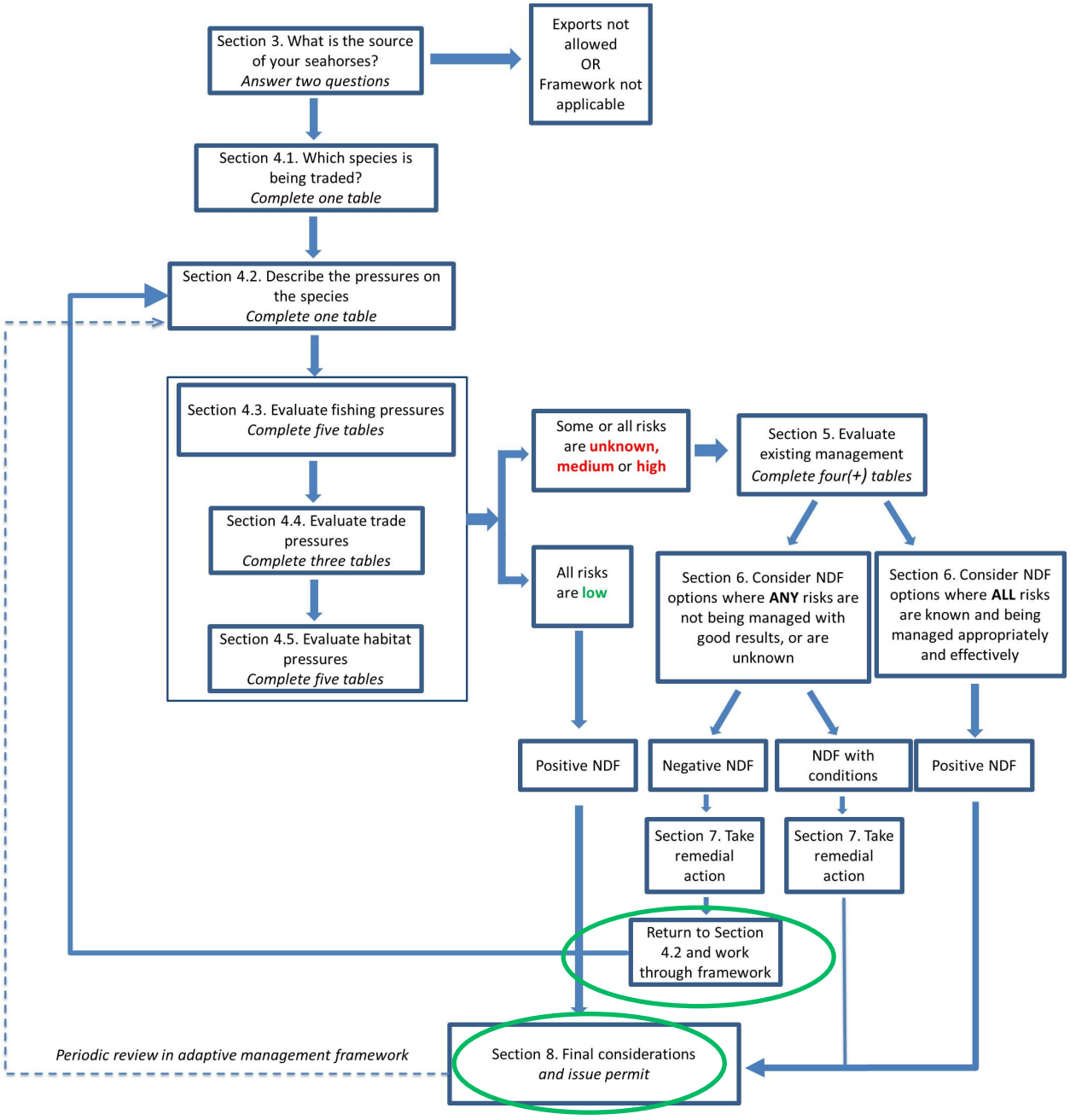
- **Take actions that reinforce your current commitments** – Pick out one or two unmanaged or unknown risks that can be addressed by taking actions you are already committed to implementing. We recognise that managing for sustainable seahorse fisheries and so trades is adding to your workload – but it will help to choose actions that address several problems at one time. A key example here would be actions that would also meet your Party's **commitment to the Aichi Biodiversity Targets of the Convention on Biological Diversity** (https://www.cbd.int/sp/targets/; e.g. Target 6: sustainable fisheries; Target 11: marine protection). Use completed Tables 5b through 5e to identify risks that could be addressed by actions you must already take.

Choosing one or two actions from each of these categories would be **a good start at a national plan of action for seahorses**. In defining the plan, you must describe the actions to be taken, define the actors, and determine the timelines. **The IUCN Species Conservation Planning Sub-Committee has some great resources on strategic planning for species conservation** (see bit.ly/1mKWc4T).

As you plan your remedial steps, we urge you to **consult the action and research recommendations issued by the CITES Animals Committee** to some Parties through the CITES Review of Significant Trade. They provide important CITES-sanctioned input to your own action plans and are available as an Annex to this framework (Annex 1).

When you have adjusted your management, or filled knowledge gaps, you should work through the framework again starting at Section 4.2. You may need to make several adjustments before you can be confident your seahorse exports are not harming wild populations – but every adjustment will get you closer to making a positive NDF.

Where we are headed next



8. BEFORE ISSUING A PERMIT - FINAL CONSIDERATIONS

You can be hopeful. Your wild seahorse populations may be under pressure, but you are trying to address these pressures effectively. Keep up the good work and you can continue to have both healthy wild seahorse populations and a seahorse trade, as intended with a CITES Appendix II listing.

Just two more issues to consider before issuing that permit. If the proposed export is of dried seahorses, skip to Section 8.2. Otherwise, start at 8.1.

8.1. Humane transport of live animals.

It is now time to consider condition 1.2.3 for issuing a permit for international export of Appendix II listed species – that *live* seahorses have to be treated humanely when shipped from one country to another.

To understand what this means for seahorses, consult the *CITES Guidelines for transport and preparation for shipment of live wild animals and plants* at: http://www.cites.org/eng/resources/transport/E-TranspGuide.pdf.

If your seahorses are going to be treated well during shipping, you can move to Section 4.6.2.

8.2. The paperwork matters.

A clear requirement and benefit of a CITES listing is that all Parties must report their export trade to CITES each year. Each Management Authority is obliged under the Convention to compile annual reports on that Party's exports in all Appendix II listed species. These trade data are held in the CITES Trade Database, managed by The United Nations Environmental Programme's World Conservation Monitoring Center (UNEP-WCMC) (http://www.unep-wcmc-apps.org/citestrade/trade.cfm). The information required in each permit is clearly outlined by CITES (http://www.cites.org/eng/res/all/12/E12-03R15.pdf).

The submitted data should allow analysis of the international trade in threatened species. Unfortunately, the many gaps, discrepancies, oddities and contradictions in the CITES database mean that it can be very difficult to assess the international trade in seahorses – and by proxy, the possible impacts on wild seahorse populations[19].

[19] http://www.fisheries.ubc.ca/publications/tracking-international-trade-seahorses-hippocampus-species

Parties should do their utmost to follow best practices in reporting, thereby ensuring the data you report are as valuable as possible.

- Report your exports. Please complete your annual report submissions to CITES, and on time. Records often arrive several years late, greatly affecting the reliability of global analyses.
- Verify the species listed on a permit is the one being exported. Seahorses are difficult to identify, so do not assume the applicant has it right. Then report to the species level and not just as *Hippocampus* spp.
- Specify shipment units. If you leave the unit blank it defaults to 'individuals' in the CITES database. You need to be clear if your shipment was actually by weight.
- Include export records of derivatives/pre-package medicines (with clear indication of their seahorse content) to the CITES database. This is a hugely growing aspect of TM and needs careful consideration, not least as the species and sizes of seahorses in prepared medicines are no longer visible to consumers or practitioners.

Well done. You did it. Take a break. Then review this guide again. Seahorse populations, fisheries and trades are always changing so it pays to monitor and evaluate regularly in a form of adaptive management. You need to know that your management measures are actually ensuring that the exports are not detrimental to the wild populations, as required by CITES.

The final part of this framework, Section 9, lists some useful resources you can consult for more information on seahorses and CITES/NDFs. Read on.

9. USEFUL RESOURCES

9.1. Seahorses

Key resources with respect to seahorse life history, conservation and management, fisheries and trades and technical guidelines can be found at: http://seahorse.fisheries.ubc.ca/seahorses**.**

Project Seahorse also hosts a citizen science site for seahorses – iSeahorse (www.iSeahorse.org)**.** Simply put, iSeahorse is a tool for seahorse science and conservation. iSeahorse harnesses the power of 'citizen scientists' — anyone, anywhere in the world who sees a seahorse in the wild — to improve our understanding of these animals and protect them from overfishing and other threats. Scientists from Project Seahorse and seahorse experts around the world will use your vital information to better understand seahorse behaviour, species ranges, and the threats seahorses face.

9.2. CITES and NDFs

- CITES website on NDFs (http://www.cites.org/eng/prog/ndf/index.shtml)
- CITES Species database (http://www.cites.org/eng/resources/species.html)
- CITES sig trade database (http://sigtrade.cites.org/)
- WCMC CITES-database (http://www.unep-wcmc-apps.org/citestrade/trade.cfm)
- Checklist to assist in making non-detriment findings for Appendix II exports (http://data.iucn.org/dbtw-wpd/edocs/SSC-OP-027.pdf)
- Workshop summary for International Expert Workshop on CITES Non-Detriment Findings, Cancun, Mexico in 2008 (http://www.cites.org/eng/com/ac/24/E24-09-01.pdf)

ANNEX 1. CITES RECCOMENDATIONS TO PARTIES UNDER RST

The following are the research and management recommendations made by the CITES Animal's Committee to Thailand, Viet Nam, Guinea and Senegal during the Review of Significant Trade process.

THAILAND: Recommendations for *K. kelloggi, H. kuda* and *H. spinosissimus*.
Extracted from https://cites.org/sites/default/files/eng/com/ac/26/wg/E26-WG07-R1.pdf.

Within 150 days the Management Authority should:
a) Clarify what legal protection is afforded to these species in Thailand and provide information to the Secretariat on controls or regulation of fishing activity that might otherwise detrimentally impact on seahorse populations;
b) Provide available information to the Secretariat on the distribution, abundance, threats and conservation status of, and any current management measures in place for, the three *Hippocampus* species in Thailand; and
c) Provide justification for, and details of, the scientific basis by which, it has been established that the quantities of the three *Hippocampus* species exported will not be detrimental to the survival of the species and in compliance with Article IV, paragraphs 2 (a) and 3 taking into account any potential unregulated and/or illegal off-take and trade.
d) Initiate measures to ensure that descriptions on all CITES permits are standardized such that trade is only permitted at species level and that, in compliance with Resolution Conf. 12.3, XIV e), trade ceases to be reported or permitted at higher taxon levels (genus or family).

Within one year the Management Authority should:
e) Undertake studies to provide evidence on variation in the spatial and temporal abundance of the three species of *Hippocampus* to enable areas of high seahorse density to be identified and provide the results of the analysis to the Secretariat, as the basis for considering area restrictions on nonselective fishing gear that obtains *Hippocampus* species as bycatch;
f) Examine the technical and logistical feasibility of returning to the sea live seahorses taken as bycatch in various types of fishing gear, particularly by inshore gear such as crab gill nets and other traps, as the basis for considering the feasibility of minimum size limits and/or other output controls.
g) Develop and implement adequate control measures and inspection to enhance the enforcement of the reported ban on trawling within 3-5 km of the coast, as the main means of reducing incidental capture of these *Hippocampus* species;

Within 2 years the Management Authority should:
h) Establish a detailed monitoring program of landings of the three *Hippocampus* species at representative sites, taking into account different gear types and means of extraction and recording catch and effort metrics and provide a report to the Secretariat;
i) Conduct a detailed study of the life history parameters of the three *Hippocampus* species, including growth rate, size and age at maturity, average annual reproductive output, and annual survivorship of different age classes and provide a report to the Secretariat. Based on the outcome of this study, model population responses to exploitation pressures in order to review and revise management measures;
j) Implement additional measures, including spatial and/or temporal restrictions on fishing activities, to support non-detriment findings;
k) Based on the studies and measures in h), i) and j) above, establish an adaptive management programme for extraction of, and trade in, the three *Hippocampus* species, enabling management measures to be reviewed and, if necessary, revised to ensure that trade is not detrimental to the survival of the species in the wild and complies with Article IV.2.a and IV.3;

THAILAND: Recommendations for *H. trimaculatus*.

Extracted from https://cites.org/sites/default/files/eng/com/ac/27/wg/E-AC27-WG-01.pdf.

Keeping in mind the action items contained in AC27 Inf Doc 9 and respecting work that has already been completed for *Hippocampus* species in Thailand:
Within six months the Management Authority should:
a) Clarify what legal protection is afforded to *Hippocampus trimaculatus* in Thailand and provide information to the Secretariat on controls or regulation of fishing activity that might otherwise detrimentally impact on seahorse populations;
b) Provide available information to the Secretariat on the distribution, abundance, threats and conservation status of, and any current management measures in place for *Hippocampus trimaculatus*
in Thailand; and
c) Provide justification for, and details of, the scientific basis by which, it has been established that the quantities of *Hippocampus trimaculatus* exported will not be detrimental to the survival of the species and in compliance with Article IV, paragraphs 2 (a) and 3 taking into account any potential unregulated and/or illegal off-take and trade.

Within one year the Management Authority should:
d) Provide information from studies (existing or new) that assess variation in the spatial and temporal abundance of *Hippocampus trimaculatus* to enable areas of high seahorse density to be identified, as the basis for considering area restrictions on nonselective fishing gear that obtains *Hippocampus* species as bycatch, and provide a report to the Secretariat;
e) Develop and implement adequate control measures and inspection to enhance the enforcement of the reported ban on trawling within 3-5 km of the coast, as the main means of reducing incidental capture of *Hippocampus trimaculatus*;

Within 2 years the Management Authority should:
f) Establish a detailed monitoring program of landings of *Hippocampus trimaculatus* at representative sites, taking into account different gear types and means of extraction and recording catch and effort metrics and provide a report to the Secretariat;
g) Implement additional measures, including spatial and/or temporal restrictions on fishing activities, to support non-detriment findings, in compliance with Article IV.2.a and IV.3.

VIET NAM: Recommendations for *H. kuda*.

Extracted from: https://cites.org/sites/default/files/eng/com/ac/26/wg/E26-WG07-R1.pdf.

Within 90 days the Management Authority should:
a) Clarify what legal protection is afforded to the species and inform the Secretariat whether the present policy allows for export of wild-taken specimens;
b) If there is no intent to allow export of wild specimens of this species for the foreseeable future establish a zero export quota which should be communicated to the Parties by the Secretariat; or
c) If trade is to be allowed, provide a justification for, and details of, the scientific basis by which it has been established that export is not detrimental to the survival of the species and is in compliance with Article IV, paragraphs 2 (a) and 3, taking into account any potential unregulated and/or illegal off-take and trade;
d) Initiate measures to ensure that descriptions on all CITES permits are standardized such that trade is only permitted at species level and that, in compliance with Resolution Conf. 12.3 , XIV e), trade ceases to be reported or permitted at higher taxon levels (genus or family).

Within 2 years the Management Authority should:
e) If trade in wild specimens is anticipated in the future conduct a study of the life history parameters of *H. kuda*, including growth rate, size and age at maturity, average annual reproductive output and annual survivorship of different age classes and make the results available to the Secretariat. Based on the outcome of this study, model population responses to exploitation pressures in order to review and revise export quotas; and if they intend to trade the species in the future,

f) Provide to the Secretariat a justification for, and details of, the scientific basis by which it has been established that any proposed export quota for wild specimens of *H. kuda* will not be detrimental to the survival of the species and is in compliance with Article IV, paragraphs 2 (a) and 3
g) If trade in wild specimens is anticipated in the future, establish a detailed monitoring program of landings of *Hippocampus kuda* at representative sites, taking into account different gear types and means of extraction and recording catch and effort metrics and provide a report to the Secretariat;

GUINEA: Recommendations for *H. algiricus*.

Extracted from https://cites.org/sites/default/files/eng/com/ac/27/wg/E-AC27-WG-01.pdf.

Within six months the Management Authority should:
a) Provide the Secretariat with annual reports for all exports of *Hippocampus* from Guinea for 2007 onwards.
b) Clarify what legal protection is afforded to *Hippocampus algiricus* in Guinea and provide information to the Secretariat on controls or regulation of fishing activity that might otherwise detrimentally impact on seahorse populations;
c) Provide available information to the Secretariat on the distribution, abundance, threats and conservation status of, and any current management measures in place for *Hippocampus algiricus* in Guinea;
d) Provide justification for, and details of, the scientific basis by which, it has been established that the quantities of *Hippocampus algiricus* exported from Guinea will not be detrimental to the survival of the species and in compliance with Article IV, paragraphs 2 (a) and 3 taking into account any potential unregulated and/or illegal off-take and trade;
e) Initiate measures to ensure that descriptions on all CITES permits are standardized such that trade is only permitted at species level and that, in compliance with Resolution Conf. 12.3, XIV, trade ceases to be reported or permitted at higher taxon levels (genus or family) and is recorded with accurate units (kg or individuals).

Within one year the Management Authority should:
f) Provide information from studies (existing or new) that assess variation in the spatial and temporal abundance of *Hippocampus algiricus* to enable areas of high seahorse density to be identified, as the basis for considering area restrictions on nonselective fishing gear that obtains *Hippocampus algiricus* as bycatch and provide a report to the Secretariat;

Within 2 years the Management Authority should:
g) Establish a detailed monitoring program of landings of *Hippocampus algiricus* at representative sites, taking into account different gear types and means of extraction and recording catch and effort metrics and provide a report to the Secretariat;
h) Implement additional measures, including spatial and/or temporal restrictions on fishing activities, to support non-detriment findings for *Hippocampus algiricus*, in compliance with Article IV.2.a and IV.3.

SENEGAL: Recommendations for *H. algiricus*.

Extracted from https://cites.org/sites/default/files/eng/com/ac/27/wg/E-AC27-WG-01.pdf.

Within six months the Management Authority should:
a) Clarify what legal protection is afforded to *Hippocampus algiricus* in Senegal and provide information to the Secretariat on controls or regulation of fishing activity that might otherwise detrimentally impact on seahorse populations;
b) Provide available information to the Secretariat on the distribution, abundance, threats and conservation status of, and any current management measures in place for *Hippocampus algiricus*
in Senegal; and
c) Provide justification for, and details of, the scientific basis by which, it has been established that the quantities of *Hippocampus algiricus* exported from Senegal will not be detrimental to the survival of the species and in compliance with Article IV, paragraphs 2 (a) and 3 taking into account any potential unregulated and/or illegal off-take and trade.

d) Initiate measures to ensure that descriptions on all CITES permits are standardized such that trade is only permitted at species level and that, in compliance with Resolution Conf. 12.3 , XIV, trade ceases to be reported or permitted at higher taxon levels (genus or family) and is recorded with accurate units (kg or individuals).

Within one year the Management Authority should:
e) Provide information from studies (existing or new) that assess variation in the spatial and temporal abundance of *Hippocampus algiricus* to enable areas of high seahorse density to be identified, as the basis for considering area restrictions on nonselective fishing gear that obtains *Hippocampus algiricus* as bycatch, and provide a report to the Secretariat;

Within 2 years the Management Authority should:
f) Establish a detailed monitoring program of landings of *Hippocampus algiricus* at representative sites, taking into account different gear types and means of extraction and recording catch and effort metrics and provide a report to the Secretariat;
g) Implement additional measures, including spatial and/or temporal restrictions on fishing activities, to support non-detriment findings for *Hippocampus algiricus*, in compliance with Article IV.2.a and IV.3