



**WILD-CAUGHT TROPICAL
SHRIMP IMPORTS INTO
THE EU & ASSOCIATED
IMPACTS ON MARINE
TURTLE POPULATIONS:**

The Need for EU Import Restrictions



Comité Régional des Pêches Maritimes et Elevages Marins de Guyane (CRPMEM Guyane)

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- A National Committee (called in French, CNPMEM)
- 14 Regional Committees (called in French, CRPMEM)
- 12 Local and Interdepartmental Committees (called in French, CDPMEM or CIDPMEM).

The Committees for Maritime Fisheries and Marine Fish Farming are composed of elected professionals, union, producer and maritime cooperative representatives coming from every fishing métier.

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At national level, its main interlocutors are State services such as the directorates of the Ministry of Ecology and Sustainable Development (Head Department for Maritime Fisheries and Fish Farming, Head Department for Environment and Biodiversity, etc.), national advisory bodies (National Committee for Ecological Transition, National Committee for Sea and Coastline, etc.), but also the French Parliament and the European institutions.

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Wild-caught Tropical Shrimp Imports into the EU & Associated Impacts on Marine Turtle Populations:

The Need for EU Import Restrictions

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Executive Summary

This study outlines the need and rationale for the European Union (EU) to ensure that effective marine turtle bycatch mitigation measures are adopted by countries exporting tropical trawl-caught shrimp into the EU. Such as regulation would be similar in nature and intent to that which currently exists in the United States. Estimates are made of the amount of shrimp imported into the EU that are potentially implicated in marine turtle bycatch. The need to strengthen EU action is related to the EU's current obligations under the various national and international treaties to which it is party, the various sustainability guidelines it has endorsed, and within the context of its existing regulations. The report concludes with recommendations for action and further research needed. Included in the annexes are new indicative estimates of the number of marine turtle bycatch incidences potentially related to EU shrimp imports. Further annexes outline relevant information concerning the interplay between farmed and wild-caught shrimp, a summary of current EU legislative processes that could be leveraged to strengthen policies already in place and drive new action, and the general situation concerning marine turtle bycatch in the Mediterranean Sea - the principal area where domestic European fleets interact with marine turtles and an issue that will also need addressing through other parallel efforts.



Nicholas Pilcher, MRF

With slow growth rates and taking up to several decades to reach sexual maturity, marine turtles are highly vulnerable to anthropogenic impacts, such as those caused by commercial fishing, consumption, trade, and climate change, to name a few. As a result, the International Union for the Conservation of Nature's (IUCN) Red List of Threatened Species classifies the hawksbill and Kemp's ridley as "Critically Endangered", the green as "Endangered", the olive ridley as "Vulnerable", and certain sub-populations of loggerhead and the leatherback as "Critically Endangered" (IUCN, 2015). (Currently there is insufficient data to classify the flatback turtle, although this is set to change in the coming year or two.)

Trawl fisheries - those that tow or push a net through water - have long been recognized as having major impacts to both species and habitats. Trawlers that target shrimp in the tropical regions of the world are especially problematic for marine turtles as they are often incidentally caught as 'bycatch' due to the habitat they share with the targeted shrimp. In the US, for example (and before measures were introduced), this bycatch was believed to have accounted for more turtle deaths than all other human activities combined (National Research Council 1990). In this report, it has been estimated that, over the 2008 to 2013 period, the total average annual catch of shrimp from selected¹ tropical shrimp trawling operations globally was 1'006'660 tonnes. These estimates highlight the overall prevalence of this activity and its potential to adversely impact marine turtle populations if appropriate bycatch mitigation strategies are not being adopted.

The problem, however, can be greatly reduced by using a Turtle Excluder Device (TED) - a grid that fits into the narrow neck of a trawl net. The spacing of

the bars and angle of the grid are designed to divert marine turtles (and other large marine fauna and objects) through an escape hatch while retaining shrimps and other target catches. TEDs have a proven ability to exclude at least 97 per cent of turtles that enter a shrimp trawl (Eayrs, 2007) with minimal target catch losses (under 2 per cent). Any losses that do occur can be largely compensated for by the many other advantages, such as quicker processing of catch, less net damage, reduced fuel costs, and higher market prices for better quality shrimp (e.g. due to reduced crushing from large objects such as turtles, sharks or logs). Despite this, a number of preventable challenges are hindering widespread TED usage. These often arise due to the concerns that fishers have about TEDs negatively impacting their target catch and thus profitability. Yet experience has shown that these concerns can be overcome through collaborative implementation programmes that involve fishers from the outset, such as those that were established in French Guiana, Gabon and the Australian Northern Prawn fishery.

Of particular importance to incentivise TED usage are regulatory measures. Most notably, foreign fleets wishing to export shrimp to the United States (US) have to first demonstrate to the US government that they have "...adopted a programme governing the incidental capture of sea turtles in its commercial shrimp fishery comparable to the programme in effect in the United States and has an incidental take rate comparable to that of the United States; or that the particular fishing environment in the harvesting nation does not pose a threat to the incidental taking of sea turtles"². Officially referred to as Section 609 of Public Law 101-162, this measure has had a critical effect on major tropical shrimp exporting countries globally (Gillett, 2008). Approximately 40

¹ Estimates were generated for all TST countries globally, though it excluded countries that are not certified to export shrimp to the United States - a country that stipulates effective turtle bycatch measures to be taken before accepting exports of trawl-caught shrimp.

² See: http://www.regulations.gov/document?D=DOS_FRDOC_0001-3692



Crew displaying a TED in Gulf of Mexico, Michel Nalovic, VASG/VIMS

countries and one economy are currently certified to export shrimp to the US. However, the European Union, the largest single market for fisheries products in the world (EC, 2015), has no such regulation and so the absence of an equivalent EU shrimp/turtle law provides an alternative market to countries that can't export shrimp to the US.

Analyses conducted as part of this report identified Bangladesh, India, Indonesia, Madagascar, Thailand, and Viet Nam as countries currently not certified to export wild trawl-caught shrimp to the US (due to concerns about marine turtle bycatch) but which are allowed to export to the EU. This report estimated that, collectively, these countries exported 289'130 tonnes of trawl-caught shrimp to the EU over the 2009 to 2014 period, with an annual average of 48'188 tonnes. Clearly, the potential marine turtle bycatch associated with these exports could be significant (Appendix 1 of this report provides estimates of the marine turtle bycatch that may be associated with these exports though it should be noted that these new figures relied on relatively old data from a specific geographic area that was then applied globally. The estimates were therefore not considered representative enough to have been included in the main body of the report). The main EU countries receiving these exports were Belgium, Denmark, France, Germany, Italy, The Netherlands, and the United Kingdom. Moreover, of six exporting countries, it should be noted that Madagascar and Thailand were formerly certified to export to the US, but then had their licence revoked due to the US determining that their marine turtle bycatch mitigation measures did not reach the necessary standard for exporting to the US. That these countries were then able to export to the EU highlights how the EU market provided a vital alternative export destination for shrimp implicated in unsustainable levels of marine turtle bycatch.

In recent years, the EU has made important progress toward creating a more sustainable fishing industry, both domestically and internationally, and

for this it must be commended. Examples include the recent Common Fisheries Policy (CFP) reform and notably its international dimension, together with its current importing legislation both specifically for shrimp and by way of the Illegal, Unreported and Unregulated (IUU) fishing regulation. In view of this, there is hope that the issues raised in this report will result in additional measures to address turtle bycatch as part of the EU's ongoing conservation efforts and international environmental obligations. Examples include multilateral environmental agreements, such as the Convention on Biological Diversity (CBD), the Convention on the Conservation of Migratory Species of Wild Animals (CMS), the United Nations Convention on the Law of the Sea (UNCLOS), and the United Nations Fish Stock Agreement (UNFSA). Furthermore, in addition to formal treaties and conventions, there are also relevant guidelines and instruments that the EU has endorsed. These include:

- The FAO Code of Conduct for Responsible Fishing
- International Guidelines for Bycatch Management and Reduction of Discards
- Voluntary Guidelines on Securing Sustainable Small-Scale Fisheries
- The International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated (IUU) Fishing.

Accordingly, it is recommended that EU stakeholders (business, consumers and government) should implement measures to ensure that wild caught tropical shrimp imports are sourced from fisheries that are not implicated in marine turtle bycatch. Such actions can be restrictive measures (condition the access to the EU market) or of a more voluntary nature.

Recommended actions |

- 1** The EU should adopt measures similar in nature and intent to those of the US (i.e. Section 609 of Public Law 101-162) to ensure that wild-caught tropical shrimp exported into the EU are not implicated in marine turtle bycatch.
- 2** EU stakeholders, especially those in the main EU countries importing tropical trawl-caught shrimp (i.e. Belgium, Denmark, France, Germany, Italy, Netherlands, UK) work with (at least) the exporting countries identified in this report (i.e. Bangladesh, India, Indonesia, Madagascar, Thailand, Viet Nam) to help implement effective turtle bycatch mitigation measures. Ideally, this would be through the establishment (or continuation) of collaborative fisheries research programmes with the fishing industry to find optimum mitigation measures for a particular fishery and subsequent best-practice implementation. To this end, a number of specific actions could be taken, such as:
 - a.** Efforts to ensure EU retailers and consumers source from turtle-free fisheries, preceded by collaborative efforts and consideration of turtle-free labelling schemes.
 - b.** EU aid to support fisheries research programmes designed specifically to tackle this issue.
- 3** Relevant seafood markets should consider interim voluntary measures to identify alternative shrimp sources. For example, accepting only those shrimp products certified as non-impactful on turtles, be they cold or warm water shrimp, at least until exporting countries become engaged in effective turtle bycatch mitigation strategies.
- 4** EU consumers, retailers, and country governments collectively demand action to reduce marine turtle bycatch.
- 5** The potential for the EU / IUU regulation to ban imports from countries that are not adhering to their own national regulations should be considered as a key part of any strategy. Of the six focal countries in this study, only Viet Nam does not have a TED regulation, yet effective compliance with the national TED regulations existing within the other five countries is doubtful. Efforts must therefore focus on working with these countries to better comply with those regulations, with the EU in parallel seeking for more conclusive evidence of effective compliance as part of gaining the catch certification necessary to export to the EU.

Actions to tackle this issue, such as those outlined, must be promoted by the secretariats of the relevant conventions, agreements, and guidelines to which the EU is associated. **Failure to act could mean the EU's acceptance of certain imports make it complicit in activities that could run counter to those agreements.**

RECOMMENDED FURTHER RESEARCH

Finally, in conducting this study a number of key data gaps have been identified that need to be addressed in order to better understand the situation. Recommended areas for further study that build upon the indicative bycatch estimates generated in this report could be to:

- **GENERATE** more robust estimates of turtle bycatch associated with countries exporting wild-caught tropical shrimps into the EU.
- **DETERMINE** the extent of marine turtle bycatch caught in EU overseas territories, and by EU vessels fishing outside of the EU that may be engaged in tropical shrimp trawling.
- **DEVELOP** estimates of turtle bycatch potentially associated with IUU fishing.
- **ESTIMATE** the bycatch associated with trawling for shrimp-seed to supply the aquaculture industry.

List of Acronyms |

ASC	Aquaculture Stewardship Council	MRF	Marine Research Foundation
BRD	Bycatch Reduction Device	MSC	Marine Stewardship Council
CBD	Convention on Biological Diversity	NGO	Non Governmental Organisation
CFP	Common Fisheries Policy	NMFS	National Marine Fisheries Service
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora	NPF	Northern Prawn Fishery
CMS	Convention on Migratory Species	NOAA	National Oceanic and Atmospheric Administration
COFI	Committee on Fisheries (of the FAO)	REBYC	Reduction of Environmental Impact from Tropical Shrimp Trawling through the Introduction of Bycatch Reduction Technologies and Change of Management
CRPMEM	French Guiana Regional Fisheries Committee	RFMO	Regional Fisheries Management Organisation
DPMA	Directorate of Fisheries and Ocean Farming of France	RFB	Regional Fisheries Body
EAP	Environmental Action Programme	SEAFDEC	South East Asian Fisheries Development Center
EC	European Commission	SSF	Small Scale Fisheries
EEZ	Exclusive Economic Zone	TED	Turtle Excluder Device
EMFF	European Maritime and Fisheries Fund	TST	Tropical Shrimp Trawling
EU	European Union	TTED	Trash fish and Turtle Excluder Device
FAO	Food and Agriculture Organisation (of the United Nations)	UK	United Kingdom
GAA	Global Aquaculture Alliance	US	United States of America
GATT	General Agreement on Trade and Tariffs	UNCLOS	United Nations Convention on the Law of the Sea
GFCM	General Fisheries Commission for the Mediterranean	UNFSA	United Nations Fish Stocks Agreement
IUCN	International Union for Conservation of Nature	VASG	Virginia Sea Grant
IUU	Illegal, Unreported and Unregulated (fishing)	VIMS	Virginia Institute of Marine Science
IIP	National Fisheries Research Institute of Mozambique	WTO	World Trade Organisation
MEP	Member of the European Parliament		

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1. Introduction

Tropical Shrimp Trawling (TST) is a method of fishing that involves towing or pushing a net through water to catch tropical shrimp, though fish can also form an important part of the catch. In the absence of appropriate technical and management measures it can be highly indiscriminate, resulting in the capture of large quantities of marine fauna additional to that which the fishers are targeting. This so-called 'bycatch' can be utilized, but much of it is discarded, often dead or dying. The heavy trawl gear used for TST (as opposed to mid-water trawling, for example) can also cause extensive damage to sensitive seabed habitats.

One notable concern is the incidental capture of marine turtles – a problem that can be greatly

reduced by using a Turtle Excluder Device (TED – see Figure 2). A TED is a grid that fits into a trawl net whereby the spacing of the bars and angle of the grid are designed to allow shrimps to pass through to the back of the trawl net (termed the 'cod-end'), while diverting marine turtles (and other large marine fauna and objects) through an escape hatch. With a well designed TED and collaborative implementation programme, shrimp – the species being targeted by the fishers - will be mostly unaffected as the spacing of the grid bars are wide enough to allow them to pass through to the cod-end. Any target catch losses that may occur are compensated for by other advantages, such as quicker and safer processing of the catch, less net damage, reduced fuel costs,

reduced danger to fishers, and higher market prices for better quality shrimp – advantages all directly arising from catching less turtles and other large animals (see section 3 for a more in-depth analysis of TEDs).

Despite their advantages, a number of preventable challenges are hindering widespread TED usage. Typical examples range from concerns about implementation costs; perception of reduced target catches; lack of understanding, absence of training and general education about their usage; improper implementation; ineffectiveness or absence of regulations defining and stipulating mandatory usage; lack of enforcement of such regulations; and difficulties in accessing the materials needed to fabricate and repair the TEDs. Many of these challenges can be overcome with well-directed domestic programmes and/or regulatory measures designed to ensure TED usage in shrimp trawlers.

In the US, there exists domestic legislation requiring TEDs to be used on trawlers (where relevant), or their equivalent, in order to reduce

marine turtle bycatch (something which is not evident in many other countries). Furthermore, foreign fleets wishing to export shrimp to the US have to demonstrate to the US authorities that their operations are conducted in a manner of comparable effectiveness to the regulations that US domestic shrimp trawlers are obliged to meet (as stipulated under Section 609 of Public Law 101-162). This shrimp import legislation for the conservation of marine turtles has had a critical and positive effect on major shrimp exporting countries globally (Gillett, 2008).

The effect of the US legislation on global marine turtle populations, however, is limited as the (EU) – the largest single market for fisheries products in the world (EC, 2015) – has no such regulation, thus providing an alternative market to countries that do not have this certification. This has an important bearing on the global situation as in 2014 alone the EU imported an estimated 233'472 tonnes of wild-caught shrimp, the harvesting of which may have caused potentially large numbers of turtle bycatch.



Hawksbill turtle © Jürgen Freund / WWF

1.1 About this report

The objective of this report was to examine the need for the EU to adopt import regulations similar in nature and intent to the US's Section 609 of Public Law 101-162. To this end, it will first outline the urgency of the conservation problem and the impacts caused by TST especially. The report generates estimates of the potential scale of TST activities globally and that of selected countries exporting shrimp to the EU identified in this report as being potentially implicated within marine turtle bycatch. The specifics of TED usage are explored and the details of the Section 609 of Public Law 101-162 are provided. The current regulatory environment regarding EU fishery policy is outlined and relevant aspects of the EU's

current conservation obligations under the various agreements to which it is associated are shown. Finally, the report makes some overall conclusions and provides a set of next-step recommendations relevant to both the EU and other external stakeholders.

The appendices provide details of estimates and source data, an outline of the various EU legislative procedures through which import legislation could be adopted, a brief examination of the interplay between wild-caught and farmed shrimp, and the general situation concerning marine turtle bycatch in the Mediterranean - an issue of relevance given the interaction of EU and other fleets with marine turtles in these waters.



2. Conservation Urgency



Frigatebirds sitting on an outrigger of a French Guiana shrimp boat waiting for a meal of bycaught fish.
Michel Nalovic CRPMEM Guyane

2.1 Current status of marine turtle populations

There are seven species of marine turtles. Six are members of the family *Cheloniidae*, these being the loggerhead (*Caretta caretta*), green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*), olive ridley (*Lepidochelys olivacea*), flatback (*Natator depressus*) and Kemp's ridley (*Lepidochelys kempii*). The leatherback (*Dermochelys coriacea*) belongs to the family *Dermochelyidae*. With slow growth rates and taking up to several decades to reach sexual maturity, marine turtles are especially vulnerable to anthropogenic impacts, such as accidental capture in fishing gear (i.e. bycatch) or when targeted (either at nesting sites or at sea) for consumption of eggs or meat (e.g. Peckham et al., 2008), as trophies/curios (i.e. carapace), or for perceived medicinal properties (e.g. Chen et al., 2009). Compounding the problem is coastal development which is a significant issue on many nesting beaches across their range and particularly in the Mediterranean (Kasperek et al., 2001); in addition to the impacts of marine litter, such as plastic bags that are mistakenly ingested by some marine turtle species (e.g. loggerheads) as their preferred prey of squid or jellyfish (e.g. Tomas et al., 2002). Furthermore, climate change poses multiple dangers to marine turtle habitats and reproductive processes (e.g. WWF, 2015).

Over the years these factors have had serious impacts on marine turtle populations globally. As a result, the International Union for Conservation of Nature (IUCN) Red List, which assesses the conservation status of species, subspecies, and sometimes selected subpopulations on a global scale (IUCN, 2015), currently classifies the hawksbill and Kemp's ridley as "Critically Endangered", the green as "Endangered"; and the loggerhead, olive ridley and leatherback as "Vulnerable". However, certain sub-populations of the leatherback and loggerhead are classified as Critically Endangered (IUCN, 2015). Currently there is insufficient data to classify the flatback turtle.

Members of the family *Cheloniidae*

Members of the family *Dermochelyidae*



The Loggerhead (*Caretta caretta*)



Green (*Chelonia mydas*)



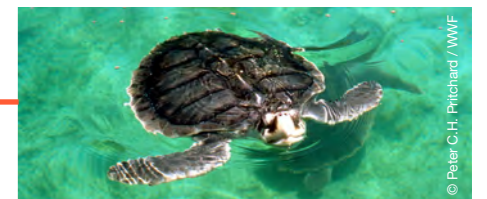
Hawksbill (*Eretmochelys imbricata*)



Olive ridley (*Lepidochelys olivacea*)



Flatback (*Natator depressus*)



Kemp's ridley (*Lepidochelys kempii*)



The leatherback (*Dermochelys coriacea*)

2.2 Threat from commercial fishing

Of the multiple threats to marine turtles, it is the impact of commercial fishing that continues to pose one of the greatest dangers (e.g. Davies et al., 2009; Wallace et al., 2013). The three main fishing gears typically seen to pose the greatest threat are longlines, gillnets and trawls. Although the focus of this report concerns the impact of TST on marine turtle populations, it is nevertheless important to understand the broader context in terms of the impacts of other fishing gear types and the different sectors that use them. Understanding this makes it clear that the global community needs to act wherever it can. For example, global marine turtle bycatch from longlines, has been estimated at more than 200'000 loggerheads and 50'000 leatherback turtles in the year 2000, with thousands estimated to be dying in the Pacific Ocean alone – an unsustainable level given the 80–95% declines for Pacific loggerhead and leatherback populations over the last few decades (Lewison et al., 2014). Turtle bycatch estimates from longlines have been made in part thanks to data availability from observer programmes on the fisheries targeting highly valuable tuna and billfish in international waters (Lewison & Crowder, 2007).

Broader estimates, however, spanning all fishing gear across artisanal, semi-industrial, and industrial fishery scales are lacking mainly due to unreliable information and paucity of data, especially from

small-scale fisheries (SSF). The lack of SSF data is a current area of concern given that many of these fisheries are carried out in regions of known marine turtle populations (Lewison et al., 2014). These fisheries, which occur in coastal waters worldwide, are significant, employing over 99% of the world's 51million fishers (Lewison et al., 2014). However, as they occur primarily in developing nations their documentation and management are limited or non-existent, precluding evaluation of their impacts on non-target mega fauna (Peckham et al., 2007). (This shortcoming, inter-alia, was recognized by Wallace et al. (2010), in their study of gillnet, longline and trawl fisheries between 1990 and 2008 that resulted in a turtle bycatch estimate of 85,000 over the study period.) More data are available from industrialised fisheries simply because their more formalised structures have brought concomitant amounts of data availability, collection and analysis (Lewison & Crowder, 2007). Moreover, global estimates are challenged by the lack of standardized metrics for reporting bycatch within or among ocean regions (Lewison et al., 2014). With respect to trawling, and especially TST, despite a global paucity of data, it is known from research conducted in various countries that this fishing activity has a particularly deleterious impact on marine turtle populations and this is examined more closely in the following section.



Courtesy of Captain Ricky Brown - Mississippi USA

2.3 Trawling impact on marine turtles

Worldwide, trawl fisheries have long been recognized as having a major impact on marine turtle populations. Despite data deficiencies resulting in an overall lack of global estimates, there is nevertheless clear recognition of the seriousness of the problem thanks to numerous fishery-specific estimates. These are summarized in Figure 1 (which includes a global estimate), that mostly shows estimates arising from data collected during the 1970s to 1990s – an important period of growing recognition of the problem and thus producing estimates that helped to precipitate action and solutions.

More recently, Wallace et al. (2013) provided the first global, multi-gear evaluation of population-level fisheries bycatch impacts on marine turtles by looking at the average scores of five criteria: population abundance, recent population trend, long-term population trend, rookery vulnerability, and genetic diversity. They found that bycatch rates and levels of observed effort for longline, net, and trawl fisheries were highest in the east Pacific, north-west

and south-west Atlantic, and Mediterranean region – findings that were supported in a later study by Lewison et al. (2014). Perhaps unsurprisingly, these areas also happened to be the regions of highest data availability.

Furthermore, the study found impacts to be statistically significantly lower in longlines than in gillnets and trawls. This study postulates that this may in part be a reflection of recent progress made in longline turtle bycatch reduction methods and training in release techniques that have improved post-release survival, especially in the eastern Pacific (e.g. Andraka et al., 2013). Also of note, the study showed that bycatch impact scores were statistically significantly higher in shrimp trawl operations, as opposed to trawling methods targeting other species. Regions with significant data gaps were identified as Africa, the Indian Ocean and south-east Asia – the very areas where shrimp trawling is significant (see Figure 3).

2.3.1. Tropical Shrimp Trawling

Of all the forms of trawling, it is those operations that trawl for shrimp in the tropical regions of the world that have received most attention (e.g. Gillet, 2008; Eayrs, 2007; MacFadyen & Banks, 2011; MacFadyen et al., 2013). Tropical Shrimp Trawling (TST) has been estimated to be responsible for as much as 15-20 million tonnes of bycatch, of which 1.9 million tonnes may be discarded annually (FAO, 2015). TST suffers at the hands of inadequate resources and often ineffective or non-existent management practices, leading to not only huge numbers of mortalities of non-shrimp species, but also habitat loss and degradation. In many regions there are now insufficient stocks to support existing fishing levels, with overexploitation threatening biodiversity and livelihoods (FAO, 2015). Moreover,

in US fisheries it was noted that, before measures were introduced, TST accounted for more deaths than all other human activities combined (National Research Council 1990) due primarily to the shared habitat between tropical shrimp and marine turtles and widespread lack of implementation of bycatch reduction technologies. However, the true extent of the problem currently remains unknown, though the current study attempted to address this by generating indicative figures based on estimated TST marine turtle bycatch rates then applied to tropical shrimp import data (see Appendix 1). In terms of focussing on solutions, however, the following section takes a closer look at Turtle Excluder Devices (TEDs) - one of the most effective technical measures to reduce marine turtle bycatch from TST operations.

Figure 1. Examples of turtle bycatch rates from shrimp trawlers around the world. *From a list cited by Robins et al. (2002).

1 Costa Rica*

Bycatch of 20'000 olive ridley turtles, around half which were assumed to die as a result of capture (Arauz, 1996a).



2 Terengganu, Malaysia*

Estimated annual average bycatch of 742 marine turtles in 1984 and 1985 (Chan et al., 1998).



3 Georgia, USA*

Estimated bycatch of 30.7 marine turtles per vessel per year (Hillestad et al., 1978). This equates to a minimum of 9'855 turtles in 1976 (mostly loggerheads) with an estimated minimal mortality rate of 7.9% (Robins et al., 2002).



4 North-eastern Venezuela*

An estimated 1'370 turtles per year, with a mortality of 260 (Marcano & Alio, 1998).



5 Gulf of Mexico, USA*

Estimated maximum of 44'000 marine turtles were killed annually (NMFS, 1999).



6 Orissa, India*

Over 35'000 olive ridleys recorded dead, likely primarily from trawling activities (Pandav & Choudhury, 1999). Considered alarming as the Orissa coastline hosts some of the world's largest olive ridley mass-nesting rookeries (Robins et al., 2002).



7 Queensland, Australia*

Estimated to catch $5'295 \pm 1'231$ turtles annually. However, due to the relatively short duration time of the trawl tows, mortality was estimated to be very low compared to other trawl fisheries, at between 1.1 % and 6.8% (Robins, 1995).



8 Guyana*

1'300 turtles were estimated to be caught annually with a mortality rate of 60% (Tambiah, 1994).



9 Suriname*

3'200 bycaught turtles were estimated annually with a 50% mortality rate (Tambiah, 1994).



10 Pacific Central America*

Total estimated turtle takes for trawl fisheries was 60'042 (Arauz, 1996a).

11 Caribbean Central America*

Total estimated turtle takes for trawl fisheries was 514 annually (Arauz, 1996a).

12 Southern Carolina, USA*

Estimated to have resulted in the potential mortality of between 860 to 1'396 marine turtles annually between 1976 and 1978 (Ulrich, 1978).

13 Sofala Bank, Coastal East Africa

Between 1'932 and 5'436 turtles estimated annual bycatch in the Sofala Bank industrial and semi-industrial shrimp trawlers (Gove et al., 2001).

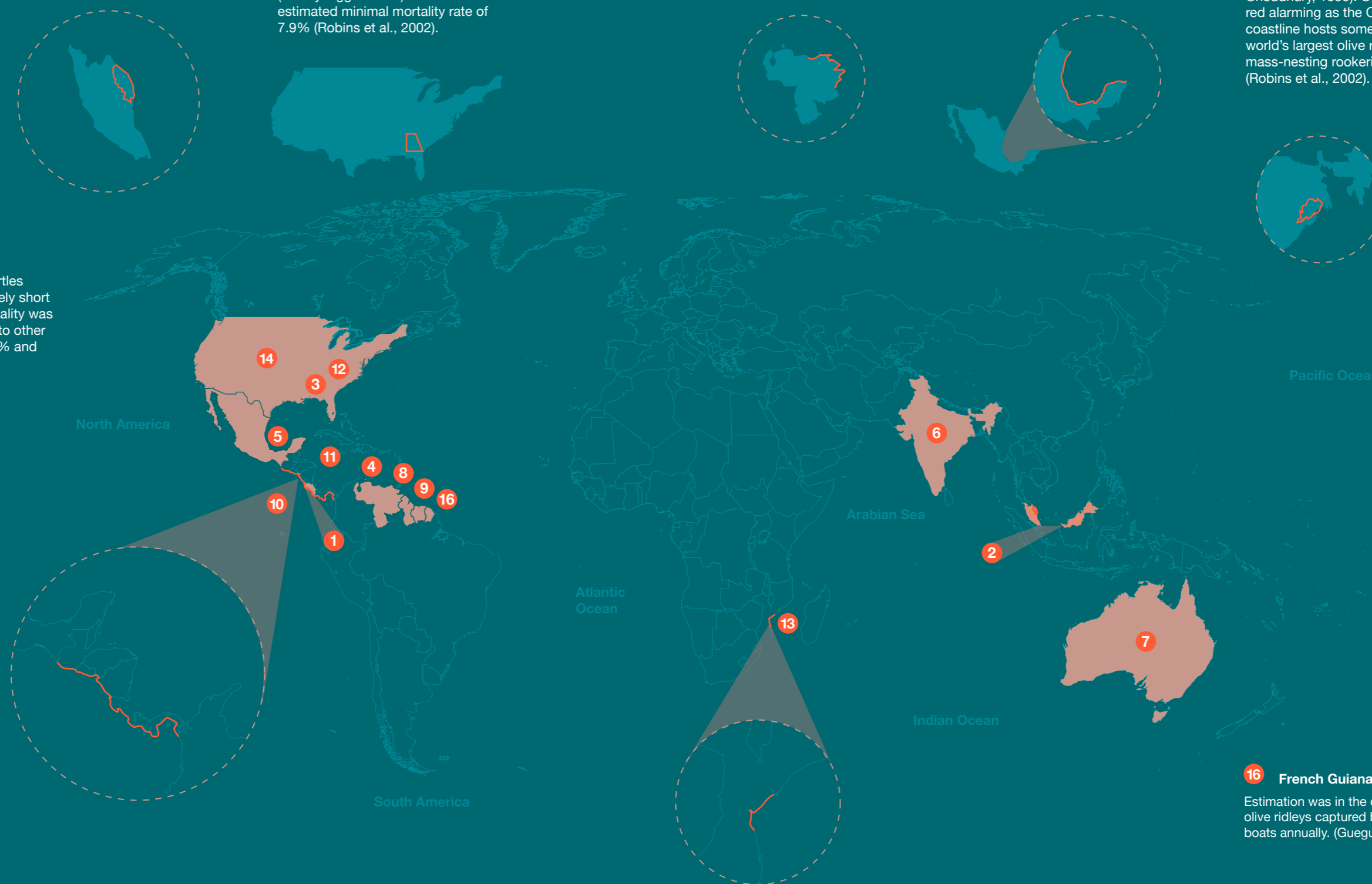


14 United States

Before the implementation of TEDs, shrimp trawlers were believed to catch 0.6 turtles for every metric tonne of shrimp caught (Henwood et al., 1992).

15 Global

Between 1990 and 2008, Wallace et al. (2010) estimated a bycatch of around 85'000 marine turtles from gillnet, longline and trawl fisheries worldwide, though this was considered to be an underestimate by two orders of magnitude.



3. The Turtle Excluder Device



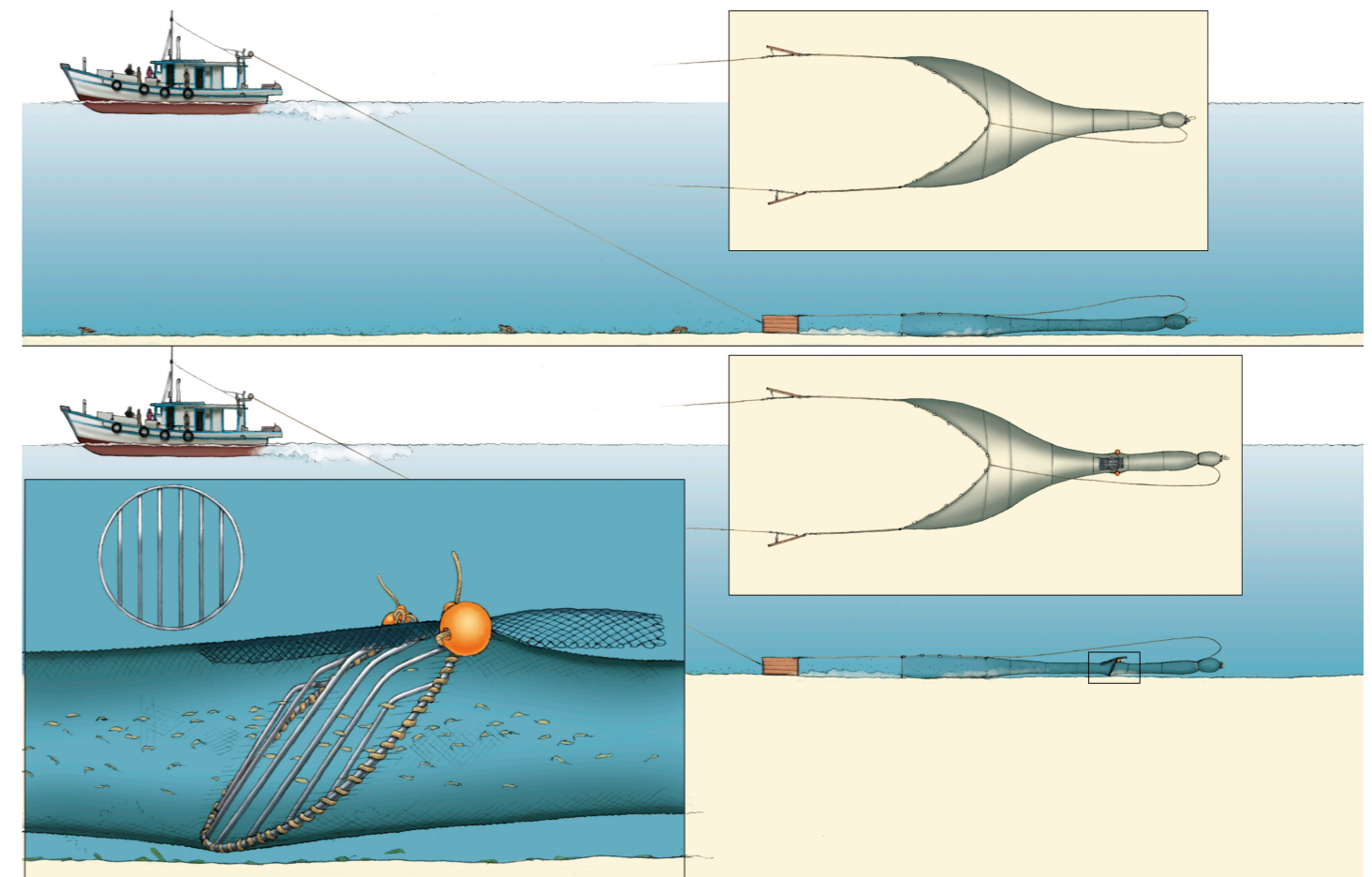
3.1 Overview

In 1973 and 1974, while observing the operation of various experimental trawl nets, the National Marine Fisheries Service (NMFS³) serendipitously recorded three sea turtles encountering the fishing gear. Recognising the opportunity to develop specific Turtle Excluder Devices (TEDs), NMFS embarked on a research programme aimed at reducing sea turtle mortality in shrimp trawls (Jenkins, 2012). The technological aspect of this programme built upon an existing design dating back to the 1960s that was originally intended to reduce jellyfish bycatch by shrimping boats operating out of Darien, Georgia in the US. This precipitated an ongoing process of continual TED development and modification according

to different fishing characteristics (see Jenkins 2012 for a more in-depth technical review) and now TEDs have a proven ability to exclude at least 97% of turtles that enter a shrimp trawl (Eayrs, 2007). The NMFS programme included a strong element of fisher-participation that was instrumental to the success of the US programme.

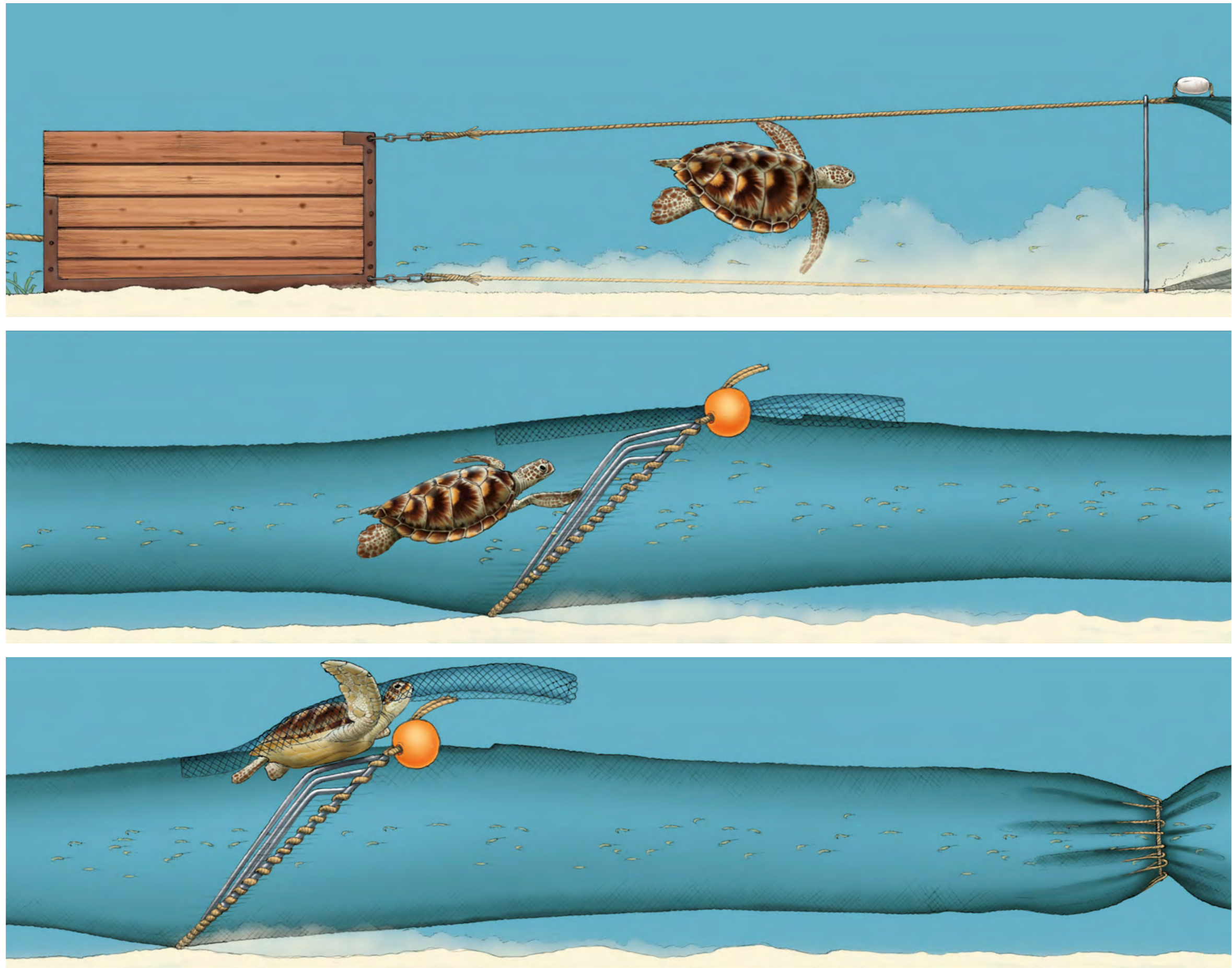
In essence, a TED, shown in Figure 2, is a grid that fits into the narrow neck of a trawl net. The spacing of the bars and angle of the grid are designed to allow shrimps to pass through to the back of the trawl net (termed the 'cod-end'), while diverting marine turtles (and other large marine fauna and objects) through an escape hatch.

Figure 2. Diagram showing a Turtle Excluder Device (TED) in operation. Illustration by Marc Dando.



³ NMFS is a division of the US government National Oceanic and Atmospheric Administration (NOAA).

Figure 2. Diagram showing a Turtle Excluder Device (TED) in operation. Illustration by Marc Dando.



3.2 Advantages of using TEDs

There are many advantages to using TEDs, particularly where they have been modified to also exclude other large animals such as sharks, rays and other large bycatch species (Eayrs et al., 1997). Gillet (2008) listed the advantages as:

- Ability for gear to stay longer on the bottom, decreasing the time wasted during sorting and hauling.
- Reduction of damage to the net caused by large animals.
- Quicker sorting time.
- Reduced injuries to the crew from potentially dangerous animals.
- Higher quality shrimp catch (e.g. Robins et al., 2002;

Wamukoya & Salm, 1997; Gove et al., 2001) due to reduced crushing effects of turtles and other large animals, which would otherwise be caught.

- Access to markets. For example, a certification programme for effective TED usage can enable a country to export to the US.
- Reduction in fuel costs since heavy turtles (and other large fauna/objects) are not being towed for hours at a time.

Despite these many advantages, implementation can sometimes be challenged by industry scepticism. Section 3.3. below summarises this and outlines how **this scepticism and opposition** can be overcome through well-designed TED implementation programmes.



It's a plus for the fishermen, its a plus for the environment, its a plus for everyone, I'm sorry the TED wasn't here 10 or 20 years ago.

Carl Sue-Chee, shrimp boat captain from French Guiana with 30 years of experience.

If the TED wasn't mandatory I would still use it. Modern TEDs work much better than they did in the past.

Tom Williams, shrimp boat captain from USA with 30 years of experience.



3.3. TED implementation: challenges and solutions

Trawlers that target tropical shrimp species typically use small meshes in order to prevent the shrimp from escaping. Such nets catch marine life indiscriminately, resulting in very high bycatch rates of species comprising not only marine turtles and other large marine life, but also juvenile fish, adult small fish, and a myriad of other creatures. In the past, these small fish were collectively termed 'trash fish' as they were often discarded as worthless. But as resources became scarcer, new markets opened up for these catches and 'trash' fish came to generate possibly over one-third of some fishers overall income (Eayrs, 2007), and potentially far more than that. This scenario was correctly predicted by Andrew and Pepperell (1992), "It seems likely that the utilisation of bycatch will increase as demand for protein escalates and the

retention and processing of bycatch becomes more economically viable".

Whilst the primary concern to fishers is to maintain shrimp catches - since this is the most profitable component of the catch - concerns about losing trash fish didn't help and fishers came to associate TED implementation with lost profitability, despite evidence that well designed programmes can help to greatly minimize this. For example, Mukherjee & Segerson (2011) estimated that total harvest loss for the US shrimp industry from TEDs was under 2 per cent, a figure considerably lower than the 15 to 20 per cent loss estimated by industry (though it should be recognized that incorrectly used TEDs can cause significant losses of target catches).



Looks can be deceiving - here an inspector is showing nylon twine used to sew the TED opening closed.
Courtesy NOAA-Michael Barrette



I appreciate the TED because when I compare the catch I see that I don't have much loss but the catch is easier to sort on the back deck and the shrimp are of higher quality, Its all a question of organization, you have to take the time to learn how it works.

James SHEPHERD (Jimbo) shrimp boat captain from USA with 30 years of experience.



Other concerns regarding TED usage include:

- Implementation costs.
- Lack of understanding, training and general education about their usage (for example, the angle of a TED's grid bars can have a significant bearing on target catch efficiency and on the ability of the turtle to actually escape).
- Lack of regulations defining and stipulating mandatory usage.
- The lack of collaborative programmes that allow fishers to become part of the solution.
- Insufficient use of fisher knowledge in developing tailor-fit solutions.
- Insufficient enforcement of regulations.

Enforcement issues are especially problematic because it is possible for a TED to be installed in a net but for the turtle escape flap to be sewn shut (Cox et al., 2007) when fishing, only to be untied once back at port where inspections usually take place. Such practices take place due to fishers being concerned about catch losses. With experience, however, it becomes possible for enforcement agents to recognise when this is occurring.

Crucially, experience has now shown that efforts to develop TEDs that suit the unique characteristics of a particular fishery can often minimize losses, as discussed earlier. The presence of a well-designed and collaborative implementation programme, whether voluntary or responding to an existing or upcoming regulation, is often highly effective at achieving this. The following section explores this in more detail.

Comparing the catch

CATCH WITH A TED

CATCH WITHOUT A TED



3.4. Best practice TED implementation

Experience gained over decades of research conducted by NMFS in helping countries comply with the US's Section 609 of Public Law 101-162, together with that carried out by many other agencies the world over such as the research conducted by the South East Asian Fisheries Development Center (SEAFDEC)⁴, or the French Guiana Regional Fisheries Committee (CRPMEM Guyane) and the FAO's REBYC⁵ I and II programmes, reveal consistent themes in successful design and implementation of TEDs. These can be summarised as:

1. Effective outreach and educational programmes on TED usage in general, the importance of turtle conservation, and the need to use TEDs in order to meet export market requirements.
2. Full stakeholder collaboration.
3. Full collaboration between fishers and scientists maintained over the long-term, and with other relevant organisations.
4. On-the-ground support from local authorities, fishing community groups, and NGOs when appropriate.
5. Working with fishers in the design and experimentation phase to ensure the TED is appropriately configured to the specific

characteristics of each fishery and the species and size of turtles caught.

6. Provision of appropriate training.
7. Locally organized workshops and capacity building.
8. Effective marketing of shrimp caught from trawls operations utilising TEDs.
9. Effective monitoring, control and surveillance.
10. Where relevant, introduction of programmes to encourage local people to not eat turtles.

By far the most important aspect, however, is to have a regulatory measure, the implementation of which fully engages the fishing industry throughout, especially regarding the design phase of the TED. Given the ever-present challenges of enforcement, emphasis must be placed on showing the advantages of TEDs and empowering fishers to actually want to use these devices. Two notable examples where this has been the case occurred in French Guiana and in Australia's northern prawn fishery. These two areas, while geographically distinct, share the common characteristic that fisher engagement was crucial to implementation. The following sections briefly summarise the main elements of these efforts.



Informal TED training in Port Gentile, Gabon 2010. Michel Nalovic, NOAA contractor

⁴ For examples of SEAFDEC's TED research under the FAO's REBYC II programme, see: <http://www.seafdec.or.th/index.php/news/218-rebyc-ii-work-planning-workshop-and-project-steering-committee-meeting>

⁵ Part of the FAO's REBYC project: Reduction of Environmental Impacts from Tropical Shrimp Trawling through the Introduction of Bycatch Reducing Technologies and Change Management (known as REBYC I, running from 2002 to 2008. REBYC II commenced in 2008 and was designed to build on the progress made in REBYC I. For further information, see: <http://www.fao.org/fishery/topic/16920/en>).

3.4.1. French Guiana

In this French over seas department there was a high degree of skepticism from local industry regarding the use of TEDs. However, by working directly with local fishers, the CRPMEM Guyane, with support from WWF-French Guiana, NOAA and IFREMER developed a modification to the standard TED – the Trash and Turtle Excluder Device (TTED) with 5cm of spacing between the flat bars of the grid rather than 10.02cm for the standard TED. The TTED is designed to not only eliminate turtles, but also other large unwanted bycatch such as sharks, rays and fish targeted by the coastal artisanal fishers. The TTED is more effective relative to the TED at reducing sorting time, lowering the risk of injury from sting rays and other animals, improving shrimp quality by preventing them from getting crushed in the trawl, and reducing a vessel's fuel consumption through lighter trawl designs being used (Nalovic 2016 pers. comm.).

Furthermore, according to a study conducted in the US TST fishery, the TTED reduces elasmobranch bycatch by 41-99 per cent in comparison with the standard TED (Nalovic, 2014). In French Guiana the TTED reduces an overall average of 30 per cent of the total bycatch without reducing catches of shrimp (WWF, 2010; Nalovic & Rieu, 2010). These are all significant advantages and in 2009 French Guiana

fishers, in a landmark development, voted to voluntarily adopt the TTED as a standard part of their fishing practice (Virginia Sea Grant, 2013). The Republic of Suriname, located just to the north of French Guiana, is currently assessing the TTED through the FAO funded REBYC program (LVV, 2016). The CRPMEM Guyane has now officially requested that France adopt TED regulations, in addition to pushing for broader TED regulations at the EU level, such as a restriction on importations of tropical shrimps caught without TEDs. To this effect the French National Fisheries Committee has endorsed this proposition in September of 2015, and the French Ministry of Ecology has requested that the Directorate for Fisheries and Ocean Farming of France (DPMA) study the measure (in progress as this report is being written). Also, the CRPMEM Guyane is now helping the Mozambique TST industry through a partnership with WWF and the National Fisheries Research Institute of Mozambique (IIP). The aim is to support Mozambique's TED efficiency experiments by building local capacity in testing towed fishing gears whilst assisting local authorities and industry in tailoring an implementation strategy which will extend into collaborations with NMFS who is the leader in TED technology development and implementation.



A TTED on the left side with 5cm bar spacing and an experimental TED with 7cm bar spacing in the middle, next a standard TED on the right with 10cm bar spacing. Michel Nalovic, CRPMEM Guyane

TTED SIDE

1 Blacknose*
13 small Atlantic Sharpnose

*Near Threatened



Michel Nalovic, VASG / VIMS

TED SIDE

2 Blacknose*
19 small Atlantic Sharpnose
1 Blacktip*
3 Bonnethead Hammerhead
1 Scalloped Hammerhead**
24 adult Atlantic Sharpnose

*Near Threatened

**Endangered

Here we see the significant difference in Elasmobranch bycatch observed during TTED testing against a standard TED. These evaluations were conducted by VIMS/VASG on board the fishing vessel Miss Bertha of Captain Howell Boone out of Darien, Georgia (USA) during the summer of 2012 in collaboration with NOAA Harvesting Systems Branch, Gulf and South Fisheries Foundation and the University of Georgia Marine Extension Service. (Nalovic, 2014)

3.4.2. Australian Northern Prawn fishery

The Australian Northern Prawn Fishery (NPF) covers approximately 880,000 square kilometres of Australia's northern waters, of which less than 12 per cent are fished. The fishery supplies both national and international markets. Six of the seven species of marine turtles are found in Australian waters: the loggerhead, green, hawksbill, olive ridley, flatback, and leatherback. Australian laws require the NPF to use approved TEDs and bycatch reduction devices (BRDs) and to help the fishery lower catches of turtles by 99 per cent (Brewer et al., 2006). As a result of these efforts, in 2000 a US shrimp export restriction was lifted from the NPF because the turtle protection program in place was deemed to be of comparable effectiveness to the US program.

There were numerous key factors contributing to the effectiveness of the NPF's TED programme. For example, given that turtles can damage shrimp catches and reduce their value, there is a high incentive for fishers to ensure TEDs rapidly exclude these and other large animals from the trawl. To facilitate this, the programme includes a protocol

to help fishers test their own TEDs and BRDs and to identify new devices suitable for approval in the fishery. Enforcement officers board approximately 70 per cent of the fishing fleet each year to check that TED regulations are being met - a process of monitoring that is sometimes augmented through independent on-board observers who monitor the effectiveness of TEDs by recording fishing practices and collecting catch data. As with other effective TED programmes, of significance to the high TED compliance rates are the effective extension programs that include such initiatives as newsletters, booklets, port workshops, idea-sharing opportunities, and loans of various TED designs, in addition to at-sea assistance to test TEDs under normal commercial fishing conditions. Such materials provide fishers with up-to-date information about TED regulations and operational details of TED performance, allowing them to make informed decisions about their fishing operation (Eayrs, 2007). Arising from these commitments, in late 2012 the NPF received Marine Stewardship Council (MSC) certification.



Nicholas Pilcher, MRF

3.5. The influence of market forces in driving TED adoption

One potentially powerful method to encourage TED implementation is to introduce a regulatory programme that requires effective marine turtle bycatch reduction as a condition of accessing markets. The impact of the US's Section 609 of Public Law 101-162 and its associated certification programme, however, is reduced as the EU, another major global seafood importer - absorbing 24% of the

world's exchanges in value of seafood - has no such regulation, which can potentially provide an alternative market to the trawl operations within countries that cannot export to the US. Given the EU's importance in the global seafood industry, the lack of any such programme represents a serious omission. The following section looks at the US programme in more detail.

3.6. The US TED Regulation

3.6.1. Background

In response to broad concerns about the impact of US shrimp trawling on marine turtle populations in US waters, in 1987 the US government implemented regulations that required all US shrimpers to use TEDs. After a period of negotiations, that regulation was strengthened and, on 1 December 1992, NMFS finalized new regulations requiring all shrimp trawlers in US waters, offshore and inshore, between Virginia and Mexico to use TEDs year-round by 1 December 1994 (at that time the regulation number was: 57 FR 57348-57359). Helping to precipitate these changes, which marked a significant turning point in marine turtle conservation in the US and around the world, was a growing, data-supported recognition of the issue, as per the summary of Crouse (1993):

1. Without TEDs, drowning in shrimp trawls was the number one factor of human-caused sea turtle mortalities in the US (National Research Council, 1990).
2. Year-round application of the regulation was necessary because marine turtles utilize near-shore and inshore waters throughout the southeastern US and throughout the year as significant developmental habitats.
3. Reducing tow times (the length of time the trawl net is fished for) as an alternative measure was deemed to be insufficient to protect endangered and threatened marine turtles.
4. Previous, seasonally based, TED regulations may have simply delayed marine turtle mortality until later in the year.

3.6.2. 1989 US Shrimp - Turtle Law - an international dimension

United States waters are not uniquely prone to this problem as wherever trawl gear is used and marine turtles occur, mortalities are likely (Crouse, 1993). In view of this, the US introduced an international element to the regulation, resulting in Section 609 of Public Law 101-162 being passed in 1989 by the US Congress. This law requires governments of the harvesting nation to provide documentary evidence of the adoption of a regulatory program comparable in effectiveness to the US to reduce the incidental capture of marine turtles. An important point concerning international trade is that the US was able to pass such a law because it had already imposed similar measures to the relevant segment of its own domestic tropical shrimp trawling fleets. This was essential for complying with World Trade Organisation (WTO) rules.



When used appropriately TEDs reduce turtle bycatch by 97% with under 2% target shrimp catch losses

As of 26th May 2016, the US certification notice states that ⁶ :

“Section 609 of Public Law 101-162 (“Sec. 609”) prohibits imports of certain categories of shrimp unless the President certifies to the Congress by May 1, 1991, and annually thereafter, that either: (1) The harvesting nation has adopted a program governing the incidental capture of sea turtles in its commercial shrimp fishery comparable to the program in effect in the United States and has an incidental take rate comparable to that of the United States; or (2) the particular fishing environment in the harvesting nation does not pose a threat of the incidental taking of sea turtles. The President has delegated the authority to make this certification to the Department of State (“the Department”). The Department’s Revised Guidelines for the Implementation of Section 609 were published in the Federal Register on July 8, 1999, at 64 FR 36946.”

It goes on to state that:

“Shrimp and products of shrimp harvested with turtle excluder devices (TEDs) in an uncertified nation may, under specific circumstances, be eligible for importation into the United States under the DS-2031 Box 7(A) (2) provision for “shrimp harvested by commercial shrimp trawl vessels using TEDs comparable in effectiveness to those required in the United States.” Use of this provision requires that the Department determine in advance that the government of the harvesting nation has put in place adequate procedures to monitor the use of TEDs in the specific fishery in question and to ensure the accurate completion of the DS-2031 forms. At this time, the Department has determined that only shrimp and products of shrimp harvested in the Exmouth Gulf Prawn Fishery, the Northern Prawn Fishery, the Queensland East Coast Trawl Fishery, and the Torres Strait Prawn Fishery in Australia and shrimp or products of shrimp harvested in the French Guiana domestic trawl fishery are eligible for entry under this provision. Thus, the importation of TED-caught shrimp from any other uncertified nation will not be allowed. A responsible government official of Australia or France must sign in Block 8 of the DS-2031 form accompanying these imports into the United States.”

Adding further that...

“In addition, the Department has determined that shrimp or products of shrimp harvested in the Spencer Gulf region in Australia and Mediterranean red shrimp (*Aristeus antennatus*) harvested in the Mediterranean Sea by Spain may be exported to the United States under the DS-2031 Box 7(A)(4) provision for “shrimp harvested in a manner or under circumstances determined by the Department of State not to pose a threat of the incidental taking of sea turtles.” A responsible government official of Australia or Spain must sign in Block 8 of the DS-2031 form accompanying these imports into the United States.”

3.6.2.1. Implementation and compliance

The US Department of State is the principal implementing agency of this law, while NOAA Fisheries serves as technical advisor. More specific information on the technicalities of this regulation is outlined in the US Department of State’s Public Notice 3086. In terms of ensuring compliance with the regulation, the same guidelines also detail the documentary evidence that a country must provide in order to gain certification and thus clearance to export to the US. To this end, the US government will require documentary evidence to show that all necessary measures to comply with regulation are being effectively taken (e.g. technical aspects, effective regulations and enforcement etc.) utilising, where necessary,

“ empirical data supported by objective scientific studies of sufficient duration and scope to provide the information necessary for a reliable determination ⁷ ”.

In assessing compliance with the regulation, it is important to note that the US, as part of its consideration, seeks evidence that, where relevant a country is taking other necessary measures to protect marine turtles, such as

“ ...national programmes to protect nesting beaches and other habitat, prohibitions on the directed take of sea turtle, national enforcement and compliance programmes, and participation in any international agreements for the protection and conservation of sea turtles ⁷ ”.

Given the ever-changing nature of this issue, the US engages in ongoing consultations with the government of the harvesting nations. Notwithstanding this, each year the US will consider for certification:

“ a) any nation that is currently certified, and b) any other shrimp harvesting nation whose government requests such certification in a written communication to the Department of State... ⁷ ”

Regarding requests from harvesting nations, US officials will seek to visit these nations to make a determination of the readiness to gain certification. Such visits are scheduled to fall between September 1st and March 1st of any given year. Formal decisions on certifications are made by 1st May of each year. (Further information on implementation and compliance can be found in Eayrs, 2007.)



Loggerhead turtle; Mediterranean Sea © Michel Gunther / WWF

⁶ For further details, see: <https://www.federalregister.gov/documents/2016/05/26/2016-12544/annual-certification-of-shrimp-harvesting-nations>

⁷ See: http://www.nmfs.noaa.gov/pr/pdfs/species/pl101-162_revised.pdf

3.6.2.2. Impact of the regulation on marine turtle populations

In view of the multiple threats faced by marine turtles, and the varying solutions needed to tackle these issues⁸ (e.g. nesting site protection, minimisation of fisheries bycatch, regulatory mechanisms, international agreements, etc.), it is not possible to delineate the specific benefits of the TED regulation from the range of other conservation measures taking place in parallel. The positive effect of TEDs is well documented, however, and the legislation has led to the effective implementation of TEDs in those countries currently allowed to export to the US. It can therefore be inferred that the regulation, in combination with other marine turtle

conservation efforts, must be having a significant and positive influence and be a major contributory factor to the recovery of some populations or at least the prevention of further declines.

Nevertheless, its effectiveness, particularly in terms of reducing marine turtle bycatch globally, would be greatly enhanced if the EU adopted similar legislation. Were this the case, then two of the most important global shrimp markets would have consistent and complimentary regulatory approaches and would thus exert significant influence on the global TST industry.

3.6.3. Current status of the US Programme to Implement Public Law 101.162 (Section 609)

Specifically 40 countries and one economy are currently certified to export shrimp to the US. On 26 May 2016, the Department of State certified, pursuant to Section 609 of 101, that 14 nations have adopted programs to reduce the incidental capture of marine turtles in their shrimp fisheries comparable to the program in effect in the US. The Department also certified that the fishing environments in 26 other countries and one economy do not pose a threat of the incidental taking of sea turtles protected under Section 609 (as listed in the second and third columns of Table 1). It is

further noted that, as mentioned in section 3.6.2. above, shrimp and products of shrimp harvested in the Australian Exmouth Gulf Prawn Fishery, Northern Prawn Fishery, the Queensland East Coast Trawl Fishery, and the Torres Strait Prawn Fishery specifically, Mediterranean red shrimp (*Aristeus antennatus*) harvested in the Mediterranean Sea by Spain (specifically), and shrimp or products of shrimp harvested in the French Guiana domestic trawl fishery are eligible for entry under the special provision for certain fisheries within uncertified countries (see section 3.6.2.).



⁸ The 2015 five-year review of the Kemp's Ridley turtle (*Lepidochelys kempii*) by the US National Marine Fisheries Service and the US Fish and Wildlife Service provides a useful overview of the complexity of the issue and can be viewed here: http://www.nmfs.noaa.gov/pr/listing/final_july_2015_kemp_s_5_year_review.pdf

Table 1. Nations and one economy (Hong Kong) and their relationship to US Public Law 101-609 (US Gov., 2015).

14	Have adopted programs to reduce the incidental capture of marine turtles in their shrimp fisheries comparable to the program in effect in the United States	<table border="0"> <tr><td>Colombia</td><td>Honduras</td></tr> <tr><td>Costa Rica</td><td>Mexico</td></tr> <tr><td>Ecuador</td><td>Nicaragua</td></tr> <tr><td>El Salvador</td><td>Nigeria</td></tr> <tr><td>Gabon</td><td>Pakistan</td></tr> <tr><td>Guatemala</td><td>Panama</td></tr> <tr><td>Guyana</td><td>Suriname</td></tr> </table>	Colombia	Honduras	Costa Rica	Mexico	Ecuador	Nicaragua	El Salvador	Nigeria	Gabon	Pakistan	Guatemala	Panama	Guyana	Suriname	TOTAL: 14		
Colombia	Honduras																		
Costa Rica	Mexico																		
Ecuador	Nicaragua																		
El Salvador	Nigeria																		
Gabon	Pakistan																		
Guatemala	Panama																		
Guyana	Suriname																		
11	Harvest shrimp using small boats with crews of less than five that use manual rather than mechanical means to retrieve nets, or catch shrimp using other methods that do not threaten marine turtles	<table border="0"> <tr><td>Bahamas</td><td>Jamaica</td></tr> <tr><td>Belize</td><td>Oman</td></tr> <tr><td>China</td><td>Peru</td></tr> <tr><td>Dominican Republic</td><td>Sri Lanka</td></tr> <tr><td>Fiji</td><td>Venezuela</td></tr> <tr><td>Hong Kong</td><td></td></tr> </table>	Bahamas	Jamaica	Belize	Oman	China	Peru	Dominican Republic	Sri Lanka	Fiji	Venezuela	Hong Kong		TOTAL: 11				
Bahamas	Jamaica																		
Belize	Oman																		
China	Peru																		
Dominican Republic	Sri Lanka																		
Fiji	Venezuela																		
Hong Kong																			
16	Have shrimping grounds only in cold waters where the risk of taking marine turtles is negligible	<table border="0"> <tr><td>Argentina</td><td>Ireland</td></tr> <tr><td>Belgium</td><td>Netherlands</td></tr> <tr><td>Canada</td><td>New Zealand</td></tr> <tr><td>Chile</td><td>Norway</td></tr> <tr><td>Denmark</td><td>Russia</td></tr> <tr><td>Finland</td><td>Sweden</td></tr> <tr><td>Germany</td><td>United Kingdom</td></tr> <tr><td>Iceland</td><td>Uruguay</td></tr> </table>	Argentina	Ireland	Belgium	Netherlands	Canada	New Zealand	Chile	Norway	Denmark	Russia	Finland	Sweden	Germany	United Kingdom	Iceland	Uruguay	TOTAL: 16
Argentina	Ireland																		
Belgium	Netherlands																		
Canada	New Zealand																		
Chile	Norway																		
Denmark	Russia																		
Finland	Sweden																		
Germany	United Kingdom																		
Iceland	Uruguay																		
07	That at one time were certified but not at this time (Forrester, 2016 and Fette 2016 pers. comm.)	<table border="0"> <tr><td>Brazil</td><td>Madagascar</td></tr> <tr><td>Brunei</td><td>Thailand</td></tr> <tr><td>Haiti</td><td>Trinidad</td></tr> <tr><td>Indonesia</td><td></td></tr> </table>	Brazil	Madagascar	Brunei	Thailand	Haiti	Trinidad	Indonesia		TOTAL: 07								
Brazil	Madagascar																		
Brunei	Thailand																		
Haiti	Trinidad																		
Indonesia																			

3.6.4. US assistance to help meet the legislative requirements

NOAA Fisheries and the US Department of State have worked closely with nations to help them develop TED programs comparable to the US program. These initiatives have been crucial in helping countries reduce marine turtle bycatch and subsequently access the US market. To this end, NOAA Fisheries have provided extensive TED training throughout the world, employing many of the best practice techniques previously summarized. These programs are now in place in various countries as evidenced by those nations that can now export their shrimp to the US (see Table 1). For a comprehensive

review of the technical contribution (i.e. TED design experimentation and reconfiguration) that NMFS has made to TED development, see Jenkins (2012). This experience allowed the US government to publish guidelines that outline the process by which countries can receive an import certification for wild-caught shrimp, known officially as The Guidelines for the Implementation of the US Shrimp/turtle law Section 609 of P.L. 101-162 Relating to the Protection of Sea Turtles in Shrimp Trawl Fishing Operations, revised in 1999 (64 FR 36946).

3.6.4.1. Potential US assistance to other nations in developing a TED regulation

Cooperation is an intrinsic element of the US regulation. Specifically, Public Law 101-162, title VI, § 609, Nov. 21, 1989, 103 Stat. 1037, provided that: “(a) The Secretary of State, in consultation with the Secretary of Commerce, shall, with respect to those species of sea turtles the conservation of which is the subject of regulations promulgated by the Secretary of Commerce on June 29, 1987—

1. Initiate negotiations as soon as possible for the development of bilateral or multilateral agreements with other nations for the protection and conservation of such species of sea turtles
2. Encourage such other agreements to promote the purposes of this section with other nations for the protection of specific ocean and land regions which are of special significance to the health and stability of such species of sea turtles
3. Initiate the amendment of any existing international treaty for the protection and conservation of such species of sea turtles to which the United States is a party in order to make such treaty consistent with the purposes and policies of this section”

In conclusion, the US government has a large body of experience in helping countries meet the requirements of Section 609 of Public Law 101-162, and has an interest in mitigating marine turtle bycatch irrespective of the export destinations. This presents an opportunity for the EU and US to collaborate in efforts that seek to support countries to meet the demands of EU-specific measures, be they voluntary or legally binding.



Nicholas Pilcher, MRF

EU would need to engage in helping countries meet the expected standard.

3.7. Compliance with World Trade Organisation rules

Lessons learned from the US regulation shows the importance of treating equally any future EU assistance provided to help countries meet such requirements. Under WTO rules, countries have the right to take trade action to protect the environment (in particular, human, animal or plant life health as well as endangered species and exhaustible resources). Furthermore, measures to protect marine turtles would be legitimate under GATT⁹ Article 20 (i.e. XX(g)) which deals with various exceptions to the trade rules of the WTO, provided certain criteria such as non-discrimination are met.

For example, in early 1997, India, Malaysia, Pakistan and Thailand brought a joint complaint to the WTO against the certification programme related to Section 609 of Public Law 101-162 - a case that the US lost because it was deemed to have discriminated between WTO members. The US provided countries in the western hemisphere — mainly in the Caribbean — with technical and financial assistance and longer transition periods for their fishers to start using TEDs than it did for India, Malaysia, Pakistan and Thailand (WTO, 2015). This is something the EU should seek to avoid when considering assistance to countries in the eventuality of a comparable EU shrimp/turtle law.

There have also been other legal challenges to Section 609 of Public Law 101-162 made through the WTO as one country's environmental goals and subsequent rulings may violate another country's basic trade rules, such as non-discrimination obligation and prohibition of quantitative restrictions¹⁰.

A significant case in point came in 2000 when Malaysia again requested the WTO to re-examine US compliance with the ruling, though despite this appeal, the WTO found the US to be compliant (Arden-Clarke 1998).

For an EU TED import regulation to be compatible with WTO rules, the actual technical / management measures likely won't need to be identical across all countries and cases; it is only the outcome, in this case marine turtle bycatch reduction, that is important.

It should be fully understood that in terms of an import requirement, the EU would need to engage in helping countries meet the expected standard (noting that the EU already has a history of providing support through development funding) and, just like the US had to demonstrate, would need to prove to the WTO that measures being imposed are for conservation purposes and not as barriers to trade.

Whilst a EU shrimp/turtle law will help reduce the turtle bycatch associated with the EU's wild-caught tropical shrimp imports from non-EU countries, that particular measure will likely only be WTO compatible if the EU first tackles the marine turtle bycatch associated with its own TST vessels, such as those within French Guiana. In those instances, effective implementation of the appropriate technical solution (such as TEDs), coupled with an effective management framework and implementation programme, must be achieved through existing legislative frameworks.

3.8. Trawlers in the Mediterranean and impacts

It is recognised that there is a regional marine turtle bycatch issue within the EU's multi-species trawl industry operating in the Mediterranean and this should also be dealt with. However, this is not the focus of the current report, which is very specific to tropical shrimp imports, and the available solution of TEDs. Trawl fisheries in the Mediterranean are very often multi-species operations, where shrimps are not the main target but are caught opportunistically as valuable components of a varied catch composed of fishes, cephalopods and other crustaceans (Casale, 2011). Yet these fisheries are not comparable to the TST fisheries that export to the EU. The US also has fish trawl fisheries that are not required to use TEDs and still the US is compliant with the WTO. Therefore although it is important to address marine turtle bycatch in Mediterranean trawl fisheries, that could be tackled as a separate issue to the proposed measures outlined in this report. However, given the importance of this issue, Appendix 5 does provide a summary of the general situation in the Mediterranean.

⁹ General Agreement on Tariffs and Trade

¹⁰ See: https://www.wto.org/english/tratop_e/envir_e/envt_rules_gatt_e.htm

4. | Trawl-caught tropical shrimp exports to the EU



Nicholas Pilcher, MRF

This section estimates the annual tonnage of trawl-caught tropical shrimp being imported into the EU from selected exporting countries implicated in marine turtle bycatch. The purpose of generating these estimates is to understand how the EU may potentially be complicit in marine turtle bycatch by virtue of importing these shrimp. Preceding this, since the methodology allowed for the production of global estimates of annual trawl-caught tropical shrimp, these estimates were also generated and are presented here since it is important information in its own right and provides a global context. Appendix 1 presents results of further analyses to estimate

the actual marine turtle bycatch associated with the estimated shrimp catch from the selected countries exporting to the EU. However, since the bycatch estimation methodology used relatively old data from a specific geographic area and then applied that globally, the estimates are not considered accurate enough to be included in the main body of this report. Nevertheless, by showing them in the appendices it provides readers an opportunity to appraise the methodology and potentially adopt a more refined process to generate improved estimates in the future – something that is clearly needed.

4.1. A global estimate of TST activities

4.1.1. Method

Data from the EUROSTAT database¹¹ was accessed in order to collate the landings of tropical shrimp from countries around the world. For the purposes of this analysis, capture shrimp landing data was collated for the same countries as those chosen by MacFadyen & Banks (2011) for their analysis of global shrimp catches for the 2000 to 2007 period – an analysis that focused on TST countries and which resulted in a blueprint for moving towards sustainability in these fisheries. In the current study, this information was updated by collecting data from the same source but

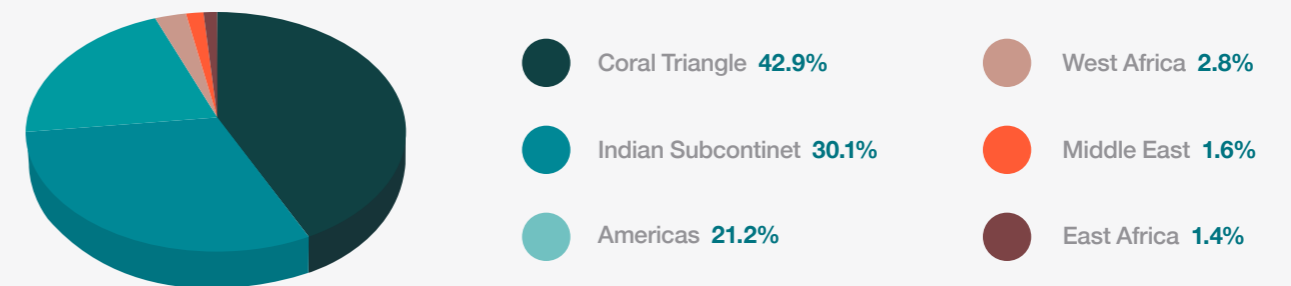
for the 2008 to 2013 period. The Eurostat figures did not differentiate between gear types, but trawling for tropical shrimp is likely the most prevalent method for catching these species. During the 1990s, for example, 86.6% of the total shrimp landings during that period came from trawling (Watson et al., 2004). It was assumed that this figure is still relevant over the 2008 to 2013 period, and was thus used to estimate the proportion of wild shrimp landings caught by trawling (see Table 2).

4.1.2. Results

The total catch of shrimp from trawlers was estimated to be 1'282'397 tonnes over the 2008 to 2013 period, with an estimated annual average of 213'732 tonnes (see Table 2). The relative regional proportions (Coral Triangle, Indian Subcontinent, Middle East, west Africa, east Africa, and the Americas) are shown in Figure 3. Looking further into this data, it is possible to show the total global shrimp tonnage caught from countries currently not certified to export to the US (rows shaded in grey in Table 2). Looking at the data with this filter, it can be seen that relatively few countries are actually certified to export to the US when compared to all

tropical shrimp producing countries. Here, of the 64 countries analysed (not including the US), 41 countries (or 64 per cent) do not export to the US. In terms of tonnage, Table 2 shows that collectively these countries not exporting to the US generated an estimated TST catch of 1'006'660 tonnes over the 2008 to 2013 period, with an annual average of 167'777 tonnes. It can thus be inferred that adoption by the EU of similar measures to those imposed by the US regarding wild caught shrimp imports could significantly help marine turtle populations globally.

Figure 3. Estimated relative proportions of the average annual trawl catch of tropical shrimp by region over the 2008 to 2013 period (overall total: 1'282'397 tonnes). Source data derived from FAO's EUROSTAT database.



¹¹ See: <http://ec.europa.eu/eurostat>

Table 2. Estimated annual catch of trawl-caught tropical shrimp from nations involved in TST fishing over the 2008 to 2013 period. Source: FAO Fishstat 2015¹². Shaded rows: building on Table 1, rows shaded in grey are those countries currently not certified to export trawl-caught shrimp to the US.

	Region and country	Average shrimp catch	% average of total	Adjusted for trawl captures (86.6%)
Coral Triangle	Australia	20'165	1.4	17,462
	Cambodia	8'640	0.6	7'482
	Indonesia	240'685	16.3	208'433
	Malaysia	104'132	7.0	90'178
	PNG	699	0.0	605
	Philippines	45'639	3.1	39'524
	Singapore	213	0.0	185
	Solomon Islands	15	0.0	13
	Thailand	49'965	3.4	43'270
	Viet Nam	165'021	11.1	142'908
	Total	635'173	42.9	550'060
	Not to US	615'008	42	532'597
	Indian Subcontinent	India	379'748	25.6
Myanmar		41'652	2.8	36'070
Pakistan		21'044	1.4	18'224
Bangladesh		3'444	0.2	2'983
Total		445'887	30.1	386'138.0
Not to US	424'843	29	367'914	
Middle East	Bahrain	3'092	0.2	2'677
	Iran	8'043	0.5	6'965
	Iraq	243	0.0	211
	Kuwait	1'695	0.1	1'468
	Oman	717	0.0	621
	Saudi Arabia	9'284	0.6	8'040
	Yemen	1'174	0.1	1'016
	TOTAL	24'247	1.6	20'998
	Not to US	23'530	1.6	20'377
West Africa	Angola	410	0.0	355
	Benin	1'175	0.1	1'018
	Cameroon	12'257	0.8	10'614
	Congo	-	0.0	0
	Cote d'Ivoire	246	0.0	213
	Gabon	87	0.0	75
	Gambia	1'517	0.1	1'313
	Ghana	1'808	0.1	1'566
	Guinea-Bissau	51	0.0	44
	Guinea	-	0.0	0
	Liberia	41	0.0	35
	Nigeria	20'446	1.4	17'707
	Senegal	3'037	0.2	2'630
	Sierra Leone	1'019	0.1	883
	TOTAL	42'094	2.8	36'453
Not to US	21'561	2.8	18'671.4	

Table 2. Estimated annual catch of trawl-caught tropical shrimp from nations involved in TST fishing over the 2008 to 2013 period. Source: FAO Fishstat 2015¹². Shaded rows: building on Table 1, rows shaded in grey are those countries currently not certified to export trawl-caught shrimp to the US.

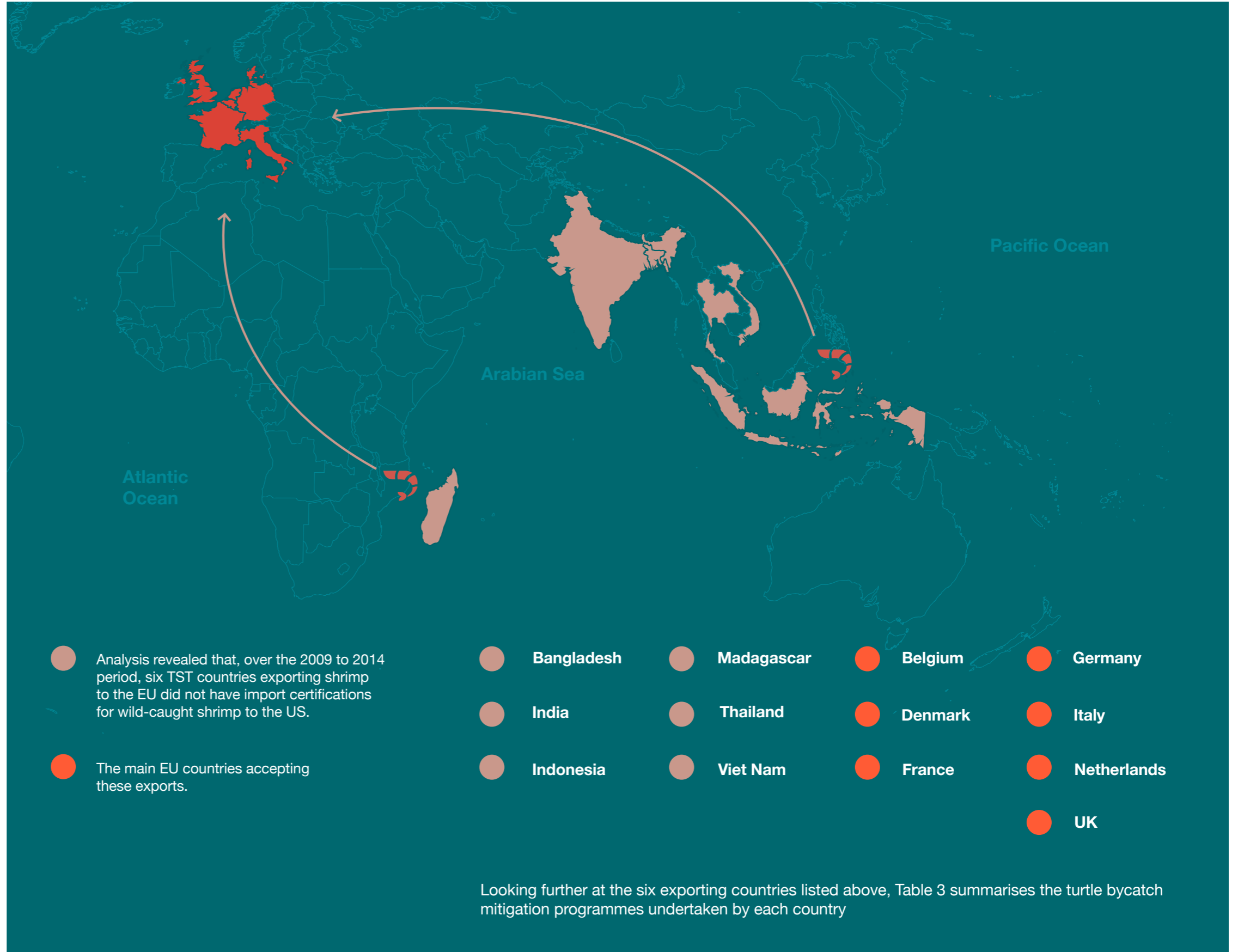
	Region and country	Average shrimp catch	% average of total	Adjusted for trawl captures (86.6%)
East Africa	Eritrea	153	0.0	133
	Kenya	207	0.0	179
	Madagascar	8'037	0.5	6'960
	Mozambique	10'440	0.7	9'041
	South Africa	85	0.0	74
	Tanzania	1'297	0.1	1'123
	TOTAL	20'219	1.4	17'509.9
	Not to US	20'219	1.4	17'509.9
	Americas	Belize	199	0.0
Brazil		38'883	2.6	33'673
Chile		4'658	0.3	4'034
Colombia		2'079	0.1	1'801
Costa Rica		1'629	0.1	1'410
Cuba		587	0.0	508
Dominican Republic		60	0.0	52
Ecuador		6'855	0.5	5'936
El Salvador		755	0.1	654
French Guiana		1'055	0.1	913
Guatemala		1'185	0.1	1'026
Guyana		20'787	1.4	18'002
Haiti		97	0.0	84
Honduras		1'650	0.1	1'429
Jamaica		-	0.0	-
Mexico		66'297	4.5	57'413
Nicaragua		1'971	0.1	1'706
Panama		5'936	0.4	5'141
Peru		16'917	1.1	14'650
Suriname		8'733	0.6	7'563
Trinidad and Tobago	780	0.1	675	
USA	129'676	8.8	112'229	
Uruguay	14	0.0	12	
Venezuela	2'408	0.2	2'085	
Total	313'209	21.2	271'239	
Not to US	57'264	4.0	49'591	
Global totals all countries	1'480'829		1'282'397	
Global totals all countries not exporting to US (grey)			1'006'660.3	

¹² See: <http://www.fao.org/fishery/statistics/software/fishstatj/en>

4.2. Trawl caught tropical shrimp exports to the EU

4.2.1. Exporting countries identification methodology

Using the FAO's Globefish Highlights report ¹³, countries that export shrimp to the US (see Table 1), and that also export to the EU were eliminated from further analysis. The inference being that such nations, given their certification to export shrimp to the US, were likely to be consistent in their shrimp fishing method and management regime irrespective of the final destination market and so any exports to the EU were unlikely to have been giving rise to large numbers of marine turtle bycatch. With these countries eliminated, a list of countries that export shrimp to the EU but which are not allowed to export to the US was formed. It is recognized that the absence of a certificate allowing for the export of wild trawl caught shrimp to the US by itself does not prove inadequate marine turtle bycatch measures. Issues of quantity, ease of transit, or industry connections (for example) may be reasons for not exporting to the US. However, it does serve as an indicator since access to the US market is often lucrative and a country's main trade barrier in this regard would be the absence of adequate marine turtle bycatch reduction measures. To help corroborate this, a summary analysis of the turtle bycatch reduction programmes of each of the 6 main countries potentially implicated in significant marine turtle bycatch that export to the EU was also undertaken (see Table 3).



¹³ See: http://issuu.com/globefish/docs/16_february_gh_online

Table 3. Summary of Turtle Excluder Device (TED) usage in tropical shrimp trawling countries exporting shrimp to the EU, but which are currently ineligible of exporting to the US.

Bangladesh

Current TED usage/regulation: Required by law.

Summary of effectiveness: Although TED usage is required by law, the regulatory framework and law enforcement in fisheries in Bangladesh is reportedly very weak, with accusations made of overfishing its marine resources and with minimal TED usage.

India

Current TED usage/regulation: The Orissa Marine Fisheries Regulation Act (1982) has made TEDs mandatory for all mechanized trawlers fishing in the coastal waters of Orissa (WWF 2011).

Summary of effectiveness: Although the use of TEDs on trawlers is mandatory in Orissa, despite many years of attempts by the authorities and NGOs, the actual use of TEDs remains low and turtle mortality due to bycatch remains high. The reasons for this are complex and varied and include a combination of perception/awareness (e.g. the belief that using TEDs will reduce fish catches by up to 30%), poor enforcement of regulations (partly due to limited capacity and poor coordination between relevant government departments), lack of incentives (trawl operators see no major long-term benefits from using TEDs), political interests (WWF 2011), and conflicts between fishers and government agencies over permitted fishery grounds.

Indonesia

Current TED usage/regulation: Trawl and seine fishing is banned under Permen KP 2/2015. Trawling was banned in 1980 through Presidential Decree No.39. However, Presidential Decree No. 85 of 1982 allows shrimp trawl operations from the shore, 130 degrees east of eastern Indonesia (Arafura Sea) if using TEDs or Bycatch Excluder Devices (FAO, no date). <http://news.mongabay.com/2015/0304-mrn-kaye-new-fisheries-regulations.html>

Summary of effectiveness: In 1996, the trawl fishery in the Arafura Sea caught around 20'000 tonnes of shrimp. In 1999, 453 vessels were involved (small wooden vessels fishing with one trawl and larger steel vessels using two trawls with outriggers). Problems have been identified as weak enforcement of regulations, lack of awareness of the existing fisheries regulations, increasing fishing effort and very high discard rates (FAO no date). In a 2014 interview with the Wall Street Journal, President Widodo revealed that 90 per cent of the 5'400 fishing boats operating within Indonesia's waters every day are illegal. Not only is it difficult to determine the effectiveness of the TED regulation in the Arafura sea, but also determining the proportion of the EU's imports of Indonesian shrimp that came from this area versus other areas where trawling is banned.

Madagascar

Current TED usage/regulation: TEDs are mandatory on shrimp trawlers (Decree Number 2003/1101) (Sylla et al., 2003).

Summary of effectiveness: Some Madagascan fisheries have made significant advancements in reducing marine turtle bycatch. In 2005, for example, reported incidences of turtle bycatch from trawling amounted to only 2 animals, compared to 142 in 2004. Though noting that these figures represented only 30 per cent of the national fleet (Humber & Hykle, 2011). On the 10th January 2007, the US government allowed Madagascar to export wild trawl caught shrimp to the US. However, that eligibility has since been withdrawn and at the time of writing Madagascar cannot export wild-caught shrimp to the US. However, given that Madagascar can still export to the EU and to other countries, it can be inferred that the revocation of the export certificate by the US may not have significantly affected Madagascar and thus places further emphasis on the need for similar regulations to exist in the EU.

Thailand

Current TED usage/ regulation: Thailand has 3'000 registered shrimp trawl vessels, all of which are required to have TEDs.

Summary of effectiveness: Although Thailand was formerly certified to export wild caught shrimp to the US, that certificate was revoked and exports to the US are now banned with the US alleging that Thai fishing vessels do not use TEDs (Seaman, 2014). In keeping with the point made earlier in this table concerning Madagascar, given that Thailand can still export to the EU and to other countries, it can be inferred that the revocation of the export certificate by the US may not have significantly affected Thailand, and thus places further emphasis on the need for similar regulations to exist in the EU. Ongoing efforts in Thailand to tackle this have occurred through cooperation between the Southeast Asian Fisheries Development Centre (SEAFDEC) and the Department of Fisheries of Thailand. Here, testing of a TED derivative – the Thai Turtle Free Device (TTFD) – designed specifically to suit Thai trawl fisheries, has shown potential, demonstrating not only good turtle bycatch reduction, but also increased fuel efficiency, ease to install, relatively inexpensive, and improvements to the overall quality of the catch. These are significant results that will help promote actual TED implementation in Thailand (SEAFDEC, 2015).

Viet Nam

Current TED usage/ regulation: No mandatory requirement.

Summary of effectiveness: No literature could be found proving effective implementation of TEDs, despite tests carried out in the past.

Based on the analysis presented in Table 3, it is not possible to conclude that any of the countries are effectively adopting turtle bycatch reduction measures, such as TED usage, to an extent that is significantly and consistently reducing marine turtle bycatch. Therefore, it is inferred that the EU maybe unwittingly complicit in marine turtle bycatch by virtue of accepting these exports.

4.2.2. Estimation of export tonnage to the EU from the six countries

To calculate the tonnage of trawl-caught tropical shrimp being exported to the EU from the six identified countries, information was first sought on the proportion of exports coming from farmed and wild sources as this differentiation was not made in the Globefish Highlights13 data sources. In the scope of the current study, such information was difficult to find, though 2011 information revealed that the apparent consumption of wild-caught tropical shrimp, per capita, in the EU was 46 per cent with the remaining 54 per cent coming from farmed sources

(EC, 2014). Accordingly, this figure was applied to the data to determine the wild-caught proportion of the exports, followed then by an estimation of the proportion of wild shrimp coming from trawl-caught sources using the 86.6 per cent figure outlined in section 4.1.1. (i.e. the estimated proportion of shrimp landings that came from trawling during the 1990s). In other words, of the 46 per cent of tropical shrimp imports estimated to derive from wild caught sources, 86.6 per cent (Watson et al., 2004) of that was estimated to come from trawling.

4.2.2.1. Results

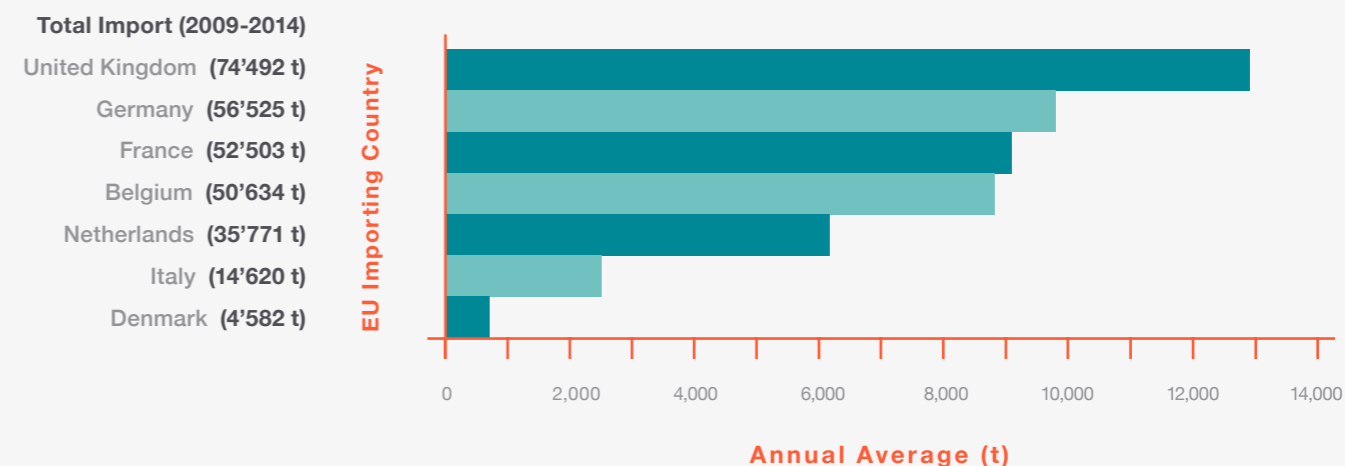
The annual average over the study period of 2009 to 2014 (see Table 4) shows that nearly 289'130 tonnes of tropical shrimp imports coming from the studied countries is being exported into the EU from the six identified countries, with an annual average of 48'188 tonnes.

Table 4. Cumulative and annual average estimated trawl-caught tropical shrimp exported into the EU over the 2009 to 2014 period from the six identified countries - Bangladesh, India, Indonesia, Madagascar, Thailand, and Viet Nam (FAO Globefish, 2015).

Exporting country	Total shrimp exports to the EU (tonnes)	Estimated proportion of wild shrimp in tonnes (46%)	Estimated proportion from TST operations (86.6%)
Bangladesh	165'200	75'992	65'809
India	243'300	111'918	96'921
Indonesia	45'000	20'700	17'926
Madagascar	29'800	13'708	11'871
Thailand	109'100	50'186	43'461
Viet Nam	133'400	61'364	53'141
Totals	725'800	333'868	289'130
Average	120'966	55'645	48'188

In terms of EU importing countries, the United Kingdom, Germany, France, Belgium, The Netherlands, Italy and Denmark were identified as the EU nations importing shrimp from the six countries. Figure 4 presents this information, with the graph clearly showing the UK to be the most significant importer, followed closely by Germany and France. Denmark imports the least amount.

Figure 4. Annual average of trawl caught tropical shrimp imported by EU countries from the six exporting nations of Bangladesh, India, Indonesia, Madagascar, Thailand, and Viet Nam. Figures next to country names show the total amount over the 2009 to 2014 period. (Raw data and sources can be seen in Appendix 2.)



It should be noted that significant shrimp imports come into the EU from unspecified countries, categorised in the Globefish report as 'Others'. In 2014 alone, this category accounted for 131'600 tonnes of shrimp imports. The TST operations of these territories and potential bycatch therein should be the subject of further investigation. The estimated export tonnage in the current study are therefore most likely an underestimate, notwithstanding the unmeasured global marine turtle bycatch associated with Illegal, Unreported and Unregulated (IUU) fishing and the subsequent laundering of associated TST shrimp that may end up in EU markets (although this is being tackled by the EU's IUU regulation - see

section 6.3. - it cannot yet be assumed to have been eliminated). It must also be recognised, however, that in some instances export tonnage may be over-estimated for certain countries and thus further research is recommended.

Given the conservation status of marine turtles globally (see section 2.1.), these figures and the potential bycatch of marine turtles that may be associated with them (e.g. see Appendix 1) highlights a potentially serious issue that requires a concerted response from the EU, especially in light of the many relevant conservation agreements to which it is party. These are outlined in the following section.

5. EU environmental obligations



Nicholas Pilcher, MRF

The EU is party to many international conservation treaties and has further endorsed a range of international conservation oriented guidelines. Many of these contain specific text that clearly outlines obligations to minimize harmful fishing practices, such as those that result in marine turtle bycatch. This section presents an analysis of those treaties and their relevance to the bycatch and mortality estimates generated in the previous section.

5.1. EU Multilateral Environmental Agreements

Given the trans-boundary nature and global scope of many environmental problems, the need for international cooperation is essential for effectively tackling these issues. Consequently, measures to tackle worldwide environmental problems must be a key objective of EU Policy, as established under the Lisbon Treaty¹⁴. The 7th Environment Action Programme (EAP) of the EU serves to guide European environment policy until 2020. It works towards three key objectives:

1. To protect, conserve and enhance the Union's natural capital.
2. To turn the Union into a resource-efficient, green, and competitive low-carbon economy.
3. To safeguard the Union's citizens from environment-related pressures and risks to health and wellbeing.

The aim is to achieve these objectives through four "enablers":

1. Better implementation of legislation.
2. Better information by improving the knowledge base.

3. More and wiser investment for environment and climate policy.
4. Full integration of environmental requirements and considerations into other policies.

Two additional horizontal priority objectives complete the programme:

1. To make the Union's cities more sustainable.
2. To help the Union address international environmental and climate challenges more effectively.

Entering into force in January 2014, responsibility for implementation now rests with EU Member States and should be met by 2020¹⁵. An essential element to achieve the three objectives rests with a series of key international environmental agreements. Success here, though, depends on these agreements being actively supported and properly implemented, both at the EU level and worldwide¹⁶.

The EU has already ratified many international environmental agreements¹⁷ under various categories, but those directly relevant to marine turtle protection are covered under the Nature and Biodiversity group. These are listed in Table 5 below, together with a brief description and their relevance to marine turtle conservation.



Leatherback turtle; Sao Tome and Principe © Michel Gunther / WWF

¹⁴ The Treaty of Lisbon meets the need to reform the structure of the EU and the way in which it functions, see: http://europa.eu/legislation_summaries/institutional_affairs/treaties/lisbon_treaty/ai0033_en.htm

¹⁵ For full information, see: <http://ec.europa.eu/environment/newprg/>

¹⁶ Further information, see: http://ec.europa.eu/environment/international_issues/agreements_en.htm

¹⁷ A full list can be seen here: http://ec.europa.eu/environment/international_issues/pdf/agreements_en.pdf#page=5

International environmental agreements to which the EU is a contracting party or signatory and that have relevance to marine turtle conservation. Text in summary column has, unless otherwise stated, been taken directly from: <http://ec.europa.eu>.

Agreement	Summary	Relevance to marine turtles
CBD: Convention on Biological Diversity (1992).	To conserve the biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources, taking into account all rights over those resources and to technologies, and by appropriate funding.	Marine turtle conservation is relevant to the agreement given the species' importance to overall biological diversity. For example, text in Article 8 states that each contracting party shall: "promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings" (CBD, 1992).
CMS: Convention on the Conservation of Migratory Species of Wild Animals (1979). Also known as the Bonn Convention. CMS instruments can be both binding and non-binding.	To conserve migratory species and take action to this end, paying special attention to migratory species the conservation status of which is unfavourable, and taking individually or in co-operation appropriate and necessary steps to conserve such species and their habitat.	All seven species of marine turtles are listed within the convention text (CMS, 2014). A specific agreement has been developed for marine turtles under CMS. The Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia (IOSEA), for example, to which the UK and France are individual EU country signatories. CMS has a specific resolution on bycatch detailing various actions needed to reduce bycatch of migratory species that will include marine turtles (UNEP/CMS/Resolution 9.18 on Bycatch).
Convention on the Conservation of European Wildlife and Natural Habitats (1979). Also known as the Bern Convention and is binding.	To conserve wild flora and fauna and their natural habitats, especially those species and habitats whose conservation requires the co- operation of several States, and to promote such co-operation.	Conserving European natural heritage is a key element of this convention (CoE, 2014) and this will include marine turtle populations in the Mediterranean, for example. The EU aims to fulfil its obligations under the Bern Convention through its Habitats Directive (a directive designed to ensure the conservation of rare, threatened, or endemic animal and plant species) ¹⁸ .
CITES: Convention on International Trade in Endangered Species of Wild Fauna and Flora.	An international agreement between governments, the aim of which is to ensure that international trade in specimens of wild animals and plants does not threaten their survival fauna and their natural habitats, especially those species and habitats whose conservation requires the co- operation of several States, and to promote such co-operation.	All seven species listed in Appendix I of CITES.
Protocol (of the Barcelona Convention¹⁹) concerning Specially Protected Areas and Biological Diversity in the Mediterranean Sea (1995).	To protect those marine areas which are important for the safeguarding of the natural resources and natural sites of the Mediterranean Sea area, as well as for the safeguarding of their cultural heritage in the region.	Contracting parties have, among other measures relevant to marine turtles, recommended the implementation of measures to reduce turtle bycatch (Margaritoulis, 2006). The Mediterranean Action Plan has, among its priorities, objectives to protect marine and coastal habitats and protected species, which will include marine turtles.

International environmental agreements to which the EU is a contracting party or signatory and that have relevance to marine turtle conservation. Text in summary column has, unless otherwise stated, been taken directly from: <http://ec.europa.eu>.

Agreement	Summary	Relevance to marine turtles
UNCLOS: The United Nations Convention on the Law of the Sea. Came into force in 1994.	An international treaty that defines the rights and responsibilities of nations with respect to their use of the world's oceans and establishes guidelines for the management of marine natural resources (Wikipedia, 2015).	Being complicit in marine turtle bycatch contradicts the objectives of UNCLOS. This is especially true in relation to UNCLOS Article 61 concerning the conservation of the living resources in Exclusive Economic Zones (EEZs), and UNCLOS Article 64 concerning highly migratory species in EEZs. Furthermore, relevant Articles under the section Conservation and Management of the Living Resources of the High Seas are Article 116, concerning the right to fish; Article 117, concerning the duty of States to adopt with respect to their nationals measures for the conservation of the living resources of the high seas; Article 118, concerning cooperation of States in the conservation and management of living resources and Article 119, concerning conservation of the living resources of the high seas ²⁰ .
UNFSA: United Nations Fish Stock Agreement. Known formally as the Agreement Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks.	A legal regime for the long-term conservation and sustainable use of straddling and highly migratory fish stocks (i.e. addressing problems related to the management of high seas fish stocks).	Ratified by 81 states and the European Union. Mentions a range of problems, including those related to unselective fishing gear. Elaborates on the fundamental principle that countries should, inter alia, cooperate to ensure conservation. Most shrimp are trawled within EEZs, though in those instances where tropical shrimp may be caught outside of EEZs, or where there are straddling stocks (i.e. stocks that migrate through, or occur in, more than one EEZ), UNFSA will have a bearing on the EU's involvement in such cases.
Regional Fisheries Management Organisations (RFMOs) and Regional Fisheries Bodies (RFBs).	The EU is party to numerous RFMOs and RFBs that although not classed as global agreements are considered as binding multilateral agreements.	The main relevance has to do with the EU's Common Fisheries Policy (CFP) - the framework that establishes the rules that govern how the shared fish stocks within European Union waters are managed. The CFP now includes an external dimension establishing the standards by which EU vessels should adhere to when fishing outside of EU waters. The relevance of the CFP to this is detailed in section 6.1.

¹⁸ See: http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm

¹⁹ Convention for the Protection of the Marine Environments and the Coastal region of the Mediterranean (known as the Barcelona Convention)

²⁰ Further information, see: http://www.un.org/depts/los/convention_agreements/texts/unclos/closindx.htm

5.2. Guidelines

In addition to formal treaties and conventions, there are also guidelines and instruments that the EU has endorsed. These are summarized in Table 6.

Table 6. EU-endorsed fisheries management guidelines/plans of action of relevance to marine turtle bycatch reduction.

Guideline	Summary	Relevance to marine turtles
FAO Code of Conduct for Responsible Fishing.	A voluntary code that promotes and provides guidance towards the long-term sustainable use of fisheries.	Specific text of clear relevance to marine turtle conservation states that: "Management measures should not only ensure the conservation of target species but also of species belonging to the same ecosystem or associated with or dependent upon the target species" ²¹ .
International Guidelines for Bycatch Management and Reduction of Discards (FAO, 2011).	Voluntary guidelines of global scope designed to help parties formulate and implement appropriate measures for the management of bycatch and reduction of discards.	The guidelines were endorsed by the Committee on Fisheries (COFI), which includes the EU, at its twenty-ninth session (February 2011). The document can be broadly related to marine turtle bycatch reduction.
Voluntary Guidelines on Securing Sustainable Small-Scale Fisheries.	The primary objectives of the guidelines are to ensure the sustainable and equitable development of small-scale fisheries.	These were recommended for development at the 29th Session of the FAO's COFI, of which the EU is a member. The now published guidelines state that: "Small-scale fisheries should utilize fishing practices that minimize harm to the aquatic environment and associated species and support the sustainability of the resource" ²² .
International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated (IUU) Fishing.	Provides States with comprehensive, effective and transparent measures to combat IUU.	Adopted by consensus at the twenty-fourth session of the FAO's COFI, of which the EU is a member, on the 2nd March 2001. Highly relevant to the unregulated portion of TST activity that may result in shrimps being exported to the EU and which may have resulted in marine turtle bycatch and mortalities, for example.

The EU is clearly committed to making fisheries more sustainable, both domestically and internationally, and it therefore follows that the EU be equally concerned about the provenance of their seafood imports. This is certainly the case, as evidenced by the EU IUU regulation that aims to eliminate the export of fish related products into the EU from IUU sources. Given the agreements to which they are party, and the guidelines they have endorsed through their membership of COFI (see

Tables 5 and 6 respectively), it is now incumbent on the EU to tackle the issue of shrimp imports by implementing measures that will prevent importing wild-caught shrimp implicated in marine turtle bycatch unless it can be proven that an effective regulatory programme to reduce such bycatch has been adopted by the exporting country. In other words, by implementing measures comparable to Section 609 of Public Law 101-162.

²¹ Further information, see: <http://www.fao.org/docrep/005/v9878e/v9878e00.htm>

²² Further information, see: <http://www.fao.org/cofi/42011-0d2bdfc444f14130c4c13ecb44218c4d6.pdf>



6. Current relevant EU legislation & management regimes



Hawksbill turtle; Brazil © Guy Marcovaldi / WWF

The mechanism for managing fish stocks both within the EU, and of European vessels fishing outside of EU waters, is established through the Common Fisheries Policy (CFP). Regarding importing legislation, there are specific rules regarding the importation of shrimp, and broader legislation designed to eliminate the importation of fishery products from IUU fisheries. These are outlined below.

6.1. The Common Fisheries Policy

The CFP establishes the rules that govern how the shared fish stocks within EU waters are managed. It was first introduced in 1970, with the most recent iteration taking effect on the 1st January 2014

following an extensive reform process. The CFP has four main policy areas and these are outlined below with specific reference to the aspects relevant to marine turtle conservation and TED implementation.

6.1.1. Fisheries management

The principal aim of the current CFP is to ensure long-term, sustainable, fishing yields for all stocks by 2020. An equally important aim is to do so by keeping unwanted catches and wasteful practices to the minimum, or to avoid them altogether. This latter aspect formed a key component of the recent CFP reform (in addition to management decisions taken at the regional level and ensuring science and ecosystem-based decision making) and is one that obliges marine turtle bycatch reduction. Of most direct relevance to reducing marine turtle bycatch

from EU vessels, are the CFP fisheries management input controls, especially the technical measures that govern how, where and when fishers may fish (EC, 2014). Given the protected status of marine turtles, it therefore follows that the EU must ensure that those operations that interact with marine turtles should implement adequate and effective measures to mitigate impacts (e.g. see Millan et al., 2014). This applies equally to both the EU domestic fleet and EU vessels fishing outside of Europe.

6.1.2. International policy

Related to its international obligations as stipulated under the reformed CFP, the EU is aiming to actively promote better international governance across the world's seas and oceans to keep them clean, safe and secure. To this end, it is closely involved with the bodies established under UNCLOS and UNFSA such as through COFI and RFMOs (see Table 6). It is currently involved in the launching of

an Implementing Agreement under UNCLOS for the conservation and sustainable use of marine biodiversity in areas beyond national jurisdiction – an initiative that followed the UN Conference on Sustainable Development (Rio+20) (EC, 2015). This dimension further underpins the need to implement TEDs should any EU vessel fishing tropical shrimp internationally be in potential contact with marine turtles.

6.1.2.1. The CFP and the external dimension

For the first time since the inception of the CFP in 1983, measures governing fisheries outside EU waters have become part of the new CFP regulation, effective since 1 January 2014 (Hutchings, 2015). Thus the CFP principles apply to all fisheries in EU waters, including the Mediterranean, and to European vessels wherever they fish in the world's oceans (WWF, 2015). The inclusion of this so-called 'external dimension' has revolutionised how the EU interacts outside home waters, especially regarding its participation in RFMOs and is a core argument as to why the EU is obliged to act internationally regarding its impact on marine turtle populations as part of measures to fulfil its obligations under the reformed CFP (Graham 2015 pers.comm.).



Gulf of California, Mexico © Gustavo Ybarra / WWF

6.1.3. Market and Trade Policy

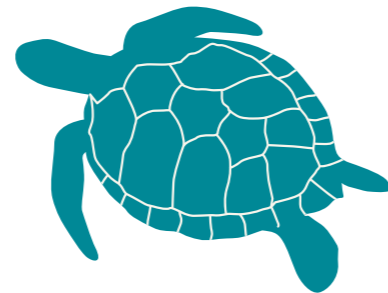
The Common Organisation of the Markets was introduced in 1970 as the first component of the CFP²³. It serves to empower producers with responsibility for the sustainable exploitation of the resources, and to better equip them to market their products. Its main elements are:

- i) organisation of the sector
- ii) marketing standards
- iii) consumer information
- iv) competition rules
- v) market intelligence

This regulation could thus play an important role in ensuring non-TED wild caught shrimp do not enter the market, should such legislation be introduced.

6.1.4. Funding of the Policy

The current fund for the EU's maritime and fisheries policies, running from 2014 to 2020, is the European Maritime and Fisheries Fund (EMFF). Among other things, the fund has resources to help fishers transition to sustainable fishing practices and this can include help in the implementation of technical measures, such as TEDs. This has particular relevance to EU fleets seeking to reduce turtle bycatch and potentially EU vessels fishing internationally.



6.2 EU shrimp importing legislation

The EU has specific requirements to meet in order to accept shrimp imports. These are summarised in Box 1²⁴.

Box 1. Current requirements for exporting shrimp to the EU.

Shrimp must come from an authorised country²⁵:

The country of origin must appear on the list of countries that can export fishery products to the EU.

Are caught by approved vessels (wild shrimps) or were produced in registered farms (aquaculture): Shrimps can only be imported into the EU if they have been dispatched from, obtained or prepared in approved establishments (cold store, processing plant, factory or freezer vessels).

Are accompanied by the proper health certificates: Shrimps need a health certificate confirming they meet the standards for export to the EU.

Illegal fishing: To help combat illegal fishing, marine fishery products entering the EU require a catch certificate proving that international conservation and management rules were respected (see below).

Labelling: Labels must be visible, legible, indelible, and clearly worded in a language easily understood by consumers. Usually this means in the official language(s) of the European country where the product is marketed. All food labels must display the following: name under which the product is sold; list of ingredients, including additives; net quantity; minimum durability date; special conditions for storage or use; name or business name and address of the manufacturer, packager, or seller established in the EU; place of origin or provenance; lot marking on pre-packaged foodstuffs. For specific fishery products, labels must display: commercial and scientific designation of the species; production method (caught at sea, in freshwater, or aquaculture); catch area: one of the maritime areas internationally identified by the FAO must appear.

For shrimp species Crangon crangon & Pandalus borealis: Labels must display: country of origin; scientific name and trade name; presentation, freshness and size categories; net weight in kilograms; date of grading and date of dispatch; name and address of exporter. Lots must contain products of the same size and uniform freshness. The freshness category, size category and presentation must be clearly and indelibly marked on labels affixed to the lot.

²³ Further information, see: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=URISERV:i66002>

²⁴ See: http://exporthelp.europa.eu/thdapp/display.htm?page=rt/rt_Shrimps.html&docType=main&languageId=EN

²⁵ As of 2014, the following countries exported shrimp to the EU : Argentina, Bangladesh, Belgium, Canada, China, Denmark, Ecuador, Faroe Islands, Germany, Greenland, Iceland, India, Indonesia, Italy, Madagascar, Morocco, Netherlands, Nicaragua, Norway, Russian Federation, Spain, Sweden, Thailand, USA, UK, Venezuela, Viet Nam, 'Others'. Source: EUROSTAT : <http://ec.europa.eu/eurostat>

6.3. EU rules to combat illegal, unreported and unregulated fishing

Illegal, unreported and unregulated fishing (IUU) depletes fish stocks, destroys marine habitats, distorts competition, puts honest fishers at an unfair disadvantage, and weakens coastal communities, particularly in developing countries (EC, 2014). In recognition of this, the EU introduced Council Regulation (EC) No. 1005/2008 of 29 September 2008 establishing a Community system to prevent, deter and eliminate IUU fishing. The regulation entered into force on 1 January 2010 and, in summary, stipulates that only marine fisheries products validated as legal by the competent flag state or exporting state can be imported to, or exported from, the EU. This status is determined by a "catch certificate" intended to guarantee that products imported into the EU do not originate from IUU fishing. Certificates are issued by the flag State and accompany fishery products throughout the supply chain to facilitate checks.

As part of EU efforts to facilitate enforcement of the regulation, an IUU vessel list is issued regularly and is based on IUU vessels identified by RFMOs. Significantly, the IUU Regulation also offers the possibility to blacklist states that turn a blind eye to illegal fishing activities. Further details, specifics, and updates can be seen at Eur-Lex (2011). EU operators who fish illegally anywhere in the world, under any flag, face substantial penalties proportionate to the economic value of their catch²⁶.

Of note, fishing shall be presumed to be engaged in IUU if, among other things, it uses prohibited or non-compliant fishing gear (see Eur-Lex, 2011). This offers scope to work within targeted countries, such as those shown to adopt a TED regulation, meaning they should not then be able to export to EU markets if TEDs are not used.



Gulf of California, Mexico. © Gustavo Ybarra / WWF

²⁶ See: http://ec.europa.eu/fisheries/cfp/illegal_fishing/index_en.htm

7. Discussion & Recommendations



This study indicates a need for EU stakeholders (business, consumers and government) to consider actions to ensure that wild caught tropical shrimp imports are sourced from fisheries that are not implicated in marine turtle bycatch. Such actions, outlined in section 7.1. – Recommendations, range from specific regulations to measures of a more voluntary nature. The cumulative estimated export tonnage from the trawl caught shrimp operations of Bangladesh, India, Indonesia, Madagascar, Thailand and Viet Nam (over the 2009 to 2014 period) at 289'130 tonnes (48'188 tonnes yearly average) is a clear cause for concern given the degree to which this activity is implicated in marine turtle bycatch. Furthermore, these figures may underestimate the total impact, since a major component of countries exporting shrimp to the EU were classified in the 'Other' section of the Globefish report, and thus all potential bycatch could not be estimated in the current study. This un-estimated category is potentially significant as in 2014 alone it accounted

for 131'600 tonnes of shrimp imports. Moreover, the unmeasured bycatch associated with IUU fishing and the laundering of associated TST shrimp imports that may end up in EU markets (i.e. those that may escape the EU's IUU regulation) also remains an unknown source of marine turtle bycatch that needs to be better understood.

Clearly the introduction of measures will have implications for the exporting countries, and the markets dependent on those imports, and will likely be met with initial industry resistance. The lack of an equivalent regulation in the EU has been highly advantageous to countries who don't meet the US export requirements, especially in those cases where certain countries lost their US export certificate, such as Madagascar and Thailand (see Table 3). However, and as mentioned earlier in this report, experience has shown that the impacts of introducing TEDs to the catching sector can be minimised. Indeed, such measures may even improve profitability in terms of access to new markets, reduced costs of fishing

Failure to take action could mean that the EU's acceptance of certain exports runs counter to its national and international conservation obligations.



activities, and improved product quality associated with TED usage (for example). This is especially the case when efforts are made to ensure the TEDs, and any associated implementation programmes, are designed to suit the unique characteristics of each specific fleet and nation.

There is little doubt that the proposed measures are a long-term undertaking with their own associated costs, both financial and in terms of the human resources needed, but the conservation benefits are worth the effort. This presents an opportunity for the EU and US to collaborate in efforts that seek to support countries to meet the demands of EU-specific measures.

The EU must be commended for the measures it is already undertaking to make fisheries more sustainable, both domestically and internationally, as evidenced by the recent CFP reform and its international dimension, together with its current importing legislation both specifically for shrimp and by way of the IUU regulation. The issues raised

here, however, demonstrate the need to demand additional measures concerning wild caught tropical shrimp imports, either by amending existing legislation, or drawing up new acts (see Appendix 4). Failure to take action could mean that the EU's acceptance of certain imports runs counter to its national and international conservation obligations, such as those defined in the various national and international conservation agreements to which it is party, in addition to the guidelines it has endorsed.

Although the proposed measures would entail a long-term undertaking, there are strategic actions that can be taken now to tackle the problem. Indeed, the time required to effectively implement fleet-specific turtle bycatch reduction measures behoves interim voluntary measures; inaction will only compound the problem, both from a conservation and business viewpoint.

Recommended actions |

- 1** The EU should adopt measures similar in nature and intent to those of the US (i.e. Section 609 of Public Law 101-162) to ensure that wild-caught tropical shrimp exported into the EU are not implicated in marine turtle bycatch.
- 2** EU stakeholders, especially those in the main EU countries importing tropical trawl-caught shrimp (i.e. Belgium, Denmark, France, Germany, Italy, Netherlands, UK) work with (at least) the exporting countries identified in this report (i.e. Bangladesh, India, Indonesia, Madagascar, Thailand, Viet Nam) to help implement effective turtle bycatch mitigation measures. Ideally, this would be through the establishment (or continuation) of collaborative fisheries research programmes with the fishing industry to find optimum mitigation measures for a particular fishery and subsequent best-practice implementation. To this end, a number of specific actions could be taken, such as:
 - a.** Efforts to ensure EU retailers and consumers source from turtle-free fisheries, preceded by collaborative efforts and consideration of turtle-free labelling schemes.
 - b.** EU aid to support fisheries research programmes designed specifically to tackle this issue.
- 3** Relevant seafood markets should consider interim voluntary measures to identify alternative shrimp sources. For example, accepting only those shrimp products certified as non-impactful on turtles, be they cold or warm water shrimp, at least until exporting countries become engaged in effective turtle bycatch mitigation strategies.
- 4** EU consumers, retailers, and country governments collectively demand action to reduce marine turtle bycatch.
- 5** The potential for the EU / IUU regulation to ban imports from countries that are not adhering to their own national regulations should be considered as a key part of any strategy. Of the six focal countries in this study, only Viet Nam does not have a TED regulation, yet effective compliance with the national TED regulations existing within the other five countries is doubtful. Efforts must therefore focus on working with these countries to better comply with those regulations, with the EU in parallel seeking for more conclusive evidence of effective compliance as part of gaining the catch certification necessary to export to the EU.

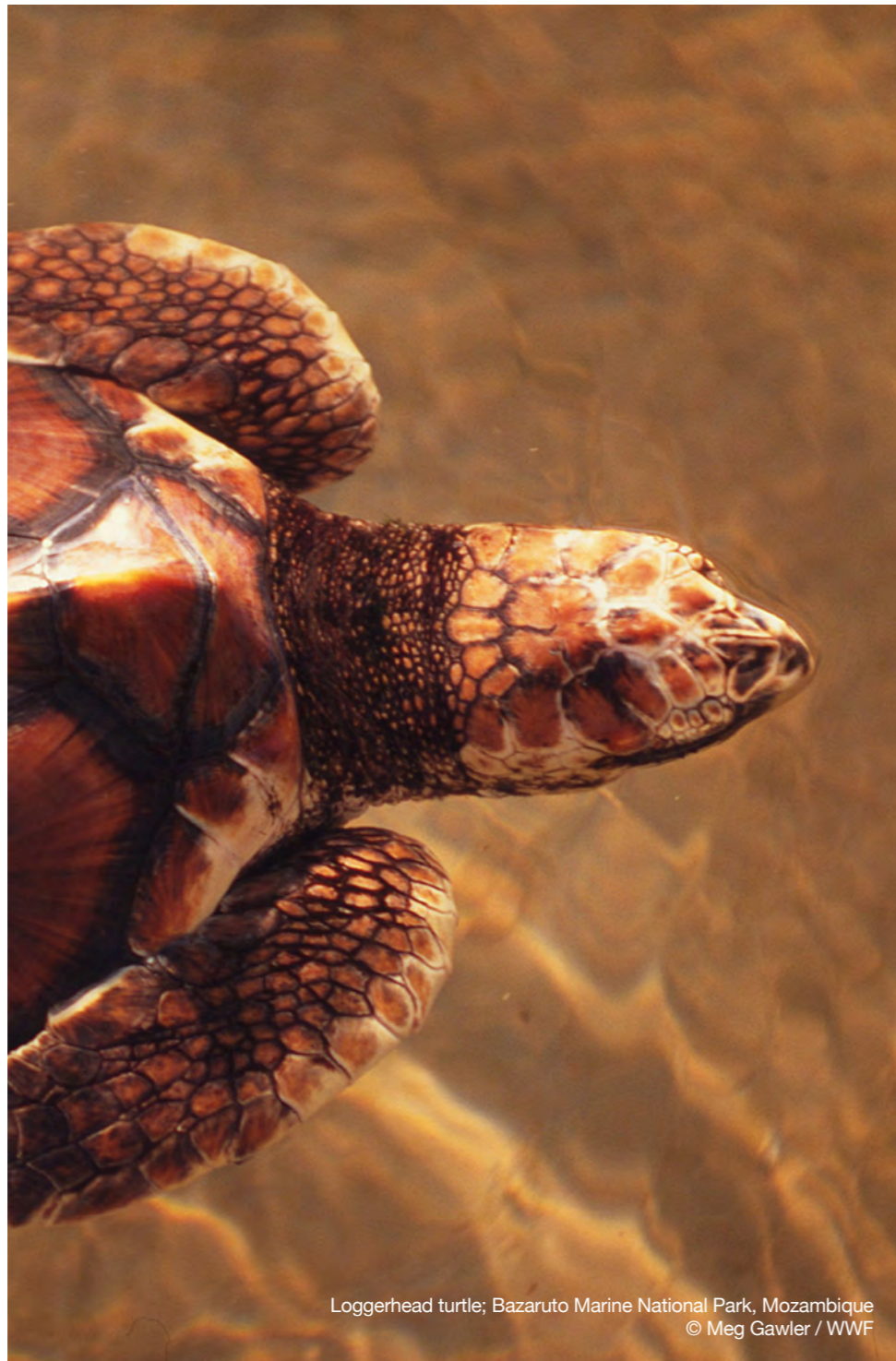
Actions to tackle this issue, such as those outlined, must be promoted by the secretariats of the relevant conventions, agreements, and guidelines to which the EU is associated. **Failure to act could mean the EU's acceptance of certain imports make it complicit in activities that could run counter to those agreements.**

RECOMMENDED FURTHER RESEARCH

Finally, in conducting this study a number of key data gaps have been identified that need to be addressed in order to better understand the situation. Recommended areas for further study that build upon the indicative bycatch estimates generated in this report could be to:

- **GENERATE** more robust estimates of turtle bycatch associated with countries exporting wild-caught tropical shrimps into the EU.
- **DETERMINE** the extent of marine turtle bycatch caught in EU overseas territories, and by EU vessels fishing outside of the EU that may be engaged in tropical shrimp trawling.
- **DEVELOP** estimates of turtle bycatch potentially associated with IUU fishing.
- **ESTIMATE** the bycatch associated with trawling for shrimp-seed to supply the aquaculture industry.

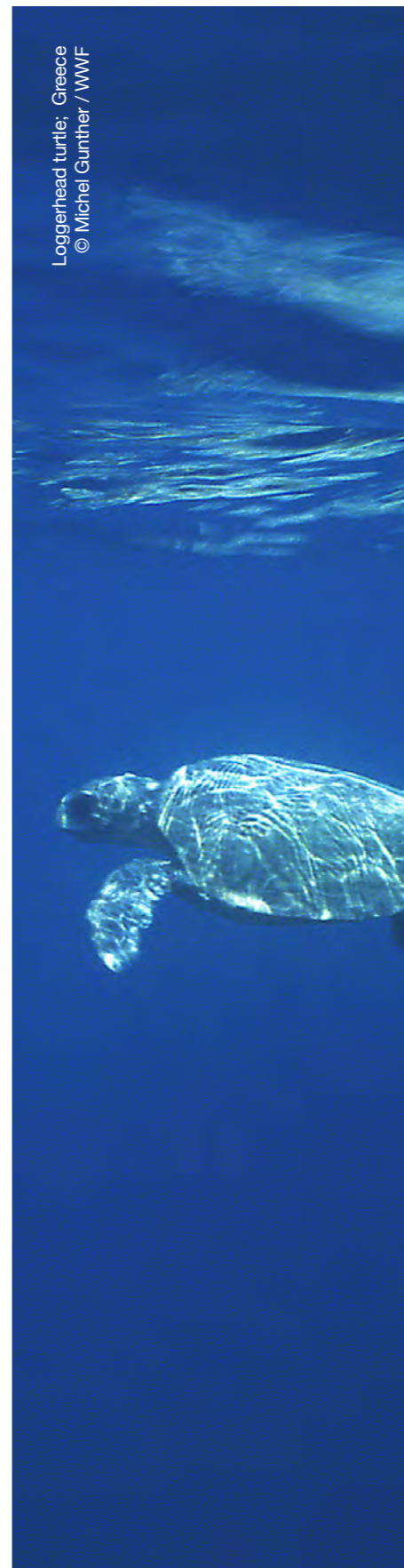
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Loggerhead turtle; Bazaruto Marine National Park, Mozambique
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Loggerhead turtle; Greece
© Michel Gunther / WWF



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Hawksbill turtle, Indonesia. © Rafael / Simon Buxton / WWF

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Olive Ridley turtle, French Guiana
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Appendix 1.

Turtle bycatch estimates

This section builds on the evaluation provided in Section 4 by estimating the turtle bycatch potentially associated with trawl-caught tropical shrimp both globally and specifically associated with exports to the EU from those countries not certified to export to the US (see section 3.6.3.). It must be recognised that the bycatch estimation methodology outlined here relied on relatively old data from a specific geographic area that was then applied globally. The estimates are therefore not considered accurate enough to have been included in the main body of this report. Nevertheless, by including them as appendices it provides readers an opportunity to appraise the methodology and potentially adopt a more refined process to generate improved estimates in the future – something that is clearly needed.

A global estimate of TST marine turtle bycatch

METHODOLOGY

To estimate the potential extent of marine turtle bycatch from the six identified countries exporting to the EU, data on the estimated marine turtle bycatch rate per tonne of shrimp caught was sought. This approach was taken because this rate could be applied to trawl-caught tropical shrimp landings tonnage to estimate the rate of bycatch potentially associated with these catches. The following sections explain this methodology in further detail.

ESTIMATING THE NUMBER OF TURTLES CAUGHT PER TONNE OF SHRIMP

Based on observer data collected between 1973 and 1984, Henwood et al. (1992) estimated that the average bycatch rate in US shrimp trawlers not using TEDs was 0.6 turtles per metric tonne of shrimp caught. Assuming the technique of shrimp trawling was broadly similar to that conducted in the wider Caribbean region, they used this bycatch rate and applied it to the known tonnage of shrimp caught from fleets in those countries not using TEDs. Using this technique, they calculated that, for 27'132 metric tonnes of shrimp caught (collectively from Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama), an estimated 15'195 turtles were also caught.

This 0.6 bycatch rate was used in the current study as a means to estimate the potential turtle bycatch associated with trawl-caught shrimp exported to the EU. It was decided to use the 0.6 rate given the apparent absence of a more recent estimate of turtle bycatch per tonne of trawl-caught shrimp. Other estimates of turtle bycatch from shrimp trawling are available, such as those summarized in Figure 1, but

the methodology adopted here specifically required an estimate of turtle bycatch per tonne of shrimp caught. As such, the adopted methodology allowed for an estimate of the bycatch potentially associated with shrimp imports into the EU - which is recorded in tonnes - to be generated.

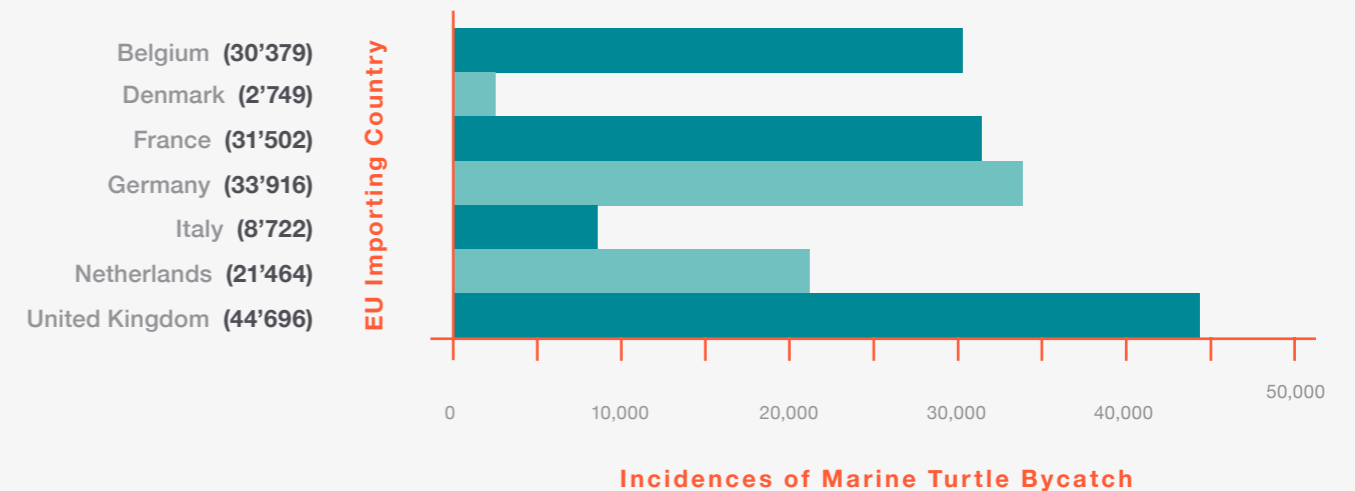
A further assumption was that TST fishing methods remain essentially the same, especially in poorer countries less able to implement any technological advancements (e.g. recon4d otter-trawl doors) that have occurred in the past few decades. It is these countries that were the focus of the current estimates since countries that had made significant TST advancements were more likely to have capitalised on that by then seeking access to the lucrative US market. It should also be recognized that this methodology does not account for any species-specific differences that may occur or differences in distribution of turtle populations. The rate of 0.6 applied to different countries would, ideally, be replaced with a rate derived from the particular country in question. However, such estimates go beyond the scope of the current study.

RESULTS

The cumulative amount of marine turtle bycatch potentially associated with the acceptance by the EU of shrimp exports from the trawling operations of Bangladesh, India, Indonesia, Madagascar, Thailand and Viet Nam, over the 2009 to 2014 period, amounts to an estimated 173'428 incidences of marine turtle bycatch from 289'130 tonnes of exported shrimp. Figure 5 breaks this down into the estimated bycatch potentially associated with the shrimp imports of the individual EU countries.

Figure 5.

Estimated cumulative marine turtle bycatch incidences over the 2009 to 2014 period potentially associated with the different European countries that accept shrimp from Bangladesh, India, Indonesia, Madagascar, Thailand and Viet Nam.



The EU country with the apparent greatest impact is the United Kingdom, whose acceptance of imports from Bangladesh, Indonesia, India, Thailand and Viet Nam could potentially be implicated in a cumulative bycatch of 44'696 marine turtles over the 2009 to 2014 period. The least impactful country was Denmark, with an estimated bycatch of 2'749 turtles potentially associated with its importation of a relatively small amount of shrimp from India and Viet Nam.

The annual average over the study period of 2009 to 2014 (see Table 4) shows that nearly 48'188 tonnes of tropical shrimp imports coming from the studied countries is potentially resulting in an annual average of 28'905 incidences of marine turtle bycatch (see Table 7).



Table 7. Cumulative and annual average (2009 to 2014) estimated marine turtle bycatch incidences potentially associated with the annual average shrimp exported to the EU from Bangladesh, India, Indonesia, Madagascar, Thailand and Viet Nam (FAO Globefish, 2015).

Exporting country	Total shrimp exports to the EU (tonnes)	Estimated proportion of wild shrimp in tonnes (46%)	Estimated proportion from TST operations (86.6%)	Estimated turtle bycatch (0.6 per tonne of shrimp)
Bangladesh	165'200	75'992	65'809	39'485
India	243'300	111'918	96'921	58'153
Indonesia	45'000	20'700	17'926	10'756
Madagascar	29'800	13'708	11'871	7'123
Thailand	109'100	50'186	43'461	26'077
Viet Nam	133'400	61'364	53'141	31'885
Totals	725'800	333'868	289'130	173'478
Average	120'966	55'645	48'188	28'905

It should be noted that significant shrimp imports come into the EU without any specific country information provided, categorised in the Globefish report as 'Others'. In 2014 alone, this category accounted for 131'600 tonnes of shrimp imports. The TST operations of these nations and potential bycatch therein should be the subject of further investigation. The estimated turtle bycatch numbers in the current study are therefore most likely an underestimate, notwithstanding the unmeasured global marine turtle bycatch associated with Illegal, Unreported and Unregulated (IUU) fishing and the subsequent laundering of associated TST shrimp that may end up in EU markets (although this is being tackled by the EU's IUU regulation - see section 6.3 - it cannot yet be assumed to have been eliminated). It must also be recognised, however, that in some instances bycatch rates may be over-estimated for specific countries and thus further research is recommended.



Appendix 2.

Results of the turtle bycatch estimates associated with shrimp exports to European Union countries from Bangladesh, India, Indonesia, Madagascar, Thailand, and Viet Nam.

The following tables show the results of calculations, following the method outlined in section 4., carried out to estimate the potential incidences of marine turtle bycatch associated with the tropical shrimp exported to the EU from countries which are not certified to export to the US. The European countries receiving these exports were Belgium, Denmark, France, Germany, Italy, Netherlands and the UK. All data was sourced from FAO Globefish Highlights: http://issuu.com/globefish/docs/16_february_gh_online.

Year	India						Viet Nam							
	Export: tonnes	Wild capture (46% of exports)	Trawl caught (86.6% of all wild capture)	Bycatch (0.6 per tonne)	Export: tonnes	Wild capture (46% of exports)	Export: tonnes	Wild capture (46% of exports)	Trawl caught (86.6% of all wild capture)	Bycatch (0.6 per tonne)	Export: tonnes	Wild capture (46% of exports)	Trawl caught (86.6% of all wild capture)	Bycatch (0.6 per tonne)
2009	3500	1610	1394	837	1800	828	1800	828	717	430	1800	828	717	430
2010	3900	1794	1554	932	1900	874	1900	874	757	454	1900	874	757	454
2011	4700	2162	1872	1123	2500	1150	2500	1150	996	598	2500	1150	996	598
2012	3700	1702	1474	884	1500	690	1500	690	598	359	1500	690	598	359
2013	3800	1748	1514	908	1800	828	1800	828	717	430	1800	828	717	430
2014	5400	2484	2151	1291	2200	1012	2200	1012	876	526	2200	1012	876	526

Appendix 2e. Estimates of marine turtle bycatch potentially associated with exports of tropical shrimp into Italy from trawl operations in India and Viet Nam.

Year	Bangladesh			Indonesia			India		
	Export: tonnes	Wild capture (46% of exports)	Trawl caught (86.6% of all wild capture)	Export: tonnes	Wild capture (46% of exports)	Trawl caught (86.6% of all wild capture)	Export: tonnes	Wild capture (46% of exports)	Trawl caught (86.6% of all wild capture)
2009	5500	2530	2191	4400	2024	1753	8200	3772	3267
2010	4700	2162	1872	3900	1794	1554	7200	3312	2868
2011	5200	2392	2071	3100	1426	1235	5000	2300	1992
2012	5600	2576	2231	2200	1012	876	4000	1840	1593
2013	5300	2438	2111	2200	1012	876	4200	1932	1673
2014	5800	2668	2310	4200	1932	1673	9100	4186	3625

Appendix 2f. Estimates of marine turtle bycatch potentially associated with exports of tropical shrimp to the Netherlands from trawl operations in Bangladesh, Indonesia and India.

Year	Bangladesh			Indonesia			India			Thailand			Viet Nam			
	Export: tonnes	Wild capture (46% of exports)	Trawl caught (86.6% of all wild capture)	Bycatch (0.6 per tonne)	Export: tonnes	Wild capture (46% of exports)	Trawl caught (86.6% of all wild capture)	Export: tonnes	Wild capture (46% of exports)	Trawl caught (86.6% of all wild capture)	Export: tonnes	Wild capture (46% of exports)	Trawl caught (86.6% of all wild capture)	Export: tonnes	Wild capture (46% of exports)	Trawl caught (86.6% of all wild capture)
2009	5200	2392	2071	1243	5700	2622	2271	1362	2990	2589	8900	4094	3545	3300	1518	1315
2010	4800	2208	1912	1147	5900	2714	2350	1410	2714	2350	11600	5336	4621	3800	1748	1514
2011	5600	2576	2231	1338	5100	2346	2032	1219	2714	2350	14100	6486	5617	4800	2208	1912
2012	4500	2070	1793	1076	2400	1104	956	574	2714	2350	15000	6900	5975	4000	1840	1593
2013	5700	2622	2271	1362	2800	1288	1115	669	3220	2789	11000	5060	4382	4500	2070	1793
2014	5200	2392	2071	1243	3100	1426	1235	741	4094	3545	5100	2346	2032	4800	2208	1912

Appendix 2g. Estimates of marine turtle bycatch rates potentially associated with exports of tropical shrimp to the United Kingdom from trawl operations in Bangladesh, Indonesia, India, Thailand, and Viet Nam. Key: Export = in tonnes; Wild = wild capture component of the exports (estimated to be 46% of the exports); Trawl = proportion of the wild capture shrimp exports arising from trawl operations (trawl operations estimated to account for 86.6% of wild catch exports); B = Bycatch (calculated at 0.6 bycaught turtles per tonne of shrimp caught).

Appendix 3.

Aquaculture production threats and the interplay on wild capture shrimp

Globally, farmed shrimp accounts for 55 per cent of shrimp production²⁷ and, consistent with this overall figure, the apparent consumption of wild tropical shrimp, per capita, in the EU was 46 per cent with the remaining 54 per cent coming from farmed sources (EC, 2014). In the long term, it is likely that demand will further increase, buoyed by the work of organisations such as the Global Aquaculture Alliance (GAA), GlobalGap, and the Aquaculture Stewardship Council (ASC), in addition to other industry and NGO initiatives. Collectively, these efforts incentivize better environmental and social standards within the industry resulting in improved consumer confidence and thus market demand.

However, in the short to medium term it should not be assumed that markets will source farmed shrimps with a consistent upward trajectory. Required measures to meet expected farming standards, for example, may result in a short to medium term increase in the demand for wild capture fisheries arising from the aquaculture sector's interim efforts to meet such standards. In addition to this scenario, three other issues exist that could individually or collectively decrease demand for, and/or supply of, farmed shrimp, in turn placing increased demand on wild-caught shrimp and thus impacting marine turtles. These issues, expanded on below, are: environmental impacts of farming tropical shrimp; the impact of disease on farmed shrimp production; and increasing demand for products derived from shrimp shells.

²⁷ See: <http://www.worldwildlife.org/industries/farmed-shrimp>

Environmental impacts of farming tropical shrimp

Concerns over farmed shrimp relate to the environmental impacts of the practice. These include issues such as wetland destruction (e.g. mangroves) for construction of shrimp farms; hypereutrophication of estuarine ecosystems by shrimp pond effluent; biological pollution of native shrimp stocks through escapement of aquaculture stocks, water use and entrainment of estuarine biota; and impacts of shrimp farm chemicals on estuarine systems (Hopkins et al., 1995).

An issue that receives less attention, however, is the bycatch of non-target species occurring in the collection of wild shrimp seed (e.g. Barg, 2005; Islam et al., 2004). For example, In India and Bangladesh estimates showed that collection of wild *Penaeus monodon* seed can result in up to 1'000 fish and other shrimp fry discarded for every penaeid shrimp collected (reviewed by Primavera,

1998). Given the billions of seed collected by such means, the amount of bycatch destroyed is high and, notwithstanding other issues, could alone have major consequences for biodiversity and capture fisheries production (Ronnenback, 2001). Of potentially even greater concern to marine turtles regarding this practice is the unknown prevalence of collecting seed at sea using trawlers. In Bangladesh, for example, a proportion of giant river prawn seed is collected by trawlers and fishing boats that catch gravid female shrimp at sea and supply these directly to shrimp farmers (Pijl et al., 2012). The degree to which this practice impacts marine turtle populations through bycatch and related mortalities is currently unknown, though it is likely to occur and could be significant. This is an area that certainly warrants further investigation.



Environmentally Friendly Shrimp Farm in Post-Tsunami Aceh
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Impact of disease

Despite the growing importance of farmed tropical shrimp in global markets, world farmed shrimp production volumes actually decreased in 2012 and particularly in 2013 mainly as a result of disease-related problems, and demonstrated the sector's vulnerability to such issues. In Thailand, for example, reports from private sector enterprises indicated annual output declines of 30 to 70 per cent (FAO, 2014). The impacts can include production losses, loss of income and profit for small-scale producers and commercial enterprises, higher shrimp prices

owing to supply shortages, and impacts on trade. Export processing industries in east and southeast Asia met the raw material shortfalls through imports, particularly from Ecuador and India, with frozen shrimp imports noted at record high levels in Viet Nam. China's imports for domestic consumption also increased (FAO, 2014). Given supply can be susceptible to disease, it should not be assumed that aquaculture can consistently meet current shrimp demand and in some years demand may have to be met through wild caught tropical shrimp.



New demands for other shrimp derived products

In the future, increased demand for shrimp may also be driven by uses for its shell as a by-product. For example, chitosan produced from shrimp shells has applications in water treatments, cosmetics, toiletries, food, beverages, agrochemicals and pharmaceuticals (FAO, 2014) and there are already well-established chitin and chitosan industries in China, Thailand and

Ecuador. By 2018, estimates suggest a global market for chitin and chitosan of 118'000 tonnes in terms of product weight (FAO, 2014) and, whilst this is likely to mostly come from aquaculture, it may place still further demands on the wild capture sector seeking to maximize profits



Appendix 4.

EU legal processes: options for introducing import requirements

This annex briefly examines the various EU processes that may be used to implement a EU shrimp/turtle import certification programme (assuming compatibility with WTO rules, see section 3.7.).

The basis, or 'ground rules' for all EU actions are based on the treaties establishing the European Union and which govern the way it works. The treaties are referred to as 'primary' legislation. Under the principles and objectives set out in the treaties comes 'secondary' legislation, comprising regulations²⁸, directives²⁹, and decisions³⁰ that can have either a direct or indirect effect on EU member states. EU legislation has to be approved by both the European Parliament and the EU Council (the governments of the 28 EU countries). It is the EU Commission that drafts and implements EU legislation. Only the Commission can propose directives or legally binding regulations. Neither the States nor the European Parliament has this power³¹.

With respect to the legislative procedure, Article 289 of the Treaty on the Functioning of the EU refers to i) the ordinary legislative procedure, and ii) the special legislative procedures. These, together with Passerelle Clauses that allow for changes to a certain policy area without formally amending the treaties, are outlined below.

²⁸ Regulation definition: a binding legislative act that must be applied in its entirety across the EU. See: http://europa.eu/eu-law/decision-making/legal-acts/index_en.htm.

²⁹ Directive definition: "a legislative act that sets out a goal that all EU countries must achieve. However, it is up to the individual countries to decide how". See: http://europa.eu/eu-law/decision-making/legal-acts/index_en.htm.

³⁰ Decision definition: a binding decision on those to whom it is addressed (e.g. an EU country or an individual company) and is directly applicable. See: http://europa.eu/eu-law/decision-making/legal-acts/index_en.htm.

³¹ See: http://europa.eu/eu-law/index_en.htm.

Ordinary legislative procedure

The ordinary legislative procedure is the most legitimate from a democratic point of view. It involves the European Parliament as a co-legislator at the Council's side and is now the most widely used legislative procedure. The Council and the Parliament are placed on an equal footing. The two institutions adopt legislative acts either at first reading, or at second reading. If, following the second reading, the two institutions have still not reached agreement, a Conciliation Committee is convened. In addition, the voting rule under the ordinary legislative procedure is qualified majority (definition: a qualified majority is achieved if it covers at least 55 per cent of Member States representing at least 65 per cent of the population of the EU. Where the Council does not act on a proposal from the Commission, the qualified majority should cover at least 72 per cent of Member States representing at least 65 per cent of the population)³².

EU CITIZEN INFLUENCE WITHIN THE ORDINARY PROCEDURE³³

Within the ordinary legislative procedure, the underlying source for considering any given proposal are varied and the European Commission listens to voices that are raised across Europe for or against the creation of new laws. The process for individuals and groups to influence European policy-making involve the European Citizen's Initiative, public consultations, petitions to the European Parliament, notification and transparency register, and formal complaints. Of particular relevance to a potential EU shrimp/turtle law within the Ordinary

Process, however, are the Petitions to the European Parliament. European citizens are able to ask directly for new draft laws and the start of this process is obtaining the signature of one million Europeans from at least seven countries. Following submission of the petition, the Commission then considers all sides and finally presents a draft law – the start of a process that can take 12 to 18 months. For a draft law to be adopted, the EU Council and European Parliament amend the drafts according to their interests and according to the majorities that take shape. Ensuing negotiation between States and Members of the European Parliament (MEPs) can lead to a satisfactory compromise and the draft law can be adopted after a vote by MEPs. This being the case, in some circumstances derogation will apply to certain States whereby that State is allowed to delay the implementation of an EU regulation into their legal system over a given timescale. However, in the event of a failure to comply within the agreed timescale, the European Commission can call upon certain powers to remedy the situation. If this fails, the Court of Justice of the EU takes over.

Since the process to adopt a new law requires agreement from all Member States, failure to reach any such agreement means that negotiations must continue against a specified deadline which, if not met (this rarely happens), results in the draft law failing and the entire process being repeated. Furthermore, States have an absolute right of veto on issues related to social security, taxation, or foreign affairs and defence, for example.

³² See: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:ai0008>

³³ Source text from: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:ai0008>

Special legislative procedures

Special legislative procedures derogate from the ordinary legislative procedure and therefore constitute exceptions. In special legislative procedures, the Council of the EU is, in practice, the sole legislator. The European Parliament is simply associated with the procedure. Its role is thus limited to consultation or approval depending on the case. Unlike the ordinary legislative procedure, the

Treaty on the Functioning of the EU does not give a precise description of special legislative procedures. The rules of special legislative procedures are therefore defined on an ad hoc basis by the Articles of the Treaty on European Union and the Treaty on the Functioning of the EU that provide for their implementation³⁴.



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³⁴ See: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:ai0016>

Passerelle Clauses

In certain circumstances, the EU's Passerelle Clauses can be applied – a derogation that allows for changes to a certain policy area without formally amending the treaties. Passerelle Clauses are applicable to all European policies (with the exception of defence and decisions with military implications) and concerns two cases:

1. “Where the Treaties provide that an act is to be adopted by the Council acting unanimously, the European Council may adopt a decision authorising the Council to act by qualified majority.”

2. “Where the Treaties provide for acts to be adopted in accordance with a special legislative procedure. The European Council may adopt a decision allowing for the adoption of such acts in accordance with ordinary legislative procedures.”³⁵

Activating a passerelle clause still requires all Member States to first be in agreement³⁶.



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³⁵ See: http://europa.eu/legislation_summaries/institutional_affairs/treaties/lisbon_treaty/ai0013_en.htm
³⁶ See: http://europa.eu/legislation_summaries/institutional_affairs/treaties/lisbon_treaty/ai0019_en.htm

Summary

The formal process for consideration of an EU shrimp/turtle law will have to be determined in consultation with the Commission. Whatever the process, the major challenge will be the need to obtain consensus across all Member States, a process necessitating considerable preliminary work with the individual members state countries, and especially with Member State retailers and consumers who have the influence to drive change.

Such challenges are likely to come from those countries whose governments are heavily lobbied by officials representing those businesses with a vested interest in maintaining current supply of shrimp imports, e.g. Belgium, Denmark, France, Germany, Italy, The Netherlands, or the UK – the main EU countries importing wild caught tropical shrimp from non-EU countries that can't export to the US, as identified in this report (see section 4.2.).



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Appendix 5.

Trawlers in the Mediterranean and impacts

This annex provides a summary of the bycatch associated with EU vessels trawling in the Mediterranean (the principle area where EU vessels interact with marine turtles) as a means to better understand the extent of the problem that would require addressing as an independent activity to the proposed measures to reduce turtle bycatch from TST exports to the EU.

Overview

Trawl fisheries in the Mediterranean are very often multi-species operations where shrimps are not the main target but are caught opportunistically as valuable components of a varied catch composed of fishes, cephalopods and other crustaceans (Casale 2011). In a review of the available information on turtle bycatch in the Mediterranean, Casale (2011) conservatively estimated that bottom trawling accounted for an annual bycatch of 39'350 turtles (mainly loggerhead, though with some green turtles) in the Mediterranean region, with the most affected areas being the north African continental shelves (along Tunisia, Libya, Egypt), the Adriatic, the Levantine basin and the Aegean. Of these, Casale (2011) also estimated that at least 20 per cent would perish, potentially resulting in around 8'000 turtles killed per year by bottom trawlers in the Mediterranean.

The problem is compounded when seen in the broader context of the overall estimates made by the same researcher that included three other main fishing methods: demersal longlining, pelagic longlining, and set netting. Taking these gears

and bottom trawling into account, the total annual bycatch of marine turtles in the Mediterranean Sea was estimated as being 132'000, resulting in an estimated annual mortality of 44'000, notwithstanding mortalities arising from intentional killings (driven by the desire to use the turtles meat, blood, carapace, oil) or sometimes even hostility (Casale, 2011). However, the extent of these intentional killings has not yet been clearly investigated, with only anecdotal and/or old information and thus needs further study. It was concluded that any country with an important Mediterranean-specific fishing effort in areas where turtles live would result in high numbers of turtle bycatch (Casale, 2011).

From the results shown in that study, it is possible to isolate the EU and non-EU fisheries to help understand the potential impact of EU-specific fleets bottom trawling in the Mediterranean and thus highlight the need to address this issue through the EU's existing regulatory regimes. These figures are shown in Table 8.



Nicholas Pilcher, MRF

Table 8. A ranked comparison of marine turtle bycatch (expressed as numbers of individuals caught annually) in the Mediterranean Sea by EU and non-EU bottom trawl fleets from countries with a Mediterranean coastline. Estimated made by Casale (2011).

Non-EU Countries	Annual numbers of turtle bycatch	EU countries	Annual numbers of turtle bycatch
Tunisia	10'900	Italy	10'600
Libya	4'700	Greece	2'900
Turkey	3'500	Croatia	2'400
Egypt	1'900	Spain	400
Algeria	700	Slovenia	200
Albania	600	France	40
Cyprus	100	Malta	0
Morocco	200		
Syria	200		
Israel	10		
Lebanon	0		
Monaco	0		
Montenegro	0		
Bosnia & Herzegovina	0		
Totals	22'810		16'540

As noted by Casale (2011), the conservative methodology adopted likely resulted in an underestimate - a view that was apparently confirmed in a later, more localized Mediterranean bycatch estimate (Domènech et al., 2014). Looking specifically at the Spanish bottom trawl fleet operating in the western Mediterranean, that team combined their estimates with bycatch rates from neighbouring regions (Carreras et al., 2014), to estimate that bycatch of loggerhead turtles in the western Mediterranean was about 500 animals a year, some 100 more than an earlier estimate of 400 for the same region made by Casale (2011), and even this figure of 500 is thought to be an underestimate due to the region of Murcia in south-east Spain having not yet been studied (Domènech et al., 2014). While the exact amount may be open to debate, the body of evidence points to levels of bycatch considered unsustainable for Mediterranean marine

turtle populations (Casale, 2011).

A complicating factor in terms of solutions has to do with the lack of Exclusive Economic Zones (EEZs) being declared in the Mediterranean, effectively designating most of it as high seas (i.e. not within any country's jurisdiction). The Mediterranean is fished by many other vessels from outside the EU, such as those from Middle East and African countries, and thus issues to do with marine turtle bycatch must be tackled by the General Fisheries Commission of the Mediterranean (GFCM) in addition to the EU and other nations. Finally, we want to acknowledge that there are projects occurring in the Mediterranean that are evaluating new TED designs and configurations for bottom trawlers. One such study conducted by Lucchetti et al. (2016) found that "the selective performance of the net was unchanged with the addition of the TED (in reference to a new flexible TED design).

³⁷ A Regional Fisheries Management Organisation (RFMO) whose objective is to "promote the development, conservation, rational management and best utilization of living marine resources as well as the sustainable development of aquaculture in the Mediterranean, the Black Sea and connecting waters: see: <http://www.fao.org/gfcm/background/about/en/>



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