VOL. 32 NO. 1

TRAFFIC

BULLETIN

IMPACT OF TRADE AND CLIMATE CHANGE ON NARWHAL POPULATIONS

DRIED SEAHORSES FROM AFRICA TO ASIA

EEL TRADE REVIEW

APRIL 2020

The journal of TRAFFIC disseminates information on the trade in wild animal and plant resources

TRAFFIC

the wildlife trade monitoring network

TRAFFIC was established in 1976 to perform what remains a unique role as a global specialist, leading and supporting efforts to identify and address conservation challenges and solutions linked to trade in wild animals and plants.

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TRAFFIC's Vision is of a world in which trade in wild plants and animals is managed at sustainable levels without damaging the integrity of ecological systems and in such a manner that it makes a significant contribution to human needs, supports local and national economies and helps to motivate commitments to the conservation of wild species and their habitats.

TRAFFIC

Trade in wildlife is vital to meeting the needs of a significant proportion of the world's population. Products derived from tens of thousands of species of plants and animals are traded and used for the purposes of, among other things, medicine, food, fuel, building materials, clothing and ornamentation; moreover, this use provides vital income to millions of people.

Most of the trade is legal and much of it sustainable, but a significant proportion is not. As well as threatening these resources, unsustainable trade can also lead to species declining in the wild to the point that they are threatened with extinction. Illegal trade undermines local, national and international efforts to manage wild natural resources sustainably and causes massive economic losses.

The role of TRAFFIC is to seek and activate solutions to the problems created by illegal and/or unsustainable wildlife trade. TRAFFIC's aim is to encourage sustainability by providing government, decision-makers, traders, businesses, consumers and others with an interest in wildlife trade with reliable information about trade volumes, trends, pathways and impacts, along with guidance on how to respond where trade is illegal or unsustainable.

TRAFFIC's reports and advice provide a technical basis for the establishment of effective conservation policies and programmes to ensure that trade in wildlife is maintained within sustainable levels and conducted according to national and international laws and agreements. The journal of TRAFFIC, *TRAFFIC Bulletin*, is the only publication devoted exclusively to issues relating to international trade in wild plants and animals. Provided free of charge to over 4000 subscribers and freely available from the TRAFFIC website (www.traffic.org), it is a key tool for disseminating knowledge of wildlife trade and an important source of information for those in a position to effect change and improve awareness.

GREAT YELLOW GENTIAN © ERNST MEIER / WWF SWITZERLAND

Much of the content published in the *TRAFFIC Bulletin* arises from investigations carried out by TRAFFIC staff, whose wide-ranging expertise allows for a broad coverage of issues. TRAFFIC has also built up a global network of contacts with, for example, law enforcement agents, scientists, and wildlife experts, some of whom are regular contributors to the *TRAFFIC Bulletin*.

TRAFFIC welcomes articles on the subject of wildlife trade that will bring new information to the attention of the wider public; guidelines are provided in this issue and online to assist in this process. For more information, please contact the editor: Kim Lochen (kim.lochen@traffic.org).

JAGUAR © ALAIN COMPOST / WWF

SOUTHERN YELLOW-BILLED HORNBILL © CHRISTIAAN VAN DER HOEVEN / WWF NETHERLANDS

The *TRAFFIC Bulletin* is a publication of TRAFFIC, a leading non-governmental organisation working globally on the trade in wild animals and plants in the context of both biodiversity conservation and sustainable development.

The *TRAFFIC Bulletin* publishes information and original papers on the subject of trade in wildlife, and strives to be a source of accurate and objective information.

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Published by TRAFFIC
David Attenborough Building, Pembroke Street, Cambridge CB2 3QZ, UK.

ISSN 0267-4297.
UK Registered Charity No. 1076722

Cover photograph:

A pod of male Narwhals *Monodon monoceros*
(© Carsten Egevang)

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Juvenile European Eels *Anguilla anguilla.*
(© Richard Thomas / TRAFFIC)

Dorsal fin cut from a Scalloped Hammerhead Shark *Sphyrna lewini*, Cocos Island, Costa Rica.
(© naturepl.com / Jeff Rotman / WWF)

Dried seahorses *Hippocampus* spp.
(© Markus Bürgener / TRAFFIC)

Funding for the production of this issue of the *TRAFFIC Bulletin* is generously provided by The Rufford Foundation.

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TRAFFIC BULLETIN

VOL. 32 NO. 1 APRIL 2020

CONTENTS

At the time of writing, the COVID-19 pandemic is raging worldwide, causing human mortality and socio-economic disruption on a massive scale and it appears highly likely that profound impacts will continue for many years to come. Although the precise origins of the disease remain unproven, there are strong indications of a wild animal source and a direct link to wildlife trade in China. Even if evidence points elsewhere in future, the magnitude of the current outbreak places under an intense spotlight concerns raised by zoonotic disease experts over many decades about human health risks linked to wild animal trade in the increasingly inter-connected global economy.

EDITORIAL

As calls for new health-focused restrictions on wildlife trade have increased in volume in response to the current pandemic, some countries have taken immediate action. Building on immediate emergency restrictions placed on wildlife markets in January 2020, China is implementing a long-term prohibition on trade and consumption of wild animals for food as a public health protection measure. Viet Nam is also considering new health-focused market restrictions and Gabon has introduced new species-specific trade restrictions. Looking ahead, there is a critical need to improve understanding of what sort of interventions might make the biggest difference in reducing risks of zoonotic disease emergence. However, it is also important to work out how such actions might best complement, rather than conflict with, the range of existing conservation-focused wildlife trade regulation and management measures that are already struggling to contain over-exploitation of nature by people.

Zoonotic disease risks have not been wholly ignored before now. Many countries have live animal quarantine requirements and other rules governing the cross-border movement of meat, fish and other animal products. Similarly, production, trade and use of live animals and products are subject to animal and human health regulations within domestic markets of most countries. However, such measures are typically designed primarily to address trade and consumption of domesticated species, the volume and value of which vastly exceed wild animal business. As a result, the provisions of such regulations are seldom tailored to the specific dynamics and risks of the trade in wild animals.

Design of new interventions should be based on evidence-based assessment of disease-related vulnerabilities in current wild animal trade chains. Based on study of past cases, experts point to heightened risks of zoonotic disease spillover in places where large numbers of stressed live animals of different species (wild or domesticated) and people are in close proximity, such as transport hubs, holding facilities and markets. However, there remains considerable uncertainty about differentiation of risk levels between different wild animal species (or species groups) and about the likelihood of transmission from different wild animal parts and products.

There is a wide range of options for future intervention based on assessment of such risks. Prohibitions on trade and consumption of certain species or products could be warranted. This would likely require new or modified national legislation in many countries, as most current restrictions are explicitly justified by conservation threat levels and jurisdiction is often limited to import/export controls only. Such measures would of course face the same challenges that undermine existing wildlife trade laws: enforcement is inconsistent, often under-resourced, undermined by criminality and corruption, and given insufficient priority by governments. Risky trade may simply continue through illicit markets.

It is possible that the greatest benefit might come from changes in management practices for holding, trade and processing wild animals in trade. These might include regulatory or voluntary private sector measures aimed to improve animal husbandry, increase separation between species in trade, enhance sanitation at holding facilities and improve personal protection for workers. Such measures may again require modification of existing animal and human health legislation, but there is considerable practical experience from the domesticated animal sector that could be applied to this challenge.

Despite the clear imperative for action provided by the tragic impacts of the COVID-19 pandemic, it will be critical to ensure that remedial restrictions on wildlife commerce are tailored to achieve specific risk reduction goals and designed to take into account potential negative impacts on social equity, livelihoods, and indirect conservation impacts. Such measures also need to be set in the context of other zoonotic disease pathways and risk factors that need careful attention, such as land-use change, domestic livestock management practices and other human/wildlife interactions.

It is also vital that amidst the urgent need to reduce zoonotic disease threats from wildlife trade, the ongoing drive to address over-exploitation threats to wildlife does not lose momentum. It is of course possible that new health-focused restrictions on wild animal trade and increased scrutiny of wildlife commerce more generally owing to its likely connection with the pandemic may reinforce conservation-focused action. However, trade in what may be identified as higher risk sectors, such as that of live wild mammals and birds, makes up a small proportion of the global wildlife trade. The greatest over-exploitation threats are faced by marine species and the biggest wildlife trade flows are of timber and other wild plant products.

There is additional cause for concern that socio-economic impacts of the COVID-19 pandemic may be driving new trends in wildlife trade patterns that need careful attention. Past disease outbreaks linked to wild meat trade have led to increased demands for marine fish and there is already evidence of greater attention to wild plant-based medicinal treatments and tonics. Although some illegal wildlife trade flows may now be suppressed by transport interruptions and retail market closures, there is every likelihood that criminal syndicates will move fast to rebuild illicit businesses and exploit diversion of government enforcement resources to other priorities.

A new focus on human health risks linked to wildlife trade practices is certainly warranted as a component of wider thought and action on the relationship between people and nature as the COVID-19 epidemic persists. The response should be targeted, appropriate to the task and its design grounded in experience gained from past wildlife trade interventions. In the same way that human and environmental health are intimately connected, it is essential that new health-focused wildlife trade interventions are considered in concert with those already focused on conservation gain. The "super-year for biodiversity" may have been delayed, but the imperative for conservation action remains.

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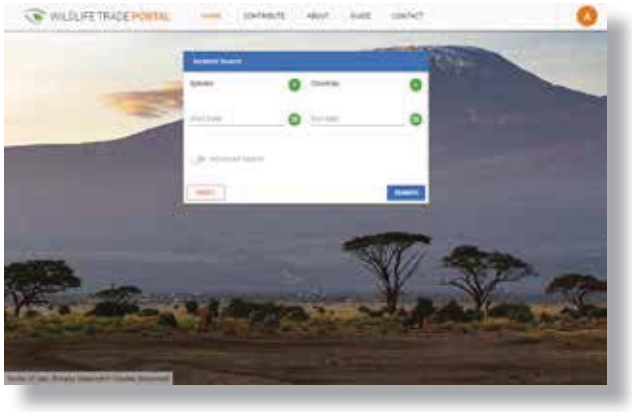
THE WILDLIFE TRADE PORTAL



In order to facilitate the sharing of data and cultivate collaboration with other NGOs, TRAFFIC has developed the *Wildlife Trade Portal*—the most comprehensive open-access portal of wildlife seizure data. Designed for NGOs, researchers and law enforcement agencies, it was developed with the generous support of Arcadia, a charitable fund of Lisbet Rausing and Peter Baldwin, via the ReTTA (Reducing Trade Threats to Africa's wild species and ecosystems) project. The *Portal* gives users unprecedented access to the open-source area of TRAFFIC's wildlife trade incident database.

Search: At its core, the *Portal* allows users to search through records of wildlife trade incidents—these include seizures, poaching events and court cases from around the world. The *Portal* interacts directly with TRAFFIC's existing database, ensuring that changes to the underlying data synchronise in real time with the *Portal* while also guaranteeing that any confidential data are protected. The comprehensive search function allows users to access the information that is relevant to their needs—filtering by the species seized, the countries in the trade chain, the date of the event, and so on.

Results: The results of a search are presented not only as a summarised list but also as a dashboard displaying a range of interactive charts and maps. These visualisations are dynamic, allowing users to analyse the contents of their requested dataset at a glance. They are also interactive—for example, a user might want to view more details by hovering over a pie chart segment, or further filter their results list at the click of a button. Selecting on a country on the map, for instance, allows a user to focus their results on this location.

Record View: Users can drill down into individual records to get a greater insight into the specifics of a single wildlife trade incident. The *Portal's* Record View displays in-depth data, such as the information sources, the smuggling methods, the enforcement outcomes, the quantities seized, the trade route, and more. Likewise, any noteworthy images or relevant media associated with the event are stored here. Suggestions and updates to a record can be sent directly within the Record View, facilitating straightforward two-way interactions between the users of the *Portal* and TRAFFIC.

Export and Upload: The *Portal* data can also be exported to CSV format, allowing users to run their own analysis of the information on their computers: users can either specify a selection of records to download or simply export their entire results list. Moreover, the *Portal* allows a variety of export formats to suit a range of analytical tasks.

In addition to exporting data, TRAFFIC is encouraging NGOs, researchers and other partners to upload their own datasets or files via the *Portal's* "Contribute" function.

Virtual Launch: On 2 April 2020, TRAFFIC launched the *Wildlife Trade Portal* to a virtual audience of nearly 280 participants based in NGOs, universities, media outlets and government agencies from around the world. Within the first 24 hours of the launch, the *Portal* saw over 200 new registrations and nearly 150 separate searches for incident data. The launch was supported by a social media push which, in the first week of April, had reached over 2,100 people on Facebook and overall garnered 13,500 impressions on Twitter. This level of interest, corroborated by dozens of messages of support and gratitude, is testament to the desire for increased collaboration within the worlds of conservation and data.

> *"Finally, a global wildlife trade dataset that we can all benefit from and contribute to. This is truly massive progress. I hope it will result in a better understanding of the illegal wildlife trade and more effective strategies to tackle it."*
>
> Pauline Verheij, Ecojust.

Impact and Outcomes: After extensive data checks are completed, the *Portal* will hold around 15,000 open-source incident records linked to over 8,000 separate locations and 25,000 wildlife commodities. This number will continue to increase as time goes on; based on data entry from 2019, it is expected that approximately 6,000 open-source incident records will be added to the *Portal* every year. In addition to this, the *Portal* will continue to receive regular user-driven updates and improvements.

The *Portal* is a mutually-beneficial tool through which outbound information leads to action by augmenting the datasets of law enforcement agencies, policy makers and researchers, while inbound information supplements the *Portal's* data and broadens global understanding of international wildlife trade. Increased inter-organisational data sharing will not only contribute to a solid body of evidence to guide conservation strategy effectively, but will also help to reduce the silo effect caused by a lack of communication and support between organisations, leading to more efficient workflows and reducing duplication of work.

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Wildlife Trade Portal: www.wildlifetradeportal.org

With the launch of the* Portal*, the wildlife seizures and prosecutions section that has been a longstanding feature of the* TRAFFIC Bulletin *to highlight enforcement action, is being replaced with a brief analysis of the trade relating to a particular species or taxon. We start in this issue with a focus on sharks and shark fins (see pages 32–36).

TWIX: *ENHANCING GLOBAL WILDLIFE LAW ENFORCEMENT*

The TWIXes—EU-, AFRICA-, SADC- and now Eastern Africa-TWIX (Trade in Wildlife Information eXchange)—continue to go from strength to strength: EU-TWIX will soon be celebrating 15 years of supporting European law enforcement, and over 1,200 enforcement officers are now engaged with the platform; in Central Africa, AFRICA-TWIX has expanded its geographical scope in the last year to include Chad, Rwanda, and Burundi, and in Southern Africa, the SADC- (Southern African Development Community) TWIX website was launched in early 2020 providing access to resources on combating illegal wildlife trade to the 12 SADC countries that have joined SADC-TWIX: nearly 450 law enforcement officials have signed up to the mailing list and three international investigations have been facilitated by the TWIX system. In Eastern Africa, TRAFFIC has conducted scoping missions to Kenya, Uganda and Tanzania with positive responses, and a TWIX awareness workshop was held in early 2020 for agencies from those countries.

As well as strong progress with existing TWIXes, several other regions have also expressed interest in joining a TWIX or development of their own TWIX. TWIX was presented to the Intergovernmental Authority on Development (IGAD) Member States of the Horn of Africa Wildlife Enforcement Network (HAWEN) Executive meeting where strong support for TWIX was articulated, and scoping studies were undertaken in Ethiopia with a possible view to the country joining Eastern Africa-TWIX in the near future. Interest has been forthcoming from West Africa, Latin America, the Caribbean, Central Asia and Southeast Asia, and discussions are under way to support improved communication and collaboration opportunities in those regions, including the possibility of further TWIX development. Progress made on three of the TWIX platforms is reported in more detail below:

AFRICA-TWIX: The AFRICA-TWIX platform was established in Central Africa in 2016 based on the successful EU-TWIX model, operational since 2005. At the time of the launch in 2016, only four of the ten Central African Forests Commission (COMIFAC) countries were enrolled in the initiative, namely Cameroon, Congo, Democratic Republic of the Congo and Gabon, followed by the Central African Republic in 2017, and Chad and Rwanda in 2019. Burundi, who applied to join in 2020, brings to eight the total number of COMIFAC member States to be part of the platform. Even though application of the tool is ongoing through capacity building sessions for agencies at the national level, it is worth noting that the platform has connected, via a mailing list, up to 190 law enforcement officials from various government agencies, wildlife administration, environment, Customs, police, justice, and gendarmerie, all committed to curbing the rising trend of wildlife crime in Central Africa. Further, AFRICA-TWIX's website provides users with invaluable resources such as seizure records of wildlife species (currently 392 cases), 93 wildlife laws and regulations of AFRICA-TWIX country members, 131 wildlife identification tools, 75 training materials for capacity building, 67 links, the exchange of around 1,200 archived messages, as well as seven laboratories and 47 rescue centres for seized specimens. As a result, no fewer than 1,182 messages have been exchanged in respect of wildlife seizures, arrests, court decisions, and new dissimulation techniques used by criminal networks to escape detection, among other issues. One example of collaboration involves a seizure of ivory items in January 2020 at Maya Maya International Airport in the Congo, which demonstrated the ever-changing nature of methods used by criminal networks. In this case, two Chinese nationals working for a logging company were arrested with worked ivory jewellery concealed in cigarette packs. This new concealment method disclosed on the AFRICA-TWIX platform will keep alert other enforcement officials in the region.

AFRICA-TWIX participants have also triggered eight international investigations involving Central African countries, including one in October 2019 involving the seizure of 82 ivory tusks and 37 elephant tails by officials of Gabon's national parks agency (ANPN) on the border between Cameroon and Gabon in the TRIDOM landscape. The items were in the hands of Cameroonian poachers who fled, leaving behind their identification cards, when the patrol team infiltrated their forest base. This information was shared on the AFRICA-TWIX mailing list and alerted the prosecutor of the court at Djoum and the conservator of the Dja Biosphere Reserve who were put in contact with each other by the AFRICA-TWIX manager to enable further investigations to be conducted and details of the traffickers involved to be shared.

SADC-TWIX: In order to maintain the momentum built during country visits conducted in the SADC region during the course of 2018 and following a comprehensive consultation workshop convened in 2019, the SADC-TWIX mailing list has been operational since 21 May 2019 and the website was launched in January 2020. Close to 450 law enforcement officials from 12 Member States of SADC (Angola, Botswana, Eswatini, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, South Africa, Zambia and Zimbabwe) are connected to the SADC-TWIX platform (mailing list and website), including officials from Customs, the police, wildlife and CITES Management Authorities, the judiciary, national security services, financial intelligence, forestry, and fisheries agencies. Between May 2019 and March 2020 close to 300 messages were exchanged via the mailing list, covering seizure alerts, the results of successful operations conducted by law enforcement agencies, and requests for assistance in species identification. The mailing list was also used by the CITES Secretariat to inform participating countries on CITES report deadlines, and on specific alerts. Although it has been operational for only a short time, SADC-TWIX has already facilitated enforcement actions in the SADC region including initiation of several ongoing investigations, including:

1) Investigation between Madagascar and Mauritius: A message on the seizure of six shark jaws imported from Madagascar was sent by the Customs agency in Mauritius. The goods were not covered by an export permit. Customs in Mauritius have provided their counterparts in Madagascar with the information at their disposal including detail of the exporter. This has allowed rapid identification of the individual and the company involved that is thought to be part of a larger network of traders in marine products from the region to Asia. The investigation is ongoing.

2) Investigation between Namibia and Zambia: Following a message sent on by the Namibian police on the arrest of a Zambian poacher with one rhino horn and one elephant ivory tusk, the Zambian enforcement authorities determined that the poacher is included in their wanted list and has previously been arrested for similar offences. The investigation to identify the possible counterparts or network continues.

The SADC-TWIX website was launched in January 2020 and is available in three languages: English, French and Portuguese. Users will shortly benefit from a Website User guide which has been developed in English and is currently being translated into French and Portuguese. The SADC-TWIX website contains a range of features including a database of seizures and an opportunity to create charts online and share documents; other resources include identification tools, training materials, legal texts that cover the 12 SADC Member States connected to the platform, and archives of the mailing list.

Eastern Africa-TWIX: From October 2019 to January 2020, TWIX was introduced to 23 law enforcement agencies in Kenya, Uganda and Tanzania, including Zanzibar. The response was positive and in early February 2020 an awareness event on TWIX was convened in Arusha, Tanzania. The event aimed to provide an overview of TWIX and its structure and to clarify questions and concerns by potential members; build the capacity of officials on TWIX implementation, and to provide an update on progress of TWIX implementation in Eastern Africa and a roadmap for the next key steps. About 35 government enforcement officials attended from Kenya, Uganda, and Tanzania representing government ministries covering wildlife and forestry, as well as the police, Customs, the judiciary, public prosecution, financial intelligence, and intergovernmental organisations such as the United Nations Office on Drugs and Crime (UNODC) and INTERPOL. Among the updates provided were the results of scoping missions to introduce TWIX in Uganda, Kenya and Tanzania (including Zanzibar), particularly among the countries' law enforcement agencies.

Due to interest in TWIX among further Horn of Africa nations (Djibouti, Eritrea, Ethiopia, South Sudan, Sudan and Somalia), in early March 2020 TRAFFIC presented and demonstrated on TWIX at the 3rd meeting of the Executive Committee of IGAD-HAWEN Member States, together with law enforcement agencies and observer organisations in Addis Ababa, Ethiopia. TRAFFIC also conducted a TWIX scoping mission to Ethiopia, involving the Ethiopian Customs Commission, Attorney General's Office, INTERPOL National Focal Office, Ministry of Federal Affairs, Centre for Criminal Investigations and Crime Prevention, and the Environment, Climate Change, and Forestry Commission.

Overall, there has been strong support from all agencies visited in Eastern Africa, seeing the platform as a means to enhance information and knowledge-sharing and initiate wildlife crime investigations. Most agencies have made a commitment to nominate users and focal points once the nomination screening process has been completed. Currently, 52 law enforcement officers have been nominated by law enforcement agencies in Kenya, Uganda and Tanzania to be connected on Eastern Africa-TWIX. Developing and testing the TWIX mailing list started in April 2020.

Report by Tom Osborn, Denis Mahonghol, Luc Evouna Embolo, Allan Mashalla, Taye Teferi, Cynthia Ratsimbazafy, Markus Bürgener, Magda Norwisz, and Roland Melisch, TRAFFIC

AFRICA-TWIX *and* ***SADC-TWIX*** *are implemented with the support of the Partnership against Poaching and Illegal Wildlife Trade (Ivory and Rhino-Horn) in Africa and Asia, implemented by GIZ on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ) and the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), and WWF France. The initiation and implementation of* ***Eastern Africa-TWIX*** *has been made possible through the support of the USAID-funded projects, Wildlife Trafficking, Response, Assessment, and Priority Setting (Wildlife TRAPS) and Conserving Natural Capital and Enhancing Collaborative Management of Transboundary Resources in East Africa (CONNECT), together with WWF Finland through its support to the East Africa Wildlife Crime Hub of WWF and TRAFFIC. Engagement at the country level in Ethiopia, and at the level of IGAD-HAWEN have been supported by a United States Department of State Federal Assistance Award.*

INSIGHTS FROM SOCIAL MEDIA INTO THE ILLEGAL TRADE OF WILD RAPTORS IN THAILAND

Report by Connor T. Panter and Rachel L. White

Introduction

The rise of the internet, e-commerce and social media has facilitated the illegal wildlife trade (Chng and Bouhuys, 2015; Krishnasamy and Stoner, 2016; Phassaraudomsak and Krishnasamy, 2018), opening new global online markets for those wishing to sell wildlife and/or wildlife products. The illegal wildlife trade has been identified as a threat to many species, especially in Southeast Asia (Blair *et al*., 2017). Numerous studies have reported "snapshots" of the extent of the online illegal wildlife trade (Morgan and Chng, 2017; Gomez and Bouhuys, 2017) and previous scientific literature has highlighted the prominence of illegal wildlife trade activities in countries such as Thailand (Nijman and Shepherd, 2011; Siriwat and Nijman, 2018). Thailand ranks highly in the world for social media use (Leesa-nguansuk and Fredrickson, 2017), with the largest social media platform estimated to have more than 26.9 million active users by the end of 2019, representing approximately 40% of the total Thai population (Statista, 2019).

The legal global trade in diurnal and nocturnal birds of prey (hereafter "raptors" and "owls", respectively) has increased since the 1970s, driven mostly by consumer demands from the pet and falconry trades (Panter *et al*., 2019). However quantified data regarding the unregulated, illegal trade in such species remains poorly represented within the scientific literature (MaMing *et al.,* 2014; Panter *et al*., 2019).

Previous studies have reported trends in illegal trading of raptors and owls in Indonesia online and during surveys at bird markets, highlighting issues concerning the effectiveness of relevant wildlife laws (Shepherd, 2012; Iqbal, 2016; Nijman and Nekaris, 2017). A rapid survey at Thailand's Chatuchak weekend market found raptors and owls for sale despite a prohibition on the trade of all native species (Chng and Eaton, 2016). Another study focusing on wildlife trade on e-commerce sites in Viet Nam found that more than half of the posts offering wildlife commodities were likely to be illegal (Nguyen and Willemsen, 2016). Such studies highlight the extent and dynamics of illegal wildlife trade and are vital baselines for effective species conservation.

Raptors and owls are particularly extinction-prone and Southeast Asia has been identified as a key area for raptor conservation (Buechley *et al*., 2019). Shifts in trade patterns from physical markets to online, e-commerce and social media platforms appear to be occurring (Phassaraudomsak and Krishnasamy, 2018) and there has yet to be a study focusing on the online trade dynamics of raptors and owls in Thailand.

This study aims to provide a snapshot of the online trade of raptors and owls across Thailand on the social media platform Facebook, providing baseline data for future raptor conservation.

▲ **Changeable Hawk-eagle *Nisaetus cirrhatus*, the most frequent raptor species recorded for sale during the study.**

Black-winged Kite *Elanus caeruleus*

Methods

Surveys of online posts offering raptor and owl species were conducted on Facebook, which is the most-used social media platform in Thailand (Statista, 2019). Data were collected on offers for sale published throughout a four-year period from February 2015 until June 2019; prior online content was unavailable.

Eight Facebook pages and three groups where offers of raptor and owls were being made were identified using an in-built search function following a keyword search methodology similar to that used by Phassaraudomsak and Krishnasamy (2018). Two of the three groups had privacy settings requiring group membership, however, all Facebook pages were public and accessible for anyone to view. Keywords were translated into Thai local language and included "buy-sell eagles", "buy-sell hawks", "buy-sell owls", "buy-sell raptors" and "raptor trade". Species, number of individuals, date of post, bird growth stage, asking price (Thai Baht) and seller location were recorded by manually scrolling through offers of sale. These were then geo-referenced using a GIS to explore the distribution of seller activity highlighting trade "hot spots". Care was taken to minimise double counting within and across trading groups and any duplicates were subsequently eliminated from data analyses.

Bird identification was assisted by a field guide (Ferguson-Lees and Christie, 2007) and verified by an expert ornithologist. Taxonomy was standardised following the accepted names recognised by del Hoyo *et al.* (2014). Data management and analyses were conducted using the software package R version 3.5.1. (R Core Team, 2018). A Pearson's Chi-square test was performed on categorical trade data to test for significant differences between trade volumes and month of the post. A two-sample *t* test was also used to test for a significant difference between mean prices for raptors and owls. Currency conversions were conducted on 23 June 2019 using the exchange rates of USD1=THB30.6 and GBP1=THB38.5 (https://www.xe.com). Conservation status and global population trend data were obtained from the International Union for Conservation of Nature's Red List of Threatened Species (IUCN Red List) (IUCN, 2019).

It should be noted that photographs of specimens offered online may not reflect actual availability and could be fraudulent posts using stock photos or images used for different offers.

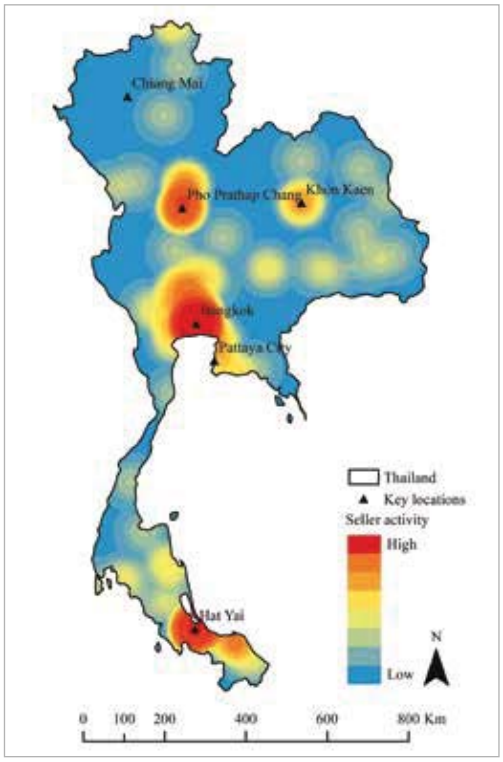


Fig. 1. Kernel density estimation of online seller activity throughout Thailand. *Map created using seller location point data (N=218 representing 84% of all recorded posts).*

Legislation

The possession and sale of all native bird species in Thailand is prohibited. The newly revised *Wildlife Reservation* [sic] *and Protection Act B.E. 2562* (2019) (WARPA) effective November 2019, and which replaces the *Wildlife Preservation and Protection Act B.E. 2535* (1992), includes a new category "Controlled Wild Animal". This covers CITES-listed species, and currently includes 50 non-native species that will be subject to immediate regulation for possession, breeding and trade. Conviction for violations pertaining to hunting, possession and trade carries a maximum fine of 10 years' imprisonment and a fine of THB1,000,000 (USD32,436). Violations relating to the import and export of species carry a maximum penalty of 15 years' imprisonment and/or a fine of THB1,500,000 (USD48,654) (Phassaraudomsak *et al.,* 2019). The law will also be supplemented by a series of subsidiary legislations that are being developed to direct its implementation and enforcement. WARPA 2019 also considers internet trade a violation (Krishnasamy and Zavagli, 2020).

Results

A total of 260 posts offering raptors and owls for sale were recorded and comprised 396 individuals. Collectively 28 species of raptors (N=18) and owls (N=10) were identified to species-level and two individuals identified to genus-level (Table 1).

Common name	Scientific name	No. of birds	CITES	National Threat Status	IUCN Threat Status	Pop. trend[1]	WARPA B.E. 2562[2]
Changeable Hawk-eagle	*Nisaetus cirrhatus*	123	II	VU	LC	↓	Listed
Black-winged Kite	*Elanus caeruleus*	64	II	NT	LC	→	Listed
Brahminy Kite	*Haliastur indus*	52	II	LC	LC	↓	Listed
Black Kite	*Milvus migrans*	23	II	EN	LC	?	Listed
Crested Goshawk	*Accipiter trivirgatus*	23	II	LC	LC	↓	Listed
Blyth's Hawk-eagle	*Nisaetus alboniger*	18	II	NT	LC	↓	Listed
Shikra	*Accipiter badius*	9	II	LC	LC	↓	Listed
Harris's Hawk	*Parabuteo unicinctus*	6	II		LC	↓	Unlisted
Crested Serpent-eagle	*Spilornis cheela*	4	II	LC	LC	→	Listed
Common Kestrel	*Falco tinnunculus*	2	II	LC	LC	↓	Listed
Oriental Honey-buzzard	*Pernis ptilorhynchus*	1	II	LC	LC	→	Listed
Ferruginous Hawk	*Buteo regalis*	1	II		LC	↑	Unlisted
Pied Harrier	*Circus melanoleucos*	1	II	LC	LC	↓	Listed
Peregrine Falcon	*Falco peregrinus*	1	I	LC	LC	→	Listed
Saker Falcon	*Falco cherrug*	1	II		EN	↓	Unlisted
Steppe Eagle	*Aquila nipalensis*	1	II	EN	EN	↓	Listed
Wallace's Hawk-eagle	*Nisaetus nanus*	1	II	EN	VU	↓	Listed
White-bellied Sea-eagle	*Halieetus leucogaster*	1	II	LC	LC	↓	Listed
	Circus sp.	1					
Spotted Owlet	*Athene brama*	22	II	LC	LC	→	Listed
Collared Owlet	*Glaucidium brodiei*	12	II	LC	LC	↓	Listed
Buffy Fish-owl	*Ketupa ketupu*	6	II	LC	LC	→	Listed
Oriental Scops-owl	*Otus sunia*	6	II	LC	LC	→	Listed
Eastern Barn-owl	*Tyto javanica*	4	II	LC	LC	→	Unlisted‡
Eastern Grass-owl	*Tyto longimembris*	3	II	LC	LC	↓	Listed
Barred Eagle-owl	*Bubo sumatranus*	3	II	NT	LC	→	Listed
Brown Boobook	*Ninox scutulata*	3	II	LC	LC	↓	Listed
Collared Scops-owl	*Otus lettia*	2	II	LC	LC	→	Listed
Brown Wood-owl	*Strix leptogrammica*	1	II	LC	LC	↓	Listed
	Tyto sp.	1					
Total		396					

Table 1. Raptor and owl species recorded for sale, February 2015 to June 2019.
National Threat Status derived from the Bird Conservation Society of Thailand (BCST, 2019). [1]Global population trend data derived from the IUCN Red List. [2]Species protected under the *Wildlife Reservation and Protection Act*, B.E. 2562 (2019). ‡Recent taxonomic change (see Recommendations).

Seller activity

The largest proportion of online seller activity was distributed across central Thailand (Fig. 1). When analysing seller activity at city-level, offers of sale in Bangkok and Hat Yai were the most frequent, comprising 45% of all geo-referenced posts (N=218). At district-level, Pho Prathap Chang comprised 6% of all geo-referenced posts. Due to the ambiguous nature of online seller locations, it was unclear whether sellers referred to Khon Kaen as a city or province. Therefore the authors regarded all offers of sale in Khon Kaen at a provincial-level, which comprised 3% of all geo-referenced posts.

Most traded species

The most frequent raptor species recorded as offered for sale was the Changeable Hawk-eagle *Nisaetus cirrhatus,* representing 31% of all identified species, followed by the Black-winged Kite *Elanus caeruleus* and the Brahminy Kite *Haliastur indus* representing 16% and 13%, respectively (Table 1). Chicks (including all hatchlings, nestlings and juvenile birds) comprised the majority of birds for sale. Approximately 76% (N=93) of Changeable Hawk-eagles, 92% (N=59) of Black-winged Kites and 85% (N=44) of Brahminy Kites were offered for sale as chicks.

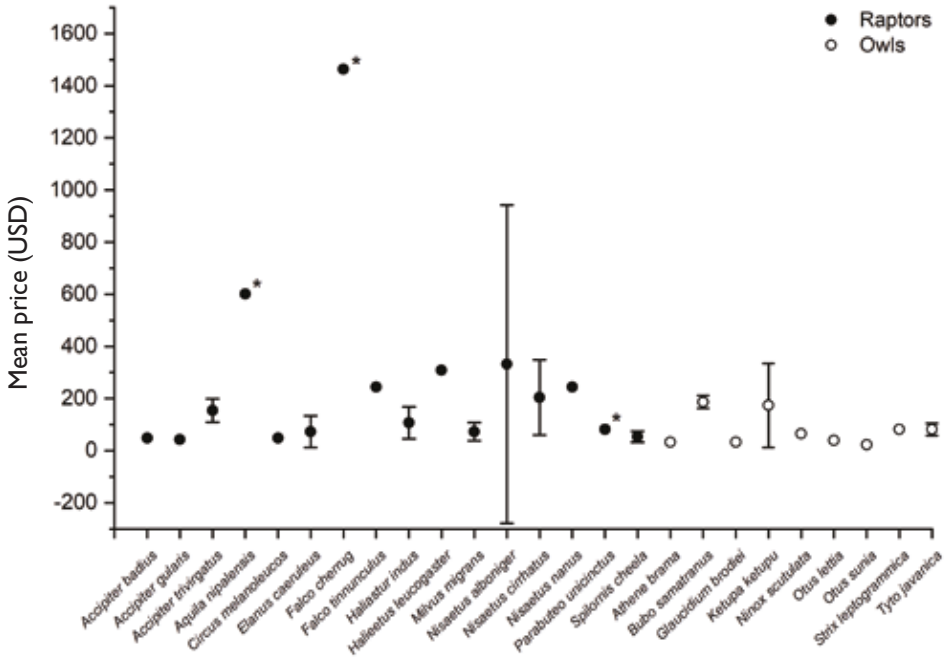


Fig. 2. Mean prices (USD) (±SD) for species recorded during the survey with available price data (N=26).

The most frequent owl species for sale was the Spotted Owlet *Athene brama* which comprised approximately 6% of all species. The Collared Owlet *Glaucidium brodiei* and the Buffy Fish-owl *Ketupa ketupu* represented the second and third most frequent owl species comprising 3% and 2% of all traded species, respectively (Table 1). The majority of owls were offered as chicks, comprising 86% (N=19) of Spotted Owlets, 83% (N=10) of Collared Owlets and 50% (N=3) of Buffy Fish-owls.

Distribution and conservation status

Of the species identified to species-level, 86% were native to Thailand (N=24) and approximately 11% non-native (N=3). Of the latter, these included the Harris's Hawk *Parabuteo unicinctus*, Ferruginous Hawk *Buteo regalis* and Saker Falcon *Falco cherrug*. All species identified to species-level are listed in CITES Appendix II, with the exception of the Saker Falcon which is listed in CITES Appendix I, prohibiting all international commercial trade. Approximately 57% of species (N=16) had decreasing global population trends, three of which are threatened and are of global conservation concern (Saker Falcon, Steppe Eagle *Aquila nipalensis* and Wallace's Hawk-eagle *Nisaetus nanus*) (Table 1). At a national level, two threatened species in Thailand, the Changeable Hawk-eagle and the Black Kite were frequently recorded for sale on Facebook (Table 1).

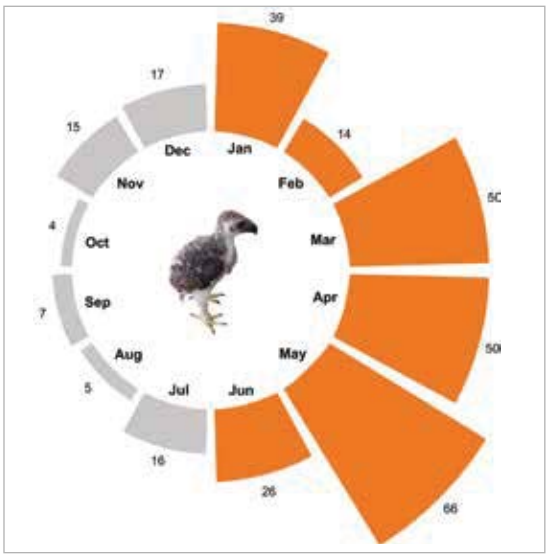
Annual trends and prices

There was a peak in the number of posts in 2018, contributing 48% of total records. Conversely, the fewest posts occurred in 2016, totalling 5%. The data collected only included posts in 2019 up until June therefore underrepresenting the total for that year. The authors surmise that the removal of older posts was the likely reason 2016 had the lowest total number of posts in their dataset.

Price data were available for 65% of posts and for 86% of species (Fig. 2). Prices ranged from USD16 and USD2,440 for all species. There was a significant difference between mean prices for raptors and owls (t=3.249, df=166, $p < 0.05$). Owls had a lower monetary value compared to raptors, with average asking prices for owls and raptors being USD87 (±98) and USD184 (±251), respectively (Fig. 2). The most expensive bird offered for sale was a mature Blyth's Hawk-eagle *Nisaetus alboniger* priced at USD2,440. Despite owls having a lower monetary value, Black-winged Kites were one of the cheapest species—two hatchlings were on sale for USD16 each.

Growth stage

Throughout the study, a total of 308 chicks were recorded for sale, comprising 78% of all recorded individuals. Of these, 79% (N=245) were offered for sale during the wild bird breeding period for the reported species (Ferguson-Lees and Christie, 2007). There was a significant difference between the number of chicks for sale during the breeding period compared to the non-breeding period ($X2$=51.415, df=1, $p < 0.05$). Posts offering chicks for sale peaked in May, with the second-highest number occurring in March and April (Fig. 3).



◄ Fig. 3. No. of chicks for sale/month.
Numeric values represent the number of chicks for sale across the surveyed trading groups in each corresponding month. Data pooled from four-year survey period. Orange = approximate breeding season.

Wild-caught birds

The authors found evidence suggesting wild-caught birds were actively being illegally offered for sale on Facebook, signifying an emerging unrecognised conservation threat for some threatened species already experiencing regional population declines, such as the Changeable Hawk-eagle. It is likely that wild birds were taken from nests and offered for sale online, however, the true origins of these birds could not be ascertained (Fig. 4a). Additionally, other sellers posted images of eggs (Fig. 4b) and chicks (Fig. 4c and Fig. 4d) in the parental nest implying that these individuals may have derived from wild sources.

Welfare concern

Considerable welfare concerns for some birds offered for sale were noted. Inadequate conditions were frequently observed, with birds often kept in small cages (Fig. 5a) and showing signs of stress such as gaping from heat stress, trying to hide from the photographer (Fig. 5b) and in poor physical condition, with visible wounds and missing feathers (Fig. 5c and 5d).

Discussion and Conclusions

This study provides a "snapshot" of the online trade of raptors and owls on social media. The majority of species offered for sale were native to Thailand and evidence suggests that the illegal taking and trade of wild birds is openly occurring online. Chicks were most frequently for sale, with posts peaking during the wild breeding season. The authors highlight an emerging conservation concern as more than half of the recorded species are experiencing global wild population declines and two of the most traded species are threatened in Thailand.

In comparison to the more generic search methodology of Phassaraudomsak and Krishnasamy

Fig. 4. Images of suspected wild raptors uploaded by sellers onto the surveyed trading groups.
a) nestlings for sale, online seller requests price bids via private message; b) a posted image of a wild nest with eggs; c) two wild nestlings in the nest; d) nestling birds in the nest (seller asks whether other members of the trading group would like to buy the birds).

(2018), more raptor and owl species were found for sale during this study suggesting the online trade is ongoing. The number of posts were higher in 2018 compared to other years, likely due to increased enforcement in physical markets resulting in a shift to online platforms, enabling sellers to trade wildlife with ease due to a wider customer reach and the ability to remain anonymous (S.C.L. Chng, pers. comm., August 2019). Seller activity was concentrated within and around the peripheries of large cities such as Bangkok and Hat Yai where nearly half of all geo-referenced posts were recorded. This is where human densities are highest and access to the internet more readily available. However a considerable number of birds were offered for sale in the more rural Pho Prathap Chang district, suggesting a single major supplier operating there.

Similar to Iqbal (2016), the Changeable Hawk-eagle was the most frequent raptor species for sale in Thailand and the second most frequent in Indonesia (Iqbal, 2016). The Black-winged Kite featured as the second most common raptor species for sale in this study and the most commonly offered raptor species recorded in Indonesia (Iqbal, 2016). This species has broad geographic distributions across Southeast Asia and often occurs within human-modified landscapes such as agricultural farmland (Li, 2011). The majority of the species recorded in this study occur throughout lowland habitats overlapping with areas of human activity such as rice fields. It is likely that lowland species are more readily poached from the wild and traded online due to the encroachment of human settlements into lowland habitats. This is evident by the high number of Changeable Hawk-eagles observed in this study. However these findings were not as numerous as those by Iqbal (2016), reporting 1,216 Changeable Hawk-eagles comprising more than 7,500 raptors and owls for sale on Indonesian Facebook groups. Those findings are likely the result of Indonesia's long cultural heritage of bird keeping and status as the largest importer and exporter of wild birds in Asia (Harris *et al*., 2016). The prevalence of Changeable Hawk-eagles offered for sale in this study and by Iqbal (2016) highlights a considerable emerging conservation threat that could result in the species' national threat status being increased from Vulnerable to Endangered due to overexploitation for the falconry and pet trade.

The majority of species for sale were native to Thailand and mostly comprised chicks. The number of posts peaked during the wild breeding period, suggesting a threat of illegal overexploitation of wild individuals subsequently entering the online trade. The majority of sellers provided no open information regarding the origin of birds, although some openly offered wild birds for sale using phrases such as "wild hawk", "strong wild bird" and offering to supply wild chicks. Such illegal activities raise considerable conservation concerns that overexploitation and unsustainable trade of wild populations is threatening many Asian species (Nijman and Shepherd, 2015). The Changeable Hawk-eagle (the most traded species in this

Fig. 5. Examples of birds offered for sale online in unsuitable conditions.
a) Juvenile Shikra *Accipiter badius* in a small cage, seller reported the bird as wild-caught; b) Two Brown Hawk-owls *Ninox scutulata* in a wooden crate; c) Changeable Hawk-eagle *Nisaetus cirrhatus* in poor condition; and d) Crested Goshawk *Accipiter trivirgatus* showing signs of stress.

study) and the Black Kite (the fourth most commonly traded species) are threatened in Thailand and listed as Vulnerable and Endangered by the Bird Conservation Society of Thailand (Table 1; BCST, 2019). This snapshot survey highlights an alarming emerging conservation issue surrounding wild populations of these and other threatened raptors in Thailand.

The study also highlights animal welfare concerns, whereby the capture, transport and sale of wild birds to fuel consumer demand is likely to be a stressful process for the birds. Animal welfare does not appear to be a high priority for many online sellers as evidenced by the unsuitable and unhygienic conditions in which some of the birds are kept (Fig. 5). Thai law states that traders must have appropriate trade permits to sell goods online, however, no evidence of any permits was observed during the survey. The findings correlate with those of a Philippines study which also found a lack of evidence surrounding the use of trade permits by online sellers advertising wildlife products (Canlas *et al*., 2017).

Local hobbyists and small falconry groups were found to be the predominant drivers of sales of raptors and owls in Thailand during this study. Falconry equipment was frequently observed for sale alongside live birds. Some posts also included videos and photographs of raptors being flown for recreational and hunting purposes.

Although identification of the bird species for sale was in some cases reviewed by a taxonomy expert, identification was sometimes based on examination of a single photograph provided by the online sellers, which were often of poor quality; furthermore the identification of juveniles can be difficult. The survey only provides a snapshot of the online trade in raptors and owls in Thailand and the sampling efforts employed were only ever likely to capture a small proportion of Facebook posts trading wild birds. Such errors may overestimate and/or underestimate some species within the dataset, however, as all native species in Thailand are protected by WARPA, this does not weaken the conservation value of these findings.

Overall legislative protection of species recorded in this study is good (Table 1), with the majority of species listed under WARPA. However perceptions of WARPA are weak across Thailand due to low prosecution rates, sending the wrong message for raptor and owl conservation (Phassaraudomsak and Krishnasamy, 2018).

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▲ **Spotted Owlet *Athene brama*, the most frequent owl species recorded for sale during the study.**

Recommendations

Recent taxonomic revisions identify the Eastern Barn Owl *Tyto javanica* as a single species (previously recognised as a subspecies of the Western Barn Owl *Tyto alba*) (Uva *et al*., 2018). Continued revisions to WARPA concerning updated taxonomic changes are recommended, however, to date there is no evidence to suggest this will help protected species. Therefore, an increase in enforcement of the WARPA legislation on illegal sellers throughout the country is imperative if overexploitation of wild populations is to be prevented and protection provided for native species. Further monitoring and specific enforcement (via the identification of key illegal wildlife trade actors) targeting the illegal trade of nationally threatened species such as the Changeable Hawk-eagle and Black Kite is highly recommended. Continued collaboration between authorities and social media platforms to tackle the online illegal wildlife trade is required, as highlighted by Phassaraudomsak and Krishnasamy (2018). The development of the Wild Hawk Unit, known locally as *Yiaw Dong* and focused on tackling online illegal wildlife trafficking in Thailand, provides a positive outlook for future conservation (Phassaraudomsak and Krishnasamy, 2018), with several arrests made in recent years (The Nation, 2018). However the effectiveness of the unit has yet to be assessed from a conservation perspective and the impact on wildlife crime prevention is unknown. The illegal trade of wild raptors and owls continues on social media. Consequently behaviour change communications and continued education are fundamental to protect wild raptor and owl populations in Thailand and across Southeast Asia.

Acknowledgements

The authors thank E. Atkinson for assisting with data collection, M. Iqbal for assisting with species identification, I. Literák, S.C.L. Chng, P. Round and K. Tonsakulrungruang for their valuable comments on earlier versions of this manuscript. Finally, we thank K. Lochen for the support and feedback during the publication process.

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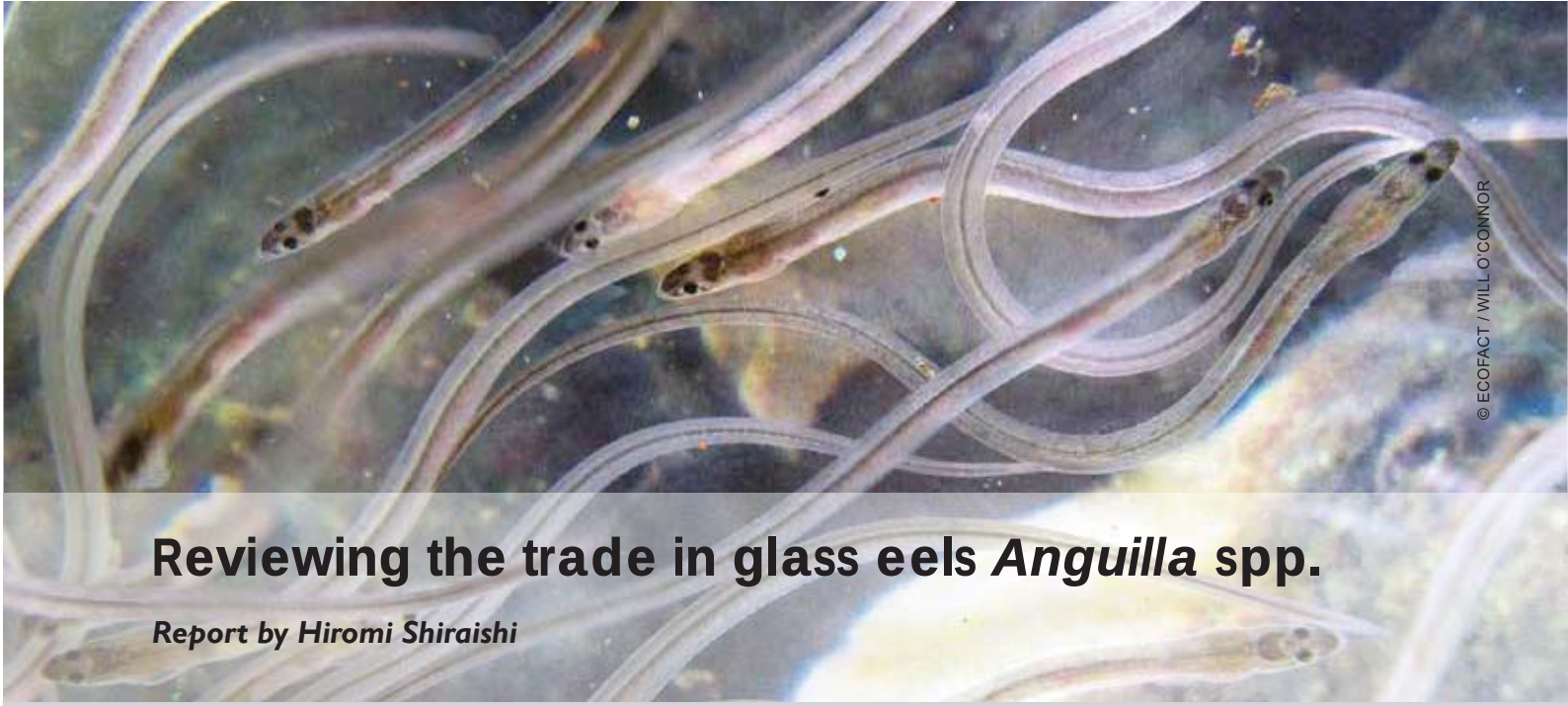

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Reviewing the trade in glass eels *Anguilla* spp.

Report by Hiromi Shiraishi

Introduction

The family Anguillidae, commonly referred to as freshwater eels, comprises 16 species, all in the genus *Anguilla* (Watanabe *et al*., 2009). Various life stages of many *Anguilla* species, ranging from glass eel to silver eel (Fig. 1), are harvested and traded internationally for consumption, and the species are of significant commercial importance, in particular the European Eel *Anguilla anguilla*, the Japanese Eel *A. japonica*, and the American Eel *A. rostrata* (FAO, 2020). Wild juvenile eels (also called glass eels, elver or live eel fry) are caught and then used as "seed" in farming/aquaculture operations as captive breeding of *Anguilla* spp. is not yet commercially viable (Butts *et al*., 2016; Kuroki *et al*., 2019).

Farming operations predominantly occur in East Asia (the People's Republic of China [hereafter China], Japan, the Republic of Korea [South Korea] and Taiwan, People's Republic of China [Taiwan], with Hong Kong Special Administrative Region (SAR) [Hong Kong] being an important trade hub for glass eels destined for farming operations in the region (Crook and Nakamura, 2013; Shiraishi and Crook, 2015). In the past, eel farming in East Asia predominantly relied on the Japanese Eel, which is native to the region; however, as catch of this species rapidly declined and the price dramatically increased, many Asian farms, especially those in China, began importing from the 1990s large quantities of other *Anguilla* spp., specifically *A. anguilla*, as seed for farming (Ringuet *et al*., 2002; Shiraishi and Crook, 2015).

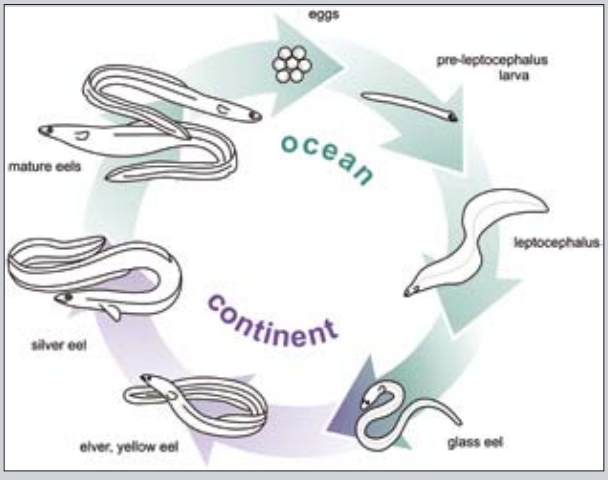

Fig. 1. Diagram of the life cycle of anguillid eels.
Source: Henkel *et al.* (2012).

Populations of several *Anguilla* species have declined considerably over the last decades due to various threats including barriers in waterways, the loss of river habitat, pollution, changes in oceanic conditions, diseases and unsustainable exploitation. *Anguilla anguilla* is currently listed as Critically Endangered on the IUCN Red List of Threatened Species and *A. japonica* and *A. rostrata* are classified as Endangered (Jacoby and Gollock, 2014a; 2014b; Jacoby *et al*., 2017). Concerns over the impact international trade was having on *A. anguilla* populations led to the species being listed in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 2007, effective March 2009. Since then, there have been significant changes in the global exploitation and trade of *Anguilla* spp. In addition to an ongoing illegal trade in *A. anguilla*, there has been increasing demand for other *Anguilla* spp. (Gollock *et al*., 2018; Musing *et al*., 2018). This article provides an overview of the international eel trade over the decades, focusing on changes in the trade dynamics of live glass eels, especially the species not native to East Asia but used for farming, and provides recommendations for decision-makers based on current and previous TRAFFIC eel trade research.

Methods

Catch production and trade data for *Anguilla* spp. were collated from several sources to provide an overview of trade dynamics.

East Asia and other Customs data

Customs import and export data for *Anguilla* live eel fry for the East Asian countries/territories for 2004–2019 were obtained from the following sources:

- China Customs Information Centre (data requested via China Cuslink Co. Ltd. up to 2017; http://43.248.49.97/indexEn since 2018);
- Hong Kong Trade Development Council (https://tradeidds.censtatd.gov.hk);
- Ministry of Finance, Trade Statistics of Japan (http://www.customs.go.jp/toukei/info/);
- South Korea International Trade Association (http://www.kita.org/); and
- Taiwan Bureau of Foreign Trade (http://cus93.trade.gov.tw/ENGLISH/FSCE/).

Globally, there is one six-digit Harmonised Systems (HS) Customs code designated for live *Anguilla* eels (HS 030192), however this code does not differentiate between the various life stages or species. All East Asian countries/territories have adopted more detailed eel Customs codes that differentiate between "live eel fry" for farming and "other live eel" for consumption purposes (except for Japan's live eel export Customs code) from 2004 (Table 1); however, the definition of "live eel fry" varies between them. For example, "live eel fry" in Japan refers to glass eels and elvers 13 g or less per specimen, but in South Korea the term includes young eels up to 50 g per specimen. Furthermore, South Korea differentiates between two different sizes of eel fry (by weight) and Taiwan between three sizes (by pieces per kg). For this article, unless otherwise specified, the following terms apply:

- "live eel fry" refers to juvenile/young eels (irrespective of the size, including glass eels and elvers) used for farming; and
- "other live eel" refers to larger sized eels used for consumption (including large elvers, yellow and silver eels).

As species-specific Customs data are not available, geographic provenance was used to infer the likely *Anguilla* spp. being traded and supplied to farms. For the purposes of analysis, it was assumed that countries/territories named in trade data as the origin of exports were the sources of live eel fry. Although several *Anguilla* spp. can be caught in one country/territory, *Anguilla* spp. from particular regions in the trade data were assumed to refer to the following species i.e. East Asia (*A. japonica*), Americas (*A. rostrata)*, Southeast Asia (*A. bicolor* and other tropical species), Oceania (*A. australis*, *A. dieffenbachii* and *A. reinhardtii*) and East/Southern Africa (*A. mossambica* and other tropical species).

Hong Kong is sometimes described as the source of live eel fry in East Asian Customs data, which obscures their actual source as there are no glass eel fisheries or eel farms in Hong Kong (Agriculture, Fisheries and Conservation Department of the Hong Kong Special Administrative Region (AFCD), pers. comm. to TRAFFIC, November 2017) and these are re-exports. Imports from Hong Kong into the East Asian countries and territories (accounting for 17% of total weight between 2004 and 2019) were therefore excluded from the analysis into the origin of live eel fry. Of two types of import data (by origin and by supplier) available in Hong Kong, the origin data were used for this report, unless otherwise specified.

Information released regarding Informal Consultation on International Cooperation for Conservation and Management of Japanese Eel Stock and Other Relevant Eel Species

Information was also sourced from joint statements arising from annual meetings of the Informal Consultation on International Cooperation for Conservation and Management of Japanese Eel Stock and Other Relevant Eel Species attended by China, Japan, South Korea and Taiwan. China was absent from the meetings held between 2015 and April 2019—the most recent meeting—and data relating to farming and trade for China for this period is therefore missing. For example, data on live eel fry input into farms for 2004–2014 is available from http://www.jfa.maff.go.jp/j/saibai/pdf/140917unagi_data.pdf). "Input" is used to describe the supply of live eel fry into grow-out eel farms.

European Eel *Anguilla anguilla*

American Eel *Anguilla rostrata*

	Customs Code	Commodity
China	0301.92.10.10	Live eel fry of Marbled Eel *Anguilla marmorata*
	0301.92.10.20	Live eel fry of European Eel *Anguilla anguilla*
	0301.92.10.90	Live eel fry, other *Anguilla* spp.
	0301.92.90.10	Live eels, other than fry of *Anguilla marmorata*
	0301.92.90.20	Live eels, other than fry of *Anguilla anguilla*
	0301.92.90.90	Live eels, other than fry of other *Anguilla* spp.
Japan	0301.92.10.0	Live eel fry "*Anguilla* spp." (only used for imports)
	0301.92.20.0	Live eels, other than fry of *Anguilla* spp. (only used for imports)
	0301.92.00.0	Live eel of *Anguilla* spp. (only used for exports)
South Korea	0301.92.10.00	Glass eel (≤0.3 g per unit, for aquaculture)
	0301.92.20.00	Young eel (>0.3 g and ≤50 g per unit, for aquaculture)
	0301.92.90.00	Live eels, other than fry of *Anguilla* spp.
Hong Kong	0301.92.10	Live eel fry "*Anguilla* spp."
	0301.92.90	Live eels, other than fry of *Anguilla* spp.
Taiwan	0301.92.10.10-1	Eels, *Anguilla japonica*, live
	0301.92.10.20-9	Eels, *Anguilla marmorata*, live
	0301.92.10.90-4	Other eels (*Anguilla* spp.), live
	0301.92.20.10-9	Glass eel (=>5000 pcs per kg)
	0301.92.20.20-7	Eel fry (=>500 and <5000 pcs per kg)
	0301.92.20.30-5	Young eel (elver) (>10 and <500 pcs per kg)
	0301.99.29.40-7	Live Australian eels

Table 1. Customs codes and descriptions of live *Anguilla* eels in East Asia (valid March 2020). Note: mainland China uses 10-digit codes for tariff purposes (along with additional 3-digit China Inspection and Quarantine (CIQ) codes), but only 8-digit data (non-species-specific) are available for analysis. *Sources: Editorial Department of the Customs Import and Export Tariff of China (2016); http://www.transcustoms.com/; Hong Kong Census and Statistics Department; Ministry of Finance, Trade Statistics of Japan; Korea International Trade Association; Taiwan Bureau of Foreign Trade.*

Other information

Other data sources include IUCN Red List assessments, documents of relevant CITES meetings and published scientific papers identified using Web of Knowledge. Grey literature was identified using web searches especially when scientific papers were not available.

Global glass eel trade over the decades

A significant volume of *A. anguilla* glass eels was being caught in Europe, specifically France, by the early 1900s, destined locally or for Spain, reaching over 530 t in 1925 (Briand *et al.,* 2008). It was not until the late 1960s that *A. anguilla* glass eels started to be exported from Europe to East Asia. Glass eel landings and exports to that region increased due to a change in fishing practices, with exports reaching a peak of 1,200 t in 1976 (Briand *et al.,* 2008). According to Japanese Customs data, imports of live eel fry from France declined over the years to less than 10 t in 1987. Exports of glass eels from France to East Asia increased again in 1994 when eel farms in China, which had lower labour and running costs, were established (Briand *et al*., 2008); glass eel exports to China reached 266 t in 1997, after which they decreased again to 78 t in 2000 (Ringuet *et al*., 2002).

While the illegal fishing and trade of *A. anguilla* has sometimes been attributed to the CITES listing of the species, such practices were already being reported in Europe by the 2000s. In 1989, more than 30% (170 t) of glass eels were caught by non-professional fishers including amateurs and poachers (Castelnaud *et al*., 1994) despite only a small amount of those caught by non-professionals allowed for sale (Casinière, 1996). De Bruyne *et al.* (2006) suggest 20 t of glass eels were caught by poachers in the 2000s.

In 2007, the EU adopted Council Regulation (EC) No. 1100/2007 (hereafter referred to as the EU Eel Regulation)[1] to ensure protection and sustainable use of *A. anguilla* which, *inter alia*, stipulated that relevant EU Member States should develop Eel Management Plans to ensure the recovery of stock across their territories. Furthermore, the species was listed in CITES Appendix II in the same year, effective March 2009. During the 2009–2010 glass eel fishing season—the first full fishing season after the CITES listing came into force—exports of glass eels were only permitted from EU Member States with approved management plans in place and export of glass eels was restricted to quotas set by the Scientific Review Group (EC, 2009). In fact, France was the only EU Member State to be allocated an export quota (14,230 kg), which was approved by the EC

[1]*Council Regulation (EC) No 1100/2007 http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32007R1100&from=EN*

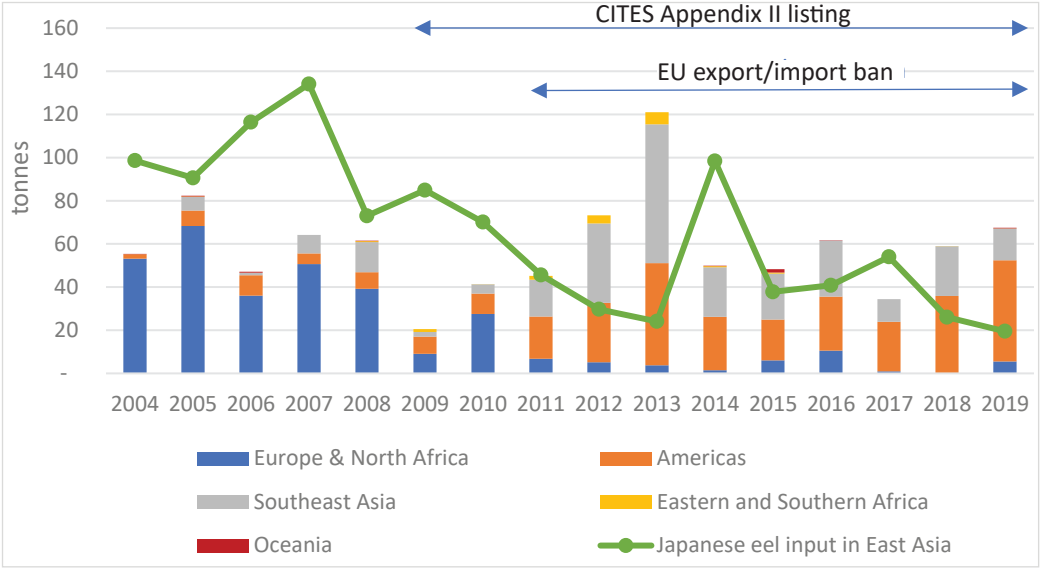

Fig. 2. Imports (t) of live eel fry for farming (all sizes) into East Asia (excluding trade between East Asian countries/territories) and the supply of *Anguilla japonica* for farming in East Asia, 2004–2019. Europe and North Africa (likely to be *A. anguilla*); Americas (likely to be *A. rostrata*); Southeast Asia (likely to be *A. bicolor* and other tropical *Anguilla* species); East/Southern Africa (likely to be *A. mossambica* and other tropical species); Oceania (likely to be *A. australis*). Note: supply of *Anguilla anguilla* for farming in East Asia was reported by fishing season; however, data for the 2018–2019 fishing season is, for example, recorded in the figure for 2019; supply of *Anguilla anguilla* for farming in East Asia in the 2013–2014 fishing season seems to have been overreported because of it being the base year to set input quota (Kaifu *et al.*, 2019). *Sources: East Asian Customs; Anon. (2019a); Joint Press Releases of the East Asian eel meetings.*

in February 2010; Spain and Portugal—other important glass eel catching countries—did not have their national management plans approved in time and the UK decided to ban temporarily all exports of glass eels caught in the UK, and Customs data suggest there may have been some illegal trade (Crook, 2010).

In December 2010, a zero-import/export policy was set for the EU, which remains in place, while harvest for internal (including within the EU) consumption/trade is still allowed. Despite this ban, East Asian Customs data indicate that glass eels were imported from EU Member States into East Asia every year until 2016, suggesting some may have been illegally exported. According to Customs data, East Asian countries and territories also began importing glass eels from North Africa in 2009, with reported trade reaching 4.5 t in 2016. Even though these countries do not permit the export of glass eels, at least in recent years (Musing *et al.*, 2018), imports from North Africa were reported by East Asian countries/territories up until 2019; it has been suggested that some of these glass eels may have originated in the EU and been transported through North Africa to avoid EU trade controls (Europol, 2018a). Annual imports of live eel fry into East Asia from Europe and North Africa (likely to be *A. anguilla*) accounted for 96% of all live eel fry imports from outside East Asia in 2004 with 53 t, which declined to 3% (1 t) in 2014, increasing again in 2016 (11 t, 17%).

There have also been significant changes in the trade in other *Anguilla* species over the last 15 years. According to East Asian Customs data, total East Asian imports of live eel fry from non-*A. anguilla* range States gradually increased, reaching over 117 t in 2013 (including over 38.5 t of young eels in 2013) (Fig. 2). Increases in sourcing for these countries is likely to have been triggered for several reasons including the CITES listing of *A. anguilla* and considerably low input of *A. japonica* glass eels for farming in the 2011–2012 and 2012–2013 fishing season in East Asia (less than 30 t respectively) (CITES, 2018).

According to East Asian Customs data, imports of live eel fry from the Americas (likely to be *A. rostrata*) increased, with fluctuations from 2 t in 2004 to 47 t in 2013 (young eels accounting for more than 16 t) but slightly declined in the following years before increasing again to 47 t in 2019. Various sources suggest that *A. rostrata* from North America have been used for farming in China since the 1990s, but imports from the Caribbean and Central American countries have increased in the last few years due to the soaring price of North American glass eels and improved farming technologies for the Caribbean and Central American glass eels, which tend to be smaller than the former (Anon, 2018; Fan and Qin, 2016; Han, 2016). In addition to reported imports into East Asia from the Caribbean and Central American countries, which began around 2012, additional live eel fry caught in the region are being traded via the USA and Canada, but do not appear as such in origin/re-exporter data (Gollock *et al.*, 2018). According to the East Asian Customs data, all the East Asian countries and territories reported imports of *A. rostrata* over the last 15

years while the majority of live eel fry seems to have been imported via Hong Kong. On the other hand, imports of *A. bicolor* and other tropical species into East Asia seem to have declined after 2012; eel farmers do not seem to have strong interests in *A. bicolor* for the moment due to its low market price (Li, 2019) although uncertainties about interests and demand remain. Considerable levels of illegal trade, driven by the demand for farming, have been documented in many countries. For example, in the USA "Operation Broken Glass"—a multi-jurisdiction investigation—resulted in 19 people pleading guilty to illegal fishing and trade of elvers, which resulted in prison sentences and fines (U.S. Fish and Wildlife Service, 2019).

There still appears to be demand for *A. anguilla* despite the difficulties in sourcing this species and the increase in demand for other *Anguilla* spp. In recent years, European authorities have increasingly reported the involvement of organised criminal networks in the movement of legally and illegally sourced European glass eels from the EU to East Asia. During the 2015–2016 glass eel fishing season, Europol initiated Operation LAKE, a European initiative aimed at combating illegal eel trade and dismantling organised networks involved in associated illegal activities (Europol, 2017). Consequently, 4 t of live eel fry were seized and 48 persons arrested in the 2016–2017 fishing season, 3.4 t of live eel fry were seized in the 2017–2018 fishing season, and 5.8 t of live eel fry were seized and 154 people arrested in the 2018–2019 fishing season (Europol, 2017; 2018b; 2019). However, there remain uncertainties about the quantity of glass eels illegally exported/supplied to eel farms in East Asia (CITES, 2018). Recent seizure data in Europe and Asia suggest that *A. anguilla* specimens have been increasingly transported from Europe to Southeast Asian countries (Musing *et al*., 2018).

Discussion and Conclusions

Trade data analysis of *Anguilla* spp. over the last 15 years shows that there have been substantial shifts in trade related to live eel fry. According to East Asian Customs data, annual imports of live eel fry from Europe and North Africa (likely *A. anguilla*) accounted for 96% of all live eel fry imports from outside East Asia in 2004, which declined to 3% in 2013, while imports from other regions increased from 2 t in 2004 to 38 t in 2011, reaching a peak of 112 t in 2013. The Americas and Southeast Asia became increasingly important live eel fry source regions for East Asian farms during this time. These fluctuations coincided with the CITES listing of *A. anguilla* coming into force in 2009, the banning of all trade in *A. anguilla* from, and to, the EU in 2010, and low harvest of *A. japonica* for four consecutive years during 2010–2013.

This shift in demand also seems to be closely related to the development of farming techniques for different *Anguilla* species/populations and the popularity as well as availability and price of glass eels. While exports of *A. anguilla* from Europe to Asia (Japan at this time) declined once, they resumed in 1994 due to demand in China and lower labour and running costs, which made farming *A. anguilla* worth investing in (Briand *et al*., 2008). Imports of *A. rostrata* from North America for farming trials started in China in 1994, and remained stable until early 2010s when imports from Central American countries to East Asia began due to the higher price of the species/populations which had been used and the development of farming techniques for *A. rostrata* glass eels from Central America (which are reportedly smaller than those from North America). The volume of *A. rostrata* live eel fry imports increased over the years, reaching over 20 t in the 2014–2015 fishing season onwards. While fisheries regulations are implemented in some *A. rostrata* range States (Gollock *et al*., 2018), and considering changes in the trade dynamics in the last few years, further research into whether current fisheries and trade regulations are sufficient and fully implemented is needed, specifically in new and/or emerging source countries e.g. the Dominican Republic, Haiti and Cuba.

Although demand for *Anguilla* species from Southeast Asia and East/Southern Africa seem to have declined after the upsurge in the mid-2010s, it could increase again as was the case with *A. anguilla* and *A. rostrata*, when techniques are successfully developed and the availability of the other currently favoured *Anguilla* spp. declines. Although some Southeast Asian countries have already implemented trade regulations (e.g. an export ban for glass eels) and initiatives to enhance sustainable resource management have been undertaken, e.g. a project of the Southeast Asian Fisheries Development Centre (SEAFDEC, 2018), further strengthening of management measures and close monitoring of exploitation and trade would be warranted. For example, despite the export ban in the Philippines of *Anguilla* spp. of 15 cm in size or less since 2012, East Asian Customs data show that specimens likely below this size have been imported from the country every year up to 2019. In addition, East Asian countries and territories report a significant volume of imports of live eel fry from Southeast Asian countries where glass eel fishing or farming does not exist (e.g. Malaysia and Thailand) (Gollock *et al*., 2018; SEAFDEC, 2018), some of which may play a role as a transit point.

Despite an increase in imports of other *Anguilla* spp. in East Asia, illegal trade in *A. anguilla* has continued, perhaps because of an apparent "ready supply" of glass eels in the EU. Although the stock has been depleted, some 58.6 t of glass eels were reportedly caught in the EU in 2018 (ICES, 2018) for example, and an additional unknown amount of glass eels are considered to be caught by IUU fishing each year. Although illegal export of glass eels from the EU is driven by demand for farming in East Asia, structural challenges of ensuring sustainability, legality and traceability in the EU have been pointed out, such as significant variation in management measures

taken by the different EU Member States, insufficient information exchange and the lack of a harmonised traceability system for *A. anguilla* within the EU (EC, 2020; Musing *et al*., 2018). In fact, even though the EU Eel Regulation sets out a clear framework as to the Member States' obligations concerning traceability of *A. anguilla* trade within the EU, there is no EU-wide traceability system; once glass eels leave one country, the recipient EU Member State is unlikely to track the origin of these glass eels (Hanel *et al*., 2019). ICES (2016) notes that more than 30% of glass eels were not traceable in the EU in 2015 and 2016.

Given that there is a considerable price gap between live eels traded in the EU and those offered in East Asia, illegal trade is likely to continue unless there are advantages to trade within the EU only and/or more stringent regulations and controls are introduced to prevent illegal fishing and trade. Specifically, introduction of an EU-wide traceability system for *A. anguilla* within the EU to ensure transparency in the supply chain, and data reliability and verification from catch to consumption, would be essential as the evaluation of the implementation of EU Eel Regulation published in early 2020 indicated, whether or not the EU import/export ban continues or imports/exports resume in the future. Along with revision of the Council Regulation (EC) No 1224/2009 (EU Fisheries Control Regulation), further actions would be needed to achieve this at the EU and Member States level by learning from other species and systems e.g. EU Trade Control and Expert System (TRACES).

Among other issues to be addressed is the lack of knowledge about farming practices in East Asia, including to what extent there is a trade-off between *A. japonica* glass eel input for farming and other *Anguilla* spp. The 2011–2012 and 2012–2013 fishing season saw considerably low input of *A. japonica* glass eels for farming and a sudden increase in imports of new/emerging *Anguilla* spp. The 2018–2019 fishing season saw the second lowest input of *A. japonica* in East Asia over the decades (Anon., 2019) and reported imports of other *Anguilla* spp. for 2019 were 67 t, which was the highest since 2014, but much lower than in 2012 and 2013. A better understanding of farming practices and demand dynamics, regulatory and reporting framework for eel farming as well as trade of glass eels and farmed eels is vital to identify fundamental problems and to take a step towards more responsible use of the species.

Based on the most recent eel trade data and previous research, it is vital that the relevant authorities of source, transit, farming and consumer countries/territories of *Anguilla* spp. ensure regional and/or global co-ordinated adaptive management and conservation measures for *Anguilla* spp. are fully implemented in order to achieve sustainable use of all *Anguilla* species. Considering that changes in the availability of certain *Anguilla* spp. has led to an increase in demand for different *Anguilla* spp. over the last few decades, mechanisms to facilitate co-operation and co-ordination between source, transit, farming and consumer countries/territories targeting the whole *Anguilla* genus are essential. These mechanisms could include, but should not be limited to, a genus-wide CITES listing for all *Anguilla* spp. Other recommendations for the relevant authorities and NGOs from this analysis included:

- focus further research on eel farming practice, farming production and consumption quantities, and species used, especially in apparently emerging markets such as China and South Korea;
- focus further research on eel exploitation and trade especially in emerging and/or lesser-known transit/source countries such as Canada, Malaysia, Thailand and the USA;
- review the scale and dynamics of the global eel industry, trade and consumption from a financial/economic point of view, including but not limited to subsidies and other financial support to the eel fisheries and farming;
- maintain, extend and further strengthen multi-lateral and bilateral co-operation between exporting/transit/importing countries, in particular between enforcement agencies, to control imports of glass eels from countries/territories that have fishing/export restrictions in place;
- ensure traceability for glass eels including in cross-border trade e.g. by introducing an EU-wide traceability system for *A. anguilla*;
- raise awareness among eel industry, traders, retailers and consumers with regards to eel legality, traceability and sustainability issues.

Top: juvenile European Eels *Anguilla anguilla* Below: smoked eel on sale at Amsterdam Airport, Netherlands, February 2015.

Acknowledgements

The author thanks Kenzo Kaifu, Matthew Gollock and Vicki Crook for their invaluable comments.

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SHIFTING PRIORITIES FOR NARWHAL CONSERVATION:

from Trade to Rapid Environmental Change

Report by Randall R. Reeves and David S. Lee

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▲ Eclipse Sound (Tremblay Sound), August 2017.

◀ Eclipse Sound (Milne Inlet/Koluktoo Bay), August 2006.

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The Narwhal Monodon monoceros *is a small whale endemic to the Arctic, best known for the adult male's long spiralled tusk which has long been valued as a novelty in international trade. Most of the world's Narwhals, currently numbering around 175,000, inhabit marine waters of northern Canada and Greenland, with smaller numbers in Svalbard (Norway) and a few parts of the Russian Western Arctic. Inuit communities with access to Narwhals hunt them for food (the skin—maktaaq—is considered a delicacy) and cash income (the sale of tusks and also maktaaq in Greenland). The export of Narwhal ivory from Greenland has been prohibited since 2006 but at least a few hundred tusks are exported by Canada each year, most of them to "traditional" importing countries like Japan, France, Italy, Germany, and Switzerland but also increasingly to China. Numerous carvings and jewellery items also enter trade. With quotas on removals, and population monitoring programmes now in place, conservation concern has begun to shift away from hunting and trade and now focuses on the direct (habitat loss) and indirect (expanding industrial, commercial, and recreational activity) impacts of climate change. However, the dramatic recent increase in China's imports of Narwhal tusks is noteworthy.*

Introduction

The Narwhal *Monodon monoceros* is a small toothed whale endemic to the Arctic; its nearest living relative is the Beluga *Delphinapterus leucas*. Narwhals have been hunted by the indigenous people (Inuit) of northern Canada and Greenland for millennia. Their *maktaaq* (Canada) or *mattak* (Greenland) (hereafter, maktaaq)—the thick skin with a portion of adhering blubber—is a nutritious delicacy; the blubber was a source of oil for warmth and light, and the sinew was used as sewing thread; Narwhal meat was eaten by people or fed to sled dogs; and the long, spiralled tusk of adult males served various domestic purposes (e.g. hunting implements, tent poles). From the early days of contact between Europeans and Inuit, Narwhal ivory was a prized item of trade. Now, in addition to the strong continuing local demand for maktaaq (Reeves, 1993a, 1993b; Heide-Jørgensen 1994), the commercial value of ivory remains an incentive for targeting large, tusk-bearing males (Reeves, 1992; Reeves, 1993b; Reeves and Heide-Jørgensen, 1994; Shadbolt *et al.*, 2015). However, the significance of hunting as a factor influencing the abundance of Narwhals and a source of concern for their future seems to have declined relative to the multi-faceted threat of climate change and expanding human activity in high-northern latitudes.

Narwhals are most numerous in eastern Canada and Greenland. They also occur regularly, but in comparatively modest numbers, north of Svalbard (Norway) and near Franz Josef Land (Russia) (Fig. 1). Occasional observations are made as far west as the Chukchi Sea and as far east as the Kara Sea. Because of the Narwhal's importance to Arctic communities, as well as the global interest in conserving biological diversity, both Canada and Greenland have invested heavily in monitoring populations, seeking to ensure that hunt removals are sustainable, and ensuring that the impacts of industrial activities are mitigated.

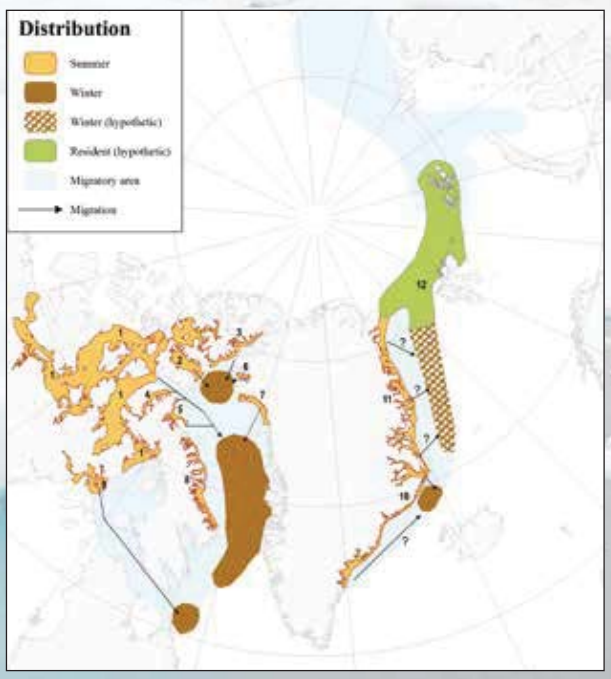

Fig. 1. Narwhal stocks recognised by the Global Review of Monodontids convened by the North Atlantic Marine Mammal Commission (NAMMCO). Stocks are identified by their summering areas. Ranges of stocks are differentiated into summering areas (tan), migration areas (light blue), and known wintering areas (brown) or assumed wintering areas (brown check); arrows show direction of autumn migration. *1. Somerset Island; 2. Jones Sound; 3. Smith Sound; 4. Admiralty Inlet; 5. Eclipse Sound; 6. Inglefield Bredning; 7. Melville Bay; 8. Eastern Baffin Island; 9. Northern Hudson Bay; 10. East Greenland; 11. Northeast Greenland; 12. Svalbard-Russian Arctic.* Map prepared by Rikke Guldborg Hansen; adapted from NAMMCO (2018) and Hobbs *et al.* (in press).

A previous article on Narwhal conservation in the *TRAFFIC Bulletin* (Reeves, 1993b) was followed by a detailed investigation carried out by TRAFFIC and WWF-Canada on the Narwhal ivory trade, regulatory issues, and threats to the species (Shadbolt *et al.*, 2015). In 2017 an international scientific workshop on monodontids (Narwhals and Belugas comprise the family Monodontidae) took place in Denmark (NAMMCO, 2018) and an updated assessment of the Narwhal downlisted the species from Near Threatened to Least Concern on the IUCN Red List (Lowry *et al.*, 2017).

This article reconsiders the role of hunting and the ivory trade when compared to that of rapid environmental change in determining the Narwhal's future.

International Legal Framework

International Whaling Commission

The mandate of the International Whaling Commission (IWC) has evolved considerably over the past 70+ years. Until recently, "small cetaceans" were considered outside its regulatory competence although the Scientific Committee's (SC's) standing Sub-committee on Small

NARWHAL STOCKS	GENERAL DISTRIBUTION	ABUNDANCE (SURVEY YEAR)	TREND IN ABUNDANCE	ANNUAL REMOVALS BY HUNTING[1]	TALCs or QUOTA[1]
Somerset Island	Barrow Strait/Peel Sound/Prince Regent Inlet summer; central Baffin Bay winter	49,768 (CV=0.20) (2013)	Possibly increasing	Hunt in Canada is below TALC	658
Jones Sound	Jones Sound summer; winter unknown	12,694 (CV=0.33) (2013)	Unknown	Low (average is fewer than 20 per year)	50
Smith Sound	Smith Sound summer; winter unknown	16,360 (CV=0.65) (2013)	Unknown	Few (if any)	5
Admiralty Inlet	Admiralty Inlet summer; Baffin Bay winter	35,043 (CV=0.42) (2013)	Stable	Hunt is at TALC	233
Eclipse Sound	Eclipse Sound summer; central Baffin Bay winter	12,039 (CV=0.23; 95% CI 7,768–18,660) (2016)[2]	Unknown	Hunt is at or below TALC	236
Inglefield Bredning	Inglefield Bredning summer; winter unknown	8,368 (CV=0.25; CI 5,209–13,422) (2007)	Stable	"Considerable" numbers in Greenland but judged "sustainable"	98
Melville Bay	Melville Bay summer; central Baffin Bay winter	3,091 (CV=0.50; 95% CI 1,228–7,783) (2014)	Stable	"Above quota advice"	84
Eastern Baffin Island	Fjords along eastern Baffin Island summer; winter unknown	17,555 (CV=0.35) (2013)	Unknown	Increasing since 1970s but judged "sustainable"	206
Northern Hudson Bay	NW Hudson Bay summer; eastern Hudson Strait winter	12,485 (CV=0.26) (2011)	Unknown	Ca 83/yr but judged "likely sustainable"	157
East Greenland	Scoresby Sound south to and including Sermilik Fjord system	Tasiilaq and offshore: 797 (CV=0.69) in 2015–17, Scoresby Sound: 476 (CV=0.38) in 2016[3]	Declining	Decline likely due to a combination of hunting and major changes in ocean conditions	
Northeast Greenland	Dove Bay and Greenland Sea	Dove Bay: 1,395 (CV=0.33; 95% CI 744–2,641); Greenland Sea: 2,908 (CV=0.30; 95% CI 1,639–5,168) in 2017[4]	Unknown	None	
Svalbard – Russian High Arctic	Uncertain	837 (CV=0.50) (Vacquié-Garcia *et al.*, 2017) but considered a minimum	Unknown	None	

Table 1. Currently recognised Narwhal stocks. *Primary source NAMMCO (2018), with a few edits and additions by the authors.* Note: all abundance estimates have been adjusted (corrected) for availability and most also for perception bias*.
[1]For stocks in Canada, TALC (Total Allowable Landed Catch) means the number of whales that can be lawfully killed and secured as established by the Nunavut Wildlife Management Board and approved by the Minister of Fisheries and Oceans pursuant to Sections 5.6.16 to 5.6.18 of the Nunavut Agreement; [2]Marcoux *et al.*, 2019; [3]Joint Scientific Working Group (2017); [4]R.G. Hansen, pers. comm.
**Availability bias* refers to the failure of observers to detect all whales present on the survey trackline because the whales were below the surface and thus "unavailable to be seen" as the survey aircraft passed. *Perception bias* refers to the fact that observers may fail to detect and count all whales that are at or near the surface along the trackline. CV=Co-efficient of Variation

Cetaceans has always tried to report catches and assess the stocks of Narwhals and Belugas. A Commission Resolution in 2014 explicitly directed the SC to deliver advice on the status and conservation of small cetaceans (IWC, 2014) and it now attempts to provide scientific advice on the 75 or so species of small and medium-sized cetaceans as well as the large whales.

North Atlantic Marine Mammal Commission and Joint Commission on Conservation and Management of Narwhal and Beluga

NAMMCO was established in 1992 by several Nordic countries that were disillusioned by the IWC's swing away from "sustainable use" and towards "protection", specifically in relation to commercial whaling. The Greenland Home Rule government is a member of NAMMCO along with Norway, Iceland, and the Faroe Islands Home Rule government. Canada has not joined NAMMCO but has nonetheless always been an active "observer" at meetings, particularly in regard to Narwhals, Belugas, and Walruses *Odobenus rosmarus*. NAMMCO scientists regularly participate in deliberations of the Joint Commission on Conservation and Management of Narwhal and Beluga (JCNB), a bilateral body established in 1989 to assess and provide management advice on "shared stocks" (12 stocks of Narwhals are currently recognised, at least three, and possibly six, of which are known to move seasonally between Canada and Greenland, Table 1). The JCNB-NAMMCO Joint Scientific Working Group (JWG) meets regularly and generates recommendations that, as explained later, are used as the basis for Greenland catch limits and other conservation measures.

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

When CITES came into effect in 1975, the Narwhal was initially listed in Appendix III by Canada. Although Denmark lodged a reservation to the listing in 1977, this was withdrawn two years later when the Parties accepted an EU proposal to list all cetaceans in Appendix II. In principle, this has meant that exports (and re-exports) of Narwhal products must be accompanied by a CITES export permit (or re-export certificate) and covered by a Non-detriment Finding (NDF) from the source country.

USA

The US *Marine Mammal Protection Act* of 1972 prohibits the importation of marine mammal products, therefore tusks are allowed to enter the USA only for non-commercial purposes (e.g., scientific research, bona fide "pre-Act" acquisitions). Substantial demand still exists in the USA, however, judging by recent well-documented smuggling operations involving shipments of large numbers of tusks (in one case approximately 250 over a seven-year period; Shadbolt *et al.*, 2015).

European Union (EU)

Historically, most Narwhal tusks exported from Canada went directly to the United Kingdom (UK), considerable numbers then being re-exported, often to other European countries (Reeves, 1992). Since 1984, the EU has treated all cetaceans as CITES Appendix I species (commercial trade prohibited) although exports from Greenland to Denmark were initially exempted from the prohibition on trade. In 2004 the EU's Scientific Review Group on Trade in Wild Fauna and Flora issued a "negative opinion" for import of Narwhal products from Greenland and a "positive opinion" for import from Canada. The latter was changed to "no opinion" in 2009 and therefore Canadian tusks are allowed into the EU for non-commercial purposes, which normally means under the household and personal effects exemption (Shadbolt *et al.*, 2015).

Trade Regulation by Range States

Canada

The CITES Management Authority for marine species in Canada is Fisheries and Oceans Canada (formerly the Department of Fisheries and Oceans, or DFO). The current Standing NDF for the Narwhal is supported by 15 peer-reviewed reports published by the Canadian Science Advisory Secretariat (CSAS) between 2008 and 2018, most of which are available in both English and Inuktitut (DFO, assorted years).

The first negative NDF for Narwhals in Canada was issued in 2010 (DFO, 2010). Based on information available at the time on stock structure, abundance, and catches, it was concluded that removals from three of the recognised stocks (Admiralty Inlet, eastern Baffin Island, northern Hudson Bay) were unsustainable and that the information on a fourth ill-defined management unit consisting of the Narwhals in Parry Channel, Jones Sound, and Smith Sound was insufficient to verify that hunting in those areas would be non-detrimental. Therefore, the products from only two stocks (Somerset Island, Eclipse Sound) were covered by a positive NDF. This decision was immediately challenged in Federal Court by Nunavut Tunngavik Incorporated (the legal representative of the Inuit of Nunavut as established under a comprehensive land-claims settlement), citing the importance of Narwhal tusk sales as "a significant source of income for many Inuit harvesters" and pointing out that no Inuit organisations had been consulted during preparation of the NDF (Nirlungayuk, 2011). Within a few months after the court challenge (early 2012), a new NDF was issued indicating that, according to updated assessments, hunting removals from the Admiralty Inlet and eastern Baffin Island stocks were sustainable (DFO, 2012a). The negative NDF for the northern Hudson Bay stock remained in effect until 2012, when an analysis of new survey results concluded that the removal rate was sustainable (DFO, 2012b).

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Narwhal tusk sculpture displayed at the National Gallery of Canada, Ottawa. *Top*: carved Narwhal tusk, Inuit artist, ca.1900–60, provenance unknown; *Bottom*: carved Narwhal tusk, sterling silver, Polar Bear claw, Sperm Whale tooth, Muskox horn, blood stone, and baleen; artist: Ruben Komangapik, Inuit. Iqaluit, Nunavut 1976.

For the purposes of tusk traceability, hunters are required under the *Marine Mammal Regulations* to attach a Marine Mammal Tag securely to the tusk, or when there is no tusk, to the carcass of the Narwhal. All tusks must be inspected and certified by a conservation officer or fisheries officer, at which time, a permanent attachment device is used to affix the tag to the tusk. Possession of untagged tusks is illegal, a licence is required to transport Narwhals or Narwhal parts from one province to another, and a CITES export permit is required to export Narwhal products.

However, not all tusks secured by hunters in Canada enter the documented legal international trade. Some are sold within Canada and stay there, "significant numbers" reportedly are in "long-term storage" (Shadbolt *et al.*, 2015), and unknown numbers are exported illegally (even though at least some of them may have been obtained legally by the hunter and dutifully reported via the tag tracking system).

Greenland

Greenland's first NDF opinion for Narwhals was issued by the Scientific Authority (Greenland Institute of Natural Resources) in 2005 and reached a negative conclusion. NDFs in Greenland are based on current information on stock structure, abundance, trends in abundance, and reported catches for each stock (Witting, 2005; Witting *et al.*, 2008). The 2005 NDF notes, "Because of several [unspecified] factors, the statistics on export of Narwhal products cannot be used directly to provide insight into the utilisation of Narwhals in Greenland" (Witting, 2005). The NDF protocol was said not to include any analysis of tusk exports and the implicit assumption was, as in Canada, that the removal rate by hunting is determined primarily by factors other than the cash income from ivory sales.

The rationale for a negative NDF was that estimated catches in West Greenland during the first year of the quota system considerably exceeded the catch limit (quota), and significant numbers of Narwhals were taken in Melville Bay where it had been recommended that there be no hunt. The sparse data available at the time on Narwhals in East Greenland suggested that the level of removals there was sustainable. However, in the absence of a practical method to determine whether tusks in trade originate from West Greenland, Melville Bay, or East Greenland, it was not considered possible to conclude that continuation of Narwhal exports from Greenland would be non-detrimental to the West Greenland and Melville Bay stocks (Witting, 2005).

Because of the 2005 negative NDF, the exportation of Narwhal ivory from Greenland was not permitted in 2006 (Witting *et al.*, 2008). This ban applied not only to whole raw tusks but also to jewellery, carvings, and other items of worked Narwhal ivory that are often sold to tourists. It did not affect the legal trade of Narwhal products within Greenland or their exportation as household or personal effects (Shadbolt *et al.*, 2015).

The next NDF of the Greenland Scientific Authority was issued in 2009, by which time a quota had been set for East Greenland based on an aerial survey conducted in 2008 (Heide-Jørgensen and Ugarte, 2009). The results of that survey and surveys of the other stocks in Greenland in 2006 and 2007, incorporated into a model along with updated catch data, had led the JWG to conclude that earlier assessments for West Greenland had overestimated the level of risk from hunting (Joint Scientific Working Group, 2009). The Greenland CITES Scientific Authority accordingly reasoned that the quotas would "at high probability allow for an increase in the stocks" and that international trade would not have a negative impact "provided that the … quotas are respected" (Heide-Jørgensen and Ugarte, 2009). Greenland has refrained from permitting exports and the prohibition on exportation of Narwhal ivory (including whole tusks as well as carvings and jewellery) remains in effect. The rationale for this continuation of the ban on exports is that catches in Melville Bay and East Greenland have been higher than the scientific advice for several years and, because Greenland has no system to link an export product with the stock of origin, issuance of a positive NDF requires that catches throughout the entire country are sustainable (Fernando Ugarte, Immikkoortortami qullersaq, Head of Department of Birds and Mammals, Pinngortitaleriffik—Greenland Institute of Natural Resources, Nuuk, 7 June 2019).

A premise of the positive NDF opinion by the Greenland Scientific Authority in 2009 was that (i)

Year	bones, carvings, ivory	tusks	skulls	teeth	specimens	other items	total items
1987	173	65	1	50	340	2	631
1988	146	151	2	40		0	339
1989	185	291	1	1		0	478
1990	114	445	2	1		0	562
1991	211 (2)	412		1		4	629 (2)
1992	238	228 (1)				47	513 (1)
1993	290	48 (1)		212		0	550 (1)
1994	520	229 (1)		84		0	833 (1)
1995	627	185		97		0	909
1996	696	207		52	1	0	956
1997	562	244	2	28		1	837
1998	263	197	3	5		0	468
1999	139	184 (2)	5	757	12	0	1,097 (2)
2000	821	260		255		75	1,411
2001	656 (37)	236 (5)		23	307	9	1,231 (43)
2002	2,084	267 (12)	7	62	262	8	2,689 (11)
2003	1,823	186 (24)		59		130	2,198 (24)
2004	3,358	197	6	268	100	157	4,086
2005	2,788	108	1	104		8	3,009
2006	751	135	8	111		9	1,014
2007	0	213	4			0	217
2008	1,556	245	4		250	0	2,055
2009	270	191	3	7	168	8	647
2010	1,159 (1)	347 (5)	8	17	1,074	9	2,614 (6)
2011	6	121	3 (1)	2			132 (1)
2012	2	229 (4)	2		10	3	246 (4)
2013	1	116 (1)	3	20	10	4	154 (1)
2014	14	250 (1)	4	5	85	3	361 (1)
2015	2	528	4	4	259	2	799
2016	2	274	4	4	125	1	408
2017		313	8		22		343
2018		446	3	15			464

Table 2. Narwhal items reported in export data, per year, 1987 to 2018 (1987–2016 includes both Canada and Greenland, 2017–2018 Canada only). *Sources: UNEP-WCMC CITES Trade Database and Shadbolt* et al. *(2015), except for 2017 and 2018 data provided by the Catch Certification Program, Fisheries and Oceans, Government of Canada, Ottawa (see Acknowledgements). Note: numbers in parentheses represent the number of items reported as pre-CITES. Items reported as exported by non-range States are not presented here.*

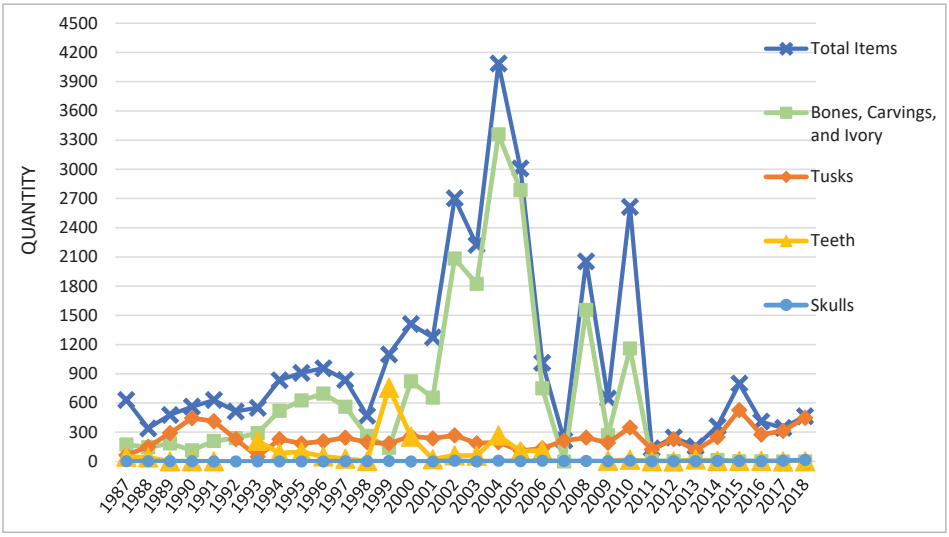

Fig. 2. Reported number of Narwhal items—bones/ivory/carvings, tusks, teeth, and skulls—exported per year, 1987–2016 (from both Canada and Greenland) and 2017–2018 (Canada only). *Sources: UNEP-WCMC CITES Trade Database and Shadbolt* et al. *(2015), except for 2017 and 2018 data provided by the Catch Certification Program, Fisheries and Oceans, Government of Canada, Ottawa.*

maktaaq, not ivory, is the "most valuable [cash-generating] hunting product" obtained from Narwhals in Greenland[1], (ii) maktaaq is not exported and (iii) tusks have low value compared with maktaaq. The authors of the NDF opinion (Heide-Jørgensen and Ugarte, 2009) argued that trade in tusks was not the primary incentive for Narwhal hunting in Greenland. They acknowledged that income from tusk sales contributed to the subsistence economy, and they did not rule out that trade in tusks and crafted parts could be "influencing the harvest of Narwhals".

Determining which item is the "most valuable" product of the hunt is difficult. In reaching its conclusion, the Scientific Authority appears not to have analysed the replacement value of maktaaq (and meat in Qaanaaq district) shared by the hunter with his or her family and other community members, the cash value realised by hunters from selling edible products directly to consumers or wholesalers, and the cash value obtained by selling tusks, whether directly to Greenlanders, to wholesalers, or to visitors and temporary residents. Any such analysis would also need to take account of the value derived from carvings and jewellery crafted wholly or in part from Narwhal ivory, as Hoover *et al.* (2013) attempted to do in Hudson Bay, Canada. The use of Narwhal ivory and bone in handicrafts (almost always exported as "personal effects") is apparently much more frequent in Greenland than in Canada (Shadbolt *et al.*, 2015). Small items such as earrings and necklaces are "easy to find and occasionally sold in art craft shops" in Greenland (Ugarte, pers. comm.). Considering that there is little or no checking of the "personal effects" of tourists on cruise ships and at airports, it seems likely that small-item exports from Greenland (as well as Canada) are considerably under-reported. In any event, the quantity of such items reported as exported (from Greenland and Canada, combined) was very large during the first decade of the 21st century but has greatly declined since then (Table 2, Fig. 2).

Domestic Management of Narwhal Exploitation

Canada

Narwhal hunting in Canada is co-managed by DFO, the regional authority (the Nunavut Wildlife Management Board in Nunavut or Nunavik Marine Regional Wildlife Board in Nunavik), the Regional Wildlife Organizations (RWOs), and the local Hunters and Trappers Organizations (HTOs) or equivalents. They jointly set total allowable landed catches (TALCs) on a stock-by-stock basis, using as guidance a formula developed in the USA to set legislatively mandated limits on the incidental taking of marine mammals in commercial fisheries. This formula determines a potential biological removal (PBR) level as follows: a minimum estimate of population size (the 20th percentile of the log-normal distribution, equivalent to the lower 60% confidence limit) x half the net recruitment rate for the species (assumed to be 0.04 ÷ 2) x a "recovery factor" which is set to reflect known or assumed conservation status (0.1 for critically small stocks, 0.5 for "depleted" stocks, and 1 for stocks that are considered secure) (Wade, 1998; Wade and Angliss, 1997). The PBR for Narwhal stocks, multiplied by a "loss rate factor" of 1.28 (to account for whales seriously injured or killed but not landed), is used to set the TALC (Richard, 2008).

[1]~DK(Danish Krone)30,000–40,000 (~USD4500–6000) per whale in 2019 for maktaaq; ~DK5000–8000 (~USD750–1200) for a good-sized tusk in 2019 (R.G. Hansen, pers. comm.)

Allocation of TALCs to the different hunting communities is a responsibility of the RWO under the Nunavut Agreement. Responsibility for enforcement and monitoring remains with DFO but is facilitated by the local HTO or equivalent. An agreed quantity of numbered, government-issued tags is provided to each HTO for distribution to the hunters (DFO, 1985). The difficulty of monitoring removals of females and young males that lack erupted tusks has been identified as a source of uncertainty because such monitoring relies solely on reported catch statistics.

Greenland

In Greenland, the Department of Fisheries, Hunting and Agriculture is responsible for co-managing the hunt and monitoring catches in collaboration with local municipal authorities, with scientific advice from the JCNB and NAMMCO. As mentioned earlier in regard to NDFs, there is strong reliance on the JWG for science to inform the setting of quotas, and on the JCNB and NAMMCO for guidance with regard to "shared stocks" and Greenland-only stocks, respectively. The issuance of hunting permits is contingent upon receipt of catch-reporting logbooks from the hunters.

Recent Trade Data

The 1984 ruling by the EU had a dramatic effect on the destinations of tusks exported from Canada: the great majority of them started going to Japan and Switzerland rather than the UK, at least in the years immediately following the EU ban (Reeves, 1992). Over the last two decades, Denmark (until 2011), France, Italy, Germany, Switzerland, and Belgium have been the main European importing countries and Japan has remained a leading importer (Shadbolt *et al.*, 2015; Table 3, Fig. 3). A noteworthy new development and potential concern is the emergence of China as by far the most significant Narwhal tusk importing country. It is unclear whether this surge reflects a true increase in demand (and purchasing power) in China, or is instead due to improved reporting. It is also unclear whether Narwhal ivory imported to China is used for decorative purposes, carvings and jewellery, or something else. Ground Narwhal ivory (powder) was used at one time in traditional medicine in the Far East (Reeves, 1992; Shadbolt *et al.*, 2015) but there is no evidence that such use is extensive at present.

Sustainability of Removals by Hunting

Summation of the point estimates of abundance for all the Narwhal stocks that have been surveyed suggests a global population of close to 175,000 individuals (Table 1). The potential rate of increase for Narwhals is 2.5–4% (Kingsley, 1989; Garde *et al.*, 2015).

Shadbolt *et al.* (2015) estimated that 979 Narwhals were landed per year between 2007–2011 (621 in Canada and 358 in Greenland), a figure that is inflated somewhat by a spike in the Canadian catch in 2008 when Pond Inlet hunters secured 624 Narwhals from an ice entrapment but also may be negatively biased due to underreporting in Greenland (Garde *et al.*, in press). As mentioned above, reported landings under-represent the number of Narwhals killed outright or seriously injured. Although loss rates vary widely across areas and seasons, managers in Canada generally assume a loss rate of close to one-third (see Richard, 2008)[2]. The number of Narwhals removed annually by hunting could be around 1,500, which would represent less than 1% of the total global population. However, Narwhal hunting is managed by stock in Canada and by hunting ground in Greenland.

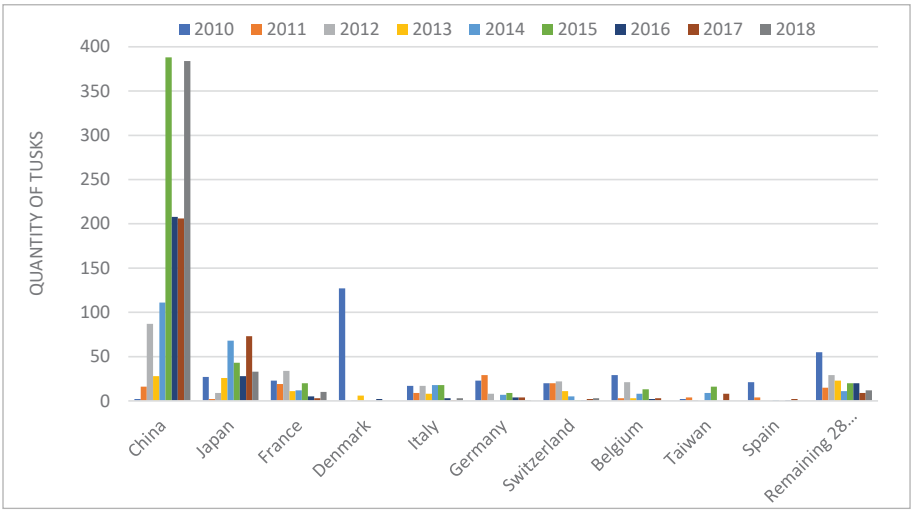

Fig. 3. Top 10 destination countries/territories for reported exports of Narwhal tusks, per year, 2010–2016 (from both Canada and Greenland) and 2017–2018 (Canada only). *Source: UNEP-WCMC CITES Trade Database, except for 2017 and 2018 data provided by the Catch Certification Program, Fisheries and Oceans, Government of Canada, Ottawa.*

[2]Greenland net and kayak hunting usually involves a lower loss rate.

DESTINATION COUNTRY/ TERRITORY (PURPOSE OF EXPORT)	2010	2011	2012	2013	2014	2015	2016	2017	2018	TOTAL
China	**2**	**16**	**87**	**28**	**111**	**388**	**208**	**206**	**384**	**1,430**
Personal			5	2	17	7	13			
Commercial trade	2	16	82	26	94	381	185			
Hunting trophy							10			
Japan	**27**	**2**	**9**	**26**	**68**	**43**	**28**	**73**	**33**	**309**
Personal	9									
Commercial trade	18	2	9	26	68	43	28			
France	**23**	**19**	**34**	**11**	**12**	**20**	**5**	**3**	**10**	**137**
Personal	22	19	32	11	12	19	5			
Commercial trade	1					1				
Educational			2							
Denmark	**127**		**1**	**6**			**2**			**136**
Personal	125			6			2			
Scientific	2		1							
Italy	**17**	**9**	**17**	**8**	**18**	**18**	**3**	**1**	**3**	**94**
Personal	17	9	16	8	18	18	3			
Commercial trade			1							
Germany	**23**	**29**	**8**		**7**	**9**	**4**	**4**	**1**	**85**
Personal	21	27	8		5	7	4			
Commercial trade	1				2	2				
Educational	1	1								
Travelling exhibition		1								
Switzerland	**20**	**20**	**22**	**11**	**5**	**1**	**1**	**2**	**3**	**85**
Personal	7	15	19	1	3		1			
Commercial trade	13	5	3	10	2	1				
Belgium	**29**	**3**	**21**	**3**	**8**	**13**	**2**	**3**		**82**
Personal	29	2	21	3	8	13	2			
Commercial trade		1								
Taiwan	**2**	**4**	**1**		**9**	**16**		**8**		**40**
Personal	2	4	1		9					
Commercial trade						16				
Spain	**21**	**4**			**1**		**1**	**2**		**29**
Personal	21	4			1					
Educational							1			
Remaining 28 countries/ territories	**55**	**15**	**29**	**23**	**11**	**20**	**20**	**9**	**12**	**194**
Educational	2	1			1					
Personal	49	13	29	23	9	16	4			
Commercial trade	3				1	4	16			
Hunting trophy	1	1								
GRAND TOTALS	**346**	**121**	**229**	**116**	**250**	**528**	**274**	**311**	**446**	**2,621**
Educational	3	2	2		1		1			
Personal	302	83	131	54	82	80	34			
Commercial trade	38	34	95	62	167	448	229			
Hunting trophy	1	1					10			
Scientific	2		1							
Travelling exhibition		1								

Table 3. Top 10 destination countries/territories for Narwhal tusks, per year, 2010 to 2016 (exported from both Canada and Greenland) and 2017–2018 (exported from Canada only). *Source: UNEP-WCMC CITES Trade Database, except for 2017 and 2018 data provided by the Catch Certification Program, Fisheries and Oceans, Government of Canada, Ottawa.*

The stock-by-stock or area-by-area assessment and management regime developed by scientists and managers in Greenland and Canada over the past 40 years is considered precautionary. However, removal estimates are sensitive to the loss rate factor applied to data on secured catches (generally 1.28 following Richard, 2008—assuming that slightly more than one out of five Narwhals killed is not secured). Several reports in the literature (Finley *et al.*, 1980; Kemper, 1980; Finley and Miller, 1982) indicate that although loss rates are highly variable for many reasons, they tend to be higher at the floe edge and when the whales are hunted from shore and they are not immediately secured by a harpoon. In some communities (such as Naujaat and Kugaaruk in Nunavut, Qaanaaq and Melville Bay in Greenland), the local authorities require that Narwhals are harpooned first. Not only should more effort be made in other areas to reduce hunting loss, but also other threats besides hunting should be accounted for in the management regime.

Other Threats

Narwhals are well adapted to Arctic conditions. Their relative abundance has allowed them, for at least several millennia, to withstand hunting by humans, predation by Polar Bears *Ursus maritimus* and Killer Whales *Orcinus orca*, and occasional large-scale mortality events due to ice entrapment. However, the recent rapid, extensive, and ongoing changes in environmental conditions are bound to test the resilience and adaptability of these quintessentially Arctic animals, which have been judged to be among the most sensitive marine mammals to such changes (Laidre *et al.*, 2008).

Virtually all of the major conservation concerns for Narwhals in addition to overhunting in a few areas—underwater noise from icebreakers (Finley *et al.*, 1990) and seismic surveys (Heide-Jørgensen *et al.*, 2013), predation by Killer Whales (Higdon and Ferguson, 2009; Breed *et al.,* 2017), ice-entrapment (Laidre *et al.*, 2012), disturbance by ships and barges (DFO, 2012c; NAMMCO, 2015; Smith *et al.,* 2015), and competition with fisheries and other consumers for their favoured prey (e.g., Greenland Halibut *Reinhardtius hippoglossoides*; Laidre and Heide-Jørgensen, 2005; NAFO, 2018; prawns *Pandalus* spp.; DFO, 2019)—are either caused or exacerbated by climate change (Ferguson and Lee, 2017; NAMMCO, 2018). The physiological and behavioural traits that served Narwhals well in a pristine and quiet environment are probably not adequate in an ever noisier and unfamiliar underwater soundscape (Moore *et al.*, 2012). The morphology and skeletal musculature of Narwhals are suited to slow, endurance swimming and deep diving, which enables them to take advantage of dense, wind-blown sea ice refugia (or alternatively, shallows near shore; Breed *et al.*, 2017) to escape Killer Whale predation as well as to reach concentrations of prey in deep offshore areas that are generally inaccessible to potential competitors in winter (Williams *et al.*, 2011). The response of Narwhals to net entanglement and stranding for instrumentation before being released back into the wild (equivalent to experimental disturbance) appeared maladaptive. The animals exhibited initial disorientation, followed by movement away from the source (flight) and powerful bradycardia (heartbeat </= four beats per minute), coincident with extreme exertion. Such a response is a recipe for the depletion of tissue oxygenation and compromised physiological homeostasis, e.g. overheating (Williams *et al.*, 2017).

Discussion and Conclusions

Although no one disputes that obtaining an important local food source and maintaining cultural traditions are the major drivers of Narwhal hunting, the commercial value of Narwhal products, including both maktaaq in Greenland and tusks in Canada, is also a driver. The significance of ivory sales and exports appears to be greater today in Canada than in Greenland given the continuing ban on commercial exports from Greenland. The authors recognise the potential usefulness of detailed studies of economic aspects of Narwhal hunting that incorporate its socio-cultural and nutritional importance as well as the monetary value of products (cf. Hoover *et al.*, 2013) and encourage periodic efforts like those of Shadbolt *et al.* (2015) to analyse and track the commerce in tusks. However, environmental impacts, both direct on the Narwhals and indirect on human activities such as fishing and resource development, may now be a greater cause for conservation concern than overhunting in some stocks—as long as authorities in both range States continue to monitor and manage the hunting as rigorously as they have tried to do in recent years. Also, close monitoring of tusk exports to countries in the Middle East and East Asia, China in particular, is especially important given the trends in available data (Table 3, Fig. 3).

The immediate direct effects of climate change on Narwhals are evident off East Greenland, where sea surface temperatures have increased, ice cover has

Screenshot of raw Narwhal ivory (left) and ► carving posted on social media.

retreated rapidly, tidewater glaciers have disappeared, and boreal and even tropical species have arrived in greater numbers in recent years (Hansen *et al.*, 2018). These major habitat changes have coincided with intensive hunting and declining abundance of Narwhals (Hansen *et al.*, 2018) as well as an apparent decline in fertility (NAMMCO, 2019a). Scientists have advised authorities in East Greenland that Narwhal hunting must be suspended if regional extirpation is to be avoided (NAMMCO, 2019b; R.G. Hansen, pers. comm.).

Although there is no published scientific evidence that Narwhal abundance or recruitment is declining in other parts of their range, this lack of evidence must be considered in a context of irregular and uneven monitoring and the usual lag (of years at least) between the completion of a survey programme and the publication of its results. In other words, it may be only a matter of time before downward trends become evident for stocks in addition to the one in East Greenland. A controversial iron ore mine in northern Baffin Island has been cited repeatedly (e.g. NAMMCO, 2015, 2018; DFO, 2012c) as a major potential threat to the Eclipse Sound stock in particular, but possibly also to the other large stocks of Narwhals that move through Lancaster Sound and Pond Inlet, including the very large Somerset Island and Admiralty Inlet stocks.

One hopeful sign is that, based on differences in stable isotope signatures among three Narwhal populations (Baffin Bay, northern Hudson Bay, East Greenland), they appear to occupy different feeding niches, and this has been interpreted to mean that Narwhals could be "more adaptable in terms of their foraging behaviour than previously thought" (Watt *et al.*, 2013). One can only hope that if indeed this proves true, the Narwhals themselves can make necessary adjustments in their behaviour (and presumably distribution) quickly enough to keep pace with the environmental changes under way in the Arctic. If they are unable to adapt to a milder, noisier, more industrialised Arctic, the global scientific and conservation communities stand to lose another iconic species, and local hunting communities whose traditional economic and cultural life is tightly bound to Narwhals are at risk of losing a valued resource.

Acknowledgements

The authors acknowledge Nunavut Tunngavik Inc. for supporting preparation of the manuscript. Helpful suggestions for improvement were received from Rikke Guldborg Hansen, Tanya Shadbolt, Steve Ferguson, and Bill Koski, all of whom reviewed an earlier version. Help with finding and obtaining illustrations was generously provided by Jeff Higdon, Kenn Harper, Rikke Guldborg Hansen, Rod Hobbs, and Marianne Marcoux. Fernando Ugarte advised the authors on Narwhal management in Greenland and Jennifer Shaw of DFO advised them and facilitated their access to data from the DFO Catch Certification Office in Ottawa, which issues CITES export permits for products from Narwhals and other aquatic species. The data on such permits are submitted annually to Environment and Climate Change Canada for transmittal to CITES and entry into the trade database.

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AERIAL VIEW OF NARWHAL POD © RIKKE GULDBORG HANSEN

ENFORCEMENT INSIGHTS:

THE TRADE IN SHARKS AND THEIR FINS

Report by Lauren Brown

Blacktip reef shark *Carcharhinus melanopterus*

Background

Sharks[1] have been caught and consumed for centuries; however, pressure has increased on wild populations as industrial and artisanal fishing fleets supply demand in global markets. Sharks are targeted mainly for their meat and fins, though their livers, cartilage, and gill rakers are also found in trade. Globally, the markets for shark commodities differ and whilst fins are generally supplied to Asian markets for consumption, the meat is diverted along different trade routes to supply major markets in Europe and South America (Dent and Clarke, 2015).

Sharks and their relatives are particularly vulnerable to overharvesting due to their low fecundity, relatively late age of maturity and slow growth rates (Cortés, 2000). As a result of the declining populations of many shark species and the need for sustainable management of shark populations, international trade regulations have been implemented to regulate trade in selected sharks and their derivatives.

Since the 12th meeting of the Conference of the Parties to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 2002, a total of 38 species of commercially important shark and ray species are now regulated by CITES.

Relatively few countries record species-specific catch records for sharks, making it difficult to measure fishing pressure on individual species, and most countries report their total capture production (live weight) data for sharks at a higher taxonomic level to the United Nations Food and Agriculture Organization (FAO). The total volume of global reported catches peaked in 2000 (888,336 t) and has since been declining to between 700,000 t and 800,000 t per year (2000–2017). However, it is difficult to know whether overfishing, changes to management of fisheries, changes in reporting, or other reasons explain this decline (Okes and Sant, 2019). Between 2007 and 2017, Indonesia was the largest reported catcher, with an average catch of 110,737,000 kg per year, followed by Spain (78,443,000 kg) and India (67,391,000 kg) (Okes and Sant, 2019). An estimate of the global catch and mortality of sharks from both reported and unreported landings, discards and shark finning in 2000 was estimated to be 1.4 million t, equivalent to 100 million sharks. Between 2000 and 2010 it was estimated that a range of between 63 and 273 million sharks were killed annually (Worm *et al.,* 2013).

Shark trade records reported in the UN Comtrade database are primarily split between meat or fins under different HS Codes[2]. Specific codes for shark fins were introduced from 2012 onwards but it is likely that some trade has still been reported under the more generic codes that were used prior to 2012. Between 2012 and 2019

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[1]Throughout this report, the term "sharks" refers to all species of sharks, skates, rays and chimaeras (Class Chondrichthyes);
[2]Harmonised Commodity Description (HS Code) is an internationally standardised system of names and numbers to classify traded products, also known as the Harmonised System of tariff nomenclature.

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SCALLOPED HAMMERHEAD SHARK

***Sphyrna lewini* thrown overboard after its fin had been removed, Costa Rica.**

Hong Kong Special Administrative Region (SAR) (Hong Kong), Singapore and China were the largest importers of shark fins, and for the last decade (2009–2019) the largest importers of shark meat were Brazil, Spain, Uruguay, and Italy (UN Comtrade Database, 2020).

The global value of trade in shark commodities was estimated to be USD438.6 million in 2011, a figure which is likely to be below the true value (Dent and Clarke, 2015). The high economic incentives associated with the trade in some shark products, in particular fins, combined with issues such as a lack of adequate traceability systems, lack of enforcement in restricted areas, difficulties in patrolling large geographic expanses, result in unregulated and unsustainable shark fishing globally (Boon, 2017; Carr *et al.,* 2013).

Shark taxa present in legal and illegal trade

Fins are the most valuable part of many sharks and it is estimated that between 26 and 73 million sharks (worth USD400–500 million) are traded each year (Clarke *et al.,* 2007).

Shark fin consumers have distinct preferences for particular species; hammerhead Sphyrnidae spp., Oceanic Whitetip *Carcharhinus longimanus,* and Blue *Prionace glauca* sharks are preferred for shark fin soup, whereas dogfish Squalidae spp., mako *Isurus* spp. and Tope *Galeorhinus galeus* sharks are favoured for meat. However, it is difficult to know the impact of species preference on global shark populations due to the lack of species-specific trade statistics (Dent and Clarke, 2015). Genetic analyses conducted in 75 retail outlets in Hong Kong identified an estimated 76 different species of sharks, of which one third were listed in threatened categories by IUCN. The most common species present was the Blue Shark, accounting for an estimated 35% of fins sampled (Fields *et al.,* 2018).

In 2018, authorities in Taiwan seized over 30 t of shark meat at Kaohsiung Xiagang Fishing Harbour, the largest seizure recorded there since revised offshore fishing rules were established in 2006 (Anon, 2018a). This seizure comprised carcasses of Oceanic Whitetip and Silky *Carcharhinus falciformis* sharks. The Oceanic Whitetip is classified as Critically Endangered by IUCN and the global population is estimated to have experienced a reduction of >98%, (Rigby *et al.,* 2019).

Shark producers and consumers

Hong Kong is the world's largest consumer and trader of shark fins and between 2000 and 2011 recorded average annual shark fin imports of 10,490 t, with a reported import value of USD302 million (UN Comtrade Database, 2020). Hong Kong also acts as a key re-exporter of shark fins and since 2009, Viet Nam has overtaken mainland China as the predominant importer of shark fin re-exports from Hong Kong (Shea and To, 2017). Top exporters of shark fins to Hong Kong between 1998 and 2013 (based on data reported to FAO) were Spain, Taiwan, United Arab Emirates (UAE), Singapore and Japan (Shea and To, 2017). Singapore and the UAE are not known shark producers but instead likely act as transit points for shark fin shipments exported from Africa, the Middle East, India and Sri Lanka (Shea and To, 2017). In 2017 a seizure of 1,280 kg of shark fins suspected to be from CITES-listed hammerhead and Oceanic Whitetip sharks was seized in Hong Kong in containers shipped from India, Egypt, Kenya and Peru without the required CITES permits (Anon, 2017a).

Countries within the EU collectively rank second in global shark catches, particularly Spain which was amongst the top three shark catchers between 2007 and 2017 (Fowler and Séret, 2010; Okes and Sant, 2019). Exports of shark fins from Spain are almost entirely destined for markets in mainland China and Hong Kong, and between 2000 and 2012, 80% of the total volume (2,648 t) had been exported by Spain (Dent and Clarke, 2015). In 2015, 59 t of shark bodies, including 4.5 t of shark fins from Shortfin Mako Shark *Isurus oxyrinchus* and Blue Shark, were seized from a fishing vessel at the Port of Vigo (Greenpeace, 2015). The sharks were caught in New Zealand and the fins had been removed from the shark bodies prior to unloading, against EU Regulations (Anon, 2015a). EU countries have also been implicated as major transit hubs for global shark fin shipments, often from countries in West Africa en route to Asia (Fowler and Séret, 2010): in 2019, 1.2 t of shark and skate fins exported from Liberia were seized at Brussels International Airport, destined for Hong Kong (Anon, 2019).

Pelagic Threshers *Alopias pelagicus* being brought ashore to be auctioned for their fins and meat, Ecuador. ►

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There are a number of key exporters and re-exporters of fins from America to Asia, including Mexico, Ecuador, Peru and Uruguay (Okes and Sant, 2019). In 2018, an estimated 25 t of Blue Sharks and Pelagic Threshers *Alopias pelagicus* were seized (estimated to be 25,000 individuals) at the Peruvian Port of Callo. The shipment had been exported from Ecuador, destined for mainland China (Anon, 2018b). In 2015, fins from an estimated 200,000 sharks were seized in the city of Manta, Ecuador, destined for Asian markets (Anon, 2015b).

The USA is a relatively important producer of shark products and between 2000 and 2011 exported an average of 171 t of shark fins annually, predominantly to Asian markets (Dent and Clarke, 2015). The USA has also been highlighted as a transit location for shipments from South America (Ferretti *et al.*, 2019). In February 2020 over 500 kg of shark fins were seized at Miami International Airport, imported from an unreported country in South America and destined for an unreported country in Asia. It was concluded that 40% of the shipment was illegally traded and included fins from a number of CITES-listed species: Silky Shark, threshers *Alopias* spp. and hammerheads Sphyrnidae spp. (National Geographic, 2020).

Trafficking methods

The predominant transport method for shark fins seized on entry to Hong Kong is by sea, followed by air transport. In April 2017, China Southern Airlines announced a ban on shark fin shipments, joining at least 43 other carriers in banning shark fin shipments and 17 of the 19 largest container shipping lines (accounting for an estimated 71% of the global market) have also banned shark fin cargo (WildAid, 2018). It should be noted that these are carriage policies adopted by companies and do not in themselves represent legal regulation.

In 2018, 980 kg of shark fins, including Whale Shark *Rhincodon typus*, were seized in Hong Kong from a Singapore Airlines shipment that had been sent from Colombo, Sri Lanka, transiting Singapore. The consignment had been declared to contain "dry seafood" (Anon, 2018c). Similarly, there are examples of shipments seized in India in 2017 and 2018, with 6,000 kg and 8,000 kg of shark fins seized respectively. In both cases the cargo had been declared to contain "fish products", "dried marine products" and "fish maw" to evade detection and both shipments were intended to be transported by sea (Anon, 2017b; Anon, 2018d). In 2013 India banned the act of shark finning and in February 2015 issued a prohibition on all shark fin exports.

Crime convergence

An operation carried out in Tanzanian waters in 2018 led to the seizure and apprehension of three fishing vessels with Chinese, Malaysian and Tanzanian flags, each found to be carrying cargoes of shark fins. On board the Chinese and Malaysian fishing vessels were Tanzanian and Indonesian fishermen who allegedly had been denied access to water and food, proper accommodation and had been threatened at gun point. All three vessels were escorted to Tanzanian ports for legal action on the grounds of shark-finning and labour abuses (Anon, 2018e).

The illegal harvesting and trade of sharks for their products to supply global markets is one factor resulting in additional pressure on over-exploited shark species, particularly those that are threatened with extinction. Furthermore, illegal catch and trade of shark populations is undermining efforts to regulate a legal and sustainable trade in species currently not threatened with extinction. In order to combat the illegal, unreported, and unregulated (IUU) fishing contributing to the shark fin trade, effective traceability systems that can demonstrate the origin and legality of shark products need to be established and will be fundamental in strengthening the CITES process. Furthermore, traceability systems can facilitate the gathering of data on species, origins and quantities in order to generate species-specific information that can be fed into existing or new management measures for sharks.

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Shark fins seized in Cape Town, South Africa, 2019. ►

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This section of the TRAFFIC Bulletin *focusing on enforcement action is sponsored by the Forestry Bureau, Council of Agriculture, Taiwan: committed to supporting CITES enforcement.*

◀ **A selection of dried seahorses used in traditional Chinese medicines to treat infertility, erectile dysfunction, and arthritis, amongst other ailments.**

Seahorse trade dynamics from Africa to Asia

Report by Simone Louw and Markus Bürgener

Introduction

Seahorses are part of the family Syngnathidae, along with pipefish, pipehorses and seadragons. This family represents marine species that are vulnerable to habitat loss and overexploitation (Vincent *et al.,* 2011). Seahorses belong to the genus *Hippocampus* and have suffered worldwide population declines in recent decades (Evanson *et al.,* 2011). The biology, ecology, and life history (i.e. low population densities, parental care, low fecundity and small home ranges) renders them particularly vulnerable to population declines (Foster and Vincent, 2004) and their shallow coastal habitats (seagrass beds, mangroves, coral reefs) are amongst the most threatened habitats in the world (Vincent *et al.,* 2011).

Seahorses are threatened by three main anthropogenic factors: targeted exploitation, accidental capture in non-selective fishing gear (retained bycatch) and habitat degradation (Otero-Ferrer *et al.,* 2017). Direct exploitation involves the targeting of seahorses by local fishermen to supply the dried seahorse trade (Giles *et al.,* 2006). The fishing methods used for large industrial scale fishing—primarily the trawl gears—significantly damages the vulnerable coastal habitats of seahorses across the world, further contributing to their declining habitats (Kuo and Vincent, 2018). The principal source of seahorses destined for international trade is from bycatch, mainly from trawling vessels (Kuo and Vincent, 2018). The extraction of seahorses as bycatch is large and unsustainable, estimated at tens of millions of seahorses each year (Vincent *et al.,* 2011). The vast number of seahorses removed from the sea, coupled with increased habitat degradation, is hampering the ability for seahorse populations to recover and is resulting in global declines (Vincent *et al.,* 2011).

The international trade in seahorses mainly involves the sale of dried seahorses for traditional Chinese medicines (TCM), live seahorses for ornamental display in the aquarium trade, and curiosities (Vincent, 1996). The trade in dried seahorses for TCM accounts for the largest consumption of seahorses—approximately 95% of the global trade (Vincent *et al.,* 2011) and targets large, pale and smooth seahorses, which are believed to have higher medicinal value (Vincent *et al.,* 2011). The specimens are ground to powder, which may be consumed directly as the sole ingredient or in combination with other products, for treatment of infertility, erectile dysfunction, and arthritis, amongst other ailments (Chang *et al.,* 2013).

All seahorse species *Hippocampus* spp. were listed in CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) in 2002. The Appendix II listing was adopted in 2004 and requires all nations that are signatories to CITES to submit export and import records for trade in seahorses. These records can be accessed through a centralised database which can be used as a basis for assessing patterns in global trade, although, as with many other CITES-listed species, the official records of trade may not represent the actual trade volumes (Vincent *et al.,* 2014). There has been a history of variation in the reporting competency between importing and exporting CITES Parties (Vincent *et al.,* 2013), however, they are the best available data on the international reported trade of CITES-listed species. This rapid assessment aims to evaluate the trade dynamics of dried seahorses from Africa to Asia by investigating the volumes of seahorses traded; identifying the main countries of export and import; and revealing any discrepancies between the volumes and value traded.

Methods

CITES Trade Database

Data for all seahorse species *Hippocampus* spp. traded from Africa over an 11-year period (2008–2018) were downloaded from the CITES Trade Database (https://trade.cites.org, accessed 2 February 2020), in a comparative tabulation report. A total of 314 records were extracted which include data that are reported by importers (importer reported quantities) and exporters (exporter reported quantities). In the database, trade terms were filtered to records labelled as "skeletons" and "bodies" to encompass the dried seahorse trade in kilogrammes. The global trade in dried seahorses is predominantly reported in weight (Vincent, 1996). However, in cases where units were not provided (30% of records), they were

assumed to represent individuals (UNEP-WCMC, 2013), in which case figures were converted to kilogrammes using published conversion rates for the global estimated weight of dry seahorses (2.69 g/seahorse), as determined by Evanson *et al*. (2011). However, in the case of the West African Seahorse *H. algiricus*, the conversion for dry seahorses was estimated at 5.6 g/seahorse based on unpublished field studies conducted in West Africa (West *et al.*, 2012). The purpose of the trade was filtered to extract records labelled "T" (commercial use) and "P" (personal use) to cover the global dried trade for TCM and curios. The source of the trade was filtered to extract records labelled "W" (wild) for analysis of wild dried seahorses. The data were then transferred into pivot tables, where only direct trade was analysed (i.e. originating from the country of export), to avoid double counting of re-exported individuals.

Hong Kong Special Administrative Region (SAR) Trade Statistics

Hong Kong SAR (hereafter Hong Kong) is a major transit hub and the world's largest importer and re-exporter of dried seafood products, including seahorses. Accordingly, this analysis focuses on reported imports from Hong Kong, provided by the Hong Kong Bureau of Statistics (accessed 3 September 2019), with a focus on the mass (kg) and trade value (USD) of seahorses over the time period 2008–2018. Specific codes were developed by Hong Kong in 2008 to encompass the live and dried seahorse trade (03011910 covering individual live and ornamental seahorses; 03055930 which includes dried seahorses recorded in kilogrammes). A total of 55 records were reported between 2008 and 2018, of which 50 records related to dried seahorses.

Results

CITES Trade Database

Using data extracted from the CITES Trade Database, reported volumes of seahorse trade and the countries involved were analysed. There are major discrepancies between the reported exports and imports for dried seahorses (Table 1), with imports showing considerably higher volumes than the exports. Over the 11-year period, the total global number of exported dried seahorses is estimated at 11,259,098 individuals and the total global number of imported dried seahorses is estimated at 15,772,838 individuals. The top five countries/territories accounting for 99% of the global reported exports in dried seahorses (Fig. 1) include: Thailand, representing 71% of the total world exports, followed by mainland China (15%), Senegal (10%), Malaysia (2%) and Hong Kong (1%). The top countries/territories accounting for 99% of the global reported imports of dried seahorses include Hong Kong (88%), mainland China (11%), and Singapore (1%). According to CITES records, there were no reported exports of live seahorses from African countries for commercial purposes. Additionally, the majority of dried seahorse exports from Africa (97%) were reportedly destined for import by countries in Asia. Therefore, the next section of this report will focus on the dried seahorse trade between Africa and Asia.

Kg/individuals	Reported exports	Reported imports
Dried (kg)	32, 058	42, 429
Dried (individuals)	11, 259, 098	15, 772, 838

Table 1. The total reported exports vs. imports from all countries trading in dried seahorses (kg) and the conversion to no. of individuals, 2008–2018.
Source: CITES Trade Database

According to the CITES Trade Database, the African countries reporting dried seahorse exports between 2008–2018 are Senegal, Guinea, and Togo. There are major discrepancies between the quantities reported as exported from Africa and the importer reported quantities of dried seahorses originating from African countries (Table 2). Senegal reported the highest number of exports (98%) of dried seahorses in Africa, amounting to approximately three tonnes by the end of 2016, however countries reporting imports from Senegal showed significantly lower quantities of imports, and reported imports in the years 2017 and 2018 indicate that Senegal reported no exports (Fig. 2). Between 2008–2018, Guinea reported one export in 2008; however, countries reported importing dried seahorses from Guinea in several years and in much higher quantities (Table 2). Togo reported a small quantity of dried seahorse exports to Hong Kong in 2011, however, no imports were reported by Hong Kong. All the seahorses exported from Africa were sourced from the wild and comprised almost exclusively *H. algiricus*, listed as Vulnerable, with populations decreasing (Pollom, 2017a). Hong Kong was the only Asian importer reporting dried seahorses from Africa, despite Africa reporting exports of dried seahorses to Hong Kong, mainland China and Taiwan (Fig. 3). For this reason, the rest of the report will show the trade between Africa and Hong Kong.

Countries Totals: kg/ individuals	Exporter reported quantity	Importer reported quantity
Senegal	3,354	2,220
Togo	30	0
Guinea	23	2,024
Total dried seahorses (kg)	3,407	4,244
Individuals (5.6 g/seahorse)	608,393	757,857

Table 2. Exporter reported quantities (kg) of dried seahorses from African countries vs. importer reported quantities (kg) of dried seahorses originating from African countries, with the conversion to no. of individuals for the West African Seahorse *H. algiricus*, 2008–2018. *Source: CITES Trade Database*

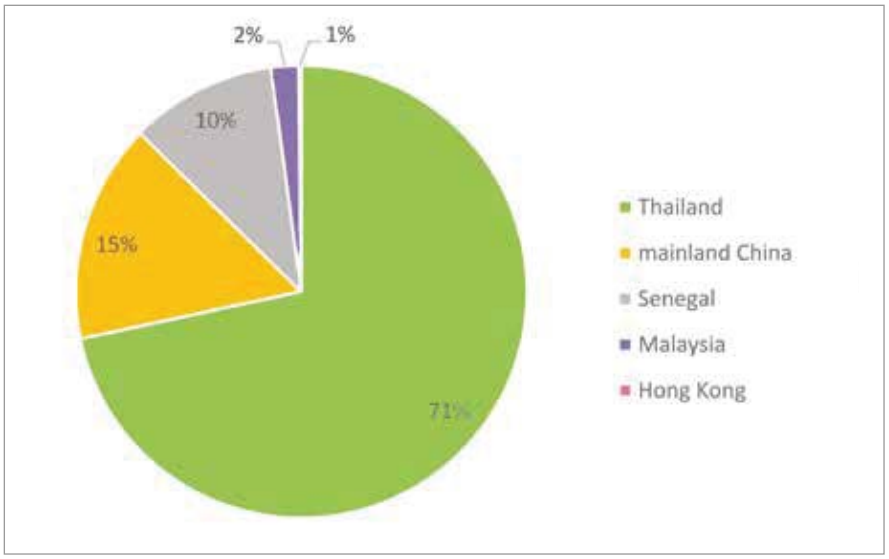

Fig. 1. The top five countries/territories accounting for 99% of the reported global exports for dried seahorses, 2008–2018.

Source: CITES Trade Database

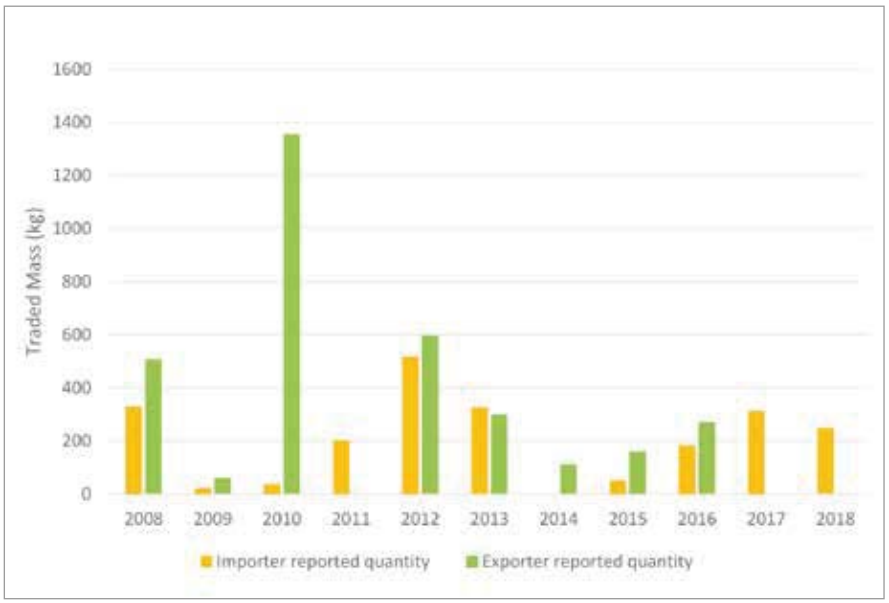

Fig. 2. The total reported quantities exported from Senegal vs. the importer reported quantities of dried seahorses reported as originating from Senegal, 2008–2018.

Source: CITES Trade Database

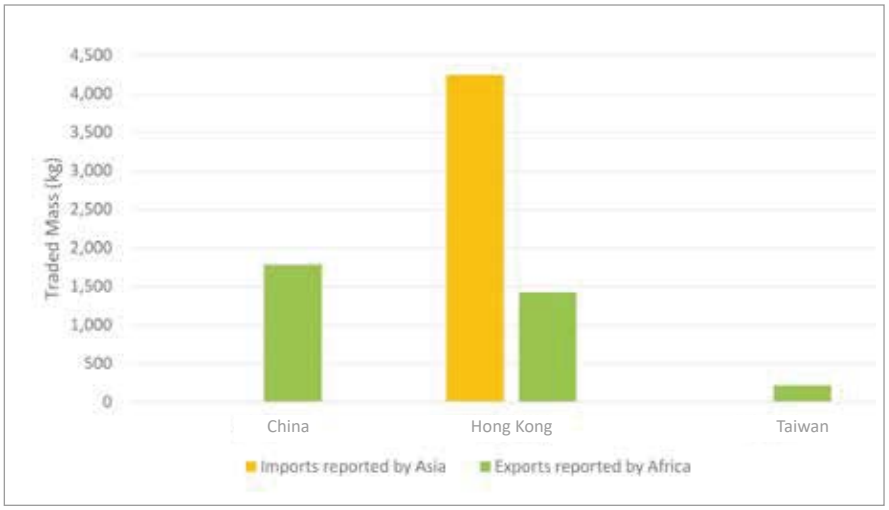

Fig. 3. The total reported exports of dried seahorses from Africa to Asia vs. the total reported imports of dried seahorses by countries/territories in Asia that originated from Africa, 2008–2018.

Source: CITES Trade Database

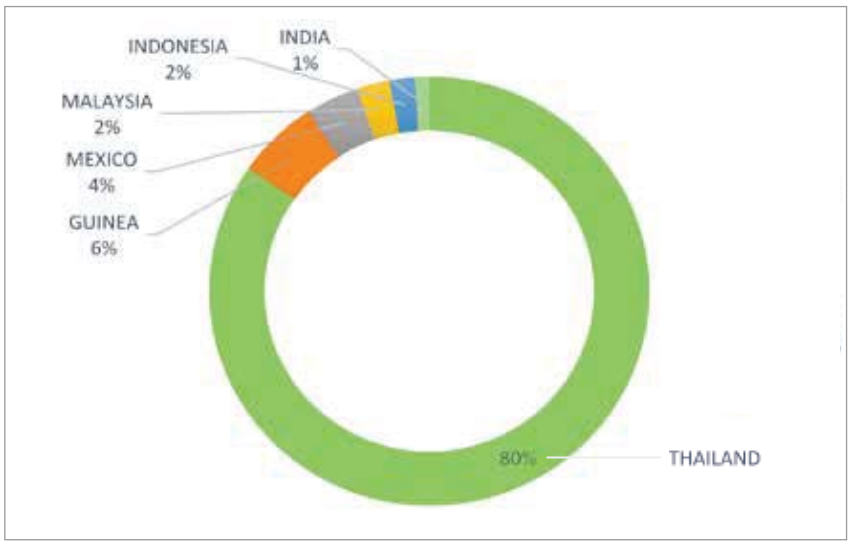

Fig. 4. The main countries of origin accounting for 95% of dried seahorses (HS Code 03055930) imported by Hong Kong between 2008–2018.

Source: Hong Kong Bureau of Statistics

Fig. 5. Total mass of dried seahorses (HS Code: 03055930) imported by Hong Kong and the total import value/kg between 2008–2018.

Source: Hong Kong Bureau of Statistics

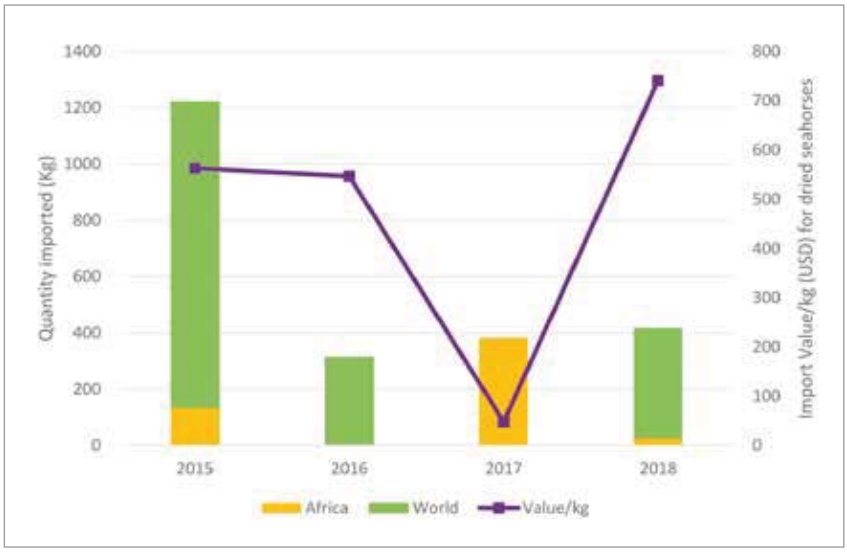

Fig. 6. Hong Kong imports of dried seahorses from 1) non-African countries and 2) all African countries, plus the import value/kg (USD) of dried seahorses represented by the purple line plotted on the secondary axis, 2015–2018.

Source: Hong Kong Bureau of Statistics

Hong Kong Trade Statistics

Hong Kong is the largest global importer of dried seahorses (Table 3) for use in TCM across Asia. According to Hong Kong's import records, Thailand accounts for 80% of the dried seahorse exports to Hong Kong, followed by Guinea (6%), Mexico (4%), Malaysia (2%), and Indonesia (2%) (Fig. 4). The volume of dried seahorses imported by Hong Kong peaked in 2009 at approximately 10 t, after which imports declined in 2012 to approximately two tonnes (Fig. 5). The sharp decline in imports from 2012 may be the result of Thailand implementing a maximum export quota of 1,500 kg per annum, following a 2012 CITES Significant Trade Review recommendation to address their unsustainable trade in dried seahorses (Kuo and Vincent, 2018). The import value per kg of dried seahorses increased from approximately USD250/kg in 2008 to approximately USD600/kg in 2013 (Fig. 5). Hong Kong's import value showed a sharp decline in 2017 to less than USD50/kg of dried seahorses, after which the import value increased to above USD700/kg in 2018 (Fig. 5). A closer look at the significant decline in 2017 (Fig. 6) showed that Hong Kong only imported dried seahorses from African countries for that year. In 2018, similar quantities of dried seahorses were imported by Hong Kong; however, the import value/kg increased significantly, and Africa represented only a small proportion of those imports (Fig. 6).

Africa accounts for 7.2% of the total dried seahorses imported by Hong Kong, from a total of five countries (Fig. 7): Guinea is the largest exporter, followed by Senegal and South Africa (Fig. 8). The results for Senegal and South Africa are particularly concerning for the following reasons: in 2016, the CITES Standing Committee recommended a suspension of trade of *H. algiricus* from Senegal for its failure to meet the Significant Trade Review process (CITES, 2019). However, Hong Kong import records indicate continued exports of seahorses from Senegal in 2017 and 2018. Additionally, the imports of dried seahorses from South Africa are also concerning, given that all syngnathids are listed as protected species under South Africa's *National Environmental Management: Biodiversity Act (No. 10)* of 2004. Ghana and Mauritania account for a small number of dried seahorses exported from Africa. According to Hong Kong's import records, the main method of transporting dried seahorses to Hong Kong is by air (Table 4), followed by a small number of seahorses transported by "other" methods, which includes hand carrier or post. Africa exported a total of 2,969 kg of dried seahorses to Hong Kong between 2008 and 2018, which is equivalent to approximately 583,688 seahorses according to the median weight of *H. algiricus* for West African countries and the average global estimated weight (2.69 g/seahorse) for the dried seahorses exported from South Africa (Evanson *et al.,* 2011; West *et al.,* 2012). There are major discrepancies in what Hong Kong has reported to CITES and the Customs data of Hong Kong's imports (Table 5), including the number of African countries from which Hong Kong has reported importing dried seahorses and differences in the reported quantities of dried seahorses imported by Hong Kong.

HKHS Code	Hong Kong imports	Unit
03011910 (live)	489	No. of individuals
03055930 (dried)	41,506	kg

Table 3. Total live seahorses vs. dried seahorses imported by Hong Kong SAR, 2008–2018.
Source: Hong Kong Bureau of Statistics

Illegal Seahorse Trade From Africa to Asia

According to media reports sourced online between 2010–2019, a number of African countries were implicated in reported seahorse seizures (Fig. 9) (TRAFFIC, 2020). Madagascar illegally exported the highest quantities of seahorses from Africa. Belgium emerged as a major transit location for a number of West African countries (Guinea, Congo, Senegal, Sierra Leone, Liberia) and all the exports were destined for import by Asian countries/territories. A seizure in South Africa had no trade route reported as the seahorses were seized on land, through joint operations, before they could be transported out of the country (TRAFFIC, 2020).

A recent study showed that 95% of global dried seahorse exports are coming from countries that are prohibited from exporting seahorses (Foster *et al.,* 2019). Despite the recommendation not to import *H. algiricus* from Senegal since 2016, it appears to remain a key exporter of dried seahorses in Africa (Foster *et al.,* 2019). The Knysna Seahorse *H. capensis*, endemic to South Africa, is a protected species under

Country	Air	Others	Total (kg)	No. of individuals
Ghana		14	14	2,500
Guinea	2,209	130	2,339	417,679
Mauritania	2		2	357
Senegal	337		337	60,179
South Africa	277		277	102,974
Total	**2,825**	**144**	**2,969**	**583,688**

Table 4. The total quantity (kg) of dried seahorses imported by Hong Kong from African countries and the conversion amount to no. of individual seahorses (5.6 g/seahorse for West African countries and 2.69 g/seahorse for South Africa), along with the main methods of transport as reported by Hong Kong imports, 2008–2018. *Source: Hong Kong Bureau of Statistics.*

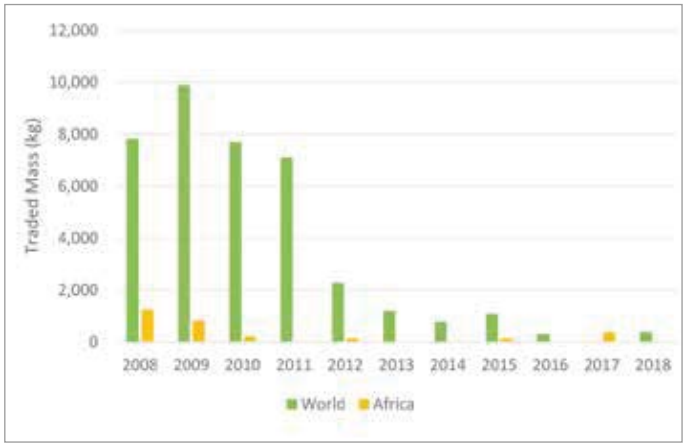

Fig. 7. The total mass of dried seahorses imported from Africa vs. the rest of the world as reported by Hong Kong, 2008–2018. *Source: Hong Kong Bureau of Statistics*

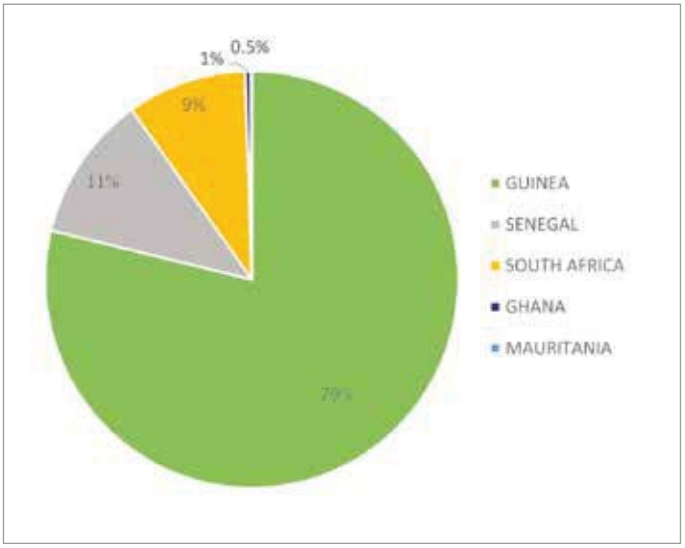

Fig. 8. Hong Kong imports of dried seahorses from African countries, 2008–2018.
Source: Hong Kong Bureau of Statistics.

	CITES (kg)	HK Customs (kg)
Senegal	2,220	337
Guinea	2,024	2,339
South Africa	0	277
Ghana	0	14
Mauritania	0	2
Total	**4, 244**	**2, 969**

Table 5. A comparison of the Hong Kong imports (kg) from African countries, 2008–2018.
Sources: CITES annual reports and Hong Kong Customs data.

the *Biodiversity Act* of 2004 and listed as Endangered according to the IUCN Red List of Threatened Species (Pollom, 2017b). Nevertheless, Hong Kong has reported imports of seahorses originating from South Africa. The illegal trade in seahorses is negatively impacting wild populations, as can be seen with the declining populations of *H. algiricus* along the coasts of Guinea, Senegal, and Mauritania, according to the IUCN Red List of Threatened Species (Pollom, 2017a).

This report focuses on recent trends in the seahorse trade using CITES data and Hong Kong import statistics (2008–2018); it is important to note, however, that studies conducted in East Africa found that seahorses were reportedly traded in high quantities from Kenya and Tanzania for TCM markets in Hong Kong (Mcpherson and Vincent, 2004; Vincent, 1996). Since the CITES listing of seahorses in 2014, there have been no reports of legal seahorse trade from East Africa, in both the CITES data and Hong Kong import records, despite anecdotal evidence of seahorse confiscations and known harvesting occurring in the region.

Conclusions

The reported trade in dried seahorses has shown major declines since 2012, but this may not be a true reflection that the international trade has actually declined. In 2011, the CITES Significant Trade Review process led to a number of recommendations to suspend trade with the major seahorse exporting countries, including Thailand, Viet Nam, Senegal and Guinea, which at the time made up 98% of the total trade (CoP18, Doc. 72). These trade suspensions resulted in sharp declines in the reported exports from 2012 onwards; however, a recent analysis of Hong Kong's import records has shown continued exports in high quantities from these major source countries, despite suspensions being recommended (Foster *et al.*, 2019). The global declines in seahorse populations as a result of incidental capture (retained bycatch) by trawling vessels and the increased degradation of threatened habitats, have also contributed to localised declines in trade volumes (Vincent *et al.*, 2011). However, the demand for dried seahorses to supply the TCM markets across Asia continues to drive the exploitation of seahorses from a growing number of source countries.

The seahorse trade in Africa has been comparatively under-studied in recent years, and this rapid assessment shows that countries in Africa play a key role in the global

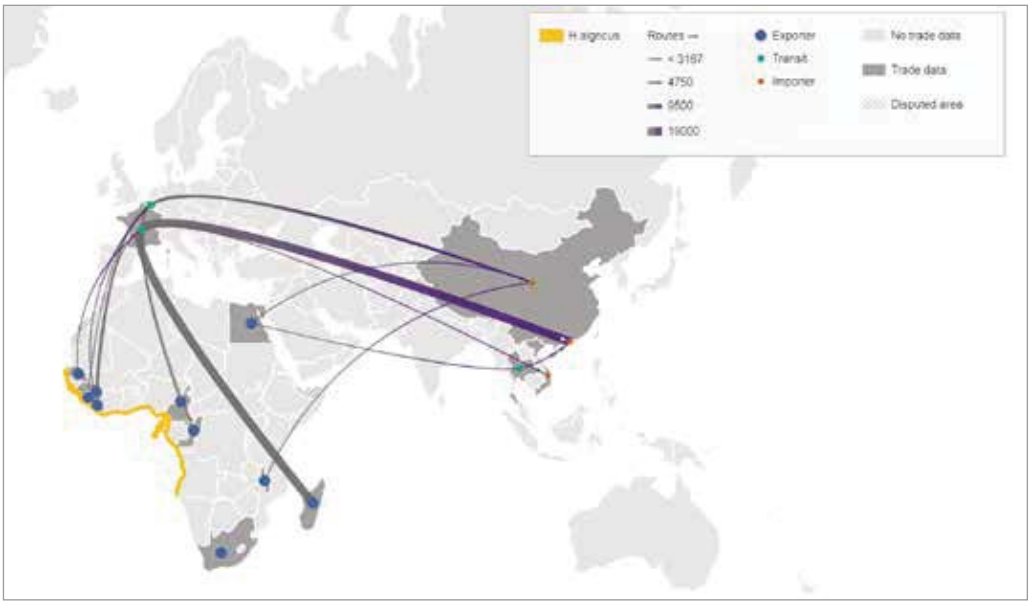

Fig. 9. Seahorse seizures implicating African countries between 2010–2019 and the range of West African Seahorse *H. algiricus*. *Source: TRAFFIC (2018) TradeMapper, a tool for visualising trade data. Available at www.trademapper.co.uk.*

Disclaimer for TRAFFIC's seizure data: *The datasets used to collate this information consist of reported wildlife trade seizures. Whilst seizure data are a vital source of information, it should not be inferred that there is a direct correlation between seizures and the overall illegal wildlife trade or that information over time is consistent. The ability and willingness of a country to target illegal wildlife trade may vary over time due to a variety of factors. The volume of seizures is not in direct proportion to the amount of illegal wildlife trade. Reported seizures are therefore an imperfect proxy for the volume of illegal wildlife trade, though they do give a good insight into what is being seized.*

dried seahorse trade, notably the emergence of West African countries such as Guinea and Senegal. Major discrepancies in reported trade volumes and the lack of regulations are contributing to unsustainable levels of seahorse exports from Senegal and Guinea. Hong Kong reported imports of 102,974 individual seahorses originating from South Africa. This result is particularly concerning since the seahorse species occurring in South Africa—*H. capensis*—is protected under South Africa's *Biodiversity Act* of 2004 and is one of the most threatened seahorse populations in the world (Lockyear *et al.*, 2006).

This report highlights several significant findings: high levels of illegal trade in dried seahorses is occurring in Africa; there is a lack of compliance with CITES trade bans for seahorses as well as a lack of enforcement to implement legislation protecting seahorses; and the current levels of seahorse harvesting are most likely unsustainable and will lead to further population declines.

Recommendations

- Future studies should investigate seahorse trade in East Africa, as there has been no legal trade following the CITES Appendix II listing in 2004, despite confiscations and known harvesting. Marine scoping studies conducted in the region by TRAFFIC will aim to investigate this trade.
- Governments and Customs agencies need to improve trade regulation of seahorses exported from Senegal, Guinea and South Africa to limit opportunities for seahorses sourced from illegal operations entering international trade.
- Capacity building and training is needed for Customs and law enforcement (fisheries compliance officers, port officials, and border police) in Senegal, Guinea and South Africa to support CITES implementation. This supports Outcome 4 of the UNODC indicators for strengthened law enforcement in response to fisheries crimes in West Africa (UNODC, 2016)
- Increased awareness is required within law enforcement (fisheries compliance officers, port officials, and border police) and Customs agencies in Senegal and Guinea of the potential for illegal seahorse products to be smuggled through borders, either with, or concealed as, legal seahorse shipments. This supports the recommendations agreed by ECOWAS Member States, in 2018, on developing a co-ordinated response to wildlife trafficking in West Africa (ECOWAS, 2018).
- Law enforcement agencies in Southern Africa wishing to share information on the illegal trade in seahorses would benefit from making use of the SADC-TWIX platform (https://www.sadc-twix.org/).

Acknowledgements

The authors thank Louw Claasens, Sarah Foster, Camilla Floros and Thomasina Oldfield for their helpful review of this report. The study was undertaken through the ReTTA (Reducing Trade Threats to Africa's wild species and ecosystems) project, which is funded by Arcadia, a charitable fund of Lisbet Rausing and Peter Baldwin.

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▲ Dried seahorses that had been concealed in a package for export to China, and seized in 2016 by the South African Post Office; they were handed over to the Department of Agriculture, Forestry and Fisheries, Cape Town.

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