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January 2022

A RAPID ASSESSMENT OF ONLINE TRADE IN

SEA CUCUMBER AND FISH MAW

IN MALAYSIA AND SINGAPORE

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TRAFFIC REPORT

ABOUT US

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PUBLISHED BY:

TRAFFIC

Southeast Asia Regional Office,
Suite 12A-01, Level 12A, Tower 1, Wisma AmFirst,
Jalan Stadium SS7/15, Kelana Jaya
47301 Petaling Jaya, Selangor, Malaysia.

SUGGESTED CITATION

Ong, E.J. and Chin, S.T. (2022). *A Rapid Assessment of Online Trade in Sea Cucumber and Fish Maw in Malaysia and Singapore*.

TRAFFIC, Southeast Asia Regional Office,
Petaling Jaya, Selangor, Malaysia.

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UK Registered Charity No. 1076722

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ACKNOWLEDGEMENTS

The authors especially thank Kanitha Krishnasamy for her valuable inputs and comments to this document. The authors also thank Elizabeth John, Glenn Sant, Yvonne Sadovy, Melissa Matthews, Saket Badola, Mayuri Chopra, Merwyn Fernandes, Serene Chng and the National Parks Board (Singapore) for their helpful review. Our gratitude also to Elizabeth John and Ain Nadirah Bukhri for layout, design and communications support. The preparation, development and production of this publication were made possible with funding from the United States Fish and Wildlife Service (USFWS), through the project "Strengthening Malaysia's effectiveness in implementing and enforcing CITES in order to reduce illegal trade of CITES-listed species".

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SEA CUCUMBER AND FISH MAW TRADE IN MALAYSIA AND SINGAPORE



Sea Cucumber



Fish Maw



TWO MAJOR ASIAN SEAFOOD DELICACIES

- High trade volumes, rising seizures, declining populations
- Improved regulation and traceability systems needed along supply chains

GLOBAL SEA CUCUMBER TRAFFICKING



92 tonnes



112,694 pcs of sea cucumber seized globally

80%⁺ of the volume confiscated in 2019 alone

6.2 tonnes seized in Malaysia, placing it among the top 5 countries

ONLINE SURVEY



11 days 2⁺ hours/day

339 sale posts 13⁺ origin countries

2,043kg sea cucumber } offered for sale
3,504kg fish maw }

☑ Trade form: Dried, frozen, cooked

☑ Supply availability seemed many folds greater than those advertised alone

☑ Trade legal, but some species offered were CITES-listed, threatened and/or protected

JAN 2022: Online trade levels remained active. Most of these sites still offered a range of products, CITES-listed species and others not recorded in 2020.

EXECUTIVE SUMMARY

SEA CUCUMBER AND FISH MAW ARE TWO OF THE BIG FOUR ASIAN TRADITIONAL SEAFOOD (THE OTHER TWO ARE ABALONE AND SHARK FIN)

An initial scoping exercise conducted for Malaysia and Singapore found sea cucumber and fish maw to be two of the most prevalent seafood commodities advertised for sale online. As legal trade volumes remains high along with concerning trafficking incidents, several countries have reported sea cucumber fishery closures due to population declines from overfishing. Equally, the illegal trade in these products is rife.

Between 2015 and 2021, 92 tonnes of sea cucumbers and an additional 112,694 pieces of sea cucumbers have been seized from at least 23 countries worldwide. These occurred in a total of 204 incidents, where sea cucumbers were occasionally trafficked with other wildlife parts including pangolin scales, rhino horns, ivory, lion teeth, abalone and shark fins. As the overall volume of sea cucumbers seized here is based solely on quantities that have been openly reported, the true volume of sea cucumbers trafficked is likely much higher. Malaysia is among the top five countries by volume of sea cucumbers seized, reporting on 14 seizures since 2017, totalling 6.2 tonnes. Over 80% of this was seized in 2019 alone. One seizure of CITES Appendix II teatfish occurred in Singapore in 2021. The trafficking in fish maw is not as widely reported, except when involving some threatened species such as the Critically Endangered totoaba *Totoaba macdonaldi*, which has over the years involved high levels of organised crime. There is also some evidence of fish maw being used as a replacement for shark fin, in terms of its importance in traditional consumption. As the

online trade in sea cucumbers and fish maw is not well reported or understood in Southeast Asia, a rapid assessment was conducted to document its online availability in Malaysia and Singapore. The survey was conducted on e-commerce platforms, social media platforms and individual business websites (hereafter these three are collectively referred as online sites).

During an 11-day period from 17 June – 6 July 2020, the survey recorded 339 advertisements and posts that offered at least 5,547 kg of sea cucumber and fish maw, from 33 online sites. Of these, 177 advertisements and posts offered at least 2,043 kg of cooked, dried and frozen sea cucumber, while 162 advertisements and posts offered at least 3,504 kg of cooked, dried, fried, frozen and roasted fish maw. As weight information was not displayed by all sellers, the actual total weight of commodities offered will therefore be much higher than what was recorded.

Two online sites – Tradekey Malaysia and Tradekey Singapore – allowed sellers to indicate their supplying ability of sea cucumbers. Although this could not be verified, sellers from these two online sites alone indicated that they had the supplying ability of 4,100 kg of sea cucumber, with 2,300 kg on a monthly basis and 100 kg on a weekly basis. This shows that the volume of sea cucumber and fish maw offered online, including traders' claimed ability to supply them, to be considerably large and could be many folds greater than what was recorded from this rapid assessment alone.

SEA CUCUMBER AVAILABILITY ONLINE

Among the sea cucumber commodities, dried products were the most common, accounting for 75% of the total advertisements and posts offering sea cucumbers online. The reported origins of sea cucumbers were very diverse, with products claimed to be originating from at least 15 countries – Australia, Canada, China, Egypt, Indonesia, Japan, Malaysia, Maldives, Mauritius, Papua New Guinea, Philippines, Solomon Islands, Sri Lanka, Vietnam, Yemen as well as unspecified countries in Africa and South America. Among 99 advertisements and posts that had sea cucumber origin indicated, Indonesia (29 advertisements and posts) and Australia (21 advertisements and posts) appeared to be the most frequently indicated countries of origin.

None of the advertisements and posts reported Singapore to be the origin of sea

FISH MAW AVAILABILITY ONLINE

Among the fish maw commodities, dried fish maw was most commonly offered, accounting for 59% of the total advertisements and posts offering fish maw online. The reported origins of the fish maw were diverse as well, covering at least 13 countries – Australia, Canada, Hong Kong, India, Indonesia, Malaysia, New Zealand, Norway, Panama, Philippines, South Africa, Thailand, United States of America as well as unspecified

cucumber products offered. This means that a vast majority, if not all, of the sea cucumber products offered for sale in Singapore were likely imported as harvesting of sea cucumber for commercial purposes is not known in Singapore. Additionally, there were 48 advertisements from nine online sites that offered sea cucumber health and skincare products. They were offered in various forms and product types such as jelly, mask, pill, oil, liquid cleanser, bar soap and concentrated liquid essence, where most sellers indicated that sea cucumber extracts for these products were obtained mostly from the species *Stichopus hermanni* (IUCN Vulnerable). However, as the true volume content of sea cucumber in these products was unclear, they were excluded from this analysis.

countries in Asia and South America. Out of 49 fish maw advertisements and posts where information on origin was included, Indonesia (9) and Thailand (7) appeared to be the most frequently indicated countries of origin. None of the advertisements and posts reported Singapore to be the origin country for the fish maw products offered, indicating that the majority, if not all, of the fish maw products offered in Singapore was most likely imported.



sea cucumbers were offered in various forms and product types



fish maw was most commonly offered in dried form

SEA CUCUMBER SPECIES OFFERED FOR SALE

Commodities advertised were identified to at least the genus level where possible, matching trade names (common names used by sellers) to their respective taxa identifications. Among the sea cucumbers, 114 advertisements and posts were identifiable to at least the genus level, representing 64% of total sea cucumber advertisements and posts. Of these, species of the genus *Holothuria* (78 advertisements and posts) was most commonly offered. Trade names used for three sea cucumber species that were listed for the first time in CITES in 2019 and came into force in September 2020 – *Holothuria fuscogilva*, *Holothuria nobilis* and *Holothuria whitmaei* – were encountered in 21 advertisements and posts. These three species are also protected under Malaysia's

International Trade in Endangered Species Act 2008 (INTESA) and Singapore's *Endangered Species (Import and Export) Act (ESA) 2006*. At least six countries were claimed by sellers to be the origin of sea cucumber involving these three species: Australia, Indonesia, Malaysia, Papua New Guinea, the Philippines and Sri Lanka, meaning that any legal international trade would have required the relevant CITES permits. Trade names for sea cucumber species on the IUCN Red List were also recorded in trade, specifically six species considered as Endangered and another five considered Vulnerable. None of the posts and advertisements mentioned legal protection status of species offered, nor a requirement for any permit.

FISH MAW SPECIES OFFERED FOR SALE

Of the 73 advertisements and posts with fish maw identifiable to the type of fish (45% of total advertisements), the most commonly encountered ones were those belonging to eels (13 advertisements). Several of the fish maw product trade names were listed as Endangered or Vulnerable species on the IUCN Red List, including *Pangasionodon hypophthalmus*, *Epinephelus itajara* and

several species in the family Acipenseridae (sturgeons). A number of sturgeon species are listed in CITES Appendix I or II, and are regulated under Malaysia's INTESA and Singapore's ESA. However, as the species of sturgeon the fish maws were obtained from was not specified, it was unable to ascertain if any CITES-listed sturgeons were offered for sale.



CONCLUSIONS AND RECOMMENDATIONS

Overall, the quantity of sea cucumber and fish maw offered online, and claims of the large supplying ability of sea cucumber sellers, suggest that the volume of sea cucumber and fish maw involved in the online trade in Malaysia and Singapore are considerably large. Information reported by sellers on the origin of these products showed that trade in these commodities are on an international scale, involving at least 15 countries of origin for sea cucumber and at least 13 for fish maw (both included Malaysia). Findings also revealed that some sea cucumber and fish maw species being traded online in Malaysia and Singapore are of moderate to high conservation concern.

Although it is not possible to draw comprehensive conclusions or make detailed recommendations from a rapid assessment alone, this research highlights preliminary areas that would benefit from further scrutiny to ensure trade is legal and sustainable. This is particularly important given the rise in sea cucumber trafficking internationally and high trade volumes for both commodities. The presence of endangered species

offered online, involving a diverse range of trade countries, warrant the need for a close monitoring in these trades to ensure strict compliance with national and CITES regulations. This also translates to the need for robust regulation and traceability systems for these commodities.

True volumes and species in trade are also often difficult to verify, particularly when the reported trade names in the various languages is quite varied and reporting is poor. Therefore, online trade monitoring should also be conducted in conjunction with a more robust assessment of availability in the physical shops. This, along with DNA analysis from sample products in the market, would allow for better identification of the species in trade. Surveys in implicated source countries should pursue efforts to determine species and volumes involved collectively, these efforts could support more robust conservation and management strategies for sea cucumber and fish maw harvest in source countries and their trade in Malaysia and Singapore, including traceability efforts to support verification and confidence in legal and sustainable supply.





INTRODUCTION

Sea cucumber and fish maw are the most highly prized seafood products in many Asian countries and in particular, the Chinese culture (Purcell *et al.*, 2018; Sadovy de Mitcheson *et al.*, 2019). Southeast Asia and East Asia have, for centuries been major markets in the trade of sea cucumber and fish maw, including Malaysia and Singapore, where large Chinese populations in these two countries drive the long-existed trade in sea cucumber and fish maw locally (Boey, 1988; Choo, 2004; Ferdous, 2004; Wen *et al.*, 2015).

SEA CUCUMBER

In both Malaysia and Singapore, sea cucumber is regarded as a delicacy with medicinal value. It is used in traditional medicine to treat a range of illnesses and is eaten for its nutritional benefits and collagen content (Slater, 2015). Increasingly, sea cucumber extracts are being used in alternative medicine and healthcare products in developed countries (Slater, 2015). Malaysia and Singapore have long been known to be one of the world's biggest markets and exporters/re-exporters of sea cucumber after China and Hong Kong Special Administrative Region of the People's Republic of China (hereafter Hong Kong) (Choo, 2004; Conand, 2004). A 2020 TRAFFIC study looking at sea cucumber imports from Africa showed that both Malaysia and Singapore were among the largest sea cucumber importers in Asia between 2012 and 2019, as they accounted for 7% and 4% of Asia's sea cucumber imports from Africa respectively (Louw and Burgener, 2020). In the 1980's, annual domestic consumption in Singapore averaged within 80 to 100 tonnes, with significantly higher volumes of imports and exports (Sakthivel and Swamy, 1994). This number has increased in recent years. From 2010 to 2018, the import of sea cucumber into Singapore ranged from 300 to more than 1,000 tonnes annually, while the annual exports ranged from 100 to more than 600 tonnes (FAO, 2020a). Export statistics for Singapore are likely to be largely re-exports as Singapore is not a producer of sea cucumber.

In Malaysia, apart from being consumed as a delicacy, sea cucumber species from the genus *Stichopus* are highly sought after for their medicinal properties and are processed to make a medicinal oil, locally known as *gamat*. This oil can be made into a medicated balm, toothpaste, soap and other products

(Choo, 2004). Malaysia has also been noted to be an important exporter, importer and consumer of sea cucumber products. Most sea cucumber fisheries in Malaysia are reported from coastal waters in Sabah, an East Malaysian state located in Borneo (Choo, 2004). Sea cucumber imports into Malaysia ranged from 300 to more than 1000 tonnes a year in the 1980s, while exports out of Malaysia ranged from 0 to more than 200 tonnes a year within the same period (Sakthivel and Swamy, 1994; FAO, 2020b). Similar to Singapore, the volumes recorded in recent years show a substantial increase in overall volume in Malaysia as well. From 2010 to 2018, the import of sea cucumber into Malaysia ranged from 200 to nearly 2,000 tonnes annually, while exports ranged from 300 to more than 6,000 tonnes annually (FAO, 2020c). Export statistics for Malaysia are likely to include re-exports as well.

In recent years, the trade, availability and demand for and value of sea cucumber products have been rising globally (Rahman and Yusoff, 2017; Rahman *et al.*, 2020). Alongside the growing demand, at least 24 countries have documented closures of sea cucumber fisheries following severe declines in sea cucumber biomass due to overfishing (Purcell *et al.*, 2013). Sea cucumber populations are especially vulnerable to overfishing – they can be easily gathered by hand in shallow waters in large quantities, but their slow growth rates mean that population replenishment is also slow. As a result, sea cucumber fishermen are forced to harvest from further offshore and in deeper waters as sea cucumbers closer to shore are depleted. Besides limiting international trade in these species, analysis of sea cucumber sizes in relation to market prices has shown that the

enforcement of a minimum harvesting size for sea cucumbers could be effective as a fisheries management method (Purcell *et al.*, 2018). Even with sea cucumber fishery closures, it was observed that sea cucumber stocks are slow to recover and might take decades to recover their population (Anderson *et al.*, 2011). A 2020 rapid assessment by TRAFFIC showed a decline of legal reported sea cucumber trade from Africa to Asia between 2012 and 2019, which may be caused by overexploitation and the collapse in sea cucumber fisheries (Louw

and Bürgener, 2020). With multiple species that are widely consumed having an IUCN Endangered or Vulnerable status, any decline in sea cucumber biomass is of utmost concern. In 2019, three species of sea cucumbers – *Holothuria fuscogilva*, *Holothuria nobilis* and *Holothuria whitmaei* were listed in CITES Appendix II which prohibits international trade in these species without a permit. This listing entered into force in August 2020.



SEA CUCUMBER SEIZURES

GLOBAL OVERVIEW AND TRENDS BY TOP COUNTRIES SEIZING SEA CUCUMBERS FROM 2015-2021

A large volume of sea cucumbers has been seized in recent times. Based on TRAFFIC's compilation of open-source global sea cucumber seizures from January 2015 to December 2021, at least 92 tonnes of sea cucumbers were seized from 204 incidents, largely being trafficked by sea. In 42 of these incidents, the volume of sea cucumber trafficked was not reported in weight, but involved another 112,694 pieces of sea cucumbers. Therefore, the overall confiscated volume is much higher than the 92 tonnes. Sea cucumber confiscations occasionally included other wildlife parts trafficked as well, including pangolin scales, rhino horns, ivory, lion teeth, abalone and shark fins.

These seizures involved 23 countries and territories. Overall, although the highest volumes by weight were seized by India, Malaysia was a hotspot (Figure 1). Malaysia and China both reported 14 seizures each and were among the top countries with the highest number of reported seizures, along with India (59)¹, Sri Lanka (42), Mexico (38) and Hong Kong SAR (9) (Figure 1). The United States of America (USA) reported six seizures, while the remaining countries had only each reported one to three seizures within the seven-year period. One seizure of CITES Appendix II teatfish occurred in Singapore in 2021 (National Parks Board, in litt.). Both Malaysia and Singapore were reportedly implicated in trade routes of sea cucumber seizures made in other countries.



one seizure reported for sea cucumber in Singapore

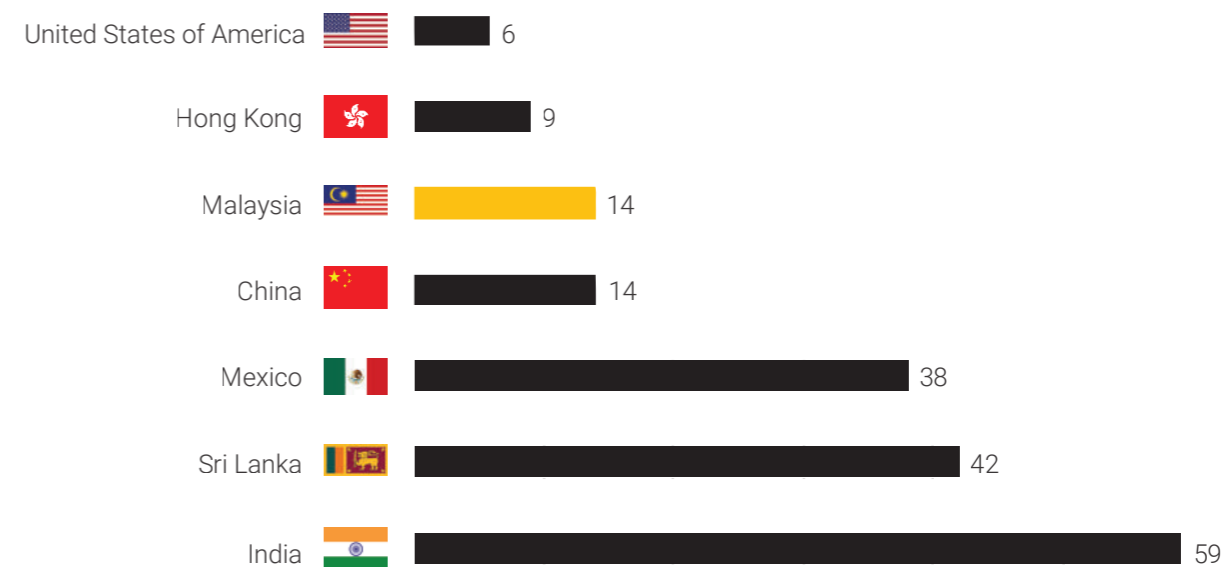


FIGURE 1
Top countries with the most number of reported sea cucumber seizures from 2015 to 2021. (Source: TRAFFIC data)

¹ All sea cucumbers are protected in India, and prohibited from any catch or trade TRAFFIC is undertaking an in-depth study on illegal sea cucumber trade in India and more detailed country-specific insights will be made available later.

India saw high volumes of sea cucumber seized yearly, peaking to almost 19 tonnes in 2015 alone and amounting to more than 44 tonnes in total during from 2015-2021 (Figure 2). Malaysia confiscated 6.2 tonnes of sea cucumber in total, with more than 5.2 tonnes of sea cucumber seized from seven seizures in 2019 alone (all in the state of Sabah), recording

the second highest volume of sea cucumber seized that year. As information on species breakdown of seizures was not reported, it was not known if any of the seizures had involved the three CITES-listed species – *H. fuscogilva*, *H. nobilis* and *H. whitmaei*. Determining species seized should be made a priority by governments.

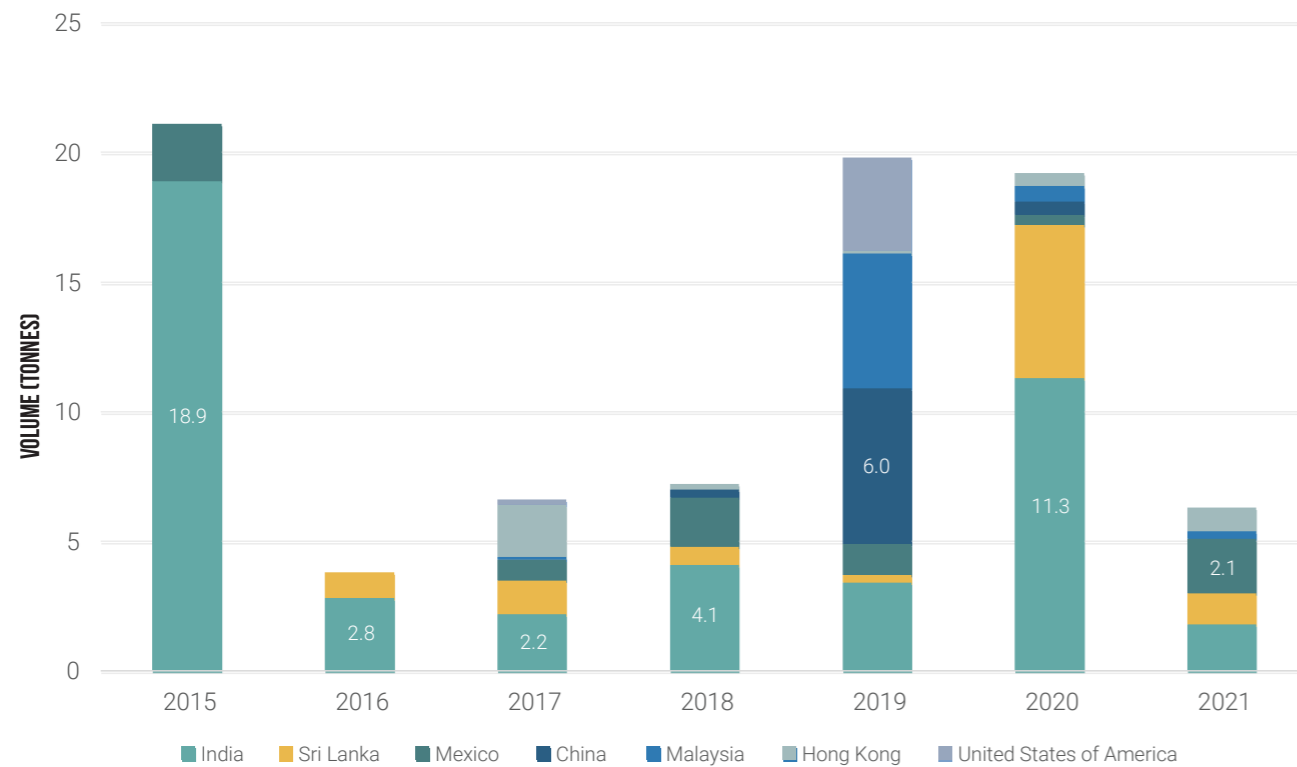


FIGURE 2
Top countries by seizure volume from 2015 to 2021. (Source: TRAFFIC data)

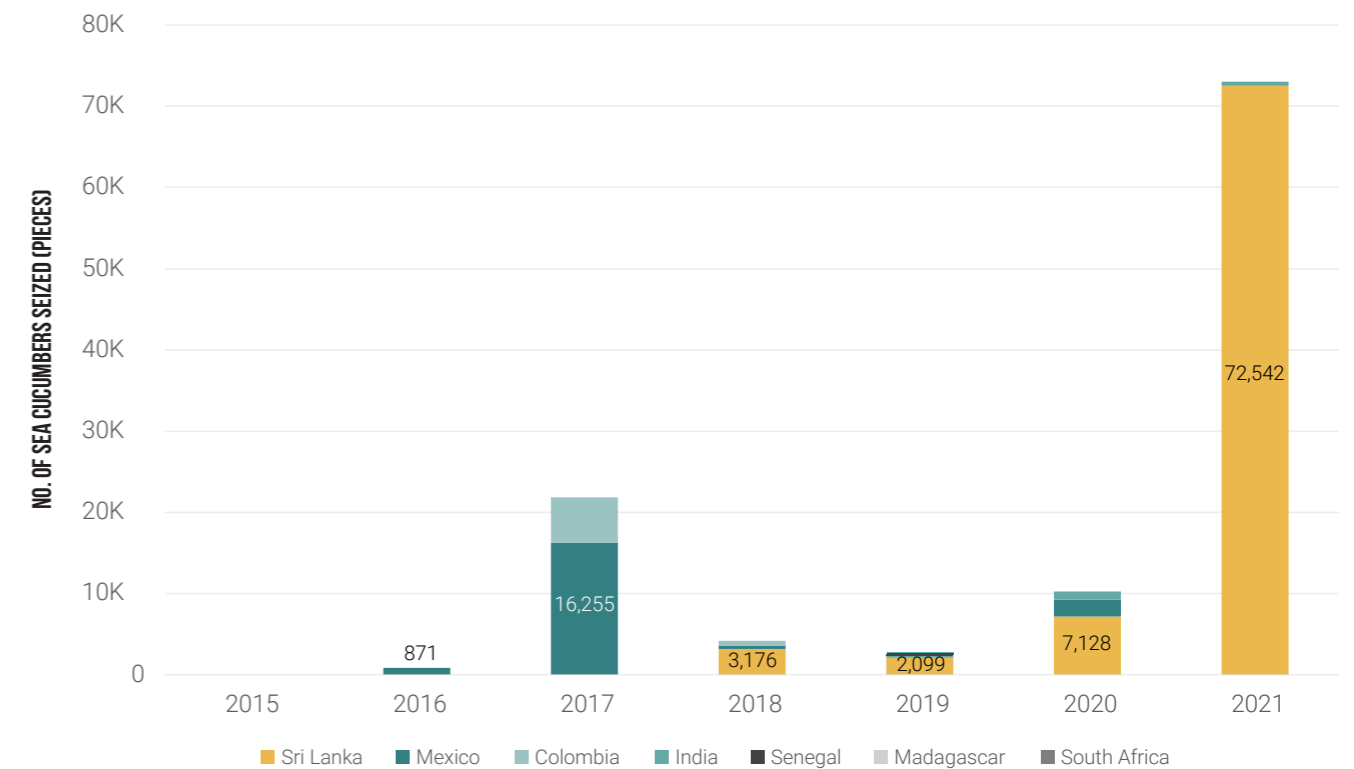


FIGURE 3
Sea cucumber pieces seized (no weight reported) from 2015-2021 (Source: TRAFFIC data)

Note: Number of sea cucumbers displayed above only represents higher figures confiscated, and thus does not include all individual sea cucumbers confiscated during the period.

An additional 112,694 pieces of sea cucumbers were seized during this period in 42 incidents, which did not have seizure weight reported; Sri Lanka and Mexico emerged as key countries (Figure 3). Sri Lanka reported the highest count of sea cucumber seized (84,945 pieces), where 72,542 pieces were seized in 2021 alone (Figure 3). Mexico and Colombia confiscated a further 19,656 and 6,094 pieces

of sea cucumbers in total, respectively. This data also shows that Sri Lanka has a much higher volume of sea cucumber seized when combining the weight and individual count sea cucumber. However, it is unknown whether these originate from Sri Lanka or are re-exports; analysis of illegal sea cucumber trade in India suggests that Sri Lanka has emerged as an important transit location in recent years (TRAFFIC, in prep).



SEIZURES IMPLICATING MALAYSIA AND SINGAPORE

Among the 14 seizures made by Malaysian authorities, eight occurred in the state of Sabah. Seven of these occurred in 2019 alone, and the remaining one in 2021. Five others were in the East Coast of Peninsular Malaysia (occurred in 2017, 2020 and 2021), while one remaining seizure occurred in the state of Sarawak in 2020. All 14 seizures reported the illegal fishing of sea cucumbers from Malaysian waters, but information on the destination countries was lacking. Eleven of the seizures involved Vietnamese fishermen or vessels that encroached into Malaysian waters, where at least 50 Vietnamese nationals were arrested. Additionally, in 2021, Singapore seized illegally imported and re-exported CITES Appendix II-listed teatfish shortly after its up-listing in CITES Appendix in 2020. The trader was fined SGD5,000 for the illegal trade of CITES-listed species without CITES permits (National Parks Board, in litt.)

Other than seizures occurring in the country, Malaysia, as well as Singapore, were reportedly implicated in at least four sea cucumber seizures that occurred in India from 2015 to 2021, indicating involvement as a transit and/or destination country for the illegal sea

cucumber trade. Information gathered by the Indian authorities from the traffickers indicated that such shipments typically headed to several Southeast Asian countries including Malaysia, Singapore and Thailand where there was an active market for them. In three of the four seizures (totalling to over 0.6 tonnes of raw sea cucumber largely), traffickers reportedly noted they were heading to Malaysia and / Singapore, either directly or transiting through other countries, though these are not verified. In another seizure of 211 dried sea cucumbers (volume not reported) in India in 2019, traffickers were reportedly smuggling them to Malaysia via air.

The massive volume of sea cucumber seizures made in or implicating Malaysia and Singapore warrants the need to further scrutinise this actual and alleged trafficking involving the two countries. Attention should also be particularly paid to the Malaysian waters surrounding Sabah, where all seizure incidents in Malaysia reported in 2019 alone occurred in the radius of this state. The management and regulation of this trade in Malaysia is currently not robust, nor clear (elaborated in the following sections).

FISH MAW

Fish maw is the dried or processed swim bladders of fish, and has been consumed largely by Chinese communities in Asia for centuries. Some consume fish maw for its traditional medicinal properties while some regard it as a luxury delicacy with nutritional benefits (Bagumire *et al.*, 2018; Tan, 2016; Tee, 2007). The trade in fish maw has long existed in Asia, where it was first regarded as a mere by-product of the fishing industry, but has evolved now into one of the most expensive fishery commodities globally, with average prices reaching USD 1,000 per kilogramme for certain fish species (Sadovy de Mitcheson *et al.*, 2019). The demand for fish maw in China and especially Hong Kong are among the world's highest (Bagumire *et al.*, 2018; Wen *et al.*, 2015). From 2015 to 2018, Hong Kong imported 13,618 tonnes of fish maw from as many as 110 countries across the world, including Brazil, Uganda, Viet Nam, Indonesia and China (Sadovy de Mitcheson *et al.*, 2019). Another study by Constant *et al.*, 2020 showed that East Asia, specifically Hong Kong, has reported an increase in fish maw supply from Africa between 2012 and 2019. Uganda, Kenya and Tanzania were among the top countries in Africa reported by Hong Kong to supply the highest volume of fish maw, exporting more than 24,232 tonnes of fish maw to Hong Kong within this period (Constant *et al.*, 2020).

Hong Kong is also a major transit hub for the fish maw trade, where fish maw is being re-exported to other countries globally. Malaysia and Singapore were among the top ten countries where high volumes of fish maw

were re-exported to, from Hong Kong. Within the four years of 2015 to 2018, Hong Kong re-exported 64 tonnes and 41 tonnes of fish maw to Malaysia and Singapore respectively (Sadovy de Mitcheson *et al.*, 2019). This however, does not represent the total volume of fish maw imported by Malaysia and Singapore, as both countries trade and source fish maw from other countries as well, including Indonesia (Zulham *et al.*, 2019). Unfortunately, information on the legal fish maw trade volume and trade countries in Malaysia and Singapore is sparse, as fish maw is often not given a specific classification on its own in fishery trade statistics, such as those from the Food and Agriculture Organization of the United Nations (FAO) and Southeast Asian Fisheries Development Center (SEAFDEC). UN Comtrade harmonised system codes also do not differentiate between fish maw and other products. This poses a challenge for studies that look into the legal trade of fish maw in other countries globally as well (Clarke, 2002). To address this issue, Hong Kong has adopted the strategy of modifying its international harmonized trade codes to distinguish maw from other dried fish products since 2015, which would be a good model for other countries to adopt. Internationally, analysis of fish maw trade is also further clouded by the difficulty in identifying fish species based on maw morphology, which impedes enforcement efforts when it comes to identifying maws belonging to protected fish species within each country's fishery regulations (Sadovy de Mitcheson *et al.*, 2018; Zeng *et al.*, 2018).



Malaysian seizures

majorly occurred in the state of Sabah



LEGAL FRAMEWORK

MALAYSIA

There is an increasing trend of illegal fish maw trade driven by an upward fish maw demand in Asia (Sadovy de Mitcheson *et al.*, 2019), sometimes causing the overfishing of fish species that are particularly targeted for their maw, such as the Chinese bahaba *Bahaba taipingensis*, totoaba *Totoaba macdonaldi* and Acoupa weakfish *Cynoscion acoupa* (Azzaro, 2019; Zhang, 2019). The Critically Endangered totoaba, sought after as a replacement to the commercially extinct Chinese bahaba, was listed in CITES Appendix I to prevent further declination of this species due to the organised criminality involved in its fish maw trade. Seizures of this species continues to be recorded, especially in Hong Kong. In just two seizures reported in 2020 alone, a total of 274 kilogrammes of totoaba fish maws worth USD44 million were seized in Hong Kong (GovHK, 2020). Among other fish species commonly preferred for the fish maw trade are croaker, perch, catfish and sturgeon, but most other species of bony fishes are also used to meet the demand in fish maw trade (Bagumire *et al.*, 2018; Zeng *et al.*, 2018). While sturgeons are listed in CITES – *Acipenser brevirostrum* and *Acipenser sturio* in Appendix I; other *Acipenseriformes* spp. in Appendix II – most of the other fish taxa commonly involved in the maw trade are not listed in any CITES Appendices.

Although Malaysia and Singapore do not observe the equivalent fish maw seizures as seen by Hong Kong, there is still a need to monitor the fish maw trade in these two Southeast Asian countries as there is a constant import and demand of fish maw into Malaysia and Singapore (Sadovy de Mitcheson *et al.*, 2019; Zulham *et al.*, 2019). On top of that, evidence suggesting a shift of consumption from shark's fin to fish maw warrant the need to observe the fish

maw trade in Malaysia and Singapore. As businesses and the public move towards a reduction in shark fin consumption, there might be a greater shift to fish maw as a substitute, which has already started to occur in Hong Kong (Ho and Shea, 2016; Sadovy de Mitcheson *et al.*, 2018; WWF, 2020). It remains unclear how this shift is affecting the fish maw trade in Malaysia and Singapore, so it is crucial to monitor this, especially given that Malaysia was the second largest importer of shark fin from 2000 to 2016 while Singapore was the fourth largest importer of shark fin within the same period (Okes and Sant, 2019). With most of the limited studies on fish maw trade focusing around the China and Hong Kong markets, there is generally a lack of studies done on the fish maw trade in Malaysia and Singapore (Clarke, 2002; Sadovy de Mitcheson *et al.*, 2019; Zulham *et al.*, 2019). What is known for sure is the persistence of the fish maw trade in these two Southeast Asian countries, where fish maw is seen as a delicacy and can be easily purchased in any seafood shops across both countries (authors pers. obs. 2020).

The high trade volumes of sea cucumber and fish maw have caused overfishing of sea cucumber and certain fish species sourced for maw to be evident in recent years. This highlights the importance of having continual monitoring efforts to keep the sea cucumber and fish maw trade in check. While there have been a number of past exercises to assess the level of trade in sea cucumbers and fish maw (Clarke, 2002; Rahman and Yusoff, 2017; Rahman *et al.*, 2020; Sadovy de Mitcheson *et al.*, 2019; Zulfaqar *et al.*, 2016), little has been reported regarding the online trade of these products in Malaysia and Singapore. To this end, TRAFFIC undertook this rapid assessment to gather some insights into its online trade dynamics.

Malaysia, as a party to CITES, enacted the *International Trade in Endangered Species Act 2008* (INTESA) to implement CITES and fulfil the country's responsibility as a party to the convention. This legislation governs the import and export of CITES listed species, with penalties for those violating the legislation reaching a maximum aggregate of MYR2 million (USD483,267), or a prison term of up to seven years. Species in the Act are categorised according to three Schedules, which are consistent with their listing in CITES Appendix I, II and III. Under this Act, trade in sea cucumber species *H. fuscogilva*, *H. nobilis*, *H. whitmaei* and *Isostichopus fuscus* (CITES Appendix II for the former three, Appendix III for the latter) are regulated. The same applies to only CITES-listed Sturgeons from the family Acipenseridae and *Totoaba macdonaldi* that are traded for its fish maw.

The Fisheries Act 1985 is the primary legislation regulating trade in marine and fisheries products. The Act does not offer protection to a vast majority of fisheries products, including sea cucumber, except for certain species of sawfish, sharks and rays.

In Sabah, sea cucumber and fish species are not listed in the *Wildlife Conservation Enactment* (WCE) 1997. However, the WCE defines "protected animals" as those listed in all CITES Appendices. This means that the harvesting and trade (including export) in any CITES-listed species is regulated and would require a permit. *Sarawak's Wild Life Protection Ordinance* (WLPO) 1998 also offers the "Protected" status to species listed in CITES Appendices I and II, signalling the presence of regulation within the state to protect CITES-listed species. The Ordinance does not specifically list sea cucumber species, but listed Arowana (*Osteoglossidae*) as the only Protected fish family. Overall, with the exception of Arowana, and regulations prohibiting fishing in gazetted Marine Parks, this essentially translates to a lack of any specific management measure in Malaysia to regulate the trade in sea cucumber and fish maw. The Malaysian authorities are currently looking into preparing Non-Detrimental Findings (NDF) for sea cucumbers (*pers comm. to TRAFFIC*, July 2021).




**shift of
consumption**
from shark's fin to
fish maw?



METHODOLOGY

A week-long scoping to identify online platforms and websites that offered sea cucumber and fish maw for sale was conducted before the survey commenced.



SINGAPORE

As a party to CITES, Singapore has listed four species of sea cucumbers under its Endangered Species (Import and Export Act) 2006 (ESA): *H. fuscogilva*, *H. nobilis*, *H. whitmaei* and *I. fuscus*. Several species of fish are also listed including sturgeons from the family Acipenseridae and *T. macdonaldi*. The ESA states that these species must be “accompanied by a valid CITES export or re-export permit or written permission issued by the competent authority of the country of export or re-export” and “where required by the country of import or final destination, a valid CITES permit or written permission” from the importing countries. The Act also more specifically states that any person who trades or introduces from the sea any species without a permit or has in his possession, or under his control, or sells, or offers, or exposes, or advertises for sale, or displays to the public such species may be fined a maximum of SGD50,000 (USD36,764) for each scheduled species in transit (not exceeding an aggregate sum of SGD500,000 (USD367,647) or imprisonment for a term not exceeding two years, or both) is in place.

The Fisheries Act and Wholesome Meat and Fish Act 1999 are also applicable to the trade in fish maw and sea cucumber. The Fisheries Act regulates the control of fishing, marketing and distribution of fish and the use and control

of fishing ports and harbours. It states that any person who lands or sells fish caught by use of poisons, explosives or trawl nets, or fish caught within prohibited areas, may be fined up to SGD10,000 (USD 7,352) or imprisoned for up to 12 months or both. The Wholesome Meat and Fish Act states that it is an offence to import, export or trans-ship any fish product without a licence and permit. The term ‘fish’ encompasses any species of fish, molluscs, crustacea, shellfish, echinoderms, and the young and eggs thereof. The penalties for breaches, such as trade without a licence, include a fine of up to SGD50,000 (USD36, 764) or imprisonment for up to two years or both.




Singapore’s *Regulation of Imports and Exports Act 1995* states that all commercial import, export, re-export consignments of both CITES and non-CITES listed wildlife have to be declared through the online platform TradeNet, that facilitates the exchange of information within the trade and logistics community led by Singapore Customs. Since 1 April 2003, all import and export declarations which have been approved by Singapore Customs are compiled through the trade statistics website, Enterprise Singapore Statlink. This data excludes postal packages which are based on particulars furnished by the Singapore Post Pte Ltd and goods supplied to non-Singapore registered aircraft, stores and ships.

The survey was conducted for 11 days between 17 June 2020 and 6 July 2020, excluding weekends, on the following 14 e-commerce and social media platforms – i) Adpost (Malaysia and Singapore), ii) Carousell (Malaysia and Singapore), iii) Facebook, iv) Lazada (Malaysia and Singapore), v) Qoo10 (Malaysia and Singapore), vi) Shopee (Malaysia and Singapore), vii) Expats Classifieds (Singapore) and viii) Tradekey (Malaysia and Singapore) – as well as 20 business websites

(Table 1). These business websites refer to web pages set up by individual businesses in Malaysia and Singapore, and they serve to provide information and advertise products offered for sale by the respective businesses. From this point forward, the term 'online sites' will be used to refer collectively on the e-commerce platforms, social media platform and business websites that were researched, unless otherwise expressed.

TABLE 1

Online sites surveyed and the respective countries of which the online sites are based in.



ONLINE SITES	MALAYSIA	SINGAPORE	MALAYSIA AND SINGAPORE
 E-commerce platforms (13)	<ul style="list-style-type: none"> Adpost MY Carousell MY Lazada MY Qoo10 MY Shopee MY Tradekey MY 	<ul style="list-style-type: none"> Adpost SG Carousell SG Expats Classifieds SG Lazada SG Qoo10 SG Shopee SG Tradekey SG 	Nil
 Social media platform (1)	Nil	<ul style="list-style-type: none"> Facebook group (Bloomington Sea Cucumber) 	Nil
 Business websites (20)	<ul style="list-style-type: none"> LSK Fishery Mei Jaya Malaysia Native Food Sdn Bhd Seafood Malaysia Sin Chip Long Sung Fish Maw 	<ul style="list-style-type: none"> Ah Hua Kelong Apollo Marine BBQ Chef Chin Guan Hong Emperor Brand Evergreen Seafood Joo Hwa Food Natural Brand New Island Food Supplier Ninja Food Sea Cucumber Singapore Wholesale Sin Ocean Pte Ltd Song Fish Dealer Pte Ltd 	<ul style="list-style-type: none"> Standard Gourmet Tam Kah Shark's Fin & Seafood

* Note: MY = Malaysia; SG = Singapore.

The survey took place for two hours each day – one hour each for sea cucumbers and fish maw searches - for a total of 22 hours during the survey period. Keywords searches were done in both English and Chinese languages, catering to predominantly Chinese (Table 2). These were entered into Google's search engine and on the respective online sites.

TABLE 2

Keywords used for online searches during the survey.

COMMODITY	ENGLISH	CHINESE
 Sea cucumber	sea cucumber dried sea cucumber	海参
 Fish maw	fish maw dried fish maw	鱼鳔

Efforts were made to identify the species of sea cucumber and fish maw being offered online. This was done by referring to the common name used by sellers (hereafter trade name) in identifying a particular taxa or species of sea cucumber and fish maw offered. A big barrier to any research on trade in sea cucumber and fish maw is the large amount of trade names and uncertainties in determining actual species offered in a comprehensive manner. This is particularly so with online trade, where information is often sparse.

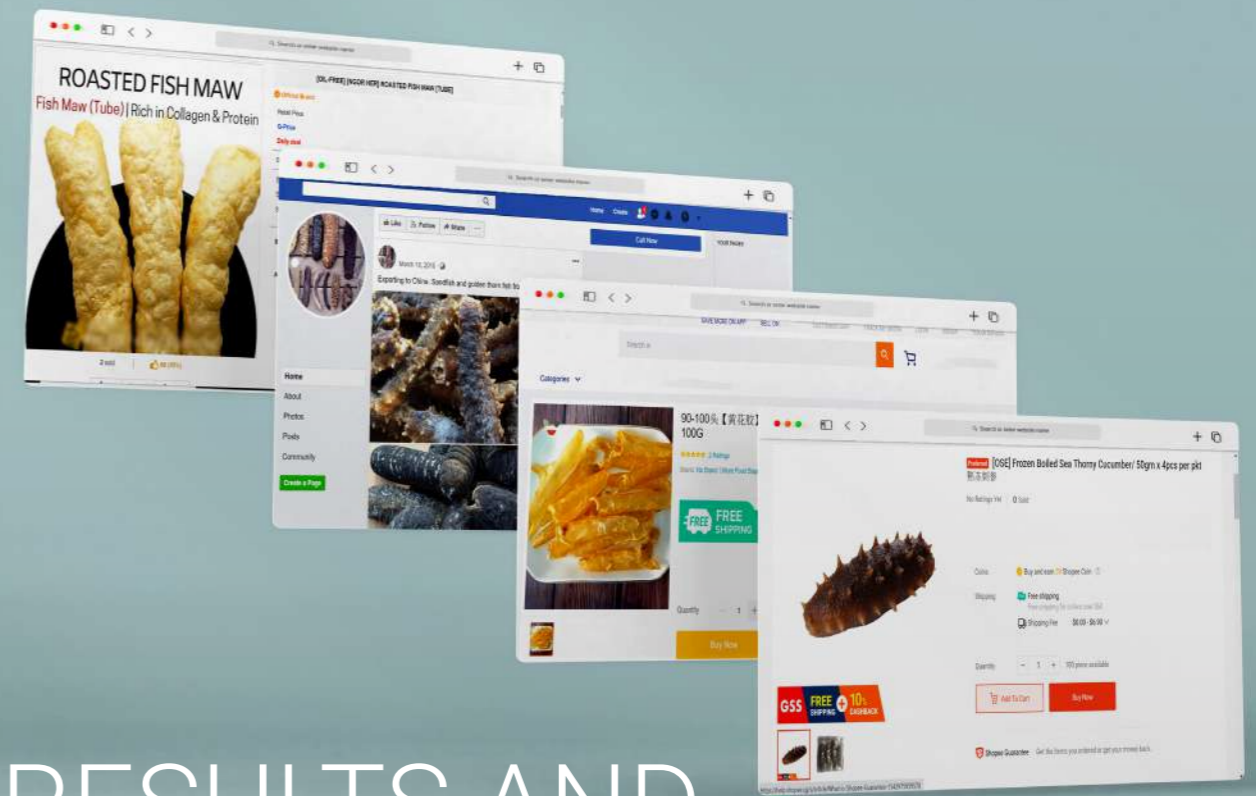
Some of the advertisements, posts and products recorded during the survey

encompass multiple species. Some species also have multiple trade names (see Table 6 and Table 10) and in these cases, effort was made to cross-check known traded species to the various trade names present online using existing literature and information from sellers. Some trade names were familiar to the surveyor whilst others had been documented in previous papers (Sadovy de Mitcheson *et al.*, 2019). Most trade names were in English or Chinese, with some Malay trade names. To aid in future identifications, a table matching species names to trade names was produced and displayed in Table 6 and Table 11 Further expansion of this table would be a worthwhile endeavour.



Details from advertisements and posts on e-commerce platforms, social media platforms and business websites were collated and used for analysis. Information recorded include trade name of product, name of the online sites with their respective URLs and countries, seller's name and location, origin of product, quantity as well as price where available. To avoid the inclusion of duplicate listings and avoid inflation of research numbers, only advertisements and posts containing unique images and/or unique listing dates were recorded. Some sellers offered sea cucumber and fish maw products across multiple online sites. To avoid double counting the same seller across different online sites, information such as username, address, country location, contact number and email address were used to identify the unique sellers. Average prices for commodity types and species/ genera were calculated in the equivalent

USD per kilogramme using only the entries which commodities can be identified to at least the genus level and had accompanying price listings. Researchers did not engage in any conversation with sellers, and therefore prices offered were assumed to be accurate. A conversion rate of USD1 = SGD1.39 and USD1 = MYR4.27 were used (as of 17 June 2020, <https://www1.oanda.com/currency/converter/>). Average prices were not calculated for species with less than three identifiable entries with pricing, due to insufficient data for an estimation. Some calculations also involved a removal of outliers that had dubiously high prices. Given this research was undertaken over a short time frame, results should be viewed as preliminary rather than comprehensive. The data also does not reflect any possible seasonality in pricing due to the short time frame.



RESULTS AND DISCUSSION

OVERALL SUMMARY

The survey recorded 339 advertisements and posts with at least 5,547 kg of sea cucumber and fish maw on 33 of the 34 surveyed online sites. Among them, 177 advertisements and posts offered a minimum of 2,043 kg of cooked, dried and frozen sea cucumber, while 162 advertisements and posts offered a minimum of 3,504 kg of cooked, dried, fried, frozen and roasted fish maw (Table 3). Of these, 156 were recorded from Malaysian-listed sites, 169 from Singaporean-listed sites and the remaining 14 were advertisements observed on online sites that were based in both Malaysia and Singapore. As not all sellers had displayed weight information, the actual total weight of products offered will therefore be much higher than what was recorded. Tradekey (Malaysia and Singapore) had the option of allowing sellers to indicate their supplying ability of sea cucumbers. In

anticipation of poor supply, sellers might tentatively be listing more conservative quantities for sale which does not reflect the true quantity available. Sellers from these two sites alone indicated that they had the supplying ability of 4,100 kg of sea cucumber. Of these, 2,300 kg of sea cucumber was noted to be available in a monthly basis, while another 100 kg of sea cucumber was available for supply in a weekly basis. Other online sites (besides Tradekey) did not display weight of supplying ability and therefore the weight information captured is just a minimum estimation and the real extent of supplying ability will likely be much larger. If claims by these sellers on their supplying ability were true, this shows that the scale of sea cucumber trade is considerably large and is on a recurring basis.

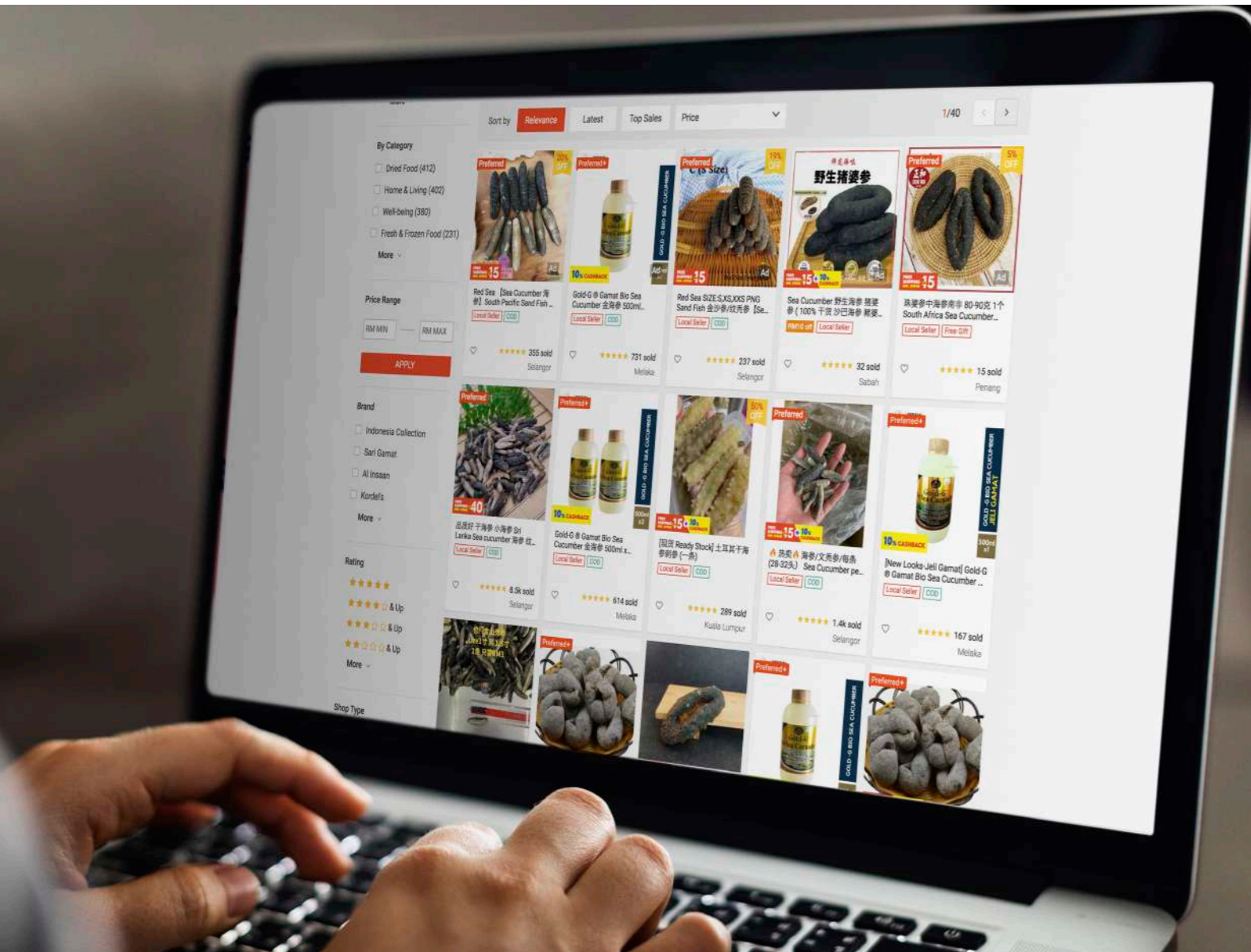


TABLE 3

Number of advertisements and posts recorded from the surveyed sites, along with the weight of commodities offered and the weight of sea cucumber supplying ability indicated by sellers.

COUNTRY OF ONLINE SITE	ONLINE SITE	NO. OF ADS AND POST		WEIGHT (KG)		SUPPLY ABILITY OF SEA CUCUMBER AND FISH MAW (KG)
		SEA CUCUMBER	FISH MAW	SEA CUCUMBER	FISH MAW	
Malaysia (MY) 	Adpost.com Malaysia	Only had sea cucumber health and skincare products which their count and weight are not included here, and will be discussed separately.				
	Carousell Malaysia	9	6	4.0	0.5	-
	Lazada Malaysia	13	20	41.1	187.1	-
	LSK Fishery	-	1	-	-	-
	Mei Jaya Malaysia Native Food Sdn. Bhd.	17	27	6.9	4.8	-
	Qoo10 Malaysia	5	6	1.4	1.8	-
	Seafood Malaysia	5	3	1.9	0.5	-
	Shopee Malaysia	5	11	31.3	311.1	-
	Sin Chip Long	3	2	-	-	-
	Sung Fish Maw	-	1	-	1.0	-
Tradekey Malaysia	20	2	1,392.0	10.0	2,200 [*]	
MY SUBTOTAL	10 ONLINE SITES; 156 ADS	77	79	1,478.6	516.8	2,200
Singapore (SG) 	Adpost.com Singapore	2	-	-	-	-
	Ah Hua Kelong	2	-	2.4	-	-
	Apollo Marine	1	1	0.5	0.5	-
	BBQ Chef	-	2	-	0.6	-
	Carousell Singapore	9	3	3.3	0.3	-
	Chin Guan Hong	2	-	-	-	-
	Emperor Brand	4	3	4.0	0.3	-
	Evergreen Seafood	1	-	0.4	-	-
	Facebook group (Blooming-ton Sea Cucumber)	2	-	-	-	-
	Joo Hwa Food	1	-	0.5	-	-
	Lazada Singapore	16	16	58.2	16.0	-
	Natural Brand	4	3	2.0	0.5	-
	New Island Food Supplier	6	6	5.0	3.6	-
	Ninja Food	-	1	-	0.1	-
	Qoo10 Singapore	13	12	6.4	1.1	-
	Sea Cucumber Singapore	5	-	-	-	-
	Shopee Singapore	10	16	211.1	2,957.6	-
	Sin Ocean Pte. Ltd.	6	4	-	-	-
	Singapore Expats Classifieds	-	1	-	4.1	-
	Song Fish Dealer Pte. Ltd.	1	1	1.0	0.3	-
Tradekey Singapore	15	-	270.0	-	1,900 ^{**}	
MY SUBTOTAL	10 ONLINE SITES; 156 ADS	100	69	564.8	2,985.0	1,900
SG & MY 	Standard Gourmet	-	1	-	-	-
	Tam Kah Shark's Fin & Seafood	-	13	-	1.7	-
SG & MY SUBTOTAL	2 ONLINE SITES; 14 ADS	-	14	-	1.7	-
TOTAL	33 ONLINE SITES	177	162	2,043	3,504	4,100
		339		5,547		

*MY = Malaysia; SG = Singapore .

^{*}1,600 kg is indicated as monthly basis, while another 100 kg as weekly basis.




^{**}700 kg is indicated as monthly basis

There was a total of 114 unique sellers who offered sea cucumber and fish maw in the surveyed online sites. Among them, 22 sellers offered both sea cucumber and fish maw, while 54 offered only sea cucumber and 38 offered only fish maw (Table 4). Some sellers were also active in offering such products in more than one online site. It was observed that among 65 sellers who offered sea cucumber

and fish maw in Singaporean online sites, at least 9 were identified to offer such products in more than one site each, across five different Singaporean online sites. There were also at least four unique sellers who offered sea cucumber and fish maw in more than one site each, across seven different Malaysian and Singaporean online sites.

TABLE 4

Number of unique sellers offering sea cucumber and fish maw products in the surveyed online sites.

ONLINE SITE USED BY SELLERS TO OFFER PRODUCTS	NO. OF UNIQUE SELLERS OFFERING PRODUCTS			TOTAL
	SEA CUCUMBER	FISH MAW	SEA CUCUMBER & FISH MAW	
 Malaysian online site	20	17	8	45
 Singaporean online site (some across multiple Singaporean sites, e.g. Lazada SG and Qoo10 SG)	34	19	12	65
 Malaysian and Singaporean sites (including across multiple Malaysian sites and Singaporean sites, e.g. Lazada MY, Shopee MY and Shopee SG)	0	2	2	4
TOTAL	54	38	22	114

* Note: One business website is counted as one unique seller in this analysis. MY = Malaysia; SG = Singapore.

JANUARY 2022 UPDATE

A follow-up check of the surveyed sites was done on 14 January 2022. There were many new listings, with searches having to go back many pages to find the listings from the original survey. These indicate that the trade remains active and the findings from the June-July 2020 survey are still relevant. Other highlights:

- Tradenames of CITES-listed species still observed (eg: White teatfish and Black teatfish)
- One of the previously open Facebook group has been changed to a closed group
- Based on visual appearance, some new species not previously recorded are likely being offered for sale.
- *Gamat* and wellness products still present in similar quantities
- Like the 2020 research, price range varied widely amongst sellers and were similar in value
- A few new source countries in the Middle East were recorded



SEA CUCUMBER SUMMARY

The 177 advertisements and posts on sea cucumber were observed under three commodity types – dried sea cucumber, frozen sea cucumber and cooked sea cucumber. Dried sea cucumber was by far the most common commodity type, making up 74.6% of the total sea cucumber observations (Table 5). Dried sea cucumber was also the priciest commodity type costing an average of USD258.8 per kg.

TABLE 5

Average price per kilogramme and proportion sea cucumber offered by commodity type.

COMMODITY TYPE	Dried Sea Cucumber	Frozen Sea Cucumber	Cooked Sea Cucumber
NO. OF ADVERTISEMENTS AND POSTS	132	44	1
AVERAGE PRICE (USD/KG)	258.8	75.8	N/A
PROPORTION OF TOTAL SEA CUCUMBER COMMODITIES (%)	74.6	24.9	0.6

Based on the description provided in 114 advertisements and posts (64% of 177 total sea cucumber advertisements and posts), sea cucumbers from at least seven genera were identified – *Actinopyga*, *Apostichopus*, *Bohadschia*, *Holothuria*, *Phyllophorus*, *Stichopus* and *Thelenota*. Genera from the remaining 63 posts could not be determined. For all genera, it was difficult to identify the exact species that was offered for sale, but a list of 20 possibilities was collated (Dissanayake et al., 2010; Purcell et al., 2012; Conand et al., 2014; Byrne and O'Hara, 2017). This is shown in Table 6 along with their respective trade names.

TABLE 6

List of sea cucumber genera and possible species traded online in Malaysia and Singapore with respective trade names offered online from June – July 2020.

GENERA	POSSIBLE SPECIES	TRADE NAME
<i>Actinopyga</i>	<i>A. echinites</i>	Deep water redfish
	<i>A. lecanora</i>	Stonefish
	<i>A. mauritiana</i>	Surf redfish
	<i>A. miliaris</i>	Blackfish
<i>Apostichopus</i>	<i>A. japonicus</i>	Prickly sea cucumber, thorny sea cucumber, <i>ci shen</i> (刺参)
<i>Bohadschia</i>	<i>B. atra</i>	Tigerfish
<i>Holothuria</i>	<i>H. atra</i>	Lollyfish
	<i>H. edulis</i>	Pinkfish
	<i>H. fuscogilva</i>	White teatfish, teatfish, <i>zhu po shen</i> (猪婆参)
	<i>H. fuscopunctata</i>	Elephant's trunkfish
	<i>H. lessoni</i>	Golden sandfish, golden sea cucumber <i>jin sha shen</i> (金沙参), <i>guang tu shen</i> (光秃参)
	<i>H. nobilis</i>	Black teatfish, teatfish, <i>zhu po shen</i> (猪婆参)
	<i>H. scabra</i>	Sandfish, <i>wen tu shen</i> (文秃参), <i>tu shen</i> (秃参)
	<i>H. spinifera</i>	Discofish, brown sandfish
	<i>H. whitmaei</i>	Black teatfish, teatfish, <i>zhu po shen</i> (猪婆参)
<i>Phyllophorus</i>	Unknown	Ball sea cucumber, <i>bola-bola</i>
<i>Stichopus</i>	<i>S. chloronotus</i>	Pinkfish
	<i>S. hermanni</i> (prev. <i>S. variegatus</i>), <i>S. ocellatus</i> or <i>S. vastus</i>	Curryfish
<i>Thelenota</i>	<i>T. ananas</i>	Red pricklyfish

29%
sea
cucumber
advertisements
has Indonesia as
its origin country

Of the 114 posts and advertisements that could be identified to its genera, 85 of them had accompanying price listings. Sea cucumbers from the genera *Holothuria* was the most commonly encountered while those from the genera *Apostichopus* and *Holothuria* were the more expensive varieties (Table 7). The reported origin of all sea cucumber observations recorded (regardless of whether they were identified to the genus level) was very diverse, with products claimed to be originating from at least 15 countries – Australia, Canada, China, Egypt, Indonesia, Japan, Malaysia, Maldives, Mauritius, Papua New Guinea, Philippines, Solomon Islands, Sri Lanka, Vietnam, Yemen as well as unspecified countries in Africa and South America. Among them, Indonesia and Australia appeared to be the most frequently indicated countries of

origin. Out of 99 sea cucumber advertisements and posts where information on origin was included, Indonesia was indicated as the country of origin in 29 (29%) advertisements and posts, while Australia was indicated in 21 (21%) advertisements and posts. In Indonesia and Malaysia, some sellers listed more specific localities where sea cucumbers are harvested which enabled the identification of possible hotspots for the harvesting of sea cucumber within the two countries. In Indonesia, Kupang, Nusa Tenggara and Maluku were identified and in Malaysia, Langkawi and Sabah were identified. Although, it must be noted that online sellers are also known to intentionally mislabel the origins of their products as sea cucumbers from certain source locations, where they are perceived to be of a higher quality than those from other locations.

TABLE 7

Average price per kilogramme (wholesale and retail) for the possible sea cucumber genera along with their reported origins.

GENERA	NO. OF ADVERTISEMENTS AND POSTS	AVERAGE PRICE (USD/KG)	REPORTED ORIGIN
<i>Actinopyga</i>	8	70.1	Indonesia (Nusa Tenggara), Maldives, Papua New Guinea, Sri Lanka
<i>Apostichopus</i>	8	492.9	Australia, China, Japan
<i>Bohadschia</i>	5	56.5	Viet Nam
<i>Holothuria</i>	78	258.7	Africa (country unspecified), Australia, Egypt, Indonesia (Nusa Tenggara, Maluku, Kupang), Japan, Malaysia (Sabah), Maldives, Papua New Guinea, Philippines, Solomon Islands, Sri Lanka, Viet Nam
<i>Phyllophorus</i>	5	97.1	Indonesia, Malaysia
<i>Stichopus</i>	8	188.2	Australia Philippines
<i>Thelenota</i>	2	NA	Australia, Indonesia
TOTAL	114		

CONSERVATION STATUS AND CITES LISTING OF SEA CUCUMBER SPECIES

The conservation status of the various sea cucumber genera, based on the possible species recorded (Table 6) were evaluated using IUCN Red List status (Table 8). Of the 20 possible species, six were considered to be Endangered by IUCN, five were each Vulnerable and Least Concern while four more were Data Deficient.

TABLE 8

Conservation status of possible sea cucumber genera identified during the survey.

GENERA	IUCN STATUS	CITES LISTING
<i>Actinopyga</i>	<i>A. echinites</i> (Vulnerable)	
	<i>A. lecanora</i> (Data Deficient)	
	<i>A. mauritiana</i> (Vulnerable)	
	<i>A. miliaris</i> (Vulnerable)	
<i>Apostichopus</i>	<i>A. japonicus</i> (Endangered)	
<i>Bohadschia</i>	<i>B. atra</i> (Data Deficient)	
<i>Holothuria</i>	<i>H. atra</i> (Least Concern)	
	<i>H. edulis</i> (Least Concern)	
	<i>H. fuscogilva</i> (Vulnerable)	Appendix II
	<i>H. fuscopunctata</i> (Least Concern)	
	<i>H. lessoni</i> (Endangered)	
	<i>H. nobilis</i> (Endangered)	Appendix II
	<i>H. scabra</i> (Endangered)	
	<i>H. spinifera</i> (Data Deficient)	
<i>H. whitmaei</i> (Endangered)	Appendix II	
<i>Phyllophorus</i>		
<i>Stichopus</i>	<i>S. chloronotus</i> (Least Concern)	
	<i>S. hermanni</i> (Vulnerable)	
	<i>S. ocellatus</i> (Data Deficient)	
	<i>S. vastus</i> (Least Concern)	
<i>Thelenota</i>	<i>T. ananas</i> (Endangered)	

Subsequently, CITES appendices were checked for listings of any of the identified species. Although there were a number of IUCN Endangered species offered, only three are listed in the CITES appendices, namely *H. fuscogilva*, *H. nobilis* and *H. whitmaei*. Due to the fact that they are listed in CITES, these three species are protected under Malaysia's

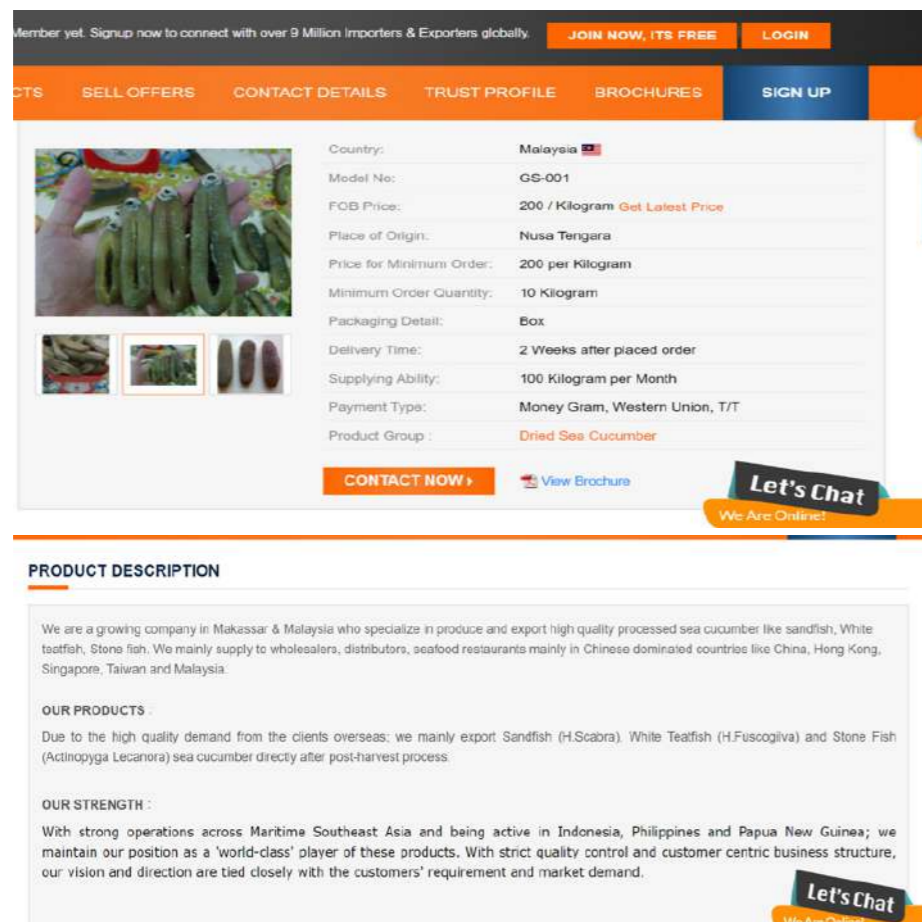
INTESA and Singapore's ESA, two pieces of legislation that aim to regulate the import and export of CITES-listed species in both countries. It is worth noting however that the CITES listings of these three species only came into effect in September 2020. As such the listings that were observed during this study were not subject to CITES regulations.

H. fuscogilva, *H. nobilis* and *H. whitmaei* are all traded under the four trade names of teatfish, black teatfish, white teatfish or *zhu po shen*. It is yet unclear whether the trade names correspond to a specific species or whether a mixture of these three species are sold under some of the same trade names. A closer look at the data showed that collectively, these four trade names were recorded from 21 advertisements and posts (18.4% of 114 sea cucumber advertisements and posts identifiable to at least the genus level) during our survey and had an average price of USD212.36 per kg. Sellers who had indicated their supplying ability for these three species have stated that they can supply within 100 kg and 1,000 kg dried sea cucumber of these species, and among them, three sellers indicated that they can supply 100 kg to 500

kg of such commodities in a monthly basis (Figure 3). Accumulatively in a recurring fashion, the quantity of these species in trade could reach a considerable volume in the long term. With the three species being listed under CITES Appendix II, efforts should be made to ensure trade involving these species strictly adhere to regulations, especially when the supplying ability of online sellers suggests large quantities and implicating multiple source countries. Governments should also scrutinise records for CITES-listed species traded, to assure that there is no misreporting or illegal trade and verify trade in pre-Convention specimens. Origins of these species were stated to be from at least six countries, namely Indonesia (Nusa Tenggara, Kupang), Philippines, Papua New Guinea, Sri Lanka, Australia, Malaysia (Sabah).

FIGURE 3

Screenshot of a Tradekey advertisement where seller claimed to be a main exporter of sea cucumber (*H. scabra*, *H. fuscogilva*, *Actinopyga lecanora*) with the claimed supplying ability of 100 kg monthly.





SEA CUCUMBER HEALTH AND SKINCARE PRODUCTS

Separately, there were an additional of 48 advertisements from nine online sites that offered sea cucumber health and skincare products (Table 9). These products contained unspecified amount of sea cucumber extracts, which were offered in various forms and product types such as jelly, mask, pill, oil, liquid cleanser, bar soap and concentrated liquid essence. They were advertised as being able to confer positive benefits to improve one's health and skin condition.

TABLE 9

Online sites and number of advertisements offering sea cucumber health and skincare products.

COUNTRY OF ONLINE SITE	ONLINE SITE	NO. OF ADS
 Malaysia 6 sites; 27 ads	Adpost.com Malaysia	2
	Carousell Malaysia	8
	Lazada Malaysia	3
	Qoo10 Malaysia	5
	Shopee Malaysia	7
	Tradekey Malaysia	2
 Singapore 3 sites; 21 ads	Lazada Singapore	8
	Qoo10 Singapore	6
	Shopee Singapore	7
TOTAL		48

There were three prominent brands that were identified to be selling these sea cucumber products – Luxor, Al-Insaan and Gold-G Bio – which made up 52% of all sea cucumber health and skincare products. Luxor and Al-Insaan are companies based in Malaysia while Gold-G Bio is an Indonesian company. All three brands claimed to use sea cucumber extracts from *Stichopus hermanni* (IUCN Vulnerable), although the this could possibly be a mixture of *Stichopus hermanni* and

Stichopus horrens. Although the exact amount of sea cucumber present in these health and skincare products were unclear, overharvesting of *Stichopus hermanni* has been reported to cause population declines in Malaysia. The *Stichopus hermanni* fishery in Langkawi collapsed in the 1990s after the species was overharvested for medicinal use (Choo, 2004). Any further unregulated harvest and trade in the species could cause further collapse in wild populations elsewhere in the country.




52%
sea cucumber health and skincare products were sold by 3 prominent brands



FISH MAW SUMMARY

A total of 162 advertisements and posts for fish maw were found during the survey, recorded under five commodity types – dried fish maw, roasted fish maw, fried fish maw, frozen fish maw and cooked fish maw. Dried fish maw was the most common commodity type, making up 59.3% of the total advertisements and posts (**Table 10**). It was also the priciest commodity type with an average price of USD270.4 per kg.

TABLE 10
Average price per kilogramme and proportion sea cucumber offered by commodity type.

COMMODITY TYPE					
	Dried Fish Maw	Roasted Fish Maw	Fried Fish Maw	Frozen Fish Maw	Cooked Fish Maw
NO. OF ADVERTISEMENTS AND POSTS	96	12	41	11	2
AVERAGE PRICE (USD/KG)	270.4	134.4	52.8	45.0	N/A
PROPORTION OF TOTAL FISH MAW COMMODITIES (%)	59.3	7.4	25.3	6.8	1.2

For fish maw, only 73 entries (45% of 162 total fish maw advertisements) were identifiable to their possible taxa (based on clarity of images posted and description available), and of those, 56 had prices listed. Some ambiguity still remained for species identification of the trade names as some grades or types of fish maw sold were sourced from several species. The possible taxa for trade names

were collated. In total, 15 possible species, three genera (*Cynoscion*, *Gadus*, *Merluccius*) and two families (*Acipenseridae*, *Cyprinidae*) were identified (**Table 11**). For fish maw, it was easier to classify the products by their reported trade names instead of species as some trade names had the possibility of being fish from different genera.

TABLE 11
List of possible fish maw taxa traded online in Singapore and Malaysia with respective trade names and conservation status.

TRADE NAMES	TAXA	IUCN STATUS
Sturgeon	Acipenseridae	Most species Critically Endangered
Chiarella/Corvina, Corvina drum	<i>Cilus gilberti</i>	Data Deficient
	<i>Larimichthys polyactis</i>	Not Evaluated
Croaker	<i>Cynoscion spp.</i>	
	<i>Protonibea diacanthus</i>	Not Evaluated
	<i>Larimichthys crocea</i>	Not Evaluated
Carp	Cyprinidae	
Senangin	<i>Eleutheronema tetradactylum</i>	Not Evaluated
Jewfish, Atlantic goliath grouper	<i>Epinephelus itajara</i>	Vulnerable
Cod	<i>Gadus spp.</i>	
Seabass, barramundi, Asian sea bass, siakap, kakap cina	<i>Lates calcarifer</i>	Least Concern
Nile perch	<i>Lates niloticus</i>	Least Concern
Huang hua fish (黄花)	<i>Lates niloticus</i>	Least Concern
	Croaker species	
Grass seabass, grass fish	<i>Lates calcarifer</i>	Least Concern
	<i>Lates niloticus</i>	Least Concern
	Croaker species	
Threadfin, ikan kurau, ngoh her	<i>Leptomelanosoma indicum</i>	Not Evaluated
Hake	<i>Merluccius spp.</i>	
Ling fish	<i>Molva molva</i>	Not Evaluated
Eel	<i>Muraenox cinereus</i>	Not Evaluated
	<i>Congresox talabonoides</i>	Not Evaluated
Shuang ya fish (双牙)	<i>Otolithoides biauritus</i>	Not Evaluated
Patin, Pangasius	<i>Pangasius spp.</i> or <i>Pangasionodon spp.</i> (probably <i>Pangasius bocourti</i> or <i>Pangasionodon hypophthalmus</i>)	<i>Pangasius bocourti</i> (Least Concern) <i>Pangasionodon hypophthalmus</i> (Endangered)
Golden dragon fish maw, jin long fish maw (金龙)	<i>Lates niloticus</i>	Least Concern
	<i>Larimichthys crocea</i>	Critically Endangered
	other croaker species	

Fish maw from the eel group (13 advertisements) were the most commonly encountered types of fish maw (Figure 4). *Shuang ya*, Nile perch, eel and ling fish maw were the more expensive varieties while patin fish maw was by far the cheapest (Table 12). The fish maw types with “NA” for average price had less than five entries and therefore average price per kg could not be accurately evaluated.

The reported origins of the fish maw (regardless of whether they were identified to the genus level) were diverse as well, covering at least 13 countries – Australia, Canada, Hong Kong (transshipment), India, Indonesia, Malaysia, New Zealand, Norway, Panama,

Philippines, South Africa, Thailand, United States of America as well as unspecified countries in Asia and South America. Among them, Indonesia and Thailand appeared to be the most frequently indicated countries of origin. Out of 49 fish maw advertisements and posts where product origin was included, Indonesia was indicated as the country of origin in 9 (18%) advertisements and posts, while Thailand was indicated in 7 (14%) advertisements and posts. Some types of fish maw were only found to be offered in either Malaysia or Singapore during the survey. For example, Ling fish was found to be sold only in Malaysia, while Corvina and *Shuang ya* fish maw were only found to be sold in Singapore.

FIGURE 4

Screenshot of eel fish maw being offered in Shopee.

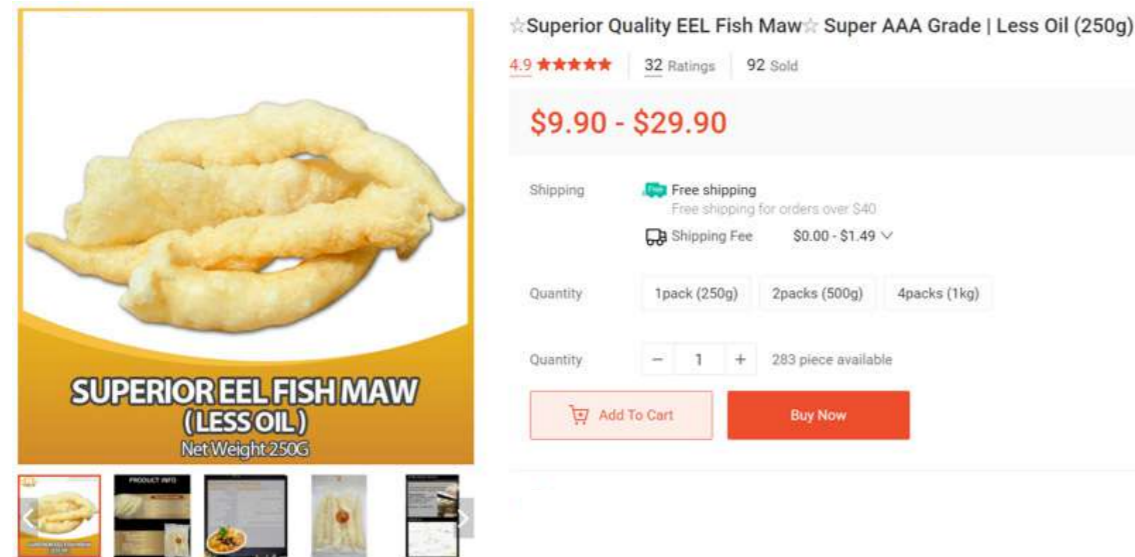


TABLE 12

Average price per kilogramme for the possible fish maw by taxa, along with reported origins.

TAXA	TRADE NAMES/TYPE	NO. OF ADVERTISEMENTS AND POSTS	AVERAGE PRICE (USD/KG)	REMARKS	REPORTED ORIGIN
<i>Acipenseridae, Merluccius spp., Muraenesox cinereus, Cynoscion spp., Protonibea diacanthus, Larimichthys crocea, Cyprinidae</i>	Assorted	1	NA		Asia, New Zealand, USA
<i>Cilus gilberti</i> or <i>Larimichthys polyactis</i>	Corvina	2	NA	Offered in Singapore only	Indonesia
<i>Eleutheronema tetradactylum</i>	Senangin	1	NA		
<i>Epinephelus itajara</i>	Jewfish	1	NA		
<i>Gadus spp.</i>	Cod	9	193.2		South Africa, New Zealand, Norway, Australia
<i>Lates calcarifer</i>	Seabass, Siakap	5	197.1		
<i>Lates calcarifer, Lates niloticus</i> or croaker species	Grass seabass, grass fish	1	NA		
<i>Lates niloticus</i>	Nile perch	6	290.7		South Africa
<i>Lates niloticus</i> or croaker species	Huang hua fish (黄花)	4	NA		Canada, Panama
<i>Lates niloticus, Larimichthys crocea</i> or other croakers	Golden dragon fish maw, jin long fish maw (金龙), dragon fish maw	4	NA		
<i>Leptomelanosoma indicum</i>	Threadfin, senangin, kurau	9	117.2		Thailand
<i>Molva molva</i>	Ling fish	5	210.5		New Zealand
<i>Muraenesox cinereus</i> or <i>Conger talabonoides</i>	Eel	13	232.6		Thailand
<i>Otolithoides biauritus</i>	Shuang ya fish (双牙)	7	366.1		India, Indonesia
<i>Pangasius spp.</i> probably <i>Pangasius bocourti</i> or <i>Pangasionodon hypophthalmus</i>	Patin, Silver fish	5	48.4		
TOTAL		73			

CONSERVATION STATUS AND CITES LISTING OF FISH MAW SPECIES

Conservation status of these possible taxa were also evaluated, again using IUCN Red List status. Generally, marine fishes are understudied in terms of conservation status and as a result, a significant number of the possible species identified are deemed Data Deficient. There are a few possible species that are Endangered or Vulnerable including *Pangasionodon hypophthalmus*, *Epinephelus itajara* and several species in the family Acipenseridae. Of all the possible species recorded, only sturgeons are listed in CITES, which translates to them being protected under Malaysia's INTESA and Singapore's ESA. However, it was unknown which CITES Appendix I or II species was recorded in the survey.



CONCLUSIONS AND RECOMMENDATIONS

These findings, recorded over a mere 11-days shows that online advertising in these two commodities in Malaysia and Singapore is highly active and involves a range of species and substantial quantities sold. It points to species that are of high conservation value being traded, which requires more scrutiny from the perspectives of its regulation.

The total weight of sea cucumber and fish maw commodities offered in the online sites surveyed was large, and the supplying ability indicated by some sea cucumber sellers was also considerably large. Among them were three sellers who claimed to have a supplying ability of 100 kg to 500 kg of CITES-listed sea cucumber on a monthly basis. Data from seizure records reinforce the high level of trafficking for sea cucumbers.

The presence of endangered species offered online, and involving a diverse range of trade countries, warrant the need for a close monitoring in this trade to ensure strict compliance to national and CITES regulations. This also translates to the need for a robust regulation system for these commodities. True volumes and species in trade are often difficult to verify, particularly when the reported trade names in the various languages is varied. However, as with any rapid research of this nature, a degree of uncertainty remains for the traded commodities, including identification of taxa using trade names. More robust data is needed to better estimate the actual

volume available for sale as not all sellers have indicated the weight of products offered and their supplying ability, and as such the data obtained is not sufficient for extrapolation.

As with the business websites surveyed, most sellers on the online platforms are operated by shops or companies that have established brand names as well as active online accounts continuously advertising sea cucumber and fish maw products, so it is assumed that they too hold sufficient quantities of these products to engage in online trade. Even though trade in both fish maw and sea cucumber is abundant in physical marketplaces and online platforms in both countries, current regulatory systems for the harvest and trade in sea cucumbers and fish maw appear to be lacking any level of robustness.

Although it is not possible to make detailed recommendations from a rapid assessment alone, this research highlights areas that would benefit from further scrutiny to ensure trade is legal and sustainable.

Online trade is clearly active and monitoring and investigations into this should be expanded. Despite the researchers' care to verify and identify its possible taxa as much as possible, photos alone do not provide the resolution needed to ascertain all species in trade. This research also pointed to species that could be globally threatened. Online trade monitoring should therefore be conducted in conjunction with physical shop surveys. This will allow better identification of the species in trade. More comprehensive physical shop and online trade surveys will enable a more complete understanding on the scale of the overall trade, and support and regulatory interventions. This, along with DNA analysis from sample products offered online and in physical marketplaces, would allow for better identification of the species in trade, and help determine what proportion of overall trade constitute species that are threatened, endangered or prohibited from trade.

ONLINE AND PHYSICAL MARKET MONITORING BY GOVERNMENTS, NGOS AND RESEARCH INSTITUTIONS

REGULATION, MANAGEMENT AND REPORTING BY GOVERNMENTS

Three sea cucumber species recorded in trade were listed on CITES Appendix II in 2019, and therefore their international trade must be governed appropriately for assurance of a legal and sustainable trade. A scrutiny into existing regulation is key to this. This could include any or all of the following: species permitted for catch and trade, either domestic or international, permit or licensing requirements, studies on non-detrimental findings to better guide species harvest levels including quota-setting, reporting requirements by harvesters and traders. Towards strengthening management and regulations, governments are encouraged to adopt harmonised code modifications and introduce traceability systems to support verification and confidence in the legal and sustainable supply of products in the market. Such traceability actions would support verification and confidence of legal and sustainable products in the market. CITES guidance on traceability requirements (CITES, 2021) is key to this process. This may also be pursued based on other piloted traceability tools such as TRAFFIC's SharkTrace, which can be modified to be applied to the fish maw and sea cucumber trade. These measures collectively will assist countries with implementing national regulations and meeting their CITES requirements.

As this trade is international and involves species that are regulated by national laws and governed by CITES internationally, countries making seizures of sea cucumbers and fish maw should prioritise the identification of species seized, to determine if species that are threatened or endangered are targeted for trade. This is crucial to ascertain actual legal and illegal trade impacting any particular species and aid any management and regulation effort.

For both maw and sea cucumbers, the opportunity for misleading consumers (given high price differentials among species) is high and this appeared to have occurred for fish maw already. Once further research and scrutiny in this trade is conducted, efforts to coordinate and engage with regulators, local authorities and businesses to improve food labelling will be important, so that consumers know what they are buying.

RESEARCH BY GOVERNMENTS, NGOS AND OTHER INSTITUTIONS

An expansion and verification of the species identity of the various trade names for sea cucumber and fish maw is also urgently needed for better monitoring. A comprehensive search online only yields literature documenting the species identity of English trade names. This is of little use in countries such as Malaysia and Singapore where a large amount of sea cucumbers and fish maw are only known or listed by their Chinese and Malay trade names. Further effort is needed into matching Chinese and Malay trade names to species identifications. These proposed efforts, if combined, can serve to be a very useful tool in supporting and better managing fisheries resources, especially in ensuring legal and sustainable trade involving not just Malaysia and Singapore, but other countries along the trade chain. NDF studies should also be considered by range countries, especially for the CITES-listed *Holothuria fuscogilva*, *Holothuria nobilis* and *Holothuria whitmaei*, to aid regulators and businesses ensure that trade in sea cucumbers and fish maws are legal and sustainable, and not a detriment to the survival of species.

REFERENCES

Anderson, S. C., Flemming, J. M., Watson, R., and Lotze, H. K. (2011). Serial exploitation of global sea cucumber fisheries. *Fish and Fisheries*, 12: 317-339.

Azzaro, C. (2019). French Guiana grapples with Asian craving for fish bladder. *Pys.Org*. <https://phys.org/news/2019-08-french-guiana-grapples-asian-craving.html>. Viewed 03 November 2020.

Bagumire, A., Muyanja, C. K., Kiboneka, F. W. (2018). *The value chain analysis of Nile perch maw trade in East Africa*. The responsible fisheries business chains project of Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). 85pp.

Boey, C. C. (1988). Fish processing in Singapore. In *Proceedings of the Twentieth Anniversary Seminar on Development of Fish Products in Southeast Asia, Singapore, 27-31 October 1987*, Marine Fisheries Research Department, Southeast Asian Fisheries Development Center, Singapore. p. 28-31.

Bondaroff, T. P. (2020). Sea Cucumber Crime In India. *OceansAsia*. <https://oceansasia.org/sea-cucumber-crime-in-india/>. Viewed 12 November 2020.

Byrne, M. and O'Hara, T. D. (2017). *Australian echinoderms: Biology, ecology and evolution*. Clayton South, VIC: CSIRO Publishing, 624pp.

Choo, P.S. (2004). Fisheries, trade and utilization of sea cucumbers in Malaysia. In: Lovatelli, A., Conand, C., Purcell, S., Uthicke, S., Hamel, J.-F., and Mercier, A. (Eds.), *Advances in Sea Cucumber Aquaculture and Management*. FAO Fisheries Technical Paper No. 463, FAO, Rome, Italy. p57-68.

CITES. (2021). Traceability. https://cites.org/eng/prog/Cross-cutting_issues/traceability

Clarke, S. (2002). Trade in Asian dried seafood: characterization, estimation and implications for conservation. *WCS Working Paper No. 22, December 2002*. Wildlife Conservation Society, USA. 95pp.

Conand, C. (2004). Present status of sea cucumber resources and utilization: An international overview. In: Lovatelli, A., Conand, C., Purcell, S., Uthicke, S., Hamel, J.-F., and Mercier, A. (Eds.), *Advances in Sea Cucumber Aquaculture and Management*. FAO Fisheries Technical Paper No. 463, FAO, Rome, Italy. p13-23.

Conand, C., Polidoro, B., Mercier, A., Gamboa, R., Hamel, J. and Purcell, S. (2014). The IUCN Red List Assessment of Aspidochirotid sea cucumbers and its implications. *SPC Beche-de-mer Information Bulletin*, 34: 1-6.

Constant, R., Okes, N., Bürgener, M., Louw, S. and Frank, M. (2020). Maw Trade: A rapid assessment of the trade in fish swim bladders from Africa to Hong Kong SAR. *TRAFFIC Report*. TRAFFIC, Cambridge, UK. 22pp.

Dissanayake, D. C. T., Athukorala, S. and Amarasinghe, C. (2010). Present status of the sea cucumber fishery in Sri Lanka. *SPC Beche-de-mer Information Bulletin*, 30: 1-8.

FAO. (2020a). Singapore sea cucumber trade flow from 2010 to 2018. *Fisheries and Aquaculture Information and Statistics Branch*. http://www.fao.org/figis/servlet/SQServlet?file=/usr/local/tomcat/8.5.16/figis/webapps/figis/temp/hqp_8348967640105466973.xml&outtype=html. Viewed 13 November 2020.

FAO. (2020b). Malaysia sea cucumber trade flow from 1980 to 1989. *Fisheries and Aquaculture Information and Statistics Branch*. http://www.fao.org/figis/servlet/SQServlet?file=/usr/local/tomcat/8.5.16/figis/webapps/figis/temp/hqp_2194179562121529600.xml&outtype=html. Viewed 13 November 2020.

FAO. (2020c). Malaysia sea cucumber trade flow from 2010 to 2018. *Fisheries and Aquaculture Information and Statistics Branch*. http://www.fao.org/figis/servlet/SQServlet?file=/usr/local/tomcat/8.5.16/figis/webapps/figis/temp/hqp_1113261280921141798.xml&outtype=html. Viewed 13 November 2020.

Ferdouse, F. (2004). World markets and trade flows of sea cucumber/beche-de-mer. In: Lovatelli, A., Conand, C., Purcell, S., Uthicke, S., Hamel, J.-F., and Mercier, A. (Eds.), *Advances in Sea Cucumber Aquaculture and Management*. FAO Fisheries Technical Paper No. 463, FAO, Rome, Italy. P101-118.

GovHK. (2020). Hong Kong Customs makes suspected scheduled fresh totoaba fish maw seizure worth about \$44 million this year. *The Government of the Hong Kong Special Administrative Region Press Releases*. <https://www.info.gov.hk/gia/general/202010/31/P2020103100275.htm?fontSize=1>. Viewed 03 November 2020.

Ho, K. H. K. and Shea, S. K. H. (2016). Comparison Report: The 2009 and 2014 surveys on shark consumption habits and attitudes in Hong Kong, Bloom Association Hong Kong, Hong Kong, 34pp.

Louw, S. and Bürgener, M. (2020). A Rapid Assessment of the Sea Cucumber trade from Africa to Asia. *TRAFFIC Report*. TRAFFIC, Cambridge, UK. 20pp.

Okes, N. and Sant, G. (2019). An overview of major shark traders, catchers and species. *TRAFFIC Report*. TRAFFIC, Cambridge, UK. 38pp.

Purcell, S. W., Samyn, Y. and Conand, C. (2012). Commercially important sea cucumbers of the world. *FAO Species Catalogue for Fishery Purposes*. No. 6. Rome, FAO. 150pp.

Purcell, S. W., Mercier, A. and Conand, C. (2013). Sea cucumber fisheries: global analysis of stocks, management measures and drivers of overfishing. *Fish and Fisheries*, 14(1): 34-59.

Purcell, S. W., Williamson, D. H. and Ngaluafé, P. (2018). Chinese market prices of beche-de-mer: Implications for fisheries and aquaculture. *Marine Policy*, 91: 58-65.

Rahman, M. A., Chowdhury, S. H., Hasan, M. J., Rahman, M. H., Yeasmin, S. M., Farjana, N., Molla, M. H. R. and Parvez, M. S. (2020). Status, Prospects and Market Potentials of the Sea Cucumber Fisheries with Special Reference on Their Proper Utilization and Trade. *Annual Research and Review in Biology*, 35(7): 84-101.

Rahman, M. A. and Yusoff, F. M. (2017). Sea Cucumber fisheries: market potential, trade, utilization and challenges for expanding the production in the South-East Asia. *Int J Adv Chem Engg Biol Sci*, 4(1): 26-30.

Sadovy de Mitcheson, Y., Andersson, A. A., Law, C. S. W., Hau, L. C. Y. and Pauly, D. (2018). Out of control means off the menu: The case for ceasing consumption of luxury products from highly vulnerable species when international trade cannot be adequately controlled; shark fin as a case study. *Marine Policy*, 98: 115-120

Sadovy de Mitcheson, Y., To, A. W., Wong, N. W., Kwan, H. Y. and Bud, W. S. (2019). Emerging from the murk: threats, challenges and opportunities for the global swim bladder trade. *Rev Fish Biol Fisheries*, 29: 809-835.

Sakthivel, M. and Swamy, P. K. (1994). International trade in sea cucumbers. *Bulletin of the Central Marine Fisheries Research Institute*, 46: 91-98.

Slater, M. (2015). Use and Exploitation of Sea Cucumbers. *Echinoderm Aquaculture*, 4: 57-73.

Tan, C. L. (2016). Demand for fish bladder may wipe out world's rarest ocean mammal. *The Star Online*. <https://www.thestar.com.my/lifestyle/living/2016/01/19/demand-for-fish-bladder-may-wipe-out-worlds-rarest-ocean-mammal>. Viewed 26 October 2020.

Tee, E. S. (2007). Festival eating. *The Star Online*. <https://www.thestar.com.my/lifestyle/health/2007/02/11/festival-eating>. Viewed 02 November 2020.

Wen, J., Zeng, L., Sun, Y., Chen, D., Xu, Y., Luo, P., Zhao, Z., Yu, Z. and Fan, S. (2015). Authentication and traceability of fish maw products from the market using DNA sequencing. *Food Control*, 55:185-189.

WWF. (2020). *Hong Kong's maw trade*. https://d3q9070b7kewus.cloudfront.net/downloads/oceans_hong_kong_s_maw_trade.pdf. Viewed 27 October 2020

Zeng, L., Wen, J., Fan, S., Chen, Z., Xu, Y., Sun, Y., Chen, D. and Zhao, J. (2018). Species identification of fish maw (Porcupinefish) products sold on the market using DNA sequencing of 16S rRNA and COI genes. *Food Control*, 86: 159-162.

Zhang, C. (2019). China renews efforts to crack down on smuggling of totoaba swim bladders. *China Dialogue Ocean*. <https://chinadialogueocean.net/7915-totoaba-swim-bladder-smugglers/>. Viewed 03 November 2020.

Zulfaqar, S., Rahman, M.A. and Yusoff, F.M. (2016). Trends, prospects and utilizations of sea cucumber fisheries in Malaysia. *Int J Adv Agric Environ Engg.*, 3(1): 114-116.

Zulham, A., Hikmah, H. and Shafitri, N. (2019). Fisheries in Merauke: linking fishermen to markets. *IOP Conference Series: Earth and Environmental Science*. 348 (2019) 012051.

IMAGE CREDITS

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Inside sleeve	Fish maws sold in a Malaysian mall	Elizabeth John / TRAFFIC
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8	Fish maws for sale at a market	Stbernardstudio Dreamstime.com
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38	Fish maw is considered as a luxury delicacies in Malaysia and Singapore	HongChan001 Dreamstime.com

JANUARY 2022

WORKING TO ENSURE THE TRADE IN
WILD PLANTS AND ANIMALS IS NOT
A THREAT TO THE CONSERVATION
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