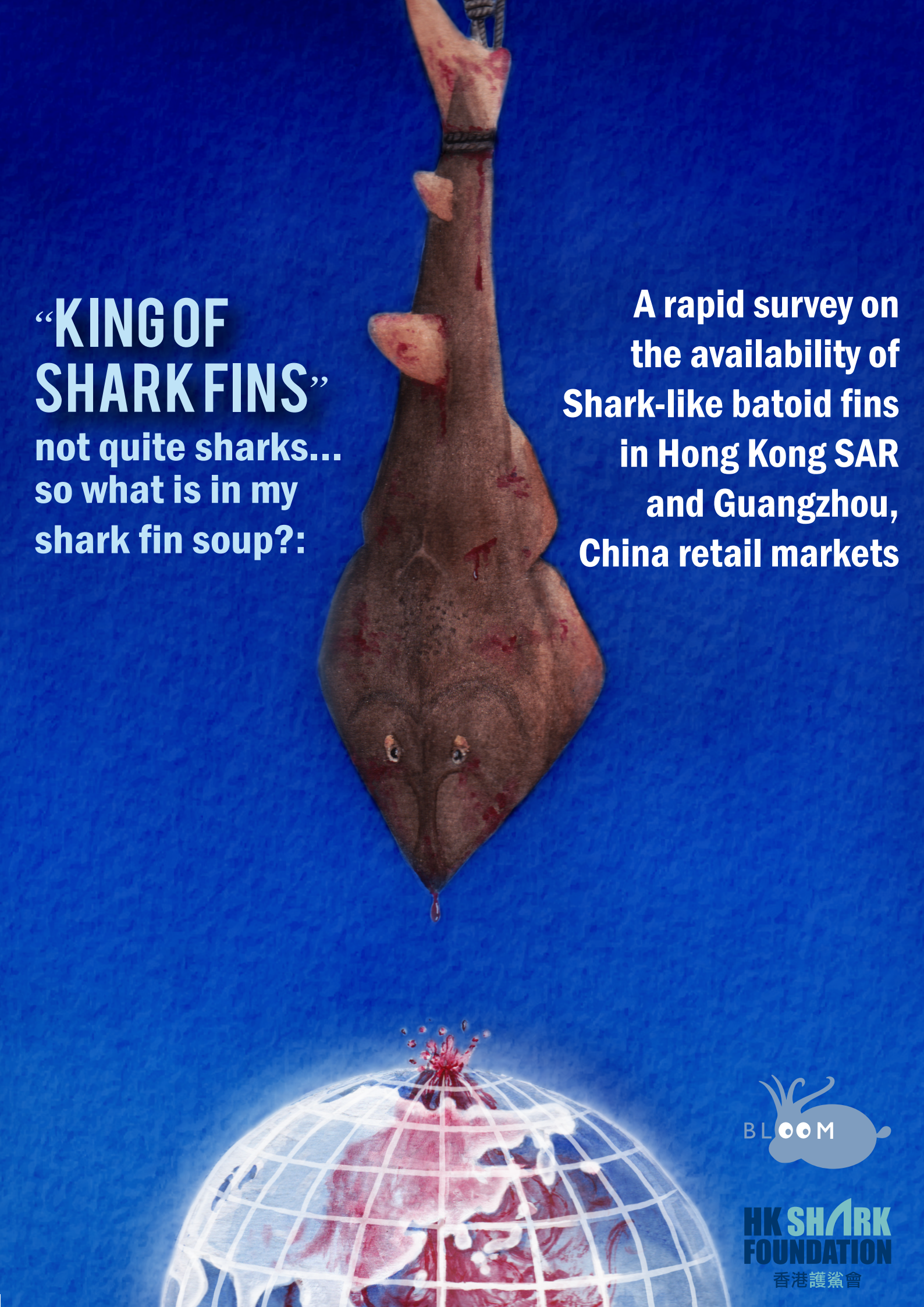
"KING OF SHARK FINS"
not quite sharks...
so what is in my shark fin soup?:
A rapid survey on the availability of Shark-like batoid fins in Hong Kong SAR and Guangzhou, China retail markets
BLOOM
HK SHARK FOUNDATION
香港護鯊會

「翅中之王」不是鯊魚鰭，那麼魚翅羹裡究竟有甚麼？
香港及廣州海味零售市場的鮫總目魚翅鰭供應情況快速調查

With the support of:

HUMANE SOCIETY INTERNATIONAL

WCS

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2018

Acknowledgements

The authors would like to thank Humane Society International (HSI) and Wildlife Conservation Society (WCS) for their generous support to the project, and to ADM Capital Foundation for their support in-kind. Thank you also to Ms. Zerlina Leung for providing the translated text, to Ms. Cherry Ho for the report design, and to Mr. Elvis Wong and all other volunteers for their contributions to the market surveys.

EXECUTIVE SUMMARY

Overexploitation has been a major threat to many chondrichthyan (sharks, batoids, and chimaeras) species causing sharp declines in global populations and even extinction risks. Among all chondrichthyans, some shark-like batoids (sawfishes, wedgefishes, giant guitarfishes and guitarfishes) are considered at the top risks to extinction (Dulvy et al., 2014). Fins from shark-like batoids are categorized as "*Qun chi*" (in Chinese, 群翅 / 裙翅) in Chinese markets, which are also recognized as the "King of shark fins" with their reputed quality and texture (Yeung et al., 2005; Lam, 2010).

Despite their popularity, market studies specific to shark-like batoid fins are still found lacking, and the current status of the contribution of shark-like batoids in global markets is hugely unknown (Chen, 1996; Vannuccini, 1999; Clarke et al., 2007). By filling knowledge gaps in their market and trade, this report aims to facilitate improvements in management and monitoring of the shark-like batoid fin trade. Through extensive market surveys, this report provides market information, including the availability and the average prices of shark-like batoid fins in Hong Kong SAR and Guangzhou, China – both significant trade hubs for fins. This study

摘要

過度捕撈已經對許多軟骨魚 (鯊魚、鰩魚和銀鮫) 構成嚴重威脅，除了令其全球數量銳減，有些甚至面對瀕臨絕種的風險。在所有軟骨魚當中，有些外形與鯊魚相似的鰰總目 (Sawfishes, Wedgefishes, Giant guitarfishes and Guitarfishes) 被視為有滅絕的高風險 (Dulvy 等人，2014 年)。由這些鰰總目身上魚鰭 (下簡稱「鰰魚鰭」) 製成的魚翅，在市場上均歸類為「群翅」或「裙翅」出售，因其品質及口感被譽為「翅中之王」(楊維湘等人，2005 年；林長治，2010 年)。

儘管群翅廣為人知，但以鰰魚鰭為研究目標的市場研究卻仍然缺乏，以致於現時全球市場上的魚翅有多少是屬於鰰魚鰭，全屬未知之數 (陳，1996 年 ; Vannuccini，1999 年 ; Clarke 等人，2007 年)。這份報告通過填補市場和貿易的知識缺口，旨在促進就此等鰰魚鰭貿易的管理及監管的改進。透過廣泛的市場調查，此報告提供了香港及廣州這兩個魚翅貿易樞紐的鰰魚鰭市場資訊，包括是否有售及其銷售價格等。

這項研究亦證實，這些鰰魚鰭在零售市場上至少以「群翅」這個類別出售。

研究結果顯示，在香港及廣州已進行調查的市場中，超過 10% 的海味店 (分別為 12.9% 及 15.5%) 有群翅出售，已加工及未加工的都有。在香港，屬尾鰭下葉的鰰魚鰭比屬其他部位的普遍，但在廣州，較常見

also proves that shark-like batoid fins are retailed at least under the *Qun chi* category.

Study results showed that, in Hong Kong and Guangzhou's surveyed markets, more than one tenth of dried seafood shops (12.9% and 15.5% respectively) were selling *Qun chi*, both processed and unprocessed. Lower caudal fins from shark-like batoids were more common than other fin types in Hong Kong, while in Guangzhou dorsal fins are the more commonly found fin type . Even though most shark-like batoid fins observed in both markets were processed fins, proportions of *Qun chi* were also sold as unprocessed fins (Hong Kong 16.9%; Guangzhou 31.8%). Prevalence of unprocessed fins leaving the skin intact made visual identification relatively easy along the trade route mainly through Hong Kong and mainland China. However, further investigations were needed to understand the reasons behind this practice of leaving shark-like batoid fins unprocessed, which today does not appear to be a common practice for shark fins.

Genetic analyses of *Qun chi* samples bought from surveyed shops revealed at least four species from two families of shark-like batoids, including *Rhina ancylostoma* (Shark ray, also known as

的卻是背鰭。儘管在兩地市場上所見的鰩魚鰭大部份已加工，但亦有部份群翅出售時仍是未經加工的 (香港：16.9%，廣州：31.8%)。未經加工的魚翅留有完整的表皮，在經香港及中國大陸的貿易運送途中亦較容易憑外觀上辨別。至於保留群翅為未加工狀態出售的背後原因，則仍需要進一步調查，因為這似乎並非現時處理魚翅的慣常做法。

從海味店購買的群翅樣本中，經基因分析發現至少涉及分屬兩科的四個物種，包括屬同科的波口鬼頭鱝 (又稱圓犁頭鰩 *Rhina ancylostoma*)、澳洲尖犁頭鰩 (*Rhynchobatus australiae*) 和吉打龍紋鱝 (又稱及達尖犁頭鰩 *Rhynchobatus djiddensis*)，還有屬琵琶鱝科的吻斑犁頭鰩 (*Glaucostegus cemiculus*)。這些品種是以往的鯊魚鰭基因分析研究 (Fields 等人，2017 年) 中未有涵蓋的。

這項研究證明，這些鰩魚鰭製成的魚翅在香港及中國大陸的魚翅貿易中起著明顯的作用。儘管這項研究未能估計群翅的總貨存量，但群翅可於海味店買到，加上鰩魚鰭均以群翅這個類別出售，已清楚顯示了群翅在魚翅貿易的重要性。

此報告建議，為了更好地瞭解和管理這些鰩魚鰭的全球貿易，特別是香港及中國大陸的情況，分析貿易統計數字時有需要作出更仔細的考慮，例如將鰩魚鰭與鯊魚鰭分開統計。現時香港及中國大陸採用的「商品名稱及編碼協調制度」未有提供足夠的資料，因此未能分辨貿易中的鰩魚鰭的分類、狀況 (乾製、新鮮或急凍) 或處理方法 (如鹽腌

Bowmouth guitarfish), *Rhynchobatus australiae* (Bottlenose guitarfish) *Rhynchobatus djiddensis* (Whitespotted wedgefish), and *Glaucostegus cemiculus* (Blackchin guitarfish), in addition to results from previous studies on genetic species identification of shark fins (Fields et al., 2017).

This study proves that fins from shark-like batoids have a clear role in Hong Kong and mainland China's shark fin trade. Although estimations of total volumes of *Qun chi* available and stockpiled in the market was not possible in this study, the availability of *Qun chi* in shops and the designated category of *Qun chi* for shark-like batoid fins are clear indications of importance of *Qun chi* in the trade.

This report recommends that, to better understand and manage global trades of shark-like batoid fins, especially in Hong Kong and mainland China, trade statistics with higher specificity to the taxa of traded products for analysis is necessary, such as separating shark-like batoid fins from fins of sharks. The harmonized system commodity codes currently used in Hong Kong and mainland China do not provide sufficient information on taxonomy, forms (dried, fresh, frozen) or treatments (e.g. salted or in brine) of shark-like batoid fins in the trades. Improvements in specificity of trade statistics can facilitate useful

或鹽漬)。貿易統計的細節化將有助進行有用的分析，為魚翅主要出口地區制訂漁業管理策略，以及在魚翅入口地區制訂貿易管理策略提供重要資料。要保育這些種群，實在有賴國際貿易管制、市場監管及完善執法，三樣缺一不可。

analyses and inform the formulation of strategies in fisheries management in major importing source regions and trade management in importing regions. Effective international trade controls, and monitoring and enforcement will be crucial to the conservation of shark-like batoid populations.

Sampled *Qun chi* of different fin positions and fin categories from markets

INTRODUCTION

"Shark-like batoid" is the term often used to refer to five families of rays (batoids): Pristidae (sawfishes), Rhinidae (wedgefishes), Rhinobatidae (guitarfishes), Glaucostegidae (giant guitarfishes) and Trygonorrhinidae (banjo rays) (Last et al., 2016). Shark-like batoids are harvested in commercial and artisanal fisheries using various types of gears, primarily for their meat and fins. While the meat is often consumed locally, fins from shark-like batoids – being morphologically and biologically similar to fins originating from sharks – enter the international shark fin trade and are considered e valuable fins in the markets due to high ceratotrichia content (Yeung et al., 2005).

While the international trade in shark fins is one of the major threats to shark populations globally, the detrimental impacts of overexploitation of shark-like batoids driven by demand for their fins remains relatively unknown due to lack of species-specific fisheries and trade data. However, despite four of the five families of shark-like batoids (sawfishes, wedgefishes, giant guitarfishes and guitarfishes) being considered among the top elasmobranches (sharks and rays) most at risk of extinctions (Dulvy et al., 2014), to date, little to almost no management has been put in place for these species.

Studies currently available suggest that shark-like batoids are being heavily fished mainly for their valuable fins in many areas throughout their natural distribution, such as Indonesia (White & Sommerville, 2010), Madagascar (Hopkins, 2011), Mozambique (Pierce et al., 2008), Tanzania (Schaeffer, 2004), the Arabian Sea (Jabado, 2018), and west Africa (Diop and Dossa, 2011). However, there have been no market studies specific to shark-like batoid fins, and the latest available research that revealed market information related to these families were completed more than 10 years ago (Chen, 1996, Vannuccini, 1999, Clarke et al., 2007). The current status of the contribution of shark-like batoids in global markets outside of their source regions remains a significant knowledge gap.

In Hong Kong[1] SAR, one of the world's most important trade hubs and consumer markets of shark fins, shark-like batoid fins have been observed to appear consistently in the local retail market, under the category name of "*Qun chi*". While it is common for stores to sell a mix of processed (dried and skinned) and unprocessed (dried, but with skin still

1 All mentions of "Hong Kong" in this report refers to the Hong Kong Special Administrative Region (SAR)

intact) fins, preliminary observations have found that shark-like batoid fins are sold to consumers in the unprocessed form. Up until this study, the reasons behind this preference had not been investigated.

Global shark fin trade

Many chondrichthyan (sharks, batoids, and chimaeras) species are facing rapid population declines and even extinction risks due to overexploitation. In the early 2010s, about 90000 tonnes of chondrichthyans were caught annually, including a large amount of illegal, unreported, and unregulated (IUU) catches (Pauly & Zeller, 2015). Over 17% of chondrichthyan species are now listed as threatened species in the IUCN Red List of Threatened Species (including conservation statuses: Vulnerable, Endangered and Critically Endangered), with another 47% of species classified as Data Deficient (Dulvy et al., 2014; IUCN, 2018). Global chondrichthyan landings have declined for 20% since its peak in 2003 (Davidson et al., 2015). Such depletion in sharks and rays is driven by overfishing, and arguably the major driver of overexploitation continues to be demand in the international shark fin trade (Musick et al., 2000; Baum et al., 2003; Dulvy et al., 2008; Dulvy et al., 2014).

Fins of chondrichthyans ("shark fins" hereafter for simplicity) are traded globally as a traditional and luxurious delicacy, consumed mainly in Asia and among Chinese communities globally (Clarke, 2004a). The large volume international shark fin trade is extremely lucrative. From 2000 – 2011, the annual total value of global imports was USD 377.9 million with an average of 16815 tonnes (Dent & Clarke, 2015).

Recognizing the role that trade played in driving population declines in several of the most overexploited species, governments began to manage some of the shark and ray trade through CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora). CITES is a convention among 183 participating countries and regions (also called Parties), that aims to ensure that international trade in wild plants and animals listed in its Appendices is legal, sustainable and traceable (CITES, 2018). Currently, 12 species of commercially important sharks[2] and all mobulid ray species are listed on CITES Appendix II (CITES, 2018), meaning that their trade must be capped at sustainable levels.

Sawfishes are the only family of shark-like batoids that are currently subject to trade management. In 2007, sawfish populations had been so overexploited that all seven species of sawfishes were

2 All of the shark species listed come under the orders of Carcharhiniformes, Heterodontiformes, Hexanchiformes, Lamniformes, Orectolobiformes, Squaliformes and Pristiophoriformes.

listed in Appendix I of CITES, a full trade prohibition. However, while all species of sawfish species have been listed on CITES Appendix I, the status of other shark-like batoids that supply the fin trade have until recently been fairly unknown, and these endangered families are not currently included under CITES trade controls.

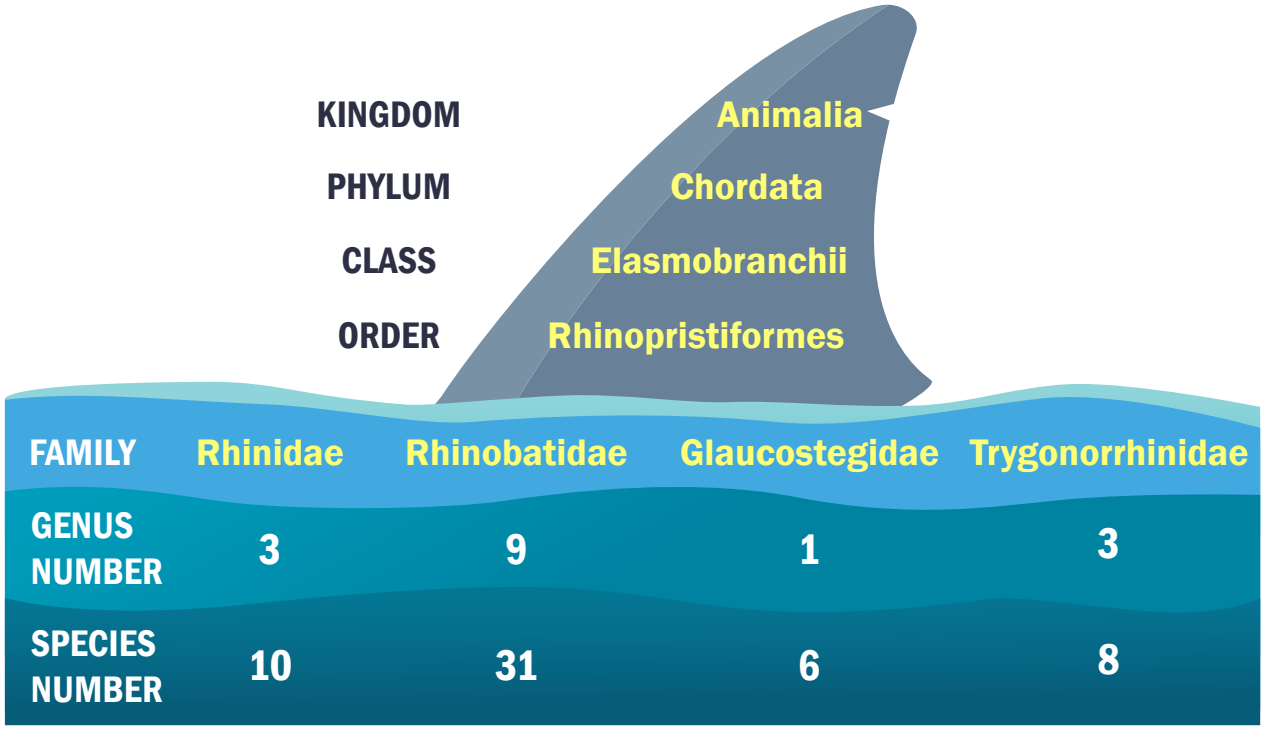
Hong Kong as a shark fin trade hub

In the global shark fin trade, Hong Kong, has long been an important entrepôt responsible for approximately 50% of the global shark fin imports (Fong & Anderson, 2002; Clarke 2004b; Clarke et al., 2006; Ho & Shea, 2015; Shea & To, 2017; Dent & Clarke, 2015). Hong Kong is documented to have been trading with more than 130 countries or regions, with an average of 83 annually (Shea & To, 2017). Important in both international trade and consumption, Hong Kong is therefore a valuable place for investigating global shark and shark-related fin trades, including that of shark-like batoids.

Clarke et al. (2006) revealed that 40% of the shark fins were categorized and 30 trade categories were found from auction records of Hong Kong. Among all the categories, 11 of them were species- or species group-specific. A recent investigation of species composition of shark fin in Hong Kong's major retail markets, Sheung Wan and Sai Ying Pun district, estimated at least 76 species of chondrichthyans involved in the shark fin trade (Fields et al., 2017). At least three species of shark-like batoids were identified in the Hong Kong retail markets study (based upon processed offcut trimmings only).

Shark-like batoids

Taxonomy



FAMILY	Rhinidae	Rhinobatidae	Glaucostegidae	Trygonorrhinidae
GENUS NUMBER	3	9	1	3
SPECIES NUMBER	10	31	6	8

Table 1. Taxonomy of guitarfishes

Currently, shark-like batoids come under five families, Pristidae (sawfishes), Rhinidae (wedgefishes), Rhinobatidae (guitarfishes), Glaucostegidae (giant guitarfishes) and Trygonorrhinidae (banjo rays) (Last et al., 2016). The current families are a result of revisions made to the classification of shark-like batoids in 2016, wherein species under a former family Rhynchobatidae became grouped under Rhinidae based on molecular evidence, and several species originally under Rhinobatidae were transferred into the new families Glaucostegidae and Trygonorrhinidae.

Threats and Barriers to Conservation

Lack of understanding and limited research

Lack of technical and financial support, enforcement and basic scientific knowledge in many of the species, were indicated to be main reasons impeding the design and establishment of appropriate conservation measures for guitarfishes (Jabado et al., 2017; Jabado & Spaet, 2017; Jabado, 2018). Information about the species' basic biology and ecology are crucial to inform the formulation of management and

conservation strategies, but existing research to gain a basic understanding about guitarfishes are scarce, hence information about these species are largely found wanted (García et al., 2008; White et al., 2014).

Previous studies have confirmed the presence of guitarfish sold as shark fins. Species from *Rhynchobatus cf. laevis* (cf. Smoothnose wedgefish), *Rhynchobatus australiae* (White-spotted guitarfish) complex and *Rhynchobatus djiddensis* (Giant guitarfish) were found from samples in genetic identification studies surveying species composition of shark fins in Australia (Holmes et al., 2009), Guangdong shark fin processing factories (Huang et al., 2011) and a Hong Kong retail market (Fields et al., 2017). However, there have not been any trade and market surveys focusing on guitarfishes to understand the availability, volume and composition of species traded. Without such crucial information, the development of effective management and conservation strategies becomes challenging.

Fishing methods and overfishing

Ironically, while research in the retail market is found severely lacking, the exploitation of shark-like batoids is well-reported (Stevens et al., 2000; Dulvy et al., 2014; Moore, 2017), and it is known that they are heavily fished throughout many areas within these species' natural distribution.

Shark-like batoids are highly susceptible to overfishing due to their life history characteristics of slow growth, late maturity and low fecundity. Four families Rhinidae, Rhinobatidae, Glaucostegidae and Pristidae are considered among the most endangered elasmobranch families (White et al., 2013; Moore, 2017). Among the shark-like batoid species assessed by the IUCN Red List of Threatened Species for conservation statuses, 25 species (42%) are categorized as threatened (Vulnerable, Endangered and Critically Endangered) and a further 15 species (25%) are described as Data Deficient.

Globally, many types of fishing gears are used in the capture of shark-like batoids , including trawls, gillnets, seine nets, and hook-and-line (Bentley, 1996; Chen, 1996; Harry et al., 2011; White et al., 2013). Meanwhile in mainland China, a specialized fishing method originated from Guangdong Province called "brother angling"（兄弟釣） (Lam, 2009) is also used. This method is sophisticated and mainly targets demersal sharks and rays. Sharks and rays will be caught by hooks attached to lines vertical to the main long-line when they swim close to the hooks (Wu & Zheng, 1982). Baits are not required

by this method, as it relies mainly on water currents for effectiveness (Vannuccini, 1999).

While their meat is usually supplied for local consumption, fins are especially desirable and highly-valued in the global fin trades (Moore, 2017). Shark-like batoid fins were found being sold at 70 USD/kg in Madagascar (Cripps et al., 2015). Another study revealed that a set of shark-like batoid fins could even fetch up to 396 USD/kg (Chen, 1996).

In response to conservation issues , species-specific catch prohibition on rhinids and rhynchobatids have been enacted in a few countries, including Brazil, India and Pakistan (Alexandre de-Franco et al., 2012; Jabado et al., 2017). However, illegal fishing and trades of the guitarfishes remain serious (Alexandre de-Franco et al., 2012).

Trade Category in the Hong Kong retail market: Qun chi – "King of shark fins"

Dried fins obtained from shark-like batoids are often marketed under the trade category of "*Qun chi*" (in Chinese, 群翅 / 裙翅).

Qun chi are also called the "King of shark fins", preferred for its high-quality fin needles and remarkable texture. Due to its rarity in the wild and popularity in the market, *Qun chi* is one of the highest-valued categories of fins (Yeung et al., 2005; Lam, 2010). According to Yeung et al. (2005), traders state that *Qun chi* can comprise at least 20 possible guitarfish species (the time of writing was pre-taxonomic revisions, including *Rhinobatos hynnicephalus* and *Rhynchobatus djiddensis*, now referred to as wedgefishes). In addition, it was also suggested in other studies (Vannuccini, 1999; Lam, 2010) that at least two common guitarfish species are sold under the *Qun chi* category.

Fins from these species are also said to be consumed for medicinal purposes. For instance, Jun Ju *Qun chi* is believed by some to be helpful in curing diabetes and improving body condition (Yeung et al., 2005; Lam, 2010).

According to Yeung et al. (2005), *Qun chi* are produced in different areas within the natural distribution of the shark-like batoids, and they are also categorised according to their sources.

South China Sea was named as one of the major sources of *Qun chi* in the past. However, *Qun chi* sourced from South China Sea is now found to be rare (Lam, 2010).

	Chinese	English	Distribution
●	軟沙	Ruan Sha Qun chi	Undocumented
●	黃沙	Huang Sha Qun chi	South China Sea
●	棉	Mian Qun chi	Indonesia, China
●	西沙	Xi Sha Qun chi	South China Sea
●	珍珠	Jun Ju Qun chi	Japan, Korea, Philippines, Vietnam, South Africa, South America

Table 2. Categories of *Qun chi* and their respective production areas (Yeung et al., 2005; Lam, 2010)

Objectives

This study aims to provide a snapshot on the availability of shark-like batoid fins in Hong Kong and Guangzhou (mainland China's dried seafood market) and demonstrate that these fins are sold under a distinct trade category, *Qun chi*, in the local market. Information that will be collected for guitarfish fins found at stores will include:

1. Availability
2. Prices
3. Sources
4. Categories
5. Species

The study furthermore aims to provide concrete evidence for the presence of guitarfish fins in the local market by DNA species identification.

As one of the first studies on the availability of shark-like batoid fins in the market, this study hopes to improve understanding of guitarfish fin trades in the market, with the goal of providing a basis for better management and monitoring of the guitarfish fin trade. It also hopes to set the scene for and encourage further research into the availability and species composition of the guitarfish fin retail market and trade.

METHODS

Market survey

A total of 318 dried-seafood retail and wholesale shops with shark fin-related products in the Sheung Wan and Sai Ying Pun districts (Hong Kong) were identified and surveyed in May 2018. The two districts are the local trading hubs of dried seafood, including shark fins (Fields et al., 2017).

Further, in total 110 retail and wholesale premises selling dried seafood products with shark fins were surveyed in Yide Lu area (Guangzhou, mainland China) in August 2018. The Yide Lu market has been reported as the largest dried seafood wholesale market in Asia, which reportedly have handled over 70% of shark fin trade volumes in mainland China (Wu, 2016).

In both Hong Kong and Guangzhou markets, visual observation was made to look for shark-like batoid fins displayed according to the shark fin category *Qun chi* in each shop. Other information including prices, categories, fin parts and sources were recorded from the packages if available. If no *Qun chi* categories were observed to be on display, enquiries with shopkeepers were made to obtain and confirm the availability (or lack thereof) of *Qun chi* in the shop. Where the information pertaining to price etc. are not readily stated on the packaging, the information will also be enquired from shopkeepers. If the shop is selling more than one type of shark-like batoid fins, records were made respective to each type.

Ya jian fins are shark fins mostly from blue shark (Prionace glauca), and also the most common category of shark fin in markets (Clarke, 2004a; Wu, 2016). Selling price data of the shark fin category, *Ya jian* (牙揀), obtained from the two surveyed markets during the same period, were used as control and compared to that of *Qun chi*.

Shark-like batoid fin CSI: DNA forensics

Due to the limited resources and the high price of the fins, the study could purchase only 12 pieces of unprocessed fins from the category *Qun chi* from 3 retail shops in the Hong Kong market, while for the mainland China market only 7 pieces of unprocessed fins from a single shop were purchased. All purchased fins were sent for DNA test sequencing to confirm the identification to species level.

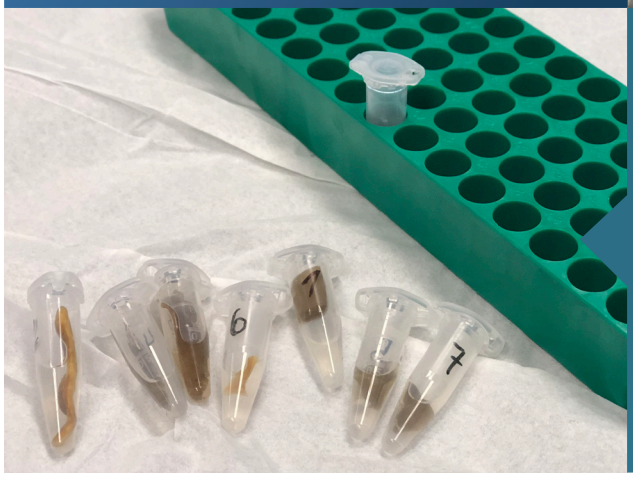
Unit conversion

Weights of dried seafood in Hong Kong markets are usually measured by catty. Unit conversion on weight were made from catty (斤) to kg (1 catty = 0.61 kg) with reference to Customs and Excise Department, HKSAR.

Currency conversion was carried out from HKD to USD (1 USD = 7.850 HKD) with exchange rate referencing Census and Statistics Department, HKSAR in May 2018. Conversion from CNY to USD (1 USD = 6.82 CNY) was carried out with exchange rate reference to State Administration of Foreign Exchange, People's Republic of China in July 2018.

Unprocessed Qun chi displayed and retailed in markets

Piles of Qun chi are available in certain shops and sorted into distinct bags



DNA forensics was used to identify fins to species level

RESULTS

Sheung Wan and Sai Ying Pun, Hong Kong

Availability and price

Among the surveyed dried-seafood shops (n=318), 12.9% (n=41) were selling *Qun chi*, including both processed and unprocessed pieces.

Among the *Qun chi* found in the market, lower caudal fins (86.4%) were more commonly observed than dorsal fins (13.6%).

Most *Qun chi* found in the shops were processed (83.1%), and 16.9% were unprocessed.

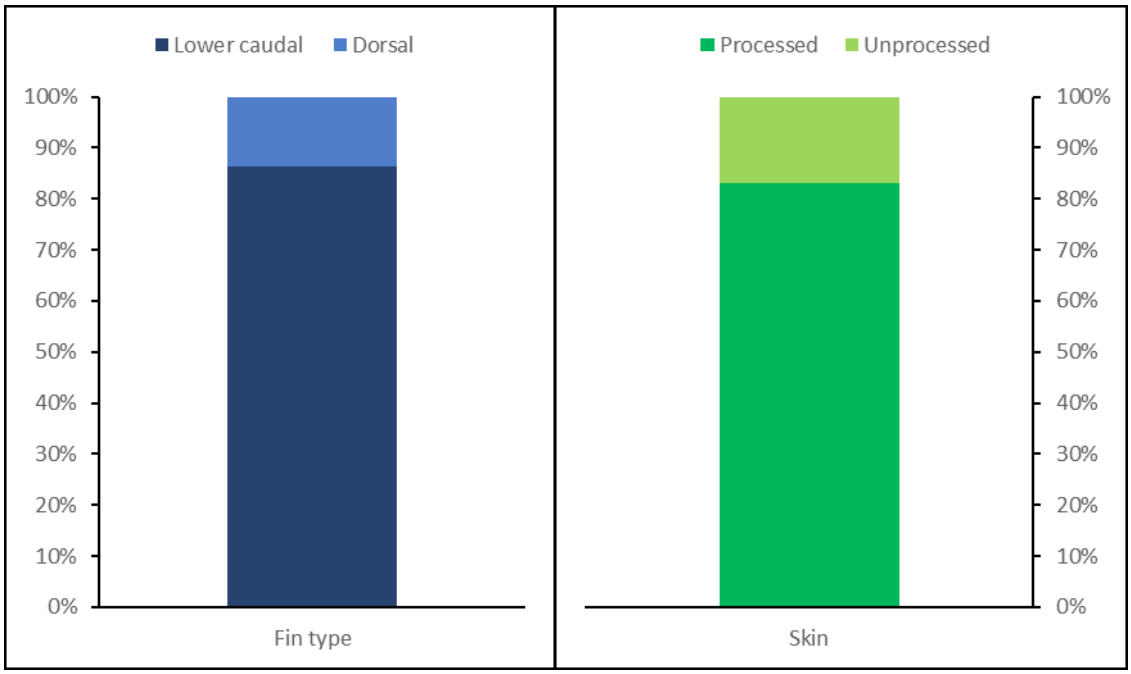


Fig 1. Percentage of *Qun chi* fin types (left) and process or unprocessed (right)

Snapshots of the average market price of *Qun chi* in this study was 184.8 ± 19.6 USD / kg (± S.E.). Comparing with price records in 2016 (233.8 ± 64.9 USD / kg) and 2017 (148.4 ± 33.4 USD / kg), the market prices fluctuated, but there are no significant differences in the recorded market prices of *Qun chi* between 2016 and 2018 (Fig. 2).

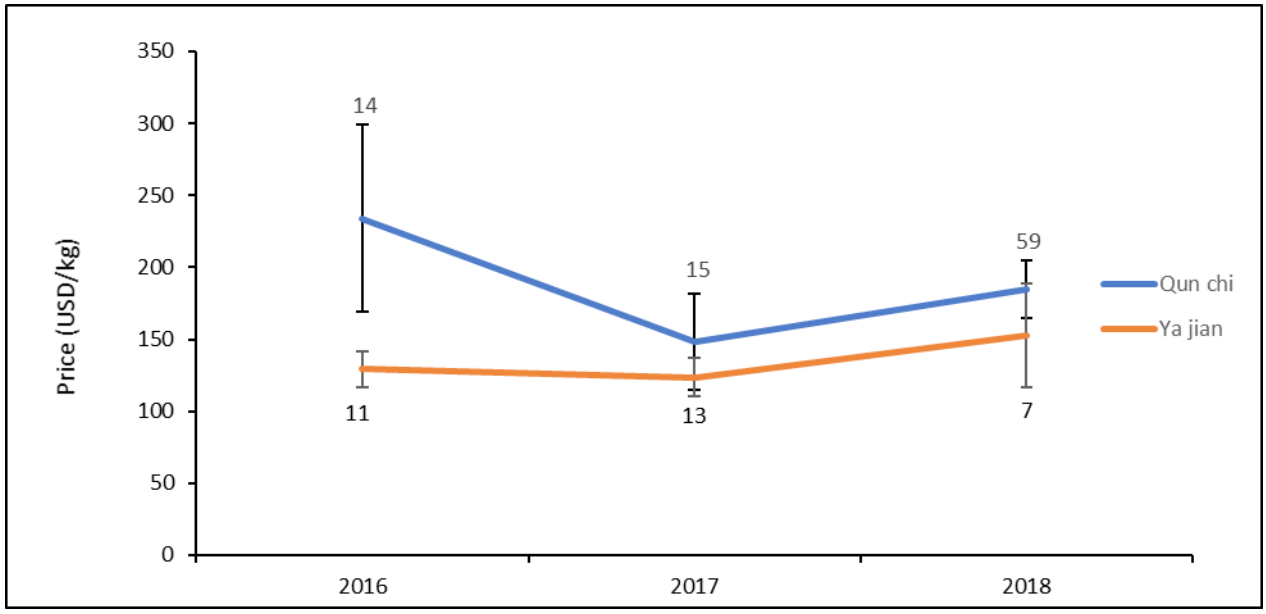


Fig 2. Mean market price of *Qun chi* and *Ya jian* in Sheung Wan and Sai Ying Pun from 2016-2018 (± S.E., n stated below error bars)

Categories

In this study, at least eight retail categories of *Qun chi* were recorded. Apart from traditional categories "Jin Shan", "Jun Ju" and "Ruan Sha", other categories were recorded in the market.

English (-Qun chi) Direct translation		Chinese (-群翅/裙翅)		
Jin Shan San Francisco, USA	金山	珍珠	**Jun Ju** Pearl, white-spotted
Ruan Sha Soft sandy	軟沙	粗沙	**Cu Sha** Coarse sandy
Chao Ding Supreme top	超頂	頂壓	**Ding Ya** Top class
Yu Jade	玉群	頂群	**Ding** Top

Table 3. Categories of *Qun chi* in Chinese and English translation

Close up of fins: One morphological feature of a certain Qun chi type is its visibly coarse texture

Sources

At least seven countries or regions were recorded as sources of *Qun chi*, including: Spain, Japan, Australia, USA, South Africa, South America and West Africa.

Yide Lu, Guangzhou, mainland China

Availability and price

In the Guangzhou Yide Lu area, 17 shops (15.5%) were selling *Qun chi* among 110 shops surveyed.

In this area, *Qun chi* from dorsal fins (81.8%) were more common than the other parts including upper (9.10%) and lower (9.10%) caudal fins.

Among the *Qun chi* found in the Yide Lu market, 68.2% of them were processed, 31.8% were unprocessed.

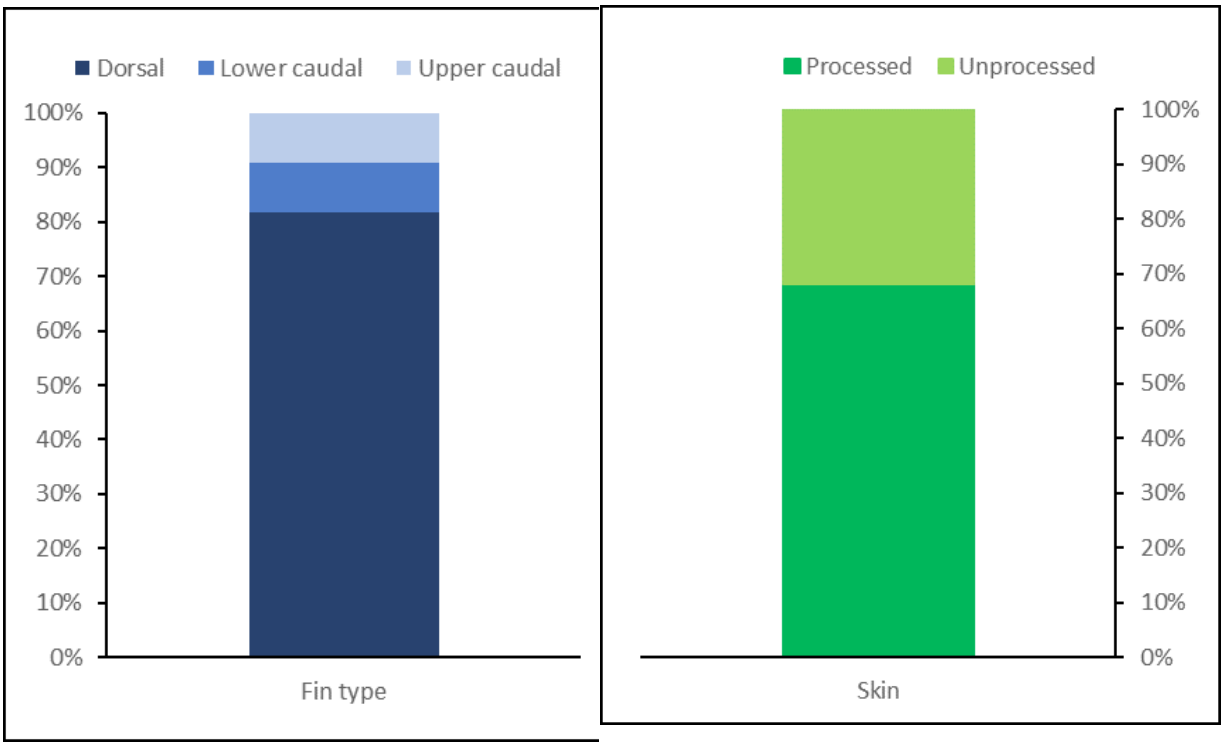


Fig 4. Percentage of *Qun chi* fin types (left) and process or unprocessed (right) in Yide Lu, Guangzhou

Mean market price of *Qun chi* in Yide Lu area was 276.2 ± 19.2 USD / kg (± S.E.). In the snapshot record in 2018, selling price of *Qun Chi* was relatively higher than *Ya Jian*. There are no available published data for the market price of *Qun chi* in Guangzou for other years for comparison.

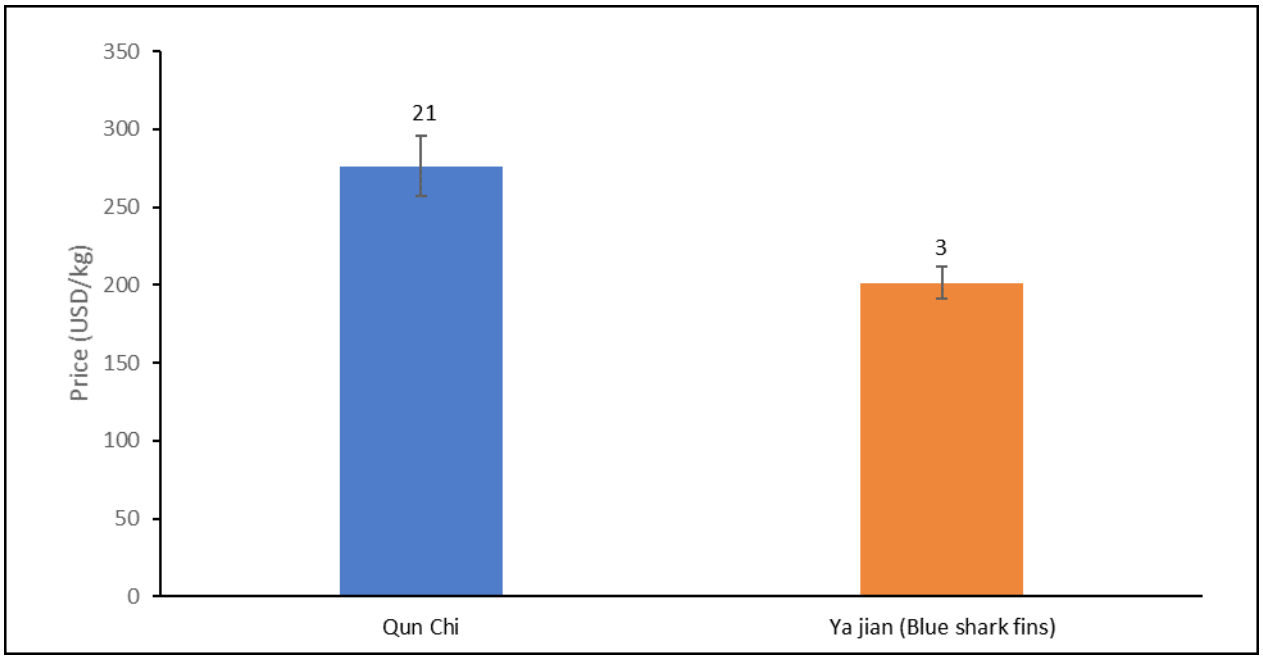


Fig 5. Average market prices of *Qun chi* and *Ya jian* fins in Yide Lu, Guangzhou

Categories

No specific naming categories were recorded in the Yide Lu market.

Genetic analysis

Of the unprocessed fins from the category of *Qun chi* bought from surveyed shops in both Hong Kong and Guangzhou, mainland China markets, at least four species of shark-like batoids were found, including *Rhina ancylostoma* (Shark ray), *Rhynchobatus australiae* (Bottlenose guitarfish) *Rhynchobatus djiddensis* (Whitespotted wedgefish), and *Glaucostegus cemiculus* (Blackchin guitarfish). This shows that the *Qun chi* categories include at least fins from the families Rhinidae (former three) and Glaucostegidae (post-taxonomic revisions).

DISCUSSION

From this study, it was found that shops in Sai Ying Pun and Sheung Wan districts were selling *Qun chi* as speculated, as well as in the Yide Lu market in Guangzhou. However, surveyors were unable to access the storage rooms within the shops or elsewhere located, hence it is not possible to estimate the total volumes of *Qun chi* currently available and stockpiled in the market. Despite this, the availability of *Qun chi* in shops and the fact that shark-like batoids has its own category in the trade implies that their fins have a clear role in Hong Kong and mainland China's shark fin trade.

In addition, genetic analyses showed that at least all the purchased unprocessed fins from the category of *Qun chi* originated from shark-like batoids. If resources become available in the future to support more extensive research, it would be worthwhile to complete a more large-scale study, increasing the sample size and including processed fins (in addition to unprocessed fins in the current study) in genetic analyses to obtain a greater understanding on the species composition in the trade.

Visual identification of shark-like batoid fins to species-level on site was challenging, particularly as identification guides are not currently available. Especially for fins without skins, it was very difficult to distinguish between species, or to confirm whether or not the fins originated from shark-like batoids.

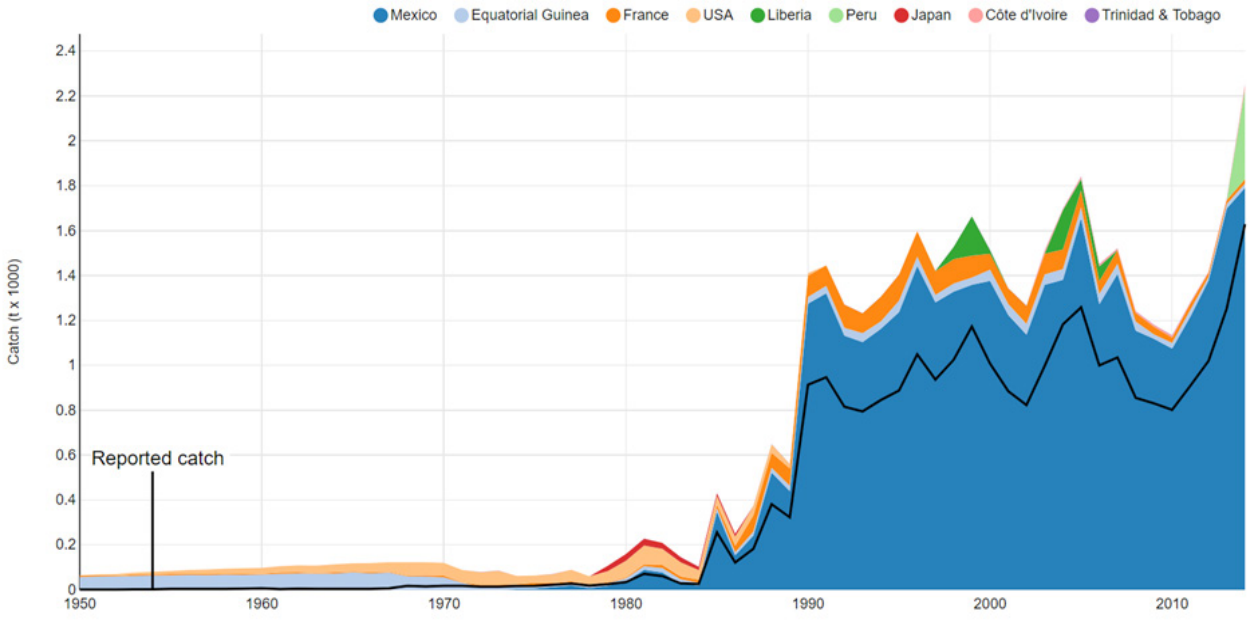


Fig 6. Reconstructed and reported catch of guitarfishes (Rhinobatidae) and catching countries (Sea Around Us, 2018)

According to the reconstructed catch of shark-like batoids, the dominant capturing country is currently Mexico. However, Mexico and Peru, the two nations making up the vast majority of shark-like batoid catches, were not mentioned specifically by any shop keepers in this study. It is possible that both locations may have been implicated under the "South America" answer when sources were enquired.

By genetic analysis, it was confirmed that species from at least two shark-like batoid families are sold as *Qun chi* in Hong Kong and mainland China markets. Due to limited resources, only 19 samples could be purchased in this study for testing. It is possible that species from different families apart from those identified in this study are also present in the trade, and previous research have also identified species from the family Rhinobatidae (Fields et al., 2017). Similar to discoveries in Hong Kong, a wide range of chondrichthyan, including sharks, guitarfishes and chimeras, were found from shark fin and cartilage samples obtained from Guangdong shark fin processing factories with genetic identification (Huang et al., 2011). Further research into the species composition of *Qun chi* in the local retail market is needed.

Reasons behind the relatively high proportion of shark-like batoid fins sold as unprocessed fins (compared to *Ya jian* category for which less than 6% are retailed as unprocessed fins with skin intact) for some species warrants further investigation. While previous research has shown that shark fins are typically re-exported from Hong Kong to mainland China for processing before being returned to Hong Kong's markets for retail (Dent & Clarke, 2015), many stores appear to offer unprocessed *Qun chi* fins. It is possible that, given the high commercial value of *Qun chi*, the skin is intentionally left intact at retail for customers to more easily identify them from fins of other sharks. Conversations with store owners have revealed that some customers indeed prefer to buy *Qun chi* in its unprocessed state, and to process the fins by themselves at home. Whether for customary preference or other reasons, further effort to understand this consistent trend may be worthwhile. A previous study surveying shark fins in Hong Kong has also found only a small percentage of processed shark fin offcuts sampled belonged to shark-like batoids, in comparison to other chondrichthyans (Fields et al., 2017). Further investigation on the reasons behind these practices for shark-like batoid fins should be investigated.

Implications to conservation

Availability of *Qun chi* in the Hong Kong dried seafood market potentially reflects a considerable demand for shark-like batoid fins in the market. Hong Kong's official fish species records suggest that shark-like batoid species, apart from sawfish species which were not found in this study, do not occur in local waters (AFCD, 2018; Astudillo et al., 2018). It is hence reasonable to assume that any shark-like batoid fins encountered in the Hong Kong shark fin-related retail market were imported from other nations or regions via international trade, sourcing from populations in different parts of the world. Given the intense fishing pressure seen across their range of distribution, coupled with the demand for their highly valuable fins, the international shark fin trade is potentially driving population declines across several ocean basins. Yet reliable species-specific fisheries and trade data for shark-like batoids is largely lacking.

Mainland China falls within the natural distribution of several species of shark-like batoids, including, Bowmouth guitarfish *Rhina ancylostoma*, Brown guitarfish *Rhinobatos schlegelii*, and a documented source of *Qun chi*, Ringstraked guitarfish *Rhinobatos hynnicephalus* (Last & Compagno, 2002; Chen et al., 2015; Chen et al., 2016). Landings of shark-like batoids and *Qun chi* production within mainland China are possible but largely unknown. Further investigation on markets and landings of shark-like batoids in mainland China would be crucial for a greater understanding of the role of mainland China in the global trade.

Fields et al. (2017) suggested that consumers are willing to accept diverse fin types of different sizes and morphologies, indicated by a high percentage of fins of small sizes and non-shark species found in the market through their study. When supplies of specific shark fin species or size categories begin to decline, it is possible that fins from other chondrichthyan taxa such as shark-like batoids may eventually rise as substitutes (Eriksson & Clarke, 2015). Listings of commercially important shark species in CITES Appendices and enactment of consequent complimentary fisheries regulations that ensure the implementation of CITES trade controls may also push the trade to seek substitutes from currently non-regulated species, such as shark-like batoids, to feed the demand. This shift in the market is potentially problematic, as the majority of shark-like batoids are already considered among the most at risk of extinction. The market's tolerance for diversity hence highlights the need

for the effective application of fisheries management strategies at fishery sources and trade monitoring and enforcement of CITES regulations at trade hubs like Hong Kong to minimize the overexploitation of specific species that supply the international fin trade.

In Hong Kong, CITES is the only legal instrument available and implemented with the aim of ensuring commercially important plant and animal species found in the international trade are not being exploited unsustainably. All five species of sawfishes, arguably the worlds most threatened marine species, are already listed under Appendix I of CITES due to their unfavorable conservation status. If other shark-like batoids are proven to meet the listing criteria, CITES would be a critical step for their conservation and management.

To facilitate effective monitoring of the trade, it is suggested that trade statistics recorded by the Census and Statistics Department, HKSAR (CSD) may further breakdown shark fin imports and re-exports into taxonomic groups. Despite the availability of shark-like batoid fins in the Hong Kong market having arrived through the international trade, the harmonized system commodity codes currently used by CSD only categorizes shark fins according to their treatment process (e.g. dried, fresh, salted or fresh), and not by taxonomic groups (e.g. Order: Rhinopristiformes) or by species.

Similarly, in trade statistics related to shark fins in mainland China, only three HS codes are used by the China Customs for shark fins specifically: one for dried fins and two for prepared/preserved fins, in airtight or other containers. This provides relatively low resolution for understanding the trade without information about forms (dried, fresh, frozen) and treatments, let alone taxonomic records.

Current trade statistics in both Hong Kong and mainland China therefore provide very low resolution on what is being traded as 'shark fin'. Clearer, more accurate records of trade routes and volumes of shark-like batoid fins would be essential for improving management and conservation of these threatened species. This would also allow for analyses of the country breakdown of import source countries, which according to store owners are quite diverse, to facilitate the formulation of fisheries management strategies in sourcing countries / territories.

CONCLUSION

Shark-like batoids (Pristidae, Rhinidae, Rhinobatidae Glaucostegidae and Trygonorrhinidae) is one of the most endangered taxons of elasmobranchs in the world (Dulvy et al., 2014). Their survival is potentially being threatened due to demand in the global fin trade. This study is the first in the past 10 years to investigate availability of shark-like batoid fins in the shark fin trade from consumer markets, and provides strong evidence that a distinct trade category exists in the Hong Kong and Guangzhou markets: "*Qun chi*", which is high in commercial value and consumer preference.

This study has also found an availability of of shark-like batoid fins in Sheung Wan and Sai Ying Pun districts in Hong Kong, the global trade hub of shark fins, and established baseline data for this information. Genetic analysis confirms that *Qun chi* includes at least species from the families of Rhinidae and Glaucostegidae, and previous research have also identified species from the family Rhinobatidae (Holmes et al., 2009; Huang et al., 2011; Fields et al., 2017).

Further research to understand the availability of *Qun chi* in major trade hubs and consumer markets is urgently needed. Such research will provide insights into the species composition of shark-like batoid fins in trade, as well as highlight regions where populations could be in decline as a result of unsustainable international trade. Our preliminary results indicate the prevalence of shark-like batoid fins in the Hong Kong retail market and the potential significance of these species in the global trade could be provided by this study. Effective international trade controls, and monitoring and enforcement will be crucial to the conservation of guitarfish populations.

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Appendix A

Scientific names, common names and current IUCN Red List statuses of the shark-like batoid species (Families, Pristidae, Rhinidae, Rhinobatidae, Glaucostegidae and Trygonorrhinidae) (CR: Critically Endangered; EN: Endangered; VU: Vulnerable; NT: Near Threatened; LC: Least Concern; DD: Data Deficient; NA: Not Assessed).

Species	English common name	Status
Family Pristidae		
Anoxypristis cuspidata (Latham, 1794)	Narrow Sawfish	EN
Pristis clavata Garman, 1906	Dwarf Sawfish	EN
Pristis pectinata Latham, 1794	Smalltooth Sawfish	CR
Pristis pristis (Linnaeus, 1758)	Largetooth Sawfish	CR
Pristis zijsron Bleeker, 1851	Green Sawfish	CR
Family Rhinidae		
Rhina ancylostoma Bloch & Schneider, 1801	Shark ray	VU
Rhynchobatus australiae Whitley, 1939	Bottlenose guitarfish	VU
Rhynchobatus cooki Last, Kyne & Compagno, 2016	Clown wedgefish, roughnose wedgefish	VU
Rhynchobatus djiddensis (Forsskål, 1775)	Giant guitarfish; white-spotted wedgefish	VU
Rhynchobatus immaculatus Last, Ho & Chen, 2013	Taiwanese wedgefish	NA
Rhynchobatus laevis (Bloch & Schneider, 1801)	Smoothnose wedgefish	VU
Rhynchobatus luebberti Ehrenbaum, 1915	African wedgefish	EN
Rhynchobatus palpebratus Compagno & Last, 2008	Eyebrow wedgefish	NA
Rhynchobatus springeri Compagno & Last, 2010	Broad-nosed wedgefish	VU
Rhynchorhina mauritaniensis Séret & Naylor, 2016	False shark ray	NA
Family Rhinobatidae		
Acroteriobatus annulatus (Müller & Henle, 1841)	Lesser sand shark	LC
Acroteriobatus blochii (Müller & Henle, 1841)	Bluntnose guitarfish	LC
Acroteriobatus leucospilus (Norman, 1926)	Grayspotted guitarfish	DD
Acroteriobatus ocellatus (Norman, 1926)	Speckled guitarfish	DD
Acroteriobatus omanensis (Last, Henderson & Naylor, 2016)	Oman guitarfish	NA
Acroteriobatus salalah (Randall & Compagno, 1995)	Salalah guitarfish	DD
Acroteriobatus variegatus (Nair & Lal Mohan, 1973)	Stripenose guitarfish	DD
Acroteriobatus zanzibarensis (Norman, 1926)	Zanzibar guitarfish	NT
Pseudobatos glaucostigmus (Jordan & Gilbert, 1883)	Speckled guitarfish	DD

Pseudobatos horkelii (Müller & Henle, 1841)	Brazilian guitarfish	CR
Pseudobatos lentiginosus (Garman, 1880)	Freckled guitarfish	NT
Pseudobatos leucorhynchus (Günther, 1867)	Whitesnout guitarfish	NT
Pseudobatos percellens (Walbaum, 1792)	Southern guitarfish	NT
Pseudobatos planiceps (Garman, 1880)	Flathead guitarfish	DD
Pseudobatos prahli (Acero & Franke, 1995)	Gorgona guitarfish	DD
Pseudobatos productus (Ayres, 1854)	Shovelnose guitarfish	NT
Rhinobatos albomaculatus Norman, 1930	Whitespotted guitarfish	VU
Rhinobatos annandalei Norman, 1926	Annandale's guitarfish	DD
Rhinobatos borneensis Last, Séret & Naylor, 2016	Borneo shovelnose ray	NA
Rhinobatos holcorhynchus Norman, 1922	Slender guitarfish	DD
Rhinobatos hynnicephalus Richardson, 1846	Ringstraked guitarfish	NT
Rhinobatos irvinei Norman, 1931	Spineback guitarfish	VU
Rhinobatos jimbaranensis Last, White & Fahmi, 2006	Jimbaran shovelnose ray	VU
Rhinobatos lionotus Norman, 1926	Smoothback guitarfish	DD
Rhinobatos nudidorsalis Last, Compagno & Nakaya, 2004	Bareback shovelnose ray	NT
Rhinobatos penggali Last, White & Fahmi, 2006	Indonesian shovelnose ray	VU
Rhinobatos punctifer Compagno & Randall, 1987	Spotted guitarfish	DD
Rhinobatos rhinobatos (Linnaeus, 1758)	Common guitarfish	EN
Rhinobatos sainsburyi Last, 2004	Goldeneye shovelnose ray	LC
Rhinobatos schlegelii Müller & Henle, 1841	Brown guitarfish	DD
Rhinobatos whitei Last, Corrigan & Naylor, 2014	Philippine guitarfish	NA
Family Glaucostegidae		
Glaucostegus cemiculus (Geoffroy St. Hilaire, 1817)	Blackchin guitarfish	EN
Glaucostegus granulatus (Cuvier, 1829)	Granulated guitarfish	VU
Glaucostegus halavi (Forsskål, 1775)	Halavi's guitarfish	DD
Glaucostegus obtusus (Müller & Henle, 1841)	Widenose guitarfish	VU
Glaucostegus thouin (Anonymous, 1798)	Clubnose guitarfish	VU
Glaucostegus typus (Bennett, 1830)	Giant shovelnose ray	VU
Family Trygonorrhinidae		
Aptychotrema rostrata (Shaw, 1794)	Eastern shovelnose ray	LC
Aptychotrema timorensis Last, 2004	Spotted shovelnose ray	VU
Aptychotrema vincentiana (Haacke, 1885)	Western shovelnose ray	LC
Trygonorrhina dumerilii (Castelnau, 1873)	Southern fiddler ray	LC
Trygonorrhina fasciata Müller & Henle, 1841	Eastern fiddler ray	LC
Zapteryx brevirostris (Müller & Henle, 1841)	Shortnose guitarfish	VU
Zapteryx exasperata (Jordan & Gilbert, 1880)	Banded guitarfish	DD
Zapteryx xyster Jordan & Evermann, 1896	Southern banded guitarfish	DD