

✧ ✧ RAPID SURVEY OF ✧ ✧
MOBULID GILL PLATE TRADE AND RETAIL PATTERNS
IN HONG KONG AND GUANGZHOU MARKETS



BLOOM Association Hong Kong
September 2016

HAU Cheuk Yu, Loby
HO Ka Yan, Kathleen
SHEA Kwok Ho, Stan



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stanleyshea@bloomassociation.org



WHAT ARE MOBULID RAYS?

Manta and *Mobula* are the two genera that come under the Family Mobulidae and Subclass Elasmobranchii. *Mobula* rays are also sometimes collectively known as Devil rays. Two species (and 1 possible species under taxonomical review) are recognized under the genus *Manta*, and 9 under the genus *Mobula*.

Mobulid rays are widely distributed around the world's oceans, found in tropical, subtropical and temperate regions [1 – 11]. They are planktivores, meaning that they feed primarily on planktons. Mobulids feed through a process called filter feeding, where water is forced in through the mouth and ejected past branchial filters or *gill plates*, trapping the food for ingestion. Interestingly, this mechanism is different from that of other filter-feeding animals, such as the baleen whale [12].

These gill plates are what has made Mobulid rays highly (commercially) valuable to humans, and pushed populations of many manta and mobula ray species to imminent extinction.

MANTA AND MOBULA I N T H E GILL PLATE T R A D E

Two Mobulid species, *Manta birostris* and *Mobula japonica*, have recognized medical properties, documented in the 中國藥用動物誌 *Zhongguo Yao Yong Dong Wu Zhi* ("Chinese Medical Animals") [13]. Gill plates of the species are said to be medicinal in healing abscesses and

measles, and as a tonic for detoxification and neutralizing the body's excessive "heat" [13]

Like many other medicinal ingredients in Traditional Chinese Medicine (TCM), gill plates have most probably had a long history of use in Chinese communities, and are known to be used by the older generation.

Feeding this demand are fisheries for manta and mobula rays which have been recorded all over the world. Up to the time of this survey, targeted fisheries have been reported in almost all areas within known *Manta* and *Mobula* natural distributional ranges, including:

- **North America: Mexico** [18 - 22]
- **South America: Ecuador and Peru** [23]
- **Mediterranean Sea** [24]
- **Africa: Senegal, Ghana, Tanzania and Mozambique** [23, 25 - 27]
- **Asia: India, Indonesia, Sri Lanka, Thailand and the Philippines** [23, 28 - 37]

Continuously high fishing pressures have put *Manta* and *Mobula* species under immense threat of extinction. The fragility of the species is highlighted by their relatively long lifespan, late maturity and low fecundity. They live as small, fragmented populations, and have predictable mass migrations and feeding aggregations, making populations highly susceptible to targeted fisheries.

Hong Kong, Guangzhou, Singapore, Taiwan and Macau are identified as the five major importers of gill plates in Asia [31, 38, 39]. Other regions with established Chinese communities were also found to have trades in gill plates, albeit in smaller quantities [38].

There are currently no known manta or mobula ray farm fisheries, meaning that the entire global supply of manta and mobula ray gill plates and related products must be provided by wild catches [23]. Whereas Mobulid rays had primarily been harvested as bycatch in the past, today at least 30 Mobulid ray fisheries in 25 countries/regions are recorded [40]. Fisheries deploy a mix of fishing

methods, including driftnets, purse-seines, gill nets [37], traps, trawls and long-lines [23], heaving almost entire aggregations from the ocean at a time.

To date, all species of **manta ray** are listed in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), meaning that their international trades are regulated. None of the **Mobula species** are currently receiving the same protection by CITES regulations¹.

CONSERVATION CHALLENGES AND HOW TO ADDRESS THEM

One of the greatest challenges to the efficient conservation of manta and mobula rays is the paucity of information and specified research.

Of the 11 recognized Mobulidae species, 3 are listed as Endangered, 2 as Vulnerable, and 3 as Near Threatened according to the International Union for Conservation of Nature (IUCN) Red List of Threatened Species. The remaining 3 species are listed as "**data deficient**". Deficiency in data hinders the development of conservation schemes, especially for strategies that are species specific.

Trade and market research is one efficient way of understanding at least the extent of human use of Mobulid rays. Many existing studies have been conducted in the landing regions of gill plates [38, 41], however only a few have targeted research on the retail level, at the destination markets.

Hong Kong and Guangzhou are both extremely important in the global gill plate trade. Guangzhou in particular has been named the trade centre of gill plates, taking on the roles of supplier, retailer and consumer [38, 41]. Hong Kong is a known trade hub for a myriad of dried seafood including shark fin, abalone and bêche-de-mer [42]. For Mobulid gill plates, the exact role of Hong Kong in the international trade has not been entirely

defined and never been thoroughly studied. Both Hong Kong's and Guangzhou's markets are hence highly worthy of examination, for it is likely that data obtained from these markets, such as species composition, sizes, categories and prices etc., can be representative of the global trade, and can lend insight into the extent of the two markets' influence on the global trade.

The present study aims to understand the basics of the Mobulidae gill plate trade in selected markets of two of the trade centres of gill plates: Sheung Wan of Hong Kong, and Yide Lu and Qingping of Guangzhou. The objectives are to:

1. Assess the availability, size, price and potential origins of gill plates found
2. Listing the gill plates' name categories

Such a study will hopefully lend insight into the way that gill plates are being sold at the consumer level, and uncover information that may inform future research and conservation measures.

More importantly, it is hoped that this study may highlight the urgency for actions to be taken towards the proper protection of *Manta* and *Mobula* species, and for the trade to be regulated and brought to a level of sustainability.



All of the largest ray species are found under the Family Mobulidae.

[36, 43]

Manta
(Stan Shea / BLOOM)

¹ However, some countries may have established their own local regulations to protect specific species.

Dried seafood and/or traditional Chinese medicine (TCM) stores of 3 key market districts, namely Sheung Wan, Yide Lu, and Qingping, were surveyed between October 2015 and January 2016. As this survey period coincided with the Lunar New Year, when the stores become highly popular and frequented by locals preparing for festivities, the surveys were conducted only during the weekdays to minimize disturbance to the shops' daily operations.

Each store in all 3 markets were visited at least once throughout the survey for conducting:

1. Face to face dialogues with shopkeepers, through which enquiries surrounding the manta/mobula trade were made, and
2. Visual observations on the gill plates sold at each shop.

Findings for every gill plate category found in stores were recorded after each visit. Each record contained, for the particular category, the genus, size, price, and origin, where the information was made available.

SITE DESCRIPTIONS

HONG KONG: SHEUNG WAN & SAI YING PUN

collectively referred to as "Sheung Wan" for short

Sheung Wan may be the district most densely populated with dried seafood stores in Hong Kong. The area is concentrated around Des Voeux Road West (coined "Dried Seafood Street" by locals), with multiple streets dispersing from its centre. More than 350 stores were recorded and visited in this survey covering:

- Bonham Strand
- Bonham Strand West
- Centre Street
- Cleverly Street
- Connaught Road West

- Eastern Street
- Ko Shing Street
- Kom U Street
- Sutherland Street
- Wilmer Street

GUANGZHOU: YIDE LU

Contrary to the dried seafood streets found in Hong Kong, most of the dried seafood stores in Yide Lu are congregated in indoor malls. Yide Lu is a main street in central Guangzhou, and is well-known for retail and wholesale stores of dried seafood [44].

More than 800 stores have been counted in Yide Lu's 5 dried seafood malls, extending to Haizhu South Road. Unlike Hong Kong, there has been no compilation of comprehensive seafood store lists.

GUANGZHOU: QINGPING

Qingping is famed as a Traditional Chinese Medicine retail and wholesale centre in Guangzhou. Similar to the case of Yide Lu, stores are gathered in shopping malls. More than 1000 Traditional Chinese Medicine shops were observed in this survey, spreading across 3 malls on Qingping Road and Tiyun East Road. As for Yide Lu, there is presently no comprehensive shop list for the Qingping area.

HONG KONG	VS	GUANGZHOU
Entire streets		In specified malls
Ground-level, streetside stores		Multilevel, indoor stores
Selling a diversity of dried seafood and other goods e.g. fungi		Each store specializes in selling only a few specific goods
Relatively large storefront		Smaller, booth-sized stores
Use of storage behind storefront / not all goods displayed		Mostly do not have storage space behind storefront

Table 1 - comparison between Hong Kong (Sheung Wan) and Guangzhou (Yide Lu and Qingping) markets surveyed.

MARKET SURVEYS

The investigator assumed the identity of a customer to conduct market surveys. During surveys, the number of shops present in each of the three markets was noted, and the number of shops selling manta or mobula gill plates was recorded.

Display conditions: It is not uncommon to find stores keeping part or all of their stocks of gill plates out of view from the storefront. Conversations with storekeepers revealed whether or not the store was selling gill plates, and the range of categories available.

Display conditions were recorded for each store surveyed where gill plates were sold. The three options were:

1. All categories displayed
2. All categories not displayed
3. Part of categories displayed

Name Categories: Most gill plates will have specific names visibly labeled. Where labels were not available, enquiries were made to storekeepers to obtain the associated name.

Size and Price: Gill plates were categorized by size and name. The selling price for each size and name categories were recorded. Where storekeepers offered discounted prices, the original price labeled or quoted by the store was recorded.

Origins: Storekeepers were also asked about whether or not the origins of the gills plates were known. Answers were recorded where provided.

IDENTIFYING CATEGORIES SOLD

Stores were asked to display all available categories (whether by size or name) of gill plates. With reference to the currently available guides [45], the genera (*Manta* or *Mobula*) of the gill plates were visually identified. Each selling category constituted a single record. Where both genera were found in the same selling category, two separate records are made.

Average length of gill plates in each selling category was visually estimated and recorded in 7 size categories: 5-14cm, 15-24cm, 25-34cm, 35-44cm, 45-54cm, >55cm, and "fragments". The gill plates were not physically measured so as to not raise

suspicion of storekeepers or cause further disturbance to their businesses.

OFFICIAL TRADE VOLUMES AND COMMERCIAL VALUES

FAO DATA

The Food and Agriculture Organization of the United Nations (FAO) publishes trade data voluntarily reported by countries.

For the study, FAO data for gill plates were collected. These included global capture production volumes from landing countries/regions, and oceanic fishing territories. The "Species" categories used for data collection included:

"Devil fish *Mobula mobular*"
 "Giant Manta *Manta birostris*"
 "Mantas, devil rays nei Mobulidae".

CSD DATA

The Hong Kong Census and Statistics Department (CSD) makes available data for import, export and re-export of goods in Hong Kong. Commodities are identified with codes assigned through the Harmonized System (HS), and the following codes were used in this study:

0302-6929 "Other marine fish, excluding fillets, livers and roes, fresh or chilled" (re-categorized into 0302-8999 since 2012);
 0303-7929 "Other marine fish, excluding fillets, livers and roes, frozen" (re-categorized into 0303-8999 since 2012);
 0302-8200 "Rays and skates (Rajidae), Fresh or chilled, exclude fillets, livers or roes" (categorized since 2012);
 0303-8200 "Rays and skates (Rajidae), frozen, exclude fillets, livers or roes" (categorized since 2012)

Data for the years 2010 - 2014 were retrieved. For each code, the yearly trade quantities, value, country of origin and country of consignment were recorded.

Note: *Manta* spp.-related CITES trade controls only came into effect in November 2014 for Hong Kong.

WHERE TO BUY MANTA & MOBULA GILL PLATES

SHEUNG WAN

Proportion of stores selling Manta or Mobula gill plates

28.42%

OUT OF 387 DRIED SEAFOOD STORES SURVEYED

OUT OF THIS PERCENTAGE:

Shops selling Manta	84.55%
Shops selling Mobula	43.64%
Only Manta sold	56.36%
Only Mobula sold	15.45%
Both sold	28.18%

SHEUNG WAN had the highest proportion of dried seafood stores retailing gill plates. Some stores in Yide Lu and Qingping displayed enormous amounts of Mobulid gill plates in bulk, far surpassing the amount seen in Sheung Wan, which typically displayed only a few bags sold among other products.

However, it was observed that many stores in Sheung Wan will keep some or all of their gill plates in storage behind storefront. As many as 33% of the surveyed stores had kept *all* of their gill plates in storage, and a further 22% had part of the gill plates stored (figure 4). The stockpiled volume is unknown and could not be estimated by this study.

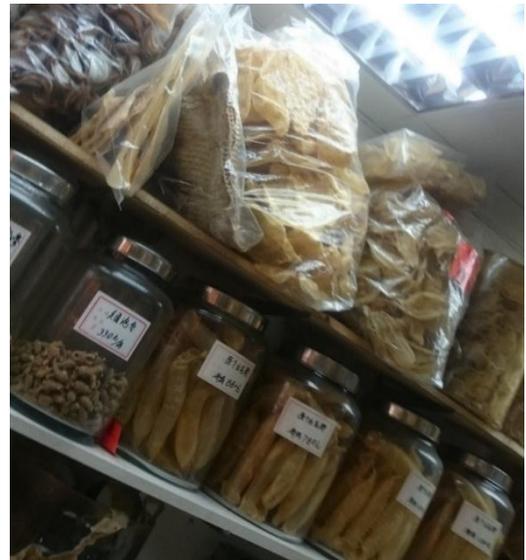


Figure 3a - 1 bag of *Manta* gill plate displayed on shelf of Sheung Wan store (third bag from left, top row.) Most stores in Sheung Wan sold gill plates alongside other dried seafood goods, such as fish maw or ginseng. Many stores kept some or all gill plates in rear storage.

Markets in Guangzhou did not appear to have rear storage space. While out-of-store storage is a possibility, this also could not be assessed by this study.

Are the gill plates sold in Sheung Wan stores hidden in storage or displayed at storefront?

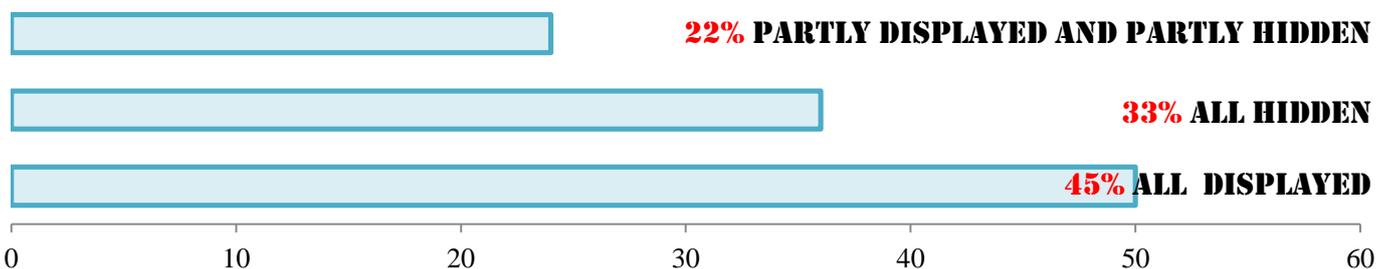


Figure 4 - Display status of *Manta* and *Mobula* gill plates in the Sheung Wan dried seafood stores

YIDE LU

QINGPING

4.58%

7.67%

OUT OF 851 DRIED SEAFOOD STORES SURVEYED

OUT OF 1056 TRADITIONAL CHINESE MEDICINE STORES SURVEYED

OUT OF THIS PERCENTAGE:

OUT OF THIS PERCENTAGE:

66.67%

50.62%

92.31%

91.36%

7.69%

8.64%

33.33%

49.38%

58.97%

41.98%

Figure 2 – Stores selling manta and/or mobula gill plates in Hong Kong and Guangzhou markets



Figure 3b - Mobulid gill plates in a market in Qingping. Unlike in Sheung Wan, Guangzhou markets typically display large quantities of gill plates in storefront.

It was also found for all three markets that stores selling gill plates typically aggregated in certain areas. In stores located outside of these "hotspots", gill plates are sold in much lower quantities. The reason behind this pattern in distribution is unknown.

A higher percentage of stores in Sheung Wan sold manta gill plates than compared to Guangzhou's markets. In Sheung Wan, more than half (56.36%) of the stores were selling manta gill plates *only*. The same figure for Yide Lu and Qingping were 7.69% and 8.64% respectively. In contrast, proportions of stores selling mobula gill plates in Yide Lu and Qingping were both more than double that of Sheung Wan.

For Yide Lu, the majority (58.97%) of the stores sold both Manta and Mobula gill plates. In Qingping, almost half (49.38%) of the stores sold *only* Mobula gill plates.

CSD DATA REVEALS...

No conclusions can be drawn from the CSD data. While the 4 HS codes used in the study were advised by CSD staff [54], the codes are not explicitly referring to or limited to gill plate-related products. Furthermore, there are currently no HS codes in Hong Kong specifically for Mobulid gill plates, and related products may possibly be declared under other codes. The CSD data hence cannot be used to conduct this study's analysis.

Communication with the Agriculture, Fisheries and Conservation Department of the Government of Hong Kong (AFCD) revealed that there have not been any imports or re-exports of manta gill plates in Hong Kong since the implementation of CITES in 2014 November [46].

SIZE MATTERS

SIZE MATTERS?

Stores selling the widest range of gill plates (from 5 cm to >55 cm) was recorded in Sheung Wan, followed by Yide Lu (5 cm to 54 cm) and then Qingping (5 cm to 44 cm). Drawing from the results of this study and from existing identification guides, it appears that manta gill plates are commonly larger than mobula gill plates. This seems in line with the markets' species composition findings, as manta gill plates were found in greater availability in Sheung Wan market, while mobula gill plates dominated in the Guangzhou markets.

For Sheung Wan, the dominant size range was 15-44 cm for manta gill plates, and 15-24cm for mobula gill plates (not taking into account of the proportion of fragments).

For Yide Lu, there was no prominent size range for manta gill plates, and for mobula gill plates, the range of 15-34 cm dominated.

For Qingping, there was also no distinctively dominant size range for manta gill plates, and for mobula gill plates the range 15-34 cm also appeared to dominate.

In all three markets, the dominating size ranges were larger for manta gill plates than for Mobula. In other words, manta gill plate sizes are more available in a larger range of sizes, whereas a relatively smaller size range of Mobula gill plates can commonly be found.



Figure 7a - Mobula gill plates found measuring over 30 cm.

Mobula gill plates were previously thought to always measure less than 30 cm, as indicated in existing species identification guides [45]. By coincidence, mobula gill plates of over 30 cm (and less than 34 cm) were found in this survey, allowing for updates to identification resources.

SIZE AND AGE

Although the size of gill plates may give clues to the actual size of the animals, there is currently no known methodology to accurately age Mobulid individuals by just looking at the size of gill plates. Future studies to reveal the correlations between size of gill plates and the age and/or sexual maturity of Mobulid individuals will lend insight into the impact of the related trade and fisheries on the species' survival and sustainability of the consumption practices.

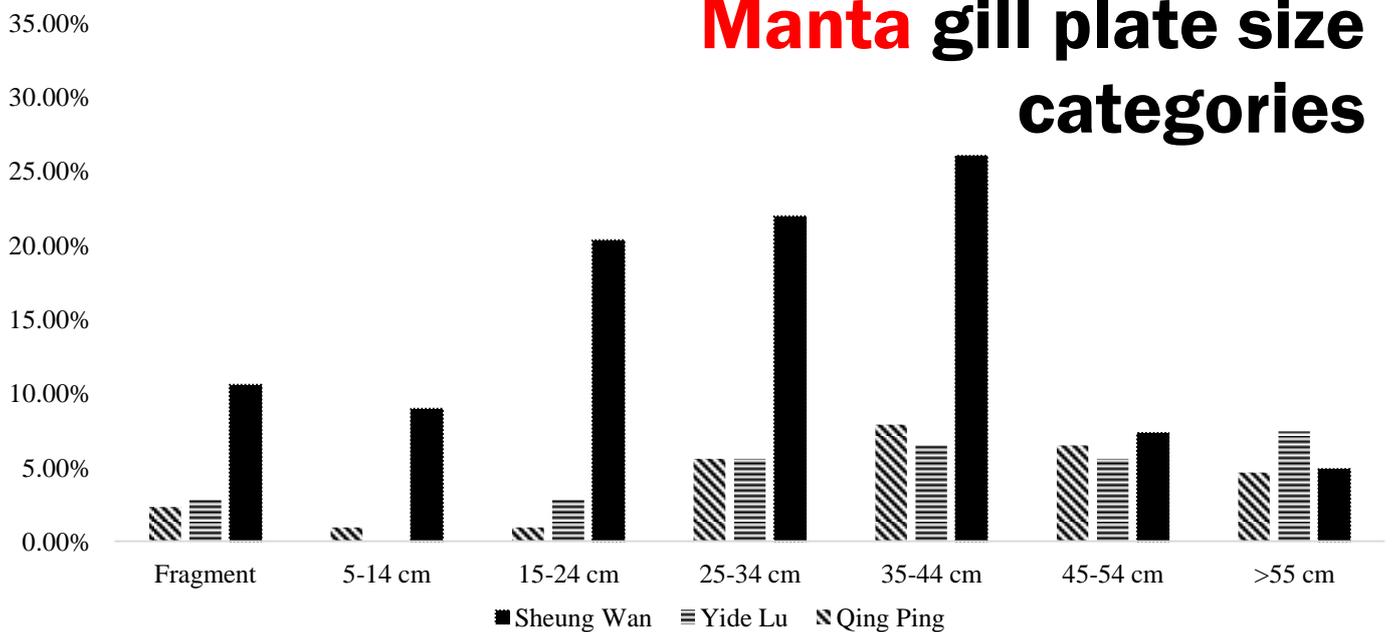


Figure 6 - Sizes of *Manta* gill plates found at Sheung Wan, Yide Lu and Qing Ping stores

AN UNEXPECTED ENCOUNTER: WHALE SHARK GILL PLATE AT YIDE LU



Figure 7b - **Top:** Whale shark (*Rhincodon typus*) gill plates sold at a shop in Yide Lu. **Bottom (left)** and **top (right)** view of whale shark gill plate.

One of the surprising findings of this study were the whale shark (*Rhincodon typus*) gill plates encountered at Guangzhou's Yide Lu dried seafood market. The gill plates were selling at USD\$ 216/500g.

Whale sharks are classified as Vulnerable (VU) under the IUCN Red List of Threatened Species. It is also listed on CITES Appendix II, meaning that its international trade is regulated. In both Hong Kong and Mainland China, the cross-border import and export of whale shark products must be accompanied by trade permits to ensure that the shipment is certified and meets criteria set out by the certifying governments. Whale sharks are also locally protected under China's *China Species Red List, Vol. 2* and under Hong Kong's *Protection of Endangered Species of Animals and Plants Ordinance* (Cap. 586). In this particular encounter, there were no visible permits or indications to the gill plates' legitimacy.



Mobula gill plate size categories

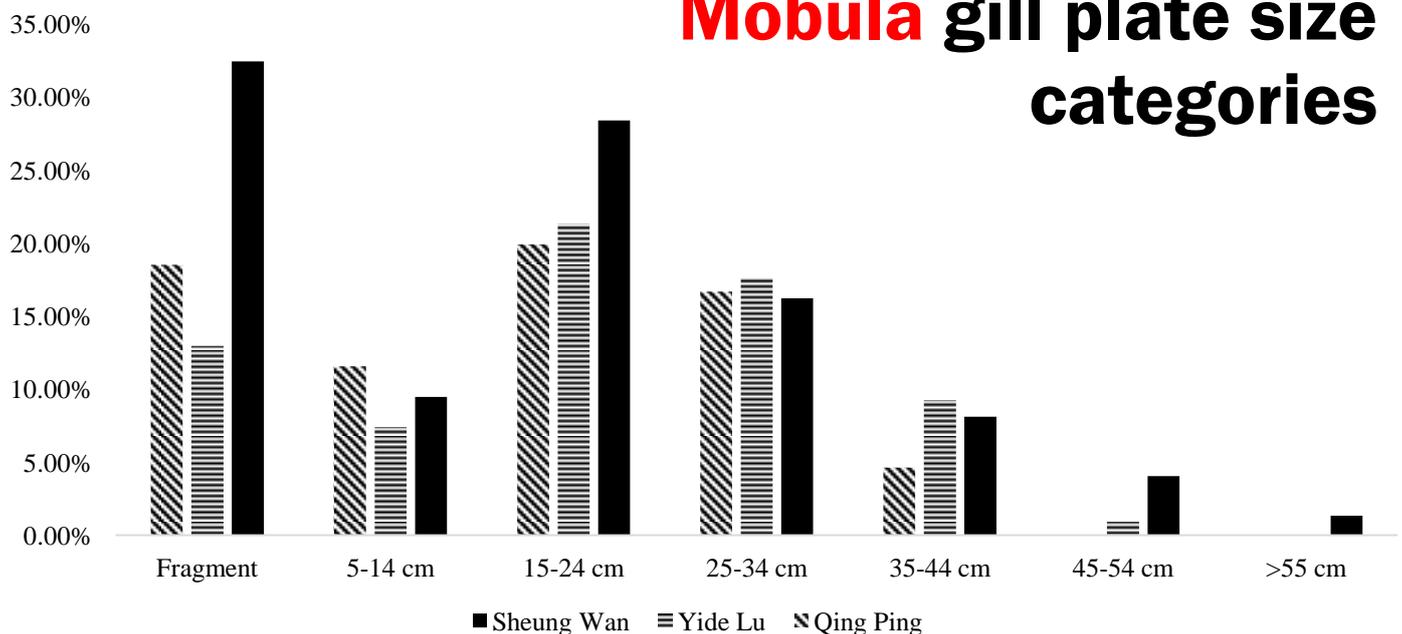


Figure 8 - Sizes of *Mobula* gill plates found at Sheung Wan, Yide Lu and Qing Ping stores

COMPARING PRICES
IN THE MARKET

SHEUNG WAN

Highest/Lowest
Manta pricing:

HIGHEST

Price range:

LARGEST: USD430.76/500G

Highest/Lowest
Mobula pricing:

HIGHEST

Price range:

USD270.84/500G

BREAKDOWN BY...

Genus

No significant genus-price correlation found

Size

No significant size-price correlation found

Within the survey period, selling prices of manta gill plates fluctuated from 219.25 to 166.56 USD/500g. Despite these fluctuations, the change was not significant.

With the exception of 45-55 cm and fragmented mobula gill plates sold in Yide Lu, manta gill plates of all size ranges were sold at higher prices than that of mobula in all three markets.

Figure 9 offers comparisons of gill plate selling prices according to their markets, genus and size. Specific comparisons between dried seafood markets (Sheung Wan and Yide Lu), and between TCM markets and dried seafood markets (Yide Lu and Qingping), were made.

Gill plates sold as dried seafood (Sheung Wan vs. Yide Lu)

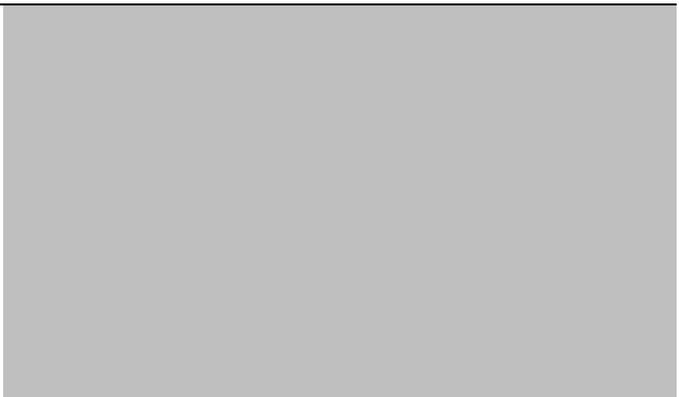
Manta
Mobula

Significantly more expensive than in Yide Lu

Significantly more expensive than in Yide Lu

Gill plates sold as dried seafood vs. as TCM (Yide Lu vs. Qingping)

Manta
Mobula



YIDE LU

QINGPING

LOWEST

SMALLEST: USD165/500G

USD420/500G

LOWEST

SMALLEST: USD132/500G

One exceptionally high priced shop recorded as anomaly

LARGEST: USD322.50/500G

Manta gill plates significantly higher than mobula's

Manta gill plates significantly higher than mobula's

Only **Manta** gill plates showed strong size-price correlation

Mobula gill plates showed intermediate size-price correlation

No significant size-price correlation found

Generally: 53-84% of the price recorded in Sheung Wan
*Fragments: only 35% of the price recorded in Sheung Wan

Generally: 64-42% of the price recorded in Sheung Wan
* Except for the size category: 45-54 cm

No significant difference found

No significant difference found

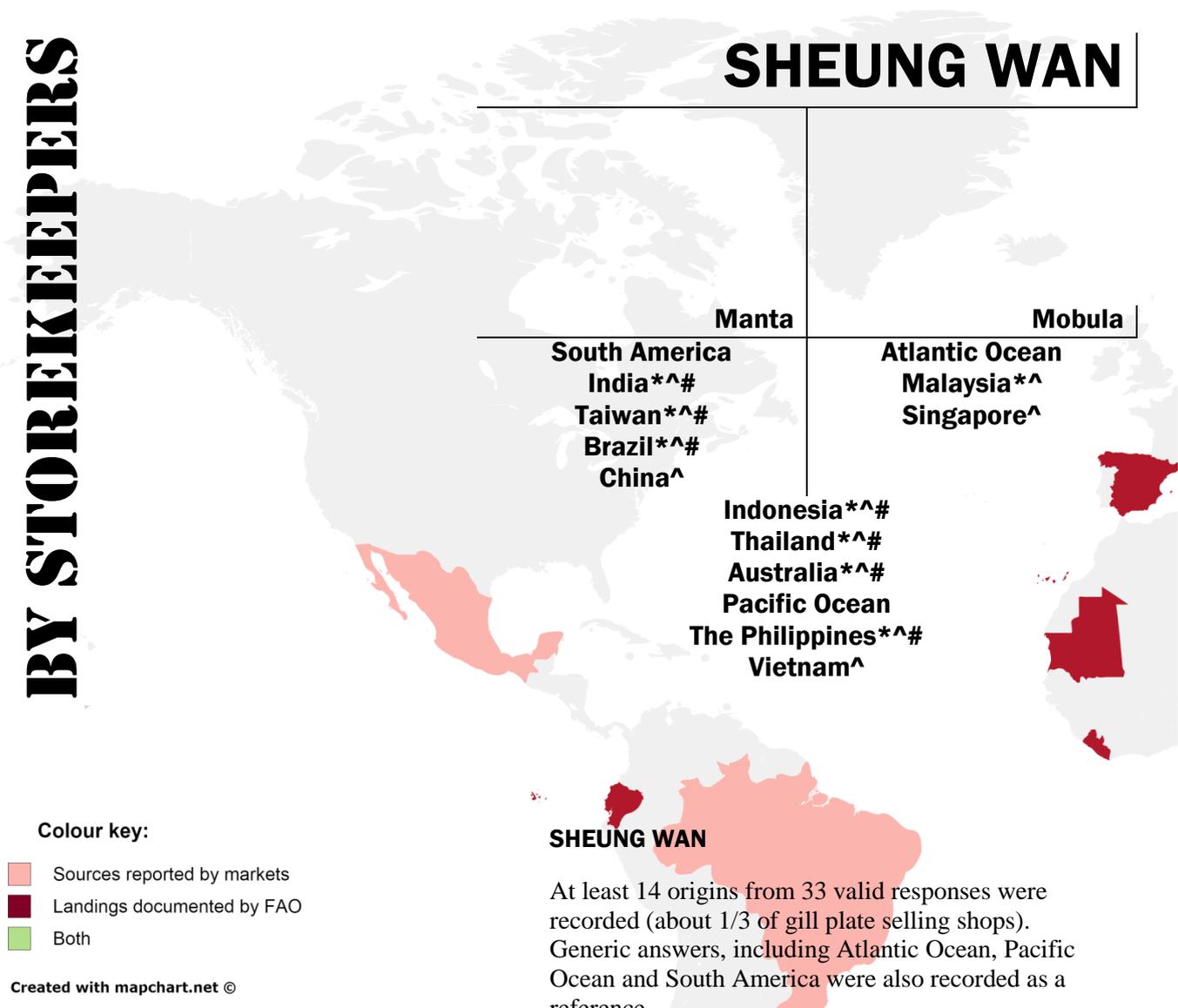
No significant difference found

No significant difference found

Figure 9 – Price analysis of manta and mobula gill plates in Hong Kong and Guangzhou markets

ORIGIN COUNTRIES AS TOLD BY STOREKEEPERS

SHEUNG WAN



SHEUNG WAN

At least 14 origins from 33 valid responses were recorded (about 1/3 of gill plate selling shops). Generic answers, including Atlantic Ocean, Pacific Ocean and South America were also recorded as a reference.

Manta rays – Brazil, China, India and Taiwan were all quoted by storekeepers as manta ray sourcing countries. However, distributions of *Manta* species do not include China, and no *Manta* fisheries have been recorded there. Brazil, India and Taiwan, on the other hand, are all reportedly both within distributions of manta ray and with known manta ray fisheries.

Mobula rays – Malaysia and Singapore were both reported as the sources of mobula gill plates by storekeepers. Both countries are within the natural distribution of *Mobula* species, but do not have mobula rays fisheries reported.

Both genera – Indonesia, Thailand and Australia were the most commonly reported origins of gill plates for both genera. These countries are within the distribution of both *Manta* and *Mobula* species, with known fisheries. This was also the case for the Philippines, although less frequently mentioned than the above three countries.

Vietnam was also reported as sources for both genera, but is not a known territory for natural *Manta* species distribution, nor reported to have manta ray fisheries.

A total of 19 origins of the gill plates were quoted by storeowners from the Hong Kong and Guangzhou markets. However, some countries of origin are not within natural distributions for both *Manta* and *Mobula* species. For Vietnam, Malaysia and Singapore, there are no known reports of manta or mobula ray fisheries or bycatch. Some answers given by storeowners were quite generic, but were noted nonetheless.

FAO DATA REVEALS...

For Mobulid gill plates, the FAO records only landing data, and not data for gill plate exports. For the species *Manta birostris* and *Mobula mobular*, Ecuador and Spain are the only countries with reported landings in the FAO records, however, both countries were not reported in any of the markets. On the other hand, Indonesia, Liberia and Mauritania are all reported as Mobuildae species landing regions.

Notably, no landings were recorded from Ecuador since 2007 and from Liberia since 2006. For other regions, landings were still recorded in the latest update (from the time of this study) in 2013.

YIDE LU

QINGPING

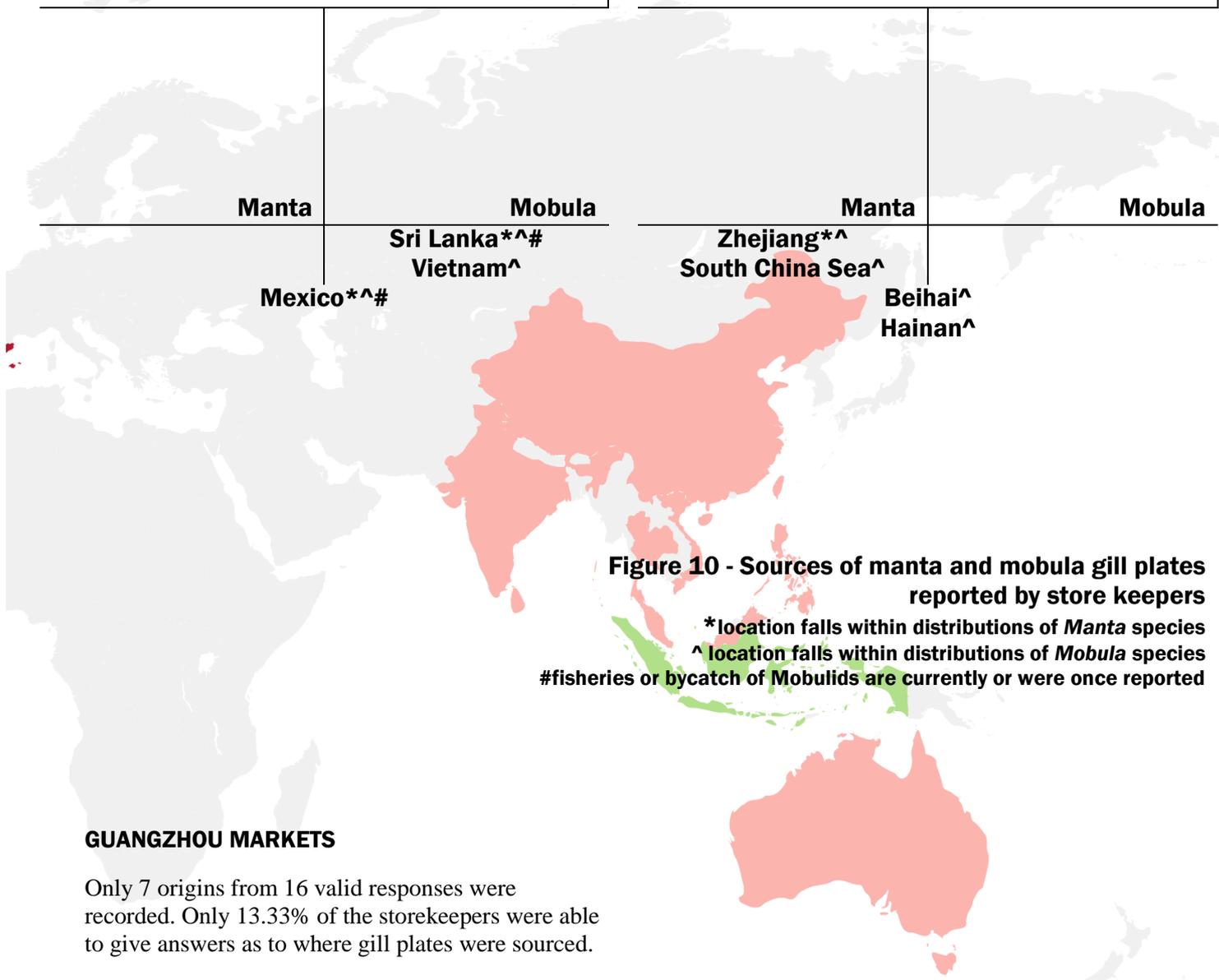


Figure 10 - Sources of manta and mobula gill plates reported by store keepers
 *location falls within distributions of *Manta* species
 ^location falls within distributions of *Mobula* species
 #fisheries or bycatch of *Mobulids* are currently or were once reported

GUANGZHOU MARKETS

Only 7 origins from 16 valid responses were recorded. Only 13.33% of the storekeepers were able to give answers as to where gill plates were sourced.

Three of the reported origins came from Yide Lu, and 4 from Qingping. Vietnam was the only source country that was reported in both Guangzhou (Yide Lu) and Hong Kong (Sheung Wan). All of the origins quoted from storeowners in Qingping were areas located within China, whereas Sheung Wan and Yide Lu quoted countries worldwide.

YIDE LU

Mobula rays – Both Sri Lanka and Vietnam were reported by storeowners as sources of mobula gill plates. Although distribution of *Mobula* species are known to occur in both countries, fisheries or by-catch of mobula rays are only reported in Sri Lanka, and not in Vietnam.

Both genera – Mexico was the only country that was quoted by storekeepers as origins for both manta and mobula gill plates. Mexico is a known region for *Manta* and *Mobula* species distribution, and fisheries of both genera are known to occur.

QINGPING

Manta rays – Zhejiang and South China Sea were both reported by storekeepers as origins of manta gill plates. Of the two locations, only Zhejiang is known to be within the distribution of *Manta* species. However, both locations are not currently known to have manta ray fisheries or by-catch.

Both genera – Beihai and Hainan were reported by storekeepers as origins of both manta and mobula gill plates. However, both locations are only known to be within the distribution of *Mobula*, and not *Manta* species. There are also no known manta or mobula rays fisheries or by-catch in those areas.

SHEUNG WAN

NAMES BY CATEGORIES

MANTA	MOBULA	BOTH				
黑 魚 旺	花 魚 旺	澎 魚 鰓	膨 魚 鰓	彭 魚 腮	鵬 魚 腮	魚朋
"HAK (BLACK) YU WONG"	"FA (FLOWER) YU WONG"	"PANG YU SAI"				
		魚 須	魚 旺	膨 魚 鰓 干	膨 魚 旺	澎 魚 旺
		"YU SO"	"YU WONG"	"PANG YU SAI GON (DRIED)"	"PANG YU WONG"	

FANCY NAMES

In the retail markets, there are two generally encountered Chinese characters used to refer to gill plates: 魚鰓 "yu sai" (fish gills) and 魚旺 "yu wong" (prosperous fish).

Of the two, *yu sai* is obviously the most directly translatable name for gill plates – so why create a new name, *yu wong*, to refer to the same item?

This is because in Chinese, the word for gills 鰓 "sai" has a very similar pronunciation to the word 衰 (*despicable* or *unlucky*) and 輸 (to lose, as in a game or competition). As often is the case in the Chinese culture, the product is given a new name in the trade, with more positive connotations, thus the name *yu wong*.

The complexity of the Chinese language adds challenge to the task of recording name categories. In the Chinese language, the pronunciation of some words do not correspond directly with a specific character, hence there are instances where names verbally reported by storekeepers could not be recorded.

SHEUNG WAN

A total of 76 valid naming records were obtained from surveys in Sheung Wan. Cumulatively, the name list leveled off at the 46th record, indicating that most, if not all, possible names given to gill plates have already been recorded.

Seven different names were recorded, including 1 for manta gill plates, 1 for mobula gill plates, and 5 that applied to

YIDE LU & QINGPING

MANTA		MOBULA		BOTH		SPECIAL FINDING: WHALE SHARK
黑 鰓	花 鰓	黑 鰓	魚 旺	膨 魚 鰓		內 鰓
"HAK SAI (BLACK GILL)" <i>Manta birostris</i>	"FA SAI (FLOWER GILL)" <i>Mobula tarapacana</i>	"HAK SAI (BLACK GILL)" <i>Mobula japonica</i>	"YU WONG"	"PANG YU SAI"		"LOY SAI (INNER GILL)" <i>Rhincodon typus</i>

Figure 11a – Name categories of manta and mobula gill plates found in Hong Kong and Guangshoul markets

Note: English translations of names presented here are not official names, but translated by the investigator and authors.

both genera. Some names with the same pronunciation and meaning were written as different characters, such as "Pang Yu Sai" in figure 11a. This is owed to the nature of the Chinese language, where different characters will have identical pronunciations, and different meanings depending on context. Use of these same-sounding characters interchangeably is common among in the application of this complex language. The variations encountered in Sheung Wan are counted as separate records, but considered as a single name category for this study.

GUANGZHOU MARKETS

A total of 51 valid naming records were obtained from surveys in Yide Lu and Qingping combined. Cumulatively, the name list leveled off at the 19th record, indicating that, like the case of Sheung Wan, most, if not all, possible names given to gill plates have already been recorded.

Only 4 name categories were recorded from the Guangzhou markets. Two of these names were found to indicate gill plates of both genera. Unlike Sheung Wan, some name categories were found connected to distinct species, i.e. "Hak Sai" for *Manta birostris* and *Mobula japonica*, and "Fa Sai" for *Mobula tarapacana*. Note that the same names can refer to different products between Hong Kong and Guangzhou, e.g. "黑鰓" refers to manta in Sheung Wan, and both manta and mobula in Guangzhou.



Figure 11b - Gill plates labeled in one variation of "Pang Yu Sai" in one of Hong Kong's dried seafood stores.

IMPLICATIONS AND FUTURE ACTIONS

The results of this survey point to several interesting implications about Hong Kong and Mainland China's Mobulid gill plate trade:

I. Hong Kong is one of the key markets in the international Mobulid gill plate trade, possibly partly "hidden from view"

At a glance, Guangzhou's markets seem to offer a greater provision of gill plates, as most of the gill plate-offering stores were specialized in one product, and display their gill plates in bulk at the storefront. However, this study has shown that the availability of gill plates is far greater in Hong Kong, where more than a quarter of the stores in the Sheung Wan dried seafood market (28.42%) had gill plates available for sale (compared to just 4.58% in Yide Lu and 7.67% in Qingping).

Stores in Sheung Wan sold gill plates among a vast selection of other dried seafood products, and as many as 55% of those gill plate-offering stores in Sheung Wan kept some or all of their gill plates in storage and are not visible from the storefront, possibly giving the illusion of low gill plate availability in Sheung Wan.

Note: It was not possible in this survey to estimate the total volumes and values of the gill plates available in each market. In particular for Sheung Wan, gill plates kept in storage behind stores or out-of-store warehouses are inaccessible to the investigator.

II. Manta gill plates were more available in Sheung Wan, and mobula gill plates in Yide Lu and Qingping...but why?

The preference for larger-sized gill plates by Hong Kong and Macau consumers, and smaller and cheaper mobula gill plates by Mainland Chinese consumers, has been suggested as a reason for the difference in genera availability between Sheung Wan and Guangzhou's markets, in a study involving trader surveys [52]. Still, more research into this area is needed to explore further possible explanations to this consumption pattern. .

III. Genus of gill plates determined selling price, followed by the location of markets

Genus: In both Yide Lu and Qingping, manta gill plates were found to be selling at significantly higher prices than those of mobula. Given that there are no perceived differences in the medical values between gill plates of the two genera [13], the more probable explanation for this difference in price is the scarcity of *Manta* in the wild. This was not observed in Sheung Wan.

Location: Gill plates sold in Sheung Wan were also generally more expensive than those sold in Yide Lu and Qingping.

One possible explanation for this is the relative position of Hong Kong and Guangzhou on the overall supply chain and trade route of gill plates. It has been hypothesized that the commercial values of goods will typically grow higher further down the supply chain/trade route [47,48]. Possibly, gill plates are imported into Mainland China from various source- or consignment countries, and then re-exported to Hong Kong, keeping a part of the goods for local consumption. In such a case, retail prices of gill plates in Hong Kong may be expected to be higher than in Guangzhou markets. However, the exact trade routes of Mobulid gill plates through Hong Kong and Mainland China are not currently known. This should be targeted as a topic for future studies.

Another possible explanation may be the difference in retail culture. Products in Hong Kong tend to fetch higher prices than those in Guangzhou, as they are more often of a "preferable grade or retail quantity" [49].

Comparatively higher rental costs for retail space in Hong Kong than in Guangzhou, may also be speculated as a possible explanation for the higher pricing of retail goods in Hong Kong. However, this reason for gill plate prices has not been encountered in existing sources.

IV. Mobula gill plates can be larger than presently estimated on existing identification guides

One of the easiest ways to distinguish manta from mobula gill plate is by looking at the specimen's size. Manta gill plates are typically wider and larger than mobula gill plates (due to the relatively larger sizes of rays), and it was recognized that gill plates measuring longer than

30 cm may be identified as belonging to *Manta* species [50, 51].

Contrary to this rule of thumb, mobula gill plates exceeding 30 cm were recorded in the observations made during the market surveys. However, mobula gill plates were not observed to exceed 34 cm in length (figure 7a).

V. Records of manta and mobula gill plate origins appear incomplete

Origins of gill plates reported by storekeepers were checked against existing datasets and literature to confirm validity. Most of the countries reported were known sources of Mobulid to some degree – either included under the natural coverage of *Manta/Mobula* species or have known fisheries.

For those regions where Mobulid trade was not previously recorded, it suggests a possible misreporting to authorities in those countries. China, for instance, has no official landing records of *Manta* species, and is not within the species' natural distributional range. Fisheries of *Mobula* were also not found for the country. The possibility of unreported fisheries for both genera is worth investigating.

Vietnam was also an unconfirmed source of manta and mobula gill plates. Coincidentally, Vietnam was also found to be an up and rising trade port for another, valuable dried seafood item – bêche-de-mer [55] – and suspected to be involved in the related products' illegal trading activity. Again, further investigation into Vietnam's role in the trade of popular seafood items into Mainland China is recommended.

Notably, identification of source countries of gill plates through CSD data is challenging. The four HS codes for which gill plates should be reported under are unspecific (generalized under "Other marine fish..." or "Rays and skates...") and cannot be separated to show information for manta and mobula gill plates only. The exporting countries, as well as the volume, of gill plates being imported into Hong Kong hence cannot be found out.

VI. There is still a multitude of unknowns about the gill plate trade

The discovery of gill plates belonging to the whale shark at Yide Lu, for instance indicates a

possibility of other non-Mobulid and filter-feeding fishes being sold as gill plates in both Hong Kong and Guangzhou's markets, such as the basking shark (*Cetorhinus maximus*). Discovery of other species used for the gill plate trade may or may not have further conservation implications, but all this cannot be known without first having information on exactly which species are involved in the gill plate trade, and to what extent.

This, along with all of the *unknowns* and *items for future research* mentioned above, demonstrate the necessity for continued and innovative research into the international gill plate trade.

RECOMMENDATIONS FOR ACTIONS FOR THE GILL PLATE TRADE

Observing the above findings, it appears that both Hong Kong and Mainland China, while being two of the world's most significant markets in the international gill plate trade, currently have limited means of combating the possible infiltration of illegal products into their markets. Information of the origins and genera of gill plates being sold are lost even to the storekeepers, who are, to some degree, experts on the matter.

The vastness of unknowns surrounding the trade poses challenges to the regulation and management of Mobulid trade and fisheries. In view of these difficulties, several recommendations for Hong Kong to be implemented at the government level and by future researchers are made below.

GOVERNMENT ACTION #1 SUPPORT CITES II LISTINGS FOR ALL MOBULA SPECIES

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Currently, only *Manta* species are included in the CITES Appendix II listings. The threats faced by *Mobula* species are no less urgent, given that the demand for gill plate in the dried seafood market is shared between the two genera. In particular, the Sicklefins devil ray (*Mobula tarapacana*) and the Spinetail devil ray (*Mobula japonica*) have faced population declines of 96% and 99% respectively in just the past 10-15 years [23].

Although other *Mobula* species may not have shown similarly drastic drops in population sizes, their gill plates, after processing, are barely distinguishable from one another. "Look-alike species" of other species that are of greater conservation concern, are sometimes listed onto CITES Appendix II as a means of added protection to the species that they resemble and that are suffering a greater threat (53). Due to the similarity in appearances of *Mobula* species and the indiscriminant nature of the mobula fisheries, it is suggested that the Hong Kong government should actively support proposals to list all *Mobula* species onto CITES Appendix II.

GOVERNMENT ACTION #2 SEPARATE HS CODE CATEGORIES FOR MOBULID GILL PLATES

It is not currently possible to use Hong Kong's CSD data to estimate gill plate import volumes and exporting countries due to the generalized categorization of gill plate-related products on the HS coding system. As Hong Kong is shown to be one of the main trade hubs for gill plate-related products internationally, collecting information at Hong Kong's ports would greatly assist the monitoring of the international trade, and enhance traceability for the products.

GOVERNMENT ACTION #3 INVESTIGATE THE (POSSIBLY ILLEGAL) ONLINE TRADE

It was found that, as online shopping platforms such as Taobao are becoming increasingly popular in Hong Kong and Mainland China, gill plates have also become obtainable through online purchase. A quick search has revealed at least 25 online stores offering sales of Mobulid gill plates. The online market for gill plates and other dried seafood is possibly up and rising, and is worth further examination to decide whether or

not new regulations and stronger means of monitoring might be needed.

RESEARCH TOPICS FOR FUTURE STUDIES

MARKET COMPOSITION: the present study focused only on the availability of gill plates in retail markets. This is insufficient to give a clear picture of the actual volumes traded and trade route taken. While official CSD data are currently unavailable, estimations made by interviews with retailers and wholesalers may be possible.

DNA SPECIES IDENTIFICATION: visual species identification of gill plates is extremely difficult, and presently official visual identification guides are only available for 1 species of *Manta* and 3 species of *Mobula*. A comprehensive study on the species composition of the gill plates available on the market, using DNA analysis to achieve accurate results, has yet to be done. Such a study would not only allow for identifying the necessity of species-specific protection and regulations, but also uncover the use of other filter-feeding species that are harvested for gill plates, such as whale sharks.

USE IN CHINESE MEDICINE: the present study only visited TCM stores in Guangzhou's Qingping. Gill plates are also known to be sold as TCM in Hong Kong markets, although shops are sparsely scattered and not concentrated in specified regions as in the case of Qingping. These stores could not be included into the present study due to resource limitations, and is definitely worth further investigation.

In addition, substitutes to gill plates in TCM are also rarely publicized. Identification of ingredients which can substitute gill plates as medicine or tonic and which do not threaten the survival of specific plant and animal species may add to the campaign for sustainable resource use.

SOCIOLOGICAL SURVEYS: while gill plates are widely available in Chinese markets, the extent of preference of the Chinese consumer population towards gill plate-related products is

unknown. Do people feel that gill plates are irreplaceable? Are they more popularly used as a medicine, a tonic, or just a soup? Are the public aware of the conservation issues attached to the product? Such a study would greatly benefit future conservation campaigns and provide a means of measuring campaign impacts.

PRICE CHANGES, BEFORE AND AFTER CITES FOR HONG KONG: Hong Kong's implementation for the CITES listings of *Manta* species came into effect in November 2014, and for Mainland China the implementation date was set to be even earlier. Research into the changes in price before and after the implementation of CITES will provide clues as to how the market had reacted to the CITES regulations, and is worthy of further study effort.

CONCLUSION: GIANTS OF THE OCEAN, GIANTS OF THE TRADE

The data retrieved in the few months of this study is limited and only provide a snapshot for the markets. However, the study has also revealed some of the basic patterns of the retail of gill plates. The clear conclusion is that far more effort into the research and conservation of Mobulid rays is needed.

Both Hong Kong and Guangzhou are indisputable giants in the global trade of manta and mobula gill plates. The results of this study have shown only a preliminary understanding of its sheer scope. Many questions are left unanswered, and there is a very real danger that continued unregulated and unmonitored trade of *Manta* and *Mobula* species will push populations beyond repair before the trade can be understood.

Conservation of Mobulid species must not be delayed. With any luck in the upcoming CITES CoP17 in September to October 2016, all *Mobula* species will, like in the case for *Manta* species, become listed onto CITES Appendix II to receive protection from overharvesting in the trade. Even then, the fight continues to ensure enforcement of

proper management in respective trading countries, and to combat illegal trades.

Needless to say, a delicate balance must be maintained between the Giants of the Ocean and the Giants of the Trade; for when the latter overthrows the former, both shall perish.

ACKNOWLEDGEMENTS

The authors would like to thank Professor Yvonne Sadovy for her guidance, Ms. Bud Wing Sum for her support, and all the traders who were involved in this study.

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