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RECEIVED 19 September 2024

ACCEPTED 19 November 2024

PUBLISHED 19 December 2024

## CITATION

Ji X, Wang Z, Zhang T, Chen D, Yang W, Li M,  
Shi H and Lin L (2024) Current status and  
trends of illegal trade in hawksbill turtle  
products in Hainan Island, China.  
*Front. Mar. Sci.* 11:1498647.  
doi: 10.3389/fmars.2024.1498647

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# Current status and trends of illegal trade in hawksbill turtle products in Hainan Island, China

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**Introduction:** Illegal wildlife trade is among the most profitable illegal businesses worldwide. The hawksbill turtle (*Eretmochelys imbricata*), which has been listed as Critically Endangered on the IUCN Red List, has long been a prominent target of illegal wildlife trading worldwide, thus posing a substantial threat to its continued survival. In China, although Hainan Island is the largest trading area and the most important transit point for the illegal trade of hawksbill turtles, very few investigations of this trade have been conducted here.

**Methods:** In this study, from 2019 to 2020, we conducted field investigations to assess the extent of the illegal trade in hawksbill turtle products in nine cities on Hainan Island.

**Results:** Among the 878 shops surveyed in 2019, 157 shops (17.9%) sold hawksbill turtle products, totaling 6,208 pieces. In 2020, 122 shops (13.6%) of 895 surveyed shops sold such products, totaling 1,821 pieces. Thus, these findings indicate that the number of shops selling hawksbill turtle products and the total number of products sold declined in 2020. Among the surveyed cities, the highest levels of illegal trade in hawksbill turtle products were recorded in Haikou and Sanya, the capital city of Hainan and a renowned tourist city, respectively. Jewelry and craft shops were found to produce the most products, accounting for 98.0% of the shops surveyed. Accessories such as bracelets and necklaces accounted for the highest proportions of hawksbill turtle products, representing 72.5% and 92.9% of the total in 2019 and 2020, respectively.

**Discussion:** The observed decline in illegal trade in 2020 can be attributed to a combination of factors, including a strengthening of government law enforcement and supervision after the COVID-19 pandemic, a shift in illegal trade from offline to online activities, and a reduction in tourists. Law enforcement agencies should continue strict enforcement and supervision to effectively combat illegal trade, particularly in the key trading areas of Haikou and Sanya. Additionally, authorities should emphasize public education to increase awareness of wildlife conservation and relevant legislation. The findings of this study will serve as a vital reference for relevant law enforcement agencies, contributing to the effective combatting and prevention of the illegal hawksbill turtle trade in China.

## KEYWORDS

hawksbill turtle, illegal trade, law enforcement, Hainan Island, China

## 1 Introduction

Sea turtles are well known as “living fossils” and a famous flagship species in marine conservation. They are critical for the maintenance of marine ecosystems and serve as important indicator species for marine environmental monitoring (Bouchard and Bjorndal, 2000; Hamann et al., 2010). However, sea turtles are threatened by human factors such as overhunting, illegal trade, habitat loss, marine pollution, and climate change (Chan et al., 2009; Hawkes et al., 2009; Lam et al., 2011; Virgili et al., 2024). The sea turtle population in China has decreased dramatically in recent decades, and their nesting grounds have almost disappeared, as a consequence of which, they may now be on the verge of local extinction (Mou et al., 2013; Lin et al., 2021). All sea turtles have been listed in Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) since 1981, which strictly prohibits the killing, transportation, and trade of these animals. In China, the five native sea turtle species were initially listed under level-II protection on the “List of Wildlife under Special State Protection” in 1989, and were not upgraded to the top level of protected animals (level I) until 2021 (Lin et al., 2021; Wu et al., 2024).

Hawksbill turtles (*Eretmochelys imbricata*) have long been an important target of illegal wildlife trade worldwide, and the survival of the population has been under great pressure (Meylan, 1998; Canin, 1991). The shells of hawksbill turtles have been valued since ancient times. Considered organic gems, the beautiful mottle patterns of these shells are characterized by a unique color after polishing that are particularly suitable for decoration and these products accordingly have a high collectible value (Zhou and Zeng, 1996). The scales are crafted to produce a range of desirable items, including bracelets, rings, combs, headdresses, cigarette holders, glass frames, fans, and so on (Bjorndal et al., 1993; Dijk and Shepherd, 2004). Moreover, traditional medicine has long used hawksbill shell pieces, blood, and meat (Yin et al., 2015). Extensive hunting is, therefore, considered the main cause of the collapse of wild hawksbill turtle populations. Since the 19th century, Japan has been a major producer of carved hawksbill turtle items (Dijk and Shepherd, 2004). Trade was not regulated until 1977, when CITES listed the global population as an Appendix I species, banning international trade in hawksbill turtles by all signatories. Many countries with hawksbill turtle populations, including Indonesia, the Philippines and Malaysia, joined in the 1970s and 1980s, whereas others, such as Fiji, Vietnam and the Solomon Islands, signed the CITES convention a few years later (Miller et al., 2019). Whereas almost all CITES signatories have now agreed to ban international trade, legal domestic exploitation and hawksbill turtle smuggling continue to occur in some countries (Dijk and Shepherd, 2004; Ly et al., 2011; Humber et al., 2014). To gain a sense of the magnitude of the capture of these turtles, it is estimated that from the 17th to the 20th century, the global trade in hawksbill turtles accounted for approximately 9 million individuals (Miller et al., 2019).

The Hainan Island is a major trading area and an important transit point for the illegal hawksbill turtle trade in China (Lam et al., 2011; Miller et al., 2019). However, there have been very few investigations into the illegal trade of hawksbill turtles in Hainan, and little is known about the situation and trends in illegal trade. The

most recent study was conducted by the TRAFFIC (Market Forces: An Examination of Marine Turtle Trade in China and Japan) in 2009. Although only a short-term investigation, the authors established that during this period, 94 hawksbill turtle specimens and 7,217 products were illegally traded in China, with Hainan Island having the largest number of shops engaged in illegal trade and the sale of turtle products (Lam et al., 2011). Since then, however, no other formal reports have been to gauge the scale of the illegal trade of hawksbill turtles in Hainan. In this study, we accordingly sought to conduct field investigations of the illegal trade of hawksbill turtle products in nine cities on Hainan Island from 2019 to 2020.

## 2 Methods

### 2.1 Study locations

A total of nine cities in Hainan Island, including Haikou, Sanya, Wenchang, Qionghai, Dongfang, Danzhou, Lingshui, Changjiang and Wuzhishan, were selected as investigation sites for illegal hawksbill turtle trade (Figure 1). Field visits were conducted in the main commercial districts of these cities. The investigation was conducted from June to September in 2019 and 2020 to ensure consistent coverage of the cities and investigation sites throughout both survey periods.

### 2.2 Field visit survey methods

Our investigations were based on an unstructured survey method, in which surveyors made a general interview outline in advance, and did not set a uniform interview standard for different merchants. Posing as buyers, surveyors interviewed merchants about the price, variety and quantity of hawksbill turtle products, and discussed the reasons for the decline in illegal trade with merchants. The final numbers recorded were based on the number of hawksbill turtle products shown to the surveyors by the merchants.

### 2.3 Statistical methods

The categorization method employed by Lam et al. (2011) was used when analyzing the survey results to classify the collected hawksbill turtle products into two primary types—accessories and sundries—which were further subdivided into 14 subcategories. Accessories included bangles, bracelets, necklaces, pendants, earrings, rings, and combs. Sundries included fans, glass frames, musical picks, pillows, cigarette holders, hawksbill specimens, and other items. A weighted average algorithm was applied to determine the average prices of hawksbill turtle products from survey results, as follows: (Lam et al., 2011).

$$\bar{x} = \frac{w_1x_1 + w_2x_2 + \dots + w_nx_n}{w_1 + w_2 + \dots + w_n} = \frac{\sum_{i=1}^n w_i x_i}{\sum_{i=1}^n w_i}$$

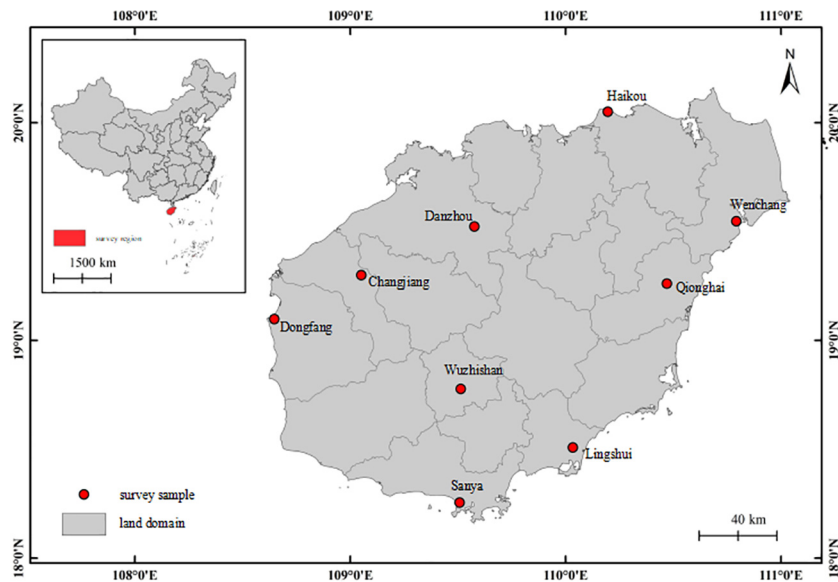


FIGURE 1  
The nine surveyed cities in Hainan Island.

where:  $w_i$  represents the number of hawksbill turtle products at the same prices, and  $x_i$  represents the prices of hawksbill turtle products.

### 3 Results

#### 3.1 Key areas and shop types engaged in the illegal trade in hawksbill turtle products

In 2019, a survey of 878 shops in nine cities revealed that 157 shops (17.88%, 157/878) illegally sold hawksbill turtle products. Haikou, Sanya and Qionghai presented the highest prevalence of such sales, with 54 (34.4%), 40 (25.5%) and 23 (14.7%) shops, respectively, engaged in illegal transactions, as presented in Figure 2. Moreover, jewelry and craft shops were found to account

for the overwhelming majority (98.1%) of illegal sales as presented in Figures 2–4.

Similarly, in repeated investigations conducted during the following year on the streets of the same cities, we identified 122 among the 895 surveyed shops (13.6%) that were illegally selling hawksbill turtle products, with Haikou, Sanya, and Wenchang having the highest numbers of shops selling such products, accounting for 48 (39.3%), 36 (29.5%), and 12 (9.8%) of the shops, respectively (Figure 2). As of 2019, jewelry and craft shops accounted for the vast majority (approx. 97.5%) of sales, as presented in Figures 2–4.

In 2020, we recorded 35 fewer shops selling hawksbill turtle products compared to 2019, with no evidence of new shops engaging in this trade. This declining trend was particularly evident in Qionghai, where the number of such shops had

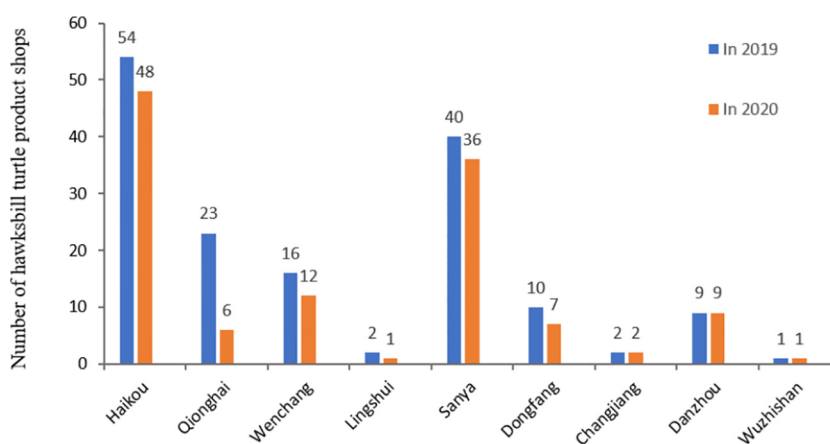
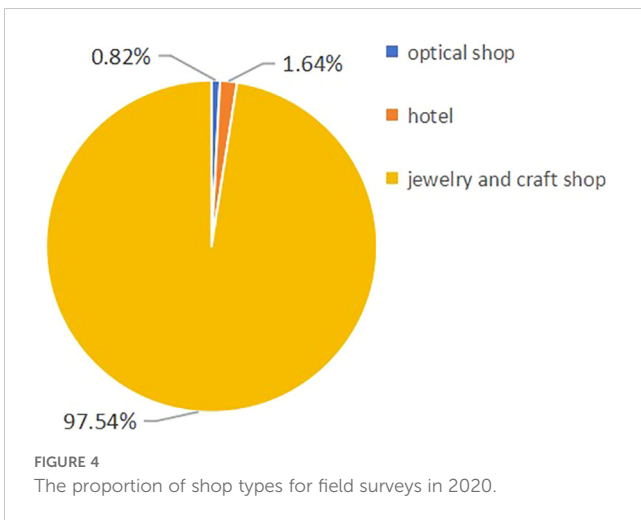
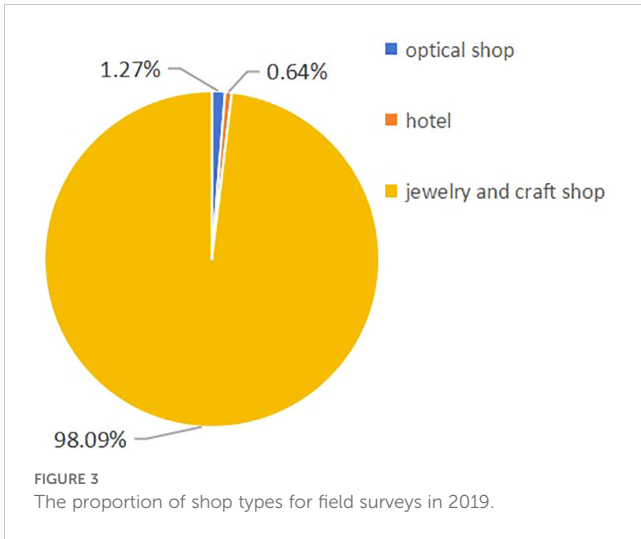


FIGURE 2  
Number of shops selling hawksbill turtle products in the nine surveyed cities in 2019 and 2020.



dropped from 23 to 6. Haikou and Sanya were identified as the most prevalent areas of the illegal hawksbill turtle trade. In Haikou, the illegal sales of hawksbill turtle products were concentrated in Arcade Streets and Yishenghe Department Store, as well as in other areas with tourist attractions and shopping centers. Similarly, in Sanya, illegal sales were predominantly observed in Jiefang Road Pedestrian Street and Yatai Commercial Center along Yalong Bay Road (refer to Table 1 for details on the other cities).

### 3.2 Number and type of hawksbill turtle products

In 2019, we documented the sale of 6,208 hawksbill turtle products among the nine surveyed cities, with the highest sales being recorded in Haikou, Sanya, and Qionghai at 4457 (71.8%), 681 (11.0%), and 499 (8.0%), respectively. Items classified in the accessory category represented the majority of hawksbill turtle products (72.5%), with those in the sub-categories bracelets, necklaces, and other items

**TABLE 1** A list of key areas associated with the illegal trade in hawksbill turtle products in the nine cities surveyed in 2019 and 2020.

Survey City	Main Areas (Streets, Malls)	Number of Shops in 2019	Number of Shops in 2020
Haikou	Arcade Streets, Zhongshan Road	23	21
	Yishenghe Department Store, Haixiu East Road	17	14
	Jiaxin Department Store, Haixiu Road	8	7
	Xingang Road	6	6
Sanya	Jiefang Road Pedestrian Street	26	25
	Yatai Commercial Center, Yalong Bay Road	6	5
	Baihua Valley Commercial Street, Yalong Bay Road	4	4
	Dadonghai International Shopping Center, Yuya Road	3	1
	Wanghai Shopping Mall, Donghai Road	1	1
Wenchang	Qinglan Road	9	7
	Guanlan Bay	3	3
	Baijin Road	2	1
	Intersection of Wenjian Wuheng Road and Wenjian Road	2	1
Qionghai	Fugang Street, Tanmen Town	22	5
	Dongshan Street	1	1
Dongfang	Longzhu Square, Renmin South Road	6	5
	Triangle Park, Qiongxi Road	2	2
	Literary play Street, Second Ring South Road	1	0
	The First Market, Jiefang West Road	1	0

(Continued)

TABLE 1 Continued

Survey City	Main Areas (Streets, Malls)	Number of Shops in 2019	Number of Shops in 2020
Danzhou	Dayong Commercial Square, Renmin Middle Road	3	3
	Jiefang North Road	3	3
	Wanfulong Commercial Building, Zhongxing Street	2	2
	Shuian Residence Community, Huasheng Road	1	1
Lingshui	Xinfuyuan, Haiyun Square	2	1
Changjiang	Baozhen Supermarket, Renmin North Road	1	1
	Nanguo Supermarket, Renmin North Road	1	1
Wuzhishan	Henan East Road	1	1

accounting for 40.6%, 11.3%, and 17.4%, respectively. Additionally, 18 entire hawksbill turtle specimens were sold, as presented in Table 2.

Of the 1,821 hawksbill turtle products traded in 2020, the highest numbers of products were sold in Haikou, Sanya, and Dongfang, accounting for 1,230 (67.6%), 146 (8.0%), and 121 (6.6%) of the items, respectively. Again, a majority of these products fell under the accessory category at 92.9%, among which items in the sub-categories bracelets, rings, and pendants accounted for 64.2%, 14.6%, and 6.9%, respectively. In addition, we documented the sale of nine entire hawksbill turtle specimens, as indicated in Table 2.

In 2020, the total number of hawksbill turtle products sold in Hainan decreased significantly by 29.3% compared to 2019. However, despite this overall decline, we recorded sales increases in Dongfang and Danzhou (Figure 5).

### 3.3 The value of hawksbill turtle products

Among all the hawksbill turtle products, the entire turtle specimens had the highest price, with an average price of CNY 12,000 (EUR 1,559.76) in 2019 and CNY 10,889 (EUR 1,415.57) in 2020 and the highest recorded price of CNY 20,000 (EUR 2599.6). Other high-priced products included pillows, fans, glass frames, and necklaces. The average price of bracelets, the most commonly sold accessory, was CNY 264 in 2019 and increased slightly to CNY 265 in 2020 (Table 3). When considering the number of various types of hawksbill turtle products, the final statistics revealed that the total value of hawksbill turtle products in Hainan was CNY 1,721,328 in 2019,

TABLE 2 Categories and total quantities of hawksbill turtle products sold in 2019 and 2020.

Type	Year	2019		2020	
		Number	Percentage	Number	Percentage
Accessories	bangles	2518	40.56%	1169	64.20%
	bracelets	103	1.66%	23	1.26%
	necklaces	699	11.26%	75	4.12%
	pendants	609	9.81%	125	6.86%
	earrings	8	0.13%	10	0.55%
	rings	467	7.52%	265	14.55%
	combs	95	1.53%	25	1.37%
Sundries	fans	8	0.13%	1	0.05%
	glass frames	45	0.72%	33	1.81%
	musical picks	437	7.04%	11	0.60%
	pillows	1	0.02%	1	0.05%
	cigarette holders	123	1.98%	52	2.86%
	hawksbill specimen	18	0.29%	9	0.49%
	others	1077	17.35%	22	1.21%
Total		6208		1821	

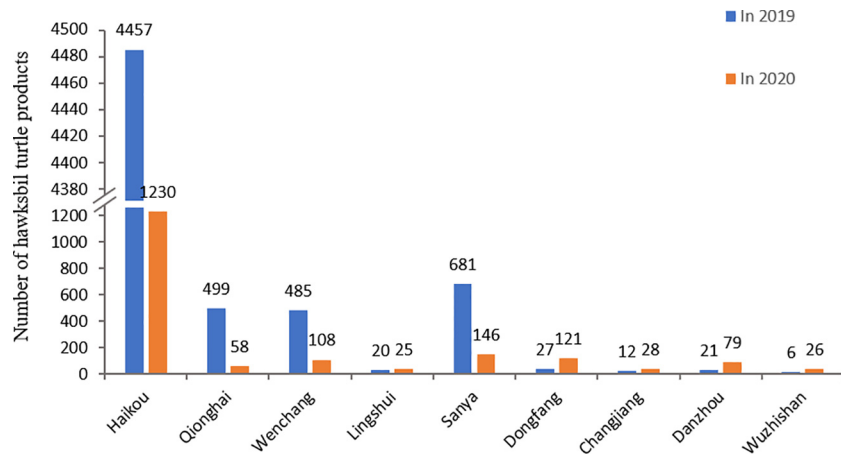


FIGURE 5 Numbers of selling hawkbill turtle products in the nine surveyed cities in 2019 and 2020.

which decreased significantly to CNY 587,280 in 2020, representing approximately one-third (34.1%) of the total value in 2019.

### 4 Discussion

Despite an overall reduction in sales documented during the investigation, the illegal trade of hawkbill turtles in Hainan remains a

significant concern. Among the surveyed cities, the highest volumes of illegal trading activities were observed in Haikou and Sanya, with the relevant shops predominantly located within popular shopping and tourism districts, such as jewelry and craft shops in urban areas, including Arcade Streets and Yishenghe Department Store in Haikou, and Jiefang Road Pedestrian Street in Sanya. As the provincial capital city and a nationally renowned tourist destination, Haikou and Sanya, respectively, are favored by tourists for travel and shopping

TABLE 3 The total value and average price of hawkbill turtle products sold in 2019 and 2020.

	Total value of hawkbill turtle products in 2019 (CNY)	Total value of hawkbill turtle products in 2020 (CNY)	Average price of hawkbill turtle products in 2019 (CNY)	Average price of hawkbill turtle products in 2020 (CNY)
<b>Accessories</b>				
bangles	665438	309394	264	265
bracelets	41360	9988	402	434
necklaces	410590	95054	587	1267
pendants	144960	41100	238	329
earrings	520	2284	65	228
rings	66750	48400	143	183
combs	24700	9990	260	400
<b>Sundries</b>				
fans	11100	1200	1388	1200
glass frames	54860	42200	1219	1279
musical picks	73160	1800	167	164
pillows	3500	3500	3500	3500
cigarette holders	45700	17800	372	342
hawkbill specimen	216000	98000	12000	10889
others	178690	4570	166	216
<b>Total</b>	<b>1721328</b>	<b>587280</b>		



in Hainan, which would thus tend to explain their status as primary hubs for the illegal hawksbill turtle trade. In addition, Tanmen Town in Qionghai has historically served as a central hub for illegal hawksbill turtle trading within Hainan Province and across China. During an investigation conducted in 2009, it was documented that 25 shops in Tanmen were engaged in the sale of 2,500 hawksbill turtle products, a significantly higher number compared with similar premises in Haikou (12 shops, 477 hawksbill products), in terms of both the number of shops and products (Lam et al., 2011). In the present study, we found a substantial decrease in the number of shops selling hawksbill turtle products in Tanmen over the intervening years, with only six shops offering a total of 58 products in 2020. This marked decline in illegal trading activities is assumed to have been attributable to a concerted crackdown on illegal turtle hunting and trading within Tanmen in recent years. Indeed, our investigations in this study revealed that business personnel showed a general sensitivity toward references to “hawksbill turtle” and other contraband, firmly denying any involvement, clearly reflecting the impact of stricter local law enforcement and supervision.

In the wake of the COVID-19 pandemic, the Chinese government strengthened the regulations and supervision of the trade of wild animals and their products, as a consequence of which, trade has tended to shift from offline to online activities, which may also have contributed to overall decline in the illegal trade of hawksbill turtle products in Hainan. On February 24, 2020, the Standing Committee of the National People’s Congress issued the “Decision on Comprehensively Prohibiting Illegal Wildlife Trade, abolishing the Bad Habits of Overeating Wild Animals, and effectively Protecting People’s Lives, Health and Safety” (The National People’s Congress of the People’s Republic of China, 2020). At the same time, the State Forestry and Grassland Administration, State Administration of Market Regulation, Ministry of Public Security, Ministry of Agriculture and Rural Affairs, and General Administration of Customs jointly launched a special law enforcement campaign against illegal wildlife trade. These measures have been launched in various parts of the country, effectively curbing the illegal trade in wildlife and associated products. During our survey conducted in 2020, we noted a heightened sense of caution among shop sales staff when displaying hawksbill turtle products, as evidenced by the frequent reference to terms such as “are not allowed to sell,” “illegal,” “contraband,” and “strict inspection.” This serves to emphasize that such products were prohibited from being carried in public modes of transportation such as planes and trains. During an investigation of Jiefang Road Pedestrian Street in Sanya, shop staff reported that the Industrial and Commercial Bureau law enforcement personnel conducted regular inspections and imposed fines and corrective measures for illegal activities. However, the surge in online platform trade has facilitated more clandestine transactions with less oversight, leading to a shift in illegal wildlife trade activities from offline to online (Xin and Xiao, 2019; Xu et al., 2020), thereby contributing to a decline in the sales of hawksbill turtle products in traditional shops. The COVID-19 pandemic further impacted Hainan in 2020 by significantly reducing tourist numbers (Agovino and Musella, 2022), potentially increasing business pressure. This may have contributed to the observed decline in the illegal trade of hawksbill

products, as evidenced by our finding that, compared to 2019, 35 fewer shops were engaged in illegal transactions in the surveyed areas in 2020, primarily due to closures or shutdowns.

In addition to economic, political, moral, and legal factors, one of the most important factors affecting illegal wildlife trade is the traditional cultures of trading countries and regions (Wu and Zhang, 2001). Since ancient times, hawksbill turtle products have been considered “organic gems” and “soft gold”, and wearing hawksbill ornaments has also been considered a symbol of status and fashion (Zhou and Zeng, 1996). Consequently, the promotional rhetoric of most of the merchants selling hawksbill turtle products has traditionally tended to include terms such as “wear to be safe,” “longevity,” “rare ornaments” and so on. Consistent with the findings of a 2009 investigation in Hainan conducted by Lam et al. (2011), we found that the main target populations for sales are women, the elderly, and children, with bracelets and other accessory items accounting for the largest proportion of hawksbill turtle products. Among the various accessories, bracelets were preferred due to their moderate price, diverse designs, and suitability for a wide range of customers, and, consequently, they have the highest sales. Notably, in this regard, consumer attitudes and preferences play a crucial role in determining illegal wildlife trade (Jiao and Lee, 2021). A further repercussion of the COVID-19 pandemic was an unprecedented increase in awareness of the illegal wildlife trade among the Chinese public, resulting in a greater reluctance to consume and trade wildlife products. The importance of behavioral changes in reducing the demand for and supply of illegal wildlife has been increasingly recognized (Ribeiro et al., 2022), and accordingly, we recommend that in addition to strengthening law enforcement, targeted educational campaigns and legal awareness programs should be conducted to raise awareness among the primary consumers of hawksbill turtle products.

Previous studies have shown that illegal sources of sea turtles and their products in the Chinese market are concentrated in the South China Sea and the Coral Triangle in Southeast Asia, with trade routes from Indonesia, Malaysia, and the Philippines to Hainan Province of China (Lam et al., 2011; Miller et al., 2019), which was partially confirmed in our survey. With regards to the source of hawksbill turtle products, some merchants claimed that these products were derived from turtles caught by local fishermen in the waters near Hainan Island and other areas of the South China Sea, whereas others have reported that the products are sourced from the illegal local farming of turtles. However, the identity and details of these sources require further investigation.

## 5 Conclusion

Despite evidence indicating a reduction in sales activities, the illegal trading of hawksbill turtles continues to be an issue of concern in Hainan, particularly in Haikou and Sanya. Our survey revealed that the Jewelry and craft shops that sell most hawksbill turtle products are primarily distributed along the main streets and popular business areas of these cities. However, we established that both the number of shops selling hawksbill turtle products and the total number of products traded had declined in the 12 month period between our first and second surveys, with the strengthening of law

enforcement and supervision by the government following the COVID-19 pandemic, a shift in illegal trade from offline to online activities, and the decline in tourists being identified as the primary factors contributing to this decline. Our findings in this study will serve as a vital reference for relevant law enforcement agencies, aiding in the effective combatting and prevention of the illegal hawksbill turtle trade in hawksbill turtle products. Based on these findings, we recommend that government departments should strengthen law enforcement and the supervision of major trade centers in key cities in which illegal hawksbill turtle trade is conducted in Hainan, notably Arcade Streets and Yishenghe Department Store in Haikou, and Jiefang Road Pedestrian Street in Sanya. At the same time, science and legal popularization among major consumer groups have contributed to altering consumption concepts and curbing illegal consumption. Moreover, the supervision of express delivery and other logistics industries involved in illegal wildlife trade should be strengthened.

## Data availability statement

The original contributions presented in the study are included in the article/supplementary material. Further inquiries can be directed to the corresponding author.

## Ethics statement

The manuscript presents research on animals that do not require ethical approval for their study.

## Author contributions

XJ: Conceptualization, Formal analysis, Investigation, Methodology, Writing – original draft. ZW: Formal analysis, Writing – review & editing. TZ: Writing – review & editing. DC: Methodology, Writing – review & editing. WY: Investigation, Writing – review & editing. ML: Investigation, Writing – review

& editing. HS: Conceptualization, Formal analysis, Writing – review & editing. LL: Conceptualization, Writing – review & editing.

## Funding

The author(s) declare financial support was received for the research, authorship, and/or publication of this article. This work was funded by the National Natural Science Foundation of China (32471736, 32170532), Zhilan Foundation (2019070341B), Hainan Province higher education teaching reform research project (Hnjg2024-47), the China Postdoctoral Science Foundation (2024M750703). The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

## Acknowledgments

We are grateful to Zhenzi Xie, Xian Cao, Fenghui Zhao, Xiangxiang Zhong, Tong Jian, Linxuan Zhao, Yiting Li, Zikang Zhang, Li Kong, Rui Li for their assistance with field investigation.

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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