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Research Article

Sea Cucumber Trade and Sustainability in Türkiye: Progress, Problems, and Opportunities

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ABSTRACT

Türkiye is rich in sea cucumber stocks and therefore offers ample opportunities for becoming the leading exporter in the world. This study aims to explore sea cucumber export trends in Türkiye for the first time using annual series data. Export-related information has been compiled from official data records and interviews with the managers of exporting companies. The data set includes the sea cucumber export process in Türkiye, export destinations, temporal shifts in export, and export tendency according to Harmonized System codes. Türkiye is in a competitive and advantageous position in the global market. This study has revealed that the export of sea cucumber products from Türkiye has performed well and seems to have grown well over the years, mainly when exporting to high-demand countries. Investing in the sea cucumber sector will also pay off through long-run economic growth and development. COVID-19, high commodity prices and inflation, and the Russia-Ukraine conflict have been identified as problems in sea cucumber exports. To reach long-term export targets, Türkiye should develop trading policies toward export performance and sustainable stock management. Maintaining exports in high-value-added markets and increasing financial support for exporters have been determined as the fundamental elements of these policies.

Keywords: Beche-de-mer, Marine policy, Marketing, Sea cucumber, Türkiye

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INTRODUCTION

The expansion and growth of the fishery sector is a crucial part of economic development for countries. International trade of fishery products is an essential source of foreign exchange earnings for countries, while providing income and employment to millions of families (FAO, 2020). The fishery sector is one of the mainstays of Türkiye's exports because it is a locomotive force of industrial and national economic growth (OECD, 2021). The source of this force is that Türkiye is a country with a coastline of 8,333 km and waters of the Exclusive Economic Zone (EEZ) covering an area of 462,000 km^2. Among the European Union (EU−28) countries, Türkiye is among the top three leaders in fisheries production, allowing it to compete with other countries in international markets (FAO, 2020). After the World Trade Organization (WTO) agreements, Türkiye quickly adapted to Hazard Analysis and Critical Control Point (HACCP) standards and EU norms to maintain the quality of seafood exports and reach the desired levels in international trade. Lastly, strategies to increase the export of fishery products in the National Eleventh Development Plan (2019-2023) contributed to this development. In fact, with the rapidly developing fishing industry in Türkiye, a record export of 1.4 billion US$ was realized in 2021, and this amount constitutes 40% of Türkiye's total animal and animal product exports (TIM, 2022).

Beche-de-mer has high commercial importance because of its rich nutrient content (Aydın, Sevgili, Tufan, Emre, & Köse 2011), and they are a tradition worldwide and generally a luxury

food item (Fabinyi, 2012). Although the prices of processed dried sea cucumbers at sales points in China vary according to species and body size, the average market price can reach 385 US$ per kg for *Holothuria lessoni* (Purcell, 2014). Sea cucumbers are gathered and traded in more than seventy countries worldwide (Purcell, Samyn, & Conand, 2012; FAO, 2023). Three million people worldwide are employed in the sea cucumber sector, and it is the main source of income for small-scale fishers (Purcell et al., 2013; Rahman et al., 2020). Harvesting of sea cucumbers is done mainly to meet seafood demand in the Far East and Asian countries (FAO, 2023). The main import markets are traditionally Hong Kong, mainland China, Singapore, and Taiwan; recently, demand has also increased in the Asian diaspora and other Southeast Asian countries (Purcell, 2010). The demand for and value of sea cucumber products in the international market have risen globally in recent years (Rahman et al., 2020).

Interest in sea cucumber fisheries in Türkiye started in 1996. Since 2011, there has been a significant increase in Türkiye's sea cucumber production, and it is still an essential source of income for local communities. Artisanal fishers, processors, intermediaries, or local traders along the coastline in the Aegean are heavily dependent on sea cucumber fishery. Commercial sea cucumber species in Türkiye are not consumed domestically; all the harvested sea cucumbers in Türkiye are exported to international seafood markets (Aydin, 2017; Dereli, & Aydın, 2021). Depending on the buyer's request, products can be shipped fresh, frozen, salted, cooked, dried, as cooked calcium-removed products, or as a combination of these (Aydın, 2017). Measures to regulate sea cucumber fishing (e.g., limitations, regulations, licensing) are the responsibility of the Ministry of Agriculture and Forestry, and the regional exporters' associations report data on trade in sea cucumber.

The international market price of sea cucumbers has increased in recent years, and producers have shown more interest in the products. Poorly managed fisheries in many countries have contributed to increased fishing pressure (Cánovas-Molina, García-Charton, & García-Frapolli, 2021). Many countries have begun developing the fisheries and aquaculture of sea cucumbers to enhance the livelihoods of coastal societies (Buonfiglio, & Lovatelli, 2023). Evaluation and good management of the countries' sea cucumber trade are necessary for their management policies. The status and significance of the worldwide beche-de-mer trade have been extensively reported in Food and Agriculture Organization (FAO) reports (Lovatelli et al., 2004; Toral-Granda, Lovatelli, & Vasconcellos, 2008; Purcell, 2010; Purcell et al., 2012) and by several researchers (Purcell, 2014; Mangubhai et al., 2016; Vidal-Hernández et al., 2019; Louw, & Bűrgener, 2020; Wirawati, Jasmadi, Pratiwi, Widyastuti, & Ibrahim, 2021). While sea cucumber exporters in Türkiye submit their activity reports to the Exporters' Associations, a member of the FAO, the data on the sea cucumber trade has never been compiled, analyzed, or used to manage the sea cucumber trade.

This study aims to reveal the structure of Türkiye's sea cucumber trade, perform a competitiveness analysis, and put forward policy proposals for the sector. The study evaluates any tendencies that may aid the regulation of sea cucumber fishery and trade in Türkiye. In addition, competitiveness with RCA analysis was used methodologically for the sea cucumber trade for the first time. The study also helps us understand the contribution and future potential of Turkish sea cucumber exports to the international market, where the demand for seafood is constantly increasing with the growing population. The outputs will contribute to policymakers, international seafood reports, and further studies.

MATERIALS AND METHODS

Data were obtained in two stages. First, Türkiye's sea cucumber export statistics and details were compiled from the official records obtained from the Aegean Exporters' Associations and the Ministry of Agriculture and Forestry. Second, interviews (face-to-face or online) were conducted with the managers of four exporting companies (hereinafter referred to as traders) of sea cucumber in Türkiye in 2021. Afterward, these data formed the basis for the competitiveness analysis, and Balassa's Revealed Competitive Advantage (*RCA*) calculation and analysis method was used (Balassa, 1965). Finally, a multi-method study was carried out in which qualitative and economic models were used together.

Türkiye's official trade records from 1996 to 2021 were included in the data set without undergoing any statistical analysis before the procedure. Since Türkiye has no sea cucumber consumption habit (Aydın, 2008), the supply is not formed. As a result, all the collected product is exported to foreign countries. Therefore, the dataset does not include import data. Yearly FAO statistics for catches or trades (both export and import) are the primary source of knowledge but are occasionally challenging to use as they rely on the declaration of the countries. Production data (in kg) has been available since 1996, and export values have only been recorded since 2014 in Türkiye. In the raw data, the export values for 2014 and 2015 are unreliable. The data are only approximate (the beginning of the transition to the national data recording system); therefore, only export figures after 2016 were included in the data set. This study focuses on the following information from the data set: the change in sea cucumber trade, current situation, market industry, trade network, and pricing. While the findings related to the data set based on national statistics are given in the Results section, the Discussion section was synthesized in line with the interviews with the local traders. The representativeness of the data and the sample size were considered to ensure the quality of the data analysis. While 16 companies that export sea cucumbers and are members of the Aegean Exporters' Association created the list of potential participants, the interviews were held with four companies that make up 70% of the total exports in order to increase the representative power of our data. To ensure the validity and reliability of the interview results, the data were interpreted by avoiding common biases in their communication.

Türkiye was included in the General Agreement on Tariffs and Trade (GATT) in 1951 and has been a member of the WTO since 1995. The data set was extracted and coded according to the coding list based on the Trade Data Categorized by Harmonized System Codes (HS), which is developed by the WTO to enable a systematic description of detailed analyses. The codes are internationally harmonized according to specific tariffs and statistical

requirements that countries can decide to apply unilaterally. Türkiye uses a 12-digit HS code to classify products for export, with the first six digits being the HS code (No 31706 dated 31 December 2021 in Official Gazette) (Table 1).

Table 1. Harmonized System (HS) codes used to describe sea cucumbers in Türkiye.

HS codes †	Descriptions
030811009000	Aquatic invertebrates; sea cucumbers; live, fresh, or chilled
030812000000	Aquatic invertebrates; sea cucumbers; frozen
030819000000	Aquatic invertebrates; sea cucumbers; dried, salted or in brine, or smoked
030819900000	Aquatic invertebrates; sea cucumbers; others

† Bold parts represent harmonized six-digit codes by the World Trade Organization

Calculating competitiveness was based on the Balassa Index (Balassa, 1965), also popularly known as Revealed Comparative Advantage (*RCA*).

$$RCA = (X_{ij}/X_{it}) / (X_{wj}/X_{wt})$$

X_{ij} is the sea cucumber exports of Türkiye, X_{it} total exports of Türkiye (all products), X_{wj} total sea cucumber exports worldwide, and X_{wt} total worldwide exports (all products). The *RCA* index of less than one can be assessed as a disadvantage. An *RCA* value greater than 1 is a higher advantage for a country exporting a particular category of commodities. The coefficient of variability (*CV*) was calculated to indicate the volatility of the competitiveness values over the years. If this coefficient is below the value of 15, it can be said that the course of the scores related to competitiveness is stable (Daly, 2008). The "*ln*" values of the *RCA* coefficients were translated to make the competitiveness values symmetrical. Sea cucumber export quantities (ton) were presented up to two decimal places, while export values (US$ 1,000) were rounded to an integer throughout the paper.

RESULTS AND DISCUSSION

Sea cucumber fisheries in Türkiye started in 1996 with the export of *Stichopus regalis* with 19.87 tons of export, which was caught as a by-catch in shrimp trawl. Although sea cucumber exports showed a slight increase in the following 10 years after 2000, the data were erratic and volatile. Sea cucumber production in Türkiye increased from 97.18 tons to over 384.65 tons per year between 2010 and 2016. The sea cucumber harvests between 2017 and 2019 provided tremendous export value to Türkiye. Total sea cucumber exports, which were 8,779,000 US$ in 2016, increased by more than 300% and reached 36,720,000 US$ in 2019. The export volume, which increased rapidly during the previous period, declined sharply from 2019 to 18,154,000 US$ in 2020 and then to 17,346,000 US$ in 2021 (Figure 1).

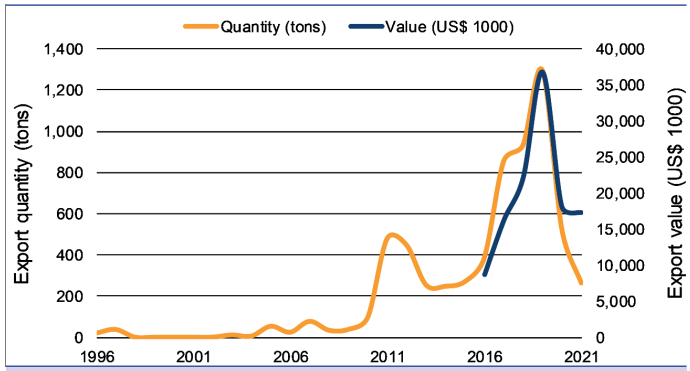

Figure 1. Türkiye's sea cucumber export quantity (1996-2021) and export value (2016-2021) trends by years.

Between 2016 and 2021, 83.5% of sea cucumber exports were to China (both China mainland and Hong Kong), with a total export value of 99,852,000 US$. The USA was in second place, receiving 12,973,000 US$ in exports, and Vietnam, Malaysia, and Canada followed it (Figure 2). China has always been the leading supplier of sea cucumber imports from Türkiye at all times. Whereas the value of exports to China rose by 118.9% in 2019, exports to the USA and Canada decreased (−65.8% and −69.4%, respectively). In the same year, exports to Vietnam stopped entirely, and there is still no export. Malaysia entered the list of countries to which sea cucumbers are exported in 2020, at 474,000 thousand US$, and commercial relations continue (Figure 3). While the sea cucumber trade was carried out with 16 countries between 2016 and 2021 (Figure 4), exports stopped to most countries except China, America, Malaysia, and Canada in 2021. In 2021, China imported approximately 90% of Türkiye's total sea cucumber production.

Frozen products accounted for 81.5% (3,474 tons) of total sea cucumber exported from Türkiye from 2016 to 2021 (Table 2). The increase in unit price was particularly evident for China (72 US$ per kg) and USA (70 US$ per kg) exports. The average price of the product exported to Malaysia was 17-25 US$ per kg due to the export of frozen products, which is cheaper than other processed products (Figure 5). The percentage share revealed that frozen sea cucumber was the major exporting commodity during the years, but in 2021, its share fell from 79.2% to 34.8%. The same condition was true for Vietnam between 2016-2018; almost all exported products (99.2%) were frozen products. Prices of sea cucumber in 2021 increased slightly to 66 US$ per kg from 20-35 US$ in previous years because the countries had turned to dried, salted, brined, or smoked products, which have the highest unit price (Figure 5).

The historical development of export

Orientation in sea cucumber fisheries in Türkiye began in 1996 with the fishing of *S. regalis*, a bycatch species of a shrimp beam trawl (Aydın, 2008). Fishers only became aware of sea cucumber fisheries and exports in the 2000s. Consequently, *Holothuria mammata* and *H. tubulosa* became Türkiye's two primary commercial products (Aydın, 2017). Their production and trade were first regulated legally in 2007 (Dereli & Aydın, 2021), so data from previous years were utterly absent or partially invalid. After

Table 2. Türkiye's sea cucumber exports according to HS codes between 2016-2021.

HS Codes	030811009000	030812000000	030819000000	030819900000	Total
2016					
Quantity (tons)	0.42	306.75	-	77.48	384.65
Value (US$ 1000)	7	5,011	-	3,761	8,779
2017					
Quantity (tons)	30.68	694.24	129.78	0.28	854.97
Value (US$ 1000)	36	10,693	5,564	13	16,306
2018					
Quantity (tons)	-	791.74	142.24	-	933.98
Value (US$ 1000)	-	15,322	6,890	-	22,212
2019				-	
Quantity (tons)	-	1172.86	124.10	-	1296.97
Value (US$ 1000)	-	29,331	7,389	-	36,720
2020	-			-	
Quantity (tons)	-	416.57	109.31	-	525.88
Value (US$ 1000)	-	10,626	7,528	-	18,154
2021	-			-	
Quantity (tons)	-	91.86	171.81	-	263.67
Value (US$ 1000)	-	2,282	15,064	-	17,346
Total (2016-2021)					
Quantity (tons)	31.10	3474.03	677.25	77.76	4260.13
Value (US$ 1000)	43	73,264	42,435	3,775	119,517
Unit price (US$ per kg)	1.4	21.1	62.7	48.5	28.1

(030811009000: live, fresh or chilled; 030812000000: frozen; 030819000000: dried, salted or in brine, or smoked; 030819900000: others).

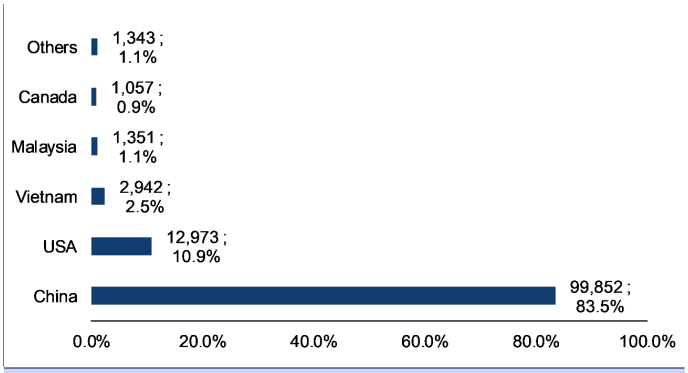

Figure 2. Countries to which sea cucumbers were exported the most between 2016-2021. Tags indicate the export values of the countries and their share in total exports (US$1000; percentage).

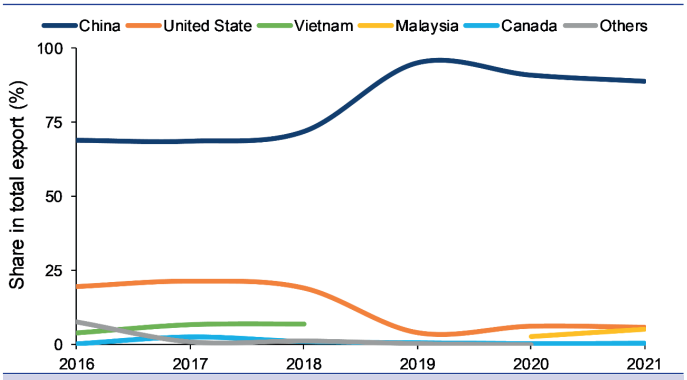

Figure 3. Türkiye's sea cucumber exports by country and years (2016-2021).

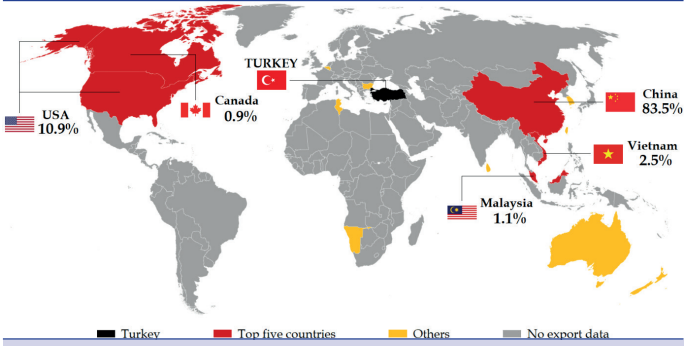

Figure 4. Türkiye's partners in sea cucumber exports between 2016 and 2021.

2011, there was a significant increase in Türkiye's sea cucumber production. Aydın (2017) attributes this rise to the increase in global demand and the beginning of the commercial harvest of *H. poli* in Türkiye. After 2017, local fishers and traders could economically benefit very significantly from their products, and production started to increase (Figure 1). The production quantities indicated here (from 1996 to 2016) represent the amount of processed sea cucumber exported by local traders based on the Ministry of Agriculture and Forestry database. Traders and previous research (Aydın, 2008; Dereli, Çulha, Çulha, Özalp, & Tekinay, 2016; Aydın, 2017) confirm the accuracy of these data. Based on the data of Turkish Exporters' Associations, the monetary equivalent of exports is only possible after 2016, and these data are shown in national (e.g., Turkish Statistical

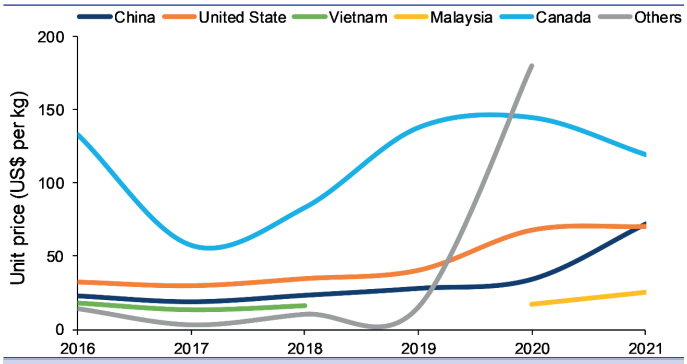

Figure 5. Unit price (US$ per kg) of Türkiye's sea cucumber exports by countries between 2016 and 2021.

Institute, Exporters' Associations) and international (e.g., FAO, WTO) statistical reports.

Current situation in exports

Since 2016, the export of sea cucumber in Türkiye has increased exponentially, making Türkiye a voice in the international market. Export figures (between 2016 and 2019) show that Türkiye is the fourth biggest sea cucumber exporter worldwide. Traders reported that the higher volumes of exported sea cucumber products result from national policies implemented to expand export volumes and maintain sea cucumber fisheries. In the same period, traders' investments in processing facilities gained momentum, and government support (e.g., investment and business loans, fuel support without excise tax) increased. Local traders expanded their investments by benefiting from the financial support of the regional development agencies and the Small and Medium Enterprises Development Organization of Türkiye. The processing facilities have been integrated with HACCP and EU standards with the investments made. The confidence in the processed sea cucumber exported from Türkiye has increased in the international market. Local traders have participated in food fairs in the international market to promote their products. There is no doubt that scientific studies on production and management activities (Aydın, 2008; González-Wangüemert, Aydın, & Conand, 2014; Aydın, & Erkan, 2015; Tolon, Emiroğlu, Günay, & Saygı, 2015; Dereli et al., 2016; Aydın, 2017; Aydın, 2019; Dereli, & Aydın, 2021) have also contributed to this development. These studies have helped traders to understand natural resources and their condition better and have guided policymakers. The traders said that "scientific studies and the support of national authorities have made a significant contribution to both production and the sustainable management of sea cucumber stocks in Türkiye."

With time, fishers and traders have realized the income potential of sea cucumber fishing and begun overfishing. Uncontrolled growth and increased fishing activities brought new responsibilities. In 2020, the Ministry of Agriculture and Forestry issued a memorandum containing a series of legal measures to prevent illegal fishing and possible reduction in stocks (No 2019/39 dated 27 September 2019 in the Official Gazette). In the memorandum, provisions were made to determine a quota for sea cucumber fishing, operating fishing and the Total Allowable Catch (TAC) and transporting and assessing the produce from fishing carried out within the TAC. With the memorandum, the TAC amount was determined to be 2,500 tons of gutted weight, and only fishing boats holding a License for Sea Cucumber could benefit from this TAC. This regulation explains the sharp decline in export figures in 2020 and 2021 (Figure 1). Although the stocks did not collapse, signals about overfishing were considered in fishing regions. It has been emphasized that most sea cucumber stocks suffer from overfishing and collapse (Conand, 1990, Rogers, Hamel, Baker, & Mercier, 2018). Overfishing in recent years has led to the extinction of high-value species in some areas and the closure of many national fisheries (Purcell, 2010). Bruckner (2005) stated that quota enforcement is an appropriate regulatory method when stock levels are in good standing but less appropriate when stocks are depleted. No risks have yet been reported for sea cucumber stocks on the coasts of Türkiye, and these regulations are purely a result of sustainable resource management efforts. This management strategy is the first policy to protect sea cucumber stocks in Mediterranean countries. Traders welcome these practices and say, "We recognize that sustainable sea cucumber management largely depends on these regulations, and we want this management policy to continue."

Sea cucumber market and industry

The questionnaires revealed there are two leading players: (1) fishers (hookah divers) and (2) local traders who are also processors and exporters. Exporter agents that buy, sell, and process sea cucumbers are collectively referred to as local traders. The Aegean Sea is one of the central regions for sea cucumber products and is a strategic location for beche-de-mer exporters in Türkiye. Most of the exporters (11 out of 17) are based in Izmir (the Aegean region was close to legal fishing areas). In contrast, fewer exporters are based far from the fishing area, considering that there are two companies each in Balıkesir and Istanbul, and one each in Çanakkale and Samsun. In line with the circular, 327 boats were legally allowed to harvest sea cucumbers in 2020. Exporters purchase harvested products such as gutted sea cucumber directly from local fishers. Exporters sell to buyers directly, but they do not deal through wholesale markets or auctions, or do not use agents. Local traders heavily finance fishers and this support gives them confidence for sustainable production and export. Four species of sea cucumber (*H. tubulosa*, *H. mammata*, *H. poli*, and lastly, *H. sanctori*) are harvested legally in Türkiye and have significant value in international markets. All the species are listed as Least Concern (LC) according to the IUCN Red List of Threatened Species (IUCN, 2022). Harvested products are processed and marketed as fresh, frozen, dried, and a small amount decalcified. Exports shifted significantly to dried products in 2021.

Trade network and export pricing

The export network and price analyses in Türkiye mainly focus on the Asian markets (Hong Kong and China mainland). Traders have traded sea cucumbers with 16 countries so far. Traders who took their place in international fairs found a place in the market due to their promotional activities, but the trade relations were not permanent. Traders define *trade relations* as temporary outside of China, America, Malaysia, and Canada. While Türkiye exports primarily to mainland China and Hong Kong, it also maintains its trade network with other countries in

smaller volumes, because they report that the main factors that increase the unit price and profit margin of the product are product quality and pricing, not the trade network. Traders stated that "Our commercial relations with China are well developed. The ever-increasing demand and high unit price result in high profits for our companies. We aim to be permanent in the Chinese market in the future."

Pricing can be the most challenging due to different market forces and pricing structures worldwide. As discussed in this chapter, the key elements include assessing foreign market objectives, market demand, product-related costs, and competition. The price of a sea cucumber varies according to its moisture content, physical damage, body size, and species. It is especially preferred in a dried form in the market (Rahman, & Yusoff, 2017). Dried products are traded at a higher price than other marketing methods (fresh or frozen). The dried product corresponds to the HS code 030819000000 in the data set. The Asian market previously demanded frozen sea cucumbers; this demand shifted to thoroughly dried products in 2021 (~87% of total export value). Traders said that "the transition from frozen product to the dried product was not our own sales policy, it was processed and produced according to the demand of the Asian market." Traders hope to export their products dried in the coming years. Because the dried product brought almost twice as much income as the frozen ones, this shift was positively reflected in the unit price (Figure 5) and HS code-based export figures (Table 2). Exporters who also benefited from currency fluctuations against the US dollar in 2021 with the increase in the product's unit price increased their revenues considerably. The hopeful thing is that the very rapid response in supply to sudden changes in demanded products reflects the success of traders in exports and processing. The degree of dryness and product quality of commercial sea cucumbers vary from species to species, and therefore the price of the product is variable. Sea cucumbers harvested and processed in Türkiye are largely considered to be of medium quality in Asian countries (according to food quality analysis reports of traders), which results in estimated losses of approximately 80% for the final dried product. Relatively low-quality products and fluctuations in product quality cause differences in market price between 5-20% (Ram, Chand, & Southgate, 2014). Thus, to receive a higher income from Asian markets, improving product quality will be a key issue for local exporters. Labor, packaging, storage, and marketing costs are considered for sea cucumber exporters. Freight costs vary by supplier and destination. Variable tariffs and exchange rates contribute to the constant fluctuation of especially freight operations. Sea shipment is the most typical transportation form for sea cucumber exports in Türkiye, although some countries, such as Canada, transport via airways. Sea cucumbers exported to Canada were priced well above the average market price each year (2016 to 2021). This increase in unit price was attributed to the fact that all shipments to Canada were conducted by airways. Trade contracts are for one year or longer and cover one fishing season in Türkiye. Buyers are typically offered higher discounts on the regular supply provided by a longer-term contract (the six months throughout the fishing season). Exporters report that there is a slight variation in the duration and structure of trading contracts, and this change does not affect price trends too much. Food safety is one of the essential non-tariff obstacles to international trade, and it plays an essential role in exports. Türkiye has complied well with food safety standards such as HACCP and EU norms, and its products have been accepted in international trade. Traders reported that their production facilities are produced according to these standards and are regularly inspected by ministry officials. Traders stated, "As the sea cucumber started to be produced following food safety standards, our export figures increased, and our products became more accepted in the international market."

According to the Balassa Index analysis results (the five-year *RCA* average is 7.12, > 1), Türkiye has an advantage in global sea cucumber exports (Table 3). The five-year *RCA* trend and coefficient of variation (*CV* = 0.32, <15) refer to the stability of competitiveness (Figure 6). It means that Türkiye has an excellent opportunity and competitiveness in exporting sea cucumber, and the ongoing trade relations between partners and Türkiye prove this harmony.

Problems, opportunities, and future policy recommendations

The coronavirus disease (COVID-19) caused tremendous pressure on global trade, causing exceptional worries to supply chains and trade collaboration (WTO, 2021). The lockdown of markets, borders, and exports limited fishing and cultivation activities in companies and countries (UNCTAD, 2022). The impact of the pandemic on economic activity in Türkiye unfolded later than in other countries but was sharp (OECD, 2021). The initial economic impacts of COVID-19 were the deep recession and higher inflation. Globally, commodity prices have pushed the cost of essential inputs higher (e.g., energy, oil prices, food). Prices have been accelerating faster in Türkiye, experiencing higher inflation before the pandemic due to exchange-rate pressures (UNCTAD, 2021). The Turkish Lira (TL) depreciated to record lows, and inflation grew (the TL peaked at 26.00 against the US dollar, and inflation reached 69.97% annually in April 2022). Traders reported that their exports were significantly affected in this period and that mainly rising costs contributed to this effect. The COVID-19 effect and high inflation are now factors weighing on world trade. The Russia-Ukraine conflict that started in February 2022 put global trade recovery, which was already fragile, at risk. The first economic effect of the conflict has been an intense increase in commodity prices in Türkiye as well as around the world. The war threatened the supply of essential goods, including food, energy, and supplies. The war is expected to disrupt Türkiye's energy, transportation, and agricultural trade (FAO, 2022). Economic integration makes Türkiye more dependent on overseas trade networks and more exposed to successive risks and threats. Undoubtedly, as in all international trade, it is thought that the export of sea cucumber will also experience its share of this turmoil. Traders are uneasy about the possible effects of the conflict, and they say that they do not have any countermeasures. They expect to have sales prices at a high level and keep their profitability at a stable level, if not at the maximum.

The international market price for beche-de-mer has increased in recent years, contributing to increased fishing pressure on many natural stocks (Purcell et al., 2018). Cultivating sea cucumbers in aquaculture systems can reduce the exploitation

Table 3. Analysis of Türkiye's rivalry in the sea cucumber market yearly, according to the Revealed Comparative Advantage (RCA) index.

Years	Sea cucumber exports (US$ 1000)		Total exports (US$ 1000)		*RCA*	*CV*	Rivalry power
	Türkiye	Global	Türkiye	Global			
2016	8,779	142,606,247	252,740	15,926,982,653	3.88	0.32 Stable	↑
2017	16,306	156,992,940	297,186	17,568,188,372	6.14		↑
2018	22,212	167,923,862	340,364	19,332,363,800	7.51		↑
2019	36,720	180,870,841	381,210	18,763,129,315	9.99		↑
2020	18,154	169,657,940	264,724	17,499,013,461	7.07		↑
Five-year total	102,171	818,051,830	1,536,224	89,089,677,601	7.24		↑

(↑ sign indicates rivalry advantage).

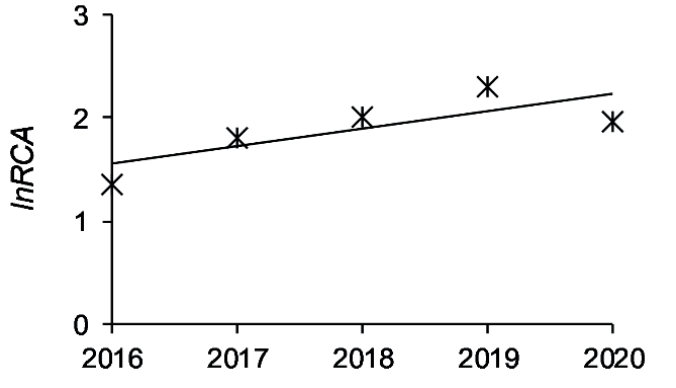

Figure 6. The trend of competitiveness (lnRCA) of Turkish sea cucumber exports, 2016-2020.

of wild stocks while providing benefits for meeting increasing demand and maintaining the sustainability of natural stocks. Sea cucumber cultivation is not yet an active industry in Türkiye. However, there are several successful laboratory-scale attempts to culture Mediterranean species such as *H. tubulosa* (Tolon et al., 2015; Han, Keesing, & Liu, 2016; Rakaj et al., 2018). If these attempts are successful, *H. tubulosa* culture can be carried out as a profitable business in Türkiye. Nevertheless, to be successful, the technical aspects of nutrition, rearing, and reproduction must be clarified before sea cucumber can be developed as a farming activity. An attempt was made within the scope of an EU project for sea cucumber cultivation with the cooperation of FAO, the Minister of Agriculture and Forestry of the Republic of Türkiye, and national traders. However, the results were not sufficient for sea cucumber cultivation in Türkiye. The government should support more scientific studies of sea cucumber cultivation and might subsidize the establishment of sea cucumber farms. In addition, government and fishery departments could encourage inward foreign direct investment and develop policies to sustain the growth of the sea cucumber industry. Transforming sea cucumbers into high-value-added products for use in the cosmetics and pharmaceutical industries should become a national policy in Türkiye.

Finally, regular and systematic recording of production as well as export data is essential for managing market networks and pricing in the sea cucumber trade in the future. Although Türkiye started to record regular export data in 2014, only after 2016 were data considered reliable. Economic analysts and policymakers need to guide their sea cucumber policies using a combination of production data and export figures. This study improves Türkiye's sea cucumber trade, relying heavily on export data.

While the results give some intriguing insights into Türkiye's sea cucumber export industry, it is also valuable to consider their broader implications for international trade, particularly in poor countries. A successful increase in sea cucumber exports can help improve a country's trade balance, especially if it has a competitive advantage in the fishery sector. Successfully penetrating international fish markets can pave the way for broader access to global markets, and open doors to explore export opportunities for other agricultural or food products. Perhaps one of the key issues is that successfully exporting fish products can contribute to building a positive brand image and reputation for a country or company. This positive perception can extend to other sectors, enhancing the country's overall competitiveness and attractiveness for international trade. Consequently, it is important to note that the applicability of results to broader international trade depends on various factors such as market dynamics, sector-specific considerations, and geopolitical factors.

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