http://www.egejfas.org
Ege Journal of Fisheries and Aquatic Sciences, 43(3), 281-289 (2026)

Su Ürünleri Dergisi (2026)
DOI: 10.12714/egejfas.43.3.12

RESEARCH ARTICLE ARAŞTIRMA MAKALESİ

Assessing Türkiye's fisheries trade competitiveness: A comparative approach with selected Mediterranean countries and Norway as a benchmark

Türkiye'nin balıkçılık ticaretindeki rekabet gücünün değerlendirilmesi: Seçilmiş Akdeniz ülkeleri ve kıyaslama noktası olarak Norveç'in kullanıldığı karşılaştırmalı bir yaklaşım

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Received date: 18.04.2026 *Accepted date: 30.06.2026*

How to cite this paper:
Sürmen, Y.E. (2026). Assessing Türkiye's fisheries trade competitiveness: A comparative approach with selected Mediterranean countries and Norway as a benchmark. *Ege Journal of Fisheries and Aquatic Sciences, 43*(3), 281-289. https://doi.org/10.12714/egejfas.43.3.12

Abstract: This research examines Türkiye's competitive position in the Mediterranean region, focusing on a comparative analysis of the fisheries sector for the period 2006-2024 and comparing it with Norway, a global reference country. The study is conducted within the framework of two main areas of the Harmonized System classification: fish and seafood (HS03) and processed/packaged fish and seafood (HS16). The study utilizes the Revealed Comparative Advantage (RCA) index/analysis developed by Béla Balassa to identify export specializations among the selected countries. The findings indicate that Türkiye significantly improved its competitive advantage in the HS03 area after 2021, but did not experience a significant increase in competitive advantage in the HS16 product group; additionally, value-added production, processed and/or packaged seafood, and technology-integrated processes remained relatively weak. Furthermore, the processed seafood markets in Italy and Spain were found to exhibit strong, well-defined positions and strategic advantages. This study, which uses Norway as its primary reference country, has shown remarkable stability in primary production and therefore considers Norway one of the most stable countries in the world, consistent with studies in the literature. Morocco's improving performance has also been observed to create new opportunities for competition and increase competitiveness. Overall, the evidence suggests that Türkiye is adopting a more advanced competitive (processed) production model alongside its primary production-based model. However, it was also observed that this momentum is not progressing at the desired level relative to Türkiye's commercial potential.

Keywords: Revealed comparative advantage (rca), trade, aquaculture, Türkiye

Öz: Bu araştırma, Türkiye'nin balıkçılık sektörüne ve 2006-2024 dönemine ait karşılaştırmalı bir analize odaklanarak, Türkiye'nin Akdeniz bölgesindeki rekabetçi konumunu incelemekte ve küresel referans ülke olarak Norveç ile karşılaştırmaktadır. Çalışma, Harmonize Sistem sınıflandırmasının iki ana alanı çerçevesinde ele alınmaktadır: balık ve deniz ürünleri (HS03) ve işlenmiş/paketlenmiş balık ve deniz ürünleri (HS16). Çalışmada, seçilen ülkeler arasında ihracat uzmanlaşmalarını belirlemek için Béla Balassa tarafından geliştirilen Açığa Çıkarılmış Karşılaştırmalı Avantaj (RCA) endeksi/analizi kullanılmıştır. Elde edilen bulgulara göre Türkiye'nin 2021'den sonra HS03 alanında rekabet avantajını önemli ölçüde geliştirdiği, ancak HS16 ürün grubunda rekabet avantajında önemli bir artış yaşamadığı; ek olarak katma değerli üretim, işlenmiş ve/veya paketlenmiş deniz ürünleri ve teknoloji entegre süreçlerinin nispeten zayıf kaldığı tespit edilmiştir. Bunun yanı sıra, İtalya ve İspanya'daki işlenmiş deniz ürünleri pazarlarının hem güçlü hem de iyi tanımlanmış konumlar hem de stratejik avantajlar sergilediği görülmüştür. Bu çalışmada temel referans ülke olarak ele alınan Norveç'in birincil üretimde kayda değer bir istikrar sergilediği ve bu nedenle dünyanın en istikrarlı ülkelerinden biri olarak kabul edildiği literatürdeki çalışmalara benzer şekilde ortaya çıkmıştır. Fas'ın iyileşen performansının da rekabet için yeni fırsatlar yarattığı ve rekabeti artırdığı gözlemlenmiştir. Genel olarak, kanıtlar Türkiye'nin birincil üretim tabanlı bir üretim modelinin yanı sıra daha gelişmiş bir rekabetçi (işlenmiş) üretim modelini de benimsediğini göstermiştir. Ancak bu ivmenin beklenen hızda ilerlemediği tespit edilmiştir.

Anahtar kelimeler: Açıklanmış karşılaştırmalı üstünlükler (RCA), ticaret, su ürünleri yetiştiriciliği, Türkiye

INTRODUCTION

The food industry has seen major shifts driven by factors such as fast-growing populations, changing consumer behavior, and increased awareness of healthy eating choices. Aquaculture, as a result, has become a strategy for producing protein by providing a sustainable supply chain and using available resources to support that production (Stevens et al., 2018). As wild fish populations decline and approach their respective sustainability thresholds, aquaculture has become the fastest-growing segment of the global food system and has a significant impact on international trade (Oglend, 2020; Miao and Wang, 2020). Therefore, aquaculture is not just a supportive industry but has now transitioned into one of the most strategically important and competitive industries in the world (Seyoum, 2007).

Due to the growing importance of aquaculture globally, countries are seeking to establish a systematic assessment of their competitive position in the global aquaculture trade. Policy formulation and research related to analyzing the competitiveness of aquaculture trade, identifying countries' positioning in global aquaculture markets, and determining whether nations should rely solely on aquaculture have gained greater interest (Kostoska and Hristoski, 2018). The international trade literature often uses the "Revealed

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Comparative Advantage" (RCA) index to measure competitiveness in International Trade, as originally formulated by Balassa (1965). As such, the RCA index is an important analytical tool for evaluating countries' patterns of specialization and export performance on a per-product basis. The framework also provides a more comprehensive view of how aquaculture, as well as many other industries, is affected by geographic resources and technology, as applied within the industry. Empirical applications consistently demonstrate that seafood's comparative advantage is product-specific rather than uniform. Across five EU Mediterranean countries, a clear RCA advantage emerged in only 30% of country-product combinations, with no single country dominant across categories (Polymeros et al., 2005). In addition, similar fragmentation has been reported for South Asian exporters, a pattern that motivates this study's HS03/HS16 product-level distinction (Navghan et al., 2017; Khanal and Deb, 2022).

Building on this theoretical foundation, the global aquaculture trade system exhibits considerable variation across countries, suggesting distinct production types and regional groups (Sampantamit et al., 2020). Asian nations, for instance, exhibit stronger production cost efficiency in the areas of raw materials than their developed counterparts; however, such nations have a comparative advantage over secondary processed products and value-added goods compared with developed countries, which are considerably more competitive in those areas (Luo and Han, 2018; Chang et al., 2016; Bostock et al., 2016). Therefore, competitiveness in aquaculture is driven not only by resource availability but also by technological development, processing capabilities, and the ability to maintain a high level of competitiveness throughout the entire supply chain. Thus, an assessment of international competitiveness must include an evaluation of regional participants, such as analyses of the competitiveness of global leaders and their relationships and positions within the multilevel global aquaculture industry (Crab et al., 2007; Gonçalves and Kaiser, 2011). Consequently, given such a diverse international structure, it will be essential to identify the established global leaders in the aquaculture sector, serving as a basis for comparison with other countries involved in aquaculture production to assess their competitiveness. An example of a global aquaculture leader, based on its processing systems and strong export performance relative to others, is Norway (Lahn, 2024). This advantage is long-standing. Constant-market-share evidence from 1980-2000 already identified Norway among the most competitive exporters while Türkiye was among the least, indicating a structural asymmetry rather than a recent divergence (Ahmad Klasra and Fidan, 2005).

From this global perspective, Türkiye is also an emerging actor in aquaculture with a rapidly changing international trade environment. This export expansion is rooted in a domestic structural shift: aquaculture has rapidly overtaken capture fisheries as Türkiye's dominant production sub-sector, generating the supply surplus needed to support export growth (Rad and Rad, 2012). Recent export data show that exports from Türkiye's aquaculture industry have risen sharply over the past few years, driven by both steadily increasing export volumes and expansion in aquaculture production capacity (Can et al., 2020; İ. Aydın et al., 2025). These exports carry macroeconomic weight beyond the sector. Cointegration evidence shows that aquaculture exports contribute positively to Türkiye's long-run economic growth (Arlı et al., 2025). However, this progress has not been without its challenges; Türkiye still has structural weaknesses in its aquaculture sector. There is a wide disparity in labor productivity among different product categories, and Türkiye's performance in value-added and processed products is significantly lower than that of several global competitors (M. Aydın and Tetik, 2024; Assadzadeh et al., 2013; Terregrossa and Gönel, 2014). Bozduman and Erkan (2025) quantify this directly and show that Türkiye holds a comparative advantage in only 14 of 42 product groups among the world's ten largest seafood exporters, the lowest count in the sample. To address a long-term structural challenge for Türkiye, it will be necessary to convert its aquaculture production potential into sustainable, competitive value-added exports to world markets.

This is called the broader comparative context, as it relates to a better understanding of Türkiye's position in global aquaculture trade. The existing literature has yet to jointly benchmark Türkiye against both a Mediterranean peer group and a global processing leader using a continuous annual RCA series, a gap this study aims to address. Thus, this study evaluates Türkiye's competitiveness at both the regional and global levels by comparing it with selected Mediterranean coastal countries and with Norway as a benchmark. Spain, Italy, Greece, and Morocco were selected as regional comparators that share Türkiye's Mediterranean resource base and overlap with European export markets (Kaimakoudi et al., 2014). Norway is included as an external benchmark representing the global processing frontier. The analysis focuses on the two most significant categories in global aquaculture trade: primary products (HS03) and processed products (HS16). The classical Balassa RCA index was adopted for its year-on-year interpretability across a continuous annual series. By doing this, the study will aim to close this gap in the literature and add new insights into Türkiye's aquaculture trade, both regionally (relative to other Mediterranean Coast Nations) and globally (relative to Norway). This study contributes threefold: an annual RCA series for 2006-2024 rather than a biennial one; a joint regional-and global benchmark within a single framework; and an explicit primary-versus-processed competitiveness separation. The last goal of this study is to answer the following research questions about these product categories:

1- In which product groups does Türkiye possess a comparative advantage in the seafood sector?

2- How does Türkiye's competitiveness differ between primary (HS03) and processed (HS16) seafood products?

3- To what extent does Türkiye's competitiveness resemble or differ from that of selected Mediterranean countries?

4- How has Türkiye's competitiveness gap, particularly in value-added products, evolved relative to Norway?

This paper's structure will be as follows: the second part will cover materials and methods, and the paper will end with the discussion and conclusion.

MATERIALS AND METHODS

Data

In this study, a quantitative research design is used to examine the international competitiveness of the fisheries sector, using previously published, widely agreed-upon datasets from TradeMap (International Trade Center-ITC) and UN Comtrade. The dataset covers 2006-2024; therefore, the collected data will provide information on historical changes that contribute to structural shifts in the sector, relationships between and to comparative performance, and overall trends. All data collected and analyzed are expressed in U.S. dollars (USD), enabling the researcher to compare economic values across countries.

The reasons for including the 6 countries involved in the research are as follows: (1) they all represent direct competition of the Turkish Aquaculture Industry, and (2) they share similar aquaculture production systems and export markets(except norway). Therefore, analyzing these countries will allow the researcher to determine Türkiye's relative market position within the Mediterranean Region. For comparative purposes, we will also use Norway as a point of reference when comparing the 5 Mediterranean Countries. Norway has developed an aquaculture industry, and its products have been exported successfully for many years. Therefore, Norway is an appropriate benchmark for evaluating the Mediterranean region's aquaculture industry.

Variables and model

The variables and analytical framework used in this study were structured to ensure the clarity, transparency, and consistency of the empirical analysis. In this context, the basic data characteristics, classification standards, and dataset scope are summarized in Table 1.

The context of the topic, country selection, and overall analytical framework have been designed to encompass both regional competitive dynamics and global benchmarking. Accordingly, country groups and their analytical roles are presented in Table 2.

Table 1. Data Description and variable definitions

Parameter	Description	Source / Basis
Data Source	TradeMap (ITC) & UN Comtrade	International Trade Centre (ITC)
Classification Standard	Harmonized System (HS)	World Customs Organization (WCO)
Product Codes (Primary)	HS 03: Fish, crustaceans, mollusks	Resource-based production
Product Codes (Processed)	HS 16: Prepared and preserved seafood	Value-added production
Time Period	2006-2024	Long-term trend analysis
Unit of Analysis	Nominal USD	Global standard unit

Table 2. Classification of countries and analytical design

Country Group	Countries	Analytical Purpose	Focus
Türkiye	Türkiye	Measuring export performance	National competitiveness
Regional Competitors	Greece, Italy, Spain, Morocco	Mediterranean competition	Market share
Global Benchmark	Norway	Best practice comparison	Technological leadership
Analytical Method	Gap Analysis	Türkiye-Norway comparison	Structural competitiveness gap

The competitiveness of countries in the aquaculture sector has been measured using the Revealed Comparative Advantage (RCA) index, developed by Balassa (1965). The RCA index assesses a country's export specialization by comparing its export share in a particular product group to its corresponding share in world trade:

$$RCA_{ij} = \frac{X_{ij}/X_{it}}{X_{wj}/X_{wt}}$$

X_{ij}: exports of country *i* in product group *j*

X_{it}: total exports of country *i*

X_{wj}: world exports of product group *j*

X_{wt}: total world exports

The analysis of the RCA revealed that a country's RCA value greater than 1 indicates a comparative advantage over its competitors, whereas a value less than 1 indicates a comparative disadvantage. The RCA was also used in this study because of its simplicity and interpretability; thus, the RCA index was employed for the purpose of analyzing the comparative advantage or disadvantage of Türkiye compared to the global reference country of Norway through the establishment of competitive gaps by defining the difference in RCA values between Norway and Türkiye. The method allows for the determination of value added through production and how close Türkiye is to achieving (converging) global competitiveness.

There were three main components to this empirical framework. The first was to evaluate the general

competitiveness of the aquaculture sector by examining the competitive landscape as a whole. The second component was to conduct a product-based analysis on the comparative advantage/disadvantage of Türkiye's HS 03 and HS 16 product groups. Finally, the third component was to do a country-based analysis to determine Türkiye's competitiveness relative to the Mediterranean and Norway. The dual nature of the framework allows for both horizontal (country-based) and vertical (product-based) dimensions of competitiveness to be analyzed.

RESULTS

General competitive outlook in the aquaculture sector

When evaluating the global seafood market, it is difficult to isolate the effects of national resource availability, transport and logistics advantages, and processing capacity on the development of global seafood trade. Türkiye's competitive position (in relation to world trade) and its relative position vis-à-vis major competitors in the Mediterranean Basin and Norway require an analysis of Türkiye's performance relative to each of its leading competitors in those regions over time (2006 - 2024). The average annual export volume of seafood products from the five nations will show structural differences between raw-material-dominant production (Türkiye, Morocco, and Greece) and industry-processed production (Italy and Spain). The average annual export volumes for the five nations are outlined in Table 3 below.

Table 3. Seafood exports by country (Average for the period 2006-2024)

Country	HS 03 Average (USD)	16 Average (USD)
Türkiye	0.8 billion	0.1 billion
Greece	0.7 billion	0.06 billion
Morocco	1.1 billion	0.7 billion
Italy	0.5 billion	1.2 billion
Spain	3.2 billion	1.7 billion
Norway	10.0 billion	0.09 billion

As shown in Table 3, the nations listed play different roles and specialize in different areas within aquaculture's value chain. Norway is the leader in exports of raw materials (HS 03) at approximately $10 billion a year, but currently has virtually no exports of processed products (HS 16), meaning it has adopted an entirely different strategy focused on supplying high volumes of fresh products. As an example of a country with little domestic production, Italy serves as an industrial processing hub, selling more than double the value of processed products ($1.2 billion) compared to the value of its raw product exports. Conversely, Spain is the only integrated power country whose aquaculture production and processing have a value greater than $1 billion, making it the most balanced and sustainable model within the sector. In the regional competition example, Türkiye has $0.8 billion in HS 03 exports, more than Greece, indicating considerable aquaculture potential. However, Morocco leads the way with a strong canning infrastructure and $0.7 billion in HS 16 exports.

Figure 1 shows that the export structure of countries differs significantly in product groups HS 03 and HS 16 as mentioned at Table 1. Norway is the clear leader in the HS 03 product group, while Spain and Italy perform more strongly in the HS 16 product group. Türkiye, on the other hand, has a moderate level of competitiveness in the HS 03 product group but shows limited performance in the HS 16 product group. Overall, the findings reveal that competitiveness differs between countries based on primary production and value-added production.

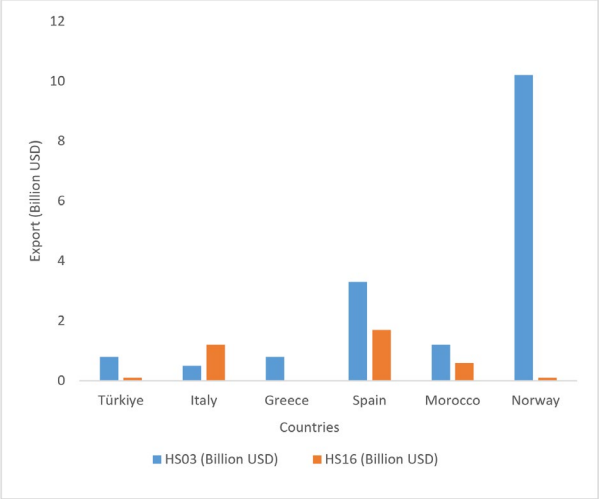

Figure 1. Comparison of average export values of selected countries under HS 03 and HS 16 (2006–2024)

HS 03 (Primary Products) competitive analysis

The HS03 product category, which includes both the raw materials used to produce aquaculture products and the products themselves that are available to consumers (fish, shrimp etc.), provides a strong indicator of nations' use of natural resources and their aquaculture capacities. This section reviews historical trends regarding Türkiye's competitive position in relation to its regional competitors; Norway is included as an example of a global leader in aquaculture. If the index value exceeds 1.0, the nation has started to achieve specialization and competitive advantages within aquaculture.

According to Table 4, Norway is clearly the most dominant country in the HS 03 category worldwide, with an RCA consistently above 15 throughout the analysis period. Türkiye had a comparative disadvantage in the 0.50 range until 2010; however, the large increase in aquaculture production experienced since 2012 has allowed Türkiye to establish strong momentum toward breaking through the critical level of 1.00 and achieving global competitiveness by 2022. Greece and Morocco are both significant competitors in the Mediterranean region, but each has lost market share between 2006 and 2010, with Greece's declining from 4.47 to 3.42 and Morocco's from 10.60 to 6.34. By contrast, Spain has had a long-standing production system with RCA test results ranging from 1.50 to 2.00. At the same time, Italy recorded test results below 0.25, indicating a lack of concentration within the HS 03 category, leading to increased dependence on imports of raw materials for

production. However, Türkiye achieved the most rapid improvement in competitiveness among the countries analyzed.

Table 4. HS 03 Product group RCA values (Periods for the term of 2006-2024)

Year	Türkiye	Norway	Spain	Italy	Morocco	Greece
2006	0.52	8.16	1.98	0.25	10.60	4.47
2007	0.53	8.50	1.96	0.23	9.77	4.60
2008	0.54	8.84	1.95	0.22	8.95	4.51
2009	0.52	10.42	1.91	0.21	8.45	4.70
2010	0.51	12.00	1.87	0.21	7.95	4.67
2011	0.55	11.12	1.84	0.20	8.03	4.39
2012	0.59	10.24	1.82	0.19	8.12	4.12
2013	0.63	10.89	1.80	0.17	8.08	3.98
2014	0.68	11.55	1.78	0.18	8.05	3.84
2015	0.73	12.33	1.75	0.14	7.97	3.76
2016	0.78	13.12	1.72	0.17	7.90	3.68
2017	0.81	15.78	1.70	0.16	7.57	3.60
2018	0.85	18.45	1.68	0.18	7.24	3.52
2019	0.89	19.41	1.61	0.18	7.13	3.57
2020	0.93	20.37	1.54	0.18	7.02	3.63
2021	1.02	18.59	1.56	0.19	6.93	3.44
2022	1.12	16.82	1.58	0.21	6.84	3.25
2023	1.18	16.28	1.54	0.22	6.59	3.33
2024	1.25	15.75	1.51	0.24	6.34	3.42

According to Figure 2, the RCA trends for HS03 (fishery products) show clear differences in comparative advantage across countries. Norway dominates the comparability rankings with a very high RCA, demonstrating an extraordinary level of specialization. Morocco has a high level of comparative advantage, but it has continued to decline over time. Greece continues to have a strong comparative advantage, as reflected in relatively high RCA levels, but it has also experienced a decline in its comparative advantage over time. Spain has remained at a moderate level of comparative advantage throughout the entire period. At the same time, Italy has consistently remained below the RCA threshold, indicating very weak competitive abilities. Türkiye has shown a balanced increase in its RCA values, and it has recently surpassed the RCA threshold (1). This indicates the development of comparative advantage. This can be related to the improvements in its production capacity and export capabilities. However, Türkiye still lags behind countries leading in this area, such as Norway, and a continuing gap persists.

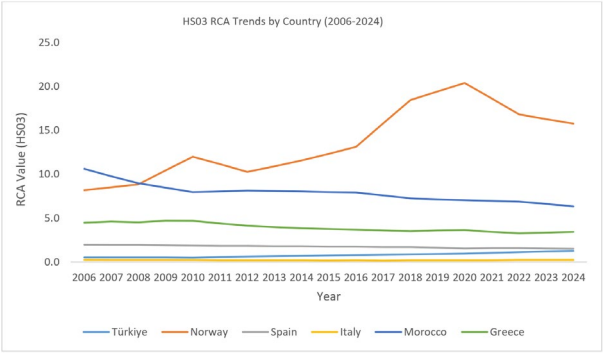

Figure 2. Changes in RCA values of countries in HS 03 product group over time (2006–2024)

HS 16 (Processed Products) competitive analysis

The HS 16 group (representing the most valuable area of aquaculture) includes products such as canned items, convenience foods, and processed or further-processed items. A country's competitiveness in this group does not solely depend on raw materials available as inputs but also on the country's technological infrastructure, manufacturing/industrial capabilities, and branding abilities. The purpose of this section is to examine the results of Türkiye's industrial transformation performance, as measured by the RCA (Revealed Comparative Advantage) index values of other selected countries, for goods classified under processed product classifications.

According to the RCA values in Table 5, Morocco has a well-deserved reputation for producing a very large amount of processed seafood (especially canned varieties), ranking just over 11.00 on a global scale. Spain displays an extremely balanced overall country profile, since its competitiveness has grown from 1.76 to 2.48 during the time period covered by the study and has maintained its overall advantage in processed and primary/processed products. Italy, starting in 2020, has finally surpassed the 1.00 mark and can now be classified as a "specialized" player in manufacturing and processing. However, Norway's RCA values have dropped dramatically to 0.14, indicating that the country is now primarily a raw-material supplier rather than an active participant in the processing sector. Finally, Türkiye has improved from a relatively low 0.15 to a much higher 0.46 from 2006 to 2024; nevertheless, its RCA value remains below 1.00, indicating that Türkiye has not yet fully translated its competitive advantage in primary products (HS 03) into value-added processed products. To provide a better visual reference, the graphical representation of the aforementioned data is given in Figure 3.

Table 5. HS 16 product group RCA values (Periods for the term of 2006-2024)

Year	Türkiye	Norway	Spain	Italy	Morocco	Greece
2006	0.15	0.49	1.76	0.65	15.65	1.13
2007	0.16	0.47	1.81	0.69	15.23	1.17
2008	0.17	0.45	1.85	0.72	14.80	1.21
2009	0.19	0.43	1.89	0.76	14.39	1.28
2010	0.20	0.40	1.92	0.80	13.98	1.34
2011	0.20	0.36	1.90	0.81	13.22	1.10
2012	0.19	0.32	1.88	0.82	12.45	0.85
2013	0.21	0.28	1.84	0.83	12.13	0.69
2014	0.23	0.24	1.80	0.84	11.80	0.52
2015	0.22	0.21	1.82	0.85	11.40	0.44
2016	0.21	0.17	1.83	0.85	11.00	0.35
2017	0.23	0.18	1.94	0.91	11.58	0.40
2018	0.24	0.18	2.05	0.96	12.15	0.44
2019	0.25	0.18	2.10	1.01	12.84	0.49
2020	0.25	0.17	2.14	1.05	13.52	0.53
2021	0.32	0.16	2.21	1.07	13.31	0.61
2022	0.38	0.15	2.28	1.08	13.10	0.68
2023	0.42	0.15	2.38	1.10	12.43	0.77
2024	0.46	0.14	2.48	1.12	11.75	0.86

RCA trend analysis for the HS16 group of processed fishery products indicates a clear hierarchy among countries, as shown in Figure 3. Morocco has consistently had a significant comparative advantage in this product line over the study period, as evidenced by relatively high RCA values (above 10) throughout the analysis period. However, an overall downward trend is evident by the end of the period. Spain ranks second; however, while its RCA values increased consistently (approximately 1.5-2.5) over the same period, it had the most consistent upward trend among countries. Among the remaining countries, Türkiye, Norway, Italy, and Greece are uniformly cohesive, with low RCA levels (under 1.5); therefore, there is little or no true competitive advantage among those countries in processed seafood. Of the countries in this group, Türkiye has exhibited the most substantial upward movement in RCA towards the end of the period, thereby indicating improvements in its processing competitiveness; conversely, there was no apparent upward movement in Norway, Italy, and Greece. In conclusion, the disparity between Morocco's position as a dominant competitor and that of other countries, including Türkiye, is pronounced and is not expected to diminish based on this analysis of the prior time period(s).

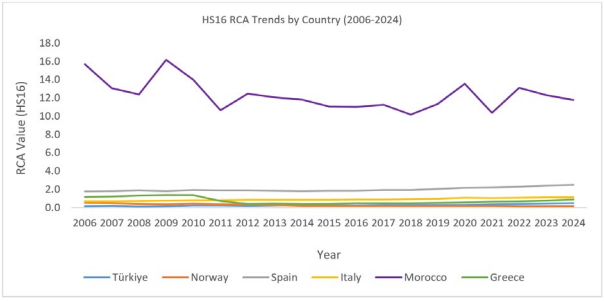

Figure 3. Changes in RCA values of countries in HS 16 product group over time (2006–2024)

Competitive gap analysis: Türkiye, selected Mediterranean countries and Norway

This section, prepared to evaluate Türkiye's global and regional competitive position in the aquaculture sector from a more dynamic perspective, examines the Revealed Comparative Advantage (RCA) differences between Türkiye and selected countries. Table 6 presents both the overall average (Avg.) for the 2006-2024 period and the current trend of the last 4 years (2021-2024), revealing Türkiye's performance in closing or widening the gap with its competitors.

Examining the data in Table 6, it is seen that Türkiye has a positive difference with Italy (+0.2), Greece (+0.4), and Morocco (+0.1) in the primary products (HS 03) group on average, and maintained this difference with Italy (+0.9) and Greece (+0.3) in the last 4-year period, but exhibited negative values with Norway (-14.8), Morocco (-5.6), and Spain (-0.4). In the processed products (HS 16) group, it is determined that Türkiye's competitive difference with all countries is negative both on average and in the last 4-year period. The gap with Spain (-1.9) and Morocco (-12.2) has deepened in recent years, while the gap with Norway (-0.1) and Greece (-0.1) has remained at its lowest levels. The data show that Türkiye has surpassed some of its regional competitors in the raw-material-focused HS 03 group, but remains below the competitiveness level of all analyzed countries in the value-added HS 16 group.

Table 6. Türkiye's competitive difference compared to selected countries (Average RCA difference)

Comparison	HS 03 Gap (Avg.)	HS 16 Gap (Avg.)	HS 03 Gap (Last 4 Years)	HS 16 Gap (Last 4 Years)
TR – Norway	-1.2	-1.8	-14.8	-0.1
TR – Spain	-0.3	-0.9	-0.4	-1.9
TR – Italy	+0.2	-1.2	+0.9	-1.0
TR – Greece	+0.4	-0.2	+0.3	-0.1
TR – Morocco	+0.1	-0.3	-5.6	-12.2

According to the comparative analysis, Türkiye has a solid global competitive position in primary goods, with competitiveness levels similar to or slightly more favorable than those of Greece and Morocco for products in HS03. For both Greece and Morocco, Türkiye is quite close to matching their competitiveness positions in HS03, usually ranked about equally favorably. On the other hand, Türkiye is clearly disadvantaged compared to Spain and Italy in processed products (HS16) due to these two countries' significantly higher overall value-added production structures. The significant gap between Türkiye's competitiveness rankings and Norway's for both HS03 and HS16 indicates that Norway serves as the global competitiveness benchmark for these two product categories.

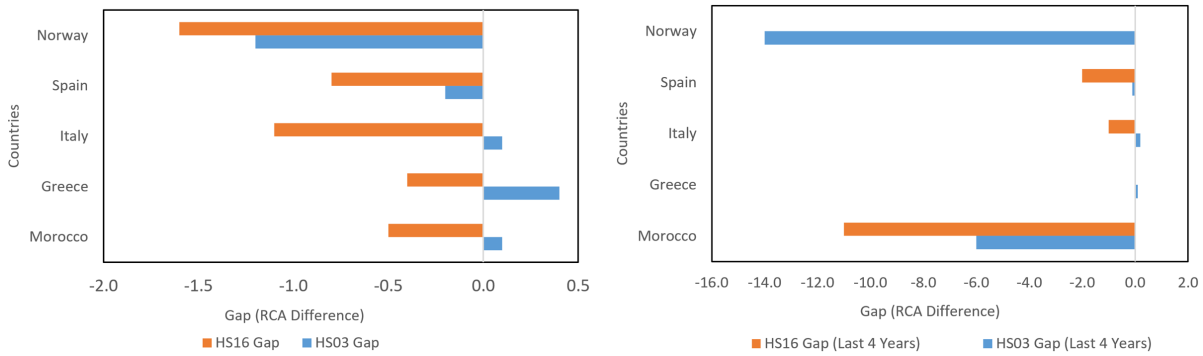

Figure 4. Comparison of Türkiye's competitiveness gap with selected countries (RCA Gap: Long Term and Last 4 Years)

When reviewing Türkiye's competitive position in the short term (past four years), the growing competitiveness gap between Türkiye and Norway is particularly prominent in HS03, indicating a loss of competitiveness and relative performance. Although Türkiye still faces a competitiveness gap with its HS16 counterparts, including Spain and Italy, both countries have shown some convergence. In addition, the competitiveness gap between Türkiye and Greece has closed nearly completely in HS03, indicating that Türkiye's competitive structure is becoming more balanced. Over the past four years, Morocco has improved its competitiveness, resulting in a stronger competitive position and greater status as a regional competitor. Based on our analysis, we conclude that Türkiye's competitiveness remains relatively higher in primary production than in value-added products; however, intense competition is emerging from both its established competitor (benchmark country, Norway) and an emerging competitor (a newly developing country).

DISCUSSION

Results of this research provide insight into the competitive position of Türkiye's aquaculture industry from 2006 through 2024, compared with other industries covered in the literature; as such, these results integrate with an existing theoretical framework. Overall, marketplace data demonstrate that Türkiye has achieved a consistent level of specialization in the marketplace for aquaculture products (HS Products 03) relative to other countries, producing a high proportion of RCA values greater than one. These results fully support the empirical literature indicating that developing economies generally possess a comparative advantage in producing primary (raw) products due primarily to their lower production costs (Rad and Rad, 2012; Abtew, 2015; Irshad and Xin, 2017). With respect to the sustainability of this advantage for Türkiye, given the doubts raised in previously published theoretical research on Türkiye's long-term ability to maintain this advantageous comparative position (Yıldırım et al., 2022; Demir and Aksoy, 2021). The evidence collected in the study shows that there is clearly a significant opportunity for Türkiye to continue maintaining and/or developing its competitive position, particularly due to continuing improvements beyond 2021 and evidence of continual evolving competitiveness (Kayıs, 2019; Ahmad Klasra and Fidan, 2005). To fully realize Türkiye's potential to convert its quantitative achievements into qualitative leadership in the aquaculture marketplace, it is important for the Ministry of Trade to quickly expand the high-quality incentive and branding programs offered to strategic industries (e.g., automotive and defense) to the aquaculture sector as well.

In addition, the results of our study on HS group 16 (processed products) indicate that Türkiye's capacity for industrial processing falls short of its global competitors (RCA < 1), and that its technological infrastructure for innovative production processes has not yet matured sufficiently (Yalçınkaya, 2017; Erkan, 2016; Bozduman and Erkan, 2025). As supported by the literature, Spain's steady rise in HS16 RCA from 1.76 to 2.48 over the same period signals a direct and growing market-share threat to Türkiye in processed seafood (Polymeros et al., 2005). These issues confirm criticisms that Türkiye is growing in quantity rather than in structural quality (Yıldırım et al., 2022). To address this structural issue, the successful use of digitalization and mechanization in Türkiye's defense and manufacturing industries should be leveraged. As a matter of strategy, the aquaculture sector must receive technology transfers for smart fisheries, autonomous aquaculture, and advanced processing systems. Increasing the number of patents and the production of high-technology products are the most essential political steps to pull Türkiye out of the "low value added spiral" position as defined in the literature.

The balanced RCA performance of the Norwegian model, in both raw and processed goods, relative to other countries, is the 'technology-oriented productivity model' that Türkiye should pursue (de Lima Galvão et al., 2005). Furthermore, market proximity and cost advantages in countries such as Morocco are putting pressure on Türkiye to transition from a cost-based strategy to a strategy focused on quality, certification, and specialization (Cao and Shen, 2023). In this context, Türkiye should also seek to establish 'Aquaculture Hub Areas' (Specialized Zones) similar to those already in place for agriculture in strategic coastal and basin regions, by providing tax exemptions and low energy costs to support economies of scale, where sustainability risks can be managed.

The momentum Türkiye has developed since 2021 is driven by an environmentally based system of global trade regulation that requires compliance with the new border carbon adjustment mechanism (CBAM). Aquaculture facilities that use renewable energy sources benefit from increased tax incentives, thereby steering the aquaculture industry toward establishing green export certification and retaining market share in Europe. Limitations of the study include using only gross export data, and the study cannot fully quantify supply and demand domestic balances due to reliance only on trade data (Brakman and Van Marrewijk, 2017); however, the synthesis makes it evident that Türkiye must change from a growth model based on processing raw materials to one which will require value-added production (i.e., high-tech integrative) forming an industrial system focused on exports.

CONCLUSION

In conclusion, Türkiye has improved its competitiveness in HS03 (primary products) since 2018. The strong upward trajectory (and trend) of Turkish exports during this time period indicates the aquaculture industry's growing capacity and increased international integration. The country's aquaculture sector remains primarily focused on low-value-added products; however, Norway's sustained leading global position in both primary and processed products will put increasing competitive pressure on Türkiye. Spain and Italy have maintained their strong positions regarding value-added (HS16) products, and despite its gradual decline, Greece still produces significant output for processed (HS16) products. Morocco has also

become a significant competitor in the marketplace, especially over the past few years, intensifying competition with Türkiye in primary products. Although Türkiye has seen significant growth over the last four years, it continues to lag in competitiveness for processed and higher-value-added products. For Türkiye to capitalize on future opportunities, a change from volume-driven growth to a strategic focus on technology and value chains will be required.

ACKNOWLEDGEMENT AND FUNDING

The authors affirm that they did not accept any grants, funding, or other forms of assistance in order to prepare this paper.

AUTHORSHIP CONTRIBUTIONS

Yunus Emre Sürmen: Writing-original draft, writing-review and editing, investigation, resources, supervision.

CONFLICT OF INTEREST

There are no relevant financial or non-financial interests that the authors need to declare.

ETHICAL APPROVAL

This research does not need clearance from an ethical committee.

DECLARATION OF AI USE

AI-assisted language editing tools (Grammarly) were used for grammatical and stylistic improvements of the English text.

DATA AVAILABILITY

The datasets used and/or analyzed in the current study are publicly available and available from the corresponding author upon request.

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