Original Research Article
ISSN: **3041-5357**
Journal homepage: https://diversity.researchfloor.org/

Journal of Diversity Studies

Occurrence, Fisheries Interactions, Utilization, and Conservation of Rajid Skates in the Mediterranean waters of the Gaza Strip, Palestine

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ABSTRACT

Rajid skates (Family Rajidae) constitute an important component of Mediterranean demersal ecosystems, yet information concerning their occurrence and fisheries interactions in the southeastern Mediterranean Sea remains scarce, particularly along the Palestinian coast of the Gaza Strip. The present study provides baseline information on the occurrence, fisheries interactions, utilization, and conservation status of rajid skates inhabiting the Mediterranean waters of the Gaza Strip, Palestine. Data were obtained through repeated landing-site surveys, fish market inspections, photographic documentation, and interviews with fishermen and fisheries personnel. Four rajid species were documented during the study, namely the Brown Ray (Raja miraletus Linnaeus, 1758), Mediterranean Starry Ray (Raja asterias Delaroche, 1809), Thornback Ray (Raja clavata Linnaeus, 1758), and Longnose Skate (Dipturus oxyrinchus Linnaeus, 1758). The Brown Ray represented the most frequently encountered species, whereas the Longnose Skate was comparatively rare. Rajid skates were captured mainly as incidental bycatch in artisanal fisheries using bottom trawls, gillnets, trammel nets, and longlines operating over sandy demersal habitats within the restricted Palestinian fishing zone. Morphometric variation and differences in abundance reflected ecological differentiation among species inhabiting shallow and deeper shelf environments. Economic hardship, declining fish availability, and food insecurity have increased the utilization of skates for local human consumption, particularly larger species incorporated into traditional seafood dishes such as "Sayadieh". Three of the four recorded species are regionally categorized as Near Threatened in the Mediterranean Sea, emphasizing the conservation importance of Gaza Strip coastal waters for demersal elasmobranch diversity. Intensive fishing pressure, unrestricted bycatch, habitat degradation, marine pollution, and geopolitical instability collectively threaten the sustainability of local skate populations. The present study represents one of the first focused assessments of Rajidae from Palestinian marine waters and highlights the urgent need for fisheries monitoring, biodiversity assessments, bycatch mitigation, and regional conservation initiatives targeting Mediterranean elasmobranchs in the southeastern Mediterranean Sea.

Keywords: *Rajidae; skates; Raja miraletus; Raja asterias; Raja clavata; Dipturus oxyrinchus; artisanal fisheries; bycatch; elasmobranch conservation; demersal fishes; Mediterranean Sea; Gaza Strip; Palestine.*

Citation: Abdel Fattah N. Abd Rabou, Samira Enajjar, Bechir Saidi, Mohamed N. Bradai, Mourad Attouchi, Rimel M. Benmessaoud, Mourad M. Cherif, Jehad Y. Salah, and Mohammed R. Al-Agha [2026]. Occurrence, Fisheries Interactions, Utilization, and Conservation of Rajid Skates in the Mediterranean waters of the Gaza Strip, Palestine. *Journal of Diversity Studies.*
DOI: https://doi.org/10.51470/JOD.2026.5.1.210

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Article History: *Received 10 February 2026 | Revised 13 March 2026 | Accepted 11 April 2026 | Available Online May 13, 2026*

1. INTRODUCTION

Skates belonging to the family Rajidae constitute an ecologically and commercially important group of cartilaginous fishes inhabiting continental shelf and slope ecosystems throughout the world oceans, including the Mediterranean Sea [1] [2]. Rajid skates are demersal batoids characterized by dorsoventrally flattened bodies, enlarged pectoral fins fused to the head, thornlike dermal denticles in many species, and oviparous reproduction through the deposition of characteristic egg capsules commonly referred to as "mermaid's purses" [3] [4]. These fish occupy important trophic positions in marine food webs, feeding mainly on benthic crustaceans, mollusks, polychaetes, and small fish [5]-[10].

The Mediterranean Sea hosts a relatively diverse rajid fauna comprising species of the genera *Raja, Dipturus*, *Leucoraja*, and *Rostroraja*, among others [11] [12]. Several Mediterranean skates, including the Thornback Ray (*Raja clavata* Linnaeus, 1758), Brown Ray (*Raja miraletus* Linnaeus, 1758), Mediterranean Starry Ray (*Raja asterias* Delaroche, 1809), and Longnose Skate (*Dipturus oxyrinchus* Linnaeus, 1758), have been documented from various sectors of the basin and are frequently associated with sandy, muddy, and mixed benthic habitats [13]-[16]. Recent investigations have expanded scientific understanding of Mediterranean skate diversity, biology, and distribution, particularly in the western and central Mediterranean regions [17]-[20].

Despite this growing body of knowledge, skates remain among the least studied groups of elasmobranchs in many parts of the eastern Mediterranean, especially along the Palestinian coast of the Gaza Strip. The Gaza Strip possesses a narrow Mediterranean coastline extending approximately 42 km and supports artisanal fisheries that provide food and income for thousands of local inhabitants [21] [22]. The marine ecosystem of the Gaza Strip is characterized by heavy fishing pressure, coastal urbanization, pollution, habitat degradation, and increasing socioeconomic instability resulting from recurrent wars and humanitarian crises [23] [24]. Such conditions may significantly influence the occurrence, abundance, and conservation status of elasmobranch populations, including rajid skates.

Elasmobranch fishes of the Gaza Strip have recently attracted increasing scientific attention. Several studies documented the occurrence, bycatch, utilization, and conservation concerns of sharks, guitarfishes, butterfly rays, electric rays, giant devil rays, and other batoids from Palestinian waters [25]-[37]. These investigations highlighted the presence of globally threatened chondrichthyans in Gaza Strip fisheries and demonstrated the growing exploitation pressure imposed on vulnerable marine fauna. In particular, the capture and consumption of endangered marine species under deteriorating humanitarian conditions have become increasingly evident during and after the recent Israeli war on the Gaza Strip [33] [38]. Nevertheless, despite the ecological importance of Rajidae, no comprehensive study has specifically addressed their occurrence, capture methods, utilization, and conservation in the Mediterranean waters of the Gaza Strip.

Throughout the Mediterranean basin, many skate species are considered vulnerable to overexploitation because of their slow growth, delayed maturity, low fecundity, and restricted population recovery potential [39]-[43]. Bottom trawling and other demersal fishing practices are among the principal threats affecting skate populations and benthic habitats [44] [45].

Several Mediterranean skates are currently recognized as threatened or Near Threatened at regional conservation levels, while additional records from the eastern and southern Mediterranean continue to reveal gaps in the understanding of skate biodiversity and distribution [46]-[55].

Biological and ecological studies conducted elsewhere in the Mediterranean have provided valuable information concerning skate feeding ecology, reproductive biology, morphometrics, growth, distribution, and fisheries interactions [56]-[64]. Molecular investigations further contributed to resolving taxonomic relationships and population connectivity among Mediterranean rajids [39] [65]-[67]. In addition, descriptions of egg capsules and reproductive traits have facilitated improved species identification and understanding of reproductive ecology [4] [68]. However, comparable data remain almost entirely lacking for the Palestinian marine ecosystem.

The present study aims to provide notes on the occurrence, fisheries interactions, utilization, and conservation of Rajidae in the Mediterranean waters of the Gaza Strip, Palestine. By contributing baseline information on the Gaza Strip rajid fauna, this study seeks to fill an important regional knowledge gap and support future biodiversity assessments, fisheries management strategies, and conservation initiatives concerning cartilaginous fishes in the southeastern Mediterranean Sea.

2. METHODOLOGY

Field data on rajid skates were obtained through a combination of landing-site observations, fish market inspections, and semi-structured interviews with local fishermen throughout the study period. Repeated visits to major landing centers allowed the documentation of freshly landed skate specimens, including species composition, morphometric characteristics, and fishing gears associated with their capture, particularly gillnets, trawl nets, and longlines. Photographic records were sometimes taken to support species verification and subsequent taxonomic confirmation. Additional information regarding species occurrence, vernacular names, fishing practices, seasonal availability, and utilization patterns was gathered through interviews with experienced fishermen and personnel of the General Directorate of Fisheries at the Ministry of Agriculture. Species identification and nomenclature were based on established taxonomic references and Mediterranean ichthyological guides [11] [69]-[71].

The investigation was carried out along the Mediterranean coastline of the Gaza Strip, Palestine, which extends for approximately 42 km within the southeastern sector of the Levantine Basin (Figure 1). The coastal environment is dominated by shallow continental shelf habitats composed mainly of sandy bottoms with relatively limited rocky substrates. Fishing activities in the area are strongly influenced by geopolitical constraints that restrict most operations to nearshore waters, generally within 6–12 nautical miles from the coast. Such restrictions have intensified fishing pressure on coastal marine habitats inhabited by diverse assemblages of cartilaginous fishes. Surveys were concentrated at the principal fish landing and marketing centers of the Gaza Strip, including Gaza City, Deir Al-Balah, Khan Younis, and Rafah, which collectively represent the major hubs for fish landing, trade, and processing activities in the region.

Figure 1: Map of Palestine showing the geographical location of the Gaza Strip along the southeastern Mediterranean coast, extending approximately 42 km in length and covering an area of about 365 km²

3. RESULTS

3.1. Species Composition and Occurrence

A total of four rajid skate species belonging to the family Rajidae were documented from the Mediterranean waters off the Gaza Strip during the present study (Table 1). The recorded assemblage consisted of the Brown Ray (*Raja miraletus* Linnaeus, 1758), Mediterranean Starry Ray (*Raja asterias* Delaroche, 1809), Thornback Ray or Thornback Skate (*Raja clavata* Linnaeus, 1758), and Longnose Skate (*Dipturus oxyrinchus* Linnaeus, 1758). All recorded species are native components of the Mediterranean ichthyofauna and were encountered in artisanal fish landings and local fish markets along the Gaza Strip coastline. The Brown Ray and Thornback Ray were the most frequently observed species, whereas the Mediterranean Starry Ray and Longnose Skate appeared comparatively less common. Most specimens originated from sandy demersal habitats within the southeastern Mediterranean shelf.

The occurrence of these rajids confirms the persistence of demersal cartilaginous fishes in the Gaza Strip coastal waters despite intensive fishing pressure and environmental degradation.

3.2. Relative Abundance, Morphometrics, and Conservation Status

Rajid skates landed along the Gaza Strip coast showed clear variation in abundance, body size, and conservation status as follows:

- The Brown Ray (Figure 2) was the most frequently encountered species, reflecting its adaptation to shallow coastal habitats exploited by artisanal fisheries. Captured individuals measured 30–50 cm in total length and weighed 0.3–1.5 kg. The species is currently classified as Least Concern in the Mediterranean region.
- The Mediterranean Starry Ray (Figure 3) occurred only occasionally in fish landings. Individuals reached 35–60 cm in total length and 1–2.5 kg in weight. Despite its lower abundance, the species is listed as Near Threatened in the Mediterranean Sea.
- The Thornback Ray (Figure 4) was moderately common and exhibited larger body dimensions, with total lengths of 50–90 cm and weights of 2–6 kg. The species is also categorized as Near Threatened.
- The Longnose Skate (Figure 5) was the rarest and largest species recorded. Specimens attained 70–110 cm in total length and 3–15 kg in weight. Its scarcity may be associated with deeper offshore habitat preference. The species is similarly classified as Near Threatened in the Mediterranean.

Overall, smaller rajids such as the Brown Ray were more abundant in Gaza fisheries, whereas larger species, particularly the Longnose Skate, were less frequent. Three of the four recorded species are considered Near Threatened in the Mediterranean region, highlighting the conservation importance of the Gaza Strip coastal waters for rajid diversity.

Table 1: Rajidae Species Landed in Gaza Strip Fisheries with Their Relative Abundance, Morphometrics, and IUCN Mediterranean Conservation Status

Order	Family	Common Name	Scientific Name	Arabic or Local Name	Catch Frequency	Approximate Total Length (TL)	Approximate Weight	Conservation Status (IUCN Med.)
Rajiformes	Rajidae	Brown Ray or Brown Skate	*Raja miraletus* (Linnaeus, 1758)	البسة العيون – الراي البني	Common / Frequent	30 - 50 cm	0.3–1.5 kg	Least Concern
Rajiformes	Rajidae	Mediterranean Starry Ray	*Raja asterias* (Delaroche, 1809)	البسة المنمشة – الراي المرقطة المتوسطية – الراي النجمي المتوسطي	Occasional / Uncommon	35 – 60 cm	1–2.5 kg	Near Threatened
Rajiformes	Rajidae	Thornback Ray or Thornback Skate	*Raja clavata* (Linnaeus, 1758)	الراي الشائكة أو الشوكي – الراي الشفنين شوك ي الظهر (الشقشلاح) – الورنك المسماري – القويع الشوكي	Moderately common	50 – 90 cm	2–6 kg	Near Threatened
Rajiformes	Rajidae	Longnose Skate	*Dipturus oxyrinchus* (Linnaeus, 1758)	الصاروخ – الزلاجة ذات الأنف الطويل – الراي طويل الخطم	Rare	70 – 110 cm	3–15 kg	Near Threatened

3.3. Description of Recorded Rajid Species

3.3.1. Brown Ray *Raja miraletus* (Linnaeus, 1758)

The Brown Ray was distinguished by its rhomboidal disc, pointed snout, slender tail, and characteristic eye-like ocelli bordered by dark rings on the dorsal surface (Figure 2). Dorsal coloration ranged from light brown to sandy beige, providing effective camouflage on softbottom substrates. The species was commonly landed as bycatch in gillnet and trawl fisheries operating over sandy seabeds, and fresh specimens were occasionally marketed for human consumption. Local fishermen commonly referred to the species as "*Al-Bassa Al-Oyoun*" (the eyed skate).

Figure 2: The Brown Ray (Raja miraletus Linnaeus, 1758) represents one of the most commonly captured rajid species in the Marine Ecosystem of the Gaza Strip, Palestine

3.3.2. Mediterranean Starry Ray *Raja asterias* (Delaroche, 1809)

The Mediterranean Starry Ray was characterized by numerous dark spots and star-like markings distributed across the dorsal surface (**Figure 3**). The snout was moderately pointed, and the tail bore rows of small dermal thorns. Most observed individuals originated from bottom-set gillnets and trammel nets operating over sandy substrates. The species was occasionally sold in local fish markets, although fishermen generally considered it of lower commercial value than many bony fishes. The species was locally known among fishermen as "*Al-Bassa Al-Monamasha*" (the spotted skate).

Figure 3: The Mediterranean Starry Ray (Raja asterias Delaroche, 1809) represents one of the least frequently captured rajids in the marine ecosystem of the Gaza Strip, Palestine

3.3.3. Thornback Ray *Raja clavata* (Linnaeus, 1758)

The Thornback Ray possessed a robust rhomboidal disc and was readily identified by strong thorn-like dermal denticles distributed along the dorsal surface and tail (Figure 4). Dorsal coloration varied from brownish to grayish with scattered darker blotches. The species was frequently associated with trawl catches and bottom gillnets. Larger individuals were occasionally processed and marketed for human consumption. Fishermen referred to the species by vernacular names associated with its thorny dorsal surface, including "*Al-Rai Al-Shawki*" and "*Al-Shaqshalah*".

3.3.4. Longnose Skate *Dipturus oxyrinchus* (Linnaeus, 1758)

The Longnose Skate was characterized by an elongated pointed snout, large rhomboidal disc, relatively smooth dorsal surface, and elongated tail (Figure 5). Most documented specimens were captured incidentally in deeper fishing grounds by trawl nets and longline fisheries. Its occurrence confirms the persistence of deeper-water rajid fauna within the southeastern Mediterranean ecosystem adjacent to the Gaza Strip. Local fishermen commonly referred to the species as "*Al-Saroukh*" (the rocket).

Figure 4: The Thornback Ray (Raja clavata Linnaeus, 1758) represents one of the commercially rajids from the marine ecosystem of the Gaza Strip, Palestine

Figure 5: The Longnose Skate (Dipturus oxyrinchus Linnaeus, 1758) represents the least frequently captured rajid in the marine ecosystem of the Gaza Strip, Palestine

3.4. Capture Methods and Fisheries Interaction

Rajid skates in the Gaza Strip were captured primarily as incidental bycatch in multispecies artisanal fisheries rather than through targeted fishing operations. The principal fishing gears associated with skate captures included bottom trawl nets, gillnets, trammel nets, and longlines. Bottom trawling was the main fishing method responsible for capturing larger demersal skates, particularly the Thornback Ray and Longnose Skate, whereas smaller species such as the Brown Ray and Mediterranean Starry Ray were more frequently associated with shallow-water gillnet fisheries. Most captures originated from sandy benthic habitats within the restricted fishing zone permitted to Palestinian fishermen. Interviews with fishermen indicated that skate catches fluctuate seasonally and often increase during colder months when demersal fishing activity intensifies.

3.5. Utilization and Local Trade

Figure 6: The lead researcher and his son before consuming the traditional Palestinian dish "Sayadieh", a coastal specialty in the Gaza Strip made of fish and rice with caramelized onions, olive oil, and spices, typically served with salads and side dishes

The utilization of rajid skates in the Gaza Strip varied according to market demand, body size, and prevailing socioeconomic conditions. Historically, skates were considered of relatively low commercial value compared with many bony fishes. However, economic hardship, food insecurity, and declining fish availability have increased their importance as a source of affordable protein. Fresh specimens were marketed whole or partially processed, with larger species such as the Thornback Ray and Longnose Skate commonly cut into portions before sale. Skate flesh was usually consumed fried or grilled, while smaller or damaged individuals were occasionally utilized as bait or animal feed. Rajid flesh was also incorporated into traditional Palestinian seafood dishes, particularly "*Sayadieh,*" a popular coastal meal consisting of fish and rice cooked with caramelized onions, olive oil, and spices, and commonly served with salads and side dishes (Figure 6). During periods of fish scarcity and recurrent wars in the Gaza Strip, skate meat represented an alternative food resource, especially the white flesh of larger species.

3.6. Conservation Concerns

The present findings indicate that Rajid skates inhabiting the Mediterranean waters of the Gaza Strip are exposed to increasing fisheries and environmental pressures. Intensive exploitation of coastal fishing grounds, unrestricted bycatch in bottom trawling operations, habitat degradation, marine pollution, and geopolitical instability collectively threaten the sustainability of local skate populations. Several of the documented species, particularly the Thornback Ray and Longnose Skate, are vulnerable to overexploitation because of their slow growth, delayed maturity, and low reproductive capacity. The capture of juveniles and reproductively mature individuals may further reduce population recovery potential. The absence of species-specific management measures and long-term monitoring programs represents an additional conservation challenge. Consequently, improved fisheries monitoring, bycatch reduction measures, and regional conservation initiatives are needed to support the sustainable management of rajid skates in the southeastern Mediterranean Sea.

4. DISCUSSION

The present study provides one of the first focused assessments of rajid skates inhabiting the Mediterranean waters of the Gaza Strip and contributes important baseline information concerning the diversity, fisheries interactions, utilization, and conservation of these demersal batoids in the southeastern Mediterranean Sea. The documentation of four rajid species, namely the Brown Ray (*Raja miraletus* Linnaeus, 1758), Mediterranean Starry Ray (*Raja asterias* Delaroche, 1809), Thornback Ray or Thornback Skate (*Raja clavata* Linnaeus, 1758), and Longnose Skate (*Dipturus oxyrinchus* Linnaeus, 1758), demonstrates that the Gaza Strip coastal waters still support a representative assemblage of Mediterranean skates despite intensive anthropogenic stressors, habitat degradation, and geopolitical instability affecting Palestinian marine ecosystems. Comparable rajid assemblages have been reported from several Mediterranean regions including Tunisia, Libya, Greece, and the central Mediterranean [17] [49] [72]. Nevertheless, the relatively limited diversity observed in the Gaza Strip may reflect the oligotrophic nature of the Levantine Basin in addition to the concentration of fishing activities within restricted nearshore waters.

The Brown Ray (*Raja miraletus*) represented the most frequently encountered rajid species during the present study. Its dominance likely reflects adaptation to shallow sandy habitats that characterize much of the Gaza Strip continental shelf. Similar abundance patterns have been documented in several Mediterranean regions where the species commonly occurs in artisanal demersal fisheries and shallow benthic environments. The relatively small body size, opportunistic ecological behavior, and apparent tolerance to moderate fishing disturbance may contribute to the persistence of the species in heavily exploited coastal ecosystems [73] [74].

The Mediterranean Starry Ray (*Raja asterias*) was comparatively less frequent in fish landings. This finding agrees with observations from other Mediterranean localities where the species often displays localized and fragmented distribution patterns associated with sandy and muddy demersal habitats [75] [76]. Taxonomic uncertainty and historical misidentification with the Thornback Ray in some regions have also been highlighted, particularly in the Sea of Marmara, where previous records of the Mediterranean Starry Ray may actually represent misidentified Thornback Ray specimens [77].

The lower abundance of the species in Gaza Strip fisheries may additionally indicate sensitivity to habitat disturbance and fishing pressure affecting shallow coastal environments. Recent investigations emphasized the conservation importance of the species because of increasing fisheries vulnerability, reproductive habitat fragmentation, and localized population declines [53] [78].

The Thornback Ray (*Raja clavata*) represented one of the largest and most commercially important rajids recorded during the study. The species was commonly associated with trawl and bottom gillnet fisheries operating over sandy demersal habitats. Similar observations have recently been documented from several Mediterranean and adjacent European waters where the Thornback Ray constitutes an important component of demersal fish communities and bycatch assemblages in commercial fisheries [17] [79] [80]. Morphological abnormalities and atypical coloration patterns have also occasionally been reported in Mediterranean Thornback Ray populations, possibly reflecting environmental stressors and developmental anomalies affecting local batoid populations [81]. Recent ecological and fisheries studies further indicated that the Thornback Ray is highly vulnerable to intensive demersal exploitation because of its slow growth, delayed sexual maturity, and low population recovery potential [82] [83]. Population structuring and stock differentiation of the Thornback Ray within Mediterranean regions have also been documented, suggesting limited connectivity between adjacent populations and reinforcing the need for localized conservation and fisheries management strategies [84]. Spatial ecology investigations additionally demonstrated that the Thornback Ray exhibits relatively localized movement patterns and habitat fidelity, increasing its susceptibility to repeated fishing disturbance in heavily exploited coastal areas [85]. Consequently, sustained fishing pressure may negatively influence the long-term stability of local populations.

The Longnose Skate (*Dipturus oxyrinchus*) was the rarest species encountered during the investigation. Its scarcity is probably associated with preference for deeper continental shelf and slope habitats that are only partially accessible to Palestinian fishermen because of maritime restrictions. Similar rarity patterns have recently been reported from several Mediterranean regions where the Longnose Skate is considered an uncommon deep-water batoid vulnerable to intensive demersal fishing activities [17] [83] [85]. Recent biological investigations demonstrated that the species exhibits slow growth, delayed maturity, and relatively low reproductive productivity, factors that considerably reduce population recovery potential under sustained fisheries pressure [86] [87]. In addition, deep-water elasmobranch assessments conducted in the central and eastern Mediterranean emphasized that the Longnose Skate is particularly susceptible to trawl fisheries operating along continental shelf margins and upper slope habitats [88] [89]. The occurrence of the species in Gaza Strip fisheries nevertheless highlights the ecological connectivity between Palestinian coastal waters and broader southeastern Mediterranean demersal ecosystems.

The morphometric differences observed among the recorded rajid species likely reflect ecological differentiation and habitat segregation between shallow-water and deeper-water skates. Smaller species such as the Brown Ray occurred mainly in shallow coastal habitats, whereas larger species including the Thornback Ray and Longnose Skate were more frequently associated with deeper fishing grounds.

Similar bathymetric and ecological segregation patterns have recently been documented for Mediterranean rajid assemblages inhabiting continental shelf and slope environments [17] [74]. Studies on Mediterranean demersal batoids further demonstrated that differences in body size, feeding ecology, and habitat preference contribute substantially to spatial niche partitioning among coexisting skate species [89]-[91]. Sandybottom habitats, although often characterized by relatively low local species richness, play a crucial role in shaping regional coastal fish β-diversity and supporting demersal assemblage structure, including rajid skates [91]. Such ecological separation probably contributes to reducing interspecific competition among sympatric rajids inhabiting Mediterranean demersal ecosystems and facilitates the coexistence of multiple species within heavily exploited benthic habitats [83] [92].

The present study further demonstrated that Rajid skates in the Gaza Strip are captured mainly as incidental bycatch in multispecies artisanal fisheries rather than through directed fisheries. Bottom trawls, gillnets, trammel nets, and longlines represented the principal fishing gears associated with skate captures. Comparable fisheries interactions have recently been documented in several Mediterranean sectors where skates and other batoids frequently occur in artisanal and mixed demersal fisheries [93]-[95]. Recent studies additionally emphasized that coastal elasmobranch assemblages are increasingly threatened by concentrated fishing effort, habitat disturbance, and chronic bycatch mortality associated with small-scale fisheries operating over continental shelf habitats [96] [97]. In the Gaza Strip, the restriction of fishing operations to relatively narrow coastal zones likely intensifies fishing pressure on local demersal habitats and continuously exposes rajid populations to fishing mortality. Similar ecological pressures have recently been recognized as important drivers of batoid decline in heavily exploited Mediterranean coastal ecosystems [98] [99].

The increasing utilization of rajid skates for human consumption in the Gaza Strip appears strongly linked to worsening socioeconomic conditions, declining fish availability, and food insecurity. Although skates historically possessed relatively low commercial value in many Mediterranean fisheries, recent evidence indicates that economic pressure and fish supply shortages can significantly increase reliance on low-trophic and previously underutilized demersal species, including rays and skates, as affordable protein sources in coastal communities [100] [101]. Similar socio-ecological shifts have been documented in Mediterranean small-scale fisheries where declining catches and market instability drive increased exploitation of nontarget elasmobranchs [102] [103]. Larger individuals, particularly Thornback Rays and Longnose Skates, were frequently marketed and incorporated into traditional Palestinian seafood dishes such as "*Sayadieh*." Comparable studies have shown that cultural food practices in Mediterranean coastal societies are highly flexible and often adapt to fluctuations in fish availability and economic constraints [104] [105]. Such adaptive utilization of available marine resources has become increasingly evident under conditions of recurrent Israeli wars and military invasions economic instability, and restricted livelihood options in the Gaza Strip [106].

The conservation implications of the present findings are particularly important because three of the four documented species are regionally categorized as Near Threatened in the Mediterranean Sea.

Recent assessments have highlighted that many Mediterranean skates continue to experience declining trends due to sustained fishing pressure and habitat degradation [107] [108]. Intensive fishing pressure, unrestricted bycatch, habitat degradation, marine pollution, and coastal anthropogenic stressors collectively threaten the sustainability of local rajid populations [109]-[111]. In addition, geopolitical instability and restricted fisheries governance capacity can exacerbate exploitation impacts in coastal systems such as the southeastern Mediterranean [42] [43]. The absence of species-specific monitoring programs, landing statistics, and bycatch mitigation measures further increases conservation concerns, as reported for several Mediterranean elasmobranch fisheries lacking effective management frameworks [112] [113]. Because rajid skates generally exhibit slow growth, delayed maturity, and low reproductive output, depleted populations may require extended periods for recovery, making them particularly sensitive to continuous artisanal fishing pressure [114] [115].

Overall, the present study highlights the ecological significance of the Gaza Strip coastal waters as part of the southeastern Mediterranean ecosystem supporting demersal chondrichthyan diversity. Despite severe environmental and socioeconomic pressures, the persistence of rajid skates demonstrates the continued ecological importance of Palestinian marine habitats and their role within broader Mediterranean biodiversity patterns [107] [108]. Continued biodiversity surveys, fisheries monitoring programs, ecological investigations, and regional conservation initiatives are urgently needed to improve scientific understanding and support the sustainable management of rajid skates and other vulnerable elasmobranchs in the southeastern Mediterranean Sea [115].

5. CONCLUSION

The present study provides one of the first focused accounts of rajid skates inhabiting the Mediterranean waters of the Gaza Strip, Palestine. Four species were documented, with the Brown Ray (*Raja miraletus*) representing the most common species and the Longnose Skate (*Dipturus oxyrinchus*) the rarest. Rajid skates were captured mainly as incidental bycatch in artisanal fisheries operating within the restricted Palestinian fishing zone and have become increasingly utilized for human consumption because of declining fish availability and worsening socioeconomic conditions in the Gaza Strip. Since most recorded species are regionally categorized as Near Threatened, intensive fishing pressure, unrestricted bycatch, habitat degradation, marine pollution, and geopolitical instability may seriously threaten the sustainability of local skate populations. The study therefore emphasizes the urgent need for fisheries monitoring, biodiversity assessments, bycatch mitigation measures, and regional conservation initiatives to support the long-term conservation and sustainable management of rajid skates in the southeastern Mediterranean Sea.

ACKNOWLEDGMENTS

The authors sincerely acknowledge the General Directorate of Fisheries at the Ministry of Agriculture for their valuable support and guidance throughout this study on rajid skates. Special appreciation is extended to the fishermen and fishmongers of the Gaza Strip for their cooperation, willingness to share field observations, and assistance in providing essential information and photographic documentation.

The authors also express their gratitude to colleagues and friends on social media platforms whose shared observations and images contributed meaningfully to the documentation and verification of dasyatid stingray species records included in this work.

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