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IDENTIFICATION OF A POTENTIAL NURSERY GROUND OF THE SPINY BUTTERFLY RAY, *GYMNURA ALTAVELA*, IN THE NORTHEASTERN MEDITERRANEAN SEA, TÜRKİYE

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ABSTRACT

This study reports the first identified potential nursery area for the critically endangered Gymnura altavela *off the coast of Samandağ in the northeastern Mediterranean. Two divers conducted seasonal surveys across a total area of 750 m² at three depth intervals (5–10 m, 11–20 m, 21–30 m) using the standard underwater visual census method. Additionally, bycatch data from nearby commercial trawling operations were collected. The highest individual density recorded was 0.051 n/m² in autumn, the lowest 0.02 n/m² in summer. The findings suggest that the area functions as a nursery habitat for the* G. altavela *population.*

Key words: *Gymnura altavela*, nursery site, breeding area, Samandağ coasts, northeastern Mediterranean

IDENTIFICAZIONE DI UN POTENZIALE LUOGO DI RIPRODUZIONE DI *GYMNURA ALTAVELA* NEL MAR MEDITERRANEO NORD-ORIENTALE, TURCHIA

SINTESI

Questo studio riporta la prima area potenziale identificata come zona di riproduzione per la specie Gymnura altavela*, gravemente minacciata di estinzione, al largo della costa di Samandağ, nel Mediterraneo nord-orientale. Due subacquei hanno condotto indagini stagionali su un'area totale di 750 m² a tre intervalli di profondità (5-10 m, 11-20 m, 21-30 m) utilizzando il metodo standard di censimento visivo subacqueo. Sono stati inoltre raccolti dati sulle catture accessorie delle vicine attività di pesca commerciale con reti a strascico. La densità individuale più alta registrata è stata di 0,051 n/m² in autunno, la più bassa di 0,02 n/m² in estate. I risultati suggeriscono che l'area funge da habitat di riproduzione per la popolazione di* G. altavela.

Parole chiave*: Gymnura altavela*, sito di nursery, area di riproduzione, coste di Samandağ, Mediterraneo nord-orientale

INTRODUCTION

Butterfly rays (Elasmobranchii: Myliobatiformes: Gymnuridae) are demersal batoids with a global distribution in the inshore coastal waters of tropical and temperate seas, typically found over soft sandy or muddy bottoms but also occurring over rocky reefs (Compagno & Last, 1999, McEachran & Carvalho, 2002; Ebert & Dando, 2020; Barone *et al*., 2022).

The family is represented by a single genus, *Gymnura*, which comprises 16 species worldwide. *Gymnura altavela* (Linnaeus, 1758) is the only member of this family present in the Mediterranean Sea (Ebert & Dando, 2020; Barone *et al*., 2022). The spiny butterfly ray *G. altavela* is the largest member of the Gymnuridae family, reaching a maximum disc width (DW) of approximately 2600 mm (Ebert & Dando, 2020). It is widely distributed in the western and eastern Atlantic Ocean, the Mediterranean Sea, and the Black Sea (Weigmann, 2016), inhabiting shallow inshore waters in the bathymetric range from 10 to 69 m (Ebert & Stehmann, 2013). Its diet consists of all kinds of benthic animals, but primarily fish and cephalopods (Bauchot, 1987). The species is aplacental viviparous, with an annual reproductive cycle that includes a six-month gestation period and results in a litter of 2–7 pups (McEachran & Capapé 1984; Bradai *et al.,* 2012). Although generally harmless to humans, *G. altavela* possesses a caudal spine capable of inflicting a painful wound if stepped on. It is also listed as a game fish in some regions (Conrath & Scarbrough, 2009).

G. altavela is caught as bycatch in trawl, trammel net, and longline fisheries (Bauchot 1987; Yağlıoğlu *et al.,* 2015). The wings are marketed fresh, chilled, or frozen in Sicily and Morocco, rarely elsewhere (Bauchot, 1987). The IUCN Red List of Threatened Species classifies the species as Endangered globally, and Critically Endangered in the Mediterranean, due to a suspected population decline exceeding 80% over the past three generations (Dulvy *et al.,* 2021). This drastic decline, documented in catch data (Abdul Malak *et al.,* 2011; Özbek *et al.,* 2016), is driven by intense fishing pressure and the species' slow reproductive rate.

The spiny butterfly ray was historically moderately abundant and commonly caught throughout the Mediterranean region. For much of the last century, up until the 1980s, it frequently appeared in the catches of demersal trawl and set net fisheries, particularly along the southern shores. In areas such as the Sicilian Channel, where it was once regularly captured, the species has now become very rare or is absent from local catch records (Bauchot, 1987). Its decline is further evidenced by its absence from the International Trawl Survey in the Mediterranean (MEDITS) records since 1994. The occasional contemporary reports of its presence are typically based on the incidental capture of individual specimens in demersal fisheries. An exception to this overall decline is the Levant coast, where the species remains relatively abundant and is regularly caught using bottom trawls, fixed nets, and longlines (Dulvy *et al.,* 2021).

Identification of critical habitats is an essential and well-established component of sustainable resource management (Gonçalves Silva and Vianna, 2018; Ergüden *et al.,* 2025; Turan *et al.,* 2025), and nursery sites are an important category of such habitats (Medeiros *et al.,* 2015; Rangel *et al.,* 2018). They can be used by many species, separated in space and time, and it is important to understand the mechanisms and drivers behind their use (Heithaus, 2007; Rosenfelder *et al.,* 2012; Cengiz *et al.,* 2024; Kabasakal *et al*., 2024; Turan *et al.,* 2024). Heupel *et al*. (2007) established three key criteria for identifying an elasmobranch nursery habitat: (1) juvenile elasmobranchs are more commonly encountered there than in other areas, (2) they remain in the area for extended periods, and (3) the area is used repeatedly across years. Therefore, the main aim of this study is to evaluate a potential nursery ground



Fig. 1: Map of the study area.
Sl. 1: Zemljevid obravnavanega območja.

for the spiny butterfly ray *G. altavela* in the north-eastern Mediterranean. If confirmed, this site would represent the second identified critical habitat for this species along the Turkish Mediterranean coast (Bilgili & Kabasakal, 2023).

MATERIAL AND METHODS

This study, carried out over a one-year research period within the framework of a project supported by the Turquoise Coast Environment Fund–Turkey (ElasmoKAP-TCEF-2024), utilized a standardized underwater visual census (UVC) method (Whitfield *et al.*, 2007; Murphy *et al.*, 2010; Turan & Doğdu, 2022) to assess the density, abundance, distribution, and reproductive status–based on observed abdominal swellings–of *G. altavela* in the Ray field region of Hatay-Samandağ coast. Two divers monitored three depth ranges: shallow (5–10 m),

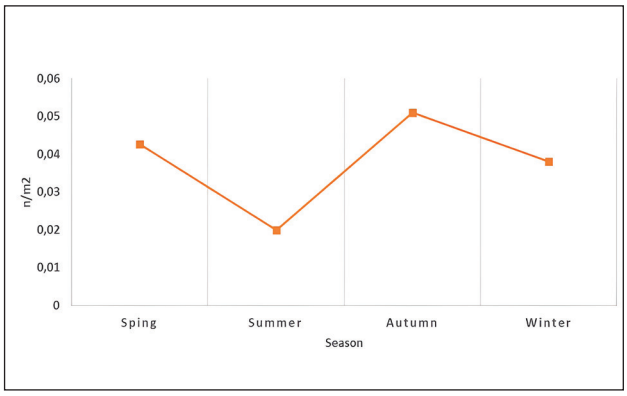


Fig. 2: Mean density of** G. altavela **across all depths and seasons within the identified nursery area.
Sl. 2: Povprečna gostota primerkov vrste** G. altavela **v vseh globinah in letnih časih znotraj opredeljenega območja jaslic.

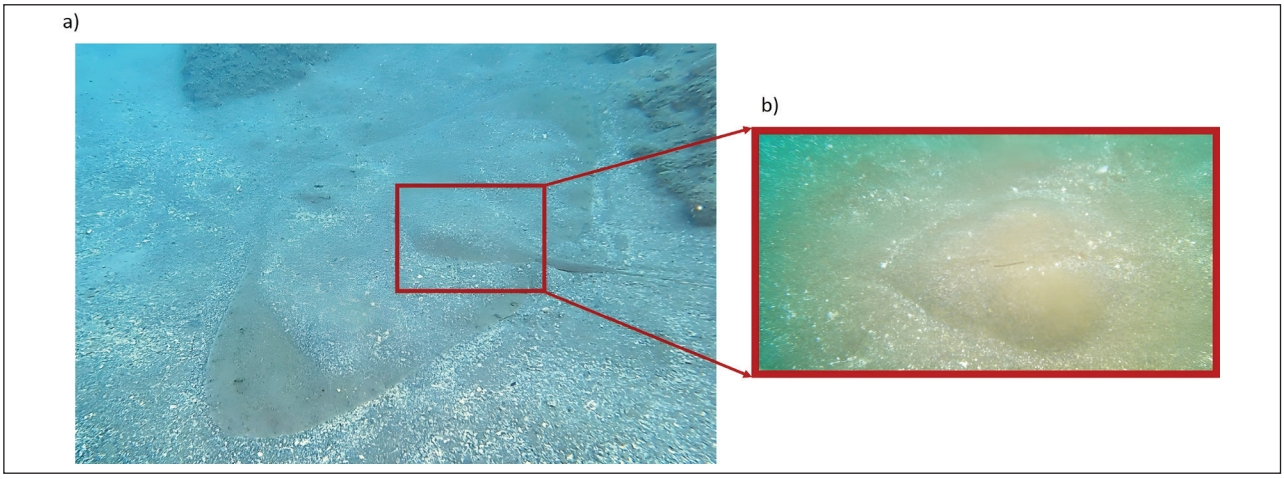


Fig. 3: Dorsal view of egg sacs from pregnant females** G. altavela **(A and B) (Photo: Cemal Turan).
Sl. 3: Pogled na hrbtno stran jajčnih vrečk brejih samic vrste** G. altavela **(A in B) (Foto: Cemal Turan).

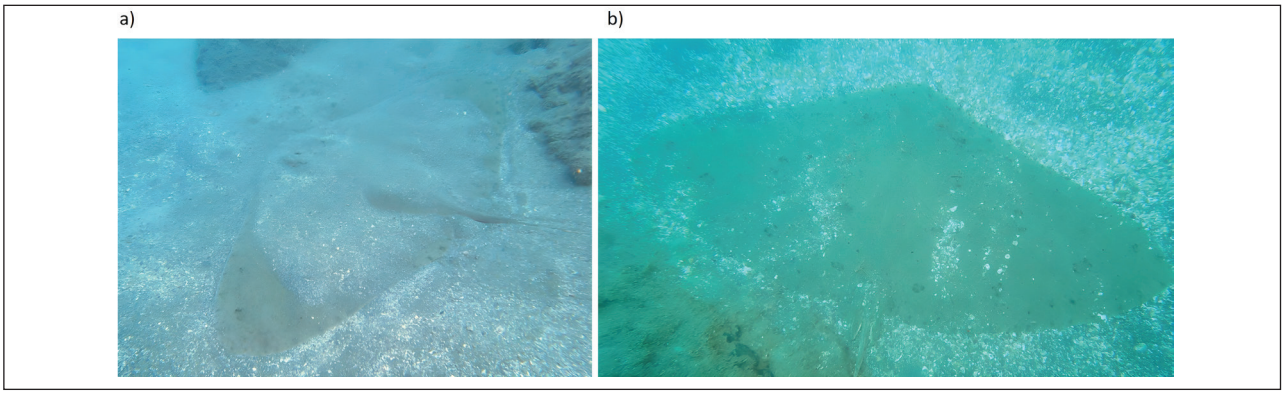


Fig. 4: Individuals of** G. altavela **in the investigating area: (A) a pregnant female and (B) an adult male (Photo: Cemal Turan).
Sl. 4: Osebki vrste** G. altavela **na raziskovanem območju: (A) breja samica in (B) odrasel samec (Foto: Cemal Turan).

intermediate (11–20 m), and deep (21–30 m). At each depth range, a 5 × 50 m transect was surveyed, resulting in a total examined area of 750 m² along the Samandağ coast (Fig. 1). Surveys were conducted four times over a year, once per season. The estimate of the mean density (*D*) on a transect is expressed as:

$$D = \frac{\sum_{i=1} n_i}{a}$$

where *n* is the number of *G. altavela* individuals observed, and *a* the census area (Whitfield *et al.,* 2007). In addition to UVC, data on *G. altavela* bycatch from commercial trawling activities near the study area were monitored for one year, and biological data were collected from captured individuals. All captured spiny butterfly rays were handled carefully and retained under appropriate conditions to minimize post-release mortality. All statistical analyses were performed using R-Studio.

RESULTS

G. altavela was observed on the Samandağ coast in all seasons, which suggests its regular occurrence in the area. The mean density across all depths and seasons was 0.038 n/m². Densities varied by depth range, with 0.0 n/m² at 5–10 m, 0.076 n/m² at 10.1–20 m, and 0.052 n/m² at 20.1–30 m. Seasonally, the highest density was recorded in autumn (0.051 n/m²), the lowest in summer (0.02 n/m²) (Fig. 2).

A single visual count in autumn along a 150 m transect in the 11–20 m depth range was documented. There were pregnant females and males were resting on the sandy seabed that a dorsal view of egg sacs from a pregnant females *G. altavela* was given in the Fig. 3A and 3B. Eight pregnant females and three males with long claspers resting on the sandy seabed (Fig. 4A and 4B). Conversely, during a summer survey in the same area and depth range, three non-pregnant females and one male were counted.

During the study, female butterfly ray–pregnant individuals in particular–were observed moving away from the area as divers approached (Fig. 5), a behavior not exhibited by males.

The UVC findings were further corroborated by trawl observations carried out in an adjacent area where commercial fishing is permitted. Trawl bycatch data collected during the local fishing season confirm that *G. altevera*–including mature individuals, juveniles, and newborns–are commonly encountered (Fig. 6) from September to May. The species is less frequently observed during the remaining, rest period.

DISCUSSION

The present study identifies a potential and rare nursery site for *Gymnura altavela* in the Mediterranean. The area is predominantly sandy, with a few small rocky structures, exhibiting similar oceanographic features as other known aggregation sites (Silva & Vianna, 2018; Castro & Meyers, 2022; Espino Ruano *et al.,* 2023).

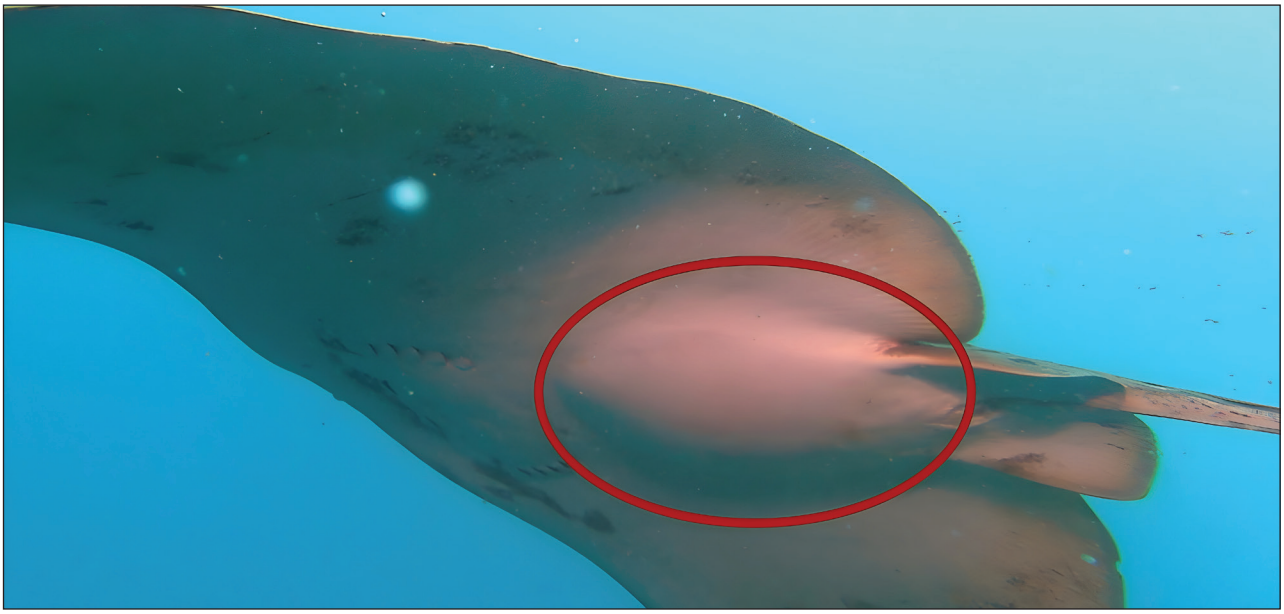


Fig. 5: Ventral surface of a pregnant female** G. altavela**, showing the egg sac and open cloaca (Photo: Cemal Turan).
Sl. 5: Trebušna površina breje samice vrste** G. altavela**, na kateri je prikazana jajčna vrečka in odprta kloaka (Foto: Cemal Turan).

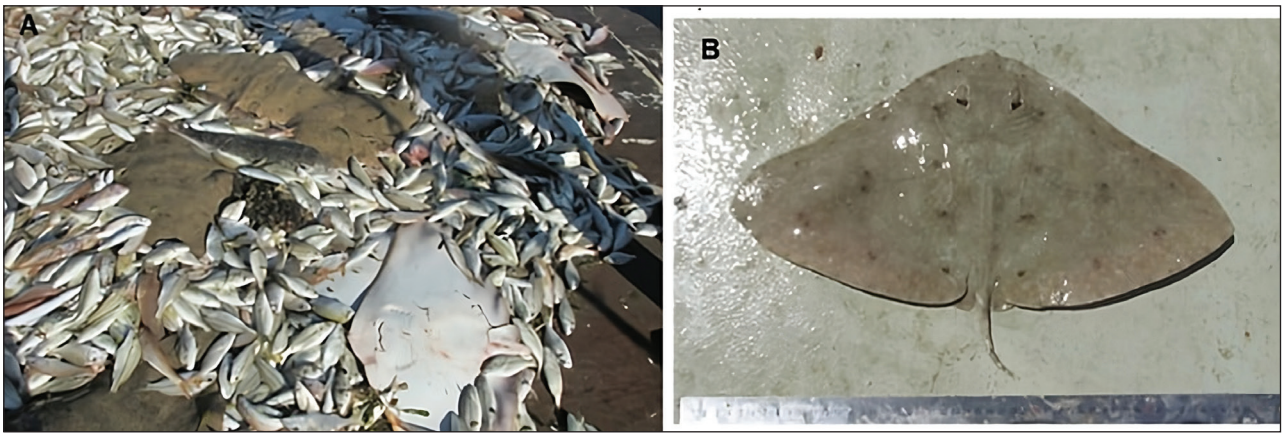


Fig. 6: Specimens of** G. altavela **on a trawler deck, captured as bycatch near the nursery area: (A) adult and (B) newborn individuals (Photo: Cemal Turan).
Sl. 6: Primerki vrste** G. altavela **na palubi vlečne mreže, ujeti kot prilov v bližini območja jaslic: (A) odrasli in (B) novoskoteni primerki (foto: Cemal Turan).

The average water temperature shows considerable seasonal variations: 30–32°C in summer (July), 20–24°C in autumn (November), 16–20°C in winter (February), and 20–22°C in spring (May). Salinity levels fluctuate between 33.6 and 37.1‰. Prior to this study, Bilgili and Kabasakal (2023) identified another aggregation site and potential breeding ground for *G. altavela* in Güllük Bay (SE Aegean Sea). Based on eight years of observation, the authors reported that aggregations of large pregnant females in that area peaked in mid-summer and were subsequently replaced by juveniles in the fall–a pattern consistent with a reproductive aggregation.

Applying the three established criteria for identifying nursery habitats (Heupel *et al.,* 2007) to our findings, we can confirm that the Samandağ Hırlavuk area functions as a nursery ground for *G. altavela*. The highest number of pregnant females was recorded in early autumn, aligning with the known fecundation period (Espino Ruano *et al.,* 2023). Furthermore, year-round observations suggest that this area serves multiple purposes, including feeding, mating, and parturition. The designation of a site as a nursery area is contingent on the presence of newborns, juveniles, and gravid females (Castro, 1993; Heupel *et al.,* 2007). Such areas typically support a higher proportion of juveniles, thereby contributing more significantly to adult recruitment compared to other habitats (Gunter, 1967; Beck *et al.,* 2001). Beck *et al*. (2001) further emphasized the essential role of juvenile survival in driving population growth. Also, in the spawning area they examined, females significantly outnumbered males among the adult population, a pattern consistent with our findings. Capapé *et al*. (2003) suggested that females migrate to shallow coastal waters to find suitable hydrobiological conditions for parturition, thereby minimizing risks to free-swimming neonates from both intra- and interspecific competition, including cannibalism. This behavior underscores the ecological importance of shallow nursery grounds in enhancing juvenile survival.

Given that *G. altavela* is classified as a critically endangered species in the Mediterranean, the identification and protection of its nursery habitats are crucial for effective conservation and population sustainability. However, research on its reproductive biology and life history remains limited, both in Türkiye and globally (Alkusairy *et al.,* 2014; Silva & Vianna, 2018; Yeldan *et al.,* 2018; Taylan *et al.,* 2019). The findings of this study contribute valuable insights into the species' reproductive ecology and habitat preferences, emphasizing the need for further research and conservation efforts.

In conclusion, the data presented in this study indicate that a sustainable population of *G. altavela* is established in the Samandağ Hırlavuk area, which serves as a critical nursery habitat. This finding adds Samandağ Hırlavuk to the list of other essential habitats for this species, alongside the Aegean coast of Türkiye (Taylan *et al.,* 2019) and Tunisian and Syrian waters (Alkusairy *et al.,* 2014; Capapé *et al.,* 1992; El Kamel *et al.,* 2009). Given the species' endangered status, it is imperative to implement conservation strategies that prioritize the protection of these nursery sites to support population recovery and long-term sustainability.

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IDENTIFIKACIJA POTENCIALNIH JASLIC ZA METULJASTEGA SKATA, *GYMNURA ALTAVELA*, V SEVEROVZHODNEM SREDOZEMSKEM MORJU, TURČIJA

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POVZETEK

Avtorji poročajo o prvem prepoznanem potencialnem območju za razmnoževanje kritično ogrožene vrste Gymnura altavela *ob obali Samandağa v severovzhodnem Sredozemlju. Dva potapljača sta izvedla sezonske raziskave na skupni površini 750 m² v treh globinskih intervalih (5–10 m, 11–20 m, 21–30 m) z uporabo standardne metode podvodnega opazovalnega popisa. Poleg tega so bili zbrani podatki o prilovu iz bližnjih komercialnih vlečnih mrež. Najvišja zabeležena gostota primerkov je bila 0,051 n/m² jeseni, najnižja pa 0,02 n/m² poleti. Ugotovitve kažejo, da območje deluje kot jaslice za populacijo vrste* G. altavela.

Ključne besede: metuljasti skat, *Gymnura altavela*, jaslice, razmnoževalno okolje, obale Samandağ, severovzhodno Sredozemlje

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