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LETTER FROM THE CONSERVATION FRONT LINE

Rediscovery and urgent conservation needs of the critically endangered spiny butterfly ray (*Gymnura altavela*) in the Adriatic Sea

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The ongoing sixth mass extinction (Ceballos, Ehrlich, & Raven, 2020; Shivanna, 2020) underscores the devastating consequences of human activities on biodiversity (Novacek & Cleland, 2001) and the critical need for immediate conservation actions (Shivanna, 2022). Elasmobranchs, being among the most threatened vertebrates (Dulvy *et al*., 2021a), demand particular attention. Despite a growing interest in elasmobranchs, many species remain elusive and under-studied (Shiffman *et al*., 2022). The absence of systematic research, in certain countries, and reliance on anecdotal reports foster a misleading impression of their abundance, risking inadequate conservation measures (Gajić, 2023). This highlights the imperative for precise and timely data, especially concerning species found in coastal regions that are particularly sensitive to anthropogenic pressures (Dulvy *et al*., 2014), such as the spiny butterfly ray.

The spiny butterfly ray, *Gymnura altavela* (Linnaeus, 1758), is a lesser-known demersal batoid easily distinguished by its body, which is about twice as wide as it is long (Barone, Mazzaoldi, & Serena, 2022). Typically found along the continental shelves on both sides of the Atlantic Ocean (Menni & Lucifora, 2007), the species prefers depths up to 100 meters (Özbek, Çardak, & Kebapçioglu, 2016). While adults may reach up to 400-cm disk width (DW) (Stehmann, 1981), the majority of recent individuals caught in the Mediterranean Sea measure less than 110 cm (Alkusairy *et al*., 2014; Özbek, Çardak, & Kebapçioglu, 2016), with the largest recent specimen not exceeding 200-cm DW (Gajić *et al*., 2023). The species is considered rare (Serena *et al*., 2020) and critically endangered in the Mediterranen Sea, experiencing substantial population declines estimated at over 80% in the last two decades (Walls *et al*., 2016). It is hypothesized that the species is absent from much of the northern Mediterranean Sea due to the absence of records during the Mediterranean International Trawl Surveys (MEDITS) (Baino *et al*., 2001; Dulvy *et al*., 2021b).

Here, we discuss the rediscovery of the species in the Adriatic Sea, the northernmost arm of the Mediterranean Sea, delivering five new records (2022–2024) and emphasizing the urgent need to enhance research and implement effective conservation actions.

In the 19th century, frequent landings of spiny butterfly ray were reported in the Adriatic Sea (Kolombatović, 1886); however, through the 20th century, records of such landings nearly disappeared (Dulčić *et al*., 2003). There were no records in this century until a large gravid female was recently described in Vlorë, Albania, marking the first record of a gravid female in the northern Mediterranean (Gajić *et al*., 2023). The subsequent systematic research conducted by the authors in Vlorë led to five new findings between 2022 and 2024. Another gravid female (153-cm DW, 24.9-kg TW) bearing seven late-stage fetuses, together with an adult male (103 cm DW and 8.15 kg TW) and a juvenile male (63-cm DW, 2-kg TW; Fig. 1), were recorded off Zvërnec, Sazan Island, and Vjose Delta, at the depths of 25 to 30 meters. Local ecological knowledge provided one additional record in 2022, and another one from 2016 (Fig. 2). This brings it to a total of five individuals recorded in Vlorë in the last 2 years, including two gravid females bearing 14 fetuses of sizes corresponding to or exceeding the regular size at birth in the Mediterranean Sea (Alkusairy *et al*., 2014; Gajić *et al*., 2023). In addition to Albania, a male (82-cm DW, 5.5-kg TW; Fig. 2) was captured near Split, Croatia, in spring 2023 and reported to the authors. A recent study (Balàka *et al*., 2023) reported another individual (*c*. 150-cm DW, 10-kg TW) caught in 2022, also near Split, at a depth of 15 m. This resurgence of records underscores the pressing need for enhanced research efforts and the implementation of conservation measures. The presence of near-term females and juveniles in Vlorë indicates the possibility of the area serving as a nursery ground, aligning with previously described nurseries (Silva & Vianna, 2018). Protecting such habitats is crucial; however, they face significant threats from unregulated and illegal fishing, habitat degradation, pollution, and disturbance.

In light of the urgent need to safeguard this species and its habitat, comprehensive surveys are essential across the

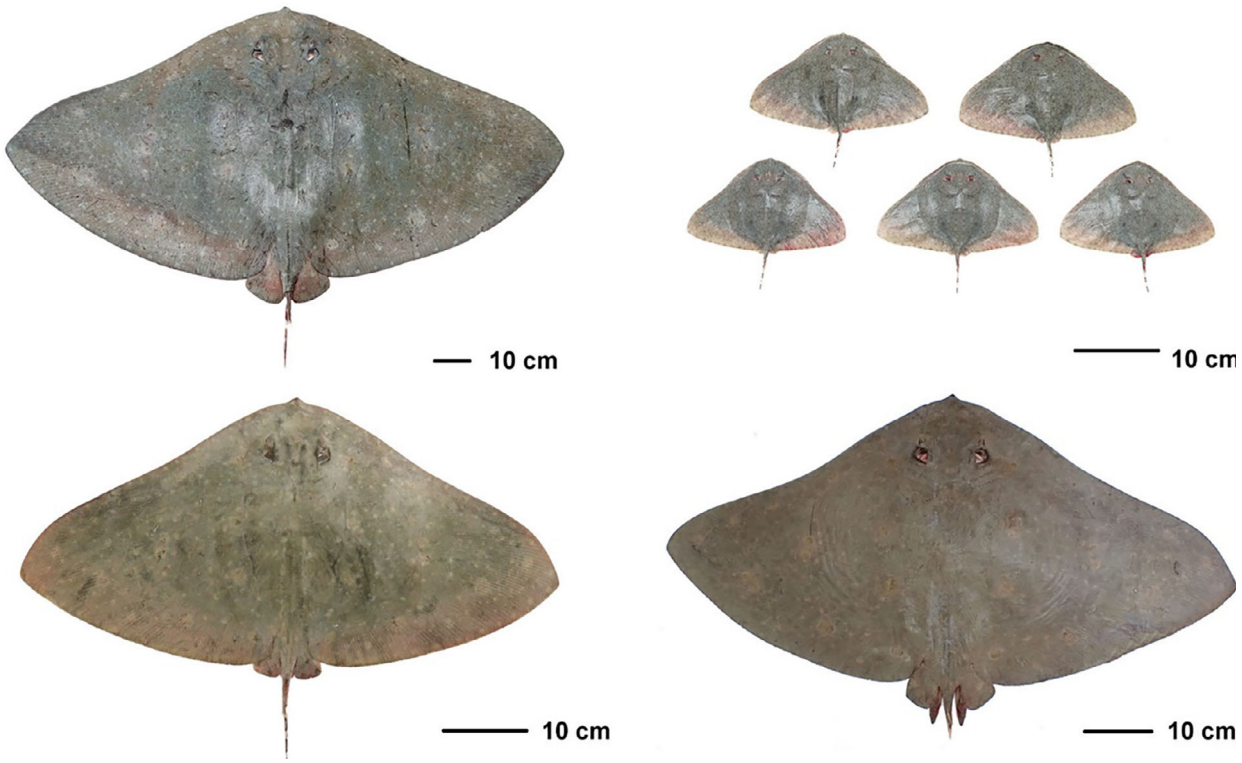

Figure 1 Spiny butterfly rays retrieved dead off Sazan Island, Zvërnec, and Vjose Delta (2022–2023), featuring a gravid female (up left) bearing near-term fetuses (up right), an juvenile male (bottom left), and a adult male (bottom right) caught by artisanal fisheries. Photographs by A. Gajić/Sharklab ADRIA.

eastern Adriatic Sea (particularly in the central and southern regions) to assess the current population size, critical habitats, and boundaries. Traditional fishery monitoring seems sufficient only when bolstered by direct and long-term engagement with local fishermen—following our example in Albania (i.e., Gajić, 2023, 2024). eDNA analysis presents a promising avenue, offering a non-invasive and efficient tool to map distribution and habitat use, and to detect possible range expansions. Post-capture survival needs to be assessed, which can be partially achieved through physiological and pathological examinations (Gajić, 2024). Local ecological knowledge can be a valuable tool for guiding large-scale monitoring efforts but should not be relied upon as a direct source of abundance data. Although most of the interviewed fishermen in Vlorë successfully identified the species, they lacked any biological knowledge and were unaware of any protective measures. Consequently, they confirmed that the species is seldom encountered, valued for its meat, and usually retained and sold once captured. Worthy of emphasis, the majority of Albanian fishermen were keen to learn more about their conservation and to support our efforts. Hence, the increasing threats to such endangered species cannot solely be attributed to fishermen; rather, they reflect a broader lack of education and collaborative efforts, which should be initiated by the scientific community, which also faces a shortage of experts in the field. While certain protective measures seem to exist in Vlorë (such as the Core Zone and Effective Management Zone of the Karaburun-Sazan Marine Protected Area), it is evident that they are not well-defined or effective in terms of elasmobranch conservation, especially considering that elasmobranchs are also threatened by artisanal fisheries, as demonstrated in our study (Gajić, 2023). In contrast, in Croatia, the species is strictly protected under the law (NN 144/2013) and subject to more careful monitoring.

As Albania is a signatory of the UNEP MAP - Barcelona Convention and has ratified the Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean (SPA/BD) in 2001, it should implement effective and strict protection measures for species listed in Annex II of the SPA/BD protocol—including the spiny butterfly ray. In addition, several other threatened elasmobranchs (including neonates and young-of-the-year) are consistently recorded in the studied area in Vlorë, including the critically endangered bull ray (*Aetomylaeus bovinus*), vulnerable common stingray (*Dasyatis pastinaca*), vulnerable eagle ray (*Myliobatis aquila*), critically endangered blue shark (*Prionace glauca*), endangered sandbar shark (*Carcharhinus plumbeus*), and vulnerable black-spotted smoothhound (*Mustelus punctulatus*).

This underscores the importance of the waters surrounding Sazan Island, Zvërnec, and Vjose Delta as critical habitats, even potentially serving as nursery areas for highly threatened elasmobranchs, including the spiny butterfly ray. Therefore, to strengthen the Albanian government's goal to

Figure 2 Observations of juvenile and adult spiny butterfly rays during field research and fishery monitoring in Vlore, Albania (a-c), and a male specimen (d) retrieved dead near Split, Croatia, in 2023.

prioritize the preservation and strict protection of its biodiversity, it is necessary to improve fishery management, enforce habitat preservation, implement disturbance mitigation measures, and conduct extensive capacity building. We strongly advocate for the removal of illegal fishing activities and the establishment of strict protection measures for the coastal waters off Sazan Island, Zvërnec, and Vjose Delta, prohibiting all fishing activities except artisanal shoreline fishing using handlines and fishing rods. By establishing such protection, the ecosystem and species therein can recover. Meanwhile, sustainable fishing practices can be promoted outside this area, in sites equally accessible for artisanal fisheries, allowing local communities to continue fishing for their livelihoods while ensuring the long-term health of target ecosystems. Ultimately, protecting these ecosystems will also lead to the recovery and growth of commercial fish stocks, providing direct benefits to both the environment and local communities.

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