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ON THE OCCURRENCE OF UNDULATE RAY, *RAJA UNDULATA* (RAJIDAE), FROM THE ALGERIAN COAST (SOUTHWESTERN MEDITERRANEAN SEA)

Farid HEMIDA

École Nationale Supérieure des Sciences de la Mer et de l'Aménagement du Littoral (ENSSMAL), BP 19, Bois des Cars, 16320 Dely Ibrahim, Algiers, Algeria

Christian REYNAUD

Laboratoire Interdisciplinaire en Didactique, Education et Formation, Université de Montpellier, 2, place Marcel Godechot, B.P. 4152, 34092 Montpellier cedex 5, France

Christian CAPAPÉ

Laboratoire d'Ichtyologie, Université de Montpellier, 34095 Montpellier cedex 5, France
e-mail: capape@orange.fr

ABSTRACT

The authors report past captures of undulate ray *Raja undulata* Lacépède, 1802 from the coast of Algeria. One specimen was an adult male, caught off Annaba in the eastern region of the Algerian coast, measuring 501 mm in disc width (DW) and 792 mm in total length (TL), with an estimated total body weight (TBW) of 3200 g. Other specimens were off caught off Tipasa in the central region of the Algerian coast. The paper describes the specimens, discussing and commenting the occurrence of the species in the local area and in the broader Mediterranean Sea.

Key words: Rajidae, *Raja undulata*, distribution, Algerian coast, migration, eastern Atlantic, Mediterranean Sea

PRESENZA DI RAZZA ONDULATA, *RAJA UNDULATA* (RAJIDAE), LUNGO LA COSTA ALGERINA (MEDITERRANEO SUDOCCIDENTALE)

SINTESI

Gli autori riportano le catture della razza ondulata *Raja undulata* Lacépède, 1802 lungo le coste dell'Algeria. Uno degli esemplari era un maschio adulto, catturato al largo di Annaba, nella regione orientale della costa algerina, e misurava 501 mm di larghezza del disco (DW) e 792 mm di lunghezza totale (TL), con un peso corporeo totale (TBW) stimato a 3200 g. Altri esemplari sono stati catturati al largo di Tipasa, nella regione centrale della costa algerina. L'articolo descrive gli esemplari, discutendo e commentando la presenza della specie nell'area locale e nel più ampio mare Mediterraneo.

Parole chiave: Rajidae, *Raja undulata*, distribuzione, costa algerina, migrazione, Atlantico orientale, Mediterraneo

INTRODUCTION

The undulate ray *Raja undulata* Lacépède, 1802 occurs in the north-eastern Atlantic, ranging from the British Isles, southern Ireland, the English Channel, and Bay of Biscay (Ellis *et al.*, 2012; Conant, 2015), to the Portuguese and Spanish coasts, and further down, south of the Strait of Gibraltar, to the coasts of Morocco (Aloncle, 1966) and Senegal (Almeida & Biscoito, 2019). In Portugal, the fish is especially captured in the south-western region, in shallow coastal waters less than 50 m deep, over sandy bottoms (Coelho *et al.*, 2005), while in the northern coasts of Spain it occurs at depths between 20 and 90 m (Bañón *et al.*, 2008).

In the Mediterranean, *R. undulata* is mainly distributed in the western areas of the basin (Stehmann & Bürkel, 1984; Conant, 2015). The species was once fairly abundant in the Gulf of Lion, but currently, captures have been declining (Capapé *et al.*, 2017). In the northern region of the western Mediterranean basin, off the Balearic Islands, there has been a report of a single specimen (Massutí & Moranta, 2003), followed by a report of two additional specimens (Massutí & Reñones, 2005). Psomadakis *et al.* (2006) noted that only 10 records have been reported from the Italian seas, confirming that *R. undulata* is a rare occurrence there.

Further to the east, in the Adriatic Sea, *R. undulata* is a rare species only found in the deep waters of the southern Adriatic region (Soldo & Lipej, 2022), with still unknown population limits. While the species is sporadically caught off Turkey (Bilecenoglu *et al.*, 2014), it has never been recorded on the coasts of Syria (Ali, 2018) or Lebanon (Bariche & Fricke, 2020). Golani (*in letteris*, 2024) has noted that the information on the presence of *R. undulata* in Israeli marine waters was based on old records in Ben-Tuvia's publications.

Additionally, Golani (*pers. com.*, 2024) assumes that he never collected or saw this species in the area where at present it probably no longer exists.

Similarly, this ray is not present on the coasts of Egypt (El Sayed *et al.*, 2017) or Libya (Shakman *et al.*, 2023). With regard to the latter area, Fitori *et al.* (2023) recently reported the capture of a specimen of *R. undulata*, but it was, apparently, a misidentified specimen of rough skate *R. radula* Delaroche, 1809.

In the central Mediterranean, *R. undulata* has been reported from the waters surrounding the islands of Malta (Borg *et al.*, 2023), but no specimens have been found for confirmation. On the other hand, the species has not been recorded in Tunisian marine waters despite extensive research carried out in the area (Capapé, 1989; Rafrafi-Nouira *et al.*, 2015; Enajjar *et al.*, 2023).

In the south-western Mediterranean, two specimens were caught off Melilla, Morocco (Dieuzeide *et al.*, 1953), both reaching a total length of 780 mm, while the species was considered very rare off the Algerian coast. These trends are also consistent with more recent observations by Hemida (2005), which suggest that the species is not currently observed in the region. Nevertheless, investigations carried out along the Algerian coast with the help of local fishermen familiar with the fishing grounds, resulted in the capture of a few specimens described herein. The document also provides a few insights into the distribution of the species in the area and throughout the Mediterranean Sea.

MATERIAL AND METHODS

On 6 January 2000, a specimen of *R. undulata* was caught with a trammel net off Annaba, a town located in the eastern region of the Algerian coast at 37°06'10" N and 7°51'02" E (Fig. 1). The catch was made at a

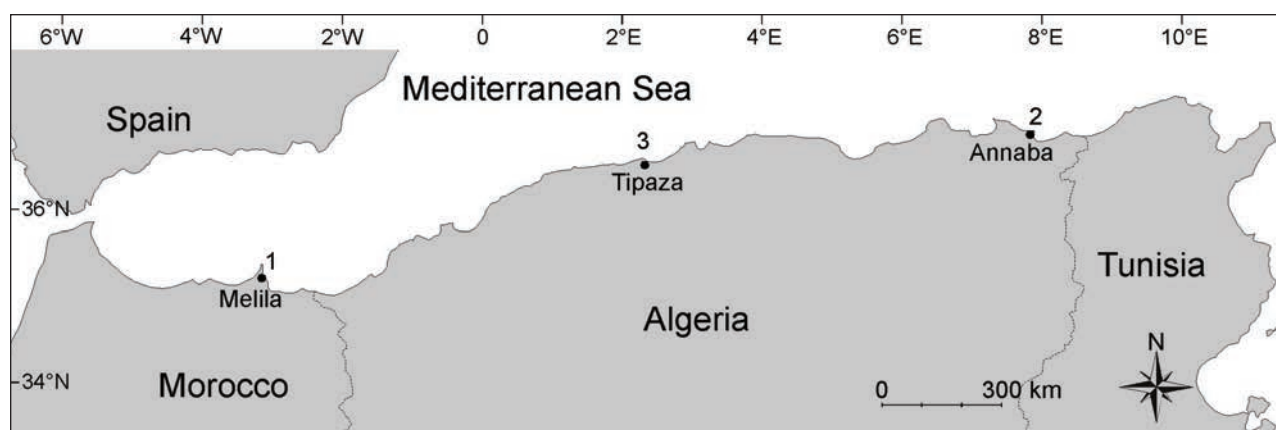


Fig. 1: Capture sites of *Raja undulata* located along the Maghreb shore. 1. Off Melilla (Dieuzeide *et al.*, 1953). 2. Off Tipaza, this study (2000). 3. Off Annaba, this study (2019).

Sl. 1: Lokalizacija ulova vrste *Raja undulata* vzdolž magrebske obale. 1. Melilla (Dieuzeide *in sod.*, 1953). 2. Tipaza, ta raziskava (2000). 3. Annaba, ta raziskava (2019).

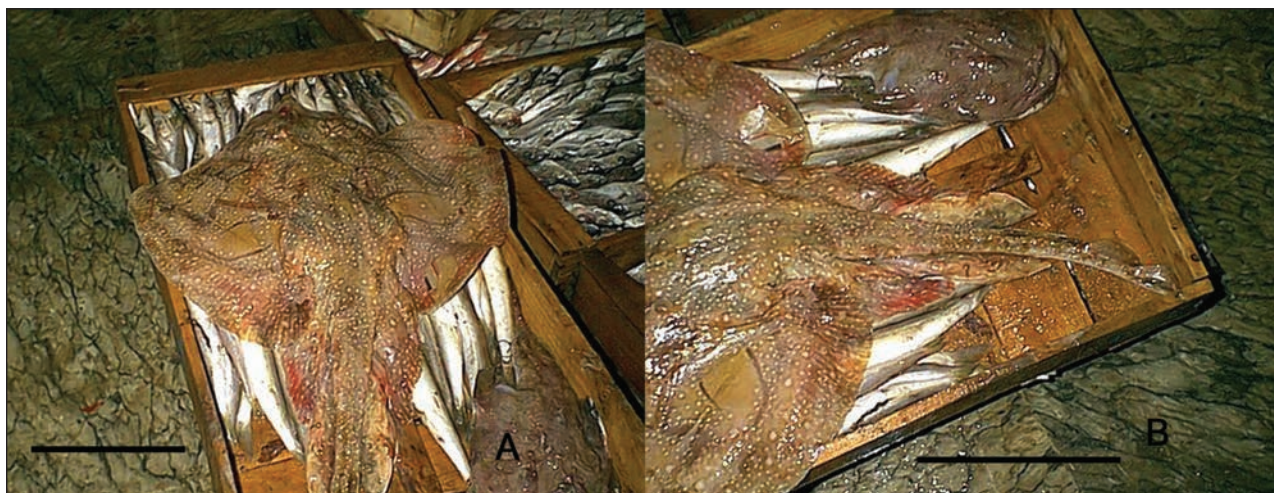


Fig. 2. Specimen of *Raja undulata* captured off Tipasa (2000). A. Anterior view, scale bar = 200 mm. B. Posterior view, scale bar = 200 mm (photos: Farid Hemida).

Sl. 2: Primerek vrste *Raja undulata*, ujet v vodah okoli Tipase (2000). A. Pogled na prednji del, merilo = 200 mm. B. Zadnji del, merilo = 200 mm (fotografije: Farid Hemida).

depth of 114 m on soft bottom, and included specimens of monkfish *Lophius piscatorius* Linnaeus, 1758 and hake *Merluccius merluccius* (Linnaeus, 1758). On 16 March 2019, new specimens, at least four, were caught off Tipasa, a town located in the central region of the Algerian coast at 36°41'18" N and 2°27'14" E (Fig. 1). The catches were made at a depth of 110 m on a sandy-rocky seabed partly covered with seaweed and algae, together with a slender rockfish *Scorpaena elongata* Cadenat, 1943, and a comber *Serranus cabrilla* (Linnaeus, 1758).

The *R. undulata* specimens were carefully examined and identified with the help of field guides in ichthyological fauna. They were photographed and, where possible, measured. It was generally difficult to obtain morphometric measurements, because the specimens were sliced and quickly sold by fishmongers for local consumption.

RESULTS AND DISCUSSION

The *R. undulata* specimen caught off Annaba was a large adult male with well-developed, rigid, and calcified claspers; it measured 501 mm disc width (DW), 792 mm total length (TL), and its total body weight (TBW) was estimated by the fish trader at 3200 g (Fig. 2). The specimens caught off Tipasa appeared to be females of similar size, of which a single specimen with 350 mm DW and 540 mm TL could be measured, but their TBW was estimated by the fishermen to be over 4000 g. It was assumed they were juveniles, based on Ellis *et al.* (2012) who found that females mature at a TL of 84 cm in Portuguese waters. However, it has been known since Leloup & Olivereau (1951) that there are

latitudinal differences between Mediterranean and Atlantic elasmobranchs, with the former maturing at smaller sizes and reaching a smaller maximum length than the latter. These latitudinal differences have been confirmed by Mellinger (1989), Capapé *et al.* (2004), and Moreira *et al.* (2021). Nevertheless, currently, there are no studies on the reproductive biology of *R. undulata* in the Mediterranean Sea to compare sizes at first sexual maturity and maximum sizes between specimens from this sea and those from the Atlantic Ocean.

All the specimens examined were identified as *R. undulata* according to the following combination of morphological characters: disc broadly rounded, especially posterior margins, anterior margins very slightly concave opposite the spiracles and at the level of the eyes; snout short and blunt, tip prominent and rounded; mouth arched; dorsal surface covered with spines, except on the posterior part of the disc and pelvic fins, where rather smooth, snout and tail covered with dense spines; ventral surface smooth except on snout, disc margins, and tail; a discontinuous median series of spines spanning from end of body to first dorsal fin, three rows of spines on tail; dorsal surface ochre to greyish brown, with white spots and long wavy dark brown bands edged with light spots resembling pearl strings; ventral surface white except for the greyish brown end of tail.

The morphology and colouration are fully consistent with previous descriptions of *R. undulata* by Garman (1913), Clark (1926), Capapé & Desoutter (1979), Stehmann & Bürkel (1984), and Capapé *et al.* (2017). Therefore, the presence of the species from the Algerian coast can be considered confirmed, however, further



Fig. 3. Specimen of *Raja undulata* captured off Annaba (2019), scale bar = 50 mm (photo: Farid Hemida).
Sl. 3: Primerek vrste *Raja undulata*, ujet v vodah okoli Annabe (2019), merilo = 50 mm (foto: Farid Hemida).

records are needed before asserting that a viable population is successfully established in the area. Doumet (1860), Moreau (1881), and Quignard (1965) noted that *R. undulata* was quite common in the Mediterranean coast of France. Nevertheless, it appears that the species is only sporadically caught in the area, with merely a few specimens observed across several decades: two captured in 1992 (Capapé et al., 2006), one captured in 2015 (Capapé et al., 2017), and one photographed in the wild by Louisy (2002). Like other skates and rays, *R. undulata* develops *K*-selected biological characteristics (*sensu* McAuley et al., 2007) and its vulnerability to fishing pressure contributes to the decline and rarity of its catches. It is very important to improve the sustainable efforts for preserving the species in this region, following Aldebert's recommendations (1997), and also in other Mediterranean regions.

R. undulata can easily be mistaken for its closely related species. Ellis et al. (2012) note that early accounts of British fishes did not include *R. undulata*

because it was likely confused with the small-eyed ray *R. microocellata* Montagu 1818. Juveniles of rough ray *R. radula* Delaroche, 1807 display wavy dark bands on the dorsal surface similar to those of *R. undulata*, which has led to misidentification and erroneous reports of the latter species off Jalta, an island in northern Tunisia (Le Danois, 1925), as well as from the Gulf of Hammamet in central Tunisia (FAO, 1970) and, more recently, off the Libyan coast (Fitori et al., 2023). An adult *R. radula* can easily be distinguished from a *R. undulata* by the presence of a circular eyespot with a dark centre surrounded by a yellowish inner ring and a brown outer ring (see Fig. 4).

In the Mediterranean, *R. undulata* appears to be captured more frequently in the western basin than in the eastern basin, where records for confirmation are sometimes unavailable (Capapé et al., 2017). *R. undulata* is not a Mediterranean species *sensu stricto* and the occurrence of specimens is likely due to migrations from the eastern Atlantic through the Strait of

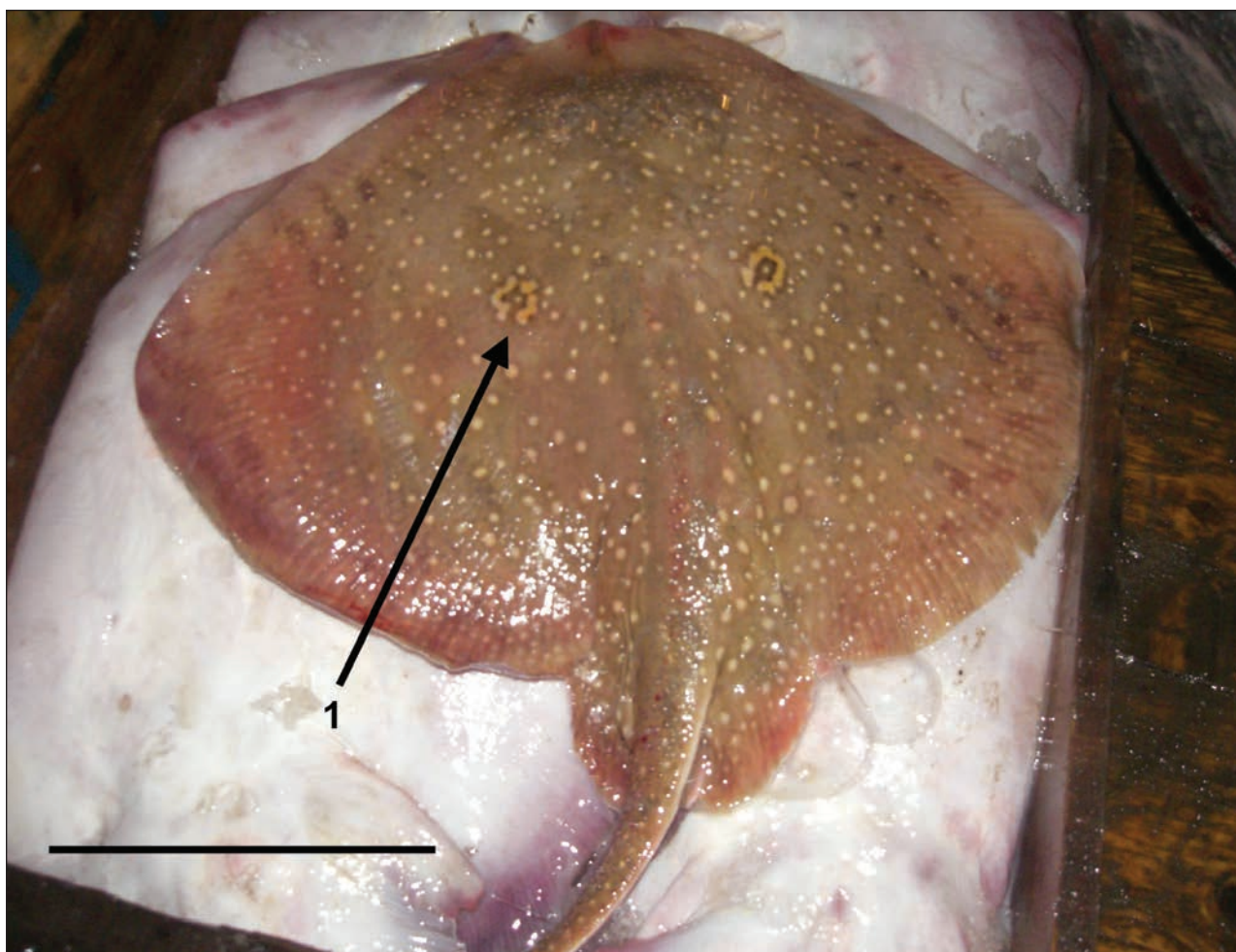


Fig. 4. Dorsal surface of the specimen of rough ray *Raja radula* Delaroche, 1809, captured off Annaba (2019), with the arrow (1) indicating a circular eyespot with a dark centre surrounded by a yellowish inner ring and a brown outer ring, scale bar = 200 mm (photo: Farid Hemida).

Sl. 4: Hrbtna površina primerka hrapave raže, *Raja radula* Delaroche, 1809, ujetega v vodah pri Annabi (2019), s puščico (1), ki kaže okroglo lažno oko s temnim središčem, rumenkastim notranjim obročem in rjavim zunanjim obročem, merilo = 200 mm (foto: Farid Hemida).

Gibraltar, where the species is relatively abundant in temperate waters (Ellis et al., 2012). This could explain why more specimens were recorded from the western than from the eastern coast of Algeria.

Furthermore, the decline and rarity of *R. undulata* catches can partly be attributed to climate change, as the warming of Mediterranean waters discourages new migrations of specimens (Ben Raïs Lasram & Mouillot,

2009), as well as to fishing pressure. Unfortunately, no statistical data are available in relation to the abundance and distribution of the species in the Mediterranean, unlike the situation in the eastern Atlantic (Ellis et al., 2012). Further in-depth studies employing biological tools are needed to provide new records of *R. undulata* and help determine the true status of this species in all regions of the Mediterranean Sea.

O POJAVLJANJU VALOVITO PROGASTE RAŽE, *RAJA UNDULATA* (RAJIDAE), IZ ALŽIRSKE OBALE (JUGOZAHODNO SREDOZEMSKO MORJE)

Farid HEMIDA

École Nationale Supérieure des Sciences de la Mer et de l'Aménagement du Littoral (ENSSMAL), BP 19, Bois des Cars, 16320 Dely Ibrahim, Algiers, Algeria

Christian REYNAUD

Laboratoire Interdisciplinaire en Didactique, Education et Formation, Université de Montpellier, 2, place Marcel Godechot, B.P. 4152, 34092 Montpellier cedex 5, France

Christian CAPAPÉ

Laboratoire d'Ichtyologie, Université de Montpellier, 34095 Montpellier cedex 5, France
e-mail: capape@orange.fr

POVZETEK

Avtorji poročajo o dosedanjih ulovih valovito progaste raže *Raja undulata* Lacépède, 1802 ob alžirski obali. Navajajo primerek odraslega samca, ujetega ob Annabi na vzhodnem delu alžirske obale, ki je meril 501 mm v premeru diska (DW) in 792 mm v totalno dolžino (TL), telesno maso (TBW) pa so ocenili na 3200 g. Drugi primerki so bili ujeti v vodah pri Tipasi v osrednjem delu alžirske obale. V prispevku opisujejo primerke in razpravljajo ter komentirajo o pojavljanju te vrste na lokalnem prostoru in v širšem Sredozemskem morju.

Ključne besede: Rajidae, *Raja undulata*, razširjenost, alžirska obala, selitev, vzhodni Atlantik, Sredozemsko morje

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