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# FIRST SUBSTANTIATED RECORD OF THE GOLDEN-BANDED GOATFISH *UPENEUS MOLUCCENSIS* (OSTEICHTHYES: MULLIDAE) FROM THE COAST OF TUNISIA (CENTRAL MEDITERRANEAN SEA)

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## *ABSTRACT*

*From a lot of mullid species captured around the Kerkennah Islands, 35 specimens of the golde.n-banded goatfish* Upeneus moluccensis *(Bleeker, 1855) were randomly collected. The present sample comprised 17 females, 7 males and 11 individuals of undetermined sex, with total lengths ranging between 99 and 153 mm and the total body weights between 31.2 and 65.2 g. Some morphometric measurements and meristic counts were also carried out in two specimens, preserved in an ichthyological collection. These specimens constitute the first substantiated record of the species from the Tunisian marine waters. Their occurrence suggests that a viable population of* U. moluccensis *is at present successfully established in the area.*

**Key words:** *Upeneus moluccensis*, substantiated record, extension range, distribution, population

# PRIMO AVVISTAMENTO CONFERMATO DELLA TRIGLIA DORATA *UPENEUS MOLUCCENSIS* (OSTEICHTHYES: MULLIDAE) AL LARGO DELLA COSTA DELLA TUNISIA (MEDITERRANEO CENTRALE)

*SINTESI*

*Da un gran numero di specie di mullidi catturate intorno alle isole Kerkennah, sono stati raccolti in modo casuale 35 esemplari della triglia dorata* Upeneus moluccensis *(Bleeker, 1855). Il campione comprendeva 17 femmine, 7 maschi e 11 individui di sesso indeterminato, con lunghezze totali comprese tra 99 e 153 mm e pesi corporei totali compresi tra 31,2 e 65,2 g. Sono state inoltre effettuate alcune misurazioni morfometriche e conteggi meristici su due esemplari conservati in una collezione ittiologica. Questi esemplari costituiscono la prima segnalazione comprovata della specie nelle acque marine tunisine. La loro presenza suggerisce che una popolazione vitale di* U. moluccensis *si sia attualmente stabilita con successo nella zona.*

**Parole chiave:** *Upeneus moluccensis,* segnalazione comprovata, estensione dell'areale, distribuzione, popolazione

## INTRODUCTION

The golden-banded goatfish, *Upeneus moluccensis* (Bleeker, 1855) is widely distributed range which extends from the Red Sea to the western Indian Ocean (Mozambique, Madagascar and Réunion), and eastward to the Caroline Islands and New Guinea. Its range extends from southern Japan to Queensland and Western Australia (Fricke *et al*., 2018). The western Indian Ocean populations were reviewed and compared with other species by Uiblein & Heemstra (2010).

Randall & Kulbicki (2006) reported the first record of *U moluccensis* for New Caledonia, using experimental trawling over mud bottoms in bays. Since commercial trawling being banned in New Caledonia, the species is not present in fishmarkets, but occurs from depths of at least 80 m, but most often found in New Caledonia between 9 and 50 m, and conversely it has not been reported from the Chesterfield area (Randall & Kulbicki, 2006).

*Upeneus moluccensis* migrated from the Red Sea through Suez Canal into the Mediterranean Sea where it has been first reported off the coast of Israel by Haas & Steinitz (1947), though misidentified as *Mulloides auriflamma* (*non* Forsskål, 1775) and then by Ben-Tuvia (1953). Since then, the species was recorded around Cyprus Island (Iglésias & Frotté, 2015), in the broader Levant Basin (Gücü et *al*., 1994; Torcu & Mater, 2000; Ali *et al*., 2018; Barish & Fricke, 2020; Golani *et al*., 2021), the Aegean Sea (Aydin & Akyol, 2016) and to the north in the Sea of Marmara (Artüz &Fricke, 2019). To the southern region of the Mediterranean Sea, the species was reported from the coasts of Egypt (El- Sayed *et al*. (2017) and Libya (El-Drawany, 2016).

*U. moluccensis* was first recorded from the Tunisian coast by Bradai *et al*. (2019), based on observations of over one hundred specimens landed at the fishing site of Teboulba, located in the southern area of the Gulf of Hammamet. Investigations conducted in the Gulf of Gabès with the assistance of local fishermen allowed to collect other specimens which are described in the present paper along with some comments on *U. moluccensis* distribution in the Mediterranean Sea.

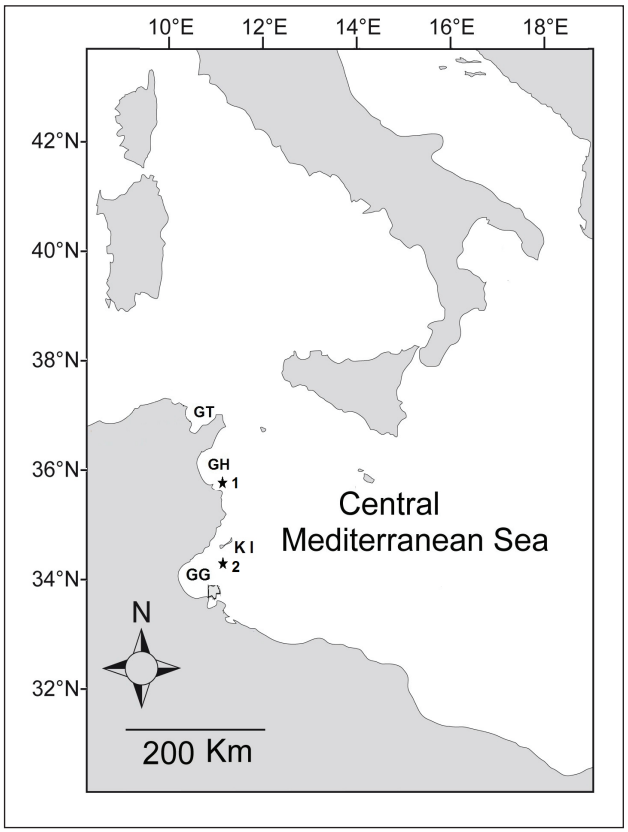


***Fig. 1: Map of the Tunisian coast, in the central Mediterranean Sea, with black stars indicating the capture sites of*** *Upeneus moluccensis*. ***1. Off the Teboulba region (Bradai*** *et al*., ***2019). 2. Around the Kerkennah Islands (this study). GG = Gulf of Gabès, GH = Gulf of Hammamet, GT =Gulf of Tunis, KI = Kerkennah Islands.***
***Sl. 1: Zemljevid tunizijske obale v osrednjem Sredozemskem morju s črnimi zvezdicami, ki označujejo mesta ulova primerkov vrste*** *Upeneus moluccensis*. ***1. Ob regiji Teboulba (Bradai*** *et al*., ***2019). 2. Okoli otokov Kerkennah (ta študija). GG = Gabeški zaliv, GH = Hammametski zaliv, GT = Tuniški zaliv, KI = otoki Kerkennah.***

## MATERIAL AND METHODS

On 17 May 2025, numerous specimens, from the family Mullidae, were captured around Kerkennah Islands in north-eastern area of the Gulf of Gabès, southern Tunisia (34° 39′ 29′′ N, 11 ° 04 ′07′′ E). The fishes were caught by trawler at a depth of approximately 20 m, over soft bottoms, and landed at a fishing site on these islands (Fig. 1). The location falls within the boundaries of GFCM geographical subarea GSA 14 (FAO, 2019).

From these fishes, 35 specimens of *U. molucensis* were randomly collected, delivered to the laboratory for examination. They were measured for total length (TL) to the nearest millimetre and weighed to the nearest decigram for total body weight (TBW), sex was determined when possible. Morphometric measurements and meristic counts were recorded in two specimens of this sample (Tab. 1) which were then photographed (Fig. 2) and preserved in 10% buffered formaldehyde. These voucher specimens were deposited in the Ichthyological Collection of the «Institut des Sciences et Technologies de la Mer of Salammbô» (Tunisia), receiving the catalogue numbers, INSTM U-mol 01 and INSTM U-mol 02, respectively. The protocol of Bello *et al*. (2014) for a first fish record and this of Salameh *et al*. (2012) for a first substantiated record were followed.

***Tab. 1: Morphometric measurements in millimetre with percentages of standard length (SL), meristic counts and total body weight in gram recorded in two specimens of*** *Upeneus moluccensis* ***collected around the Kerkennah Islands [voucher INSTM U-mol 01 and INSTM U-mol 02].***
***Tab. 1: Morfometrične meritve v milimetrih z odstotki standardne dolžine (SL), meurističnimi štetji in skupno telesno težo v gramih, zabeležene pri dveh primerkih vrste*** *Upeneus moluccensis****, zbranih okoli otokov Kerkennah [bon INSTM U-mol 01 in INSTM U-mol 02].***

| **References** | **INSTM U-mol 01** | | **INSTM U-mol 02** | |
|---|---|---|---|---|
| **Area** | **Kerkennah Islands (Southern Tunisia)** | | | |
| **Morphometric measurements** | **mm** | **%SL** | **mm** | **%SL** |
| Total length | 133 | 111.9 | 151 | 111.1 |
| Length to fork | 119 | 107.2 | 142 | 106.3 |
| Standard length | 111 | 100.0 | 134 | 100 |
| Head length | 26.1 | 23.4 | 33 | 24.6 |
| Snout length | 8 | 7.2 | 10.1 | 7.5 |
| Interorbital width | 8.4 | 7.6 | 10.9 | 8.13 |
| Eye diameter | 8.3 | 7.5 | 9.7 | 7.2 |
| Barbel length | 17.8 | 16.1 | 20.8 | 15.5 |
| Caudal fin height | 21.5 | 19.4 | 27.9 | 20.8 |
| Caudal peduncle length | 27.1 | 24.4 | 31.1 | 23.2 |
| Caudal peduncle depth | 10.2 | 9.2 | 13.2 | 9.85 |
| Predorsal length | 35.4 | 31.9 | 43 | 32.1 |
| Pectoral fin length | 21.4 | 19.3 | 26 | 19.4 |
| Pectoral fin base | 7.2 | 6.5 | 8.9 | 6.6 |
| First dorsal fin height | 18.7 | 16.8 | 22 | 16.4 |
| First dorsal fin base | 15.1 | 13.6 | 18 | 13.4 |
| Second dorsal fin height | 12.8 | 11.6 | 16 | 11.9 |
| Second dorsal fin base | 16.4 | 14.7 | 20.5 | 15.3 |
| Pelvic fin length | 17.9 | 16.2 | 23 | 17.1 |
| Pelvic fin base | 6.7 | 6.1 | 8 | 5.9 |
| Anal fin height | 17.0 | 15.3 | 21.2 | 15.8 |
| Anal fin base | 12.6 | 11.4 | 14.9 | 11.2 |
| **Meristic counts** | **INSTM U-mol 01** | | **INSTM U-mol 02** | |
| Dorsal rays | VIII+9 | | VIII+9 | |
| Pelvic rays | I+5 | | I+5 | |
| Anal spines | 1 | | 1 | |
| Anal soft rays | 7 | | 7 | |
| Gill-rakers | 7+19 | | 7+19 | |

A relation between TL and TBW was used as a complement following Froese *et al.* (2011) to assess if the species found sufficient resources in the wild. This relation is TBW = $a$TL$^b$, and was converted into its linear regression, expressed in decimal logarithmic co-ordinates and correlations were assessed by least-squares regression. as: log TBW= log $a$ + $b$ log TL. Significance of constant b differences was assessed to the hypothesis of isometric growth if $b$ = 3, positive allometry if $b$ > 3, negative allometry if $b$ < 3 (Pauly, 1983). Correlations were assessed by least-squares regression. and performed by using logistic model STAT VIEW 5.0.

## RESULTS AND DISCUSSION

The present sample of *U. moluccensis* comprised 35 specimens and among them, 17 females, 7 males and 11 individuals of undetermined sex. The total lengths ranged between 99 and 153 mm, the total body weights ranged between 31.2 and 65.2 g. The specimens were identified as *U. moluccensis via* the combination of main morphological characters: body moderately elongated, subcylindrical at the beginning of the first dorsal fin, mouth terminal, snout rounded with a pair of small barbels attached to tip of ceratohyal, behind symphysis of lower jaw not reaching posterior part of operculum margin, two dorsal fins well separated, first dorsal spine minute, second spine the largest, second dorsal fin opposite the anal fin, dorsal and anal fins basally with scaled area, caudal fin deeply forked, color of back pinkish-reddish, belly white, dorsal part of body with golden yellow longitudinal band as wide as pupil, extending from eye to caudal-fin base, barbels whitish, 3 orange stripes on first dorsal fin, 2 on second, 6 thin red bars on upper caudal-fin lobe, lower lobe of caudal fin with a broad rose longitudinal stripe.

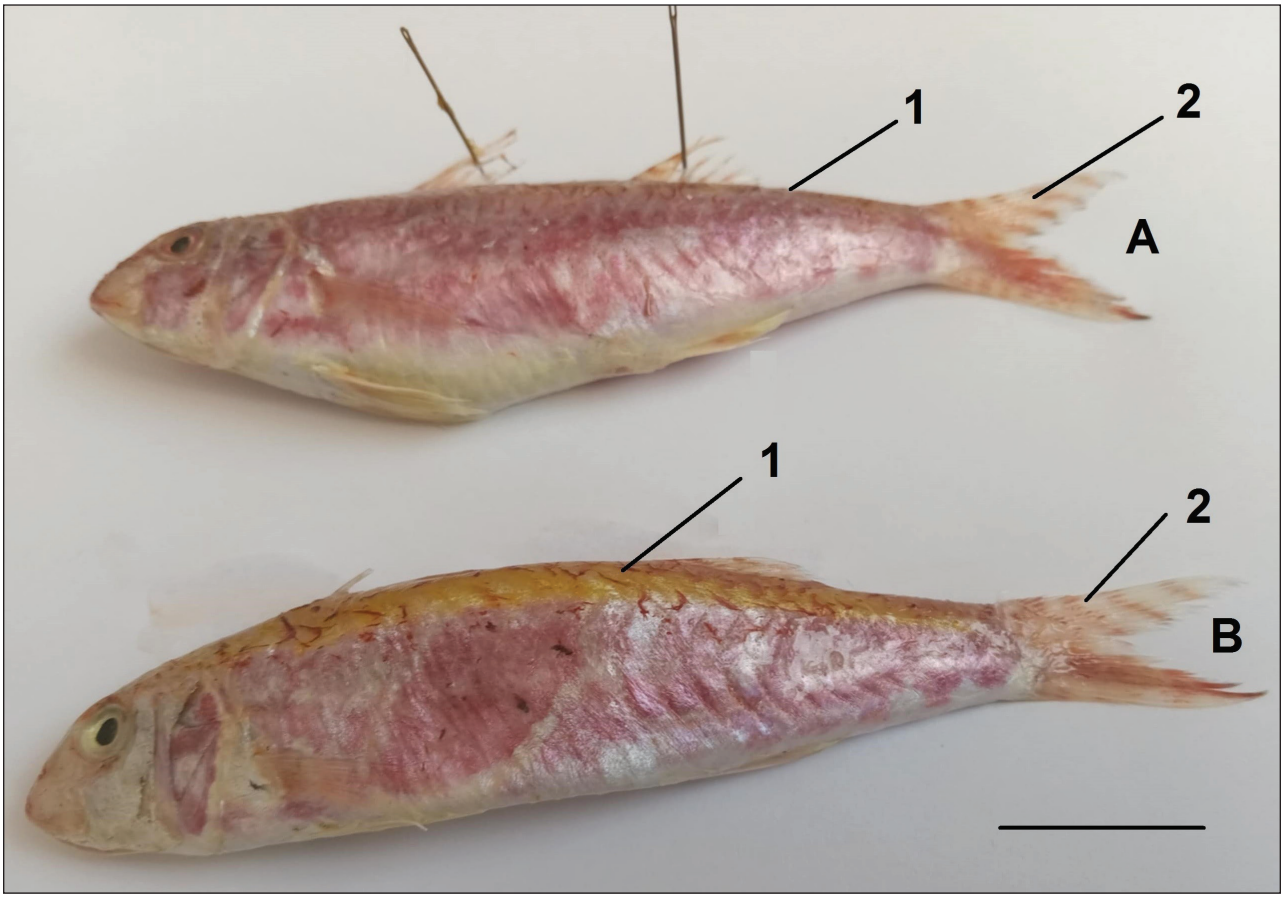


***Fig. 2: Specimens of** Upeneus moluccensis **collected from the Kerkennah Islands. A. Specimen with catalogue number INSTM U-mol 01. B. Specimen with catalogue number INSTM U-mol 02. 1. Golden-yellow longitudinal band. 2. Thin red bars on the upper caudal-fin lobe. Scale bar = 100 mm.***
***Sl. 2: Primerki vrste** Upeneus moluccensis**, ulovljeni na otokih Kerkennah. A. Primerek s kataloško številko INSTM U-mol 01. B. Primerek s kataloško številko INSTM U-mol 02. 1. Zlato rumen vzdolžni pas. 2. Tanke rdeče črte na zgornjem režnju repne plavuti. Merilo = 100 mm.***

The general morphology, morphometric measurements, meristic counts, and coloration of the present *U. moluccensis* are consistent with previous descriptions of the species, provided by Hureau (1986), Golani & Darom (1997), Randall & Kulbicki (2006), Aydin & Akyol (2016), Artüz & Fricke (2019), Bariche & Fricke (2020) and Golani *et al*. (2021).

The present specimens of *U. moluccensis* [referenced INSTM U-mol 01 and INSTM U-mol 02] constitute the first substantiated records of the species from the Tunisian coast, as no voucher material was preserved from the previous record reported by Bradai *et al*. (2019). Similarly, when Salameh *et al*. (2012) reported the occurrence of the yellowbar angelfish *Pomacanthus maculosus* (Forsskål, 1775) in the Levant Basin where specifically from Lebanon, the record was based on a photographed but unpreserved specimen preventing further examination (Bariche, 2012). Therefore, the subsequent specimen recorded and described by Salameh *et al*. (2012), deposited in the Hebrew University Fish Collection, under the catalogue number HUJ 20102, became the first substantiated record of *P. maculosus* for the Mediterranean Sea.

The observations of *U. moluccensis* by Bradai *et al*. (2019) and in this study show a westward extension range of the species in the Mediterranean Sea. They also suggest that a viable population is at present successfully established in the Tunisian marine waters. It is corroborated by the fact that the TL –TBW relationship displays a positive allometry expressed in logarithmic co-ordinates as follows log TBW = -5.375 + 3.292 * log TL; r = 0.994, n = 35. This positive allometry, indicates that the species found in the wild sufficient resources to develop and likely reproduce. Similar observations were reported by Bengil (2019) who noted a positive allometry of length-weight relationships in specimens of *U. moluccensis* collected from different regions of the Mediterranean Sea.

In addition, Tikochinski *et al*. (2013) showed no significant genetic differences between populations of *U. moluccensis* from the Mediterranean Sea, Red Sea and Japan. Conversely, Pazhayamadom *et al*. (2017) noted significant differences in the body shape of the fish, reflecting their adaptations to swim and improve visibility in their respective environments indicating that the *U. moluccensis* populations in the Red Sea and the Mediterranean Sea represent two separate fish stocks. These observations explain the wide distribution and abundance of the species everywhere, allowing to study some aspects of its life history in the Mediterranean, concerning age determination, growth, spawning season, and diet (Kaya *et al*., 1999; Saad, 2001; Torku-Koç & Erdogan, 2025).

Hureau (1986), Kaya *et al*. (1999) and Golani *et al*. (2021) noted that *U mluccensis* feeds on benthic organisms, primarily crustacean species are the main preys and teleost species appear in the stomach of larger specimens. The diet of *U. moluccensis* is clearly like that of the red mullet *Mullus barbatus* Linnaeus, 1758 as reported from the Tunisian coast by Chérif *et al*. (2011).

Galil (2007) and Aydin & Akyol (2016) suggested that an interspecific competition pressure for food between *U. moluccensis* and native *Mullus barbatus* cannot be totally ruled out in the Mediterranean regions where both species inhabit on soft bottoms, at depths between 50 and 200 m maximum. Aydin & Akyol (2016) reported that in the Levant Basin, the global warming of waters has been accompanied by an increase in captures of *U. moluccensis* and a concomitant decline in those of *M. barbatus*. Aydin & Akyol (2016) also noted that in the concerned areas this phenomenon can be the cause of financial losses of fishermen, as the native *M. barbatus* commands a higher market value than *U. moluccensis*.

The occurrence of *U. moluccensis* in Tunisian waters is relatively recent and at present no reports are available that detailing the abundance of the species and its economic contribution to local fisheries. Interviews conducted with fishermen indicate that local consumers do not distinguish between the two species, which are sold at similar prices. Further investigations are needed to quantify the number and the abundance of the indigenous and non-indigenous mullid species in the Tunisian marine waters, as these species should be monitored to prevent declines in captures and their potential depletion. The implementation of a management plan in collaboration with local fishermen would help to preserve and ensure the sustainability of viable populations in the area.

# PRVI POTRJEN ZAPIS O ZLATOPROGEM BRADAČU *UPENEUS MOLUCCENSIS* (OSTEICHTHYES: MULLIDAE) Z OBALE TUNIZIJE (OSREDNJE SREDOZEMSKO MORJE)

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*POVZETEK*

*Izmed številnih vrst bradačev (Mullidae), ujetih okoli otokov Kerkennah, je bilo naključno zbranih 35 primerkov zlatoprogega bradača* Upeneus moluccensis *(Bleeker, 1855). Vzorec, ki je osnova temu delu, je obsegal 17 samic, 7 samcev in 11 osebkov nedoločenega spola, s skupno dolžino med 99 in 153 mm in skupno telesno težo med 31,2 in 65,2 g. Pri dveh primerkih, ki sta shranjena v ihtiološki zbirki, so bile opravljene tudi nekatere morfometrične meritve in meristična štetja. Ti primerki predstavljajo prvi potrjen zapis o vrsti iz tunizijskih morskih voda. Njihova prisotnost kaže, da je na tem območju trenutno uspešno vzpostavljena viabilna populacija vrste* U. moluccensis.

**Ključne besede:** *Upeneus moluccensis*, potrjeni zapis o pojavljanju, širjenje areala, razširjenost, populacija

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