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Annals for Istrian and Mediterranean Studies
Series Historia Naturalis, 36, 2026, 1





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VSEBINA / *INDICE GENERALE* / *CONTENTS*

BIOTSKA GLOBALIZACIJA
GLOBALIZZAZIONE BIOTICA
BIOTIC GLOBALIZATION

Alen SOLDÓ, Rigers BAKIU & Sherif DURMISHAJ
The First Record of Bastard Grunt *Pomadasys incisus* (Bowdich, 1825) in Albanian Waters (Adriatic Sea) 1
Prvi zapis o pojavljanju neprave prašičevke Pomadasys incisus (Bowdich, 1825) v albanskih vodah (Jadransko morje)

Pero UGARKOVIĆ, Ilija ČETKOVIĆ, Olivera MARKOVIĆ, Aleksandar JOKSIMOVIĆ, Nikola ĐORĐEVIĆ & Jakov DULČIĆ Additional Records of the Bastard Grunt, *Pomadasys incisus* (Bowdich, 1825), from the Eastern Adriatic Sea 7
Dodatne najdbe neprave prašičevke, Pomadasys incisus (Bowdich, 1825), iz vzhodnega Jadranskega morja

Rüştü KIRMAN & Murat BİLECENOĞLU Significant Range Expansion of *Sepioteuthis lessoniana* (Cephalopoda: Loliginidae) in the Aegean Sea Based on Scuba and Photographic Observations 15
Znatno razširjanje areala vrste Sepioteuthis lessoniana (Cephalopoda: Loliginidae), v Egejskem morju na podlagi podvodnih opazovanj in fotografiranja

Adrian BRAJKOVIĆ, Iris MATULJA & Neven IVEŠA
Conquering the North: New Occurrence of the Common Lionfish, *Pterois miles* (Bennett, 1828), in the Adriatic Sea 21
Osvajanje severa: novi zapis o pojavljanju navadne plamenke, Pterois miles (Bennett, 1828), v Jadranskem morju

Alan DEIDUN, Bruno ZAVA, Maria CORSINI-FOKA, Arnold SCIBERRAS & Alessio MARRONE First Record of the Devil Firefish *Pterois miles* (Bennett, 1828) (Actinopterygii: Scorpaenidae) from Maltese Coastal Waters 29
Prvi zapis o pojavljanju plamenke Pterois miles (Bennett, 1828) (Actinopterygii: Scorpaenidae) v malteških obalnih vodah

Chirine HUSSEIN, Amir IBRAHIM, Firas ALSHAWY, Mouina BADRAN & Rahaf ABO ASA First Mediterranean Record of the Diagonal Butterflyfish, *Chaetodon fasciatus* Forsskal, 1775, Reported from Syrian Waters 35
Prvi sredozemski zapis o pojavljanju poševnoprogame ščetinozobke, Chaetodon fasciatus Forsskal, 1775, iz sirskih voda

Houssein ELBARAASI, Tarek SHOEIB, Mona SAID & Laith A. JAWAD A Further Record of the Barred Knifejaw, *Oplegnathus fasciatus* (Temminck & Schlegel, 1844), a Pacific Species, from the Mediterranean: A New Record from Benghazi, Libya 41
Novi zapis o vrsti Oplegnathus fasciatus (Temminck & Schlegel, 1844), pacifiški vrsti, v Sredozemlju: nova najdba iz Bengazija v Libiji

Alen SOLDÓ & Rigers BAKIU Rapid Increase in Records of the Invasive Silver-cheeked Toadfish *Lagocephalus sceleratus* (Gmelin, 1789) in the Adriatic Sea 49
Hitro naraščanje pojavov invazivne srebrnoproge napihvalke Lagocephalus sceleratus (Gmelin, 1789) v Jadranskem morju

Gerasimos KONDYLATOS, Konstantinos KALAENTZIS, Styliani MINOUDI & Maria CORSINI-FOKA Further Molecular Identification Confirms the Occurrence of *Lagocephalus guentheri* Miranda Ribeiro, 1915 in the Aegean Coastal Waters of Greece 55
Nadaljnja molekularna identifikacija potrjuje prisotnost vrste Lagocephalus guentheri Miranda Ribeiro, 1915 v egejskih obalnih vodah Grčije

Deniz ERGÜDEN & Cem ÇEVİK Length–Weight and Length–Length Relationships, and Condition Factor of *Ambassis dussumieri* Cuvier, 1828, in the Northeastern Mediterranean, Türkiye 65
Dolžinsko-masni odnos med dolžino in kondicijskim faktorjem pri vrsti Ambassis dussumieri Cuvier, 1828, v severovzhodnem Sredozemskem morju, Turčija

Okan AKYOL & HALİL ŞEN Unexpected Occurrence of Prussian Carp *Carassius gibelio* (Cyprinidae) in Homa Lagoon (Izmir Bay, Aegean Sea) 73
Nepričakovani pojav srebrnega koreslja Carassius gibelio (Cyprinidae) v laguni Homa (Izmirski zaliv, Egejsko morje)

SREDOZEMSKE HRUSTANČNICE
SQUALI E RAZZE MEDITERRANEE
MEDITERRANEAN SHARKS AND RAYS

Terry CARBON, Emily GIGNON, Justine LALLAU-VAZZOLER, Hugo MENARD, Claudio BARRIA, Ana I. COLMENERO & Nicolas ZIANI Precopulatory Behaviour of *Pteroplatytrygon violacea* (Myliobatiformes: Dasyatidae) in the Northwestern Mediterranean 81
Predkopulacijsko vedenje vijoličnega morskega biča (Pteroplatytrygon violacea) (Myliobatiformes: Dasyatidae) v severozahodnem Sredozemlju

Hakan KABASAKAL Distribution of <i>Odontaspis ferox</i> in the Mediterranean Sea: Insights from Spatial and Temporal Analyses 87 <i>Razširjenost vrste Odontaspis ferox v Sredozemskem morju: Spoznanja na podlagi prostorskih in časovnih analiz</i>	
Hristina GELEVSKA, Borut MAVRIČ, Lovrenc LIPEJ & Christian CAPAPÉ Is the Gulf of Trieste a potential nursery area for some elasmobranch species? 99 <i>Ali je Tržaški zaliv potencialno območje odraščanja (jaslice) za določene vrste hrustančnic?</i>	
IHTIOFAVNA ITTIOFAUNA ICHTHYOFAUNA	
Cem DALYAN, Yunus GÖNÜL, Mahmud Samed ŞAHİNOĞULLARI & Hakan KABASAKAL New data on the Occurrence and Morphology of the Armless Snake Eel, <i>Dalophis imberbis</i> (Ophichthidae), from the Northeastern Mediterranean Sea 119 <i>Novi podatki o pojavljanju in morfologiji kačaste jegulje, Dalophis imberbis (Ophichthidae), iz severovzhodnega Sredozemskega morja</i>	
Chirine HUSSEIN, Firas ALSHAWY & Amir IBRAHIM First Record of the Mediterranean Dealfish, <i>Trachipterus trachipterus</i> (Gmelin, 1789) (Trachipteridae), in Syrian Marine Waters 127 <i>Prvi zapis o pojavljanju kosice, Trachipterus trachipterus (Gmelin, 1789) (Trachipteridae), v sirskih morskih vodah</i>	
Igor AGOSTINI & Okan AKYOL On the Occurrence of the Currently Largest Recorded <i>Pagellus erythrinus</i> (Sparidae) in the Tyrrhenian Sea (Italy) 133 <i>O pojavljanju trenutno največjega evidentiranega primerka vrste Pagellus erythrinus (Sparidae) v Tirenskem morju (Italija)</i>	
Ismail Burak DABAN & Yusuf ŞEN Substantiated Record and Preliminary Biological Insights of <i>Microlophrys dalmatinus</i> (Steindachner & Kolombatović, 1883) from the Sea of Marmara, Türkiye 141 <i>Potrjen zapis o pojavljanju in predhodna biološka spoznanja o vrsti Microlophrys dalmatinus (Steindachner & Kolombatović, 1883) iz Marmarskega morja, Turčija</i>	
Zeliha ERDOĞAN, Gülçin ULUNEHİR AYDIN, Hatice TORCU-KOÇ & Tuğba ANBAROĞLU Population Study of <i>Trachurus mediterraneus</i> Focused on Reproductive Biology in Edremit Bay, Northern Aegean Sea 151 <i>Razmnoževalna biologija sredozemskega šura (Trachurus mediterraneus) v sklopu populacijske raziskave v Edremitnem zalivu (severno Egejsko morje)</i>	
MORSKA FAVNA FAUNA MARINA MARINE FAUNA	
Francesco TIRALONGO, Paola LEOTTA & Riccardo MARTELLUCCI <i>Physalia physalis</i> in the central Mediterranean Sea: Recent observations associated with mass strandings of <i>Velella velella</i> and surface circulation dynamics 165 <i>Portugalska ladjica (Physalia physalis) v osrednjem Sredozemskem morju: nedavna opažanja v povezavi z masovnimi nasedanji morskega jadrčka (Velella velella) in dinamiko površinskega kroženja vode</i>	
Andrea LOMBARDO, Juba CHABANE & Rachida GHALMI First Contribution to the Study of the "Sea Slug" Fauna (Gastropoda, Heterobranchia) of the Algerian coast 177 <i>Prvi prispevek k proučevanju favne „goliš morskih polžev“ (Gastropoda, Heterobranchia) alžirske obale</i>	
Borut MAVRIČ, Tjaša PREMRL, Martin MAVRIČ, Tina MIRT, Neža LEBAN, Tihomir MAKOVEC & Lovrenc LIPEJ Assessing Soft-Bottom Epibenthic Communities: Methodological Insights into Dredging and Video Surveys 203 <i>Ocenjevanje epibentoških združb mehkega dna: metodološki vpogledi v dredžanje in video pregleda</i>	
FAVNA FAUNA FAUNA	
Kim LEBAN, Iztok ŠKORNIK, Špela ČONČ, Mateja BREG VALJAVEC, Žan KURALT, Lenart ŠTAUT, Jure TIČAR, Katarina POLAJNAR HORVAT, Primož GAŠPERIČ, Aleš SMREKAR & Melita VAMBERGER Habitat Insights for the European Pond Turtle (<i>Emys orbicularis</i>) in the Coastal Wetland Area Sečovlje Salina Nature Park, Slovenia 221 <i>Habitatne značilnosti močvirske sklednice (Emys orbicularis) v krajinskem parku Sečoveljske soline, Slovenija</i>	
Leon CIMERMAN & Matija KRIŽNAR Najdbe pleistocenske avifavne v kamnolomu Črni Kal (Primorska, Slovenija) 243 <i>Pleistocene Avifauna Finds in the Črni Kal Quarry (Primorska Region, Slovenia)</i>	
Kazalo k slikam na ovitku 255 Index to images on the cover 255	

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A FURTHER RECORD OF THE BARRED KNIFEJAW, *OPLEGNATHUS FASCIATUS* (TEMMINCK & SCHLEGEL, 1844), A PACIFIC SPECIES, FROM THE MEDITERRANEAN: A NEW RECORD FROM BENGHAZI, LIBYA

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ABSTRACT

The occurrence of the barred knifejaw, Oplegnathus fasciatus, has been documented for the first time in Libyan waters, south Mediterranean Sea. This species is native to the Northwestern and central-eastern Pacific and its presence in the Mediterranean has been reported through previous scattered records. A single specimen was captured on 3 February 2023 off the coast of Benghazi at a depth of approximately 12 m using a trammel net. Both morphological and meristic examinations as well as a genetic validation via the mitochondrial COI gene were used for species identification. This report discusses the potential pathways for the species' arrival in the southern Mediterranean. A key forthcoming objective is to leverage citizen science, enhancing public awareness and improving the capacity for early detection of alien species.

Key words: non-indigenous species, mitochondrial COI, Oplegnathidae, shipping

ULTERIORE SEGNALEZIONE DEL PESCE PAPPAGALLO GIAPPONESE (*OPLEGNATHUS FASCIATUS* (TEMMINCK & SCHLEGEL, 1844)), SPECIE DEL PACIFICO, NEL MEDITERRANEO: NUOVA OSSERVAZIONE A BENGASI, LIBIA

SINTESI

La presenza del pesce pappagallo giapponese, Oplegnathus fasciatus, è stata documentata per la prima volta nelle acque libiche del Mediterraneo meridionale. Specie originaria del Pacifico nord-occidentale e centro-orientale, era già stata segnalata sporadicamente nel Mediterraneo. Un esemplare è stato catturato il 3 febbraio 2023 al largo di Bengasi, a circa 12 m di profondità, mediante rete da imbrocco-tramaglio. L'identificazione è stata confermata tramite analisi morfologiche, meristiche e genetiche del gene mitocondriale COI. Lo studio discute le possibili vie di introduzione della specie nel Mediterraneo meridionale e sottolinea l'importanza della scienza partecipativa per aumentare la consapevolezza pubblica e favorire l'individuazione precoce delle specie aliene.

Parole chiave: specie non-indigene, COI mitocondriale, Oplegnathidae, trasporto marittimo

INTRODUCTION

The Mediterranean Sea is widely recognized as a global hotspot for marine bio-invasions (Rilov & Galil, 2009; Edelist *et al.*, 2013). It stands as the world's most invaded marine basin, with non-indigenous species (NIS) now representing nearly every major taxonomic group, including fishes (Streftaris *et al.*, 2005; Azzurro *et al.*, 2022a; Galanidi *et al.*, 2023). Considering fishes, in recent decades, at least 188 fish species have been introduced into the basin with an accelerating pace that has triggered significant environmental, social, and economic consequences (Azzurro *et al.*, 2022b). Most of these introduced fishes originate from the Red Sea/Indo-West Indian Ocean and entered into the Mediterranean via the human-made Suez Canal, other species entered through natural range expansion from the eastern Atlantic via the Strait of Gibraltar, while other arrived via direct and indirect human-mediated transport such as aquaculture, the aquarium trade, and shipping, generally from regions far from the eastern Atlantic or the Red Sea/Indo-West Indian Ocean (Galil, 2007; Katsanevakis *et al.*, 2014; Golani *et al.*, 2021; Azzurro *et al.*, 2022b).

Within this context, the Libyan coastline remains one of the Mediterranean's least-explored regions (Coll *et al.*, 2010). Its native fish fauna is still poorly documented (Quignard & Tomasini, 2000; Elbaraasi *et al.*, 2019), and records of non-indigenous fishes appear to date limited (Nour *et al.*, 2022).

The barred knifejaw, *Oplegnathus fasciatus* (Temminck & Schlegel, 1844) (Oplegnathidae), is a benthopelagic species indigenous to rocky reefs in the Northwest Pacific (Japan, Korea, China) and the Eastern Pacific (Hawaii) (Nakabo, 2002). The occurrence of this species has recently been documented beyond its native range, including the Pacific coast of North America. Its initial arrival in North America is linked to the 2011 Japanese earthquake and tsunami, whose transoceanic debris is believed to have transported specimens, leading to subsequent observations in Washington, Oregon, and California waters. In the Mediterranean Sea, this species was reported from Malta (Schembri *et al.*, 2010), from Italy and the Adriatic Sea (Ciriaco & Lipej, 2015), and Dulčić *et al.* (2016) from the Adriatic Sea. These occurrences underscore the species' capacity for long-distance dispersal via ocean rafting on marine debris, highlighting a significant mechanism for invasive species expansion beyond their historical boundaries (Ta *et al.*, 2018). Reaching a maximum length of 80 cm and a weight of 6.4 kg in its natural range, it preys chiefly on hard-shelled invertebrates like crustaceans and mollusks. Juveniles are strongly associated with floating objects; they are a dominant species found with drifting seaweed and have been recorded accompanying oceanic debris. The barred knifejaw is of commercial importance, supports aquaculture operations, and is valued as a game fish (Nakabo, 2002; Schembri *et al.*, 2010; Froese & Pauly, 2026).

This work documents the first finding of the barred knifejaw, *O. fasciatus*, from Libyan waters, south Mediterranean Sea, and discusses the potential pathways of its introduction.

MATERIAL AND METHODS

On 3rd February 2023, a single subadult *Oplegnathus fasciatus* was captured in a trammel net set at a depth of approximately 12 meters off the coast of Benghazi (32.1194° N, 20.0868° E), Libya (Fig. 1) alongside various demersal fish species like *Pagellus erythrinus*, *Diplodus sargus*, and *Mullus surmuletus*. The specimen was immediately placed on ice and transported to the Aquaculture and Fisheries Laboratory within the Department of Zoology, Faculty of Science, University of Benghazi.

In the laboratory, the specimen was photographed, and standard morphometric and meristic analyses were conducted (Fig. 2). It was measured to the nearest mm and weighed to the nearest 0.1 g. The individual was identified based on its distinctive pattern of light and dark vertical bands, following the taxonomic key of Nakabo (2002). Finally, the specimen was preserved and accessed into the Museum Collection of the Department of Zoology, University of Benghazi under the catalogue number Z9388.

A tissue sample was excised from the caudal fin using sterilized scissors and preserved in 95% ethanol for genetic analysis. At the genetics laboratory, DNA was amplified using the cytochrome c oxidase subunit I (COI)

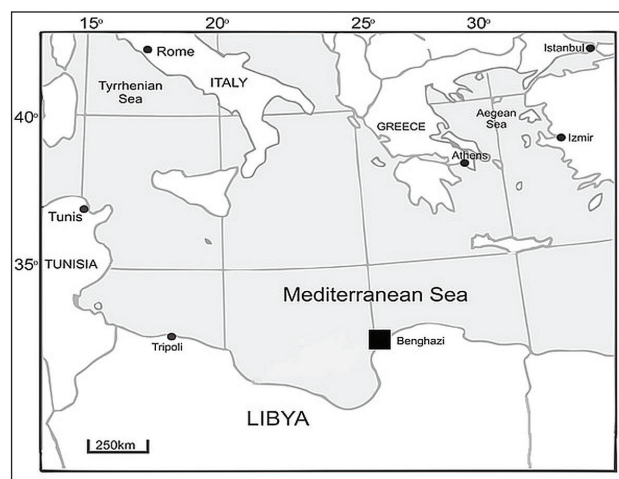


Fig. 1: Capture location of *Oplegnathus fasciatus* (141 mm TL) off the coast of Benghazi, Libya (32.1194 N, 20.0868 E). Black square showing the locality of the fish collection.

Sl. 1: Zemljevid obravnavanega območja z lokacijo ulova cunami ribe (141 mm TL) ob obali Bengazija v Libiji (32.1194 S, 20.0868 V). Črn kvadrat prikazuje mesto vzorčenja (ulova) ribe.

gene primers described by Ward *et al.* (2005): forward 5'-TCAACCAACCACAAAGACATTGGCAC-3' and reverse 5'-TCGACTAATCATAAAGATATCGGCAC-3'. The resulting consensus sequence was deposited in the GenBank database under accession number PX317154.

For phylogenetic reconstruction, 11 additional COI sequences for *O. fasciatus* were downloaded from GenBank, along with three sequences from related species as outgroups. All sequences, including the Libyan sample, were trimmed to a uniform length of 534 bp. Phylogenetic trees (Maximum Likelihood (ML) and Neighbour-Joining (NJ)) were constructed using MEGA v10.0.5. The ML tree was built using the Kimura 2-parameter model to calculate genetic distances, while the NJ tree was constructed using the Maximum Composite Likelihood model. Branch support for both trees was assessed with 1,000 bootstrap replicates.

RESULTS AND DISCUSSION

The specimen measured 141 mm in total length and weighed 66.3 g. Table 1 presents a comparison of its principal morphometric and meristic characteristics with those of specimens from other geographic regions.

The body is relatively deep and laterally compressed, tapering to a small head with a pointed snout (Fig. 2). The mouth is small and terminal, with the jaw failing to extend to the anterior margin of the eye. The operculum bears a single spine, while the preopercular margin is distinctly serrated. A single dorsal fin is present, marked by a deep notch separating the spinous anterior portion from the soft-rayed posterior section; the membranes between the spines exhibit a pronounced incision. The anal fin is triangular, and the caudal fin is truncated with rounded lobes. The body is uniformly covered with small ctenoid scales.

The coloration consists of seven bold, black vertical bars set against a bluish-grey background. The first band is through the eye, followed by four bars approximately equal in width to the pale intervals separating them, while the final two bars are narrower, one on the caudal peduncle and one at the base of caudal fin (Fig. 2). The soft-rayed portions of the dorsal and anal fins, along with the entirety of the pelvic fins, as well as the outer portion of caudal fin are jet black. Pectoral fin is transparent.

The Maximum Likelihood (ML) phylogenetic tree based on a 534-bp fragment of the mitochondrial COI gene (Fig. 3) revealed that the Libyan *O. fasciatus* sample (PX317154) clustered with specimens from East Asia, specifically Japan, South Korea, and Taiwan. All *O. fasciatus* sequences formed a well-differentiated, coherent cluster that was clearly distinct from the outgroup species (*Kyphosus sydneyanus* and *Acanthistius* spp.). A Neighbour-Joining (NJ) tree constructed from the same dataset showed a nearly identical topology, with the Libyan sequence again grouping with those from East Asia. In both analyses, the outgroup taxa were positioned outside the *O. fasciatus* cluster.

Following Golani *et al.* (2021), the barred knifejaw, *O. fasciatus* is distinguished from *Abudefduf* spp. by its seven vertical bars, in contrast to the five typically found in the latter, while species within the families Scaridae, Tetraodontidae, and Diodontidae are easily differentiated from *O. fasciatus* by their complete lack of vertical body bars. The total length (141 mm) falls within the Mediterranean range (140 mm Malta, Schembri *et al.*, 2010) estimated 140 mm in Italian Adriatic, Ciriaco & Lipej, 2015, 100 mm Croatia, Dulčić *et al.*, 2016). This similarity among Mediterranean specimens reflects a comparable



Fig. 2: *Oplegnathus fasciatus* specimen (141 mm TL) collected off the coast of Benghazi, Libya, in the southern Mediterranean Sea (Photo by H. Elbaraasi).

Sl. 2: *Primerek cunami ribe* (141 mm TL), ulovljen ob obali Bengazija v Libiji v južnem Sredozemskem morju (Fotografija: H. Elbaraasi).

Tab. 1: Biodata of specimen of *Oplegnathus fasciatus* caught in the Libyan coast of the Mediterranean Sea at the coast of Benghazi City.**Tab. 1: Biološki podatki o primerku vrste *Oplegnathus fasciatus* (cunami riba), ulovljenem ob libijski obali Sredozemskega morja blizu mesta Bengazi.**

Morphometric (mm)/ Meristic characters	Present study	Jordan & Fowler (1902)	Schembri <i>et al.</i> (2010)	Ciriaco & Lipej (2015)	Dulčić <i>et al.</i> (2016)
Total length (TL)	141	-	130, 200	140	100
Standard length (SL) (% in TL)	120 (85.1)	-	-	-	75(75%in TL)
Head length HL (%SL)	41 (34.2)	-	-	-	27 (27% in TL)
Eye diameter (%HL)	8 (19.5)	-	-	-	8 (29.65in HL)
Preorbital length (%HL)	9 (22)	-	-	-	8 (29.6% in HL)
Postorbital length (%HL)	18 (43.9)	-	-	-	12 (44.4% in HL)
Interorbital distance (%HL)	10 (24.4)	-	-	-	7 (25.9% in HL)
Predorsal length (%SL)	39 (32.5)	-	-	-	32(32% in TL)
Length of dorsal fin base (%SL)	75 (62.5)	-	-	-	51 (51% in TL)
Prepelvic length (%SL)	47 (39.2)	-	-	-	32 (32% in TL)
Preanal length (%SL)	87 (72.5)	-	-	-	54 (54% in TL)
Length of anal fin (%SL)	35 (29.2)	-	-	-	22 (22% in TL)
Length of pectoral fin (%SL)	26 (21.7)	-	-	-	18 (18% in TL)
Length of pelvic fin (%SL)	27 (22.5)	-	-	-	19 (19% in TL)
Body depth (%SL)	69 (57.5)	-	-	-	47 (47% in TL)
Depth of caudal peduncle (%SL)	17 (14.2)	-	-	-	9 (9% in TL)
Total weight (g)	66.3	-	-	-	18.1 18.1% in TL)
Dorsal fin spine and ray counts	XII, 15	XI-XII, 17-18	-	-	XII, 16
Pectoral fin ray count	15	I, 16	-	-	18
Anal fin ray count	III, 13	III, 12-13	-	-	III, 13
Pelvic fin ray count	I, 5	I, 5	-	-	I, 5
Caudal fin ray count	14	-	-	-	15

juvenile ontogenetic stage, recent introduction history (early 2000s), and possible sampling bias toward smaller individuals (Schembri *et al.*, 2010; Froese & Pauly, 2026). The difference from the native range is due to ontogenetic maturity—the 700 mm specimen is a fully grown adult—and the Mediterranean population's early establishment stage, lacking sufficient time or conditions to reach large sizes (Froese & Pauly, 2026).

Several morphometric proportions showed close agreement with the Croatian specimen (Dulčić *et al.*, 2016), including postorbital length (43.9% vs. 44.4% HL) and interorbital distance (24.4% vs. 25.9% HL), reflecting developmental stability, low environmental sensitivity, and genetic constraint (Nakabo, 2002; Froese & Pauly, 2026). Eye diameter varied (19.5% vs. 29.6% HL), which is best explained by allometric growth, smaller juveniles have proportionally larger eyes (He *et al.*, 2012), along with measurement methodology differences and natural intraspecific variation.

The meristic counts of the Libyan specimen (Table

1) generally aligned with native range records (Jordan & Fowler, 1902) reflecting genetic stability and developmental canalization (Froese & Pauly, 2026). Slight deviations—15 pectoral rays vs. 16, and 15 dorsal soft rays vs. 16–17—are unlikely to indicate taxonomic distinction and are attributable to intraspecific variation (1–2 ray difference is common), counting errors, fin regeneration or damage, specimen size, and geographic clines such as Jordan's Rule (Jordan, 1891; He *et al.*, 2012; Froese & Pauly, 2026).

Phylogenetic reconstruction of *O. fasciatus* using 534 bp of the mitochondrial COI gene, via both maximum likelihood and Neighbour-Joining methods (Fig. 3), indicates limited genetic divergence. The analyses place the Libyan sample within a cohesive group comprising East Asian specimens from Japan, South Korea, and Taiwan, failing to support a deeply isolated lineage. In contrast, broader phylogeographic studies (Chen *et al.*, 2017) have documented three major, well-differentiated mtDNA clades across northern and

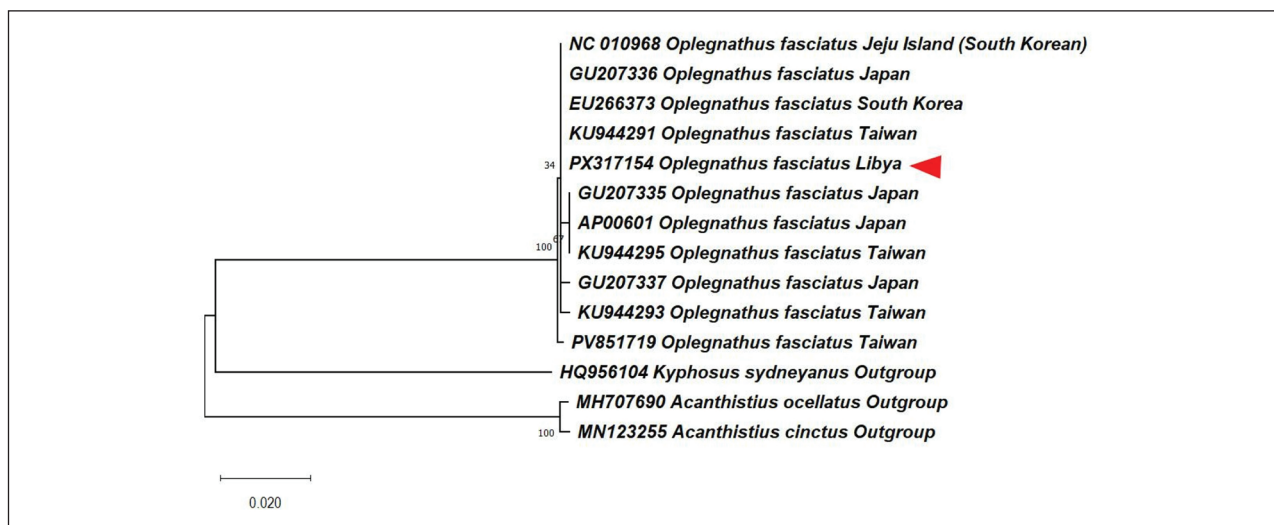


Fig. 3: A maximum likelihood phylogenetic tree, based on 534 bp of the mitochondrial COI gene, shows the relationships among *Oplegnathus fasciatus* samples from East Asia and Libya. The red arrow indicates the Libyan sample. Outgroup species include *Kyphosus sydneyanus* and two species of *Acanthistius*. Bootstrap values (expressed as percentages) are shown at the nodes.

Sl. 3: Filogenetsko drevo po metodi največjega ujemanja, zasnovano na 534 baznih parih (bp) mitohondrijskega gena COI, prikazuje sorodstvene odnose med vzorci vrste *Oplegnathus fasciatus* iz Vzhodne Azije in Libije. Rdeča puščica označuje libijski vzorec. Zunanje skupine (outgroup) vključujejo vrsto *Kyphosus sydneyanus* in dve vrsti iz rodu *Acanthistius*. Na vozliščih so prikazane vrednosti 'bootstrap' (izražene v odstotkih).

southern China, attributed to historical biogeographic barriers and subsequent population expansions.

Since the known Pacific Ocean native range of *O. fasciatus* is at a great distance from the Mediterranean, transport due to human activity, mainly shipping, was considered as the most plausible explanation for the introduction of the species in the waters of Malta and later in the North Adriatic Sea (Schembri *et al.*, 2010; Dulčić *et al.*, 2016; Golani *et al.*, 2021). Due to the scarce number of records in the Mediterranean and the large distance between them, to date it is unknown if the species was able to successfully colonize some Mediterranean regions, allowing the dispersion of individuals in other areas (Azzurro *et al.*, 2022b). This fish lives in shallow waters and being the juvenile aspect easy distinguishable from other native or introduced species, it is unlikely that other individuals were undetected or neglected by fishermen.

Thus, on the basis of the current knowledge, the occurrence of one sub-adult barred knifejaw *O. fasciatus* in Libyan waters is likely due to another independent introduction through human activities such as shipping, that have enabled this Pacific species to traverse the globe and to be released into the wild in the Mediterranean. The literature gives examples of introductions via shipping as a vector for long-distance translocations of fish like the present case (e.g.,

Mastrototaro *et al.*, 2007; Goren *et al.*, 2009; Insacco & Zava, 2017; Azzurro *et al.*, 2022b). On the other hand, as already mentioned above, it is unknown whether established populations of the species exist in the basin. If exist, we cannot exclude that juveniles associated with floating objects or drifting seaweeds or debris arrived at Libyan waters.

The complexity of the environmental management of introduced species is a pressing concern, especially since the Libyan Mediterranean coast lacks dedicated research to evaluate the impacts of alien fishes on native ecosystems. This is compounded by an insufficiency of ongoing monitoring programs in critical zones, such as major ports, which are recognized hotspots for the introduction of non-indigenous organisms. Consequently, a key forthcoming objective is to leverage citizen science to raise public awareness and improve the probability of detecting non-indigenous species along areas where the capacity for conventional scientific monitoring surveys is still in its nascent state (e.g. north African – Nour *et al.*, 2022).

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NOVI ZAPIS O VRSTI *OPLEGNATHUS FASCIATUS* (TEMMINCK & SCHLEGEL, 1844), PACIFIŠKI VRSTI, V SREDOZEMLJU: NOVA NAJDBA IZ BENGAZIJA V LIBIJI

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POVZETEK

Avtorji poročajo o prvem pojavljanju cunami ribe, *Oplegnathus fasciatus*, v libijskih vodah v južnem Sredozemskem morju. Ta vrsta domuje v severozahodnem in osrednjem vzhodnem Tihem oceanu, o njeni prisotnosti v Sredozemlju pa so poročali že v prejšnjih posameznih zapisih o pojavljanju. Primerek te vrste je bil ulovljen 3. februarja 2023 ob obali Bengazija na globini približno 12 m s triplastno stoječo mrežo. Za identifikacijo vrste so avtorji uporabili tako morfološke in meristične analize kot tudi genetsko potrditev s pomočjo mitohondrijskega gena COI. Avtorji nadalje razpravljajo o možnih poteh vnosa te vrste v južno Sredozemsko morje. Ključni prihodnji cilj je usmerjen v izkoriščanje potenciala ljubiteljske znanosti za krepitev ozaveščenosti javnosti in izboljšanje zmogljivosti za zgodnje odkrivanje tujerodnih vrst.

Ključne besede: tujerodne vrste, mitohondrijski COI, Oplegnathidae, ladijski promet

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