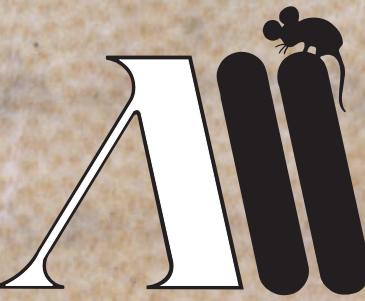


ANNALES



*Analí za istrske in mediteranske študije
Annali di Studi istriani e mediterranei
Annals for Istrian and Mediterranean Studies
Series Historia Naturalis, 31, 2021, 2*



UDK 5

ISSN 1408-533X
e-ISSN 2591-1783



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Anali za istrske in mediteranske študije
Annali di Studi istriani e mediterranei
Annals for Istrian and Mediterranean Studies

Series Historia Naturalis, 31, 2021, 2

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Redakcija te številke je bila zaključena 13. 12. 2021.

**Sofinancirajo/Supporto finanziario/
Financially supported by:**

Javna agencija za raziskovalno dejavnost Republike Slovenije (ARRS), Mestna občina Koper

Annales - Series Historia Naturalis izhaja dvakrat letno.

Naklada/Tiratura/Circulation: 300 izvodov/copie/copies

Revija Annales, Series Historia Naturalis je vključena v naslednje podatkovne baze / La rivista Annales, series Historia Naturalis è inserita nei seguenti data base / Articles appearing in this journal are abstracted and indexed in: BIOSIS-Zoological Record (UK); Aquatic Sciences and Fisheries Abstracts (ASFA); Elsevier B.V.: SCOPUS (NL); Directory of Open Access Journals (DOAJ).

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VSEBINA / INDICE GENERALE / CONTENTS 2021(2)

BIOINVAZIJA
BIOINVASIONE
BIOINVASION

- Cemal TURAN, Mevlüt GÜRLEK,
Deniz ERGÜDEN & Hakan KABASAKAL**
A New Record for the Shark Fauna
of the Mediterranean Sea: Whale shark,
Rhincodon typus (Orectolobiformes:
Rhincodontidae) 167
Nova vrsta v fnavi morskih psov
Sredozemskega morja: morski pes
kitovec, Rhincodon typus
(Orectolobiformes: Rhincodontidae)

- Andrea LOMBARDO & Giuliana MARLETTA**
New Evidence of the Ongoing
Expansion of *Okenia picoensis*
Paz-Sedano, Ortigosa & Pola,
2017 (Gastropoda: Nudibranchia) in
the Central-Eastern Mediterranean 173
Novi podatki o širjenju areala vrste Okenia
picoensis Paz-Sedano, Ortigosa & Pola,
2017 (Gastropoda: Nudibranchia) v
srednjem vzhodnem Sredozemskem morju

SREDOZEMSKI MORSKI PSI
SQUALI MEDITERRANEI
MEDITERRANEAN SHARKS

- Hakan KABASAKAL**
A Review of Shark Biodiversity in
Turkish Waters: Updated Inventory,
New Arrivals, Questionable Species,
and Conservation Issues 181
Pregled pestrosti morskih psov v
turških morjih: dopolnjen seznam,
novi prišleki, vprašljive vrste in
naravovarstveni problemi

- Hakan KABASAKAL & Erdi BAYRI**
Great White Sharks, *Carcharodon*
carcharias, Hidden in the Past:
Three Unpublished Records of the
Species from Turkish Waters 195
Trije neobjavljeni primeri pojavitve belega
morskega volka, Carcharodon carcharias,
iz turških voda izbrskani iz preteklosti

IHTIOLOGIJA
ITTOLOGIA
ICHTHYOLOGY

- Malek ALI, Vienna HAMMOUD,
Ola FANDI & Christian CAPAPÉ**
First Substantiated Record of
Crested Oarfish *Lophotus lacepede*
(Osteichthyes: Lophotidae) from the
Syrian Coast (Eastern Mediterranean Sea) 205
Prvi utemeljeni zapis o pojavitvji
čopovke Lophotus lacepede
(Osteichthyes: Lophotidae) ob
sirske obale (vzhodno Sredozemsko morje)

- Mohamed Mourad BEN AMOR,
Khadija OUNIFI-BEN AMOR,
Marouène BDIOUI & Christian CAPAPÉ**
The Second Record of Oilfish,
Ruvettus pretiosus (Gempylidae),
in Tunisian Waters (Central
Mediterranean Sea) 211
Drugi zapis o pojavitvji vrste
Ruvettus pretiosus (Gempylidae)
v tunizijskih vodah (osrednje
Sredozemsko morje)

- Okan AKYOL & Vahdet ÜNAL**
On the Occurrence of *Seriola fasciata*
(Carangidae) in the Eastern
Mediterranean Sea 217
O pojavitvji vrste Seriola fasciata
(Carangidae) v vzhodnem
Sredozemskem morju

- Nassima EL OMRANI,
Hammou EL HABOUZ,
Abdelbasset BEN-BANI,
Abdellatif MOUKRIM,
Roger FLOWER & Abdellah BOUHAIMI**
Age and Growth of the Pouting
Trisopterus luscus (Linnaeus, 1758)
(Pisces, Gadidae) from Moroccan
Central Atlantic Waters 223
Rast in starost francoskega moliča
Trisopterus luscus (Linnaeus, 1758)
(Pisces, Gadidae) v atlantskih
vodah osrednjega Maroka

Mourad CHÉRIF, Rimel BENMESSAOUD & Christian CAPAPÉ	Rudi VEROVNIK, Nejc RABUZA, Miroslav REPAR, Matjaž ZADRGAL & Paul TOUT	
Age and Growth Parameters of the Red Mullet <i>Mullus barbatus</i> (Mullidae) from Northern Tunisia (Central Mediterranean Sea)	On the Presence of Two-Tailed Pasha (<i>Charaxes jasius</i> (Linnaeus, 1767), Papilioidea: Nymphalidae) in the Northeastern Adriatic Region	
<i>Starostni in rastni parametri pri navadnem bradaču Mullus barbatus (Mullidae) iz severne Tunizije (osrednje Sredozemsko morje)</i>	235	285
Yana SOLIMAN, Adib SAAD, Vienna HAMMOUD & Christian CAPAPÉ	Viktor BARANOV & Borut MAVRIČ	
Heavy Metal Concentrations in Tissues of Red Mullet, <i>Mullus barbatus</i> (Mullidae) from the Syrian Coast (Eastern Mediterranean Sea)	New Records of Non-Biting Midges (Diptera, Chironomidae) from Marine and Coastal Habitats of the Slovenian Part of the Adriatic Sea	
<i>Vsebnost težkih kovin v tkivih bradača, Mullus barbatus (Mullidae) iz sirske obale (vzhodno Sredozemsko morje)</i>	243	291
Christian CAPAPÉ, Youssouph DIATTA, Almamy DIABY, Sihem RAFRAFI-NOUIRA & Christian REYNAUD	<i>Nove najdbe trzač (Diptera, Chironomidae) iz morskih in obmorskih habitatov v slovenskem delu Jadran</i>	
Record of a Single Clasper Specimen in <i>Zanobatus schoenleinii</i> (Chondrichthes: Zanobatidae) from the Coast of Senegal (eastern tropical Atlantic)	FLORA	
<i>Najdba primerka vrste Zanobatus schoenleinii (Chondrichthes: Zanobatidae) le z enim klasperjem iz senegalske obale (vzhodni tropski Atlantik)</i>	FLORA	
FAVNA	FLORA	
FAVNA		
FAVNA		
Ana FORTIČ, Domen TRKOV, Lovrenc LIPEJ, Marco FANTIN & Saul CIRIACO	Amelio PEZZETTA, Marco PAOLUCCI & Mario PELLEGRINI	
New Evidence of the Occurrence of <i>Knoutsodonta pictoni</i> (Nudibranchia, Onchidorididae) in the Northern Adriatic	Le Orchidaceae del sito di interesse comunitario "Monte Pallano e Lecceta d'Isca d'Archi" e delle zone limitrofe	
<i>Novi podatki o pojavljanju vrste Knoutsodonta pictoni (Nudibranchia, Onchidorididae) v severnem Jadranu</i>	301	
Noureddine BENABELLAH, Djillali BOURAS, Mohammed RAMDANI & Nicolas STURARO	<i>Kukavičevke območja, pomembnega za skupnost "Monte Pallano e Lecceta d'Isca d'Archi" in sosednjih območij</i>	
Biodiversity and Structural Organization of Mollusk Communities in the Midlittoral Coastal Area Between Bouzedjar and Arzew (Western Algeria)	DELO NAŠIH ZAVODOV IN DRUŠTEV ATTIVITÀ DEI NOSTRI ISTITUTI E SOCIETÀ ACTIVITIES BY OUR INSTITUTIONS AND ASSOCIATIONS	
<i>Biodiverziteta in struktura združbe mehkužcev v bibavičnem območju med predeloma Bouzedjar in Arzew (zahodna Alžirija)</i>		
267		
Jadran FAGANELI	Marina DERMASTIA, Tina ELERŠEK, Jadranka JEZERŠEK, Lučka KAJFEŽ BOGATAJ, Matjaž KUNTNER, Tamara LAH TURNŠEK, Matjaž LIČER, Lovrenc LIPEJ, Miha MIKELJ, Izidor OSTAN OŽBOLT, Maja RAVNIKAR, Katja SINUR, Darja STANIC, Timotej TURK DERMASTIA, AI VREZEC	
<i>V spomin prof. dr. Jožetu Štirnu (1934-2021)</i>	Okoljski manifest	
	315	
IN MEMORIAM		
Jadran FAGANELI		
<i>V spomin prof. dr. Jožetu Štirnu (1934-2021)</i>	321	
Kazalo k slikam na ovitku	326	
<i>Index to images on the cover</i>	326	

received: 2021-10-25

DOI 10.19233/ASHN.2021.30

RECORD OF A SINGLE CLASPER SPECIMEN IN *ZANOBATUS SCHOENLEINII* (CHONDRICHTHYES: ZANOBATIDAE) FROM THE COAST OF SENEGAL (EASTERN TROPICAL ATLANTIC)

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ABSTRACT

*The authors report on the capture of an abnormal specimen of striped panray, *Zanobatus schoenleinii* (Müller & Henle 1841) from the coast of Senegal. The specimen measured 250 mm in disc width (DW) and weighing 621 g in total body weight (TBW). It exhibited a lack of the right clasper, already visible from the view of the dorsal surface, and an undeveloped and reduced pelvic fin, especially in its distal margin. The dissection of the abdominal cavity showed on both sides a genital apparatus morphologically male and almost similar. The lack of any female structure allows to state that this present specimen didn't display a case of pseudo or true hermaphroditism , but rather a case of morphological abnormality.*

Key words: batoid species, lack of clasper, morphological abnormality, coast of Senegal

RITROVAMENTO DI UN ESEMPLARE DI *ZANOBATUS SCHOENLEINII* (CHONDRICHTHYES: ZANOBATIDAE) CON UN SOLO PTEROPODIO LUNGO LA COSTA DEL SENEGAL (ATLANTICO TROPICALE ORIENTALE)

SINTESI

*Gli autori riportano la cattura di un esemplare anomalo di *Zanobatus schoenleinii* (Müller & Henle 1841) lungo la costa del Senegal. L'esemplare misurava 250 mm di larghezza del disco (DW) e aveva 621 g di peso corporeo totale (TBW). Presentava una mancanza del pterigopodio destro, notabile già alla vista della superficie dorsale, e una pinna pelvica non sviluppata e ridotta, specialmente nel suo margine distale. La dissezione della cavità addominale ha mostrato su entrambi i lati un apparato genitale morfologicamente maschile e quasi simile. La mancanza di una struttura femminile permette di affermare che questo esemplare non mostrava un caso di pseudo o vero emafroditismo, ma piuttosto un caso di anomalia morfologica.*

Parole chiave: specie batoide, mancanza di pterigopodio, anomalia morfologica, costa del Senegal

INTRODUCTION

The striped panray, *Zanobatus schoenleinii* (Müller & Henle, 1841), is an endemic species known from the eastern tropical Atlantic, from southern Morocco (Lloris & Rocabado, 1998) to the Gulf of Guinea (Blache *et al.*, 1970), captured by handicraft fisheries, especially throughout the coast of Senegal in shallow coastal waters at low depth, not exceeding 50 m depth (Capapé *et al.*, 1995). These captures allowed to provide preliminary data about some traits of reproductive biology and feeding habits of the species (Capapé *et al.*, 1995). Among the collected *Z. schoenleinii* some abnormal specimens were found and formed the object of papers (see Tab. 1). Additionally, an other abnormal specimen was recently discovered and described in the present paper.

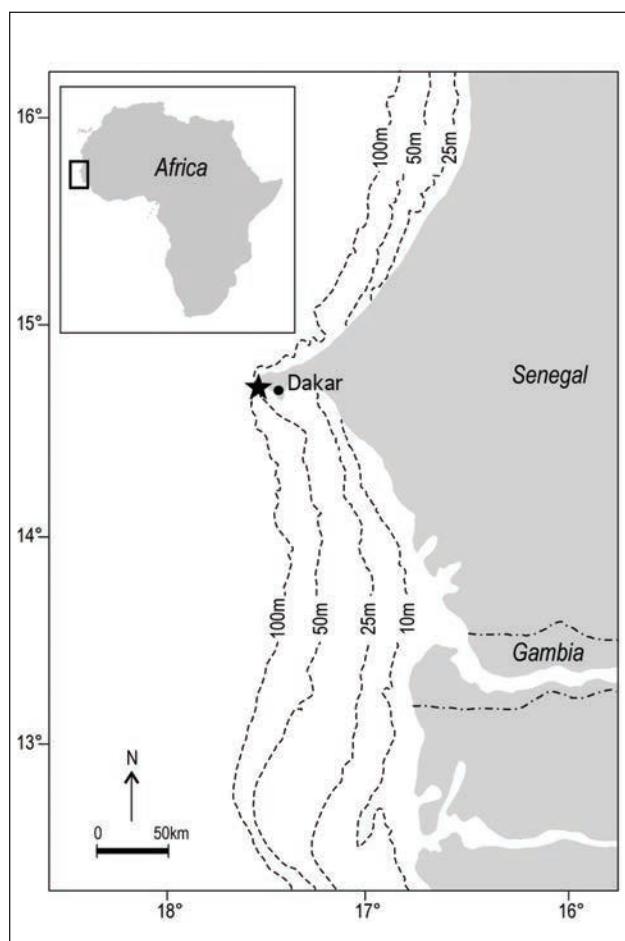


Fig. 1: Map of the Senegalese coast indicating the capture site of the abnormal specimen of *Zanobatus schoenleinii* (black star).

Sl. 1: Zemljovid senegalske obale z označeno lokaliteto, kjer je bil ujet neobičajen primerek vrste *Zanobatus schoenleinii* (črna zvezdica).

MATERIAL AND METHODS

A total of 33 specimens of *Z. schoenleinii* were captured off Dakar, located in Cape Verde Peninsula, and collected at the fishing site of Hann on 11 December 2020. They were caught by commercial trammel net made of three layers of mesh, having a stretched size of 48 mm, 50 mm and 60 mm, respectively, at a depth between 5 and 16 m, on sandy-muddy bottom, together with other telost species, by 14°43'32.1» N and 17°25'35.4» W (Fig. 1). Of the 33 specimens, 32 were normal and a single specimen displayed a lack of clasper.

All specimens were measured to the nearest millimetre for disc width (DW) and weighed to nearest gram for total body weight (TBW). Morphometric measurements were recorded on the abnormal specimen following Diatta *et al.* (2013) and presented in Table 1. The specimen was fixed in 10% buffered formaldehyde, successively preserved in 75 % ethanol and deposited in the Ichthyological Collection of the Institut Supérieur d'Aquaculture et de Pêche of Bizerte (Tunisia), with the catalogue number, ISPAB-Zan-sch-09.

The relation between DW and TBW was used as a complement following Froese *et al.* (2011), including all specimens, normal and abnormal to show if this latter is able to develop in the wild as normal specimens. This relation is $TBW = aDW^b$, and was converted into its linear regression, expressed in decimal logarithmic coordinates and correlations were assessed by least-squares regression. as: $\log TBW = \log a + b \log DW$. Significance of constant b differences was assessed to the hypothesis of isometric growth if $b = 3$, positive allometry if $b > 3$, negative isometry if $b < 3$ (Pauly, 1983). These two latter tests were performed by using logistic model STAT VIEW 5.0.

RESULTS AND DISCUSSION

All specimens were identified as *Zanobatus schoenleinii* as follows: morphological characters: disc subcircular, wider than long; snout blunt, angle nearly 120° in front; nostrils narrow, anterior valves united across the internarial space; mouth straight with small teeth; spiracles large without folds; dorsal and caudal fins small and rounded; covered by a rigid skin, unlike and minute scales, a medial row of thorns in disk and tail, and a three rows arranged in arc of circle on each shoulder; back brown with dark cross bands with white spots between toward the pectoral edges. Such description is in total agreement with Garman (1913), Cadenat (1951), Blache *et al.* (1970) and Capapé *et al.* (2020a, b).

Southward, a new congeneric species was described in the area *Zanobatus maculatus* Séret, 2016. Which displays a smaller size panray, disc more rounded, rhombic in the striped panray; exhibiting numerous dark brown blotches of various sizes vs. wavy medium brown

Tab. 1: Morphometric measurements (in mm and as % DW), meristic counts and mass recorded in the abnormal specimen of *Zanotatus schoenleinii* (ISPAB-Zan-sch-09).

Tab. 1: Morfometrične meritve (v mm in kot delež premera diska % DW), meristična štetja in masa neobičajnega primeka vrste *Zanotatus schoenleinii* (ISPAB-Zan-sch-09).

REFERENCES	ISPAB-Zan-sch-09	
Measurements	mm	% Disc width
Total length	455	182.00
Disc length	235	94.00
Disc width	250	100.00
Disc depth	34	13.60
Eyeball length	14	5.60
Pre-orbital length	49	19.60
Inter-orbital length	22	8.80
Spiracle diameter	21	8.40
Interspiracular width	27	10.80
Space between eye and spiracle	11	4.40
Pre-oral length	52	20.80
Mouth width	33	13.20
First gill-slit	7	2.80
Second gill-slit	9	3.60
Third gill-slit	8	3.20
Fourth gill-slit	8	3.20
Fifth gill-slit	6	2.40
Width between first gill-slit	64	25.60
Width between fifth gill-slit	35	14.00
Snout tip to eye	62	24.80
Snout tip to mouth	60	24.00
Snout tip to first gill-slit	90	36.00
Snout tip to fifth gill-slit	119	47.60
Snout tip to vent	202	80.80
Pectoral fin anterior margin	160	64.00
Pectoral fin posterior margin	141	56.40
Pectoral fin inner margin	14	5.60
Pelvic fin anterior margin	37	14.80
Pelvic fin posterior margin	54	21.60
Pelvic fin inner margin	24	9.60
Span of pelvic fins	99	39.60
Clasper length	45	18.00
First dorsal anterior edge	39	15.60
First dorsal posterior edge	26	10.40
First dorsal inner edge	7	2.80
Second dorsal inner edge	7	2.80
Interdorsal distance	27	10.80
Second dorsal to caudal birth	24	9.60
Total body weight in gram	621	



Fig. 2: Abnormal specimen of *Zanotatus schoenleinii* (ISPAB-Zan-sch-09). A. Dorsal surface. B. Ventral surface. Scale bar = 50 mm.

Sl. 2: Neobičajen primerek vrste *Zanotatus schoenleinii* (ISPAB-Zan-sch-09). A. Hrbtna stran. B. Trebušna stran. Merilo = 50 mm.

crossbars; a dermal armature more pronounced, and has spear-shaped dermal denticles vs. polygonal flat denticles and smaller number of tooth rows, probably due to its smaller size.

The sampled specimens ranged between 154 and 270 mm DW and their TWB from 104 to 914 g. The abnormal specimen measured 250 mm DW and weighed 621 g, and it exhibits a lack of the right clasper, already visible from the view of the dorsal surface (Fig. 2A). An examination of the ventral surface displays the presence of a left clasper developed but still flexible, characteristic from a juvenile specimen (see Capapé et al., 1995). The right pelvic area exhibits a total lack of clasper and an undeveloped and reduced pelvic fin, especially in its distal margin. No unhealed scar were observed on this distal margin, conversely it was pigmented and covered by small denticles. This reduced pelvic fin is not consequence of an injury caused by a predator but a morphological abnormality probably occurring during the embryonic development, rarely after birth, in the wild.

The dissection of the abdominal cavity shows on both sides a genital apparatus morphologically male and almost similar (Fig. 3). Testicles are absent, Leydig's gland is relatively developed and spermiducts are convoluted ending in a rounded seminal vesicle. Lack of female structure allows to state that this present specimen does not display a case of pseudo or true hermaphroditism (Atz, 1964), but rather a case of abnormality. All relevant cases of clasper abnormalities are reported in some elasmobranch species in Table 2. It clearly appears that of the 16 cases herein presented, 12 are related to hermaphroditism, and only 4 cases could be considered as monstrosities (*sensu* Ribeiro-Prado et al., 2008).

Tab. 2: Condition of clasper and pelvic fin (lack and/or atrophy) observed in some elasmobranch species recorded from different marine areas.**Tab. 2: Stanje klasperja in trebušne plavuti (odsotnost ali atrofija), ugotovljeno pri nekaterih vrstah hrustančnic iz različnih morskih predelov.**

Species	Region	Condition of claspers and pelvic fins	Type of abnormality	Authors
<i>Raja miraletus</i>	Coast of Tunisia	Lack of left clasper	Hermaphroditism	Quignard & Capapé (1972)
<i>Aetomylaeus nichofii</i>	Coast of Pakistan	Atrophy of right clasper and pelvic fin	Hermaphroditism	Capapé & Desouter (1979)
<i>Bathyraja interrupta</i>	Coast of Alaska	Atrophy of both claspers	Hermaphroditism	Haas & Ebert (2008)
<i>Pteroplatyrygon violacea</i>	Coast of Brazil	Lack of left clasper	Hermaphroditism	Ribeiro-Prado <i>et al.</i> (2009)
<i>Dasyatis tortonesei</i>	Coast of Tunisia	Coast of Brazil	Hermaphroditism	Capapé <i>et al.</i> (2012)
<i>Carcharhinus limbatus</i>	Coast of Mexico	Atrophy of both claspers	Morphological abnormality	Hendon <i>et al.</i> (2013)
<i>Urotrygon microphthalmum</i>	Coast of Brazil	Atrophy of left clasper, lack of right clasper	Hermaphroditism	Santander-Neto & Lessa (2013)
<i>Urotrygon chilensis</i>	Coast of Mexico	Lack of left clasper	Hermaphroditism	Torres-Huerta <i>et al.</i> (2015)
<i>Bathyraja parmifera</i>	Bering Sea	?	Hermaphroditism	Mata (2015)
<i>Zapteryx exasperata</i>	Coast of Mexico	Lack of right clasper, atrophy of left pelvic fin	Hermaphroditism	González <i>et al.</i> (2016)
<i>Myliobatis aquila</i>	Coast of Tunisia	Atrophy of both claspers	Hermaphroditism	Raftari <i>et al.</i> (2017)
<i>Pseudobathos percellens</i>	Caribbean Sea	Lack of left clasper, atrophy of right pelvic fin	Hermaphroditism	Ehemann & González-González (2018)
<i>Galeus melastomus</i>	Coast of Algeria	Severe atrophy of right clasper and pelvic fin	Morphological abnormality	Capapé <i>et al.</i> (2019)
<i>Potamotrygon marquesi</i>	Coast of Brazil	Atrophy of both claspers	Morphological abnormality	da Silva & da Silva Casas (2020)
<i>Zanobatus schoenleinii</i>	Coast of Senegal	Lack of right clasper, atrophy of right pelvic fin	Hermaphroditism	Capapé <i>et al.</i> (2020a)
<i>Zanobatus schoenleinii</i>	Coast of Senegal	Lack of right clasper, atrophy of right pelvic fin	Morphological abnormality	This study

The causes of hermaphroditism in elasmobranchs species still remain unclear, and could be various and different. The causes of hermaphroditism in chondrichthyans remains difficult to explain (Atz, 1964), and they probably have an endogenous origin, genetic and/or hormonal as in other vertebrates. Unfavorable environmental conditions cannot be neglected such as radio-activity contamination (see Yano & Tanaka, 1989), though other pollutants could also be involved. Additionally, hermaphrodite *A. longicephalus* from New Caledonia, including juveniles and adults, were collected with five other gonochoric species, showing that hermaphrodite specimens could live sympatrically with the gonochoric ones and reproduce (Iglesias *et al.*, 2005).

Among the causes of these reproductive abnormalities, lack or atrophy of claspers, Ehemann and González-González (2018) noted the most probable origin is related to the embryonic development. This opinion is in total accordance with Bensam (1965) and Moore (2015), who noted that such deformities are probably caused by intrauterine pressure exerted by other embryos in viviparous species. Conversely, Bonfil (1989) suggested that the pre-natal abnormalities have a genetic origin or related to mutations.

The lack of one clasper probably plays a minor role in reproduction processus due to the fact that male specimens introduce a single clasper during copulation (Chapman *et al.*, 2003). Conversely, atrophy of both claspers

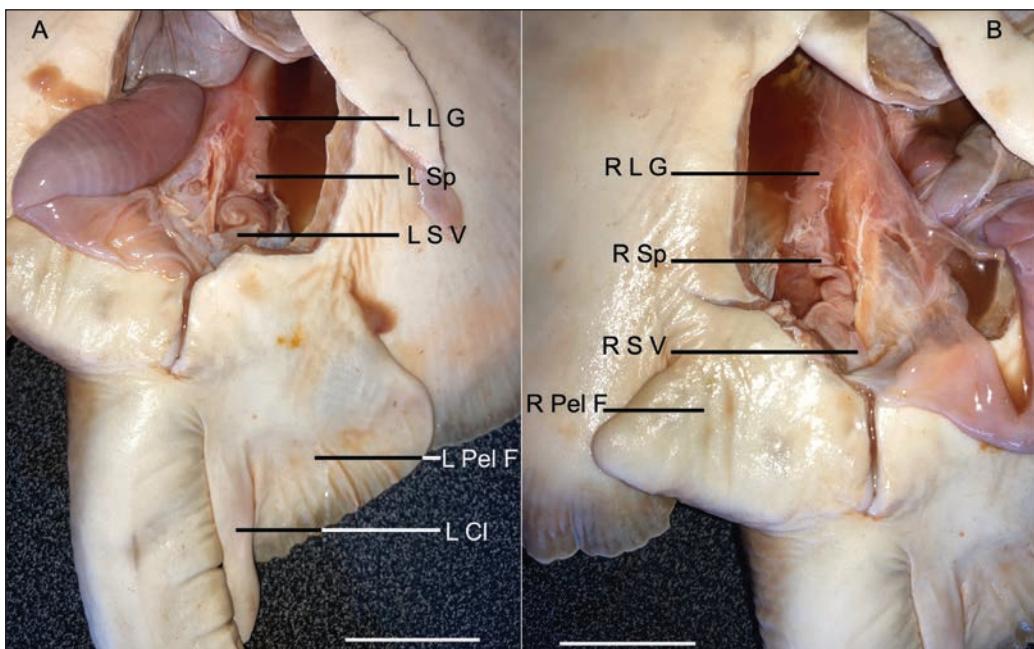


Fig. 3: Ventral view of the abdominal cavity of the abnormal specimen of *Zanobatus schoenleinii*. A. LLG: left Leydig's gland, LSp: left spermiduct, LSV: left seminal vesicle, LPelF: left pelvic fin, LCl: left clasper. B. RLG: right Leydig's gland, RSp: right spermiduct, RSV: right seminal vesicle, RPelF: right pelvic fin. Scale bar = 20 mm.

Sl. 3: Spodnja stran trebušne votline neobičajnega primerka vrste *Zanobatus schoenleinii*. A. LLG: leva Leydigova žleza, LSp: levi semenovod, LSV: leva semenska vrečka. LPelF: leva trebušna plavut, LCl: levi klasper. B. RLG: desna Leydigova žleza, RSp: desni semenovod, RSV: desna semenska vrečka. RPelF: desna trebušna plavut. Merilo = 20 mm.

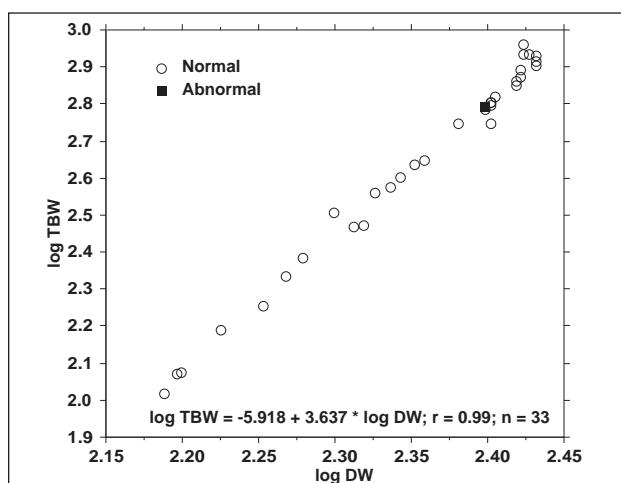


Fig. 4: Relationship total body mass (TBW) versus disc width (DW) expressed in logarithmic co-ordinates for abnormal and normal specimens of *Zanobatus schoenleinii* collected from the coast of Senegal.

Sl. 4: Odnos med celokupno telesno maso (TBW) in premerom diska (DW), pri neobičajnih in normalnih primerkih vrste *Zanobatus schoenleinii* iz senegalske obale, izražen v logaritemski skali.

reduces the success of the reproduction processus. The relationship TBW vs DW including the abnormal specimen and other specimens of similar sizes of *Z. schoenleinii* is $\log \text{TWB} = -5.918 + 3.637 * \log \text{DW}$; $r = 0.99$; $n = 33$, displaying a positive allometry (Fig. 4), all specimens having a regular increase in development. Therefore, lack of right clasper and reduced right pelvic fin did not assume the development of the abnormal specimen in the wild, similar patterns were provided in other batoid species (Capapé et al., 2012, 2019).

Unfavourable environmental conditions probably play a role in different case of abnormalities reported in elasmobranch species such as large exposure to pollutants, especially in species having a benthic life (Ribeiro-Prado et al., 2008; Diatta et al., 2013). Such patterns were mostly reported in batoids which generally inhabit sandy-muddy bottoms (Ribeiro-Prado et al., 2008). Diop et al. (2012) and Bonnin et al. (2016) noted that the coast of Senegal, especially around the touristic area of Dakar is facing to pollutants which is increasing in the wild since some decades and their impact on the local biodiversity cannot be totally ruled out. *Z. schoenleinii*, a benthic species remains probably the main instance due to the fact that several abnormal specimens were found in the area (Diatta et al., 2013; Capapé et al., 2020a,b; this study).

NAJDBA PRIMERKA VRSTE *ZANOBATUS SCHOENLEINII* (CHONDRICHTHYES:
ZANOBATIDAE) LE Z ENIM KLASPERJEM IZ SENEGALSKE OBALE
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POVZETEK

Avtorji poročajo o ulovu nenavadnega osebka skata vrste *Zanobatus schoenleinii* (Müller & Henle 1841) iz senegalske obale. Primerek je merit 250 mm v premeru diska (DW) in tehtal 621 g telesne teže (TBW). Bil je brez desnega klasperja, kar se je videlo že s hrbitne strani, in z nerazvito in pokrneno trebušno plavutjo, še posebej na skrajnjem robu. Seciranje trebušne votline je razkrilo samčev razmnoževalni aparat, ki je bil na obeh straneh podoben. Odsotnost samičjih delov kaže na dejstvo, da ne gre za primer pravega ali lažnega hermafroditizma, le morfološko anomalijo.

Ključne besede: vrste skatov, odsotnost klasperja, morfološke anomalije, senegalska obala

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