

# ANNALES

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## ATYPICAL CLASPERS IN SMOOTHHOUND, *MUSTELUS MUSTELUS* (CHONDRICHTHYES: TRIAKIDAE) FROM THE COAST OF SENEGAL (EASTERN TROPICAL ATLANTIC)

*Christian CAPAPÉ*

Laboratoire d'Ictyologie, Université de Montpellier, 34 095 Montpellier cedex 5, France  
e-mail: christian.capape@umontpellier.fr

*Almamy DIABY & Youssouph DIATTA*

Laboratoire de Biologie marine, Institut fondamental d'Afrique noire, (IFAN Ch. A. Diop), Université Cheikh Anta Diop de Dakar, BP 206, Dakar, Senegal

*Sihem RAFRAFI-NOUIRA*

Unité de Recherches Exploitation des Milieux aquatiques, Institut Supérieur de Pêche et d'Aquaculture de Bizerte, Université de Carthage, BP 15, 7080 Menzel Jemil, Tunisia

*Christian REYNAUD*

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

### ABSTRACT

*The authors report the capture of an abnormal specimen of smoothhound Mustelus mustelus (Linnaeus, 1758). The specimen measured 1045 mm in total length (TL) and weighed 3615 g. It exhibited claspers of dissimilar morphology: a normally developed right clasper characteristic of an adult male, and a smaller left clasper, rounded in its distal end, with a large aperture on the ventral surface. An examination of the abdominal cavity revealed a total absence of the genital apparatus on the left side, which probably explains the aberrant shape of the left clasper. The relationship of total body weight to total length revealed that the abnormal specimen was considerably less heavy than normal specimens from the same TL class.*

**Key words:** *Mustelus mustelus*, abnormality, weight, condition, genital apparatus

## PTERIGOPODI ATIPICI IN *MUSTELUS MUSTELUS* (CHONDRICHTHYES: TRIAKIDAE) LUNGO LA COSTA DEL SENEGAL (ATLANTICO TROPICALE ORIENTALE)

### SINTESI

*Gli autori riportano la cattura di un esemplare anomalo di palombo, Mustelus mustelus (Linnaeus, 1758). L'esemplare misurava 1045 mm di lunghezza totale (TL) e pesava 3615 g. Presentava pterigopodi di morfologia diversa: quello destro normalmente sviluppato, caratteristico di un maschio adulto, e quello sinistro più piccolo, arrotondato nella sua estremità distale, con una grande apertura sulla superficie ventrale. L'esame della cavità addominale ha rivelato l'assenza totale dell'apparato genitale sul lato sinistro, il che spiega probabilmente la forma aberrante dello pterigopodio sinistro. Il rapporto tra il peso corporeo totale e la lunghezza totale ha rivelato che l'esemplare anomale era notevolmente meno pesante degli esemplari normali della stessa classe di TL.*

**Parole chiave:** *Mustelus mustelus*, anomalia, peso, condizione, apparato genitale

## INTRODUCTION

The smoothhound *Mustelus mustelus* (Linnaeus, 1758) is a medium-sized shark known in the eastern Atlantic from the British Isles to the coast of Portugal (Branstetter, 1984). To the south of the Strait of Gibraltar, the species occurs from Morocco (Lloris & Rocabado, 1998), Mauritania (Kallah, 2013) to the Gulf of Guinea (Blache *et al.*, 1970), as far as south African waters (Smale & Compagno, 1997).

*M. mustelus* is commonly reported throughout the Mediterranean Sea, and generally greatly appreciated for human consumption (Branstetter, 1984; Compagno, 1984). However, the species is facing fishing pressure and a drastic decline in some areas where it was previously considered abundant (Capapé *et al.*, 2000).

Along the coast of Senegal, *M. mustelus*, like other shark species, is the focus of intensive fishing, both commercial and artisanal. Its flesh is dried and used locally or exported to other African countries under the vernacular name of *sali*. Fins of larger specimens are collected and prepared as *laâf* and exported to Asian markets (Gueye-Ndiaye, 1993).

The landings of shark species in fishing sites located along the Senegalese shore offered us the opportunity to collect data and describe some aspects of the smoothhound's reproductive biology (Capapé *et al.*, 2006). Recent investigations conducted throughout the Senegalese coast and supported by local and experienced fishermen, allowed the collection of a specimen of *M. mustelus* from the examined area which displayed an anomalous clasper. The aim of this paper is to describe the specimen and comment on this atypical characteristic in the mentioned elasmobranch species.

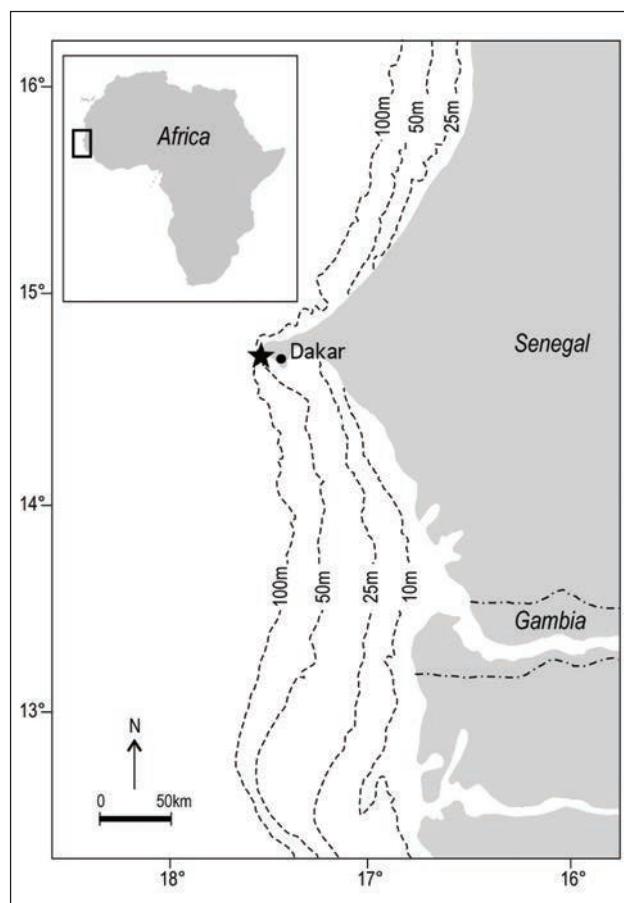
## MATERIAL AND METHODS

The abnormal specimen of *M. mustelus* was captured off Dakar, Cape Verde Peninsula, and collected on 18 January 2021 at the fishing site of Hann, 14°43'32.1" N and 17°25'35.4" W (Fig. 1). It was caught by a commercial 3-layer trammel net measuring 50 m in length and 2 m in height, with stretched mesh sizes of 48 mm, 50 mm, and 60 mm, respectively. The capture occurred at a depth between 5 and 16 m, on a sandy-muddy bottom, together with striped panrays, *Zanobatus schoenleinii* (Müller & Henle, 1841), marbled stingrays *Dasyatis marmorata* (Steindachner, 1892) and other teleost species.

Morphometric measurements of the abnormal specimen, recorded to the nearest millimetre following Compagno (1984), are presented in Table 1. The claspers of the abnormal specimen were fixed in 10% buffered formaldehyde, successively preserved in 75% ethanol and deposited in the Ichthyological Collection of Institut Supérieur d'Aquaculture et de

Pêche of Bizerte (Tunisia), under the catalogue number, ISPAB-Must-must-01.

Additionally, in order to know if the abnormal *M. mustelus* was able to develop in the wild like normal specimens, the relation between total length (TL) and total body weight (TBW) was used as a complement following Froese *et al.* (2011). This relation –  $TBW = aTL^b$  – was studied in the abnormal specimen and 14 normal previously sampled in the same area (see Capapé *et al.*, 2006), and converted into its linear regression, expressed in decimal logarithmic coordinates. Correlations were assessed by least-squares regression as  $\log TBW = \log a + b \log DW$ . The values of constant  $b$  were used to confirm or reject the hypothesis of isometric growth, indicating: isometry if  $b = 3$ , positive allometry if  $b > 3$ , negative allometry if  $b < 3$  (Pauly, 1983). These two latter tests were performed using logistic model STAT VIEW 5.0.



**Fig. 1:** Map of the Senegalese coast with the capture site of the abnormal specimen of *Mustelus mustelus* indicated (black star).

**Sl. 1:** Zemljovid senegalske obale z označeno lokaliteto ulova atypičnega primerka vrste *Mustelus mustelus* (črna zvezdica).

**Tab. 1: Absolute and relative values of selected morphometric measurements (in millimetres) and total body weight (in grams) of the abnormal specimen of *Mustelus mustelus* collected from the coast of Senegal.**  
**Tab. 1: Absolutne in relativne vrednosti izbranih morfometričnih meritev v milimetrih in celokupna telesna teža v gramih atypičnega primerka vrste *Mustelus mustelus*, ujetega ob senegalski obali.**

References	ISPAB-Must -must-01	
Sex	male	
Measurements	mm	% TL
Total length (TL)	1045	100.00
Fork length	891	85.26
Standard length	825	78.95
Pre-caudal length	835	79.90
Pre-first dorsal length	305	29.19
Pre-second dorsal length	660	63.16
Head length	205	19.62
Head height	60	5.74
Mouth width	56	5.36
Abdomen height	80	7.66
Eye length	20	1.91
Eye height	10	0.96
Pre-pectoral fin length	210	20.10
Interdorsal space	252	24.11
Pectoral fin base	46	4.40
Pectoral fin anterior margin	141	13.49
Pectoral inner margin	56	5.36
Pectoral posterior margin	106	10.14
First dorsal fin base	100	9.57
First dorsal fin anterior margin	110	10.53
First dorsal fin inner margin	40	3.83
First dorsal fin posterior margin	83	7.94
Second dorsal fin anterior margin	82	7.85
Second dorsal fin inner margin	25	2.39
Second dorsal fin posterior margin	47	4.50
Pelvic fin base	50	4.78
Pelvic fin anterior margin	72	6.89
Pelvic inner margin	44	4.21
Pelvic fin posterior margin	75	7.18
Caudal base	21	2.01
Dorsal caudal margin	205	19.62
Terminal caudal lobe	70	6.70
Lower post-ventral caudal margin	80	7.66
Pre-ventral caudal margin	72	6.89
Right clasper length	101	9.67
Left clasper length	44	4.21
<b>Total body weight (g)</b>	<b>3615</b>	

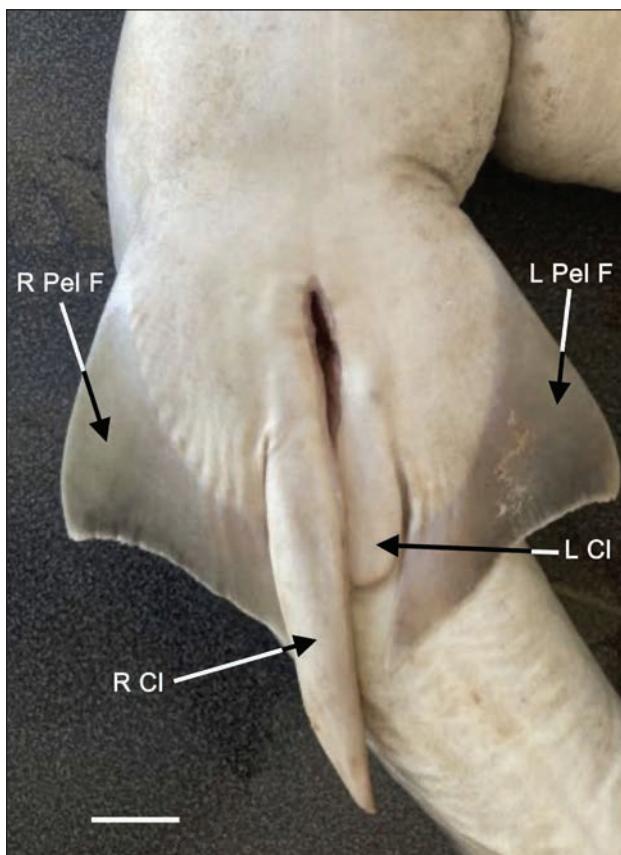
## RESULTS AND DISCUSSION

The studied specimen measured 1045 mm in TL and weighed 3615 g. It was identified as *M. mustelus* following a combination of main morphometric characters: body slender, head short, snout slightly rounded and moderately long, first dorsal origin over free pectoral fin, both dorsal fins similar in shape, second slightly smaller, pectoral fins broadly triangular, large notch on upper caudal lobe, dermal denticles tridentate, teeth molariform with reduced cusplets; dorsal surface grey to brown, belly whitish to beige (Fig. 2). This description is in total agreement with Quignard & Capapé (1972a), Branstetter (1984), Compagno (1984) and Ebert & Stehmann (2013).



**Fig. 2: Abnormal specimen of *Mustelus mustelus* collected from the coast of Senegal. A. Entire specimen. B. Fins of larger specimens are collected and prepared as laâf and exported to Asian markets (Gueye-Ndiaye, 1993). Scale bar = 100 mm for both A and B.**  
**Sl. 2: Atypični primerek vrste *Mustelus mustelus*, ujet ob senegalski obali. A. Cel primerek. B. Plavuti večjih primerkov uporablajo za pripravo laâf in ga izvažajo na azijski trg (Gueye-Ndiaye, 1993). Merilo = 100 mm za obo, A in B.**

The specimen exhibited two claspers of dissimilar morphology (Fig. 3). The right clasper was normally developed and characteristic of an adult male (Capapé et al., 2006). It was rigid, calcified and longer than the right pelvic fin, slender and pointed at its distal end. The left clasper was smaller than the right clasper and both pelvic fins, rounded in its distal end, exhibiting a large aperture on the ventral surface. This clasper was

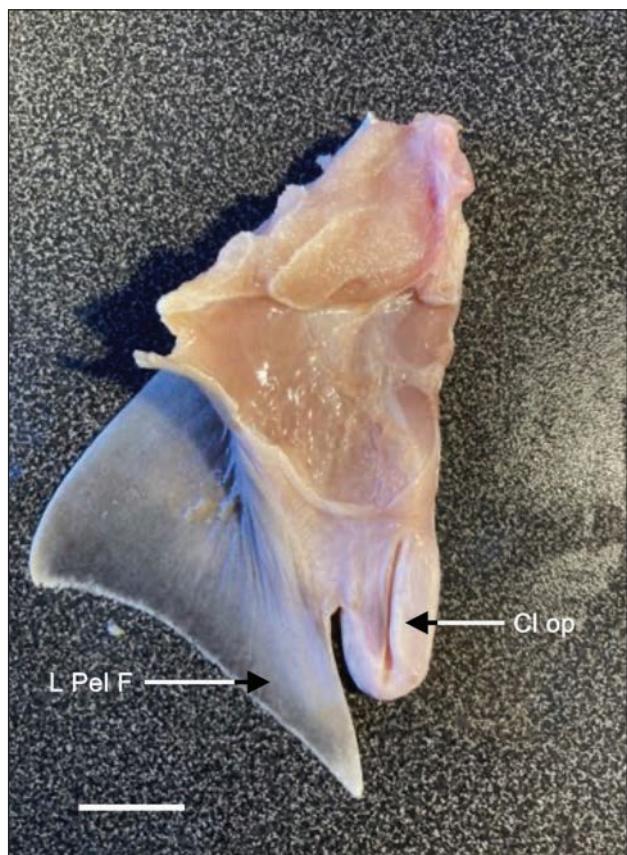


**Fig. 3:** Claspers of the abnormal specimen of *Mustelus mustelus* collected from the coast of Senegal. L Cl: left clasper, L Pel F: left pelvic fin, R Cl: right clasper, R Pel F: right pelvic fin. Scale bar = 20 mm.

Sl. 3: Klasperja atipičnega primerka vrste *Mustelus mustelus*, ujetega ob senegalski obali. L Cl: levi klasper, L Pel F: leva trebušna plavut, R Cl: desni klasper in R Pel F: desna trebušna plavut. Merilo = 20 mm.

soft and flexible due to the complete absence of internal cartilages (Fig. 4).

An examination of the specimen's abdominal cavity showed a complete genital apparatus on the right side, comprising a testicle, a Leydig gland, a rather convoluted spermiduct, and a well-developed seminal vesicle with sperm. Conversely, the left side revealed a total lack of genital apparatus, which probably explains the aberrant shape of the left clasper (Fig. 5). Generally, in elasmobranch species lacking claspers, the presence of aberrant or reduced claspers is a morphological consequence of hermaphroditism or pseudo-hermaphroditism (Quignard & Capapé, 1972b; Capapé et al., 2012; Rafrafi-Nouira et al., 2017). Previously, Ehemann & González-González (2018), Quigley et al. (2018, 2019) and Capapé et al. (2021) noted that of the 16 cases of abnormal

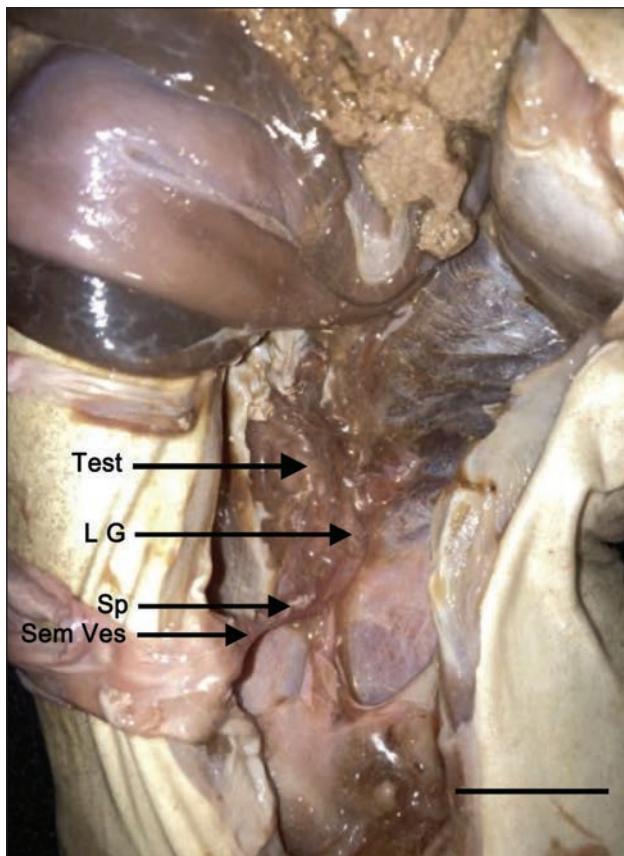


**Fig 4:** Left clasper of the abnormal specimen of *Mustelus mustelus* collected from the coast of Senegal. Cl Op: clasper opening, L Pel F: left pelvic fin. Scale bar = 20 mm.

Sl. 4: Levi klasper atipičnega primerka vrste *Mustelus mustelus*, ujetega ob senegalski obali. Cl Op: odprtina na klasperju, L Pel F: leva trebušna plavut. Merilo = 20 mm.

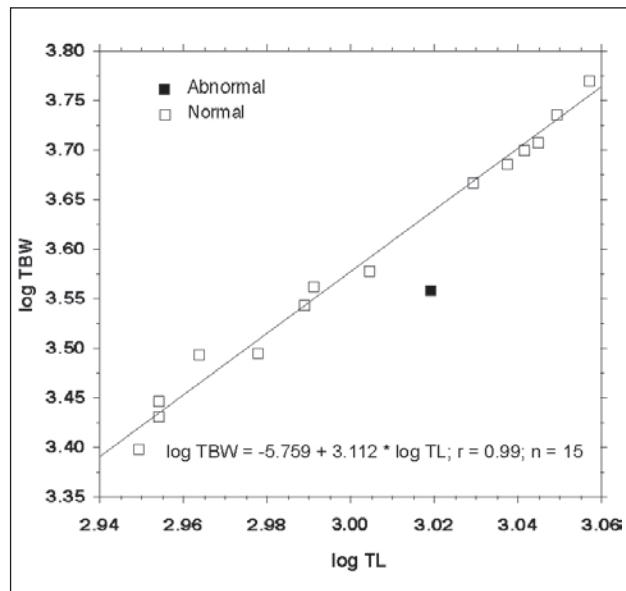
claspers recorded among elasmobranch species, only 4 cases could be considered monstrosities (*sensu* Ribeiro-Prado et al., 2008), or 5 cases including the studied specimen.

The causes of aberrant claspers are diverse, following Capapé et al. (2021); they probably have an endogenous origin, genetic and/or hormonal, like in other vertebrates. However, the role of unfavourable environmental conditions, such as pollution due to anthropogenic activity, cannot be totally ruled out. The coast of Senegal, in fact, has been affected by an increase of pollutants in the wild (Diop et al., 2012; Bonnin et al., 2016). Consequently, several cases of abnormalities have been reported from the area with regard to benthic species, especially the most sensitive and locally abundant ones, such as *Zanobatus schoenleinii* (Diatta et al., 2013; Capapé et al., 2021).



**Fig. 5:** Abdominal cavity of the abnormal specimen of *Mustelus mustelus* collected from the coast of Senegal. L G: Leydig gland, Sem Ves: seminal vesicle, Sp: spermiduct, Test: testicle. Scale bar = 20 mm.  
**Sl. 5:** Trebušna votlina atypičnega primerka vrste *Mustelus mustelus*, ujetega ob senegalski obali. L G: Leydigova žleza, Sem Ves: semenski mešiček, Sp: semenovod, Test: modo. Merila = 20 mm.

The atrophy of the left clasper could not be considered as very important, because males only use a single clasper during copulation (Chapman et al., 2003). The TBW vs. TL relationship was:



**Fig. 6:** The total body mass (TBW) to total length (TL) relationship expressed in logarithmic co-ordinates for abnormal and normal specimens of *Mustelus mustelus* collected from the coast of Senegal.

**Sl. 6:** Odnos med celokupno telesno težo (TBW) in totalno dolžino (TL) izražena z logaritmičnimi osmi za atypičnega in normalne primerke vrste *Mustelus mustelus*, ujetih ob senegalski obali.

$\log \text{TBW} = -5.759 + 3.112 * \log \text{TL}$ ;  $r = 0.99$ ;  $n = 15$ , displaying positive allometry (Fig. 6), as all specimens exhibit a regular increase in growth. Conversely, the abnormal specimen was considerably less heavy than normal specimens of the same TL class. This suggests that it did not develop in the same way as other normal specimens, possibly due to the absence of the left genital apparatus, which may play an important physiological (hormonal) role in elasmobranch species (Mellinger, 1989). It is, in fact, well known that the lack of organs reduces to some degree the development of the body in elasmobranch species (see El Kamel et al., 2009).

NETIPIČNA KLASPERJA NAVADNEGA MORSKEGA PSA, *MUSTELUS MUSTELUS*  
(CHONDRICHTHYES: TRIAKIDAE) IZ SENEGALSKE OBALE (VZHODNI TROPSKI  
ATLANTIK)

*Christian CAPAPÉ*

Laboratoire d'Ictyologie, Université de Montpellier, 34 095 Montpellier cedex 5, France  
e-mail: christian.capape@umontpellier.fr

*Almamy DIABY & Youssouph DIATTA*

Laboratoire de Biologie marine, Institut fondamental d'Afrique noire, (IFAN Ch. A. Diop), Université Cheikh Anta Diop de Dakar, BP 206, Dakar, Senegal

*Sihem RAFRAFI-NOUIRA*

Unité de Recherches Exploitation des Milieux aquatiques, Institut Supérieur de Pêche et d'Aquaculture de Bizerte, Université de Carthage, BP 15, 7080 Menzel Jemil, Tunisia

*Christian REYNAUD*

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

*POVZETEK*

Avtorji poročajo o ulovu netipičnega primerka navadnega morskega psa *Mustelus mustelus* (Linnaeus, 1758). Primerek je meril 1045 mm v dolžino in tehtal 3615 g. Klasperja sta bila različna; desni je bil normalno razvit, kot je značilno za odraslega samca, levi pa manjši, zaokrožen in z veliko odprtino na trebušni strani. Preiskava trebušne votline je pokazala, da primerek nima genitalnega aparata na levri strani, kar verjetno razloži nenavadno obliko levega klasperja. Dolžinsko-masni odnos je pokazal, da je atipični primerek znatno lažji od normalnih primerkov v istem velikostnem razredu.

**Ključne besede:** *Mustelus mustelus*, atipičen primerek, masa, stanje, genitalni aparat

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