

Original scientific article
Received: 2011-09-20

UDK 591.159:597.317.5(262.26)

ABNORMALITIES IN COMMON TORPEDOS, *TORPEDO TORPEDO*
(CHONDRICHTHYES: TORPEDINIDAE) FROM THE LAGOON
OF BIZERTE (NORTHERN TUNISIA, CENTRAL MEDITERRANEAN)

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ABSTRACT

*The authors report on the capture of two abnormal specimens of common torpedo *Torpedo torpedo* Linnaeus 1758 in the Lagoon of Bizerte, northeastern Tunisia. Both specimens, one a juvenile male and the other a juvenile female, presented the pectoral fin non adherent to the head and an incomplete pelvic fin. The specimens are described and their atypical characteristics commented and discussed.*

Key words: Chondrichthyes, *Torpedo torpedo*, abnormalities, Lagoon of Bizerte, northern Tunisia

ANORMALITÀ IN TORPEDINE OCCHIUTA, *TORPEDO TORPEDO* (CHONDRICHTHYES:
TORPEDINIDAE), NELLA LAGUNA DI BIZERTE (TUNISIA SETTENTRIONALE,
MEDITERRANEO CENTRALE)

SINTESI

*Gli autori segnalano la cattura di due individui anormali di torpedine occhiuta, *Torpedo torpedo* Linnaeus 1758, nella Laguna di Bizerte, Tunisia settentrionale. Entrambi gli esemplari, un giovane maschio e una giovane femmina, presentavano pinne pettorali non aderenti alla testa e pinne pelviche (ventrali) incomplete. Nell'articolo i due esemplari vengono descritti e vengono commentate e discusse le loro caratteristiche atipiche.*

Parole chiave: Chondrichthyes, *Torpedo torpedo*, anormalità, Laguna di Bizerte, Tunisia settentrionale

INTRODUCTION

Torpedo torpedo is known in the eastern Atlantic from the Bay of Biscay (Quéro *et al.*, 2003) to Portugal (Albuquerque, 1954-1956), and south of the Strait of Gibraltar, from off Morocco (Lloris & Rucabado, 1998) to the waters of South Africa (Smith & Heemstra, 1986).

T. torpedo occurs throughout the Mediterranean Sea, but appears to be more frequently caught in southern areas (Capapé, 1989), especially off the Maghreb coast (Capapé, 1989; Bradai *et al.*, 2004). Additionally, the common torpedo was also recorded in Tunisian brackish areas such as the Bahiret El Biban (Capapé *et al.*, 2004), Tunis Southern Lagoon (Mejri *et al.*, 2004) and especially in the Lagoon of Bizerte, where a sustainable population developed and reproduced (Ben Brahim & Capapé, 1997; Ben Brahim *et al.*, 1998; El Kamel *et al.*, 2009a, b).

Investigations were conducted between 1995 and 2000 in the Lagoon of Bizerte, and of 863 specimens collected during this period two were abnormal (Ben Brahim & Capapé, 1997; Ben Brahim *et al.*, 1998). Similar investigations started again in 2006 and are still in progress (El Kamel *et al.*, 2009a, b; Mnasri *et al.*, 2010); during this time, an abnormal specimen was collected (El Kamel *et al.*, 2009a) and two abnormal embryos were found in a pregnant female (Mnasri *et al.*, 2010).

The aim of this paper is to present and describe these new cases of abnormality recorded in the Lagoon of Bizerte and to comment on atypical characteristics found in torpedinid species.

MATERIAL AND METHODS

Two abnormal specimens were found on 2 October 2010 and 5 October 2010, respectively, and both were caught by gill-nets having 26 mm mesh size, at depth not exceeding 10 m, on sandy bottom, by 37°12'06.76" N and 9°54'13.86" E (Figs. 1, 2).

Fresh specimens were identified soon after capture following Quignard & Capapé (1974), Capapé & Desoutter (1981) and Mejri *et al.* (2004), measured to the nearest millimetre and weighed to the nearest decigram following Mejri *et al.* (2004). Morphometric measurements, meristic counts and total body mass recorded in both abnormal specimens and 4 normal specimens of similar size class are presented in Table 1. The latter specimens were included in order to compare percents of total length, carried out for each measurement, between abnormal and normal specimens.

All specimens from Table 1 were preserved in 10% buffered formalin and deposited in the Ichthyologi-

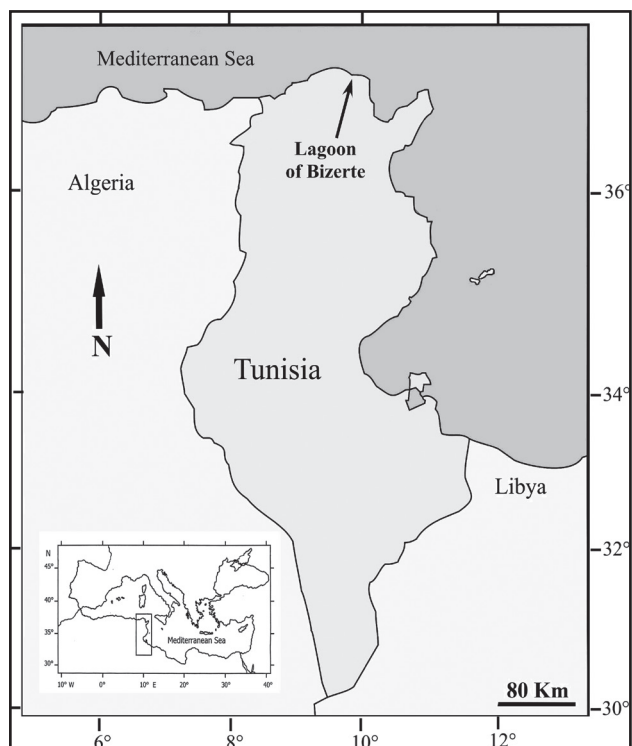


Fig. 1: Map of the Mediterranean showing the Tunisian coast and pointing out the Lagoon of Bizerte. Sl. 1: Zemljevid Sredozemlja z obalo Tunizije in označeno Laguno Bizerte.

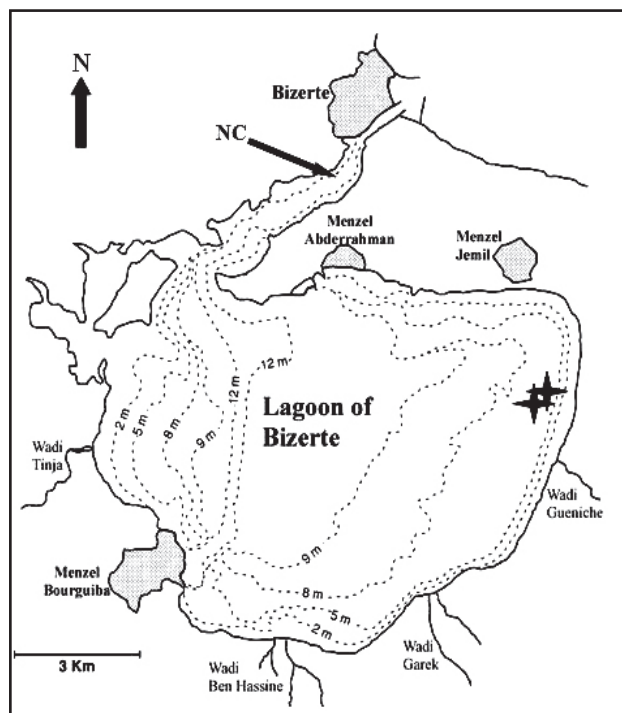


Fig. 2: Map of the Lagoon of Bizerte showing the capture site (black stars) of the abnormal torpedos (FSB T-torp.08 and T-torp.09). Sl. 2: Zemljevid Lagune Bizerte z označenima mestoma ulova (črni zvezdi) abnormalnih primerkov električnega skata (FSB T-torp.08 in T-torp.09).

cal Collection of the Faculté des Sciences of Bizerte (Tunisia). The two abnormal specimens received the catalogue numbers: FSB T.-torp 08 and FSB T.-torp 09,

respectively, while the 4 normal specimens were catalogued from FSB T.-torp 10 to FSB T.-torp 13.

Tab. 1: Morphometric measurements and meristic counts recorded in the abnormal common torpedos (FSB T.-torp.08 and FSB T.-torp.09), and 4 normal common torpedos (FSB T.-torp.10 to FSB T.-torp.13).

Tab. 1: Morfometrični in meristični podatki za abnormalna primerka (FSB T.-torp.08 in FSB T.-torp.09) in 4 normalne primerke navadnega električnega skata (FSB T.-torp.10 do FSB T.-torp.13).

References	FSB T.-torp.08		FSB T.-torp.09		FSB T.-torp.10		FSB T.-torp.11		FSB T.-torp.12		FSB T.-torp.13	
Sex	M		F		F		M		F		M	
Condition	abnormal		abnormal		normal		normal		normal		normal	
Total mass (g)	259.8		47.40		254.30		226.90		63.4		50	
Morphometric measurements	mm	% of TL	mm	% of TL	mm	% of TL	mm	% of TL	mm	% of TL	mm	% of TL
Total length	260.0	100.0	150.4	100.0	260.0	100.0	260.0	100.0	156.4	100.0	149	100.0
Disk-length	132.0	50.8	72.3	48.1	127.0	48.8	130.0	50.0	79	50.5	80	53.7
Disk-width	160.0	61.5	89.9	59.7	156.0	60.0	155.0	59.6	93.3	59.7	100	67.1
Disk-depth	25.1	9.6	13.7	9.1	22.0	8.5	24.0	9.2	10.9	7.0	11.3	7.6
Eyeball length	6.5	2.5	4.4	2.9	6.9	2.7	6.4	2.5	5.4	3.5	4.8	3.2
Cornea	3.9	1.5	2.2	1.4	3.4	1.3	3.0	1.2	2.2	1.4	2.8	1.9
Pre-orbital length	16.3	6.3	9.9	6.6	17.6	6.8	17.4	6.7	10.5	6.7	10.9	7.3
Inter-orbital width	14.4	5.5	7.1	4.7	11.5	4.4	13.4	5.2	7.3	4.7	8.3	5.6
Nasal curtain	15.3	5.9	8.7	5.8	14.5	5.6	14.7	5.7	7.8	5.0	8.4	5.6
Spiracle diameter	4.8	1.8	3.6	2.4	4.6	1.8	4.5	1.7	3	1.9	2.8	1.9
Inter-nasal width	12.9	5.0	7.0	4.6	11.5	4.4	11.2	4.3	6.3	4.0	6.1	4.1
Space between eye and spiracle	6.8	2.6	3.6	2.4	5.6	2.2	4.8	1.8	3.8	2.4	3	2.0
Inter-spiracular width	13.3	5.1	7.5	5.0	10.8	4.2	11.6	4.5	8.7	5.6	7.8	5.2
Pre-oral length	21.1	8.1	11.5	7.6	13.9	5.3	14.3	5.5	7.8	5.0	13	8.7
Mouth width	15.2	5.8	10.6	7.0	16.2	6.2	17.6	6.8	11.3	7.2	8.9	6.0
First gill slit	5.5	2.1	2.5	1.7	7.6	2.9	6.4	2.5	3.4	2.2	3	2.0
Second gill slit	5.3	2.0	2.8	1.9	6.7	2.6	6.9	2.7	3.6	2.3	3.6	2.4
Third gill slit	5.7	2.2	3.1	2.1	7.0	2.7	8.1	3.1	3.6	2.3	3.6	2.4
Fourth gill slit	6.7	2.6	3.0	2.0	6.9	2.7	7.2	2.8	3.9	2.5	3.7	2.5
Fifth gill slit	6.0	2.3	2.3	1.5	4.4	1.7	5.6	2.2	3.1	2.0	3.3	2.2
Width between first gill slit	38.6	14.8	21.4	14.2	35.3	13.6	36.5	14.0	24	15.3	20.9	14.0
Width between fifth gill slit	36.8	14.2	20.1	13.3	34.1	13.1	33.2	12.8	23.3	14.9	19.9	13.4
Snout tip to eye	22.0	8.5	11.4	7.6	21.2	8.2	21.9	8.4	12.8	8.2	12.5	8.4
Snout tip to mouth	26.3	10.1	13.6	9.0	23.0	8.8	25.0	9.6	14	9.0	12.7	8.5
Snout tip to first gill slit	49.3	19.0	30.2	20.1	53.0	20.4	54.0	20.8	32.5	20.8	29	19.5
Snout tip to fifth gill slit	74.5	28.6	43.4	28.9	83.0	31.9	82.0	31.5	48.8	31.2	45.4	30.5
Snout tip pelvic fin	120.8	46.5	72.7	48.3	132.0	50.8	127.0	48.8	69.7	44.6	70.6	47.4
Snout tip to vent	136.9	52.6	80.0	53.2	145.0	55.8	143.0	55.0	82.6	52.8	78.6	52.8

Pectoral fin anterior margin	67.8	26.1	39.8	26.4	56.0	21.5	49.2	18.9	44.2	28.3	35.7	24.0
Pectoral fin posterior margin	89.3	34.4	48.8	32.4	88.7	34.1	87.6	33.7	49	31.3	48.2	32.3
Pectoral fin inner margin	10.2	3.9	6.3	4.2	8.1	3.1	8.2	3.2	4.5	2.9	6	4.0
Pelvic fin anterior margin	31.1	12.0	17.1	11.4	27.6	10.6	28.4	10.9	20.2	12.9	14.4	9.7
Pelvic fin posterior margin	46.6	17.9	26.3	17.5	46.7	18.0	33.7	13.0	26.8	17.1	25.7	17.2
Pelvic fin inner margin	7.9	3.0	3.9	2.6	7.9	3.0	3.7	1.4	7	4.5	6	4.0
Span of pelvic fins	8.9	3.4	42.1	28.0	79.0	30.4	98.0	37.7	48	30.7	48.3	32.4
Tail base width	19.8	7.6	10.5	7.0	51.1	19.7	47.6	18.3	32	20.5	14.3	9.6
Tail base depth	25.3	9.7	6.6	4.4	16.1	6.2	16.2	6.2	5.5	3.5	8.8	5.9
Tail length	89.1	34.3	49.3	32.8	131.5	50.6	131.0	50.4	76.8	49.1	58.7	39.4
Snout tip to first dorsal	155.0	59.6	91.1	60.5	165.0	63.5	160.0	61.5	93	59.5	93	62.4
Snout tip to second dorsal	185.0	71.2	105.8	70.3	195.0	75.0	191.0	73.5	111.5	71.3	111	74.5
Snout tip to birth of dorsal caudal	215.0	82.7	122.0	81.1	221.0	85.0	217.0	83.5	124.9	79.9	125	83.9
Snout tip to birth of ventral caudal	213.0	81.9	119.6	79.5	218.0	83.8	215.0	82.7	123.2	78.8	123	82.6
Caudal superior	37.1	14.3	20.1	13.4	39.5	15.2	43.0	16.5	23.9	15.3	23.4	15.7
Caudal inferior edge	34.9	13.4	18.1	12.0	32.1	12.3	34.1	13.1	19.4	12.4	19	12.8
Caudal posterior edge	42.6	16.4	16.0	10.6	40.1	15.4	38.4	14.8	24	15.3	24.1	16.2
First dorsal anterior edge	29.8	11.5	17.1	11.4	29.9	11.5	32.8	12.6	18.2	11.6	18.2	12.2
First dorsal posterior edge	20.7	8.0	9.1	6.1	18.8	7.2	24.6	9.5	11.8	7.5	9.9	6.6
First dorsal inner edge	7.6	2.9	3.7	2.5	1.5	0.6	2.5	1.0	2.5	1.6	4.2	2.8
First dorsal base	17.1	6.6	9.4	6.3	16.5	6.3	19.0	7.3	14.5	9.3	9.6	6.4
Second dorsal anterior edge	24.3	9.3	11.4	7.6	21.3	8.2	25.3	9.7	15.5	9.9	13.8	9.3
Second dorsal posterior edge	15.4	5.9	5.1	3.4	13.1	5.0	15.4	5.9	7.3	4.7	7.2	4.8
Second dorsal inner edge	6.4	2.4	4.2	2.8	0.7	0.3	1.3	0.5	1.3	0.8	4.3	2.9
Second base	14.3	5.5	7.4	4.9	10.5	4.0	13.1	5.0	9.9	6.3	6.9	4.6
Inter-dorsal distance	12.0	4.6	5.5	3.7	10.0	3.8	14.1	5.4	5.3	3.4	6.3	4.2
Second dorsal to caudal birth	15.0	5.8	7.3	4.9	13.1	5.0	13.8	5.3	6.3	4.0	6.8	4.6
Caudal careen	45.0	17.3	18.6	12.3	44.0	16.9	43.0	16.5	14	9.0	15.4	10.3
Clasper length	39.5	15.2					34.1	13.1			18.7	12.6

RESULTS AND DISCUSSION

The first specimen, catalogued FSB T.-torp 08, was a juvenile male, exhibiting flexible claspers and having 260 mm in total length and 259.80 g in total body mass (Fig. 3). The specimen exhibited an incomplete anterior right margin disc due to the fact that the pectoral fin was not totally adherent to the head. Such morphological abnormality was more evident in ventral surface (Fig. 3B, 1) than in dorsal surface (Fig. 3A, 1). The specimen also presented an incomplete left pelvic fin (Fig. 3A, 2; Fig. 3B, 2), which was not the consequence of an injury, because no scar was externally visible on the outer margin of the fin. By contrast, the other regions of the body were normally developed, as showed by percents of total length calculated for specimens FSB T.-torp 08 to FSB T.-torp 13 (Tab. 1). Nineteen specimens of similar size class than specimen FSB T.-torp 08 were collected in the Lagoon of Bizerte; data concerning ranges and means of

their total length and total mass are presented in Table 2, and compared with total length and total mass recorded in the abnormal specimen referenced FSB T.-torp 08. No difference was observed between them.

The second specimen, catalogued FSB T.-torp 09, was 150 mm in total length and weighed 47.4 g. It was a juvenile specimen, since in Tunisian waters *Torpedo torpedo* females are considered adult at total length over 275 mm TL (Quignard & Capapé, 1974; Ennajar et al., 2002; El Kamel et al., 2009b). The specimen had both pectoral fins not totally adherent to the head (Fig. 4A, 1, 2, 3; Fig. 4B, 1, 2, 3), but this abnormality was very slight compared to the one described above for specimen FSB T.-torp 08. Additionally, the right pectoral fin of FSB T.-torp 09 is incompletely developed at the distal end of the posterior margin (Figs. 3, 4).

Pectoral fins non adherent to the head were found only in batoid species. Such morphological abnormalities occur when fins fail to fuse together in front of the head in early development, according to Bigelow &

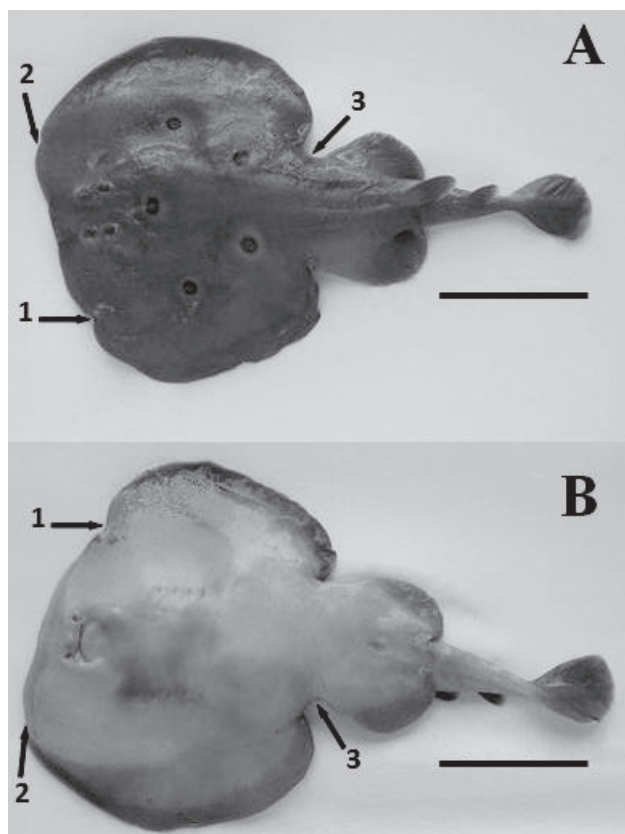


Fig. 3: Abnormal *Torpedo torpedo* (FSB T-torp.08), scale bar = 60 mm. A: dorsal surface; B: ventral surface. 1 - right pectoral fin non adherent to the head; 2 - incomplete left pelvic fin.

Sl. 3: Abnormalen primerek *Torpedo torpedo* (FSB T-torp.08), merilo = 60 mm. A: hrbtna stran; B: trebušna stran. 1 - desna prsna plavut se ne stika z glavo; 2 - nepopolna leva trebušna plavut.

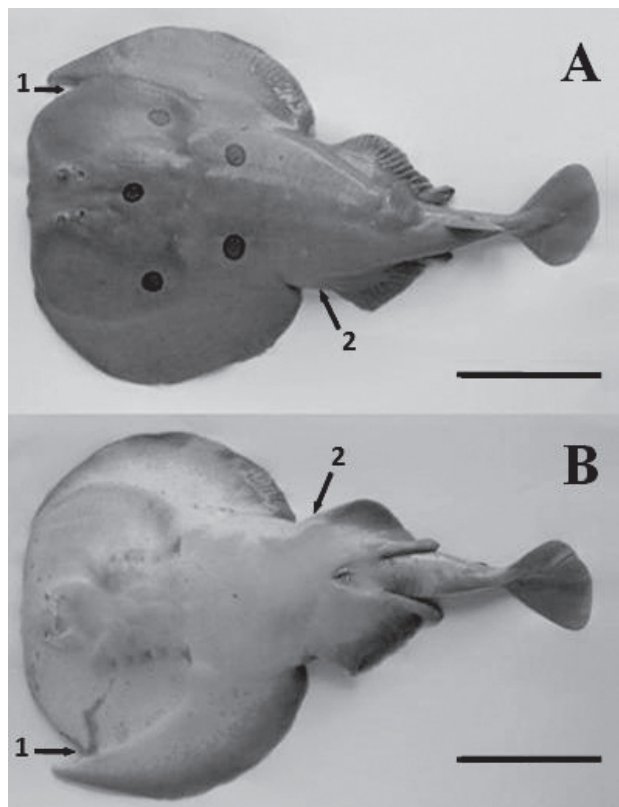


Fig. 4: Abnormal *Torpedo torpedo* (FSB T-torp.09), scale bar = 30 mm. A: dorsal surface; B: ventral surface. Right pectoral fin (1) and left pectoral fin (2) non adherent to the head; 3 - incomplete left pelvic fin.

Sl. 4: Abnormalen primerek *Torpedo torpedo* (FSB T-torp.09), merilo = 30 mm. A: hrbtna stran; B: trebušna stran. Desna prsna plavut (1) in leva prsna plavut (2) se ne stikata z glavo; 3 - nepopolna leva trebušna plavut.

Schroeder (1953) and Thorson *et al.* (1988). They are commonly recorded in rajid and dasyatid species. 24 similar cases were up to date recorded for rajid species and 11 cases for dasyatid species (Ribeiro-Prado *et al.*, 2008), with hardly any for torpedinid species. Three cases were recorded to date in free swimming specimens (Tab. 2); two cases concerned the marbled electric ray *Torpedo marmorata* Risso, 1810 and a single case concerned the black torpedo *Torpedo nobiliana* Bonaparte, 1835. Mnasri *et al.* (2010) recorded a similar pattern in two embryos carried by a pregnant female *T. torpedo*. Consequently, the two specimens herein described were the first swimming *T. torpedo* which exhibited such abnormality. They did not appear to influence the development and life of these specimens. This observation was in agreement with an interesting instance described by Oldfield (2005) in a female ocellated freshwater stingray *Potamotrygon motoro* (Müller & Henle, 1841) placed

in captivity, which gave birth to a couple of abnormal specimens. Oldfield (2005) noted that the first specimen died two days after birth while the second specimen grew rapidly, and developed a nice colour pattern.

Five specimens presenting different cases of abnormalities were reported from the Lagoon of Bizerte (Tab. 3). This relative occurrence could be explained by the pollution affecting a restricted brackish area such as the Lagoon of Bizerte, polluted by both inorganic and organic nutriment and heavy metals (Mzoughi *et al.*, 2002; Harzallah, 2003). A sustainable population of common torpedos lives buried in sandy and muddy bottoms, where such pollutants are accumulated. Additionally, a genetic origin of these abnormalities cannot be neglected in this isolated population of *T. torpedo* in which migrations from the open sea into this restricted area are reduced to a minimum. However, these suitable hypotheses need further confirmation.

Tab. 2: Comparison of total length and total mass of abnormal common torpedos (FSB T-torp.08 and FSB T-torp.09) and those of normal specimens of the same size class, all collected in the Lagoon of Bizerte.

Tab. 2: Primerjava celotne dolžine in celotne mase abnormalnih primerkov navadnega električnega skata (FSB T-torp.08 in FSB T-torp.09) in normalnih primerkov istega velikostnega razreda, vsi ujeti v Laguni Bizerte.

Abnormal specimen		Normal specimens	
FSB T-torp.08		N = 19	
Total length (mm)	Total mass (dag)	Total length: range (mean±SD)	Total mass: range (mean±SD)
260	259.8	258-261 (259.7±1.1)	194.8-274.9 (252.1±35.5)
Abnormal specimen		Normal specimens	
FSB T-torp.09		N = 9	
Total length (mm)	Total mass (dag)	Total length: range (mean±SD)	Total mass: range (mean±SD)
150.4	47.4	139-160 (148.8±8.2)	48.4-71.1 (55.2±6.5)

Tab. 3: Morphological abnormalities recorded in the ichthyological literature in specimens of the genus *Torpedo*.

Tab. 3: Morfološke nepravilnosti, zabeležene v ihtiološki literaturi pri primerkih iz rodu *Torpedo*.

Species	Case of abnormality	Marine region	Authors
<i>T. marmorata</i>	Pectoral non adherent to the head	Adriatic Sea	Valle (1931)
<i>T. marmorata</i>	Pectoral non adherent to the head	Adriatic Sea	Jardas & Homen (1977)
<i>T. nobiliana</i>	Pectoral non adherent to the head	Atlantic Ocean	Palmer & Wheeler (1958)
<i>T. torpedo</i>	Surnumerary dorsal fin	Lagoon of Bizerte	Ben Brahim & Capapé (1997)
<i>T. torpedo</i>	Lack of gill-slit	Lagoon of Bizerte	El Kamel <i>et al.</i> (2009a)
<i>T. torpedo</i>	Pectoral non adherent to the head	Lagoon of Bizerte	Mnasri <i>et al.</i> (2010)
<i>T. torpedo</i>	Pectoral non adherent to the head	Lagoon of Bizerte	Mnasri <i>et al.</i> (2010)
<i>T. torpedo</i>	Pectoral non adherent to the head Pelvic fin incomplete	Lagoon of Bizerte	This study
<i>T. torpedo</i>	Pectoral non adherent to the head Pelvic fin incomplete	Lagoon of Bizerte	This study

NEPRAVILNOSTI PRI NAVADNEM ELEKTRIČNEM SKATU, *TORPEDO TORPEDO*
(CHONDRICHTHYES: TORPEDINIDAE) IZ LAGUNE BIZERTE (SEVERNA TUNIZIJA,
OSREDNJE SREDOZEMLJE)

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POVZETEK

Avtorji članka poročajo o dveh abnormalnih primerkih električnega skata *Torpedo torpedo* Linnaeus 1758, ujetih v Laguni Bizerte, severovzhodna Tunizija. Pri obeh primerkih, eden je mladostni primerek samca, drugi pa mladostni primerek samice, so zabeležili enaki nepravilnosti, in sicer prsno plavut, ki se ne stika z glavo, in nepopolno trebušno plavut. Primerka sta opisana, njune atipične karakteristike pa komentirane in diskutirane.

Ključne besede: Chondrichthyes, *Torpedo torpedo*, nepravilnosti, Laguna Bizerte, severna Tunizija

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