

## **Atypical characteristics of an albino embryo of *Carcharhinus plumbeus* (Chondrichthyes: Carcharhinidae) from the Gulf of Gabès (southern Tunisia, central Mediterranean)**

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*An abnormal partially-albino embryo with atypical characteristics was removed from a pregnant female sandbar shark, *Carcharhinus plumbeus*, caught in the Gulf of Gabès in southern Tunisian, central Mediterranean. The specimen is described and atypical characteristics and albinism in shark species is reviewed.*

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**Key words:** Chondrichthyes, Carcharhinidae, *Carcharhinus plumbeus*, atypical characteristics, albinism, Gulf of Gabès, southern Tunisia, central Mediterranean

### **INTRODUCTION**

The sandbar shark *Carcharhinus plumbeus* (NARDO, 1824) is frequently and abundantly landed in fishing sites in the Gulf of Gabès (southern Tunisia, central Mediterranean; BRADAÏ *et al.*, 2002, 2004; SAÏDI *et al.*, 2003, 2005). The species is captured throughout the year and especially targeted in spring and early summer (SAÏDI *et al.*, 2003, 2005). Data about its reproductive biology were given by CAPAPÉ (1984) and SAÏDI *et al.* (2005). Recent investigations in the area allowed us to remove a partially albino embryo with atypical characteristics from a pregnant female.

### **DESCRIPTION OF THE SPECIMEN**

A pregnant female *C. plumbeus* was captured on a swordfish longline (hook no. 4) on a sandy substrate at a depth of 40-50 m off El Keft, 70 km south of Zarzis in southern Tunisia, on June 14, 2005 (Fig. 1). The pregnant female was 1920 mm in total length and its eviscerated mass reached 30 kg. Two of the 16 embryos carried by the mother were abnormal. Unfortunately, only one specimen was recovered, the other 15 were discarded at sea.

The embryo was a male with a total length of 320 mm and weight of 194 g (Fig. 2). It was

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Fig. 1. Map of the Gulf of Gabès and the site of capture (★) of a pregnant female sandbar shark, *Carcharhinus plumbeus*, carrying two abnormal embryos

preserved in a 5% buffered formalin solution and deposited in the Ichthyological Collection of the Institut National des Sciences et Technologies de la Mer (INSTM), Tunisia (catalogue no. INSTM/CARCHAR 02). The main morphome-

tric measurements and counts are presented in Table 1, following COMPAGNO (1984); clasper length, following COLLENOT (1969).

The snout was conical, the distal end sharp, and the ventral surface obviously rounded (Fig. 3).



Fig. 2. Abnormal male albino embryo of the sandbar shark, *C. plumbeus* (X-ray photo) (catalogue no. INSTM/CARCHAR 02; Ichthyological Collection, Institut des Sciences et Technologies de la Mer, centre de Sfax, Tunisia)

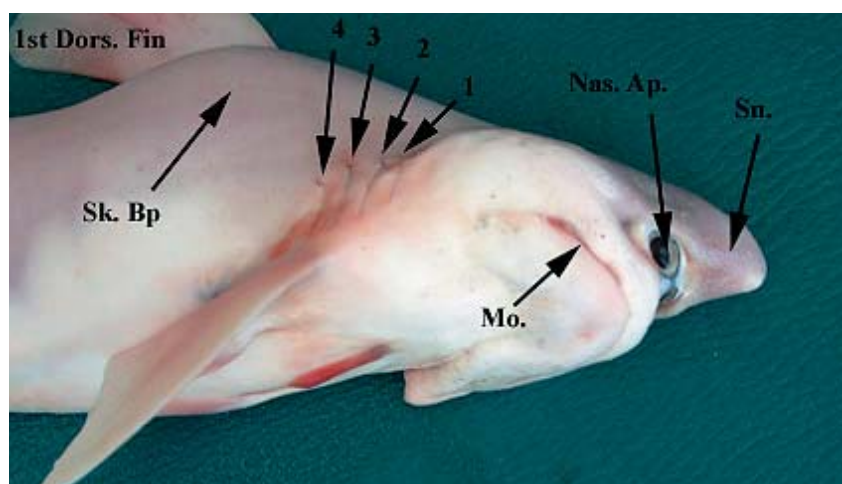


Fig. 3. Anterior part of the abnormal embryo. 1: first gill slit; 2: second gill slit; 3: third gill slit; 4: fourth gill slit; 1st Dors. Fin: first dorsal fin; Nas. Ap.: nasal aperture; Sn: snout; Sk. Bp: skeletal bump

Table 1. Size (mm) and percent of total length (% TL) of morphometric features in an abnormal male albino embryo of the sandbar shark, *Carcharhinus plumbeus*

Reference	INSTM/CARCHAR 02	
	mm	% TL
Measurements		
Total length (TL)	320	100
Fork length	260	81.3
Pre-caudal length	235	73.4
Inter-dorsal space	100	31.3
Pre-first dorsal length	85	26.6
Pre-second dorsal length	200	62.5
Mouth width	35	10.9
First dorsal base	25	7.8
First dorsal length	45	14.1
First dorsal height	20	6.3
Second dorsal base	12	3.8
Second dorsal length	20	6.3
Second dorsal height	10	3.1
Pectoral base	22	6.9
Pectoral length	38	11.9
Pectoral height	43	13.4
Pelvic base	20	6.3
Pelvic length	30	9.4
Pelvic height	13	4.1
Anal base	17	5.3
Anal length	30	9.4
Anal height	10	3.1
Space between pectoral and pelvic fins	54	16.9
Space between vent and caudal length	160	50
Eye length	10	3.1
Eye height	6	1.9
Intergill length	15	4.7
Pre-oral length	30	9.4
Pre-orbital length	15	4.7
Space between pelvic and anal fins	30	9.4
Clasper length	30	9.4

The nasal apertures were large, oval, and lacking nasal valves. The mouth was slightly rounded. There were only four gill slits; the fifth was apparently lacking. The first dorsal fin was deformed and incomplete, with a concave upper margin. There was a large spinal curvature with a pronounced bump under the first dorsal fin. The color was grayish, with large completely unpigmented areas in the spaces between the first and second dorsal fins and both flanks. The eye is small, but not red.

## DISCUSSION

During a twenty-year period, CAPAPÉ (1984, 1989) observed more than two thousand free-swimming sandbar sharks and one hundred embryos collected in Tunisian waters. Recent observations in the Gulf of Gabès (SAÏDI *et al.*, 2003, 2005) added over one thousand exemplars and two hundred embryos. Of these exemplars, only two embryos were abnormal, corroborating the view that atypical characteristics are very rare in *Carcharhinus plumbeus*, as in other shark species (HEUPEL *et al.*, 1999; BARRULL *et al.*, 2002). A literature review reveals only 33 cases of deformities in sharks (Table 2).

The snout deformity and lack of one gill slit in the present embryo may be congenital, as described by HOENIG & WALSH (1983). The large nasal apertures and lack of nasal valves may be related to the lack of the gill slit. The deformed first dorsal fin was probably the consequence of the skeletal deformity (the spinal curvature with pronounced bump).

The litter size in pregnant female sandbar sharks (1720-2185 mm TL) from the Gulf of Gabès ranges 2-12 embryos, with a positive relationship between litter size and total length (SAÏDI *et al.*, 2005). Therefore, the litter of 16 in the current female was exceptionally high and, perhaps, some embryos could not develop under optimal conditions, partially explaining the atypical characteristics of the examined specimen.

The origin of skeletal deformities generally remains uncertain. HEUPEL *et al.* (1999) attributed such deformities to parasitic infection, arthritis,

Table 2. Reported cases of deformities in sharks

Family	Species	Deformity	Reproductive mode	Capture site	Authors
1 Odontaspidae	<i>Odontaspis taurus</i>	Skeletal deformities	Aplacental viviparous	Delaware Bay (USA)	HOENIG & WALSH (1983)
2 Hemiscyllidae	<i>Hemiscyllium ocellatum</i>	Skeletal deformities	Oviparous	Western coast of Australia	HEUPEL <i>et al.</i> (1999)
3 Scyliorhinidae	<i>Scyliorhinus canicula</i>	First dorsal fin deformed	Oviparous	Off Catalogna (northern Spain)	BARRULL <i>ET AL.</i> (2002)
4 Ginglymostomatidae	<i>Nebrius concolor</i>	Lack of second dorsal fin	Aplacental viviparous	Japon	TANIUCHI & YANAGISAWA (1987)
5 Triakidae	<i>Furgaleus macki</i>	Skeletal deformities	Aplacental viviparous	Western coast of Australia	HEUPEL <i>et al.</i> (1999)
6	<i>Galeorhinus galeus</i>	Skeletal deformities	Aplacental viviparous	Southern Australia	OFFICER <i>et al.</i> (1995)
7	<i>Mustelus antarcticus</i>	Skeletal deformities	Placental viviparous	Western coast of Australia	HEUPEL <i>et al.</i> (1999)
8	<i>Mustelus punctulatus</i>	Skeletal deformities	Placental viviparous	Tunisian coast	CAPAPÉ & PANTOUSTIER (1975)
9 Carcharhinidae	<i>Carcharhinus leucas</i>	Skeletal deformities	Placental viviparous	Northwestern Atlantic	CLARK (1964)
10	<i>C. leucas</i>	Skeletal deformities	Placental viviparous	Brazilian waters	SADOWSKY (1971)
11	<i>C. leucas</i>	Skeletal deformities	Placental viviparous	Off Florida (USA)	SCHWARTZ (1973)
12	<i>Carcharhinus limbatus</i>	Skeletal deformities	Placental viviparous	Indian Waters	BENSAM (1965)
13	<i>Carcharhinus plumbeus</i>	Skeletal deformities	Placental viviparous	Off Florida (USA)	SCHWARTZ (1973)
14	<i>C. plumbeus</i>	Snout deformed	Placental viviparous	Off Long Island (USA)	HOENIG & WALSH (1983)
15	<i>C. plumbeus</i>	Snout deformed	Placental viviparous	Off Long Island (USA)	HOENIG & WALSH (1983)
16	<i>C. plumbeus</i>	Snout deformed	Placental viviparous	Off Long Island (USA)	HOENIG & WALSH (1983)
17	<i>C. plumbeus</i>	Snout deformed	Placental viviparous	Off Long Island (USA)	HOENIG & WALSH (1983)
18	<i>C. plumbeus</i>	Skeletal deformities	Placental viviparous	Off Long Island (USA)	HOENIG & WALSH (1983)
19	<i>C. plumbeus</i>	Skeletal deformities	Placental viviparous	Off Alabama (USA)	HOENIG & WALSH (1983)
20	<i>C. plumbeus</i>	Snout deformed	Placental viviparous	Gulf of Gabès	HOENIG & WALSH (1983)
		Skeletal deformities			This study
		First dorsal fin deformed			
		Lack of fourth gill slit			
21	<i>Glyphis sp. C</i>	Skeletal deformities	Placental viviparous	Western Australian freshwaters	THORNBURN & MORGAN (2004)
22	<i>Negaprion brevirostris</i>	Skeletal deformities	Placental viviparous	Off Long Island (USA)	HOENIG & WALSH (1983)
23	<i>Prionace glauca</i>	Cyclopic embryo	Placental viviparous	Japanese waters	ABE (1972)
24	<i>Traenodon obesus</i>	Skeletal deformities	Placental viviparous	Western coast of Australia	HEUPEL <i>et al.</i> (1999)
25	<i>Rhizoprionodon acutus</i>	Skeletal deformities	Placental viviparous	Indian waters	BAKHSI & SAXENA (1966)
26 Squalidae	<i>Deania profundorum</i>	Missing gill slit	Aplacental viviparous	Off southern Portugal	COELHO & ERZINI (2006)
27	<i>Squalus acanthias</i>	Bicephalic embryo	Aplacental viviparous	Black Sea	BOSINCEANO (1934)
28	<i>S. acanthias</i>	Cranial deformities	Aplacental viviparous	Florida waters	SCHWARTZ (1973)
29	<i>S. acanthias</i>	Skeletal deformities	Aplacental viviparous	Florida waters	SCHWARTZ (1973)
31	<i>S. acanthias</i>	Pelvic fin deformed	Aplacental viviparous	Southwestern England	QUÉRO (1978)
32	<i>S. blainvillei</i>	Bicephalic embryo	Aplacental viviparous	Mediterranean Spanish coast	LOZANO CABO (1945)
33	<i>S. blainvillei</i>	Lack of first dorsal spine	Aplacental viviparous	Tunisian coast	CAPAPÉ & PANTOUSTIER (1975)

injury, tumors, malnutrition, or congenital abnormality. Of seven *Glyphis* sp. C collected from western Australian freshwater bodies, three had spinal deformations (HEUPEL *et al.*, 1999) caused by genetic abnormality, indicative of inbreeding within a small gene pool (THORNBURN & MORGAN, 2004). Skeletal deformities occur in aplacental viviparous sharks such as *Galeorhinus galeus* and *Furgaleus macki* and placental sharks such as triakids and carcharhinids that develop chambers containing single embryos during gestation, as in the case of the Tunisian specimen.

A literature review revealed only twenty cases of partial and/or full albinism in 18 shark species (Table 3). The scarcity of this phenomenon may be the result of the aberrant coloration making albinos easy prey for larger specimens (TALENT, 1973). However, some albino specimens reach a large size, such as a tawny nurse shark, *Nebrius ferrugineus*, of 2904 mm TL, recorded

off Japan by TANIUCHI & YANAGISAWA (1987) and a zebra shark, *Stegostoma varium*, 1850 mm TL, caught in the Indian Ocean. TALENT (1973) first reported albinism in embryos in a viviparous species, *Mustelus californicus*, in which the entire litter was affected. The two abnormal embryos in our study were partial albinos, and the lack of pigmentation does not seem to be congenital; it may have resulted from the large number of embryos carried by the mother. No previous cases of partial or full albinism were reported for sharks in Tunisian waters and only two cases were recorded for free-swimming batoid species (CAPAPÉ & PANTOUSTIER, 1975; BEN BRAHIM *et al.*, 1998). This record is the second record of a specimen with both deformities and albinism, the first was described by TANIUCHI & YANAGISAWA (1987).

Table 3. Cases of albinism in shark species

	Family	Species	Albinism	Capture site	Authors
1	Hexanchidae	<i>Notorynchus maculatus</i>	Partial	California	HERALD (1953)
2	Cetorhinidae	<i>Cetorhinus maximus</i>	?	Norvège	FRØILAND (1975)
3	Ginglymostomatidae	<i>Nebrius concolor</i>	Full	Japon	TANIUCHI & YANAGISAWA (1987)
4	Stegostomatidae	<i>Stegostoma fasciatum</i>	Full	Indian Ocean	NAKAYA (1973)
5	Lamnidae	<i>Carcharodon carcharias</i>	Partial	?	SMALE & HEEMSTRA (1997)
6	Triakidae	<i>Mustelus californicus</i>	?	Monterey Bay	HERALD <i>et al.</i> (1960)
7		<i>M. californicus</i>	Full	California	TALENT (1973)
8		<i>M. californicus</i>	Full	California	COHEN (1973)
9		<i>M. schmittii</i>	Full	Brazil	FERREIRA TEIXERRA & GOES DE ARAUJO (2002)
10		<i>Hemitriakis japonica</i>	Partial	Japan	FURUTA (1985)
11		<i>Triakis semifasciata</i>	Full	California	FOLLETT (1976)
12		<i>Galeorhinus galeus</i>	Full	Channel	SEE DEYNAT (2003)
13	Carcharhinidae	<i>Carcharhinus amboinensis</i>	Partial	?	SEE DEYNAT (2003)
14		<i>C. plumbeus</i>	Partial	Gulf of Gabès	This study
15		<i>G. cuvier</i>	Full	Pacific (off Mexico)	SANDOVAL-CASTILLO <i>et al.</i> (2006)
16	Sphyrnidae	<i>Sphyrna lewini</i>	Full	Georgia	MCKENZIE (1970)
17	Squalidae	<i>Squalus acanthias</i>	Partial	Georgia	FRØILAND (1975)
18		<i>S. megalops</i>	Full	?	SANDA & DE MADDALENA (2003)
19	Dalatiidae	<i>D. licha</i>	Partial	Italy	BOTTARO <i>et al.</i> (2005)
20	Somniosidae	<i>Centroscymnus coelolepis</i>	Partial	NE Atlantic	DEYNAT (2003)



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**Atipične karakteristike albino embrija psa tupana  
*Carcharhinus plumbeus* (Chondrichthyes: Carcharhinidae)  
u Gabeškom zaljevu (južni Tunis, centralni Mediteran)**

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**SAŽETAK**

Neuobičajeni embrio s atipičnim obilježjima, djelomično albino, koji je odstranjen iz skotne ženke psa tupana, *Carcharhinus plumbeus* uhvaćen je u Gabeškom zaljevu (južni Tunis), centralni Mediteran. U ovom radu opisan je nađeni primjerak. Dat je pregled atipičnih obilježja i albinizma ove vrste morskog psa.

**Ključne riječi:** Chondrichthyes, Carcharhinidae, pas tupan *Carcharhinus plumbeus*, atipična obilježja, albinizam, Gabeški zaljev, južni Tunis, centralni Mediteran

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