On the occurrence of the arrowhead dogfish, *Deania profundorum* (Chondrichthyes: Squalidae) off southern Portugal, with a missing gill slit

by

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RÉSUMÉ. - Signalement d'un *Deania profundorum* (Chondrichthyes : Squalidae) capturé dans le sud du Portugal, avec absence d'une fente branchiale.

Dans ce travail, nous rapportons la capture d'un chien de mer pointe de flèche, *Deania profundorum* (Smith & Radcliffe, 1912), dans les eaux portugaises méridionales. Le spécimen, une grande femelle mature de 87,5 cm de longueur totale, n'avait que quatre fentes branchiales du côté droit, sans présenter de cicatrice à l'endroit où la cinquième fente aurait dû se situer. Des mesures comparatives entre les tailles des fentes branchiales gauches et droites amènent à conclure que la fente manquante est probablement la première.

Key words. - Chondrichthyes - Squalidae - *Deania profundorum* - ANE - Southern Portugal - Gill slit deformation - Record.

The arrowhead dogfish, *Deania profundorum* (Smith & Radcliffe, 1912), is a squalid shark characterized by a greatly elongated snout, that is spatulate dorsal-ventrally and thin-depressed laterally (Compagno, 1984). This is a widely distributed species found on both sides of the Atlantic, from the Western Sahara to South Africa and from North Carolina to the Gulf of Mexico, as well as the lesser Antilles (Compagno *et al*., 1989), Cape Verde (Reiner, 1996), Azores (Santos *et al*., 1997) and the Canary Islands (Brito *et al*., 2002). It has also been reported from the Western Indian and Western Pacific (Philippines) oceans (Compagno, 1998). This deepwater dogfish is found on or near the bottom at depths from 275 to 1785 m (Compagno, 1984). This aplacental viviparous shark feeds on small benthic and midwater bony fishes, including lanternfish, as well as squids and crustaceans (Compagno, 1984).

Some previous studies have reported deformities in elasmobranchs, especially skeletal deformities (Capapé and Pantoustier, 1975; Officer *et al*., 1995; Heupel *et al*., 1999), morphological deformities in fins (Capapé and Pantoustier, 1975; Brahim and Capapé, 1997; Barrull *et al*., 2002) and tooth deformities (Becker *et al*., 2000).

Here, we report the northernmost extension of the *Deania profundorum* in the eastern Atlantic, and the lack of a gill slit in this specimen with only four gill slits on one side of the head.

MATERIAL AND METHODS

The specimen was captured by a commercial deep-water longliner targeting wreckfish, *Polyprion americanus* (Bloch & Schneider, 1801) and European conger, *Conger conger* (Linnaeus, 1758), on 9 February 2004, 16 nautical miles southwest of Cape São Vicente, at a depth of approximately 530 m (Fig. 1).

The specimen was taken to the University of the Algarve laboratory (FCMA/DP/01/2004), where most of the measurements were taken following Compagno (1984). Some additional meristic characterics, such as the number of intestinal turns and the crown length of the dermal denticles were also recorded. The sex was determined and, after dissection, the maturity stage determined macroscopically according to the maturity stages for aplacental viviparous sharks (Stehmann, 2002).

Figure 1. - Map of the southwest coast of Portugal with location of the capture (★) of the *Deania profundorum* specimen. *[Carte de la côte sud-ouest du Portugal, indiquant le lieu de capture (★) du spécimen de* Deania profundorum.*]*

RESULTS

The specimen was a large female of 87.5 cm total length, weighing 2.42 kg (Fig. 2). It was identified on the basis of diagnostic features given by Compagno (1984): presence of a subcaudal keel on the underside of the caudal peduncle, which distinguishes this species from the others in the genus *Deania* Jordan & Snyder, 1902; and distance from the origin of the first dorsal spine to the first dorsal fin free rear tip (145 mm) only slightly greater than the distance from the free rear tip to the second dorsal spine (143 mm). The specimen also had small dermal denticles, with an average crown length of 0.21 mm (standard deviation = 0.06 mm, range = 0.15 to 0.36 mm, sample = 20 denticles), concordant with the value of 0.25 mm presented for this species by Compagno (1984). The morphometric and meristic characters are presented in table I.

This specimen presented 5 gill slits on the left side and only 4 on the right side of the head (Fig. 3). Table II presents the morphometric characteristics of the gill slits on both sides of the head.

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Figure 2. - Photograph of the *Deania pro - fundorum* specimen captured along the Portuguese south coast. Scale bar = 20 cm. *[Photographie du spécimen de* Deania profundorum *capturé dans le sud du Portugal. Barre d'échelle = 20 cm.]*

Table I. - Morphometric and meristic characterization of the *Deania profundorum* specimen. "Abs. Val." = absolute values in mm; "Rel. Val." = relative values as a percentage of TL. All values are in mm except TW (in g) and intestinal turns (absolute value). Measurements with an asterisk (*) have a precision of 0.01 mm and all others a precision of 1 mm. TW has a precision of 1 g. *[Données morphométriques et méristiques pour le spécimen de* Deania profundorum*. "Abs. Val." = valeurs absolues en mm ; "Rel. Val." = valeurs relatives, en pourcentage de LT. Toutes les valeurs sont en mm, excepté TW (en g) et le nombre de tours intestinaux (valeur absolue). Les mesures avec un astérisque (*) ont une précision de 0,01 mm, toutes les autres une précision de 1 mm. Pour TW la précision est de 1 g.]*

	Abs. Val.	Rel. Val. (%TL)		Abs. Val.	Rel. Val. (%TL)
TL (total length)	875.00		CTL (terminal caudal-fin lobe)	56.00	6.40
FL (fork length)	795.00	90.86	D1L (first dorsal-fin length)	310.00	35.43
PCL (precaudal-fin length)	735.00	84.00	D1A (first dorsal-fin anterior margin)	205.00	23.43
PD2 (pre-second dorsal-fin length)	630.00	72.00	D1B (first dorsal-fin base)	245.00	28.00
PD1 (pre-first dorsal-fin length)	225.00	25.71	D1H (first dorsal-fin height)	45.00	5.14
HDL (head length)	225.00	25.71	D1I (first dorsal-fin inner margin)	63.00	7.20
PG1 (prebranchial length)	180.00	20.57	D1P (first dorsal-fin posterior margin)	110.00	12.57
PSP (prespiracular length)	135.00	15.43	D2L (second dorsal-fin length)	141.00	16.11
POD (preorbital length)	84.00	9.60	D2A (second dorsal-fin anterior margin)	89.00	10.17
PP1 (prepectoral-fin length)	225.00	25.71	D2B (second dorsal-fin base)	108.00	12.34
PP2 (prepelvic-fin length)	560.00	64.00	D2H (second dorsal-fin height)	58.00	6.63
SVL (snout-vent length)	610.00	69.71	D2I (second dorsal-fin inner margin)	34.00	3.89
IDS (interdorsal space)	175.00	20.00	D2P (second dorsal-fin posterior margin)	91.00	10.40
DCS (dorsal caudal-fin space)*	24.00	2.74	P2L (pelvic-fin length)	95.00	10.86
PPS (pectoral-fin pelvic-fin space)	320.00	36.57	P2A (pelvic-fin anterior margin)	67.00	7.66
PCA (pelvic-fin caudal-fin space)	125.00	14.29	P2B (pelvic-fin base)	61.00	6.97
VCL (vent caudal-fin length)	115.00	13.14	P2H (pelvic-fin height)	45.00	5.14
PRN (prenarial length)*	44.46	5.08	P2I (pelvic-fin inner margin)	52.00	5.94
POR (preoral length)*	118.04	13.49	P2P (pelvic-fin posterior margin)	49.00	5.60
EYL (eye length)*	35.16	4.02	CPH (caudal-fin peduncle height)	30.00	3.43
EYH (eye height)*	17.39	1.99	MOL (mouth length)*	9.65	1.10
P1A (pectoral-fin anterior margin)	100.00	11.43	MOW (mouth width)*	53.81	6.15
P1B (pectoral-fin base)	55.00	6.29	ULA (upper labial furrow length)*	21.64	2.47
P1I (pectoral-fin inner margin)	66.00	7.54	LLA (lower labial furrow length)*	17.49	2.00
P1P (pectoral-fin posterior margin)	56.00	6.40	NOW (nostril width)*	12.91	1.48
P1H (pectoral-fin height)	103.00	11.77	INW (internarial space)*	33.56	3.84
P1L (pectoral-fin length)	95.00	10.86	ANF (anterior nasal flap length)*	3.36	0.38
CDM (dorsalcaudal-fin margin)	148.00	16.91	INO (interorbital space)*	54.83	6.27
CPV (preventral caudal-fin margin)	92.00	10.51	SPL (spiracle length)*	10.10	1.15
CPU (upper postventral caudal-fin margin)	55.00	6.29	ESL (eye spiracle space)*	12.98	1.48
CPL (lower postventral caudal-fin margin)	26.00	2.97	GIR (girth)	265.00	30.29
CFW (caudal-fin fork width)	61.00	6.97	1st dorsal spine origin to 1st dorsal rear tip	145.00	16.57
CFL (caudal-fin fork length)	94.00	10.74	1st dorsal free rear tip to 2nd dorsal spine	143.00	16.34
CST (Subterminal caudal-fin margin)	27.00	3.09	TW (total weight)	2420.00	
CSW (Subterminal caudal-fin width)	44.00	5.03	Intestinal turns	25.00	
CTR (terminal caudal-fin margin)	56.00	6.40	Dermal denticles crown length	0.21	

The macroscopic inspection of the reproductive organs, with the vent widely opened and relaxed, the uteri without embryos but very enlarged and with remains of blood, and the gonads at an immature stage, suggests that this was a post partum female.

DISCUSSION

In eastern Atlantic, *Deania profondorum* occurs generally in more southern waters, up to the latitude of the Western Sahara, making this capture the northern-most for the species. In addition,

Table II. - Left side and right side measurements of the gill slits of this *Deania profundorum* specimen. "Abs. Val." = absolute values in mm: "Rel. Val." = relative values as a percentage of TL. All values have a precision of 0.01 mm. *[Mesures des fentes branchiales droites et gauches du spécimen de* Deania profundorum. *"Abs. Val." = valeurs absolues en mm et "Rel. Val." = valeurs relatives, en pourcentage de LT. Toutes les valeurs ont une précision de 0,01 mm.]*

Left Side	Abs. Val.	Rel. Val. (%TL)	Right Side	Abs. Val.	Rel. Val. (%TL)
GS1 (first gill slit height)	13.19	1.51	GS1 (first gill slit height)		
GS2 (second gill slit height)	11.92	1.36	GS2 (second gill slit height)	10.17	1.16
GS3 (third gill slit height)	12.33	1.41	GS3 (third gill slit height)	11.50	1.31
GS4 (fourth gill slit height)	12.03	1.37	GS4 (fourth gill slit height)	12.74	1.46
GS5 (fifth gill slit height)	17.35	1.98	GS5 (fifth gill slit height)	16.49	1.88
ING (intergill length)	32.49	3.71	ING (Intergill length)	30.38	3.47

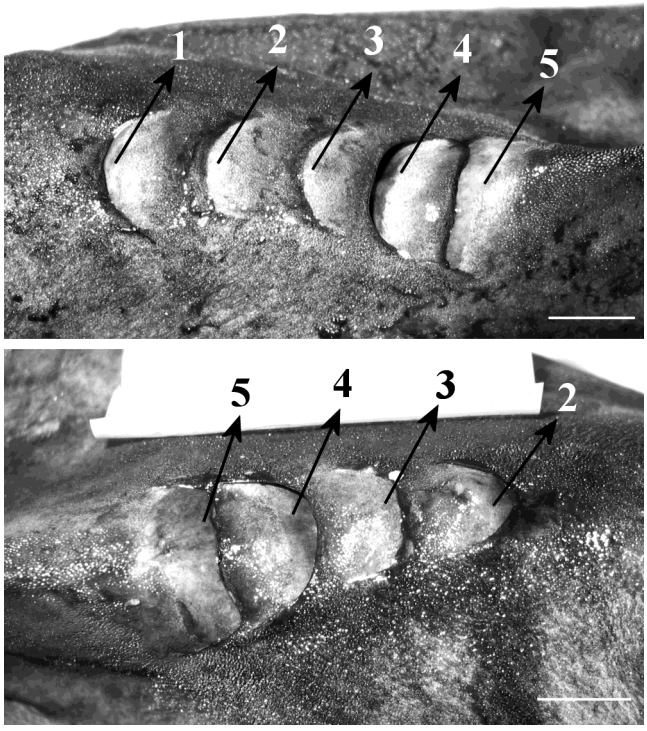

Figure 3. - Photographs of gill slits on the left (top) and right side (bottom) of the *Deania profundorum* specimen. Scale bars = 10 mm. *[Photographies des fentes branchiales gauches (en haut) et droites (en bas) du spécimen de* Deania profundorum. *Barres d'échelle = 10 mm.]*

this specimen was larger than the maximum size (i.e., 76 cm for females) given by Compagno (1984).

The gill slits area of this specimen showed no evident scars, suggesting that the missing gill slit on the right side of the head was a real lack and not the result of a previous wound. Comparison of the height of the gill slit on the right and left side suggests that the missing one was probably the first one, since the others had comparable sizes between them.

A few studies have reported deformities in elasmobranches, and to our best knowledge this is the first description of a shark lacking a gill slit on one side of the head. Officer *et al*. (1995) reported vertebral deformities in a female tope shark, *Galeorhinus galeus* (Linnaeus, 1758), and suggested that the deformity was the result of an internal injury, showing evidence of internal resorption of mineralized tissue. Heupel *et al*. (1999) reported skeletal deformities in four species of elasmobranchs from Australia, the whitetip reef shark, *Triaenodon obesus* (Rüppell, 1837), the epaulette shark, *Hemiscyllium ocellatum* (Bonnaterre, 1788), the gummy shark, *Mustelus antarcticus* Günther, 1870, and the whiskery shark, *Furgaleus macki* (Whitley, 1943). These authors did not present any explanation for the occurrence of these deformities, but suggested a common cause, due to the similarities of the disorders across different species. Capapé and Pantoustier (1975) described a series of deformities in several species. They described skeletal deformities in an embryo of *Mustelus mediterraneus* Quignard & Capapé, 1972 (current valid name is *Mustelus punctulatus* Risso, 1827) and concluded that these deformities were not genetic but the result of the embryo position in the abdominal cavity of the female. The same authors described the total absence of the first dorsal spine in a *Squalus blainville* (Risso, 1827) that was not accidental but congenital. They also described a separation of the pectoral fin at the rostrum level in a *Raja radula* Delaroche, 1809. Although no explanation for this anomaly is known, the authors stated that the anomaly was not accidental but probably had an embryological origin. Other authors have described deformities in fins. Barrull *et al*. (2002) described morphological deformities in both the first dorsal and caudal fins of a *Scyliorhinus canicula* (Linnaeus, 1758) and forwarded the hypothesis that these deformities may have been caused either by genetic mutation or due to a bite, although the lack of bite wounds might suggest that the cause was genetic. Brahim and Capapé (1997) described a *Torpedo torpedo* (Linnaeus, 1758) that had an additional dorsal fin that did not seem to be supported by rays. However, the authors suggested that submicroscopic rays, undetectable by radiography, might have supported the dorsal fin. Becker *et al*. (2000) described a series of deformed teeth in both modern and fossil chondrichthyans and concluded that most of these deformities are related with feeding injuries to the tooth forming tissue of the jaws.

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