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Scientific Note

Record of a tailless Richardson's ray *Bathyraja richardsoni* (Garrick, 1961) (Rajiformes: Arhynchobatidae) caught off the Mid-Atlantic ridge

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Abstract. This note reports a complete loss of tail in young female Richardson's ray *Bathyraja richardsoni.* Some morphometric measurements are provided and compared with those of normal females of similar size. We suggest this loss of tail is result of predation on this specimen during juvenile state.

Keywords: abnormalities, skate**,** tail loss, morphometrics, the North Atlantic

Resumen. Registro de una raya de Richardson sin cola, *Bathyraja richardsoni* (Garrick, 1961) (Rajiformes: Arhynchobatidae) capturada aguas afuera de la dorsal Medio Atlántica. Se cita por primera vez la ausencia total de cola en rayas de la familia Arhynchobatidae en general y en la raya de Richardson *Bathyraja richardsoni* en particular. Se sugiere que esta pérdida de la cola es resultado de predación sobre este ejemplar durante su estado juvenil.

Palabras clave: anormalidades, rajídeo, ausencia de cola, morfometría, dorsal Medio-Atlántica

The Richardson's ray is distributed in the North Atlantic from the North America to Europe (Forster 1965, 1967, 1968, Tempelman 1973a, 1973b, Stehmann & Bürkel 1984, Clarke 2000, Stehmann & Merrett 2002, Orlov *et al.* 2006) and also is known from off New Zealand (Garrick 1961). Any morphological abnormalities in this species were never previously described. The main purpose of this report is to document the first record of a completely tailless specimen of the Richardson's ray *Bathyraja richardsoni* from the Mid-Atlantic ridge and to compare some characters of its external morphology with those of females of similar size.

The specimen was caught 20 June 2004 in a bottom trawl during international MAR-ECO expedition aboard Norwegian RV "G.O. Sars" (www.mar-eco.no) in the area of Mid-Atlantic ridge (superstation 62, local station 380, latitude 51º55'04" N, longitude 30º25'02" W) at depth 1911 m. The skate was initially frozen and subsequently, along with other material, was transported to Zoological Museum of Bergen University (Norway) where it was first preserved in formalin and then transferred to alcohol. It is currently deposited in the Zoological Museum of the University of Bergen (catalogue number ZMUB 19514). Species identification was based on characters described by Garrick (1961), Forster (1965), Tempelman (1973a, 1973b), and Stehmann & Bürkel (1984). Measurements were made according to Bigelow and Schroeder (1953) and Hubbs & Ishiyama (1968) and taken with the use of caliper to the nearest 0.1 mm. Only available measurements were made (i.e. which not required the presence of tail) and subsequently recalculated to the percent of total length. Total length (*TL*) was estimated from disc width (*DW*) using relationship:

$TL = 1.466\ DW + 1.149$ ($R^2 = 0.998$), based on examination of 12 females.

For comparative purposes, three female Richardson's rays of similar size: ZMUB 19364, ZMUB 19522, and BMNH 1999.10.1 (institutional abbreviations follow Leviton *et al.* (1985)) were examined in terms of the same morphological characters as in ecaudate specimen.

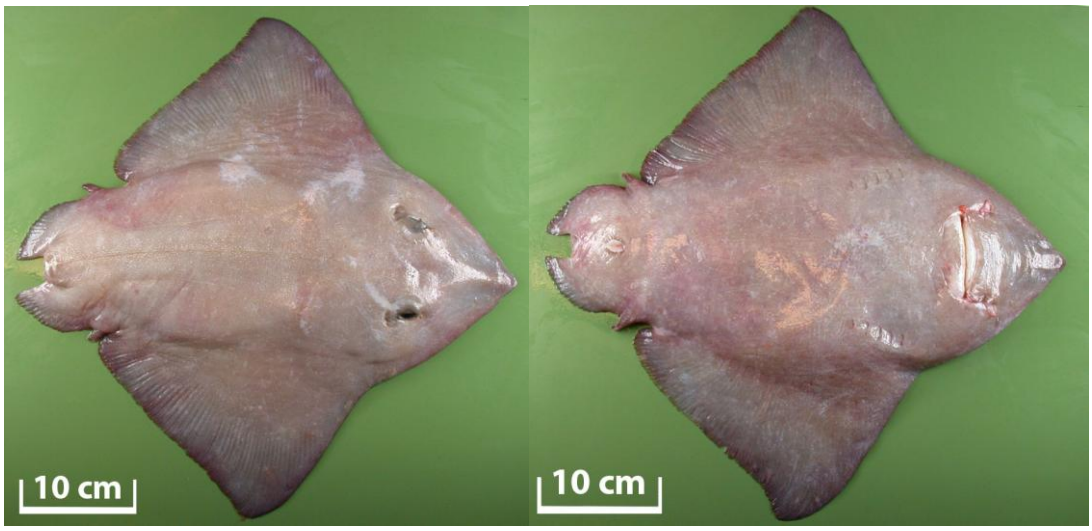

Figure 1. Ecaudate female of the Richardson's ray, *Bathyraja richardsoni*: left panel - dorsal view, right pannel – underside view.

The ecaudate specimen we consider here was undoubtely Richardson's ray *Bathyraja richardsoni* (Garrick 1961) since it had typical for this species morphological characters such as long, soft and moderately pointed snout, almost entirely spinulose upper surface, no thorns on disc and others described in number of papers (Garrick 1961, Forster 1965, Tempelman 1973a, 1973b, Stehmann & Bürkel 1984). This specimen was female with a disc width of 46.9 cm and disc length of 38.1 cm (Fig. 1). The tail was absent completely (Fig. 2). The skin had grown entirely over the stub of the tail with well visible scar that testifies to remote injury, probably when the skate was young. According to opinion of Tempelman (1965), lost of the part of tail in skates could be the result of abnormal development or predation. We suggest that the reason of tail loss in case described in this report is most likely associated with predation by sharks or other fish. Studies conducted along the Mid-Atlantic ridge (Fossen *et al.* 2008) showed that Richardson's ray in longline catches is often accompanied by various shark species and other large fishes such as *Spectrunculus* spp., grenadiers (Macrouridae), moras (Moridae), wolffishes (Anarhichadidae) that might be potential predators to juvenile Richardson's rays.

Figure 2. Caudal area of ecaudate Richardson's ray, *Bathyraya richardsoni*.

The coloration of our specimen was typical for the species (Forster 1965, Tempelman 1973a, Stehmann & Bürkel 1984). But the most distinctive coloration pattern of it were two large whitish patches of irregular shape on the left side of dorsal surface (see Fig. 1) with well visible scars inside (most likely result of predation).

Table I presents morphological measurements of ecaudate female and of three normal females of similar length. The comparison of external morphological characters showed that most of them in tailless specimen are in normal range with minor exceptions (given in bold) for preoral snout length, orbit + spiracle length, ventral head length, internasal width, width of nasal curtain lobe, space between nasal curtain lobes, length of pelvic fin posterior lobe, and distance between snout tip and maximum disc width. However, distinctions between characters of normal specimens and ecaudate one are very small and most likely reflected intraspecific variations rather than impact of the loss of tail. The data provided testify to the lack of effect of tail loss to the development and growth of specimen under question.

Table I. Some morphometric measurements of Richardson's ray *Bathyraja richardsoni* (characters of ecaudate specimen that are out of the normal range given in bold).

Character	ZMUB 19514	ZMUB 19364, 19522; BMNH 1999.10.1	
		Min-Max	Average
Morphometric measurements, mm			
Total length	689*	526-846	666
Disc width	469	371-572	456
Morphometric measurements, % TL			
Disc, width	68.1	67.6-70.5	68.6
Disc, length	55.3	56.1-57.7	56.8
Snout length, preorbital	14.7	12.2-15.4	14.2
Snout length, preoral	**14.1**	14.2-14.5	14.4
Snout length, prenasal	11.2	10.4-11.5	10.9
Orbit, horizontal diameter	2.6	2.3-5.0	3.3
Interorbital width	7.2	7.0-7.7	7.3
Spiracle length	2.2	2.1-2.7	2.4
Interspiracular width	11.5	11.1-11.8	11.4
Orbit + spiracle length	**4.8**	5.1-6.8	5.8
Head length, ventrally	**22.5**	25.4-28.3	27.0
Mouth width	10.3	10.2-11.2	10.6
Internasal width	**11.2**	11.7-12.8	12.2
Nasal curtain, length	4.3	4.1-5.5	4.8
Nasal curtain, width each lobe	**1.6**	1.9-2.3	2.1
Nasal curtain, space between lobes	**8.2**	6.5-8.1	7.3
Gill slit length, 1st	1.5	1.4-1.7	1.5
Gill slit length, 3rd	1.9	1.4-2.0	1.7
Gill slit length, 5th	1.6	1.2-1.9	1.4
Space between 1st gill slits	19.2	13.6-19.7	17.5
Space between 5th gill slits	15.6	10.3-15.8	13.6
V-length, anterior lobe	9.3	7.7-10.1	9.1
V-length, posterior lobe	**18.3**	13.2-17.1	15.8
Snout tip to center of anus	51.5	50.0-55.3	53.3
Snout tip to max. disc width	**32.4**	34.7-36.8	35.6
Snout angle	89	86-103	92.3

Note: *total length is estimated from disc width.

The number and diversity of abnormalities found in elasmobranchs are considerably less as compared to bony fishes (Dawson 1964, 1966, 1971, Dawson & Heal 1976). In our opinion, this fact is associated with more viable posterity of elasmobranchs and with lesser predation on them during their life span. The analysis of available data on anomalies found in batoids (Dawson 1964, 1966, 1971, Dawson & Heal 1976, Scenna *et al.* 2007, Escobar-Sánchez *et al.* 2008, Haas & Ebert 2008, Ramírez 2008, Ribeiro-Prado *et al.* 2008, 2009, Bornatowski & Abilhoa 2009, Mnasri *et al*. 2009, Rubio-Rodríguez 2010) showed that abnormalities of pectoral fins occur most frequently (more than 50% of cases) followed by gonadal anomalies, including hermaphrodism (ca. 7.5%), abnormal coloration, teeth, internal organs, other fins, and wounds (each by about 6%). Abnormalities of tail in batoids occurred very rare (ca. 4%) that is likely associated with extraordinary importance of this organ. Loss of part of tail due to injury are quite frequent in stingrays but in rajids occurs very rare (Clark 1926, Tempelman 1965, Ishihara *et al*. 1993). Tail in batoids serves as helm and protection tool and is used in courtship and copulation (Gurtovoj *et al.* 1976, Tricas 1980). Therefore the lost or damage of tail may result in increasing of natural mortality of the animal (especially during early life stages) or prevent normal reproduction during adulthood. Ecaudate female under consideration was able to survive, kept normal body proportions and condition. We suggest that tail loss in specimen under question did not affect its swimming capability since for locomotion batoids use pectoral fins, and tail serves them as helm (Gurtovoj *et al.* 1976, Rosenberger 2001).

The majority of abnormalities found in batoids were observed in stingrays (Myliobatoidei) and very few in skates (Rajioidei). Among latter group, the most number of anomalies are known for hardnose skates (Rajidae) and very few for softnose skates (Arhynchobatidae) (Dawson 1964, 1966, 1971, Dawson & Heal 1976, Scenna *et al.* 2007, Escobar-Sánchez *et al.* 2008, Haas & Ebert 2008, Ramírez 2008, Ribeiro-Prado *et al.* 2008, 2009, Bornatowski & Abilhoa 2009, Mnasri *et al.* 2009, Rubio-Rodríguez 2010). Presently, only few cases of tail abnormalities in batoids were known (Clark 1926, Gudger 1933, Chamberlain 1934, Tempelman 1965, Mnasri *et al.* 2009).

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