Notes on the dentition of the bigeye sandtiger shark, *Odontaspis noronhai* (Lamniformes: Odontaspididae)

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Abstract

Odontaspis noronhai (Maul) is a rare extant lamniform shark. In this paper, dental data of this species are reviewed, and new data are added based on one previously unreported jaw specimen. The specimen shows a notable intraindividual tooth variation, particularly near the jaw symphysis.

1.Introduction

The bigeye sandtiger shark, Odontaspis noronhai (Maul), is arguably the most rarely reported extant lamniform species (Odontaspididae; Fig. 1A). While some additional specimens have been caught occasionally (G. Hubbell, pers. comm., 1998), only seven specimens of this species have been described to date (Branstetter and McEachran, 1986; Humphreys et al., 1989; Maul, 1955; Sadowsky et al., 1984). Odontaspis noronhai is reported from the Atlantic, Pacific, and Indian(?) Oceans. It is often classified as a "deepwater" shark, captured at depths ranging from about 450 m (Humphreys et al., 1989) to 800-1000 m (Maul, 1955), but it has also been captured within the upper 100 m of water (Branstetter and McErchran, 1986). The total length (TL) of this shark ranges up to about 360 cm (Compagno, 1984). Its feeding biology is poorly known, but it apparently feeds on squid and teleosts based on the stomach contents of one specimen (Branstetter and McEachran, 1986).

Gordon Hubbell (GH) collection (JAWS International, Key Biscayne, Florida, U.S.A.) is one of the largest and best modern shark jaw collections in the world, which has been referred to in several scientific papers (e.g., Gruber and Compagno, 1981; Randall, 1987; Applegate and Espinosa-Arrubarrena, 1996; Hubbell, 1996). One of the specimens is a set of jaws of an unreported *Odontaspis* noronhai individual (GH-Odont2-01; sex unknown; referred to also in Shimada, in press; Fig. 2; for dental measurements, see Appendix). The individual was presumably caught from the western Pacific Ocean. Its exact TL is unknown, but it is estimated to be about 3 m TL (G. Hubbell, pers. comm., 1998). In addition to reviewing published dental data of *O. noronhai*, the aim of this report is to describe some dental features not previously reported for this species.

2.Dental morphology

Odontaspis noronhai has moderately large teeth with a prominent central cusp, one pair of lateral cusplets, and moderately arched root lobes (Compagno, 1984; Quero, 1984; Fig. 1B). Based on GH-Odont2-01 (Fig. 2) and published illustrations (e.g., Compagno, 1984), the central cusp is awl-shaped with a smooth surface. Each central cusp is narrow at the occlusal half with well-defined mesial and distal cutting edges and is rather robust toward the base. The central cusp of most non-symphysial teeth strongly curves lingually and is nearly symmetrical or slightly inclined distally. Each lateral cusplet is straight and tends to point away from its central cusp. There may be as many as five "functional" tooth series.

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Fig.1. The bigeye sandtiger, Odontaspis noronhai (for body size, see text). 1, whole body in lateral view (after Compagno, 1984); 2, upper and lower dental series in labial view (mesial to the left; after Shimada, in press; for size of teeth, see Appendix). Abbreviations: A, upper anterior teeth; a, lower anterior teeth; I, upper intermediate tooth; i, lower intermediate tooth; L, upper lateral teeth; I, lower lateral teeth; s, lower symphysial teeth.



Fig.2. Jaw specimen of *Odontaspis noronhai* described in this paper (GH-Odont2-01).



Fig.3. Mesial portion of left upper and lower dental series of *Odontaspis noronhai* (GH-Odont2-01; labial view; mesial to the left; "S" from the right dental series [image reversed]; abbreviations, A1, first upper anterior tooth; a1, first lower anterior tooth; S, upper symphysial tooth; s, lower symphysial teeth).

GH-Odont2-01 possesses a small symphysial tooth (Fig. 3) in the right upper dental bulla (sensu Shimada, in press) with no replacement series behind it. The tooth consists of a mesially directed, short, conical crown, robust neck (twice as high as the crown), and a short(?), unbifurcated root. In the lower left dental bulla, four types of symphysial teeth are present (Fig. 3). While the mesialmost one has no replacement series, each of the other types forms a distinct tooth row. The size of the four types of lower symphysial teeth increases from mesial to distal. All show a sharply pointed, nearly symmetrical central cusp with a bilobed root, except the mesialmost one having an unbifurcated root and the second one showing amesially directed cusp. The mesialmost tooth lacks lateral cusplets or heels. The distalmost one has one pair of lateral cusplets, and the middle two possess well-marked mesial and distal heels.

3. Tooth row count

Contrary to its rarity, each described specimen of *Odontaspis noronhai* includes reasonable row count data. Based on Shimada (1999), Shimada (inpress) gave its row count range of 17-22 for the upper jaw (mode = 20 rows) and 17-24? for the lower jaw (mode = 22 rows). In this species, variation in the row number occurs in symphysial teeth (Humphreys *et al.*, 1989; Sadowsky *et al.*, 1984), in upper intermediate teeth (Humphreys *et al.*, 1989), and in lateral teeth (Shimada, in press).

Branstetter and McEachran (1986) noted that the 171cm-TL holotype of *Odontaspis noronhai* has one upper symphysial tooth row on each side, while larger specimens of this species have a symphysial tooth row only on one side or none at all. Branstetter and McEachran considered that symphysial teeth must disappear through ontogeny. The holotype also has the fewest lower symphysial tooth rows among individuals reported, including GH-Odont2-01 (Shimada, 1999). Thus, one may also argue that the lower symphysial tooth rows decrease in number through ontogeny. However, such suggestions are yet to be tested statistically. It should be noted that the range of variation in the number of lower symphysial tooth rows as well as their average number are the greatest among all extant macrophagous lamniforms (see Shimada, in press).

Humphreys *et al.* (1989) noted that their specimen of *Odontaspis noronhai* possessed three rows of lower anterior teeth on each side. However, they admitted that their "third lower anterior tooth ... might also be classified as a 1st lateral tooth by other investigators" (p. 358). In

fact, the dental pattern of macrophagous lamniforms recognized by Shimada (in press) suggests that only two of the three teeth were actually the anterior teeth (Fig. 1B).

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Appendix

Crown height (first value; in mm) and basal crown width (second value; in mm) of each tooth in GH-Odont2-01 (*Odontaspis noronhai*; TL and sex unknown). For tooth types, detailed measuring protocols, and additional dental data, see Shimada (in press). All measurements are from left teeth except "S." Value in parenthesis = estimated measurement; asterisk = single tooth representing the tooth row. The length of the palatoquadrate from the symphysis to the center of the lateral quadratomandibular joint contouring the occlusal jaw rim (i.e., "UJL" of Shimada, in press) = 256 mm.

Upper teeth: S, 2.3, 1.4; A1, 13.0, 9.1; A2, (15.0), 11.0; 11, (10.0), 7.5; L1, 9.5, 8.7; L2, 11.3, 9.8; L3, 9.8, 10.0; L4, 9.7, 9.7; L5, 9.3, 9.0; L6, 8.1, 7.1; L7, 7.3, 6.7; L8, 7.0, 6.1; L9, 6.5, 5.5; L10, 5.5, 5.5; L11, 4.6, 4.6; L12, 4.4, 4.1; L13, 4.3, 4.4; L14, 3.7, 4.2; L15, 2.9, 4.2; L16, 2.8, 4.2; L17, 2.1, 3.5; L18, 1.3, 3.0.

Lower teeth: s*, 2.3, 0.9; s, 3.3, 2.1; s, 3.4, 1.8; s, 4.8, 3.3; a1, 16.7, 8.3; a2, 18.7, 10.5; i1, 15.3, 9.7; 11, 14.3, 9.5; 12, 11.6, 8.5; 13, 11.5, 8.4; 14, 10.7, 8.3; 15, 9.7, 7.3; 16, 9.3, 6.5; 17, 6.7, 6.5; 18, 5.6, 6.0; 19, 5.5, 5.4; 110, 4.8, 4.3; 111, 3.2, 3.6; 112, 3.0, 3.0; 113, 2.4, 2.8; 114, 2.3, 2.1; 115, 1.3, 1.9; 116, 1.1, 2.7.

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