

Northeast Gulf Science

Volume 8
Number 2 *Number 2*

Article 8

11-1986

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DOI: 10.18785/negs.0802.08

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Recommended Citation

Branstetter, S. and J. D. McEachran. 1986. A First Record of *Odontaspis noronhai* (Lamniformes: Odontaspidae) for the Western North Atlantic, with Notes on Two Uncommon Sharks from the Gulf of Mexico. *Northeast Gulf Science* 8 (2). Retrieved from <https://aquila.usm.edu/goms/vol8/iss2/8>

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A FIRST RECORD OF *Odontaspis noronhai* (LAMNIFORMES: ODONTASPIDIDAE) FOR THE WESTERN NORTH ATLANTIC, WITH NOTES ON TWO UNCOMMON SHARKS FROM THE GULF OF MEXICO

Large deep-water sharks are poorly known and poorly represented in museum collections for several reasons. Their large size presents difficulties in adequately preserving and storing them. In addition, open-ocean waters are not intensely fished with appropriate gear to collect these fishes. In offshore waters of the Gulf of Mexico the most common type of effort which yields sharks is the commercial swordfish/tuna longline operation during the winter months. Shark captures are still few because the gear is not designed to retain sharks, and with the limited onboard storage capabilities and lack of monetary value of sharks, they are not often landed. With the cooperation of several commercial longliners we have obtained specimens of three poorly known shark species, and report on them here.

MATERIALS AND METHODS

All specimens were collected during commercial swordfish longline operations in the western Gulf of Mexico. Longlines were fished in the upper 100 m of water along the edge of the continental shelf (140-730 m). All measurements were made on a straight line between perpendiculars and the caudal fin was placed in a natural position (Dodrill, 1977; Branstetter, 1980). Total lengths are used throughout this report. Tooth terminology follows Applegate (1965) where P = posteriors, L = laterals, I = intermediates, A = anteriors, and S = symphyseals.

The intact specimens of *Odontaspis noronhai*, *Hexanchus griseus*, and one juvenile *Carcharhinus signatus* were deposited in the Texas Cooperative Wildlife Collections (TCWC), Texas A&M University. Cleaned, dried, and varnished jaws of four other *C. signatus* were placed in the private collection of the senior author.

Odontaspis noronhai (Maul, 1955)

Odontaspis noronhai is known from only a few specimens; two from Madeira, the type locality (Maul, 1955; in litt.), nine from off Brazil (Sadovsky *et al.*, 1984), and a set of teeth from the Indian Ocean/South China sea area (Compagno, 1984; Sadovsky *et al.*, 1984). Here we report the first capture for the western North Atlantic and Gulf of Mexico. Our specimen, a 321 cm immature female (TCWC 3922.1) was taken 10 March 1984 approximately 70 miles east of Port Isabel, Texas (ca. 26° 30'N 96° 15'W) in the upper 100 m of water 640 m deep.

The specimen was identified as *O. noronhai* based on its tooth formula and the posterior position of the pelvic fins. Our specimen (Fig. 1b) differs in several aspects from the holotype (Fig. 1a); thus the specimen is completely described below. A 342 cm specimen illustrated by Sadovsky, *et al.* (1984) agrees more closely with our specimen than the holotype also.

Description: Body relatively slender. Head slightly depressed with a low rounded interorbital crest which tapers to snout tip. Snout sharply pointed; 4.9 into head length. Spiracle small, located behind and lateral to ventral margin of eye, distance from eye 1.73 into horizontal eye diameter. Eye large, vertically oval, 3.27 into snout. Upper and lower jaw labial folds short; approximately equal in length. Teeth 34/37:

(P)4-(L)10-(I)1-(A)2-(S)0--0(S)-2(A)-1(I)-10(L)-4(P)
 (P + L + I + A)16------(S)2--2(S)-----17(A + I + L + P)

teeth in lower jaw outside symphyseals gradually decreasing in length; teeth in both jaws with single cusplet on each side of main cusp; cusps smooth edged. First two gill slits equal in length, third longest, fifth shortest. Pectoral fins broadly triangular, trailing edge much shorter than leading edge. First dorsal fin low, longer than high, tip rounded; origin over tip of apressed pectoral fin. Second dorsal fin shape similar to first but distinctly smaller; origin over posterior one-third of pelvic fin base. End of pelvic fin base under anterior half of second dorsal fin base. Pelvic fins large. Anal fin triangular, sides sub-equal; origin under midpoint of free tip of second dorsal fin. Free tip of anal fin anterior to pre-caudal notch. Pre-caudal notch well developed above, slight depression present ventrally. Caudal fin broad and stout; trailing edge of fin almost a straight line between

upper and lower lobe tips; lower lobe sharply pointed, upper lobe 2.5 into pre-caudal length (PCL). All fins very ragged and darker on trailing edge. Color after freezing gray with brownish-red undertones. Lateral line produced and distinct from head to tip of upper caudal lobe in fresh specimen; not as distinct after preservation.

Members of the family Odontaspidae are poorly understood taxinomically, and the group is in need of revision (Bigelow and Schroeder, 1948; Garrick, 1974; Bass *et al.*, 1975a; Compagno, 1984). Several nominal species have been found to be varied morphs of *O. taurus* (Compagno, 1984). However, *O. noronhai* is distinguished from all other nominal species in the family except *O. ferox* (synonymized with *O. herbsti*, *vide* Compagno, 1984) by having a 2(A) tooth count in the upper jaw instead of 3(A). *O. noronhai* is distinguished from *O. ferox* in that it has only one cusplet on each side of the main cusp vs. two for *O. ferox*,

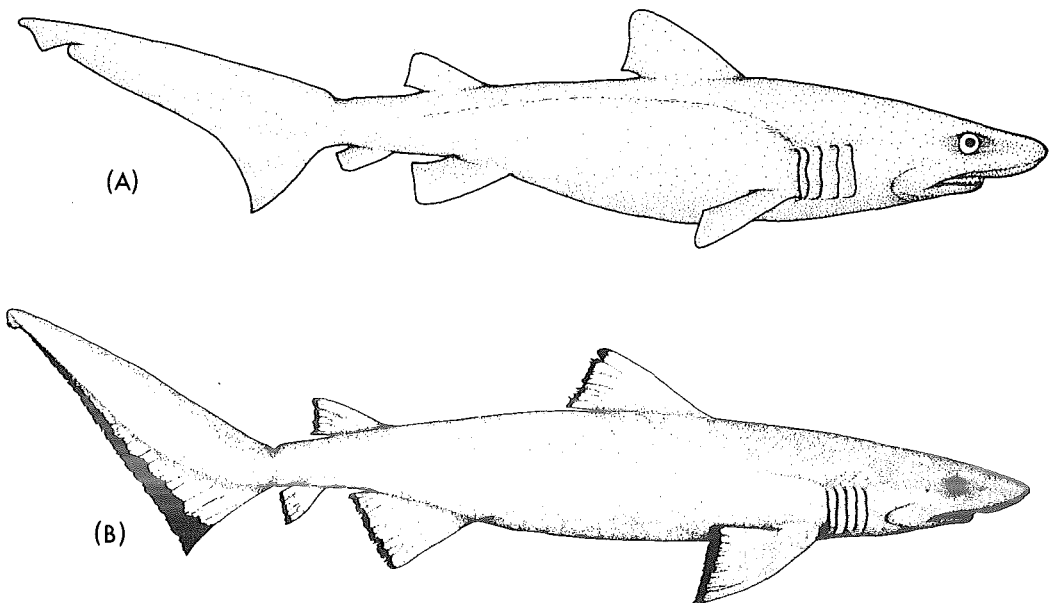


Figure 1. a) holotype of *Odontaspis noronhai* (redrawn from Maul, 1955; Fig. 4); b) *O. noronhai* from the Gulf of Mexico. Note relative differences in fin placement between the two specimens.

and it has a 1(I) tooth count in the upper jaw vs. 4(I) in *O. ferox*. *O. noronhai* has the pelvic fin base under the origin of the second dorsal fin, whereas all other nominal species in the family have the pelvic fins positioned anterior to the second dorsal fin origin.

Our specimen differs from the much smaller holotype in several morphometric and meristic characters, and the variations are assumed to be from allometric growth. However, the holotype was stuffed, and some morphometric differences may be an artifact of the difference in preservation methods. A second smaller specimen from Madeira which was preserved in liquid more closely matches our specimen in morphometrics as do the large specimens taken from off Brazil (Table 1). The lack of upper jaw symphyseal teeth in our specimen (Fig. 2a) is in agreement with two large specimens (342, 360 cm) from off Brazil (Sadowsky *et al.*, 1984) but the much smaller holotype has a minute symphyseal file (row) on each side, and a 353 cm specimen from Brazil had one file on the left side only. These teeth must disappear with growth. In the lower jaw, our specimen has two files of symphyseal teeth on each side (Fig. 2b), in agreement with the Madeiran specimens (Maul 1955; pers. comm. 1984), and the 353 cm specimen from Brazil but the other two specimens from Brazil have 3(S) counts each side (Sadowsky *et al.*, 1984). Only the outer file of symphyseal teeth continues to the front of the jaw; the inner files are located on the inner jaw ridge (Fig. 2b). Lateral series (L) tooth counts for Brazilian specimens and the set of teeth from the Indian Ocean/South China Sea are higher (12-13) than in our specimen or the Madeiran specimens. The holotype has the second dorsal fin origin over the middle of the pelvic fin base; the anal fin origin is posterior to

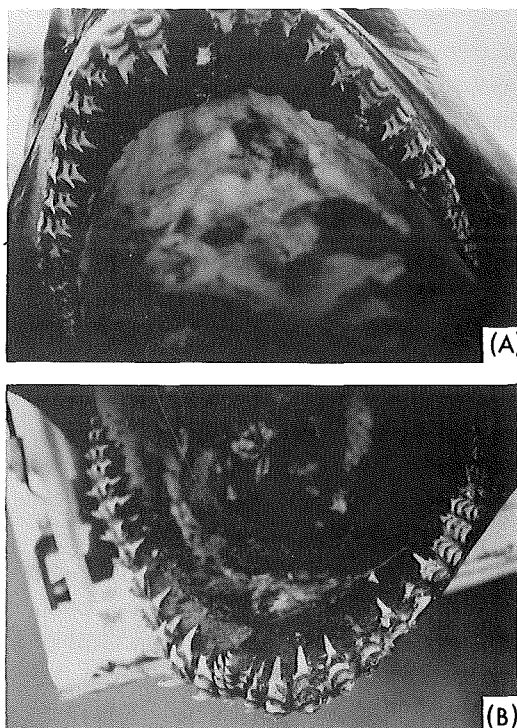


Figure 2. a) upper jaw of *Odontaspis noronhai* taken from the Gulf of Mexico showing diagnostic tooth formula and lack of symphyseal teeth; b) lower jaw of same specimen showing diagnostic tooth formula.

the free tip of the second dorsal fin; the free tip of the anal fin ends under the pre-caudal notch; the first dorsal fin origin is over the pectoral axil; the upper caudal lobe is 2.25 into pre-caudal length; eye diameter is 2.7 into snout length; and the snout is 4.0 into head length (Maul, 1955) (see description above and Fig. 1 for comparisons).

The internal anatomy of *O. noronhai* is similar to other odontaspidids. Our specimen is immature with little reproductive tract development. The functional right ovary is approximately 10 x 5 cm with no follicles present. Oviducts are small and tubular, 1 cm in diameter. The uteri are short (< 50 cm) and 3 cm in diameter. The hymen covering the distal end of the uteri is intact. Stomach contents consisted of a squid beak and otoliths. The spiral valve is of corkscrew type with ca. 30 turns (anterior

and damaged during dissection and some turns may have been destroyed). The liver lobes extend the length of the body cavity and contain much oil. The rectal gland is well developed.

Hexanchus griseus (Bonnaterre, 1788)

The sixgill shark is found worldwide in temperate and tropical deep waters (Castro, 1983), but is uncommon in the western North Atlantic (Springer, 1979). Specimens are occasionally taken by commercial fishermen, especially in the Caribbean, but are rare in study collections because of their large size (Springer and Waller, 1969). The species has been documented only once from the Gulf of Mexico; a 433 cm female taken off the Mississippi River south of the Mississippi/Alabama coast (Springer and Waller, 1969). We could not confirm a second capture locality south of Cape San Blas, Florida (Gulf of Mexico Fishery Management Council, 1979; fig. 4-2) from a literature search.

In February 1984 a commercial swordfish vessel caught a 325 cm mature male (TCWC 3923.1) approximately 60 miles northeast of Port Isabel, Texas (ca. 26° 20'N 96° 10'W) in the upper 100 m of water 585 m deep. The species is easily recognized by its short, blunt snout; straight hind edge of the pectoral fin; and posterior position of the dorsal fin — distance from its axil to the upper caudal lobe origin about equal to dorsal fin base (Bass *et al.*, 1975b).

This is the first confirmed record of a mature male. Size at maturity for males has not been previously documented because of confusion with the smaller *H. vitulus*. This specimen is much smaller than an immature 348 cm male noted by Springer and Waller (1969).

The pelvic fins, claspers and siphon sacs of immature specimens are dis-

cussed and illustrated by Huber (1901), Krall (1907), and Leigh-Sharpe (1922). The claspers are encased in "scrolls" formed by the inner margins of the pelvic fins, and in very young specimens the claspers are not visible (Bass *et al.*, 1975b).

For our specimen, the claspers are rigid and appear to be fully developed (8.5% TL, 11.8% PCL) (Fig. 3). The anterior half of the clasper is encased in the pelvic scroll, and the distal portion extends only slightly past the tip of the pelvic fin. The clasper lacks most of the distal elements noted in many sharks (Leigh-Sharpe, 1920, *et seq.*; Gilbert and Heath, 1972; Compagno, 1978a), and forms a simple rolled tube. Where the clasper exits the pelvic scroll, a cavernous muscular siphon sac extends laterally from the clasper groove. The siphon sacs are confined to the claspers, similar to that found in *Chlamydose-lachus anguineus* (Leigh-Sharpe, 1926; Gilbert, 1943), and *Notorhynchus cepedianus* (D. Ebert, Moss Landing Mar.

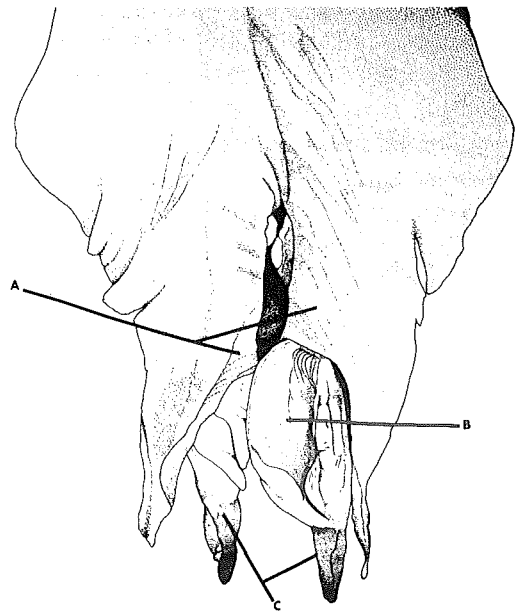


Figure 3. Pelvic fins, claspers, and siphon sacs of mature *Hexanchus griseus* taken from the Gulf of Mexico. (a) pelvic scrolls, (b) siphon sac, (c) claspers.

Table 1. Morphometric data on *Odontaspis noronhai* and *Hexanchus griseus*. Data for MP 547 from Sadowsky, *et al.* (1984); for MMF 2691 (holotype) and MMF 3376 from Maul (1955, and pers. comm. July 1984).

Measurement	<i>O. noronhai</i>					<i>H. griseus</i>	
	TCWC 3922.1 321 cm TL cm %TL	MMF 2691 171 cm TL %TL	MMF 3376 118 cm TL %TL	MP 547 342 cm TL %TL	TCWC 3923.1 325 cm TL %TL		
Fork length	272	84.7	----	----	----	264	81.2
Pre-caudal length	234	72.9	68.4	71.8	73.7	234	72.0
Snout to:							
dorsal 1 fin	106.5	33.1	30.4	31.6	31.3	196	60.3
dorsal 2 fin	201	62.6	55.0	57.9	59.6	----	----
pectoral fin	67	20.9	22.6	24.1	22.8	65	20.0
pelvic fins	173	53.9	51.7	50.2	52.6	160	49.2
anal fin	217	67.6	62.0	63.8	68.1	197.5	60.8
mouth	17	5.3	5.0	7.0	4.4	14.5	4.5
eye	22.5	7.0	5.9	6.3	5.7	14.0	4.3
Mouth breadth	29.5	9.2	8.9	7.8	6.3	----	----
Between nostrils	15	4.7	4.9	4.3	3.7	15	4.6
Horizontal eye diameter	5.2	1.6	2.8	2.3	1.8	4.3	1.3
Gill lengths							
#1	18	5.6	5.5	5.0	5.1	23.5	7.2
#2	18	5.6	5.5	4.8	----	21	6.5
#3	19.5	5.9	5.1	4.6	----	19	5.8
#4	16	5.0	4.9	4.0	----	17.5	5.4
#5	15.2	4.7	4.9	3.9	4.8	16	4.9
#6	----	----	----	----	----	13	4.0
Dorsal 1 fin height	20	6.2	5.1	6.2	6.0	14.8	4.6
Dorsal 1 fin base	35	10.9	8.1	10.6	9.6	25	7.7
Dorsal 1 fin free margin	9.5	3.0	1.9	2.7	2.3	8.3	2.6
Dorsal 2 fin height	14	4.4	4.4	4.7	4.3	----	----
Dorsal 2 fin base	18.5	5.8	5.3	6.4	6.4	----	----
Dorsal 2 fin free margin	7.4	2.3	1.8	2.5	2.1	----	----
Pectoral fin anterior margin	49	15.3	12.5	12.7	11.6	40	12.3
Pectoral fin ht. (axil-tip)	41	12.8	9.8	8.0	----	----	----
Pectoral fin base	16.5	5.1	9.8?	4.9	4.6	29	8.9
Pectoral fin inner margin	22	6.9	4.0	4.9	4.2	12.5	3.8
Pelvic fin anterior margin	30.5	9.5	9.4	7.9	7.5	18	5.6
Pelvic distal margin	27	8.4	5.4	7.0	----	38.5	11.8
Anal fin height	13.2	4.1	2.8	4.5	3.1	13.5	4.2
Anal fin base	12.5	3.9	3.3	5.2	3.5	19	5.8
Anal fin free margin	7.2	2.2	1.9	1.9	2.0	7	2.2
Upper caudal length	94	29.3	29.2	28.1	26.3	93	28.6
Lower caudal length	36	11.1	----	----	8.5	24.5	7.5
Interspace:							
base dorsal 1 fin to origin dorsal 2 fin	64	19.9	16.5	15.5	----	----	----
base dorsal 2 fin to caudal pit	18	5.6	6.9	7.6	----	23.5	7.2
origin pectoral fin to origin pelvic fin	106	33.0	28.6	26.0	----	88	27.1
origin pelvic fin to anal fin	44	13.7	11.7	14.3	----	44.5	13.7
Clasper length	----	----	----	----	8.9	27.5	8.5
Weight (kg)	182.3		6.1*		----	211.4	

* without liver

Lab., pers. comm.).

Because morphometric data are scarce for large specimens, measurements are given in Table 1.

***Carcharhinus signatus* (Poey, 1868)**

The night shark is found in tropical waters of both the eastern and western

Atlantic (Raschi *et al.*, 1982). In the western Atlantic it is reported from the east coast of the United States, through the Antilles, to southern Brazil, and is most common off Cuba and southern Florida (Compagno, 1978b). Only four specimens have been reported from the Gulf of Mexico (Springer and Thompson, 1957; Boschung, 1979; Branstetter, 1981), and all are from the eastern Gulf.

During our survey six *C. signatus* (62-226 cm) of both sexes were taken from the western Gulf of Mexico (Table 2). All six were single captures on longline sets along the Texas shelf edge from 27° 40'N 93° 56'W (south of Sabine Lake) to 26° 10'N 96° 17'W (east of Port Isabel). No specimens were mature, but the capture of three small juveniles with umbilical scars indicates the area contains reproductively active individuals, and is not just a temporary feeding ground for adolescents.

Lack of records in the Gulf of Mexico and low catch rates for this species may be an artifact of sampling. The species is most common at depths greater than 100 m (Bigelow and Schroeder, 1948; Compagno, 1978b), but most of the fishing effort by commercial and research vessels is at depths above 100 m. The night shark is only known to inhabit waters along the outer shelf and upper slope areas (100-600 m), therefore it would not appear in the catch records of the extensive open ocean Japanese tuna fishery either. Further sampling at

appropriate depths may show this species to be a relatively common inhabitant of the shelf-edge waters of the Gulf of Mexico.

ACKNOWLEDGMENTS

We wish to express our sincerest thanks to the several boat owners and captains who allowed us to participate in their fishing trips: Olin Welborn, "Buddy" and "Tinker" Lindley of the FV TERESA W; Arnold Davila of the FV CAPT. ARI D; Gayman Fisheries Inc. and Carlos Garces, Jr. of the FV MANASSAS JUNCTION; Gayman Boats Inc. and Henry Jones of the FV MISSIONARY RIDGE. Appreciation is extended to Gary Graham, Joe Surovik, and Tony Reisinger and the Marine Advisory Service for their help during the survey. We are grateful to Victor Sadowsky for supplying us with photographs and unpublished information of specimens he examined. We wish to thank G.E. Maul for providing additional comments and measurements on the holotype of *Odontaspis noronhai* and an additional specimen located at the Museu Municipal do Funchal. We thank Katherine Wolfram for bringing literature records to our attention. Thanks go to all the people who helped transport, handle, and preserve the sharks: Michael J. McCoid, R.E. Matheson, Jr., Michael Retzer, Robert Dean, Ed Michaud, Tsutomu Miyake, and Debbie Branstetter. Tsutomu Miyake prepared the

Table 2. Data on six *Carcharhinus signatus* taken from the western Gulf of Mexico.

Specimen No.	TL(cm)	Sex	Capture Locality	Date
M 61583*	62	F	27°50'N 95°05'W	19 Sept. 1982
SB 01138301	75	M	27°45'N 94°00'W	13 Jan. 1983
TCWC 3924.1	80	F	26°10'N 96°17'W	28 Mar. 1984
SB 01118309	161	M	27°40'N 93°56'W	11 Jan. 1983
SB 04088301	171	F	27°43'N 95°34'W	8 Apr. 1983
SB 01098301	226	F	27°40'N 94°10'W	9 Jan. 1983

* Shark tagged and released. Tags supplied by NMFS, Narragansett, RI.

illustrations. This research was supported in part by the Gulf and South Atlantic Fisheries Development Foundation, Inc. through contracts 21-13-21375 and 22-13-22881 with the Texas A&M Research Foundation, and the Texas A&M Sea Grant College Program through two University Marine Fellowships to the senior author.

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