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Scientific Note

Observations on a rare shark, *Oxynotus centrina* (Chondrichthyes: Oxynotidae), in the Sea of Marmara (north-western Turkey)

HAKAN KABASAKAL

Ichthyological Research Society, Tantavi mahallesi, Menteşoğlu caddesi, İdil apt., No: 30, D:4, Ümraniye, TR-34764 İstanbul, Turkey; E-mail: hakankabasakal@superposta.com

Abstract. A female angular rough shark, *Oxynotus centrina* (Linnaeus 1758), ca. 60 cm of TL, was observed in the Sea of Marmara, Turkey. It never exhibited any aggressiveness when it was immobilized by divers.

Key words: Locomotion, carangiform swim, rough sharks, protection.

Resumen: Observaciones sobre el tiburón raro, *Oxynotus centrina* (Chondrichthyes: Oxynotidae) el mar de Mármara (noroeste de Turquía). Una hembra del tiburón cerdo marino *Oxynotus centrina* (Linnaeus 1758), de aproximadamente 60 cm de longitud, fue obervada en el mar de Mármara, Turquía. La misma se mostro inofensiva para on los buzos.

Palabras clave: De movimiento, natación carangiform, tiburon cerdo marino, la protección.

The angular rough shark, *Oxynotus centrina* (Linnaeus 1758), is an uncommon, little-known shark, reported throughout the entire Mediterranean Sea (Serena 2005) and eastern Atlantic from the British Isles (Calderwood 1892) to South Africa (Compagno 1984). *O. centrina* is a sluggish shark found across continental shelves and upper slopes at depths ranging between 30 and 800 m (Compagno 1984; Sion *et al*. 2004).

In the Mediterranean Sea, *O. centrina* has been obsereved in rare numbers (*e.g.* Tortonese 1956; Golani *et al*. 2006) since 19th century. Due to this rarity, little is known about the biology of *O. centrina* within this region. For example, only a description of embryos (Megalofonou & Damalas, 2004) and observations on the reproductive tract of a mature female exist (Dragičević *et al*. 2009). Some aspects of the diet of *O. centrina* also exist (Capapé 1975; Barrull & Mate 2001; Capapé 2008), but the research is incomplete.

The aim of this paper is to present a record of an angular rough shark from the northern coast of the Sea of Marmara, north-western Turkey (Fig. 1), at a depth of 30 m, with observations on it's behaviour.

A compact digital camera (SEA&SEA 860G) in an underwater housing was used to record the behaviour of said shark. Species identification of the present specimen follows Compagno (1984). The total length of the examined shark was approximated using to the nearest centimeter with a tape measure. A total of 03:48 minutes underwater video footage was recorded and is available on http://derintakip.blogspot.com/2009/11/angular-rough-shark-in-sea-of-marmara.html

Based on the following characteristics, the female shark was identified as *O. centrina*: Two large dorsal fins with spines buried in the fins; stout, compressed and high trunk with strong abdominal ridges; large spiracles behind the eyes; enlarged nostrils close each other; long labial furrows encircling the mouth. Total length of the specimen was ca. 60 cm.

At 16:00 hours the angular rough shark was observed slowly moving across the muddy/sandy bottom and frequently stopping and hovering over the sea floor at irregular intervals. During the non-swimming phase, the angular rough shark maintained it's body in an oblique position, snout in contact with the bottom and kept itself in this

oblique hovering for a few seconds before returning to a horizontal swimming pattern.

The observed specimen exhibited a clear avoidance to bright light. Under illumination, the shark maintained it's swimming direction for a short time (max. 15 seconds), then changed it's course again, rising nearly one meter off the bottom while gently arching it's body, and turned in the opposite direction to the light source and immediately descended to the bottom again and continued swimming. When not illuminated, the angular rough shark kept swimming alongside the divers and did not exhibit any sudden changes in course.

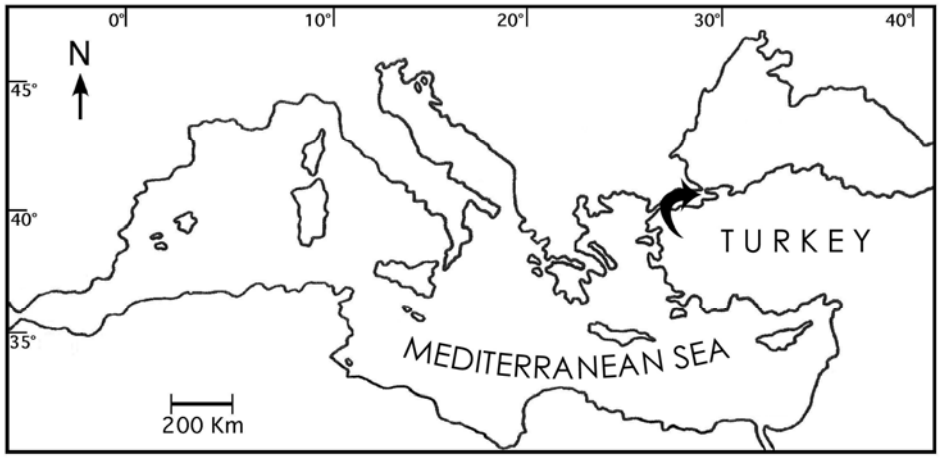

Figure 1. Map indicating the locality of encounter with the angular rough shark, *Oxynotus centrina*, in the Sea of Marmara, NW Turkey (arrow denotes the approximate locality).

During steady swimming in the horizontal plane, undulations were mostly confined to the posterior half of the body with less than one wave present. However, the amplitude of body motion increases markedly over the posterior half of the body. In addition, the posture of the pectoral fins changed, relative to the direction of movement (Fig. 2). During vertical movements or hovering activity, the shark rapidly moved the trailing pectoral fin edge ventrally (Fig. 2) until the movement/activity was complete. During descent in the water column (maneuvering down or sinking), the angular rough shark rapidly elevated the trailing pectoral fin edge. Before touching down, the angular rough shark elevated the leading pectoral fin edge, and even undulated the pectoral fins in a clockwise rotational movement for several times to reduce the speed of sinking, and to maintain a horizontal position over the bottom (Fig. 2). During ascent in the water column (maneuvering up or rising), the angular rough shark rapidly elevated the leading pectoral fin edge, and undulated the posterior half of it's body rapidly.

According to Wilga & Lauder (2004), *O. centrina* fits to body type 4, since it lacks an anal fin but does have a large epicaudal lobe. In contrast Capapé (2008) mentioned *O. centrina* as a shark with body type 3; however, sharks of this type have relatively large heads, more anterior pelvic fins, more posterior first dorsal fins and a low heterocercal tail angle (Wilga & Lauder 2004). In *O. centrina*, position of the pelvic fins on the body is more posterior, close to caudal fin, and the leading edge of the first dorsal fin is almost on the same perpendicular with the leading edges of the pectoral fins. Furthermore, heterocercal tail angle of the angular rough shark is clearly high. According to Wilga & Lauder (2004), sharks with body type 3 are demersal sharks such as *Scyliorhinus*, *Ginglymostoma*, *Chiloscyllium*, *Galeus*, *Apristurus*, *Pseudotriakis* and Hexanchiformes. Therefore, *O. centrina* should be included in body type 4.

All sharks swim using continous lateral undulations of the axial skeleton. Based on decreasing proportion of the body that is undulated during locomotion, Wilga & Lauder (2004) described four modes of axial undulatory propulsion from anguilliform to thunniform. Following their descriptions, *O. centrina* is a carangiform swimmer, where undulations are mostly confined to the posterior half of the body with less than one wave present (Wilga & Lauder 2004). *O. centrina* moves over the bottom slowly but constantly, and uses pectoral fins effectively to change its' orientation in the water column.

Our observations of *O. centrina* contrast those from the literature. For example, several authors (Compagno 1984, Lipej *et al*. 2004, Capapé

2008) suggest that this species is a 'sluggish' bottom-dwelling shark. In addition Compagno (1984) suggests that *O. centrina* relies on their expanded body cavities and large oil livers to attain neutral buoyancy, so they can hover and slowly swim above the substrate without needing forward motion for lift. Although *O. centrina* was observed sinking slowly towards the substrate in the current study, it was also observed needing forward motion for lift in deep water. In addition Lipej *et al*. (2004) suggest *O. centrina* is a slow, timid, nocturnal shark. Our observations suggest that despite the specimen's avoidance of bright light, the shark did not avoid the divers. Finally, the suction behavior suggested by Capapé (2008) to capture wormlike prey along with sediments was only observed once during the video footage.

Due to the limited knowledge on the biology of *O. centrina*, the observations put forth herein on a solitary individual, has increase the general understanding of this species in Mediterranean waters (*e.g*. Barrull & Mate 2001, Megalofonou & Damalas 2004, Dragičevic *et al*. 2009).

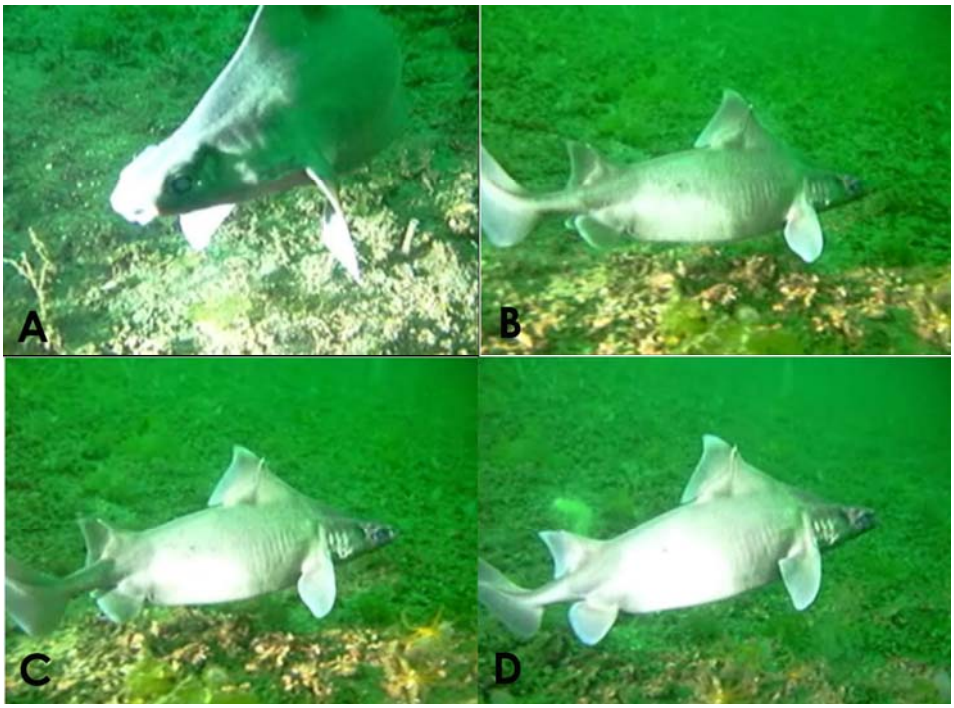

Figure 2. Patterns of movement observed in the present specimen of *Oxynotus centrina*. Posture of the pectoral fins is markedly changed relative to the direction of movement; (a) posture of pectoral fins during vertical maneuvering or hovering; (b) at the begining of maneuver up, trailing edge of the pectoral fins are lowered; (c) during the progression of maneuver up, trailing edges of pectoral fins are kept in the lowered posture; and (d) before the begining of horizontal movement, pectoral fins are returned to natural posture. All images are captured from the video footage recorded on 27 September 2009, between 16:00 to 16:05 hours.

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