New record of *Rhinochimaera atlantica* (Chimaeriformes: Rhinochimaeridae) spawning ground in the Gulf of Mannar along the south-east coast of India

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ABSTRACT

The egg capsules and one embryo of *Rhinochimaera atlantica* were collected from the Gulf of Mannar while conducting fishery resource survey by bottom trawling. In total, 89 egg capsules were collected from the surveyed area (Latitude 08°51’N to 08°53”N and Longitude 78°47’E to 78°53’E) at a depth range of 281-301 m, which indicated that this area is the probable spawning ground of the species in the Gulf of Mannar. The egg capsule measured 257 mm in total length and weighed 28 g. It was ovoid in structure with a central longitudinal hollow core surrounded on both sides with a wing-like ribbed lateral web. Embryo was spindle shaped and perfectly placed in the tubular structure of the egg capsule. The ratio of the number of unhatched egg capsules to the empty capsules indicated that, March / April may be the terminal period of incubation. The embryo observed was in the advanced stage of release as the embryo nearly occupied the full length of central hollow core.

Introduction

The living chimaeroid fishes, although somewhat shark-like in appearance are neither shark nor ancestral shark but, true cartilaginous, shark-like fishes (Chondrichthyes) with no bony skeleton, fin rays, or scales. There are currently 30 known species. As many new species have recently been discovered, the actual number may probably be greater than 40 (Didier, 2002). Chimaeroids are distributed throughout the world’s oceans from the Arctic and sub Antarctic to the tropics, where they are deep-water slope inhabitants. However, data on their geographic distribution is based primarily on fishing records. They tend to occur on or near the bottom and near continental land masses or off oceanic islands and on the slopes of seamounts and underwater ridges. It is locally migratory and congregate in large breeding aggregations inshore, and many species tend to segregate into unisexual groups that are additionally separated by age (Didier, 2002). The species under study, *Rhinochimaera atlantica* generally inhabits deep waters and are usually found at depths, ranging from 800 to 1800 m (Didier, 1995; 2004). Females are larger than males, oviparous and lay pairs of eggs, one from each oviduct, each of which contains a single egg, encased in an ovoid egg capsule. The egg capsule has a fan-like lateral web that surrounds a hollow, ovoid central chamber. They are laid in pairs on the bottom and the embryos may take from 6 to 12 months to develop (Didier, 2002). A few egg capsules and at least one hatchling have been reported (Dagit and Compagno, 2005). However, in Indian waters, neither the spawning ground nor egg capsules of *R. atlantica* are reported. In this paper, apart from locating the spawning ground in the Gulf of Mannar, an attempt is made to describe the egg capsule and its embryo.
Materials and methods

Egg capsules collected were identified as of *R. atlantica* by the morphological attributes of the embryo, such as the antero-dorsal profile of the head and snout, absence of anal fin and the position of mouth. Samples were collected during the March, 2007 cruise of MAtlaysia Varshini, a fishery survey vessel of the Fishery Survey of India. During the cruise, demersal resources survey was carried out in the 200 – 500 m depth strata of the Gulf of Mannar, by stratified random sampling method using shrimp trawl. Samples were collected from nine stations in the area (Latitude 08°41’N to 08°54’N and Longitude 78°30’ E to 78°53’E) at a depth range of 174 to 301 m. The survey was carried out during daylight and the net was dragged for a maximum duration of 90 minutes in a station with 3.5 knot speed.

Results

A total of 89 egg capsules of *R. atlantica* were collected from the bottom of the upper continental slope region of the Gulf of Mannar below Keelakarai in the 200 – 500 m depth strata. Bottom topography was even and muddy at all stations. Among the nine stations covered, egg capsules of *R. atlantica* were observed only at four stations in the area (Latitude 08°51’N to 08°53’N and Longitude 78°47’E to 78°53’E) at a depth range of 281-301m. No egg capsules were observed in the adjoining areas, where sampling was carried out on previous day and on the subsequent day to ascertain the spread of spawning ground. The details of the sampling stations are furnished in Table 1 and illustrated in Fig. 1. A total of 88 empty egg capsules and one egg capsule with embryo were collected along with other deep sea fauna such as *Thyrsitoides marleyi*, *Rexea prometheus*, *Ancistrocheirus lesueurii*, *Heterocarpus woodmasoni*, *Heterocarpus gibbosus*, amphitretids and ophisthotuethids.

The egg capsule

The egg capsule with fully developed embryo inside measured 257 mm in total length and 28 g in weight. It is bilaterally symmetrical and ovoid in structure with a central longitudinal hollow chamber surrounded on both sides with a wing-like ribbed lateral web. The web is strengthened by the parallel venation originating from the side of central core. The veins are placed at right angle to central core and numbering 68 on one side. For the purpose of description, the side at which the egg is attached to the mud is called as ventral and the opposite side as dorsal. The central hollow core is spindle shaped (Fig. 2) with outward bulging at dorsal side and indentation at the posterior half of the ventral side. The interior of the hollow chamber can be differentiated into three distinct areas, corresponding to the definite portion of the embryo (Fig. 3d). A short conical tubular structure of length 38 mm is the anterior

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New record of *Rhinochimaera atlantica* spawning ground in the Gulf of Mannar

Fig. 1. Chart of Gulf of Mannar showing the sampling area and the location, where *Rhinochimaera atlantica* egg capsules and embryo were collected

![Chart of Gulf of Mannar](image)

Fig. 2. Diagrammatic representation of the *Rhinochimaera atlantica* egg capsule (dorsal view)

A - Total length (257 mm), B - Anterior width (85 mm), C - Posterior width (46 mm), D - Tail length of central hollow core (103 mm), E - Middle chamber length (75 mm), F - Length of anterior cone (38 mm), G - Length of anterior pad (17 mm), H - Anterior width of hollow core (20 mm), I - Posterior width of hollow core (15 mm), J - Central chamber width (42 mm), K - Length of posterior pad (24 mm)
part of the central hollow core, which accommodate the head region of the embryo. The outer wall of this conical tube contains a bunch of threads at the ventral side (Fig. 3a & c). This may facilitate the anchoring of egg capsules on to the muddy substratum, as evidenced by the presence of good quantity of mud at this bunch, invariably in all the capsules collected. There is a pad-like flattened structure (Fig. 3a) measuring 17 mm in length, anterior to the conical tubular structure. The pad split anteriorly in the axis of lateral web (Fig. 3b) to facilitate the easy unhindered outward movement of the embryo on hatching. The conical tubular structure is followed by a central broad chamber measuring 75 mm in length and

Fig. 3. *Rhinochimaera atlantica* egg capsule and embryo (a) Ventral structure of the egg capsule – Arrow -1 points to the pad, Arrow -2 points to the bunch of threads (b) Anterior half of the ventral side of the egg capsule highlighting the area of split, through which the embryo moves out on hatching (c) Internal structure of the anterior portion of central hollow core with arrows pointing at the inner and outer side of bunch of threads (d) Central chamber cut open to expose the embryo inside (e) Fully grown embryo
42 mm in width at the middle. This accommodates the body portion of the embryo. The posterior end of the central chamber is produced into a lengthy tail measuring 103 mm in length and accommodates the tail portion of the embryo. The tail extends further posteriorly as a membranous pad measuring 24 mm in length. The total internal length of the central hollow core, where the embryo is accommodated measures 216 mm in length. In general, the egg capsule looks like a dark brown miniature banana leaf with bulged central core.

The embryo

The embryo (Fig. 3 e) is spindle in shape, measuring 191 mm in length and 16.5 g in weight. With its conical head, broad trunk and lengthy tail, it is perfectly placed in the tubular structure of the egg capsule (Fig. 3d). The antero-dorsal portion of the head is prolonged into a long nose called snout, which may help to whirl out the embryo from the egg capsule on hatching and in adult, it helps to smell the prey hiding in the mud. The snout measures 14 mm in length. The pre-orbital length is 23 mm and the diameter of the orbit is 6 mm. The head from the anterior end of the snout to the anterior end of the gill opening is 34 mm in length. The length of the body from the anterior end of the gill opening to the posterior end of the II dorsal is 74 mm. The tail beyond the II dorsal measures 92 mm in length.

The pectoral fin is membranous and conspicuous in its appearance. It measures 36 mm in length and is longer than the head and bluish black in colour. Pelvic fin measures 20 mm in length. The I and II dorsal fin base measures 210 mm and 250 mm respectively with the I dorsal spine height of 250 mm. The body colour is yellowish brown.

Discussion

The occurrence of a large number of empty egg capsules and one with embryo in an advanced state of development in the study area (Latitude 08°51’N to 08°53’N and Longitude 78°47’E to 78°53’E) at 290–301 m depth range indicates that, this area is the probable spawning ground of *R. atlantica* in the Gulf of Mannar. This is strengthened by the fact that no adults were collected from the area of egg abundance as they are in the habit of congregating in large breeding aggregations inshore and migrate back to their deeper habitat after spawning (Didier, 2002). The ratio of unhatched egg capsule to the large number of empty capsules found during the survey period indicates that March / April may be the terminal period of incubation. It is also supported by the fact that the embryo collected was full-grown and occupied 88% of the total length of central hollow core, which accommodates the growing embryo. As chimaeroids need a minimum of six to twelve months incubation period (Didier, 2002), the adults might have undertaken the inshore spawning migration six to twelve months earlier i.e., April to September 2006. This may be the reason for the non-availability of adult specimens during the sampling period. During spawning, the egg capsules might anchor at the muddy substratum with the help of bunch of threads found at the ventral wall of the anterior conical tube. This is evident by the presence of good quantity of mud at the bunch, invariably in all the capsules collected. On the completion of incubation period, the hatchling emerge from the capsule by splitting the anterior pad in the axis of lateral web. The embryo observed in this study may be in the advanced stage of release, as the size of the embryo nearly occupied the full length of the central hollow core.

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References


