EGG CAPSULES OF DEEP-SEA CATSHARKS FROM EASTERN NORTH ATLANTIC, WITH FIRST DESCRIPTIONS OF THE CAPSULE OF GALEUS MURINUS AND APRISTURUS APHYODES (CHONDRICTHYES: SCYLIORHINIDAE)

by

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ABSTRACT. - Egg capsules of four species of the deepwater catshark genera Galeus and Apristurus are described and compared. The egg capsules of G. murinus and A. aphyodes are firstly described from 4 and 9 capsules respectively, collected in the mother’s oviducts. Unlike numerous species of the family, their egg capsules do not have prolonged tendrils. The smallest gravid females of G. murinus and A. aphyodes measure 460 and 490 mm respectively. Their oviparaous mode of reproduction was confirmed. There is only one egg capsule per oviduct for both species, indicating they are single oviparaous species. Comments are made on the oviparity of the catsharks of these genera.


Les capsules ovigères de quatre espèces de Scyliorhinidae de profondeur de genres Galeus et Apristurus sont décrites et comparées. Les capsules ovigères de G. murinus et A. aphyodes sont décrites pour la première fois, respectivement à partir de 4 et 9 capsules prélevées dans les oviductes des mâeres. Contrairement à de nombreuses espèces de la famille, leurs capsules ovigères ne sont pas prolongées par des virels. Les plus petites femelles gravides de G. murinus et d’A. aphyodes mesurent respectivement 460 et 490 mm. L’oviparité de ces roussettes a été confirmée. Il n’y a qu’une seule capsule ovigère par oviducte pour chacune de ces espèces, ce qui indique une reproduction de type simple oviparité. L’oviparité des roussettes appartenant à ces genres est commentée.

Key words. - Scyliorhinidae - Galeus murinus - G. aphyodes - Apristurus aphyodes - A. laurussoni - ENA - Egg capsule - Oviparity.

In the eastern North Atlantic Ocean and the Mediterranean Sea, three species of Galeus occur: G. melastomus Rafinesque, 1810, G. atlanticus (Valiante, 1888) and G. murinus (Collett, 1904). Descriptions of the egg capsules of G. melastomus are given by Tortonese (1956), Capapé and Zouali (1977) and Cadenet and Blache (1981). Muroz-Chipimi and Perez Ortega (1985) described egg capsules of G. atlanticus. However, there is no description of the egg capsule of G. murinus.

Five species of Apristurus are known from the eastern North Atlantic i.e., Apristurus laurussoni (Saemundsson, 1922) (= A. maderensis Cadoret & Maul, 1966), A. microps (Gilchrist, 1922), A. atlanticus (Kofoed, 1927), A. munts (Springer, 1979), and A. aphyodes Nakaya & Stelmann, 1998. However, the egg capsule is not known for these species, except for A. laurussoni (Cadenet et Maul, 1966; Nakaya and Sato, 1998).

Egg capsules of G. murinus and A. aphyodes were obtained from commercial fisheries and are herein described for the first time, together with those of species of the genera from eastern North Atlantic; then the oviparity of the catsharks is discussed.

MATERIALS AND METHODS

The terminology of the egg capsule follows Cox (1963) and Gomes and de Carvalho (1995). The specimens examined were collected by commercial bottom trawlers. Specimens of Galeus murinus and Apristurus aphyodes, and their egg capsules are catalogued in the collections of the Muséum National d’Histoire Naturelle (MNHN) in Paris.

Specimens examined

Galeus murinus (4 egg capsules from 2 specimens). - 2 egg capsules from MNHN 2000-1734, female, 471 mm TL, 52°26'-52°38'N, 15°09'-15°06'W, 1100-1130 m, 20 Mar. 2000; 2 egg capsules from MNHN 2001-1049, female, 460 mm TL, 55°41'-55°54'N, 9°50'W, 900-950 m, 13 Mar. 2001.

Galeus melastomus (34 egg capsules from 9 specimens).
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- 2 egg capsules from 636 mm TL female, 56°N, 9°30′W, 1,100 m, 1999; 3 egg capsules from 641 mm TL female, 56°N, 9°30′W, 1,100 m, 1999; 2 egg capsules from 650 mm TL female, 56°N, 9°30′W, 1,100 m, 1999; 1 egg capsule from 676 mm TL female, 59°40′N, 6°13′W, 235 m, 20 Jul. 1999; 11 egg capsules from 790 mm TL female, off British Isles, Dec. 1999; 4 egg capsules from 621 mm TL female, off British Isles, 2000; 6 egg capsules from 671 mm TL female, off British Isles, 2000; 2 egg capsules from 646 mm TL female, off British Isles, 2000; 3 egg capsules from 639 mm TL female, 57°05′N, 9°W, 400-420 m, Mar. 2001.


*Apristurus laurusseni* (4 egg capsules from 4 specimens), 2 egg capsules from 689 mm TL female, 56°30′N, 9°15′W, 1,080 m, Aug. 1998; 2 egg capsules from 667 mm TL female, 53°54′-53°48′N, 13°43′-14°02′W, 1,140-1,159 m, 11 Mar. 2000; 2 egg capsules from 685 mm TL female, 54°30′N, 11°W, 1,300 m, 19-28 Jun. 1999; 2 egg capsules from 681 mm TL female, 52°26′-52°38′N, 15°09′-15°06′W, 1,100-1,130 m, 20 Mar. 2000.

RESULTS

Detailed measurements and weights of the full egg capsules are given in table I.

Egg capsule of *G. marinus* (Fig. 1A) is small in size and relatively slender (54-56 mm in length and 14-17 mm in width); a weak neckline constriction is present at about one fifth of the length from the anterior end; surface of the capsule is completely covered by weak and fine fibrous tissue, giving a thick hairy appearance when submerged in the water; capsule is opaque because of its fibrous texture; anterior end is truncate, without any process; posterior end is rounded gently and possesses a single budly defined process, extending beyond the capsule; lateral edge is not developed; color is uniformly golden yellow. Only one egg capsule is found from each ovipara.

Egg capsule of *G. melastomus* (Fig. 1B) is slightly larger than those of *G. marinus* in size (51-65 mm in length and 18-23 mm in width) and is roughly vase-shaped, with pos-

Table I. - Measurements (in mm) and weight (in g) of full egg capsules of *Galeus marinus, G. melastomus, Apristurus aphyodes* and *A. laurusseni.*

<table>
<thead>
<tr>
<th>Reference</th>
<th>TL</th>
<th>Weight</th>
<th>n</th>
<th>Length</th>
<th>Width</th>
<th>Depth</th>
<th>Weight</th>
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</thead>
<tbody>
<tr>
<td>MNHN 2000-1734</td>
<td>471</td>
<td>373</td>
<td>2</td>
<td>54-55</td>
<td>14.5</td>
<td>11.5</td>
<td>3.4-3.5</td>
</tr>
<tr>
<td>MNHN 2001-1049</td>
<td>460</td>
<td>391</td>
<td>2</td>
<td>55-56</td>
<td>17</td>
<td>9</td>
<td>2.5-2.7</td>
</tr>
<tr>
<td>636</td>
<td>712</td>
<td>2</td>
<td>59</td>
<td>20</td>
<td>-</td>
<td>3.5</td>
<td></td>
</tr>
<tr>
<td>641</td>
<td>762</td>
<td>3</td>
<td>56-60</td>
<td>18-21</td>
<td>8-10</td>
<td>3.0-4.9</td>
<td></td>
</tr>
<tr>
<td>650</td>
<td>902</td>
<td>2</td>
<td>55-57</td>
<td>21</td>
<td>10</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>676</td>
<td>852</td>
<td>1</td>
<td>60</td>
<td>22</td>
<td>-</td>
<td>4.2</td>
<td></td>
</tr>
<tr>
<td>790</td>
<td>-</td>
<td>11</td>
<td>60-65</td>
<td>21-23</td>
<td>10-13</td>
<td>4.6-6.3</td>
<td></td>
</tr>
<tr>
<td>621</td>
<td>657</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>671</td>
<td>913</td>
<td>6</td>
<td>61-65</td>
<td>20-21</td>
<td>12-13</td>
<td>6.6-7.1</td>
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<tr>
<td>646</td>
<td>732</td>
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<td>31-33</td>
<td>19-19.5</td>
<td>11-11.5</td>
<td>5.2-5.6</td>
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<tr>
<td>639</td>
<td>717</td>
<td>3</td>
<td>33-54</td>
<td>21</td>
<td>10-11</td>
<td>4.5-5.4</td>
<td></td>
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<tr>
<td>MNHN 1999-0792</td>
<td>501</td>
<td>380</td>
<td>1</td>
<td>46</td>
<td>16</td>
<td>9</td>
<td>2.2</td>
</tr>
<tr>
<td>MNHN 2000-1735</td>
<td>490</td>
<td>458</td>
<td>2</td>
<td>49-55</td>
<td>14</td>
<td>10</td>
<td>3.5</td>
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<tr>
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<td>2</td>
<td>47-54</td>
<td>16-16.5</td>
<td>8.5</td>
<td>2.9-3.1</td>
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<tr>
<td>MNHN 2000-1742</td>
<td>523</td>
<td>393</td>
<td>2</td>
<td>31.5</td>
<td>16</td>
<td>9.9-9.5</td>
<td>3.1-3.4</td>
</tr>
</tbody>
</table>

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Fig. 1. - Egg capsules of Galeus marinus (A: MNHN 2006-1734, 54 mm in length; G. melastomus (B: uncatalogued, 60 mm); Apristurus phyodes (C: MNHN 1999-0792, 46 mm) and A. laurastoni (D: uncatalogued, 66 mm). Scale bars = 10 mm.

Egg capsule of A. phyodes (Fig. 1C) is rather small in size (43-52 mm in length and 14-17 mm in width), and is roughly vase-shaped, with posterior part oval in shape; a necklike constriction is at about a third of the length from anterior end; surface is smooth and glossy, keratin-like texture; capsule is opaque, posterior end is rounded, with 2 very short coiled horns in close touch; anterior end of the capsule is truncate, with a small horn on each corner; lateral edge weakly flanged; four white respiratory fissures as grooves of 5-8 mm in length, two on each side (one anterior left and one posterior left) are present; color is golden brown when extracted from the oviduct, changing to dark brown after exposure to sea water. Each oviduct contained one to six egg capsules.

Egg capsule of A. laurastoni (Fig. 1D) is larger than that of A. phyodes in size (61-72 mm in length and 24-27 mm in width); a necklike constriction is at about a third to two fifth of the length from the anterior end; surface is entirely covered by villus-like fibers forming 25 to 26 longitudinal striations; capsule is opaque because of its rough, suede texture; posterior end with two very long and tightly coiled tendrils; anterior end more or less rounded with long and weak fibrous thread one each corner; lateral edge flanged, forming keel-like ridge; color is bronze brown.

Only one egg capsule is found from each oviduct.

DISCUSSION

All the described capsules were found in the posterior part of the oviducts, suggesting that all were completely formed and ready for oviposition. Because egg capsules within genera of Scyliorhinidae present an important variability in the shape, texture and ornamentation, they can be used as good taxonomic characters, specially in morphologically homogeneous genus like Apristurus.

Although the mode of reproduction of the members of the family Scyliorhinidae is generally oviparous, the genus Galeus is an exception, with both oviparous and viviparous species. G. polli from the Atlantic off southern Morocco to Namibia is a viviparous species (Poll, 1951; Cadena, 1959). However, G. melastomus is oviparous, with up to 13 egg capsules in the oviducts at one time (multiple oviparity of Nakaya, 1975). According to Muñoz-Chápuli and Perez Ortega, (1985), G. atlanticus is also a multiple oviparous species, with at least 9 egg capsules in both oviducts. They described the egg capsules to be very similar in shape to, but smaller (38-40 mm in length and 11-13 mm in width) than that of G. melastomus. According to Compagnone (1984), G. marinus grows maximally at least to 63 cm in total length, and Muñoz-Chapuli and Perez Ortega (1985) reported 479-545 mm TL male having fully calcified claspers, but almost nothing is known about its biology. Discovery of an egg capsule from each oviduct in 460 and 471 mm TL specimens indicates that G. marinus is a single oviparous species, same as G. castaneus and G. nipponensis from western North Pacific (Nakaya, 1975), and that the female of G. marinus are mature at 460 mm or less in total length.
The genus *Apristurus*, on the other hand, is oviparous throughout the genus, as far as known. The only egg capsule of *Apristurus* known from eastern North Atlantic is that of *A. lasarssonii* (Nakaya and Sato, 1998; also as *A. maderensis* by Cadenat and Maul, 1966). The egg capsule of *A. aphyodes* is quite different from that of *A. lasarssonii* in that the anterior and posterior ends possess neither fibrous tissues nor tendrils, and that the surface is quite smooth. Presence of an egg capsule in each oviduct suggests *A. aphyodes* also to be a single oviparous species. The smallest *A. aphyodes* containing egg capsules was 450 mm TL, and this coincides with the size of sexual maturation of the species, shown by Nakaya and Stehmann (1998).

Together with the measurements given by Cadenat and Maul (1966), Muñoz-Chápuli and Perez Ortega (1985), and Nakaya and Sato (1998), the sizes of egg capsule are 38-40 mm in length x 11-13 mm in width for *G. atlanticus*, 54-56 mm x 14-17 mm for *G. marinus*, and 50-66 mm x 16-23 mm for *G. melastomus*. The capsule sizes of *Apristurus* species are 43-52 mm in length x 14-17 mm in width for *A. aphyodes*, and 61-72 mm x 24-27 mm for *A. lasarssonii*. The sizes of egg capsules depend on the species, but also appear to widen and lengthen with body growth (Figs 2, 3).

Egg capsules of *Galeus* species known to date are similar and rather simple in morphology, but the mode of reproduction of the *Galeus* species is diverse from oviparity (with single and multiple oviparity) to viviparity (aplacental yolk sac viviparity; or formerly ovoviviparity). The egg capsules of *Apristurus* species are diverse in morphology, probably reflecting their biological and/or phylogenetic differences. However, consistent presence of one egg capsule per oviduct (together with unpublished data of K. Nakaya) suggests that the mode of reproduction of *Apristurus* is quite uniform, being totally single oviparous throughout the genus.

In oviparity, the egg capsule is held in the oviduct for several days prior to oviposition (Hanslet and Koib, 1999), but this is the case only for single oviparous species. In such species of multiple oviparity as *Haloceps huergeri*, the egg capsules are kept for several months in the oviduct, and this results in accumulation of multiple egg capsules in an

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**Fig. 2.** - Egg capsule width in relation to mother total length for *Galeus marinus*, *G. melastomus*, *G. atlanticus*, *Apristurus aphyodes* and *A. lasarssonii*. Data for *G. atlanticus* and *G. melastomus* (Mediterranean Sea) were taken from Muñoz-Chápuli and Perez Ortega (1985), and are shown as a range (square).

**Fig. 3.** - Egg capsule length in relation to mother total length for *Galeus marinus*, *G. melastomus*, *G. atlanticus*, *Apristurus aphyodes* and *A. lasarssonii*. Data for *G. atlanticus* and *G. melastomus* (Mediterranean Sea) were taken from Muñoz-Chápuli and Perez Ortega (1985), and are shown as a range (square).

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References


