

## Fecundity and spawning frequency of Cobia, *Rachycentron canadum* (Linnaeus, 1766) from the North West coast of India

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An attempt has been made to provide some vital aspects on spawning frequency and fecundity of Cobia based on the samples collected from fishery exploratory surveys and from the landing centers at Mumbai. Frequency of spawning was determined based on the modes of ova diameters in the mature ovaries. The Ova Diameter study indicated that Cobia follows a protracted spawning season with the individual spawning more than once in a season. Absolute fecundity estimated ranged from 1,231,630 to 1,800,350 numbers. Fecundity index obtained was from 2,123 to 2,372 eggs per gram ovary weight. The results obtained in the present study were compared with similar studies round the world and discussed.

[**Keywords:** Fecundity, Ova diameter, Spawning biology, Reproductive biology, Cobia, Indian Ocean, Arabian Sea]

### Introduction

Cobia, *Rachycentron canadum* (Linnaeus, 1766) is a coastal, pelagic, fast growing fish distributed worldwide in tropical and subtropical seas except for the eastern pacific<sup>1-3</sup>. In Indian waters, they occur along the coastal waters of both west and east coast. Fast growth (reach 6-7 Kg in one year), high conversion ratio and high unit price make Cobia as a very good candidate species for aquaculture<sup>4</sup>

Information on the fecundity and spawning frequency of Cobia inhabiting in different water bodies are available<sup>5-10</sup>. Except some limited information<sup>11-12</sup>, knowledge on the fecundity and reproductive behavior of Cobia inhabiting the Indian waters is scanty.

Information on the spawning frequency and fecundity is very essential for understanding and predicting the likely changes in the fish population and also for creating management plans including; closed season suggestion, mesh size regulation and minimum size of capture. Present study is an attempt to provide some vital aspects on spawning frequency and fecundity of Cobia and thereby bridging the knowledge gaps on the biological details of this species.

### Materials and Methods

Cobia samples for the present study were collected from the North West coast of India during the fishery survey of *M.V. Matsya Nireekshani*, belonging to the Mumbai Base of Fishery Survey of India, Mumbai and also from the landing centers at Mumbai, Maharashtra during January 2008 to December 2009. Specimens were dissected following standard procedure<sup>13</sup>.

In the laboratory, samples were cleaned with fresh water and surface moisture was removed by using blotting papers. Total length (TL) of fish was measured to the nearest 1 centimeter (cm) and total weight to the nearest 1.0 gram (g). Weight of ovary was recorded to the nearest 0.1 g. Maturity stage of each gonad was recorded. Ovaries were fixed in 5 % formaldehyde for ova diameter and fecundity studies.

Frequency of spawning was determined based on the modes of ova diameters in the mature ovaries<sup>14</sup>. Ova diameter was measured using ocular micrometer. The entire range of ova measured were divided into 50 micrometer division ( $\mu\text{m}$ ) groups and plotted against percentage frequency to get frequency polygons. Spawning frequency was assessed based on the

frequency polygons.

Fecundity was studied by examining mature preserved ovaries. Mature ovaries were weighed to the nearest milligram (mg) and samples representing anterior, middle and posterior parts of both lobes of ovaries were taken from the ovaries<sup>11</sup>. Three such duplicate samples were counted for each section to get average number of ova. Absolute fecundity was calculated using the formula:

$$F = \frac{R(Fa + Fm + Fp)}{(wa + wm + wp) + L(Fa + Fm + Fp)} \div \frac{2XW}{(wa + wm + wp)}$$

Whereas, F = Absolute fecundity; R = Right ovary; L = Left ovary; W = Total weight of ovary  
 Fa/ Fm/ Fp = No. of eggs in anterior/ middle/posterior sample  
 Wa/ Wm/ Wp = weight of anterior / middle/posterior sample.

Fecundity Index was calculated as Absolute fecundity/ Weight of ovary in gram.

## Results

Ova diameter study of mature ovaries showed that ova diameter ranged from 250-1250  $\mu$ m. Ova collected from anterior, middle and posterior parts of both lobes were pooled together and grouped into classes of 50  $\mu$ m intervals and plotted against their percentage of frequency. Polygons obtained by plotting the ova diameter against frequency are depicted (Fig.1), from where it can be seen that there are three polygons representing three size groups of ova at 250-550  $\mu$ m, 550-700  $\mu$ m and 700-1250  $\mu$ m. From these polygons, it was inferred that third group of ova i.e. 700-1250  $\mu$ m represents the mature group. Presence of different sizes of ova in the mature ovary clearly shows the spawning frequency of the fish.

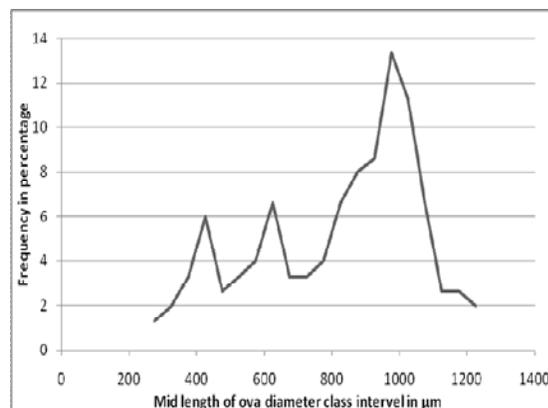


Fig. 1— The ova diameter (in  $\mu$ m) frequency polygons of *Rachycentron canadum*

Results indicates that *Cobia*, *Rachycentron canadum* spawn more than once in a season, as its ovary contains three batches of ova namely ripe, ripening and immature ova. In between immature and ripe ova, there is a batch of eggs in the ripening condition (intermediate maturing stock). From this, it can be inferred that *Cobia* follows a protracted spawning season with the individual spawning more than once in a season.

Absolute fecundity obtained by the fecundity estimation studies ranged from 1,231,630 to 1,800,350 numbers for fishes ranging from 125-147 cm TL. Range of fecundity index obtained was from 2,123 to 2,372 eggs per gram ovary weight. Ova diameter frequency polygons illustrated in Fig. 1 shows that eggs of 700  $\mu$ m and above were mature and they occupies 69% of all yolked eggs.

## Discussion

Investigation on ova diameter of mature ovaries of *Cobia* has identified three distinct groups of ova in the ovary, which elucidated that *Cobia* breeds more than once in a spawning season. Results of earlier studies<sup>5-7,10</sup> also reported occurrence of more than two distinct groups of ova and inferred that *Cobia* breeds more than once in a spawning season.

Table 1. Fecundity estimates of *Cobia* *Rachycentron canadum* reported by various authors from different localities

Author/s	Area of study	Fecundity in '000 numbers
Richards (1967)	Chesapeake Bay - USA	1,900-5,400
Lotz <i>et al.</i> (1996)	North central Gulf of Mexico	2,600-191,000
Somvanshi <i>et al.</i> (2000)	North west coast of India	1,955
Brown-Peterson <i>et al.</i> (2001)	Southern United States of America	377-1,980 (Batch fecundity)
Williams (2001)	Gulf of Mexico	377-1,981
Behnam <i>et al.</i> (2006)	Northern water of Persian Gulf	1,684±118
Tonya <i>et al.</i> (2010)	Northeastern Australia	577-7,372
Present study	North west coast of India	1,231-1,800

Range of ova diameter studied was 250-1250 µm, of which mature ova group was between 700-1250 µm. Results of ova diameter studies from coastal waters of the southern United States<sup>7</sup> and from North West coast of India<sup>11</sup> also reported that ova diameter more than 700 µm as mature stock; hence agree with the findings of the present study. However, studies from Chesapeake Bay and adjacent mid-Atlantic waters<sup>5</sup> and the north central Gulf of Mexico<sup>5</sup> reported ova diameter of mature stock as above 600 µm and 650 µm respectively.

Present study estimated total fecundity of *Cobia* as 1.23 to 1.80 million (125 cm TL – 147 cm TL), which is more or less similar to the estimate of solitary study available from north west coast of India<sup>11</sup>. Fecundity estimates of *Cobia* from different localities by various authors are compiled in Table 1, which ranged from 0.37 million to 19.1 million eggs/fish.

Fecundity estimates from coastal waters of the southern United States<sup>7</sup> Iran<sup>9</sup> and the north-west Indian EEZ<sup>11</sup> are within the range of the present study results, hence are in agreement. However, estimates of Chesapeake Bay and adjacent mid-Atlantic waters<sup>5</sup>, from the north central Gulf of Mexico<sup>6</sup> and from northeastern

Australia<sup>10</sup> are on higher side. Variation in the geographical location and changes in the ecosystem may be the reason for these differences. Studies on fecundity of fishes reported significant variations in fecundity due to differences in stock<sup>15</sup> geographical differences<sup>16-17</sup> and differences in environment<sup>18</sup>. Hence the results of the present study can be considered as significant as far as *Cobia* inhabiting in Indian waters.

### Conclusion

Results of the present study confirms that *Cobia*, spawn more than once in a season and estimated the total fecundity of *Cobia* from North West coast of India as 1.23 to 1.80 million. High fecundity of *Cobia* confirms their pelagic mode of life<sup>19</sup>. Ova diameter frequency polygons illustrated showed that eggs of 700 µm and above were mature and they occupy 69% of all yolked eggs.

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