PRELIMINARY ANALYSIS OF REPRODUCTIVE BIOLOGY OF PELAGIC STINGRAY, Pteroplatytrygon violacea IN SOUTHWESTERN ATLANTIC

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SUMMARY
The pelagic stingray, Pteroplatytrygon violacea, is the only member of the Dasyatidae family with an entirely pelagic behavior. In the present work a total of 367 specimens, 137 females (37.3%) and 230 males (62.7%), were examined, with a view to study their reproductive biology. The specimens were collected between October 2005 and January 2008, by observers onboard of Brazilian commercial longliners. The disc width (DW) ranged from 28.0 to 63.2 cm for females and from 34.0 to 59.6 for males. Females were classified as immature (n= 30; 22.4%); maturing (n= 41; 30.6%); pre-ovulatory (n= 25; 18.7%); pregnant in early gestation (n= 14; 10.4%); pregnant in mid gestation (n= 8; 6.0%); pregnant full term (n= 2; 1.5%); postpartum (n= 4; 3.0%); and resting (n= 10; 7.5%). For the 24 (17.9%) pregnant females the DW ranged between 46.0 and 60.8 cm. The monthly distribution of the reproductive stages does not indicate any clear seasonality for the reproductive cycle of the species. Ovarian vitellogenesis seems to happen simultaneously with gestation, indicating that females are ready to ovulate close after parturition. Size at first sexual maturity was estimated at around 45 cm DW for females, and at or below 34 cm for males, since all sampled specimens were equal or larger than this size and were all already mature.

KEYWORDS
elasmobranches, bycatch, biology

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1. Introduction

The pelagic stingray, Pteroplatytrygon violacea, is the only stingray that has an entirely pelagic behavior (Wilson e Beckett, 1970), being distributed in oceanic areas in relatively shallow waters, up to 100m in depth (Wilson and Beckett 1970; Last and Stevens 1994). Tortonese (1956) apud Mollet (2002) suggested that this species occurred frequently only in the Mediterranean Sea, being rare in other places, but several recent papers have shown that P. violacea has a worldwide distribution with highest abundances in tropical and subtropical regions, although it can be also found in temperate latitudes (Wilson and Beckett 1970; Last and Stevens 1994; Mollet, 2002; Domingo et al., 2005).

In spite of the fact that it has no commercial value, the P. violacea has been reported as an important bycatch species in many of the tuna longline fisheries throughout the world (Wilson e Beckett, 1970; Amorim et al., 1998; Mollet, 2002; Domingo et al., 2005; Joung et al., 2005), a fact that might put their conservation at risk. In this context, is extremely important to increase the present knowledge about the biological aspects of the pelagic stingray and to include this information in future management plans. The aim of the present paper, therefore, was to provide information on the reproductive biology of pelagic stingrays, caught by Brazilian tuna longliners (including both chartered and national vessels) in the southwestern Atlantic Ocean.

2. Material and Methods

All specimens were collected by onboard observers of the National Observer Program for the commercial chartered vessels of the Brazillian fleet, between October 2005 and January 2008. Although the fishing ground was delimited by the square of 09°N, 28°S, 018°W and 053°W, the P. violacea was only caught between 06°N, 22°S, 018°W and 037°W.

After being boarded, the specimens were labeled and frozen. Later, in the laboratory, they were weighed (total and dressed weight: TW and DW) and measured (disc width and length: DW; and DL). It was not possible to measure the total length because, for safety reasons, the tail is cut onboard.

From the females, the ovaries and the oviducal glands were removed and then weighed and measured (length and width). The development stage of the ovaries was observed macroscopically and the ovarian fecundity was determined by counting the number of vitellogenic and non-vitellogenic follicles. The diameter of the largest follicle was measured (Hazin, 2000). After the length and width of the uterus were measured, they were longitudinally sectioned, in order to allow the examination of its contents. Whenever eggs or embryos were present, they were counted, with embryo sex, total length and disc length being recorded.

From the males, the testicles were extracted, weighed and measured (length and width). Only the right testicle was used for the biological analysis. The claspers lengths were also measured and their calcification stage assessed as flexible, semi-calcified or calcified.

3. Results

3.1. Size composition and sex ratio

Of the 367 analyzed specimens, 230 were male (62.7%) and 137 were females (37.3%), resulting in a sex ratio of 1 male: 0.6 female. Statistical differences in sex ratios were observed for the months of January and February only (P < 0.05) (Table 1). Males ranged between 34.0 and 59.6 cm of disc length (DL), and 780.0 and 3,660.0 g of total weight (TW). Females ranged between 28.0 and 63.2 cm of DW, 20.6 and 50.5 cm of DL and 380.0 and 5,360.0 g of TW. In general, females were larger than males. The most frequent size class of males was between 45 and 50 cm DW, while females had the largest number of individuals included within the lengths from 50 to 55 cm (Figure 1). It was possible to identify the geographical position of catch of 143 males and 92 females (Figure 2).
3.1. Biological aspects

Of the 137 females sampled, only 134 could have their reproductive organs analyzed, being classified as immature (n= 30; 22.4%); maturing (n= 41; 30.6%); pre-ovulatory (n= 25; 18.7%); pregnant in early gestation (n= 14; 10.4%), with only eggs in the uteri; pregnant in mid gestation (n= 8; 6.0%), with embryos ranging between 4.9 and 12.2 cm WD; pregnant full term (n= 2; 1.5%), with embryos ranging between 14.2 and 18.8 cm WD; postpartum (n= 4; 3.0%); and resting (n= 10; 7.5%) (Table 2). The ovary weight varied between 0.1 and 17.0 g (Figure 3), the uteri width between 0.5 and 12.0 cm (Figure 4) and the diameter of the largest ovarian follicle (DLOF) between 0.3 and 2.0 cm (Figure 5), for the different maturity stages. No clear seasonal pattern was observed within the different stages.

From the total of 37 observed embryos, 17 were males and 17 were females, whilst the sex of the remaining three could not be estimated, due to their very small size. The uterine fecundity was equal to 3.7 embryos per female, while the ovarian fecundity, measured for 64 females, was equal to 8.3 oocytes per ovary.

The length of the testicle ranged between 1.0 and 2.9 cm (Figure 8) and the weight between 2.0 and 19.0g. The relationship between disc width and clasper length presented no significant trend (Figure 7). Despite a histological analysis is needed to confirm the development stage of testicles, all analyzed males were likely adults.

4. Discussion

Hemida et al (2003), studying the P. violacea in the Mediterranean Sea, reported a sexual proportion of 1 male: 1.5 female. Neer (2006), working in the Pacific Ocean, found a proportion of females even higher (1 male: 2.4 females). These results differ from the sex ratio found in the present work (1 male: 0.6 female), a difference that might be related to the different sampled areas.

The mean ovarian fecundity in the present work (8.3 oocytes per ovary), agrees well with Hemida et al. (2003), who reported an ovarian fecundity ranging between 5 and 10 oocytes. The mean uterine fecundity found in the present work, in turn, equal to 3.7 embryos per female, was a little less than the number of 5.4 embryos observed by Mazzoleni (2002), but again within the range reported by Hemida et al (2003), between 2 and 7.

A higher ovarian fecundity than the uterine one should be expected, since during the ovulation process some oocytes are not liberated, being reabsorbed by the ovary. Another reason for a lower uterine fecundity is the possible abortion at the moment of catch, a phenomenon that has already been observed for other Dasiatidae species (Mllinger, 1989 apud 2003). The sex ratio found for embryos, equal to 1:1, was similar to the one observed by Hemida et al (2003) for P. violacea and by Snelson et al (1988) for Dasyatis sabina.

The monthly distribution of maturity stages does not seem to show any clear seasonal pattern in the reproductive cycle of the species. Furthermore, the larger ovarian follicles observed in the pre-ovulatory and pregnant females suggest that this species is ready for a new ovulation close after parturition. These results coincide with those of Hemida et al (2003), as well, indicating that this species carries out the vitellogenic process simultaneously with pregnancy.

According to Bester et al. (2005), the size at first maturity for the females of P. violacea ranges between 40.0 and 50.0 cm DW. The results obtained in the present work agrees with that size range, suggesting that the first maturity occurs around 45 cm DW. In the present work, all but 12 females presented a DW larger than the suggested size for first maturity.
In the present work, the clasper development of *P. violacea* did not show any correlation with DW, a result similar to the one found by Neer (2008). Hemida (2003), nevertheless, did observe a positive correlation between disc width and clasper length. The most likely reason for such a divergence is the different size ranges of the sampled specimens, much larger for the last author. This result also seems to confirm that all males sampled in the present study were sexually mature. The male size at first maturity for the species estimated by Bester et al. (2005) lied between 35.0 and 40.0 cm, while the males sampled in the present study ranged from 34.0 to 59.6 of DW, confirming that all males sampled had indeed reached maturity. The present data suggest that males of *P. violacea* mature at a smaller size than females, a trend that is commonly observed in many elasmobranches species (Ismen, 2003; Snelson et al., 1988)

References


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**Table 1**- Number of pelagic stingray sampled by year, in the southwestern Atlantic Ocean.

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<th>Year</th>
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<td>M</td>
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<td>78</td>
<td>47</td>
<td>35</td>
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*Values statistically significant at 95% confidence level.

**Table 2**- Measurements of analyzed females by reproductive stage.

<table>
<thead>
<tr>
<th></th>
<th>Number</th>
<th>% of total</th>
<th>disc width (DW) - cm</th>
<th>total weight (TW) - g</th>
<th>uteri width (UW) - cm</th>
<th>ovary weight (OW) - g</th>
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<td>30</td>
<td>22,4%</td>
<td>28.0 - 41.1</td>
<td>380.0 - 2100.0</td>
<td>0.5 - 3.5</td>
<td>0.1 - 3.1</td>
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<td>maturing</td>
<td>41</td>
<td>30,6%</td>
<td>46.0 - 60.8</td>
<td>1440.0 - 4120.0</td>
<td>2.3 - 6.0</td>
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<tr>
<td>pre-ovulatory</td>
<td>25</td>
<td>18,7%</td>
<td>46.0 - 60.8</td>
<td>2320.0 - 5360.0</td>
<td>3.1 - 8.0</td>
<td>2.0 - 17.0</td>
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<tr>
<td>pregnant</td>
<td>24</td>
<td>17,9%</td>
<td>47.0 - 56.3</td>
<td>2180.0 - 5160.0</td>
<td>3.6 - 12.0</td>
<td>0.7 - 15.0</td>
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<td>postpartum</td>
<td>4</td>
<td>3,0%</td>
<td>49.4 - 63.2</td>
<td>2500.0 - 4640.0</td>
<td>4.3 - 6.0</td>
<td>4.0 - 7.0</td>
</tr>
<tr>
<td>resting</td>
<td>10</td>
<td>7,5%</td>
<td>49.1 - 57.4</td>
<td>2260.0 - 3940.0</td>
<td>2.8 - 7.2</td>
<td>0.7 - 1.8</td>
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</tbody>
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Figure 1- Disc width (DW) frequency distribution of male and female pelagic stingrays caught in the southwestern Atlantic Ocean.
Figure 2- Geographical distribution of the pelagic stingrays sampled, by sex, by observers on board Brazilian longliners based in Natal- RN and Cabedelo- PB.

Figure 3- Relationship between DW and weight of ovary by female maturity stages.
**Figure 4**- Relationship between DW and width of uterus by female maturity stages.

**Figure 5**- Relationship between DW and DLOF (diameter of the largest ovarian follicle) by female maturity stages.
**Figure 6**- Monthly distribution of female maturity stage.

**Figure 7**- Relationship between DW and length of clasper in males of *P. violacea*. 

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n = 206
Figure 8- Relationship between DW and width of testis in males of *P. violacea*.