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REPRODUCTIVE CYCLE OF *DENTEX MACROPHTHALMUS* (BLOCH, 1791) IN CENTRAL ATLANTIC WATERS, ESPECIALLY ON SENEGALESE COAST.

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ABSTRACT

Dentex macrophtalmus has a significant commercial value in Senegal. Despite this importance few biological studies have been conducted in our country. This work has been initiated in order to fill this gap. We conducted monthly withdrawals at the banks of landings surrounding the city of Dakar, Yoff, Ouakam Yarakh and Soumbédioum. Macroscopic observations and photonic associated monthly monitoring of gonadosomatic ratio hepatosomatic, condition factor summers were performed to determine reproduction periods of *D.macrophtalmus.* This species has a breeding season that goes from February to June; sexual rest is from July to August. The size at first maturity is 13.94 cm in females and 13.89 cm in males.

KEYWORDS: Gonadal maturation, reproduction period, size at first sexual maturity, *Dentex macrophtalmus*, Senegal.

INTRODUCTION

The Senegalese Atlantic coast is a center of upwelling phenomena which causes the rise of deep waters rich in nutrients what generally explains the diversity of the fish fauna in African northwest coast particularly in Senegal. Despite this variety of fishes, the availability of biological data for many fish species remains basic. As is the case of *Dentex macrophtalmus* which belongs to Sparidae family. In Senegal *Dentex macrophtalmus* has a significant

economic value. It is an exported fish mainly to the European Union (EU), which receives 60% of the exported volume. The flesh is very appreciated by local people. With a view to a good management, the study of the reproductive biology of this species was undertaken. *D.macrophtalmus* is a demersal species that lives between 40 m and 500 m of depth. In cold season it migrates to the coast. The *D.macrophtalmus'* size can reach 40 cm, but the most common one is 20 cm. *D.macrophtalmus* has only one breeding season which extends from February to June for both sexes.

MATERIALS AND METHODS

This was a two time work: from 2003 to 2004 then from 2008 to 2009. Monthly sampling was realized at Soumbédioum, Yarakh and Yoff beaches. The samples are from artisanal fishing. Every monthly sampling involves at least 30 individuals. We used 643 *D.macrophtalmus* in order to study the reproduction mechanism and the size evaluation at first sexual maturity. On each individual collected we performed measurements of the eviscerated weight (WE), the gonads weight (GW), the liver weight (LW) to the meadows gram. We also measured the standard length (Lst) in centimeters. The hepato-somatic index (HSI) is the ratio of the liver's weight (WL) to the animal eviscerated weight. Variations in the HSI reflect periodically the liver's weight changes.

The condition factor (Kv) is the ratio of the eviscerated weight of the animal to the cube of the standard length of the fish.

$GSI = W_G/W_E \times 100$	(1)
$HSI = W_L/ W_E \times 100$	(2)
$Kv = [W_E/(Lst)^3] \times 100$	(3)

These three parameters are calculated as a percentage using the following formulas:

The length at first sexual maturity is the size at which 50% of the population show signs of sexual activities (from stage III to stage VI). These individuals are split by gender and by size class. The estimate of this parameter is made on samples taken during the reproduction period. The size at first sexual maturity is calculated using the following formula:

$P= 100/(1+\exp^{(-a(Lst-L_{50}))}).$

The sex of each fish collected is given visually or microscopically. The gonad's color and consistency are also noted. To follow gonad's maturation we used a scale of seven stages

adapted.[1] In the middle region of the selected gonads, fragments are removed and then fixed in Bouain -Holland. After they are dried, they are soaked in paraffin and then 7µm sections are cut with a microtome and stained with Stassnie Masson's Trichrome according to Gabe technique. The sections were mounted between slide and cover slip in Canada balsam. They were observed with light microscope Motic associated with image analysis system.

RESULTS

The Gonadal Maturation

A- Ovarian maturation

The ovarian maturation phenomenon *in D.macrophtalmus* can be divided into previtellogenesis, vitellogenic and post-vitellogenic.

A1- Previtellogenesis

Stage I and stage II correspond to the previtellogenesis during which the ovary farm appears light pink. It is filiform and attached to the rear wall of the abdominal cavity at the beginning of the previtellogenesis. Ovarian lamellae are occupied only by small ovarian follicles. They become more bulky at stage II. Ovarian follicle at previtellogenesis phase consists of an oocyte comprising a nucleus surrounded by a cytoplasm. The nucleus contains multiple nucleoli. The oocyte envelopes are not yet identified (Fig.1). Stage I is observed in September. Stage II covers October.

A2-Vitellogenesis and Post Vitellogenesis

They cover stages III, IV, V and VI; stages during which the ovarian follicle accumulates its reserves and builds up all its oocyte envelopes.

Stage III: it marks the beginning of vitellogenesis. In the abdominal cavity, the ovary is colored light pink. The ovary is finely grained. The irrigation system becomes visible. Photonic examinations reveal that first reserves which appear in stage III are cortical alveoli. They first occupy the peripheral zone before invading the cytoplasm. It lasts from November to December.

Stage IV: the ovarian color becomes dark pink. The ovaries occupy 2/3 of the abdominal cavity. The cortical alveoli are distributed all around the nucleus (Fig.2). The stage IV is observed from January to February.

Stage V: the ovaries are very vascularized and hypertrophied. They occupy almost the entire abdominal cavity. Their consistency becomes more or less creamy. The deposition of yolk inclusions intensifies at this stage.

They appear as globules that accumulate in the cytoplasm except the perinuclear area. The ovarian follicle also builds its different oocyte envelopes that is the theca which is separated from follicular envelope by basal lamina (Figure 3). The stage V is observed from March to April.

Stage VI: ovary color becomes yellow-orange. The occytes are individualized. They are identifiable by transparency through ovarian wall. They escape from the urogenital opening in the abdomen by a simple push. This stage marks the end of vitellogenesis and post - vitellogenesis. It lasts from May to June.

Stage VII: the ovaries are highly vascularized. They become flaccid. They are dark red colored with red spot which are necrotic areas. The stage VII is the sexual rest period. There are only previtellogenetic ovarian follicles and atretic follicles in the ovaries. The lamellae are occupied by oocytes at the start of previtellogenesis. They are invading the testicular territory after spawning has occurred (Fig. 4). It lasts from July to August.

B- The evolution of the testicles

Even testes are located in the abdominal cavity. The testicle is divided into compartments by the extensions of Sertoli cells. Each compartment is a cyst. The evolution of spermatogonia and spermatocytes happens entirely within the cysts; however spermiogenesis takes place in the testicular lumen.

Stage I: with a macroscopic view the testicle appears filiform and transparent. They are only spermatogonia in the cysts. The evolution of spermatogonia is synchronous within a cyst. Spermatogonia appear from September to October.

Stages II and III: the testicle becomes white. Histological observations show that the spermatocytogenesis occurs in cysts (Fig.5). Spermatocytes I prevail from November to December. Spermatocytes II are very fleeting.

Stages IV and V: the large testes appear pearly white. Spermatids are in the testicular lumen following the opening cyst (Fig. 6). They last from January to April.

Stage VI: vascularization is at its maximum, the testicle becomes round. The testes are colored milky white. Sperm has a fine grains appearance. It lasts from May to June. Milt flows as soon as you press the abdomen.

Stage VII: the testicles are flabby and they are less voluminous. The color is grey-white.

The monthly monitoring reports average changes in Gonado-Somatic Index (GSI) Hepato-Somatic Index (HSI) and Condition Factor (Kv)

The monthly monitoring reports average changes in Gonado-Somatic Index (GSI) Hepato-Somatic Index (HSI) and Condition Factor (Kv). That confirms the evolution of gonadal maturation. The increase in average values of GSI is from February to May in females. In males it is lagging months behind. The maximum values are 5.92 in females and 1.88 in males for *D.macrophtalmus*. The GSI values remain low from June to November .The minima are reached in June in both sexes, with values of 0.83 for females and 0.25 for males. The HSI increases regularly in females, peaking in April (3.12). The minimum value is 0.59, it is reached in October. In males the maximum value of 1.54 is achieved in July. The minimum value is 0.53, it is reached in October. The maximum Kv are reached respectively in May with 2.78 in females and 2.77 in males. The minima are reached in August for both, in females (2.07) and in males (1.94).

The size at first maturity

It is the standard size at which 50% of the population show signs of sexual activity. The *D.macrophtalmus* size at first maturity is estimated to be at 13.94 cm for females and 13.89 cm for males.

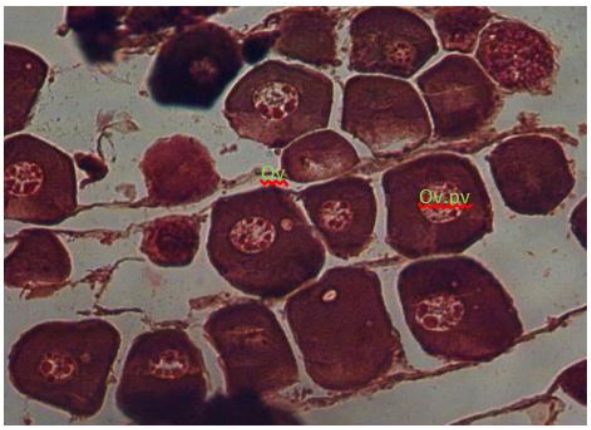


Fig. 1: Ovarian lamellae contain only previtellogenetic oocytes, they have a large and homogeneous cytoplasm with several nucleoli Gr:
40 previtellogenetic oocyte: p o.

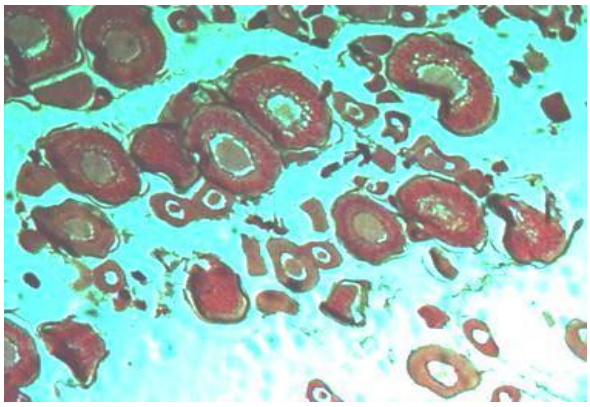


Fig. 2: Cortical alveoli are located in the perinuclear area. Nuclear volume dropped. Gr.

40. Cortical Alveoli: ca.

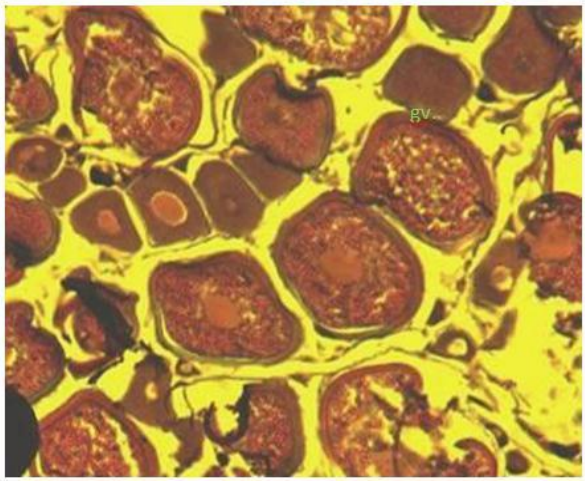


Fig.3: Cortical alveoli and yolk globule occupy the entire cytoplasm of the oocyte surrounded by all its envelopes. GR.

40, yolk globule: yg.

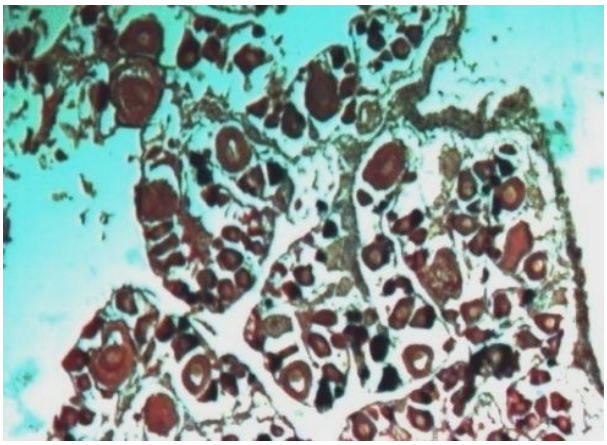


Fig.4: previtellogenetic oocyte i n v a d i n g the testicular tissue. Gr.: 10.

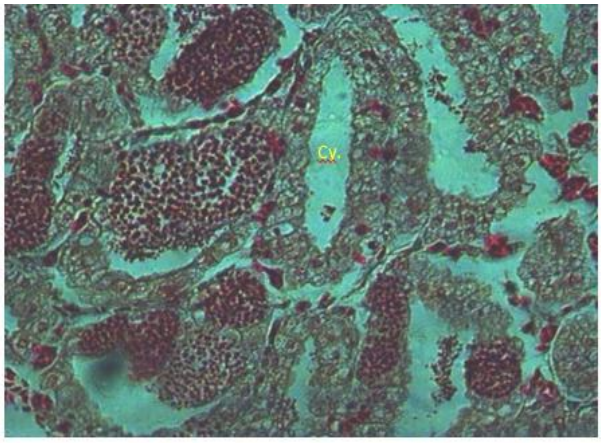
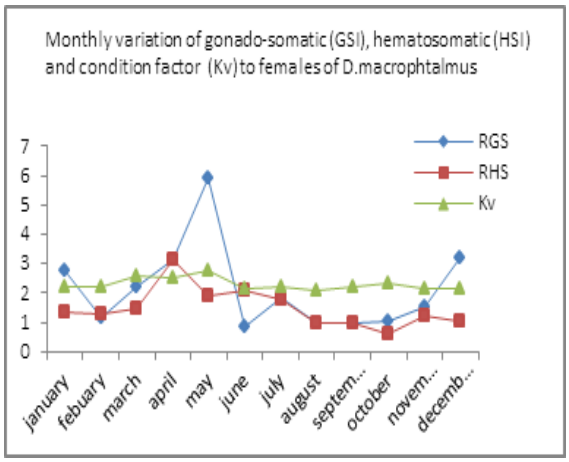
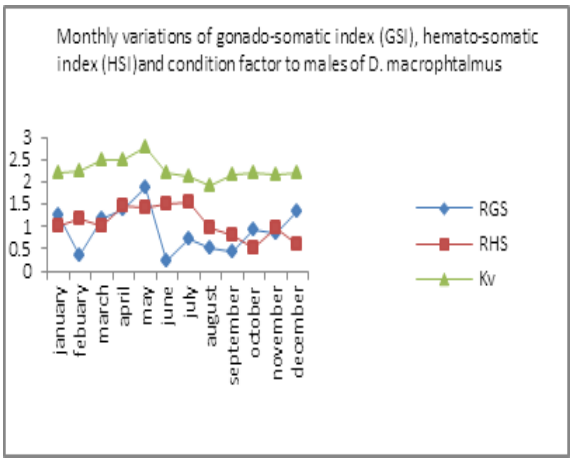
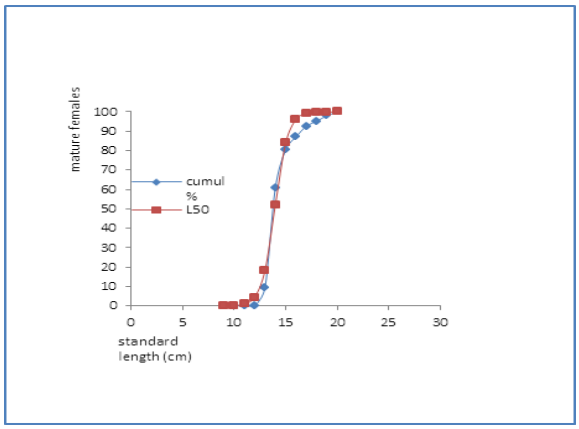


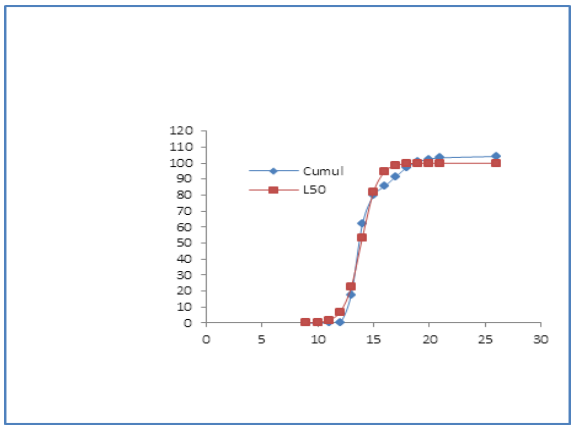
Fig. 5: Spermatogonia and spermatocytes; progressing in testicular cysts Gr.: 40

cyst: cy









DISCUSSION

The examination of gonadal maturation in D.macrophtalmus combined with monthly monitoring of GSI, HSI and Kv shows that this species breeds only once a year. We find this same situation in other Sparidae as Dentex maroccanus (Chemmam 2002), Rhabdosargus sarba (Alex Hesp, 2003) and Pagellus erythrinus (Metin, 2011).

The only reproductive period of *D.macrophtalmus* extends from February to June. In females there is a massive accumulation of reserves in the oocyte cytoplasm during ovaries maturation. This upward phase culminates in May where the GSI reaches its maximum value. The issue of genital products in both sexes is from May to June before *D. macrophtalmus* begins its sexual rest. The sexual rest lasts from July to August in both sexes. This period is short for some Sparidae such as Pagellus bellottii (Ndiaye, 2014), Pagellus bogaraveo (Lechekhab, 2010). The sexual rest period is long for Spondyliosoma cantharus (Bouguamou, 2008-2009). During this period the values of HSI and Kv are greater than the GSI's in both sexes. However the maximum values are reached during the breeding season. This proves reserves accumulation happens during reproduction period.

The size at first sexual maturity is smaller for some Sparidae. It is estimated at 15.40 cm in *D.angolensis* (Konan, 1979). It is reached at 15.6 cm (LF) in *Dentex maroccanus* (Lamrini, 2002).

It is 14.99 cm in females and 15.03 for males, in *D. maroccanus*, in *D. gibbosus* it measures 29.27 cm in females and 29.89 cm in males (LT), in *D. Dentex* is 22.58 cm in females and 23.32 cm in males (LT).[2] The size at first maturity in females and males in *P. erythrinus* in Tunis is 14.6cm and 15.8cm respectively (LT) (Zarrad, 2010). In *P. bogaraveo* it measures is 28cm in males and in females 29.5cm (Micale, 2011). In *Diplodus bellottii* the size at first maturity was 14.2 cm for females and 14.07 cm in males (Ndiaye, 2015). The size at first sexual maturity is smaller than the minimum recommended capture size for this species is 15 cm (LF) in Senegal.

CONCLUSION

Dentex macrophtalmus only breeds only once a year. The reproduction period is from February to June. The sexual rest extends from July to August. The size at first maturity varies a little between males and females.

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