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Macroscopic evolution of the *Pomadasys jubelini* testis from the Ivorian continental shelf

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Abstract

Undernourishment linked to a lack of animal protein is rife in Africa. Fish consumption appears to be the solution to this problem. However, fish products are becoming increasingly scarce due to the depletion of fish farming resources in maritime and continental waters. Hence the need to intensify fish farming. This requires mastery of the reproduction of the fish to be domesticated. After dissecting the fish, their sex and stage of sexual maturity were determined. An anatomical study showed that the *Pomadasys jubelini* testis consists of 2 lobes and presents 5 stages of sexual maturity. They become spermiant at stage 4, making stage 4 males ideal broodstock for fish farming.

Keywords: *Pomadasys jubelini*; Testes; Spermiants; Fish farming

1. Introduction

Malnutrition is becoming a major public health problem worldwide, and particularly in Africa [1]. It is mainly due to protein deficiencies, and animal proteins in particular [2]. Restrictions on transhumance movements and high livestock concentrations in certain areas are exacerbating the deterioration in pastoral conditions [3]. Fish is therefore becoming the most accessible source of animal protein. It comes mainly from marine and inland fisheries [4]. However, most of the world's fish stocks are depleted [5]. Fish farming therefore appears to be the solution to this crucial problem [6]. Fish farming requires knowledge of the reproductive biology of the species to be domesticated.

Numerous authors [7], [8], [9], [10], [11], [12] have carried out studies on certain reproductive parameters of a number of species with fish farming potential. Most of the work already carried out has focused on size at first sexual maturity, fecundity, oocyte diameter, gonadosomatic ratio and, above all, hepatosomatic ratio. The aim of the present work was to describe the macroscopic evolution of the *Pomadasys jubelini* testis.

2. Material and methods

The study involved 92 males of *Pomadasys jubelini*. Sampling was carried out at the fishing port of Abidjan from January 2016 to January 2017. To have intact testes, some fish were dissected on site. All testicles were removed for macroscopic study.

After dissection of the fish, their sex and stage of sexual maturity were determined using the method of [12]. Testes corresponding to different stages of sexual maturity were described taking into account the following criteria:

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- Coloration
- Shape
- Superficial vascularization
- size
- weight

3. Results

Macroscopic examination of the testicles has enabled us to differentiate 5 stages. The testicles vary in appearance, color, size and shape.

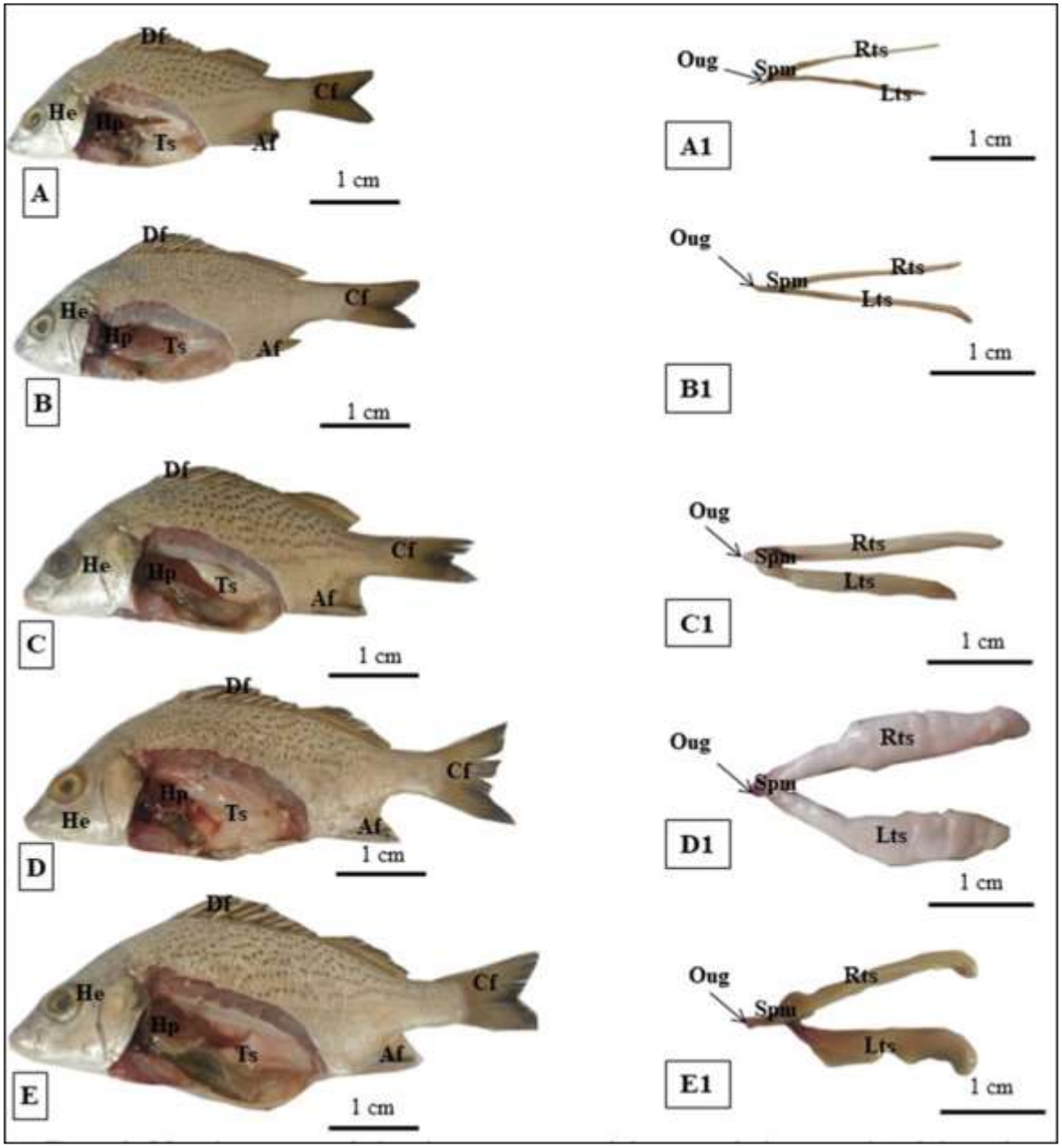

Figure 1 Maturiy stages and changing appearance of the tests during maturity of the male *pomadasys jubelini*: A: juvenilw male at stage 1: AL: male testis at satage 1; B juvenile male at stage 2: B1: male testis at stage 2: C; adult male testis at stage 3; C1 abult at stage 3; C1; adult male testis at stage 3; D: adult male testis at stage 4; D1: adult male testis at stage 4 E: stage 5 adult male E1 ; stage 5 male testicle ; Af; anal; Cf; caudal fin; Df dorsal fin; Rts ;rifht testis; Lts; left testis; Spm: spermiduct; He head; Ts: testis; Hp; hepatopancreas

3.1. Stage 1

The testis consisted of two unequal, filiform lobes (Figures 1 A and A1). The left lobe measured 2.7 cm with a diameter of 0.2 cm, and the right lobe measured 2.3 cm with a diameter of 0.2 cm.It weighed 5 g. The testicle was translucent and whitish. Blood vessels were not apparent.

3.2. Stage 2

The male gonad was poorly developed, firm and with two unequal lobes (Figure 1 B and B1). The left and right lobes measured 3.7 cm and 0.3 cm in diameter respectively, and 3.4 cm and 0.3 cm in diameter. Weight: 7 g. She had a whitish coloration (Figure 1 B1). Blood vessels were not visible.

3.3. Stage 3

The male genital gland testis was developed (Figures 1 C and C1). It had two unequal lobes. The left lobe measured 6.1 cm with a diameter of 1 cm, and the right lobe measured 6.8 cm with a diameter of 0.9 cm. It weighed 16 g and was whitish. No semen discharge was observed following abdominal pressure.

3.4. Stage 4

The testis was developed with two unequal lobes (Figure 1 D and D1). The left and right lobes measured 6.8cm and 2cm in diameter respectively, and 7.3cm and 1.7cm. It weighed 34 g and was whitish. Semen flowed at the slightest pressure from the abdomen.

3.5. Stage 5

The testis consisted of two lobes of equal length (Figure 1 E and E1). The left lobe measured 6.4 cm with a diameter of 1.1 cm, and the right lobe measured 6.4 cm with a diameter of 0.9 cm. It weighed 27g and became flaccid and brownish.

4. Discussion

The testis of the male *Pomadasys jubelini* is composed of two generally unequal lobes which meet in the posterior part to form a vas deferens or spermiduct.[13] has shown that the testes of *Heterobranchus longifilis* take the form of two tongues connected at their posterior end to seminal vesicles forming bangs. This reflects the polymorphism of testes in fish, depending on the species.

The size, color and vascularization of the testes are highly variable, enabling us to identify 5 stages of sexual maturity. The present results are similar to those of [14], [15] and [16]. [17] also identified 5 stages of sexual maturity in *Brachydeuterus auritus* males. [12] also determined 5 stages of sexual maturity in *Pomadasys jubelini* males. For [18], males of *Pomadasys jubelini* showed 7 stages of sexual maturity. The variation in the number of stages of sexual maturity in *Pomadasys jubelini* between authors can be explained by differences in criteria and, above all, by the experimenter's judgement, in the absence of a universal reference for determining stages of maturity.

Testicular size and diameter increase from stage 1 to stage 4, then decrease from stage 4 to stage 5. The increase in testicular size and diameter from stage 1 to stage 4 is due to the multiplication and accumulation of sex cells and the production of milt in these organs. In stage 4, the testicles are more turgid, as they contain the maximum amount of milt and spermatozoa. These males are therefore referred to as spermiants. From stage 4 to stage 5, the decline in testicular size and diameter is explained by the fact that, once milt and sperm have been released, the testicles become flaccid. Stage 5 individuals are post-spermiant males. These results corroborate those of [13] in *Heterobranchus longifilis*,[19] and [20] in forty fish species they studied, including *Anguilla anguilla*, *Carapus acus* and *Danio rerio*.

5. Conclusion

Macroscopically, the *Pomadasys jubelini* testis consists of 2 generally unequal lobes. It displays 5 stages of sexual maturity.

This anatomical study of the *Pomadasys jubelini* testis shows that stage 1 and stage 2 individuals are immature. They reach maturity in stage 3, become spermiants in stage 4 and post-spermiants in stage 5. Stage 4 males are therefore ideal broodstock for fish farming.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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