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SUMMARY – The results obtained by the histological analysis of Mediterranean bluefin tuna testes collected over a seven-month period (February-August) are reported. Five phases of the testicular cycle were characterised: (i) quiescence (February-March); (ii) early spermatogenesis (April-early May); (iii) late spermatogenesis (middle May); (iv) spawning (late May-early July); and (v) regression (late July-September).

Key words: Bluefin tuna, reproductive cycle, testis, histology, Mediterranean Sea.

RESUME – *"Cycle testiculaire du thon rouge méditerranéen (*Thunnus thynnus *L.)". Les résultats obtenus par analyse histologique des testicules de thon rouge méditerranéen prélevés sur une période de sept mois (février-août) sont reportés. Cinq phases du cycle testiculaire ont été caractérisées : (i) quiescence (février-mars) ; (ii) spermatogenèse précoce (avril-début mai) ; (iii) spermatogenèse tardive (mi-mai) ; (iv) reproduction (fin mai-début juillet) ; et (v) régression (fin juillet-septembre).*

Mots-clés : *Thon rouge, cycle reproductif, testicules, histologie, mer Méditerranée.*

Introduction

The knowledge of Mediterranean bluefin tuna (BFT) reproductive cycle is limited to research based on the study of seasonal variations of the gonadosomatic index (IG) (de la Serna and Alot, 1992), and on macroscopic classification of the gonads (Rodríguez-Roda, 1964, 1967). Susca *et al.* (2001) carried out the first attempt to correlate vitellogenin (VTG) and sex steroid plasma levels with ovarian cycle. Here a histological description of the changes occurring in BFT testis throughout the reproductive cycle is reported.

Materials and methods

Testis samples were obtained from 81 adult (fork length ≥ 120 cm) bluefin tuna caught by professional vessels from February to September in Italian and Spanish seas. The samples were fixed in Bouin's solution, dehydrated in ethanol and embedded in paraffin wax. Sections (5 µm thick) were stained with haematoxylin-eosin.

Results

Bluefin tuna testis (Fig. 1A) is constituted by seminipherous tubules radiating from the longitudinal main sperm duct toward the testicular periphery. Testicular structure is cystic: each cyst contains germinal cells in the same development stage, branched by the cytoplasm of somatic cells (Sertoli cells). The activity of the testes showed seasonal changes allowing the characterisation of five periods during the reproductive cycle:

(i) Quiescence (February-March) – seminipherous tubules showed germinal cysts containing spermatogonia and spermatocysts. Rare spermatidic cysts and few spermatozoa in the lumina were also observed (Fig. 1B).

(ii) Early spermatogenesis (April-early May) – testes showed germ cells at all stages of spermatogenesis and there was an increase in the number of spermatocytes and spermatids. Only few spermatozoa were observed in tubule lumina (Fig. 1C).

(iii) Late spermatogenesis (middle May) – active spermatogenesis took place in testes. The wall of seminipherous tubules was lined with meiotic and spermatidic cysts. Spermatozoa were more abundant in the lumen of seminipherous tubules, efferent ducts and main sperm duct than in previous stage (Fig. 1D).

(iv) Spawning (late May-early July) – the lumen of seminipherous tubules, efferents and main sperm duct were filled with spermatozoa. Residual meiotic and spermatidic cysts were still present along the tubule wall (Fig. 1E).

(v) Regression (late July-September) – lumina of seminipherous tubules and efferent ducts were almost devoid of spermatozoa, whereas residual spermatozoa could be observed in efferent ducts and in the main sperm duct (Fig. 1F).

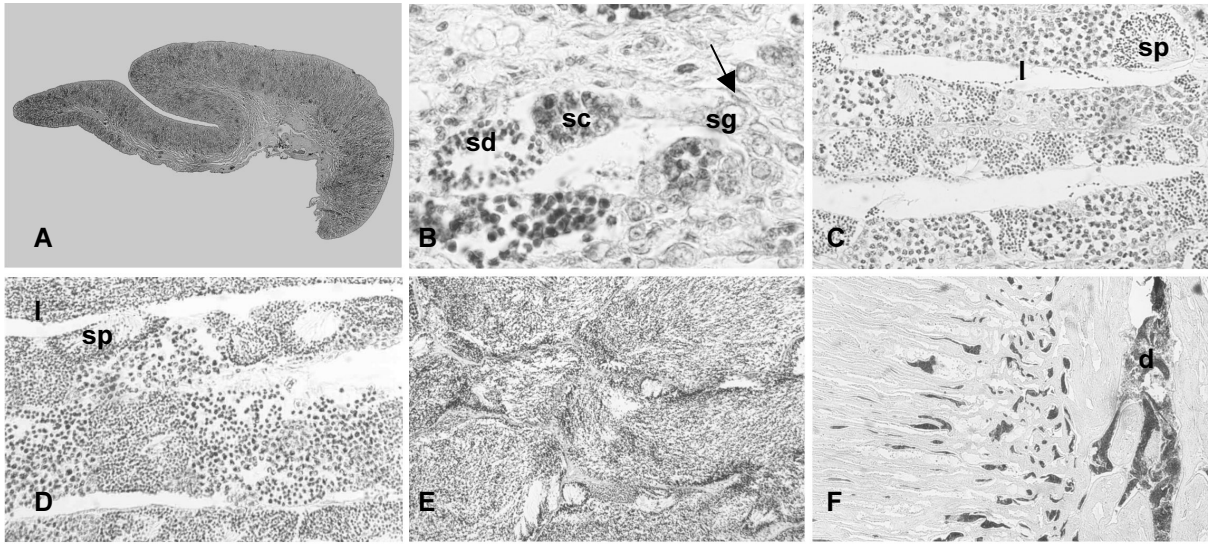

Fig. 1. A: Photomicrographs of the testis from a BFT specimen caught in March. Magnification, x 9. B: Higher magnification of part of Fig. 1A showing a seminipherous tubule. Magnification, x 500. C: Photomicrographs of the testis from a BFT specimen caught in April. Note the presence of rare spermatozoa in the lumen. Magnification, x 250. D: Photomicrographs of the testis from a BFT specimen caught in May. Note the abundance of sperm cysts and spermatozoa in the lumen of seminipherous tubule. Magnification, x 250. E: Photomicrographs of the testis from a BFT specimen caught in June. Seminipherous tubules are filled with spermatozoa. Magnification, x 123. F: Photomicrographs of the testis from a BFT specimen caught in September showing residual spermatozoa in the efferent ducts and in the main sperm duct. Magnification, x 30. Haematoxylin-Eosin staining. Arrow: Sertoli cell nucleus; d: main sperm duct; l: lumen of seminipherous tubule; sg: spermatogonium; sc: spermatocytic cyst; sd: spermatidic cyst; sp: spermic cysts.

Conclusions

The results obtained in this study show that maturity development of BFT testes starts in early spring with the renewal of spermatogonial mitotic activity. Testes are full mature from late May to the end of July when seminipherous tubules, efferent ducts and main sperm duct are filled with spermatozoa. The quiescent phase starts at the end of July when testes appear to regress, spermatogenetic activity is stopped, and only residual spermatozoa can be observed.

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