Histological and stereological assessment of batch fecundity, spawning frequency and maturation of female Atlantic bluefin tuna around the Balearic Islands

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Histological and stereological assessment of batch fecundity, spawning frequency and maturation of female Atlantic bluefin tuna around the Balearic Islands

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SUMMARY – The average batch fecundity of female eastern Atlantic bluefin tuna, *Thunnus thynnus thynnus* L., estimated from stereological quantification was of 92.8 oocytes per gram of body weight, and the spawning interval was calculated to be of 1.2 days. All the individuals from 3 years of age (19 kg of total body weight, 92 cm of fork length) showed mature ovaries, with migratory-nucleus oocytes and postovulatory follicles in most of the cases.

Key words: *Thunnus thynnus*, fecundity, stereology, maturation.

RESUME – *"Evaluation histologique et stéréologique de la fécondité des lots, de la fréquence de ponte et de la maturation de femelles de thons rouges de l'Atlantique dans la zone des Iles Baléares". La fécondité moyenne des lots de femelles de thons rouges de l'Atlantique Est,* Thunnus thynnus thynnus *L., estimée par quantification stéréologique, était de 92,8 ovocytes par gramme de poids corporel, et l'intervalle de ponte était estimé à 1,2 jours. Tous les individus à partir de 3 ans d'âge (19 kg de poids corporel total, 92 cm de longueur à la fourche) présentaient des ovaires matures, avec des ovocytes à noyau migratoire et des follicules post-ovulatoires dans la plupart des cas.*

Mots-clés : Thunnus thynnus*, fécondité, stéréologie, maturation*.

Introduction

The eastern stock of Atlantic bluefin tuna (BFT) extends from Norway southwards to the Canary Islands, into the Mediterranean Sea and further south to the coast off South Africa. This BFT stock spawns in the Mediterranean Sea, with two main spawning grounds located around the Balearic Islands and south of the Tyrrhenian Sea (Dicenta, 1977).

Recently, high fishing pressure has caused reduction in the biomass of BFT populations. The effective management of this resource requires a deep knowledge of their biology, particularly their reproduction.

The aim of this study is to contribute to the understanding of the reproductive biology of Atlantic BFT.

Materials and methods

A total of 45 female BFT, captured by purse seine in spawning grounds around the Balearic Islands from 1999 to 2001, were used for the determination of the relative batch fecundity and spawning frequency.

Gonad samples were fixed in 4% formaldehyde, dehydrated in ascending concentrations of ethanol and embedded in paraffin wax. 6-µm sections were stained with haematoxylin-eosin.

The mean spawning interval was determined by the postovulatory follicle method of Hunter and Macewicz (1985). For the estimation of the relative batch fecundity, the numerical density of migratory-nucleus stage oocytes was calculated using the stereological method (Weibel and Gómez,

1962; Weibel, 1969). This value was raised to the whole volume of the gonad and divided by the total body weight of the animal.

Results and discussion

The ovaries of all BFT larger than 92 cm in fork length (~19 kg) contained oocytes at different developmental stages, the most advanced group of oocytes being at the migratory-nucleus stage. Only in one individual were fully hydrated oocytes found. The average relative batch fecundity calculated for this specimens was 92.8 oocytes per gram of body weight. No relationship was found between batch fecundity and total body weight. The spawning interval estimated for the sample was 1.2 days.

In 2001, small tuna weighing less than 35 kg were sampled during the spawning season. Among these specimens, two distinct size classes were present. In the smaller size class (9-13 kg) all the individuals examined showed immature ovaries, while all the tuna belonging to the larger size class (19-34 kg) had spawning ovaries.

Conclusions

The simultaneous occurrence of migratory-nucleus stage oocytes and postovulatory follicles indicates the capability of BFT of spawning several batches of mature oocytes during the spawning season. This is characteristic in species with an asynchronous pattern of development of the ovaries. The estimated value obtained for the spawning interval shows that this species is able to spawn daily.

The eastern stock of Atlantic BFT appears to be able to spawn from the age of 3 years. This observation may be of interest in aquaculture, since the use of small BFT as broodstock would reduce problems of handling.

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