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OOGENESIS IN WILD AND REARED GREATER AMBERJACK *Seriola dumerili* (RISSO, 1810)

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Introduction

The incorporation of new species in the aquaculture industry necessitates to control the reproductive function in captivity and to produce high numbers of high-quality eggs. Greater amberjack *Seriola dumerili* (Risso, 1810) caught from the wild and reared in captivity have been shown not to develop further than early vitellogenesis or if they did complete vitellogenesis, they failed to undergo oocyte maturation and required exogenous hormonal therapies to induce ovulation and spawning (Mylonas et al., 2004). The present work represents an overview of the results obtained in a study on the oogenesis of wild and captive-reared greater amberjack carried out within the EU FP7 project Diversify (Zupa et al, 2017; Pousis et al., 2018, 2019).

Material and Methods

Twenty-one wild and twelve captive-reared greater amberjack females were sampled during 2014, 2015 and 2016 at three different phases of the reproductive cycle: early gametogenesis (EARLY), late April-early May (wild fish = 5; captive-reared fish = 4); advanced gametogenesis (ADVANCED), late May-early June (wild fish = 4; captive-reared fish = 4); spawning (SPAWNING), late June-early July (wild fish = 12; captive-reared fish = 4). Wild fish were sampled on board a professional purse-seine fishing vessel operating around the Pelagie Islands (Sicily, Italy); captive-reared individuals belonged to a broodstock captured as juveniles and moved to a sea cage of Argosaronikos Fishfarming S.A. (Salamina Island, Greece). For each fish, biometric data (fork length, FL, in cm; body mass, BM, in kg; testis mass, TM, in g) were registered and gonadosomatic index ($GSI = 100 \times TM/BM$) was calculated. Liver samples were stored at -80°C and subsequently used for the analysis of vitellogenin (*vtga*, *vtgb* and *vtgc*) expression through RT-PCR. Ovary samples were used for histological analysis and for vitellogenin receptor (*vtgr* and *lrp13*) expression analysis through RT-PCR. Blood samples were centrifuged and plasma was stored at -20°C for the analysis of testosterone, 17β-estradiol and 17,20β-dihydroxypren-4-en-3-one by ELISA assays.

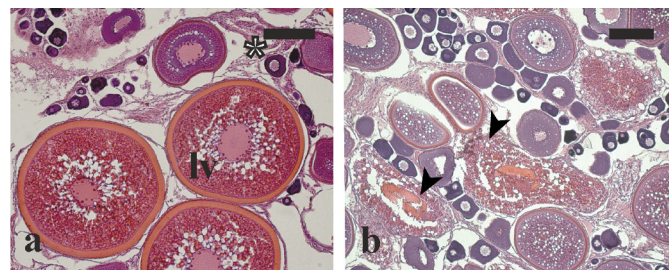


Fig. 1. Micrographs from greater amberjack ovaries sampled during the ADVANCED phase of the reproductive season. (a) Wild fish showing late vitellogenic oocytes and post-ovulatory follicles. (b) Captive-reared fish showing extensive atresia of late vitellogenic follicles. Haematoxylin-eosin staining. Magnification bars = 150 µm. Arrowheads: atretic late vitellogenic follicles; asterisk: post-ovulatory follicle; lv: late vitellogenic follicle.

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Results and Discussion

The GSI and all the sex steroid plasma levels were lower in captive-reared fish. During the EARLY phase, wild and captive-reared fish displayed perinucleolar or early vitellogenesis as the most advanced oocyte stage. During the ADVANCED phase, when the wild greater amberjack breeders were already in spawning condition (Fig. 1a), ovaries of captive-reared breeders showed extensive atresia of late vitellogenic oocytes (Fig. 1b). During the SPAWNING period, all captive-reared fish had regressed ovaries, while wild breeders still displayed oocytes at late vitellogenesis and maturation stages as well as postovulatory follicles.

The expression levels of *vtga*, *vtgb* and *vtgc* did not differ significantly between captive-reared and wild females. Ovarian *vtgr* and *lrp13* transcription was more active during early gametogenesis, suggesting that vitellogenin receptor transcripts were synthesized by previtellogenic oocytes and remained in the cellular mRNA pool until oocytes resumed meiosis and entered vitellogenesis. A reduced *vtgr* and *lrp13* transcription was observed in captive-reared compared wild greater amberjack during the EARLY phase. The observed reproductive dysfunction, leading to oocyte atresia and reduced gonadosomatic index, arose during the early phase of oogenesis, when transcription of vitellogenin receptor genes appeared to be reduced, and did not appear to be associated to a lower liver capacity to synthesize the egg yolk precursors. Severe reproductive dysfunctions were observed also in males of the same broodstock and involved low sex steroid plasma concentrations and precocious cessation of spermatogenesis (Zupa et al., 2017). Preliminary data obtained within the H2020 project NewTechAqua indicate that hatchery-produced greater amberjack reared in sea cages in Salamina (Greece) have similar GSI compared with wild fish sampled in the same period of the reproductive cycle (early June 2021). Although further analyses are required, the available data indicate that hatchery-produced individuals might be less affected by captivity-induced stress than wild-caught breeders.

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