IMPROVEMENT OF REPRODUCTIVE PERFORMANCE OF F1 GENERATION GREATER AMBERJACK (*Seriola dumerili*) WITH SUCCESIVE IMPLANTS OF GONADOTROPIN-RELEASING HORMONE AGONIST (GnRHa)

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Introduction

The greater amberjack (*Seriola dumerili*) is a species with high potential for aquaculture, due to its excellent flesh quality, worldwide market availability and high consumer acceptability. However, the industrial production is still negligible as a result of several bottlenecks. The most important one, being the absence of reliable reproduction observed in captivity. Agonists of gonadotropin-releasing hormone (GnRHa) have been used to overcome these problems in wild-caught and hatchery-produced greater amberjack broodstock (F1 generation). Previous results have shown that treatment with GnRHa implants at a dose 50µg GnRHa kg^{-1} body weight in females produced the first successful reproduction of F1 greater amberjack broodstock. However, one of the parameters required to optimize the therapy is to establish the best performing dose. The present study shows the results of an optimized hormonal spawning induction method using GnRHa delivery systems on the reproduction of F1 greater amberjack broodstock.

Materials and Methods

A group of 9 greater amberjack born in captivity was maintained in an outdoor covered raceway ($500m^3$) supplied with 6 renewals day^{-1} of seawater, under natural photoperiod at the Instituto Español de Oceanografía, Tenerife, Spain. The fish (4 males of 16.9±5.0kg and 5 females of 20.1±6.8kg) were sampled five times during the 2016 spawning season (from June to October) and biometric parameters of length and body weight were measured. Ovarian biopsies were obtained and a wet mount was examined under a microscope to evaluate the stage of oogenesis and the mean diameter of the largest, most advanced vitellogenic oocytes (n=10). A portion of the biopsy was fixed in a solution of 4% formaldehyde-1% glutaraldehyde for further histological processing. Maturation of the males was confirmed by the release of sperm upon application of gentle abdominal pressure. If this was not possible, a sperm sample was obtained by inserting a plastic catheter. The collected sperm was stored (4°C) until evaluation of sperm density, sperm motility and motility duration.

Fish were treated with an Ethylene–Vinyl acetate (EVAc) GnRHa implant (Mylonas and Zohar, 2001) in June, July, August and September. Although there were variations in the effective GnRHa dose applied to each fish (due to the fact that implants are loaded with fixed amounts of GnRHa), the females and males were treated with a dose of ~ 75 and 50μg GnRHa kg^{-1} body weight, respectively. At the time of GnRHa implantation, females were in advanced vitellogenesis and males had intra-testicular sperm.

Results and Discussion

Spawning of F1 greater amberjack started 24-48h after each hormonal treatment (Table I) and a total of 61 spawning were obtained during a period of 103 days. The number of spawnings and released eggs after each treatment was similar from June to August and decreased in September. After the 1st treatment (June to July), 20 spawns were collected almost daily during the first 15 days and each 4-5 days after. Following the 2nd and 3th treatments in July and August, 23 and 17 spawns were recorded, respectively, but in August no eggs were collected in the last 12 days. In the 4th period, only 1 spawning was observed after implantation.

A total of $22.6x10^6$ eggs were collected, and there were no significant difference between periods, except after the 4th treatment. There was a trend toward an increased number of eggs per spawning between June and July. Mean fertilization and hatching exhibited similar trends during the four spawning periods, reaching their highest values in the third period (July to August).

Mean sperm motility was 54±29% during the reproductive period and no differences were observed between the samplings. Mean motility duration was 2.3±0.9 min, and in June and August were significantly lower than in September. Moreover, sperm density decreased after the 1st treatment and remained lower from July to September.

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Table I. Treatment time of greater amberjack and spawning starting date (Treat. (Sp.), duration (Dur.), number of spawnings (Sp.), number of eggs (Eggs), number of eggs per spawning (Eggs/sp), fertilization (Fertilizat.) and hatching rates in each period after hormonal treatment with GnRHa implants.

Treat. (Sp.) (date)	Dur. (day)	Sp. (nº)	Eggs ($x10^6$)	Eggs/sp ($x10^4$)	Fertilizat. (%)	Hatching (%)
2 (4) June	35	20	6.97	34.8±22.8	72.3±27.5	16.8±16.4
7 (9) July	31	23	8.08	35.1±29.1	83.9±13.5	20.6±13.5
9 (10) Aug.	22	17	7.33	43.1±34.3	76.6±26.1	11.9±13.2
13 (15) Sep.	2	1	0.20	19.8±0.0	0±0	0±0
Total	103	61	22.6	37.0±28.4	75.1±26.4	16.0±14.7

Conclusions

Hatchery produced greater amberjack (F1 generation) exhibited improved reproductive performance and they underwent repeated spawning for 4 months with a total production of almost 23 million eggs after successive treatments with GnRHa implants at a dose of 75µg GnRHa kg^{-1} in females. These results show an improvement in successful reproduction of F1 greater amberjack broodstock, producing multiple spawns of fertilized and viable eggs.

References

Mylonas and Zohar. 2001. Use of GnRHa-delivery systems for the control of reproduction in fish. Rev. Fish Biol. Fish., 10: 463-491.

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