Spawning and hatching performance of the Silvery Black Porgy *Sparidentex hasta* under Hypersaline conditions

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Abstract

Abu Al Abyad island is characterized by harsh environmental conditions. A preliminary trial conducted at the island to investigate the spawning and hatching performance of the blue finned sea bream *Sparidentex hasta* indicated that the fish can be successfully bred at high salinity levels exceeding 50 ppt.

Introduction

The silvery black porgy or blue finned sea bream *Sparidentex hasta*, known as subaiti in the United Arab Emirates, is native to the Arabian Gulf, western Indian Ocean and coasts of India. It occurs in habitats varying from shallow (Fig. 1) coastal waters to deep water. The fish feeds mostly on invertebrates and crustaceans (Bauchot and Smith 1984; Kuronuma and Abe 1986; Al-Abdessalaam 1995).

The fish are protandrous hermaphrodites, that is, they possess both female and male gonadal tissue and mature first as males, then become females as they get older (Parvez and Ahmed 2000). They are highly prized in the region. In the 1980s it was recognized that these fish possess characteristics desirable for aquaculture, such as readiness to spawn in captivity, rapid growth, and tolerance to a relatively wide range of culture conditions (Hussain et al. 1981). Hatchery technology for the commercial production of fingerlings of the species was established by the National Mariculture Center, Bahrain (Al-Ansari et al. 1998).

The Abu Al Abyad island is situated west of Abu Dhabi and has low annual rainfall, high evaporation rates, high air temperature and high humidity. These factors have directly contributed to the unusually harsh marine conditions prevailing in the island. The island is characterized by its wide network of natural and artificially dredged channels that are fringed with a substantial expanse of mangrove trees (*Avecinia marina)* and shrubs.

The desirable characteristics for and the success achieved in culturing it have encouraged the introduction of this fish into Abu Al Abyad island. The results of a preliminary trial undertaken in the Abu Al Abyad hatchery to assess whether this species can be spawned and hatched under hyper saline conditions, ranging between 50 and 55 ppt, are presented in this paper.

Fig. 1. A 2.5 kg female *Sparidentex hasta*

Fig. 2. Oval spawning tank with the egg collector placed at the overflow water exit

Table 1. Induced spawning and hatching rate of *S. hasta* in 40 t indoor concrete tanks

Spawning period	Lunar cycle	Collected eggs			Incubation period (hrs)	Hatching rate (%)	Water temp. (°C)	
		Total (10^6)	good (%)	bad (%)			max	min
8 - 13 Jan	2nd quarter	0.99	39.30	60.70	24	6.05	20	19
14 - 27 Jan	1st quarter	3.29	33.70	66.30	30	2.16	19	18
28 Jan - 12 Feb	2nd quarter	3.78	33.40	66.60	42	72.48	19	18
27 Feb - 13 Mar	2nd quarter	16.32	78.80	21.20	22	20.65	23	22

Fig. 3. Separation and volumetric counting of eggs

Brood stock management

The hatchery bred fingerlings were reared to sexual maturity in 5x5x2.5 m floating net cages placed in one of the artificially dredged channels of the island. During the grow-out period the fish were fed to satiation with a combination of 52 per cent crude protein commercial pelleted feed and trash fish (sardines) enriched with fish oil (10 g/kg). At the end of the first year of rearing, the *S. hasta* fingerlings in the net cages reached a size of 500 g in weight and the whole population was observed to have matured as males with thick and glutinous flowing milt. At the end of the second year, the fish had an average weight of 1 kg and some of them were observed to have changed sex but had not attained complete maturity. In the third year, about 10 per cent of the population was easily distinguishable as females.

In mid-December 2000 when the fish were two years old, eighty males with an average weight of 1.9 kg (1.30 to 2.50 kg) and eighty females with an average weight of 2.1 kg (1.60 to 2.75 kg) were segregated into two net cages. Beginning early January 2002, females with swollen abdomens were selected, injected with HCG at 400 IU per kg body weight of fish and kept in a separate net cage. After 24 hours a resolving dose of 100 IU/kg body weight was administered to the females. Immediately after the second injection, females and males with free flowing milt were transferred to the hatchery where they were stocked for spawning, at a sex ratio of 1:1, in an oval 40 t concrete tank at a density of one fish/m^3. Filtered seawater was continuously supplied at 40 l/min, allowing a 200 per cent daily water exchange. Fish in the spawning tanks were fed squid meat at a rate of two per cent body weight. During the spawning season the water salinity was constant at 54 ppt and the average maximum and minimum water temperatures ranged between 18 to 19 ºC and 22 to 23 ºC, respectively. In another identical tank, a second group of spawners was also stocked at a sex ratio of 1:1 and left to spawn naturally.

Spawning and hatching

The induced fish were observed to spawn 48 hrs after the second hormonal injection. The buoyant eggs were directed towards the overflow opening by the gentle inlet water current. Pelagic eggs were collected twice daily (8:00 hrs and 17:00 hrs) in fine-meshed 400µ collection buckets placed at the overflow waters from the spawning tanks (Fig. 2). The eggs were then washed thoroughly with fresh seawater and placed in a measuring cylinder for separation of good buoyant fertilized eggs from sinking bad eggs as well as for volumetric estimates (Fig. 3). To ensure good water quality, about 50 per cent of the bottom water from the tank was drained out daily after the second egg collection in the afternoon through a drain exit located at the bottom of the tank.

The total number of eggs collected from 30 females during the whole spawning period (8 January-13 March) was 24.4 million eggs at an average of 0.39 million eggs per one kilogram of female (Table 1). Each female spawned once during this period. The good floating eggs comprised 64 per cent of the total number of eggs collected. Only buoyant eggs were stocked in 600 µ mesh incubators (70 cm in diameter and 65 cm in height) placed in 5 t rectangular fiberglass tanks with flow-through filtered and sterilized seawater. Eggs were stocked at an average rate of 300 ml/incubator (approx. 600 000 eggs/incubator). Dead eggs were continuously siphoned out from the bottom of the incubators. The average hatching rate was only 23.17 per cent of the total incubated eggs. The incubation period ranged between 42 hrs (at a minimum water temperature of 18 ºC) and 23 hrs (at a maximum water temperature of 23 ºC).

In the control tank, the first natural spawning occurred at the end of January and continued till the middle of March. The total number of eggs collected from 30 females was 32.6 million eggs at an average of 0.52 million eggs per one kilogram of female. About 81.41 per cent of this number were good eggs. The average hatching rate was only 27.87 per cent of the total incubated good eggs (Table 2).

For both the induced and naturally spawned groups, spawning was continuous at both the first and second quarters of the moon, suggesting that spawning of this species is not synchronized with the lunar cycle. On the other hand, it was observed that fish spawning activity increased following the flushing out and sudden refilling of the spawning tanks. This suggests that there is a correlation between spawning and tidal floods or currents. Further investigations are suggested to test the use of this natural trigger in initiating and controlling the

Table 2. Natural spawning and hatching rate of *S. hasta* in 40 t indoor concrete tanks

Spawning period	Lunar cycle	Collected eggs			Incubation period (hrs)	Hatching rate (%)	Water temp. (°C)	
		Total (10^6)	good (%)	bad (%)			max	min
28 Jan - 12 Feb	2nd quarter	14.46	73.24	26.76	42	20.65	19	18
13 Feb - 26 Feb	1st quarter	3.16	68.35	31.65	30	51.06	21	20
27 Feb - 13 Mar	2nd quarter	14.98	92.05	7.95	22	29.78	23	22

Fig. 4. Newly hatched larvae collection from the 600 µ eggs incubators

spawning activity of *S. hasta*. The incubation period was observed to increase with decreasing water temperature. Owing to limited hatching facilities, spawning activity was discontinued by the middle of March and the spawners were transferred back to their respective net cages.

Conclusion

The husbandry procedures applied in this trial indicate that hormonal injections are unnecessary for spawning induction, especially when the water temperature is above 20 ºC, and fish can spawn naturally. The incorporation of polyunsaturated fatty acids in the brood stock feed improved to some extent the quality of the eggs as well as the hatching rate.

Hormonal treatment resulted in poorer egg quality and a lower hatching rate than natural spawning. However, the spawning performance obtained in this trial is considered low as compared to those reported from other parts of the region (Al-Ansari et al. 1998). The cause for this low performance is not specifically known but high salinity could be a factor. Towards the end of the spawning season, the total number of eggs produced, fertilization and hatchability increased compared to those obtained at the beginning of the season. This might be due either to lower water temperatures in January or to the immaturity of the eggs. These observations suggest that the proper spawning season for *S. hasta* in Abu Al Abyad island is between February and March. In general, these findings indicate that the spawning and hatching of *S. hasta* is possible in the harsh environmental conditions of the island and plans for mass larvae production should be encouraged.

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