Marine Finfish Aquaculture Network

Induced spawning and larviculture of grey mullet, *Mugil cephalus* (Linnaeus 1758) in the Emirate of Abu Dhabi

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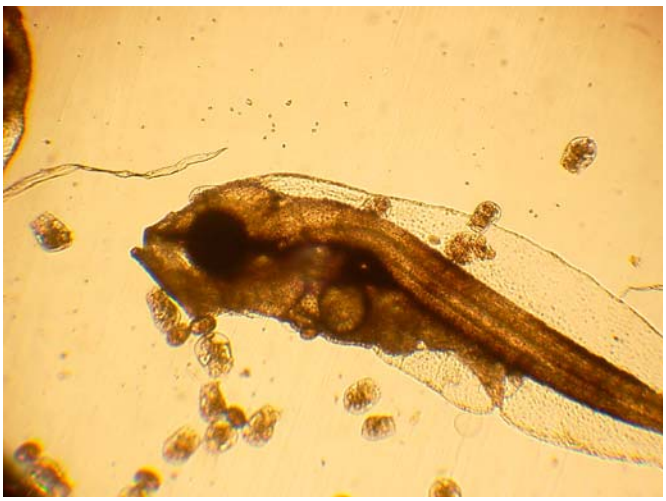
Grey mullet, *Mugil cephalus*, is one of the most widely distributed food fishes in the world (McDonough et al., 2003). In the United Arab Emirates (UAE), the fish, locally known as Biah or Wagena, is considered as one of the most highly demanded fish. However, it was recently recognized that the landings of this species have drastically decreased and its presence in the local fish markets became rare (MAF, 2003). In captivity, grey mullets do not spawn spontaneously and that could be achieved successfully by hormone administration (Lee and Tamaru, 1988, El-Gharabawy and Assem, 2006).

This has lead to increasing interest by the Aquaculture Center, Abu Al Abyad Island (ACAAB), Emirate of Abu Dhabi, UAE to propagate the fish. The ACAAB is situated in Abu Al Abyad Island which is the major island of the Emirate of Abu Dhabi covering an area of 490 km^2. The island is characterised by its harsh environmental conditions where water temperature and salinity during summer time reach as high as 36 ºC and 58 ppt, respectively (Al Abdessalaam and Yousif, 2002).The results of the first induced spawning and larviculture trials of this species under the environmental conditions of Abu Al Abyad Island (50 -55 ppt) are presented in this article.

Broodstock and spawning

Wild grey mullet fingerlings averaging 4 g body weight (bw) were introduced in 2002 from Egypt and grown in indoor 40 tonne circular concrete tanks at ACAAB. The fish were first stocked in freshwater and after an acclimation period of seven days the water salinity in the tanks was gradually raised by 8 ppt/day until the fish were completely acclimatised to the natural seawater salinity of Abu Al Abyad Isalnd (55 ppt). During the grow-out period the fish were fed floating marine fish feed (45% protein and 10% lipid). In September 2008 a number of six years old fish were selected and conditioned by feeding with 6 mm pelleted feed supplemented with 1% fish oil (DHA 20-22%, EPA 4%) and 0.5% vitamin mix and vitamin E. In the first week of December 63 ripe females averaging 1.03 kg with average cannulated oocytes diameter of 427 µm, and 126 males averaging 0.83 kg with running milt were transferred to indoor 30 tonne concrete oval shape and 36 tonne concrete rectangular spawning tanks at a rate of 1 male : 2 females. Clove oil (4-Allyl-2-methoxyphenol) in a dose of 0.01 ppm was used to anaesthetize the fish during transportation, cannulation and injection processes. The selected broodstock was acclimated to 37 ppt salinity by gradually adding freshwater over a period of seven days.



Ten day old mullet larvae preying on rotifers.

Table 1: Effect of different hormones on induction of females spawning and hatching rate of fertilised eggs.

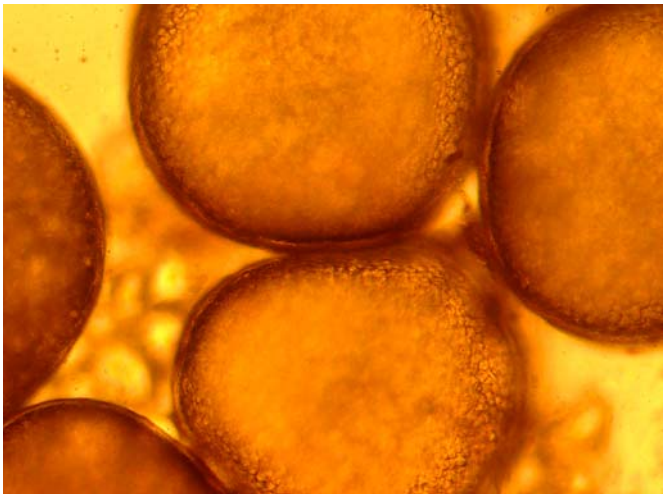
Primary/resolving	Males injected	Females spawned	Eggs (x10^3)	Eggs/ female (x10^3)	Eggs/g body weight	Fertilised eggs (x10^3)	Hatched larvae (x10^3)
CP/LH-RHa	11	4	1060	265	257.28	520	440.3
CP+HCG/LH-RHa	25	23	3404	148	143.69	2040	1111.2
HCG/LH-RHa	21	8	480	60	58.25	160	None
TP/LH-RHa	6	1	160	160	155.34	100	None

The fish were induced with carp pituitary (CP, 20mg/kg body weight), human chorionic gonadotropin (HCG, 1000 IU/kg bw) and tilapia pituitary, extracted from local tilapia stocks (TP, 20 mg/kg body weight) administered as priming injections to four groups of females and each was followed 24 hours later by a resolving injection of luteinizing-hormone-releasing-hormone-analogue (LH-RHa) at dose of 200 µg/kg bw. Spawning took place 24 hours following the resolving hormonal injection at an average water temperature of 20.8 ± 1.08ºC. All hormonal applications were successful in inducing spawning and females receiving carp pituitary as a priming injection achieved the highest fecundity (257.28 eggs/g bw). This was followed by the females injected with the priming dose of tilapia pituitary (155.34 eggs/g bw). The priming dose of HCG produced the lowest fecundity (58.25 eggs/g body weight). Use of a combination of carp pituitary and HCG as a priming injection improved spawning (Table 1). These fecundities are very much below those reported elsewhere for captive mullets (Nash and Koningsberger, 1986, El-Gharabawy and Assem, 2006). The low fecundity values obtained in this study could be attributed to the hypersaline conditions (55 ppt) under which the fish were grown from the fingerling stage until they attained maturity. The spawning season in this trial was observed to be very short extending only for 17 days. For the aquaculture of this species to succeed, a plan for a consistent supply of fingerlings should be developed and thus it is recommended to study the possibility of its induction out of the spawning season (El-Greisy and Shaheen, 2007).

Buoyant eggs were collected, washed and placed in measuring cylinders for separation of fertilised eggs and volumetric counting. Fertilised eggs were incubated in 600 µ mesh baskets placed in 5 tonne rectangular fiberglass tanks supplied with gentle flow of 37 ppt seawater and aeration. The incubation period was 48 hours following the second resolving injection at an average water temperature of 20.84 ± 1.08ºC. The average hatching rate was 60.07% ranging between 26.5 and 84 %.

Larval rearing

After hatching, the larvae averaging 2.3 ± 0.11 mm in total length were counted and stocked in 4 tonne fiberglass rectangular larval rearing tanks (LRTs) at a density of 30 ± 2.71 larvae/litre. All LRTs were indoors under clear acrylic sheets roof. The green algae, *Tetraselmis* sp. was added to the LRTs from day 3 to day 22 post-hatch (ph) at a daily rate of 400 l per tank. From day 3 to day 20 ph, rotifers, *Brachionus rotundiformis* (66-146 µm), were added twice daily at 8:00 and 17:00 hr. A density of 15 rotifers/ml was always maintained in the LRTs. Prior to their introduction into the LRTs, rotifers were enriched for 6 hours after harvest with super HUFA (>45% ω3 fatty acids, >16% EPA , >30 DHA, >2.0% ARA, Salt Creek Inc. Utah, USA) at a rate of 0.25-0.35 ml/million rotifers. Newly hatched *Artemia* salina nauplii were enriched following the same protocol of rotifers enrichment and introduced beginning day 15 ph at 0.5-1 nauplii/ml. *Artemia* nauplii were added twice daily until day 25 ph at 9:00 and 17:00 hr to maintain the initial starting density. The artificial feeding started on day 11 ph with the 198 µm love larva 1 (57.40% crude protein, 12.42% lipid, Hayashikane Sangyo Co. Ltd., Japan) and lasted on day 25 ph. From day 20 to day 35 ph and from day 30 to day 40 ph artificial progression feed 2 (<200 µm) and progression feed 3 (300-500 µm) were served, respectively (crude protein 56.6%,



Cannulated 427µ mullet oocytes

Postlarval mullet in the rearing tanks.

Outlet screen fixed to the larval rearing tank

13.8% lipid, 0.8% DHA, 1.1% EPA, 1000 pm vitamin C, Salt Creek Inc., USA). From day 35 until day 40, crumble feed 300 -900 µm (45% crude protein, 10% lipid) was added.

Water exchange in the LRTs was carried out by flow-through filtered and sterilised 37 ppt seawater systems. In the first two days post-hatch, water exchange was carried out during night at a rate of 60-80% and from day 3 to day 33 ph at 80-100%.

1kg female.

From day 34 to 40 ph a continuous flow of 37 ppt seawater was maintained throughout the day this was stopped only during the administration of the artificial food. In the first 2 days post-hatch, the LRTs were kept under complete darkness and from day 3 to day 40 ph, a photoperiod of 14 h light : 10 h darkness was maintained. The water temperature, dissolved oxygen, ammonia, nitrite and pH recorded during the larval rearing stage were 21.4 ± 0.5 ºC, 5.15 ± 0.8 mg/l, 0.24 ± 0.04 mg/l, 0.029 ± 0.003 mg/l and 7.5 ± 0.5 , respectively.

All LRTs were harvested on day 40 ph and the total number of 40-day old post larvae collected was 240,700 averaging 15.10 mm in total body length and 21.4 mg body weight. The average survival rate of the larvae was 15.52 ± 7.32%. The survival rate achieved is encouraging and demonstrates the possibility of successfully producing grey mullet in captivity despite the prevailing environmental conditions of Abu Al Abyad Island. Although the stocking density adopted in this study (30 /litre) seems acceptable, the use of lower densities in the future trials might further improve the survival rates.

References

Al Abdessalaam, T.Z. and O.M. Yousif. 2002. The marine environment and mariculture of Abu Al Abyad. In: Perry, R.J. (Ed.), The Island of Abu Al Abyad. Environmental Research and Wildlife Development Agency, Abu Dhabi. pp. 39-65.

El-Gharabawy, M.M. and S.S. Assem. 2006. Spawning induction in the Mediterranean grey mullet *Mugil cephalus* and larval development stages. African Journal of Biotechnology, 5(19): 1836-1845.

El-Greisy, Z.A. and A.A. Shaheen. 2007. Comparative difference between the effects of Lhrh-a, 17 A-Methyltestosterone pellets and HCG on reproductive performance of *Mugil.cephalus*. J. Applied Science Research, 3(9): 890-895.

Lee, C.S and C.S. Tamaru. 1988. Advances and future prospects of controlled maturation and spawning of grey mullet (*Mugil cephalus* L.) in captivity. Aquaculture, 74: 63-73.

MAF (Ministry of Agriculture and Fisheries). 2003. Fishes. United Arab Emirates.Cultural Foundation, Abu Dhabi. pp. 255.

McDonough, C. J., Roumillat, W.A. and Charles A. W. 2003. Fecundity and spawning season of striped mullet (*Mugil cephalus* L.) in South Carolina estuaries. Fish Bull. 101:822–834.

Nash, C.E. and R.M. Koningsberger.1986. Mullet: artificial propagation. In: Loix, B. (Ed.). Production in marine hatcheries, Rovinij, Zadar, Yugoslavia, 10-28 Feb. 1986. http://www.fao.org/docrep/field/007/af007e/AF007E05.htm#ch2.14.