Farmers who are interested to offer their facilities for demonstrations may do so in consultation with CIBA / RGCA.

Seed rearing centres can also be strengthened which can work as nursery centres to supply larger fingerlings for stocking, so that the culture duration can be reduced.

All stakeholders agreed that they should cooperate to have mutual, open dialogues at frequent intervals and be involved in evaluation of farming trials.

Training

A 10 days training programme on the Asian seabass breeding and culture was organized at CIBA, Chennai during 20-29 August 2008. It was attended by fifteen participants including farmers, scientists from CMFRI, Kochi, and Central Agricultural Research Institute (ICAR), Port Blair, Andamans, a lecturer from University of Kerala, Thiruvananthapuram, officers from MATSYAFED and Central Institute of Fisheries Nautical Engineering and Training, Kerala, consultants from Andhra Pradesh, officials from State Fisheries Department,

Government of Orissa and technical staff from Annamalai University. The training provided hands on exposure to the participants on the seed production under controlled conditions and culture of seabass.

Comparative study for broodstock management of grey mullet (*Mugil cephalus* L.) in cages and earthen ponds with hormone treatment

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The grey mullet *Mugil cepalus* is a commercially important fish in the Bay of Bengal, locally known as khorul bata, commonly found in coastal and offshore waters of Bangladesh. It is caught in large quantities from shallow fishing grounds[1].

The grey mullet is available in the Bakkhali River estuary during their breeding season from October to December, where salinity may range from 0 to 35ppt. Broodstock of grey mullet are not well utilized in the coastal area of Bangladesh. Local fishers generally catch them with seine nets and sell them in the local market for human consumption without realizing the actual importance of grey mullet broodstock for hatchery operation.

Marine finfish hatchery techniques are not well developed in Bangladesh due to the lack of technical knowhow. Collection of the naturally produced fry of grey mullet is not popular and as a result there is limited seed available and farmers are not interested to develop mullet farming in coastal areas. The development of breeding technology for this species including through the proper management of broodstock would, however, open up new opportunities. The objective of this study was to develop breeding and hatchery technology for grey mullet using hormone treatment.

Harvesting grey mullet and other species from net and cages.

Materials and methods

Samridhi Multipurpose Aquaculture Farm and Fish Research Center (SMAFRC) and Bakkhali Associates' farm were selected for the study. Both research stations are private initiatives, located at Jilwanja, Cox's Bazar, about two km away, towards north-west of the Cox's Bazar bus terminal, on the left bank of the Bakkhali river estuary. The research work was conducted in two study area in the months of June to December, 2005.

Brood fish were collected from Bakkhali River by seine net at high tide. The live fish were returned to the stations in 2.5m PVC pipes to reduce physical injury. Broodstock at SMAFRC were stocked into ponds and at the Bakkhali Associates farm they were stocked into cages, both in equal proportions. Fish were acclimatized before stocking.

The pond of SMAFRC used for brood stock management was rectangular in shape and approximately 106 m^2 in area and 1 m in depth. Two types of cages (bamboo and net cage) were installed in the Bakkhali Associates farm for broodstock management. They were situated in proximity to the sluice gate area. Broodstock were reared for at least two months on the stations, maintaining water quality and supply of supplemental food to encourage gonad maturation.

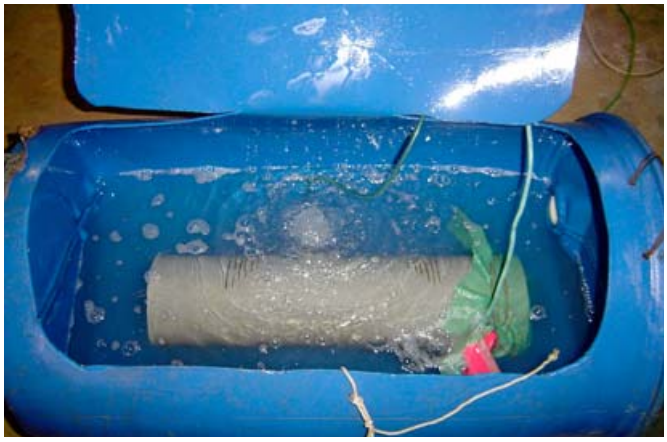
The Bakkhali River is the water source for both stations. In SMAFRC, water was taken in only during high tides at the full and new moon, when the water level reached the level of the inlet piple. However, water was more easily exchanged in Bakkhali Associate farm during every high tide. During this experiment, broodstock maturity was examined at stocking, middle salinity condition and at harvesting time (higher salinity condition) in ponds and cages. The gonadal-somatic index of the representative broodfish was determined during stocking and harvesting period in order to identify the gonadal maturation.

Hormone treatment of broodfish were performed in SMAFRC hatchery complex. The hatchery complex was facilitated with fresh and filtered sea water, aeration, siphoning system, temperature control, and sufficient number of tanks for broodstock, spawning, incubation and algal culture.

After two months of rearing in the ponds and cages, healthy and strong brood fish were collected and transferred to the hatchery for operation. Broodstock were treated with 1 ppm $KMnO_4$ as an antiseptic. Fishes were than weighted. Pond and cage reared brood fish (male and female) were kept in separate tanks until the hormone treatment was complete. Physio-chemical parameters of the tank were recorded. Broodfish were fed artificially prepared diets rich in protein. Spawners were selected by external morphological characters. In some cases, these characters are not reliable indicators of maturity. For this reason, ovarian maturity of the spawner was accurately measured[2].

Males were selected by the observation of flow of milt when gentle pressure was applied along the abdomen towards the cloaca. Three representative pond and cage reared female broodstock were selected for hormone treatment on the basis of their egg maturity. The egg size was determined in three observations[2,3]. Hormone treatment of gravid females was started when intra-ovarian oocytes were filled with yolk i.e. the tertiary yolk globule stage and having an egg diameter above 500µ, at least 600-650µ. Hormone was injected at the pectoral fin region or intra muscular region at 12 hour intervals. Stripping of brood fish was conducted 24 hours after the first injection and stripping percentage (weight of stripped eggs / body weight) was determined[4].

Bamboo and net cages for grey mullet broodstock.



Broodstock transportation container.

Brood fish in spawning tank.

Results and discussion

Broodstock maturity: Salinity plays an important role in broodstock maturation. Grey mullet reach full maturity at thirty parts per thousand (ppt) salinity[3]. The maturity of broodstock was observed by the determination of egg size, expressed as egg diameter (µ). First observations were done at 8 ppt or 10 ppt salinities during stocking, the second observation at 25ppt and final observation at 30 ppt in both experimental sites. In three observations, egg diameters were found between 200-585 µ in pond and 210 to 620 µ in cage reared brood. Mean egg diameters were calculated from 222.125 µ to 569.75 µ in pond reared and 222.88 µ to 608.75 µ in

cage reared brood respectively. All of the male broodstock were sexually mature because they yielded milt when gentle pressure was applied along the abdomen.

From the experiment, it has been showed that maturation of eggs was directly proportional to the salinity. Salinity increased very slowly in the earthen ponds due to improper tidal water exchange. However, in the cage equipped station, salinity increased earlier than in the ponds due to more frequent tidal water exchange. Thus, egg maturation was delayed in broodstock kept within ponds because of inadequate water exchange.

Mature gonad indication: It was observed that gonad weight of two representative brood fish in pond and cages during stocking time was about 65 g and 105 g respectively and at harvesting time the gonad weight of the two representative pond and cage reared brood fish was 130 g and 200 g respectively. Gonad weight was higher (200 g) in cage reared broodstock than in those reared in ponds (130 g). The GSI value of the two representative weights of brood fish during stocking in pond and cage were about 6.5 and 7.0 respectively and after two month rearing in pond and cages, the GSI value of the same fish was about 11.81 and 12.34 respectively. GSI value was higher (12.34) in cage reared broodstock than in pond reared broodstock (11.81) indicating that the gonad of cage reared fish was more highly mature than pond reared fish.

Breeding performance by hormone treatment: In order to assess the spawning performance of grey mullet, broodstock were collected from pond and cage and transferred to the hatchery brood stock tank for hypophysation. For successful spawning, salinity was maintained at 30 ppt and water temperature at 22.7°C, dissolved oxygen at 6 mg/l and pH 7.8 in the broodstock and spawning tank. Pond and cage reared brood were kept in separate tanks for proper spawner selection. Among them, three pond and cage reared brood were selected on the basis of their body weight and egg maturity.

Egg maturity was found higher (600 to 612 µ) for selected cage reared brood-stock than pond reared broodstock (560 to 600 µ). Highly mature eggs require lower concentration of PG than dose

Hormone preparation.

Injecting hormone into grey mullet.

Collecting eggs from broodstock.

than slightly matured egg[5]. To determine the effective dose of pituitary gland for successful stripping, different concentration of pituitary glad were injected for representative pond (7mg/kg; 6mg/kg; 5mg/kg) and cage reared (5mg/kg; 3mg/kg; 3mg/kg) brood fish. They were applied on the basis of their body size and state of egg maturation.

From this experiment, it has been shown that pond reared broodstock with slightly mature eggs (560 to 600 µ) required higher pituitary gland dose (7mg/kg; 6mg/kg; 5mg/kg) and highly mature cage reared broodstock (600 to 612µ) required lower pituitary gland dose (4mg/kg, 3mg/kg, 3mg/kg) to attain the ripe stage, which enhanced successful ovulation. It has well been shown that stripping percentage was higher in cage reared broodstock (4.13%; 5.58; 5.18%) than pond reared broodstock (2%; 3.3%, 4.45%). Stripping was related with the hormone dose and egg maturation. Highly mature eggs (600 to 612 µ) required lower PG because they were in near about the ripe stage. This amount of pituitary gland was sufficient to attain the ripe stage and stripping percentage was recorded higher at this lower pituitary gland dose.

Conclusion

This type of experiment was the first time in Cox's Bazar where the utilization of coastal waters have been used both in cages and pond for the gonadal maturation of Mugil cephalus. With this scientific intervention, a remarkable maturity of grey mullet was found in cage reared broodstock compared to ponds. It has well been shown that cages located near the flow of tidal water can be better utilized for broodstock management, thus the gonadal maturation was facilitated in cages due to the availability of tidal water and increase in salinity which was not possible in the enclosed water in the inland pond systems of SMAFRC. This new concept in the arena of aquaculture will create a new hope for the fish farmers. If this technology is further developed and disseminated among the coastal people and fish farmers, they will be able to improve the hatchery technique of grey mullet. Thus, the economic development of the country will surely be improved.

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Eggs are put in a hatching jar for easy management.

The research team visiting the experimental pond.

Cultivation of gilthead sea bream (*Sparus auratus* L.) in low saline inland water of the southern part of Israel desert

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Fish development, growth and survival are influenced by various physiological factors among which water salinity is one important parameter. Many studies have indicated that the various developmental stages during fish embryogenesis depend on water salinity. Salinity also plays a key role in growth control, influencing growth rate, metabolic rate, feed intake and feed conversion. Keeping this in mind a short term trial was conducted to adapt and/or acclimatize the gilthead sea bream, *Sparus auratus* L., into low saline inland waters. Gilthead sea bream is a euryhaline teleost capable of living in environments of different salinities ranges from 2‰ to 60 ‰[1]. Adaptation of euryhaline fish to different environmental salinities induces changes/activation of ion transport mechanisms.