FEATURE

# Closing the Cobia life-cycle in Brazil

## A Brazilian-led team reports on its first successful closed-cycle cobia reproduction


*Mature cobia exhibiting spawning behaviour.*

BY ARTUR ROMBENSO, MICHAEL SCHWARZ AND LUIS A. SAMPAIO

The first research on spawning and grow-out of cobia (*Rachycentron canadum*) occurred in Taiwan in the early 1990s, and in 2009, the global cobia fingerling production bottleneck was resolved through collaboration between the International Initiative for Sustainable and Biosecure Aquafarming, Virginia Tech, and the Federal University of Rio Grande.

In Brazil, there is tremendous interest in expanding marine finfish production through the production of species such as cobia. As a result, one of the first Brazilian closed-cycle demonstrations of natural maturation of cobia in near-shore cages, followed by spawning and fingerling production in tanks, and subsequent growout in marine cages began in 2009, near IIha Grande.

### CULTURE BACKGROUND

The cobia culture facility is located in Ilha Grande, an island of the Angra dos Reis archipelago located off the coast of Rio de Janeiro in 23°06'54"S; 44°15'50"W. The weather is tropical: water temperatures range from 19°C in winter to 30°C in summer, averaging around 25°C. Depth averages 6-14 m and the site is fairly well protected from the open sea.

In 2009, 1000 juvenile cobia were obtained from Laboratório Nacional de Maricultura (LANAM) located on Ilha Comprida, SP/Ministry of Fisheries and Aquaculture of Brazil, and were stocked and cultured for two years in near-shore cages. At the end of the second year 200 fish were selected as brood-stock, with an average weight of 15kg, the largest reaching 25kg. These brood-fish were fed frozen cut fish (mainly Clupeid sardines) four days a week to satiation. In mid-spring with the increase in water temperature from 25 to 27$^0$C the first natural spawning occurred, and continued until late summer when water temperature began to decrease to (24$^0$C).

### BROODSTOCK MANAGEMENT

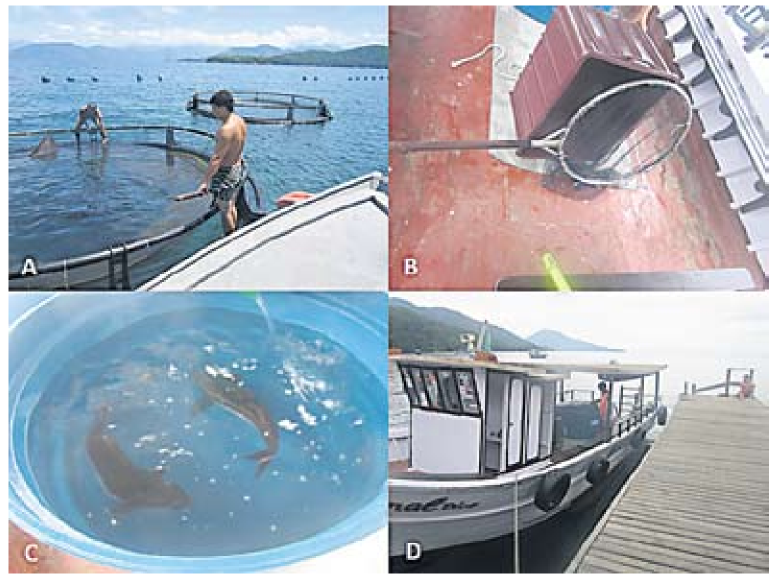
Spawning occurred predominantly in the late afternoon or early morning, and was noted by the different behaviour observed in the cages. The pre-spawning behaviour consisted of several males pursuing a female that was about to spawn. This medium-speed pursuit was punctuated by stalling and touching throughout the water column. When this behavior was observed consistently, the active broodstock were brought ashore and indoors to the spawning tank.

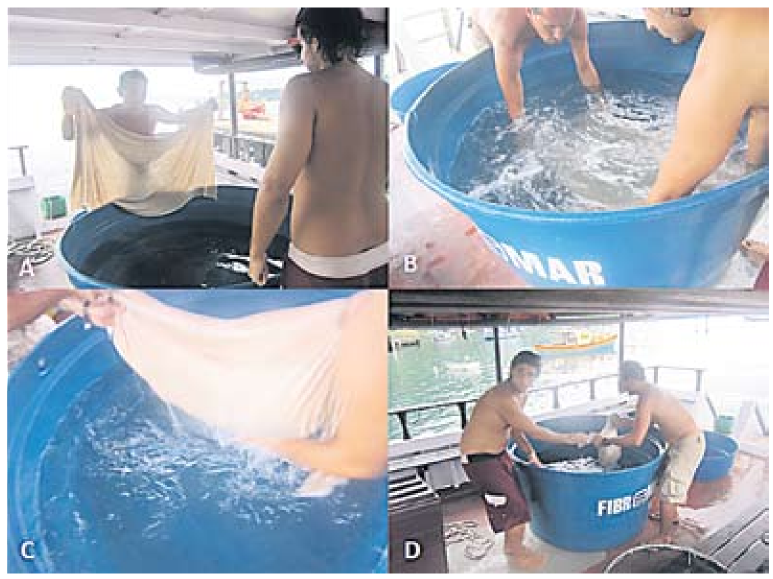
Sunset in summer is around 6:30pm, so the fish were selected in the late afternoon (5:00 - 6:00pm) when spawning behavior and pursuit of females by males was at a maximum. Fish were collected at a sex ratio of two males to one female. The females were easily identified owing to their dilated abdomen due to hydration of the oocytes. The most actively chasing (dominant) males were captured first and then the females.

Fish were transported ashore in a 1000 L tanks at a maximum density of 65 kg/m$^3$. The temperatures was the same as the seawater (average of 26$^0$C) and dissolved oxygen levels were maintained over 5 mg/l by air delivered from compressed air cylinders. The stocking density, temperature and oxygen levels were not within the optimal range suggested in the literature, but due to the short transit time from the cages to the land-based hatchery were deemed sufficient. Fish were transferred from transit tanks to the maturation tank in moist towels. Neither anesthetics nor prophylactic treatments were used in order to minimize handling stress.

Brood-fish were stocked into a 27m$^3$, 3.5m diameter indoor maturation tank at Ilha Grande Laboratório. The system was very simple due to the short residence period for the fish. It consisted of a spawning tank (27 m$^3$), supplied with a continuous flow of water (50% daily exchange) and a 30 µm bag filter. The average temperature was 26$^0$C, the same as at the cages, salinity: 28‰, D.O. 7 mg/l, pH 6-7, and natural photoperiod.

Typically, the same evening that the fish were transferred from the cage to the spawning tank, natural spawning behavior occurred, and fertilized eggs were harvested from the egg collector the following morning. This successful spawning was attributed to the excellent health of the animals, and the minimal handling stress they were exposed to. This procedure was repeated numerous times with other broodstock from the cage, each time with predictable, high-quality egg production.


*Choosing and transporting brood-stock A- selecting fish from cages; B- dipnet used to catch fish; C- transporting broodstock in 1000-l tank; D- boat used to transport fish to the lab.*


*Transferring fish to spawning tank. A- wet towel; B- fish captured in 1000-l tank; C- wrapping the fish in the towel; C- transferring the fish.*

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*Maturation, phase-rearing, and grow-out cages for cobia.*

### EGG AND LARVAL QUALITY

Floating fertilized eggs were collected in a 600 µm net in an external egg collector, and unfertilized eggs were removed from the bottom drain with other associated organic wastes. Fertilized eggs were incubated in a 1000 L incubator supplied with flow-through seawater and strong aeration. Incubation sea water passed through a bag filter (30 µm), gradual cartridge filter (25 to 1 µm) and a U.V sterilizer. Egg development was monitored closely during the first few hours of cleavage to estimate egg quality and viability. Viable eggs were disinfected in 100 ppm formalin bath for 1 hr; at 27$^0$C. Hatched occurred 24 hours post-fertilization.

Each spawning event resulted in over 1 million eggs being collected, with fertilization rates of approximately 70%. The resulting larvae were in excellent condition with a low percentage of deformities.

Larvae were reared in 1000-l circular tanks supplied with flow through seawater (300-400% exchange) strong aeration and a circular flow. Temperature was maintained at 27°C by heaters. Other water quality parameters were maintained at optimum levels for the larval development (28‰, D.O. 6-8mg/L and pH 7-8). Larviculture was performed according to Virginia Seafood Agricultural Research and Extension Center (Virginia Tech) standard protocols, using rotifers and *Artemia* as live food until the fish were weaned onto dry diets, then finished in land-based phase-rearing. Fingerlings were stocked into near-shore cages for grow-out to market size.

### FINAL CONSIDERATIONS

This project showed that the extensive maturation system is valuable in helping advance the nascent cobia industry in Brazil and other countries with emerging mariculture sectors. This is in part due to the number of high-quality eggs, good fertilization rates, and low percentage of deformed larvae that can be obtained using this technique. In the near-term IIha Grande team plans to increase egg quality and fecundity by improving brood-stock feeds by augmenting the diet with squid, shrimp, and vitamin- and mineral pre-mixes. As the Brazilian cobia production sector expands, a transitional trend from extensive to intensive biosecure hatcheries will likely occur, resulting in enhanced consistency and biosecurity of fingerling production.

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