# Cobia (Rachycentron canadum) Farming: A Promising Frontier in Marine Aquaculture

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**ABSTRACT**

Cobia (*Rachycentron canadum*), commonly known as black kingfish, lemon fish or ling, is a fast-growing, warm-water pelagic finfish that has emerged as one of the most promising candidate species for marine cage culture. Prized for its firm, pinkish-white flesh and high market demand, cobia combines rapid growth, a favourable feed conversion ratio, adaptability to captive breeding, and suitability for offshore cage farming (Abdul-Nazar *et al*., 2019). Globally, China and Taiwan dominate production, while in India the first successful captive breeding and seed production was achieved in 2010 by the ICAR-Central Marine Fisheries Research Institute (CMFRI), Mandapam Regional Centre (Gopakumar *et al*., 2011). This article presents an overview of the biology, habitat and distribution of cobia, followed by a systematic account of its culture practices, spanning broodstock development, induced spawning, larval rearing, nursery and grow-out phases, harvesting, and the major disease and management challenges faced in cage aquaculture. The discussion underscores cobia's potential to strengthen and diversify India's mariculture sector, while highlighting the biosecurity and site-selection challenges that must be addressed for sustainable expansion.

## INTRODUCTION:

*Rachycentron canadum*, popularly called Cobia, Black kingfish, Black salmon, runner or sergeant fish, and Crab eater, is an oceanodromous, migratory, pelagic fish inhabiting brackish and marine waters (MPEDA, 2020). It is a fast-growing warm-water marine species whose pinkish-white flesh is served raw as sashimi across Southeast Asia. China leads global farmed cobia production, accounting for roughly 80% of world output, with Taiwan as the other major producer (Ali *et al*., 2023). In India, the first successful captive breeding and fingerling production of cobia was achieved in 2010 at the ICAR-CMFRI Mandapam Regional Centre, marking a milestone for the country's mariculture programme (Gopakumar *et al*., 2011).

## 1. Biological Characteristics

Cobia has an elongated, torpedo-shaped body with a long, depressed head, and a lower jaw that projects beyond the upper jaw. The caudal fin is rounded to truncated in juveniles and becomes lunate in adults, with the upper lobe extending beyond the lower. The anal fin originates beneath the apex of the second dorsal fin, and the pectoral fins are pointed. Notably, cobia lacks a swim bladder (NOAA Fisheries).

As a voracious carnivore, cobia often swallows its prey whole, feeding on crustaceans, cephalopods and small fishes such as mullet, eels, jacks, snappers, , croakers, and herring. Crabs are the particular favourite, giving rise to the common name "**crab eater**" (Abdul-Nazar *et al*., 2019).

### 1.1 Taxonomic Classification

| Rank | Classification |
|---|---|
| Kingdom | Animalia |
| Phylum | Chordata |
| Class | Actinopterygii |
| Order | Perciformes |
| Family | Rachycentridae |
| Genus | Rachycentron |
| Species | Canadum |

**Source**- NOAA Fisheries last updated on 05/22/2025.
**Scientific name**- *Rachycentron canadum*

## 2. Habitat and Distribution

Cobia occupies a wide range of habitats, occurring over mud, rock, sand and gravel bottoms, coral reefs, mangrove sloughs, and inshore areas around pilings and buoys, as well as offshore around drifting and stationary objects. While adults mainly inhabit coastal waters and occasionally enter estuaries, the species is pelagic and may occur throughout the water column, having been recorded at depths up to 50 m and over waters as deep as 1200 m (NOAA Fisheries).

Globally, it is distributed throughout tropical, subtropical and warm temperate seas, except in the central and eastern Pacific Ocean. In the Indian Ocean it ranges from East Africa to Australia, and it is also found in the West and East Atlantic, the Caribbean, and the Indo-Pacific off India, Australia and Japan (FAO, 2020).

## 3. Culture of Cobia

Cobia farming proceeds through three broad management phases (Abdul-Nazar *et al*., 2012):

- Pre-stocking management: site selection, broodstock selection, and larval rearing
- Stocking management: nursery phase and grow-out phase
- Post-stocking management: feeding, water quality monitoring, health management, and harvesting.

### 3.1 Pre-stocking Management

Broodstock were initially sourced from wild populations; once cobia farming became established, brooders began to be selected from grow-out cages and transferred to onshore ponds. The ideal broodstock age is 1.5-3 years, at a weight of approximately 10 kg (Abdul-Nazar *et al*., 2012).

Broodstock holding systems include onshore ponds (a method pioneered by Taiwan in the late 1990s, typically 400-600 m² and about 1.5 m deep) and FRP/RCC tanks (round fibreglass tanks about 5.5-6.0 m in diameter and 1.5-1.8 m deep, successfully used for spawning in the USA). These tanks are fitted with egg collectors and run as recirculating aquaculture systems (RAS), flow-through systems, or a combination of both (Abdul-Nazar *et al.*, 2012). Because of cobia's high metabolic rate, broodstock development in FRP/RCC tanks is feasible only with RAS; alternatively, circular or square (5 m × 5 m) sea cages provide more effective broodstock development. In India, provision of sea cages of 6 m diameter and 4.5 m net length is mainly practised (Gopakumar *et al.*, 2011).

### 3.2 Spawning and Incubation

A single female cobia can spawn between 0.4 and 2.5 million eggs, averaging around 2.1 million, with fertilization rates of about 90%. Eggs are collected using a 500 µm mesh net and stocked in incubation tanks of 3-5 tonnes capacity, hatching within 18-24 hours (average 22 hours) at a temperature range of 28-30 °C (Abdul-Nazar *et al.*, 2012).

### 3.3 Larval Rearing

Newly hatched larvae measure about 3.5 mm and initially depend on their yolk sac, which is fully absorbed by the third day post-hatch (dph). Larval rearing proceeds through five stages (Abdul-Nazar *et al.*, 2012; Gopakumar *et al.*, 2011):

- Early larval stage (0-10 dph): Mouth opens at 3 dph; larvae are fed rotifers (*Brachionus plicatilis*) and copepod nauplii at 10-12 nos./ml, four times a day, until 10 dph.
- Intermediate stage (from 8 dph): Larvae are fed Artemia nauplii at 1-3 nos./ml, 2-3 times a day.
- Weaning stage (15-18 dph): A gradual shift from live feed to formulated feed occurs; artificial feed (smaller than mouth size) is given 30 minutes before live feed, with co-feeding of rotifers and Artemia recommended alongside continuous water exchange.
- Metamorphosis stage (18-21 dph): Larvae begin transforming into the juvenile form.
- Cannibalism stage (25-40 dph): Larvae become highly cannibalistic, requiring size grading every four days; fry is fully weaned onto artificial diets and, on reaching about 10 cm, are ready for stocking in hapas.

### 3.4 Water Quality for larviculture

The following ranges are recommended for successful larviculture of cobia (Abdul-Nazar *et al.*, 2012):

| Parameter | Optimum Range |
|---|---|
| Temperature | 27-33 °C |
| pH | 7.8-8.4 |
| Dissolved Oxygen | More than 5 mg/l |
| Salinity | 25-35 g/l (ppt) |
| Ammonia ($NH_3$) | Less than 0.1 mg/l |
| Nitrite | Less than 0.4 mg/l |

### 3.5 Nursery Rearing

Nursery rearing is carried out in outdoor ponds or inshore cages, including hapas, sea cages and indoor FRP/cement tanks; juveniles smaller than 30 g are not stocked in cages. Stocking density is maintained at 1 no./10 L in indoor nursery tanks, and 1.8-3.0 kg/m³ (with 200% water exchange) in nursery cages (Abdul-Nazar *et al.*, 2019).

Nursery rearing occurs in two phases: The 4 weeks old fingerlings are reared for 6 weeks indoor (Nursery Phase 1) followed by 8 weeks outdoor (Nursery Phase 2) before stocking in grow-out cages. **Phase 1**, Carried out in 7-ton FRP tanks containing 5 tons of filtered seawater, at a stocking density of 8 nos./ L. The fingerlings are fed INVE (Thailand) formulated feed of assorted sizes ranging from 400-1200 um, three times daily with water exchange of upto 100%. and **Phase 2**, Nursery Phase 2 is carried out in specially designed floating sea cages for about 4 weeks. A square cage of 4 x 4 m with a 1 m high handrail or a circular cage of 6 m diameter can be used. The cages are made of 2.5 mm HDPE rope, with 20 mm mesh for the inner net and 40 mm mesh for the outer net. The net cage has a depth of 3 m and is kept in shape using ballast (Athithan, S., 2021). Floating or slow-sinking pellets with 45-50% crude protein and 10% crude fat, sized 800-1800 microns, support successful nursery rearing, with fingerlings fed chopped low-value fish at 5-10% of biomass, gradually reduced to 5% as they grow (Abdul-Nazar *et al*., 2019).

### 3.6 Grow-out Phase

Grow-out culture takes place in circular floating sea cages of 6 m diameter and 3.5-4 m net depth, with frames built of HDPE or GI pipes and circular ballast maintaining cage shape. Fingerlings from nursery Phase 2 are stocked at a density of about 900 fingerlings per cage (9-10 fingerlings/ $m^3$) and reared for 6-8 months. Many farms integrate nursery and grow-out operations within a single site to simplify the transfer of stock between phases (Abdul-Nazar *et al*., 2019).

### 3.7 Harvesting

After a 6-8 month grow-out period, cobia typically reach 3-5 kg (and 8-10 kg within two years), with survival rates around 90%. A single 6 m diameter cage can yield an expected production of 2.0- 4.0 tonnes (Abdul-Nazar *et al*., 2019).

## 4. Challenges in Cobia Farming

Sustainable cobia culture depends on the timely adoption of Better Management Practices (BMP), including regular cleaning and exchange of cage nets to maintain water flow (Abdul-Nazar *et al*., 2019). Cobia is susceptible to the parasites and diseases common to other warm-water species, and disease remains the most significant constraint on the expansion of cage farming. Among the most prevalent are infections caused by the parasitic *Amylodinium sp.* and the bacterial *Photobacterium sp.*, while *Vibriosis* and *Enterobacteriaceae* infections are frequently observed in fingerlings (Abdul-Nazar *et al*., 2012). Regular prophylactic treatment with disinfectants and freshwater dips is therefore essential, along with sun-drying and cleaning of nets to remove biofouling, barnacles and algal growth.

Poorly managed cages in shallow water, marked by overcrowding, overfeeding and inadequate waste handling, can pollute surrounding waters, lowering oxygen levels, increasing turbidity, promoting harmful bacteria, and harming bottom-dwelling organisms (Ali *et al*., 2023). Sites with warm (26 °C and above), clean, fast-flowing water improve oxygen availability and reduce both grow-out time and disease risk, although identifying such ideal locations remains difficult.

## 5. Aquaculture Importance

Cobia's rapid growth, adaptability to captive breeding, excellent meat quality, low production cost and strong market demand make it an outstanding candidate for mariculture (Ali *et al*., 2023). Its feed conversion ratio of about 1:1.6 and daily weight gain of roughly 45 g further underline its suitability for commercial culture. In India, cobia farming offers particular promise for ecological aquaculture linked to rural fishing communities along the coastline, where the fish commands a market price of around Rs. 310/kg (Abdul-Nazar *et al*., 2019). Reflecting this global potential, annual cobia aquaculture production rose from 3,000 tonnes in 1995 to 25,373 tonnes in 2006, and further to about 53,000 tonnes during 2018-2020 (WJRR 2023) or 54,188 tonnes (Revised FAO 2024).

## CONCLUSION

Cobia stands out as a fast-growing, high-value candidate species that is well suited to offshore cage mariculture, offering strong prospects for diversifying coastal aquaculture and improving rural livelihoods. Continued research into biosecure hatchery systems, disease-resistant broodstock and vaccine development, alongside careful site selection, will be essential to realise its full potential as a sustainable aquaculture commodity.

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**Related link**

- https://www.fisheries.noaa.gov/species/cobia.