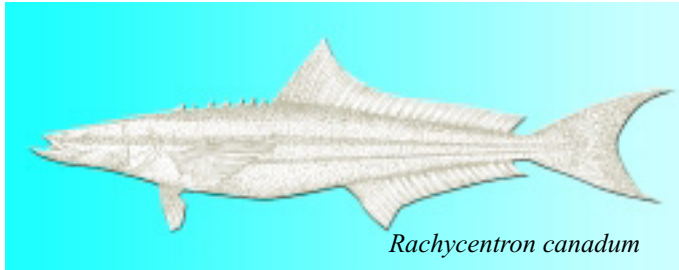


The sargeant fish and the eel

By AP Surtida



Sargeant fish or cobia

Locally known as *kume*, *dalag-dagat*, *gile* or *pandawan* (Rau and Rau 1980), the sargeant fish or cobia (*Rachycentron canadum*) is one species that possesses desirable characteristics for fish farming. Cobia is recognized as a fine food fish.

The cobia has a worldwide distribution in tropical and subtropical areas and is found seasonally in temperate waters. Within this geographic range, cobia encounters both marine and estuarine environments and is therefore able to tolerate a wide range of environmental conditions.

Cobia favors crustaceans for food, but will feed on other invertebrates and fishes as well. Hassler and Rainville (1975) said that cobia grows fast, up to 67 lbs in the first 7 years of its life. It attains a maximum size of over 60 kg. Sexual maturity is attained by male cobia at about 52 cm fork length in its second year and by female at about 70 cm in its third year. Fecundity for females 100-125 cm fork length varies from 1.9 to 5.4 million eggs.

A well-established, commercial market has been hindered by the small and unpredictable nature of the catch. Cobia is caught incidentally by commercial hook-and-line and net fishers, and by sport fishers as well. In the US, which ranks behind Pakistan, Mexico and the Philippines in commercial production of cobia, recreational landings exceed commercial landings by more than ten fold (Shaffer and Nakamura 1989).

In Singapore, cobia is known as black king fish, *hai wei* (in Fokkien) or *aruan tasik* (in Malay). Singapore has started the culture of cobia with fry imported from Taipei in 1996 (Lim et al. 1999).

Recently in the Philippines, the Chung Chen Development Corp (CCDC), a joint venture of Taiwanese and Filipino investors, started farming cobia (Fish Farming International 1998). The fish cage farm is situated in Barangay Lago, Sarangani Province in southern Philippines.

According to Charlie Ng, Operations manager of CCDC, the project was set-up in 1997. He admits that the project is really a gamble considering that sargeant fish has yet to find a solid

market in Asia. However, Ng is optimistic that in time, Taiwan and its neighboring countries -- where sargeant fish is served as sashimi and is considered a close competitor of the popular yellowfin tuna sashimi -- will soon acquire a taste for sargeant fish.

In General Santos City in southern Philippines, cobia sells for up to US\$10/kg whole and as much as US\$15/kg if packed as fillets. CCDC is also trying to penetrate other markets by introducing the fish to consumers in Japan, the US and Singapore.

The fish is grown in cages about 500 meters offshore. Starting with 10 cm fingerlings from Taiwan -- the main distributor of the fish -- CCDC grows them to more than 5 kg in six months. Each 216 m³ cage can accommodate 250 fish. So far, the biggest specimen that Ng has produced was about 40 kg.

Ng says his company spends more than P30,000 (US\$750) a day to feed 2000 fish currently growing in eight cages. They are voracious eaters and can consume about 1.5 tons of feed daily. Feed comprises raw reef fish, chopped and distributed at carefully monitored intervals.

According to Ng, the current demand requires the fish to weigh 5-10 kg. With their present stocking, their fish are not crowded in their cages. Faster growing fish are transferred to cages with other larger fish, so the smaller ones would get their equal share of feed.

Ng spends most of his time monitoring growth and tracking signs of disease by monitoring fish skin, behavior, and feeding patterns.

The company has high hopes for a major success. The biggest edge in the market is the fish itself. It has a distinct taste that would surely attract large consumers like Japan and the US, says Ng. With a creamy white flesh, connoisseurs say it tastes like blue marlin but has the smoother texture of tuna.

The breeding of sargeant fish is one of the many projects the CCDC is planning. With spawning technology, it would give the company control over the quality of the fingerlings and also would lessen operating costs, removing the need to import fingerlings.

The company also would like to expand into other high-value species such as groupers and lobsters in a couple of years time, according to Ng.

For inquiries about sargeant fish cage culture contact: Charlie Ng, Chung Chem Development Corp, at fax 552 3168.

Eel culture

All cultured eels belong to the genus *Anguilla*. These snake-like fishes have very small scales and their skin is rich in mucous



The eel (above) is grown in hapa nets inside a small concrete pond in southern Philippines (left)

Glass eel or elvers are stocked in a concrete tank with a glass front to better monitor fish condition

glands. The eel habitat includes: marine and coastal waters, brackishwaters (estuaries, lagoons, mangroves), and inland waters (rivers, streams, lakes and marshes). For most of their lives (3-12 to 15 years), eels are mainly sedentary though they migrate from time to time (Brusle 1990)

Eels are extremely carnivorous. They feed on crustaceans, insect larvae, polychaetes, gastropods and small fishes.

Their color varies (yellowish, brownish, greenish, blackish or silver) depending on age and their environment. Male eels generally measure 20-40 cm; females are longer, they can exceed 50 cm and may reach 150 cm!

Nineteen species are recognized, but only three are cultured: the European eel (*Anguilla anguilla*), the Japanese eel (*A. japonica*) and the American eel (*A. rostrata*). The main eel-eating areas are Europe and the Far East. The main catches of eels are in Europe, North America, the Far East, Australia and New Zealand.

Eel meat generally ends up as *kabayaki*, the Japanese style of marinated roasting; smoked, mainly done in continental Europe; and jellied and stewed, the London method (Usui 1991).

An unusual feature of the eel is that it is exploited at almost all stages of development. Still, it has proved impossible to breed eels in captivity, although attempts have been made. So far, development relies on a steady and adequate source of elvers.

In Asia, the major players are: Japan which started eel culture in 1894, China, Taiwan, Korea, Australia and New Zealand. According to Juan Torres (*Fish Farming International*, June



1997), managing director of Valencia De Acuicultura, Spain's biggest producers of eels, the top producers in Europe are: Italy, Holland, Denmark and Germany. In 1995, Mr. Torres said, Europe's total production was 7,720 tons. In Asia, Mr. Torres added, Japan catches an average of 35,000 tons of elvers a year, 10,000 tons come from Korea and Taiwan, and 50-55,000 tons from China. Still, this volume is not enough to supply the farms serving the huge Japanese market.

Mr. Torres estimated that European glass eels being caught is between 30-50 tons a year and the bulk winds up in the Far East, particularly, China. Japan is said to import over 72,000 tons of live and processed eels mainly from China (over 49,000 tons)

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observed are a pH of 6.5-8, alkalinity of 30-40 ppm, salinity of 5 ppt (more than that level, mortality will occur), and iron content of not more than 0.2 ppm. Dissolved oxygen should not be less than 3 ppm.

Turtles are stocked at a density of 8-12 per m². Being a carnivorous species, *Trionyx sinensis* requires high protein (45-55%) and low fat diet. They are fed with trash fish, poor grade chicks, and intestines of poultry. Feeding is done once or twice daily, in the morning and/or afternoon at about 2% body weight.

To reach the size that can be sold in the Chinese market (400-600 g), farming period is about 6-8 months. Sex segregation is generally undertaken when the turtles mature, as females become subject to male biting attacks.

Marketable sized turtles may be harvested partially or completely. Partial harvest is done by lowering the water level and capturing the animals by hand. Complete harvest involves draining the water. Turtles of insufficient size are transferred to grow-out ponds for further culture. The marketable turtles are placed in tanks with running water to clean them before delivery to customers. Fast-growing turtles may be chosen as broodstock.

Markets

To prevent fighting, turtles bound for market are segregated individually in small nets or black perforated plastic bags. Adult turtles are normally sold live to export and local markets. Poor grade hatchlings can be also sold to aquarium shops as pets. Unfertilized eggs can be processed into medicinal food.

Outside Malaysia, the major market for turtles are China, Japan, Taiwan, Hongkong and Singapore. Local demand for cultured turtles has increased recently due to lack of supply from the wild.

Future potential

The potential of rearing soft-shelled turtles in tropical environments seems bright. Higher ambient temperatures for poikilotherms like reptiles and fish stimulate rapid and consistent growth patterns.

Taste for the soft-shelled turtle has to be acquired. Currently, only those with exotic, epicurean taste appreciate it. (Muslims do not eat it.) There is a need, therefore, to develop the delicacy's mass appeal, as well as explore and prove its medicinal value. Gory displays of public slaughter should be stopped to avoid casting a negative light on the development of turtle-derived products.

Conclusion

Cultural prejudices against exotic aquaculture species must be overcome to ensure the continuous development of their industries and markets.

This article is based on extension materials from the Sepang Today Aquaculture Centre and from responses to a questionnaire emailed by Mr. Khoo Eng Wah to NJ Dagoon

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and Taiwan (over 20,000 tons) and 2,500 tons from elsewhere.

According to Mr. Torres, the biggest challenge to European growers is the high price of growing glass eel. There is huge demand for European elvers from China. He said the bigger problem is sustainability -- there may be no glass eels left in four or five years. EU should either stop or regulate this trade. *Fish Farming International* estimated that 65-75% of Europe's glass eels are being exported to the Far East.

The European Eel Fisheries Conservation Group (EEFCGO) has already issued a strong warning last year that too many eels from European waters are being exported across the world. Most die before they reach maturity and their steady depletion threatens eel fishing in Europe, as well as the further development of eel cultivation (*Fish Farming International*, February 1999). There are also reports that the International Council for Exploration of the Seas (ICES) has concluded that adult spawning stock of European eel (*A. anguilla*) is now outside safe biological limits. Between 1996 and 1997, France exported 150 tons; Spain, 70 tons; and UK, 30 tons at prices reaching up to US\$327 per kg of elvers.

Aquaculture potential

The factors that favor eel culture include the following (Usui 1991):

- Biological: high survival rates in culture, high tolerance to water quality variables (salinity, oxygen, nitrogenous waste), highly adaptable to a variety of diets (natural and artificial), high satisfactory growth rates (commercial size of 150-250 g can be reached in 12-24 months at optimum temperatures of 22-24°C).
- Technology: highly established rearing methods
- Economics: high value as food, high sale price, high commercial demand which exceeds supply (deficit in Europe is estimated at 13,5000 tons a year), elvers and young eels are available in the wild (estuaries and lagoons), and there are some opportunities to combine fishing and rearing
- Scientific: there is active research and extensive literature (Brusle 1990). The principles of eel culture are the same as for all fish culture

Eel culture in the Philippines

Eel culture is still in its fledgling stage. Known as *igat*, *casili* or *palos*, it started in the early '70s when the estuarine delta of the Cagayan river in northern Luzon has been discovered to yield commercial quantity of elvers. The elver season in the Philippines occurs most of the year but it peaks in March and August.

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The two most dominant species caught in Philippine waters are *A. marmorata* and *A. celebesensis*, while the minor species are *A. bicolor pacifica* and *A. japonica*. The dominant ones appear mainly in October to February, while the minor species only in January and February (Magsumbol, undated).

In addition to the Cagayan river system, the rivers of Cotabato and Davao del Sur provinces in southern Philippines also yield elvers in commercial quantity. We manage to interview one eel farmer from Isulan, Sultan Kudarat, Mindanao, Southern Philippines.

Lister Granada, a former trainee at SEAFDEC and a native of the place owns Sultan Feed, a manufacturing, retail and marketing enterprise of hog and poultry feeds. He is also into fish feeds which he hopes to market to eel and catfish farmers in the area.

According to Lister, Metro Manila price for adult eels is P300-400 per kg depending on size. In Cotabato City in Mindanao, price ranges from P180-280 per kg for wild-caught eels. But, Lister said, the ideal market size of eels would be about 300 g a piece. This is the size required by Manila exporters who ship to Japan and Taiwan.

Lister sourced his elvers from the surrounding area which can supply in commercial quantities. Elvers are available 10 months a year. Lister's problem is determining the seasonality.

Two other companies in General Santos City, also in Mindanao, are into eel culture, but the mortality rate is extremely high. Lister's demonstration farm is at Barangay Palian, Tupi South Cotabato. Here, Lester experiments and conducts feeding trials with eels and catfish.

To get the ideal market size, Lister said the culture period must be 9-10 months. Eels can be cultured in tanks or in ponds (area, 5 x 5 m²; water depth, 1 m). Stocking density is around 200-300 elvers per tank or pond. Continuous water flow and sufficient feeding are the secrets to faster growth.

Lister said he feeds 7 kg of fresh fish or 1.3-1.5 kg of commercial diet to get 1 kg of eel flesh. He feeds his own formulated moist feed which was designed according to locally available feedstuffs. He said the formulation is based on the protein and amino acid requirements of carnivores.

With regards to handling and diseases, Lister said eels need extra-care because they are "supersensitive." If eels get hurt, they die within 3-5 days. With diseases, it can be easily cured if symptoms are detected early on. He mixes his medicines with the moist feed.

Lister clarified that he has four kinds of eels in his stock: *A. marmorata*, *A. bicolor pacifica*, *A. celebesensis* and *A. japonica*. These species were identified and verified by Dr. Tabrez Nasser, Sr, an aquaculture expert of the International Institute of Rural Reconstruction (IIRR) on a recent visit to his farm. Lister described the color of his eels as blackish, some brownish, with white dotted brown.

Ask about harvesting his stock, Lister said it is the same method as harvesting tilapia and other fishes.

Lister painted a rosy picture for eel culture. There is abundance of elvers (at least in his place) in commercial quantity almost all year round, he has got his own formulated moist feed, and the warm waters of the tropics can be very conducive to fast growth rates. Diseases are under control, and there is a ready market abroad. "I am extremely grateful to SEAFDEC for my knowledge in feed formulation. I spent long hours at the AQD Library reading all the eel literature I could get my hands on."

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- Dr. Tabrez Nasser (*Senior Aquaculture Specialist*)
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