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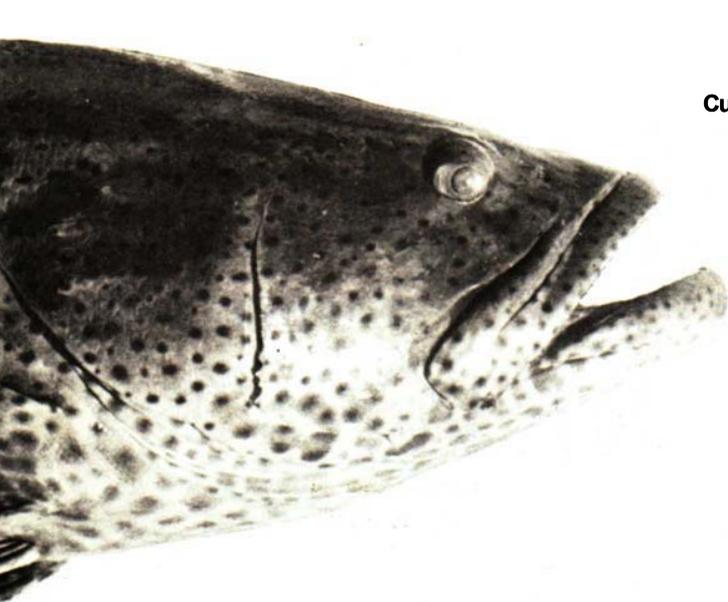
Grouper aquaculture in Southeast Asia

Aquaculture Department, Southeast Asian Fisheries Development Center

Southeast Asian Fisheries Development Center, Aquaculture Department (1992). Grouper aquaculture in Southeast Asia. Aqua Farm News, 10(3), 2-3.

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Culture species and methods

Culture species. Groupers have been cultured in Southeast Asia for more than 10 years. *Epinephelus tauvina* was the first recorded species for culture in Kuwait, Singapore, and Thailand while *E. salmoides* have been cultured in Penang, Malaysia. At present, many species of grouper are cultured in Asia (Table 1). However, only *E. tauvina*, *E. salmoides*, and *E. malabaricus* have been cultured in commercial scale in Southeast Asia and Middle East. *E. akaara* have been cultured in Japan and China.

Culture methods. Cage culture has been practiced in many countries such as Thailand, Malaysia, Singapore, Philippines, Indonesia, and Hongkong, while pond culture has been reported in the Philippines. Cage

culture has some advantages like:

- Cages are set in sites with better aquatic environmental condition. Therefore, cages can be stocked with more fish than ponds;
- Cost of cage preparation is less than the cost of pond construction;
- Cage culture does not need water changing and elaborate preparation, thus, its operation is less costly than pond culture.

Floating cages

Galvanized iron or wooden parts are used for the cage frame in Thailand, Singapore, and Malaysia. The cage is kept afloat by styrofoam drum, plastic carbuoy, or bamboo. In the Philippines, wooden parts are used for the frame. Styrofoam drum, plastic carbuoy, or

Grouper aquaculture in Southeast Asia

Some species of groupers such as estuarine grouper, black-spotted grouper, brown-spotted grouper, red grouper, and red-spotted grouper have been found to be suitable for aquaculture. Grouper culture can be conducted both in cages and in ponds. However, cage culture is more popular than pond culture in many countries. The major constraint to large-scale development of grouper culture is the shortage and uncertain supply of fingerlings from the wild.

Artificial breeding has been done in many countries such as Singapore, Thailand, Kuwait, and Japan. The hatchery techniques are still under experiment. However, research efforts have been directed at larval rearing techniques aimed at achieving sufficient supply of fingerlings.

Table 1.
Species of grouper cultured in some countries in Asia.

Species	Common names	Countries
1. <i>Epinephelus</i>		
<i>E. malabaricus</i>	Black spotted grouper	Thailand, Philippines
<i>E. salmoides</i>	Estuarine grouper	Malaysia, Thailand
<i>E. tauvina</i>	Brown spotted grouper	Singapore, Kuwait
<i>E. akaara</i>	Red spotted grouper	Japan, Hong Kong, China
<i>E. amblycephalus</i>	White-spotted green grouper	Hong Kong, Philippines
<i>E. bleekeri</i>	Yellow-spotted grouper	Philippines, Hong Kong
2. <i>Plectropomus</i>		
<i>leopardus</i>	Leopard grouper	Indonesia, Singapore
3. <i>Cromileptes altivelis</i>	Hump-backed grouper	Thailand

Table 2.
Suitable
water quality
for cage
culture of
grouper.

Parameter	Range
pH	7.5-8.3
Dissolved oxygen	4-8 mg/l
Salinity	20-32 ppt
Temperature	26-32°C
Ammonia-nitrogen	< 0.2 mg/l
Current	normal

bamboo are also used for supporting the cage frame.

Cage is usually 5 m × 5 m × 5 m in Thailand. However, 3 m × 3 m × 3 m cages are used in the Philippines.

Stocking density

At present, grouper fry are collected from the wild. Fry of size 7.5-10 cm are usually collected by fish trap from coastal water near mangrove areas. The fry are first stocked in nursery cages. Stocking is done separately for each size group to prevent cannibalism. Suitable water quality for cage culture of grouper is presented in Table 2.

The stocking density up to the marketable size varies from 10 to 100 fish per m³. This is due to insufficient supply of fry.

Feeding

Groupers are carnivorous and voracious, taking live fish and crustaceans as food. However, it is not difficult to train the grouper to feed on trash fish. For the first two months of culture,

feeding rate is 10% of body weight. After that, it can be reduced to 5%.

Supply of trash fish is always insufficient and expensive in some seasons and areas. Artificial diets can be recommended for feeding. It is easy to train grouper to feed on artificial diet. Growth rate is similar to fish fed trashfish (Table 3).

Market size and rearing period

Market- sized fish varies from 0.5 to 1.3 kg. In the Philippines, fish of high demand ranges from 0.5 to 1.0 kg. In Thailand, 1.3 kg fish are usually exported live by air to Hongkong.

Fish cultured in net-cage can reach 0.6 kg in 8 months.

Polyculture of grouper and other fish

Polyculture of grouper and tilapia have been reported in the Philippines. A ratio of 1 grouper to 20 tilapia proved to be the most effective in earthen ponds. Grouper yield is higher since they fed on tilapia fingerlings.

The basic construction of the polyculture pond is similar to milkfish or shrimp ponds. A suitable site with salinity higher than 10 ppt is preferred. However, feeding techniques, water management, growth rate, and food conversion ratio should be studied in more detail.

Marketing

Grouper is more expensive than most other fish species in Thailand. The local demand is rather limited. At present, production from cage culture in Thailand is exported live by air to Hong Kong. The demand is year-round. Therefore, the income from grouper could be more than the other species. In Singapore, production from cage culture is only sold live in the local market.

Source: S Tookwinas. 1989. *Review of knowledge on grouper aquaculture in South East Asia*. In: **Proceedings of Advances in Tropical Aquaculture**; 20 Feb - 4 Mar 1989; Tahiti. AQUACOP IFREMER, Actes de Colloque: 429-435.

Table 3.
Growth of
grouper at
different
stocking
densities in
cages

Culture period (days)	Stocking density	
	*58/m ³	**100/m ³
0	83.7	26.9
30	158.7	45.6
60	186.5	65.9
90	243.9	98.7
120	283.7	137.0
150	296.8	217.1
180	355.8	312.4
210	433.9	387.6
250	-	586.6

*Fish fed trashfish; **fed artificial diets.