The status of grouper culture in Southeast Asia

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Full-cycle aquaculture (the use of hatchery-reared fingerlings) of many grouper species is becoming more common throughout Asia. Grouper are cultured at various scales in every country of Southeast Asia — Hong Kong, Indonesia, Malaysia, Philippines, Taiwan, Thailand and Vietnam. While currently making up only about 10–15 per cent of the total trade, there is an increasing supply of full-cycle, cultured fish. The most important source countries are Taiwan, Indonesia and Thailand. Grouper culture is also ongoing in Australia and the People's Republic of China, although the industry in these countries will not be discussed here.

A brief review of the status of the grouper aquaculture industry in each of the seven Southeast Asian countries is presented below.

Hong Kong

Grouper culture has been undertaken for over 30 years in Hong Kong. Groupers are cultured in floating cages in 26 designated aquaculture zones. The industry depends entirely on grow-out. The average farm size of rafts is about 250 square meters (Chan 2000). The colder winter water temperatures in Hong Kong restrict both the type of species to be cultured successfully, and the mortality and culture period of several species. Commonly cultured species include *Epinephelus tauvina, E. lanceolatus, E. malabaricus, E. areolatus* and *E. bleekeri*. A number of other fish species are also cultured.

There are no fry hatcheries in Hong Kong. Fry for culture were once provided from local capture but now almost all fry are imported from other countries in Southeast Asia. Traditionally, grouper were fed with trash fish supplied by purse seiners and trawlers. The use of trash fish was identified as one of the major sources of pollution around culture areas. In the early 1990s a moist pellet was developed by the government to replace the use of trash fish, and fish farmers are slowly adopting it.

In the early 1990s grouper production in Hong Kong was about 3000 t a year. In the last few years, production has dropped to 1000 t a year due to a number of production and environmental problems and stresses (Sadovy 2000). High levels of mortality exist from stress during the first few weeks or months after introduction of fry to the cages, and during water temperature changes, which occur twice a year, increasing in April/May and decreasing in November (Sadovy 2000). Differential growth rates of individuals lead to cannibalism. Poor water conditions and disease are also serious problems. Water quality in the culture zones is getting worse due to the high density of cages, build up of waste on the sea bottom, overfeeding using trash fish, algal blooms (including a recent red tide), and poor water flow. Viral infections and disease result both from infected imported fry and from poor water quality. Access to medication to treat diseases is limited in Hong Kong (Chan 2000).

Indonesia

Grouper culture is expanding in many areas of Indonesia. While there is no statistical data available on grouper culture in Indonesia, national aquaculture statistics show brackish water and cage culture growing at 8 and 16 per cent, respectively, during the 1990s. The primary areas for

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grouper grow-out culture in Indonesia are Aceh, north Sumatra (Nias and Sibilga), Riau Islands, Bangka Islands, Lampung, west Java, Karimunjawa Islands (central Java), Teluk Saleh (west Nusa Tenggara), south Sulawesi, north Sulawesi and southeast Sulawesi. Grouper culture is generally characterised in Indonesia by the use of wild-caught seed and use of trash fish for feed. There is limited use of hatchery-reared seed, although this is growing. Grouper are primarily grown-out in net cages. There is some limited pond grow-out culture, particularly for small size classes, but a general shortage of land for ponds has been identified (Sadovy 2000).

There has been a good deal of research on hatchery production of grouper. This has been stimulated by the development of a large number of milkfish hatcheries near the Gondol station and by increased interest from these private hatcheries in Bali and throughout Indonesia to produce grouper seed on a commercial basis. At the Gondol Research Institute for Mariculture on the north coast of Bali, the mass seed production of *Cromileptes altivelis* has been successful. Broodstock have been able to spawn naturally all year round, although the survival rates of larvae are low at the early stage. There are slow growth rate and disease problems at the grow-out stage.

Some private hatcheries have succeeded in seed production, applying technologies learned from the Gondol station. In addition, humpback grouper seed has been provided from the station to many aquaculture operations in Bali and elsewhere in Indonesia and Southeast Asia for grow-out. The Gondol station has also succeeded in full-cycle culture of *E. fuscoguttatus*. The spawning period for this species in the hatchery has been found to be very short, only three to four days a month, and not all year round. Survival rates are low due to high levels of cannibalism, although survival rate and growth rate in cages is high. Many of the hatcheries in Bali culture several species of fish in addition to grouper such as sea bass, milkfish and humphead wrasse (*Cheilinus undulatus*).

Research on a variety of species has also been undertaken at the Regional Brackishwater Aquaculture Development Center in Situbondo in eastern Java. At the Marine Finfish Production and Research Center (MAFPREC) in Besut, Terengganu, natural spawning of *E. fuscoguttatus* was achieved in 1995 in a 150-t tank. Research at MAFPREC continues to improve spawning and larval culture. Other research work has been carried out at the Research Institute for Coastal Fisheries in Sulawesi and the Mariculture Development Center at Lampung.

The Nature Conservancy has developed a full-cycle mariculture operation in the area of the Komodo National Park in western Flores. The project was originally started as an alternative enterprise for local fishers who were utilising destructive fishing practices. Fingerlings were obtained from the wild, but after a trial period it was decided to enter into full-cycle grouper culture. A number of species are being used as broodstock, including *E. coioides*, *E. fuscoguttatus*, *Cromileptes altivelis*, and *Lates calcarifer*. The first spawning of *Cromileptes altivelis* and *E. fuscoguttatus* occurred during the project in late 2000.

There are currently some problems with expansion of grouper culture in Indonesia. There is an oversupply of grouper seed available due to too many hatcheries being built. While the grow-out of grouper seems to provide considerable economic profit to small producers, the expansion of net cage grow-out operations are limited by high initial investment costs and lack of funds and credit. This oversupply of seed has led to a recent sharp decline in seed prices, which has caused hatcheries to stop producing seed. Thus, there is a need for improved market information for hatcheries on seed demand and on wholesale and retail prices and markets for grow-out operations. There is also a need for extension assistance to potential and existing small culturists, as many lack the technical skills to grow grouper. In some areas, water quality is emerging as a serious problem (Dr Ketut Sugama pers. comm. 2001). It is important to note that the Indonesian government has given aquaculture development a high priority for support.

Malaysia

There are over 2000 fish farmers involved in marine finfish culture in Malaysia. Grouper make up over 16 per cent by weight and 30 per cent by value of total marine finfish produced by aquaculture in Malaysia (Subramaniam 1999). Approximately 15 per cent of the fish seed are collected from the wild and/or produced in government or private hatcheries. The remaining 85 per cent is imported, primarily from Taiwan and Thailand (Subramamiam 1999). Net cages are the most popular grow-out system. The major grow-out sites for grouper in Malaysia are in Sabah, particularly Tuaran and Sandakan, and Sarawak (where wild seed are also captured) in East Malaysia. In Sabah, it is reported that there are two types of grouper culture — 'system' culture and 'real' culture (Sadovy 2000). System culture is the feeding of a variety of large captive juvenile or small adult grouper species in net cages. Real culture is the raising of wild-caught fry/fingerlings, primarily *E. coioides* and *E. malabaricus*.

Grouper are also cultured in Peninsular Malaysia in protected coastal areas in Johore, Selangor, Penang and Kedah. Several species of grouper are being grown-out in floating net cages including *E. coioides, E. tauvina, E. fuscoguttatus, E. lanceolatus, Plectropomus leopardus*, and *Cromileptes altivelis*. Wild seed are the major source of local supply of grouper seed.

Fish farmers in Malaysia have also been importing large numbers of hatchery-produced fish fry / juveniles from Taiwan in the last few years. The primary species imported are *E. lanceolatus* and *E. fuscoguttatus* and *Cromileptes altivelis*. It is reported that the survival rate of *E. lanceolatus* and *C. altivelis* was not very good and that the fish are susceptible to disease. The survival rate of *E. fuscoguttatus* was higher (Seng 2001).

There are few grouper hatcheries in Malaysia. There are two private hatcheries in Sabah working on grouper and other species. It is reported that they have had some problems with post-hatch larvae mortalities (Sadovy 2000). The University of Malaysia–Sabah has research underway or planned on several species including *C. altivelis*, *E. fuscoguttatus* and *E. lanceolatus*. It is important to note that no grouper fry / fingerlings can be imported into Sabah, thus the importance and need for hatcheries is significant (Sadovy 2000).

The Marine Finfish Production and Research Centre, at Terangganu in Peninsular Malaysia, a government facility, conducts research and produces fish fry for culturists, private hatcheries, and nursing. It also provides training to local finfish hatchery operators. The Centre is working on *E. coioides* and *E. fuscoguttatus* (Subramaniam 1999). There is a private hatchery in Penang working on *E. coioides* and *E. fuscoguttatus* using techniques learned from Taiwan (Sadovy 2000).

Trash fish is used to feed groupers but with decreasing amounts of trash fish available, some private feed mills have been producing a formulated diet for groupers. There is a need for more disease-free seed and fingerlings for industry development. There is also a need to maintain healthier broodstock. The government of Malaysia is encouraging an increase in the number of hatcheries. The government has identified aquaculture zones and provided infrastructure for aquaculture development. Research and development is also being encouraged. To protect grouper fry, there is a closed season on their capture during November and December, and only permitted from January to April in West Malaysia (Subramaniam 1999).

Philippines

Grouper aquaculture in the Philippines is based on the grow-out of wild-caught fry and fingerlings. Grouper fry and fingerlings are caught using a variety of methods including hook and line, scoop or dip nets, traps, *gango* or fish nest, fish corral, and several types of nets. In the Philippines, the major sources of grouper fry include the provinces of Pangasinan, Cavite, Mindoro, Quezon, Masbate, Bulacan, Cagayan, Dadiangas, Zamboanga del Sur and Negros Oriental. The Philippines is one of the largest suppliers of wild-caught grouper fry, fingerlings and juveniles in Southeast Asia.

Grouper culture in the Philippines is limited by the lack of enough fry and fingerlings of the preferred size for grow-out, poor quality of the fry due to capture method, and by sufficient supply of trash fish for feed. Overfishing, destructive fishing and the large amount of fry and fingerling exported are all stated reasons for the supply problem. The high dependence upon wild-caught fry and fingerlings in the Philippines is due, in part, to the lack of commercial hatcheries in the country (Marte pers comm. 2001). Some fish farmers in the Philippines are importing fingerlings from Taiwan and from the Gondol station in Bali, Indonesia.

Increasing numbers of fish farmers in the Philippines are now engaged in grouper culture. Grow-out is carried out using floating net cages, fixed net cages, and in ponds which were formerly used for shrimp culture. In addition to the lack of fry and fingerling supply, other problems with grow-out include disease, water quality and storm damage to cages (Sadovy 2000).

The Southeast Asian Fisheries Development Center-Aquaculture (SEAFDEC) in Tigbauan, Iloilo, is the primary source of technical information and research on grouper in the Philippines. SEAFDEC's work focuses on *E. coioides* and *E. malabaricus*. SEAFDEC's research is on broodstock development, seed production, and nursery and grow-out culture of groupers. SEAFDEC is now transferring the results of its research to the private sector (Marte 1999; Quinitio 1999; Baliao et al 2000).

There is reportedly one private broodstock operator in the country and several small private hatcheries. Three main species of grouper produced are *E. coioides*, *E. malabaricus* and *E. lanceolatus*. It is reported that spawning is still a problem, hatcheries are having problems with post-hatch larvae and diseases, and production is not at commercial levels. Recently, a development project in the province of Samar constructed hatchery facilities to produce fry and fingerlings of *E. coioides* and

E. malabaricus. The project was designed to produce fry and fingerlings for grow-out as an alternative livelihood for local people. SEAFDEC provided technical assistance to the project.

A model of grouper culture that has been discussed for the Philippines is to have one broodstock facility in an area or region of the country that would supply larvae to a number of satellite hatcheries. While the spawning and egg production of several grouper species can be achieved on a commercial level in the Philippines, a limiting factor to development is the reliance on trash fish for feed. A commercial diet for grouper will need to be made available. Parasitic infestations of grouper are causing increasing mortality (Marte 1999).

Chinese Taipei (Taiwan)

Hatcheries in Taiwan are currently able to hatch more than 40 species of marine fish for mariculture, with *E. coioides, E. lanceolatus, Trachinotus blochii, Lutjanus argentimaculatus, L. stellatus* and *Acanthopagrus latus* being the species in greatest numbers. Early grouper culture in the 1970s and 1980s consisted of growing-out wild-caught fry from Taiwan and other Southeast Asian countries. Full-cycle grouper aquaculture of *E. coioides* and *E. malabaricus* was achieved in the early 1980s. Currently, fifteen species of grouper are being cultured in Taiwan, many on demand. The most common grouper species are *E. lanceolatus, E. coioides, E. malabaricus* and *E. fuscoguttatus*. By 2001, more than 600 hatchery and grow-out farms produced over 20 million fry and over 7000 t of grouper annually from a production area of more than 700 ha. Both hatchery produced and imported seed are used in production. Taiwan supplies fertilised grouper eggs and seed to export markets.

Grouper mariculture operations in Taiwan are usually specialised in one of several areas of production system such as broodstock / eggs, hatchery, nursery, and grow-out. The specialisation has led to a decrease in the price of fry and fingerlings (Cesar and Hempel 2000). Broodstock are kept in outdoor ponds and are induced to spawn artificially or allowed to spawn naturally (Sadovy 2000). Larviculture uses both indoor and outdoor methods. Two-pond culture systems are used for the nursery phase — a small pond, 100 m^2 in size with small cages, and a large pond used during winter (Rimmer 1998). Grow-out occurs in both floating net cages and in ponds. The majority of Taiwanese grouper farmers now use moist pellet, artificial feed. Water quality and diseases are increasing problems (Rimmer 1998).

Cesar and Hempel (2000) reported that the reasons for the relative success of Taiwan's grouper aquaculture industry include: 1) success in mass production of fertilised eggs, 2) advances in the fry production system, 3) highly specialised subsystems and division of labour, 4) high efficiency in the production of live feeds, 5) aggregated hatchery business, 6) wide use of formulated feeds, 7) thoroughly experienced hatchery operators, and 8) sound research and development infrastructure. To this list should be included strong government support for the industry and well organised industry associations.

Thailand

Grouper aquaculture is growing rapidly in Thailand. Grouper culture is primarily undertaken in floating net cages in the southern and eastern provinces of Thailand including Suratthani, Chumpon, Nakhonsrithamarat, Songkhla, Pattani, Satul, Krabi, Trang, Phangnga, Chachengsao, Rayong and Chantaburi. As the shrimp farming industry in these provinces declined during the 1990s due to lower prices, disease and environmental problems, many farmers shifted to brackish water finfish culture including grouper. The two most important species cultured in Thailand are *E. coioides* and *E. malabaricus*; in addition *E. lanceolatus, E. areolatus, E. fuscoguttatus, Plectropomus maculatus* and *Cromileptes altivelis* are cultured.

Thailand is a major supplier of wild-caught grouper seed in Southeast Asia, although some local seed is also used to support the growing grouper culture industry in the country. A constraint to industry growth, is however the insufficient supply of suitable size and quality of seed. It has been reported that without the export of seed, there would be enough seed available to meet the demand in the country (Sadovy 2000). Hatchery production will need to be increased to meet the demand.

The government of Thailand has made grouper culture a priority for the country. There are several research institutions in the country working on grouper culture. The most prominent is the National Institute of Coastal Aquaculture (NICA) located in Songklha in southern Thailand. NICA works on *E. coioides, E. malabaricus* and *E. lanceolatus*. NICA provides grouper seed to farmers and well as technical assistance. There are several other research stations associated with the Department of Fisheries working on grouper in Phuket, Krabi and Satun. There is reportedly one private hatchery located in southern Thailand producing *E. malabaricus* seed.

Viral diseases and parasites are an increasing problem for grouper culture in Thailand. The availabil-

ity of trash fish is another problem and even though artificial feed is available, it is too expensive for many farmers.

Vietnam

Grouper culture is a relatively new enterprise in Vietnam. There has been considerable growth in grouper grow-out culture, and other finfish, in net cages throughout the 1990s. Culture is centred in a number of provinces including Hai Phong and Quang Ninh in the north, and Phu Yen and Khanh Hoa in the south central. The Ministry of Fisheries has reported that marine fish aquaculture production was 5000 t in 1999, mostly groupers (Sadovy 2000).

Grow-out in the country is based primarily on the use of wild-caught fry and fingerlings. Most operations are small-scale and family-operated. Commonly cultured grouper species include *E. coioides, E. malabaricus* and *E. bleekeri*.

In addition to floating net cages, fixed net cages and ponds (formerly used for shrimp) are used for grow-out. Only locally caught trash fish are used for feed. Disease is currently reported as not being a significant problem.

Although grouper hatchery technology has been developed, there are no private grouper hatcheries in Vietnam. The Research Institute for Aquaculture-1 (RIA-1), located in north Vietnam, maintains broodstock and a research programme at Cat Ba Island. The Fisheries University in Nha Trang has begun grouper hatchery research and maintains broodstock of several grouper species. It is reported that RIA-1 is building a hatchery research station and grow-out cages with foreign development assistance in Nghe An Province (Sadovy 2000).

Grouper seed supply and poor quality of seed due to catching and handling practices are two constraints faced by the industry. In addition, there needs to be cost-effective alternatives to trash fish for feed (Nguyen and Hambrey 2000).

References

Baliao, D.D., M.A. de los Santos, N.M. Franco and N.R.S. Jamon. 2000. Grouper culture in floating net cages. Aquaculture extension manual no. 29. SEAFDEC-Aquaculture Department, Tigbauan, Iloilo, Philippines.

Cesar, H and E. Hempel. 2000. Opportunities and constraints for grouper aquaculture in Asia. EASES discussion paper series. World Bank, Washington DC

Chan, P. 2000. Reviews and future of grouper aquaculture. Hong Kong Chamber of Seafood Merchants, Inc. Hong Kong, China

Marte, C. 1999. Grouper research at the Southeast Asian Fisheries Development Center Aquaculture Department. www.enaca.org/grouper/research/hatchery/1999

Nguyen van Trai and J.B. Hambrey. 2000. Grouper culture in Khanh Hoa Province, Vietnam. Asian Institute of Technology, Bangkok, Thailand

Quinitio, G.F. 1999. The status of seed production of grouper and other coral reef fishes in the Philippines. www.enaca.org/grouper/research/ hatchery/1999

Rimmer, M. 1998. Grouper and snapper aquaculture in Taiwan. Austasia Aquaculture. 12(1):3–7.

Sadovy, Y. 2000. Regional survey for fry/fingerling supply and current practices for grouper mariculture: Evaluating current status and long-term prospects for grouper mariculture in Southeast Asia. Final report to the collaborative APEC Grouper Research and Development Network (FWG 01/99)

Subramaniam, K. 1999. grouper aquaculture development in Malaysia. www.enaca.org/grouper/research/hatchery/1999