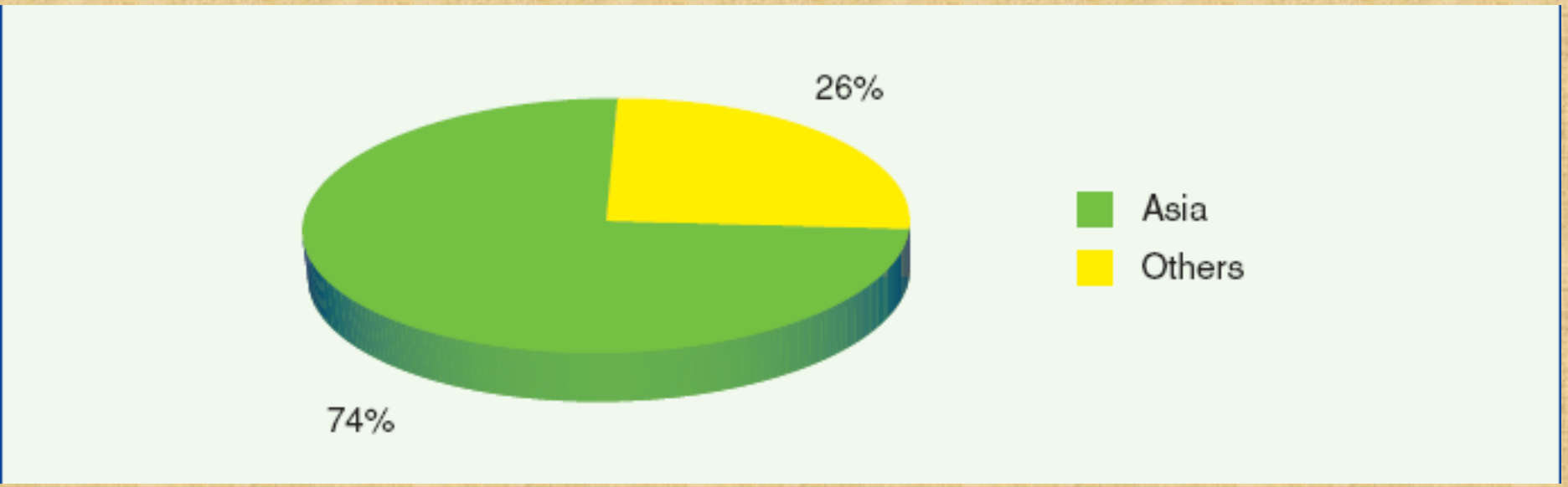
Marine Aquaculture 6

PhD. student

Dr.A.Y.Al-Dubakel

Groupers

Grouper production through aquaculture is mainly reported by countries in Asia, where over 9 300 tones were produced in 2000. The actual figures of grouper production in SE Asia are reported by Sadovy (2000) to be far higher, at 23 000 tones; however, about 20% of this production may be based on hatchery produced fry, while the remainder is from wild seed. According to this author, China is the main producer (8 300 tones). Asian production to be around 15 000 tones. In each case, these figures are significantly higher than the official statistics published by FAO.



Grouper aquaculture production by continent in 2000

Groupers

Accurate information is difficult to obtain; hence the production estimates vary significantly, depending on the authors' sources. Their data comes from interviews, questionnaires, literature reviews and pers. comm. gathered by each author. When information is collated from a variety of sources, e.g. government offices, private producers, traders, middlemen, exporters and importers, and from fishing communities, academic institutions and hatcheries, etc., it is not easy to obtain reliable estimates.

Estimates of farmed grouper production in selected countries

LOCATION	YEAR	Tonnes	REFERENCE
Hong Kong	1990	3 000	Li (1999)
	1999	1 000	Sadovy (2000)
	2000	523	FAO (2002a)
India	2000	200	James (2000)
Indonesia	1999	1 000	Sadovy (2000)
	2000	1 159	FAO (2002a)
Republic of Korea	1999	50-100	Young Don (2002)
	2000	data unavailable	FAO (2002a)
Malaysia	1994	600	Ali and Ali (1999)
	1994	800	Biusing, Phillips and Cabandan (1999)
	1995	513	Komilus and Biusing (2002)
	1995	834	Ali (1998)
	1997	798	Subramanian (2002)
	2000	1 217	FAO (2002a)
Philippines	1997	496	Somga, Somga and Reantaso (2002)
	1997	654	Bureau of Agricultural Statistics (1997)
	1998	33	Agbayani (2002)
People's Republic of China	1997	2 500 (Guangdong Province)	Yongzhong (2002)
	1999	8 300 (Total China)	Sadovy (2000)

Groupers

Culture systems

There are many different systems used for the culture of groupers worldwide, although there appears to be an agreed set of stages: nursery, transition, and on-growing. Grouper “seed” has to be nursed before being cultured to marketable size. The nursery stage is reared either in tanks, net cages, and hapas (nylon netting enclosures), or in earthen ponds. Grading is a prerequisite to minimize cannibalism, especially in the nursery and early grow-out stages. After nursing, there are two main systems used for on-growing: pond culture or cage culture. The stocking density and rearing conditions in both nursery and grow-out phases vary, depending on the site, the fish sizes, and the grouper species cultured.

Wild fry (2.5-7.2 cm) or fingerlings (7.5-12 cm) may initially be held in tanks or net cages or earthen ponds for a month or more (nursing period) after catching. The density may range from 100 to 150 fish/m2, e.g. a net of 2 x 2 x 2 m would hold 400-600 fingerlings. Sorting is undertaken every week, and stock sampling every 15 days. Groupers are normally retained in the nursery until they reach about 16 cm, when they are thinned out and transferred to transition nets (5 x 5 x 5 m) that each hold 1 100 fish.

Groupers

The fish are finally transferred to production nets after 2-3 months. Floating cages are often constructed from bamboo poles and polyethylene netting material (25-50 mm mesh size). The net cage is formed by two types of panels: 4 side panels forming the walls, and one bottom panel. The net is secured to the raft structure (bamboo poles) by ropes. Buoyancy is provided by empty plastic containers attached to the bamboo frames.

Net cages come in several sizes (3 x 3 x 2.5 m; 4 x 4 x 2.5 m; 10 x 10 x 3 m); the mesh size ranges from 10 mm to 35 mm. The optimum stocking density averages 120 fish/m3. Growth to marketable size (600-800 g) takes approximately 8 months, with survival rates of 50% or less . Groupers can grow to 600 g in 12 months, to 1 kg within 18 months, and to 2 kg within 24 months

Groupers

Summary of the characteristics of grouper culture systems

Culture	Temperature (°C)	Salinity (ppt)	DO_2 (ppm)	Dimension	Stocking density	Culture period
Nursery	24-31	21-41	4.9-9.3	2X2X2 m	400-600	1 month
Transition	24-31	21-41	4.9-9.3	5X5X5 m	1 100	2-3 months
Grow-out	24-31	21-41	4.9-9.3	3X3X2.5 m 4X4X2.5 m 10X10X3 m	120/m^3	8 months
Pond	24-31	21-41	4.9-9.3	800-12 800 m^2	5 000/ha	14 months

Groupers

Feeds and feeding regimes

As with all culture systems, there are many local variations in the feeds and feeding regimes utilized. There appears to be no universal system, and local availability seems to be the key criteria in developing a feeding schedule. Fry and fingerlings are fed with mysids and small shrimp for a couple of days post-catching in tanks, to acclimatize them and check that all individuals are eating. Trash fish forms the main feed in nursery and production cages, which is minced or chopped to suit each size group; trash fish may be supplemented with vitamins and minerals. This kind of feed is gradually being replaced by moist pelleted feed.

A suitable starter feed for groupers should contain 50-60% high quality protein, 12-16% fat, ≤15% carbohydrate, ≤3% fibre and ≤16% ash . Lower quality feeds may result in higher feed conversion ratios (FCR) and possibly slower growth. In grow-out cages, fish are fed at 10% of body weight daily, while those in nursery cages are given about 8% of body weight/day. The optimum feeding rate in production cages is 5% of body weight and the range of FCRs achieved is 0.94 to 7.5:1, depending on the feed and the species, FCRs average between 2.5-2.8:1 for dry pellets and 6.3:1 for trash fish. When temperatures fall below 15°C, the fish do not feed. Some species of groupers feed indifferently during the day or night; others (for example *Epinephalus akaara*) favour feeding just before sunset.

Groupers

Cultured red groupers exhibit a special feeding behavior: the fish can be trained to know when to expect food. When they sense the sound of trash fish being chopped or a wooden plank being knocked, they gather at the cage edge. As groupers are of a suspicious nature, they watch for food but do not move. However, if one fish attempts to approach the food, all the fish will immediately attack it violently, sometimes injuring themselves in the process. Groupers usually eat one to three pieces of minced trash fish, then disperse. No attempts are ever made to eat any food which falls to the net bottom, no matter how hungry the groupers might be. Owing to this special feeding behavior, groupers are generally reared with seabream which act as scavengers and stimulate the groupers to feed . This is also a means of preventing water pollution due to decaying feed.

Trash fish is commonly used for feeding in grouper cage culture, but its increasing cost, shortage of supply, variable quality and poor feed conversion ratios indicate that this form of feed may not be the best from either a nutritional or an economic point of view. However, groupers fed with by-catch (trash fish) in a study, fared significantly better in terms of final length and total production than when fed other diets (live tilapia, formulated diet). The quality of the by-catch used may be estimated from the efficient feed conversion achieved (1:1 on dry basis), significantly better than the formulated diet, which had an FCR of 2.8. Using by-catch, 47% of the harvest weighed more than 400 g, with only 14% being classified as <200 g

Groupers

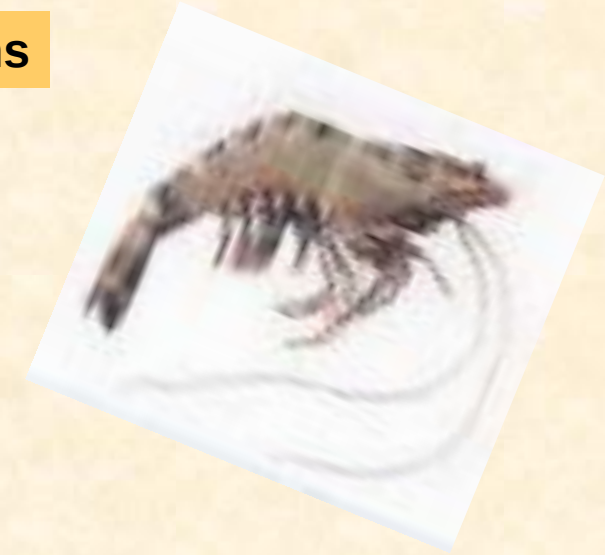
A major problem is the limited supply of trash fish, so there is a need to develop a suitable diet for grow-out grouper production . Fishery products, either in the form of low value trash fish or fishmeal, are presently the major sources of protein in the grow-out culture of most fish species and constitute up to 70% of their dietary composition . As the demand for fishmeal and fish oil for aquaculture increases, costs are expected to rise unless new sources (e.g. fish discards; krill; mesopelagics) can be economically exploited or substitutes for these marine products for inclusion in aquafeeds prove commercially applicable

A dependable supply of cost-effective, non-marine, sources of alternative protein must be provided if fish farming is to remain profitable ,conducted a feeding trial to evaluate the potential of replacing fishmeal with processed animal by-product meals, meat meal and blood meal, in practical diets for juvenile groupers (*Epinephelus coioides*). The study demonstrated that up to 80% of fishmeal protein can be replaced by processed meat meal and blood meal derived from terrestrial animals with no adverse effects on growth, survival, and FCR.

Groupers

From an economic standpoint, replacement of fishmeal with cheaper animal by-product meals in practical diets can alleviate the problem of low fishmeal availability and high costs. These processed by-products can be delivered in the Philippines, for example, at US$ 0.40/kg, less than half the price of most commercial fish meals (US$ 1/kg). The effective use of meat meal-based diets for grouper grow-out also reduces the requirements for trash fish, another fishery resource that is extensively used . Economic sensitivity analysis showed that a combination of improvements resulted in higher return-on-investment (ROI). However, these apparently favourable results must be balanced with the fact that some countries (e.g. in the EU) have banned the inclusion of all terrestrial meat-meal based products in fish feeds, due to fears concerning the linkage between the mad-cow disease (BSE) and CJD in humans.

Shrimps and Prawns



The popular names shrimps and prawns have been used variously to denote crustaceans of the families Penaeidae and Palaemonidae. Even though there is still some confusion in the use of these names, in most recent aquaculture literature the name prawn appears to be used for fresh-water forms of Palaemonids and shrimp for the others, particularly the marine species.

Shrimps form a group of subsidiary species in most types of fish culture in coastal impoundments and ponds in Asia; and in countries like India, rice fields have been used for a form of extensive culture of shrimps (see Chapter 30) for centuries. However, intensive and semi-intensive culture of these crustaceans are of recent origin. Like the marine finfish referred to in earlier sections, interest in their culture, particularly of shrimps, was triggered by the recent increased market demand and the inadequacy of the capture fishery landings to meet the demand. As the expanding markets were in economically advanced countries like Japan and the USA, the prospects of an export market and opportunities for earning foreign exchange attracted the support of the governments of developing countries and led to investment by private industry. In fact, shrimps and prawns became high-value commodities in many developing countries, mainly because of their export market. There is as much interest in private investment in shrimp farming in tropical countries today as there is for salmon farming in countries in the colder climates, for the very reason of prospects associated with exports.