

# **Marine Aquaculture 5**

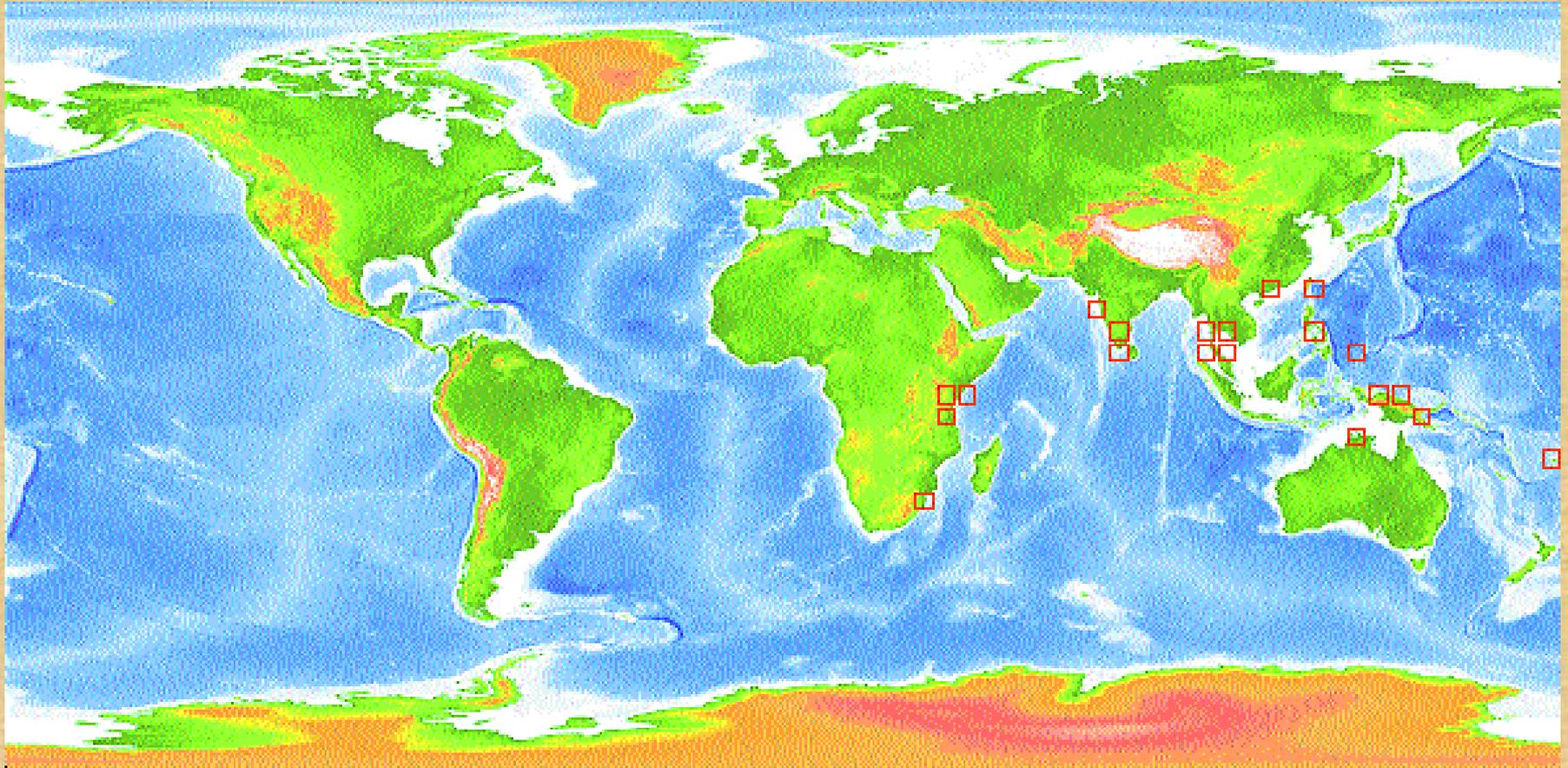
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# Groupers

## *Epinephelus coioides*

<b>Common name</b>	Orange-spotted grouper.
<b>Size and age</b>	Maximum length of 100 cm SL (male/unsexed); maximum weight of 15 kg; can live for 22 years.
<b>Environment</b>	Lives in brackish and marine waters; lives to a depth of 100 m.
<b>Climate and latitude</b>	Subtropical (38°N-33°S).
<b>Resilience</b>	Population doubling time of 1.4-4.4 years, with medium resilience.
<b>Distribution</b>	Indo-West Pacific, south to at least Durban, south Africa and eastward to Palau and Fiji, north to the Ryukyu Islands, south to the Arafura Sea (Russell and Houston 1989) and Australia.
<b>Biology and ecology</b>	Present in turbid coastal reefs (Lieske and Myers 1994) and in brackish water (Randall, Allen and Steene 1997) over mud and rubble (Kailola <i>et al.</i> 1993). Eats larval stage of crustaceans, larger crustaceans, fish, and molluscs (Tucker 1999). Probably form aggregations during spawning.
<b>Importance</b>	Represents an important species for fisheries and aquaculture (Heemstra and Randall 1993). Considered vulnerable (Morris, Roberts and Hawkins 2000).

## Groupers



Zoological sites sampled for geographic distribution (indicated by the red squares) of *Epinephelus coioides* (FishBase 2002)

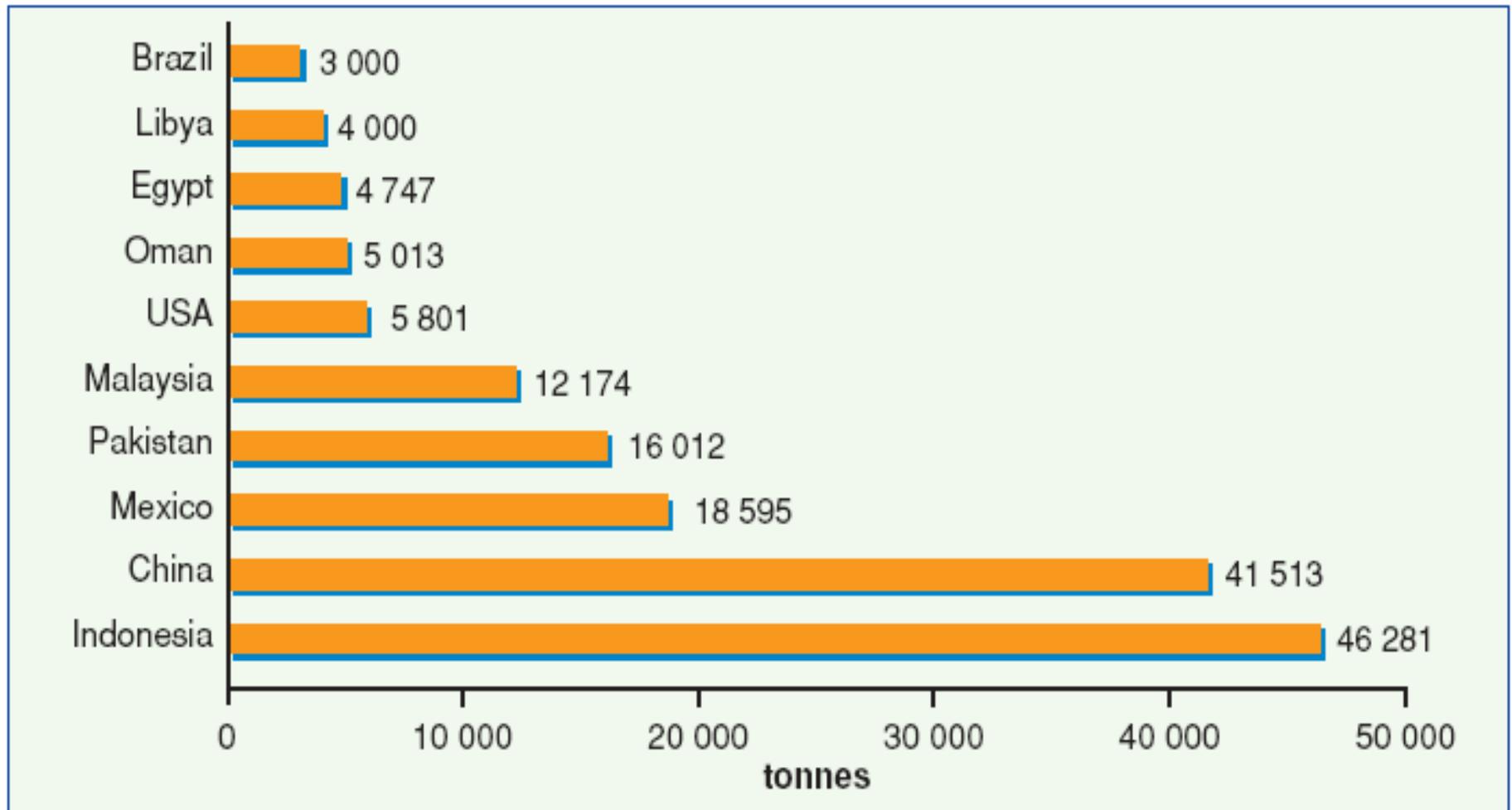
# Groupers

## Fishery trends

Groupers are **highly prized** for the quality of their **flesh**, and most species fetch high market prices. This has led to **overfishing** in many areas, with species that are commercially favoured showing signs of **declining numbers**. A large proportion of the world's groupers are caught in **artisanal fisheries**, and even low-level artisanal fisheries can adversely affect stocks. Recreational fishing may also have significant impact on stocks; for example, the recreational fishery of groupers in Florida accounts for between **25% and 35%** of the State's total grouper catch . The global catch of groupers showed a **68% increase** from **100 724** tones in 1991 to **168 943** in 2000 .

The impact of intensive fishing is worsened by the **life strategies** of these genera, their tendencies to form predictable **spawning aggregations**, and their **frequent occurrence** on relatively shallow, easily accessible coral reefs, which are severely over-exploited in many parts of the world. For many of these species, spawning aggregations represent the **total reproductive activity** for a given year, and many species consistently return to the same aggregation area, year after year. Fisheries often **target spawning** aggregations, since they are consistent in **time and space**. When fishing pressure removes a high proportion of the fish forming these aggregations, these may quickly decline, and within a few years may cease to form altogether.

## Groupers



**Capture fisheries for groupers: the top ten countries in 2000**

## Groupers

Groupers belonging to the genus *Epinephelus* (family Serranidae) are highly-priced fish in the Indo-Pacific, Middle East and Caribbean regions. Among the several species of the genus, the most important for aquaculture are the estuarine or greasy grouper *E. tauvina*. It is a hardy species which can stand rapid changes in salinity between 2.5 and 45.5 ppt. The optimum salinity is reported to be 15–26 ppt. It is carnivorous in feeding habits and feeds on smaller fish and shrimps. Juveniles feed on *Acetes* and mysid shrimps in nature. It spawns throughout the year, probably with a peak in the wet months. The red grouper, *E. akaar*, which has habits very similar to *E. tauvina*, is the important species for culture in Hong Kong.

One of the major problems in the controlled reproduction of the species is that it is a protogynous hermaphrodite. Like other groupers, it matures as a female but becomes a male with advance in size and age. Fish of 45–50 cm length mature as females, while fish of more than 74 cm weighing more than 11kg become males and develop ripe testes. An intersex condition can be found in fish of length 66–72cm, with transitional gonads containing male and female gonadal tissues.

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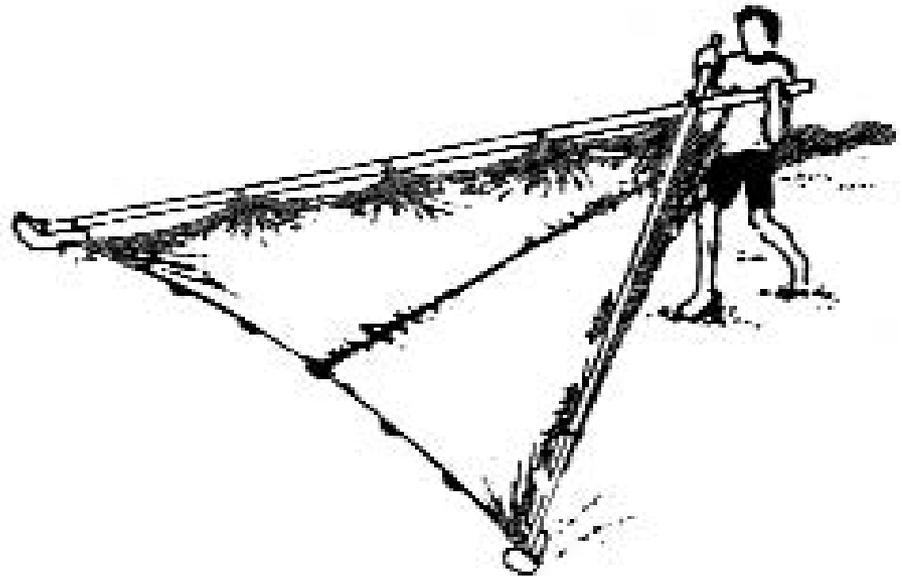
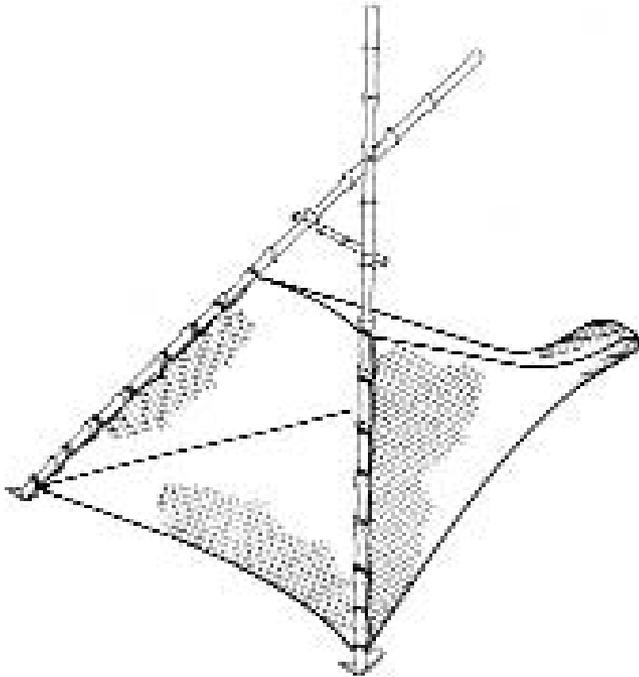
### Availability of “seed” for capture-based aquaculture

Generally, groupers spawn on offshore reefs where they form aggregations of **tens of thousands** of individuals, in a **few specific locations**. They produce **pelagic larvae** that may disperse over hundreds of kilometers in the course of **20-50 days** and experience **high** density-independent **mortality**. Larvae, transported to near-shore nursery habitats settle as **juveniles in sea-grass** beds, **mangroves**, **oyster reefs**, and **marshes**. For this reason grouper “seed” is mainly caught in **coastal areas**, particularly around sea-grass, mangrove and shallow brackishwater areas near river mouths and estuaries, as well as in tidal pools and around reefs.

The peak grouper “seed” season is often associated with the relatively wet months in the year (e.g. monsoon seasons); in several areas, grouper “seed” collectors have claimed that their **best catches** were associated with **windy weather**. The volume of “seed” caught each year exceeds **hundreds of millions** of individuals. The greatest catches tend to be of the smallest size classes (**1–3 cm**); during peak seasons a catch can be of tens of thousands by a single unit of gear, in a single night, by one fisherman. Even larger sizes of fish are being captured in massive numbers region-wide each year. It is a sobering thought to realize that the equivalent of the typical annual amount of seed produced in the hatcheries in the whole of SE Asia (excluding Taiwan Province of China), i.e. 20 000–80 000 fry, can be caught by one fisherman in one night.

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When “seed” catches are compared to the numbers of marketable fish produced, the results are astonishing and strongly suggest crude and wasteful culture practices. To produce the regional estimate of 23 000 tonnes of table-size live fish from culture annually (roughly 10 000 tonnes of which is included in the regional live reef fish trade (LRFT) volume provided above), about 60 million seed fish are needed . The trade in grouper “seed” throughout South East Asia is complex and extensive .



**Example of catching method: scissor nets**

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## Catching methods for “seed” material

Grouper “seeds” are collected using several different methods, depending on their location. Catching methods are generally artisanal and the fishermen employ a variety of artificial habitats. Moreover, **different** fishing **gears** are used at **different times** of the year: the gear change follows the **growth of the seed** and their **movement** to **deeper** waters as the season progresses. Gears used to take grouper “seed” can be divided into **8 different** categories: 1-large fixed nets; 2-traps and shelters; 3-hook and line; 4-scoop and push nets ; 5-artificial reefs;6- fish attractors; 7-tidal pools; 8- chemicals. The sizes of grouper “seed” caught and traded vary between **1-25 cm**, i.e. from the moment of **settlement** to fish that are over **one year** old. However, most of the catch focuses on fish up to about **15 cm**

For *Epinephelus coioides*, “seed” sizes are categorized as follows:

- un-scaled post-larvae, which are transparent or reddish, averaging 1 to 2.5 cm total length;
- scaled fry, which have begun to darken, ranging from around 2.5 to 7.5 cm (often measured from the eye to the caudal peduncle);
- fingerlings, from 7.5 to 12.5 cm .

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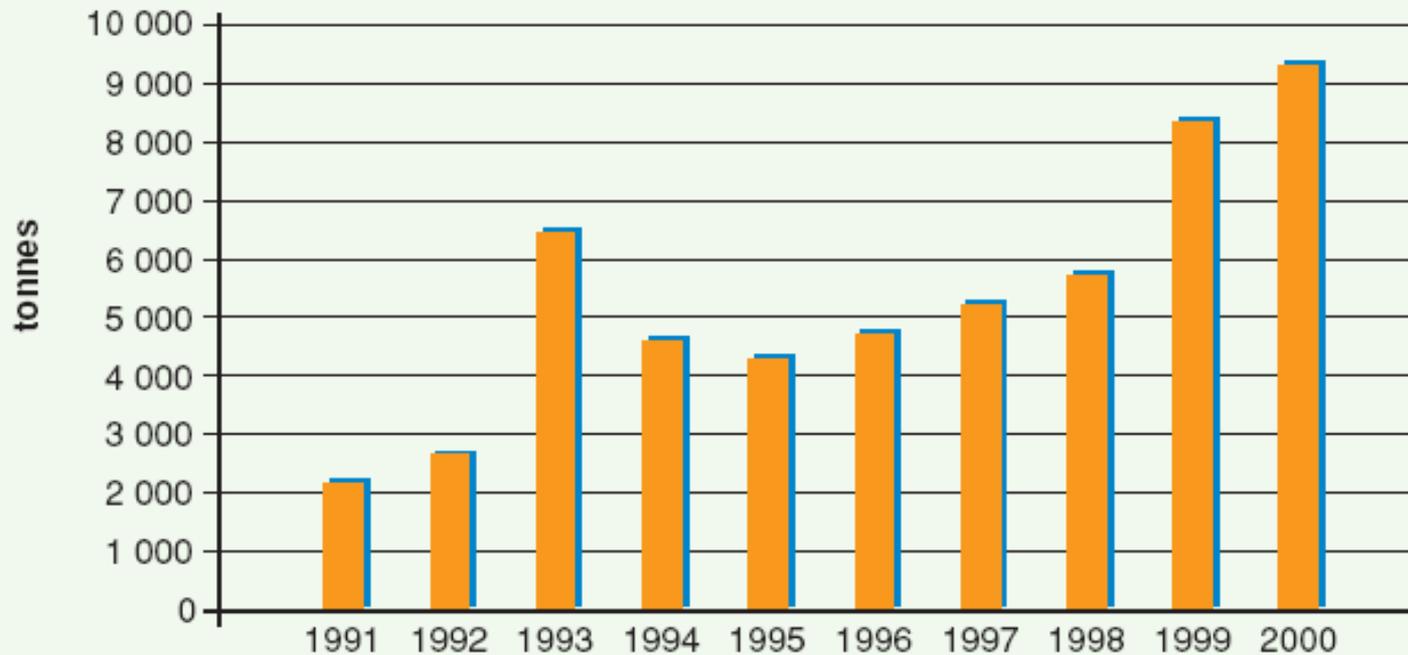
## Mortality rates from catching to stocking

“Seed” quality depends on the type of fishing gears used, and there are significant differences in seed mortality rates. Mortality rates associated with fish traps are usually low. For example, the use of “*Bubu*” (fish traps used in Malaysia) cause a 5% mortality rate, while artificial aggregators such as *Temarang* (also used in Malaysia) cause 3% mortality. Other catching methods, like scissor nets and fyke nets, can generate a high mortality. “*Pompang*” (fyke net) and “*Wunron*” (push/scissor net), which are used in Thailand, are reported to cause 20-30% and 80% mortality rates respectively. It is likely that subsequent mortalities during transport and stocking will also be high, as many of the “seed” fish will also have been damaged, and are therefore susceptible to disease. “seed” groupers should be shipped in 4 mm (or thicker) food-grade polyethylene bags filled with oxygen and water in equal parts. The bags should be kept at the spawning temperature or a few degrees lower, in an insulated, rigid container. Juvenile groupers can be shipped in bags at 120g/l at 23°C with oxygen for up to 12 hours. The mortality rates that follow capture and transport are not exactly known; estimates for over the first 2 months after catching are quite variable (30-70%), depending on the quality of fry, the level of transport stress, and the presence of disease and cannibalism.

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### Trends in aquaculture production

Groupers are cultured in many Southeast Asian countries, including Indonesia, Malaysia, Philippines, Taiwan Province of China, Thailand, Hong Kong, the southeast of the People's Republic of China, and Viet Nam – as well as other parts of the tropics in the south eastern USA and Caribbean. Grouper culture is also undertaken in India, Sri Lanka, Saudi Arabia, Republic of Korea and Australia



### Trends in global grouper production by aquaculture