Marine Aquaculture 4

PhD. student

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Artificial propagation

Captive *M. cephalus* have also been spawned by the administration of partially purified salmon gonadotropin, with the potency of 1mg, equivalent to 2150IU human chorionic gonadotropin (HCG) . The easily available and less expensive HCG can also be used effectively for induced breeding. Female spawners with oocytes of at least 600mm diameter require a dose of approximately 60IU HCG per g body weight, administered in two injections. The first injection of about 20 IU per g body weight is followed in 24 hours by an injection of 40 IU per g body weight

Both *M. cephalus* and *M. capito* raised in fresh-water ponds have been induced to breed by injection of carp pituitary homogenates.The brood fish are acclimatized to full sea water for at least two weeks, after which the females are given a series of three injections of homogenized carp pituitaries. The first injection contains one half of a pituitary for every kg of the recipient; the second, given after about seven hours, contains one pituitary per kg; and the third injection, after 14 hours, contains two pituitaries per kg. Males are also given one half of a pituitary per kg, at the time of the last injection of the females.The females can be stripped 16–24 hours after the third injection and the eggs fertilized with milt stripped from the males. After rinsing in sea water, the fertilized eggs are transferred to incubators. The hatchlings are fed with brine shrimp and zooplankton. The larvae grow to fry stage in about a month and can be acclimatized back to fresh water.

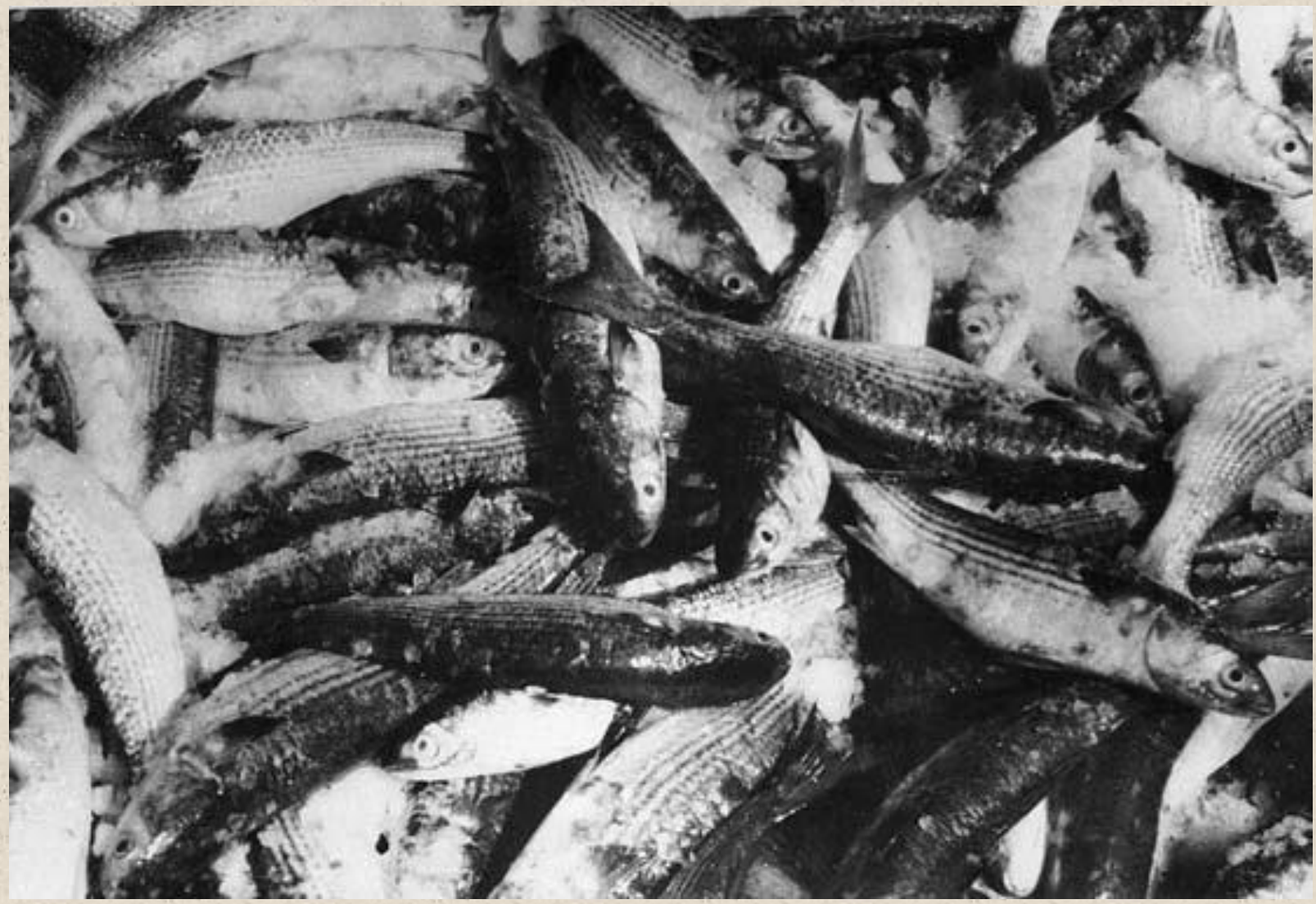
Artificial propagation

Mugil macrolepis has been successfully induced to spawn in India by the administration of pituitary of the same species .The experiments were conducted with mature wild fish caught in Chinese dip nets. The effective dose was reported to be three to four glands per female of 40–130 g weight, injected intramuscularly at six-hour intervals. The males did not require any injection. When the injected fish were kept in hapas together with males in salt water of 29–31 ppt salinity, spontaneous spawning occurred, but the rate of fertilization was poor. However, by stripping and artificial fertilization better results were obtained. At temperatures ranging from 26 to 29°C most of the developing eggs hatched in about a day. Three- to four-day-old larvae could be reared in cement tanks in brackish water containing rich growths of chlorella, diatoms, copepods, etc. *Mugil parsia* has also been induced to breed with a single low dose of mullet pituitary at the rate of 5 mg per kg body weight of the female Spontaneous spawning of untreated fish was also observed. Despite experimental success in induced spawning, farmers continue to depend on wild stocks of fry and fingerlings for culture operations.

Grow-out

In traditional coastal fish farming mullets are raised along with other species such as milkfish, shrimps, sea-bass, etc. When the system of tidal stocking is adopted,the stocking rate depends on several extraneous factors and therefore the quantity and composition of the seed stock can seldom be determined. This practice often leads to understocking and the inadvertent presence of slow-growing species. Because of this, fish culturists now often supplement the stocks with fry and fingerlings caught from the wild. The proportion of grey mullets in the impoundments is controlled to some extent depending on the market value of the species, but generally in brackish-water areas mullets constitute about 10–40 per cent of the stock. In extensive systems of culture, neither fertilization nor feeding are practiced. Regular exchange of water is performed, based on the tidal regime in the area. In estuarine regions, the incoming tidal water often contains large quantities of detritus, besides planktonic organisms. The detritus settles on the bottom of the impoundments and adds to the fertility of the soil. These areas are characterized by rich benthic growths of algal complexes, containing bacterial and microscopic animal populations as well. This is the main food source for the mullets and the milkfish in such waters. In well managed impoundments, the total production can vary between 150 and 1500 kg/ha.

Grow-out



A catch of mullets from a Mediterranean

Grow-out

Even in properly designed coastal farms monoculture of mullets is seldom practiced, but mullets can form the main species if selective stocking is carried out. In the coastal fish farms on the west coast of India, mullets, milkfish and the pearlspot are cultured together. In the extensive system adopted in these farms, production seldom exceeds 400 kg/ha. By adopting improved rates of stocking of *M. tade* and *M. parsia* in pilot farms in the Gangetic delta, a production of up to 2200kg/ha has been obtained . Production in Hawaiian coastal ponds, before their decline in the last century, used to be around 230 kg/ha, of which about two-thirds were mullets and the rest milkfish. Mullets form a constituent of stocks in milkfish farms of Southeast Asia, although many farmers consider mullets to be incompatible with milkfish in intensive culture. Mullets seldom constitute more than 10 per cent of the stock in such ponds.

Grow-out

Mullets are reared in polyculture with common carp, silver carp and tilapia.The fry of mullets collected from coastal waters are overwintered and then grown in nursery ponds to a weight of about 1–2 g for stocking polyculture ponds. Fry of this size are generally stocked at the rate of 5000/ha, when the total stocking density is about 12 300/ha (3000 common carp, 4000 tilapia and 300 silver carp). The mullet reaches around 100 g in weight in about four months and about 200 g by the end of the year. As *M. cephalus* fry are not readily available in sufficient numbers, many farmers use *M. capito*. This species grows at a much slower rate and has to be reared for two years to reach a marketable size. Pond fertilization and the type of feeds used in these polyculture ponds are generally the same as in carp ponds.

Diseases

Records of diseases of grey mullets in culture facilities are relatively scarce, a number of parasites and disease conditions occurring in open waters, some of them causing serious fish kills. Fish farms are generally stocked with fry and fingerlings collected from such waters, and so there is every likelihood of these infestations being transmitted to the farms. Heavy infestations of *Ergasilus lizae* in *M. cephalus* have been observed to cause serious losses in brackish-water ponds on the Mediterranean coast. The crustacean parasite *Pseudocaligus apodus* is believed to infect *M. cephalus*, and *M. capito* is infected by *Caligus pagete* in fish ponds, causing mortality. In fresh-water ponds, *Saprolegnia* infections have been found to cause serious mortalities.

Groupers

Groupers (class Actinopterygii, order Perciformes, family Serranidae, subfamily *Epinephelinae*) are classified in 14 genera, that comprises at least half the 449 species in the family Serranidae . There are 15 major grouper species that are cultured; the dominant species varies somewhat regionally. The most consistently abundant species that are captured for culture purposes and also reared in hatcheries are *Epinephelus coioides* and *E. malabaricus*. Other important species are *E. bleekeri*, *E. akaara*, *E. awoara* and *E. areolatus*. Also cultured in smaller amounts are *E. amblycephalus*, *E. fuscoguttatus*, *E. lanceolatus, E. sexfasciatus, E. trimaculatus, E. quoyanus, E. bruneus, Cromileptes altivelis, Plectropomus leopardus* and *P. maculatus*. In the literature, *E. tauvina* is often referred to but it is very probably a misidentification of *E. coioides* (or *E. malabaricus*), as it has not been confirmed from most economies in the region, with the exception of Taiwan Province of China . Moreover, reports of *E. akaara* caught in central and southern Viet Nam may be misidentifications of *E. fasciatomaculosus* (Sadovy 2000). In the south eastern USA and the Caribbean, *E. striatus*, *E. itajara*, *Mycteroperca microlepis* and *M. bonaci* seem to have good farming potential .

Groupers

Juveniles and adults of some grouper species live in coastal waters and estuaries, while others prefer the cleaner waters of offshore reefs. Their eggs are single, non-adhesive, and buoyant at normal salinities. The larvae of most species spend at least their first few weeks drifting with the oceanic plankton. As they become juveniles, groupers settle in shallow waters where they can find hiding places. At first, wild grouper larvae eat copepods and other small zooplankton, then larger crustaceans - amphipods and mysid shrimp. Wild juveniles and adults eat fish, crabs, shrimp, mantis shrimp, lobsters and molluscs

The maximum size ranges from 12 cm for Pacific groupers (e.g. *Paranthias colonus*) to more than 4 m (e.g. *Epinephelus lanceolatus*); most groupers that have been studied mature within 2-6 years. Most serranids are protogynous hermaphrodites (خنثى نضج الاناث قبل الذكور)
. As a rule, some change from female to male as they grow older; others may change only if there is a shortage of males. In nature, species like the Nassau grouper (*E. striatus*) spawn in large aggregations (hundreds to thousands of fish) with a sex ratio nearing 1:1

Groupers

Groupers are some of the top predators on coral reefs, and tend to be piscivorous demonstrating slow growth, late reproduction, large size and long life-spans which make them vulnerable to over-exploitation. They are sedentary in character and strongly territorial

Orange spotted grouper,
green grouper
Epinephelus coioides (Hamilton)