CMFRI

Course Manual

Winter School on

Recent Advances in Breeding and Larviculture of Marine Finfish and Shellfish

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PRESENT STATUS OF MARINE FINFISH SEED PRODUCTION AND FARMING IN THE ASIA-PACIFIC REGION

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Introduction

Marine finfish seed production and farming has been well developed in the Asia- Pacific Region and is expanding very fast. Over the last twenty years, marine finfish aquaculture, predominantly cage farming has spread throughout Asia and the predominant involved are China, Indonesia, Taiwan Province of China, Japan, Philippines, Republic of Korea and Vietnam. A large number of finfish species are farmed in cages and yet there is a significant reliance on wild caught young ones for farming such as groupers. The main species farmed in brackishwater are the barramundi or Asian sea bass (*Lates calcarifer*) and the milk fish (*Chanos chanos*). In inshore marine cage farming, the major farmed species include *Seriola* spp., snappers (*Lutjanus* spp.), groupers (*Epinephelus* spp.) and cobia (*Rachycentron canadum*).

The Japanese amberjack *Seriola quinqueradiata* contributes upto 17% of marine finfish production in Asia, with a production of about 160,000 t annually and its major production is from Japan amounting to 140,000 – 170,000 t/ annum since 1980s. Other carangids that are becoming popular for culture are the snub-nosed pompano *Trachinotus blotchii* and the silver pomfret *Pampus argenteus.* Seabreams are the mainstay of Asian finfish mariculture production *L. calcarifer* is cultured in both brackishwater and marine environments, though most production is from brackishwater and its global production has been relatively constant over the past ten years (20,000 – 26,000 t/ annum), although production has decreased in Asia and increased in Australia during this period.

Grouper culture has been expanding rapidly in Asia, driven by high prices in live fish markets of Hong Kong and China. Since grouper farming is mainly dependent on wild collected seed, the decreasing availability of wild seeds due to over fishing is a major constraint for the expansion of grouper culture. Southern bluefin tuna (*Thunnus maccoyii*) is cultured in Australia using wild caught juveniles. Although production of this species is relatively small (3500-4000 t/ annum), it brings very high prices in the Japanese market and thus supports a highly lucrative local industry in South Australia.

Cobia (*R.canadum*) a species of much interest for tropical marine finfish aquaculture has become a global commodity, in the same way as salmon has become a global commodity in temperate aquaculture. Most production currently comes from China and Taiwan Province of China and totaled around 20,000 tonnes in 2003. Production of this fast growing species is yet to expand rapidly in Asia.

Milkfish (*Chanos chanos*) is traditionally cultured in Philippines. Indonesia is a major producer of seed and are contributed by small-scale hatcheries. Milkfish culture is also practised in some Pacific Islands viz. Kiribati, Nauru, Palau and the Cook Islands. Although most milkfish culture is undertaken in brackishwater ponds, there is increasing production from intensive mariculture cages.

Seed Production

Hatcheries are producing greater numbers and a wider range of marine finfish species, but the industry is still heavily reliant on capture of fingerlings for grow out (capture based aquaculture) particularly for species that are difficult or costly to raise in hatcheries such as grouper or Napoleon wrasse, or for which there is no established hatchery technology such as tunas. In general the availability of seed from wild sources is declining due to over fishing

and habitat destruction. Hence there is an urgent need to develop sustainable technologies for hatchery production.

In Asia, there has been considerable development of small-scale or backyard hatcheries that have only a couple of larval rearing tanks and use basic but effective techniques to produce large numbers of seed of a range of marine finfish species. Traditionally much of their production is from milkfish, but production is also diversifying to groupers which are more difficult to rear. Large and sophisticated technology dependent hatcheries have been developed in Australia and Japan and Australia has been adopted the technology form from Europe and modified to meet local conditions, and also to reduce high labour inputs.

Taiwan province of China has established itself as a major seed production centre for the Asia-pacific region, with around 1000 farms are producing fry and juvenile marine finfish. Marine finfish production in Taiwan Province of China is typified by highly specialized production sectors: one farm may produce eggs from captive broodstock, a second will rear the eggs, a third may rear the juveniles through a nursery phase (3-6cm TL) and a fourth will grow the fish to marketable size.

Nursery rearing

There is substantial mortality of juvenile seed stock captured from the wild occurs due to transportation whereas in hatchery produced juveniles, the cannibalism is a major cause of losses in many species. Frequent grading is the only solution to overcome the problem cannibalism.

Grow -out Technology

Grow-out technology employed in the Asia Pacific region ranges from small floating or fixed cages used by small-family run operations, to extremely large cages (15 x 15x15m) used for amberjack grow-out in Japan or 30-50m diameter circular cages used for southern bluefin grow-out in Australia. Much of the marine finfish aquaculture production in the Asia-Pacific Region is from small to medium scale farms. Many farms use relatively simple technologies, with wooden or bamboo cages and plastic barrels or polystyrene blocks to provide buoyancy. However, Japan and Australia use larger and more sophisticated cage systems.

The traditional Asian cage system is suited to sheltered inshore waters. As many coastal sites have become increasingly crowded, now several countries started to adopt cage designs form Japanese or European which can withstand more open water and it has opened up more coastal areas for farming. However, environmental impact is a major issue in the Asia-Pacific Region which needs more focus as relatively little work has done in tropical environments.

Indian scenario

In India marine finfish aquaculture is only an emerging sector and the most common cultivable marine finfishes include the *Siganus* spp., *L. calcarifer*, groupers (*Epinephelus* spp.), pompano (*Trachynotus* spp.), snappers (*Lutjanus* spp.) and sea breams (*Lethrinus* spp.) and cobia. Currently their mariculture is almost entirely supported from the seeds collected from the wild, except for seabass.

One of the milestones in the seed production of marine finfishes was the development of hatchery technology for commercial seed production of seabass Protocols for captive broodstock development, induced maturation, breeding and larval rearing have been standardized. The success obtained by CIBA and the mass production of seed by Rajiv Gandhi Centre for Aquaculture in Tamil Nadu set up by Marine Products export Development Authority can lead to commercial level farming of sea bass in the country.

Another milestone in marine finfish breeding is the successful broodstock development of the grouper (*Epinephelus tauvina)* in captivity .The grouper broodstock was developed by rearing fingerlings in the size range 90 to 200mm collected from the wild. These were developed into healthy female broodstock by giving them feed enriched with vitamins and minerals. Simultaneously a few of them were administered male hormone methyl testosterone for sex reversal to males. Mature spermiating males were developed by this technique. Success was also in the broodstock

development and larval rearing of the honey comb grouper *Epinephelus merra*. However, successful commercial level seed production methodologies for groupers still remain to be developed and standardized.

A number of experiments on culture of marine/brackishwater finfishes were done by CMFRI since 1960s. Significant achievements were made in the coastal pond culture of milkfish and grey mullets at Mandapam, Tuticorin, Madras, Calicut, Narkkal and Mangalore by CMFRI from 1970s. Pen culture experiments carried out at Mandapam and Tuticorin with milkfish and grey mullets and sand whiting at a stocking density of 50,000/hectare yielded 400 to 800 kg per hectare. Cage culture of rabbit fish (*Siganus canaliculatus, S.javus*) groupers (*Epinephelus tauvina* and *E.hexagonatus*) and the sand whiting *Sillago sihama* were done at Mandapam. Experiments conducted on the cage culture of grouper, *E.tauvina* in fixed net cages at Mandapam yielded 288 kg in eleven months.

The lack of commercial scale availability of hatchery produced seed is the major bottleneck for any large scale venture of marine finfish farming. The availability of seeds from wild is often unpredictable and hence farming based on wild collected seeds may not be a sustainable venture. Hence the development and standardization of seed production techniques for a few species belonging to groupers, siganids, pompano, snappers, breams and cobia should receive research priority. It is felt that the development of commercial hatcheries for ready supply of seeds is the primary step for the development and expansion of marine finfish farming in India. The lack of frontline demonstration of large scale farming systems like open sea / coastal cage farming is another constraint in this sector. In recent years, open sea / coastal cage farming has been expanding on a global gain. In China in 2004, the number of cages reached 1 million and more than 40 marine fishes are farmed. Huge cage farms for culturing big fishes like tuna are also being practised at different parts of the world. The expanding scenario of cage culture should be an eye opener to us for the development of cage farms in India. For the first time in India a marine cage was successfully launched and operated at Visakhapatnam, in the east coast of India by the Central Marine Fisheries Research Institute. Recently five cages for broodstock development of marine finfishes were installed at Mandapam. It is felt that development of broodstocks in cages, hatchery production protocols of high value finfish such as groupers and cobia and sea cage farming ventures will pave the way for India to develop commercial level marine finfish farming in the immediate future.