MILKFISH AQUACULTURE IN SRI LANKA

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Milkfish fry and fingerlings are abundant in coastal and brackishwater areas in Sri Lanka, yet the industry remains in a stage of underdevelopment. The main seed collection centers are Mannar and Kalpitiya in the northwest and the season is from March to June. The annual fry production potential of the Mannar tidal flats is estimated to be about 4 million. The brackishwater aquaculture potential of Sri Lanka is estimated to be about 120 000 ha. In the past, returns from fry collected from tidal pools and stocked into perennial tanks have been very poor. The recently initiated seed resources survey and investigations into scientific collection, transport, and culture including pen culture should help develop farming of milkfish in Sri Lanka. Polyculture of the species with other fish and shrimp and its culture in salterns are being attempted.

INTRODUCTION

The milkfish, *Chanos chanos* (Forsskal), known in Sinhala as *wekkaya* and as *palmeen* in Tamil, is one of the principal species used in brackishwater aquaculture in the Indo-Pacific Region. Schuster (1960) reported that the coastal area encircling the southern part of the east and west coasts of India and the whole of Sri Lanka constitute a zone where milkfish fry are available. The abundance of fry and fingerlings of the species in tidal pools has been revealed through surveys conducted in Sri Lanka. Plans by the Ministry of Fisheries are underway for the proper utilization of this valuable seed resource for raising of food fish.

AREAS OF AVAILABILITY OF SEED AND JUVENILES

Location and Extent

Milkfish fry and fingerlings are abundant along the coastal and inland waters of Sri Lanka. They occur from March to June in shallow tidal pools such as in Mannar, South Bar, and Vankalai (Ling 1962); in brackishwater areas such as Puttalam, Negombo, and the Mannar district (Ramanathan 1969); and in tidal creeks such as in Erukulampiddy and Vankalai.

Villaluz et al (1982), who conducted a survey of known and possible fry and fingerling grounds in Mannar and Puttalam, confirmed earlier observations. Figure 1 shows the main fry and fingerling collection grounds. About 1500 ha of shallow tidal pools could definitely serve as collection grounds for milkfish fry if the estimates of Pillai (1965) and Ramanathan (1969) for Mannar are put together. The fry season at the Kalpitiya lagoons begins almost simultaneously with that in the coastal areas. The Gulf of Mannar serves as a breeding ground (Pillai 1965) and natural nursery for milkfish fry (Ramanathan 1969), and it needs to be properly preserved and developed. Table 1 indicates the numbers of fry collected in the years 1961-68 and 1979-83 by the Ministry of Fisheries. The major part of the collection was done at Vankalai and Erukulampiddy in Mannar, and the rest in Kalpitiya.

Season of Availability of Fry

Milkfish fry first make their appearance in mid-March in the Mannar tidal flats. The collection season is usually from March to June, with the peak in April-May. Milkfish fry also occur from March to June in estuaries and bays and off sandy beaches throughout the Indo-Pacific Region (Pitcher and Hart 1982). A second season of much lesser magnitude is October-November (Ramanathan 1969). Pillai observed that large-scale collection of fry in Mannar occurs in April, May, June, and November. In recent years, however, collections in November have been very poor. Milkfish fry can also be collected in April and May in the Kalpitiya area and in some areas around Negombo. The reduction in fry occurrence in the month of June may be due to the increased salinity of the shallow tidal pools of the Puttalam area, which may result in large-scale fry mortality. Fry collection in Sri Lanka and the Ramnad District in South India extends over the same period, from April to July (Schuster 1951).

Fry are most abundant in April-May, when salinity varies from 36 to 38 ppt. Availability is lowest in June, when salinity is high; tidal pools dry up and the salinity rises to lethal levels, thus destroying the biota. However, there appears to be a positive correlation between fry availability and lunar phases; the peak collections were recorded during full moon and new moon periods (Ramanathan 1969).

METHOD OF COLLECTING AND TRANSPORTING SEED

Gear Used and Method of Operation

The method of capturing fish fry presently employed in Sri Lanka is by the use of a piece of organdy cloth or nylon netting (1.6 mm mesh) about 80 cm wide and 1.3 m long attached to the ends of two wooden sticks. This fry seine, known as *kaddipuwa* in

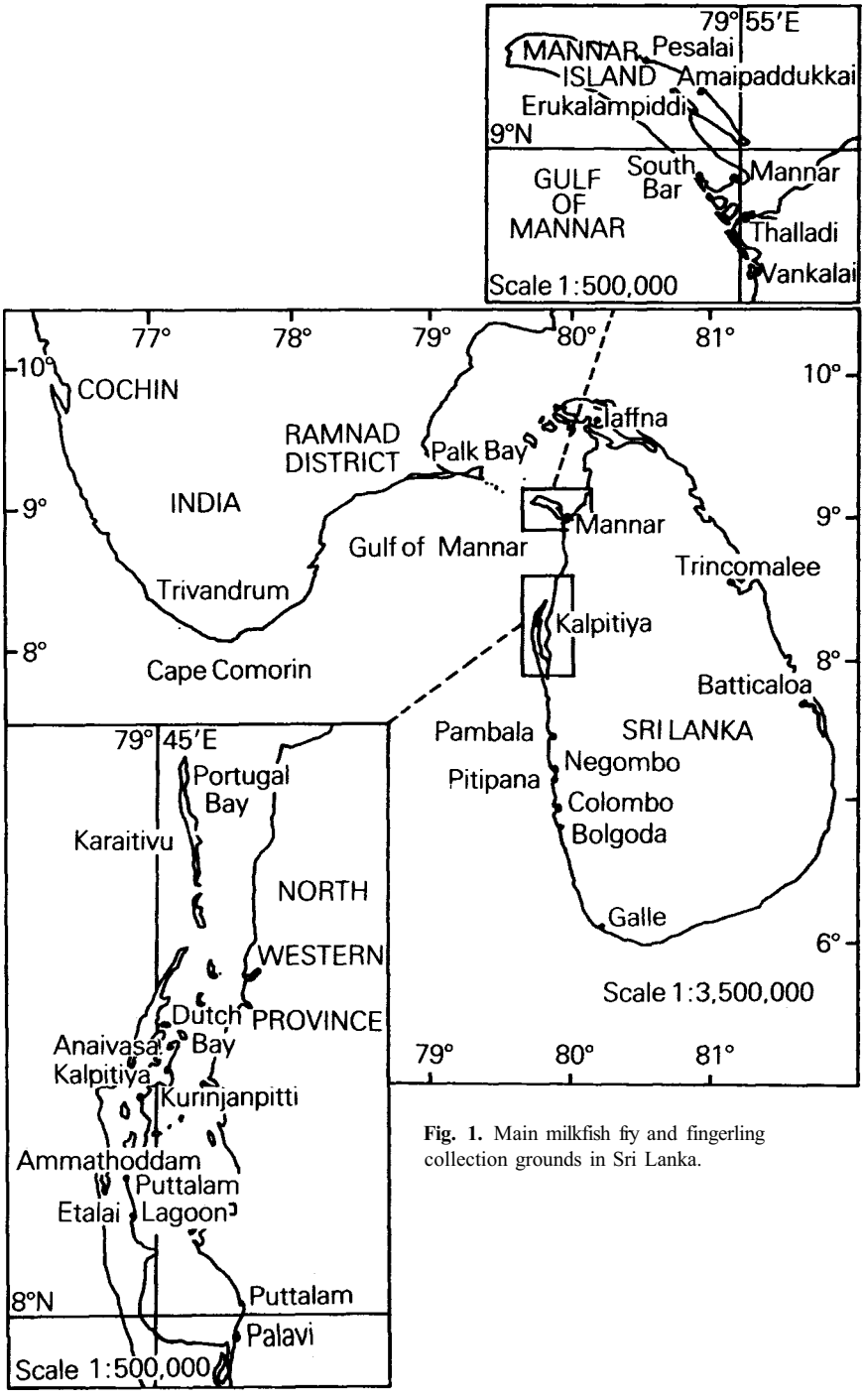

Fig. 1. Main milkfish fry and fingerling collection grounds in Sri Lanka.

Table 1. Milkfish fry collection during 1961-68 and 1979-83[a].

Year	Fry captured	Season
1961	9 000	April - May
	3 000	October - November
1962	18 000	April - May
	Nil	October - November
1963	68 000	April - June
	2 000	October - November
1964	56 000	April - June
	Nil	October - November
1965	31 000	April - June
	Nil	October - November
1966[b]	2 000	April - May
	Nil	October - November
1967[b]	45 000	April - June
	Nil	October - November
1968	46 000	April - May
	1000	October - November
1979	213 500	March - May
	Nil	November - December
1980	1 356 200	March - June
	Nil	November - December
1981	702 500	April - June
	Nil	November - December
1982	626 850	April - July
	Nil	November - December
1983	786 155	April - May

[a]Fry collection figures for the years 1969-78 are not available.
[b]Regular surveys were not carried out.

Sri Lanka and *sagap* in the Philippines, is operated by two persons dragging the cloth in the shallow tidal pools where the fry take shelter and grow. Ramanathan and Jayamaha (1972) mentioned that fry are encountered 5-15 cm below the water surface. Sheltered tidal pools 40-50 cm deep provide the maximum number of fry. The schooling behavior of young milkfish is observed during the collecting season when the translucent, needlelike young ones swim in the same direction. Fish larvae and juveniles form small schools in the early morning hours, then combine to form bigger schools later in the day. The fright stimulus is used to drive the fry to form a compact "ball," and the seine net is moved toward such fry concentrations that have been guided to shallow portions of the tidal pools, where the fry are scooped up. This is accomplished before midday to avoid re-scattering of the fry. Villaluz et al (1982) mentioned that about 500-3000 fry and fingerlings (sizes varying from 11.5 to 50 mm fork length) can be captured in 15-20 minutes of seine net operation by two persons, usually between 0800 and 1130 h.

Fry Potential

In a four-year survey, Pillai (1965) estimated the milkfish fry potential of a hectare in Mannar to be 500 fry/man per hour. He calculated that Mannar could produce about 400 million fry annually. Ramanathan (1969) estimated the milkfish fry potential of the Puttalam lagoon area to be about 200 million/year.

Transport of Fry

The collected fry are transferred at the site to plastic bags by scooping. The double polyethylene bags are filled with oxygen at the ratio of 1 part water to 2 parts oxygen. The bags are then arranged vertically in vehicles and transported to brackishwater fishery stations. The number of fry placed in each bag, filled with 4-6 liters of seawater, may vary from 200 to 2000. Fry mortality is almost negligible, as salinity is reduced from 20 to 0 ppt. Transfer to lower levels of salinity will.not cause mortality in young milkfish; fish seed can therefore be released and transported easily in either fresh or brackish water.

REARING OF FRY

Acclimation and Sorting of Fry

The dilution with fresh water of the saline water in the plastic bags carrying the fish seed is the only acclimation done during transport. It is only at the brackishwater station that the fry are gradually acclimated to temperature and salinity conditions, in cement cisterns, prior to their release in ponds to be raised to fingerlings.

The fry collected in the nets are usually needle-like and translucent. Also trapped in the collection are fry of *Megalops cyprinoides, Elops machnata, Oreochromis mossambicus,* and mullet. Ramanathan and Jayamaha (1972) mentioned the practice of removing the unwanted species from the collection before transport. This could be impractical when large collections are to be handled and transported quickly. The removal of unwanted associated fry is generally done during the process of acclimation in cisterns at the fishery station.

Fertilization

The acclimated fry, devoid of unwanted species, are now stocked in rearing ponds fertilized earlier with cow dung. The fry are fed a supplemental diet using poultry feeds. About 2 weeks after rearing at the fishery station, fingerlings are distributed for freshwater and brackishwater fish culture. Baliao (1982) mentioned the improved nursery rearing techniques using the *lablab* method that he conducted in concrete ponds with earthen bottoms at the Pitipana Brackishwater Experimental Station in Negombo. Before stocking, the pond bottom was dried and treated with a mixture of lime and urea to eradicate unwanted species. Nylon screen substrates, pretreated with *lablab*-mud mixtures, were installed like tennis nets across the pond bottom to increase the area for attachment of fish food. The ponds were fertilized with chicken manure and then gradually filled with water over 10 days until they reached 45 cm deep. Milkfish fry (average weight 0.067 g) were stocked at the rate of 500 000/ha.

Inorganic manure was applied every 2 weeks. At the end of 30-45 days, 98-100% survival of fingerlings of 2.25-2.45 g was attained. Mean salinity and pH values ranged from 12 to 30 ppt and 6.9 to 9.1, respectively. Baliao (1982) considered these findings comparable to those obtained in the Philippines.

SEED DISTRIBUTION AND CULTURE OF MILKFISH

Stocking Waters, Kind and Extent

The brackishwater aquaculture potential of Sri Lanka is estimated to be about 120 000 ha (Ministry of Fisheries 1980). Pillai (1965) indicated that of 100 000 acres of shallow lagoons, tidal flats, mangrove swamps, and saline marshes, about 27 000 acres are suitable for milkfish farming. The salterns can also be used fot milkfish culture and pilot studies.

Milkfish fingerlings may be stocked in either fresh or brackish water. Milkfish can be used as the principal species in brackishwater fish culture along with mullet and shrimp. In fresh water, milkfish can be cultured with carp.

Culture Trials

In 1965, an experimental yield of 781 kg/acre of milkfish and grey mullet was reported (Pillai 1965). Samarakoon (1970) recorded yields of 99.9 kg and 144.9 kg of milkfish in a 6-month culture period in two ponds of 0.12 ha stocked with about 17 000/ha and 30 000/ha, respectively.

In 1982, a pond area of 0.7 ha was stocked at the rate of 2400 milkfish fingerlings/ha with an average weight of 5 g. After 5 months of rearing, a production of 547 kg/ha was obtained with an average weight of 177 g. The survival rate was 99%.

Despite these attempts, no systematic effort at farming milkfish has ever been made in Sri Lanka. The fingerlings collected by the Ministry of Fisheries are stocked in existing freshwater bodies that have not necessarily undergone pond preparation, therefore resulting in poor production.

An important factor that hinders the culture of milkfish in seasonal tanks is the very low water level in July-August, the period when milkfish seeds reared in ponds are available for stocking. In addition, restricted periods of water availability and the presence of predators and competitors (mostly tilapia) greatly hamper the growth and survival of the stocked milkfish. Farming of the fish under desirable conditions would be an effective way of utilizing this commodity.

Pen Culture

A trial pen culture of milkfish sponsored by the International Development Research Centre (IDRC) of Canada revealed the possibility of farming milkfish using this method in Sri Lanka. A 0.25 ha fishpen (50 m × 50 m) was constructed in the Puttalam Lagoon in October 1982 using bamboo poles spaced about 6 mm apart. About 8000 milkfish with average length of 2 cm and weight of 0.79 g were stocked in November 1982. The average water depth in the pen was 1.5 m and the maximum 2 m at high tide. The fish were fed daily with a mixture of rice bran and fish meal in the proportion of 9:1. To date, three harvests in all yielding 83 kg of milkfish have been

made. Some shrimp (*Penaeus indicus*), mullet, and a few other fish species were harvested with the milkfish.

Another pen culture trial is about to begin in Bolgoda Lake, near Colombo.

PROBLEMS IN MILKFISH FARMING

Technology Transfer

One of the principal reasons for the underdevelopment of milkfish farming in Sri Lanka is lack of technology. Brackishwater farming techniques have appeared to be less developed than freshwater fish culture. To fill up the technology gap it is necessary to get experts to train technical personnel at the Ministry in fry handling and transport, pond culture and management, and production of fish food organisms to enable them to extend new techniques to fanners effectively.

Nonavailability of Suitable Waters

Well laid out brackishwater farms or ponds are lacking. The freshwater ponds available are utilized mainly for the farming of carp, along with which milkfish could be cultured, but only in small numbers. The large perennial ponds have established fisheries, particularly for tilapia, and the chances of adequate survival and good growth of milkfish in these ponds appear small. The seasonal ponds that abound in Sri Lanka and have an estimated area of 100 000 ha (Thayaparan 1982) are located in the Dry Zone. These ponds have limited periods of water retention, which fluctuate from year to year. They also abound in fish brought by the incoming water. Until methods of keeping milkfish fingerlings in stunted condition are developed that might ensure their availability for stocking when the seasonal ponds are properly filled with water, effective use of these bodies of water for growing milkfish does not appear possible.

Untested Market Preference and Demand

Milkfish is liked by the fish-eating population in Sri Lanka as evidenced by its ready sale and good market price of about US $0.61-0.74/kg (Rs 24 = US $ 1). (The market price of the most commonly available freshwater fish, tilapia, varies from US $0.33 to 0.41/kg. Seer, *Scomberomorus* sp., the preferred marine food fish, fetches a price of US $1.85-2.05/kg in the market.) Ling (1962) mentioned that large milkfish are caught throughout the year all over the island, particularly in and near the large lagoons. He referred to not less than 999 kg of the fish being caught per year in the Negombo area. Milkfish has been observed in markets in the Jaffna area and also in Mannar Town, Vankalai, and Arippu. In the absence of catch statistics on the species, it is difficult to estimate the quantity captured and marketed each year, but the species constitutes only a small percentage of the known marketable supply of fish in Sri Lanka, as observed in fish markets. The market preference and demand for the species is essentially not known. It is difficult to say if this lack of knowledge of the market could be a factor retarding development of milkfish farming, considering that brackishwater farming itself is not well developed.

CULTURE POTENTIAL FOR MILKFISH

A very rough estimate of the production potential of milkfish based on fry availability and land resources for pond construction reveals the immense possibilities of milkfish farming. The fry available, allowing for reasonable mortalities, may be adequate for stocking over 10 000 ha of brackishwater ponds. The attractive selling price of milkfish should serve as an incentive for taking up its culture.

Programs for the development of milkfish farming in Sri Lanka are being assisted by international agencies such as IDRC, SEAFDEC, and the Asian Development Bank (ADB). This assistance is in the area of expertise as well as financing for the development of brackishwater milkfish monoculture and polyculture with shrimp. With financial support from IDRC, the SEAFDEC Aquaculture Department has provided experts who have surveyed seed resources and demonstrated fry rearing techniques. IDRC is also supporting a research project to determine the feasibility of pen culture of milkfish in selected areas. In 1984, ADB will begin its Aquaculture Development Project for Sri Lanka, which aims to provide assistance in the development of brackishwater resources in which polyculture of milkfish would be tried in experimental as well as commercial ponds and pens.

CONCLUSIONS

The available resources of Sri Lanka are not being utilized in milkfish monoculture. The future of milkfish farming in the country seems to be tied up with the growth of brackishwater fish farming, an area where, despite available resources, little investment and attention have been given. Gradually, however, the Ministry of Fisheries is taking up this program in earnest.

In recent years requests have been received from Iraq, Singapore, Taiwan, the Philippines, and the US for export of milkfish seed from Sri Lanka, but there are no private operators engaged in milkfish seed capture or transport. The Ministry has limited manpower engaged in seasonal seed collection and transport that is geared to support local aquaculture programs. With the expansion of brackishwater fish farming, particularly among private fish farmers, skilled manpower may emerge capable of handling seed collection and transport on a large scale.

With better seed collection, transport methods, and improved culture techniques, it is hoped that the milkfish aquaculture potential of Sri Lanka will be developed. This should contribute to the country's improved nutrition and economy.

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