ON A POTENTIALLY RICH MILKFISH SEED COLLECTION GROUND NEAR MANDAPAM ALONG WITH THE METHODS OF COLLECTION AND TRANSPORATION

K. DORAIRAJ, G. MOHANRAJ, V. GANDHI, A. RAJU,
V. S. RENGASWAMY AND JOSEPH XAVIER RODRIGO
Central Marine Fisheries Research Institute Regional Centre, Mandapam Camp.

ABSTRACT

A potential ground for milkfish seed collection has been located at Manoli Island in the Gulf of Mannar, where fry and fingerlings of the species congregate in large numbers in the tidal pools under the dense shades of the mangrove bushes in April-May. The ecology of the ground, the methods and results of fry and fingerlings collection, handling, and packing and transportation are mentioned.

INTRODUCTION

The milkfish *Chanos chanos* (Forskal), which is cultured on a very large scale in Indonesia, Philippines and Thaiwan, breeds in the sea, and its young ones appear in dense shoals along coastal regions. The rapid development of culture in these countries was mainly due to the availability and the techniques developed for collection of the seed of this good-quality fish. In India too, several aspects of milkfish culture had been attempted over the last four decades. Tampi (1968) had recorded the occurrence of milkfish fry and fingerlings from several centres along the west and east coasts of India and indicated the possibility of the existence of many collection centres. Recently, Silas et al (1980) had given an account of the quantitative distribution of fry of the milkfish in space and time along both these coasts. As a part of the project on culture of finfishes, surveys were made by the present authors in Mandapam region to locate seed collection grounds to meet the milkfish-seed requirement for farming activities in the newly constructed pond system there. During April 1982, a potentially very rich ground for the collection of the seed of milkfish and mullet was discovered at Manoli Island in the Gulf of Mannar. Description of this collection ground, its ecology and other useful particulars of the fry and fingerlings collected from the Manoli Island as well as a centre at Pillaimadam lagoon are presented in this paper. The methods adopted for collection and the procedures followed in acclimatization and transportation of the milkfish seed from the collection centres to the fry-rearing laboratory are also given.

Description of the Ground

Manoli Island, 1 km long and 350 m wide, with an area of 24 ha (Stoddart and Fosberg 1972), lies approximately 6 km south of Mandapam Camp. It is a sand cay of complex topography. There are three main tidal creeks in the Island: the first enters on the eastern side, the second on the northern side, near the beacon, and the third from the western aspect of the island (Fig. 1). The first creek with a very wide mouth meanders east to west, forming a few tidal pools (Plate I, A) on low-lying portions on either side and ends in a cul de sac of about 2 ha. The water-logged area fluctuates 30 to 50 cm in depth between the two tides. Most part of the creek (Plate I, B) and the tidal pools (Plate I, C) get exposed during the lowest low tide, leaving pools of water here and there. The second creek, which enters from the northern side of the island, runs as a deep canal into the island and after a distance of about 400 metres, it bifurcates, one branch ending in a shallow pool (Plate I, D) and the other, running further straight, ending into an expansive water-logged area of about 3 ha. During the low tide most of the water in the creek flows back to the sea, leaving a little quantity of water in the tidal pools as well as in the shallow basins that are in the main creek bed. The water-logged area has always a minimum of 0.5 m deep water. During high tide water flows into the creek steadily, carrying with it a variety of fish from the sea. The third creek was not investigated.

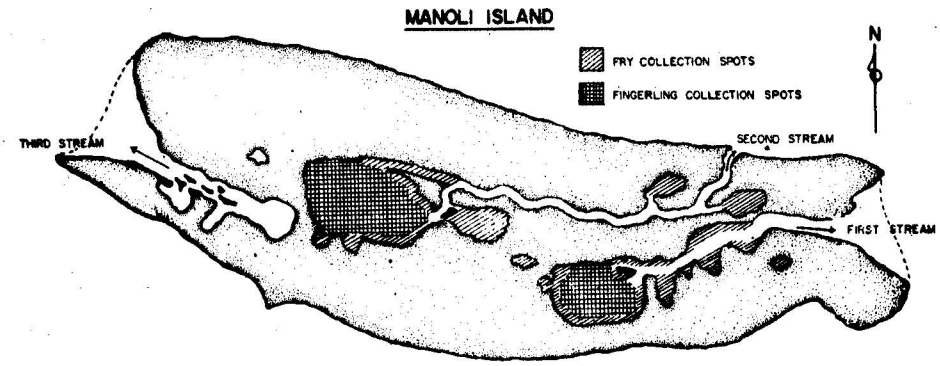

FIG. 1. Map of Manoli Island showing the location of the creeks and the seed collection spots.

Ecology of the Ground

Hydrology

All the three creeks used to get inundated during high tides (Plate I, E & F), but the pools were filled only during the highest spring tides. The fluctuation in the water level ranged from 0 to 24 cm in the pools, and in the main creeks from 6 to 65 cm. The surface water temperature in the tidal pools and creeks fluctuated widely, from 29° to 41°C, between 08.00 hrs and 14.00 hrs

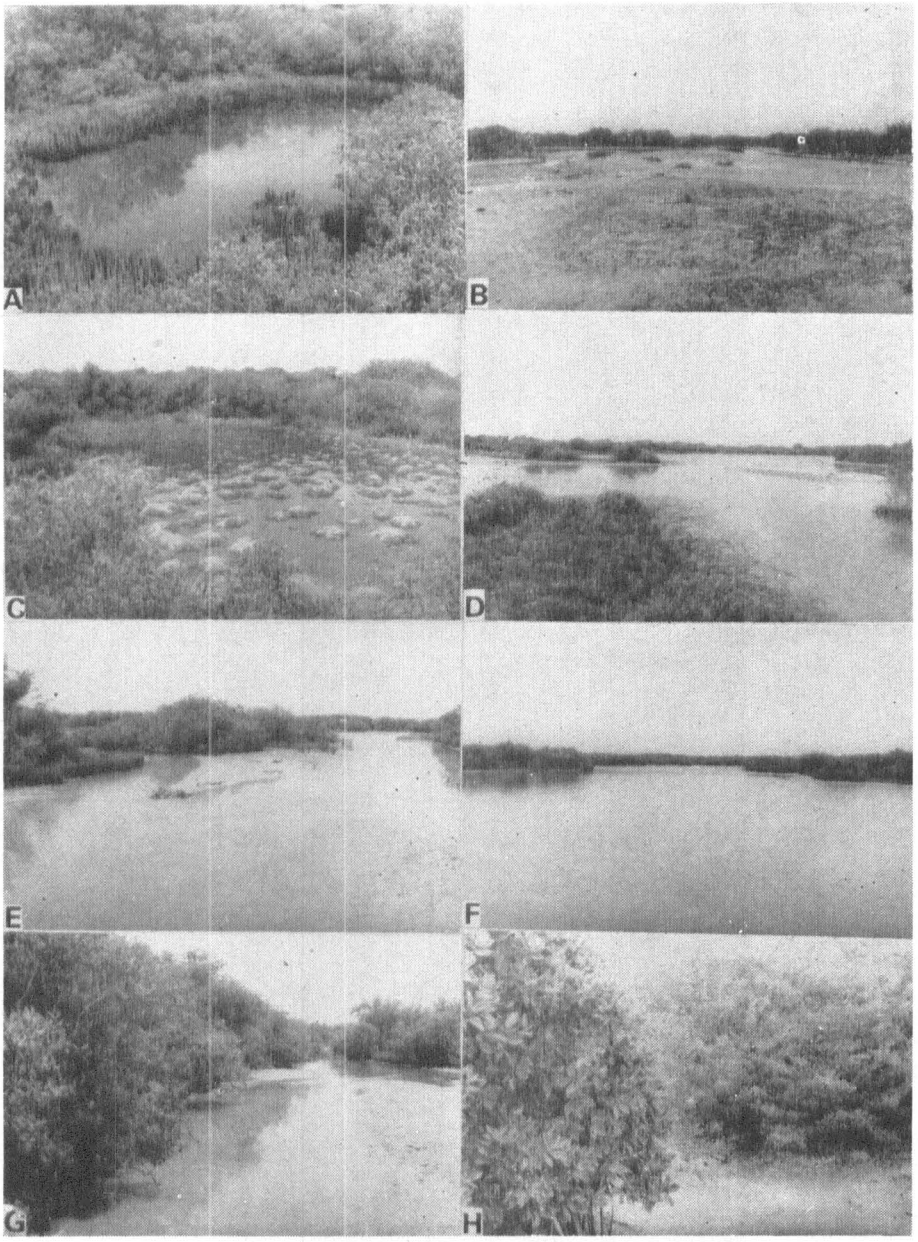

PLATE I. A. Tidal pool full of water during high tide; B. Creek exposed during low tide; C. Tidal pool showing pools of water during low tide; D. Bifurcation of the creek; E. Water entering the creek during high tide; F. Creek flooded during high tide; G. Thick vegetation bordering the creek; H. The mangrove *Rhizophora murcronata*.

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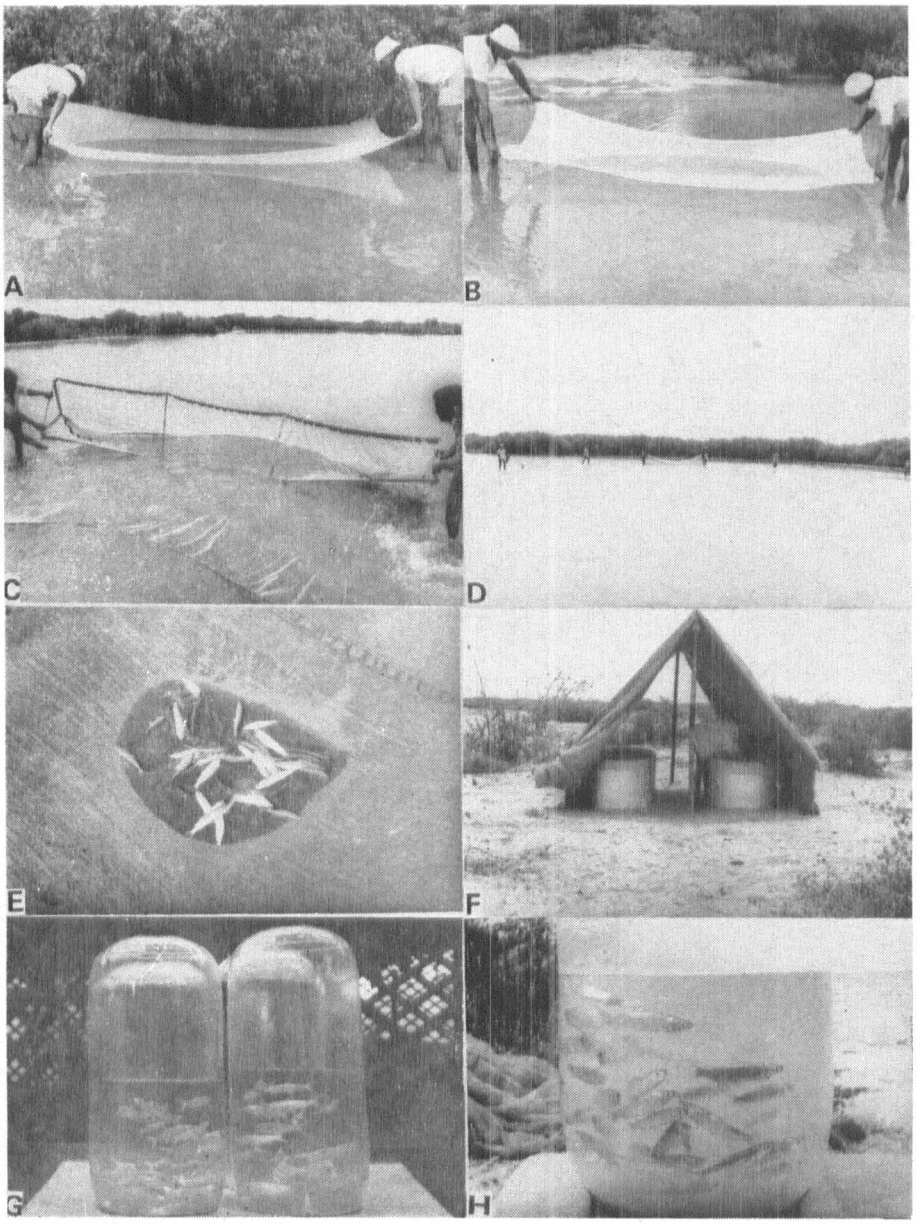

PLATE II. A. Collecting fry from under the shade of mangrove; B. Trapping the shoal of fry; C. Closer view of the dragnet with scareline; D. Operation of dragnet; E. A catch of fingerlings; F. Conditioning of the seed in 3' pools; G. Transportation of fingerlings through oxygen-filled transportation bottles; H. closer view of the fingerlings.

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in April 82, owing to the very shallow nature of the pools and creeks. The dissolved oxygen varied between 0.23 and 10.41 ml|l. In the early mornings low oxygen level was recorded, whereas maximum concentration was observed after the noon hours. Salinity was found to vary from 34.23 to 41.40 ppt. Phosphate values varied from 41.54 to 71.92 mg|l; nitrate from 1.62 to 4.85 mg|l and nitrite from 1.76 to 3.94 mg|l. The gross production ranged between 300.16 and 428.80 mg C/m^3/day.

Core samples were taken from the creeks and the tidal pools for studying the nature of soil grain size and fertility. Samples taken in one of the creeks from a depth of 60 cm revealed coarse particles in the upper stratum, up to a depth of 20 cm, coarse particles mingled with shells and mud in the middle stratum, down to 35 cm, and coarse and fine particles down below. The topmost stratum consisted of 92.8% sand grains, 4.4% silt and 2.8% clay. These were 91.06%, 3.81% and 5.13%, respectively, in the middle stratum and 94.6%, 4.81% and 0.59%, respectively, below.

The organic carbon values were 0.21% dry wt. in the upper stratum; 0.23% dry wt in the middle, and 0.19% dry wt below. The organic carbon value in the tidal pools was found to be slightly higher than in the creeks, ranging from 0.21 to 0.3% dry wt.

Flora and Fauna

Fairly dense growth of wild vegetation was bordering the high tide water mark (Plate I, G). The important plants around the creeks were *Pemphis acidula, Sesuvium portulacastrum, Rhizophora mucronata* (Plate I, H), *Avicennia officinalis, Thespesia populnea, Salicornia brachiata* and *Enicostemma littorale*. In addition to these some climbers were also found on the shrubs. *Pemphis acidula* and *Salicornia brachiata* were the dominant species bordering the tidal pools. None of the plants were above 3 m in height. A thick matrix of algae was observed over the bottom of the pools and at certain places of the creeks. This 'lab-lab' complex was mainly composed of filaments of blue-green algae, with *Oscillatoria* spp. dominating. Occasionally filaments of *Spirulina* spp. and *Phormidium* spp. were met with.

Faunistically also the creeks and the water-logged areas were rich. This richness together with the prolific flora made the location an ideal niche for a nursey ground for milkfish and mullets, which were observed in large quantities in April and May. (The locations are shown in FIG. 1).

Method of Seed Collection

Collection of fry

The gear and the method of collection depended on the size of the seed to be taken. For collecting milkfish fry a rectangular piece of organdie cloth, 2.0-3.0 m long and about 1.0 m wide, was used as net.

The fry were generally congregated in dense shoals in the tidal pools and under the shades of mangrove bushes in the creeks (Fig. 1) and were easily taken. Tightly holding the two ends by two persons the net was slowly dragged along the bottom, from the middle portion of the creek to an edge, and the net was slowly lifted up (Plate II, A). The fry were then carefully transferred, with minimum handling, into a bucket containing a liberal quantity of water.

A slightly different technique was adopted to collect the fry from the tidal pool. One end of a long piece of cloth was positioned over the bottom while the other end held over the water in the fashion of shallow bag. The fry were smoothly herded over the immersed end and the end was slowly lifted above the water level, trapping them in the central portion of the cloth which was still in water. This way the fry were taken without exposing them to air. The habit of fry swimming in shoals was taken advantage of to thus heard them and trap them. It was possible to collect as many as 2000 fry by the above method in a single attempt.

Collection of fingerlings

For the collection of milkfish fingerlings a 5-m long, 1.5-m wide drag net made up of mosquito netting (locally called *'Kondadi valai'*) was employed along with a 50-m long scareline, on which palmyra leaves were attached (*'Olai kayiru'*) (Plate II, C). The mode of operation of this net was, however, slightly different from the one described by Ranganathan and Ganapathi (1949). Owing to the larger size of the net, six persons had to be employed in the operation (Plate II, D). While two persons waded ahead through the water, dragging two ends of the scare line, which then formed a semi-circle, two others dragged the *'Kondadi valai'*, keeping its bottom close to the water surface, and following the behind the midportion of the scare line (Plate II, C). Two other persons standing on either side of the drag net splashed water to scare the fingerlings toward the net. Scared by the palmyra leaves on the dragging scare line, and disturbed by the splashing water, the fingerlings jumped above the water, over the scare line, into the bag-like space of the closely following *'Kondadi valai'*. The semicircular area covered by the drag net was narrowed down as the net was dragged toward the edge of the water-logged area, trapping all the fingerlings within the semicircle. Fingerlings as much as 300 numbers per haul were thus collected. The above method was effectively tried also in other centres like Pillaimadam lagoon.

Results of Collections

At Manoli Island

During the first collection, on 5-4-1982, 2000 milkfish fry ranging in size from 12 to 25 mm in total length were collected from the tidal pools and

the main creek. The fry were fragile, needle shaped, fully transparent, with two black spots on the head indicating the position of the eyes, and a single black spot on the centre of the dorsal side of the body. Fry of 13-14 mm size were found to be generally dominant in April and May, forming over 50% of the total collections (Fig. 2). But on 24-4-82, 15 to 27-mm fry, with a dominant

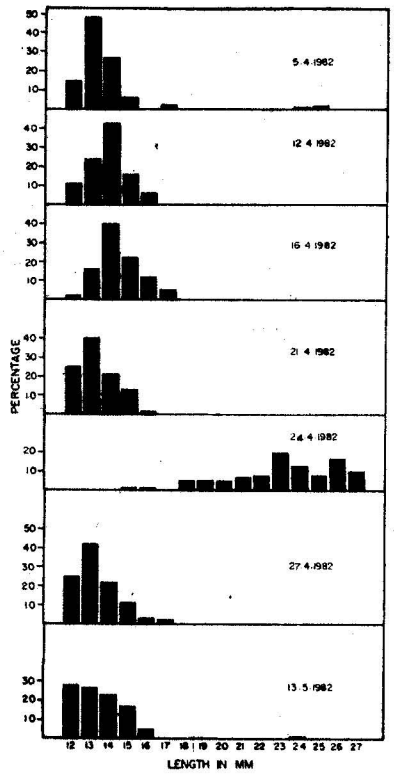

FIG. 2. Size groups of milkfish fry collected at Manoli Island during April-May '82.

mode of 23 mm, were also noticed. A total of 1,17,600 fry were collected in 10 trips made during April-May 1982. The number of fry collected per day ranged between 2,000 and 38,000 (Table 1), 98% of the aggregate collection being in May 82.

At the beginning of May 82, milkfish fingerlings appeared in the water-logged areas of the two creeks (Fig. 1). These continued to occur till the end of December. In all, 4,078 fingerlings, in the size range 30-135 mm, were collected in 8 trips on different occasions (Table 1). The occurrence of 50-mm size fingerlings during November-December seemed to support the earlier view of Tampi (1957) that the species in this region might be having a secondary spawning.

TABLE 1. *Details of the collection of Chanos seed at Manoli Island.*

Sl. No.	Date	Period of collection	No. of seed collected		Mortality of seed in the field		Size range (mm)
			Fry	Fingerlings	Fry	Fingerlings	
1.	5-4-82	Forenon & Afternoon	2000	——	200	——	12-25
2.	7-4-82	—do—	8000	——	500	——	13-25
3.	12-4-82	—do—	7000	——	1000	——	12-16
4.	13-4-82	—do—	3300	——	300	——	14-26
5.	16-4-82	—do—	19600	——	1600	——	12-17
6.	21-4-82	—do—	9000	——	1000	——	12-16
7.	24-4-82	—do—	22000	——	2000	——	15-27
8.	27-4-82	—do—	38000	——	3000	——	12-17
9.	13-5-82	—do—	4300	500	800	——	12-24 40-100
10.	18-5-82		4400	600	2400	——	15-27 40-80
11.	24-5-82		——	1500	——	——	30-50
12.	15-7-82	Forenoon & Afternoon	——	645	——	20	65-120
13.	20-8-82	—do—	——	50	——	——	70-120
14.	21-9-82	—do—	——	65	——	——	90-170
15.	11-11-82	—do—	——	200	——	——	50-135
16.	21-12-82	—do—	——	518	——	——	56-90
			17600	4078	12800	20	

At Pillaimadam lagoon

The Pillaimadam lagoon in the Palk Bay was another centre suitable for the collection of milkfish fingerlings. The ecological and other characteristics of this lagoon has been reported in detail by Tampi (1959). 19 trips made during May-July 82 at three centres of the lagoon resulted in a total collection of 22,295 fingerlings (Table 2). The collections were made either in the mornings or late afternoons. The numbers collected in each trip ranged between 3 and 5,000 (Pl. II, E). The size groups as occurred in June and July 82 are shown in Fig. 3. The size of the fingerlings ranged between 50 and 60 mm in May, 30 and 131 mm in June, and 40 and 209 mm in July, with modes respectively at 51-60 mm, 41-50 mm and 71-80 mm. All considered, June appeared to be the ideal month for collection.

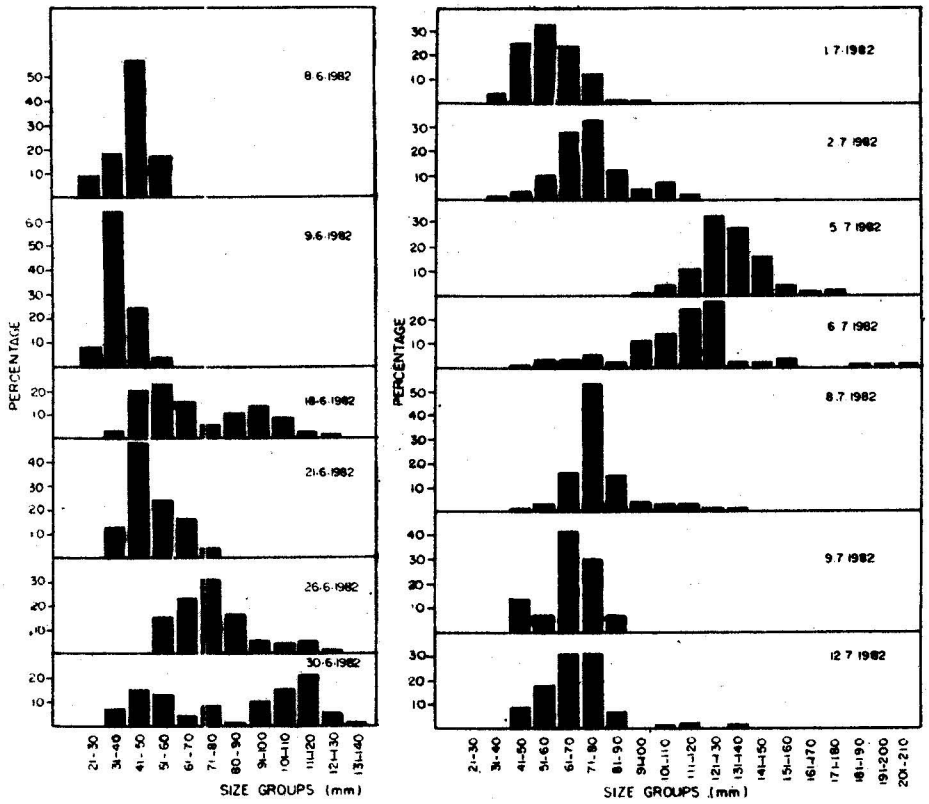

FIG. 3. Size groups of milkfish fingerlings collected at Pillaimadam lagoon during June-July '82.

Handling of Seed in Field

As the spasmodic hyperactivity to which the fry and fingerlings might easily resort to on rough handling is reported to lead to 'oxygen debt' which might result in mortality (Black 1955), good care was taken at the time of handling. When scooped out of the gears of capture they were slowly lifted up to about a few centimetres below the water level, causing least agitation to the fish, and where they were retained for about three minutes before being transferred into the bucket containing filtered seawater collected from the same locality. This procedure, when carefully followed, allowed virtually no exposure of the seed to bright sunlight or to the ambient atmospheric temperature at the time of transfer. The transfer was effected with a plastic strainer. The bucket holding the seed was covered with a wet cloth to prevent them from jumping out, which they would do when confined within a limited space. From the buckets they were then transferred into 3'-diameter plastic tanks kept under the shade of a tent (Pl. II, F) and provided with aeration. Lest the direct transfer of the fingerlings from higher

TABLE 2. *Details of the collection of Chanos fingerlings at Pillaimadam lagoon.*

Date of collection	Place of collection	Number collected	Number died	Size range (mm)
17-5-82	Theedai	487	——	50-60
8-6-82*	—do—	900	——	30-60
9-6-82*	—do—	1750	25	30-60
10-6-82*	—do—	30	——	30-60
15-6-82*	—do—	3	——	40-48
16-6-82*	—do—	200	——	30-60
17-6-82	Near Railway bridge	5000	3000	33-75
18-6-82	—do—	1500	500	40-130
21-6-82	—do—	1170	370	21-75
26-6-82	—do—	1500	800	52-121
30-6-82	Near fishfarm	1500	200	31-131
1-7-82	Near Railway	1935		40-93
2-7-82	—do—	1078	25	40-120
5-7-82	—do—	120	80	98-171
6-7-82	—do—	1200	300	46-209
8-7-82	—do—	1258	58	48-132
9-7-82	—do—	1000		46-85
12-7-82	—do—	1545	85	43-134
14-7-82	—do—	119		70-120
		22295	5413	

* Collected at night (the rest collected in the forenoon)

temperature (41°C) of the tidal pools (in the bucket) to the lower temperature of the field tank cause mortality, as it had happened at first when a few of them were directly transferred from the bucket to the tank, they were acclimated to the new temperature of the tank by slow addition of tank water to the bucket till the temperature of the latter came down to that of the former, which took about 20-30 min., and then only transferred to the tank.

As the survivavl of the seed in the field tanks depended very much on water quality, temperature and stocking density, special attention was given to maintain the optimum of these conditions. Two or three quick changes of water in the tank appeared to help not only to get clear the dirt adhering to the body of the fish, but also to make them adjust faster to the new surroundings. Any sludge which had collected at the bottom of the tank was immediately siphoned off to prevent quick depletion of oxygen. A centrifugal anticlockwise current at intervals, created in the tank, by slow and smooth stirring, appeared to keep the oxygen

level uniform besides the seed, which has the habit of swimming clockwise, kept in condition. Observing these conditions the number of seed, of 13-27 mm, that could be kept in the tank containing 500 1 of water, without incurring any mortality for about 11 h, was 10,000. The death of 12,800 fry and 5,275 fingerlings, accounting to 12.62% mortality, occurred during the process from collection to acclimation, was but inevitable owing to the experimental nature of the work, and might be reduced considerably by deft handling following the technique evolved.

Packing and Transportation

The fry and fingerlings were transported in fibreglass tanks of size 75 cm x 50 cm x 50 cm (175 l) and in oxygen-filled polythene bottles 45 cm tall and 24.4 cm diameter. The densities in the containers depended upon the size of the seed. With frequent changes of water during transit, 190-4000 fry of 13-30 mm size or 17-600 fiingerlings of 30-209 mm size were transported in the fibreglass tanks. In the oxygen-filled bottle 500-7000 fry of 13-30 mm size or 50-750 fingerlings of 30-209 mm size were transported (Pl. II, G and H). The temperature of water in OFP bottle at packing varied between 29.5° and 32.0°C and the salinity between 28.73 and 41.18 ppt. The time taken for transporting the seed from the collection site to the rearing laboratory was from 15 min. to 4h 40 min. In all, 1,25,740 fry and fingerlings were transported from various collection centres (Table 3). The overall mortality of seed during transportation was 4.1%.

Some experiments were also conducted using diluted seawater to transport the seed collected from hypersaline water, such as at Pillaimadam. Here the fingerlings were collected from a pool near the railway bridge, where the salinity was 139.93 ppt and dissolved oxygen 0.62 ml|l at 30°C. The seed on collection was acclimatized to 41.41 ppt in the Pillaimadam creek, near the collection site, in a 'hapa' for one-and-half to two hours. Then the seed were packed in diluted seawater. Altogether 10 dilutions were made ranging from 18.01 to 40.38 ppt. Finglerlings of 30-209 mm size range were packed in various densities and transported to the rearing laboratory at Mandapam Camp (Table 4), with satisfactory results.

In addition to this, transportation of the fry and fingerlings for long distance by road and railway also was tried on experimental basis. 26,500 fry and fingerlings were transported to CMFRI Research Centres at Tuticorin, Madras and Calicut, by road/rail with very high survival rate. 20,000 fry, packed in 12 OFPB, were transported by jeep to Tuticorin with cent percent survival. By similar packing, 17,600 fry and fingerlings were sent to Calicut by train|jeep, which had reached the destination after 20 h with 99.5% survival. Out of the three consignments sent to Madras by train, the first consignment (4000) had reached with 96% survival, while the other two consignments reached with cent percent survival (Table 5).

TABLE 3. *Details of the transportation of live Chanos seeds from the collection centres to CMFRI Laboratory.*

Sl. No.	Date	Collection centre	No. of seeds transported	Type of container (*)	Nos.	No. of seeds per container	Mode of transportation	Time taken for transportation (mt)	No. of seed died and (%) of mortality during transportation
1.	5-4-82	Manoli Island	1800	FGT	1	1800	Boat	75	Nil
2.	7-4-82	—do—	7500	FGT	1	4000	Boat	75	Nil
					1	3500	Boat	75	Nil
3.	12-4-82	—do—	6000	FGT	2	3000	Boat	75	Nil
4.	13-4-82	—do—	3000	OFPB	2	1000	Boat	240	Nil
					2	500	Boat	240	Nil
5.	16-4-82	—do—	18000	OFPB	4	4500	Boat	130	2000 (11.1)
6.	21-4-82	—do—	8000	OFPB	4	2000	Boat	180	Nil
7.	24-4-82	—do—	20000	OFPB	5	4000	Boat	165	Nil
8.	27-4-82	—do—	35000	OFPB	5	7000	Boat	280	1000 (2.86)
9.	13-5-82	—do—	4000	OFPB				120	Nil
				FGT	1	500	Boat	120	Nil
10.	17-5-82	Theedai	487	FGT	1	487	Jeep	30	Nil
11.	18-5-82	Manoli Island	2600	OFPB	1	2000	Boat	120	Nil
				FGT	1	600	Boat	120	Nil
12.	24-5-82	—do—	1500	OFPB	2	750	Boat	120	Nil
13.	8-6-82	Theedai	900	FGT	2	450	Jeep	30	Nil
14.	9-6-82	—do—	1725	FGT	3	400	Jeep	30	Nil
					1	525	Jeep	30	Nil
15.	10-6-82	—do—	30	FGT	1	30	Jeep	30	Nil
16.	15-6-82	—do—	3	FGT	1	3	Jeep	30	Nil
17.	16-6-82	—do—	200	FGT	1	200	Jeep	30	Nil
18.	17-6-82	Pillaimadam	2000	OFPB	4	500	Jeep	90	1000 (50.0)

TABLE 3. (*Continued*)

Sl. No.	Date	Collection centre	No. of seeds transported	Type of container (*)	Nos.	No. of seeds per container	Mode of transportation	Time taken for transportation (mt)	No. of seed died and (%) of mortality during transportation
19.	18-6-82	Pillaimadam	1000	OFPB	4	250	Jeep	90	600 (40.0)
20.	21-6-82	—do—	800	OFPB	4	200	Jeep	90	Nil
21.	26-6-82	—do—	700	OFPB	4	175	Jeep	175	210 (30.0)
22.	30-6-82	Near fish farm	1300	OFPB	5	200	Jeep	30	
					1	300	Jeep	30	9 (3.0)
23.	1-7-82	Pillaimadam	1935	Plastic buckets	—	100-150 bucket	Jeep	15	Nil
24.	2-7-82	—do—	1053	—do—	—	—do—	Jeep	15	73 (6.96)
25.	5-7-82	—do—	40	—do—	—	40	Jeep	30	Nil
26.	6-7-82	—do—	900	OFPB	6	100	Jeep	75	5 (0.85)
				OFPB	1	170	Jeep	75	18 (10.59)
				OFPB	1	130	Jeep	75	2 (1.54)
27.	8-7-82	—do—	1200	OFPB	6	200	Jeep	75	77 (6.40)
28.	9-7-82	—do—	1000	OFPB	5	200	Jeep	60	43 (4.30)
29.	12-7-82	—do—	1490	OFPB	7	200	Jeep	90	128 (8.60)
				OFPB	1	90	Jeep	90	Nil
30.	14-7-82	—do—	119	OFPB	2	60	Jeep	75	Nil
31.	15-7-82	Manoli Island	625	OFPB	5	125	Boat	45	Nil
32.	20-8-82	—do—	50	OFPB	1	50	Boat	60	Nil
33.	21-9-82	—do—	65	OFPB	1	65	Boat	60	Nil
34.	11-11-82	—do—	200	OFPB	4	50	Boat	45	Nil
35.	21-11-82	—do—	518	FGT	1	518	Boat	45	Nil
			125740						

(*) FGT = Fibreglass tank; OFPB = Oxygen filled polythene bottle

TABLE 4. *Details of the transportation of milkfish seed under different concentrations.*

Sl. No.	Salinity (ppt)	Seed transported	Nos. packed per bottle	Size range (mm)	Duration of transportation	Percentage survival
1.	18.01	50	50	70-120	1 h. 45 mt.	100
2.	19.18	69	69	70-120	—do—	100
3.	28.31	200	200	43-134	1 h. 30 mt.	95.50
4.	28.78	400	200	43-134	—do—	95.25
5.	29.02	200	200	43-134	—do—	96.00
6.	30.31	400	200	46-85	1 h. 40 mt.	99.75
7.	34.05	400	200	46-85	—do—	93.75
8.	38.14	240	240	43-134	1 h. 30 mt.	87.91
9.	38.64	450	225	43-134	—do—	86.00
10.	40.48	200	200	46-85	1 h. 40 mt.	91.50

GENERAL REMARKS

Seed survey conducted in the past had helped to locate some important collection on both the coasts of India (Tampi 1968). The Chinnapalam creek at Pamban in the Gulf of Mannar had been the best known ground for milkfish fry, on which the relevant statistics are available since 1950. The existence of several areas of seed collection including the present one, in the Gulf of Mannar shows that the milkfish breed close around these areas. Silas et al (1980) have recently pointed out the concentration of milkfish breeders in the Ariyankundu area on the Palk Bay in certain months. Data so far collected by different workers on the distribution of the early stages and the observations made on the adults show that the fish probably has two spawning periods a year. The young fry collected during the present study in April and November-December confirms this finding.

Hardly any published information is available on the ecology of the milkfish-seed collection grounds apart from that of Tampi (1959), who made a detailed study on the ecology and fishery characteristics of the Pillaimadam lagoon. The ecology of the newly discovered ground in Manoli Island is somewhat different from that of Pillaimadam. The mangrove area in the island seems to be an ideal nursery for the milkfish. Each high tide can bring in copious unpolluted water, carrying with it a large number of fry, which stay back sheltering under the dense shade of the mangrove bushes when the tide recedes. The presence of innumerable small and large water basins and tidal pools in the island would undoubtedly offer excellent protection for the growing seed.

TABLE 5. *Details of live transportation of seed of milkfish Chanos chanos from Mandapam Camp.*

Sl. No.	Transported to	No. of seed	Packed in OFPB	Transported by| distance (km)	Duration of transportation (h)	Survival rate	Remarks
1.	Tuticorin	20,000	12	Road|195	6.00	100%	Fry only
2.	Calicut	1,760	4	Rail|374 Road|210	20.00	99.5%	Fry & Fingerlings
3.	Madras	4,000	6	Rail|650	24.00	96%	—do—
5.	Madras	303	3	—do—	22.00	100%	Fingerlings only
5.	Madras	300	4	—do—	22.00	100%	—do—

The observation on the salinity and temperature tolerance of milkfish fry made during this survey needs special mention. The salinity ranged between 34.23 ppt and 41.4 ppt in the Manoli Island, where the milkfish seed were found to thrive well. The temperature of the tidal pools ranged from 29°C to 41°C. Although the earlier known maximum temperature from where the milkfish fry were collected was 38.5°C (Schuster 1952), during the present survey the young fry were found to thrive well in water up to 41°C. It has also shown that the milkfish fingerlings can survive in hyper-saline water of 140 ppt with a considerably low dissolved-oxygen concentration of 0.62 ml/l, when the fishes, such as *Elops, Tilapia, Therapon, Gerres,* etc., and the penaeid prawns and crabs failed to survive.

The net and the method of collection adopted in the Manoli Island and the Pillaimadam lagoon helped to get better results than that reported from the South East Asian countries by Blanco (1972). Also mortality of seed while collection and handling was very low. The size of the fry collected, 13-14 mm, were similar to that reported from the collection grounds of the Indo-Pacific region.

The characters useful in the identification of the live milkfish fry are the presence of two black spots on the head and a single black spot on the middle of the body. The characteristic clockwise movement in shoals is yet another character that would confirm the identification (Schuster 1952). The best collections of fry may be made during lowest low tide, immediately a day after both the full moon and the new moon, particularly in the summer months, April to

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