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Milkfish 'fry' supply from the wild

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Milkfish farming has been possible for centuries because of the availability of seed from the wild — shore waters, river mouths, and mangrove areas. During the breeding season, adult milkfish occur in small to large schools near the coasts or around islands where reefs are well developed. The eggs and larvae are pelagic up to 2-3 weeks. Milkfish larvae migrate towards the coast and the 10-17 mm postlarvae (known as 'fry' in the industry) reach shore waters where they are collected in large numbers and used as seed in the grow-out industry. The fry that escape the collection gear move into coastal wetlands, mainly mangrove swamps and lagoons, where they transform into juveniles and grow on the abundant food in relative safety.

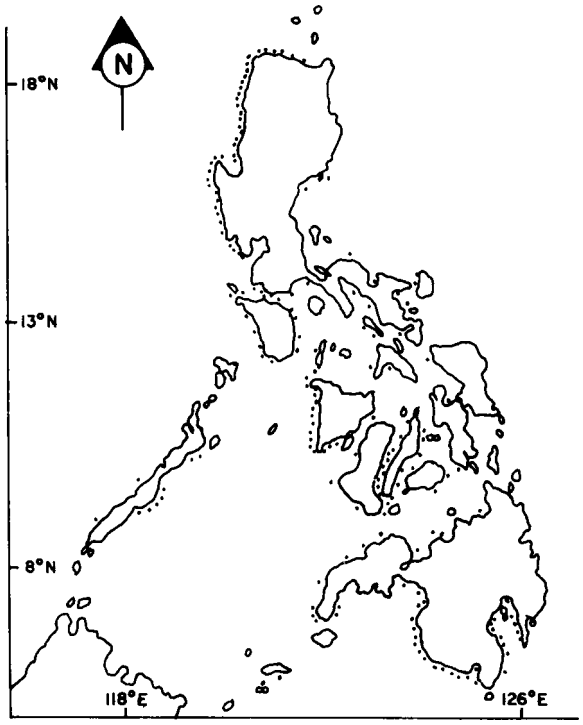
The Philippines has a well established milkfish fry fishery. Figure 1 shows the distribution of milkfish fry grounds relative to milkfish ponds in the Philippines in 1969 (new maps are not available). Fry grounds are mostly sandy beaches adjoining human communities. These fry grounds are fished and regulated through concessions granted by the municipal governments to the highest bidder for terms of up to five years. Fry concessions demand high capital investment; the most productive fry grounds fetched fees of ₱100,000-250,000 in 1976. The concession system is a form of indirect municipal tax on fry gatherers. Concessions provided an average 12.7% of the 1976 incomes of the municipal governments, and as much as 50% of the income of Hamtik and other towns in Antique (west coast of Panay Island) where the fry catch was 88 million in 1975.

Various forms of seines and bag nets of indigenous design are used in fry gathering (Fig. 2); some of these fry gear were already in use 70 years ago. By the 1980s, the technologies for fry gathering were already highly developed and efficient. Fry injury and mortality rates during capture are generally low, 1-8% by different gears, and reach 20% only in the fry sweeper operated during rough seas. However, milkfish fry gathering contributes substantially to the depletion of fishery resources. Billions of larvae and juveniles of other fishes and crustaceans are captured with milkfish fry and are killed incidentally and intentionally. This larval bycatch includes some species such as mullets that might be used in aquaculture. The fisheries industry has become acutely conscious of wastes and more attention must be paid to the bycatch of fry gathering, milkfish or otherwise.

The milkfish fry industry was worth ₱57.4 million in 1976 and about 26,000 families or about 166,400 people derived income from fry gathering in 1978. Fry gatherers in the Philippines are local residents, mostly men with elementary education and families with six children, the older ones of whom help in fry gathering. Fry gatherers spend three months gathering, six months in other occupations, usually fishing, but are not gainfully employed the rest of the time. An additional 779,375 man-days are devoted to fry counting, sorting, storage, transport, and marketing to move the fry catch from fry grounds to fishponds. Technologies for fry storage and transport are also well established and generally efficient. Fry mortality rates during storage and transport averaged 8.7% and 6.6%, whereas mortality in grow-out ponds averaged 54% in the 1976.

Milkfish spawn year-round at locations near the equator but for shorter periods (3-6 months) at higher lati-

Figure 1 Milkfish fry grounds.



Dr. Bagarinao is a marine biologist on AQD's milkfish R&D team.

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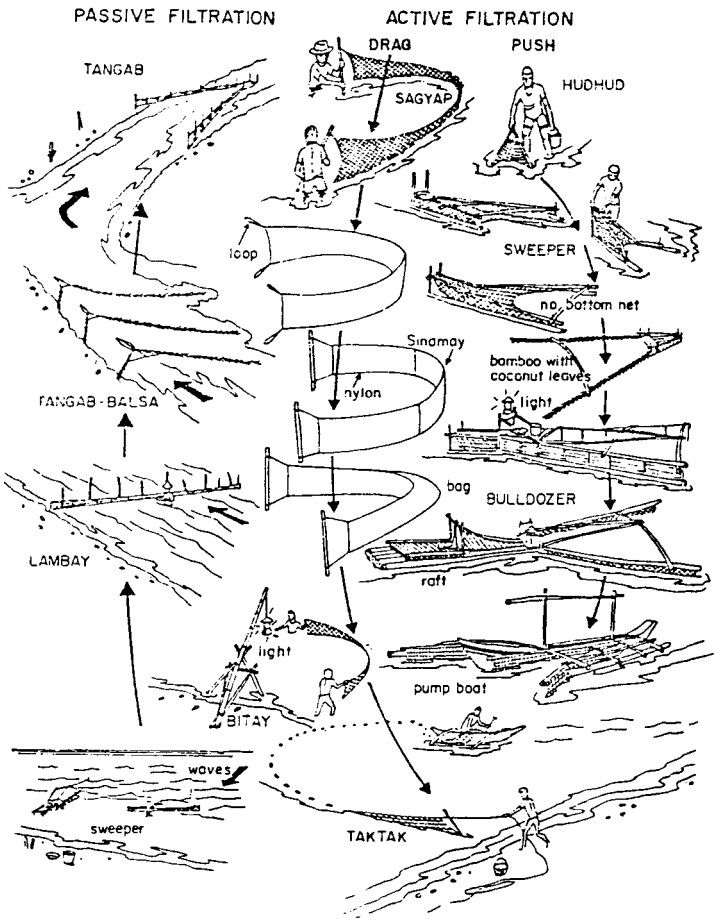
Figure 2 Variety in the collection gear used for milkfish fry around Panay in west central Philippines: (1) operation in shore waters and at entrances to coastal wetlands; (2) use of fine mesh nets and lamps; (3) utilization of currents and waves or motor power to move the gear; and (4) other adaptations of structure, materials, and methods according to fry behavior and conditions of fry grounds.



tudes up to about 23°N and 23°S. The seasonality of milkfish reproduction has serious effects on the fry industry — fry are abundant and low-priced during the peak months, but scarce and highly priced during the lean months. The problem of mismatched timing between fry availability, low price and pond stocking schedules is commonly perceived as 'fry shortage.' Unfortunately, there are no good records of the milkfish fry catch despite the long history and economic importance of the industry. About 30 years ago, the milkfish fry catch was assessed at 334 million and considered adequate to meet the requirement of the 165,000 ha of ponds in 1970. In 1973, the fry supply was estimated at 466 million fry and the demand at 1,157 million — a large deficit. However, in a 1982 survey of 324 milkfish farmers, only 13% complained of fry shortage and most of these were complaints of the high cost (₱87 per thousand fry in 1978) rather than inavailability. Nevertheless, in response to this perceived fry shortage and in anticipation of the increased fry requirement due to the desired intensification of milkfish farming, the Philippine government in the 1970s adopted a 'milkfish policy' that included breeding the fish in captivity, conservation programs, and restrictions on the fry fishery and trade.

The question of a national fry shortage and other alleged imperfections of the fry and fingerling industry were examined in detail and found to have been greatly exaggerated. The fry catch was estimated at 1.35 billion in 1974 and 1.16 billion in 1976, both adequate to meet the annual requirements. Allegations of fry shortage were based on the underestimation of catch, the overestimation of stocking requirements (10,000 fry per ha for 176,000 ha of ponds), and the increase in demand and price of fry and fingerlings due to an expanded fishpen area. The average cost of fry gathered from the wild was ₱121-148 per thousand fry during the period 1974-1992. Whereas a family of gatherers obtained an average of 39,740 fry in 1974, they got 31,117 fry in 1992, and these they sold at ₱280-570 per thousand. The milkfish fry catch was estimated at 1.24-1.4 billion in 1991-1992, adequate to meet the estimated demand of about one billion.

Complaints of fry shortage persist, and the government fails to collect fry catch data systematically. In 1995, the milkfish fry shortage became a highly emotional issue, coming as it did in the wake of the rice shortage. The Bureau of Fisheries and Aquatic Resources (BFAR) projected that 1.726 billion fry will be required yearly by the milkfish industry during the next several years to stock 114,795 ha of ponds in operation. BFAR also estimated a fry supply of 161 million from the wild and thus a deficit of 1.566 billion fry, which must be imported from Taiwan or Indonesia or produced by private hatcheries in the Philippines. The calculation of the fry requirement and the method used to obtain the fry catch data were not explained. However, it is simple enough to show that the fry catch of 161 million is a wrong figure. About 150,000 mt of milkfish were produced each year in 1993-1995. At the usual market size of 250 g, that harvest comprised of 600 million juvenile milkfish. From 600 million juveniles can be back-calculated the number of fry that was caught from the wild — 1.53 billion fry — after accounting for mortalities during grow-out (54%), fry transport (6.6%), and fry storage (8.7%). The same calculation can be applied to the total annual milkfish production to estimate the fry catch during the past 25 years. The production of 100,000-240,000 mt suggests fry catches of 1-2.45 billion or an average of 1.7 billion a year. The milkfish industry is a very important one and policies, decisions and action plans must be based on hard data. It is quite distressing

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that BFAR has not instituted official ways by which the milkfish fry catch is accurately recorded for research and policy, if not for tax purposes. In contrast, Taiwan's fisheries yearbooks include fry catch data since 1920.

About one billion milkfish fry may continue to be available from natural fry grounds *if* action is taken *now* to conserve the wild stocks (about which nothing is known) by protecting the ecosystems of which milkfish is a part. Since a large number of already poor fisherfolk depends on the milkfish fry fishery, the fry fishery must not be allowed to decline through environmental neglect. The remainder, about 700 million fry, has to be supplied by hatcheries. Now, more than ten years after a milkfish hatchery technology has been developed at the SEAFDEC Aquaculture Department and elsewhere, only a few private hatchery operators in the Philippines produce milkfish fry.

Literature citations are given in full in the original paper entitled *Historical and recent trends in milkfish farming in the Philippines*. In press. IN: S.S. de Silva (ed) Tropical Mariculture. Academic Press, London.

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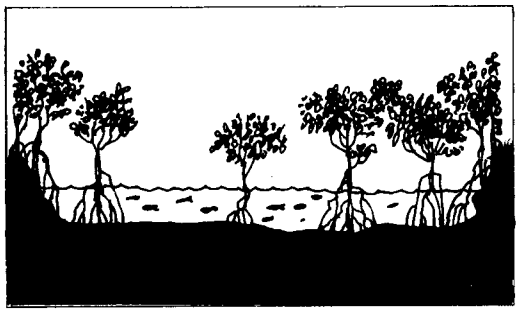

TABLE 1 Records or estimates of the milkfish fry catch in the Philippines, various years.

Place of collection	Year	Quantity (million)	Reference
Philippines	1958	344.25	Blanco (1972)
	1973	466	[a]Deanon et al. (1974)
	1974	1,350	[b]Smith (1981)
	1976	1,116	(b)
	1991	1,241	Librero, Aragon &
	1992	1,400	Evangelista (1994)
Luzon, Mindoro, Palawan	1973	73.5	(a)
Visayas	1973	285.4	(a)
Mindanao	1973	106	(a)
Ilocos Norte, Ilocos Sur,	1970	70	[c]Delmendo (1972)
La Union, Pangasinan, Zambales	1973	28.8	(a)
Ilocos Norte	1973	11.5	(a)
	1986	18.7	[d]Ungson (1990)
	1987	9.3	(d)
Mindoro	1970	6.39	(c)
	1973	6.5	(a)
Batangas	1973	3.8	(a)
Palawan	1973	10	(a)
Bicol	1973	5	(a)
Panay Island	1973	72	[e]Villaluz (1975)
	1974	92	(e)
	1975	120	(e)
Iloilo	1975	18	(e)
Guimaras	1975	4.45	(e)
Aklan	1975	6.3	(e)
Capiz	1975	0.37	(e)
Antique	1975	88.36	(e)
Negros Occidental	1973	21.8	(a)
Negros Oriental	1973	2.5	(a)
Zamboanga Sur, Norte	1973	19	(a)
Misamis Occ., Or.	1973	13.5	(a)
Davao del Sur, Or.	1973	7.2	(a)
Cotabato	1973	62.5	(a)