THE MILKFISH INDUSTRY IN THE PHILIPPINES

Elizabeth Samson
Fishery Industry Development Council
Metro Manila, Philippines

Milkfish is the most commercially important fish species in the Philippines. Out of the present 208 120 ha of fishponds, 195 830 ha are brackishwater ponds, of which 91% are milkfish farms. Fishpens, concentrated mainly in Laguna Lake, constituted 30 000 ha in 1983, but are now being curtailed; 62 000 ha of mangrove are available for fishpond development. Milkfish production from the marine fisheries and aquaculture sectors has increased at an average rate of 22%. In 1981, production was valued at ₱19 billion (212 000t), representing 14% of total fish production value. About 73% of milkfish production came from brackishwater ponds, while the rest was contributed by fishpens (26.3%) and marine fisheries (0.5%). The national yield average was 870 kg/ha per year. Local marketing is handled by brokers, who distribute the fish to wholesalers, cooperatives, retailers, and consumers. Exports experienced a more than 600% increase from 1977 to 1980 and a slight decrease in 1981. Traditional export markets include the US, Canada, Japan, and Singapore. The frozen/chilled form constitutes the bulk of exports. Inherent problems of the industry include shortage of input supply, frequent typhoons and flooding, presence of acid sulphate soils, and extreme tidal fluctuations. Inadequate credit, deficient ice and cold storage facilities, an inadequate transport system, and limited processing plants are additional bottlenecks. Nevertheless, the potential for further growth of the industry is strong in view of recent research on intensive farming, induced spawning,

Tearing in controlled conditions, and polyculture techniques. The government is providing support through the establishment of infrastructure facilities, strengthening of extension and training, provision of credit, and development of efficient marketing.

INTRODUCTION

The aquaculture industry in the Philippines is one of the most important segments of the fishing industry in the country. It is continuously gaining attention as a potential source for increasing production. Over the years, aquaculture has expanded as a result of technological developments and widening knowledge of the biology and life cycle of various cultivable species. Production intensification in existing fishpond areas is being carried out to increase yields. Seafarming has grown to include not only the traditional mussel and oyster culture operations, but the propagation of seaweeds as well as various finfishes in cages. Fish farming in cages has also been adopted in inland waters such as rivers, lakes, and reservoirs. The expansion of fishpen culture in Laguna de Bay has been contributing a significant percentage to aquaculture production. Recently, rice-fish culture techniques, after passing several trials, have reached actual implementation and are expected to expand extensively in Central Luzon and in landlocked areas where the fish supply is scarce.

The series of fuel price increases in the last decade has negatively affected both marine municipal and commercial fisheries, and a leveling off of production from these sectors is foreseen. Aquaculture is thus the sector most capable of meeting the future fish requirement of the country. In 1981, the aquaculture sector contributed 19% to a total fish production of 1.8 million tons. Of the total aquaculture production, brackishwater fishponds contributed 50%, freshwater fishponds 3%, fishpens 17%, fish cages 2%, and seafarms 28%. Milkfish dominates aquaculture production; its popularity among local consumers has continually expanded the milkfish industry over the years. Aside from its culture in brackishwater ponds, milkfish has recently been extensively cultured in fishpens and, to a small extent, in freshwater ponds.

CURRENT RESOURCES

Of the total of 195 830 ha of brackishwater fishponds in the Philippines, 91% are assumed to be milkfish farms (GOPA Consultants 1983). Existing milkfish ponds are in various stages of development, years in operation ranging from less than 5 years to over 20 years. The size of the farms ranges from a few hundred square m to 250 ha or more (Chong et al 1982).

The culture of milkfish in fishpens is concentrated mainly in Laguna Lake, the largest lake in the Philippines, with a total area of 90 000 ha. In 1980, it was estimated that fishpens in operation around the lake covered 7000 ha (Mane 1981). However, reports reveal that this figure increased to about 30 000 ha in the early part of 1983, exceeding the total carrying capacity of the lake, which is estimated at about 20% of the total lake area (LLDA 1983). For better management, conservation, and protection of the lake, the Laguna Lake Development Authority (LLDA) is currently

implementing a comprehensive zoning plan of the lake to gradually reduce the existing fishpens by 30%.

From survey data, the country still has many mangrove areas that can be utilized for fishpond development or other industrial and commercial purposes such as logging or land reclamation for human settlement. The Bureau of Forest Development (BFD) estimated the existing mangrove areas at 242 000 ha (1981), while the Natural Resources Management Center (NRMC) figured 140 000 ha (1978). The discrepancy in the figures is due to the definition and methods of inventory used. BFD defines a mangrove swampland as a forest that stands in a swamp tidal area consisting primarily of *Rhizophora* and associated species. The methods of inventory used by BFD are ground survey, air photo analysis, and statistical projections based on 1977 data of 249 083 ha of mangrove. NRMC defines mangrove as an area with characteristic *Rhizophora* and associated species wavelength emissions, shown by digital analysis of LANDSAT imagery with Image 100. Cognizant of the immense value of mangrove resources to the country, the government proclaimed 78 000 ha out of the NRMC total of 140 000 ha as preservation and conservation areas under Presidential Proclamations 2151 and 2152, leaving only 62 000 ha open for fishpond development. In support of this, the Ministry of Natural Resources, through the Integrated Fisheries Development Plan (IFDP), gave emphasis to the intensification of production in existing fishponds rather than to the opening of new areas.

PRODUCTION PERFORMANCE

Milkfish production steadily increased from 1977 to 1981, with an average growth rate of 22%. In 1981, it reached a total of 211 586 t valued at ₱1.9 billion, including production from marine fisheries and aquaculture from brackishwater fishponds and fishpens and representing 12% of total fish production and 14% of total fish production value for the year. Production from brackishwater fishponds was 155 092 t or 73.3% of total milkfish production, while fishpens and marine fisheries contributed 56 299 t or 26.6% and 195 t or 0.1%, respectively (Table 1).

Table 1. Milkfish production (tons).

		Marine		Aquaculture			
Year	Commercial	Municipal	Total	Brackishwater[a] fishpond	Fishpen	Total	Grand total[b]
1977	1	358	359	105 338		105 338	105 697
1978	—	411	411	108 001	—	108 001	108 412
1979	—	982	982	121 574	—	121 574	122 556
1980	—	163	163	155 092	56 299	211 391	211 586
1981	—	195	195				

[a] 91% of total brackishwater fishpond production.
Ave. Growth Rate 9%.
[b] Annual average growth rate of 22%.
Source: BFAR Fishery Statistics of the Philippines, 1977-81.

Average production figures per hectare per year for different provinces and for different sizes of milkfish farms vary considerably. According to 1981 Bureau of Fisheries and Aquatic Resources (BFAR) statistics, Bulacan and Iloilo are the two highest producing provinces with an average production of 1500 and 1250 kg/ha per year, respectively. These figures are far above the present national average of 870 kg/ha per year (Table 2). In a study conducted by the International Center for Living Aquatic Resources Management (ICLARM), the Fishery Industry Development Council (FIDC), and the Bureau of Agricultural Economics (BAEcon) (Chong et al 1982), these two provinces were also identified as the highest producing areas in the country (Tables 2, 3, and 4).

The study revealed that generally there is a direct relationship between yield and size of milkfish farm (Table 3). However, a wide variation in production can be observed, as shown in Table 4. In terms of the variables influencing milkfish pond yield, the study revealed that out of the 11 variables examined, 5 have significant relations to production output. Three of these 5 variables relate to production inputs, namely, stocking rate, use of organic and inorganic fertilizers, and miscellaneous operating costs. Thus, it can be assumed that production output can be increased with the optimum use of fertilizers and improved stocking rates.

SUPPLY AND DEMAND PROJECTIONS

The Integrated Fisheries Development Plan (IFDP) for the 1980s expects that the increase in brackishwater fishpond production will continue over the next 10 years. Thus, the IFDP targetted brackishwater fishpond production at 256 700 t by 1985 and at 395 000 t by 1990. To achieve these production targets, the IFDP programmed for the intensification of culture in the existing 176 000 ha of fishponds and the conversion of 20 000 ha of mangrove into new ponds. Out of the total area available for fishpond development, the IFDP projects that these 196 000 hectares will still be used for milkfish culture until 1990. Based on this assumption of cultivable area and an average production target of 1 t/ha per year in 1985 and 1.5 t/ha per year in 1990, milkfish ponds are expected to produce 216 730 t by 1985 and 335 095 t by 1990 (Table 5). On the other hand, the LLDA's Comprehensive Laguna Lake Zoning Plan, which takes into consideration the lake's carrying capacity, the concept of fish sanctuary, and the provision of access navigational channels and fish enclosures, projected that the 30 000 ha of fish enclosures existing in the lake will be reduced by 30% in 1985. Assuming that 70% or 21 000 ha of these fish enclosures are retained and produce an average production of 4 t/ha per year, a total production of 84 000 t will be attained in 1985. Assuming further that out of the 21 000 ha, 99% will be allocated for fishpens culturing milkfish, a total annual milkfish production of 83 000 t will be expected from 1985 to 1990.

The demand for milkfish is likewise projected to increase from 1985 to 1990. Demand for fresh milkfish alone was targetted at 132 771 t in 1985 and 145 6901 in 1990 based on a per capita consumption of 2.5 kg. However, demand for locally consumed processed milkfish cannot be projected since per capita consumption for processed milkfish is not presently available. Meanwhile, milkfish exports are also

Table 2. Fish production by province (1981).

Region	Province	Hectarage	Average production (kg/ha)		Total production (kg)
			BFAR statistics[a]	Based on studies[b]	
I		13 409	1 169		15 679 000
	Ilocos Norte	41	488		20 000
	I locos Sur	284	598		170 000
	La Union	704	899		633 000
	Pangasinan	12 380	1 200	589	14 856 000
II		819.03	649		532 000
	Cagayan	819.03	649	253	532 000
III		42 992.88	1 192		51 267 000
	Bataan	2 105.48	1 200		3 727 000
	Bulacan	18 876.60	1 500	1066	28 315 000
	Pampanga	19 509.58	920		17 949 000
	Zambales	1 501.22	850		1 276 000
NCR		752	900		677 000
	Metro Manila	752	900		677 000
IV		29 982.79	619		18 553 000
	Batangas	590.40	450		266 000
	Cavite	883.35	480		424 000
	Marinduque	1 915.26	480		919 000
	Mindoro Occ.	5 603.25	840		4 707 000
	Mindoro Or.	1 656.00	760		1 259 000
	Palawan	2 181.66	350		764 000
	Quezon	16 719.33	600	969	10 032 000
	Romblon	335.54	447		150 000
	Aurora	100.00	320		32 000

Continued on pages 220-221

Table 2. continued

Region	Province	Hectarage	Average production (kg/ha)		Total production (kg)
			BFAR statistics[a]	Based on studies[b]	
V		12 090.52	424		5 130 000
	Albay	497.43	322		160 000
	Camarines Norte	1 685.15	320		539 000
	Camarines Sur	3 415.33	320		1 093 000
	Catanduanes	485.11	348	95	169 000
	Masbate	3 778.66	650		2 456 000
	Sorsogon	2 228.84	320		713 000
VI		44 500.70	1 149		51 123 000
	Aklan	4 173.26	970		4 048 000
	Antique	307.50	849		261 000
	Capiz	11 323.35	1 210		13 701 000
	Iloilo	17 666.74	1 250	1 1.10	22 083 000
	Negros Occ.	11 029.85	1 000		11 030 000
VII		6 783.71	608		4 126 000
	Bohol	2 743.73	620	308	1 722 000
	Cebu	2 847.11	600		1 709 000
	Negros Or.	1 192.87	599		715 000
VIII		9 658.39	399		3 857 000
	Eastern Samar	192.25	359		690 000
	Leyte	3 618.12	460		1 664 000
	Northern Samar	1 858.53	360		669 000
	Southern Leyte	192.02	458		88 000
	Western Samar	3 797.47	360		1 367 000

continued on opposite page

Table 2. continued

IX-A		57.46	296		17 000
	Banian	57.46	296		17 000
IX-B		18 592.60	453		8 418 000
	Zamboanga del Norte	1 494.18	370		553 000
	Zamboanga del Sur	17 098.42	460	204	7 865 000
X		5 487.29	438		2 407 000
	Agusan del Norte	2 662.07	460		1 224 000
	Misamis Occ.	814.78	450		366 000
	Surigao del Norte	1 174.34	360		432 000
	Misamis Or.	837.10	470		394 000
XI		5 442.79	791		4 305 000
	Surigao del Sur	926.44	600		556 000
	South Cotabato	565.06	501		283 000
	Davao del Norte	1 018.18	750		764 000
	Davao del Sur	1 777.23	1 000		1 777 000
	Davao Oriental	1 155.88	800		925 000
XII		5 262.73	824		4 340 000
	Lanao del Norte	2 690.27	800		2 153 000
	Maguindanao	2 337.61	850		1 987 000
	Sultan Kudarat	234.85	851		200 000
	GRAND TOTAL	195 831.89	870		170 431 000

[a] Average production = total production ÷ total hectarage.
[b] Average production based on studies undertaken by Chong et al 1982.
Sources: BFAR Fishery Statistics of the Philippines, 1981. pp. 292-293, Chong et al 1982.

Table 3. Yield of milkfish farms by size and by province (1978).

Province	Small farms — 6 ha (kg/ha per year)	Medium farms — 6-50 ha (kg/ha per year)	Large farms — 50 ha (kg/ha per year)
Cagayan	296	239	—
Pangasinan	527	666	—
Bulacan	796	1 136	987
Masbate	337	113	16
Iloilo	433	905	1 195
Bohol	149	327	—
Zamboanga del Sur	163	207	—
Philippines	423	580	1 056

Source: Chong et al 1982.

Table 4. Yield of milkfish farms by province (1978).

Province	Average yield (kg/ha per year)		
	All farms	High-yielding farms	Low-yielding farms
Cagayan	253	424	153
Pangasinan	589	900	341
Bulacan	1 066	1 886	560
Masbate	95	432	35
Iloilo	1 110	I 616	621
Bohol	308	962	177
Zamboanga del Sur	204	427	116
Philippines	761 (n=324)	1 429 (n=97)	266 (n=227)

Note: High and low yields have been defined relative to the average yield. Those farms with above-average yield are grouped as high-yielding farms and those with below-average yield are grouped as low-yielding farms.
Source: Chong et al 1982.

Table 5. Projected supply of milkfish (tons).

Year	Marine[a] (capture fisheries)	Aquaculture[b]		
		Brackishwater fishponds	Fishpens	Total
1981	195	155 092	56 000	211 287
1982	240	168 625	61 975	230 840
1983	295	183 338	68 588	252 221
1984	363	199 336	75 906	275 605
1985	446	216 730	83 000	300 176
1986	549	236 446	83 000	319 995
1987	676	257 999	83 000	341 675
1988	831	281 493	83 000	365 324
1989	1 022	307 127	83 000	391 149
1990	1 257	335 095	83 000	419 352

[a]Projection was computed based on 1977-81 projection data using an average growth rate of 23%.
[b]Projection was computed based on compounded growth rate using 8.7% for 1981-85 and 9.1% for 1986-90.

Table 6. Projected demand of milkfish.

Year	Population[a]	Demand (tons)		
		Domestic[b]	Export[c]	Total
1982	49 836 983	124 592	926	125 518
1983	50 925 789	127 314	951	128 265
1984	52 016 230	130 041	977	131 018
1985	53 108 304	132 771	1 002	133 773
1986	54 163 971	135 410	1 028	136 438
1987	55 208 592	138 021	1 053	139 074
1988	56 242 166	140 605	1 078	141 683
1989	57 264 694	143 162	1 104	144 266
1990	58 276 176	145 690	1 129	146 819

[a]NCSO data, medium assumption.
[b]Based on annual per capita consumption of 2.5 kg of fresh/frozen/chilled milkfish.
[c]Method of projection used was the linear regression based on NCSO Foreign Trade Statistics, 1977-81.

projected to increase to 10021 in 1985 and 11291 in 1990 based on BFAR historical data (Table 6).

As shown in Table 7, the country is expected to experience a surplus of milkfish of 166 403 t in 1985, which is expected to increase further to 272 533 t in 1990. This surplus may be attributed to: (1) wide adoption of intensive culture by fishpond operators, (2) further improvement of culture methods, (3) increased credit assistance, and (4) accelerated technology transfer. However, the IFDP has targetted this surplus in milkfish production as an alternative to fill in the gap in marine fisheries production, which is expected to stabilize over the plan period as a result both of the near depletion of marine resources due to overfishing and of the high cost of some types of marine operations due to increasing fuel prices.

Marketing System

Local marketing of milkfish is generally handled by brokers, who absorb about 90% of total fish production. The brokers in turn distribute the fish to different market outlets, i. e., to wholesalers, cooperatives, retailers, and consumers (GOPA Consultants 1983). The BFAR reported that in 1981 some 3267 t of frozen and processed milkfish valued at ₱27 million were transported to the different market outlets.

Table 7. Milkfish supply and demand situation, 1982-90 (tons).

Year	Total supply	Total demand	Surplus
1982	230 840	125 518	105 322
1983	252 221	128 265	123 956
1984	275 605	131 018	144 587
1985	300 176	133 773	166 403
1986	319 995	136 438	183 557
1987	341 675	139 074	202 601
1988	365 324	141 683	223 641
1989	391 149	144 266	246 883
1990	419 352	146 819	272 533

About 77% of the total milkfish transported came from Region VI (Table 8). The majority of the operators generally sold their produce to different market outlets situated within their province. However, about 50% of fishpond production from Pangasinan was sold in Northern Luzon, while 20% of the production of Iloilo was sold in Metro Manila and other parts of Luzon (GOPA Consultants 1983).

Moreover, a marketing study conducted by the Philippine Fisheries Development Authority (PFDA) showed that milkfish is partly sold outright at the farms, where buyers pick up the harvested fish at preset prices arranged with the fishpond owners. This is especially true in cases wherein large supplies of milkfish are sold to only one buyer. However, the study likewise showed that a major percentage of milkfish production is delivered by the fishpond operators to the various wholesale markets, where brokers sell the products for them at 4% commission. In cases wherein the brokers transport the fish to the market, a 5% commission is charged by the brokers.

Pricing

The price of milkfish fluctuates in accordance with the prevailing fish supply. When the supply is abundant, which often occurs from April to October, prices are relatively low. A peak in prices is usually observed from January to March. According to the Aquaculture Development Project Technical Assistance Study financed by the Asian Development Bank (ADB), the average retail price paid for milkfish was highest in Dagupan City at ₱16.00/kg and lowest in Metro Manila at ₱12.80/kg.

On the other hand, according to PFDA data, the national average wholesale price of milkfish in 1982 was ₱10.30/kg while retail prices ranged from ₱11.45 to ₱17.40/kg, or a markup of 11.69% over the wholesale price.

Export Performance

Philippine export of milkfish has improved significantly. From a recorded export of 74.5 t in 1977, it increased to 564.5 t in 1980, or a more than 600% increase. However, a slight decrease to 528 t was experienced in 1981 (Table 9).

Table 8. Volume of frozen and processed milkfish transported from point of origin, 1978-1981 (kg).

Region	1978	1979	1980	1981
I			—	—
II	—	260	21 053	—
III	—	—	—	—
IV	671 282	85 790	67 724	97 450
NCR		700	—	—
V	67 659	18 530	52 138	221 595
VI	3 029 304	9 451 142	403 547	2 518 817
VII	1 605	12 483	—	58 960
VIII	—	11 200	—	3 000
IX-A	70 092	31 794	15 939	—
IX-B	17 275	—	127 785	250 555
X	28 351	167 009	15 864	20
XI	32 239	93 557	12 164	8 992
XII	451 168	39 352	142 329	107 625
Total	4 368 975	9 911 817	858 543	3 267 014

Source: BFAR Statistics of the Philippines, 1977-81.

Table 9. Philippine export of milkfish by product form (tons).

Type	1977	1978	1979	1980	1981
Live (fingerlings)	—	17	15	13	1.3
Frozen/chilled	74.5	150	323	551	526.4
Dried	—	—	—	—	.02
Canned	—	4	2	.6	—
Total	74.5	171	340	564.5	527.72

Source: BFAR Fishery Statistics of the Philippines, 1977-81.

The major traditional export markets for milkfish are the United States, Canada, Japan, and Singapore, which account for about 90% of the country's milkfish exports. There are four milkfish products being exported, namely, live fingerlings and frozen, dried, and canned fish. The majority of milkfish exported are in the frozen/chilled form. Live fingerlings ranked second, followed by canned, and lastly by the dried form (Table 9).

The international price for fish varies considerably, depending on the type of product being sold and on its destination. On a per product form basis, canned milkfish cost the most at an average price of ₱20.30/kg (at 1980 prices). Live fingerlings, which ranked second, cost ₱18.70/kg (Table 10). In terms of destination, Singapore paid more (₱37.60/kg) for live fingerlings than Taiwan (₱24.00/kg). The USA paid the highest price for canned milkfish (₱24.10/kg), followed by Hongkong (₱21.20/kg) and Saudi Arabia (₱17.40/kg). For frozen/chilled milkfish, most prices fell between ₱20 and ₱29/kg except for the USA, which bought at ₱15.50/kg, and the Netherlands, which paid ₱18.15/kg (Table 10).

Table 10. Export price of milkfish by country of destination.

Country	Price (₱/kg)
Live (fingerlings)	
Singapore	37.60
Taiwan	24-00
Frozen/chilled	
Belgium	20.60
Canada	22.00
England	21.50
Japan	29.10
Hongkong	22.90
Netherlands	18.15
Saudi Arabia	24.40
Singapore	20.50
USA	15.50
Dried	
USA	1.80
Canned	
Hongkong	11.20
Saudi Arabia	17.50
USA	24.10

Source: BFAR Fishery Statistics of the Philippines. 1977-81.

PROBLEMS CONFRONTING THE INDUSTRY

Various problems and risks confront the milkfish industry. Seasonal and geographical distribution of fry and fingerlings is the most common constraint. Operators are faced with other problems that are beyond their control and considered inherent in the area of operation, including frequent typhoons and flooding, the presence of acid sulphate soils, and extreme tidal fluctuations. Moreover, the lack of technical assistance seriously contributes to low production yields.

Inadequate credit, particularly for fishpond development and reconstruction, is another bottleneck for prospective operators. The inadequacy of financial assistance could disrupt the operation and thus incur more costs to the operator. Other constraints are related to marketing. These include deficient ice and storage facilities, an inadequate transport system, and limited processing plants for fish surplus. Poor market facilities cause further deterioration of fish, thereby forcing operators to sell their products at a low price and sometimes on credit.

POTENTIALS

The potential for expanding the milkfish industry in the Philippines cannot be overemphasized. There are indications which show that production targets for milkfish are realistic and can therefore be attained, among which are:

- Among the more progressive operators, milkfish production in ponds of 2000 kg/ha per year is easily attainable. Intensively fanned fishponds in Bulacan, Pangasinan, and Iloilo have repeatedly attained production performance of 3 t/ha per year (ICLARM-BAEcon-FIDC Milkfish Production Function Survey).
- Research is continuously discovering new technologies and improving existing ones.
    1. Research on induced spawning of milkfish and fry rearing under controlled conditions is actively gaining momentum. A series of experiments are being conducted at the SEAFDEC Tigbauan Research Station in an effort to increase the catch and survival of fry caught from the wild, induce maturation of captive milkfish, and develop techniques to induce spawning and rearing of larvae. All these studies could lead to an increased and more stable supply of milkfish fry.
    2. Polyculture of milkfish with other commercially important species such as prawn (*Penaeus monodon*) is now receiving wide attention. This production technique offers further possibilities for increased yield and efficiency. SEAFDEC is undertaking a research study on the production and economics of integrated farming of shrimp (*P. indicus*), milkfish, and poultry in brackishwater ponds which is already showing encouraging results.
- Support facilities, e.g., ice and cold storage plants, fertilizer and feed plants, fry banks, and hatcheries, are now being and will be established by both the government and the private sectors. Problems associated with transport, unavailability, and high cost of inputs and post-harvest handling activities are

expected to ease up with the presence of these infrastructure facilities, especially in areas where intensive culture will be promoted.

- Government programs to develop the industry further are in the pipeline. The ADB Aquaculture Development Project, which is currently being negotiated by the government, is aimed at intensifying production of existing brackishwater areas through provision of credit for fishpond reconstruction and cost of inputs, e.g., fry, fertilizer, etc. Likewise, extension and training programs are continuously being strengthened and improved to support the industry.

CURRENT DIRECTIONS

To attain the goals of the industry, government planners in cooperation with the private sector may consider the immediate implementation of the following important activities:

- *Effective technology transfer*
  Quite apart from the research findings of our institutions, there exists within the industry a wealth of applicable technology that can be harnessed to spread the benefits of science to the smaller operators in the interest of increasing their incomes, optimizing the use of given resources, and improving nutrition in the rural areas. There is a pronounced need for a mechanism for the effective industry-to-industry transfer of technology to supplement BFAR extension workers. A meaningful step toward this objective was taken recently when the fishpond federation officially agreed to make available portions of the ponds of active members for demonstration purposes, as detailed and formalized in a memorandum of agreement between the Philippine Federation of Fishpond Producers (now the Philippine Federation of Aquaculturists, Inc.), BFAR, and FIDC.
- *Responsive credit*
  The availability of institutional credit from government and private banks has stimulated industry development, albeit not yet at the desired pace, scope, and magnitude. However, surveys have shown that less than half of the total number of fishpond operators finance their development operations from funds borrowed from these institutions. Meanwhile, the repayment rate of rural bank credit has been a low 30%.
- *Efficient marketing*
  Improved marketing of milkfish can lower the prices and at the same time increase the producer's returns. The increase in income would come from a reduction of losses due to wasteful practices and unscrupulous trading manipulations. Moreover, an improved monitoring system of markets and prices of milkfish for the information of the fish farmers should be undertaken. At the same time, a system better than the currently practised open bidding system should be implemented to protect the fish farmers.

LITERATURE CITED

BFAR. 1977-81. Fishery statistics of the Philippines. Quezon City.

Chong, K. C., M. S. Lizarondo, V. F. Holazo, and I. R. Smith. 1982. Inputs as related to output in milkfish production in the Philippines. ICLARM Tech. Rep. 3, 82 p.

GOPA Consultants. Aquaculture development project technical assistance study. Manila, ADB. March 1983. 420 p.

NCSO. 1977-81. Foreign trade statistics. Manila: NCSO.