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The economics of the milkfish fry and fingerling industry of the Philippines

Ian R. Smith

AQUACULTURE DEPARTMENT, SOUTHEAST ASIAN FISHERIES DEVELOPMENT CENTER
INTERNATIONAL CENTER FOR LIVING AQUATIC RESOURCES MANAGEMENT

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Preface

Although many of the constraints to aquaculture development are technical, a large number are in fact economic, cultural and institutional. The past few years have brought the realization that increased production from aquaculture on the scale earlier envisioned is still more promise than reality. National and international proponents of aquaculture, by and large, have not devoted adequate attention to the fact that the development of aquaculture on a grand scale most probably will lead to conflicting demands for basic resources, such as land, labor, water, feed and fertilizer, currently used largely by agriculture and land-based animal husbandry. The extent to which aquaculture will successfully compete for these resources depends in part on the relative efficiency with which aquaculture producers are able to convert them into a competitively priced product. Aquacultural products compete in domestic and international markets with both agricultural proteins and capture fishery products.

Until such time as food production sectors may be protected from competition with non-food sectors for resources, the private entrepreneurs who produce much of the current aquaculture output are likely to be guided primarily by economic considerations. Due to diminishing returns, for example, private producers may find it more profitable to produce less than that which is technically feasible. Also, choice of species, within certain bounds, is most often determined by relative profitability rather than by productivity per hectare.

Aquaculture research and development have long been the preserve of biologists and other technologists. Little information on economic aspects is available. Moreover, available economic studies are often based on very limited samples or observations, and tend to be descriptive rather than rigorously analytic. It cannot be denied that the biological and technological aspects of aquaculture are important and in fact serve to underpin the success of the aquaculture enterprise. However, it is also necessary to understand the economics of aquaculture if the sector is to remain viable as a business proposition, and enhance its contribution to meet worldwide nutrition requirements.

The International Center for Living Aquatic Resources Management believes that there is a pressing need to bring about a more coordinated approach to aquacultural economics research if the results of such research are to support the objective of increased production from an economically viable aquaculture sector. Consequently, ICLARM is developing a network of cooperating research institutions and individuals with initial focus on (1) country case studies of aquaculture trends and development prospects, and (2) economic analysis of selected existing aquaculture production and marketing systems.

Likewise, the Aquaculture Department of the Southeast Asian Fisheries Development Center (SEAFDEC), realizing the need for evaluating the economics of existing aquaculture practices and of newly developed aquaculture technologies has been conducting and supporting studies in line with socioeconomics and aquaculture economics.

This technical report, jointly published with the SEAFDEC Aquaculture Department, is the first of several that deal with the economics of various aspects of the milkfish *(Chanos chanos)* industry. It concentrates on the fry and fingerling industries in the Philippines. Subsequent reports will cover the production economics of milkfish rearing in the Philippines and the entire fry to market system in Taiwan.

IAN R. SMITH, ICLARM

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LIST OF ABBREVIATIONS

ADB	Asian Development Bank
BFAR	Bureau of Fisheries and Aquatic Resources
FAO 115	Fisheries Administrative Order No. 115
ICLARM	International Center for Living Aquatic Resources Management
LLDA	Laguna Lake Development Authority
MNR	Ministry of Natural Resources
NFAC	National Food and Agriculture Council
PAL	Philippine Airlines, Ltd.
PC	Philippine Constabulary
PCARR	Philippine Council for Agriculture and Resources Research
PD 704	Presidential Decree 704
PFFP	Philippine Federation of Fishfarm Producers, Inc.
PNR	Philippine National Railways
SEAFDEC	Southeast Asian Fisheries Development Center
USAID	United States Agency for International Development

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Abstract

Smith, I.R. 1981. The economics of the milkfish fry and fingerling industry of the Philippines. ICLARM Technical Reports 1, 146 p. International Center for Living Aquatic Resources Management, Manila and Aquaculture Department, Southeast Asian Fisheries Development Center, Iloilo, Philippines.

The fry and fingerling industry of the milkfish *(Chanos chanos* Forskal) in the Philippines is alleged to suffer from certain imperfections. Primary among these are an annual shortage of catch necessary to meet the stocking requirements of the 176,000 ha of fishponds; high fry mortality rates during transport; failure of the pricing system to perform its spatial and form allocative functions; and exploitation of fry gatherers and pond operators by middlemen and nursery pond operators who form the core around which the whole fry and fingerling industry has developed. These alleged imperfections provide the rationale for various government policies affecting the fry and fingerling industry.

This study indicates a higher level of industry performance than hitherto supposed. In 1974, an estimated 1.35 billion fry were caught, adequate to meet annual stocking requirements. Allegations of fry shortage were based on simultaneous underestimation of catch and overestimation of stocking requirements, and were traced to temporary price increases resulting from expanded fishpen area, which subsequently declined. Fry storage and transport mortality rates of 8.7% and 6.6%, respectively, compared with a mortality rate of 54% during rearing, indicated that major technical inefficiencies arise in fishponds rather than in the distribution system. Of every 100 fry caught, 38 are harvested at marketable size.

Monthly average fry prices among 17 major trading regions were significantly correlated, indicating a high level of information flow in the industry. An examination of the concession system which restricts first sale opportunities of gatherers indicated that concessionaires are unable to capture their full monopsony advantage due to the "competitive fringe" of smugglers. Rather than exploitation, the concession system is a form of indirect municipal tax on fry gatherers.

Since the fry industry is a 57-million-peso-per-year industry upon which approximately 170,000 people directly and indirectly depend, it is suggested that the location of future milkfish hatcheries and timing of production be planned such that they complement rather than displace the natural fry fishery and distribution system.

1. Alleged Imperfections and Policy Issues

INTRODUCTION

The culture of milkfish (*Chanos chanos* Forskal) has been practiced for several hundred years in Southeast Asia. Milkfish, valued for its high quality flesh, has become a popular food fish in the Philippines, Taiwan and Indonesia. Producers of milkfish throughout Southeast Asia rely on the natural fry fishery for their ponds, since the milkfish neither reaches sexual maturity nor breeds in confinement in sufficient numbers to support hatcheries.

It is widely assumed that a shortage of milkfish fry exists, constraining production in brackishwater ponds. The alleged shortage of fry from the natural fishery provides the rationale for various government programs in the Philippines, Taiwan and Indonesia, one of the most ambitious and far-reaching of which is the attempt to induce spawning of the milkfish under controlled conditions. Individual governments have also adopted measures to regulate the supply and distribution of fry. For example, exportation of fry is now banned in the Philippines and, in an effort to answer complaints of sectoral fry shortages from 1975 until 1978, the government placed restrictions on free trade of milkfish fry within the country. In short, the issue of fry shortage has important implications for the milkfish industry throughout Southeast Asia.

The issue is also extremely provocative in that assumptions of shortage are highly subjective, based more on conjecture than on carefully gathered catch data. With the exception of Taiwan, which has gathered the statistics for decades, catch data are virtually nonexistent. Occasional, annual estimates have been made in the Philippines and in Indonesia, but the reliability of these estimates is suspect due to the industry's admitted unwillingness to share business information with government researchers whom they fear will use it for tax purposes.

In addition to fry shortage, the fry system in the Philippines is alleged to suffer from several other inefficiencies and imperfections. For example:

1. Mortality rates in storage and transport prior to pond stocking are alleged to be high. Transport over long distances in the Philippines is assumed to weaken fry so that nursery and rearing pond mortality rates are higher than those experienced in Taiwan.

2. Rearing pond operators claim that prices of fry (12-16 mm) and fingerlings (5-10 cm) are manipulated by both fry dealers and nursery pond operators who specialize in raising fry to fingerling size primarily to be sold to fishpen operators in Laguna de Bay, southeast of Manila.

3. Pond operators in some fry ground areas claim that they are excluded from sources of supply.

4. The fry distribution system is allegedly price inefficient, that is, prices do not respond to supply and demand changes and other stimuli throughout the various regions where fry are caught and fishponds are located, resulting in regional shortages and surpluses which cannot be resolved by the marketing and distribution system.

These allegations provide the rationale for government policies ranging from conservation measures to protect against possible overfishing to price control and subsidy programs for fishponds of less than 10 ha. To date, there has been little factual evidence to either

support or contradict these allegations of shortages and other imperfections. Policy planning is, however, necessarily proceeding despite inadequate knowledge of the structure and performance of the present fry gathering and distribution system. Consequently, there is danger of misdirected and restrictive regulations. Even if these imperfections do exist in the nature and to the extent alleged, it remains to be seen whether or not present policies ameliorate or exacerbate these conditions.

The purpose of this study was to evaluate these allegations regarding imperfections in the Philippine fry industry, and to determine the effects of related fisheries policies. Analysis was based upon data collected during a field survey conducted in the Philippines from January to September 1977.

The study on which this report is based was a follow-up to the Socioeconomic Survey of the Aquaculture Industry in the Philippines, a joint project of the Southeast Asian Fisheries Development Center (SEAFDEC) and the Philippine Council for Agriculture and Resources Research (PCARR), which identified certain problem areas within the fry marketing system for further research.

THE BIOLOGY OF THE MILKFISH AND THE NATURAL FISHERY

The milkfish is well known throughout the Indo-Pacific region, and is found from the East coast of Africa to California and from southern Japan to New Zealand (Schuster 1960). Despite widespread knowledge of its existence, however, very little is known about the biology or possible migratory habits of this fish.

Bardach et al. (1972) report that *Chanos* spawn annually or bi-annually in the sea near the coastline in about 25 m of water, each female broadcasting up to 5 million pelagic eggs which hatch in about 24 hr. Specific spawning grounds are generally unknown, although recent studies by SEAFDEC have pinpointed one or two such areas off the island of Panay in the Philippines. The larvae seek out clear coastal and estuarine waters warmer than 23°C with 10-32‰ salinity and abundant phytoplankton. This is where fry are caught for distribution to fishponds. The worldwide distribution of *Chanos* as well as the major fry gathering areas are shown in Figure 1.1. There is some dispute as to how long fry stay near the coast, ranging from 10 days to 1 year, but it is universally agreed that no one knows what happens to them from the time of their departure from the coastline until they mature in about their sixth year when they return to the coastal areas to spawn.

Adults feed on both phytoplankton and zooplankton, and reach lengths up to 1 m and weights of 20 kg. (Hofstede et al. 1953). Due to their importance as the source of fry, fishing for mature milkfish is prohibited in some areas. Hence, all references to the natural fishery in this report will refer to that for milkfish fry.

Hundreds of millions of fry are caught for pond culture in the Philippines, Taiwan and Indonesia during gathering seasons that have marked peaks and slack periods depending upon location. The peak season in the Philippines and Taiwan is from April to June, although fry are available year round in certain regions of the Philippines, particularly Southern Mindanao, where a second though less pronounced peak occurs from September to November. Interestingly, this second peak coincides with the peak season in Indonesia across the Celebes and Java Seas. Indonesia also experiences a second less productive peak from March to May. In addition to this seasonal pattern, there are fluctuations within each month; catches are highest during the two monthly high tides.

Although there is disagreement as to the exact age at which fry are caught, their anatomical structure at catch is roughly equivalent to stage 7 in Fig. 1.2. Milkfish are known by various names depending upon stage of growth. In the Philippines, for example, distinc-

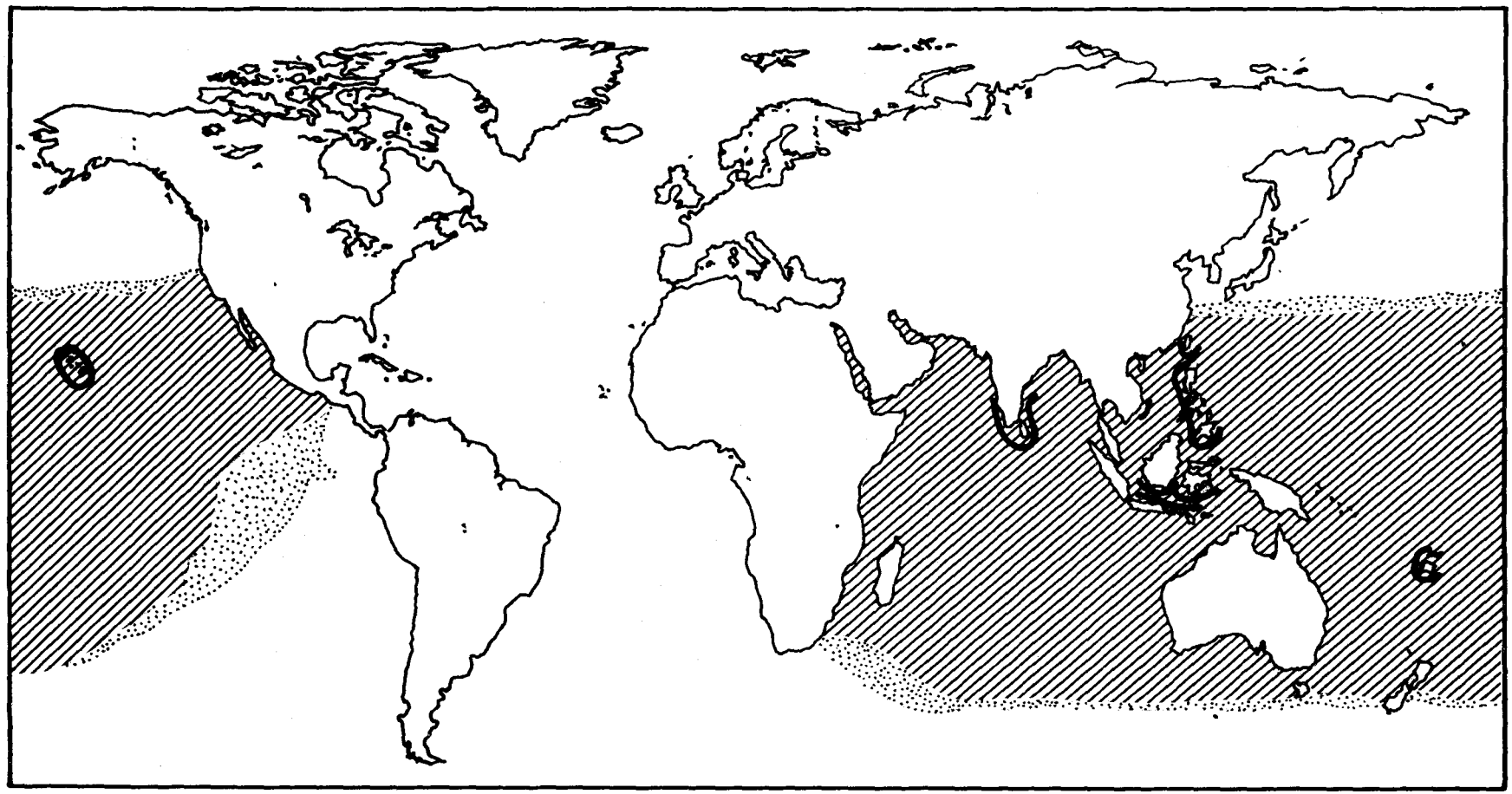


Fig. 1.1. Worldwide distribution of milkfish. (Source: Schuster 1960).

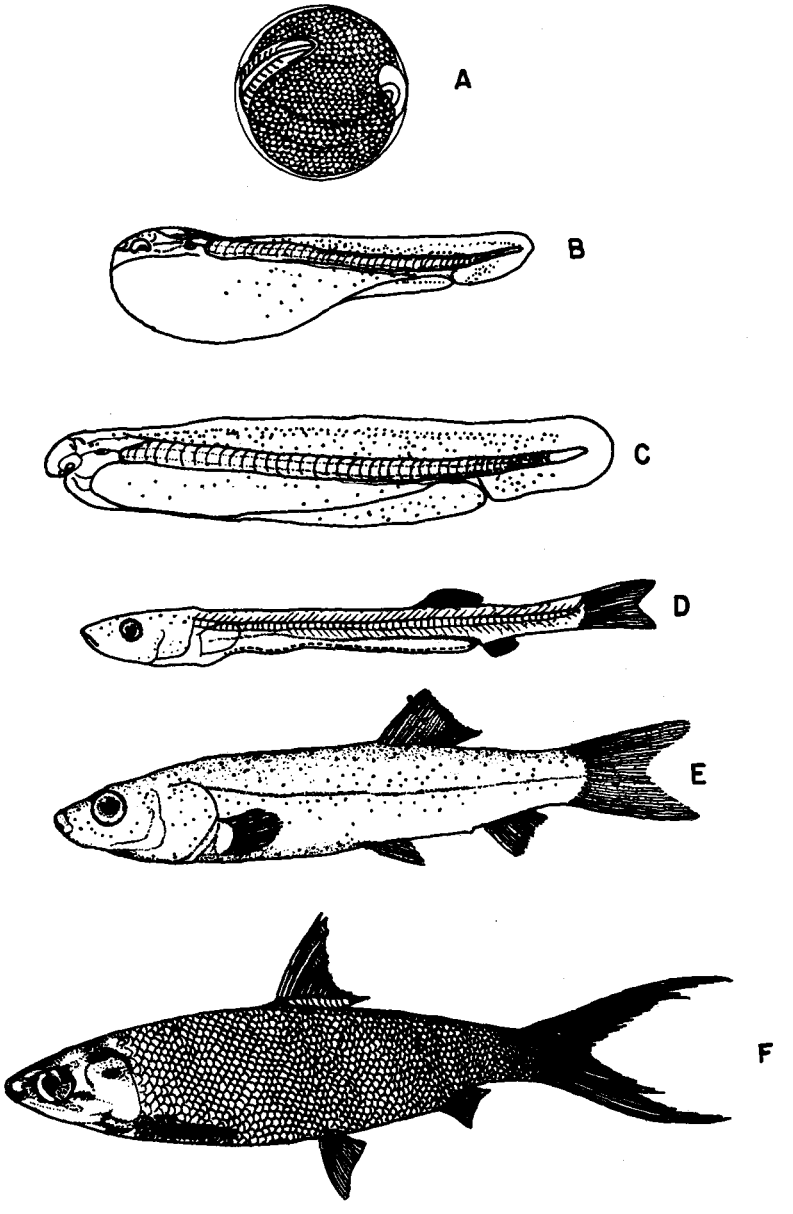


Fig. 1.2. Milkfish stages of development. A, egg; B, newly hatched larva; C, day-old larva; D, week-old fry; E, fingerling; F, adult. Sources: A-C, Schuster (1952); D-E, Villaluz (1953).

tions are made between fry (kawag-kawag), fingerling (hatirin), marketable size (bangos), and adult (sabalo) (Table 1.1). Similar differentiation is made in Indonesia and Taiwan. Traveling for distances of up to 1,200 km in containers with oxygenated water, the fry pass through a network of buyers and sellers before reaching the fishponds in which they are stocked.

IMPORTANCE OF MILKFISH IN SOUTHEAST ASIA

The milkfish is euryhaline and one of the fishes best suited to brackishwater pond culture (Bardach et al. 1972). It is disease resistant and feeds near the bottom of the food chain. The milkfish also grows rapidly, and is a high quality food fish. Large numbers can be

Table 1.1. Development of the milkfish.

Name				
English	Filipino	Length	Weight	Age
Fry	kawag-kawag or semilia	12-16 mm	–	3-14 d
Fingerling	hatirin	5-10 cm	1.2-5 g	4-8 wk
Marketable	bangos	30-40 cm	250-300 g	6-9 mo
Adult	sabalo	up to 1 m	up to 20 kg	5-6 yr

supported in a restricted area. However, a major disadvantage is that it does not mature sexually in fishponds.

The milkfish is the most important of the cultured species in brackishwater ponds in the Philippines, Taiwan, and Indonesia. In 1974 it represented 25.3% of production volume from aquaculture in Taiwan (Chen 1976), and approximately 90% in the Philippines (BFAR 1975). Bardach et al. (1972) state that milkfish farming probably originated in Indonesia where saltwater farming has been practiced for over 500 years. Herre and Mendoza (1929) claim that extensive nipa swamps, which at first were exploited for the nipa thatch and for the alcoholic beverage made from nipa sap, were walled off by dikes to form natural enclosures at high tide. These enclosures were initially stocked by free entry of fry, but later stocking was done deliberately with fry caught along the coasts. There are now 184,609 ha of fishponds in Indonesia, concentrated on the islands of Java and Sulawesi (Satari and Soewardi 1974).

After the initial development of fishponds in Java, the business spread to Taiwan and the Philippines. Early fishponds in the Philippines were concentrated around Manila Bay. In 1929 Herre and Mendoza (1929) reported 3,193 ha in Rizal Province, 16,700 ha in Bulacan, 14,200 ha in Pampanga, and 4,000 ha in Bataan, similar to today's totals. The rapid growth in production area in recent years (28% in the past decade) has occurred as fishponds have spread to other areas of the country, particularly to the Visayas and Mindanao. There are now 176,032 ha of fishponds in the Philippines. The small town of Malabon just north of Manila earned early reputation as the area with the highest skill in raising milkfish to marketable size. The town is now known as the center of nursery pond specialists who raise fry to fingerlings.

Taiwan has also long been engaged in milkfish farming. Lin (1968) mentions a fishfarm built in 1661 in honor of Koxinga (Cheng Cheng-Kung) near what is now Tainan City. This area continues to be the center of the 15,624-ha milkfish culture area (Chen 1976). Taiwan has emerged as the leader of milkfish rearing with highest annual productivity per hectare, close to 2,000 kg, achieved through intensive methods. In contrast, primarily extensive methods yield annual average productivities of 580 kg/ha in the Philippines (Librero 1976), and 358 kg/ha in Indonesia (Poernomo 1974). Taiwan's intensive methods of fertilizer and supplemental feed use and of stock manipulations to achieve multiple stocking and consequent higher yields, are slowly spreading to the Philippines, and to a lesser degree, to Indonesia.

The potential for expansion is limited in Taiwan, but both the Philippines and Indonesia have extensive mangrove swamp areas suitable for fishpond development. Although technically feasible, it must be stressed that it is neither ecologically sound nor financially feasible to expect full development of Indonesia's 6 million ha of swamplands or of the Philippines' 125,000 ha of mangroves. The attractiveness of further development, however, stems from two compelling reasons. First is the desire of both governments to increase aquaculture production to offset protein deficiencies. Second is the extent of employment opportunities that further fishpond development will generate.

In the Philippines, protein deficiency is a major problem, with 70-80% of the population receiving less than the recommended daily allowance of 50 g. The vast majority of this protein-deficient group fall into the low income categories. Milkfish represented 18% of the total fresh and frozen fish consumed in the Philippines during 1970-1973 (Guerrero and Darrah 1975). Expansion of milkfish through intensification and extensification represents a possible solution to this problem. It is important, however, to avoid overstating the contribution of milkfish to low income diets; the average wholesale price of milkfish increased from ₱1.67/kg in 1963 to ₱7.60/kg in 1975, making it very much a middle and upper class fish (Table 1.2). At an average weight of 250 g, per-unit price of marketable milkfish in 1975 was slightly less than ₱2.00. The minimum wage in the Philippines in 1976 was ₱8.00/day.[1] Whether increased productivity will result in lower prices depends upon the elasticity of supply and demand and upon the relative power of market intermediaries.

It is extremely difficult to estimate the extent of employment derived from present fishponds and supporting activities in the Philippines, but assuming that one person per hectare is directly involved, and others peripherally, employment could increase by as much as 150,000 or more if the 125,000 ha of mangroves were developed. Due primarily to ecological concerns regarding mangrove conversion, the Philippine government is pursuing the alternative of promoting intensification programs to increase production.

THE CRITICAL ISSUES

The locale

The Philippines, Taiwan and Indonesia share a common concern for the adequacy of fry catch from the natural fishery, and for the efficiency of their fry distribution systems to meet annual stocking requirements of their milkfish ponds. Although in years past there had

Table 1.2. Production and value of milkfish from fishponds in the Philippines, 1963-1977. Data in (1) and (2) are from BFAR Fisheries Statistics of the Philippines 1977. Column (3) = (2) ÷ (1). Value computed at estimated wholesale prices.

Year	Ha	(1) Quantity (in kg)	(2) Value (Pesos)	(3) Wholesale price ₱ per kg
1951	82,292	–	–	–
1963	–	62,044,000	103,614,000	1.67
1964	131,367	62,680,000	104,050,000	1.66
1965	–	63,198,000	106,172,000	1.68
1966	137,000	63,654,000	129,855,000	2.04
1967	–	63,912,000	135,493,000	2.12
1968	–	86,811,000	182,441,000	2.10
1969	–	94,573,000	191,038,000	2.02
1970	168,118	96,461,000	252,727,000	2.62
1971	171,446	97,915,320	328,016,320	3.35
1972	174,101	98,927,490	332,379,570	3.36
1973	176,032	99,599,830	434,255,560	4.36
1974	176,032	113,194,870	784,440,450	6.93
1975	176,032	106,460,950	809,103,220	7.60
1976	176,231	112,761,000	845,704,100	7.50
1977	176,231	115,756,000	845,704,100	7.31

[1] Exchange rate used throughout is ₱7.32 = US$1.00.

been legal trade in fry among the three countries, particularly exports from the Philippines to Taiwan, the fry marketing systems in these countries are now essentially closed systems. Each country believes that it suffers a fry shortage. This study is a first step in a comparative analysis of the milkfish fry and fingerling industries of the Philippines, Taiwan and Indonesia.

The major issues in the Philippines can be grouped into two categories: 1) the need to resolve certain allegations of imperfections that exist in the fry gathering and distribution system, and 2) the need to determine the appropriateness of government policy as it relates to milkfish fry.

Alleged imperfections in the fry and fingerling industry

Allegations of imperfections and inefficiencies in the Philippine fry industry come from many sources and provide the rationale for various government regulations and programs that influence the free market gathering and distribution of milkfish fry. Some of the alleged imperfections are rooted in the nature of a commodity that is highly seasonal in supply and experiences year-to-year fluctuations both in specific locales and in total. Others derive primarily from the nature of interactions among the organizations and market functionaries that have evolved over several hundred years to distribute fry from gatherers to fishponds. Three categories of imperfections relevant to this study can be identified; inadequate supply of fry, technical and pricing inefficiencies, and exploitation of other market functionaries by middlemen.

(a) Inadequate supply. Mention has already been made of the Philippine government's concern for the adequacy of fry supply from the natural fishery to meet the recommended stocking requirements of milkfish ponds. There is a commonly expressed fear that there is an annual shortfall in catch. Bardach et al. (1972) claim that the principal restraint, both to development of new areas and universal application of improved technique, is the scarcity of fry. This statement and most others of a similar vein are based on an assumed annual stocking rate of 10,000 fry per hectare. By this standard, the 176,032 ha of fishponds require an annual fry catch in excess of 1.75 billion pieces. Mane (1976) estimates a 36% shortfall in the 1974 requirements of 1.4 billion, and says that the lack of seed is becoming more and more acute. To further substantiate this problem, Librero et al. (1976b) offer some reasons why this alleged shortage has developed: increase in pond area; intensification of stocking rates; consistently high mortalities in collecting, sorting, counting, storing and transporting fry, and the establishment of fishpens in Laguna de Bay. As evidence of the unsatisfied demand for milkfish fry, milkfish producers usually point to the tripling of fry price from ₱25-₱80 per thousand between 1972-1974.

To date, it has proved impossible to statistically substantiate estimates of annual fry catch. In a project for the Bureau of Fisheries and Aquatic Resources (BFAR), Deanon et al. (1974) completed a thorough inventory of fry grounds throughout the country resulting in a 1973 catch estimate of 466 million fry, well below the estimated stocking requirements as pointed out by Bardach et al. (1972) and Mane (1976). Deanon points out, however, that this is almost certainly an underestimate due to the industry's admitted unwillingness to share business information with government researchers whom they fear will use it for tax purposes (R.A. Genaden, pers. comm.).

In addition to annual shortfalls, BFAR is concerned about the industry's ability to provide stocking materials for ponds that lose their initial crops to typhoons and the resulting floods (F. Gonzales, pers. comm.). Implied here is the need for reserve stocks, an insurance scheme in a sense, that will reduce the risk to pond operators located in typhoon prone areas, particularly on Luzon.

(b) Technical and price inefficiency. The second major area of alleged imperfections is that of technical and pricing inefficiency in the fry marketing system. As already noted by Librero et al. (1976b) mortality rates in the gathering and distribution of fry are high; fry may arrive at their destination in such a weakened state that mortality is extremely high during the first few days after pond stocking (C.E. Nash, pers. comm.).

To deal with this issue, I decided to classify reduction in mortality rates in gathering and transport as improvements in technical efficiency. Allegations commonly made by fisheries officials of duplicative buying and selling in the marketing chain, that is, of "too many" middlemen or "too long" marketing chain, would fall under pricing inefficiency. As pointed out by Jones (1972, p. 11) complaints of too many middlemen seem strange to economists who "ask why, if redundant middlemen take excessive profits, other traders or producers do not bypass them". Still, there may be inherent rigidities in the system that make such action impractical, and because policy is often developed from such opinions, the allegation deserves serious examination.

BFAR personnel are also concerned that price does not adequately perform its spatial allocation function, implying that surpluses and deficits are not resolved through arbitrage. Similarly, form price differentials, that is, between fry and fingerlings, have been described as excessive, compared to the fingerling rearing costs involved.

(c) Exploitation. The third major alleged imperfection in the fry industry, is that of exploitation by buyers or sellers at various levels in the marketing chain. Fry gatherers complain that the monopsony power of concessionaires, to whom they must sell their catch, enables the latter to reap inordinate profits at the former's expense. This potential for exploitation has been supported by Librero et al. (1976b) who noted the far greater buying and selling price margin for concessionaires as opposed to that for dealers who also bought directly from gatherers but without the benefit of municipal granted concessions to assure supply. Deanon et al. (1974) have advocated the abolition of the concessionaire system.

Manila pond operators are criticized by pond operators in other parts of the country because of their ability, through vertical integration or partnerships, to control fry supply at its source, to the exclusion of other fry buyers. Manila area nursery pond operators are also alleged to manipulate fry and fingerling prices to their benefit. This view is shared by many regional BFAR personnel.

The foregoing alleged inefficiencies and imperfections include those that can be generalized to the entire fry industry. Localized problems are not included.

Government policy

Within the framework of the overall objective of Philippine government policy to "accelerate and promote the integrated development of the fishery industry . . . through proper conservation and protection" (The Integrated Fisheries Development Plan, 1977-1981, p. i), current milkfish policy has evolved over many years and has several major components:

1) Conservation measures:
   - Prohibition of catching adult milkfish.
   - Designation of one-fifth of each fry ground as fry reserve.
2) Regulation of fry gathering and first sale:
   - Municipal ordinances required to designate fry grounds as concession areas or as "free zones".
   - Awarding of concessions only after competitive bidding.

Prohibition of sale by gatherers other than to designated concessionaire.

3) Regulation of fry trade:
   Exports of fry banned.
   Price ceiling (₱80 per thousand).
   Permits required for domestic interregional fry shipments (suspended in July 1978).
   De facto restrictions on interregional trade until local stocking requirements are satisfied.
4) Supplementing and controlling supply of fry and fingerlings:
   Subsidy programs for small fishponds (less than 10 ha) and for communal waters).
   Induced spawning experiments.

Conservation measures, regulations for fry gathering, the setting of a price ceiling, and the banning of fry exports are all covered in Presidential Decree No. 704 (PD 704) which consolidated all fishery-related policies and regulations in 1975. Fisheries Administrative Order No. 115 (FAO 115) is the legal basis for the permits and auxiliary invoices that were required for interregional fry trade. FAO 115 was in effect at the time of this study but has since been suspended. De facto restrictions on international trade, and policies to supplement the fry supply and to subsidize small fishponds, have their legal basis in various policy directives of the Secretary of the Department of Natural Resources (now Ministry of Natural Resources), of which BFAR is a part.

Certain components of the milkfish policy package do not lend themselves to detailed analysis at present. Conservation measures have been undertaken because it is assumed that the risk of overfishing the fry stock is high. However, no stock assessment data or biological survey are available that would either support or contradict this assumption. Moreover, the designation of one-fifth of each municipal fry ground as a fry reservation began only in 1976 and 1977, and at the time of the study, had yet to achieve uniformity of application. BFAR officials have now designated personnel to coordinate the program.

Programs to control or supplement the supply of fry are also of very recent origin, and data to evaluate their effects are not available in either secondary or primary form. A feasibility study of milkfish hatchery operations is definitely premature, although in this report, some insight into the potential impact of such a hatchery network on the natural fishery has been developed. In 1977, an ongoing audit of the fishpond and communal water subsidy program restricted the availability for research purposes of data on government acquisition of fry and disbursement of fingerlings under this program, making evaluation and appraisal impossible.

There is an underlying urgency to this study. The potential success of induced spawning techniques for milkfish and the subsequent establishment of commercial hatcheries, though heralded by many as the panacea of the milkfish industry throughout the region, pose a major threat to the present gathering and distribution system based on the natural fishery with which hatchery-produced fry would compete. Intelligent policy planning with regard to timing and location of milkfish hatchery production demands thorough understanding of the structure and performance of the present system, so that disruptions to, and displacement of, participants in the natural fishery and its distributors can be anticipated and their impact evaluated.

OBJECTIVES

Because of the inseparability of policy from the conditions it attempts to remedy, the general objectives of this study were to determine the nature of imperfections in the fry

gathering and distribution system, and to examine the extent to which government policy does and can address them.

Specific objectives were:

1. To describe the structure and conduct of the fry gathering and distribution system, with particular attention to:
   a) The extent and nature of the naturally occurring fry resource.
   b) Techniques and methods of fry gathering, catch and effort, employment levels, labor force composition and skill requirements, alternative sources of income and employment, sources of credit, and investment levels and returns to gatherers.
   c) Role of concessionaires, dealers, cooperatives, and other marketing organizations and middlemen.
   d) Present marketing channels for fry, storage, transport, handling methods and costs, margins, sources of credit for middlemen, and patterns of distribution within and between regions.
   e) Fry mortality rates under various distribution alternatives.
   f) Price levels and stability at each link in the marketing chain.
   g) The economic and social relationship between fry gatherers, middlemen, and fishpond and fishpen operators.
   h) Government policies affecting components and overall operation of the fry industry.
2. To evaluate the performance of the fry industry according to the following criteria:
   a) Adequacy of annual fry catch to meet stocking requirements.
   b) Technical efficiency, in terms of mortality rates in storage and transport.
   c) Distribution efficiency in terms of extent of overlapping trade flows.
   d) Profit rates of market intermediaries.
   e) Pricing efficiency--measures of market integration; spatial price differentials vis-a-vis transfer costs; form price differentials vis-a-vis fry to fingerling rearing costs.
3. To assess the effects of government regulations restricting free fry gathering and distribution on the structure and performance of the milkfish industry, and to determine their consistency with overall fisheries development goals.

The creation of time, form and place utilities that result from a marketing system is a form of productive activity often overlooked by producers and consumers, and by government officials anxious to demonstrate their concern for equitable development. Bressler and King (1970, p. vii) have stated their view of marketing goals as follows:

"Although there are many social objectives to which marketing may contribute, the direct and fundamental goals for the marketing system are 1) to provide efficient and economical services and ownership transfers in the movement of commodities from producer to consumer, and 2) to provide an effective and efficient price-making mechanism. Only insofar as the prices that are established through the marketing system transmit the demands of consumers back to producers and transmit the supply conditions forward to consumers with a minimum of lags, imperfections, and distortions, can the economy achieve the efficient allocation and the economical use of resources in satisfying wants.

From this viewpoint, the first objective, relating to efficiency in the handling and transferring of commodities, is simply a specific aspect of the second. The creation of marketing services does not differ from other productive processes in this respect, and the efficient operation of the pricing mechanism includes the economical allocation of resources to marketing uses. Thus, the real and direct contribution of the marketing system is to provide for and participate in price formation, with the understanding that the pricing

system will have as its prime functions the guiding of the allocation of resources into production (including marketing) and the rationing of goods and services in consumption."

The functioning of the pricing system is thus of central importance to marketing analysis, and played a key role in this evaluation of the performance of the Philippine fry and fingerling industry.

METHODOLOGY

Analytical framework

This study combines elements of descriptive, organizational and price efficiency approaches to market analysis. Appendix A discusses these alternative approaches and the rationale for combining elements of all three approaches. These approaches are complementary, and relying on any single approach would unnecessarily limit the usefulness of this study, particularly since the marketing system has not before been described, much less analyzed in toto.

Since this study deals with a specific subsector of the aquaculture industry, the organizational approach (Bain 1968) becomes primarily a descriptive tool. To extend this study beyond mere description to analysis, the price differential (Bressler and King 1970) and organizational approaches were combined. A discussion of the structure of the marketing system and of factors that influence the spatial pattern of fry distribution is found in Chapter 3. Performance dimensions were substantially modified to include spatial and form price efficiency analysis. Profit margins, technical efficiency, and progressiveness are the dimensions to which industrial organization analysis is directed (Bain 1968), and the first two of these were retained. To these were added 1) the adequacy of the annual fry catch to meet annual stocking requirements; 2) distributional efficiency in terms of the extent of overlapping or duplicative trade flows between regions; and 3) pricing efficiency including measures of market integration and spatial and form price differentials. Evaluation of the performance of the fry gathering and distribution system based on these criteria is discussed in Chapter 4.

Data requirements, sources and collection

Secondary data on Philippine aquaculture, except in the very broadest of brush strokes, are nonexistent. Annual statistics show hectares of fishponds and production estimates as submitted by regional BFAR offices. Collection of reliable statistics is, of course, extremely difficult, and area figures suffer from three defects. First, they are overstated to the extent that they include areas within fishpond lease agreements that are not yet fully developed for fishpond purposes. Second, they are understated in that they do not include fishponds—estimated at up to 30% in some regions—that are operational but do not hold the necessary licenses and permits. Third, regional estimates are extremely out of date. Not only have listed owners passed away, but the pond areas have occasionally been converted to alternative agricultural use, primarily to avoid stock losses due to floods.

In contrast, BFAR records of fishery products moving in interregional trade are much more comprehensive. Though not complete at BFAR headquarters in Manila, a careful search of records in all 12 regional and most provincial offices allowed the compilation of a base set of figures on interregional trade in fry. Price data were not collected on any systematic basis by BFAR for fry, however.

The lack of secondary data meant, of course, that reliance would have to be placed on primary data. Six different questionnaires were administered to follow the fry through the marketing channels from gatherers, through concessionaires and dealers to nursery pond operators, and rearing pond and fishpen operators. To supplement and verify the responses to these questionnaires, additional interviews were conducted with knowledgeable BFAR officials and private individuals. Transport rates were collected from Philippine Airlines (PAL), the Philippine National Railways (PNR), William Lines, and private jeepney operators to cover the various air, rail, sea and land alternatives available to shippers of fry.

Given the annual fluctuations in fry catch in specific locations, purposive rather than random sampling became a practical necessity. Tracing only a very small proportion of the fry catch had to be avoided. Because of interest in both intraregional and interregional trade flows, three fry surplus and three fry deficit regions were chosen, based on 1973 fry ground productivity figures as estimated by Deanon et al. (1974) in their study for BFAR. Southern Mindanao, the Western Visayas and Ilocos were designated as surplus regions; Northern Mindanao, Bicol and Southern Tagalog as deficit regions. Limited financial resources for the project, as well as peace and order conditions, made expansion of sampling to other areas impossible. The locations of the 50 fry grounds sampled from these six regions are shown in Figure 1.3. In general, the fry season was followed as it shifted northward from Mindanao to the Visayas, and finally to Ilocos.

Subsequent to interviews with each concessionaire, two to three fry gatherers who sold to that concessionaire were selected as respondents. Also, as part of the concessionaire interviews, a list of the names of dealers or fishpond operators to whom they sold was secured. The list then served as the sampling frame for subsequent interviews. Although this procedure appears extremely complex given the number of transactions taking place, it was not as difficult as at first expected. Dealers were found to concentrate in certain trading centers. General Santos City and Davao City in Southern Mindanao; San Jose, Roxas City, and Iloilo City in Western Visayas, and Dagupan City and Laoag City in Ilocos were quickly identified as the major trading centers in these fry surplus regions.

The names of buyers, provided by concessionaires, yielded for each trading center a fairly complete list of potential respondents. To complete the sampling frame in each location, local BFAR officials and dealers, whose names already appeared on the list, were consulted. Due to the fairly rapid turnover, especially of small dealers, the frame did not always cover the entire population. This was especially true in Dagupan City. However, other trading center sampling frames were reasonably complete, and were adequate for selecting respondents. The sample was in effect defined more by availability of respondents and their willingness to share information than by randomness of selection. In most cases however, all potential respondents on the dealers' lists were contacted.

It was quickly determined that interregional fry trade flows converged in Manila and to the immediate north, in nursery and rearing pond areas in the provinces of Rizal and Bulacan. Purposely leaving interviews in these areas until last, and using the 1975 SEAFDEC-PCARR sample, supplemented by BFAR lists of fry shippers as a sample frame, Manila area nursery pond operators were stratified into two groups—permittees and non-permittees. Permittees were pond operators who held BFAR permits authorizing them or their representatives to engage in interregional shipment of fry. The purpose of this stratification was to aid in determining the effects of the permit system on fry prices and availability in the Manila area.

Rearing pond operator respondents were selected in two ways. BFAR lists were used as a base from which to choose specific geographic areas or municipalities. Once a given locale was selected, town property tax records were used, along with the BFAR list, from which approximately one respondent per 1,000 ha was chosen. Similarly, fishpen operators were

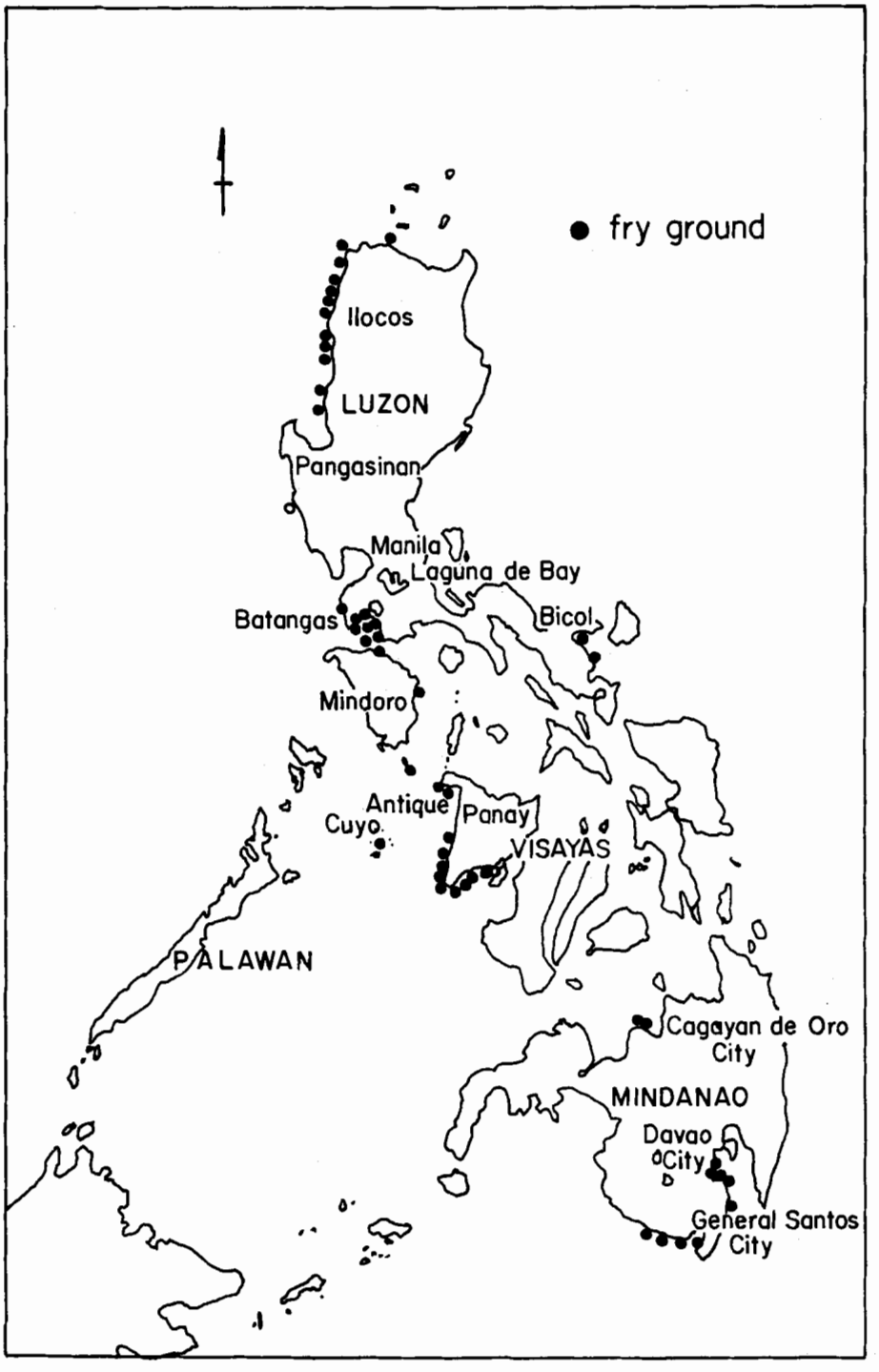


Fig. 1.3. Locations of 50 sample fry grounds.

chosen on a geographic basis from lists of licensees obtained from the Laguna Lake Development Authority (LLDA) for the three Laguna de Bay municipalities of Binangonan, Cardona and Los Baños, proportional to area in production in each of the three locations. These three municipalities contain the major fishpen areas of the lake.

The resulting sample of 264 respondents obtained by the above methods is shown in Table 1.3. Interviews were conducted from March to August 1977, and cover the period January 1976 until the date of the respective interviews. To give an idea of the volume of 1976 catch handled by the respondents, the 36 concessionaires sold a total of 193 million fry, the 33 dealers sold 144 million fry, and the 29 nursery pond operators purchased 376 million fry.

Table 1.3. Sample breakdown.

Region	Fry gatherers	Concessionaires	Dealers	Nursery pond operators	Rearing pond operators	Fishpen operators	Totals	Number of fry grounds
I Ilocos	8	7	10	2	10	–	37	11
II Cagayan Valley	–	1	–	–	–	–	1	1
III Central Luzon	–	–	1	15	19	–	35	1
IV Southern Tagalog	6	8	–	10	14	30	68	11
V Bicol	5	2	–	–	4	–	11	2
VI Western Visayas	19	8	16	2	22	–	67	13
VII Central Visayas	–	–	–	–	–	–	–	–
VIII Eastern Visayas	–	–	–	–	–	–	–	–
IX Western Mindanao	–	–	–	–	–	–	–	–
X Northern Mindanao	4	3	–	–	4	–	11	2
XI Southern Mindanao	8	7	6	–	13	–	34	9
XII Central Mindanao	–	–	–	–	–	–	–	–
Totals	50	36	33	29	86	30	264	50

There are acknowledged constraints to collection of reliable primary data. As soon as the decision was made to make the study's scope national to establish interregional relationships, it became necessary to abandon any behavioral study that could be conducted with a smaller sample in a specific locale during the 8 months available for data collection. A national study was expected to be more useful to governmental policymakers in resolving the alleged imperfections in the fry industry.

Achieving high quality and reliability of data is always a major concern of the researcher, not necessarily alleviated by working to the maximum extent possible with secondary data, which may not have been collected rigorously. Primary data offer certain advantages of verification, achieved through adequate supervision of interviewers and regular editing of questionnaires. However, in cases of "one-shot" interviews, reliance on the memory of respondents for production and price data covering the previous fry season to the present is necessary, and the concern for the accuracy of such information remains. Moreover, there is a natural hesitation on the part of respondents, particularly the larger businessmen, to share their records with researchers. Written records are usually not available, if indeed, they are kept at all. There is a mistrust of interviewers in the Philippines as elsewhere, whom respondents believe may share their responses with tax authorities or other government agencies. For the most part, this problem was overcome through assurances of confidentiality and of our university and research agency affiliation. The interviewers' personalities also did much to elicit the cooperation of respondents. Refusal rates did not exceed 10%,

but were highest among nursery pond operators. With careful editing and re-visits to respondents to resolve contradictions when necessary, a high level of confidence in the primary data resulted. Obvious misrepresentations were discarded.

Another unavoidable limitation in studies of this kind remained of concern, and this was whether or not 1976 was a representative year for the fry industry, suitable for generalization to other years. This study indicates that only in certain areas of the country was the year atypical.

2. Overview of the Fry and Fingerling Industry

DEFINITIONS

Earlier reference was made to a fry industry, a fry marketing system, and a fingerling industry. Although certain aspects have been described by others (Blanco and Villadolid 1939; Frey 1947; Rabanal et al. 1951; Bunag 1957; Blanco 1970a, 1970b), no previous research has dealt with the fry and fingerling industry as a system.

The system has numerous interacting components. The fry industry consists of fry gatherers as producers of fry, of nursery and rearing pond operators as consumers, and of the various middlemen that link these producers and consumers. The fry marketing system is a more restrictive term and refers to that sector of the fry industry responsible for the distribution of fry from fry grounds to fishponds. The fingerling industry, on the other hand, treats nursery pond operators as producers of fingerlings, and fishpen and rearing pond operators as consumers of fingerlings. Nursery pond operators who raise fry to fingerlings are thus a key element as consumers of fry and as producers of fingerlings. Since fry and fingerlings are under certain conditions substitutable as stocking materials for rearing ponds, and fry demand is in part derived from fingerling demand, both fry and fingerling industries must be understood before allegations regarding the fry industry can be resolved.

Important functionaries are defined as follows:

1. Fry gatherer: An individual, usually working as part of a small team, who captures fry along the coastline with various nets and traps.
2. Concessionaire: That individual, partnership, corporation, or cooperative designated by a coastal municipality, usually after competitive bidding, as having exclusive use rights to exploit a given fry ground.
3. Dealer: An individual, partnership, or corporation (other than a concessionaire) engaged in buying and selling of fry. While taking title to the fry, the primary functions of dealers are storage and transport, not form transformation from fry to fingerlings.
4. Commissionman: A buyer's or a seller's representative, who does not take title to fry or fingerlings in his own name, but in the name of the person he represents, and is paid a commission based on the volume of the purchase or sale.
5. Broker: A facilitator of fry and fingerling exchanges between buyers and sellers, who does not take title to the commodity in his own name. Brokers are of two types, based on the means of payment. The first type acts as broker for the seller, stores the fry until a buyer is found, and charges either a flat fee per thousand fry sold, or more likely, a percentage commission (usually 5%) based on the selling price. The second type represents neither buyer nor seller but arranges the exchange between the two, and has a return based on the spread that the individual can create between the selling price and the buying price.
6. Runner: A smuggler of fry, who acts as a dealer or as commissionman. Frequently, a runner is financed by a particular buyer for whom he is smuggling.
7. Nursery pond operator: One who specializes in raising fry to fingerling size for sale to rearing pond or fishpen operators.
8. Rearing pond operator: One who raises either fry, fingerlings, or a combination of both to marketable size in a pond.

9. Fishpen operator: One who raises fingerlings to marketable size in a fixed bamboo and net enclosure rather than in a pond.

As in any large-scale business activity, functionaries in the fry and fingerling industries cannot always be as clearly delineated as the above categories imply. Fry gatherers occasionally double as runners. Nursery pond operators also serve as dealers and brokers. Commissionmen can also perform functions of dealers and brokers. These categories will become clearer later.

OVERVIEW OF THE FRY INDUSTRY

Sources of supply

Fry grounds are located throughout the Philippines, although they are more prevalent on the western and southern coasts of islands than on eastern and northern shores (Fig. 2.1). Fry are available throughout the year from one location or another, but individual fry grounds experience marked peaks and slack periods at certain times of the year. Production

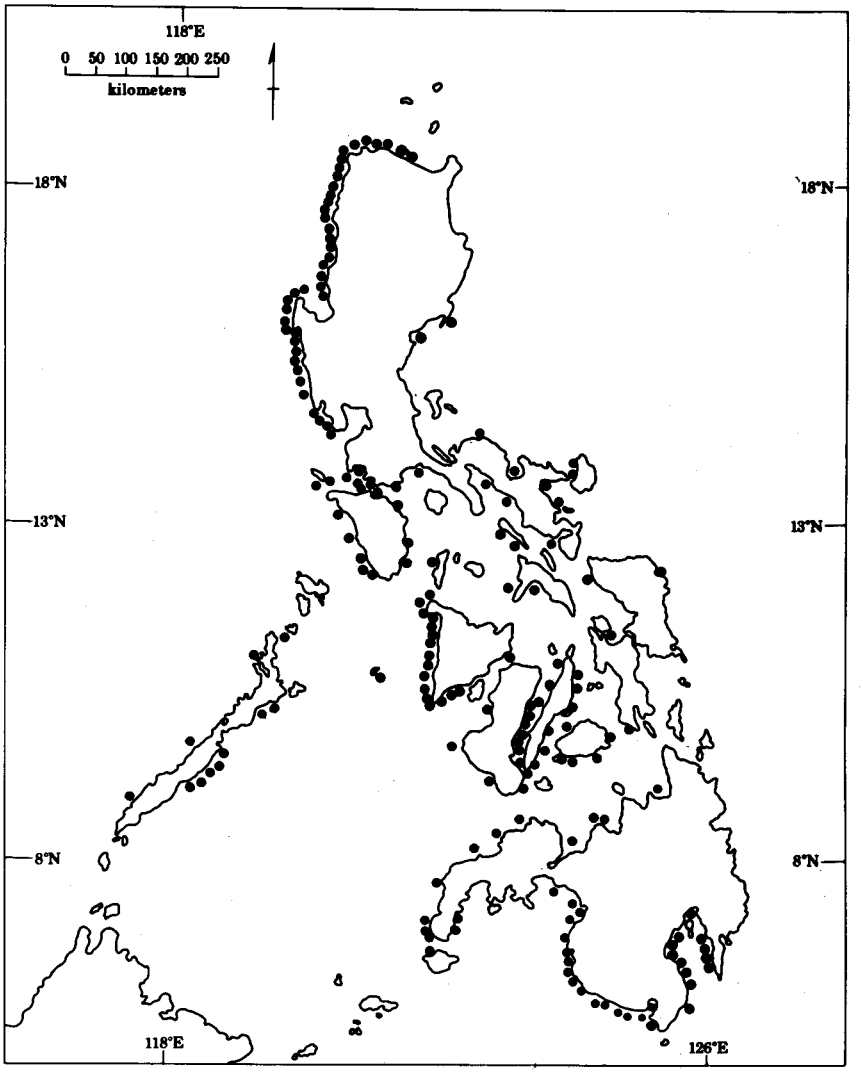


Fig. 2.1. Fishing grounds of milkfish fry. (Source: Ohshima 1973).

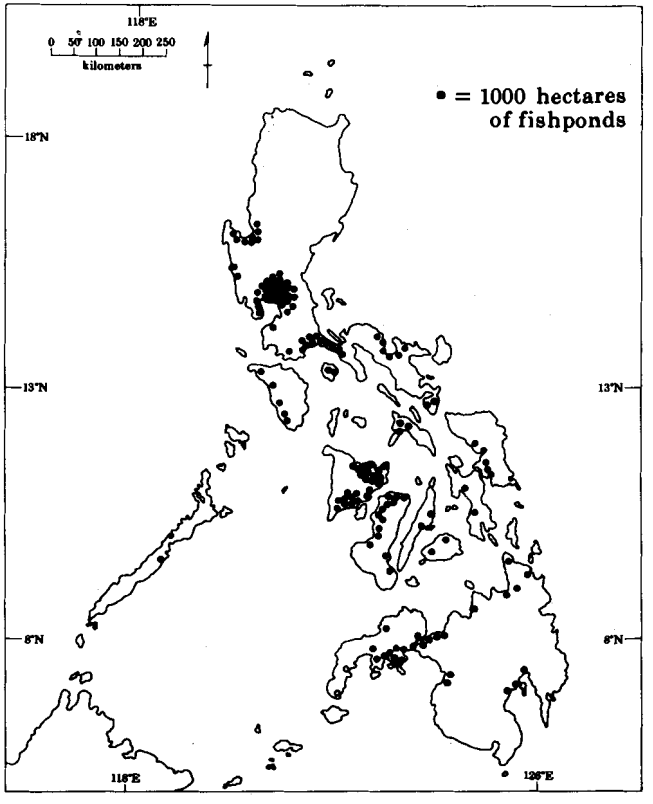


Fig. 2.2. Distributions of fishponds. (Source: Ohshima 1973).

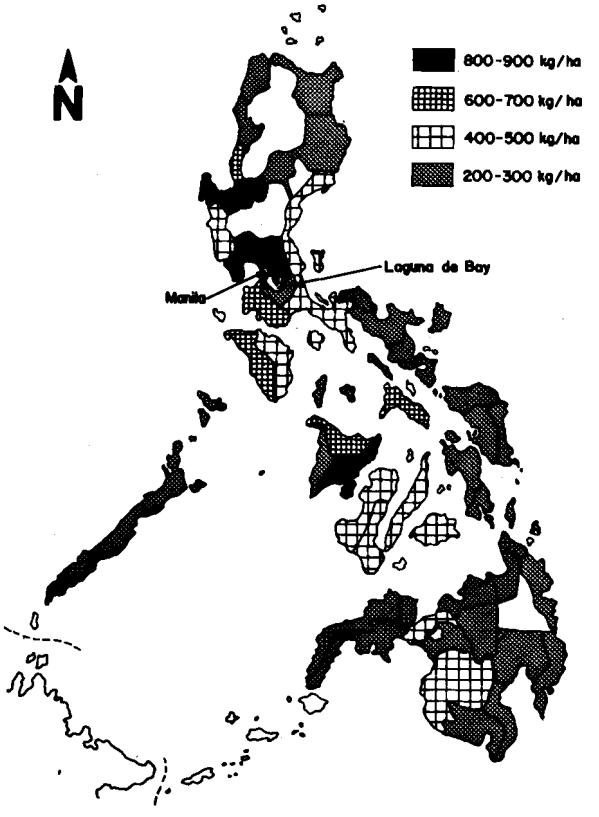


Fig. 2.3. Annual productivities of fishponds. (Source: Ohshima 1973).

from fry grounds nationwide in 1976 showed seasonality (Table 2.1). Librero et al. (1976b) found a similar seasonal pattern for 1974 (Table 2.2). In 1976 the season began earliest in Mindanao where it peaked in May. After a decline in production through August, a second smaller peak occurred from September to November. In the Visayas the season began in April, peaking in May. In 1976 Northern Luzon experienced an early typhoon that effectively stopped the fry season there at the end of May. This appears atypical, however, in that the 1974 season continued well beyond that date, as did the 1977 season. Although neither Luzon nor the Visayas experienced a second smaller peak similar to Mindanao's in 1976, both did so in 1974.

According to some businessmen in the fry industry, a further fluctuation in fry supply occurs from year to year. Although there is no concrete evidence to support this statement, or to enable some projection of possible cyclical fluctuations in the Philippines, Taiwan also experiences a widely varying catch from year to year. For instance, over the decade 1963-1972, Taiwanese catch varied from a low of 28 million in 1967 to a high of 207 million in 1970 (Chen 1976). However, there would be reason to suspect that Philippine fry catch, covering a much wider geographic area, might be more stable from year to year. Indeed, variation in annual catch was more apparent in Luzon than in the Visayas and Mindanao which are relatively free from typhoons. Respondents in Mindanao reported only a steady growth in annual fry catch over the past decade.

In addition to annual fluctuations, fry catch for a given level of effort varies from day to day within the month. Peak gathering periods occur during the monthly high tides associated with full and new moons. SEAFDEC researchers in Hamtik, Antique province in the Western Visayas, have reported that shore fry catches were highest for the 2 to 3 days immediately after the new and full moon, and that offshore catches from an otoshi-ami (not a method used by fry gatherers) were greater 1 to 2 days prior to the new and full moon

Table 2.1. Fry catch by month expressed in percentage of annual catch for 50 fry grounds, 1976.

Region	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Luzon	00	00	05	14	52	14	05	04	05	01	01	(a)	100
West Visayas	00	00	(a)	14	38	24	11	05	03	03	01	(a)	100
Mindanao	01	(a)	17	21	28	16	02	(a)	04	03	06	(a)	100
Philippines	(a)	(a)	10	18	34	19	05	02	03	03	04	(a)	100

(a) Less than 1%. Cuyo, Palawan fry ground included in West Visayas figures rather than in Luzon due to its geographic proximity to the former. All other data from survey data.

Table. 2.2. Fry catch by month expressed in percentage of annual catch, 1974.

Region	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Luzon	00	02	08	09	16	16	09	08	15	16	(a)	00	100
Visayas	02	01	04	07	19	27	18	03	07	11	03	00	100
Mindanao	00	03	09	15	25	20	10	(a)	03	07	04	03	100
Philippines	01	02	07	11	24	19	12	04	08	11	02	01	100

(a) Less than 1%. Source: Librero et al. (1976b). Compiled from Appendix Tables 6, 7, and 8 for concessionaire purchases only.

(SEAFDEC 1975). Unfortunately, no daily price data were collected either by the SEAFDEC-PCARR survey or by this survey that might indicate the price effects of such day-to-day catch fluctuations. The price effects of month-to-month fluctuations are great, however.

In summary, fry supply in the Philippines a) shifts from location to location as the year progresses; b) is characterized by extreme seasonality with marked peak and slack periods, and c) fluctuates from year to year, though probably to a lesser extent than in Taiwan.

Fry requirements

As fry supply points are dispersed nationwide, so too, but to a lesser degree, are fishponds that require fry for milkfish rearing (Fig. 2.2). Fishponds are concentrated in the provinces of Iloilo (17,373 ha), Quezon (16,390 ha), Zamboanga del Sur (16,279 ha), Bulacan (16,173 ha), Capiz (11,240 ha), Negros Occidental (10,621 ha), Pangasinan (9,544 ha), and Pampanga (9,209 ha) (BFAR 1976). Highest average annual productivity of more than 800 kg/ha is achieved in Pangasinan, Bataan, Pampanga, Bulacan and Rizal provinces in Luzon, and in Iloilo province in the Western Visayas (Fig. 2.3). The number of hectares of fishponds dramatically increased by 28% in the past decade (1966-1975), indicating a growing demand for fry and fingerlings. Annual productivity per hectare increased from 464 kg in 1966 to 604 kg in 1975.

During the same period, production of marketable milkfish increased by 67% but not all of this increase was due to increased fishpond area and increased productivity. In the early 1970s, an alternative method of rearing milkfish developed when the first fishpens were established in Laguna de Bay southeast of Manila. In 1974 fishpens were stocked with an average of 35,560 fingerlings per hectare, and annual yields averaged 3,798 kg/ha (Nicolas et al. 1976). Fingerlings to stock these fishpens were reared in nursery ponds in Rizal, Bulacan, and Pampanga provinces north of Manila. The early success of the fishpens attracted Manila businessmen, professionals, and even movie stars until a peak of almost 7,000 ha was reached in 1975. However, owing to the failure of many of these inexperienced entrepreneurs, the number of hectares of fishpens steadily declined to less than 3,000 ha in 1977. The Laguna Lake Development Authority had licensed 2,694 ha by July 1977, but this figure is probably low due to operation of unlicensed fishpens and understatement of actual area by owners. Consequently, demand for fingerlings and the derived demand for fry from this sector was also reduced. By 1979, the fishpen area was again on the increase.

In the absence of secondary data on historical fry prices or catch, it is impossible to derive any functional supply or demand relationships. However, in an attempt to make broad statements regarding demand and the influence on demand of the expansion of fishpond and fishpen area, primary data on historical prices were collected during the field survey. Nursery pond operators in Malabon, Metropolitan Manila, where for generations families have been in the fingerling business, were asked to recall from memory—most had no written records—high and low fry prices since 1966. All respondents reported prices which exhibited no marked upward trend until 1970, after which both the highest and the lowest average monthly prices during the year increased dramatically (Fig. 2.4).

The general increase in fry prices after 1970 was confirmed by fry businessmen in Iloilo and Antique provinces in the Western Visayas, who attributed the price rise to increased demand by Manila area dealers and nursery pond operators. As price increases coincided with the introduction of fishpens, which were supplied by these nursery pond operators, it appears that fishpens, rather than the steadily rising fishpond area, were the major cause of these price increases. Fry catch, of course, may also have been low during this period, but respondents claimed only a steady increase in nationwide catch, perhaps

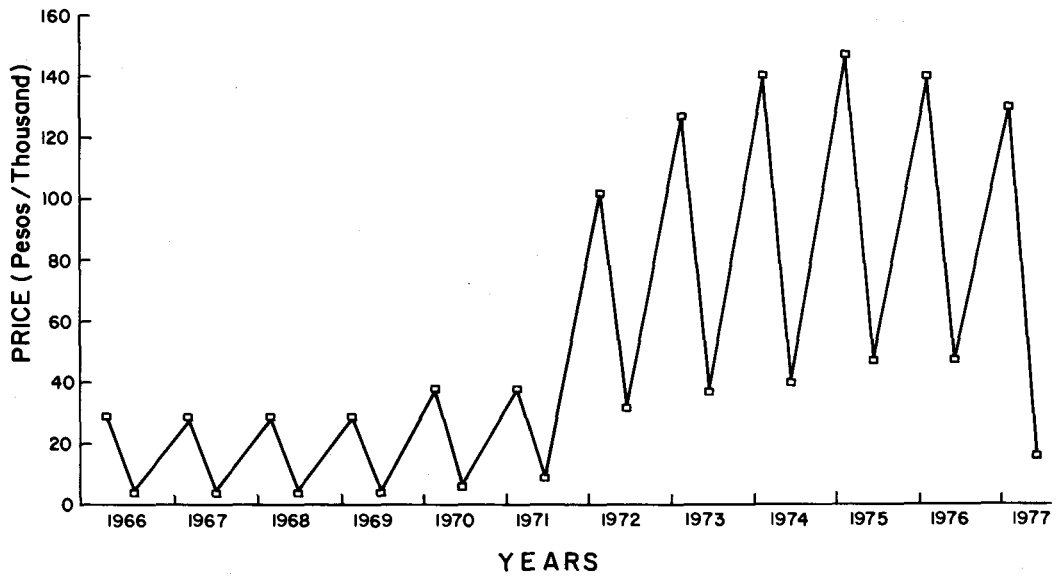


Fig. 2.4. Annual fry prices in the Manila area.

elicited by the higher prices. This observation that increased demand, rather than reduced supply, caused upward shifts in prices, was evident in milkfish production figures which also steadily increased (Table 1.2).

Significant economic characteristics of fry

There are certain economic characteristics of fry that influence the structure, conduct and performance of the fry industry. The major characteristic is seasonality of catch which causes extreme price fluctuations. Since fry are the major input expense for rearing pond operators—31% of operating costs (Librero et al. 1977)—these fluctuating prices have a strong influence on timing of stocking, particularly for smaller fishpond operators who make only a single stocking during the year. Seasonality and the associated risk that bad weather or other factors may bring a sudden end to the fry season also influences pricing decisions of concessionaires who are attempting to recover their concession fee as early as possible in the fry season.

Milkfish fry are a highly perishable commodity. Mortality occurs at all stages in the fry industry. Time is of the essence, especially in the first week following catch. Fry dealers and concessionaires consider three to four days without feeding, the longest period fry can be stored in temporary containers without risking high mortality. A seller who fails to arrange for a buyer before the end of these periods will certainly lose his fry unless he sells them to the first available buyer regardless of price offered.

Because of their perishability, fry can also be differentiated depending upon their strength. Experienced buyers and sellers are able to distinguish between strong and weak fry by tapping the storage containers to observe movement or lack thereof. Depending upon whether or not the buyer believes the weak, sluggish fry can be reconditioned through storage and feeding, the price offered will be different. The price of weak fry is often discounted by 50%. Apart from this type of differentiation which results from the distances

that fry travel and the care with which they are handled, fry are a homogeneous product. Each fry-catching province in the Philippines claims that its fry are stronger, grow faster, and suffer less mortality during the rearing period. Dealers and pond operators who purchase from all regions of the country believe that no one has an inherently superior product. However, fry caught early in the season are preferred because the presence of predators is believed to be less. Fry from nearby sources are preferred to those from distant sources because of the stress that transport causes. The product is thus differentiated based on its characteristics at time of exchange, rather than on any geographic nonhomogeneity at time of catch.

Finally, fry are usually bought and sold in indivisible lots of 1,000 individuals. Prices are quoted in pesos per 1,000 fry, and lots of 1,000s or multiples of 1,000 are used as basis for counting fry. As will be discussed in more detail in Chapter 4, difficulty in accurately counting fry leads to serious problems in the industry. Sellers are usually asked by buyers to include an additional allowance, or *pasobra,* of up to 20% to cover expected mortality and possible undercounting. Adjustments in the allowance are often made in lieu of price reductions for weak fry. These adjustments meant that it was extremely difficult to accurately measure the exact quantity and quality of fry sold for a given price. This difficulty resembles that faced by researchers in other locations when examining transactions of a crop that has no apparent standard of measurement and no standard of grading (Jones 1974). The cost of observing sufficient individual transactions to make the necessary quality gradation distinctions was thought to be too high for the project. Therefore, prices and quantities are rough estimates only. The *pasobra* or automatic allowances reported are averages over the year's transactions as usually practiced by respondents.

The concession system: exploiting the fry resource

Milkfish are essentially a fugitive common property resource, but in 1932, the Philippine government legislated Act 4003 which provided for the establishment of resource use rights by empowering coastal municipalities to grant exclusive fishing privileges for fry through a bidding process for the fry ground concession. The purpose of this legislation was to provide a source of municipal income and this potential has led to extensive adoption of the concession system by municipalities throughout the country. Of the 50 fry grounds included in this study only three had no concessionaire.

For most municipalities the income from the concession represents a significant proportion of total municipal income. In the 35 municipalities from which municipal income data were collected, concession fees averaged 12.7% of total 1976 calendar year income (Table 2.3). Of these, the highest was Hamtik, Antique province, Western Visayas where 49.9% of municipal income came from the fry concession in 1976, despite a 28.6% drop in the concession fee from the previous year. Of all provinces in the Philippines, Antique appears to be the most dependent upon fry concession income. The total ₱1,457,000 in concession fees represented 21.2% of the ₱6,910,948 income to the 15 coastal municipalities in the province.

Concessions are awarded on the basis of competitive bidding held at the municipal hall before the fry season begins. Public advertisements and letters of invitation are used to attract bidders. In the event that the upset bid amount is not met, the municipality may designate a permittee to operate the fry ground in the same manner as would a concessionaire. In 1976, three of the 50 sample fry grounds were awarded on permit basis. This does not include the three free zones mentioned earlier. Concession rights to the remaining 44 were awarded after competitive bidding. Successful bidders were required to pay the full amount

bid on the day of bidding (28% of the cases), or to make an initial deposit ranging from 10-50% of the full concession fee. In the remaining cases, payments were scheduled over a specified period. The vast majority of municipalities allowing these interest-free installments scheduled them over a period of up to three months following the bidding. Only one municipality allowed an installment payment to be made after the fry season was over. Of the 36 concessionaires interviewed, all but one were expected to make payment in full by the end of April, that is, before the peak of the fry season. The need for up-front capital to make concession payments has important implications, as shall be shown, for risk transferability and for the flow of financing in the fry industry.

Table 2.3. Concession fees as a percentage of municipal income from selected fry grounds, 1976. Sources of data on municipal incomes are municipal and provincial treasurers; information on concession fees is from municipal treasurers, BFAR regional offices and concessionaire respondents. Note that these 35 fry grounds are not necessarily included in the sample for the overall study.

Municipality	1976 Income	1976 Concession fee	Concession fee as % of income
Pasuquin, Ilocos Norte	₱ 874,466	₱101,000	11.5
Paoay, Ilocos Norte	963,719	90,100	9.3
Burgos, Ilocos Norte	241,634	5,000	2.1
Pagudpud, Ilocos Norte	144,793	6,000	4.1
Bangui, Ilocos Norte	255,190	2,000	0.8
Santa Cruz, Ilocos Sur	419,938	88,512	21.1
Candon, Ilocos Sur	652,141	67,051	10.3
Santa Maria, Ilocos Sur	172,044	15,000	8.7
Cabugao, Ilocos Sur	132,329	70,500[a]	36.8
Bauan, Batangas	2,500,000	37,000	1.5
Balayan, Batangas	1,020,030	111,000	10.9
Nasugbu, Batangas	1,353,184	30,500	2.2
Taal, Batangas	1,000,000	16,000[b]	1.6
Sagnay, Camarines Sur	156,462	25,670	16.4
San Jose, Camarines Sur	157,187	68,000	43.3
Tiwi, Albay	345,448[c]	55,000[d]	15.9
San Jose, Antique	1,133,374	80,000	7.1
Hamtik, Antique	500,678	250,000	49.9
Anini-y, Antique	272,822	130,000	47.7
Dao, Antique	419,174	45,000	10.7
Belisan, Antique	315,441	102,000	32.3
Patnongan, Antique	427,064	no concession[e]	–
Bugasong, Antique	557,013	100,000	18.0
Laua-an, Antique	278,844	47,000	16.9
Barbasa, Antique	510,504	125,000	24.5
Tibiao, Antique	467,576	52,000	11.1
Culasi, Antique	523,451	185,000	35.3
Sebaste, Antique	400,907	190,000	47.4
Pandan, Antique	420,392	55,000	13.1
Libertad, Antique	306,380	60,000	19.6
Caluya, Antique	202,964	36,000	17.7
El Salvador, Misamis Oriental	197,899	15,000	7.6
Santa Cruz, Davao del Sur	931,247	64,902	7.0
Malalag, Davao del Sur	528,848	517 (permit)	0.1
Glan, South Cotabato	500,273	131,772	26.3
Average 35 fry grounds:	500,950	70,215	12.7

[a] ₱59,000 still owed to municipality (6/28/77). Percent computed as if paid.
[b] ₱11,000 still owed to municipality (3/23/77). Percent computed as if paid.
[c] FY 1976-1977 income.
[d] 1977 concession fee. No bidding in 1976.
[e] Concession run by municipal council.

PD 704 limits the length of concession contracts to five years, although almost all are shorter. During the rapid price increases in the early 1970s, municipalities sought to capitalize on the growing interest in and increased competitiveness for fry grounds by offering shorter-term contracts. At present, one to three years is the norm, with concessionaires, unless they foresee future losses, preferring the longer-term contracts so as to recover their equipment investment costs.

As is typical of fishing businesses in the Philippines and other parts of Southeast Asia, single proprietorships and partnerships were by far the most common forms of concession business organization. Of the 36 concessionaires, 16 were single proprietorships, 18 were partnerships, one was a cooperative, and one was a corporation. Fry concessions were thus primarily directly supervised by "owner-operators." The use of dummy bidders was occasionally practiced, particularly by those bidding on fry grounds in several different provinces. In these cases, as used by three respondents, a resident of the municipality would bid on behalf of an outside financier, who in return would give him a share of the partnership by, say, naming him fry ground manager with a corresponding monthly salary. Concessionaires who used this procedure claim that it gave them an advantage in municipalities that preferred not to award the concession to outsiders for fear that payment would be more difficult to collect in the event of a bad season.

Municipal preferences for local or outside concessionaires were mixed and were often based on previous experiences. Some local concessionaires complained that outsiders were more likely to resort to offering bribes, or *tong* to municipal officials to ensure award of the concession. Accurate data on this were, of course, extremely hard to gather, but concessionaire respondents admitted to five cases of *tong* payments representing 10% of the fry grounds surveyed, and ranging from ₱1,000 to ₱100,000. The great majority of municipalities awarded their fry concessions competitively through open or closed bidding as required by law.

Fry gatherers fishing within concession grounds are required to sell their catch to the concessionaire, who has exclusive rights to the area. Of the three basic types of buying and selling arrangements between gatherers and concessionaires, the most widely practiced is straightforward purchase by the concessionaire at a price per thousand individuals or fraction thereof agreed upon at the time of sale. In these cases the fry gatherers are required to give an extra automatic allowance, or *pasobra*, that ranges anywhere from 10% to as high as 100%. Most commonly the *pasobra* is pegged by the concessionaire at 20%, which means that for every 1,200 fry the gatherer sells to the concessionaire, he or she is paid for only 1,000. Since the *pasobra* is usually fixed at some specified amount, it does not serve as an incentive to gatherers to take more care with their gathering to reduce stress on fry.

The other three fry grounds, all in Ilocos Norte, practiced a combination of two other systems of labor utilization and payment. One group of gatherers works directly for the concessionaire, is paid a nominal monthly salary, is provided with food and shelter, and receives a percentage share of the concession profits. The second group, often working alongside the employed gatherers, shares its catch with the concessionaire but gets no share of the profits. Share basis gatherers such as these are called *sungyaman* and are under contract to provide one-half to one-third of their catch free to the concessionaire, with the concessionaire retaining the option to purchase the remainder. If the concessionaire's option is not exercised, the gatherer is then free to sell his share to whomever he pleases. These two systems—employed gatherers and *sungyaman*—are apparently the traditional form of relationship between gatherers and concessionaires, but have now given way to the buyer/seller relationship common in the other parts of the country. The traditional methods give concessionaires theoretical control over the number of fry gatherers operating in any given fry ground while the strict buy-and-sell arrangement does not. The use of the word

"theoretical" is deliberate because smuggling of fry is prevalent despite this system, and may even be encouraged by it.

Concessionaires also serve as a major credit source for fry gatherers, both for in-kind and cash loans. Financing is often necessary for the gatherer to purchase gathering and temporary storage equipment. About 40% of the gatherers not employed by concessionaires obtained loans in the form of equipment to begin gathering as soon as the fry season began. Of the gatherers who were loaned gear, 45% repaid the concessionaires at no interest through deductions from their catch revenues, 55% returned the equipment to concessionaires either at the end of each gathering day or at the end of the season. Gear loans enabled gatherers to begin gathering with no capital outlay and assured the concessionaires of supply. Loans of ₱25 to ₱250 were extended to 12% of the gatherers and all but one were able to repay these interest-free loans.

Of the gatherers, 36% also received other amenities from concessionaires such as food, clothing, medical attention, and gifts on special occasions. However, only 8% received amenities valued at over ₱50. Cooperative members received participation bonuses from their cooperative which served as their concessionaire. The actual degree of support given gatherers by concessionaires, besides loan of gathering gear, was quite small, averaging only ₱737 per concessionaire in 1976. The per-gatherer amount was approximately ₱7. Sixty-four percent of the fry gatherers received no amenities at all from their concessionaires.

This level of support from concessionaires to gatherers would appear to provide insufficient evidence of a patron-client relationship between the two. Although the fry gatherer-concessionaire relationship in the Philippines is one of mutual benefit for guaranteed outlet and supply as far as provision of catching gear is concerned, it does not approach the level of complexity and mutual obligation as found in patron-client relationships elsewhere. There are two major reasons for this. First, concessionaires are often outsiders with frequent turnover, and are not always well known to fry gatherers who live along the shores of the fry grounds. Secondly, and more importantly, because fry gathering is seasonal, it is really only a part-time activity. Librero et al. (1976a) found that fry gatherers spend an average of slightly over three months each year in this type of work. Their families typically have numerous other income-earning activities, primarily fishing. Schoolchildren, especially, gather mainly during school holidays, which fortunately coincide with the peak fry season.

Only 22.1% of income for households engaged in gathering comes from that source (Table 2.4). Average annual per capita income for households of fry gatherers is ₱704,

Table 2.4. Annual household income from fry gathering and other activities, 1974. Data are from Librero et al. (1976a) (table 7, p. 13; table 8, p. 15; table 40, p. 88; table 41, p. 90, and Appendix Table 4).

Regions	Household fry gathering income ₱	%	Income from other activities of gatherers ₱	%	Income from activities of non-gatherers ₱	%	Total family income from all sources ₱	Average size of household	Average annual per capita income ₱
Ilocos	1905	36.5	1819	34.8	1500	28.7	5224	6.7	780
Cagayan Valley	609	15.1	2703	67.2	713	17.7	4025	6.7	601
Central Luzon	1314	34.3	2088	54.5	428	11.2	3830	5.1	751
Southern Luzon	896	20.7	2395	55.4	1036	23.9	4327	6.3	687
Bicol	1623	16.6	2675	27.4	5450	55.9	9748	4.5	2166
Western Visayas	1226	31.0	1773	44.8	955	24.2	3954	6.4	618
Central Visayas	1594	30.4	2864	54.7	779	14.9	5237	6.7	782
Western Mindanao	2040	32.4	1794	28.5	2458	39.1	6292	6.9	912
Northern Mindanao	670	21.7	740	24.0	1677	54.3	3087	6.8	454
Southern Mindanao	770	21.3	2352	64.9	500	13.8	3622	6.3	575
Philippines	998	22.1	2225	49.3	1289	28.6	4512	6.4	705

almost identical with per capita income levels of fishing households (Smith et al. 1980), but less than half the poverty threshold established by the Development Academy of the Philippines (Abrera 1976).

It is also interesting to note in passing the age breakdown of fry gatherers and their families. It is a common misconception that fry gathering is the domain of older people and of young children. Data from Librero et al. (1976a) clearly refute this and show the average gatherer's age is 39. Seventy-eight percent of fry gatherers were male.

Municipal fry grounds not designated as concessions are known as free zones. Gatherers in these zones are allowed to sell to whomever they please. There is evidence that the resulting competition between dealers to buy the gatherers' fry increases the prices that gatherers receive (Librero 1976a). Gatherers in free zones do not benefit from the loan of gathering equipment normally provided by the concessionaire, however. Free zones remain greatly outnumbered by concessions, and production from these zones is negligible in terms of total fry production. Two free zones produced only 1.7% of the 196.3 million fry that were caught in 1976 from the 50 fry grounds surveyed.

Fry gathering techniques

There are a number of different methods used to gather fry, ranging from the simple scissors dip-net *(sakag)* that can easily be used by children, to the more sophisticated bulldozer which can be operated with a motorized vessel. Descriptions of the most common methods follow, taken in part from "The Philippines Recommends for Bangus" (PCARR 1976):

Sakag (scissor net): (Fig. 2.5). Made of either sinamay (abaca) or cotton netting and mounted on a collapsible, triangular frame. Generally used in wading depths by a single gatherer.

Sagap (fry seine): (Fig. 2.6). A seine made of either sinamay, nylon, or fine-meshed cotton netting measuring about 1.5 m wide and up to 5 m long. Two gatherers, one at each end, drag the seine along the shoreline. *Sayod* is a longer version of the *sagap.*

Sweeper: (Fig. 2.7). Fan-like structure composed of whole bamboo to enable it to float, below which is strung a bag net. The end is made up of whole bamboo in a rectangular shape, wrapped around with fine-mesh netting where the fry are collected. The sweeper is usually pushed by a single gatherer from the catching end.

Fry trawl: (Fig. 2.8). A longer version of the *sagap,* with a bag end in the middle. Two gatherers, one at each end, drag the fry trawl along the shoreline. The net itself is supported by floats and weighted on the lower edge.

Bulldozer: (Fig. 2.9). Essentially a portable type of *saplad,* operated like a push net. The V-shaped wings and box end use whole bamboo to keep the gear afloat. Sinamay cloth or other fine-meshed netting forms the box crib. Above the crib is a platform upon which the gatherer can stand, propelling the gear with a bamboo pole.

Saplad (set fry trap): (Fig. 2.10). A stationary bamboo and net trap set at the mouth of rivers, estuaries, and tidal creeks. Consists of a V-shaped barricade of crushed bamboo set firmly into the bottom facing downstream. At the point of intersection of the crushed bamboo walls is an opening through which the fry enter the *saplad* proper, a half-hoop fine-meshed net of sinamay fiber cloth 1.5 m long and 60 cm wide and held in place by two parallel bamboo poles. The trap is set in shallow water about 1 m deep. A number of *saplad* together may span the whole width of a tidal creek.

Fig. 2.5. "Sakag" in General Santos City, South Cotabato. This photograph shows a variation of the usual scissor net which is about the same size.

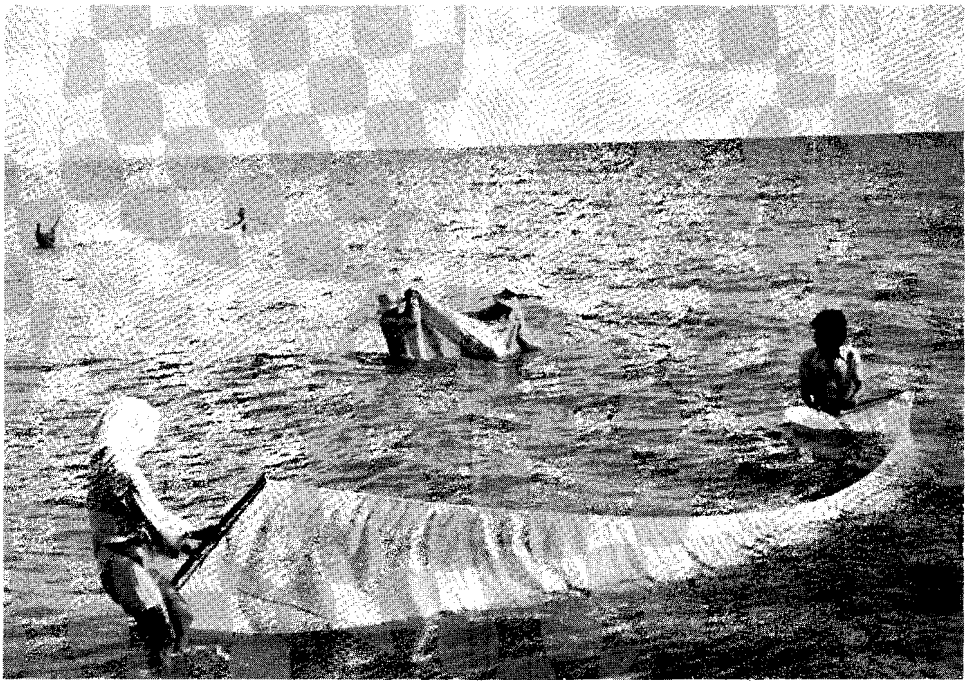


Fig. 2.6. "Sagap" in Hamtik, Antique Province, Western Visayas. This is the most commonly used fry gathering gear in the Philippines.

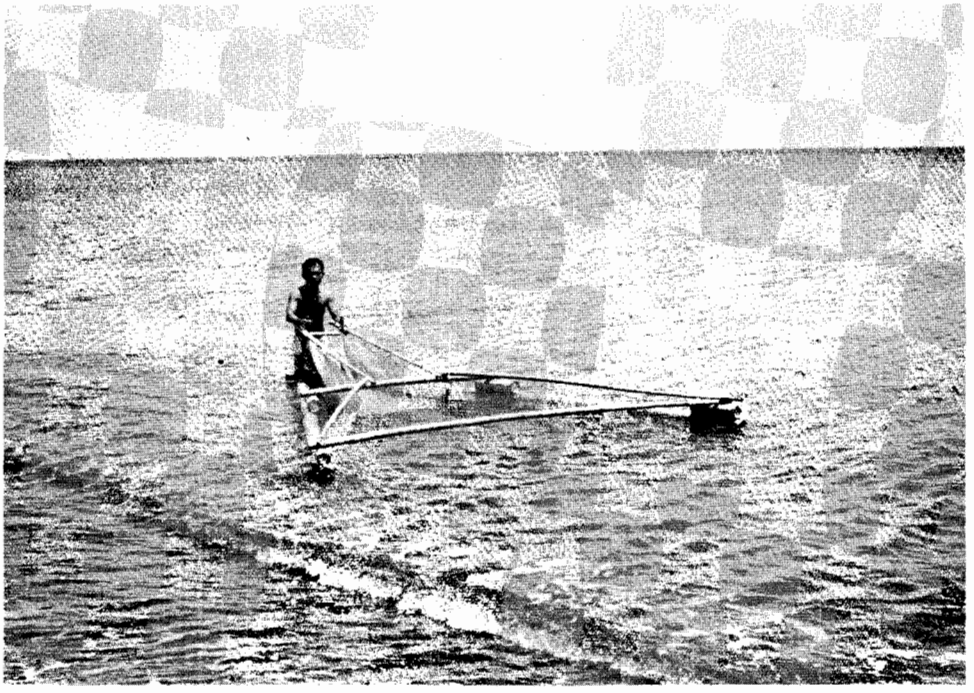


Fig. 2.7. "Sweeper" in Hamtik, Antique. This gear can be used by a single fry gatherer.

Fig. 2.8. "Fry trawl" in General Santos City, South Cotabato Province, Mindanao.

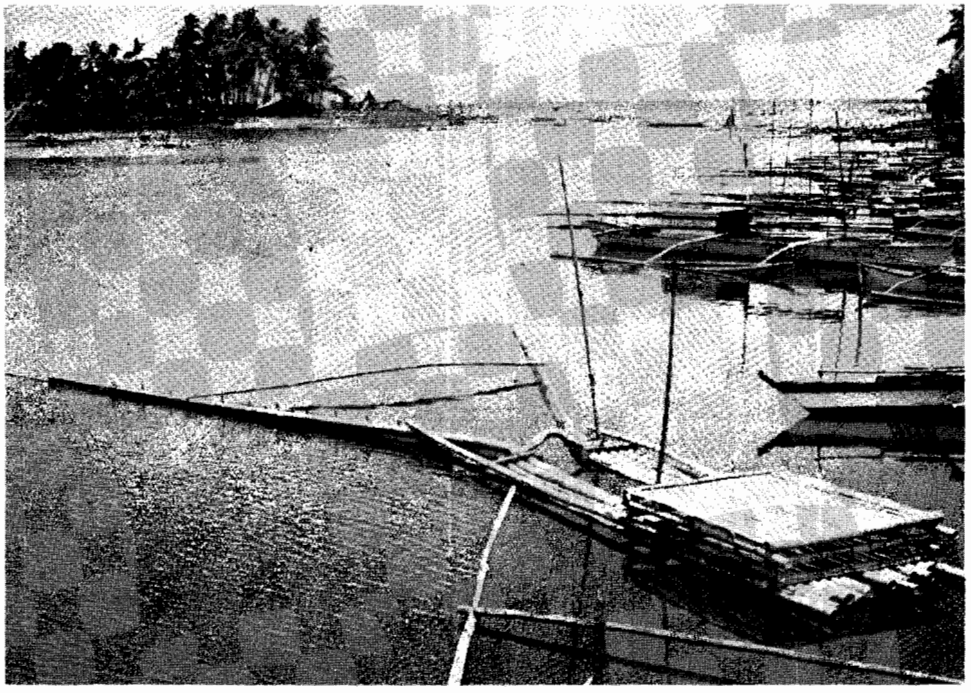


Fig. 2.9. "Bulldozer" in Hamtik, Antique. This gear can be used at night at depths beyond wading depths.

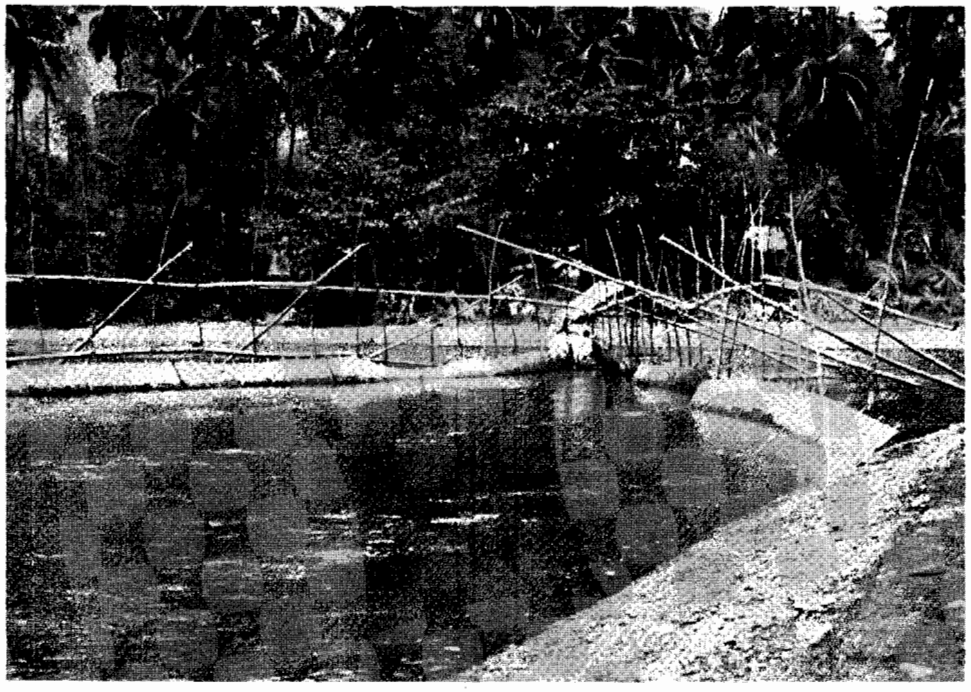


Fig. 2.10. "Saplad" set in river mouth near Barbaza, Antique Province. This is the most productive type of fry gathering gear.

By far the most common method used by gatherers is *sagap* (Table 2.5). In certain parts of the country, the *sagap* has been replaced by the more recently developed fry trawl, bulldozer, and sweeper, all of which produce higher catch per unit effort. Antique Province in Western Visayas has been the center of these technological improvements, the fry trawl having been introduced 20 years ago, the bulldozer 10 years ago, and the sweeper just five years ago. As Table 2.5 indicates, these methods have been slow in spreading to other areas of the country. In fact, during the survey, several locations were discovered where fry gatherers had deliberately resisted the introduction of the fry trawl because they thought it would displace some of the gatherers using *sagap*, and give unfair advantage to those few who could afford this more expensive gear.

Gatherers work in teams, the composition of which depends upon the gear used. *Sagap* requires two members to use the net, and an optional third member to carry fry from the net to a basin on shore in which fry are temporarily stored, and to sort out predators and other unwanted species. The attractiveness of the *sakag* and the sweeper comes from their being easily handled by a single gatherer. Bulldozers are used primarily at night with petromax lanterns by a pair of gatherers who pole the gear at depths of up to 3 m, beyond the reach of *sakag*, *sagap*, fry trawls, and sweepers, all of which are limited to wading depth. *Saplad*, fixed in creek mouths, is most efficient during the two monthly high tide periods, when it is often operated 24 hours per day by teams of gatherers. Three eight-gatherer teams who used a single *saplad* in Antique were able to catch three million fry in three days of a single high tide in May 1977. Smaller groups may operate the *saplad* during nonpeak high tides. Revenue from the daily catch is usually divided equally among team members, with an extra share going to the owner of the gear.

There is definite skill associated with gathering, and interviewers were often referred to particular gatherers or family teams who had the reputation of being the best in the barrio. Reputation seems to stem from working harder when gathering, and not gossiping with other gatherers, for there is no doubt that gathering is often a social occasion.

An attempt was made to determine at what lowest level of catch per hour gatherers would forego gathering for some other activity. Surprisingly, gathering continued at very low catch levels because the respondents said the activity was fun. Of course, this is understandable when gatherers are young children, but family groups would also gather in the early evening when catch rates per hour were less than 50 fry. At an average price received

Table 2.5. Gathering methods used by region, 1976, expressed as percentages.

Method	Luzon	Visayas	Mindanao
Sakag (scoop net)	11	–	33
Sagap and sayod	68	74	75
Sweeper	–	42	–
Fry trawl	32	5	–
Bulldozer	–	32	–
Saplad	(a)	26	33
Percentages of gatherers using two or more methods	11	58	42

(a) Less than 1%. Total percentages may be greater than 100% because a gathering team may use more than one method at different times during the fry season.

of ₱20 per thousand, two hours of gathering would bring the team ₱2, or approximately ₱0.67 each, if using *sagap*.

Librero et al. (1976a) estimate catching rates of some types of gear for 1974:

Sagap	24,000 fry per season
Sayod	33,000 fry per season
Bulldozer	39,000 fry per season
Saplad	57,000 fry per season

Attempts to verify this information on a daily catch per unit effort basis were unsuccessful due to time constraints. However, these catch rates, using the 1974 average price received per thousand of ₱27.67, imply that average annual income ranging from ₱664 from *sagap* to ₱1,520 from *saplad* are roughly consistent with the income figures presented in Table 2.4.

Concessionaires often offer monthly or seasonal incentives to gatherers, usually in the form of clothing or food. Apart from sharing of catch among family members, no evidence of a more extensive sharing system was found that would allow gatherers who made no catch on any particular day to share returns with those gatherers who did. Concessionaires, except for trying to control smuggling, make no attempt to restrict the number of gatherers, preferring rather that there be as many gatherers as possible. There is thus no built-in conservation aspect to fry gathering, and the BFAR took steps, beginning in 1976, to achieve this objective by establishing fry reservations, each representing one-fifth of the respective fry grounds, from which gathering is then prohibited.

Storage, counting, and feeding of fry

Fry are scooped from the net with a white porcelain basin, against the background of which the eyes of the almost transparent fry can be seen (Fig. 2.11). After being stored temporarily on the beach (Fig. 2.12), fry are either delivered to the concessionaire where they are counted so that the gatherer can be paid for the day's catch, or stored by the gatherer for later sale. To count fry, a person scoops out a small number with a small bowl or clam shell and calls out the number to a second individual who separates a corresponding number of shells, pebbles, or stones from a collection of 100 such items (Fig. 2.13). After 1,000-5,000 fry have been thus counted, their density can be used as the basis for comparison for the separation of the rest of the catch into lots of similar size. Actually, this comparative density technique was found to be practiced by only 26% of the fry gatherers. Sixty-eight percent counted all the fry, while 6% did not count the fry at all, but left this to the buyer who paid them based on a visual estimation of their catch. Counting all the fry individually can be done at this stage because individual gatherers' daily catches are relatively small. Individual counting becomes impossible when dealing with hundreds of thousands or even millions of fry as is common further along in the marketing chain.

Fifty-two percent of the gatherers sell their fry immediately after catch. Whether sold immediately or stored temporarily by the gatherer, fry end up in white plastic basins or in clay pots *(palayok)* for temporary storage prior to shipment to buyers (Fig. 2.14). Those 48% of gatherers who did not sell their fry immediately stored them for an average of 2.75 days; 67% using *palayok*, 29% using plastic basins, and 4% using plastic bags inside woven baskets. Fry were stored by gatherers to accumulate more, to wait for the buyer, or most commonly to condition the fry, that is, to rest them after catch. Up to 2,500 fry can be stored in each half-filled 20 l *palayok;* up to 6,000 fry can be stored in the circular basins.

Fig. 2.11. Fry are scooped from the net using a white porcelain basin.

Fig. 2.12. Fry stored temporarily on the beach before delivery to concessionaire.

Fig. 2.13. Counting fry by use of pebbles.

Fig. 2.14. Fry stored temporarily in white plastic basins or in clay pots.

Evidently no experiments have been conducted to determine mortality rates of fry stored in basins. However, Antonio and Manacop (1956) reported the results of experiments conducted with fry stored in *palayok*. With 3,000 fry per pot, half-filled (10 l), they found that the mortality rate on a daily basis actually declines during the first 7 days of storage in salt water, after which it increases rapidly, lending support to the need for conditioning fry after catch. Mortality can be reduced through the use of fresh water (Fig. 2.15), although this is seldom practiced by gatherers who often have ready access only to salt or brackish-water. Librero et al. (1976a) reported a mortality rate of 5.5% before disposal by fry gatherers, not significantly different from the 4.6% found by this survey's 50 respondents for their most recent catch. These estimates do not include fry that die during gathering and during temporary storage on the beach which, based on visual observation only, was estimated to be approximately another 5%. A later more rigorous study (Kumagai et al. 1980) estimated gathering mortality to be as high as 14%.

While fry are being temporarily stored, predator and competitive species are sorted out and discarded. At this early stage of development, it is extremely difficult to distinguish between milkfish fry and the fry of other species. The experienced sorter, however, can pick out an astonishing number of unwanted species, among them the Hawaiian ten-pounder or *bid-bid (Elops hawaiiensis)*, tarpon or *buan-buan (megalops cyprinoides)*, and grunter or

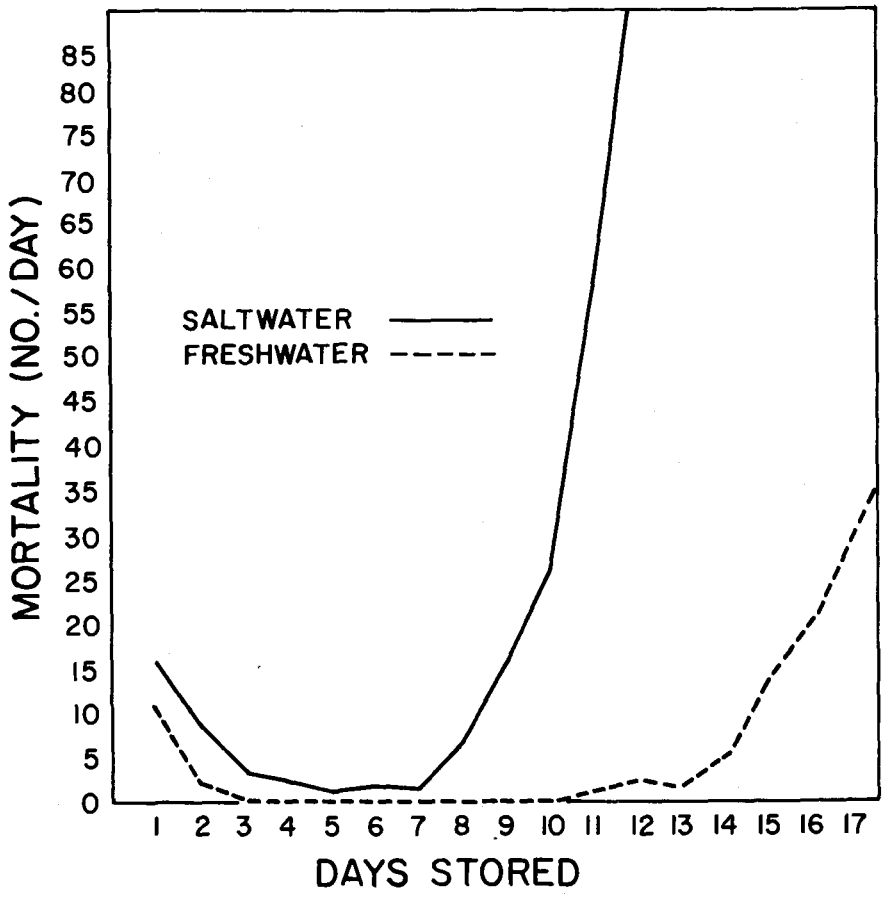


Fig. 2.15. Mortality rate (individuals per day) of milkfish fry in freshwater and saltwater while stored in clay pots. Original number per pot was 3,000 (From Antonio and Manacop 1956).

bugaong (Therapon sp.). The *bid-bid* and *buan-buan* are particularly voracious predators of the young milkfish fry according to gatherers, concessionaires, and pond operators. A complete list of these species occurring either with the fry when caught or in the ponds into which the fry are stocked is included in Appendix B.

Fishermen in fry ground areas complain that milkfish fry gathering is detrimental to other species because unwanted fish are discarded on the beach rather than returned to the sea. The complaint is legitimate. BFAR is attempting to educate gatherers on this point, and 66% of gatherer-respondents now claim to be returning unwanted species to the sea. The actual percentage is probably lower.

Concessionaires, once they have purchased fry, store them for an average four to five days, and it is during this phase that feeding usually begins. The yolk of a boiled egg mixed with water is sufficient to feed approximately 50,000 fry, or 10 basins per day. Two hours after feeding, the water must be changed to avoid contamination from uneaten egg yolk and from excreta. Concessionaires report a further 5.8% mortality of fry during this period while awaiting resale to subsequent buyers. Mortality rates dramatically increase after 15 days of storage despite continued feeding, reaching 20-30% after 21 days and 30-60% after 30 days. Consequently, concessionaires make every effort to sell their fry within the first week after catch.

Smuggling of fry

The foregoing discussion implies that the gatherer-concessionaire fry trade works as the concession regulations require. In truth, this is far from the case. Although concessionaires are granted a legal monopsony, fry gatherers can circumvent concessionaires by selling their catch to fry smugglers or runners, or by smuggling fry themselves. Price received for smuggled fry is anywhere from 50-100% higher than the price paid by concessionaires, hence its attractiveness. Smuggling has its risks, however, ranging from confiscation of the smuggled catch by the Philippine Constabulary (PC) or by the Army, to being shot by guards hired by concessionaires to enforce their monopsony rights to the fry catch.

Smuggling of fry to circumvent restrictions on free trade can be classified in three ways. The first extra-legal channel, that of smuggling from concessionaires, is prevalent throughout the country, though most widely practiced in Mindanao. In Southern Mindanao, concessionaires, though all publicly claiming that smuggling was their biggest problem, were all actively engaged in smuggling from each other. All concessionaire-respondents in this region employed runners to whom cash advances were given to purchase fry from gatherers in other fry grounds. The result was that an astonishing 50.5% of concessionaire purchases were smuggled fry. Individual fry grounds were estimated to lose up to 80% of their total catch to this extralegal channel. In Western Visayas concessionaire smuggling was not so prevalent, with only 6% of concessionaire purchases coming from runners. Due to the presence of dealers who also used and purchased from runners, however, the total estimate of fry smuggled from concessionaire fry grounds in Antique and Iloilo provinces was 16%. In the Bicol region and in Ilocos Sur and Ilocos Norte, concessionaires estimated that they lost 26%, 7% and 30%, respectively, of their fry smuggled to dealers. These estimates of losses made by concessionaires are only rough approximations, although it appears that a large portion of the 1976 fry catch was smuggled.

The second smuggling category involves the shipment of fry between regions without the necessary permits and auxiliary invoices. Over 50% of interregional shipments are smuggled this way, either without the necessary papers, or more usually in the form of understatements in the invoices. Section B.10 of this chapter deals with interregional trade and explores this aspect in more detail.

Finally, there is smuggling of fry from the Philippines to other countries in the region, particularly Taiwan and Hong Kong, as evidenced by occasional confiscation of fry at the Manila International Airport. An alternative route is by boat through Sabah. Unfortunately, as expected it was not possible to establish the true extent of these illegal exports, though more recent visits to Taiwan by the author indicate that approximately 50 million fry are illegally exported from the Philippines each year.

In conclusion, smuggling is an important element to understanding the industry's response to government regulations that restrict free trade in fry.

Methods of transport

Although a small quantity of fry are transported interregionally, by both sea and land, the vast majority are transported by air. With the exception of short distances when fry might be hand-carried in buckets or *palayok*, they are transported in plastic bags, measuring 50 cm wide, 83 cm long, and .0075 cm thick, and containing approximately 5 l of oxygenated water. Using double bags as a precaution against inadvertent oxygen leaks, the plastic bags are packed inside a bag of woven pandan leaves *(bayong)* if to be transported by surface, or inside styrofoam boxes if to be transported by air (Fig. 2.16). The capacity of each bag is 4,000 to 6,000 fry depending upon the time to be spent in transport. Generally, 24 hours without reoxygenation is acknowledged as the absolute maximum without risking wholesale mortality of fry.

Time is thus of the essence when transporting fry long distances, and unscheduled delays, diverted flights, or off-loadings can present serious problems to shippers. For the system to work smoothly, close cooperation between shippers, agents, and consignees is essential. Daily communication by telegrams and telephones have developed to make this possible. Shipments of more than 500,000 fry are often accompanied by the shipper or the consignee's commissionman to assure prompt and careful delivery to the destination ponds.

Private planes, including DC-3's with a capacity of 560 fry boxes, and smaller single- and twin-engined planes with capacities of 30 to 70 fry boxes are occasionally chartered for large shipments from Visayas or Mindoro to Manila. However, the most common method throughout the country is via commercial jets and turbo-prop planes of Philippine Airlines, Ltd. (PAL). PAL prescribes white, oil-based styrofoam boxes, inside of which are placed the polyethylene bags. Outside containers used must either be corrugated plastic or corrugated cardboard boxes (Figs. 2.16, 2.17).

In 1976, PAL had only two basic express cargo rates that were applied to fry; a short haul rate of ₱1.10 per kg (₱5.50 minimum charge), and a long haul rate of ₱1.375 per kg (also ₱5.50 minimum charge). Fry boxes weigh approximately 6 kg, the short haul rate thus translating into ₱6.60 per box and the long haul rate ₱8.25 per box. Assuming an average packing rate of 5,000 fry per box, the basic cargo rate is ₱1.32 per thousand for short hauls and ₱1.65 per thousand for long hauls. For instance, as far as shipments to Manila are concerned, all points of Luzon, Mindoro, and Western Visayas are within the short-haul range. Central and Eastern Visayas, Palawan, and all of Mindanao are considered long hauls to Manila.

PAL uses a formula ($\frac{\text{length x width x height in cm}}{5000}$) to compute the theoretical volumetric weight for empty fry boxes. The result is a chargeable weight of 9.2 kg for an empty box, when the full box chargeable weight is only 6 kg. Consequently, most shippers return the empty fry boxes to the fry grounds by surface instead of by air. A few simply fill them with water to qualify for the lower chargeable weight.

Fig. 2.16. Fry are transported in woven pandan bags or in styrofoam boxes.

Fig. 2.17. Fry to be transported by air from General Santos City to Manila.

Interregional shipments within Luzon, and intraregional shipments generally, are primarily handled by surface rather than by air. Jeeps, with a capacity of 100 woven pandan bags (500,000 fry), can be hired on a daily basis to transport fry. Many dealers, whose primary function is arbitrage and assumption of transport risks, own their own vehicles, traveling to fry grounds and buying from several sellers on any given trip. Smaller quantities of fry are transported by bus, train, and even "tricycle," a motorcycle with a sidecar and with a capacity of about 10 fry bags.

Intraregional fry trade

In 1976, the Philippines was divided administratively into 12 regions (Fig. 2.18). The increase in number from 11 regions in 1974 for which the SEAFDEC-PCARR data

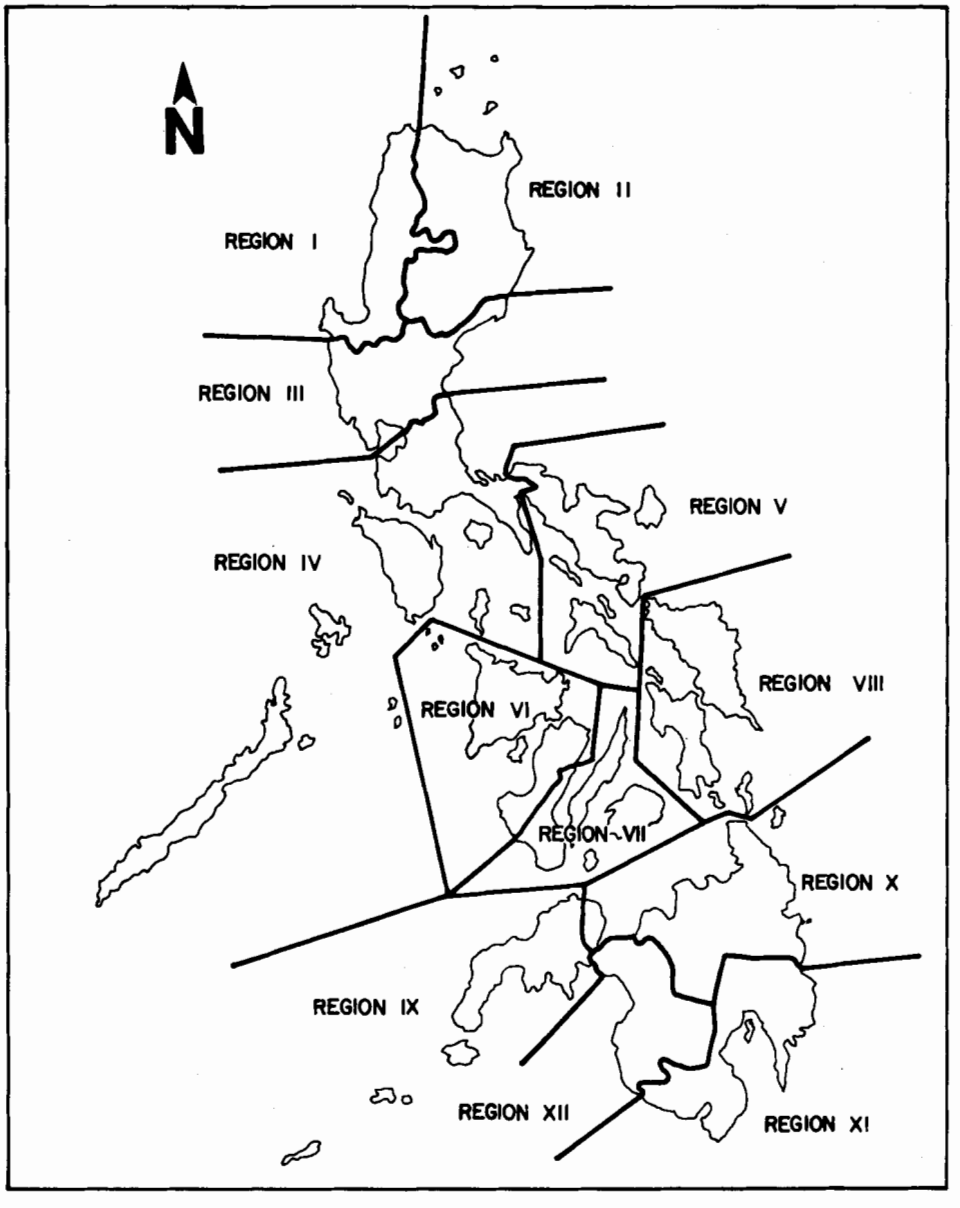


Fig. 2.18. The 12 administrative regions of the Philippines.

were collected is the result of further subdividing Mindanao from three to four regions. With the exception of Region IV (Southern Tagalog), fry can be transported within the region of catch without having to comply with shipping requirements, e.g., permits and presentation of auxiliary invoices. Consequently, recorded data regarding intraregional trade flows are impossible to come by.

However, from interviews with concessionaires in 1975, Librero et al. (1976b) estimated the location of buyers who purchased from concessionaires. Thirteen percent came from within the same barrio, 14% from other barrios in the same municipality, 38% from other municipalities in the same province, and 35% from outside the province. Because these figures are not weighted by sales volume they probably overestimate the extent to which fry stay in the general vicinity where they are caught. Librero and her staff personally suggested that local buyers are more likely to be rearing pond operators purchasing for their own pond, while buyers from outside the province are more likely to be dealers and nursery pond operators purchasing in much larger quantities. In addition, first buyers, particularly if they were dealers, may have sold fry to subsequent buyers outside the region, thus reducing the percentage that remains in the region.

Using data collected for 1976 when fry were followed through the marketing channels in selected regions, it was estimated that 14% of the fry caught in Southern Mindanao, 40% caught in Northern Mindanao, 47% caught in the Western Visayas, and 18% caught in Ilocos were stocked in fishponds in the same regions where caught (Figs. 2.19-2.23). None of the fry caught in Batangas province remained there. In reaching these conclusions, I made some simplifying assumptions regarding the marketing chain. Specifically, for the sake of visual simplicity, resale transactions between dealers, between concessionaires, and between pond operators have not been shown because they do not significantly affect the intraregional distribution of fry. The discussion of market coordination in the next chapter will include these transactions as well as interrelationships that involve runners, agents, and brokers.

These trade flows should be recognized for what they are; rough approximations based on the best estimates of those involved in the business. It appears that despite this mild disclaimer, they are reasonably accurate and provide sufficient information to compare the flows in the five regions studied.

Northern Mindanao (Fig. 2.19). Respondents in Northern Mindanao were from the vicinity of Cagayan de Oro City in Misamis Oriental, where there are no fry dealers. Consequently, the marketing channels are relatively simple, with 92% of the catch going directly to concessionaires who sell roughly one-third of it to local pond operators and export the remainder to Manila. Pond operators purchase a small amount of fry directly from gatherers, but compared to other regions, smuggling is only a minor problem here. Pond operators in Butuan City occasionally import fry from Western and Southern Mindanao.

Southern Mindanao (Fig. 2.20). Fry dealers are concentrated in General Santos City and Davao City, with a few smaller ones in Digos, the provincial capital of Davao del Sur, which is a "free zone." Since South Cotabato province was the country's major fry producing area in 1976, General Santos City is the scene of intense competition for fry, especially at the beginning of the fry season before fry are available in large quantities from other parts of the country. Hotels are full of commissionmen and representatives of Manila, and to a lesser extent Iloilo dealers and nursery pond operators. In 1976, there were 22 fry *bodegas* or *palapalas* (small warehouses) in the city operated by concessionaires and dealers who made daily contact with their Manila financiers and partners by telephone or by telegram to keep abreast of price movements.

Dealers are often former concessionaires who have lost out in the bidding for fry grounds, and smuggling of fry is rampant.

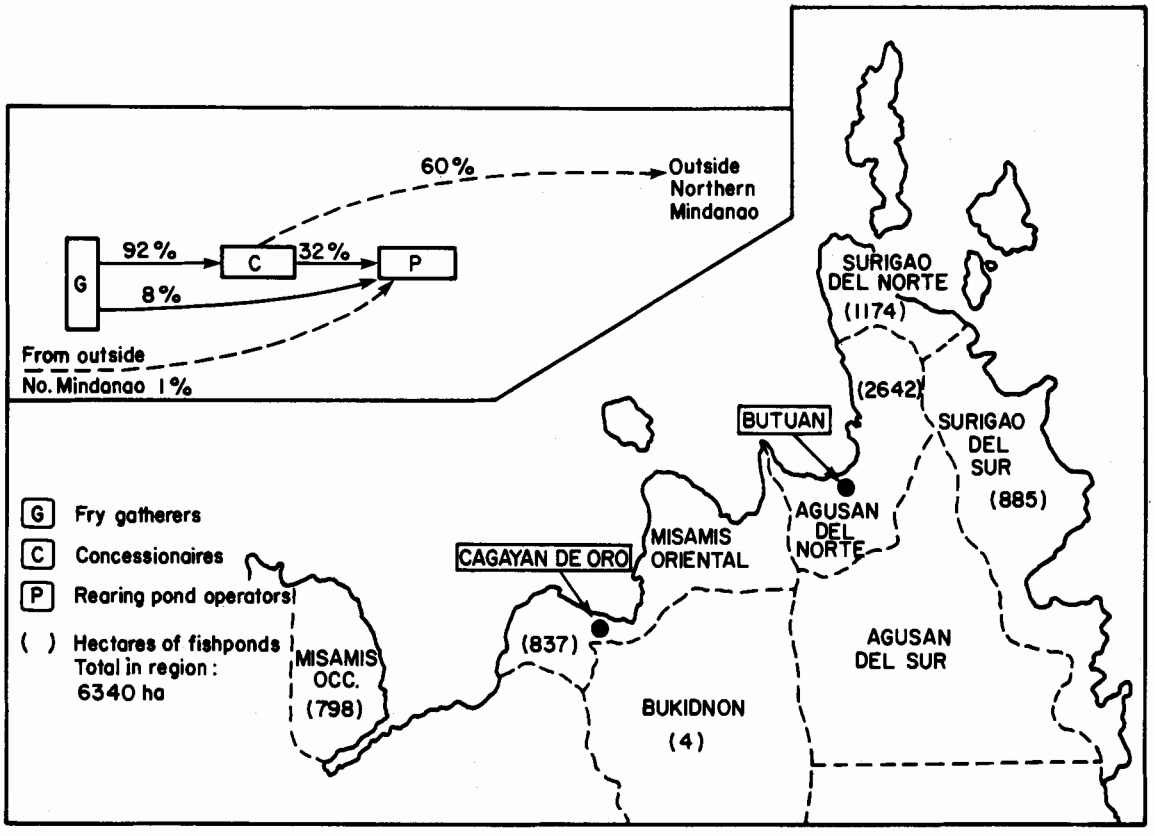


Fig. 2.19. Fry trade in Northern Mindanao, 1976.

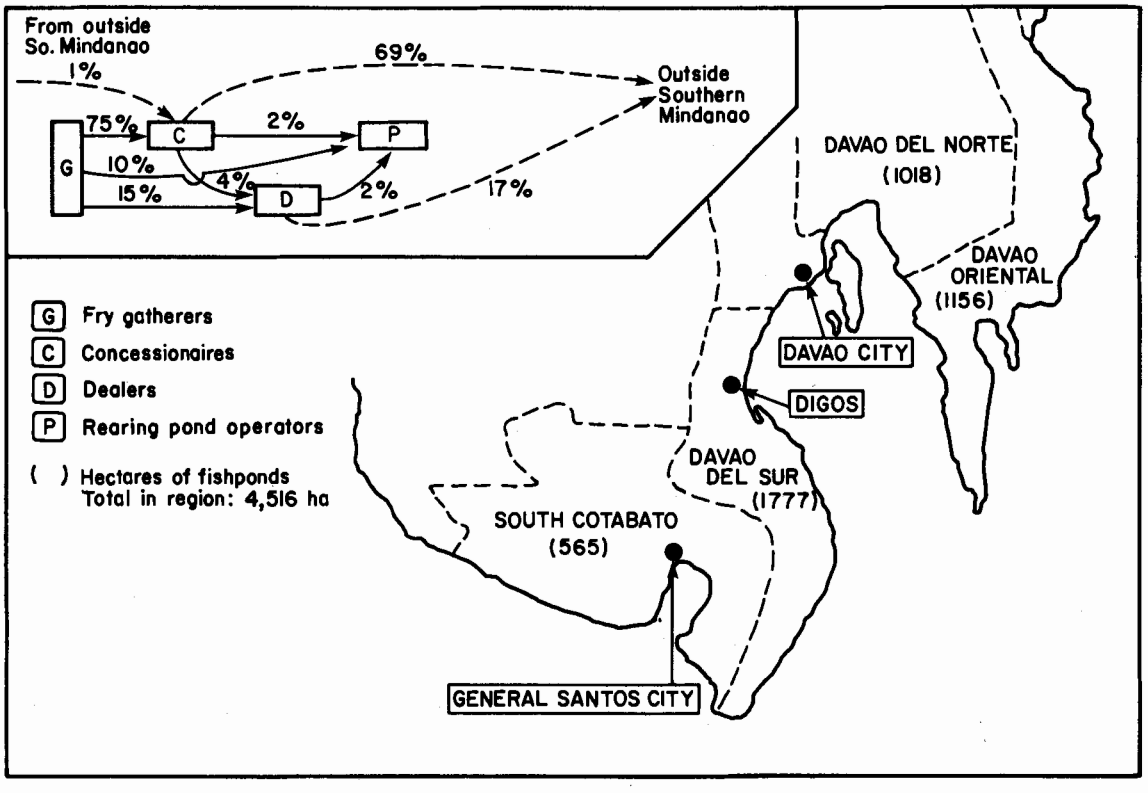


Fig. 2.20. Fry trade in Southern Mindanao, 1976.

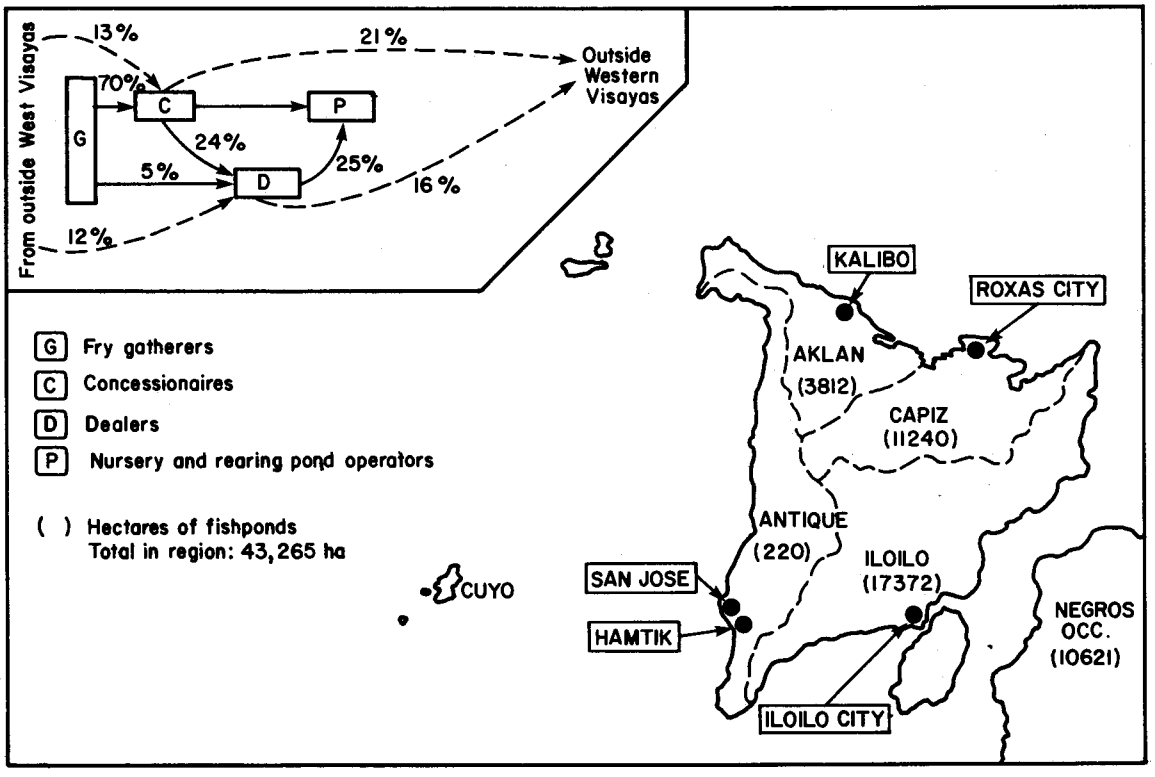


Fig. 2.21. Fry trade in Western Visayas, 1976.

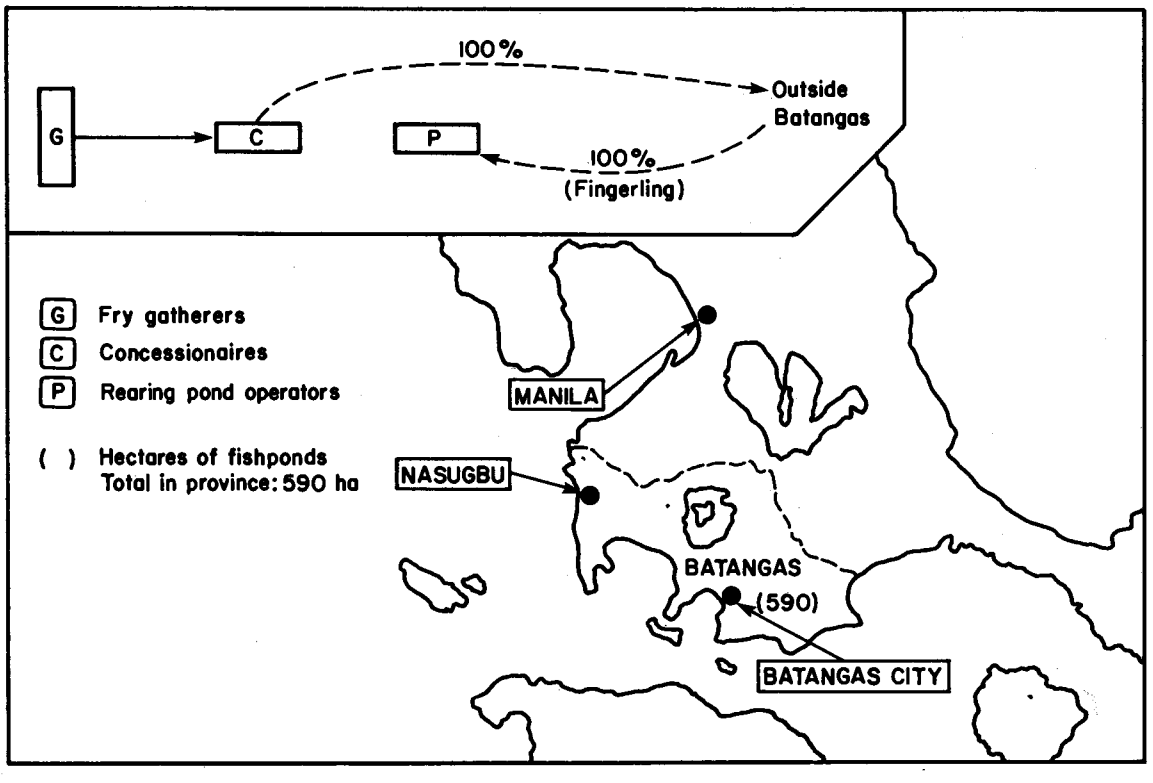


Fig. 2.22. Fry trade in Batangas Province, 1976.

It is estimated that over 60% of the total fry catch does not reach concessionaires who have legal rights to the fry grounds. This includes the 50% of concessionaire fry purchases that are smuggled from fry grounds of other concessionaires, and the quantities purchased by dealers and pond operators directly from fry gatherers or from runners.

Pond operators complain through the local branch of the Federation of Fishpond Producers that the financial obligations of local concessionaires to outside financiers make it difficult for them to buy fry, even when fry are a local resource. Interviews with pond operators, however, elicited no evidence of fry shortage; all, without exception, stocked the desired amounts for their ponds. The pond operators' complaint appears to be one of higher prices rather than lack of supply. To stock the desired amount, pond operators purchased fry either directly from gatherers who caught fry along the coast adjacent to the ponds, or from fry smugglers. Fry smuggling is thus the means by which fry gatherers and pond operators in this region compete with the localized monopsony and oligopoly power of concessionaires. Because of the high catch and the relatively small area of fishponds in the region, 86% of fry caught in Southern Mindanao is exported, primarily to Manila.

Western Visayas (Fig. 2.21). The major fry-producing area in the Western Visayas is Antique province on the island of Panay. In contrast to Northern and Southern Mindanao with their lower pond areas, fishponds are concentrated in the Western Visayas and dealers consequently play a much more prominent role in handling the large quantities of fry that must be transported from fry grounds in the west of Panay to the fishponds in the east. There are four major buying and selling centers in Panay; San Jose/Hamtik in Antique, Kalibo in Aklan, Iloilo City in Iloilo, and Roxas City in Capiz. In Southern Antique, there were approximately 10 small dealers (1976 purchase of less than 10 million fry each) who purchased fry from concessionaires up and down the coast of Antique and from smugglers bringing fry from Palawan and Cuyo to the west. These dealers transported fry as far as Iloilo, selling them either to Iloilo dealers and pond operators, or to representatives of Manila buyers. Occasionally these dealers would travel as far as Roxas City to make deliveries.

In Iloilo, there were 8 major dealers who, in addition to receiving the Antique fry, also received fry from Mindanao and Cebu, Central Visayas. These dealers, 6 of whom had *bodegas* in the central market in Iloilo City, sold fry to local pond operators, or to representatives of Manila or Capiz buyers. In contrast to Iloilo dealers who stored fry in basins for no more than seven days, Kalibo and Roxas City dealers also owned small nursery ponds which gave them added flexibility in timing of fry disposal. In the absence of immediate buyers or if the dealer chose to wait for a possible future price increase, fry were temporarily stored in ponds with apparent minimal mortality. The dealer also had the option of rearing fry to fingerlings.

Batangas Province, Southern Tagalog (Fig. 2.22). Batangas is of interest because in 1976, 100% of the fry caught in this province were shipped to a single buyer in Manila who then sold fingerlings back to Batangas pond operators. No evidence could be found of smuggling from fry gatherers to the small number of fishponds, located primarily in Nasugbu.

Ilocos (Fig. 2.23). Major markets for fry caught in Ilocos are the provinces of Pangasinan in the same region, and Pampanga, Bulacan, and Rizal to the south. Fry from Ilocos Norte, Ilocos Sur, and La Union move southward to major dealers in the vicinity of Dagupan City, Pangasinan, because there is minimal fishpond area locally. Fry from Cagayan Valley (Region II) move around the northern tip of Luzon to the same destination. Because of the distance involved (284 km from Laoag City to Dagupan City by road) and because their catches were small in 1976, concessionaires rely on dealers who visit the fry grounds to assemble and transport fry. Dealers handled 89% of the fry caught in or imported to the region, of which over three-fourths was exported to Central Luzon and to Bulacan and Rizal provinces to the south. Smuggling was a major problem for concessionaires, especially in Ilocos Norte

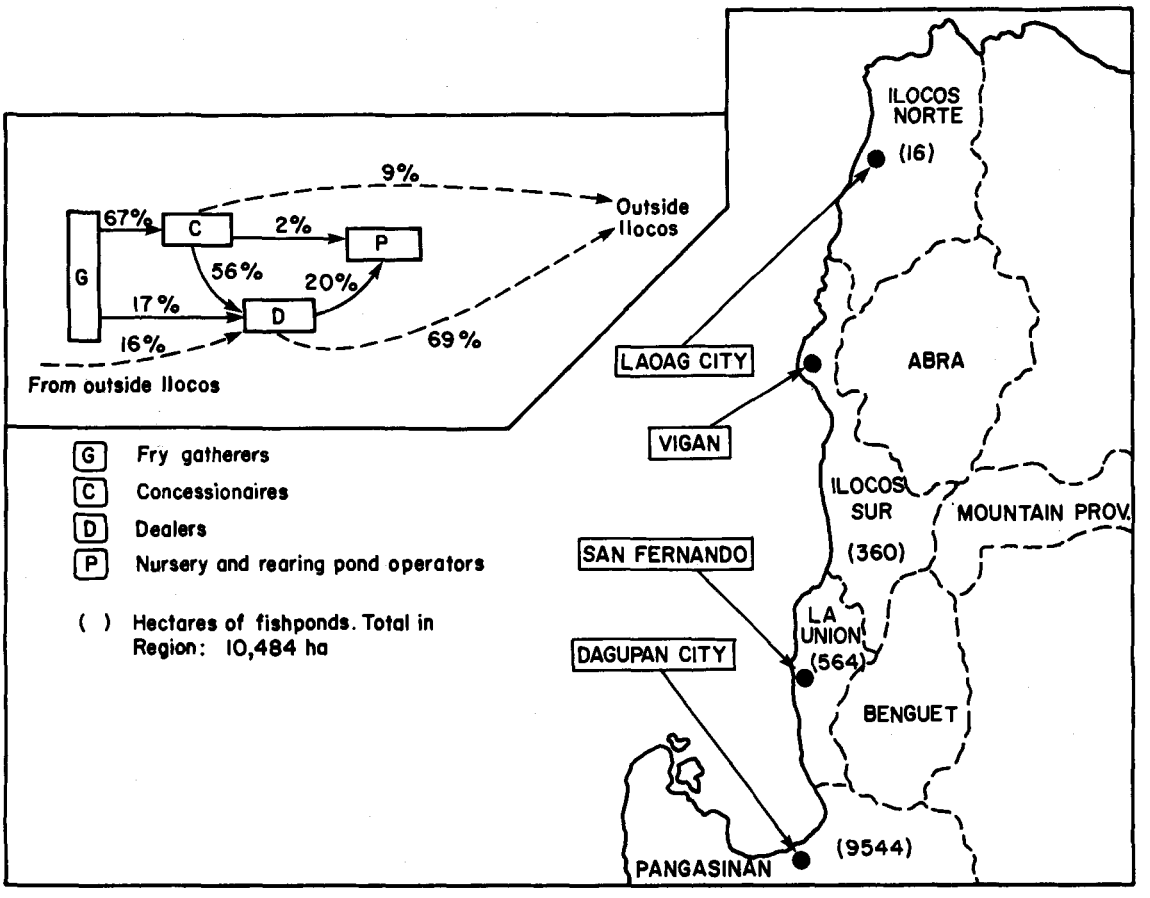


Fig. 2.23. Fry trade in Ilocos, 1976.

who lose over 20% of their fry ground catch to runners and to small dealers. Smuggling appears to be the result of fry gatherers' objections to the *sungyaman* catch-sharing system described earlier which favors the concessionaire. Dealers, not concessionaires, are thus the primary exporters of fry to buyers outside this region.

In summary, the exact pattern of intraregional trade and the role of market intermediaries varies greatly from region to region. Dealers play a relatively more important role in Western Visayas and Ilocos than they do in northern and southern Mindanao and in Batangas province (Table 2.6). Chapter 3 deals with the structure of the fry industry and examines the reasons for these differences.

Interregional trade flows, 1976

The designation of fry trading regions in the Philippines is essentially arbitrary. It is based, with some modifications, upon the regional administrative breakdown, because it is these regions that issue the permits and auxiliary invoices from which the picture of interregional trade was compiled. Fifteen fry trading regions were chosen (Fig. 2.24). Since these trading regions represent a regrouping of provinces in Central Luzon and Southern Tagalog, they should not be confused with the 12 government administrative regions shown in Fig. 2.18. The provinces of Bulacan and Rizal have been combined into a single trading region, and the islands of Palawan and Mindoro established as trading regions in their own right. The Bulacan-Rizal grouping is appropriate for two reasons. These provinces are the major fry importing provinces in the country, accounting for 82.1% of all interregional imports in

Table 2.6. Relative importance of concessionaires and dealers in intraregional and interregional trade, for selected regions, 1976.

Region	Concessionaire sales			Dealer purchases			Dealer sales		
	Percent outside region	Percent inside region to dealers	Percent inside region to pond operators	Percent from concess.	Percent from dealer	Percent from gatherer	Percent outside region	Percent inside region to dealers	Percent inside region to pond operators
Northern Mindanao	65	0	35	0	0	0	0	0	0
Southern Mindanao	92	5	3	27	46	27	90	0	10
Western Visayas	25	29	46	83	4	13	27	28	45
Ilocos	14	83	3	51	42	7	73	6	21
Batangas, Southern Tagalog	100	0	0	0	0	0	0	0	0

1976. In addition, the regrouping became a practical necessity when it was discovered that the BFAR auxiliary invoice records in many cases showed only "Manila" as the destination, rather than the actual pond destination in Bulacan or Rizal provinces.

Compiling a complete picture of interregional trade is like putting together pieces of a puzzle. Beginning with BFAR auxiliary invoice records as a base, one must also account for the shipper's understatement on the invoices and for shipments made without invoices at all. Both are versions of smuggling, distinct from the fry gatherer who smuggles fry from the fry grounds to nonconcessionaire buyers.

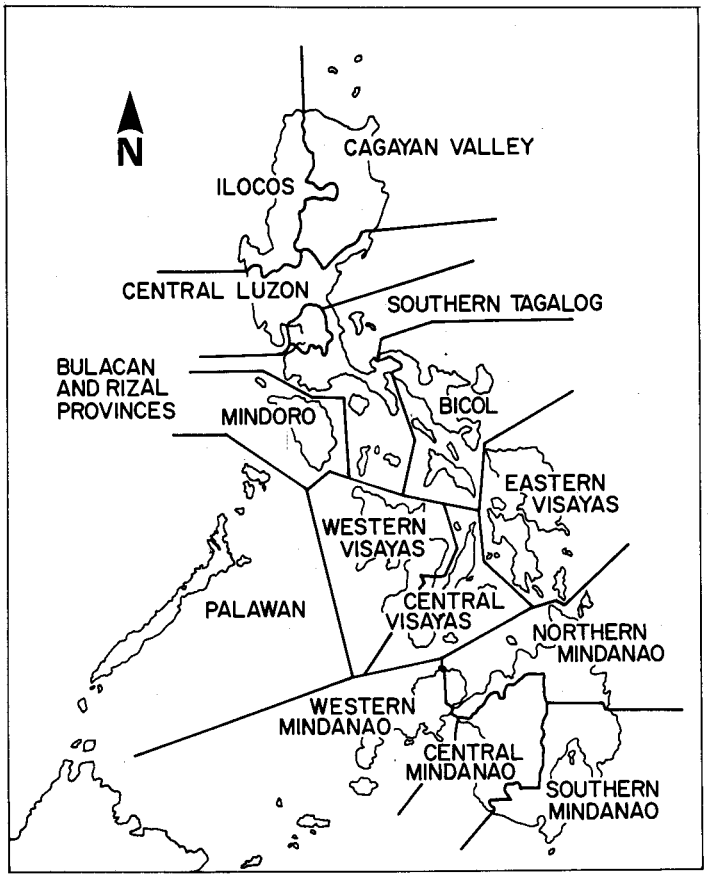


Fig. 2.24. Milkfish fry trading regions, 1976.

Table 2.7. 1976 Interregional fry trade in thousands. Reproduced from Smith et al. (1978) with permission of the publisher.

Shipping regions (exports in thousands)	Receiving regions (imports in thousands)																Percentage including re-exports
Region	Ilocos	Cagayan Valley	Central Luzon	Rizal and Bulacan	South Tagalog	Mindoro	Palawan	Bicol	Western Visayas	Central Visayas	Eastern Visayas	Western Mindanao	Northern Mindanao	Southern Mindanao	Central Mindanao	Export subtotals	
Ilocos	–	–	1363.2	26647.8	–	–	–	–	–	–	–	–	–	–	–	28011.0	3.55
Cagayan Valley	1722.0	–	–	438.0	–	–	–	–	–	–	–	–	–	–	–	2160.0	.27
Central Luzon	5000.0	–	–	–	–	–	–	–	–	–	–	215.2	–	–	58.7	5000.0	.63
Rizal and Bulacan	–	–	43026.7[a]	–	1187.3[a]	–	–	–	508.6[a]	–	–	–	–	–	–	44996.5	5.70
South Tagalog	–	–	–	6924.0	–	497.4	–	–	399.6	–	–	–	–	–	–	7821.0	.99
Mindoro	–	–	–	14975.2	–	–	–	–	–	–	–	–	–	–	–	14975.2	1.90
Palawan	–	–	–	12545.1	–	–	–	–	11935.0	–	–	–	–	–	–	24480.1	3.10
Bicol	245.5	–	–	1584.4	14946.0	133.0	–	–	5000.0	–	–	–	–	–	–	21908.9	2.78
Western Visayas	–	–	–	89562.2	–	–	–	–	–	304.3	275.3	–	–	–	–	90141.8	11.42
Central Visayas	–	–	–	29835.9	–	–	–	768.0	18888.5	–	989.9	7.2	731.6	114.5	–	51335.6	6.50
Eastern Visayas	–	–	–	342.4	–	–	–	–	–	6098.3	–	–	–	–	–	6440.7	.82
Western Mindanao	–	–	–	43440.5	–	–	–	–	1664.1	790.3	–	–	3146.0	–	45.6	49086.5	6.22
Northern Mindanao	–	–	–	1934.9	–	–	–	–	–	–	–	–	–	–	–	1934.9	.25
Southern Mindanao	–	–	7082.4	302486.4	860.8	–	–	–	10599.9	–	–	–	1594.8	–	–	322624.3	40.88
Central Mindanao	–	–	–	117439.8	–	–	–	–	887.6	–	–	–	–	–	–	118827.4	14.99
Import subtotals	6967.5	–	51472.3	648156.6	16994.1	630.4	–	768.0	49883.3	7192.9	1265.2	222.4	5472.4	114.5	104.3	789243.9	= Total fry traded (1976)
Percentage including re-exports	.88	–	6.52	82.12	2.15	.08	–	.10	6.32	.91	.16	.03	.69	.02	.01		

[a]Re-exports by permittees in Bulacan and Rizal.

Total trade less re-exports = 745029.9

First of all, a universal practice among shippers was to declare fewer fry than were actually packed. Shippers understated the actual number of fry packed per box to avoid the necessity for early renewal of the permit against which the auxiliary invoice was credited, and to hide the true volume of their business. Based on respondents' admissions during the survey, all auxiliary invoice records were adjusted upwards by the following adjustment factors: 1.96 for all shipments to Bulacan and Rizal, 1.52 for all other shipments from Mindanao; 1.45 for all other shipments from the Visayas; 1.02 for all other shipments from Bicol; and 2.00 for all shipments from Cagayan Valley. It is believed that these adjustments give a conservative estimate of the degree of understatement made by shippers.

The problem of lack of auxiliary invoices in some regions and of shipments made without the necessary papers was much more complex, and required assembling the pieces of the puzzle on a region-by-region basis, using information gathered from respondents, knowledgeable BFAR officials, and other private individuals. In addition, it was necessary to adjust for the 24.1% of all fry imports to holders of permits in Bulacan and Rizal province that were illegally resold to other pond operators. Slightly over 28% of these resales were re-exported to Central Luzon and Southern Tagalog regions. A region by region listing of the adjustments and extrapolations necessary to complete the interregional trade picture is found in Appendix C.

Discounting the re-exports from Bulacan and Rizal to other trading regions, it is estimated that the total number of fry involved in interregional trade in 1976 was 745,029,900. The first quarter of that year accounted for 79,682,600 (10.7%); the second, 492,144,300 (66.1%); the third, 111,306,300 (14.9%); and the last, 61,896,700 (8.3%). These interregional trade flows are summarized in Table 2.7 and are graphically shown in Figures 2.25-2.28.

A number of interesting observations can be made from these results. First and immediately striking are the findings that Mindanao (Southern Mindanao in particular) is the major fry exporter (62.3%), and that Bulacan and Rizal are the major importers (82.1%). In part this merely reflects that Southern Mindanao, with only 4,516 ha of fishponds, is a surplus area, and that Bulacan and Rizal, with no fry grounds, are deficit areas with 18,095 ha of fishponds and are the suppliers of fingerlings to fishpens in Laguna de Bay. It also supports the contention that nursery pond operators in Bulacan and Rizal are the major financing sources for Southern Mindanao concessionaires. Only one of 10 concessionaire respondents there was able to finance his concession without cash advances from or partnerships with buyers in Bulacan and Rizal.

Secondly, fry are apparently available throughout the year from one area or another, albeit in relatively small quantities during some months (Table 2.8). The season begins in Mindanao and moves northward as the year progresses, with the Visayas assuming the role of major exporter in the third quarter, but with Mindanao regaining preeminence in the fourth quarter.

Thirdly, one can notice the effects that the typhoon in May 1976 had on the Ilocos catch that accounted for an unusually poor season in that area. Fry exports from the Ilocos slowed to a dribble after the second quarter, whereas in a normal season there would be exports well into the third quarter.

Finally, there is apparent inefficiency in the distribution of fry where two-way trade takes place between regions during the same month, and where regions import and export fry at the same time. A more detailed examination of these overlapping trade flows will be made in Chapter 4 when the performance of the fry industry is analyzed.

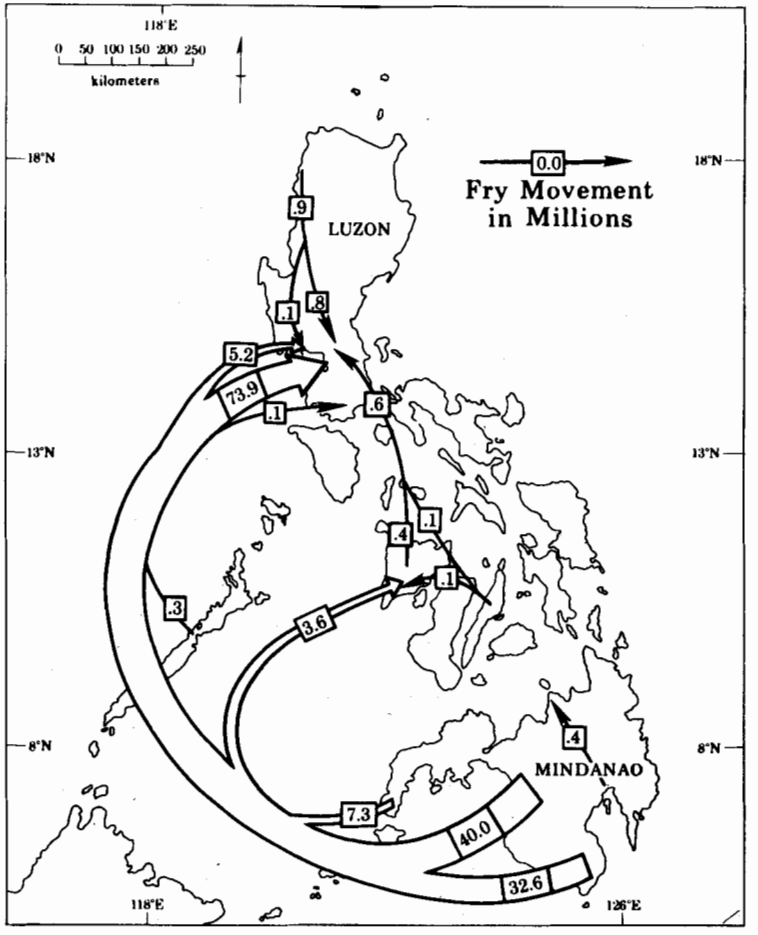


Fig. 2.25. Interregional trade in milkfish fry, January-March 1976. (Reproduced from Smith et al. (1978) with permission of the publisher.)

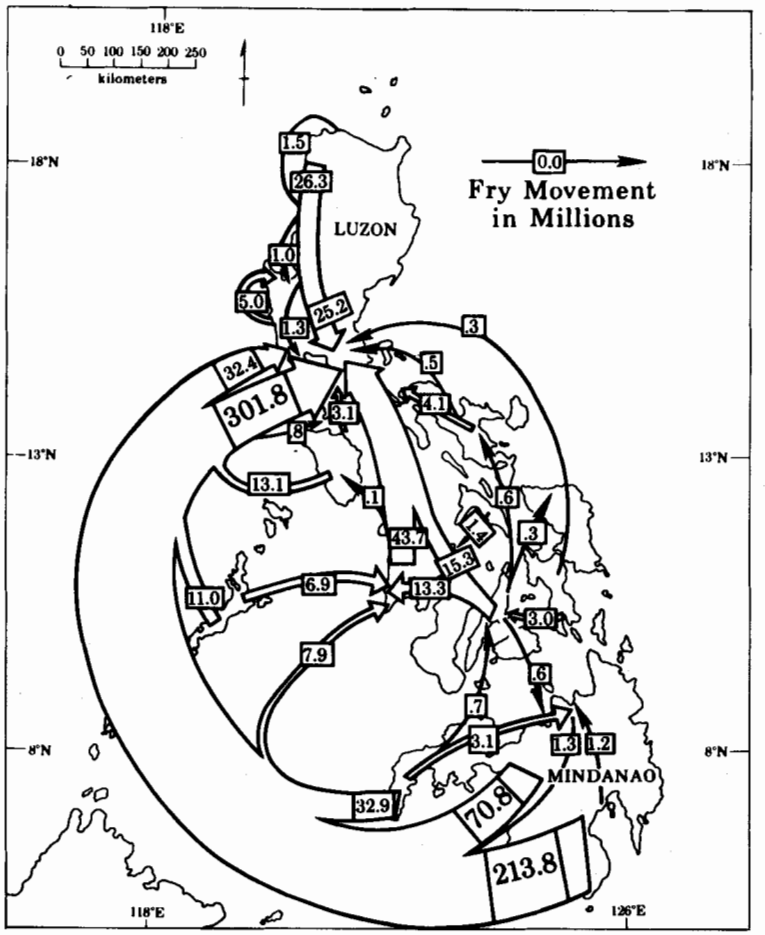


Fig. 2.26. Interregional trade in milkfish fry, April-June 1976. (Reproduced from Smith et al. (1978) with permission of the publisher.)

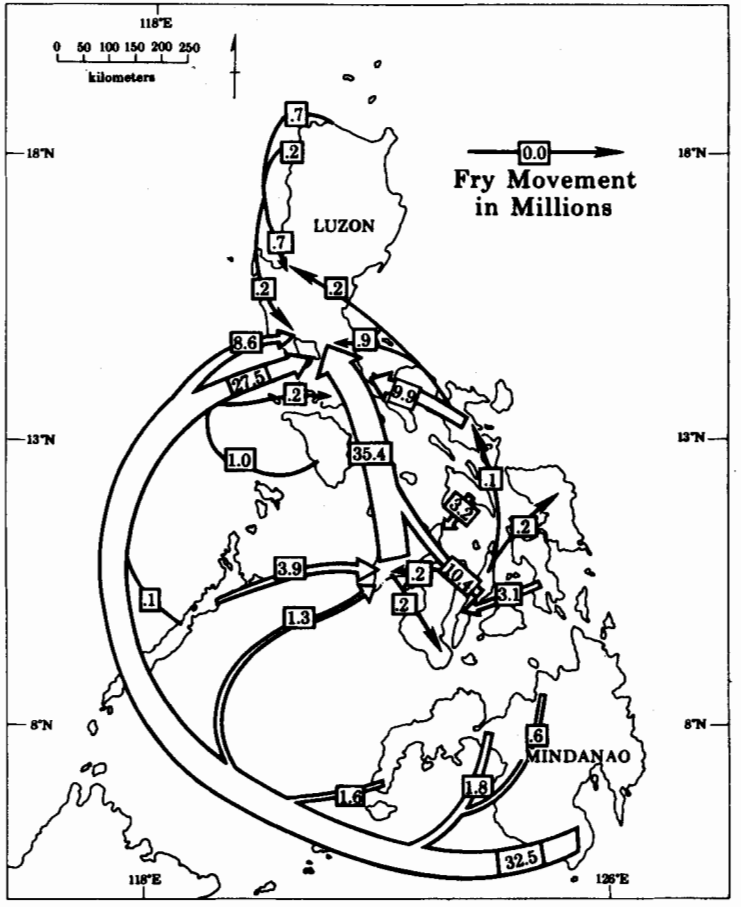


Fig. 2.27. Interregional trade in milkfish fry, July-September 1976. (Reproduced from Smith et al. (1978) with permission of the publisher.)

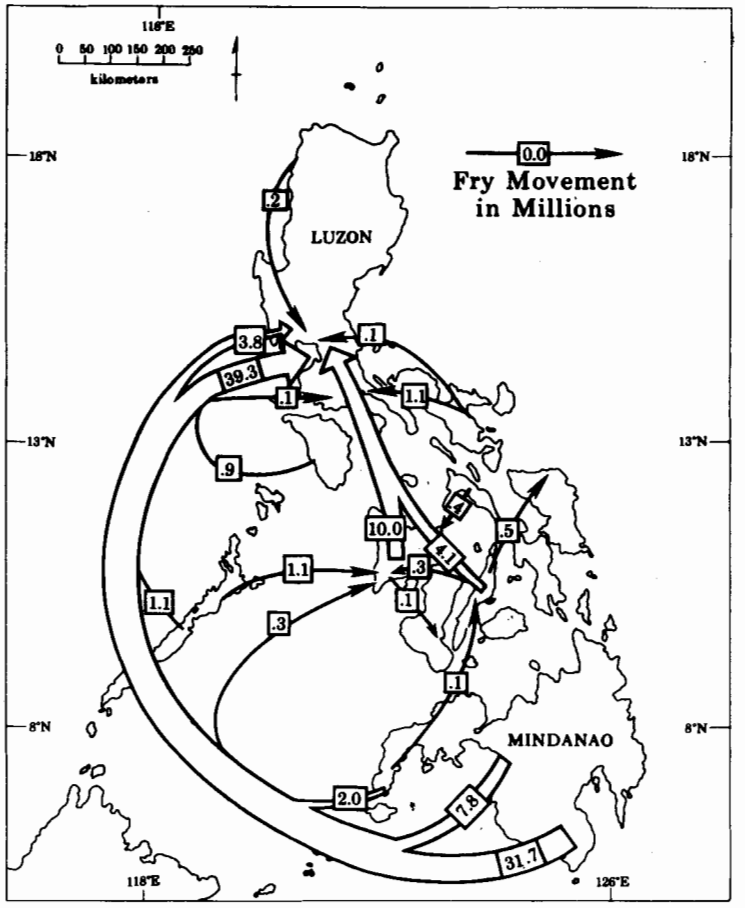


Fig. 2.28. Interregional trade in milkfish fry, October-December 1976. (Reproduced from Smith et al. (1978) with permission of the publisher.)

Table 2.8. Monthly interregional fry trade in thousands, 1976 (including re-exports).

Month	Quantity (000's)	Percentage of annual trade
January	1,596.2	.2
February[1]	802.6	.1
March	82,422.3	10.4
April	155,788.5	19.7
May	227,927.9	28.9
June	137,876.4	17.5
July	66,370.8	8.4
August	27,027.1	3.4
September	23,623.5	3.0
October	29,200.7	3.7
November	28,332.4	3.6
December	8,275.5	1.0
Total	789,243.9	99.9

[1]This is an understatement of February trade. Unfortunately, the auxiliary invoice records from southern Mindanao for that month were incomplete and provided no basis for an estimate of exports.

OVERVIEW OF THE FINGERLING INDUSTRY

Factors affecting the development of nursery ponds

In Malabon, Bulacan, and to a lesser extent in Pampanga, specialist nursery pond operators rear fry to fingerling size (known locally as 2-4 in fingerling) for sale to nearby rearing pond operators and to owners of fishpens in Laguna de Bay (Fig. 2.29). As with rearing ponds for milkfish, it is difficult to determine when or why nursery ponds began in Barrio Dampalit, Malabon. Today nursery pond operators recall at least three previous generations engaged in this business, but the industry is undoubtedly older than that. The industry developed to supply fingerling to fishpond operators who did not want to assume the risks of higher mortalities associated with stocking fry. Nursery pond operators claim to achieve 65% or greater survival rates from fry to 3 in fingerling, whereas nonspecialist pond operators who stock fry directly into rearing ponds feel lucky if a 50% survival over the same rearing period is achieved.

Both internal and external factors affect the operation of the fingerling business. Internal factors have affected fry supply and fingerling demand, and thus the number of hectares devoted to raising fingerlings. External factors have shifted the center of fingerling business northward, further away from Malabon.

Some 50 years ago, when only Luzon and Mindoro fry grounds were exploited and fry were transported in clay pots, Malabon nursery pond operators were important suppliers of stocking materials for fishponds. As additional fry grounds were discovered in other parts of the country, and as fishponds spread southward, the importance of fingerlings in relation to fry for stocking began to diminish. In the early 1960s oxygenated plastic bags were used to transport fry by air, and demand for fingerling began to decline as fry became more readily available to rearing pond operators especially in Luzon. The use of oxygenated bags originated in 1963 apparently concurrently from Taiwanese investors in the Hamtik fry concession and ornamental fish exporters.

However, in 1971 the fingerling business received a substantial boost as fishpens, which must use fingerlings rather than fry for stocking, were established in Laguna de Bay.

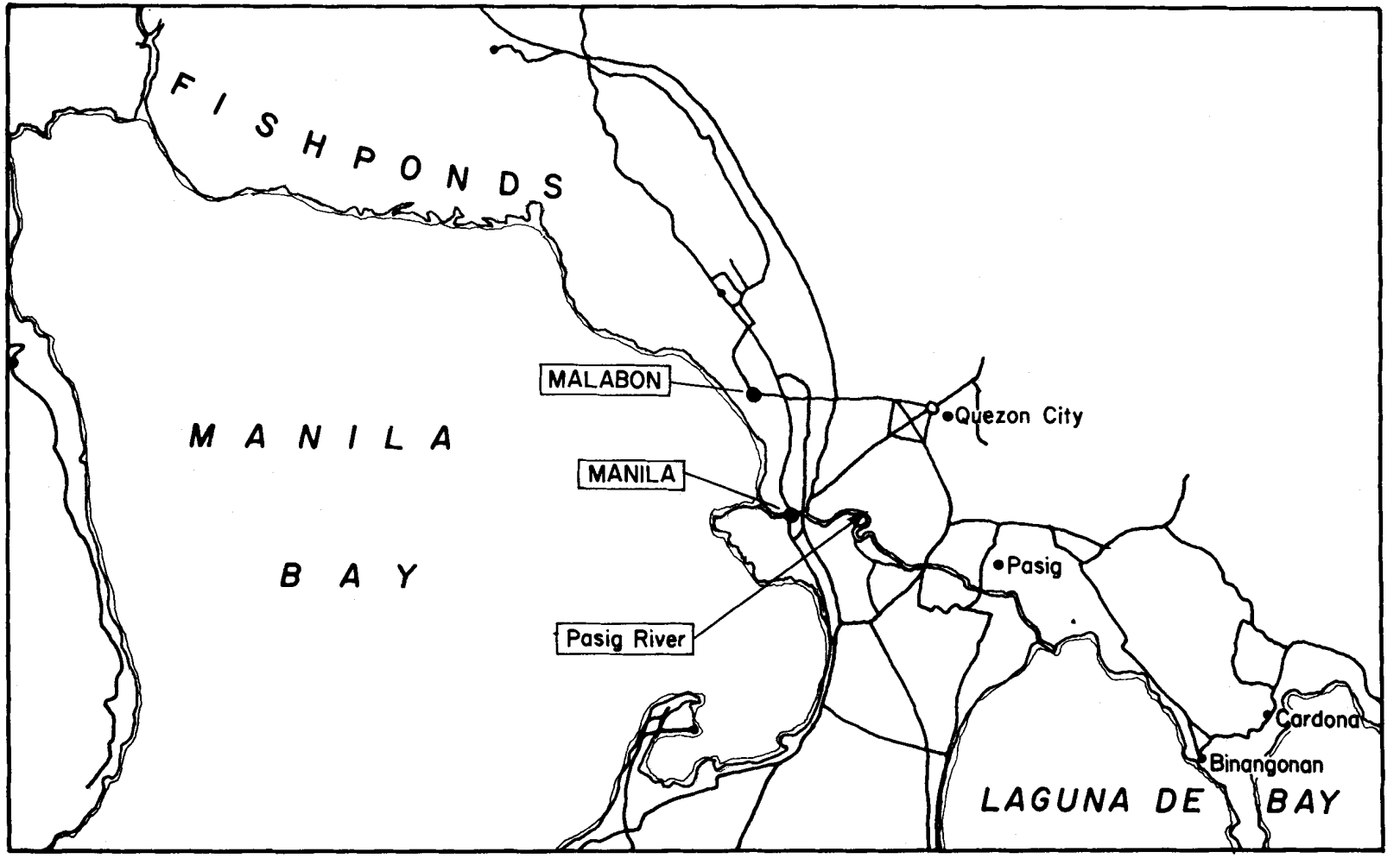


Fig. 2.29. Fishpond and fishpen areas of Bulacan and Rizal Provinces.

One notices a sudden rise in the price of fingerlings in 1972, from an average of ₱160 per thousand to ₱240 per thousand, as fishpens continued to expand, reaching a peak of 7,000 ha in 1974-1976. Assuming an average stocking rate of 35,000 fingerlings per hectare per year, fingerling requirements thus were 245 million. As demand for fingerlings increased, new nursery ponds came into operation in Bulacan and Rizal, Malabon having been fully developed for this purpose. Malabon operators also expanded their operations by purchasing and leasing ponds in these neighboring provinces, and retained their reputation as the experts in the business. From 1975 to 1978, however, the number of fishpens steadily declined to less than 4,000 ha. Consequently the demand for fingerlings was reduced. The Laguna Lake Development Authority (LLDA) issued licenses to 2,694 ha in 1977, but this figure is probably low due to operation of unlicensed fishpens and understatements of actual area by owners. By 1979 however, fishpen area was again increasing.

In addition to the reduced demand from fishpens, demand from rearing ponds in Luzon also declined as fry prices fell, making fry preferable to fingerlings for stocking. Since pond operators can achieve a 50% survival rate from fry to fingerling, a rough rule of thumb used by rearing pond operators, discounting factors of pond design and added rearing time, is to stock fry instead of fingerlings whenever the price of fry is one-half or less of fingerling price. In 1977 fry price in Manila fell to ₱11 per thousand, and 2-3 in fingerling price to ₱80 per thousand, hence the attractiveness of fry for stocking.

Certain external factors have also influenced the fingerling business, resulting in a shift of operations, even by Malabon operators, to the neighboring province of Bulacan. Malabon's nursery and rearing ponds are supplied by the Dampalit River, which has become increasingly polluted with the establishment of cigarette, textile, and metal factories upstream. In addition, siltation has made parts of the river unnavigable for live-boats or *petuya* which are used to transfer fingerlings from the nursery ponds to rearing ponds and fishpens. As the population of nearby Manila has expanded, the demand for housing has pushed northward and large areas of fishponds in Malabon and Navotas have been converted into subdivisions. A large area between Malabon and Navotas, known as Dagatdagatan, used to be a freshwater lake until the 1500s when it was flooded and turned brackish by receding flood waters which opened it to Manila Bay; it was converted to fishponds during the 1950s (J. Roldan, pers. comm.). This area is now being developed as a public housing project for residents of Tondo, thus further reducing potential fishpond area in Metro Manila.

Role of nursery pond operators

Previous sections have referred to the central role nursery pond operators play in the fry industry, as financiers of fry concessions throughout the country. In addition to this key role, many of them double as fry dealers and fry brokers. Thus, the respondent breakdown, with its single dealer in Regions III and IV (Table 1.3), does not adequately reflect the amount of buying and selling of fry that takes place once fry shipments reach Manila. Based on respondents' data, 24.1% of all incoming fry is resold to other nursery pond operators (21.7%) and to rearing pond operators (2.4%). The markup for such resales ranges up to ₱10 per thousand. In addition, nursery pond operators often serve as brokers, charging 5% commission of the selling price.

Success in fingerling production depends greatly upon management expertise. In 1950, Rabanal et al. described the operation of nursery ponds in Malabon and indicated that "one hectare of nursery ponds with good growth of lab-lab may be capable of supporting 300,000 to 500,000 bangos fry" (p. 13). *Lab-lab* is the microbenthic fauna and flora that form the natural feed for milkfish fry and fingerlings. Growth of fry is rapid for the first few

weeks following stocking. More experienced nursery pond operators claim to be able to raise fry to 2-in fingerlings in less than 1 mo. Since fingerlings are measured in finger-widths a 2-in fingerling is actually slightly less than that in length, 2-in commonly meaning the width of two fingers. A 4-in or four-finger fingerling is actually only slightly more than 3 in in actual length. In addition to adequacy of *lab-lab*, the extent of supplemental feeding also influences growth rates. The larger nursery pond operators who practiced such supplemental feeding with rice bran achieved much faster growth rates than did smaller nursery pond operators who reared fingerlings primarily for stocking their own ponds. Average rearing periods for those nursery pond operators with 1976 purchases of more than 1.5 million fry were 2 in—28 days; 3 in—44 days; and 4 in—61 days. For pond operators with purchases of less than 1.5 million fry, the rearing periods for fingerlings were almost twice as long: 2 in—45 days; 3 in—101 days; and 4 in— 118 days. Consequently, after allowing for pond preparation time and assuming no adverse weather conditons, anywhere up to six stocking and croppings of 2-in fingerlings are possible from a single pond in one year. Only the most successful operators achieve this rapid turnover. The number of stockings and croppings for the average nursery pond operator is much lower; 1.63 in Central Luzon and 2.0 in the Malabon area. A complete discussion of techniques of pond preparation and management can be found in Rabanal et al. (1951).

Market outlets for fingerling

The two potential outlets for fingerlings are rearing ponds and fishpens, the latter being of greater relative importance. In 1976, 65-70% of fingerlings sold by nursery pond operators was sold to fishpen operators; 30-35% was sold to rearing pond operators. Fishpens were the predominant outlet for nursery ponds with 1976 sales in excess of one million fingerlings, and rearing ponds were the primary outlet for nursery ponds with sales of less than one million. (Fig. 2.30). In 1977, because of a decrease in hectares of fishpens, the demand for fingerlings by fishpen operators significantly declined. In 1976, 7,000 ha of fishpen were stocked with approximately 184 million fingerlings; in 1977, 4,000 ha of fishpen were stocked with 127 million, a reduction of 31%.

Numerous difficulties have caused the decline in hectares of fishpens. Initial investors in the business were predominantly Manila businessmen with little or no experience in fisheries. Inadequate knowledge of appropriate stocking rates and the usual difficulty of newcomers' finding trustworthy fingerling sellers and fishpen caretakers led to abandonment of many of their fishpens. Sabotage of fishpens by small-scale fishermen who live along the shores of Laguna de Bay, and who claim that the fishpens have adversely affected their fish catch by blocking access to the lake and by reducing water circulation in productive fishing grounds, continues to be a major problem, particularly in the eastern part of the lake near Cardona and Pililla. Jurisdictional confusion between BFAR and municipalities bordering the lake has been resolved only recently in favor of LLDA, resulting in the declaration of a potential 15,570 ha "fishpen belt" in the lake and relocation of all fishpens within 200 m of the shoreline. As if these problems were not enough to discourage fishpen investors, fishpens also suffered damage from typhoons such as that which struck in May 1976. The net result of these problems is that the number of fishpens operational in 1977 was roughly only half the 1974-1976 high of 7,000 ha. The fishpen relocation project, known as "bunot linis," has now been expanded to remove abandoned fishpens as rotting bamboo stakes and netting are hazards to navigation and to capture fishing.

The reputation of nursery pond operators rests on the survival rate of fingerlings after they are stocked in rearing ponds and fishpens, even though they have little influence

over the physical or managerial environment in these subsequent operations. High survival rates imply that the buyer was not cheated during the counting, and that repeat orders can be expected. Nursery pond operators thus have vested interests in successful rearing pond and fishpen management. Today's successful nursery pond operators are those who have extended technical advice to fishpen operators, and, in some cases, entered into partnerships with them. Partnerships have proved beneficial to some other nursery pond operators for another reason as well. As fishpens have been abandoned by unsuccessful entrepreneurs, the

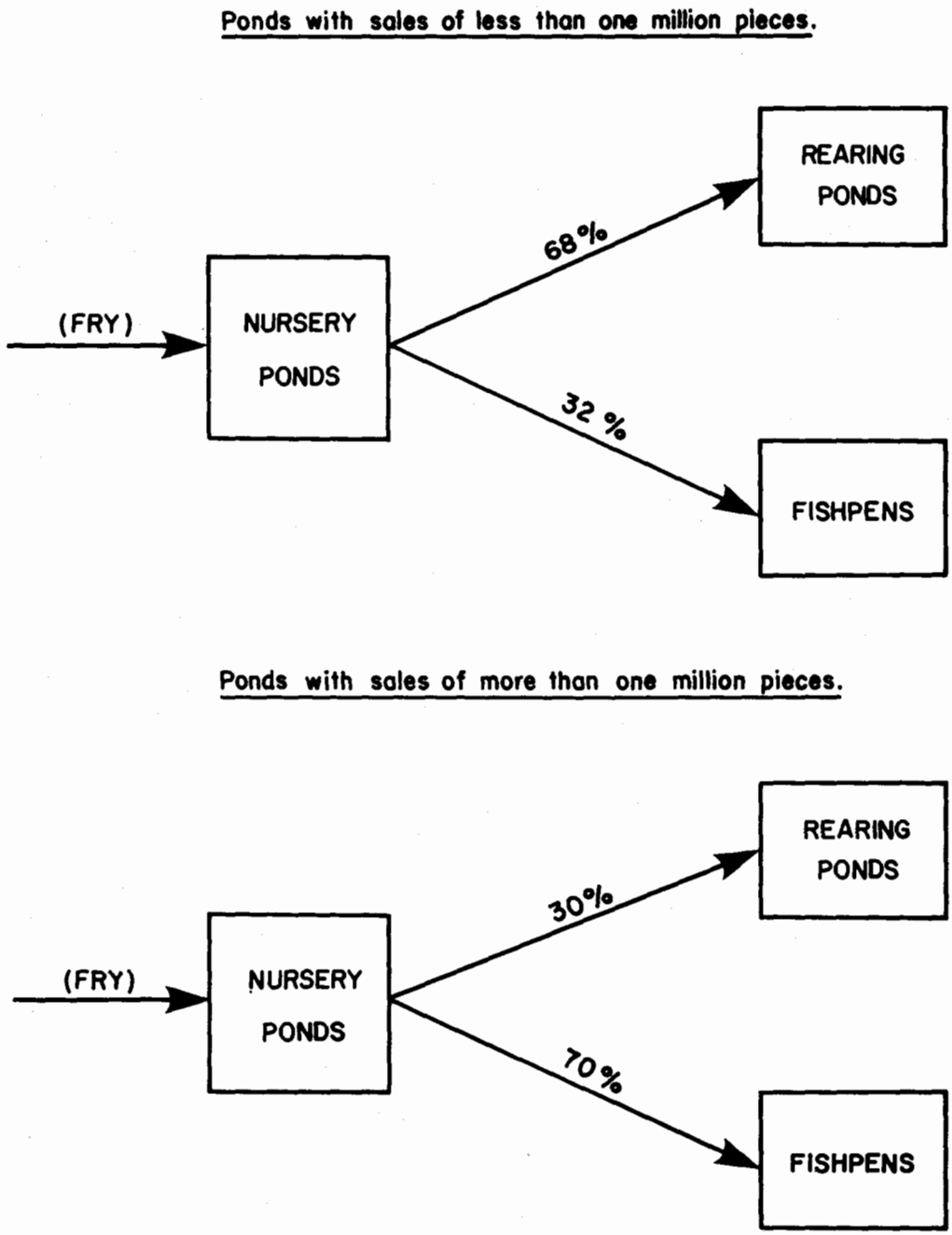


Fig. 2.30. Marketing channels for fingerlings sold by nursery fish pond operators in Bulacan and Rizal, 1976.

remaining fishpen operators, having developed stable relationships with particular nursery pond operators, in effect have insulated these fingerling suppliers from the declining fingerling demand that faces the business as a whole. Nursery pond operators who have suffered the most are those who failed to develop a regular clientele of successful fishpen operators over the past five years.

With the less experienced fishpen operators weeded out and the remaining operators more closely integrated with their fingerling suppliers, a more stable period of development of the fishpen business appears likely. Still, there appear to be two distinct groups of fishpen operators. On the one hand are those who have developed a long-standing patron-client relationship *(suki)* with a particular supplier, who can usually purchase on credit, who are usually satisfied with both the quantity and the quality of their purchases, and whose fingerlings dying within the first week after stocking are often replaced free-of-charge by the seller. On the other hand are those who buy from no particular supplier, who have difficulty arranging for credit purchases, and who often complain of having been cheated in the counting by unscrupulous sellers. Respondents claim that it takes several purchases and mutual satisfaction with the other's reliability to establish this *suki* relationship.

Transport of fingerlings

Despite the fact that the fry have grown into more visible fingerlings, the lack of an instrument to accurately count the fingerlings results in the necessity of relying on the comparative density technique to establish the quantity sold. After the buyer has chosen a representative container, the contents of which will be used to calculate the total number of fingerlings in all such containers, the fingerlings are transferred from nursery ponds to rearing ponds and fishpens by *petuya.* (Figs. 2.31, 2.32, 2.33). *Petuya* are 12- to 20-m open boats, powered by inboard gasoline engines. Fingerlings are placed in an open well in the petuya through which water from outside is circulated (Fig. 2.34). Carrying capacity varies from 15,000-75,000 fingerlings depending on *petuya* dimensions, fingerling size, and weather conditions expected during transport (Fig. 2.35). The trip from Bulacan to Laguna de Bay takes four to six hours depending upon fishpen location (Fig. 2.36), and fingerlings are acclimated to lower salinity during transport through the circulation of water in the well. Pollution in the Pasig River through which the *petuya* must pass necessitates closing of water intakes while still in Manila Bay, resulting in a fairly abrupt adjustment to the fresh water of Laguna de Bay when the intakes are reopened. Mortality during actual transport was reported to be minimal—less than 2% in 28 of 30 recent shipments. However, mortality as high as 36% occurred within three days of stocking, lending credence to the belief that acclimation while in transport or before stocking is inadequate.

Because fingerlings are very fragile, much more so than the relatively hardy fry, they are transported for short distances only. Plastic bags with oxygenated water can also be used to transport fingerlings, although at a much less dense packing rate. Approximately 200 fingerlings per bag, or 40 per liter, is considered maximum. Smaller shipments to rearing ponds in Bulacan and the other provinces of Central Luzon are made in plastic bags, enclosed in pandan bags or styrofoam boxes, and delivered by jeepney. The fragility of the fingerlings stems from their susceptibility to disease when even a small number of scales are lost, so maximum care must be taken to avoid overcrowding and rough handling at this stage. The *petuya* thus represent the best way to transport large numbers of fingerlings.

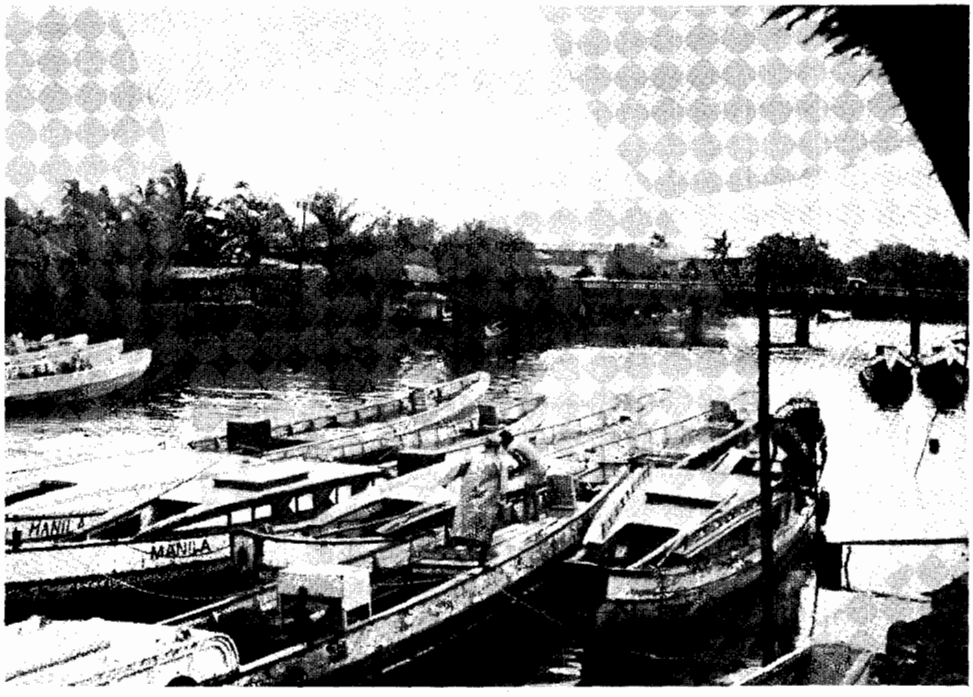


Fig. 2.31. "Petuya" in Barrio Dampalit, Malabon, Rizal Province.

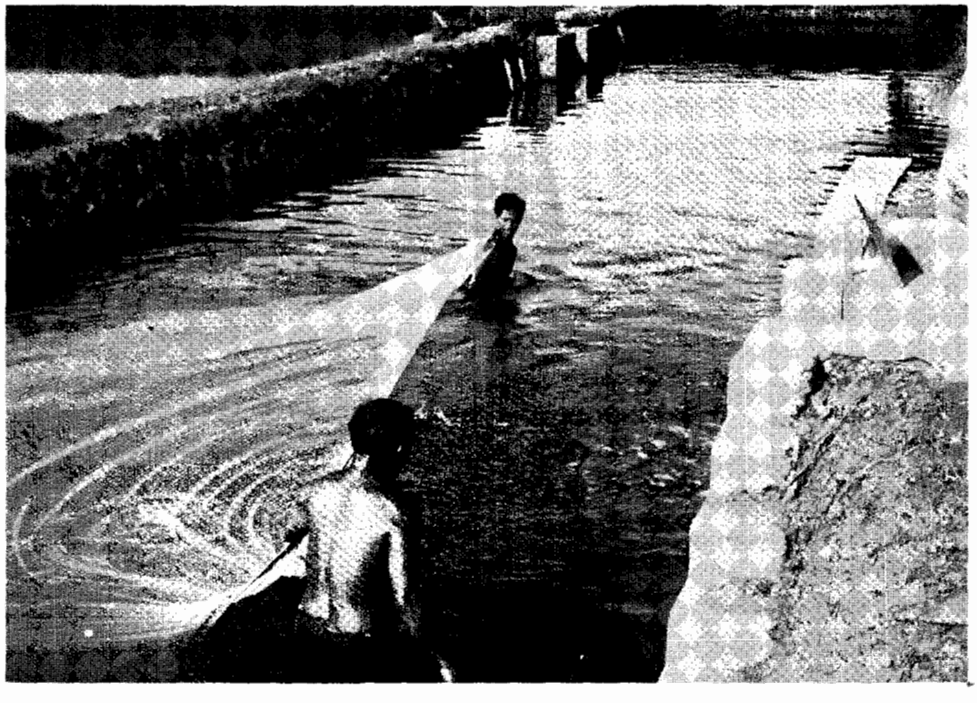


Fig. 2.32. Encircling the fingerlings at gate.

Fig. 2.33. Transferring fingerlings from the pond to "Petuya".

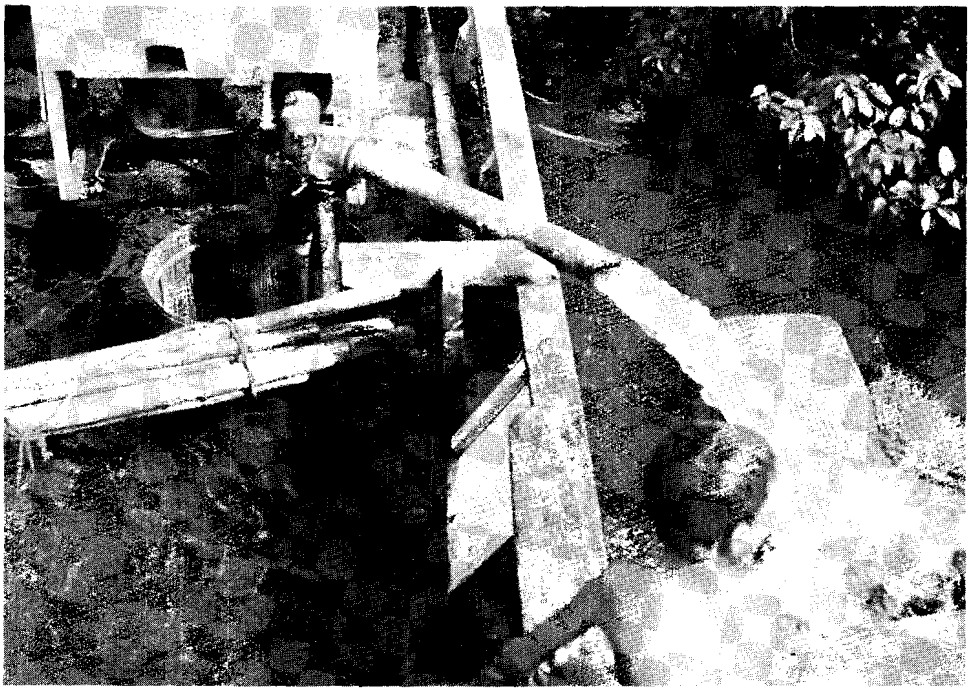


Fig. 2.34. Transporting fingerlings in "Petuya"

Fig. 2.35. Stocking fingerlings in rearing pond.

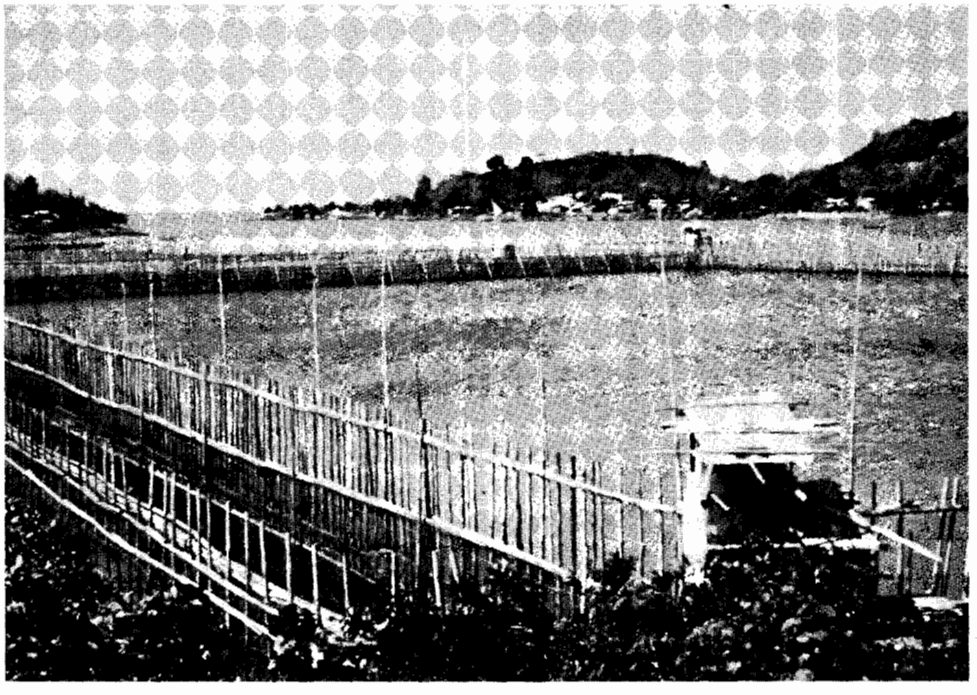


Fig. 2.36. Fishpen in Laguna de Bay. Photo by L. Hollenbeck.

FACTORS AFFECTING CHOICE OF STOCKING MATERIALS

During 1976, nursery ponds were operated in Regions I (Ilocos), III (Central Luzon), IV (Southern Tagalog), and VI (Western Visayas). Rearing pond operators in these regions thus have the option of stocking fry or fingerlings, or some combination of both. BFAR nursery ponds are also producing fingerlings as part of the fishpond subsidy program. The breakdown of stocking materials by type was revealed by the SEAFDEC-PCARR study (Fig. 2.37). In all regions, except Central Luzon and Southern Tagalog, the majority of pond operators stocked fry.

To some extent pond layout determines the type of stocking material preferred. Ponds which have their own nursery and transition compartments will be stocked with fry, and fingerlings for stocking will be raised in rearing compartments. The majority of ponds,

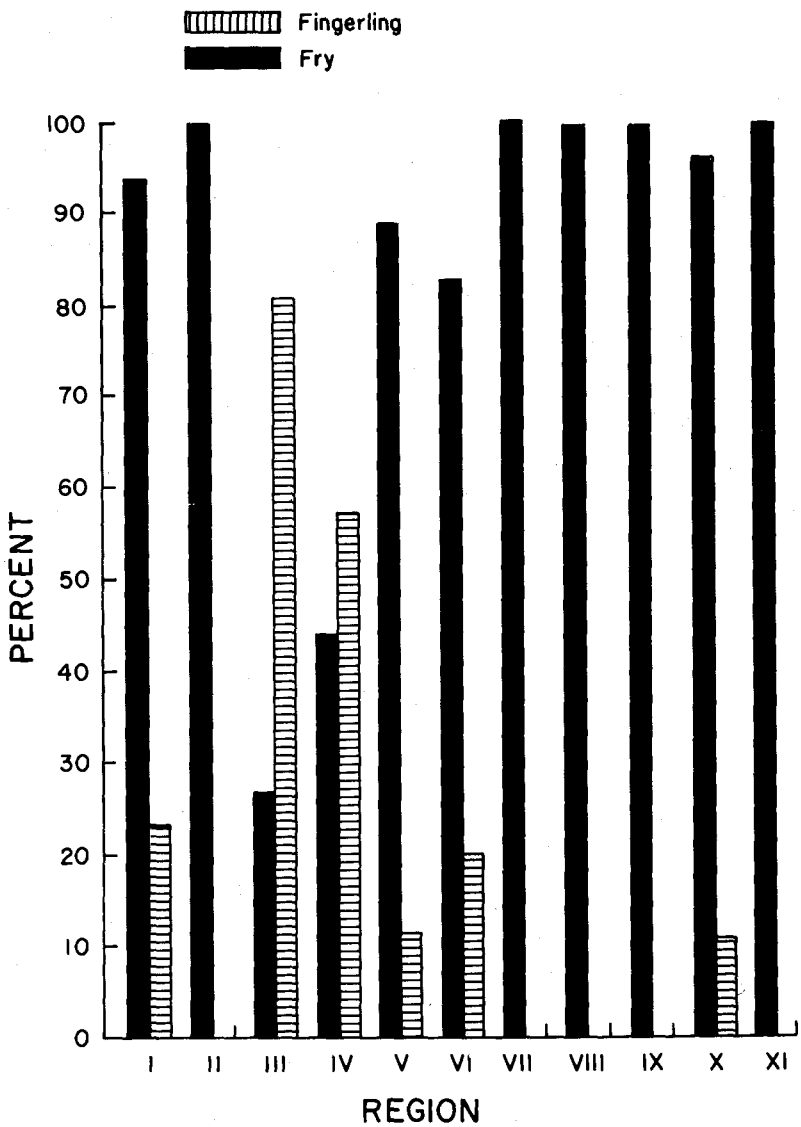


Fig. 2.37. Stocking materials used by rearing pond operators by region, 1974. (Source: SEAFDEC 1976 Annual Report, pertaining to work of the SEAFDEC-PCARR Socioeconomic Survey of Aquaculture. Note that percentages in any one region may total more than 100 since some operators stocked both fry and fingerlings.)

however, do not have such compartments, having traditionally been stocked only with fry, or as in the case of many in Luzon, only fingerlings. Regions without specialist nursery pond operators must rely exclusively on fry. Relative availability of the two alternative stocking materials is thus a second determinant of the stock chosen.

For rearing pond operators who have the option of stocking fry or fingerlings, the relative price of each is also a determinant of demand. While the data base is inadequate to estimate cross elasticities, many respondents indicated that relative prices are important enough to their decision making for a very general statement to be made. Fingerling prices exhibit seasonal fluctuations, just as do fry prices (Fig. 2.38). The preference of Central Luzon and Bulacan and Rizal rearing pond operators for fry over fingerlings during summer 1977 can be understood by a quick comparison of their relative prices. At no time in 1976 were fry prices less than 36% of 2-in fingerling prices. However, in July 1977, these prices dropped to only 20% of the 2-in fingerling price. Since rearing pond operators can achieve a

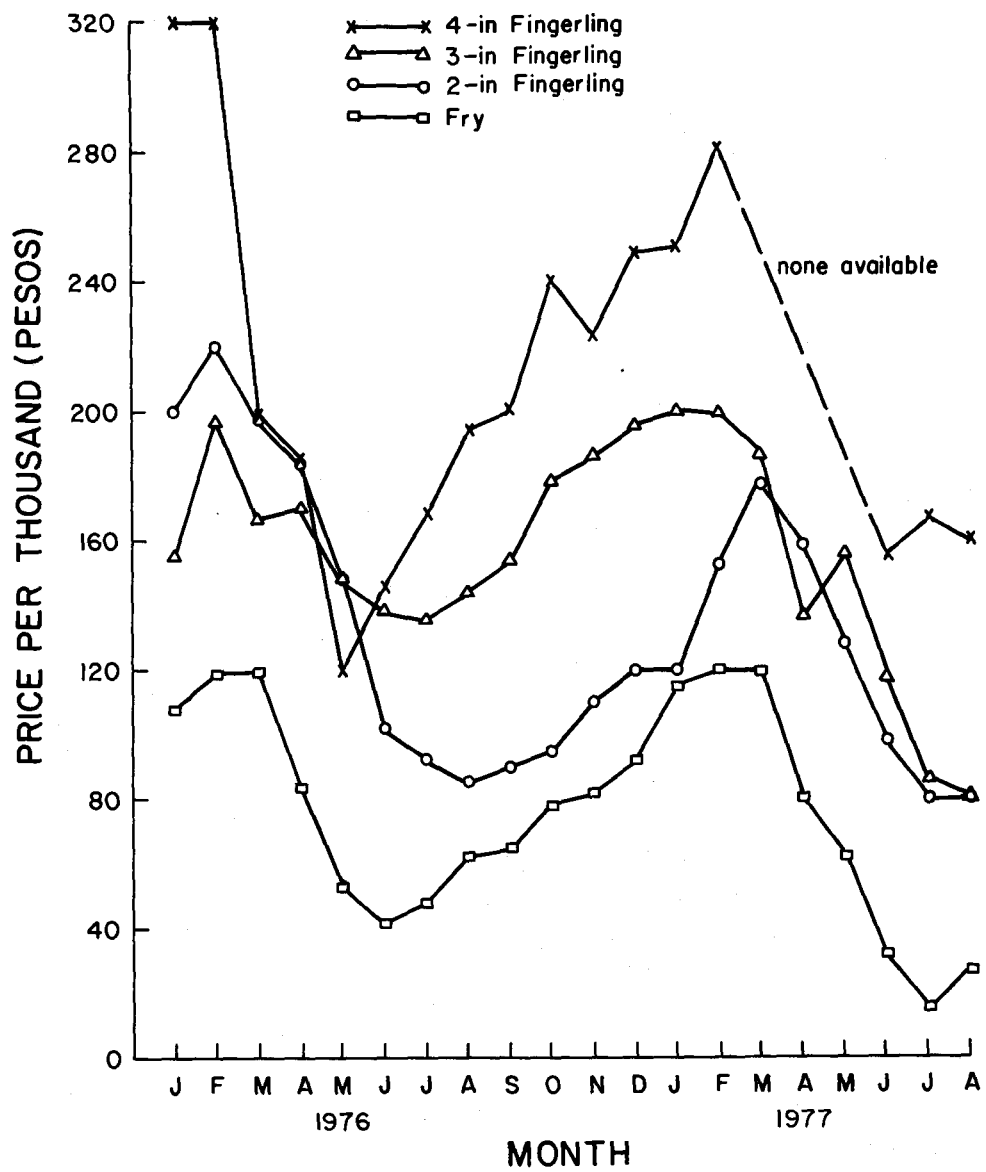


Fig. 2.38. Manila area fry and fingerling prices, 1976-1977.

fry-to-fingerling survival rate close to 50%, even allowing for the extra 45 days of rearing period required for fry over 2-in fingerlings, the attractiveness of fry in 1977 is obvious. This buyer preference for fry was confirmed by observations on the extreme storage difficulties that many nursery pond operators encountered in mid-1977 because of lack of fingerling buyers.

SUMMARY

This chapter has provided a broad overview of the fry and fingerling industries and has set the stage for the analysis in succeeding chapters. Information presented to this point documents the existence of a fry industry that is national in scope, involving all regions of the country in varying degrees. The predominant role of nursery pond operators in Bulacan and Rizal has been demonstrated by their importation of 82.1% of the fry involved in interregional trade in 1976, and by their role as fry "consumers" and fingerling "producers."

The next two chapters will examine and analyze in detail the industry's structure, conduct, and performance.

3. Market Coordination: The Economic Structure of the Fry and Fingerling Industry

STRUCTURE DEFINED

The preceding chapter provided an overview of the logistics and mechanics of the fry gathering and distribution system and of the nursery pond business. The purpose of this chapter is to add economic meaning to the physical system so far described by analyzing the factors that have led to the evolution of the present industry structure. Webster's New World Dictionary defines structure as "the arrangement of all the parts of a whole; something composed of related parts." By establishing the relative position of fry gatherers, middlemen, and pond operators to each other, and the linkages among them, it will be possible to analyze and evaluate the contribution of each to the whole system.

Markets are organized in dimensions of space, time, and form, and industry structure will be a reflection of how the industry organizes itself to provide the associated space, time, form, and possession utilities. Although all dimensions are important to any marketing system, the primary concern in this study is the spatial dimension. There are several reasons for this emphasis. The extreme perishability of fry removes any wide-scale storage (time utility) potential from the market. Once fry are stocked in fishponds, they begin to grow; hence the time dimension is inextricably tied to the creation of form utility as fry are transformed to fingerlings. The previous chapter indicated the nature of this transformation by nursery pond operators and of the rearing (processing) time involved. With widespread fry production geographically separated from fishpond area, and the creation of space utility the primary function of middlemen, the spatial efficiency of the fry marketing system is of major importance.

Market systems can range from two-level to hierarchical. With localized, self-sufficient markets dependent upon a small supply hinterland, one would expect a two-level system to be predominant. Such a system would be characterized by the commodity's moving from the producing center to the consuming center with no change of title between the two (Jones 1974). An example would be the farmer who sells his own produce at nearby markets, and where middlemen play no role. Such systems have been described by Jones for African foodstuffs and by Carol Smith (1972) for Guatemalan handicrafts, and certain other produce such as firewood, greens, flowers, and eggs, all characterized by limited urban demand and widespread production.

The opposite extreme to the two-level system is one of hierarchical redistribution, reflecting a prominent role for the various middlemen who handle the bulking and redistribution of the commodity. The model is predicated on the existence of central places where bulking and redistribution takes place and where supply and demand information is absorbed to facilitate price formation. Skinner (1964-1965) has applied this central place theory of Losch (1954) to an analysis of marketplaces in China. Assuming ubiquitous resources, uniform population (demand), lack of geographic distortions, only an upward flow of the commodity, and no trade between redistribution centers of the same level, the idealized model of the resulting hierarchical structure would be that shown in Figure 3.1.

Each redistribution center represents a location of title exchange. The length of the marketing chain can then be measured by the flow of commodities through each redistri-

bution center. As distinct from the geographic physical commodity flows presented in the previous chapter, the marketing system can be visually presented in a series of economic maps. The length of the marketing chain, in the economic sense, is measured by the number of title exchanges per unit of fry.

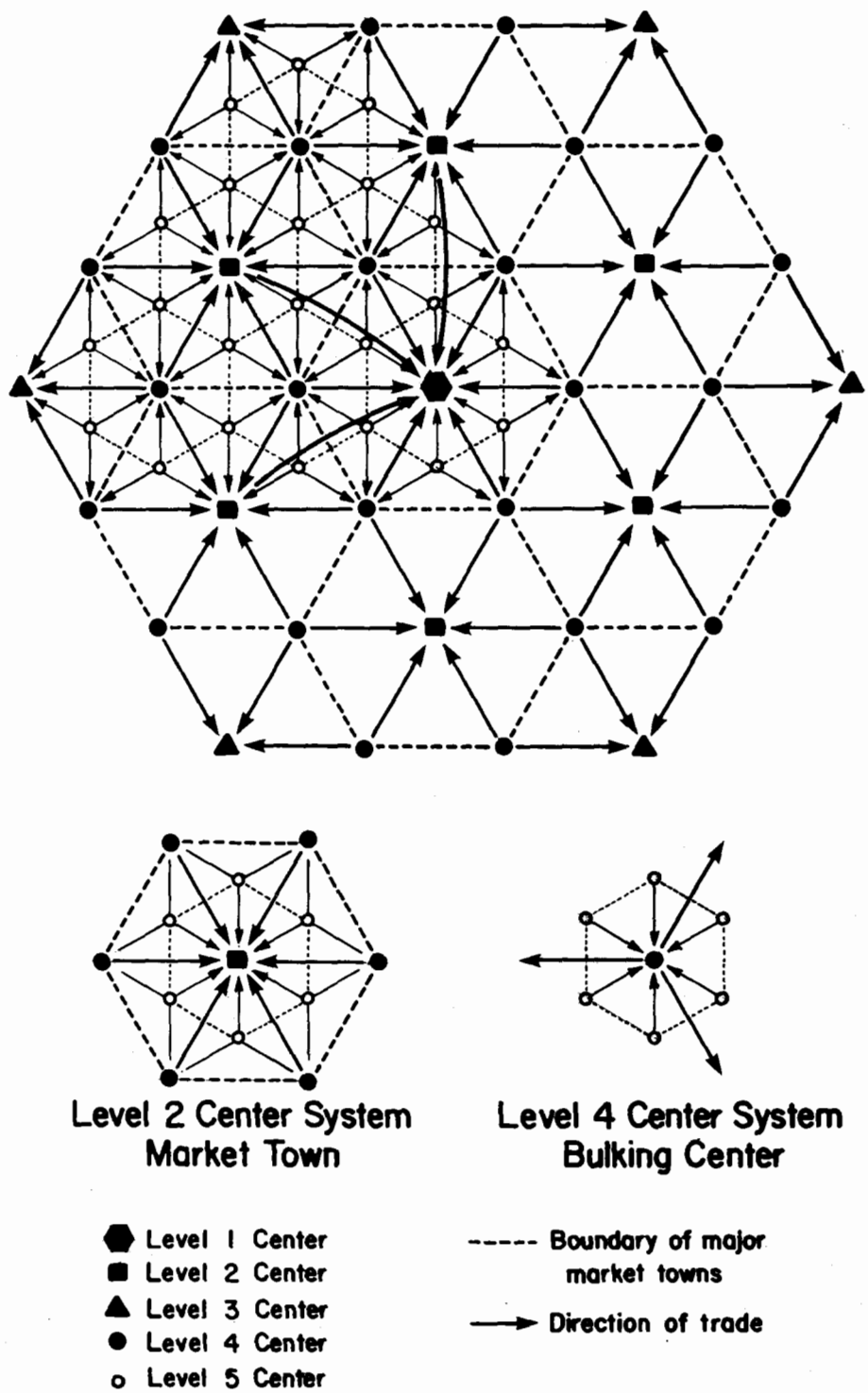


Fig. 3.1. Idealized model of hierarchical commodity flows. (Reproduced from Smith (1972), with permission of the publisher.)

The two-level and the hierarchical models are presented here as a framework for analyzing the spatial dimensions of the market structure of the fry industry. The structure-conduct-performance paradigm as espoused by Bain (1968) and as discussed earlier is not thought to be as useful as the spatial dimension approach because the former does not readily permit detailed examination of the subsectors of the fry and fingerling industry and of the linkages among them.

DETERMINANTS OF ECONOMIC STRUCTURE

With substantial intra- and interregional trade, it would be most unlikely that the structure of the fry and fingerling industry be of the two-level type. Fry gatherers (producers) clearly could not sell directly to pond operators (consumers) except in the off-chance that the pond is in close proximity to the fry ground. Nor, if there were economies of scale in transport of fry, would it be efficient for them to do so. However, with fry grounds only along coastlines, rather than geographically ubiquitous, and concentrations of fishponds in provincies where fry are not caught in large quantities, it would also be surprising to find a distributional pattern approaching Lŏschian uniformity.

To varying degrees, certain factors will influence the structure towards a two-level system or towards an hierarchical redistribution system. Some, such as the characteristics of the fry commodity, particularly its seasonality and perishability, have already been mentioned. Certainly in an island country such as the Philippines, one would expect the geographical setting and associated transportation and communication network to play a role in determining fry industry structure. The ethics of conducting business will influence the structure of business relationships and redistribution, as will the patterns of ownership of productive resources, particularly of capital. Finally, government regulations that either restrict or enhance free competition will affect interrelationships between components of the industry. Indeed, the study found the industry to be essentially hierarchical, modified by the geography of the country.

Characteristics of the fry commodity

The major economic characteristics of fry are seasonality, uncertainty of catch, and perishability. Uncertainty of catch creates risk, the transfer or minimization of which becomes a major factor in determining market outlets and degree of integration. One can predict that concessionaires will attempt to minimize their risk due to uncertain catch by securing more than one fry ground concession, and to minimize their risk due to perishability by arranging for assured outlets to which fry can be expediently shipped. Such assurance of purchase may be achieved through partnerships or through written or unwritten contracts with buyers of fry.

The uncertainty of catch also creates problems for buyers who desire an assured supply of stocking material for their ponds. One can expect them to minimize this risk by offering guaranteed outlets to concessionaires in various locations in the country. Such responses on the part of concessionaires and pond operators will tend to shorten the marketing chain, implying a tendency towards only two transactions in the system: the first between fry gatherer and concessionaire, and the second between concessionaire and nursery or rearing pond operator.

Geographical setting and the transportation network

Improved transportation and communication facilities will also shorten the marketing chain for a given distance. The island nature of the Philippines and the consequent impossibility of land transport between islands result in a fry transport network heavily dependent upon the freight services of Philippine Airways, Ltd. (PAL). Prior to 1963 when fry were transported by ship in clay pots, time in transport often exceeded two days. Today, however, shippers from the farthest points in the country can reach Manila or other major markets in a matter of hours. These rapid air shipments, coupled with telegraph communications which provide information on supplies and prices, have allowed closer contact among concessionaires, nursery pond operators, and the large rearing pond operators, resulting in large numbers of fry in interregional trade.

All major cities in the country are connected by air and no fry ground is more than one day's surface transport away from an airport serviced by a minimum of three flights a week. Because concessionaires can ship fry directly to consignees or can sell from their *bodega* (warehouse) to the consignee's commissionman, the number of transactions for fry involved in interregional trade is low. One transaction takes place when gatherers sell to the concessionaire, and another when concessionaires sell to the consignee's commissionman. The increase in the relative proportion of fry involved in interregional trade, taking advantage of the directness and reduced costs (due to reduced mortality) of air routes, has thus tended to shorten the marketing chain.

However, certain geographic features and the nature of fry occurrence combine to produce market hierarchies and redistribution centers. With low catch levels spread over wide geographic areas as in the Ilocos, for example, dealers have entered the marketing system to collect fry from several dispersed fry grounds, taking advantage of surface transport economies of scale related primarily to vehicle rental (Table 3.1). While single concessionaires may not experience high enough catch levels to warrant the hiring of a 500,000-fry-capacity vehicle, the dealer from a redistribution center can do so, knowing that he can fill the vehicle and thus minimize per unit transfer cost through purchases from several concessionaires in the same general vicinity.

Table 3.1. 1976 Fry transfer costs and economies of scale (Pesos).

	Surface (by jeepney, 275 km)				Air (by PAL jet, 1,180 km)			
	5,000 fry	100,000 fry	500,000 fry	1 M fry	5,000 fry	100,000 fry	500,000 fry	1 M fry
Labor								
Packing technican and water boys	10	200	1,000	2,000	10	200	1,000	2,000
Driver and helpers	–	60	80	160	10	20	30	60
Vehicle rental	50 (bus)	250	250	500	10 (bus)	50	50	100
Gasoline	–	150	150	300	–	10	10	20
Freight charges	–	–	–	–	8	166	826	1,650
Food for laborers	10	40	200	400	–	50	100	200
Communications	–	26	26	26	26	26	26	26
Return of empty containers	–	–	–	–	4	84	421	843
Miscellaneous[a]	1	55	75	100	2	60	96	142
Total ₱	71	781	1,781	3,486	70	666	2,559	5,041
Cost per 1,000 fry	14.20	7.81	3.56	3.49	13.80	6.66	5.12	5.04

[a]Includes oxygen, depreciation on shipping containers, permit fees, and public relations ("tong").

Business conduct

Sections of the preceding chapter have alluded to the presence of opportunistic behavior in the fry system. Because of the difficulties of accurately counting fry, the development of a *suki* relationship, or a permanent trusted-customer connection, becomes of paramount importance to both buyers and sellers. Opportunism, that is, behavior which promotes one's ends with no particular regard for principles, was cited by respondents at all levels as the major problem facing the industry. Several respondents even characterized the fry business as attracting more gamblers and cheaters than any other business in the country. I have been challenged by some who claim this observation of mistrust at all levels in the marketing chain overemphasizes its importance as a determinant of market structure. While I agree that actual occurrences of counting irregularities and cheating probably occur somewhat less frequently than is claimed by respondents, the fact that buyers and sellers fear such an occurrence whenever selling to or buying from unknown individuals significantly affects their choice of business relationships. The belief in the potential opportunism of others, rather than its actual occurrence, is the determining factor for industry structure. The inventor of a cheap, easy-to-use device to count large quantities of fry would do more to aid the industry than any university researcher ever will.

Williamson (1975) links opportunism to uncertainty and small numbers in a manner useful for understanding how opportunism influences market structure. Williamson depicts opportunism as the "strategic manipulation of information or misrepresentation of intentions" (p. 26). Because in an initial transaction the opportunistic seller cannot be distinguished from sincere types, the costs of initial contracting and contract monitoring may be high, leading to a desire to internalize these costs. However, as argued by Williamson, "merely to harbor opportunistic inclinations does not imply that markets are flawed on this account" (p. 27). Without a small-numbers condition, rivalry among large numbers of bidders renders opportunistic inclinations ineffectual because the opportunistic bidder will not be able to repeat his behavior at contract renewal time as customers shift to other assumed sincere types.

The effect of opportunistic behavior is important, however, in that over time it can transform a large-numbers condition into a small-numbers condition with consequent implications for market structure. To avoid the added transaction cost associated with uncertainty, sellers and buyers will attempt to establish *suki* relationships with particular outlets or suppliers, thus over time, reducing the potential transactions for opportunists. Alternatively, family members or other trusted individuals will be established in business either as suppliers or as outlets, or used as commissionmen for long-distance transactions. The net effect of opportunistic behavior and the widespread belief of its high cost is thus to shorten the marketing chain and to concentrate buying and selling activities in fewer hands as fry businessmen internalize the associated transaction costs through various forms of vertical integration.

One other important sociological factor in determining the structure of the industry is related somewhat to the issue of opportunism and trust. This is the tendency of certain ethnic groups in the Philippines to prefer business dealings with members of their own group. The fry industry and indeed the entire milkfish industry has relied on the expertise of Tagalog entrepreneurs. Tagalogs come from the Manila area and they remain the most active participants in the fry and fingerling industry throughout the country. Tagalog emigrants from Luzon built the first milkfish ponds in Mindanao and control the fry concessions in southern and central Mindanao, the most productive fry ground areas in the country. To the degree that Tagalogs prefer conducting business with their own group, fry business opportunities are restricted for others.

Ownership of capital

The flow of capital through an industry is a measure of interrelatedness between components of the system. Strict buying and selling activities with no cash advances or credit payments would imply that each level within the industry is financially independent and thus free to make marketing decisions without regard to financial obligations to other components of the industry. In contrast, one would expect that interdependence due to capital repayment obligations would shorten the marketing chain if the flow of capital was from pond operators to concessionaires. The latter's obligation to supply pond operators with fry in return would result in more direct fry shipments than would occur if the marketing outlets of concessionaires were not predetermined. The result would be a tendency to bypass redistribution centers and to approach a two-level system.

In general, capital flows in the opposite direction to the commodity flow. As indicated in Table 3.2, 40% of fry gatherers are dependent upon concessionaires for their gathering equipment and 12% for cash advances, the cost of which is repaid without interest through charges against catch. Runners are totally dependent upon concessionaires and dealers for their operating costs. Concessionaires receive interest-free cash advances from and form partnerships with nursery pond operators in Bulacan and Rizal. Forty-seven percent of the concessions were partnerships; 42% single proprietorships; one was a cooperative, another a corporation, and still another a municipal-run concession. Forty-four percent of the partnerships relied exclusively on the Manila-based consignee for financing. A larger proportion of single proprietorships depended on buyers of their fry for cash advances. Only 25% of the concessionaires was self-sufficient, indicating the high degree of dependence upon outside financing to meet their concession fees.

Dealers were somewhat more self-sufficient, 38% not borrowing for their 1976 operations. Several dealers, particularly in the Western Visayas and the Ilocos regions, also doubled as fishbrokers, and as such, financed 12% of the rearing pond operators by agreeing to accept payment for fry after harvest of the marketable milkfish. Dealers in Ilocos suffered, however, when fishponds in Pangasinan were flooded in 1976 and resulted in no

Table 3.2. Credit sources, 1976 (Percent of respondents availing of each source). Totals may equal more than 100%, since more than one source was used in some cases.

			Lenders (Providers of capital)						
			Interest free				Interest charged		
Borrower	Concessionaire	Dealer	Nursery pond operator	Rearing pond operator	Relatives and friends	Cooperative	Govt. & private banks	Money lender	Self-sufficent
Fry gatherers	12 (cash) 40 (gear)				2	4			48
Runners	67	33							0
Concessionaires:									
Partnerships and single proprietor			50		6		33	3	25
Cooperative									100
Corporation									100
Dealers			31		24		7		38
Nursery pond operators				4	7		43		57
Rearing pond operators		12	1		12		37	1	44
Fishpen operators			17		13		23		57

harvest for rearing pond operators who naturally were unable to meet their obligations to the dealers.

Nursery pond operators are the most self-sufficient group within the whole industry, and are the primary financing source for concessionaires and dealers. In 1976 they also sold on credit to 17% of the fishpen operators. In 1977, with falling demand for fingerlings, nursery pond operators competing with each other for sales increased their credit to fishpen operators by offering partnerships and delayed payments until after harvest. Nursery pond operators were also the most dependent upon private and government banks for financing.

There is thus a heavy flow of capital from nursery pond operators backwards through the marketing chain to concessionaires and dealers and from them, to runners and fry gatherers. Since the primary purpose of these largely unwritten and interest-free financing arrangements is to assure supply, the overall tendency of capital flows has been to regimentalize and shorten the fry marketing chain as borrowers repaid their obligations through subsequent shipments of fry to lenders.

Unwritten financial obligations such as cash advances, however, did present problems. Failure to repay cash advances or to make good on postharvest obligations was cited as a major problem by nursery pond operators. Bad debts are significant, and the lender's desire to minimize such occurrences through *suki* relationships also tends to narrow the potential sources and outlets, and thus reduce the effective competition at each link in the chain.

Government regulations

The Loschian hierarchical model tacitly assumes that perfectly competitive conditions direct resource use and product flows. As was noted in the preceding chapter, various governmental regulations restrict free trade in fry. Chapter 5 will analyze in detail the effects of these policies. Suffice it to say at this point that restrictions on free trade, to the extent that they make it more difficult for dealers and other middlemen to operate, will narrow the selling opportunities of concessionaires. FAO 115 made it possible for only pond operators, either nursery or rearing or their designated representatives, to ship fry interregionally. One would predict that this regulation would regimentalize fry distribution, and lead to increased integration in the fry industry as producers are tied more closely to consumers.

The extent to which FAO 115 and the concession regulations are circumvented by smugglers will lead the structure of the industry in the opposite direction; that is, towards a redistributive network.

Implications of determinants for market structure

The preceding discussion has revealed a complement of interrelated forces that influence the structure of the fry industry. The underlying factor is uncertainty and the associated risk. Uncertainty arises due to four major factors: a) seasonality of catch and its possible non-appearance in a given locale; b) the extreme price fluctuations associated with seasonality of catch; c) the perishability of fry and the resulting time-constraint in distribution; and d) the belief in the widespread opportunistic behavior of others. One can predict that these price and nonprice uncertainties will lead to certain strategies by components in the industry to minimize risks involved.

Vertical and horizontal integration, either formally through partnerships or through unwritten agreements of cash advances and credit, will lead the structure of the industry

away from the Löschian redistributive network towards a more direct means of distribution. Based on the determinants identified, the general tendency of the fry industry is towards a shortened marketing chain. Smuggling and economies of scale in transport related to geographic dispersion of production are the only factors slowing this development away from redistribution hierarchies.

MARKET COORDINATION

Redistribution centers have been defined as places where title exchanges occur. The extent to which such centers have developed for fry can best be seen by examining the distribution network by economic mapping showing locations of title exchange in the three major producing regions studied: Southern Mindanao (Fig. 3.2), Western Visayas (Fig. 3.3) and Ilocos (Fig. 3.4).

Each of these three regions exhibits a hierarchical pattern with identifiable redistribution centers. There are several differences, however, from the uniform redistributive model. First and most obvious are the geographic disturbances to the model resulting from producing areas' being located only along coasts. In fact, geography so distorts the uniformity of the model as to make it almost unrecognizable but for the retention of the essential element of hierarchicies. A second difference is that the next highest level in the hierarchy is bypassed on occasion. This is particularly true in Western Visayas and Ilocos. In Western Visayas, fry are sometimes sold by San Jose dealers directly to rearing pond operators in

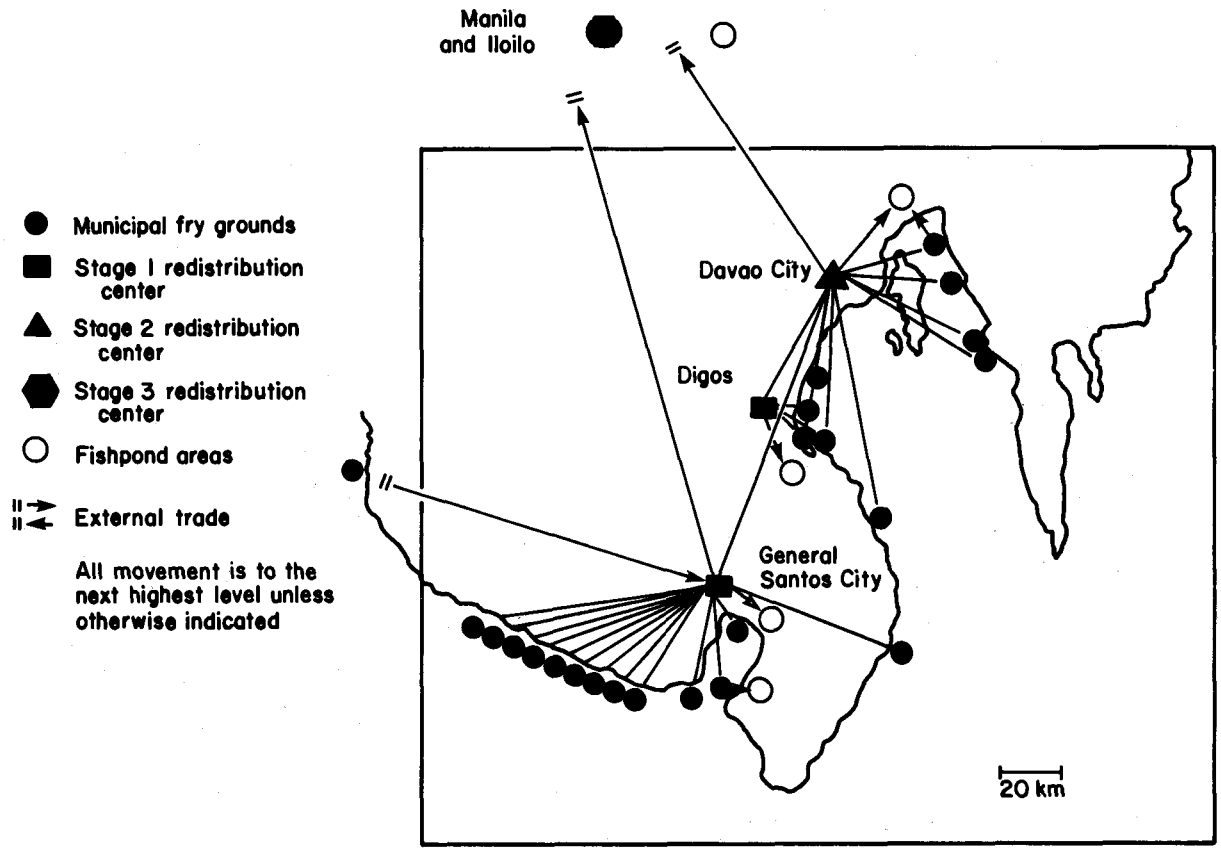


Fig. 3.2. Southern Mindanao fry distribution pattern.

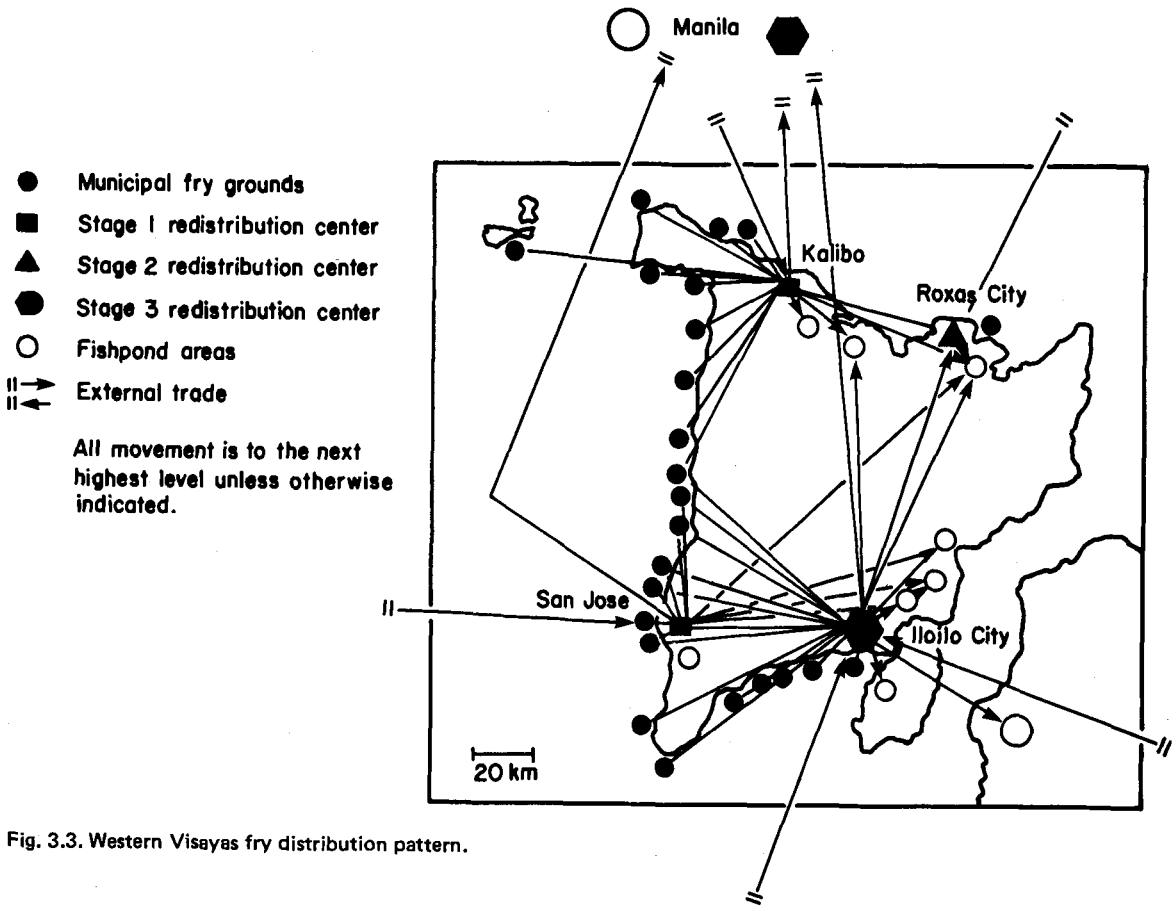


Fig. 3.3. Western Visayas fry distribution pattern.

Iloilo City and Roxas City. Kalibo dealers also make sales directly to rearing pond operators in Roxas City. The Löschian model (Fig. 3.1) showed only an upward flow of the commodity. What is actually taking place in Western Visayas is both upward and downward flows, with intermediaries being bypassed when the purchase is large enough (approximately 500,000 fry) to warrant the pond operator either using his own vehicle or hiring one to buy directly from concessionaires.

In Ilocos, dealers based in Dagupan City buy from both concessionaires in the municipal fry grounds and dealers in stage 1 redistribution centers. These centers in Ilocos consist of dealers who have smuggled fry from concession areas. Their volume is not high enough for Dagupan City dealers to depend entirely on them for supply; hence purchases are also made directly from concessionaires. In addition to those in Ilocos, stage 1 redistribution centers in Southern Mindanao reflect smuggling activity. In Western Visayas they represent primarily legitimate bulking and redistribution activities, although some smuggling and illegal importation from Palawan also shows up here. Were it not for the smuggling activity creating other stage 1 centers, Dagupan City in Ilocos and Davao City in Southern Mindanao would also be considered stage I redistribution centers.

Manila (Fig. 3.5) is the primary stage 3 redistribution center for the entire country, not only for the three regions studied. In fact, one could almost upgrade this center to reflect the trade flows coming from Iloilo City, another stage 3 redistribution center, to be consistent with the Löschian requirement of no trade flows between hierarchies of the same level. This upgrading would imply a longer marketing chain than in fact exists, however. As is apparent from the figures, trade flows to Manila come from stage I and stage 2 redistribution centers and on occasion, directly from municipal fry grounds. It is more accurate to refer to Manila as a fishpond area rather than a redistribution center, although 25-30% of fry shipped to Manila is resold to other nursery pond operators or rearing pond operators.

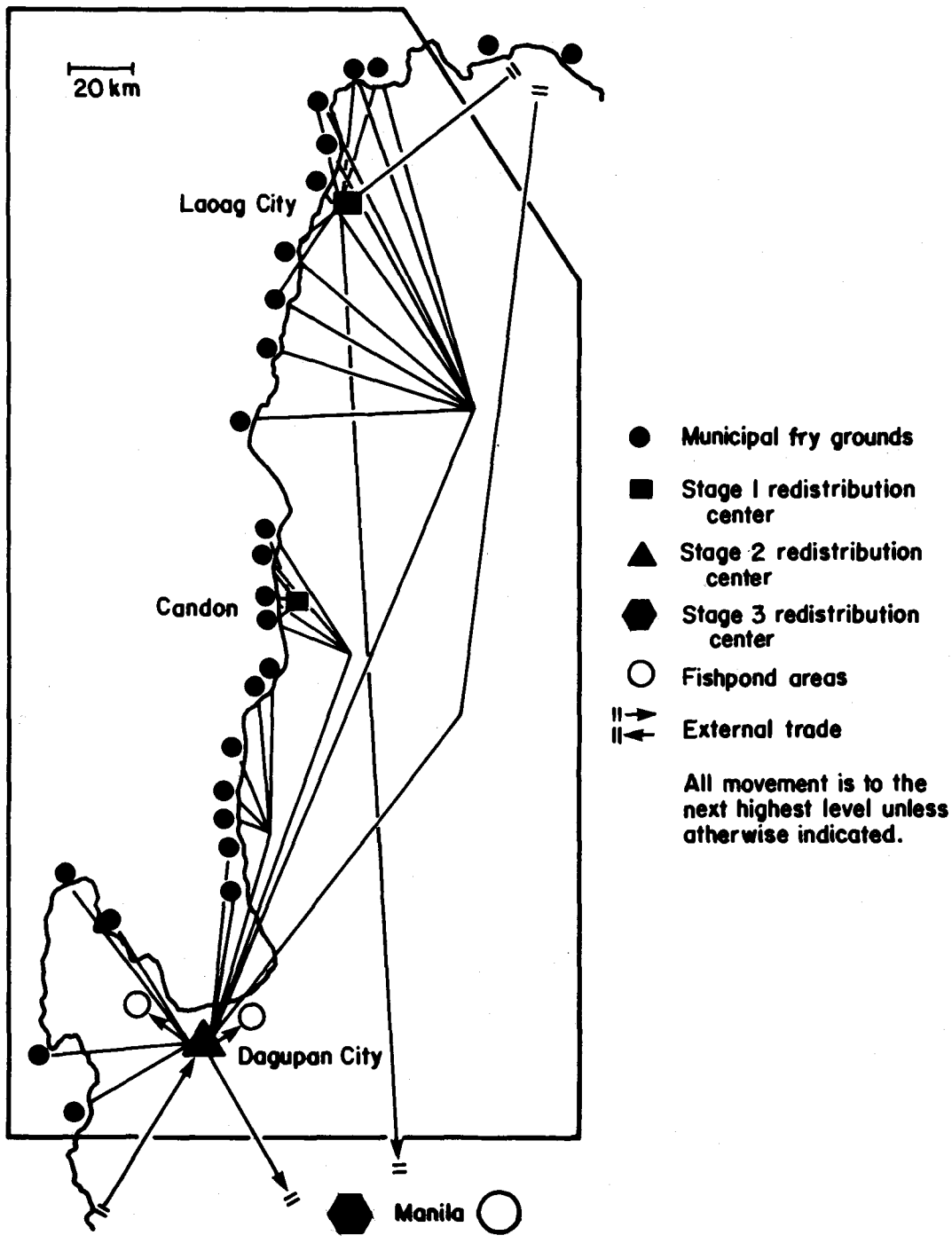


Fig. 3.4. Ilocos fry distribution pattern.

The structure of the fry industry as a whole can best be viewed if these hierarchical trade flows are shown in tabular form (Table 3.3) or in the traditional marketing channel diagram (Fig. 3.6). Table 3.3 indicates the estimated flow of fry in a spatial sense, and Figure 3.6 shows the same information in a functional sense. Both were compiled from information from respondents on marketing outlets supplemented by physical trade flows as compiled for interregional trade statistics. Both table and figure include title and non-title exchanges. Title exchanges are those in which title changes hands. Non-title exchanges include simple physical exchanges and facilitating exchanges. Physical exchanges such

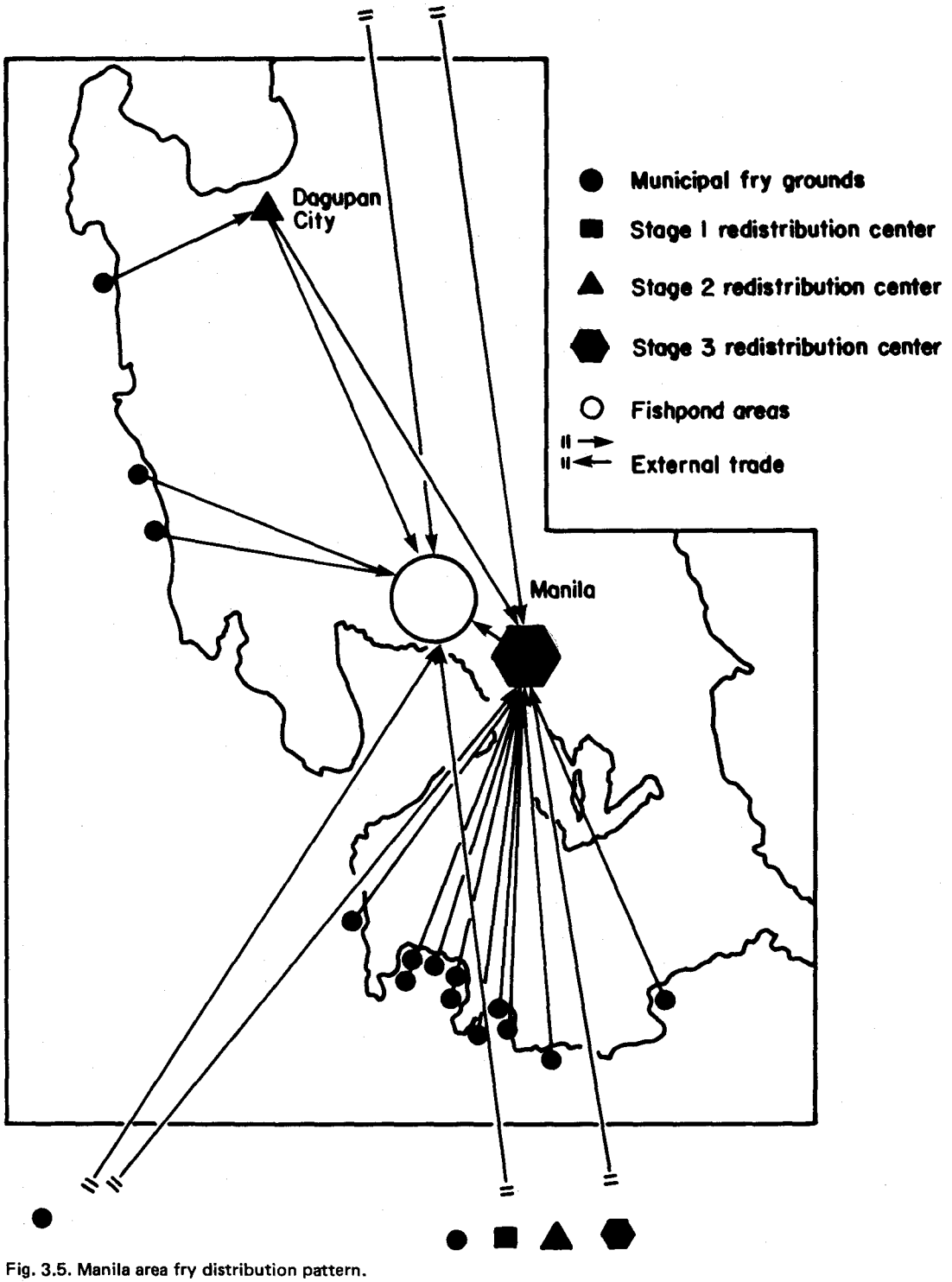


Fig. 3.5. Manila area fry distribution pattern.

as those involving commissionmen exhibit no title change although the commissionman does take physical possession of the fry for the buyer or seller he or she represents. Facilitating exchanges involve brokers and exhibit neither physical possession of the fry by the brokers , nor change of title except by the principals to the exchange.

It is important that these distinctions be clearly understood, for the terms are frequently misused in describing the Philippines' fry and fingerling industry. Because they are

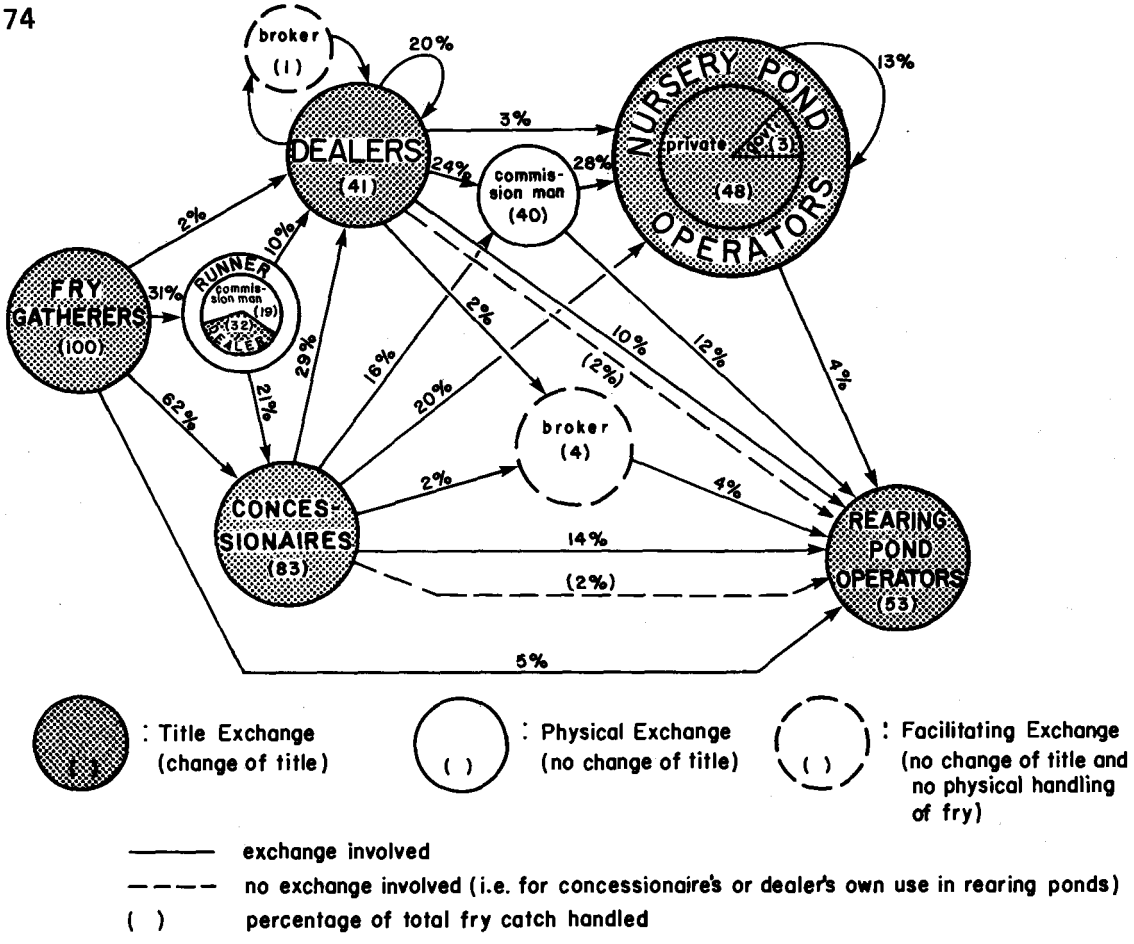


Fig. 3.6. Fry marketing channels.

often misused, the prevailing impression is that the marketing chain is longer than it really is. The total of title exchanges in the fry marketing system is 270 (based on percentages in Table 3.3), which, when divided by 100, indicates a marketing chain involving an average of 2.7 title-exchange transactions per unit of fry. If physical and facilitating exchanges are incorrectly included, the length of the marketing chain increases to 3.4. Since 0.7 of these transactions do not involve change of title, such as occurs when commissionmen (commonly called "agents" in the Philippines) act on behalf of purchasers or sellers, it is easy to understand why BFAR officials assume that the fry marketing chain averages three to four title exchanges from fry gatherers to pond operators.

To put this actual length of 2.7 in proper perspective, the extreme possibilities should be mentioned. Fry gatherers who smuggle fry directly to pond operators have a marketing chain length of 1.0, or the two-level system described earlier. The concession system which requires fry gatherers to sell directly to concessionaires adds another link or transaction. Fry following this route and sold by concessionaires directly to pond operators, such as occurs for much of the interregional fry shipments, would travel through a marketing chain length of 2.0. At the upper extreme would be fry sold by gatherers to runners acting as dealers rather than as commissionmen, who then in turn sell to dealers. These second dealers may then sell to third dealers who in turn sell to nursery pond operators in Manila. Nursery pond operators may then resell fry to other smaller nursery pond operators or to rearing pond operators. The length of this marketing chain is 5.0. The following few paragraphs clarify how the 2.7 length for the marketing chain was determined.

At the municipal fry grounds, fry gatherers who handled 100% of the catch sell 93% of it at the fry ground itself, 12% to runners who act as itinerant dealers, 70% to concession-

Table 3.3. Estimated fry flow: spatial transactions (percent of total marketed). Figures in parentheses represent physical and facilitating exchanges or non-title exchanges. The number of total title exchanges, as distinct from simple physical or facilitating exchanges, is 270. This figure, divided by 100, equals the length of the marketing chain (270 ÷ 100 = 2.7). Total title exchanges plus total physical and facilitating exchanges equal total exchanges.

	Buyers (title exchanges)						Physical and facilitating (non-title exchanges)					
Sellers	Runners (dealers)	Concessionaires	Dealers	Nursery pond operators	Rearing pond operators	Total title exchanges	Runners (commissionmen)	Brokers	Commissionmen	Rearing pond operators	Total non-title exchanges	Total exchanges
Municipal fry grounds												
Fry gatherers	12	70	6		5	93	(19)				(19)	112
Concessionaires			12		6	18				(2)[a]	(2)	20
Dealers					4	4						4
Stage 1 bulking and redistribution center												
Fry gatherers		5	2			7						7
Runners (dealers)		8	4			12						12
Concessionaires			17		8	25			(3)		(3)	28
Dealers				1	5	6			(3)		(3)	9
Stage 2 redistribution center												
Concessionaires				3		3		(2)	(13)		(15)	18
Dealers			21	10	17	48		(3)	(21)	(2)[b]	(26)	74
Stage 3 redistribution center												
Concessionaires				35		35						35
Dealers				2		2						2
Nursery pond operators				13	4	17						17
Total transactions all locations												
Fry gatherers	12	75	8		5	100	(19)				(19)	119
Runners (dealers)		8	4			12						12
Concessionaires			29	38	14	81		(2)	(16)	(2)[a]	(20)	101
Dealers			21	13	26	60		(3)	(24)	(2)[b]	(29)	89
Nursery pond operators				13	4	17						17
Totals	12	83	62	64	49	270	(19)	(5)	(40)	(4)	(68)	338

[a]Used by concessionaires in their own rearing ponds.
[b]Used by dealers in their own rearing ponds.

aires, 6% to dealers, and 5% to rearing pond operators. Of the 70% to concessionaires and the 6% to dealers, 19% are also physical exchanges involving commissionmen. Dealers at the municipal fry grounds resell 4% to rearing pond operators. Concessionaires resell 12% at this level to dealers, 6% to rearing pond operators, and keep 2% for their own use in rearing ponds. Title exchanges at the municipal fry ground level total 115; physical exchanges total 21.

At the stage 1 bulking and redistribution centers, the remaining 7% of fry gatherers catch is sold to other concessionaires (5%) and to dealers (2%). Runners, concessionaires, and dealers also resell some of their fry at this stage. A further 50 title exchanges and 6 physical exchanges take place at this level.

At stage 2 redistribution centers, concessionaires and dealers resell fry to other dealers (21%), to nursery pond operators (13%), and to rearing pond operators (17%). Dealers at this stage keep 2% for their own use. Brokers facilitate 5% of the exchanges and commissionmen, acting on behalf of nursery and rearing pond operators, physically take possession of 34%. Total title exchanges are 51 and physical and facilitating exchanges are a further 41.

At stage 3 redistribution centers, concessionaires and dealers sell 35% and 2%, respectively, to nursery pond operators. Nursery pond operators, acting as dealers, resell 13% to other nursery pond operators and 4% to rearing pond operators.

The net result of these transactions is that nursery pond operators, both private and government operated ponds, "consume" 47% of the original 100% of fry caught. Fifty-three percent is "consumed" by rearing pond operators, of which 2% is for concessionaires' own use and 2% for dealers' own use. For the sake of simplicity, mortality of fry in transport has not been included in these computations.

The total transactions in all of the above locations as shown at the bottom of Table 3.3, are represented graphically in Figure 3.6. The fry marketing channels as shown thus represent the total system, with its length of 2.7 title exchanges. The marketing system is thus hierarchical, but short when one considers that 2.0 of these title exchanges are required by the law that establishes the concession system and consequent title exchange between fry gatherers and concessionaires.

As implied earlier, a useful distinction can be made between interregional and intraregional trade. The marketing channel for interregional trade tends to be shorter than that for intraregional trade. Because of volume of shipments, economies of scale, and financial ties between concessionaires and nursery pond operators, the former approaches a length of 2.0, involving itinerant commissionmen to complete the exchange. Commissionmen handle 40% of the fry, most of which are destined for interregional shipment. It should again be emphasized that these commissionmen are not directly involved in title exchanges since they do not take title to the fry in their own names but rather in the names of buyers whom they represent.

Intraregional trade, on the other hand, involves smaller shipments on average and results in more assembly and disassembly of fry in stage 1 and stage 2 redistribution centers, thus a more dominant role for dealers and a longer marketing chain.

In contrast to the fry marketing system, marketing channels for fingerlings represent a two-level system with only 1.0 title exchange. With minor exceptions of physical exchange using commissionmen, fingerlings are marketed directly by nursery pond operators (producers) to rearing pond and fishpen operators (consumers) (Fig. 3.7).

There is nothing inherently valuable to a short marketing chain, however. While it appears that the complement of structural determinants identified has led to a fairly direct marketing chain for fry, the value of this particular form of industry structure depends upon the performance it achieves. One of the purposes of the next chapter will be to examine

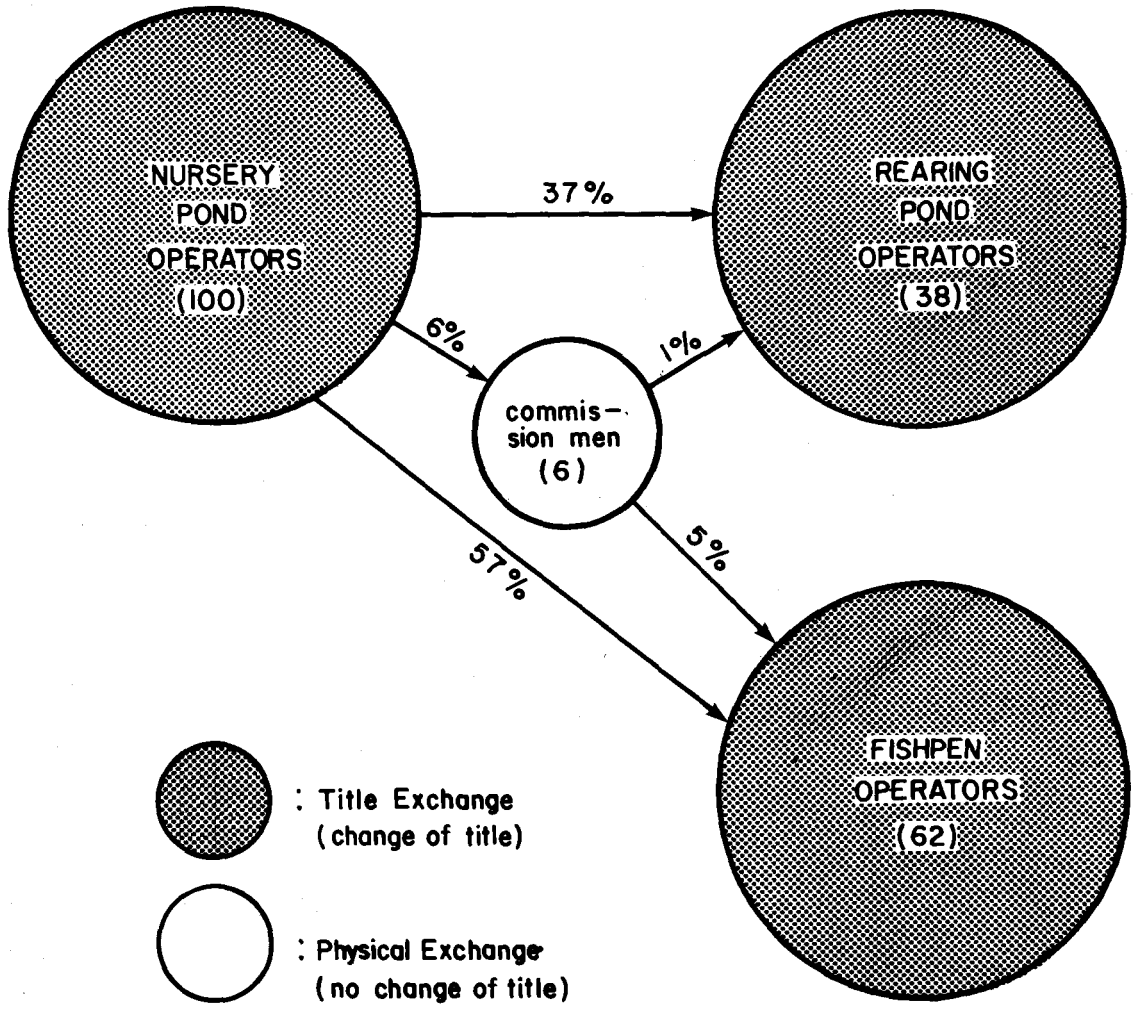


Fig. 3.7. Fingerling marketing channels.

these marketing channels for possible imperfections. For example, do the services provided by dealers warrant the extension of the marketing chain from 2.0 (the minimum required by law) to 2.7? Does the marketing system achieve high levels of technical and price efficiency?

STABILITY OF INDUSTRY STRUCTURE

So far, a static view of the fry and fingerling industry structure has been presented. The actual structure is clearly dynamic, the degree of which depends upon entry and exit of market intermediaries, the permanence of buying and selling relationships, and the attempts of functionaries to integrate vertically and horizontally. While no time series data are available, an indication of the stability of the structure was gained from interviews with buyers and sellers regarding their marketing sources and outlets.

Four factors which indicate change in the industry were identified (Table 3.4). These are: a) years in the business and occurrence of off-periods; b) change in competition from close competitors during the last five years; c) number of years with major supplier and change in supplier choice; and d) number of years with major outlet and change in outlet choice. These factors indicate that competition within the industry has increased in recent years.

While the number of years spent in the business varies greatly within each group, nursery and rearing pond operators with an average of 16.9 and 16.1 years, respectively,

Table 3.4. Indicators of stability and integration of the fry and fingerling industries.

	Gatherers	Concessionaires	Dealers	Nursery pond operators	Rearing pond operators	Fishpen operators
Years in Business						
a. Average	14.7	6.9	11.5	16.9	16.1	3.9
b. Range	2-44	1-30	2-37	2-33	3-48	1-7
c. Percent experiencing off-periods	10	31	14	03	02	20
Competitors						
a. Approximate number of close competitors	n/a	11	14	16	many	many
b. Percent believing that industry is more competitive in 1976 than 5 yr ago	54	60	93	93	90	–
Suppliers						
a. Number from whom one can choose		290	25	20	8	4
b. Number from whom one actually buys		290	15	6	3	1
c. Percent having wide choice of suppliers	n/a	n/a	86	97	83	67
d. Change in supplier choice since 1975		n/a	less choice	no change	less choice	–
e. Number of years with major supplier		n/a	3.5	5.0	5.3	2.4
Outlets						
a. Number to which one sells in a season	1	6	18	14		
b. Number to which one sells in a month	1	2	5	3		
c. Percent having wide choice of outlets	00	55	77	–	n/a	n/a
d. Change in outlet choice since 1975	no change	no change	more choice	less choice		
e. Number of years with major outlet	3.2	3.5	3.5	2.6		
Integration						
a. Vertical[a]	none	31% own rearing ponds	42% own rearing pond; 6% own nursery pond	21% own concessions; 31% own rearing pond 10% own fishpen	none	none
b. Horizontal	2% gather from more than one fry ground	44% have more than one concession; Average 2.1 fry grounds	none	23% have nursery ponds in more than one location	27% have rearing ponds in more than one location	30% have fishpens in more than one location

[a]Does not include use of cash advances.
n/a Not applicable.
– Information not available.

have more experience than do fry gatherers (14.7 years), dealers (11.4 years), and concessionaires (6.9 years). Nursery and rearing pond operators have, for the most part, operated continuously, while 31% of concessionaires, 14% of dealers, and 10% of fry gatherers have experienced one or more off-seasons. The primary reasons for these off-seasons are many. Concessionaires left the fry business because they were outbid for the concession, and in several cases, because they broke the concession contract in the middle of the season due to a lower fry catch than anticipated. Dealers, on the other hand, withdrew temporarily to pursue other more lucrative businesses, and because of shortages in operating capital. Fry gatherers temporarily stopped gathering due to poor health, the non-occurrence of fry, and the pursuit of other occupations.

All groups believed that the fry business has become more competitive in the last five years. This was especially true of dealers and nursery pond operators who had the widest exposure to alternative sources and outlets. Since fry demand is derived in part from fingerling demand, respondents are undoubtedly correct in their observation that increases in

fishpens led to this greater competition. While an increase in fishpen area in the early 1970s led to a corresponding increase in nursery pond area and greater competition for fry supply, a decline in fishpen area during the 1977-1978 period led to increased competition among nursery pond operators for the remaining outlets for their fingerlings. Until the decline in fishpen area, however, to concessionaires, it meant stiffer competition made evident by a larger number of bidders for concessions and higher concession fees; to fry gatherers it meant greater number of fry gatherers competing for the catch. Rearing pond operators throughout the country cited the demand of Manila nursery pond operators and increased fry prices as proof of greater competition. Dealers and rearing pond operators both believed that this increased competition gave them less choice of suppliers in 1976 than in 1975.

Only dealers believed they had more choice of outlets in 1976 than in 1975, while nursery pond operators experienced a narrowing of their outlet choice as floods damaged both fishponds and fishpens in Luzon. This different view indicates that nursery pond operators were slow to adjust to declining fishpen area, thus absorbing the continued fry supply and consequently experiencing difficulty in disposing of fingerlings. This slow response to changing fingerling demand was especially evident in 1977 when nursery pond operators without assured outlets experienced great difficulty in disposing of their fingerlings.

The number of years that each group spent with their major suppliers and major outlets, an indication of how well-developed are *suki* relationships, is lower than one might expect, given the industry's concern with the opportunism of others. Much of this can be traced to turnover of concessionaires who are major suppliers to both dealers and nursery pond operators. For example, in 1977 10 of 14 concessions in Antique changed hands, resulting in four concessions being held by newcomers, all formerly fry dealers.

The industry shows varying degrees of vertical and horizontal integration, fluctuations of which will influence the length of the marketing chain, and the level of risk assumed by the entrepreneur. Nursery and rearing pond operators and fishpen operators practice a limited form of horizontal integration by operating ponds and pens in several different locations. This multi-location business which arose due to difficulties in obtaining contiguous land, has the effect of reducing risk due to adverse weather and floods. Fry gatherers occasionally fish in more than one fry ground, often at the invitation of a concessionaire who wishes to train residents of new fry grounds in fry gathering techniques. The most important form of horizontal integration occurs when concessionaires secure the rights to more than one fry ground. Forty-four percent of the concessionaires were found to be holding more than one fry concession, the average being 2.1. This reflects an increased concentration of concessionaires since the 1.5 average observed in 1974 (Librero et al. 1976b).

Vertical integration is also prevalent in the industry, and has important implications for supply control and flexibility in fry disposal decisions. Thirty-one percent of concessionaires, owned rearing ponds, but only 6% indicated that they secured their concessions primarily to supply their fishponds. As shown in Figure 3.6, only 2% of fry catch was used by concessionaires for their own ponds. Similarly, dealers used only 2% of fry catch for their own ponds although 42% of them owned such ponds. One important development, particularly in Western Visayas, is the movement of dealers into the ownership of nursery ponds and the production of fingerlings along the lines already practiced in the Manila area. The development is important because it gives dealers added flexibility in their marketing decisions as their nursery ponds can be used for temporary storage of fry or for fingerling rearing depending upon the market outlook for each.

The central role of nursery pond operators is evident in their attempts to assure supply of fry and outlets for fingerlings. In 1976 21% held fry concessions but this was apparently a decline over previous years according to nursery pond operators who claimed they had abandoned concession bidding because of the inflated concession fees stimulated by the

increased fingerling demand from fishpens. Respondents treated concessions and nursery ponds as separate economic entities because of the partners usually involved in the concession. Consequently, no flow of fry was shown in Figure 3.6 directly from fry gatherers to nursery pond operators. The primary impetus for such vertical integration appears to have been to assure supply, rather than to specifically lower fry cost. On the outlet side, 31% of nursery pond operators owned rearing ponds and 10% owned fishpens.

The overall direction of change in the industry since 1970 shows no clear pattern. Fishpen activity prompted development of nursery pond areas, thereby increasing competition among nursery pond operators for fry supply. Competition for concessions also increased, and as prices of fry rose, more dealers entered the business. The operating capital requirements to buy and sell fry are low, the primary barrier to entry being the natural mistrust of newcomers. Because the interregional marketing channel is shorter than the intraregional one, the effect of increased interregional trade in fry due to increased fingerling demand was to shorten the overall marketing chain. Since 1975, however, the extent of backward vertical integration by nursery pond operators to bid for fry concessions has reversed. Turnover among concessionaires is frequent, thus making the development of long-term *suki* relationships difficult. Risks due to seasonality and perishability of catch, and to opportunistic behavior thus remain high.

SUMMARY

It has been shown that fry industry structure is determined by several major factors including uncertainty of resource availability and the perishability of the fry after catch, the belief in the opportunistic behavior of buyers and sellers in the industry, the flow of capital from nursery pond operators to suppliers, and governmental regulations that restrict free trade in fry. The resulting marketing chain involves an average of 2.7 title exchanges from fry gatherers to nursery or rearing pond operators.

The industry roughly fits a hierarchical distribution pattern, with well-defined bulking and redistribution centers. Marketing channels for interregional trade are shorter than those for intraregional trade due to the higher volume purchases of nursery pond operators and the financial ties between concessionaires and dealers on the one hand and nursery pond operators on the other.

With the structural dimensions of the industry defined, it is now possible to analyze the industry's performance so that allegations of fry shortage, inefficiencies and exploitation can be resolved.

4. The Performance of the Fry and Fingerling Industry

PERFORMANCE CRITERIA

The second specific objective of this study entailed the evaluation of the performance of the fry and fingerling industry. Criteria chosen were 1) adequacy of annual fry catch to meet annual stocking requirements; 2) degree of technical efficiency; 3) degree of distributional efficiency in terms of the extent of overlapping or duplicative trade flows between regions; 4) profit rates of market intermediaries reflecting adequate returns to management and risk; and 5) degree of pricing efficiency in terms of measures of market integration, and spatial and form price differentials.

The purpose of evaluating the performance of the fry industry according to the above criteria was to answer the following questions related to the imperfections alleged to exist in the fry industry:

1. Is fry catch sufficient to meet the annual stocking requirements of Philippine milkfish ponds?
2. Is the fry marketing system technically efficient?
3. Is the fry and fingerling industry price-efficient?
4. Are buyers and/or sellers exploited by competitors or adversaries in the marketing chain?

The analysis showed that there was no shortage of fry in the Philippines in 1976 or 1977. The fry marketing system was judged to be technically efficient, but high mortalities occur once fry are deposited in fishponds. The fry marketing system was found to be highly price efficient, but the fingerling business was found to be much less so with high profit rates accruing to nursery pond operators. Finally, the study found no basis for allegations of exploitation in the fry marketing chain, but concluded that the fry concession system results in a form of indirect taxation by municipalities on fry gatherers.

This chapter is organized so that criteria primarily relevant to the industry as a whole are analyzed first, followed by an analysis of criteria applicable to specific subsectors.

FRY SUPPLY: IS THE PROBLEM ONE OF SHORTAGE?

The term "shortage" can lead to confusion unless it is clearly defined. In the usual economic sense, a shortage can only arise if some external factor, such as government price control, makes it impossible for demand and supply to achieve market equilibrium. Shortage develops when consumers demand larger quantities of the commodity at the price set by government than producers would be willing to supply. With the release of price from control, it would rise to that level where quantity demanded would equal quantity supplied, and the shortage would be removed.

In the case of the Philippines the concept of fry shortage does not conform to the above described situation. Fry price is not effectively controlled, despite Presidential Decree 704 which sets a maximum price of ₱80 per thousand fry. Price freely moves to market equilibrium, eliminating shortage in the economic sense. The alleged fry shortage, then, refers simply to the allegation that the annual catch of fry is less than the quantity recom-

mended by biologists to maximize production. Shortage in this sense is not due to market distortions. An analysis of functional input-output relationships in the rearing operation would be the ideal method to determine stocking rates required to maximize profits for the pond operators. Data to allow this analysis could not be collected during this fry and fingerling study, however. Beginning in 1979, a joint project of the Fishery Industry Development Council (FIDC), the Bureau of Agricultural Economics (BAEcon), and the International Center for Living Aquatic Resources Management (ICLARM) began to examine production economics of milkfish rearing in the Philippines, from which optimal stocking rates can be determined.

Given climatic, soil, and biological conditions, the recommended annual stocking rate commonly used to project fry requirements is 10,000 fry per hectare. Based on 176,000 ha of fishponds, extrapolated annual fishpond fry requirements would be 1.76 billion fry. Add to this the fry required by nursery pond operators to supply fingerlings to fishpens, and the annual fry requirements would be approximately 2 billion. With current estimates of Philippine fry catch ranging from 300-900 million, a shortage does indeed seem possible. This study, however, contends that this shortage is highly exaggerated. Due to pond engineering and biological constraints, current annual stocking rates are much lower than the 10,000 fry/ha rate which is recommended. Additionally, fry catch in 1974 and 1976 was considerably higher than current estimates. These two findings are used to reject the allegation that there is currently a fry shortage in the Philippines. In addition to such direct evidence, indirect evidence related to fry prices also supports this contention.

The primary data collected for 1974 by the SEAFDEC-PCARR research team and the BFAR auxiliary invoice records for 1976 offer two alternative approaches to the estimation of fry catch for the years mentioned. Using data collected by the SEAFDEC-PCARR researchers for area of ponds used for rearing purposes (defined as rearing area), stocking rates per hectare of rearing area, and fry mortality in storage and transport, it is possible to estimate the quantity of fry actually stocked in fishponds in 1974 and the approximate fry catch for that year. Table 4.1 presents the calculations necessary to compute the rearing area by region, from the total of 176,000 ha of fishpond area in the country. Adjusting for nonoperational area, which though included in fishpond lease or privately owned records of area is undeveloped for fishpond purposes, and for non-rearing area such as dikes and catching ponds, 119,637 ha are available for rearing purposes.

Table 4.2 extends these computations by using stocking rates per hectare of rearing area as reported by Librero et al. (1977). These extrapolations indicate that in 1974 approximately 641 million fry were stocked in rearing ponds, representing an average annual stocking rate of 3,640 fry per hectare of total fishpond area (176,000 ha). This figure is considerably lower than the 10,000 fry/ha commonly used to project annual fry requirements. An additional 510 million fry were stocked in nursery ponds to supply 125 million and 208 million fingerlings to rearing ponds and fishpens, respectively. The total quantity of fry stocked in rearing and nursery ponds in 1974 was thus 1.15 billion.

To estimate 1974 fry catch from this stocking figure, one must adjust for mortality in gathering and storage prior to transport (5.6%) and during transport (11%) as observed by Librero et al. (1976a, 1977) to reach an estimated 1974 catch of 1.35 billion fry.

Auxiliary invoice records for 1976 indicated that 745 million fry were shipped interregionally. If one assumes approximately the same stocking rates in 1976 as in 1974, and adjusts for the reduced fishpen area, total fry requirements would have been lower by 161 million, or equal to a catch of 1.16 billion fry. This figure and the interregional trade figure appear roughly consistent, although with no nationwide stocking rates available for 1976, there is no refined way to compare the two. However, these results for 1974 and 1976 imply a rate of fry catch far greater than was previously supposed.

Table 4.1. Calculation of effective rearing area, by region, 1974. In 1974, 11 governmental administrative regions existed. Recently, Mindanao was further divided into four regions, and Southern Luzon into two, making 13 in all.

Regions	A Total hectares of fishponds	B Operational area as percent of total area	C Operational area (ha) A × B	D Percent of operational area devoted to rearing	E Rearing area (ha) C × D
I Ilocos	10,483	86	9,016	77	6,942
II Cagayan	881	48	423	92	390
III Central Luzon	30,620	99	30,314	83	25,342
IV Southern Luzon	30,575	82	25,071	83	20,834
V Bicol	11,519	67	7,718	86	6,645
VI Western Visayas	43,266	79	34,180	79	27,173
VII Central Visayas	5,768	74	4,268	89	3,837
VIII Eastern Visayas	9,368	45	4,215	90	3,798
IX Western Mindanao	17,612	78	13,737	90	12,487
X Northern Mindanao	9,081	95	8,627	96	8,308
XI Southern Mindanao	6,853	66	4,523	85	3,876
	176,032	81	142,097	84	119,637

Sources: A—BFAR.
B—Librero et al. (1977), p. 319. A nonoperational area is one which, though included in the fishpond area, is still undeveloped for fishpond purposes.
C—Librero et al. (1977), p. 27. Nonrearing areas are nursery and transition ponds, catching ponds, and the dike area.
Reproduced from Smith et al. (1978) with permission of the publisher.

Table 4.2. Calculation of quantity of fry stocked in rearing ponds and nursery ponds, by region, 1974.

Region	A Rearing area (ha)	B Fishpond fry stocking rate per ha of rearing area (000's)	C Fry stocked in fishponds (000's) A × B	D Fishpond fingerling stocking rate per ha of rearing area (000's)	E Fingerlings stocked in fishponds (000's) A × D	F Fingerlings stocked in fishpens (000's)	G Fry to fingerling survival rate (%)	H Effective fry requirement to supply fingerling stock (000's) [E + F) ÷ G]	I Total stocking of fry (000's) C + H
I	6,942	7.56	52,484	0.64	4,443	—	63	7,052	59,537
II	390	3.14	1,224	—	—	—	—	—	1,224
III	25,342	1.99	50,431	3.54	89,713	—	70	128,161	178,593
IV	20,834	6.15	128,132	0.86	17,917	208,026	63	358,640	486,773
V	6,645	1.85	40,868	0.23	1,528	—	69	2,215	43,083
VI	27,173	9.16	248,909	0.41	11,141	—	84	13,263	262,172
VII	3,837	4.26	16,348	—	—	—	—	—	16,348
VIII	3,798	2.76	10,483	—	—	—	—	—	10,483
IX	12,487	2.36	29,470	—	—	—	—	—	29,470
X	8,308	4.39	36,474	0.09	747	—	69	1,083	37,558
XI	3,876	6.73	26,090	—	—	—	—	—	16,090
Totals	119,637	5.36	640,919	1.05	125,491	208,026	69	510,417	1,151,336

Sources: A—From Table 4.1.
B—From SEAFDEC-PCARR survey data. These per-hectare stocking rates include ponds that stock both fry and fingerlings and therefore differ from those rates for ponds stocking only fry (Librero et al. 1977, p. 67), which are generally higher.
D—From SEAFDEC-PCARR survey data. Because not all ponds stocked fingerlings, these regional average-per-hectare stocking rates are lower than rates for ponds stocking only fingerlings (Librero et al. 1977, p. 75), which are much higher.
F—Fishpens at Laguna de Bay, Rizal and Laguna Provinces, Southern Luzon Region. 5,850 ha of fishpens in 1974 stocking average of 35,560 fingerlings per ha per year (Nicolas et al. 1976, p. 66).
G—Unpublished data collected by SEAFDEC-PCARR Aquaculture Program survey team.
Reproduced from Smith et al. (1978) with permission of the publisher.

Indirect evidence provides strong support to the argument that the Philippines has not yet fully exploited its fry resource and that the industry adequately transmits demand shifts back to gatherers and concessionaires. The rapid decline in fry prices in 1977, with lows not experienced since 1971, indicate that the upward trend in annual average fry prices can be traced to the increased fingerling demand from Laguna de Bay fishpens (Fig. 2.4, p. 21). With reduced fingerling demand, these low prices indicate an adequate supply for 1977. This conclusion was confirmed by respondents. First, fry gatherers in Ilocos and Mindanao stopped gathering in July 1977, claiming that prices had fallen to a level insufficient to reward their efforts. Second, nursery pond operators were forced to temporarily stop purchasing fry in the same month because their nursery ponds were fully stocked. Third, only a minority (20%) of rearing pond operators claimed to have been unable to stock the desired quantity of fry into their ponds in 1976. Close examination of the reasons for these difficulties showed that 11% had difficulty restocking ponds that had been flooded by the same typhoon that prematurely halted the Ilocos fry gathering season in late May 1976. Six percent had insufficient capital to make the desired purchase, the remaining 3% believed that the development of *lab-lab* (natural feed) was insufficient to support their normal stocking rates. None said fry were simply not available at any time of the year.

The direct and indirect evidence leads to the conclusion that the fry industry was able to supply sufficient fry to meet the stocking requirements of rearing and nursery pond operators in 1974, 1976, and 1977. Severe weather problems can cause temporary shortages, however. Substantial growth in fishpen area might jeopardize the industry's performance, but at present, catch from the natural fishery appears adequate.

There is one other factor that will help put the danger of a fry shortage in a more balanced perspective. Taiwanese fishpond operators, farming approximately 15,000 ha, have been able to achieve relatively stable kilogram-per-hectare yields despite wide fluctuations in annual fry catch, indicating that with proper management, including over-wintering, a given weight of fish per hectare can be achieved even when the number of fish varies (Table 4.3). With reduced numbers stocked and adequate feeding, each fish weighs more, keeping the biomass constant. Moreover, the need for improved Philippine pond management techniques

Table 4.3. Annual fry catch and annual production of milkfish in Taiwan, 1963-1974.

Year	Fry catch[a] (millions)	Milkfish production[b] (kg/ha)
1963	85.0	1,800
1964	153.2	1,900
1965	98.2	1,760
1966	187.0	1,863
1967	34.0	1,479
1968	124.7	1,224
1969	137.5	n.a.
1970	207.0	n.a.
1971	133.3	n.a.
1972	128.3	1,600
1973	116.1	n.a.
1974	124.8	1,852
Average for period	127.4	1,685

[a]Chen (1976) and Taiwan Fisheries Yearbook.
[b]Lin (1968) and Taiwan Fisheries Yearbook.
n.a. Not available.

can be seen by the sharply different marketable milkfish yield per fry catch ratio. Adjusting for imported fry estimated to be approximately 50 million fry annually, in Taiwan, during the period 1963-1974, this ratio was 142.47 t production of milkfish per one million fry caught and imported. In 1974 in the Philippines, the ratio was much lower at 83 t per one million fry caught. Philippine milkfish production could thus be significantly increased even with no change in the present level of fry catch.

In summary, the shortage of fry in the Philippines has been greatly exaggerated by simultaneous overestimation of stocking requirements and underestimation of fry catch.

TECHNICAL EFFICIENCY

Mortality as a measure of technical efficiency

A second allegation made regarding the fry industry is that fry mortality is consistently high during storage and transport after catch and before deposit in nursery and rearing ponds. Since the major indicator of the technical efficiency of the fry industry is survival rates of fry during their transfer from fry grounds to fishponds, minimizing mortality should be a primary objective of the industry. For example, with a catch of 1.35 billion fry, a 1% reduction in transport mortality rates, after losses during storage, would result in an additional 12 million fry available for fishponds. Based on 83 t yield per one million fry catch, a 1,000-t increase in total milkfish production would be possible for each 1% reduction in transport mortality rates.

The purpose of this section is to demonstrate that fry mortality during transport is low and to indicate that the major mortalities occur in rearing. First, factors which are most highly correlated with increased fry mortality during transport will be identified. In a later section the specified mortality rate function will be used to adjust transfer costs between regions for an analysis of spatial price differentials. Second, mortality of milkfish from time of catch at the fry grounds until harvest from fishponds and fishpens will be estimated.

With no basis for comparison with other systems, the designation of certain mortality rates as reflecting technical "efficiency" or "inefficiency" is essentially arbitrary. However, the discussion can be expected to reveal certain areas for improvement, confirmed by the survey team's observations.

Transport mortality of fry

To determine what factors have the greatest influence on fry mortality rates during transport, the following mortality rate function was used:

$$M_{ij} = f(T_{ij}, C_{ij}, Q_{ij}, e_i)$$

Where: M_{ij} = fry mortality rate (percent) between points i and j
T_{ij} = time in transport (hours) between points i and j
C_{ij} = type of container used (oxygenated water or non-oxygenated water)
Q_{ij} = quantity of fry packed per liter

It was hypothesized that each of the above factors would have a significant effect on transport mortality rates. Time in transport was thought to be exponentially related to

mortality, and the sample was stratified depending upon use or non-use of oxygen. Data to estimate the relationship were gathered from shippers (concessionaires and dealers) and receivers (nursery and rearing pond operators) for their most recent sale or purchase. Data from shippers were excluded when it was found that their estimates of mortality were unreliable, since they had not usually accompanied shipments to their destination.

Since quantity packed per liter for shipments to nursery and rearing pond operators was almost without exception constant at 1,000 fry, it was found that for the sample, quantity per liter had no significant correlation with mortality rates. While in theory one could, through controlled experiments, establish a direct relationship between quantity per liter and mortality, the survey data do not allow this.

Time and use of oxygen both affected mortality rates significantly. For containers such as clay pots and plastic bags with non-oxygenated water, the following function was estimated:

$$M_{ij} = -.003 + .006(T_{ij})^2 + e_i \qquad R^2 = .50 \qquad (4.1)$$

$$\text{s.e.} = (.0028)$$

By the t-test there is a significant correlation between time in transport (T_{ij}) and mortality at the 0.10 level. The estimation of a functional relationship for containers using oxygenated water resulted in the following:

$$M_{ij} = 0.017 + 0.00024(T_{ij})^{5/2} + e_i \qquad R^2 = .33 \qquad (4.2)$$

$$\text{s.e.} = (0.00004)$$

In this case, by the t-test there is a highly significant correlation between time in transport $(T_{ij})^{5/2}$ and mortality at the .01 level.

The two functions are consistent with observations of respondents regarding the need to expedite shipments (Fig. 4.1). Total mortality occurs in non-oxygenated water after 13 hours and in oxygenated water after 28 hours. Because transfer in non-oxygenated water involves no change of containers, mortality during the first hour is negligible. Oxygenated shipments require initial transfer from clay pot or basin to plastic bags and oxygenated water, and the resulting stress on fry causes a higher initial mortality of 1.7% on the average (the intercept of equation 4.2). This, too, is consistent with respondents' observations.

The most important result of the above analysis is that it is time in transport rather than distance that is of primary influence on transport mortality rates. Fry shipped 1,100 km in six hours primarily by air will experience no higher mortality than will fry shipped in six hours over 200 km of road. In fact, if the surface journey is particularly rough, mortality may even be higher than for the time-equivalent air journey.

With a significant correlation established between time in transport and mortality rates, transfer costs between various trading points can be adjusted accordingly to reflect mortality. This will be done when spatial price differentials are analyzed.

Overall mortality rates

It was found that mortality during rearing is a much more serious inefficiency than is fry mortality during storage and transport prior to stocking. Mortality occurs at many stages from the time of fry catch to the time that the marketable milkfish are harvested (Fig. 4.2).

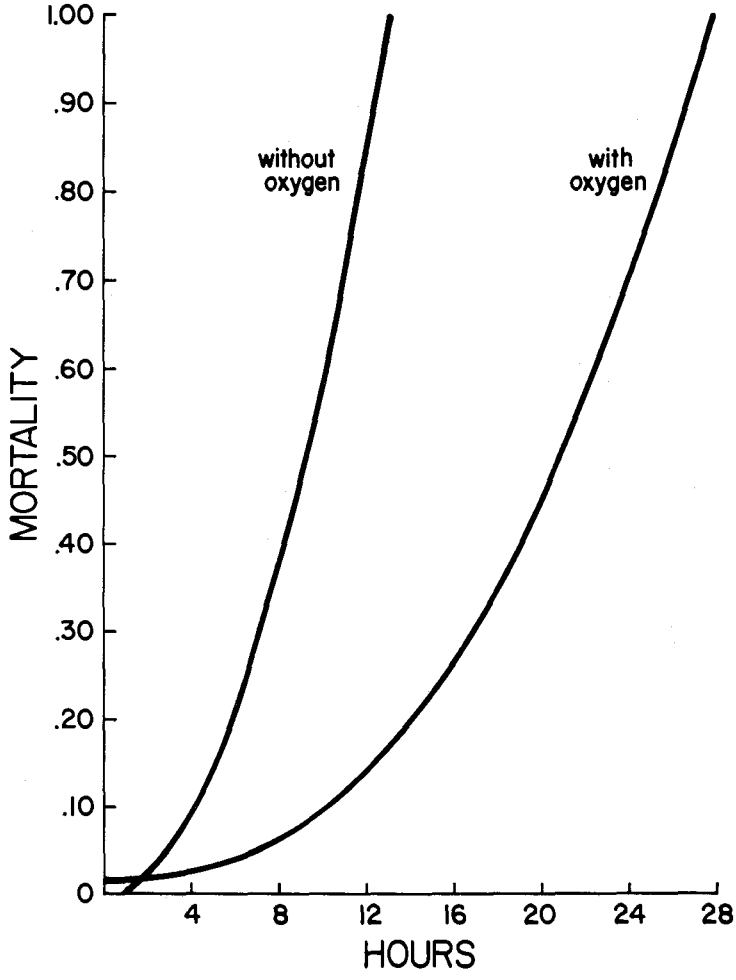


Fig. 4.1. Fry mortality during transport.

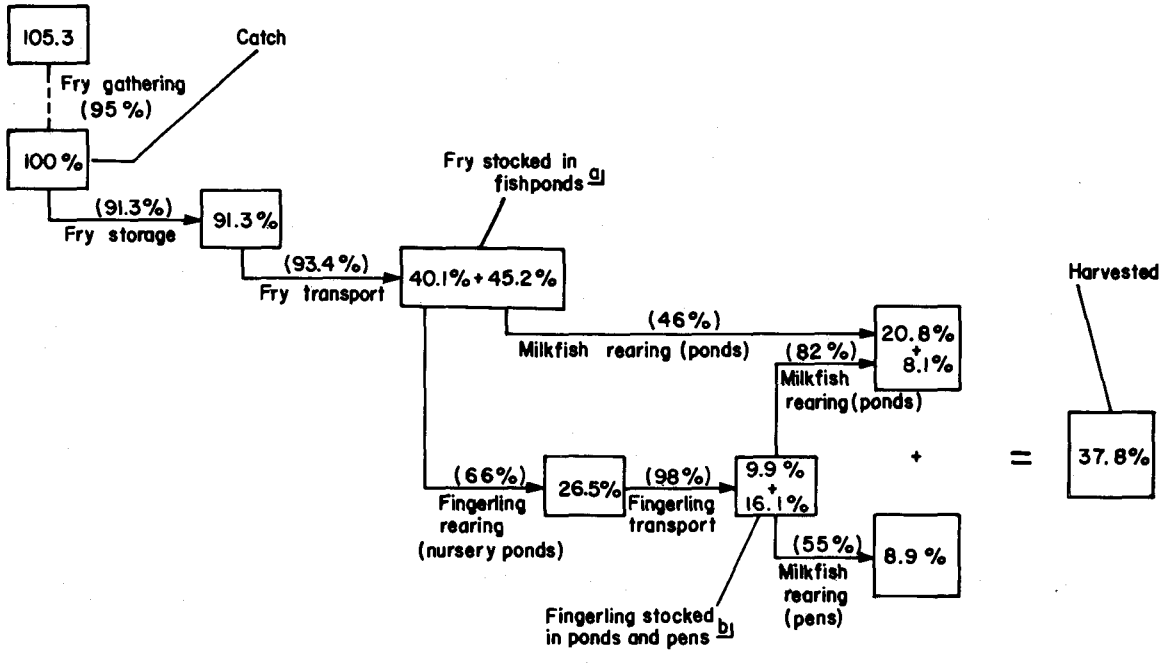


Fig. 4.2. Milkfish survival. Fry gathering to harvest, 1976.

The gathering operation causes stress and mortality of fry before they even reach temporary storage containers on the beach. Gatherers estimate mortality at this stage to be only 1.7%, but based on personal observations at the shore, this estimate is probably low by a factor of at least three. Mortality while in temporary storage prior to sale to concessionaires was set by gatherers at 4.6%, adjusted to 2.2% since slightly more than half of the gatherers sold their catch immediately. Concessionaires also store fry, and a further 5.8% fails to survive this stage. After initial shipments, dealers also store fry for an average of 3.4 days with a mortality rate of 3.9%. Total mortality during these various stages of storage is 8.7% or a survival rate of 91.3%. Total storage mortality was derived by adjusting the average mortality rate by the percentage of the commodity handled by each intermediary, and then summing the resulting rates (Table 4.4).

Based on the earlier estimated transport mortality rate function (Equations 4.1 and 4.2 p. 84) and on an average total time of fry transport of nine hours, it is estimated that a further 6.6% fails to survive transport. Average time in transport was calculated as follows (Table 4.4):

$$[\text{Flow (000's)}_{ij}] \bullet [\text{Time(hours)}_{ij}] = (\text{Fry hours})_{ij}$$

$$\frac{\Sigma(\text{Fry Hours})_{ij}}{\Sigma \text{Flows}_{ij}} = \text{Average time in transport per shipment}$$

Interregional trade flows were taken from Table 2.7. Intraregional trade was estimated at 415 million fry. $[\text{Time(hours)}_{ij}]$ = Packing Time + Elapsed Transport Time + Acclimation Time.

Assuming a shipment of 500,000 fry (100 bags), these components of $[\text{Time(hours)}_{ij}]$ were estimated as follows:

Packing Time: One hundred bags at one minute per bag = 100 minutes + 20% leeway equals two hours total time. Divided by 2 = one hour average packing time prior to departure.

Elapsed Transport Time: If by land, actual time in jeepney. If by air, includes one hour delivery to airport; two hours waiting time at airport prior to departure; two hours waiting time for any connecting flight (only affects shipments from General Santos City); and two hours from airport to fishpond. Total: five to seven hours plus actual flight time.

Acclimation Time: Average one hour upon arrival at fishpond.

Thus:

$$\text{Average time in transport per shipment} = \frac{10{,}378.1}{2{,}732.6} = 3.8 \text{ hours}$$

Since fry make an average of 2.4 trips, total time in transport for fry until stocking in fishponds is nine hours. This figure of 2.4 trips on the average is less than the 2.7 marketing chain length reported in Table 3.3, p. 73, because the latter is not adjusted for mortality in storage and transport. Thus, of every 1,000 fry caught, 853 are actually stocked in nursery and rearing ponds.

Table 4.4. Fry mortality from catch to deposit in fishponds (1976). Includes storage and transport mortalities.

(1) Quantity in possession[a] (millions)	(2) Storage mortality rate while in possession (percentage)	(3) Quantity shipped (millions)	(4) Percentage flows[b]	(5) Quantity $flow_{ij}$ (millions)		(6) Time in transfer (hr)		(7) $(^{Fry}_{hours})_{ij}$	(8) Transport mortality from equations (4.1) or (4.2) (percentage)	(9) Quantity ending (millions)[d]	(10) Disposition	(11) Quantities stocked in nursery or in rearing ponds (millions)
1,160	2.2%	1,134	5% from G to RP	56.7	@	2	=	113.4	2.1%	55.5	Fishpond	55.5
1,160	2.2%	1,134	10% from G thru runner to D_1	113.4	@	2	=	226.8	1.8%	111.4	Resold	—
1,160	2.2%	1,134	21% from G thru runner to C	238.1	@	2	=	476.2	1.8%	233.8	Resold	—
1,160	2.2%	1,134	2% from G to D_1	22.7	@	.5	=	11.4	0.0%	22.7	Resold	—
1,160	2.2%	1,134	62% from G to C	703.1	@	.5	=	351.6	0.0%	703.1	Resold	—
937	5.8%	882	35% from C to D_1	308.0	@	4.4[c]	=	1355.2	2.7%	299.7	Resold	—
434	3.9%	417	34% from D_1 to D_2	141.8	@	5.2[c]	=	737.4	3.2%	137.3	Resold	—
434	3.9%	417	36% from D_1 to RP	150.1	@	5.2[c]	=	780.6	3.2%	145.3	Fishpond	145.3
137	3.9%	132	54% from D_2 to RP	71.3	@	5.2[c]	=	370.7	3.2%	70.0	Fishpond	70.0
937	5.8%	882	27% from C to RP	233.7	@	5.2[c]	=	1215.2	3.2%	226.2	Fishpond	226.2
937	5.8%	882	39% from C to NP_1	339.9	@	7.7[c]	=	2617.2	5.6%	320.9	33% Resold	213.9
434	3.9%	417	31% from D_1 to NP_1	130.4	@	7.7[c]	=	1004.1	5.6%	123.1	33% Resold	82.1
137	3.9%	132	46% from D_2 to NP_1	60.7	@	7.7[c]	=	467.5	5.6%	57.3	33% Resold	38.2
501	1.5%	493	25% from NP_1 to NP_2	123.3	@	4	=	493.0	2.5%	120.2	Fishpond	120.2
501	1.5%	493	8% from NP_1 to RP	39.4	@	4	=	157.8	2.5%	38.5	Fishpond	38.5
				$\sum Flows_{ij}$ = 2,732.6				$\sum(^{Fry}_{Hours})_{ij}$ = 10,378.1			Total fry stocked:	999.9 million

Notes:

[a] Initial quantity in possession of gatherers is 1,160 million. Subsequent quantities computed from columns (4) and (9).

[b] From Table 3.3: G = gatherers; D = dealer; C = concessionaire; RP = rearing pond operator; NP = nursery pond operator.

[c] Weighted according to interregional trade flows as shown in Table 2.7.

[d] Computed from columns (5) and (8).

Mortality in rearing ponds was estimated from survey data to be 54%; in nursery ponds 34%. In nursery ponds fry are reared to fingerlings, 38% are sold to rearing ponds where a further 18% dies before harvest; and 62% to fishpens, which suffer a higher mortality rate of 45%. During transport in *petuya* from nursery ponds to rearing ponds and fishpens, 2% of the fingerlings die. Thus, of each original 1,000 fry caught, only 378 are harvested for sale to consumers.

In 1974 fry catch, excluding mortality during gathering, was estimated at 1.35 billion fry. Adjusting for mortality during storage, transport, and rearing, a total of 510 million marketable milkfish would have been harvested. At an average of 4.3 fish per kilo, as reported by respondents, total production in the Philippines in 1974 would have been approximately 118.6 million kg roughly equivalent to the 113 million kg reported by BFAR for the same year.

It has already been pointed out that small reductions in fry mortality can have a significant effect upon milkfish yield. For this reason, extreme care in handling fry during storage and transport is of utmost importance. It was generally observed that acclimation of fry immediately after transport was inadequate. Adjustments to changes in salinity and temperature were most often made abruptly. Less than 30% of rearing pond operators tried to introduce the fry to their new pond environment gradually by allowing the plastic bag to float on the pond surface until temperatures between the two were equalized. Fry were usually poured from the transporting container directly into the pond, unless they were in such an obviously weakened state that resting in a basin and possible later feeding would strengthen them. Since only 14.7% of the fry died during the average of 7- to 10-day of storage and transport, and 55.7% of those stocked in ponds died before harvest, it appears that improvement in acclimation techniques at stocking and reduction of pond and pen mortality would have a high payoff in terms of increased production. Improvements in the technical efficiency of the industry thus appear to be incumbent upon pond operators who receive fry shipments.

In summary, there is room for improvement in the technical efficiency of the fry marketing system. Mortality rates of fry in storage and transport have been established. With 33% of the variation in transport mortality rates explained by time in transit, reduction in mortality rates is apparently possible through better handling and control of physiological parameters. Controlled experiments, rather than the survey techniques used here, would be more successful in identifying other variables affecting survival during transport and in estimating a mortality rate function over time with a higher R^2 value (better fit). Such experiments should be conducted.

DISTRIBUTIONAL EFFICIENCY

The interregional trade flows compiled and presented in Figs. 2.25-2.28, p. 46-47 indicate apparent inefficiency in fry distribution where two-way trade is taking place between regions during the same month, or where a region imports and exports at the same time. On closer analysis, however, it was found that 57% of these monthly flows consisted of less than 200,000 fry representing at most one or two individual shipments. These small overlapping shipments can be explained by such factors as proximity to transportation facilities such as airports, coupled with urgent needs for fry on a particular date due to readiness of fishponds. The remaining 43%, however, requires more detailed examination.

One example of inefficient shipment of fry occurred in Northern Mindanao during the second quarter (Fig. 2.26). While 1.3 million fry were being exported from the fry grounds of Misamis Oriental to Manila, 5 million fry were being imported from elsewhere in Mindanao

to neighboring Agusan del Norte. In this case, the Misamis Oriental concessionaires had financial obligations to Manila buyers and thus they had to give them priority if they needed fry. Also, the 190-km road over which fry would travel between Misamis Oriental and Agusan del Norte was rough and unpaved. Fry could be shipped by air to Manila with lower mortality in half the time it would take them to reach Butuan City in Agusan del Norte by road.

More significant incidents apparently occurred in Western Visayas during the second and third quarters. During the second quarter, exports totaled 43,927,700 and imports 34,693,500. During the third quarter, exports totaled 35,554,700 and imports 9,186,000. A monthly breakdown for these two quarters illustrates the extent of that overlap (Table 4.5). The total overlap was estimated to be 32,365,200 fry. For the most part, individual overlaps can be explained as re-exports, particularly as the fry crossed and recrossed the arbitrary boundaries of the Western Visayas trading region which separates neighboring islands or divides a given island. For example, 10,835,000 fry imported from Cuyo, Palawan were partially re-exported. Shipments from Cuyo were made by boat, the only available means of transportation to the Panay Island, and about 12% (1,300,200) were re-exported through Iloilo City to Manila. Imported fry (4,600,000) from the island of Masbate in Bicol were smuggled fry (i.e. without permit or auxiliary invoice) for fishponds in Capiz Province, and actually traveled a shorter distance than did fry from Antique Province on the other side of Panay Island. Of the 18,519,000 fry imported from Central Visayas, however, about 6,985,900 (37.7%) were actually shipments made within one island, from Negros Oriental in Central Visayas to Negros Occidental in Western Visayas. The division of the island of Negros into two fry trading regions and the aggregation of trade flows between regions gave the impression of inefficiency.

Re-exports can also be readily explained. Iloilo, a large city in the center of the Philippines, is the fry trading center of the whole Visayas area, and concessionaires in the Central Visayas often ship their fry to Iloilo contacts who have exposure to a wider group of buyers from other regions.

With these exceptions, and a few other minor ones in other regions, the survey found 19,500,000 fry in overlapping, seemingly inefficient trade flows, representing only 2.6% of total interregional trade. Knowing that concessionaires were financially obligated to Manila buyers to varying degrees (for example, one area in Antique supplied 90% of its catch of 15,000,000 fry to Manila), the survey concluded that these minor distribution inefficiencies were primarily due to the financial obligations of the concessionaires, and to the lack of, or inability to use, alternative markets.

It is reasonable to conclude that the fry distribution system of the Philippines exhibits a satisfactory level of efficiency in interregional trade. However, because they deal with

Table 4.5. 1976 second and third quarter fry trade: Western Visayas (in thousands).

Month	Imports from					Total imports	Total exports	Overlap
	Palawan	Bicol	Mindanao	Central Visayas	Others			
April	1,430.0	1,045.0	3,351.2	4,177.7	–	10,003.9	5,756.5	5,756.5
May	2,750.0	–	4,538.1	10,875.2	121.6	18,284.9	11,015.0	11,015.0
June	2,750.0	340.0	–	3,287.9	26.8	6,404.7	27,156.2	6,404.7
July	1,760.0	1,815.0	1,301.0	178.2	398.9	5,453.1	18,521.5	5,453.1
August	1,292.5	1,380.0	–	–	156.5	2,829.0	8,694.6	2,829.0
September	852.5	45.0	–	–	6.4	903.9	8,338.6	903.9
Total	10,835.0	4,625.0	9,190.3	18,519.0	710.2	43,879.5	79,482.4	32,365.2

aggregates, this conclusion and previous ones regarding adequacy of supply and technical efficiency may gloss over inefficiency within or between particular subsectors of the fry industry. The remainder of this chapter examines each subsector in more detail.

MARKETING COSTS AND PROFIT RATES

Net income defined

The fourth criterion by which the performance of the fry industry was evaluated was adequacy of return to the capital, labor, management, and risk of market intermediaries. This involved a subsector-by-subsector analysis. In itself, profit rate as a performance dimension is insufficient to establish a rationale for government intervention and regulation (Marian and Handy 1973). It may be that high profit rates are only temporary or a reward to the innovative, soon to be reduced over time as new entrepreneurs enter the industry at various levels. Coupled with an analysis of spatial and form price efficiency, however, examination of profit rates allows conclusions to be drawn regarding allegations of exploitation within the fry system.

Keeler and Marutani (1977) and Castle et al. (1972) discuss alternate measures of farm income and ways in which to allocate the residual net income (defined as total revenue minus total costs) among the entrepreneur's labor, unpaid family labor, capital, management, and risk. Castle et al. suggest distributing income to fixed and operating capital based on an estimation of their opportunity cost. The residual would thus be the return to entrepreneur's labor, management and risk. For simplicity, lack of detailed hourly task breakdowns, and to allow comparison between intermediaries, it was decided not to rely on disaggregation of the net income in every case, but to represent net income more inclusively as residual to entrepreneur's and family's labor, capital, management, and risk.

In addition to determining net income for each of the market intermediaries, gathering and marketing costs as percentages of average price per thousand fry paid by nursery and rearing pond operators were also computed. These calculations indicate the disposition of the consumers' peso and the marketing margin for fry.

Costs and returns of fry gatherers

Fry gatherers were asked to provide information on family gathering activity because, most often, gatherers operated as teams consisting primarily of other family members. Lone gatherers were the exception rather than the rule. Total revenue minus total costs yielded a net income to the labor and capital of the gathering team. In the case of fry gatherers whose capital investment was very low, net income represents primarily return to labor.

Total revenue for the average gathering team in 1976 was ₱862.0 (Table 4.6). Gathering teams collected an average of 38,200 fry for which they received an average price of ₱21.9 per thousand. Receipts for milkfish fry totaled ₱837; ₱25 additional came from the sale of other species such as shrimp. In most cases, however, shrimp fry were not separated from milkfish fry and the gatherer received the same price for both species. Total costs were ₱115.4 yielding a net income of ₱746.6.

The average gathering team spent 133.6 man-days gathering which yielded an average income per man-day of ₱5.60. This was ₱2.40 less than the Philippine daily minimum wage in 1976, thus reflecting the limited alternative employment opportunities for gatherers. Gathering days were defined as being of eight-hour duration, and no distinction was made

Table 4.6. Fry gatherer's costs and returns, 1976.

	Subtotals (₱)	Totals (₱)
Revenue from fry sales:		
Milkfish fry (average 38,200 fry per family at average price of ₱21.9/000	837.0	
Non-milkfish fry (shrimp)	25.0	
Total revenue:		862.0
Operating expenses:		
Municipal fees	1.2	
Vehicle fare	6.4	
Repair of gathering gear	5.5	
Miscellaneous (fuel for banca and for lanterns, repair of banca)	16.5[a]	
Plastic bags and tying materials	0.5	
	30.1	
Depreciation:		
Gathering gear	50.2	
Banca	12.4[a]	
Basins/pails	18.7	
Miscellaneous items (e.g., lanterns)	4.0	
	85.3	
Total costs:		115.4
Net income (total revenue minus total costs):		746.6
Average number of man-days family spends gathering		133.6
Average return per man-day[b]		₱ 5.60

[a]Only 2% of fry gatherers used a banca (dugout) in fry business.
[b]Includes return on gatherer's investment.

between adult and teenage or male and female gatherers in calculating this daily income. The 1976 net income to gatherers of ₱746.6 was 25% lower than the 1974 net income reported by Librero et al. (1976a) when average price received by the gatherers was 26.5% higher. Catch rates were therefore roughly equivalent during these two years implying that the reduced price received was due to shifting demand with reduced prices passed backwards through the marketing chain. Examination of concessionaire's net income showed that price manipulation by concessionaires can be eliminated as a factor in the reduced price received by gatherers, however.

Costs and returns of concessionaires

Librero et al. (1976b) pointed to the wide margin between concessionaires' buying price and selling price, and after a comparison with the lower margin for those dealers who purchased directly from gatherers, suggested an analysis of concessionaire costs to resolve allegations of concessionaire exploitation of gatherers. One of the purposes of this presentation of concessionaire costs and returns is to speak to this issue.

Data collected for 1976 clearly showed a reasonable net income to concessionaires, and did not support allegations of monopsony exploitation of fry gatherers. Theoretical arguments supporting this contention will be more fully developed in Chapter 5. Relevant costs and returns data are summarized here.

Total 1976 revenue was ₱230,595 per concessionaire (Table 4.7). Of the 27 concessionaires from whom complete cost and sales data were collected, only 10 had a positive net revenue in 1976; 17 experienced a loss. Average milkfish fry sales were ₱221,530 for 4,201,000 fry at an average price of ₱52.7 per thousand. Additional revenues of ₱3,851 and ₱5,214 came from the sale of non-milkfish fry and from the imputed value of milkfish fry kept for the concessionaire's own use.

Concessionaires purchased 4,193,000 milkfish fry at an average price of ₱26.7 per thousand. The difference between the price received by gatherers (₱21.9) and the price paid by concessionaires (₱26.7) is the margin for runners who sold fry to concessionaires or for their legitimate agents. Concessionaires were able to sell more fry than they actually paid for because mortality of fry while in their possession (5.8%) was less than the automatic allowance *(pasobra)* that they received from gatherers, which averaged slightly over 10%. Concessionaires also spent an average of ₱2,164 for shrimp fry. Cost of goods sold was therefore ₱113,952, yielding a net revenue of ₱116,643. Fixed costs of ₱56,699, operating costs of ₱46,641, and depreciation costs of ₱4,965 brought total costs (excluding costs of goods sold) to ₱108,305.

Several of the more significant operating costs deserve mention. The largest single cost, representing 54% of the total non-fry costs, is the annual concession fee. The desire to recoup this expenditure as early as possible in the fry season is understandably strong. Labor costs of ₱19,237 are the second largest item, and represent 18.6% of costs other than fry purchase costs. Most of these labor costs were paid in the form of commissions of ₱0.25 to ₱5.00 per thousand, depending upon the task being performed. Water boys who aided in the packing of fry for shipment received the lowest commission; assistants who collected fry from various shoreline storage locations or who managed central warehouses *(bodegas)* received the highest commissions. Bad debts or accounts receivable which had been written off by the concessionaire totaled ₱7,193 or 3% of total sales. This figure is not surprising given the frequent dependence of concessionaires upon cash advances from buyers, against which sales are charged. *Tong*, informal tax payments to either secure the concession or facilitate shipments of fry, represented only 1.5% of non-fry related costs. With an average price paid of ₱26.7 per thousand and an average price received of ₱52.7, a concessionaire's margin is ₱26 per thousand.

Net income for the concessionaires surveyed in 1976 was ₱8,338. This amount represents a 3.6% return on sales. It also represents the all-inclusive return to the concessionaires' capital (₱17,960), own labor (82 man-days), unpaid family labor (27 man-days), management, and risk. Assigning opportunity costs of 10% return to investment capital, ₱25 per day to unpaid family labor and ₱50 per day to the concessionaires' own labor, yields a residual return of ₱1,767 to management and risk. One would be hard pressed to conclude that this represents an unreasonable rate of return to concessionaires, or that it portrays concessionaires who exploit fry gatherers. The lower fry price received by gatherers in 1976 appears to have been the result of shifting fry demand rather than concessionaires' manipulation of purchase price.

Costs and returns of dealers

As discussed in Chapter 3, dealers acquire fry from concessionaires, from their own runners or from runners acting as dealers in their own right, or less frequently directly from fry gatherers. They in turn sell to other dealers, to rearing pond operators, and to nursery pond operators. In addition, dealers occasionally provide other services. If they own nursery ponds or have other temporary storage facilities, they can offer brokerage services at a 5%

Table 4.7. Concessionares' costs and returns, 1976.

	Subtotals (₱)	Totals (₱)
Revenue:		
Milkfish fry sales (average 4,201,000 fry at ₱52.7 per thousand)[a]	221,530	
Shrimp fry sales	3,851	
Value of milkfish fry kept for own use	5,214	
Total revenue:		230,595
Cost of goods sold:		
Milkfish fry (4,193,000 at ₱26.7 per thousand)[a]	111,788	
Shrimp fry	2,164	113,952
Net revenue:		116,643
Costs:		
Fixed:		
Concession fee	56,184	
Other permits/taxes/licenses	76	
Concession public relations (tong)	439	
Total fixed costs:		56,699
Operating:		
Business travel	2,969	
Feed (eggs)	45	
Oxygen refills	141	
Plastic bags	1,044	
Pandan bags	528	
Tying materials	57	
Vehicle rental	599	
Banca rental	601	
Freight charges	4,229	
BFAR transport permit (auxiliary invoice)	189	
Return of empty containers	590	
Office/warehouse rental	209	
Communications	217	
Utilities (electricity/water)	35	
Kerosene/gasoline/oil	1,017	
Tong (representation/informal taxes)	1,149	
Gifts to gatherers	409	
Repair of equipment	1,796	
Bad debts	7,193	
Miscellaneous (office supplies, food, and equipment rental)	1,425	
Commission labor	15,498	
Casual labor (daily wage)	243	
Wage labor (monthly wage)	3,496	
Interest	2,962	
Total operating costs:		46,641
Depreciation:		
Gathering gear (nets)	1,464	
Boats (bancas)	434	
Miscellaneous gathering gear	242	
Storage containers and equipment	733	
Transport materials	537	
Vehicles	889	
Buildings (warehouses, office)	666	
Total depreciation:		4,965
Total costs:		108,305
Net income: (Net revenue minus total costs)		
Represents return to concessionaires' capital, labor (82 man-days), unpaid family labor (27 man-days), management and risk		8,338[b]
Net income as percent of sales		3.6%

[a] [Purchases] + [Automatic Allowance Received] − [In Possession] − [Mortality] − [Automatic Allowance Given] = [Sales] + [Fry kept for own use]

[b] Of 27 concessionaire respondents from whom complete cost and returns data were collected, 17 lost in 1976 and 10 had positive net income.

fee to sellers who are having difficulty disposing of their fry. More importantly, 15% of the dealers interviewed were also brokers or wholesalers of marketable milkfish. As such they were able to sell fry on credit to rearing pond operators with payment deducted from the value of the later harvest of marketable milkfish. Mention of this variety of roles is relevant to costs and returns for two reasons. First, it calls attention to the fact that dealers paid and received varying prices depending upon who they were dealing with, the differences between which become hidden when prices are aggregated as is necessary here. Second, it points out a degree of vertical integration that has not been fully taken into account in evaluating costs and returns in this necessarily broad-brush study.

The average dealer sold 3,982,000 fry, almost as large a volume as that sold by the average concessionaire. An average price of ₱56.1 was received, resulting in fry sales revenue of ₱223,395 (Table 4.8). With an additional ₱616 from brokerage fees and ₱6,078 imputed value assigned to fry which the dealer kept for his own use, total revenue for the average dealer in 1976 was ₱230,089.

The dealers' major cost was the purchase of fry; 3,977,000 fry at an average price of ₱39.3 cost ₱156,388. Net revenue was thus ₱73,701. Dealers, like concessionaires, also benefited from the fact that actual mortality rates during possession were lower than the automatic allowance given to them by sellers. The major operating cost other than fry purchase was bad debts which represented 25% of the total. Hired labor and transport related items such as vehicle rental, freight charges, and business travel were also significant. Total operating expenses were ₱21,550. Total costs including depreciation but excluding cost of goods sold were ₱24,956.

The resulting net income was ₱48,745. Unlike concessionaires who did not share profits with their employees, dealers distributed ₱15,403 representing 31.6% of the net income to their warehouse manager, if there was one, or to other employees. The residual ₱33,342 represents the return to the dealer's capital (₱17,035), labor (105 man-days), unpaid family labor (22 man-days), management, and risk. This residual represents a 14.9% return on sales, higher than the return of concessionaires. The average price markup for dealers was ₱16.8 per thousand.

The above figures represent the average for 22 dealers from whom complete cost and return data were collected. If the three largest dealers who handled 34.6% of the total volume of the 22 dealers were excluded, residual net income would drop considerably to ₱9,254, or an average return on sales of 6.2%. Each of the three largest dealers was a special case and had a particular trading advantage leading to rates of return considerably above the norm. Two bought exclusively smuggled fry, one from gatherers in the concession for which he had been hired as a manager. One of these two plus the third dealer also had their own concessions. Since it was not possible to separate concession-related costs from dealer-related costs except in obvious cases of the concession fee and gathering gear, the net income to these two includes a portion of that accruing to the concession activity. To that extent, it represents the cost-saving benefits of such vertical integration. Discounting these three exceptions, net income to dealers appears reasonable.

Miscellaneous marketing costs

The previous sections cover the major gathering and marketing costs. To complete the picture, however, it is necessary to include the costs of the services of runners, brokers, and commissionmen as well as fry transport costs incurred by nursery and rearing pond operators.

As noted in Chapter 3, runners are of two types. The majority work as commissionmen who receive approximately ₱5 per thousand fry above their costs of operation which

Table 4.8. Dealers' costs and returns, 1976.

		Subtotals (₱)	Totals (₱)
Revenue:			
Milkfish fry (3,982,000 fry sold at ₱56.1/000)[a]		223,395	
Brokerage fees		616	
Value of fry kept for own use		6,078	
	Total revenue:		230,089
Cost of goods sold:			
Purchase of fry (3,977,000 at ₱39.3/000)[a]		156,388	156,388
	Net revenue:		73,701
Operating costs:			
Licenses/fees/taxes		44	
Business travel		1,796	
Feed		138	
Bodega rental		205	
Oxygen refills		271	
Plastic bags		986	
Pandan bags		311	
Tying materials		66	
Vehicle rental		2,619	
Gasoline/oil		1,074	
BFAR permits		70	
Tong (representation/informal taxes)		858	
Communications		280	
Utilities		13	
Freight charges		1,562	
Return of empty containers		445	
Interest		529	
Repairs to equipment, buildings, etc.		322	
Insurance		14	
Bad debts		5,166	
Food for workers		259	
Commission labor		1,864	
Casual labor (daily wage)		978	
Wage labor (monthly wage)		1,680	
	Total operating costs:		21,550
Depreciation:			
Gathering gear		1,520	
Boats/bancas		200	
Storage containers		492	
Buildings		306	
Transport equipment		528	
Vehicles		360	
	Total depreciation:		3,406
	Total costs:		24,956
Net income (Net revenue minus total costs)			48,745[b]
Distribution of net income:			
31.6% to manager and other employees			15,403
Residual is return to dealers' capital, labor (105 man-days), unpaid family labor (22 man-days), management and risk			33,342
Dealers' net income as percent of sales:			14.9%[b]

[a] [Purchases] + [Automatic Allowance Received] − [Mortality In Possession] − [Automatic Allowance Given] = [Sales] + [Fry kept for own use]

[b] Average for 22 dealers; discounting largest three dealers, average net income was ₱9,254; return on sales was 6.2%.

are met by concessionaires and dealers from whom they have received cash advances. Runners who serve as dealers apply a markup of approximately ₱10 per thousand. Brokers, most of whom are nursery pond operators, receive 5% commission on the sales price, which at an average price of ₱82.6 received for fry resales in Rizal and Bulacan is ₱4.13 per thousand. Commissionmen receive anywhere from ₱2-₱5 per thousand, or since most are in the lower range, an average of ₱2.50 per thousand.

Nursery pond operators incurred a total of ₱180,857 transport related expenses for the 322.8 million fry that they purchased, and storage-related expenses for the 86.7 million fry that they resold, or ₱.56 per thousand. Rearing pond operators, many of whom traveled personally to pick up fry from sellers, incurred average costs of ₱.55 per thousand.

Summary of gathering and marketing costs

Weighting each of these sets of costs by the percentage of fry flows handled by each market intermediary (Fig. 3.6, p. 72) allows summation to determine total gathering and marketing costs. The resulting compilation (Fig. 4.3 and Table 4.9) indicates an average cost of ₱58 per thousand fry. This estimate appears reliable since it is only slightly less than the average ₱60 per thousand paid by the nursery and rearing pond operators surveyed. Of the ₱58, ₱32.9 (57%) can be attributed to gathering costs and ₱25.1 (43%) to storage and transport related costs. The marketing bill thus represents a 76% markup over the costs of gathering.

The various net returns (incomes) to market functionaries have been shown separately. The total net return to all entrepreneurs in the fry industry, including gatherers, is ₱28.6 per thousand, or 49.3% of the cost of fry to rearing and nursery pond operators. Not including gatherers, total net return to entrepreneurs is ₱9.5 per thousand, or 16.4% of the fry "retail" price.

Fingerling rearing: costs and returns of nursery pond operators

The nursery pond sample was divided into two strata: a) permittees who held permits for interregional transport of fry and b) non-permittees who relied on local purchase of fry. Stratification was designed to allow evaluation of the effects of Fisheries Administrative Order 115 (FAO 115), which is one of the topics discussed in the next chapter. Costs and returns based on this stratification indicate significant differences in net income of nursery operations for the two groups. Rearing fingerlings by permittees is a very profitable business indeed.

Permittees, with average sales 75 times as large as non-permittees', fill multifarious roles. In addition to their sale of fingerlings, they also serve as fry dealers, in 1976 illegally reselling approximately 25% of their purchases to non-permittees in Rizal, Bulacan, and neighboring provinces. Also, on occasion they serve as brokers, charging those they represent 5% of the fry selling price. Each of these functions provides revenue to permittees (Table 4.10).

The resulting net incomes for 1976 indicate a loss of ₱199 for the average non-permittee and a gain of ₱1,060,096 for the average permittee. If the largest permittee, whose sales were 59% of the total for sample permittees, is not included, the remaining permittees received a net income of ₱178,030. The success of this individual operation on the fingerling industry's profit is readily apparent.

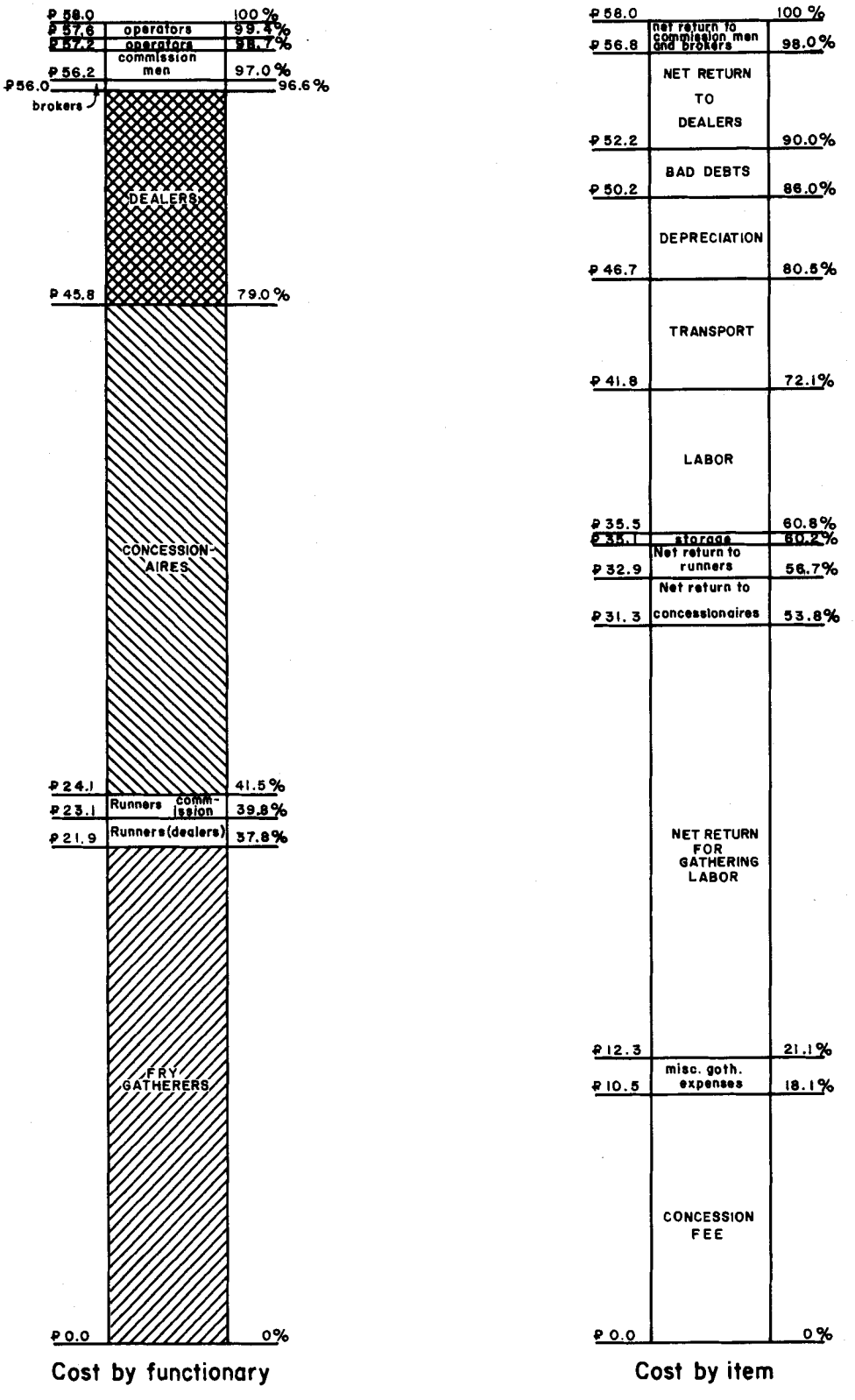


Fig. 4.3. Fry gathering and marketing costs. (Based on average fry price paid by pond operators = ₱58 per thousand).

High net incomes (returns) for this sector had been expected even prior to the survey, and it was therefore not surprising that nursery pond operators had the highest respondent refusal rate, approaching 10%. Although no data were collected to confirm it, the survey team was told by Malabon residents that the relative positions of the town's successful nursery pond operators changed significantly in 1977. Although the same six to 10 families still dominate the business, the most successful ones in 1976 were far less so during 1977 because they had failed to vertically integrate forward to include fishpens in their operations, and thus had difficulty disposing of their fingerlings as the market became glutted in July and August 1977.

Calculations of costs per hectare also indicate significant management differences between permittees and non-permittees. While non-permittees stocked only an average of 126,400 fry per hectare in 1976, permittees stocked 1,361,000 fry per hectare for the same period. The intensive use of permittee ponds through multiple stockings and croppings is further reflected by the higher per hectare expenditures on fertilizer, supplemental feed, and hired labor. Non-permittees, after sharing of profits by the 3 out of the 14 in the sample strata who made a positive net income, experienced a loss of ₱1,248 per hectare. In striking contrast, permittees averaged a positive net income of ₱53,010/ha.

Table 4.9. Summary of 1976 fry gathering and marketing costs (per thousand fry).

Item	₱	% of total
Gatherers		
Net return to gatherer's labor	19.0	32.7
Depreciation on gathering gear	2.1	3.8
Miscellaneous gathering expenses	0.8	1.3
Runners		
Net return to runners (dealers)	1.2	2.0
Net return to runners (commissionmen)	1.0	1.7
Concessionaires		
Net return to concessionaire	1.6	2.7
Concession fee	10.5	18.1
Miscellaneous gathering expenses	1.0	1.7
Storage	0.3	0.5
Transport	2.5	4.3
Labor	3.6	6.2
Bad Debts	1.3	2.3
Depreciation	0.9	1.6
Dealers		
Net return to dealers	4.6	8.0
Net return to manager/laborers	2.1	3.6
Storage	0.1	0.1
Transport	1.6	2.8
Labor	0.6	1.1
Bad Debts	0.7	1.2
Depreciation	0.5	0.8
Others		
Net return to brokers	0.2	0.4
Net return to commissionmen	1.0	1.7
Pond operators' transport expense	0.8	1.3
Totals	58.0	100.0

Table 4.10. Nursery pond operators' costs and returns, 1976.

	Per nursery pond		Per hectare	
	Non-permittees (Pesos)	Permittees (Pesos)	Non-permittees (Pesos)	Permittees (Pesos)
Revenue:				
Fingerling sales	48,378	3,274,893	11,924	169,684
Fry resales	0	352,730	0	18,726
Broker fees	0	14,041	0	728
Total revenue:	48,378	3,641,664	11,924	189,138
Cost of goods sold:				
Purchase of fry	27,964	2,237,722	6,893	115,944
Net revenue:	20,414	1,403,942	5,031	73,194
Costs:				
Operating costs				
Pond lease (or opportunity rent)	11,637	60,071	2,868	3,113
Equipment rental	26	200	6	10
Repair materials	631	2,105	156	109
Pesticides	156	2,906	38	151
Fertilizer	907	17,676	224	916
Feed	981	10,245	242	531
Hired labor	2,497	66,768	615	3,459
Assembly and transport of fry	67	14,260	16	739
Assembly and transport of fingerling	26	3,095	6	161
Electricity/water	24	922	5	48
Fuel and oil	170	17,981	42	932
Taxes	469	5,440	115	282
Licenses and permits	54	1,094	13	57
Tong (representation/informal fees)	0	17,967	0	931
Communications	19	5,570	5	289
Interest	733	11,856	181	614
Bad debts	0	40,900	0	2,119
Food for laborers	499	13,354	123	692
Commissions	231	30,044	57	1,557
Office rental	0	2,400	0	124
Total operating costs:	19,127	324,854	4,712	16,834
Depreciation:				
Buildings	384	2,208	94	115
Boats (bancas, petuya)	338	9,007	83	467
Vehicles	24	2,205	6	114
Nets	550	1,263	136	65
Miscellaneous containers, equipment	190	4,309	47	224
Total depreciation:	1,486	18,992	366	985
Total costs:	20,613	343,846	5,078	17,819
Net income (Net revenue minus total costs):	(199)[a]	1,060,096[b]	(47)[a]	55,375[b]
Distribution of net income				
Share of profits to manager and other employees	4,871[a]	45,645[b]	1,201[a]	2,365
Residual is return to nursery pond operator (see Table 6.9)	(5,070)	1,014,451[b]	(1,248)	53,010[b]
Percent return on sales	0	27.7%		

[a]Despite a negative net income for non-permittees on the average, a positive share of profits to the manager and other employees is possible because not all non-permittees experienced such a loss.

[b]If the largest nursery pond operator in the permittee sample is not included, net income per operation is ₱178,030 or ₱9,830/ha; residual to nursery pond operator is ₱177,307 or ₱9,790/ha. Percent return on sales for these remaining permittee nursery pond operators is 13.5%.

To further define the return to the nursery pond operator, returns to capital were calculated (Table 4.11) indicating an annual return to operator's labor (185 man-days), unpaid family labor (123 man-days), management, and risk of ₱943,503.

Reasons for losses by non-permittees were examined. It was initially thought that mortality rates between the two strata were not significantly different. Flooding of nursery ponds and subsequent loss of stock affected 36% of non-permittees and 30% of permittees. However, separating the largest non-permittee who made a positive net income on purchases of 3 million fry from the strata indicated significantly different mortality rates for permittees and non-permittees. The remaining non-permittees, all of whom had purchases of 800,000 fry or less, experienced a mortality rate of 44% from fry stocking to fingerling harvest compared to 34% for permittees. The mortality rate differences were also, of course, in part a reflection of the average growing period of non-permittees' fingerlings which was roughly twice as long as that of permittees' fingerlings of the same size. The less intensive use of their nursery ponds, coupled with the higher mortality rates, appears to be the major difference between profit rates of non-permittees and permittees.

Further analysis of these costs and returns of nursery pond operators will be reported in the last section of this chapter when the pricing efficiency of the fry and fingerling industries is examined.

Conclusions regarding costs and returns

Higher returns were found to be related to higher concentration ratios. With no industry-wide sales information and no complete listing of entrepreneurs, it is not possible to calculate exact concentration ratios for each subsector of the fry and fingerling industries with which the observed net incomes could be compared. However, some very rough estimates were made.

Fry gatherers are atomistic, with each sample fry ground averaging 290 gatherers during the peak season. Concessionaires, because of their legal monopsonies, are obviously more concentrated. The largest five concessionaires in the sample handled slightly over 7% of the estimated 1976 fry catch of 1.16 billion fry. The largest five dealers in the sample also handled slightly over 7% of the total fry trade. In contrast, the five largest nursery pond operators in the sample purchased 28% of the nationwide fry catch and sold 64% of the total 1976 fingerling volume. Rearing pond operators and fishpen operators to whom fry

Table 4.11. Allocation of residual net income to nursery pond operators (permittees).

Residual net income	₱ 1,014,451
To investment capital at 12% (₱151,936)[a]	₱ 18,232[b]
To operating capital (₱284,730 at 10%)[a]	₱ 28,473[c]
Opportunity cost of cash advances (₱93,274 at 10%) plus credit sales (₱90,969 at 12%)[a]	₱ 20,243[d]
To operator's labor, unpaid family labor, management, and risk	₱ 943,503

[a]Short-term interest rate = 10%; long-term interest rate = 12%.

[b]Investment capital does not include land, the appreciation of which is assumed to offset the opportunity rent of the land.

[c]Operating capital = cost of goods sold + total operating costs ÷ 9 mo operation.

[d]Opportunity cost computed based on average accounts receivable:

1. Average monthly purchases: 2,545,000 at ₱73.3/000 = ₱186,548. Assume 50% cash advances, compute interest at 10% on ₱93,274 = ₱9,327.
2. Average monthly sales: ₱272,908. Assume 33% on credit (after harvest), compute interest at 12% on ₱90,969 = ₱10,916.

and fingerlings are sold are atomistic, with little individual influence over fry or fingerling price, except through "suki" relationships.

Net incomes as percentage of sales were 3.6%, 14.9% and 27.7% for concessionaires, dealers, and permittee nursery pond operators, respectively. The implication, consistent with the hypothesis of market structure analysts regarding structure and performance, is that higher rates of return are positively correlated with higher concentration ratios.

PRICING EFFICIENCY

Price determination

Since Manila nursery and rearing pond operators purchased over 56% of the 1976 fry catch and over 82% of fry in inter-regional trade, and have itinerant commissionmen throughout the country in their employ, the center of price information is Manila. Concessionaires and dealers who sell both intra- and interregionally rely on potential buyers or partners in Manila for initial price quotations, and use these prices as a means to determine local prices and their markup over fry purchase price. Most sellers claimed that daily telephone or telegram contact with buyers was absolutely essential during the early part of the season when prices fall rapidly. The need for up-to-date price information was made very clear in discussions with small dealers near Laoag City, who without daily price information from Dagupan City, sold two-thirds of their May-July 1977 fry purchases at a loss. These cases of information shortcomings were the exception rather than the rule, however. The first purpose of this section is to report the degree to which information flows bring about direct interrelationships between prices in major fry markets.

Economic theory predicts that in a competitive market satisfying certain preconditions of product mobility, intermarket price differentials in excess of transfer costs will result in arbitrage by traders until the excess is eliminated. Thus, the second purpose of this section is to determine the extent to which price differentials between major market centers are a function of the transfer costs between them.

In a similar vein, theory also predicts prices of successive forms of a product will be interrelated through processing costs. In other words, prices of fingerlings and fry should differ by an amount equal to rearing costs involved. The third objective of this section is to report the extent to which this prediction holds true for the fingerling industry.

In the fry industry, fry gatherers, except to the extent they engage in smuggling, are the only ones who believe they have no influence over prices. All other market intermediaries claim that they can bargain over prices to some degree, primarily through adjustments to the level of the automatic allowance given or received. As one would expect, rearing pond operators who wish to purchase on credit give up some of their bargaining influence with sellers. Cash advances from and COD payments by Manila buyers give them an advantage over local pond operators who must pay a ₱5-₱10 premium if they wish to defer payment until after harvest of their marketable milkfish. The final purpose of this section is to briefly examine price differentials at several local levels, notably General Santos City, Davao City, Cagayan de Oro City, and Laoag City to look for evidence of exploitation.

Taken together and supplementing results already presented on rates of return, these findings refute allegations of price inefficiencies in the fry marketing system, and the presence of exploitation in the fry industries. The findings tend to support allegations of price inefficiencies in the fingerling business, however. For the sake of evaluation, the system was said to be price efficient if prices do not depart significantly from the predictions of the perfectly competitive model. Exploitation would be present if price manipulation or discrimination can be shown to exist.

Ideally, daily prices would be available for such analysis, but in this case they were unobtainable. Instead, monthly weighted average prices as recalled by respondents were collected (Figs. 4.4-4.9). The prices presented in these figures cover 7 of the 11 markets for which such prices were collected.

Because the fry season begins at different times in different regions and is not continuous during the year in each location, monthly prices in every market are not available for each month since January 1976. However, available price observations are reasonably complete for the major trading centers. The price data collected adequately represent the

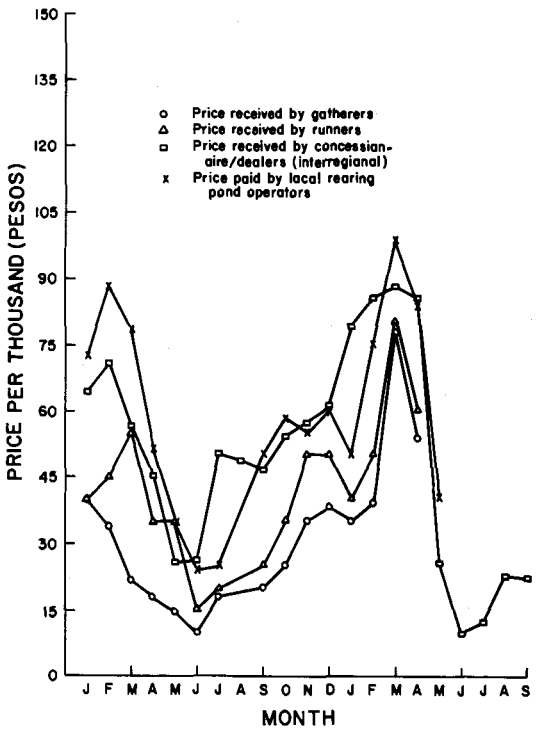


Fig. 4.4. Fry prices: General Santos City, 1976-1977.

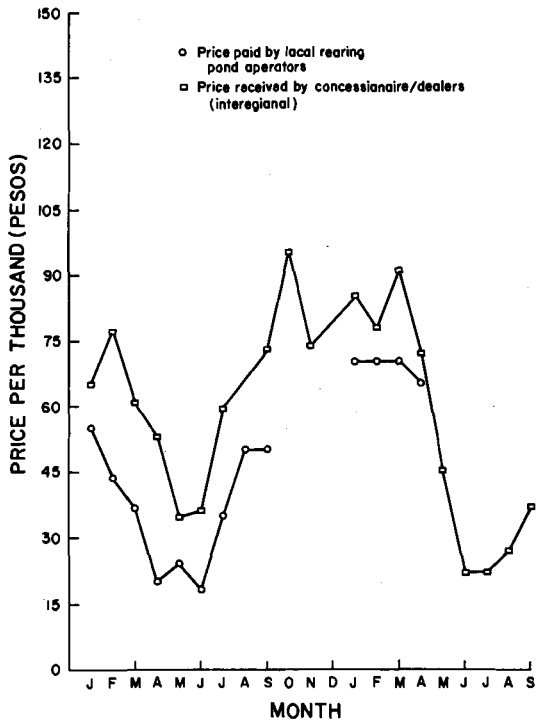


Fig. 4.5. Fry prices: Davao City, 1976-1977.

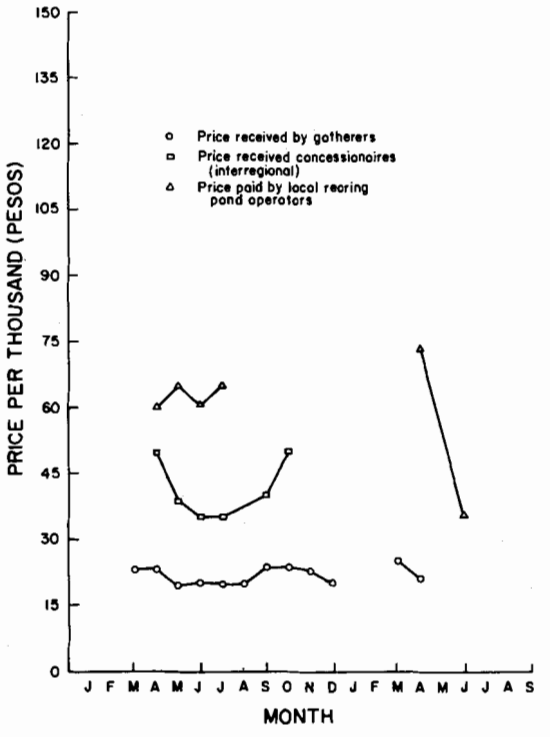


Fig. 4.6. Fry prices: Cagayan de Oro City, 1976-1977.

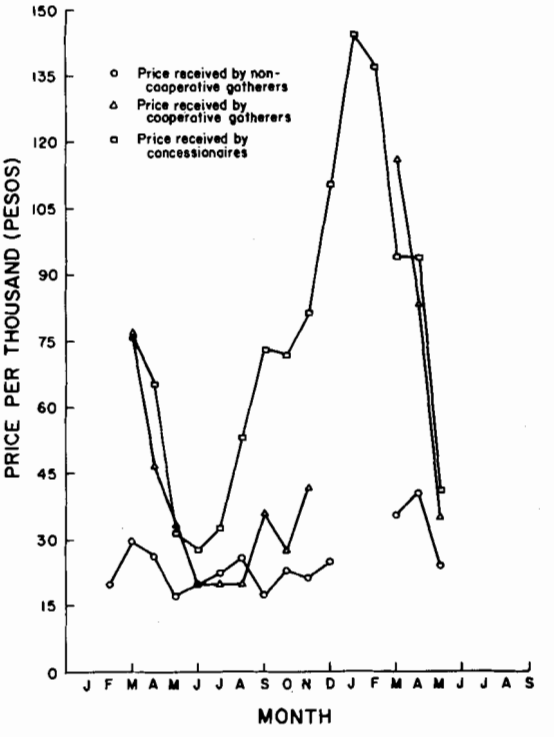


Fig. 4.7. Fry prices: Antique Province, 1976-1977.

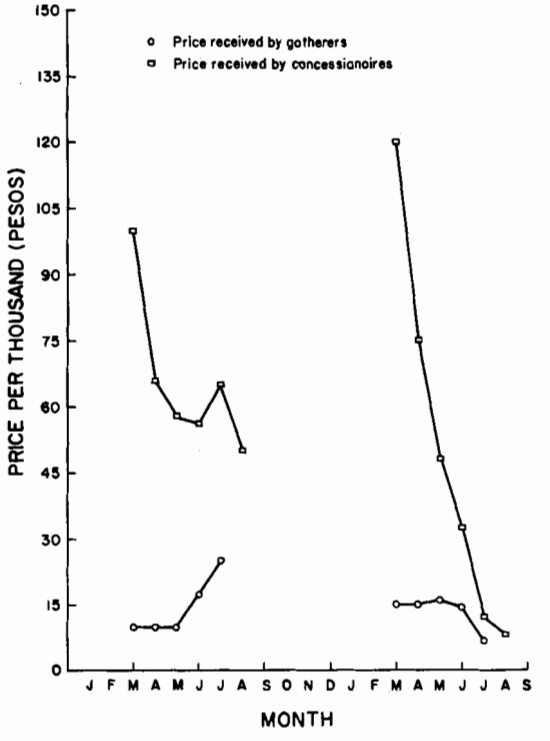


Fig. 4.8. Fry prices: Laoag City, 1976-1977.

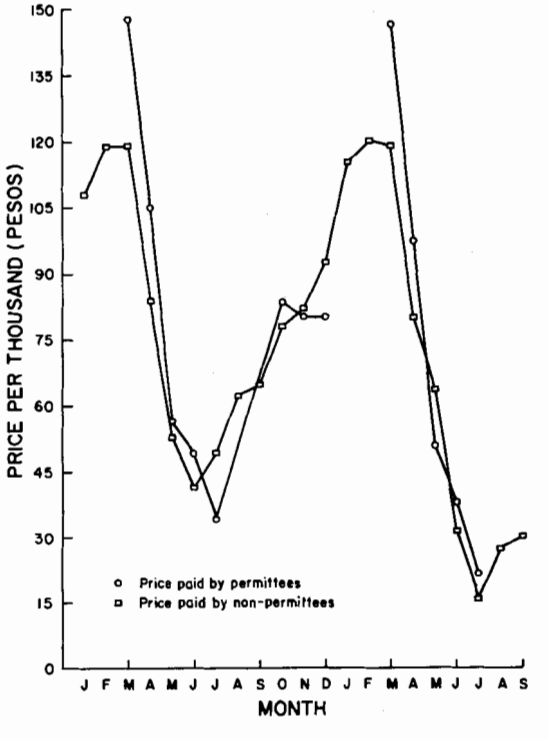


Fig. 4.9. Fry prices: Manila Area, 1976-1977.

extreme seasonality of fry prices and the differences among gatherer, runner, concessionaire, dealer and pond operator prices. The peak of the season (April to July) with corresponding lower price is readily visible for all locations. From highs in excess of ₱120 per thousand fry to lows of ₱20 and below, one can understand why many pond operators, particularly the smaller ones with limited capital, stock fry only once annually to take advantage of low fry prices.

Market integration

The accuracy and speed with which prices react and adjust to stimuli (demand, supply and other factors) can be taken as the degree of interrelationship in the mechanism of price formation between various markets. Correlation coefficients between prices in the various trading regions, therefore, provide a measure of the information flow between markets.

Calculation of correlation coefficients between paired prices in markets within the sample area engaging in trade indicates a high level of information flow between markets (Table 4.12 and Fig. 4.10). Correlation coefficients (r) were computed for all 17 trading partners and were in all cases found to be significant at the .01 level.

These results imply the existence of a milkfish fry marketing system with markets closely interrelated through price movements. Telegram and telephone communications and the network of itinerant commissionmen are effective in keeping buyers and sellers up to date on changing demand and supply and the resulting prices.

Ruttan (1969) has suggested a test for monopsony power that hypothesizes a model in which the supply function for marketing services is highly elastic, demand for marketing services is highly inelastic, and in which both curves shift to the right with the long-term growth of the volume of the commodity marketed. Fry marketing services are labor intensive, and no specialized storage or transport facilities are required; thus the assumption of a highly elastic marketing services supply function is quite reasonable.

> Under these conditions, if the slope coefficient of a linear regression equation relating the farm to the retail price is not significantly different from 1.0, it would imply that the marketing margin is independent of price, that the supply of marketing services approximates perfect elasticity. (Ruttan 1969, pp. 84-85)

A constant absolute marketing margin between buyers and sellers in the various markets studied would not be consistent with middlemen's monopsony behavior, but would instead be consistent with the competitive market model in which scale economies are limited and the marginal cost of providing the marketing services is horizontal over the relevant range.

The calculation of price relationships between trading partners showed that in most cases the price markup between markets in different hierarchies was constant. Concessionaire and dealer respondents claimed to use such constant markups (actually markdowns from the Manila price) to determine purchase prices and local selling prices. In 14 of 17 trade routes, the price markup was constant (Table 4.12). In only three cases was there an apparent percentage markup. However, less than 4% of 1976 interregional trade traveled over these three routes (General Santos/Iloilo; Cagayan de Oro/Manila; and Laoag/Dagupan).

One further step taken in this analysis before any final conclusions were drawn regarding the absence of monopsony power in that part of the marketing chain between concessionaires and pond operators, was to analyze the relationship between interregional price differentials and transfer costs.

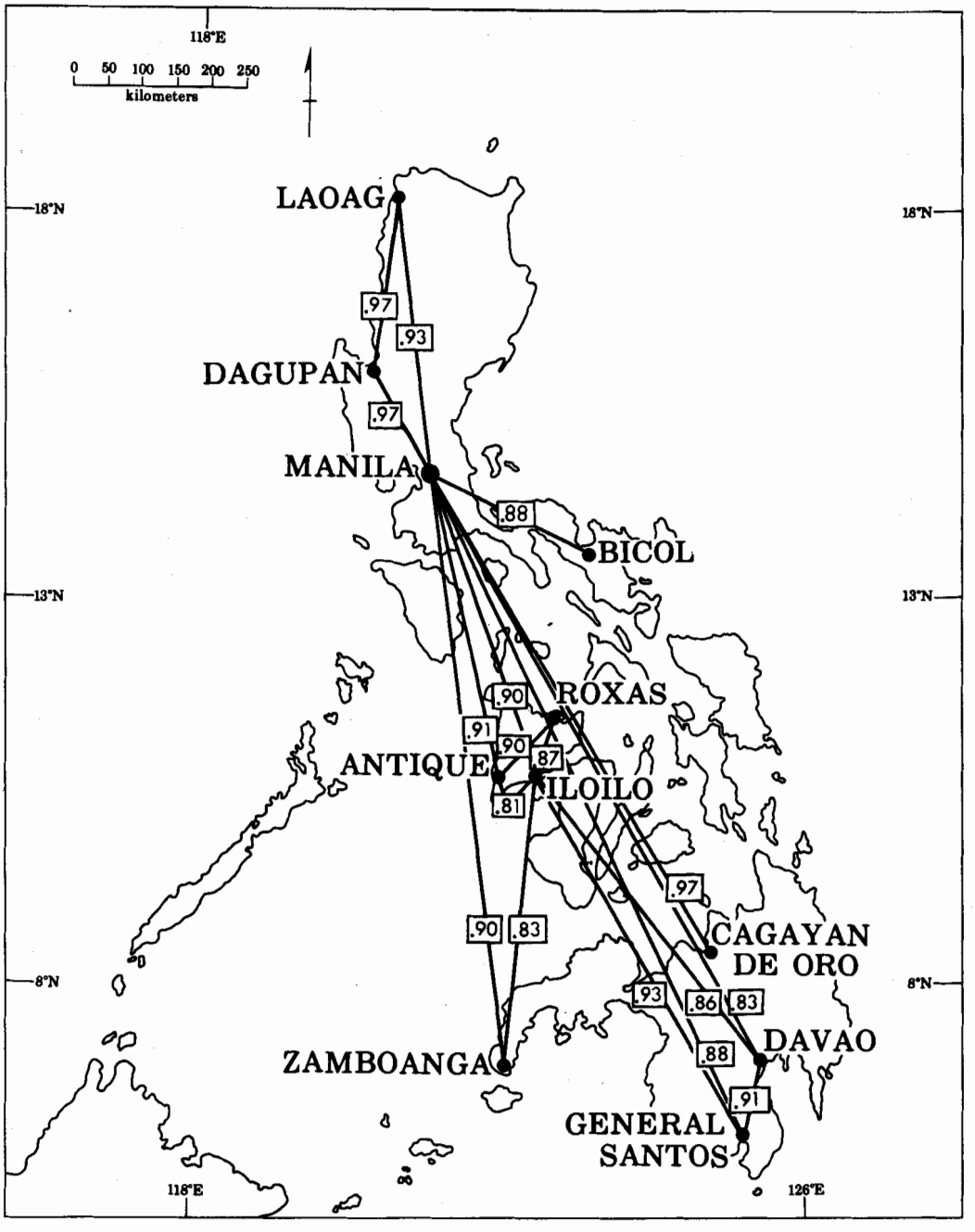


Fig. 4.10. Mapping of 1976 price correlation coefficients.

Spatial price efficiency

While correlation coefficients indicated a significant interrelationship between inter-regional market prices, it remained to be seen if these prices differed by amounts roughly equal to the transfer costs between the markets. Theory predicts that in competitive markets any excess price differential over transfer costs will result in arbitrage until the excess disappears. In a practical sense where not all costs can be measured, the price differential in

excess of transfer costs can be interpreted as the net return to marketing intermediaries. From previous analysis of costs and returns (Section E), it was found that ₱7.4 per thousand fry represented the combined return to the capital, labor, unpaid family labor, management, and risk of concessionaires, dealers, brokers, and commissionmen.

Examination of price differentials showed that the fry marketing system is highly efficient except at certain times during the non-peak season when inter-regional trade volume is low. The determination of net return to marketing intermediaries using price analysis was accomplished in the following manner. Let:

$$NR = (|P_j - P_i| - \text{adjusted } TC_{ij})$$

Where: NR = net return to marketing intermediaries
P_j = price in the j^{th} market
P_i = price in the i^{th} market
adjusted TC_{ij} = transfer cost between i^{th} market and the j^{th} market (adjusted for mortality)

All prices and costs are measured in pesos per thousand fry. Adjusted TC_{ij} reflects the adjustments for mortality in transport that in effect raises the actual transfer cost. That is:

$$\text{Adjusted } TC_{ij} = \frac{\text{Transfer Costs}_{ij}}{(1 - \text{Mortality Rate}_{ij})}$$

For example, transfer costs of ₱5.00 per thousand would be adjusted to ₱5.56 per thousand if 10% mortality occurred over the route between market i and market j, or to ₱5.26 if mortality was only 5%.

The first step was to calculate the transfer costs (TC_{ij}) over those routes for which market price data had been collected. Based on the primary data of respondents and upon relevant rates for land, air, and sea freight, $terminal_i$, $terminal_j$, and $transport_{ij}$ costs were tabulated for each of the 17 fry trade routes for which price correlation coefficients were earlier computed (Table 4.13). Transfer costs thus represent the sum of terminal costs in the shipping and receiving points, and the transport costs between them. Based on auxiliary invoice records average size shipments ranging from 100,000 fry (20 containers) to 400,000 fry (80 containers) were established for each route. The resulting transfer costs (TC_{ij}) ranged from ₱4.4 per thousand between Antique and Iloilo to ₱12.0 for smaller average shipments between Cagayan de Oro City and Manila.

Based on respondent data, average time in transfer for each route was estimated. The average time in transfer was then used in the earlier estimated mortality rate function (Equation 4.2) to estimate average mortality rates over each route. Adjusted transfer costs for each route were then calculated, ranging from a low of ₱4.60 per thousand to a high of ₱12.90.

It is interesting to note that there is no direct relationship between distance en route and transfer costs unless the entire transfer was by road. Fixed charges for air transfer are a larger part of total transfer costs than are variable distance charges because Philippine Airlines (PAL) in 1976 had only two air freight rates for fry; a short-haul rate of ₱1.10/kg and a long-haul rate of ₱1.375/kg.

For all 17 routes, weighted average price differential in absolute terms $|P_j - P_i|$ was ₱18.6; weighted average adjusted transfer costs TC_{ij} were ₱7.4. The residual, ₱11.2 per thousand fry represented the net return to marketing intermediaries, higher than the estimate resulting from the analysis of costs and returns which was ₱7.4. The difference between the

Table 4.12. Intermarket price relationships among major cities in the Philippines.

Route	Number of months	$P_j = \alpha + \beta P_i + e_i$[a]	R^2[b]	Markup
General Santos-Davao	19	$P_j = 16.8 + .87P_i$ (.098)	.91	constant
General Santos-Iloilo	20	$P_j = 4.74 + 1.39P_i$ (.132)	.93	percentage
General Santos-Manila	21	$P_j = 13.48 + 1.22P_i$ (.153)	.88	constant
Davao-Iloilo	18	$P_j = -5.54 + 1.31P_i$ (.19)	.86	constant
Davao-Manila	19	$P_j = 2.75 + 1.20P_i$ (.20)	.83	constant
Zamboanga-Iloilo	12	$P_j = 8.33 + .91P_i$ (.19)	.83	constant
Zamboanga-Manila	13	$P_j = 10.34 + .92P_i$ (.14)	.90	constant
Cagayan de Oro-Manila	6	$P_j = -37.60 + 2.39P_i$ (.32)	.97	percentage
Antique-Iloilo	15	$P_j = 22.83 + .77P_i$ (.156)	.81	constant
Antique-Roxas	15	$P_j = 6.91 + .98P_i$ (.14)	.90	constant
Antique-Manila	15	$P_j = 15.14 + 1.01P_i$ (.12)	.91	constant
Iloilo-Roxas	15	$P_j = 3.05 + .98P_i$ (.15)	.87	constant
Iloilo-Manila[d]	20	$P_j = 15.33 + .80P_i$ (.09)	.90	constant
Bicol-Manila[d]	7	$P_j = 17.12 + .76P_i$ (.19)	.88	constant
Laoag-Dagupan	10	$P_j = -5.65 + 1.35P_i$ (.12)	.97	percentage
Laoag-Manila	12	$P_j = 6.63 + .96P_i$ (.12)	.93	constant
Dagupan-Manila[d]	10	$P_j = 6.28 + 1.13P_i$ (.11)	.97	constant

[a] P_i = price in exporting market
P_j = price in importing market
[b] All correlation coefficients are significant at the 1% level.
[c] Rejection of H_o:B = 1 implies that the slope (B) is significantly greater than 1 at the 5% level and that the price markup between the two markets is not constant, but is a percentage markup.
[d] Trade between these markets is reversed at certain times of the year (see text for explanation).

two, ₱3.8, is thought to represent the amount accruing to buyers, primarily Manila area nursery pond operators (permittees) who use commissionmen to make purchases around the country, thus capturing any price differential in excess of transfer costs for themselves. This amount was not reflected in the marketing costs breakdown (Fig. 4.3) because only nursery and rearing pond operators' marketing expenses were included. The implication, of course, is that part of the net return to nursery pond operators comes from making their own inter-regional fry purchases, and part from their fingerling operations.

The question remains whether or not this ₱11.2 residual is excessive. Other studies on pricing efficiency (Farruk 1970) have proceeded to show this net return to marketing intermediaries as a percentage of the price in the shipping market (P_i) and then making an arbitrary judgment on "excessiveness." However, when markup between markets is constant and where wide price fluctuations are experienced, such an approach would be misleading,

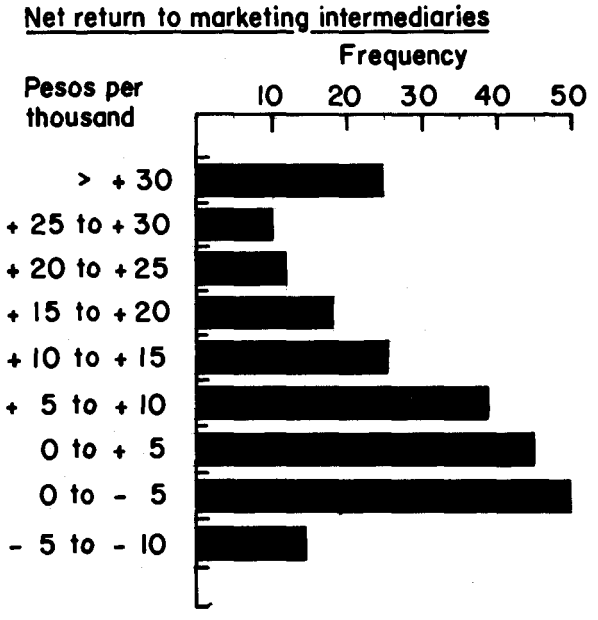
Table 4.13. Transfer costs and adjusted transfer costs, 1976.[a]

Cost item	General Santos City/Davao	General Santos City/Iloilo	General Santos City/Manila	Davao/ Iloilo	Davao/ Manila	Cagayan de Oro/Manila	Zamboanga/ Iloilo	Zamboanga/ Manila	Antique/ Iloilo	Antique/ Roxas	Antique/ Manila	Iloilo/ Roxas	Iloilo/ Manila	Bicol/ Manila	Dagupan/ Manila	Laoag/ Dagupan	Laoag/ Manila
Average quantity shipped[b]	400	350	350	350	350	100	250	250	400	400	350	400	350	100	400	400	400
Commission labor: packing technician, helpers, and water boys @ ₱2/000	800	700	700	700	700	200	500	500	800	800	700	800	700	200	800	800	800
Drivers and helpers	160	30	30	30	30	20	20	20	80	80	20	80	20	25	80	80	160
Vehicle rental/gasoline	350	40	40	40	40	55	40	40	200	490	200	275	40	70	235	300	525
Freight charges	–	462	578	462	578	165	330	413	–	–	462	–	462	–	–	–	–
Food for laborers, driver	200	80	80	80	80	40	55	55	100	100	80	100	80	30	200	200	400
Communications	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
Return of empty containers[c]	–	239	495	239	516	257	174	347	–	–	339	–	339	–	–	–	–
Miscellaneous[d]	70	125	125	90	90	60	75	75	70	70	125	70	90	55	70	10	70
Vehicle hire/gasoline (airport to fishpond or warehouse)	–	150	250	150	250	250	150	250	–	–	250	–	250	–	–	–	–
Commission labor: technician, helpers and driver at ₱1.25/000	500	438	438	438	438	125	313	313	500	500	438	500	438	125	500	500	500
Total transfer cost (₱)	2106	2590	2762	2255	2748	1198	1683	2039	1776	2066	2640	1851	2445	531	1911	1916	2481
Transfer cost (₱ per thousand)$_{ij}$	5.3	7.4	7.9	6.4	7.9	12.0	6.7	8.2	4.4	5.2	7.5	4.6	7.0	5.3	4.8	4.8	6.2
Distance and route	140 km road	650 km air 20 km road	1180 km air 50 km road	570 km air 20 km road	1060 km air 50 km road	875 km air 50 km road	455 km air 20 km road	912 km air 50 km road	96 km road	120 km air and sea	495 km air 145 km road	130 km road	495 km air 50 km road	443 km air 60 km road	213 km road	284 km road	466 km road
Average time in transfer (hours)$_{ij}$	9	11	12	8	9	8.5	8	9	6	7	12	6	8	9	7	8	13
Average percent mortality$_{ij}$[e]	7.5%	11.3%	13.7%	6.0%	7.5%	6.8%	6.0%	7.5%	3.8%	4.8%	13.7%	3.8%	6.0%	7.5%	4.8%	6.0%	16.3%
Adjusted transfer cost (₱ per thousand)$_{ij}$	5.7	8.3	9.1	6.9	8.5	12.9	7.2	8.8	4.6	5.4	8.7	4.8	7.5	5.7	5.0	5.1	7.4

[a] Does not include own and unpaid family labor of marketing intermediaries.
[b] Assume 5,000 fry per container; each container weighs 6 kg. Quantities are approximations from auxiliary invoice records (000's).
[c] Includes freight charge and vehicle hire.
[d] Includes depreciation on containers, permits and informal taxes (tong).
[e] From equation (4.2).

because the percentage $(\frac{NR}{P_i}) \times 100$ would be much higher when prices were low than when they were high. An alternative is to simply present the net returns in absolute amounts for each of the observed monthly trade flows (Fig. 4.11). As can be seen, 74.5% of the monthly net revenues fall between minus ₱5 and plus ₱20.

The 19.6% of net revenues that exceed plus ₱20 is cause for serious concern regarding the pricing efficiency of the fry marketing system. However, there was a pattern to these high net returns. They occurred more frequently during non-peak periods, with 84% during the months of January to April before the beginning of the fry season in most locations. The implication is that the pricing efficiency of the fry marketing system is much higher during peak season than it is when fry catches are much smaller. In fact, net returns did not exceed ₱20 from May to September in 1976 and 1977.



Net return to marketing intermediaries	Frequency	Percent
> + 30	25	10.4%
+ 25 to + 30	10	4.2
+ 20 to + 25	12	5.0
+ 15 to + 20	18	7.5
+ 10 to + 15	26	10.8
+ 5 to + 10	39	16.3
0 to + 5	46	19.2
0 to - 5	50	20.8
- 5 to - 10	14	5.8
Totals:	240	100.0 %

Fig. 4.11. Frequency distribution of net returns to marketing intermediaries based on interregional price differentials and transfer costs.

Negative net returns to marketing intermediaries are also difficult to explain, especially those 58% between minus ₱5-₱10. One reasonable explanation is that nursery pond operators may have been willing to pay slightly more than the transfer cost would warrant to keep their stocking management plan on schedule, and then hope to recover the added expense through fingerling profits. Certainly, the costs and returns analysis for nursery pond operators indicated that their high fingerling profit rates would provide the assurance that the fry cost would be recoverable. A second explanation rests in the nature of the relationship between nursery pond operators and commissionmen. The itinerant commissionmen who follow the fry season as it moves northward from Mindanao to the Visayas and then back to Mindanao are trusted "compadres" or relatives of the operators. As such, the nursery pond operators have an obligation to maintain their commissionmen, even to the point of accepting occasional higher priced shipments.

In summary, the results indicate a fry marketing system that is efficient during the peak fry season. The extreme price fluctuations experienced in 1976 and 1977 put great pressure on the information network to provide reliable current price information in a variety of locations throughout the country. It must also be recognized that the foregoing analysis is based on monthly average prices as recalled by respondents. Monthly averages will hide daily price fluctuations, an examination of which will undoubtedly shed considerable light on the efficiency with which price performs its spatial allocation function.

Form price efficiency

An earlier discussion of costs and returns of nursery pond operators indicated that substantial profits were made by fingerling entrepreneurs in 1976, and this was confirmed by analysis of form price differentials. If one assumes freedom of entry and exit for the industry and other perfectly competitive conditions, price differentials between fry and fingerlings will reach equilibrium when the difference equals the rearing costs involved. Analysis of form price differentials and the costs of transforming fry to fingerlings of various sizes is really only the other side of the coin of costs and returns analysis. One difference is that similar to spatial price analysis, all price measurements are in pesos per thousand, rather than in aggregates per pond or per hectare. Because a time dimension is included, changes in net return over time to nursery pond operators also provided an indication of entry barriers in the fingerling industry. Data requirements for form price analysis were the prices of input and output, the processing (rearing) costs for the various sizes of fingerlings, the length of the processing (rearing) period, and mortality rates during rearing.

Fry and fingerling prices over the period studied (Fig. 2.38, p. 58) were highly correlated, supporting contentions regarding their substitutability as stocking materials for fishponds. Fry are not suitable stocking material for fishpens because the required enclosure net mesh size would be so small as to restrict water flow through the pen. Prices for fry, and 2, 3, and 4 in fingerlings, in addition to being highly correlated, also exhibit a constant markup for fingerlings selling at that particular time (Table 4.14).

Pricing methods for nursery pond operators are not, of course, as simple as a constant markup implies. Spatial arbitrage takes place over a short period of time. In contrast, rearing fingerlings takes anywhere from 1 to 3 mo; hence the price risks to nursery pond operators are much greater than they are for fry concessionaires or dealers. Nursery pond operators must judge present fry price vis-a-vis expected future fingerling price, which will be a function of future fry price. In other words, a larger future fry catch than expected will reduce return to nursery pond operators; a smaller future fry catch than expected will increase operators' return. Nursery pond operators whose ponds were not flooded probably bene-

Table 4.14. Fry and fingerling price relationships.

Product forms	$P_{fing} = \alpha + \beta_i P_{fry} + e_i$	R^a	Markup
Fry–2-in fingerling	$P_{f2''} = 55.9 + \underset{(.21)}{.99P_{fry}}$	.75	constant
Fry–3-in fingerling	$Pf3'' = 88.5 + \underset{(.12)}{.89P_{fry}}$	.86	constant
Fry–4-in fingerling	$P_{f4''} = 110.9 + \underset{(.23)}{1.32P_{fry}}$	.81	constant

[a]All correlation coefficients are significant at the 1% level.

fited from the May 1976 typhoon that so curtailed the Luzon fry catch. Indeed, prices of 4-in fingerlings began to climb immediately after May 1976. In contrast, the successful 1977 fry season resulted in fingerling prices falling to their lowest levels since 1971. Due to rapid and extreme price fluctuations, the risk that nursery pond operators face is high.

Information on length of rearing period was obtained from both permittees and non-permittees. However, because of permittees' dominance in the fingerling business, only rearing periods used by pemittees are relevant here. Average rearing periods were 1 mo for 2-in fingerlings, 1.5 mo for 3-in fingerlings and 2.0 mo for 4-in fingerlings. Establishing the length of the rearing period was important for two reasons. First, it led to the designation of the appropriate lagged fingerling prices with which fry prices could be compared. Second, it was a necessary input to the prorating of rearing costs.

The approach taken to form price anlaysis was to impute a fingerling cost with which lagged fingerlings price could be compared. An imputed fingerling cost, rather than an actual rearing cost, is necessary to account for mortality in rearing. The difference between the two represents the net return to the labor, unpaid family labor, management, and risk of nursery pond operators. Imputed fingerling cost is a function of fry purchase price and of direct operating and depreciation costs adjusted for mortality in rearing. That is:

$$[(Q_{fry}) \cdot (SR) \cdot (P_{fing})] - \{[(Q_{fry}) \cdot (P_{fry})] + [DC = f(Q_{fry}), (SR)]\} = \text{Net Return}$$

$$\text{Total Revenue} - \text{Total Costs} = \text{Net Return}$$

Where: Q_{fry} = quantity of fry purchased (thousands)
P_{fry} = price of fry (pesos per thousand)
P_{fing} = price of fingerlings (pesos per thousand)
SR = survival rate from fry to fingerling (percent)
DC = operating costs plus depreciation (pesos)

Dividing all terms by $(Q_{fry}) \cdot (SR) = Q_{fingerlings}$ yields

$$[P_{fing}] - [\frac{P_{fry}}{(SR)} + \frac{DC}{Q_{fing}}] = [\frac{\text{Net Return}}{Q_{fing}}], \text{ or}$$

$$\underset{\text{Price}}{\text{Lagged [Fingerling]}} - \underset{\text{Cost}}{\text{Imputed [Fingerling]}} = \text{Net Return per thousand fingerlings}$$

An example further clarifies these adjustments. If a nursery pond operator purchased 5,000 rry at ₱58 per thousand, had total operating costs of ₱130 and total depreciation costs of ₱20, experienced 70% survival during rearing to the fingerling stage, and sold the resulting 3,500 fingerlings at ₱150 per thousand, the net return per thousand would be:

$$[150] - [\frac{58}{.7} + \frac{130 + 20}{3.5}] = ₱24.3 \text{ per thousand}$$

Imputed rearing costs thus equal the difference between the imputed fingerling cost and the original fry purchase price.

$$[\frac{P_{fry}}{(SR)} + \frac{DC}{Q_{fing}}] - P_{fry} = \text{Imputed rearing cost per thousand fingerlings}$$

In the above example, imputed rearing cost per thousand fingerlings would be:

$$[\frac{58}{.7} + \frac{130 + 20}{3.5}] - (58) = ₱67.7$$

compared to the direct rearing costs (DC/Q_{fing}) = ₱42.9.

Four simplifying assumptions were necessary for the analysis. First, it was assumed that direct rearing costs (operating costs plus depreciation) were evenly spread throughout the fry-to-fingerling rearing period. Second, in light of no information to the contrary, it was assumed that the mortality rate is constant throughout the rearing period. Third, it was assumed that rearing costs and mortality did not vary with the time of the year. Fourth, 3-in fingerlings were assumed the average for which direct rearing costs were applicable. These four assumptions allowed the proration of imputed rearing costs according to the 1 mo, 1.5 mo and 2 mo required to rear 2-, 3- and 4-in fingerlings respectively.

Based on survey data of an average price paid for fry of ₱72.8 per thousand, direct rearing costs of ₱20.9 per fingerling, and a 66% survival rate, imputed fingerling cost was estimated at ₱131.2 per thousand, and imputed rearing cost at ₱58.4 per thousand. Prorating this estimate based on number of days rearing time established the imputed rearing costs at ₱36.2 for 2-in fingerlings; ₱58.4 for 3-in fingerlings; and ₱80.6 for 4-in fingerlings Imputed fingerling costs (per thousand pieces) were ₱109 (2 in), ₱131.2 (3 in), and ₱153.4 (4 in). During the period, lagged fingerling prices (per thousand pieces) averaged ₱122.9 (2 in), ₱146.9 (3 in), and ₱187.6 (4 in).

These imputed fingerling costs were then compared with the appropriate lagged fingerling price for each fingerling size for the period January 1976 to July 1977 and the differentials were found to consistently exceed the rearing costs involved. The month-by-month calculation of net return (loss) to nursery pond operators for 2-, 3-, and 4-in fingerlings indicates a weighted average net return (by sales volume) for the whole period of ₱13.9 per thousand 2-in fingerlings, ₱15.7 per thousand 3-in fingerlings, and ₱34.2 per thousand 4-in fingerlings (Table 4.15). These results confirm the high profit rates for nursery pond operators and seriously question the efficiency with which price performs its function of equating form price differentials with the costs of rearing fry to fingerlings.

No evidence of collusive behavior among Bulacan and Rizal nursery pond operators was found, however. Though primarily centered in and around the town of Malabon, nursery pond operators claim to have infrequent contact with one another, adding further that they make purchases only from each other to fill large orders or to rent each other's

petuya for fingerling transport. Outsiders, including those who sell their fry to Malabon pond operators, claim that one technique widely practiced by nursery pond operators to increase their profits is to hoodwink the seller when purchasing fry. Because of the comparative density counting technique used at this stage, the fry seller may find that the two or three containers chosen by the nursery pond buyers, the quantity of fry which determines the quantity of the whole shipment, contain fewer fry than the seller thought. It is comparatively easy for experts to undercount or to deliberately discard a few hundred in a single container. Sellers claim it is very difficult to keep their eyes on 100 or more basins spread around a *bodega* before the representative containers are chosen. These allegations are really no more than innuendos, but certainly arguments over quantities are frequent and acrimonious.

Nursery pond operators appear to have benefitted both from their control of the fry resource through various financing arrangements and from their ability to capture high rates of return for their fingerling rearing operations. These rates of return, however, do not appear to be the result of discriminatory barriers to entry, but rather due to factors within the fishpen business working in favor of established nursery pond operators. The unexpected

Table 4.15. Net return (loss) to nursery pond operators for rearing 2-in, 3-in and 4-in fingerlings, January 1976-July 1977 (in pesos per thousand).

	Net returns (loss)[a]		
	For 2-in fingerling	For 3-in fingerling	For 4-in fingerling
1976			
January	76.0	15.5	11.5
February	42.3	(8.9)	(13.2)
March	28.6	(18.6)	(79.9)
April	28.6	0.5	(18.2)
May	13.1	25.5	34.4
June	14.8	39.9	71.8
July	0.8	42.5	71.4
August	(8.3)	45.8	97.7
September	(5.9)	59.1	77.6
October	(4.3)	54.2	90.3
November	1.9	57.5	88.2
December	(8.2)	49.1	108.4
1977			
January	1.4	19.2	n.a.
February	21.7	(16.9)	n.a.
March	3.2	(31.8)	n.a.
April	17.8	(1.5)	(5.1)
May	(0.4)	(18.7)	23.9
June	12.2	(6.4)	47.8
July	27.9	6.3	n.a.
Weighted average for whole period	₱ 13.9	₱ 15.7	₱ 34.2

[a]Net return (loss) to nursery pond operator's capital, own and family labor and management.

n.a. not available

increase in fingerling demand due to fishpen operations in the early 1970s provided the opportunity for the larger nursery pond operators to consolidate their positions. Several years passed before new entrants to the fingerling business could become established, and no sooner had they done so than fishpen fingerling demand began to decline. In support of this conclusion, there appears to have been a downward trend in the nursery pond operator's net return for 3" and 4" fingerlings, since the end of 1976. Rapid shifts in fingerling demand during the 1970's thus made it difficult for price to efficiently perform its form allocation function.

Intraregional price relationships

Local rearing pond operators, particularly in Mindanao, complain about the "unfair" competition of Manila area buyers, and claim to be excluded from local fry sources. In fact, these complaints were so vociferous that BFAR instituted a de facto policy on a region-by-region basis to supply local operators before allowing interregional trade. However, the evidence collected by the survey team did not support these allegations made by local rearing pond operators, except in a few limited cases outside Mindanao.

The weighted average price paid by local rearing pond operators (₱47.6) in General Santos City is slightly higher than the weighted average price received (₱41) by concessionaires for their interregional sales (Fig. 4.4, p. 102). Concessionaires sell to local rearing pond operators primarily on credit, charging a premium of ₱5-₱10 per thousand. This price surcharge can be offset by the rearing pond operator who does not need credit through purchases of smuggled fry from runners or from local dealers. Reliance on smuggled fry shows up even more clearly in Davao (Fig. 4.5, p. 102) where the average price paid by rearing pond operators (₱27) is consistently less than the price received by concessionaires and dealers (₱50.8) for their interregional sales. Smuggling of fry is the apparent means by which both gatherers and rearing pond operators circumvent the concessionaire system, thus achieving price terms more in their favor.

There are really two issues involved here, both of which were brought out clearly in an April 1977 meeting of pond operators and concessionaires in Davao. One is the question of access to fry, which pond operators have apparently resolved through smuggling. The other is the question of price. The "unfairness" of Manila competition was in reality a complaint about high fry prices. The increased demand for fingerlings in Manila stimulated fry demand, thus raising prices throughout the country. Because of the late beginning of the 1977 fry season (due to the unseasonally dry weather, respondents claimed) fry prices throughout the country were at their highest levels ever for the first few weeks of April. It was these high prices more than anything else that prompted rearing pond operators' demands for price control and trade restrictions until local stocking requirements had been satisfied. The complaints probably dissipated as prices fell in May and June 1977 to their lowest levels since 1971. The implications of policy measures to restrict trade will be examined in the next chapter.

In Cagayan de Oro, Northern Mindanao, local rearing pond operators who are relatively few paid concessionaires an average price ₱21.1 higher than the price those concessionaires received for interregional sales (Fig. 4.5, p. 102). Credit sales will explain ₱5-₱10 of this differential. The remainder provides evidence of price control by concessionaires, thus substantiating the claims of pond operators that such behavior is practiced by the small number of concessionaires in the area. These concessionaires have also agreed to fix the price paid to gatherers in an effort to control smuggling.

One clear-cut case of exclusion of pond operators from local fry supply was found in Batangas Province. Eight concessionaires were interviewed and all sold their fry to a single nursery pond operator in Manila. This nursery pond operator then sold fingerlings to Batangas rearing pond operators, who because they are primarily small pond operators, complained about the high fingerling price (P220 per thousand) charged and concessionaires' refusal to sell them fry. BFAR's plans to establish a government-run nursery pond that would sell fingerlings at a subsidized price (P120 per thousand) will undoubtedly alleviate this problem.

Throughout the rest of Luzon and the Western Visayas, no complaints of price manipulation were heard from pond operators. However, chapter 5 will examine further complaints of exclusion from fry sources directed to the trade restrictions of Fisheries Administrative Order 115 that were in effect in 1976, and will resolve allegations regarding exploitation within the fry and fingerling industries.

SUMMARY OF PERFORMANCE CRITERIA

Five performance criteria were established according to which allegations related to fry shortage, technical and pricing inefficiencies, and exploitation were examined. These were: 1) adequacy of annual fry catch to meet annual stocking requirements; 2) technical efficiency in terms of storage and transport mortality rates; 3) distributional efficiency in terms of the extent of overlapping trade flows between regions; 4) profit rates reflecting adequate returns to management and risk; and 5) pricing efficiency in terms of measures of market integration, and spatial and form price differentials.

In 1974, fry catch was adequate to meet annual stocking requirements, and indirect evidence regarding interregional trade flows and prices supported a similar conclusion for 1976 and 1977. Future fry shortages may result, however, if fingerling demand increases from reestablished fishpens in Laguna de Bay. One major problem facing the milkfish industry in the Philippines is the extreme volatility of fry prices caused by seasonality of catch and the resulting restriction by many pond operators to a single stocking during times of expected low fry prices. Although fry supply does appear to be adequate overall, the industry has difficulty providing stocking materials in sufficient numbers late in the season to restock ponds whose crop has been lost due to typhoon and flooding.

Mortality rates were estimated for storage, transport, and rearing activities throughout the industry from time of fry catch to time of sale of marketable milkfish. Of every 1,000 fry caught, only 378 are eventually harvested at marketable size. Mortalities in storage and transport were estimated at 8.7% and 6.6%, respectively. Transport mortality was shown to be significantly correlated with time in transport and the use or nonuse of oxygenated water. It was not possible to categorically conclude that the fry marketing system is technically efficient because personel observations indicated that improvements could be made in the care and handling of fry, and particularly in the degree of acclimation given fry by pond operators before they are stocked in fishponds. However, because mortalities during rearing were found to exceed 54%, it appears that major reductions in mortality are within the control of pond operators rather than fry marketing intermediaries.

Distributional efficiency was high. Overlapping trade flows occurred during several months, but the total fry thus involved were less than 3% of the total interregional trade in 1976. These trade flows appeared to be the result of urgent needs for fry by pond operators on particular dates, re-exports from certain regions to take advantage of central markets such as Iloilo City and a wider exposure to potential buyers, or the repayment of financial obligations to buyers.

During 1976, net returns in the industry increased with the level of concentration in the various subsectors of the fry and fingerling industries. Daily net return to fry gatherers was only 70% of the minimum daily wage. Net return to the capital, labor, unpaid family labor, management, and risk of marketing intermediaries as a percentage of sales was higher: 3.6% for concessionaires, 14.9% for dealers, and 27.7% for nursery pond operators. The net returns for nursery pond operators were especially high, and warrant further investigation.

Prices in 11 major fry markets were highly correlated at the .01 level, indicating adequate flow of information between the markets. For individual routes, however, there were occasional price differentials significantly in excess of the transfer costs between markets. The spatial pricing efficiency of the fry marketing system was high during the peak season, but not so during the non-peak winter months. Analysis of fry/fingerling price differentials and rearing costs confirmed the high rates of return to nursery pond operators. Although there has been a slight downward trend in nursery pond profit rates since early 1976, this aspect of the fry and fingerling industries offers a significant return to the private investor who has been able to withstand the decline in fingerling demand since 1975-1976. The difficulty of establishing *suki* relationships and a reliable reputation are major non-discriminatory barriers to entry in the nursery pond business.

Finally, price comparisons at several local levels, particularly General Santos City and Davao City, offered no support to local pond operators' contentions that they were excluded from local fry sources in 1976 and 1977. The prices reflected the ₱5-₱10 premium that concessionaires charge to local pond operators who desire to purchase on credit, and the more favorable price that can be availed of through the purchase of smuggled fry. Batangas Province, however, is an exception where pond operators must rely on imported fingerlings despite the availability of fry along neighboring coastlines. The issue of concessionaires' monopsonistic exploitation of gatherers will be examined in the next chapter in the framework of the fisheries policies which establish fry concessions.

5. Restricting Free Trade: Anticipated and Unanticipated Effects of Government Policy

POLICY IMPLICATIONS OF INDUSTRY PERFORMANCE

The fry industry is national in scale with markets closely interrelated through price movements and a high degree of distributional efficiency. In the previous analysis, certain areas of potential improvement were indicated, particularly in regard to technical efficiency and to the allocative role of prices. Pricing efficiency was low during the non-peak fry season and with respect to the fingerling industry where high net incomes prevailed. The question remains, however, whether government policy toward the fry and fingerling industries is directed towards these imperfections or whether it indirectly contributed to them.

Alleged imperfections in the fry and fingerling industries have provided the rationale for a host of government policies designed to improve the operation of the Philippine milkfish industry. As discussed in the Introduction, these policies range from conservation measures, regulations of fry gathering and first sale, and regulations on fry trade to programs that will supplement or control the supply of fry and fingerlings available to pond operators. Policies examined in this study included the fry concession system and trade restrictions. Both have an immediate and direct effect on prices, and the former is the central issue of allegations regarding monopsonistic exploitation of fry gatherers by concessionaires.

When evaluating policy effects, one must keep in mind all components of the aquaculture industry. Certain subsectors have more ready access to fisheries decision-making than others. The Philippine Federation of Fishfarm Producers, Inc. (PFFP), for example, has provincial associations throughout the country. Membership is primarily drawn from the larger rearing pond operators (Librero et al. 1977), and the president of the federation has easy access to BFAR officials and to the Minister of Natural Resources. PD 704, which in 1975 consolidated all fisheries policies and regulations, reflects the interest of the Federation in fry and fingerling price ceilings, regulation of movement, shipment, and transportation of fry and fingerlings, and the banning of fry exports.

Under PD 704, the Minister of Natural Resources is empowered to fix the fry price, "provided . . . that the price so fixed shall guarantee the gatherers of fry a just and equitable return for their labor." A price ceiling can be established

> . . . when due to destruction wrought upon fishponds, fishpens, or fish nurseries, by typhoons, floods and other fortuitous events, or due to speculation, monopolistic and other pernicious practices which tend to create an artificial shortage of fry and/or fingerling, the supply of fish and fishery/aquatic products can reasonably be expected to fall below the usual demand therefore and the price thereof, to increase . . .

FAO 115 set a fry price ceiling of ₱80 per thousand, but as is apparent from prices reported by respondents, this has proved generally unenforceable.

In practice, a price ceiling will, if enforced, actually reduce the quantity of fry available after a typhoon. Assume Figures 5.1 and 5.2 illustrate the demand and supply conditions before and after a typhoon, respectively. Before the typhoon and price control (Fig. 5.1), assume demand and supply are in equilibrium at a price of ₱70 per thousand fry, with

quantity Q_1 being offered in the market by concessionaires at this price. The supply curve for fry is assumed to be inelastic, but not infinitely so, because fry gatherers do limit their amount of effort if fry prices fall, and intensify it if prices rise. After the typhoon and consequent loss of fishpond stock, demand will shift outward to D' (Fig. 5.2). The supply curve (S) is assumed to remain unchanged, as a shift does not affect the implication of this analysis. Due to the increased demand, price will rise to a higher equilibrium level of, say ₱100, with quantity Q_2 being offered and purchased in the market. When a price ceiling is instituted at ₱80, concessionaires consequently reduce the price that they pay fry gatherers and gatherers then reduce their gathering effort catching only quantity Q_3. At this price ceiling (₱80), pond operators demand quantity Q_4. The effect of the price ceiling is thus to reduce the quantity available in the market from Q_2 to Q_3, less than would have been made available had price control not been instituted. Because of the unsatisfied demand Q_4-Q_3, nonprice rationing of the available quantity Q_3 will take place.

PD 704 also reiterates regulations established earlier in Act 4003 (1932), which gives municipalities the authority to grant fry concessions to the highest qualified bidder.

The Philippine government has thus taken an active regulatory role in the fry and fingerling industries. While the interests of pond operators, fry gatherers, and municipalities are explicitly mentioned in PD 704, the interests of marketing intermediaries such as concessionaires, dealers, brokers, and commissionmen are referred to only in the negative light of their potential profiteering in times of natural disaster. Characterization of middlemen in such a manner is common throughout the developing world. It is hoped, however, that the economic contribution of these intermediaries to the fry industry has been made clear in earlier sections, and that their functions of transport, storage, and risk assumption can now be seen in a more favorable light.

The rest of this chapter examines concession and free trade restrictions and their effects on the fry and fingerling industries, and the policy implications of future developments in the industries.

THE CONCESSION SYSTEM: RESTRICTIONS ON FIRST SALE

Legalized in 1932 through Republic Act 4003, the concession system empowers coastal municipal councils to award fry gathering rights in municipal waters to the individual, partnership, corporation, or cooperative that bids the highest for the fry ground or zone in

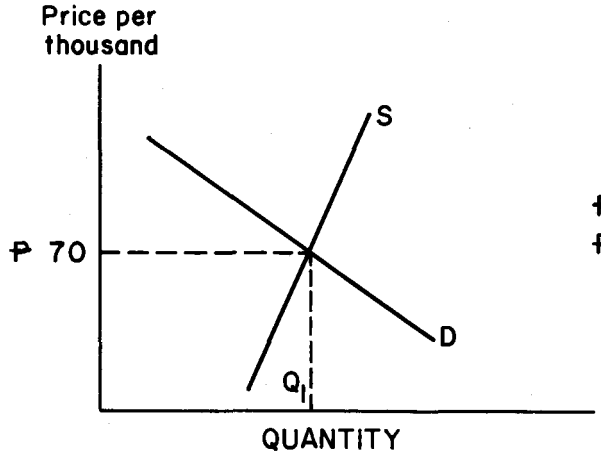


Fig. 5.1. Hypothetical pre-typhoon market conditions with equilibrium market clearing price of ₱70 per thousand fry.

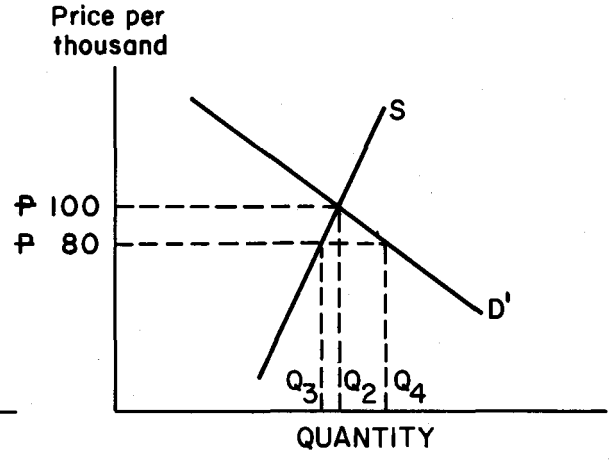


Fig. 5.2. Hypothetical post-typhoon market conditions with shortage brought about by controlled price of ₱80 per thousand fry.

question. The granting of concession rights obligates fry gatherers to sell their catch to their respective concessionaires. The purpose of the legislation was to provide a source of income to municipalities. Concessions can be granted for a maximum of five years, although in actual practice, most concessions are awarded annually. It is instructive to discuss the effects of the concession system on risk, gatherer's income, and competition.

The concession system has a major effect on the incidence of risk. Because annual bidding for concession rights is held before the fry season begins, the risk of poor catch is very neatly passed from the municipality to the capitalist who is awarded the concession. Since the municipality collects from a single entity for each fry ground or fry zone, the risk of lost income due to collection difficulties is also much reduced. The system also provides the incentive for the development of new fry grounds, as the initial investment of the concessionaire is protected through the exclusive use rights granted him by the municipal council. As shown earlier (Table 2.3, p. 23), annual concession fees can make up a significant proportion of annual municipal income. If the concessionaire refuses or is unable to pay the concession fee installments in full, municipal income can be seriously affected. For example, at the time of data collection in 1977, 10% of the sample fry ground concessionaires were delinquent in their 1976 concession fees. For this reason, municipal councils often prefer to award concessions to local residents. This preference also explains the use by nonresident capitalists of local partners to aid in securing the concession.

Fry gatherers' income is likely to be lower under the concession system than if there were no restrictions on first sale. Figure 4.7, p. 103 clearly indicates the higher average price received by Antique gatherers who were members of the San Jose Fisherman's Cooperative (₱30.7), than by gatherers from neighboring fry grounds who sold directly to concessionaires (₱20.6). The lack of a concessionaire does not, however, always assure that a higher price is received. Fry gatherers in the Iloilo City "free zone," for example, received a price comparable to that paid by concessionaires because the dealers to whom they sold had colluded to set the price paid at ₱20 per thousand. Other "free zones" in Southern Mindanao and Luzon were not controlled by dealers in such a manner, and gatherers received higher prices. Offsetting the benefits of higher prices were the lack of a credit source from which gathering gear could be borrowed, and the exposure to wide fluctuations in price received. To many gatherers one advantage of the concession system was the relative stability of price received, despite the lower total income.

The concession system severely restricts the level of competition at the early stages after fry catch. Large capital requirements have also encouraged vertical integration in the industry. However, the existence of smuggling, more prevalent in some areas, notably Mindanao, than in other areas, provides for a competitive fringe that tempers the abilities of concessionaires to take advantage of their local monopsonies.

This study concluded that the concessionaire system is a form of indirect taxation by municipalities on fry gatherers. Theoretical considerations predict that the monopsonist, as the sole legal buyer, would restrict his purchases to maximize his return. For example, Figure 5.3 depicts the monopsonist facing a competitive market for his product. The demand curve that he faces (D) is his average value product (AVP) curve, and marginal value product (MVP) curve because he has little, if any, influence over the market price, as is the general case with Philippine concessionaires. The concessionaire monopsonist faces a fry supply curve (S) that is assumed to be upward sloping, and is also equal to the average factor cost curve.[1] This curve shows the maximum quantities of fry that would be offered for sale

[1]This model assumes that the industry is operating in that portion of the supply curve that slopes upward to the right, that is, below the point of maximum sustainable yield (MSY) for the fry fishery. At catch levels above MSY, the supply curve would bend backwards (Copes 1970). For a theoretical discussion of monopsony, see Wharton (1962).

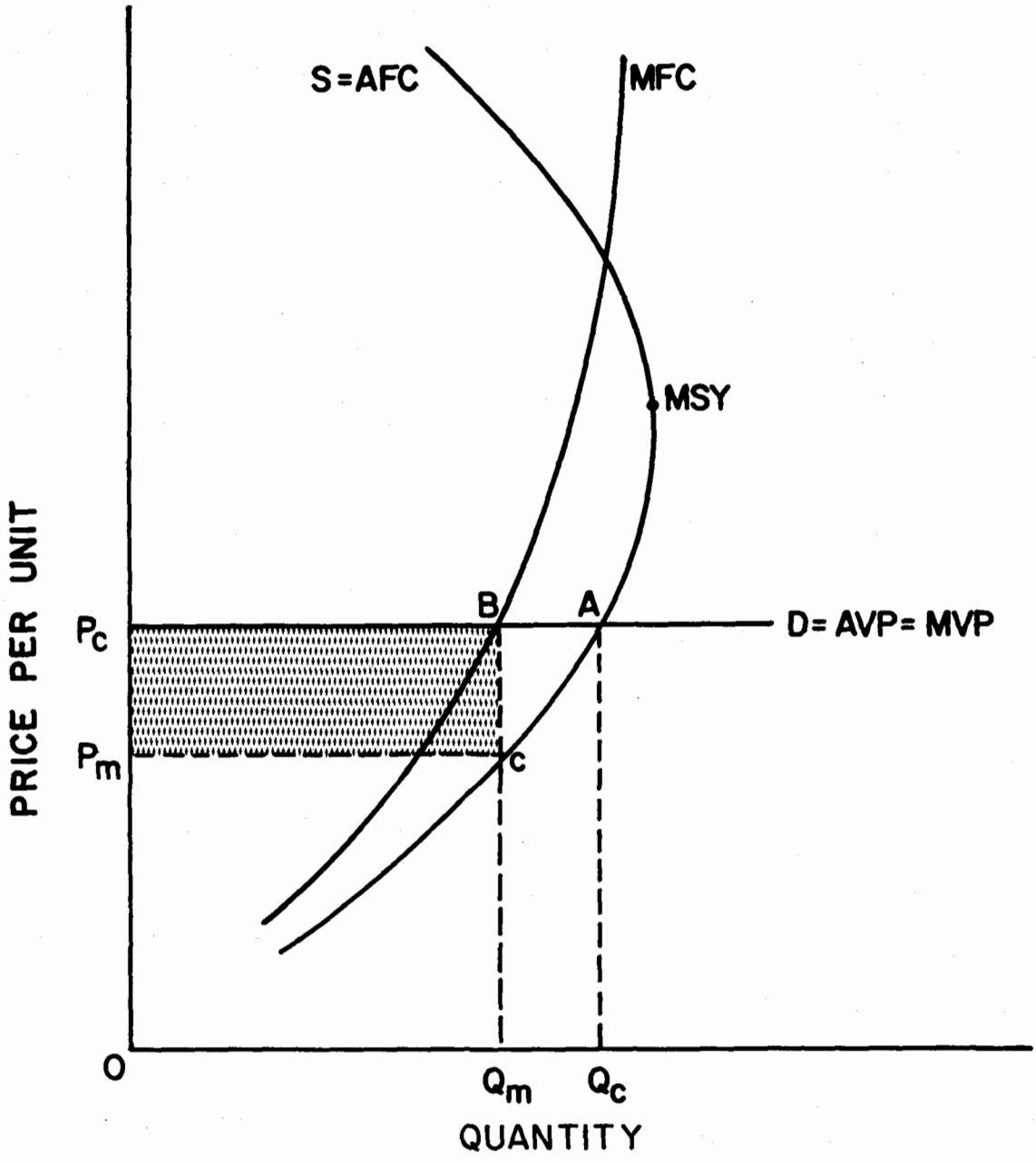


Fig. 5.3. Theoretical model of monopsonist in factor market facing perfect competition in product market.

by gatherers at each price level, or alternatively, the amount of fry that can be purchased by the concessionaire at each price level. A marginal factor cost curve (MFC) can be derived from the supply (average factor cost) curve. Under perfect competition, equilibrium would result at Point A, with a price of P_c and quantity purchased of Q_c. The monopsonist, however, would equate MFC = MVP, the marginal factor cost to the marginal value product. Purchases would be restricted to Q_m, and a lower price of P_m would be paid to suppliers. The shaded rectangle, P_mCBP_c, would thus represent potential monopsony gains. The monopsonist would be willing to pay a price as high as P_c, but only needs to pay a price of P_m to secure the desired quantity, Q_m.

This model is not an accurate description of the gatherer and concessionaire fry market. Because of smuggling or the potential for it, the concessionaire is unable to enforce the

lower price P_m through purchase reductions, and consequently unable to reap the full monopsony gain. As evidence of the inability of concessionaires to capitalize on their legal monopsonies is the fact that none of them limit their purchases in any way. All will purchase all fry caught by gatherers in their fry grounds, thus offering fry gatherers the major advantage of an assured outlet. The resulting purchase of the concessionaire is thus Q_c, the same as the competitive amount.

Depiction of hypothetical cost curves of concessionaires provides a more accurate description of their behavior (Fig. 5.4). Average fixed costs (AFC), average variable costs (AVC), average total costs (ATC), and marginal costs (MC) are shown. AFC_2 is higher than AFC_1 by an amount equal to the annual concession fee which is assumed to be a "sunk" or fixed cost. ATC_2 is thus also higher than ATC_1, by the same amount. Assuming an average selling price for the concessionaire of P, concession profit would be the shaded rectangle PABE with the concession fee, or PACD without the concession fee. The concessionaire could increase profits by paying a lower price for fry, thus shifting the AVC, MC, and ATC curves downward.

In practice, this is exactly what happens. Because he has assumed all risk of a poor season, the concessionaire pays a fry price which he projects will be sufficient to meet his average variable costs (AVC) and to recover his fixed costs (AFC), which includes the concession fee. The concession fee, therefore, is a form of tax that the concessionaire because of his sole use rights, is able to pass back to fry gatherers. Because of the more competitive situation faced in the product market, the concessionaire cannot as easily pass it forward to his buyers.

In conclusion, the necessary conditions exist for monopsony exploitation by concessionaires in that a less than perfectly inelastic fry supply curve exists. However, the sufficient condition of concessionaires' being able to translate the potential into actual economic rewards does not exist.

Monopsonistic exploitation could be solved by setting a price floor, but would be extremely difficult to enforce. Recognizing the system as a form of indirect municipal tax

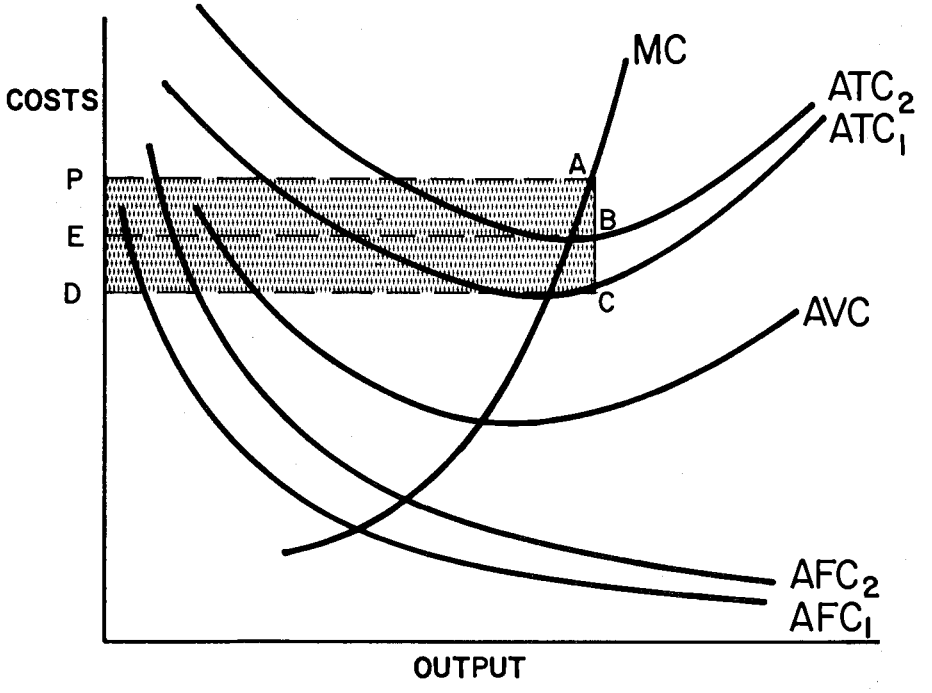


Fig. 5.4. Theoretical concessionaire cost curves, with and without concession fee.

on fry gatherers on the one hand makes it more understandable, but on the other hand, makes alternatives much more difficult to propose. Taxes on catch return the risk to municipalities, and would still in part be passed back to fry gatherers depending upon the respective elasticities of supply and demand. A more attractive alternative to municipalities and gatherers alike would be to encourage the formation of gatherers' cooperatives, such as the San Jose Fishermen's Cooperative, so that gatherers could reap the potential benefits from the concession. Ultimately, whether the present system remains, or whether some alternatives such as taxes on catch or cooperatives are adopted, the decision will rest on which group—municipalities, concessionaires, or gatherers—should bear the risks and potential windfalls of a highly variable annual fry catch, and to which group the economic rent from this resource should be distributed.[2]

FISHERIES ADMINISTRATIVE ORDER 115: RESTRICTIONS ON INTERREGIONAL TRADE

Restrictions on free trade in fry were embodied in FAO 115 dated May 1975, and subsequent Memorandum Circular No. 05. FAO 115 was in effect until July, 1978, at which time it was suspended by FAO 115-1. Because it was in effect during this study, it is instructive to report its effects on the fry industry. FAO 115 stated that "no person, cooperative, association, partnership or corporation shall ship or transport bangus fry, or "Kawag-Kawag" without first securing a Special Permit from the Secretary of Natural Resources" (Section 2). Special transport permits were issued for one-month periods for a specified quantity of fry to fishpond or fishpen owners/operators or their designated representatives. Fry transported under these permits were to be for the personal use of the consignee and could not be resold to others.

The primary purpose of the regulation was to provide the basis for BFAR collection of statistics (BFAR Director, Felix Gonzales, February 8, 1977, pers. comm.). Through FAO 115, BFAR control of supply was also possible in case of emergency. A small tax of ₱.25 per 3,000 fry shipped was also collected by BFAR. Judging by the wording of FAO 115 and its corollary Memorandum Circular No. 05, there was also an unwritten purpose to eliminate middlemen and to put shipping responsibility in the hands of ultimate consignees. Memorandum Circular No. 05 also prohibited permit applicants from buying fry at a price more than ₱80 per thousand.

The mechanics of the permit system were reasonably straightforward, but time-consuming. Applicants' fishponds were first inspected and a maximum stocking allocation was approved by the BFAR Regional Director where the pond was located. The applicant then secured the permit itself from the BFAR Regional Director from which area he expected to secure fry. Permits were thus location specific and required prior knowledge or opinion of fry availability. Auxiliary invoices were then issued as fry were shipped, the quantity of fry covered credited against the permit quota. A permittee could increase the likelihood of locating available fry by securing permits for more than one area at a time, but since the total allocation was fixed for each stocking, each permit would be for smaller amounts. Nursery pond operators that stock each pond four to five times per year thus had to repeat this process many times throughout the season. Commissionmen or dealers were a key link in the process because they could be designated as official representatives of pond operators.

The permit and auxiliary invoice requirements were reasonably well enforced for air shipments. The auxiliary invoices were presented with an accompanying bill of lading at all

[2]The concession system can also be analyzed from a fisheries economics point of view (see Chong, et al., in press). While providing added insight to the extraction of rent from the fry resource, this alternative approach reaches similar conclusions with regard to the impact of the concession system on fry gatherers.

airports, and at the destination in the case of Manila. It was extremely difficult, if not impossible, however, to cover surface shipments. There was no control over pumpboats between islands, and only slight control for overland routes. Checkpoints set up only on major routes unfortunately became a source of graft ("tong"). To ensure passage of an illegal shipment, ₱50 usually sufficed.

FAO 115 had several important implications for the efficiency of the fry marketing system. First, it narrowed the sources of supply available to permittees as permits were location specific. Second, it narrowed sources of supply available to non-permittees as fry resale by permittees was prohibited. Third, it narrowed outlets for concessionaires and dealers located in fry areas as interregional sales could only be made to holders of permits. Concessionaires and dealers could no longer transport fry in their own right. Each of these three effects to the extent FAO 115 was successfully enforced, made it more difficult for the pricing efficiency of the system to be maintained. Trade flows became regimentalized and less able to respond with flexibility to demand and supply stimuli that had in the past created a system of high responsiveness.

A final effect had important implications for the technical efficiency of the fry industry. While the permit system is no longer in effect, under FAO 115-1, auxiliary invoices are still required for interregional shipments. Time is of the essence in fry transport and any delay results in increased mortality. While the direct cost of FAO 115 is only the auxiliary invoice fee of ₱.25/3,000 fry, a one-hour delay in shipment to secure the invoice from regional or district BFAR offices increases mortality. Assuming an average nine hours in transport, mortality would increase from 7.5% to 9.3% if the trip were to take 10 hours instead. The industry can ill afford this additional 1.8% mortality, the ultimate result of which is the loss of 1,150 t of marketable milkfish, with a potential wholesale value of ₱8,732,400. If one assumes a 1976 catch of 1.16 billion, 745 million (64%) of which were transported inter-regionally, then from Chapter 4, Section C, each 1% reduction in transport mortality rates increases milkfish production by 1,000 t. (1,000) (.64) (1.8) = 1,150 t. At ₱7.6/kg, the value equals ₱8,732.400.

Respondents from the fry and fingerling industry, with the exception of pond operators in areas of surplus fry catch, were outspoken in their criticism of FAO 115, and responded to it in a variety of ways. Because they wished to avoid early renewal of the permits and revealing the true volume of their business, shippers consistently understated their auxiliary invoice declaration by amounts up to 50% of the quantity being shipped (Chapter 2, Section B.10). In addition, smuggling without the necessary auxiliary invoices was especially prevalent in Luzon where fry are shipped primarily overland. Permittees, who prior to FAO 115 were the major suppliers for small rearing and nursery fishponds in Central and Southern Luzon, continued to resell up to 25% of their imports despite FAO 115's prohibition to do so. Their dual role of nursery pond operator/dealer was thus sustained, and to the extent that non-permittees such as concessionaires and dealers were unable to ship fry interregionally, even strengthened by FAO 115. This result was quite the opposite of the regulation's unspoken intent of eliminating middlemen. In Luzon, small fishpond operators who had neither the contacts nor the finances to arrange for permits would have suffered considerably had the prohibition against resale been strictly enforced.

Could the objectives of FAO 115 have been achieved in some other way? Since auxiliary invoices, not the permits themselves, are the source of the desired statistics, it should have been possible to abandon the permit requirements, but retain the auxiliary invoices. This is the course of action subsequently decided upon by BFAR and the Ministry of Natural Resources. The auxiliary invoice records could then be adjusted for the under-statement, thus providing a reasonably accurate record of fry shipments. However, it must be stressed that every effort must be made to avoid delay of fry shipments as the cost of mortality increases is so high. With a "cost" of over ₱8 million due to increased mortality

due to a one hour delay in the average shipment, BFAR must decide if the statistics generated by the auxiliary invoices are worth this cost.

In 1976 and 1977, the situation was complicated by the de facto extension of FAO 115 restricting interregional trade until local stocking requirements were satisfied. In some regions, BFAR Regional offices refused to issue permits in response to local pond operators' complaints of "unfair" competition from Manila area buyers. An average annual stocking rate of 10,000 fry per hectare was used in these regions to estimate local stocking requirements. As previously indicated (Chapter 4), this estimate would considerably overstate local stocking requirements in all regions, with the possible exception of Iloilo Province in Western Visayas. When monitored and enforced, however, de facto trade restrictions could result in a substantial drop in fry prices in areas of fry surplus, at the expense of pond operators in fry deficit areas such as Manila.

The effects of trade restrictions as exemplified by extension of FAO 115 could be far-reaching, particularly in possible future times of fry shortage. The present system which allows relative freedom of movement of fry as long as auxiliary invoices are secured, means that fry tend to move first to pond areas of greatest productivity in Manila and Iloilo. Because the marginal return of fry is greatest there, pond operators are willing to pay higher prices for them. If a fry shortage existed and less productive ponds were supplied first, the net result would be an actual decrease in milkfish production in the country. Only with the shift of resources and of fishponds to areas of fry surplus would milkfish production again be maximized.

The statement that production should be maximized is not strictly correct, because the objective of producers is not production but rather profit maximization. Because of diminishing returns, maximum profits will be achieved at a lower production level than that which maximizes production.

There is a basic conflict between a regional and a national approach to the fry resource. The de facto trade restrictions and local enforcement of ₱80 price ceilings, while apparently reasonable from a local pond operator's viewpoint, are not so if fry are thought of as a national resource with attendant objectives of maximizing production of marketable milkfish and keeping the price within the reach of the average consumer. Because of this, the decision to suspend the permit requirements of FAO 115 was a wise one.

EXPORT CONTROLS

The banning of fry exports in the 1960s and subsequent decision to continue the ban in PD 704 is based on the assumption that the Philippines suffers from an annual fry shortage. Take away this basis as previously presented results do, and the rationale for continuing the ban on a permanent basis disappears.

Control on exports of fry is through inspection at the Manila International Airport where shipments destined for Taiwan and Hong Kong are occasionally confiscated. Rumors of fry smuggling to Taiwan by sea abound but are impossible to pin down.

Export controls act as a price-controlling mechanism in that Philippine entrepreneurs are cut off from the lucrative Taiwanese fry markets, where fry prices are 7-8 times the Philippine price. However, when fry ground prices in the Philippines drop below ₱10 per thousand as they did in mid-1977, export control acts as a barrier to gathering. Instead of providing a release valve which would help dispose of the catch, there was none and gathering subsequently halted despite the continued presence of fry along the coastline.

It appears that there is a convincing argument in favor of a more flexible approach to fry exports. Relaxing controls at times of low fry price would maintain the price received by

fry gatherers and concessionaires and would provide incentive for continued gathering. However, selective relaxing of the export ban requires accurate price information that may be difficult to collect. There is always danger in market news services of this kind that the quoted prices will not accurately reflect the actual supply and demand conditions but rather misleading prices quoted by those who would personally benefit from a relaxation of export controls.

There is an alternative approach that may be politically more acceptable to a government that would be sensitive to criticism, should a later typhoon require restocking of ponds after the export ban was relaxed. Government purchases of fry would be another way to maintain fry prices, provided they were made during periods of low prices. Although evaluation of such a program is beyond the scope of the present study, the fishpond and communal water subsidy program, already underway on a regional basis, provides a potential mechanism for price maintenance. The program could thus fill three important roles: first, its stated one of subsidizing fry purchases of small fishpond operators; second, its ability to maintain fry prices and thus gathering incentive if purchases are made at times when gathering would otherwise stop; and third, its holding of reserve stocks of fingerlings that could be made available after typhoons and floods. This assumes, of course, that the government-run nursery ponds under the subsidy program are built so that they too are not flooded during typhoons.

SUMMARIZING THE FREE TRADE ISSUE

Do existing imperfections in the fry and fingerling industries warrant restrictions on free trade? Do the imperfections shown to exist warrant alternative forms of government involvement or regulation?

Major imperfections in the industry lie primarily in the areas of technical and pricing inefficiency. Restrictions on free trade as embodied in FAO 115 actually increase rather than reduce such imperfections. Given an expanded role that would reduce severe price fluctuations and provide an insurance scheme against loss of stock during typhoons and floods, BFAR subsidy programs would do much to reduce existing imperfections in the industry. Moreover, further examination of net incomes to nursery pond operators is necessary to determine whether their high levels were due primarily to expanded fishpen operations or are more long-term in nature. If these high returns continue despite the reduction in fishpen area, the evidence of market manipulation by these nursery pond operators would be convincing and would provide a rationale for government involvement. Such involvement could take a number of forms, from financing for concessionaires to open competition through government nursery ponds, both of which would reduce the dominant role played by private nursery pond operators. Before such a step is taken, however, the high degree of risk presently assumed by these concessionaires and their nursery pond financiers must be more completely assessed. The degree of government involvement should be determined in terms of the risk it wishes to assume.

POLICY IMPLICATIONS OF FUTURE DEVELOPMENTS AFFECTING THE FRY INDUSTRY

Estimates of the employment-generating potential of the aquaculture industry are commonly based on one man-year per hectare of fishponds. Input factor and product markets provide additional employment opportunities. Extrapolating from data collected in

this survey, it is possible to estimate the scale of the natural fry fishery in terms of revenue and employment.

Assuming a 1976 catch of 1.16 billion, 85.3% or 989 million of which were stocked in fishponds, and an average price paid by pond operators of ₱58 per thousand, pond operators' expenditures for fry in 1976 totaled ₱57,362,000. Of this ₱57.4 million, 37.8% or ₱21.7 million accrued to fry gatherers, and 18.1% or ₱10.4 million to coastal municipalities in the form of concession fees. A further 10.9% or ₱6.2 million was paid to commissionmen, and salaried and casual laborers who worked for concessionaires and dealers.

Based on the same total catch figure of 1.16 billion and an average catch of 38,200 fry per family, one can estimate that approximately 26,000 families derive income from fry gathering. With an average family size of 6.4 members, 166,400 persons thus depend to some degree upon the natural fry fishery for their sustenance. Assuming an average of ₱8 per day paid commission, salaried, and casual laborers, the marketing system provides an additional 779,375 man-days of work annually. Such work covers all counting, sorting, storage, and transport functions necessary to move the fry catch from fry grounds to fishponds. Future developments in the aquaculture industry will thus potentially affect many individuals in the fry industry.

Foreseeable future developments in the industry fall into two major categories: 1) those that will shift the fry demand curve upward and to the right and 2) those that will shift the fry supply curve downward and to the right. While exact demand, supply, and price responses cannot be projected from existing data, it is imperative that these factors be discussed and examined at the earliest possible date. The following summarizes the potential changes so that the impact that these changes will have on the fry industry can be anticipated.

Shifts in demand for fry can be expected as government extensification and intensification programs take effect. The increase in demand resulting from these programs will be long-term in that farmers' response to the extension efforts of BFAR and the Fishpond Producers Association will be gradual. Increased demand for fingerlings resulting from an expansion of fishpens in Laguna de Bay, however, will be short-term and immediate. LLDA has set aside 15,570 ha for potential fishpen development and the Asian Development Bank (ADB) has approved a loan that will facilitate expansion of 2,500 ha of fishpens to be operated in 2.5- and 5-ha modules by former lakeshore fishermen. When fully developed, fishpen area in this lake alone would be double that reached in 1975-1976. At an average stocking rate of approximately 35,560 fingerlings per hectare (Nicolas et al. 1976), fingerling requirements would be 553.7 million. The number of fry required by nursery pond operators to rear this number of fingerlings would be 838.9 million or 84% of the total fry that were available for stocking in 1976. It is quite clear that expanded fishpen area will result in keen competition between rearing pond and nursery pond operators for the available fry supply. It is interesting to note that while yields per hectare are higher from fishpens than from rearing ponds, fewer marketable milkfish are produced from fishpens than if a similar quantity of fingerlings were stocked in rearing ponds. Fingerling mortality in fishpens is approximately 45% but only 18% in rearing ponds. Therefore, while yields per hectare and profits from fishpens may be high, the reduced quantities produced will result in higher, not lower, milkfish prices. This fact alone seriously questions the wisdom of fishpen expansion.

Prices of fry are certain to increase if fishpen expansion proceeds. An average fry price, retail to the pond operators, in excess of ₱100 per thousand seems quite possible with this almost doubling of demand. In addition, fishpen expansion will strengthen the dominant role played by nursery pond operators. As has been shown, these operators play a central role in industry financing and price formulation. Their control of fry supply through financing of concessionaires will undoubtedly lead to even more vociferous complaints of "unfair"

competition from rearing pond operators. The decision of the government regarding a national or regional approach to the fry resource will be crucial in this respect. An entirely regional approach to the fry resource that supplies local fishpond operators first will severely constrain the development of fishpens.

The expected increase in fry prices will benefit the coastal municipalities and fry gatherers. One need only point to the higher concession fees and the higher prices received by gatherers in 1974 over 1976 to see the effect of increased fishpen area. This assumes that fry catch in the 2 yr was roughly comparable, evidence of which was provided in Chapter 4.

Lack of knowledge regarding the extent of the fry and the adult milkfish resource has made it impossible to determine whether or not overfishing is occurring. While it has been shown that fry catch between 1974, 1976 and 1977 was undoubtedly higher than earlier estimates, it is not known if these catch levels in excess of one billion fry are overexploiting the resource. As a cautionary measure, BFAR has wisely set aside one-fifth of all fry grounds as fry reserves in which fry gathering is restricted. Further efforts to examine the biological potential of this resource are imperative.

The successful commercialization of milkfish fry hatcheries will shift the fry supply curve downward and to the right, thus potentially offsetting the price increases resulting from increased demand. In April 1977, SEAFDEC successfully produced a limited number of milkfish fry under controlled conditions. Considerable research remains to be done to commercialize the technique, but efforts to close the life cycle of the milkfish are continuing in the Philippines, Taiwan, Indonesia and Hawaii.

It is premature to evaluate the potential effects of milkfish hatcheries on the natural fry and the associated fry marketing system. The impact will be determined by the potential output of hatcheries and the price at which hatchery fry will be offered in the market. With the extreme price fluctuations caused by variability of fry catch from the natural fishery, it is quite possible that hatchery-produced fry will be competitive with natural fry during non-peak periods of low prices. As such, hatcheries could have a stabilizing effect upon fry prices that would greatly benefit the milkfish industry and aid intensificiation programs that require multiple stockings. In addition, they could provide fry even after typhoons, a form of insurance stock that would also greatly benefit the industry.

The extent to which hatcheries will displace those presently dependent upon the natural fishery depends on the placement of hatcheries and the timing of their production. There is the opportunity, if hatcheries are government owned, to phase in their production so that the displacing effects upon fry gatherers are gradual, allowing for adjustment within the natural fishery. For example, BFAR could decide to use hatcheries primarily as a price stabilization and insurance scheme rather than one that would totally replace the natural fishery. If hatcheries are privately owned and are able to produce large quantities of competitively priced fry, one can expect the impact on gatherers, municipalities, and middlemen depending on the natural fishery to be more rapid and dramatic. Careful planning of hatchery development is thus of major importance and will require continued monitoring of progress towards artificial propagation of milkfish so that the impact on the natural fishery and the milkfish industry can be controlled for maximum social benefit.

Since commercialization of hatchery techniques is several years, if not a decade in the future, the milkfish industry must be prepared for fry price increases as extensification and intensification programs and particularly fishpen expansion are promoted. The higher fry prices may, in fact, be a blessing in disguise in the short run for those seeking to maximize nationwide production of milkfish. Higher fry and fingerling prices will lead to an increased awareness of the "costs" of high mortalities in the rearing stages and a consequent desire to

reduce pond mortality. As the Taiwanese have demonstrated, high per-hectare yields can be maintained despite a reduced number of fry available for stocking.

The preceding analysis of imperfections in today's fry industry and this discussion of future developments lead to the same general conclusion. The payoff in terms of increased production from extension efforts that would reduce pond mortalities and facilitate adoption of intensification techniques will be high. In contrast, trade restrictions will likely reduce, rather than increase production.

6. Summary and Conclusion

Based on data collected from primary and secondary sources in 1977, and supplemented by data collected earlier by the SEAFDEC-PCARR Socioeconomic Survey of Aquaculture, this study analyzed the structure and performance of the fry industry of the milkfish (*Chanos chanos* Forskal) in the Philippines. The primary objectives were to determine the nature of imperfections in the fry gathering and distribution system and the fingerling business, and to examine the extent to which government fisheries and aquaculture policies ameliorate or exacerbate such imperfections.

Alleged imperfections of the Philippine fry and fingerling industry fall into three major categories: 1) inadequate supply; 2) technical and pricing inefficiency; and 3) exploitation of fry gatherers and fishpond operators by middlemen. The theoretical framework adopted for the study combined elements of the descriptive, organizational, and price efficiency approaches to marketing analysis and relied upon predictions of the competitive model as a norm with which findings were compared.

Underlying the behavior of fry market intermediaries and the resulting industry structure are the risks and uncertainties inherent to fry. Uncertainty arises due to four major factors: 1) the seasonality of catch and its possible non-appearance in any given locale; 2) the extreme price fluctuations, albeit exhibiting a regular seasonal pattern caused by seasonality of catch and year-round demand; 3) the perishability of fry and the resulting time constraint for distribution; 4) the belief in the widespread opportunistic behavior of others, made possible by the lack of an accurate method for counting large quantities of fry and fingerling. These price and non-price uncertainties led to strategies by components in the industry to minimize the risks involved, with important implications for the structure of the industry.

Fry industry structure exhibited characteristics of an hierarchichal system with well-defined redistribution centers, rather than a two-level system characterized by the commodity's moving from fry grounds to fishponds and with no change of title between the two. Nationwide fry demand and localized supply points, economies of scale in transport, and the concession system reinforced tendencies towards market hierarchies. The smuggling of fry to circumvent concessionaires, in that individual-smuggled shipments were usually small, also led to the development of assembly points consistent with the predictions of the hierarchical model.

Strategies of intermediaries to minimize risk, however, shortened the marketing chain and tempered the development of market hierarchies. The perishability of fry and government trade restrictions narrowed the choice of marketing outlets for sellers. The heavy flow of capital from nursery pond operators backwards through the marketing chain to concessionaires and dealers, and from them to runners and fry gatherers, was of mutual benefit to lenders and borrowers. The primary purpose of these interest-free financing arrangements was to assure supply. Their effect, however, was to regimentalize and shorten the fry marketing chain as borrowers repaid their obligations through subsequent shipments of fry to lenders. Finally, the desire to avoid business dealings with opportunists and to internalize the high costs associated with such behavior led to various forms of vertical integration and *suki* (most-trusted-customer) relationships.

The net effect of these structural determinants is an industry that is national in scope but with a prominent role played by nursery pond operators in the Manila area. The market-

ing chain averaged 2.7 title exchanges between fry ground and fishponds, only 0.7 above the legal minimum established by the concession system. The interregional marketing channel, through which 64% (745 million) of the 1976 fry catch moved, is more direct than that for intraregional trade.

Five criteria were applied to evaluate the performance of the fry industry. These criteria were: 1) adequacy of annual fry catch to meet annual stocking requirements; 2) technical efficiency in terms of storage and transport mortality rates; 3) distributional efficiency in terms of the extent of overlapping trade flows between regions; 4) net incomes reflecting adequate returns to management and risk; and 5) pricing efficiency in terms of measures of market integration, and spatial and form price differentials.

Fry supply was found to be adequate to meet national stocking requirements in 1976 and 1977. It was found that previous estimates of fry catch were seriously understated and that fry stocking requirements were overestimated. A catch of 1.35 billion fry was found to be adequate to meet annual stocking requirements in 1974, and indirect evidence regarding interregional trade flows and prices supported a similar conclusion for 1976 and 1977. Fry catch was estimated to be 1.16 billion in 1976. Allegations of fry shortages were traced to increased fishpen area in Laguna de Bay during the early 1970s, which resulted in higher average fry prices. Increased demand for fry and thus higher prices, will continue in the future, however, if fingerling demand increases to stock reestablished fishpens.

Mortality rates were estimated for storage, transport, and rearing activities from time of fry catch to time of sale of marketable milkfish. Of every 1,000 fry caught, only 378 (37.8%) are eventually harvested at marketable size. Mortalities in storage and transport were estimated at 8.7% and 6.6%, respectively. Transport mortality was found to be highly correlated with time in transport and use or nonuse of oxygenated water. It was not possible to categorically conclude that the fry marketing system is technically efficient because personal observations indicated that improvements could be made in the care and handling of fry, and particularly in acclimation of fry before they are stocked in fishponds, where mortalities during rearing exceeded 54%. However, reductions in mortality are primarily the responsibility of pond operators who need to take much more care acclimating their fry before stocking.

Distributional efficiency was high. Overlapping trade flows occurred during several months, but the total fry thus involved was less than 3% of total interregional trade in 1976. These trade flows appeared to result from urgent needs for fry by pond operators on particular dates, of reexports from certain regions to take advantage of central markets such as Iloilo City, and a wider exposure to potential buyers, or of the repayment of financial obligations to buyers.

Net incomes in the industry were positively correlated with the level of concentration in the various subsectors of the fry and fingerling industries. Daily net income to fry gatherers was only 70% of the minimum daily wage of ₱8. Net income to the capital, labor, unpaid family labor, management, and risk of marketing intermediaries as a percentage of sales was higher; 3.6% for concessionaires, 14.9% for dealers, and 27.7% for nursery pond operators. The net incomes for nursery pond operators were especially high, and warrant further investigation. It must be determined if high incomes occur yearly or if 1976 brought windfall returns due to the May typhoon that curtailed fry supply in Ilocos and flooded Luzon fishponds, thus leading to higher than expected fingerling prices.

Survey data indicated that fishpond operators paid an average price of ₱58 per thousand fry in 1976. Gathering costs accounted for ₱32.9 (57%) of this expenditure and the marketing margin was ₱25.1 (43%). The marketing margin thus represented a 76% markup over gathering costs.

Prices in 11 major fry markets were highly correlated indicating adequate flow of information within the industry. When individual routes were examined, however, it was found that there were occasional price differentials significantly in excess of the transfer costs between markets. The spatial pricing efficiency of the fry marketing system was high during the peak season, but not so during the non-peak winter months.

Analysis of form (fry/fingerling) price differentials and rearing costs confirmed the high rates of return to nursery pond operators. Although there has been a slight downward trend in nursery pond net incomes since early 1976, this aspect of the fry and fingerling industries still offers a significant return to the private investor. The difficulties in establishing *suki* relationships and a reliable reputation are major barriers to entry to the nursery pond business, though they are non-discriminatory. Coupled with the time lag for development of new nursery ponds, these entry barriers have combined to reward those nursery pond operators who were able to withstand the industry-wide reduction in fingerling demand since 1976.

Given the structural rigidities in the industry caused by uncertainty, it was concluded that pricing efficiency was high, but with the proviso that further research should be undertaken to evaluate and possibly quantify the substantial risks borne by nursery pond operators and to establish 1976 as a typical or an atypical year.

Finally, price comparisons at several local levels, particularly General Santos City and Davao City, offered no support to local pond operators' contentions that they are excluded from local fry sources. The prices reflected, on the one hand, the ₱5-₱10 premium that concessionaires charge local pond operators who desire to purchase on credit, and the more favorable price that can be availed of through the purchase of widely available smuggled fry. An exception, however, was Batangas Province where pond gatherers relied on imported fingerlings despite the availability of fry along nearby coastlines. Claims of exclusion from sources of supply should be viewed not as evidence of exploitation or market imperfections, but rather as objections to the higher fry prices nationwide that resulted from the 1971-1975 expansion of fishpen area.

Imperfections in the industry are due primarily to technical inefficiency and to a lesser extent to pricing inefficiency. Reductions in mortality rates in the whole aquaculture industry can probably be most readily achieved through better acclimation and pond management techniques, and as such lie outside the control of the fry marketing system per se.

BFAR policies which restrict or regulate free trade were examined for their effects upon industry structure and performance. The concession system which provides exclusive use rights of fry grounds to the highest bidder was shown to be a form of indirect municipal tax on fry gatherers. Concessionaires treated their concession fee as a fixed cost, to be recovered as early as possible during the fry season. Smuggling by fry gatherers should thus be viewed as an attempt to avoid this indirect tax rather than as evidence of exploitation of fry gatherers by concessionaires. More importantly, smuggling provides a "competitive fringe" which prevents concessionaires from capturing their monopsonistic advantage. The necessary conditions exist for monopsony exploitation in that concessionaires face a less than perfectly inelastic fry supply curve. However, the sufficient condition of being able to translate the potential into actual economic gain does not exist. The formation of fry gatherers' cooperatives, such as the San Jose Fishermen's Cooperative in Antique was suggested as a means to increase income of fry gatherers. This would, however, expose gatherers to the price risks presently assumed by concessionaires.

Results indicated that FAO 115 created, rather than eased imperfections in the fry industry. By narrowing potential outlets for sellers and potential sources for buyers, it became more difficult for price to perform its spatial allocative function. Moreover, the regulation reinforced the position of nursery pond operators as illegal dealers of fry, quite the opposite of its implied intention. Moreover, the regulation even as modified by FAO

115-1 which suspended permit requirements, results in extremely high hidden costs due to the increased mortality of fry because of the additional time required to secure the necessary auxiliary invoices.

Restrictions in interregional trade in fry until local stocking requirements are met, in times of low fry catch will actually reduce total milkfish production in the Philippines. Providing fry to less productive ponds rather than to ponds in fry deficient areas where marginal return would be higher, is in essence treating the fry resource as of local importance only rather than as a national resource from which milkfish production must be maximized. Even in times of adequate fry catch, the logistical problems of equitably administering such restrictions appear formidable.

Export controls presently act as a price controlling mechanism, and evidence was provided in 1977 to show that the controls actually restricted fry gathering efforts when prices fell to ₱10 per thousand fry. As an alternative to the selective relaxing of export controls, the mechanism for a price stabilization program exists in the already established fishpond subsidy program. If BFAR fry purchases are made during times of relatively low fry prices, and fingerlings are sold during times of higher prices later in the season, a price stabilization program cum subsidy and flood insurance program can be established for the benefit of the industry. Such a program would put BFAR in competition with private nursery pond operators in regions where they operate, and would expose the government to risks presently assumed by the private sector.

The final comments in this study center upon the necessity to antipate the effects of fishpen expansion and commercial milkfish hatcheries on the existing natural fishery and distribution system. Since the fry industry is a ₱57 million per year industry which provides sustenance to over 25,000 families, I suggest that the location of hatcheries and the timing of their production be planned such that they complement rather than displace those dependent upon the natural fry fishery and distribution system.

In conclusion, the fry industry appears to demonstrate high levels of performance. Price increases should be expected in the future as intensification and extensification programs and fishpen expansion proceed. The challenge to the Philippine aquaculture industry for the next decade is to improve pond management techniques so that higher per-hectare yields can be achieved despite limited quantities of fry available for stocking.

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Appendix A. Alternative Methods for Studying Marketing Systems

The purpose of a methodology is to establish a general theoretical framework, that may or may not be mathematical, within which specific objectives can be achieved. Marketing studies of the type proposed here face two basic interrelated problems. The first is the need to select an appropriate norm against which the observed system can be measured or compared. Once a norm is selected, the problem of how to view and evaluate departures from the norm remains. How great a departure is too great?

Market analysis studies can be grouped into three broad methodological categories (Table A.1). The first of these is basically descriptive, contains little statistical analysis, and reaches conclusions regarding performance and efficiency based primarily on the researcher's subjective analysis of the situation (Some excellent descriptive studies are Darrah 1958; Dewey 1962; Mears 1961). Functional and institutional approaches fall into this descriptive category. Although not all authors extend these approaches beyond description, Ruttan (1969) claims that "much of what passes for analysis in the marketing literature represents little more than the repetition of the conventional wisdom regarding middleman behavior with little or no empirical content" (p. 83). Ruttan is referring to Southeast Asian product and factor market studies in which he claims that the middleman monopsony hypothesis is supported primarily by anecdotal material in lieu of empirical evidence.

The descriptive approach has been extensively used, particularly in marketing textbooks, as a basis for studying commodity flows and marketing techniques. It is not as useful for intercommodity comparisons.

A second category of market analysis has developed since the 1950s based on the work of Bain (1968) in the field of industrial organization. Bain attempts, in an examination of U.S. manufacturing, to show a one-way causal relationship between an industry's structure, conduct, and performance. He finds, however, that causality flows in all directions among the relevant variables, making the predictive and analytical value of this organizational approach extremely limited (Marian and Handy 1973; Lucas 1969). Sosnick's (1968) extension of Bain's work establishes 25 flaws from which a market must be free to be judged effectively competitive.

The organizational approach with modifications has been used to analyze the California fresh and frozen fishery trade (O'Rourke and DeLoach 1971), and the Florida shrimp processing industry (Alvarez et al. 1976). In both cases, the paradigm is useful because the researchers are examining structural changes over time and the resulting effects upon industry performance. In cases where time series data are not available, the value of this approach to single sector analysis is much reduced. Its value to interindustry comparisons, consistent with Bain's original approach, remains, however.

The organizational approach evolved in the developed country industrial context, and one can seriously question its applicability to the more atomistic situation typical of most agricultural factor and products markets. Moreover, Smith (1972) believes that the structure-conduct-performance framework has limited transferability to the developing country context because of underdeveloped infrastructures, intersectoral relations, and development objectives, and their unique social and political structures. Smith proceeds to develop several performance criteria that he considers more relevant to the developing countries, including:

1. Progressiveness within the marketing sector;
2. Provision of opportunities for technical efficiency;
3. Favorable price-cost relations and minimization of marketing margins;
4. Minimization of price and market risks to producers and to marketing firms;
5. Reliability of export product quality and effective articulation of relative demand for different qualities of product (price signals) to producers and processors;
6. Minimization of opportunities for corruption of government officials; and
7. Reliability of farm inputs and intermediate products in marketing channels.

As with Sosnick's 25 criteria, in the absence of some suitable norm, the above points while phrased for the developing country context, appear to be restatements of the hypotheses underlying the per-

Table A.1. Alternative market analysis methodologies.

Descriptive	1. Functional approach a. Exchange: Buying Selling b. Physical: Storage Transport Processing c. Facilitating: Standardization Financing Risk bearing Market intelligence	2. Institutional approach a. Merchant middlemen Retailers Wholesalers b. Agent middlemen Brokers Commissionmen c. Speculative middlemen d. Processors/manufacturers e. Facilitative organizations
Organizational	1. Structural dimensions Concentration Profit differentiation Entry conditions 2. Conduct dimensions Interactions between competing sellers: Predatory Exclusionary Collusion Aims of price determination Methods of price determination	3. Performance dimensions Profit margins Technical efficiency Progressiveness Conservation
Price Efficiency	1. Price differentials Spatial Inter-temporal Form	2. Index of market integration 3. Location theory 4. Regional analysis 5. Interregional trade analysis

fectly competitive model. The problem of evaluating departures from the model remains. Smith's points, however, deserve one additional comment which support the approach of this study: he sees the necessity for revising only performance dimensions of the organizational approach, while leaving structural and conduct dimensions as specified by Bain basically intact.

The third major category of marketing analysis, the price efficiency approach, makes no bones about its dependence on the perfectly competitive model as a norm, and analyzes marketing in its dimensions of space, time, and form (King and Henry 1959; King 1965; Bressler and King 1970). Examination of the efficiency with which the marketing system transmits information among the different producer, wholesale, and retail markets is achieved through the application of various pricing efficiency criteria (Farruk 1970; Lele 1971; Mears 1974). Criteria include:

1. Index of market integration. The accuracy and speed with which prices react and adjust to stimuli (demand and supply changes, and other factors) can be taken as the degree of interrelationship in the mechanism of price formation between various markets. This index, based on correlation coefficients between prices in the various markets, provides a measure of the flow of information between markets.

2. Spatial price differentials. In a competitive market structure satisfying the preconditions of perfect product mobility, inter-market price differentials will result in arbitrage by traders until price differentials in excess of transfer costs are eliminated. One can compute the transfer costs between the various points in the marketing channel, calculate the actual price spread between those points, and interpret the difference in terms of price efficiency.

3. Inter-temporal price differentials. In a competitive market structure, inter-temporal price differentials will result in storage by traders until price differentials in excess of storage costs are eliminated. The difference between inter-temporal price differentials and storage costs can again be interpreted in terms of pricing efficiency.

4. Form (processing) price differentials. In a similar way, a market can be viewed as extending through alternative and successive forms of a product with a consistent structure of prices interrelated through processing costs.

Also falling within this third category of marketing analysis are studies of equilibrium among spatially, temporally, and form separated markets.

The development of a general theory of location and space economy has been of considerable interest to economists (See Moses 1968; Flores 1972; Sohn 1969; and King 1965). From J. H. Von Thünnen's 1826 categorization of agricultural activities around a town center and river transportation system, spatial economic theory now includes a) location theory with its emphasis on alternative locations for specified activities such as processing plants; b) regional analysis which is concerned with groupings of interrelated economic activities in proximity within specified areas; and c) interregional trade theory referring to the economic relationships between such areas (Hoover 1968). One of the reasons for the theory's development has been the awareness that a comprehensive economic theory should consider both time and space dimensions (Dean et al. 1970).

Spatial equilibrium models developed range from the single product transportation model to the more recent quadratic programming multi-product model formulated by Takayama and Judge (1964). The spatial transportation model is a particularly useful tool to determine minimum cost transportation routings between regions. However, since predictions depend upon the competitive model, the problem of evaluating departures from the norm remains.

Regarding evaluation of efficiency of the pricing system's spatial, inter-temporal, and form functions, Farruk (1970) points out that

> . . . in any situation where we depart from the norms of perfect competition which clearly set the limit of intermarket price differentials, any judgment on the question of too wide and monopolistic price spreads has to be entirely arbitrary (p. 101).

It is at this point that the researcher's experience and knowledge gathered from primary data sources must provide the basis for best judgment.

The middle ground between the two well developed and widely accepted economic models of perfect competition and of monopoly is thus ill-defined and quickly leads the analyst into the realm of subjectivity. Discussions of Chamberlin's (1962) and Robinson's (1933) works and subsequent endeavors to provide a theory of imperfect competition useful for behavioral studies can be found in innumerable works, so no attempt will be made to review them here. The relevance of all of the above to the fry and fingerling topic is finding that no matter the norm adopted for analysis of marketing systems, the necessity to rely on the informed judgment of the researcher remains paramount when examining departures from such norm. In essence, this implies the necessity for further behavioral research once these departures have been identified.

Reliance on the perfectly competitive model, as is implied by the study of pricing and distributional efficiency, as a norm or frame of reference must be justified. Assumptions of perfect competition include a) large numbers of buyers and sellers, each too small to affect the price of the commodity; b) homogeneous output of firms in the market; c) perfect mobility of resources; and d) perfect knowledge of prices and their costs by consumers, resource owners, and producers. Clearly, no real world market achieves this ideal. Why is it, then, that this model and its associated tools of analysis remains among the most widely used by economists today? First, as pointed out by Ferguson (1972, p. 253), "generality can be achieved only by means of abstraction." Secondly, as pointed out by Friedman (1971) in his well-known essay, "The Methodology of Positive Economics," a theory should not be judged by the realism of its assumptions, but rather by its ability to predict. It is the conclusions of the model, not its assumptions, that are tested against reality. "The conclusions derived from the model of perfect competition have, by and large, permitted accurate explanation and prediction of real world phenomena" (Ferguson 1972, p. 253).

Pricing efficiency analysis in terms of spatial and form (processing) price differentials allows determination of where the fry gathering and distribution system and the fingerling rearing operation depart from the perfectly competitive model, and consequent examination of the reasons for such departure. Because the stunting of fry for purposes of later sale is not widely practiced in the Philippines, analysis of inter-temporal price differentials and storage costs has not been covered in this report.

Given the importance of price as an allocator of resources within and between sectors, as an intersectoral distributor of income and as a generator of capital (Mellor 1969), studies of pricing efficiency appear to be highly relevant. This is particularly true of factor markets, such as those for milkfish fry, on which so little empirical research has been conducted.

One can hypothesize that improvements in the technical and pricing efficiency of the milkfish fry gathering and distribution system will potentially be felt in one or more of three ways: a) lower prices to consumers of fry (and indirectly to consumers of the marketable milkfish); b) higher prices received by fry gatherers; and/or c) higher profits to intermediaries.

Although no exact measurement has been made, indications are that the demand for milkfish in the Philippines is price inelastic, implying that consumers would be a primary beneficiary of improvements in technical and pricing efficiency. Guerrero and Darrah (1975) cited a price elasticity of demand for milkfish of −0.60. Whether consumers will actually be the primary beneficiary depends, in addition to demand and supply elasticities, upon the nature of relationships between and relative power of elements in the fry marketing system. Demand and supply elasticities have not been estimated in this report. This report, however, sheds considerable light on interrelationships between marketing intermediaries and their effect upon the structure, conduct, and performance of the milkfish fry and fingerling industry.

Appendix B. Philippine Fishes Found Mixed with Milkfish Fry Catch or In Ponds Upon Harvest of Marketable Milkfish

Local names	English names	Scientific names
Ahaan	Red Snapper	Lutianus malabaricus
Apahap[1,2]	Silver Sea Bass	Lates calcarifer
Awa (Visayan)[1]	Ten Pounder	Elops hawaiiensis
Bagsang[2]	Glassfish	Ambassis sp.
Balanak[2]	Mullet	Family Mugilidae (all species)
Balaongan, Baraongan[1]	Grunter	Therapon sp.
Banak[1]	Mullet	Family Mugilidae
Barewa, Barira[1]	Silver-Bar fish	Chirocentrus dorab
Ber-ber, Bayiribir	Ten Pounder	Elops hawaiiensis
Bia, Biyang-dagat	Goby	Family Gobiidae (all species)
Bid-bid[1]	Ten Pounder	Elops hawaiiensis
Birao-birao, birau-birau, biraw-biraw[1]	Silver-Bar fish	Chirocentrus dorab
Bilinao, Bolinao	Anchovy	Family Engraulidae
Botete, Butete	Puffer, Globefish	Family Tetraodontidae
Buan-buan, Bulan-bulan[1]	Tarpon	Megalops cyprinoides
Bugaong,[1,2] Bagaong	Grunter	Therapon sp.
Bugok	Wrasse	Family habridae
Bugsang[1]	Glassfish	Ambassis sp.
Bulawis[1]	Rabbit fish	Siganus javus
Buliglig, Bulig (Tagalog)[1,2]	Snakehead fingerling	Ophicephalus striatus
Bulanus, Bolungnas, Bolungonas	Cutlass fish	Trichiurus haumela (Family Trichiuridae)
Bunggan, Bolgan, Bulgan[1]	Silver Sea Bass	Lates calcarifer
Bunhor, Bunor, Bunog	Goby	Trichiurus haumela
Dalag, Bulig (Bicolano)	Snakehead fry	Ophicephalus striatus
Dangit (Bicolano)	Hump-Backed Red Snapper	Lutjanus gibbus
Dangit (Bicolano and Visayan)	Rabbitfish	Family Siganidae (all species)
Dilis	Anchovy	Stolephorus commersoni
Elver, Obud	Elver (eel fry)	Family Congridae
Gisaw, Gìsao	Mullet fingerling	Family Mugilidae
Ibis (Visayan)	Glassfish	Family Ambassidae
Ibis, Ivis (Muslim dialect)	Balacbac Barb	Barbus ibis
Ibis pula (Muslim dialect)	Cardinal fish	Family Apogonidae
Kitang[1]	Butterfish	Scatophagus argus
Lanay (Laway-laway)	Slipmouth	Family Leiognathidae
Lapu-lapu, Lapolapo[1]	Grouper	Epinephelus sp. (all species Family Serranidae)
Liwit	Cutlass fish	Trichiurus haumela
Malaga (Pangasinan)	Rabbitfish	Family Siganidae
Malaga (Ilokano)[1,2]	Butterfish	Scatophagus argus
Osoos	Whiting	Family Sillaginidae
Paitan, Pait	Rasbora	Rasbora sp. (Family Cyprinidae)
Palo	Goby	Glossogobius giurus
Panengan	Cardinal fish	Apogon sp.
Rompi, Rumpe[1]	Barracuda	Family Sphyraenidae
Samarae, Samarera[1]	Rabbitfish	Family Siganidae (all species)
Sangitan	Goby	Family Gobiidae
Sugpo	Prawn	Penaeus sp.
Tagum-tagum (Tagum)[2]	Mullet	Family Mugilidae
Talakitok	Jack	Caranx sp.
Talilong[2]	Mullet fingerling	Family Mugilidae
Tamayak, Tamasak	Mudskipper	Periophthalmus barbarus
Tangigi, Tanigi[1]	Spanish Mackerel	Scomberomorus commerson
Tilapia[1,2]	Tilapia	Sarotheron sp. (T. mossambica, common)
Tirok[1]	Striped Barracuda	Sphyraena obtusata

[1] Predators.

[2] Fishes found in fishpond probably after free entrance. Unidentified local common names are: imbis, balan, siyab, daplit, purong, alabang, tido, tabodios, and gurayan. Other invertebrate species which mix and compete with milkfish during collection and culturing in the pond are: shrimps, crabs, prawn or prawn fry (*Penaeus* sp.), squid, and mussel. Compiled by Franklin C. Cas, SEAFDEC-PCARR Aquaculture Project, Los Baños, Laguna, Philippines. The assistance of Mr. Bruce Carlson of the Waikiki Aquarium is also gratefully acknowledged.

Appendix C. Adjustments and Extrapolations Necessary to Calculate 1976 Interregional Trade Flows

Since all interregional fry shipments from and within Mindanao are made by air, no further adjustment was necessary on auxiliary invoice records other than the understatement adjustment factors (Chap. 2). The extrapolations and further adjustments for exports from the remaining 11 trading regions were as follows:

1. *Western Visayas*
   a. Understatement adjustment factors only.
2. *Central Visayas*
   a. Understatement adjustment factors only.
3. *Eastern Visayas*
   a. Understatement adjustment factors.
   b. BFAR Provincial Officer estimates annual Leyte (Eastern Visayas) catch of 6,000,000 fry is smuggled to Cebu (Central Visayas). The smuggled fry were allocated equally among the six months of April to September since these were the only months of legal fry shipments from Leyte to Cebu. The smuggling estimate was confirmed by a private fry dealer located in Southern Leyte.
4. *Bicol*
   a. Understatement adjustment factors.
   b. Smuggling of Masbate fry to Capiz Province (Western Visayas) independently estimated at 5,000,000 by the Bicol Region BFAR office and by a Roxas City dealer. The 5,000,000 was allocated among the months of April, June-September, and November, according to the percentage catch in Bicol as recorded by BFAR.
   c. Smuggling of Bicol fry to Quezon (Southern Tagalog). Using 1976 stocking rates from Quezon rearing pond respondents (2,183 fry/ha per year) and adjusting for those 32.35% of ponds that stock fingerlings rather than fry, Quezon fry requirement was estimated as 24,302,900 fry of which 61.75% (14,946,000) according to respondents, came from Bicol. This total was then also allocated among the months of April, June-September, and November.
5. *Palawan*
   a. Understatement adjustment factors.
   b. Shipments of 10,850,000 fry from April to November from Cuyo to Antique (West Visayas) based on concessionaire interviews.
   c. Smuggling from Palawan (primarily Cuyo) to Antique, estimated at 10% of annual Palawan catch by concessionaires, increased Cuyo to Antique flows by 10% in each month April to November.
6. *Mindoro*
   a. Understatement adjustment factors.
   b. Smuggling from Mindoro Oriental to Bulacan and Rizal. Based on concessionaire interviews and a comparison with 1973 catch data available from BFAR, fry shipment was projected at 855,000 in each month of June and July.
7. *Southern Tagalog*
   a. Understatement adjustment factors.
   b. Smuggling from Romblon, estimated by BFAR Provincial Program Officer at 800,000 fry. Half went to Roxas, Mindoro and the other half to Kalibo, Aklan, allocated to the months May-September, November, based on auxiliary invoice records of legal fry shipments.
8. *Bulacan/Rizal*
   a. Understatement adjustment factors.
   b. Illegal resales by permittees to smaller nursery pond operators and rearing pond operators, based on our interviews were estimated at 24.1% (156,205,600) of total imports, of which, based on number of hectares in the provinces of Bulacan, Rizal, Pampanga, Bataan, and Quezon, 43,026,700

were resold to Central Luzon and 1,187,300 to Southern Tagalog. Allocated by month according to monthly Bulacan/Rizal imports. The remaining resales (112,041,600) stayed in Bulacan and Rizal.

9. Central Luzon

a. Smuggled fry from Zambales to Pampanga, estimated at 5,000,000 by Dagupan City, Pangasinan fry dealers. Allocated 50% to May and 50% to June based on fry season duration reported by a Zambales concessionaire.

10. Cagayan Valley

a. Understatement adjustment factors only.

11. Ilocos

a. Although the region issued no auxiliary invoices, BFAR did compile 1976 fry catch estimates for each province. Comparing these figures with higher ones supplied by concessionaire respondents allowed an extrapolated catch estimate of 37,248,000 fry for the entire region. Based on the replies of respondents, regional exports were estimated at 28,011,000 fry, and then distributed by month, based on catch.