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**PRICE ANALYSIS OF SOME ECONOMICALLY IMPORTANT
MARINE SPECIES IN THAILAND**

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PREFACE

Marine fish prices are an important economic factor since they influence the level of fishermen's income, the welfare of consumers and the amount of export earnings. During the past decade, marine fish prices in Thailand have risen steadily owing to increases in both domestic and overseas demand for Thailand's fish and fishery products, concurrently with a reduction in marine fish catch owing to the depletion of marine resources in the Gulf of Thailand and the declaration of the 200 mile economic zones by neighbouring countries. Recent increases in marine fish prices were also consequences of rising costs in fishing, i.e. fuel, gears and other fishing supplies ice and net in particular. Moreover, prices of marine fish landed at the Bangkok Fish Market and other fish markets have fluctuated daily in response to changes in the quantities of marine fish landed, which in turn vary depending on weather and seasonal conditions of fishing. Therefore, information on marine fish prices is important for fishermen, fish merchants, and government officials who are involved in fishery activities. Knowledge of marine fish prices will assist them in planning their activities favourably.

This study aims to make an economic analysis of marine fish prices from the Fish Marketing Organization data in order to assist the above-mentioned persons. The investigation will be made on the price formation of marine fish in the Bangkok Fish Market and some major provincial markets, and on factors affecting domestic wholesale prices. Price movements in each market, and price relationships between markets will also be analysed in order to understand the long-term trend and seasonal movement in each market, and their relationship with other markets.

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Chapter I

INTRODUCTION

1.1 Introduction

Fishery is one of the most important industries in Thailand, contributing about 2 percent of the Gross Domestic Product. Fishery production is about two million metric tons per annum. In 1985, total fishery production was 2,225,204 tons. The production is not only for domestic consumption but is also exported to other countries in Asia, Europe and North America. By exporting fishery commodities, Thailand earns annually foreign exchange amounting to about 10,000-15,000 million Baht and there is high potential for increasing the export value in the future. In 1985, Thailand exported marine fish and fishery products mainly in the form of frozen shrimp and prawn, and frozen squid and cuttlefish valued at 18,528 million Baht.

During the past decade marine fish prices in Thailand have risen steadily due to increases in both domestic and overseas demand for Thailand's fish and fishery products, concurrently with a reduction in marine fish catch owing to the depletion of marine resources in the Gulf of Thailand and loss of access to fishing grounds resulting from the declaration of the 200 mile exclusive economic zones by neighbouring countries. Recent increases in marine fish prices were also caused by rising costs in fishing supplies such as fuel, gears, and others, in particular ice and nets.

Fish price is an important economic factor since it influences the level of the fishermen's income, the welfare of consumers and the amount of export earnings. Therefore, information on fish prices is important for fishermen, fish merchants, and the government officials who are involved in fishery activities. The knowledge of price formation in various

fish markets and price relationships between these markets assist fishermen and fish merchants in bargaining for better prices. Understanding the pattern of price movements also assists fishermen in planning their short-term and long-term fishing operations. On the basis of the long-term trends of fish prices, the government officials would be in better position to make a decision on whether they should intervene in fish markets in order to protect the welfare of both consumers and fishermen.

At present the Fish Marketing Organization (FMO) keeps most records of marine fish prices in the Bangkok Fish Market and several provincial fish markets. However, this price information has never been analysed systematically. This study aims to make an economic analysis of marine fish prices from the FMO data bank. The investigation will be made on the price formation of marine fish in the Bangkok Fish Market and some major provincial markets, and on factors affecting domestic wholesale prices. Price movements in each market and price relationships between markets will also be analysed in order to understand the long-term trend and seasonal movement in each market, and their relationship with other markets.

1.2 Objectives

The objectives of the study are to clarify:

- (1) The price formation of marine fish at the Bangkok Fish Market and some major provincial fish markets;
- (2) Price movements of marine fish in each market, i.e. long-term trend and seasonal movement;
- (3) Price relationships between Bangkok Fish Market and some major provincial markets;
- (4) Factors affecting national and Bangkok wholesale prices of marine fish.

1.3 Research Methodology

In order to understand the present marketing system of marine fish in Thailand, field surveys were made in the Bangkok Fish Market and some provincial fish markets, namely, Samut Sakhon, Ranong, Surat Thani, Phuket, Rayong, Chantaburi and Trat during October to November 1986. Major fish agents, fishermen and fishing port managers in these markets were interviewed by the research team regarding their marketing operations as well as price formation and price movements of marine fish. However, owing to the limitation of the fish price records of FMO, not all of these markets were included in the statistical analysis, while some other provincial fish markets for which fuller fish price records were kept at FMO were included in the study. Therefore, there are eight fish markets for which fish price information was analysed in this study, i.e., Bangkok, Samut Sakhon, Hua Hin, Ranong, Surat Thani, Phuket, Songkhla and Pattani. All of them are fish markets and fishing ports belonging to FMO, for which the FMO Statistical Section has kept price records of fish landed and sold at these fish markets and fishing ports.

Five major marine species were selected for the study, namely, Shrimp and Prawn, Squid and Cuttlefish, Indo-Pacific Mackerel, Tuna and Trash Fish. The time frame of the study is from 1971 to 1985 for the long-term price analysis at the national level, the Bangkok Fish Market and provincial fish market levels and the study of price relationships between markets and factors affecting wholesale prices of each marine species. For the short-term price analysis, the time frame is between 1 January 1981 and 31 December 1985 for the analysis of seasonal price movements of these marine species at the Bangkok Fish Market and provincial fish markets.

Research methodologies used to attain the objectives of the study comprised the following techniques:

- (1) interviews of fish agents, fishermen and fishing port managers to obtain information on the fish marketing system and price formation as well as factors affecting the wholesale price of fresh marine fish;
- (2) a comparison of price trend and landed quantity trend of each marine species over a 15-year period for the long-term price analysis and a comparison between seasonal price indices and seasonal landed quantity indices of each species for the seasonal price movement analysis at the Bangkok Fish Market and provincial fish market levels;
- (3) a correlation analysis to ascertain the price relationship between the Bangkok Fish Market and eight major provincial fish markets for each marine species;
- (4) a regression analysis to determine factors affecting national and Bangkok wholesale prices of each marine species.

Chapter II

MARKETING SYSTEM AND PRICE FORMATION

2.1 Present Marine Fish Marketing System in Thailand

At present there are about 40 major fish landing centers along the coasts of the Gulf of Thailand and the Indian Ocean. Most of them are privately owned. The Fish Marketing Organization (FMO) operates three wholesale fish markets: one in Bangkok and one each in Samut Sakhon and Samut Prakarn, and manages eight fishing ports: one each in Prachuap Khiri Khan (Hua Hin), Chumphon, Ranong, Surat Thani, Phuket, Songkhla, Pattani and Satun.

At these fish landing centers, fishermen may sell their fish directly to various dealers and middlemen such as fish assemblers, local wholesalers and retailers, cold storages and processors, or they may sell their fish through fish agents who charge them about 5-6 percent of their selling prices as commission. Fish in these fish landing centers are usually sold by negotiations between buyers and sellers (either fishermen or fish agents) or by an auction system. From these fish landing centers, fish are either transported by trucks in refrigerated containers by trucks or by refrigerated trucks to the terminal markets in Bangkok, Samut Sakhon and Songkhla - Had Yai or distributed directly to local consumers and processing plants, while trash fish are transported to local fish meal factories. Figure 2.1 shows the diagram of the fresh marine fish marketing channel in Thailand.

In Bangkok and Samut Sakhon Fish Markets, fresh marine fish are bought and sold through an auction system and then shipped by various means of transportation, e.g., refrigerated trucks or taxi boats, or sold directly to cold storages for further processing and export. At present there are 12 marine

fish agents in the Bangkok Fish Market and 22 fish agents in the Samut Sakhon. Figures 2.2 and 2.3 show diagrams of the fresh marine fish marketing channels of Bangkok and Samut Sakhon Fish Markets in 1985, respectively.

2.2 Price Formation of Fresh Marine Fish

The number of fish buyers per day and fish agents per day in each fish market is shown in Table 2.1. In Bangkok Fish Market, there were, in 1985, approximately 1,254 fish buyers per day as against 12 fish agents while there were approximately 263 buyers against 27 fish agents in Samut Sakhon Fish Market, and 20 fish buyers and 26 fish agents in Songkhla fishing port.

In Bangkok, Samut Sakhon and Songkhla terminal markets, prices of fresh marine fish such as shrimp and prawn, squid and cuttlefish, Indo-Pacific mackerel and tuna are determined by auctioneers and bidders or bargainers on the basis of their freshness and sizes, and current market and supply conditions. Export prices of frozen shrimp and prawn, squid and cuttlefish and canned tunas also determine local wholesale prices of these marine species. In other provincial fish markets, Bangkok, Samut Sakhon and Songkhla wholesalers' buying prices are also used as criteria for bargaining.

In both Bangkok Fish Market and provincial fish markets, the price bargaining or auction of fresh marine fish, including shrimp and prawn, and squid and cuttlefish is usually made per fish container (e.g. bamboo basket, plastic container, and wooden case) or per piece for large-sized fish. For cheap fish or low quality fish, the negotiations are often made on bulk-basis. Prices are quoted as Baht per kilogram. At each negotiation, the fisherman or fish agent will announce the maximum price he wants to receive for his fish, then each bidder from a group of approximately 5 to 25 buyers will bargain from the lowest price he wants to pay. The buyer who offers the highest price will get the fish.

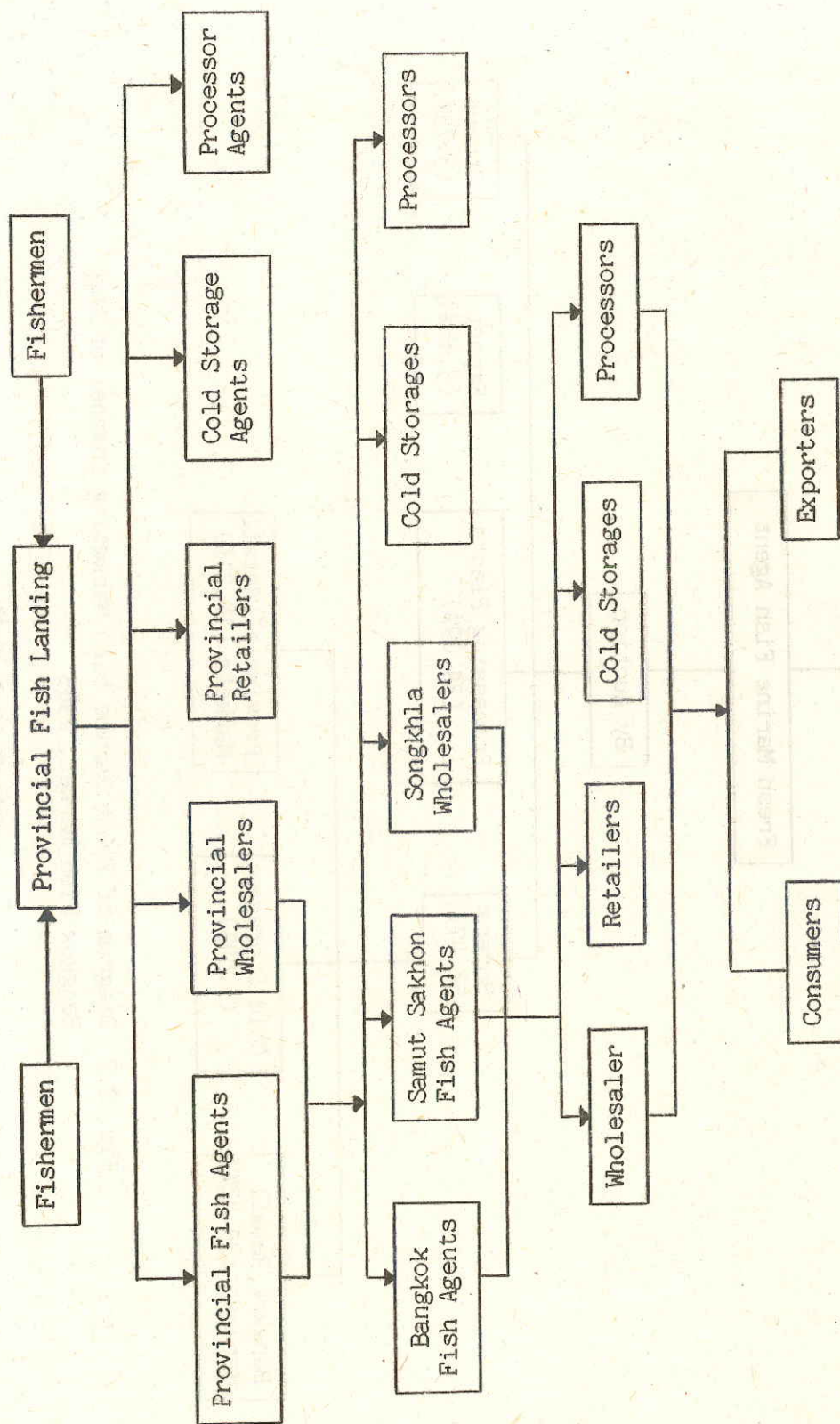


Fig. 2.1 Diagram of Fresh Marine Fish Marketing Channel in Thailand

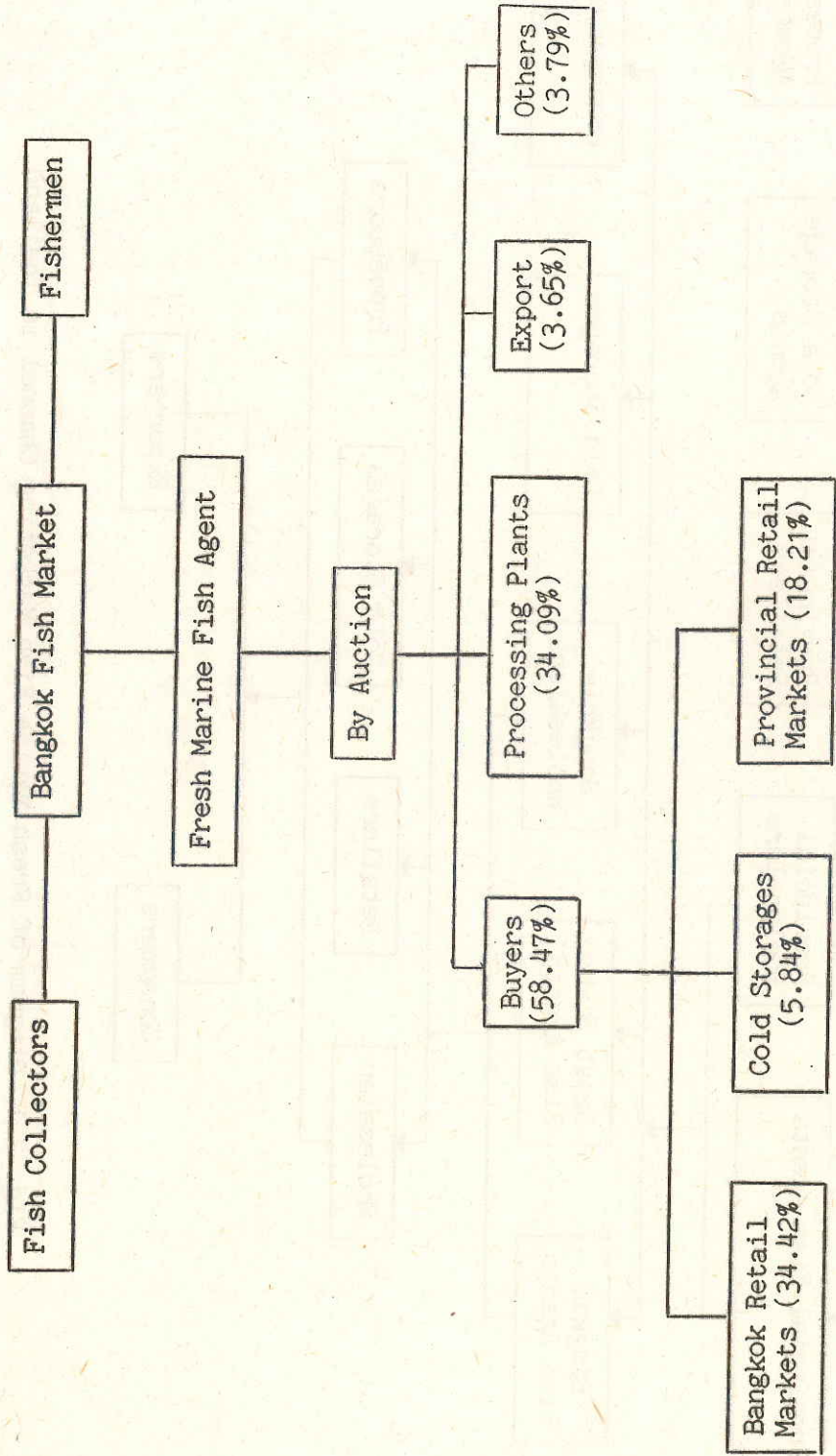


Fig. 2.2 Diagram of Fresh Marine Fish Marketing Channel of the Bangkok Fish Market, 1985

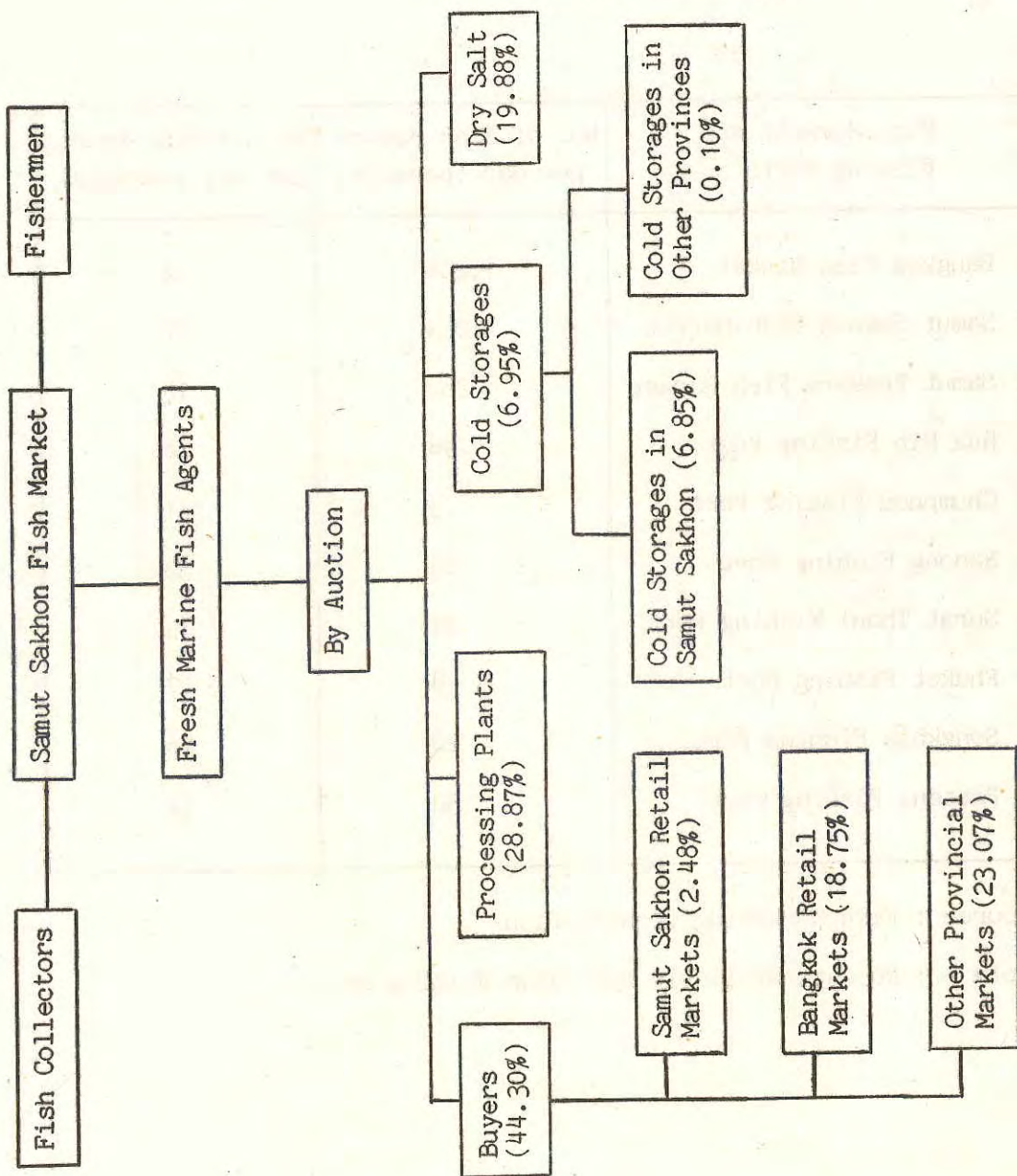


Fig. 2.3 Diagram of Fresh Marine Fish Marketing Channel of the Samut Sakhon Fish Market, 1985

Table 2.1 Number of Fish Buyers and Fish Agents per day at Fish Markets and Fishing Ports of the Fish Marketing Organization, 1985

Fish Markets and Fishing Ports	No. of Fish Buyers per day (persons)	No. of Fish Agents per day (persons)
Bangkok Fish Market	1,254	12
Samut Sakhon Fish Market	263	27
Samut Prakarn Fish Market	280	10
Hua Hin Fishing Port	96	8
Chumphon Fishing Port	3	1
Ranong Fishing Port	20	32
Surat Thani Fishing Port	97	5
Phuket Fishing Port	8	17
Songkhla Fishing Port	20	26
Pattani Fishing Port	50	12

Source : Fish Marketing Organization

Note : No data available for Satun Fishing Port

Trash fish are landed only in the provincial fishing ports. Wholesale prices of trash fish are determined by the quality and quantity of trash fish landed in each fishing port and from the current wholesale price of fish meal in that province as well as in Bangkok and other nearby provinces. Generally, the negotiations on trash fish prices are made directly between fishermen and agents of local fish meal factories. Trash fish from small trawlers that were caught near shore are of lower quality and command lower prices than those from large trawlers and purse seiners since they are often mixed with small shrimp, molluscs and crabs. Buying prices of trash fish are often quoted in Baht per kilogram. However, trash fish are sometimes sold per picul unit (1 picul equals approximately 32-35 kilogram), e.g. the fish meal factories in Samut Sakhon set trash fish prices per picul whereas those in Samut Prakarn and other provinces set prices per kilogram.

Chapter III

SHRIMP AND PRAWN

3.1 Analysis of Price Trends

3.1.1 Trend of Domestic Wholesale Price

Fluctuations in the domestic price of shrimp and prawn were often influenced by changes in the export price and export quantity of frozen shrimp and prawn rather than by domestic demand and supply conditions. Major importers of frozen shrimps and prawns from Thailand are Japan, U.S.A. and Hong Kong. From 1971 to 1985, the quantity of frozen shrimp and prawn exported increased from 5,570 tons in 1971 to 24,037 tons in 1985; subsequently their f.o.b. export price increased from 43.34 Baht/kg in 1971 to reach 157.05 Baht/kg, the maximum price, in 1983 and 143.08 Baht/kg in 1985. (See Table 3.2 and Figs. 3.3 and 3.4) These changes in export price resulted in fluctuations in the domestic prices of shrimp and prawn.

From 1971 to 1985, the production of shrimp and prawn in Thailand increased from 67,614 tons in 1971 to the maximum production of 166,614 tons in 1982. Subsequently shrimp and prawn production has gradually declined and accounted for 107,541 tons in 1985. (See Table 3.1 and Fig. 3.1) On the other hand, the domestic wholesale price of shrimp and prawn increased from 26 Baht/kg in 1971 to 34 Baht/kg in 1973 when the export quantity of frozen shrimp and prawn and their export prices increased by 12.1 percent and 6.9 percent over those of the preceding years. Then the domestic wholesale price of shrimp and prawn dropped to the minimum price of 14.25 Baht/kg in 1974 owing to the export quantity of frozen shrimp and prawn being reduced by 31.1 percent that year when Japanese importers of Thai frozen shrimp and prawn reduced their orders from Thailand and turned to Indonesia and Viet Nam for more imports.

From 1975 onwards, the domestic prices of shrimp and prawn showed an upward trend, as overseas demand of frozen shrimp and prawn kept on rising steadily while the domestic production of shrimp and prawn tended to decline, causing severe competition among exporters for supplies. Shrimp and prawn prices increased from 17.22 Baht/kg in 1975 to reach the maximum price of 43.23 Baht/kg in 1979, 31.91 Baht/kg in 1982 and 37.72 Baht/kg in 1985 resulting from changes in the export quantity and price as well as in the domestic production of shrimp and prawn. (See Table 3.1 and Fig. 3.2)

3.1.2 Trend of Bangkok Wholesale Price

The analysis of the Bangkok wholesale price trend of shrimp and prawn utilized the data of quantity, and wholesale price of shrimp and prawn landed at the Bangkok Fish Market which were collected by the Fish Marketing Organization (FMO) during 1971-1985. According to FMO, shrimp and prawn wholesale prices were classified into three categories with respect to size of shrimp and prawn, i.e. large, medium and small, while the data on quantity of shrimp and prawn were aggregated as total quantity without specifying either species or sizes.

Quantities of marine shrimp and prawn landed at the Bangkok Fish Market (BFM) showed a rising trend during 1971-1973. They increased from 2,809 tons in 1971 to 5,263 tons in 1973. Subsequently there were only slight fluctuations in the quantity trend until 1978 when the quantity of shrimp landed increased to 5,352 tons which was the largest quantity of shrimp and prawn landed at the BFM within the 15-year period of this study; then there was a gradual decline to 3,117 tons in 1985. (See Table 3.3 and Fig. 3.5) The quantity of shrimp and prawn landed at the BFM has declined in recent years since many cold storage agents and exporters of frozen shrimp and prawn have bought their supplies directly from fishermen at the provincial fishing ports in order to secure their needs and to obtain lower prices, hence the quantity of shrimp and prawn left for landing at the BFM has diminished.

Table 3.1 Quantity and Average Wholesale Price of Shrimp
in the whole Kingdom of Thailand

Quantity : Tons
Price : Baht/kg

Year	Quantity	Price
1971	67,614	26.00
1972	66,887	28.00
1973	77,525	34.00
1974	80,093	14.25
1975	87,039	17.22
1976	88,672	22.41
1977	118,953	23.91
1978	127,404	33.34
1979	116,456	43.23
1980	118,341	30.13
1981	133,435	38.53
1982	166,614	31.91
1983	139,134	34.23
1984	117,401	35.26
1985	107,541	37.72

Source : Fisheries Record of Thailand, Department of
Fisheries

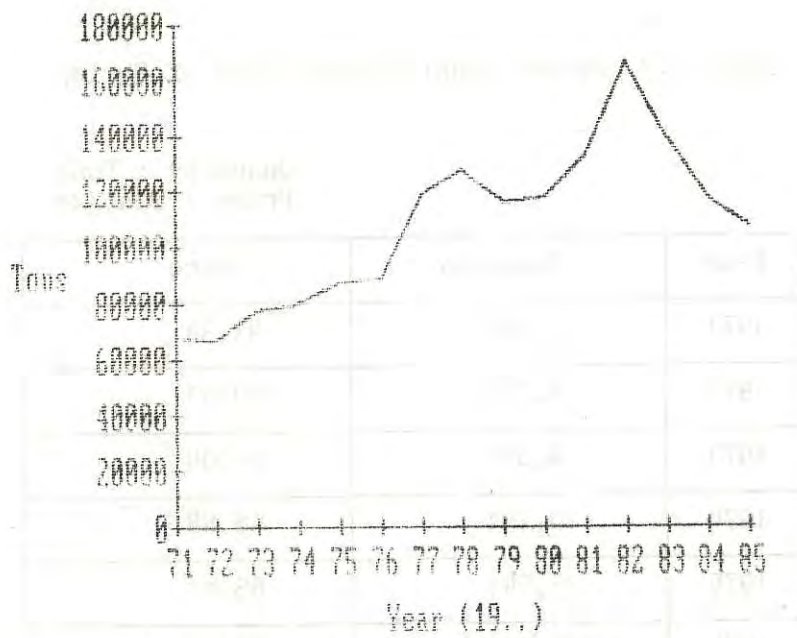


Fig. 3.1 National Production of Shrimp

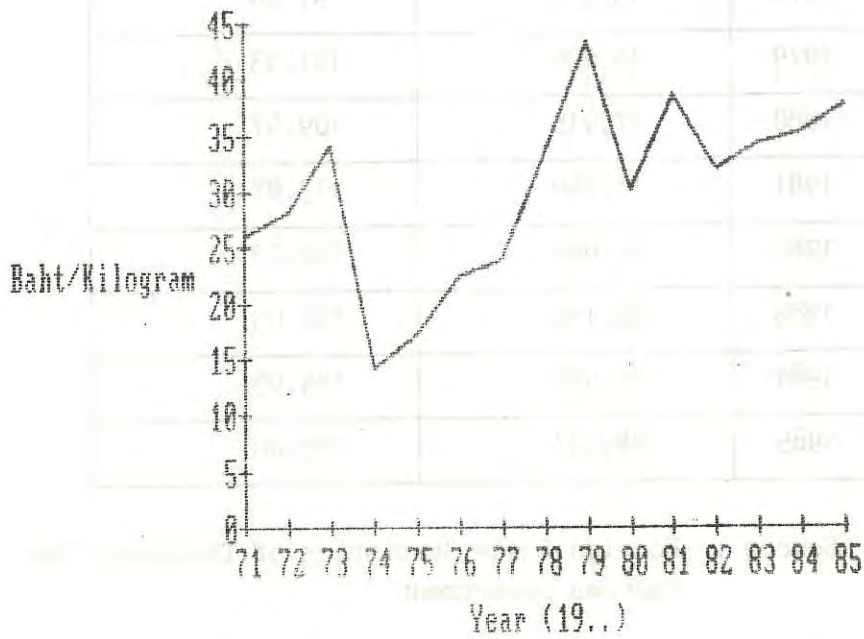


Fig. 3.2 National Wholesale Price of Shrimp

Table 3.2 Export Quantity and Price of Shrimp

Quantity : Tons
Price : Baht/kg

Year	Quantity	Price
1971	5,570	43.34
1972	6,725	50.51
1973	14,875	54.04
1974	10,251	58.88
1975	13,541	65.81
1976	15,216	88.54
1977	13,663	85.74
1978	15,378	97.56
1979	18,626	127.33
1980	17,915	109.47
1981	18,760	113.87
1982	22,646	122.03
1983	20,150	157.05
1984	19,428	144.05
1985	24,037	143.08

Source : Foreign Trade Statistics of Thailand, The
Customs Department

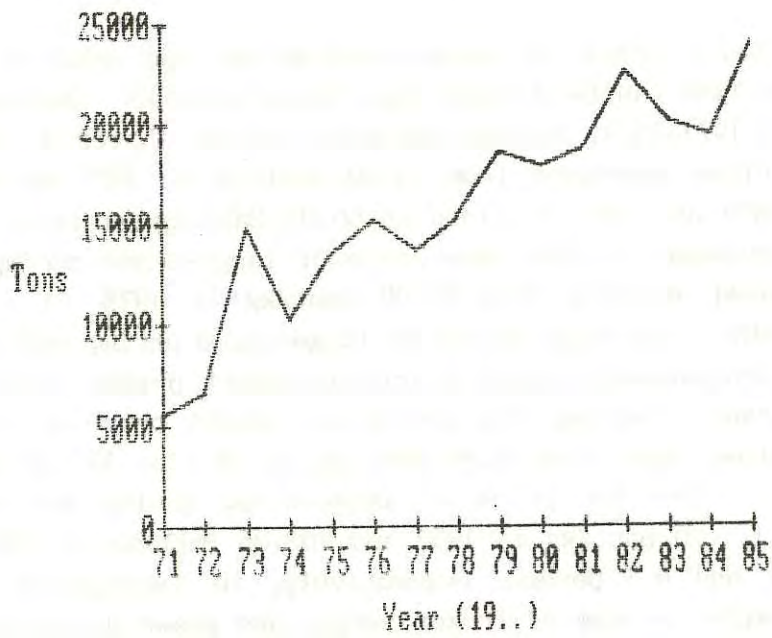


Fig. 3.3 Shrimp Export Quantity

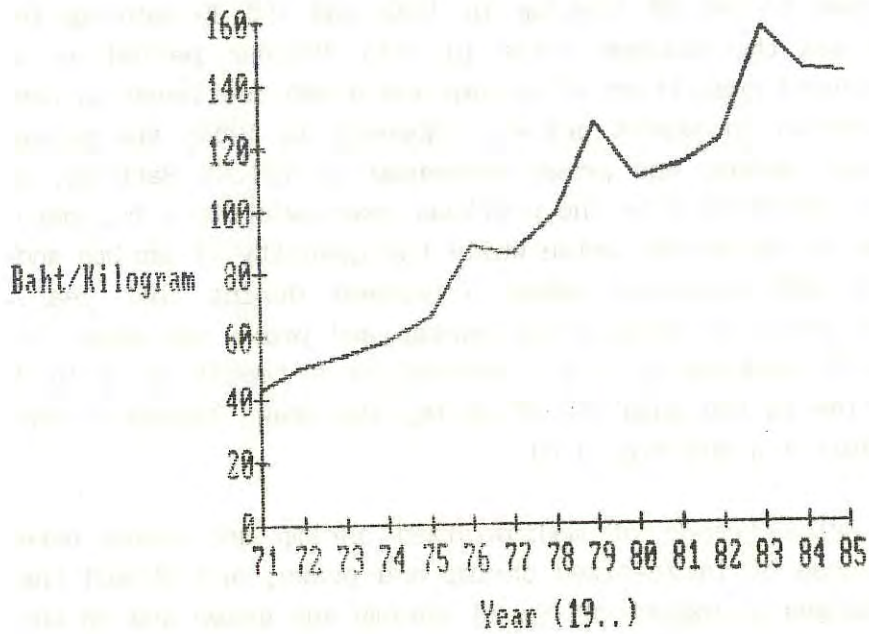


Fig. 3.4 Shrimp Export Price

Price trends of large-sized shrimp and prawn at BFM from 1971 to 1985 can be divided into three periods. During the first period 1971-1974, shrimp and prawn prices showed a rising trend and prices increased from 43.00 Baht/kg in 1971 to 55.00 Baht/kg in 1973 and then declined to 50.00 Baht/kg in 1974. The second period began in 1975 when price of large-sized shrimp and prawn increased steadily from 68.00 Baht/kg in 1975 to 130.00 Baht/kg in 1979. The high prices of large-sized shrimp and prawn during this period were caused by rising export prices of frozen shrimp and prawn. During this period the export price of frozen shrimp and prawn rose from 43.34 Baht/kg in 1971 to 127.33 Baht/kg in 1979. Then the price of large-sized shrimp and prawn declined to 111.00 Baht/kg in 1980 and 102.06 Baht/kg in 1981 or 14.6 percent and 8.1 percent respectively, in consequence of a decline in export prices of frozen shrimp and prawn during those years. The third period of price trends of large-sized shrimp and prawn started in 1982 when the price of large-sized shrimp and prawn rose to 146.88 Baht/kg in 1982 and 158.25 Baht/kg in 1983, which was the maximum price in this 15-year period as a result of reduced quantities of shrimp and prawn auctioned in the BFM and increases in export prices. However in 1984, the price of large-sized shrimp and prawn decreased to 137.44 Baht/kg, a 13.1 percent reduction from the previous year owing to a 8.3 percent decline in the export price while the quantity of shrimp and prawn in the BFM increased about 5 percent during that year. Finally, the price of large-sized shrimp and prawn increased in 1985 to 150.55 Baht/kg or a 9.5 percent as a result of a 10.2 percent decline in the quantity of shrimp and prawn landed in the BFM. (See Table 3.3 and Fig. 3.6)

Price trends of medium-sized shrimp and prawn were similar to those of large-sized shrimp and prawn, and showed the impact of changes in export prices of shrimp and prawn and in the quantity landed in the BFM. The first price trend showed medium-sized shrimp and prawn prices fluctuating between 26.00 Baht/kg in 1971 and 38.00 Baht/kg in 1975 and rising sharply to 58.00 Baht/kg, or a 52.6 percent increase, in 1976 when the shrimp and prawn landed quantity in the BFM declined about 4.8 percent while

the export price of frozen shrimp and prawn increased about 30 percent over the previous year. The second price trend started in 1977 with shrimp and prawn prices declining slightly to 53.67 Baht/kg, or a 7.5 percent decrease, when the shrimp and prawn landed quantity in the BFM increased about 3.7 percent in 1977. Then the price of medium-sized shrimp and prawn increased to 68.00 Baht/kg in 1978 and 70.00 Baht/kg in 1979 and then declined to 65.00 Baht/kg in 1980. The last price trend of medium-sized shrimp and prawn began in 1981 when prices increased from 65.16 Baht/kg in 1981 to reach the maximum price of 100.00 Baht/kg in 1983 and then declined to 76.82 Baht/kg in 1984 and 75.35 Baht/kg in 1985. (See Table 3.3 and Fig. 3.6)

The trends of small-sized shrimp and prawn prices had a pattern similar to that of large-sized and medium-sized shrimp and prawn. However, there were fewer fluctuations. The price of small-sized shrimp and prawn rose from 12.00 Baht/kg in 1971 and 1972 to 19.00 Baht/kg, or 58.3 percent, in 1973 when prices of both large-sized and medium-sized shrimp and prawn rose about 22.2 percent and 54.6 percent respectively. In 1974, however, prices of small-sized shrimp and prawn declined to 18.00 Baht/kg, or 5.3 percent, in 1974 when prices of both large-sized and medium-sized shrimp and prawn declined 9.1 percent and 2.9 percent respectively. After 1975, prices of small-sized shrimp and prawn increased steadily from 23.00 Baht/kg in 1975 to 35.00 Baht/kg in 1978 and 1979 when prices of the large and medium-sized shrimp and prawn had risen steadily. The price of small-sized shrimp and prawn then dropped again to 32.00 Baht/kg, or 8.6 percent, in 1980 when prices of large-sized and medium-sized shrimp and prawn declined by 14.6 percent and 7.1 percent respectively.

Table 3.3 Quantity and Wholesale Price of Shrimp Landed at Bangkok Fish Market

Quantity : Tons
Price : Baht/kg

Year	Quantity	Price		
		Large	Medium	Small
1971	2,809	43.00	26.00	12.00
1972	3,592	45.00	22.00	12.00
1973	5,263	55.00	34.00	19.00
1974	4,813	50.00	33.00	18.00
1975	4,990	68.00	38.00	23.00
1976	4,752	96.00	58.00	32.00
1977	4,927	115.52	53.67	32.00
1978	5,352	125.00	68.00	35.00
1979	4,873	130.00	70.00	35.00
1980	3,929	111.00	65.00	32.00
1981	3,681	102.06	65.16	33.50
1982	3,717	146.88	84.06	42.00
1983	3,308	158.25	100.00	40.63
1984	3,472	137.44	76.82	37.50
1985	3,117	150.55	75.35	37.72

Source : Fisheries Record, The Fish Marketing Organization

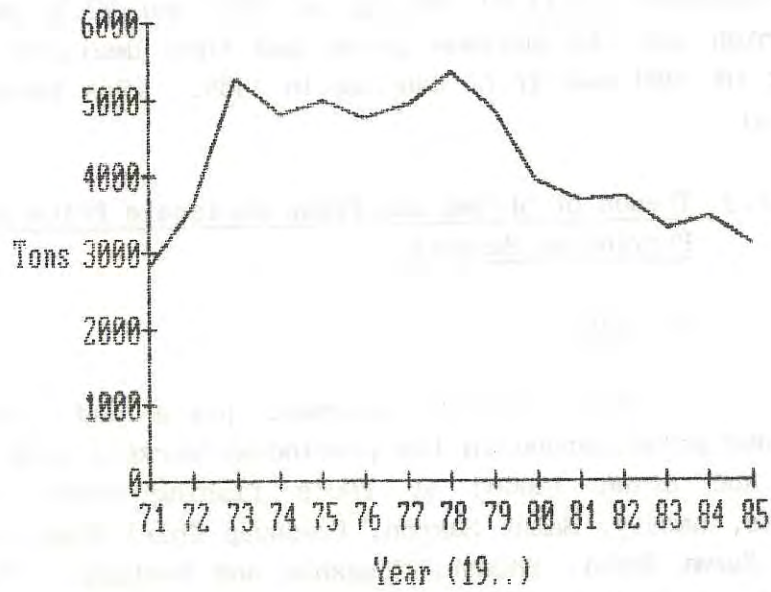


Fig. 3.5 Quantity of Shrimp at Bangkok Fish Market

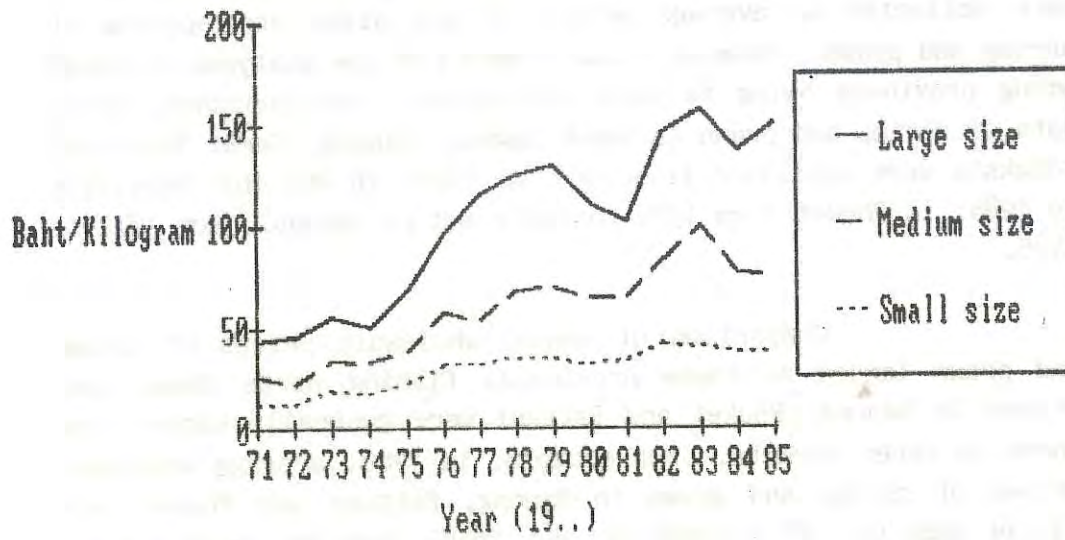


Fig. 3.6 Wholesale Price of Shrimp by Size at Bangkok Fish Market

Subsequently the price of small-sized shrimp and prawn increased to 33.50 Baht/kg in 1981 and 42.00 Baht/kg in 1982 which was the maximum price and then declined to 37.50 Baht/kg in 1984 and 37.72 Baht/kg in 1985. (See Table 3.3 and Fig. 3.6)

3.1.3 Trends of Shrimp and Prawn Wholesale Price in Provincial Markets

1. Data

The data on wholesale price and quantity of shrimp and prawn landed in the provincial markets were those of shrimp and prawn landed at FMO's fishing ports in seven provinces, namely, Samut Sakhon, Prachuap Khiri Khan (Hua Hin), Ranong, Surat Thani, Phuket, Songkhla and Pattani. Therefore, they did not include data on shrimp and prawn landed at private fishing ports in these provinces. At all seven provincial fishing ports of FMO, data on shrimp and prawn wholesale price were collected as average prices of all sizes and species of shrimp and prawn. However, time frames for the analyses differed among provinces owing to data limitation. For instance, price data of shrimp and prawn in Samut Sakhon, Ranong, Surat Thani and Songkhla were available from 1971 to 1985; in Hua Hin from 1975 to 1985; in Phuket from 1978 to 1985; and in Pattani from 1972 to 1985.

Comparison of annual wholesale prices of shrimp and prawn landed at these provincial fishing ports shows that prices in Ranong, Phuket and Pattani were generally higher than those in other markets. For example, in 1980, average wholesale prices of shrimp and prawn in Ranong, Pattani and Phuket were 131.34 Baht/kg, 97.30 Baht/kg and 76.82 Baht/kg respectively, while those in Bangkok were 69.33 Baht/kg; in Samut Sakhon 14.58 Baht/kg; in Songkhla 7.42 Baht/kg; and in Hua Hin 6.89 Baht/kg. Also in 1982, while the average wholesale price of shrimp and

prawn in Ranong was 130.60 Baht/kg and the average prices in Phuket and Pattani were 110.24 Baht/kg and 100.12 Baht/kg respectively; those of the Bangkok Fish Market were 90.90 Baht/kg; Samut Sakhon 25.62 Baht/kg; Surat Thani 15.48 Baht/kg; and Songkhla 10.72 Baht/kg. Average wholesale prices of shrimp and prawn in Pattani (130.41 Baht/kg), Phuket (96.04 Baht/kg), Ranong (87.46 Baht/kg) and Bangkok (88.33 Baht/kg) were much higher than those in Samut Sakhon (27.83 Baht/kg), Surat Thani (14.94 Baht/kg), Songkhla (9.90 Baht/kg) and Hua Hin (7.93 Baht/kg) in 1985. (See Table 3.5) These price differences were caused mainly by differences in the sizes of shrimp and prawn landed in these fishing ports since those of Ranong, Phuket and Pattani were generally larger than those of other provinces and hence commanded higher prices.

2. Price Trend in Each Provincial Market

Samut Sakhon

The trend of shrimp and prawn wholesale prices from 1971 to 1985 in Samut Sakhon shows three cyclical movements. First the price trend shows a rising movement of shrimp and prawn wholesale prices from 1971 to 1978 and a high level of prices. At the beginning of the trend, shrimp and prawn prices increased from 48.68 Baht/kg in 1971 and 48.60 Baht/kg in 1972 to 50.63 Baht/kg in 1973 and declined to 42 Baht/kg in 1974, while the quantity of shrimp and prawn landed in Samut Sakhon increased from only 23 tons in 1971 to 129 tons in 1972, declined slightly to 118 tons in 1973 and increased again to 212 tons in 1974. Later shrimp and prawn prices increased again to 52.00 Baht/kg in 1975 and 80.38 Baht/kg in 1976, which was the maximum price in the 15-year period; then declined sharply to 66.00 Baht/kg in 1977 and increased again to 72.05 Baht/kg in 1978, while the quantities of shrimp and prawn landed at Samut Sakhon FMO's fishing port during these years were at a low level.

Table 3.4 Quantity of Shrimp Landed at Major Fish Markets and Fishing Ports

(MT)

Year	Bangkok	Samut Sakhon	Hua Hin	Ranong	Surat Thani	Phuket	Songkhla	Pattani
1971	2,809	23	-	463	266	-	199	-
1972	3,592	129	-	649	295	-	890	30
1973	5,263	118	-	354	374	-	3,209	99
1974	4,813	212	-	206	664	-	4,329	116
1975	4,990	152	165	437	1,343	-	1,805	103
1976	4,752	199	592	1,987	1,907	-	2,596	32
1977	4,927	160	1,266	1,806	2,414	-	2,180	300
1978	5,352	255	3,224	2,009	4,194	375	1,638	144
1979	4,873	743	3,858	1,807	3,438	1,437	2,031	175
1980	3,929	1,901	4,076	1,339	2,922	970	1,671	237
1981	3,681	664	3,809	492	2,154	720	1,203	260
1982	3,717	1,131	2,999	635	1,924	265	1,417	271
1983	3,308	973	3,992	519	1,661	639	1,608	187
1984	3,472	926	4,758	477	1,685	379	2,234	270
1985	3,117	714	4,926	505	1,503	542	2,190	111

Source : Fisheries Record, The Fish Marketing Organization

Table 3.5 Average Wholesale Prices of Shrimp Landed at Major Fish Markets and Fishing Ports

(Baht/kg)

Year	Bangkok	Samut Sakhon	Hua Hin	Ranong	Surat Thani	Phuket	Songkhla	Pattani
1971	27.00	48.68	-	28.00	37.17	-	41.25	-
1972	26.33	48.60	-	42.00	53.00	-	48.00	40.75
1973	36.00	50.63	-	48.00	45.00	-	55.00	37.00
1974	33.67	42.04	-	54.00	45.00	-	65.00	40.00
1975	43.00	52.00	3.50	55.00	52.00	-	48.00	43.00
1976	62.00	80.38	4.29	100.00	56.00	-	50.09	45.57
1977	65.73	66.00	4.39	103.31	60.00	-	44.71	48.64
1978	67.00	72.05	4.27	87.48	33.58	106.45	16.71	60.52
1979	78.33	25.94	5.08	135.82	21.02	81.73	9.95	82.55
1980	69.33	14.58	6.89	131.34	18.32	76.82	7.42	97.30
1981	66.91	22.15	7.33	105.90	14.14	87.20	9.19	109.86
1982	90.90	25.62	7.83	130.60	15.48	110.24	10.72	100.12
1983	99.63	22.30	8.00	112.97	16.00	108.85	8.98	115.87
1984	79.77	21.98	7.77	85.69	16.00	101.60	9.44	125.85
1985	88.33	27.83	7.93	87.46	14.94	96.04	9.90	130.41

Source : Fisheries Record, The Fish Marketing Organization

The second period of the price trend started in 1979 when the shrimp and prawn price in Samut Sakhon FMO's fishing port declined drastically to 25.94 Baht/kg, a 64 percent reduction, as the result of a 191.4 percent increase in the shrimp and prawn quantity landed in the market which had increased from 255 tons in 1978 to 743 tons in 1979. In 1980, the quantity of shrimp and prawn landed in Samut Sakhon again increased by 155.8 percent to reach the amount of 1,901 tons, which was the maximum quantity, hence causing a further reduction in price down to 14.58 Baht/kg, which was the minimum price.

In the last period of the price trend, the shrimp and prawn price rose again, in 1981, to 22.15 Baht/kg or 51.9 percent when the quantity of shrimp and prawn declined to 664 tons or 65 percent that year. The price increased again to 25.62 Baht/kg in 1982 in spite of a 70.3 percent increase in the shrimp and prawn quantity landed in the Samut Sakhon market since the export price increased by 7.2 percent and caused the domestic price to rise. However, the price of shrimp and prawn in Samut Sakhon declined to 22.30 Baht/kg in 1983 and 21.98 Baht/kg in 1984 although landed quantities of shrimp and prawn in Samut Sakhon decreased and export prices of frozen shrimp and prawn increased during these two years. The small size of shrimp and prawn landed in Samut Sakhon during these two years was the major cause of their low prices. However, the price of shrimp and prawn increased again to 27.83 Baht/kg or 26.6 percent in 1985 when the quantity of shrimp and prawn landed declined by 22.9 percent. (See Tables 3.4, 3.5 and Figs. 3.7, 3.8)

Hua Hin

Data on quantity and wholesale price of shrimp and prawn landed at FMO's Hua Hin fishing port were available only from 1975 to 1985. In general, wholesale prices of Hua Hin

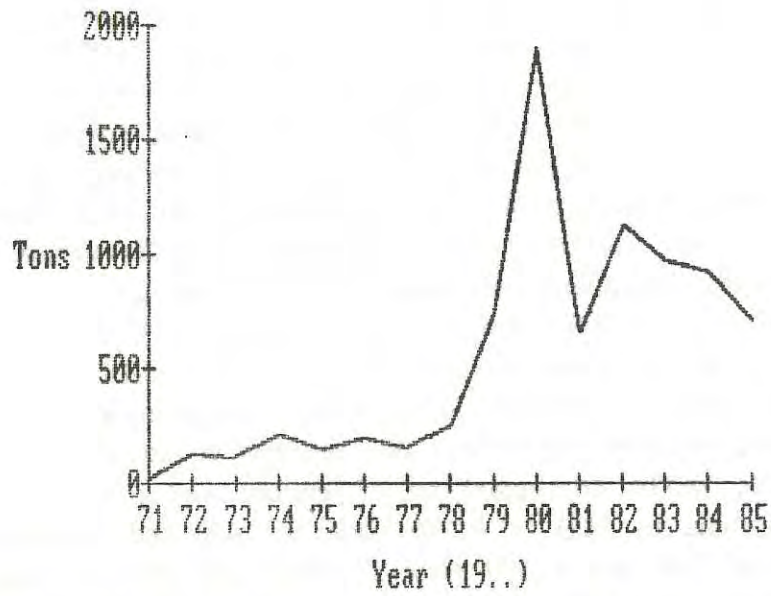


Fig. 3.7 Quantity of Shrimp at Samut Sakhon Fish Market

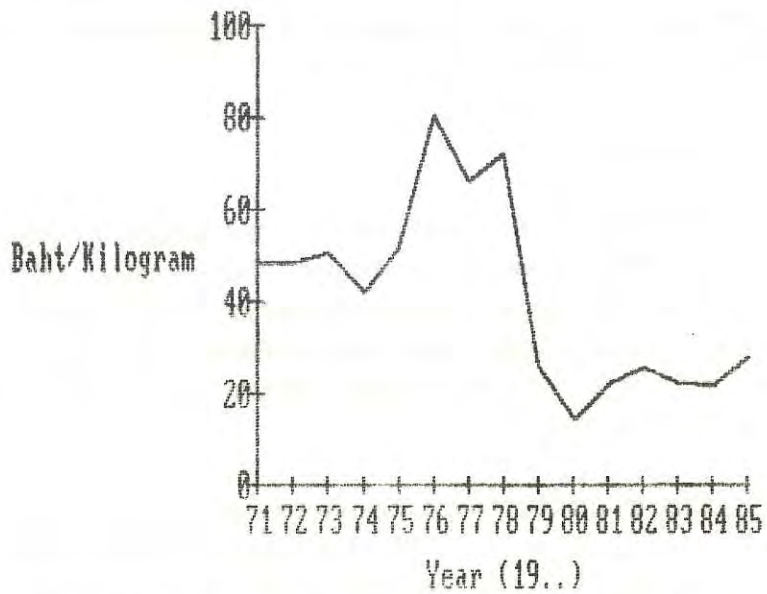


Fig. 3.8 Price of Shrimp at Samut Sakhon Fish Market

shrimp and prawn were much lower than those of other provinces since Hua Hin shrimp and prawn were of smaller size. A comparison between the trend of wholesale prices and that of quantity of shrimp and prawn landed at the Hua Hin fishing port from 1975 to 1985 showed that both trends moved mostly in the same direction. The wholesale price of shrimp and prawn at Hua Hin fishing port rose from 3.50 Baht/kg in 1975 to 4.39 Baht/kg in 1977 and declined to 4.27 Baht/kg in 1978, while the quantity of shrimp and prawn increased from 165 tons in 1975 to 1,266 tons in 1977 and 3,224 tons in 1978. After 1979 the wholesale price of shrimp and prawn in Hua Hin increased steadily from 5.08 Baht/kg in 1979 to 6.89 Baht/kg in 1980, 7.83 Baht/kg in 1982 and 8.00 Baht/kg in 1983 which was the maximum price within this 11-year period, while the quantity of shrimp and prawn increased from 3,858 tons in 1979 to 4,076 tons in 1980 and decreased to 3,809 tons in 1981 and 2,999 tons in 1982 and then increased again to 3,992 tons in 1983. The quantity of shrimp and prawn landed in Hua Hin fishing port continued to rise to 4,758 tons in 1984 and 4,926 tons in 1985, while the wholesale price declined to 7.77 Baht/kg in 1984 and increased slightly to 7.93 Baht/kg in 1985. (See Tables 3.4, 3.5 and Figs. 3.9, 3.10)

Ranong

Wholesale prices of shrimp and prawn in Ranong's FMO fishing port were generally higher than those in other provinces since most shrimp and prawn landed in this fishing port were of large-size and caught from the Andaman Sea where there were abundant supplies of large-sized shrimp and prawn; hence they commanded high prices.

The quantity trend of shrimp and prawn landed at FMO's Ranong fishing port during 1971-1985 can be subdivided into three periods. The first period was from 1971 to 1975 when

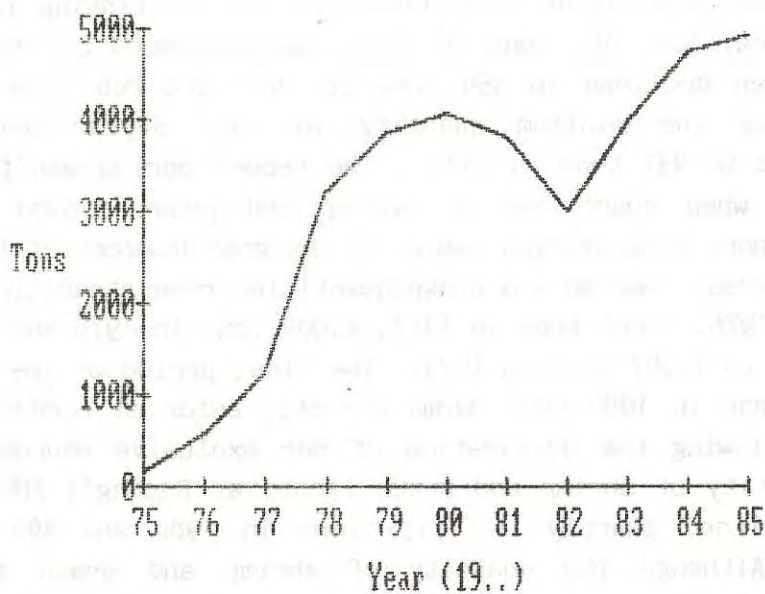


Fig. 3.9 Quantity of Shrimp at Hua Hin Fish Market

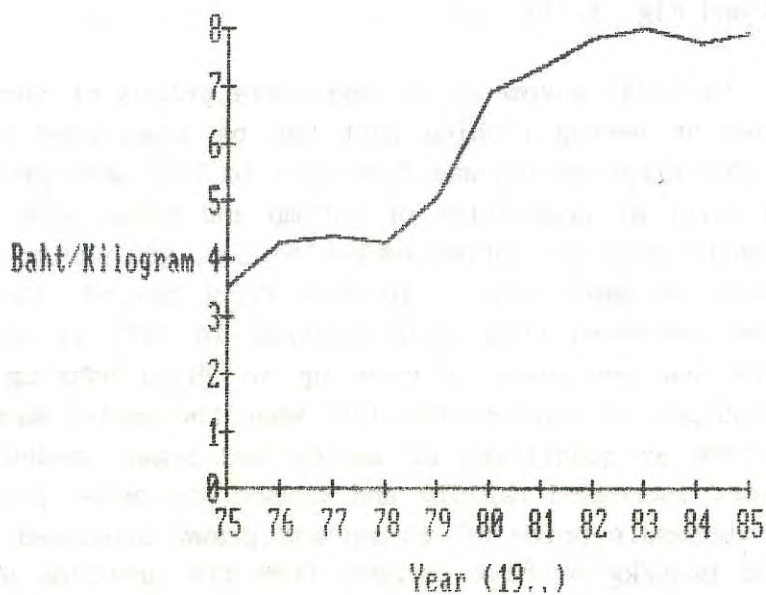


Fig. 3.10 Price of Shrimp at Hua Hin Fish Market

shrimp and prawn quantities landed at Ranong fishing port were rather low, i.e. 463 tons in 1971, and increased to 649 tons in 1972, then declined to 354 tons in 1973 and 206 tons in 1974 which was the minimum quantity in the 15-year period and increased to 437 tons in 1975. The second period was from 1975 to 1979 when quantities of shrimp and prawn landed at this fishing port rose sharply owing to the good harvest of fisheries in this area. Shrimp and prawn quantities rose steadily to 1,987 tons in 1976, 1,806 tons in 1977, 2,009 tons in 1978 and declined slightly to 1,807 tons in 1979. The final period of the quantity trend began in 1980 when Burma strictly enforced border patrolling following the declaration of her exclusive economic zone. The quantity of shrimp and prawn landed at Ranong's FMO fishing port declined sharply to 1,339 tons in 1980 and 492 tons in 1981. Although the quantity of shrimp and prawn increased slightly to 635 tons in 1982, it moved downwards in later years to 519 tons in 1983, 477 tons in 1984, and 505 tons in 1985. (See Table 3.4 and Fig. 3.11)

Cyclical movements of wholesale prices of shrimp and prawn landed at Ranong fishing port can be subdivided into four periods. The first period was from 1971 to 1975 when prices were at a low level as quantities of shrimp and prawn were not plentiful enough to make the shrimp market active, and shrimp and prawn landed were of small size. In this first period, shrimp and prawn price increased from 28.00 Baht/kg in 1971 to 42.00 Baht/kg in 1972 and continued to rise up to 55.00 Baht/kg in 1975. The second period started from 1976 when the shrimp market became more active as quantities of shrimp and prawn landed at this fishing port increased rapidly and caused wholesale prices to rise. The wholesale price of shrimp and prawn increased, in 1976, to 100.00 Baht/kg or 81.8 percent from the previous year while the quantity of shrimp and prawn increased from 437 tons in 1975 to 1,987 tons in 1976 i.e. an approximate 4.5-fold increase. The shrimp and prawn price again increased to 103.31 Baht/kg in 1977 when the quantity declined to 1,806 tons or 9.1 percent during that year.

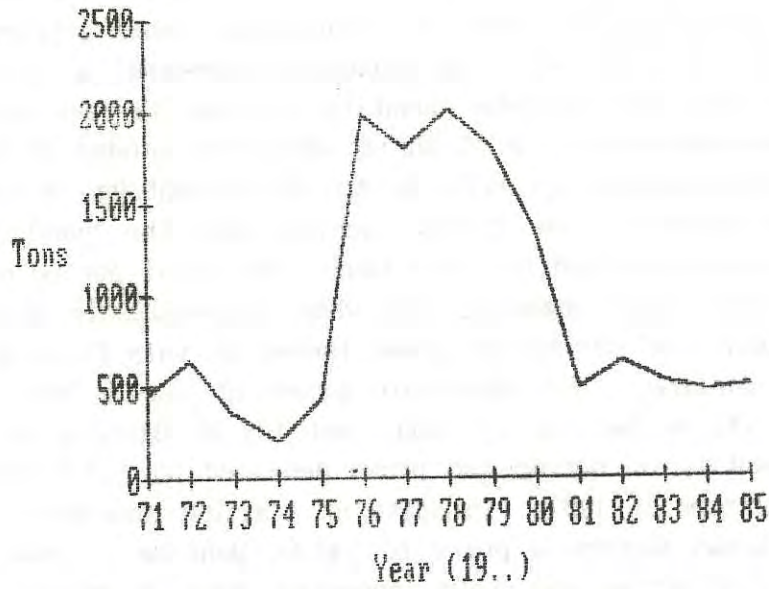


Fig. 3.11 Quantity of Shrimp at Ranong Fish Market

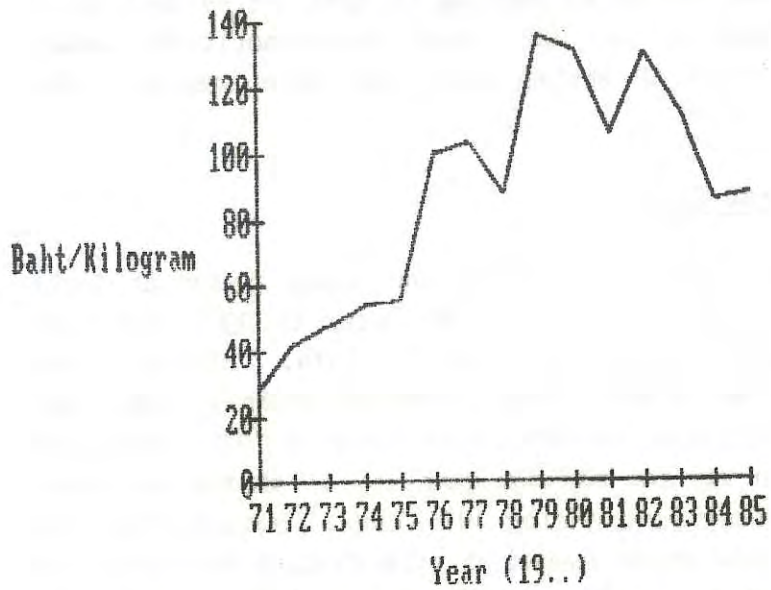


Fig. 3.12 Price of Shrimp at Ranong Fish Market

The third period of the trend was from 1978 to 1979 when the wholesale price of shrimp and prawn declined to 87.48 Baht/kg in 1978, while the quantity increased up to 2,009 tons, which was the maximum quantity in the 15-year period. However, the wholesale price of shrimp and prawn landed at Ranong fishing port increased, in 1979, up to 135.82 Baht/kg, which was the maximum price in the 15-year period when the quantity of shrimp and prawn declined to 1,807 tons. The final period of the wholesale price trend began in 1980 when the wholesale price as well as quantity of shrimp and prawn landed at this fishing port started to decline. The wholesale price of shrimp and prawn dropped to 131.34 Baht/kg in 1980, and 105.90 Baht/kg in 1981 when the quantity of shrimp and prawn declined to 1,339 tons in 1980 and 492 tons in 1981. In spite of a slight increase in the shrimp and prawn wholesale price to 130.60 Baht/kg in 1982 when the quantity of shrimp and prawn increased about 29 percent, the wholesale price of shrimp and prawn landed at Ranong's FMO fishing port declined to 112.97 Baht/kg in 1983, 85.69 Baht/kg in 1984 and 87.46 Baht/kg in 1985 when the quantities landed declined and the sizes of shrimp and prawn were smaller. (See Table 3.5 and Fig. 3.12)

Surat Thani

The quantity of shrimp and prawn landed at Surat Thani's FMO fishing port was only 266 tons in 1971 and then increased slightly to reach 664 tons in 1974. However, the quantity of shrimp and prawn landed increased sharply from 1,343 tons in 1975 to 1,907 tons in 1976, 2,414 tons in 1977, and 4,194 tons in 1978, which was the maximum quantity of shrimp and prawn landed at this fishing port during 1971-1985. Subsequently the quantity of shrimp and prawn landed at this fishing port declined sharply from 3,438 tons in 1979, 2,922 tons in 1980, and finally to 1,503 tons in 1985. (See Table 3.4 and Fig. 3.13) The reduction in the quantity of shrimp and prawn landed at Surat Thani's FMO fishing port was caused mainly by the diversion of fish landings of many fishermen from Surat Thani's fishing port to a new fishing port recently developed in Khanom district of Nakhon Sri Thammarat province, which was closer to them, and by

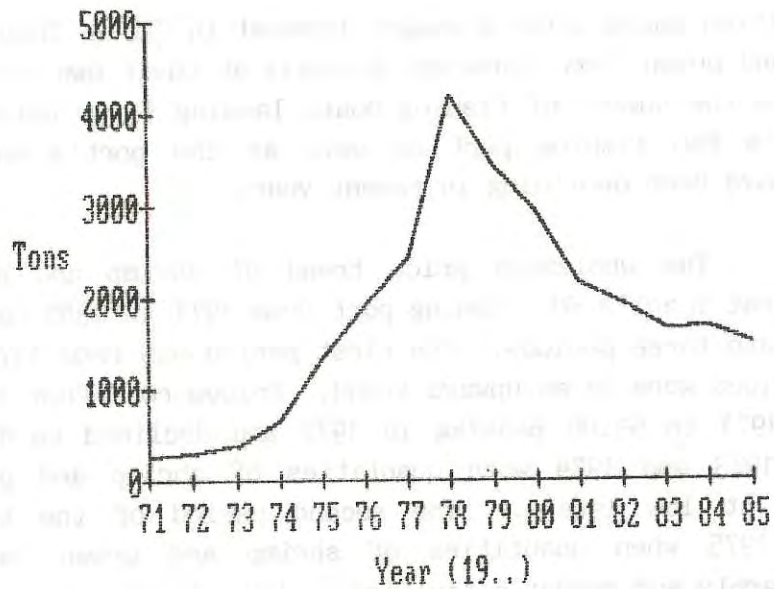


Fig. 3.13 Quantity of Shrimp at Surat Thani Fish Market

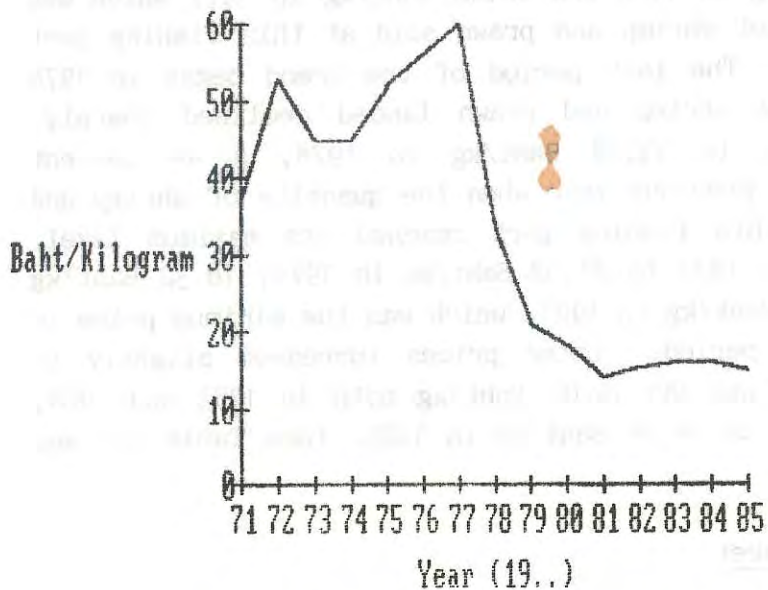


Fig. 3.14 Price of Shrimp at Surat Thani Fish Market

high competition among cold storages located in Surat Thani to buy shrimp and prawn from fishermen directly at their own fishing ports. Hence the number of fishing boats landing their catch at Surat Thani's FMO fishing port as well as the port's market activities have been declining in recent years.

The wholesale price trend of shrimp and prawn landed at Surat Thani's FMO fishing port from 1971 to 1985 can be subdivided into three periods. The first period was from 1971 to 1977 when prices were on an upward trend. Prices rose from 37.17 Baht/kg in 1971 to 53.00 Baht/kg in 1972 and declined to 45.00 Baht/kg in 1973 and 1974 when quantities of shrimp and prawn landed were at low levels. The second period of the trend started in 1975 when quantities of shrimp and prawn landed increased sharply and market activities in this fishing port were very active. Shrimp and prawn price rose to 52.00 Baht/kg in 1975, 56.00 Baht/kg in 1976 and 60.00 Baht/kg in 1977 which was the maximum price of shrimp and prawn sold at this fishing port during 1971-1985. The last period of the trend began in 1978 when quantities of shrimp and prawn landed declined sharply. The price dropped to 33.58 Baht/kg in 1978, a 44 percent reduction from the previous year when the quantity of shrimp and prawn landed at this fishing port reached its maximum level. Prices continued to fall to 21.02 Baht/kg in 1979, 18.32 Baht/kg in 1980 and 14.14 Baht/kg in 1981, which was the minimum price in the 15-year study period. Later prices increased slightly to 15.48 Baht/kg in 1982 and 16.00 Baht/kg both in 1983 and 1984, and declined again to 14.94 Baht/kg in 1985. (See Table 3.5 and Fig. 3.14)

Phuket

Data on quantity and wholesale price of shrimp and prawn landed at Phuket's FMO fishing port were available only for the period 1978 to 1985. The quantity of shrimp and prawn landed at this fishing port was rather less than that landed at Hua Hin, Ranong and Surat Thani. The quantity of shrimp and

prawn landed at this fishing port was only 375 tons in 1978 but increased sharply to 1,437 tons in 1979, the maximum quantity of shrimp and prawn landed in Phuket's FMO fishing port during 1978-1985. Subsequently the quantities of shrimp and prawn landed declined steadily owing to the adverse impact of the declaration of the exclusive economic zones by Thailand's neighbouring countries, in particular Burma. The quantity of shrimp and prawn landed declined steadily from 970 tons in 1980 to 720 tons in 1981 and 265 tons, in 1982, the minimum quantity of shrimp and prawn landed at this fishing port during 1978-1985. Then the quantities of shrimp and prawn landed increased to 639 tons in 1983 and declined again to 379 tons in 1984 and finally increased to 542 tons in 1985. (See Table 3.4 and Fig. 3.15)

Shrimp and prawn wholesale prices at Phuket's FMO fishing port were generally higher than those of other provinces but rather similar to those of Ranong's FMO fishing port as these two fishing ports are close to each other, and shrimp and prawn landed in both fishing ports were caught from the Andaman Sea; hence species and sizes were similar. The wholesale price of shrimp and prawn landed at Phuket's FMO fishing port was 106.45 Baht/kg in 1978 but declined to 81.73 Baht/kg, a 23.2 percent reduction, in 1979 when the quantity of shrimp and prawn landed at this fishing port increased approximately four times over the previous year's quantity. In 1980, the shrimp and prawn wholesale price declined further to 76.82 Baht/kg, the minimum price for the period 1978-1985, while quantities of shrimp and prawn landed at this market were falling, their wholesale prices increased again to 87.20 Baht/kg in 1981 and 110.24 Baht/kg, a maximum price, in 1982, when the quantities of shrimp and prawn landed dropped to the minimum amount of 265 tons in 1982. In the following years wholesale prices of shrimp and prawn kept on falling from 108.85 Baht/kg in 1983, to 101.60 Baht/kg in 1984 and 96.04 Baht/kg in 1985 while the quantities of shrimp and prawn landed increased slightly but still remained at a lower level than during the earlier period. (See Table 3.5 and Fig. 3.16)

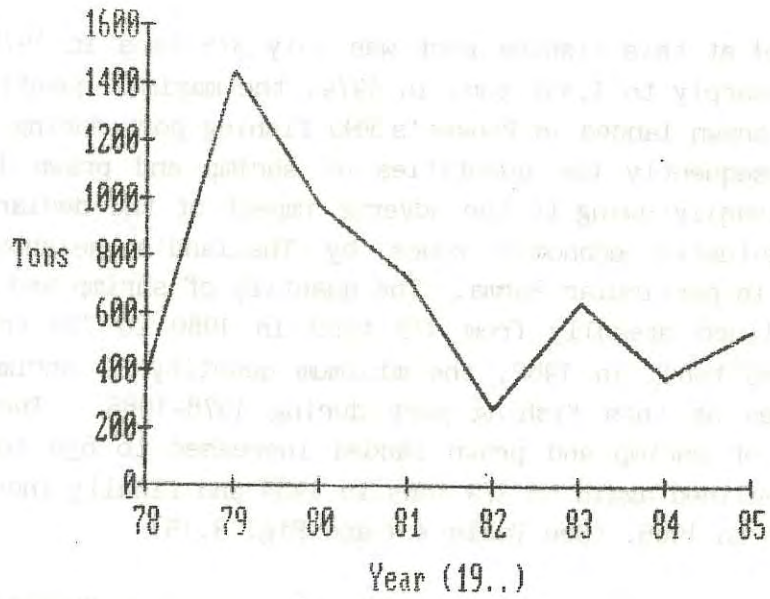


Fig. 3.15 Quantity of Shrimp at Phuket Fish Market

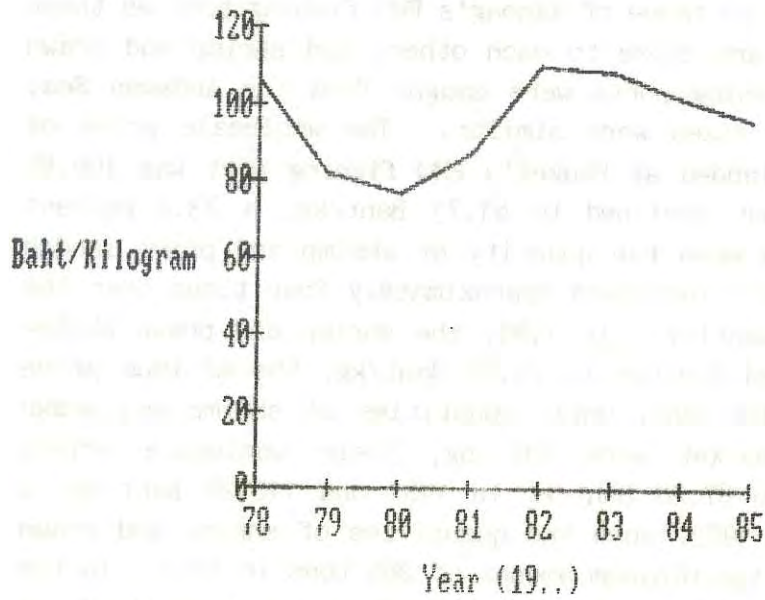


Fig. 3.16 Price of Shrimp at Phuket Fish Market

Songkhla

Data on wholesale price and quantity of shrimp and prawn landed at Songkhla's FMO fishing port were available for the years 1971 to 1985. The quantity of shrimp and prawn landed at this fishing port was rather high and similar to the quantities landed in Surat Thani and Ranong. Quantities landed at Songkhla's FMO fishing port increased sharply from 199 tons in 1971 and 890 tons in 1972 to 3,209 tons in 1973 and 4,329 tons, the maximum quantity in the 1971-1985 period, in 1974. Subsequently quantities of shrimp and prawn landed at Songkhla's FMO fishing port dropped to 1,805 tons in 1975 and increased to 2,596 tons in 1976. Then they fluctuated from 2,180 tons in 1977 to 1,638 tons in 1978, 2,031 tons in 1979, 1,203 tons in 1981, and increased up to 2,234 tons in 1984, and 2,190 tons in 1985. (See Table 3.4 and Fig. 3.17)

The trend of wholesale prices of shrimp and prawn landed at Songkhla's FMO fishing port can be subdivided into three periods. The first was from 1971 to 1974 when prices increased steadily from 41.25 Baht/kg in 1971 to 65.00 Baht/kg in 1974 and quantities of shrimp and prawn also increased sharply during this period. The second period of the price trend began in 1975 when wholesale prices of shrimp and prawn dropped steadily from 48.00 Baht/kg in 1975, with an exceptional increase to 50.09 Baht/kg in 1976, to 44.71 Baht/kg in 1977, then decreased sharply to 16.71 Baht/kg in 1978, and continued to decline and reached the minimum price of 7.42 Baht/kg in 1980, while the quantity of shrimp and prawn landed declined slightly. The final period of the price trend was from 1981 to 1985 when prices increased gradually from 9.19 Baht/kg in 1981 to 10.72 Baht/kg in 1982, then declined to 8.98 Baht/kg in 1983, increased again to 9.44 Baht/kg in 1984 and 9.90 Baht/kg in 1985. (See Table 3.5 and Fig. 3.18) The low price of shrimp and prawn landed at Songkhla's FMO fishing port in the latter period was attributed mainly to their small size.

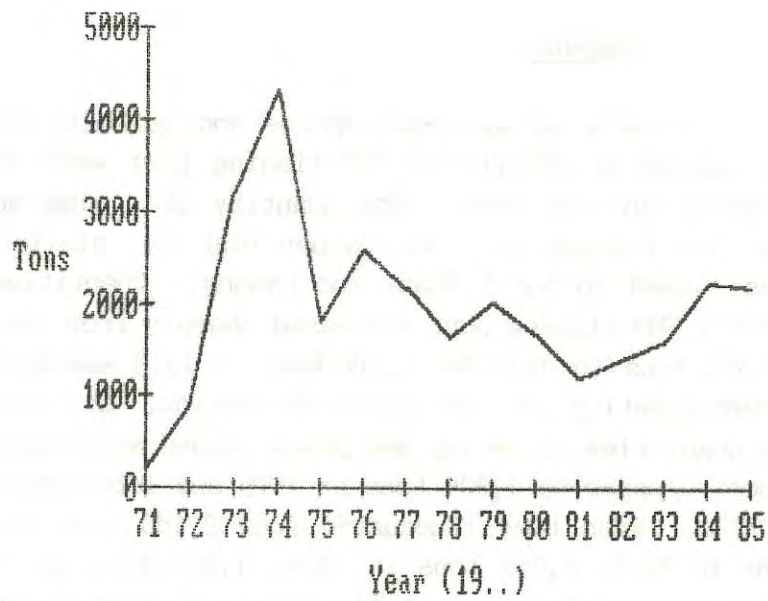


Fig. 3.17 Quantity of Shrimp at Songkhla Fish Market

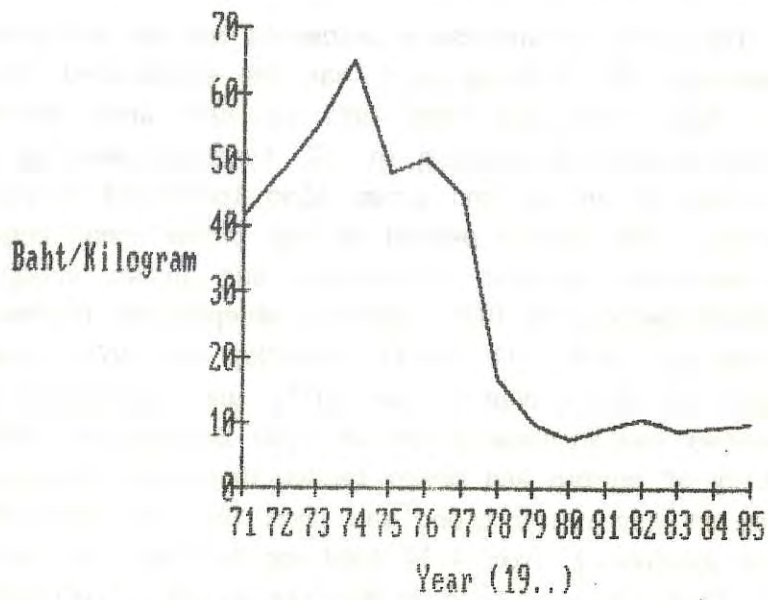


Fig. 3.18 Price of Shrimp at Songkhla Fish Market

Pattani

Data on wholesale price and quantity of shrimp and prawn landed at Pattani's FMO fishing port were available for the years 1972 to 1985. During this period, quantities of shrimp and prawn landed were much lower than those of other provinces and fluctuated highly. The quantities of shrimp and prawn landed in Pattani's FMO fishing port increased from only 30 tons in 1972 to 116 tons in 1974 and 103 tons in 1975. Then the quantities of shrimp and prawn landed dropped again to 32 tons in 1976 and increased to reach 300 tons, the maximum quantity in the 1975-1985 period, in 1977 and dropped to 144 tons in 1978. After 1979 the quantities of shrimp and prawn landed increased steadily from 175 tons in 1979 to reach 271 tons in 1982 and dropped to 187 tons in 1983. Finally, the quantities of shrimp and prawn landed increased again to 270 tons in 1984 and declined to 111 tons in 1985. (See Table 3.4 and Fig. 3.19)

Although the quantities of shrimp and prawn landed were rather low and fluctuated, wholesale prices of shrimp and prawn in Pattani's FMO fishing port were relatively higher than those in other provinces but similar to those of Ranong and Surat Thani since most of them were large-sized, and market demand in these markets was rather high. Wholesale prices of shrimp and prawn landed in Pattani's FMO fishing port generally showed a rising trend from 1972 to 1985. Shrimp and prawn prices increased steadily from 40.75 Baht/kg in 1972, with an exceptional drop to 37.00 Baht/kg in 1973 when shrimp and prawn quantity increased nearly three fold, and reached 109.86 Baht/kg in 1981. Shrimp and prawn price dropped again to 100.12 Baht/kg in 1982 when the quantity of shrimp and prawn landed increased by 4.3 percent. Then prices kept on rising steadily from 115.87 Baht/kg in 1983 to reach 130.41 Baht/kg in 1985. (See Table 3.5 and Fig. 3.20)

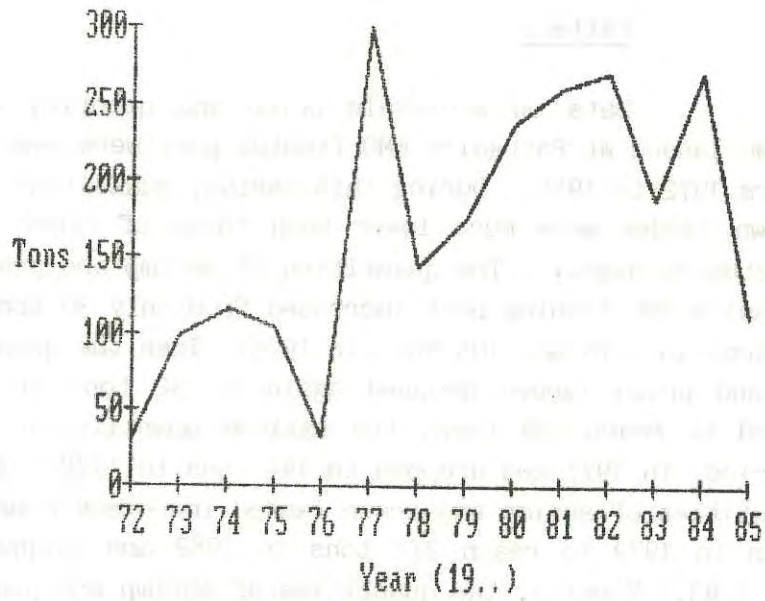


Fig. 3.19 Quantity of Shrimp at Pattani Fish Market

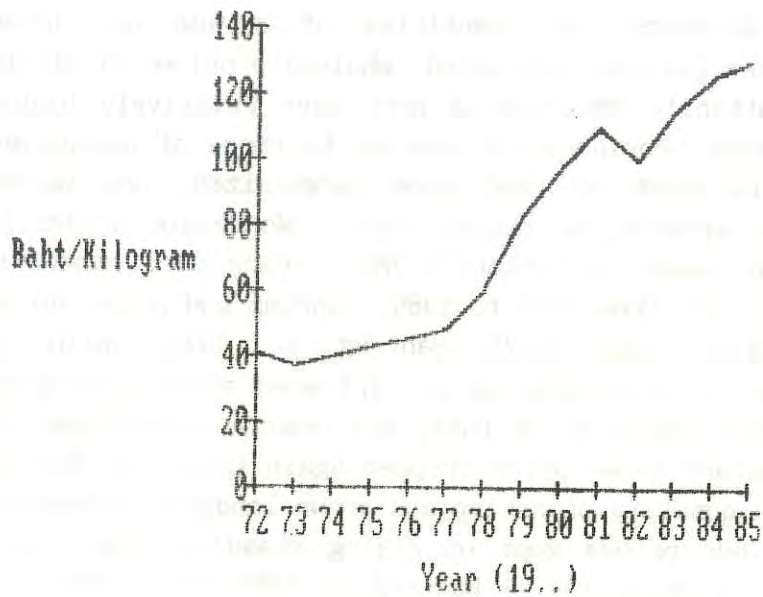


Fig. 3.20 Price of Shrimp at Pattani Fish Market

3.2 Seasonal Indices of Shrimp and Prawn

3.2.1 Data

The analysis of the seasonal movement of shrimp and prawn wholesale prices was based on the monthly data on wholesale prices and quantities of shrimp and prawn landed at the Bangkok Fish Market and seven of FMO's provincial fishing ports from 1 January 1981 to 1 December 1985.

In order to understand the reasons behind the movement patterns of shrimp and prawn monthly prices, not only seasonal price indices of shrimp and prawn landed in each fishing port were calculated, but also both seasonal quantity indices of shrimp and prawn landed at each fishing port and seasonal export price indices of frozen shrimp and prawn were calculated for comparison purposes. Seasonal price indices of shrimp and prawn landed at the Bangkok Fish Market were calculated for two species of shrimp, namely, white shrimp and Tiger prawn, and both were classified into three sizes, i.e., large-size (16-20 pieces/kilogram for white shrimp and 12 pieces/kilogram for Tiger prawn), medium-size (40-50 pieces/kilogram for white shrimp and 24-35 pieces/kilogram for Tiger prawn) and small-size (approximately 60 pieces/kilogram for white shrimp and 50 pieces/kilogram for Tiger prawn), while seasonal quantity indices were calculated as aggregate indices for all species and sizes of shrimp and prawn. Seasonal price and quantity indices of shrimp and prawn landed at seven of FMO's provincial fishing ports were also calculated by using monthly aggregated data on all species and sizes.

In all cases, variations of monthly wholesale prices throughout a year in any market were analysed from fluctuations of seasonal price indices. Factors affecting variations of monthly wholesale prices in any market were considered from fluctuations in seasonal quantity indices of shrimp and prawn landed in that market and seasonal export prices of frozen shrimp and prawn as well as Bangkok seasonal price indices for cases of provincial wholesale prices.

3.2.2 Results

1. Bangkok Fish Market

a. White shrimp

The analysis of monthly price trends of all three sizes of white shrimp auctioned at the Bangkok Fish Market from 1 January 1981 to 31 December 1985 showed that these price trends moved mostly upward and in parallel. Prices of large-sized white shrimp and medium-sized white shrimp fluctuated highly and correlated while the price of small-sized white shrimp was rather stable. As the average wholesale price of large-sized white shrimp increased from 123.21 Baht/kg in 1981 to 174.83 Baht/kg in 1983 and 175.72 Baht/kg in 1985, average wholesale price of medium-sized white shrimp increased from 78.75 Baht/kg in 1981 to 118.90 Baht/kg in 1983 and dropped to 97.44 Baht/kg in 1985. On the other hand, the average wholesale price of small-sized white shrimp increased steadily from 36.61 Baht/kg in 1981 to 46.60 Baht/kg in 1983, 44.58 Baht/kg in 1984 and 46.46 Baht/kg in 1985.

Seasonal price indices of large-sized white shrimp showed that prices of white shrimp in January and February were likely to be higher than the average monthly price. Price of large-sized white shrimp was highest in February. Then prices dropped steadily from March through September. September was a month when the price of large-sized white shrimp was the lowest of the year. The price of large-sized white shrimp then increased again to be higher than the average monthly price from October to December. (See Table 3.6 and Fig. 3.21)

Seasonal movements of medium-sized white shrimp prices were that prices tended to be higher than the average monthly price from January through March. The price of medium-sized white shrimp was highest in March and then dropped to below the annual average price from April through September. The medium-sized white shrimp price was lowest in September, then increased to above the average price from October through December. (See Table 3.6 and Fig. 3.22)

Table 3.6 Seasonal Price Indices of Shrimp at Bangkok Fish Market, 1981-1985

Month	White Shrimp			Tiger Prawn			Shrimp Export Price
	Large	Medium	Small	Large	Medium	Small	
Jan.	102.73	106.22	102.87	105.24	105.38	101.75	109.07
Feb.	107.54	105.61	100.89	106.05	106.36	106.40	97.50
Mar.	106.60	106.63	100.34	104.16	105.43	104.19	87.58
Apr.	104.44	102.89	101.00	103.10	100.98	103.03	101.08
May	100.29	99.20	94.94	97.80	102.61	97.58	96.13
Jun.	95.21	92.15	97.31	96.94	97.95	95.70	101.04
Jul.	95.56	94.10	100.19	93.06	93.49	90.63	102.23
Aug.	93.18	92.82	103.31	92.64	91.42	96.28	99.10
Sep.	90.29	91.57	102.42	88.48	89.31	97.35	100.15
Oct.	98.90	101.07	100.16	99.92	98.87	101.86	96.98
Nov.	101.59	105.04	99.76	104.54	104.13	100.44	104.63
Dec.	103.67	102.71	96.80	108.07	104.07	104.79	104.99

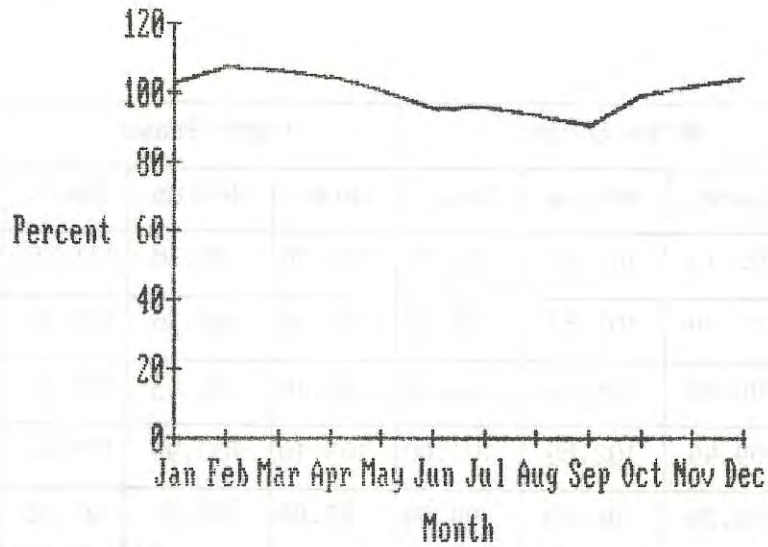


Fig. 3.21 Seasonal Price Indices of Large-sized White Shrimp at Bangkok Fish Market, 1981-1985

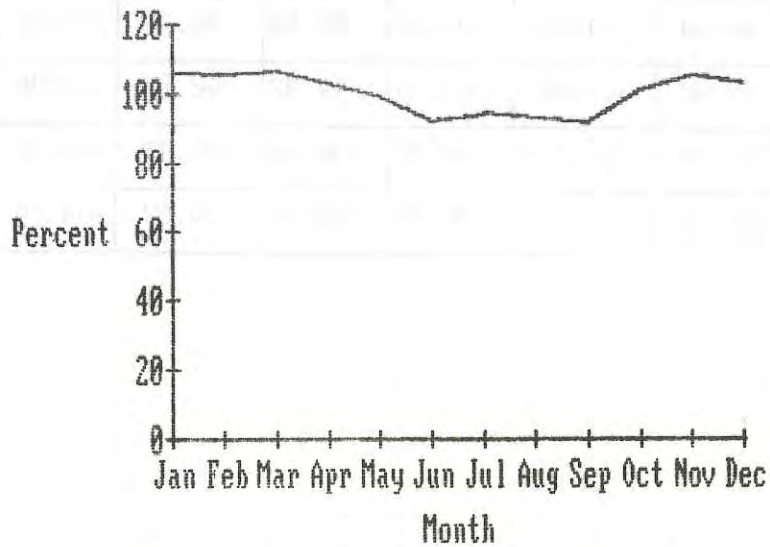


Fig. 3.22 Seasonal Price Indices of Medium-sized White Shrimp at Bangkok Fish Market, 1981-1985

Prices of small-sized white shrimp were likely to be higher than the average monthly price from January to April then declined to below the average price in May and June. Small-sized white shrimp price was lowest in May, then increased to above the average price from July through October, with the maximum price in August. The price dropped to below the average price again in November and December. (See Table 3.6 and Fig. 3.23)

Variations in monthly prices of all three sizes of white shrimp were affected by monthly fluctuations in the quantity of shrimp and prawn landed at the Bangkok Fish Market and the export price of frozen shrimp and prawn. These effects could be seen from fluctuations in seasonal quantity indices of shrimp and prawn landed at the Bangkok Fish Market and seasonal export prices of frozen shrimp and prawn. Prices of all three sizes of white shrimp tended to be high from January to April when quantities of shrimp and prawn landed at the Bangkok Fish Market were low, especially in February and March, hence they caused the wholesale price of large-sized white shrimp to increase and reach the maximum in February, and medium-sized white shrimp price to increase and reach the maximum in March. (See Table 3.7 and Fig. 3.24)

Similarly, export prices of frozen shrimp and prawn were generally high in November, December and January, hence they caused Bangkok wholesale prices to rise although landed quantities of shrimp and prawn landed during these months were rather large. On the other hand, prices of all three sizes of white shrimp were rather low from June through October when quantities of shrimp and prawn landed in the market in these months were large and export prices were low. (See Table 3.6 and Figs. 3.25, and 3.26)

b. Tiger Prawn

Prices of Tiger prawn in the Bangkok Fish Market fluctuated highly. The average wholesale price of large-sized Tiger prawn increased from 139.58 Baht/kg in 1981 to 213.04

Table 3.7 Seasonal Quantity Indices of Shrimp and Prawn at Bangkok Fish Market and Provincial Fish Market, 1981-1985

Month	Bangkok	Samut Sakhon	Hua Hin	Ranong	Surat Thani	Phuket	Songkhla	Pattani	Shrimp Export Quantity
Jan.	97.17	94.62	37.33	86.65	119.67	91.03	139.25	191.81	99.09
Feb.	75.46	85.19	47.74	89.27	77.39	82.22	85.37	114.62	90.91
Mar.	80.75	106.88	83.85	127.02	91.87	71.26	79.64	98.60	144.73
Apr.	82.51	98.11	106.54	110.95	88.60	68.85	95.42	86.40	91.95
May	90.84	101.39	157.99	105.31	99.76	87.46	96.35	134.01	89.96
Jun.	97.80	94.19	164.32	96.27	109.64	69.04	93.53	74.52	95.00
Jul.	118.93	94.62	167.07	86.97	94.20	65.86	81.86	86.01	113.49
Aug.	100.65	92.91	169.47	81.71	97.98	80.32	87.60	80.47	102.70
Sep.	102.76	107.20	123.47	100.11	92.02	169.44	88.33	87.88	95.09
Oct.	116.90	114.90	82.58	109.45	106.94	148.17	106.03	88.55	100.49
Nov.	116.21	111.79	32.74	113.11	125.57	173.06	114.20	83.86	91.26
Dec.	120.01	98.22	26.89	93.16	96.36	93.30	132.40	73.27	84.86

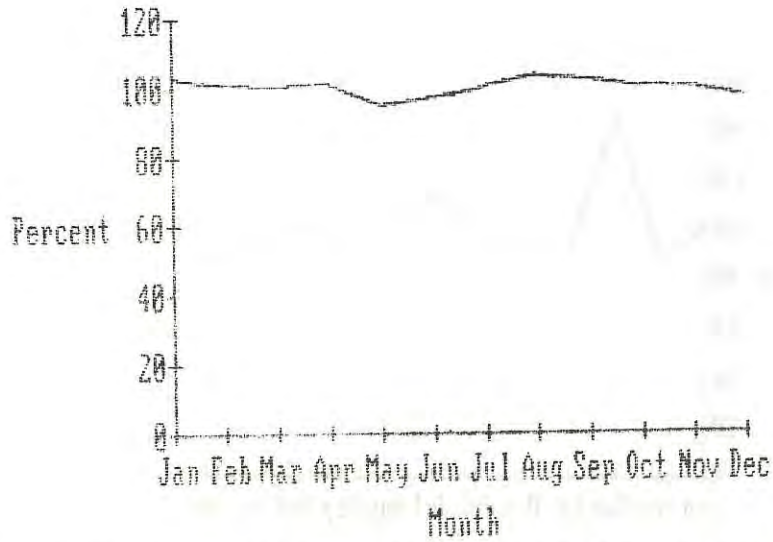


Fig. 3.23 Seasonal Price Indices of Small-sized White Shrimp at Bangkok Fish Market, 1981-1985

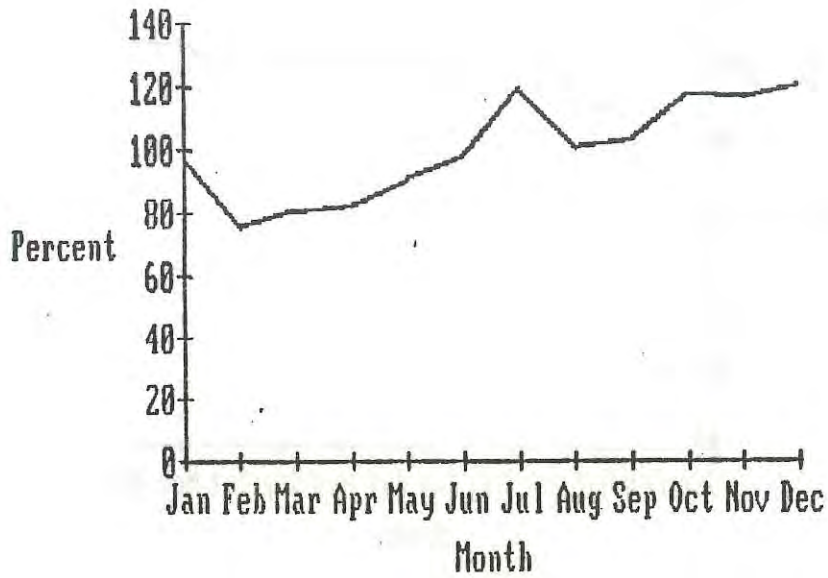


Fig. 3.24 Seasonal Quantity Indices of Shrimp and Prawn at Bangkok Fish Market, 1981-1985

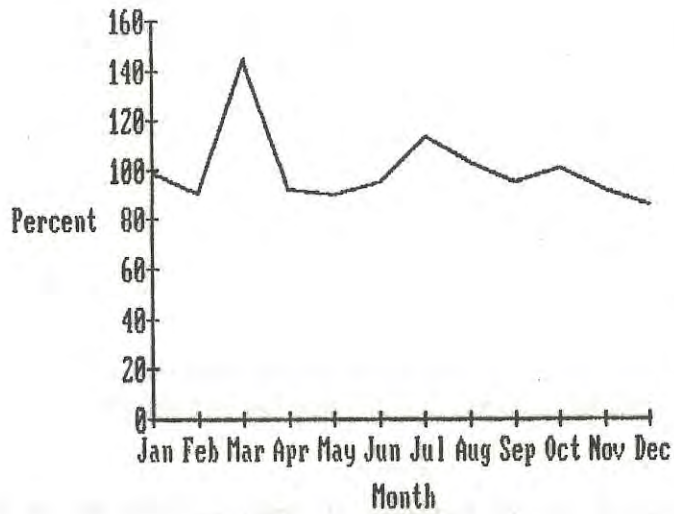


Fig. 3.25 Shrimp Export Quantity Indices, 1981-1985

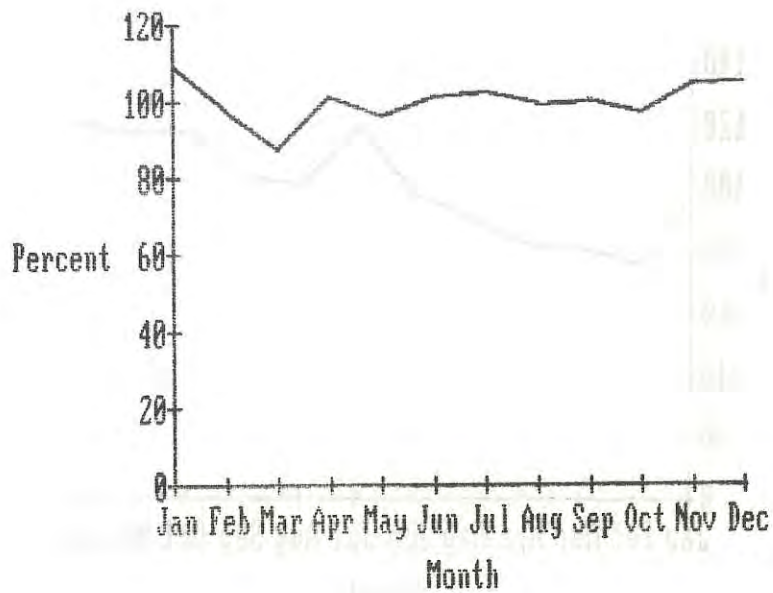


Fig. 3.26 Shrimp Export Price Indices, 1981-1985

Baht/kg in 1982, then declined to 191.22 Baht/kg in 1983 and 160.46 Baht/kg in 1984 and increased to 198.79 Baht/kg in 1985. Average wholesale price of medium-sized Tiger prawn increased from 82.71 Baht/kg in 1981 to 112.92 Baht/kg in 1982 and 139.11 Baht/kg in 1983, then declined to 105.15 Baht/kg in 1984 and 101.64 Baht/kg in 1985. Average wholesale price of small-sized Tiger prawn increased from 38.14 Baht/kg in 1981 to 49.75 Baht/kg in 1982 and 52.92 Baht/kg in 1983, then dropped to 47.32 Baht/kg in 1984 and 51.67 Baht/kg in 1985.

Monthly fluctuations of large-sized Tiger prawn prices were as follows: monthly prices tended to be higher than the average price from January through April then dropped to below the average price from June through October and increased again to be higher than the average price in November and December. The price of large-sized Tiger prawn tended to be highest in December and lowest in September. (See Table 3.6 and Fig. 3.27)

The pattern of monthly price fluctuations of medium-sized Tiger prawn was similar to that of the large-sized Tiger prawn. Prices of medium-sized Tiger prawn tended to be high above the average monthly price from January through May, then dropped to below the average price from June through October and increased again to be higher than the average price in November and December. The price of medium-sized Tiger prawn tended to be highest in February and lowest in September. (See Table 3.6 and Fig. 3.28)

Monthly price fluctuations of small-sized Tiger prawn were as follows: prices were likely to be higher than the average monthly price from January through April, then declined to below the average price from May through September and increased again to be higher than the average price from October through December. Price of small-sized Tiger prawn tended to be highest in February and lowest in July. (See Table 3.6 and Fig. 3.29)

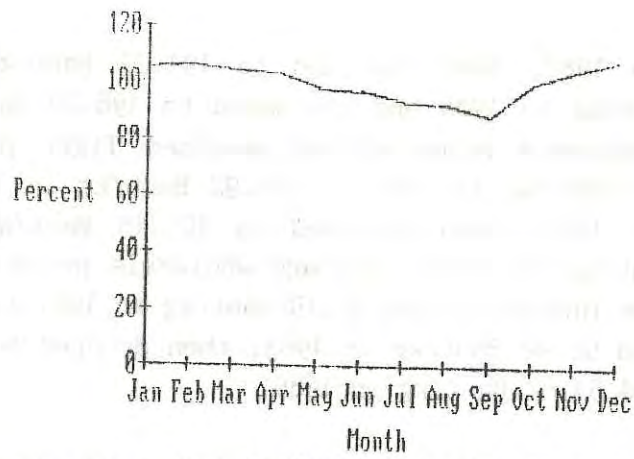


Fig. 3.27 Seasonal Price Indices of Large-sized Tiger Prawn at Bangkok Fish Market, 1981-1985

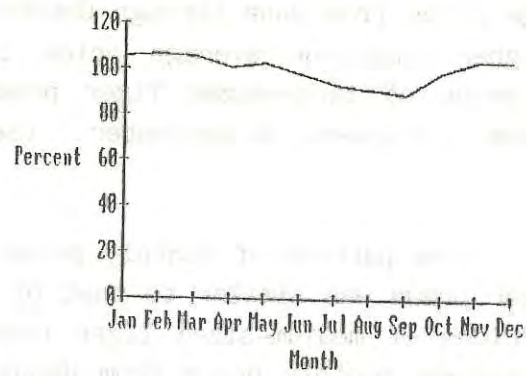


Fig. 3.28 Seasonal Price Indices of Medium-sized Tiger Prawn at Bangkok Fish Market, 1981-1985

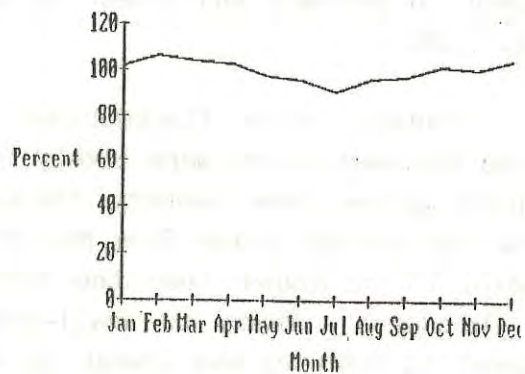


Fig. 3.29 Seasonal Price Indices of Small-sized Tiger Prawn at Bangkok Fish Market, 1981-1985

Monthly fluctuations of Tiger prawn prices throughout the year were also affected by fluctuations in the quantity of shrimp and prawn landed in the Bangkok Fish Market and export prices of frozen shrimp and prawn. For instance, prices of all three sizes of Tiger prawn were high from January through April when quantities of shrimp and prawn landed were low. Especially in February when the quantity of shrimp and prawn landed at the Bangkok Fish Market was likely to be the lowest, prices of both medium-sized and small-sized Tiger prawn were highest. Similarly, the price of large-sized Tiger prawn was highest in January when the export price of frozen shrimp and prawn was highest. Prices of all three sizes of Tiger prawn were also high in November and December although quantities of shrimp and prawn landed in the market in these months were rather large but export prices of frozen shrimp and prawn were also high and had more influence on domestic prices. On the other hand, prices of all three sizes of Tiger prawn were rather low from June through October when quantities of shrimp and prawn landed in the market in these months were rather large and export prices of frozen shrimp and prawn were not so high or were even low compared with those of other months. (See Figs. 3.24, 3.25 and 3.26)

2. Provincial Fish Market

Samut Sakhon

Quantities of shrimp and prawn landed at Samut Sakhon's FMO fishing port were likely to be below the average monthly level in January, February, April and from June through August and in December, and higher than the average level in March, May and from September through November. (See Table 3.7 and Fig. 3.30)

Wholesale prices of shrimp and prawn in Samut Sakhon were likely to be higher than the average monthly price from January through April when shrimp and prawn landed quantities at Samut Sakhon's FMO fishing port were low in these months.

Table 3.8 Seasonal Price Indices of Shrimp and Prawn at Provincial Fish Markets, 1981-1985

Month	Samut Sakhon	Hua Hin	Ranong	Surat Thani	Phuket	Songkhla	Pattani
Jan.	105.22	108.73	107.58	100.59	113.79	102.33	78.50
Feb.	104.71	108.80	103.20	102.47	118.75	102.66	104.87
Mar.	105.84	99.54	104.36	102.20	90.13	108.71	105.30
Apr.	102.80	93.48	99.89	101.92	85.38	133.65	99.41
May	99.88	96.22	101.55	87.44	100.94	101.10	104.23
Jun.	98.20	93.13	97.65	98.03	98.12	102.31	102.22
Jul.	95.73	95.67	92.82	98.20	95.42	97.50	100.48
Aug.	98.15	100.31	98.96	102.29	84.11	88.72	99.39
Sept.	96.75	97.67	96.85	102.58	90.01	84.03	99.58
Oct.	97.57	102.40	95.19	101.20	108.73	84.95	100.65
Nov.	96.65	102.15	100.50	102.40	96.16	95.93	102.10
Dec.	98.50	101.90	101.46	100.69	118.46	98.11	103.27

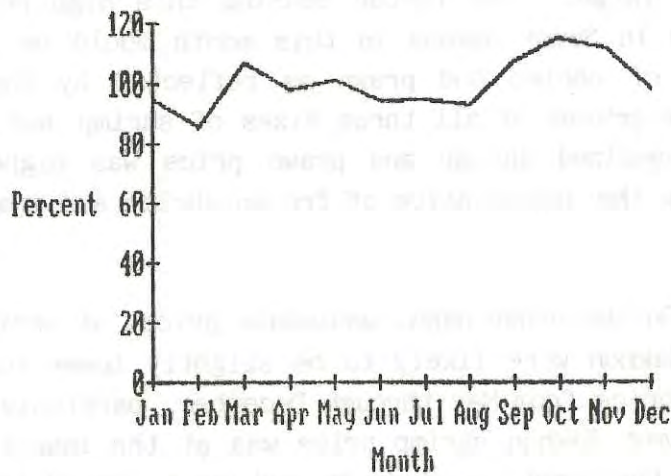


Fig. 3.30 Seasonal Quantity Indices of Shrimp and Prawn at Samut Sakhon Fish Market, 1981-1985

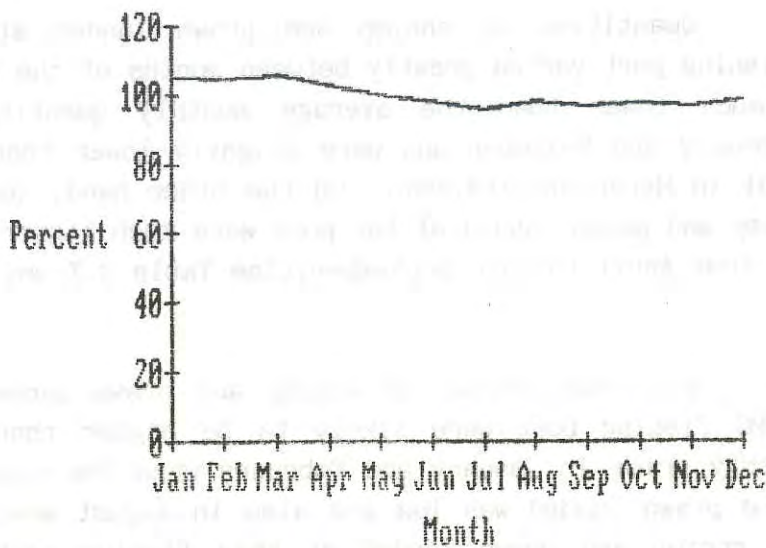


Fig. 3.31 Seasonal Price Indices of Shrimp and Prawn at Samut Sakhon Fish Market, 1981-1985

However, the month of March was an exceptional case when the wholesale price of shrimp and prawn in Samut Sakhon was highest while the quantity of shrimp and prawn landed in this fishing port was rather large. The factor causing this high price of shrimp and prawn in Samut Sakhon in this month could be a high domestic demand of shrimp and prawn as reflected by the high Bangkok wholesale prices of all three sizes of shrimp and prawn, especially medium-sized shrimp and prawn price was highest in this month, while the export price of frozen shrimp and prawn was rather low.

On the other hand, wholesale prices of shrimp and prawn in Samut Sakhon were likely to be slightly lower than the average monthly price from May through December, particularly in July when the Samut Sakhon shrimp price was at the lowest level and October when the quantity of shrimp and prawn landed in Samut Sakhon market was highest. (See Table 3.8 and Fig. 3.31)

Hua Hin

Quantities of shrimp and prawn landed at Hua Hin's FMO fishing port varied greatly between months of the year. They were much lower than the average monthly quantity in January, February and November and were slightly lower than the average level in March and October. On the other hand, quantities of shrimp and prawn landed at the port were much higher than the average from April through September. (See Table 3.7 and Fig. 3.32)

Wholesale prices of shrimp and prawn landed at Hua Hin's FMO fishing port were likely to be higher than the average monthly price in January and February when the quantity of shrimp and prawn landed was low and also in August when the quantity of shrimp and prawn landed at this fishing port was highest and in November and December when quantities of shrimp and prawn landed were much lower than the average monthly quantity. Prices of shrimp and prawn, on the other hand, tended to be at low levels from March through July and in September when quantities of shrimp and prawn landed were high in these months. (See Table 3.8 and Fig. 3.33)

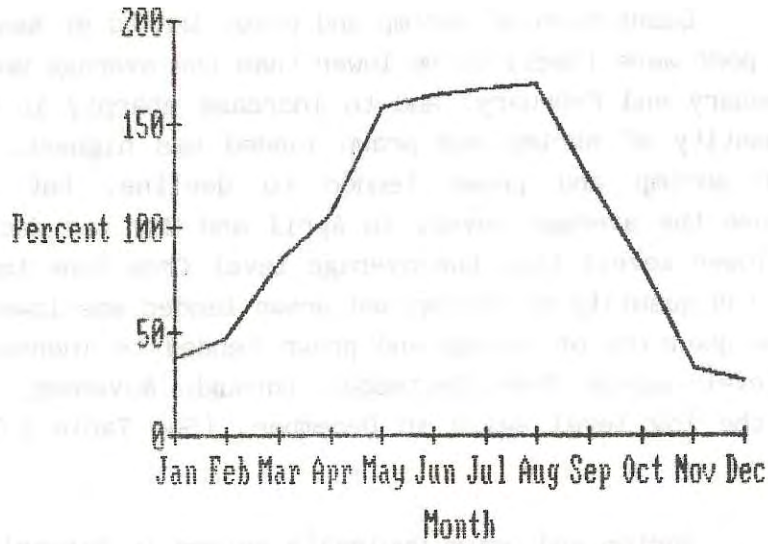


Fig. 3.32 Seasonal Quantity Indices of Shrimp and Prawn at Hua Hin Fish Market, 1981-1985

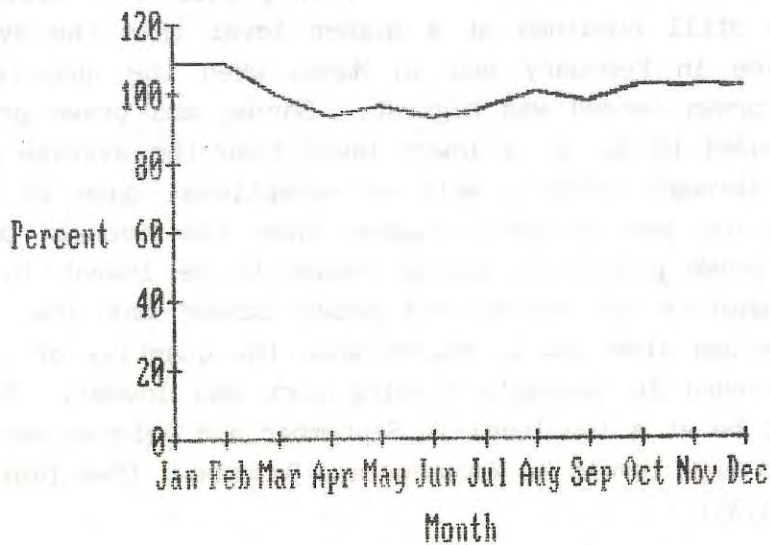


Fig. 3.33 Seasonal Price Indices of Shrimp and Prawn at Hua Hin Fish Market, 1981-1985

Ranong

Quantities of shrimp and prawn landed at Ranong's FMO fishing port were likely to be lower than the average monthly level in January and February, and to increase sharply in March when the quantity of shrimp and prawn landed was highest. The quantity of shrimp and prawn tended to decline, but still remained above the average level, in April and May and declined sharply to lower levels than the average level from June through August when the quantity of shrimp and prawn landed was lowest in August. The quantity of shrimp and prawn tended to increase to the high level again from September through November, then decline to the low level again in December. (See Table 3.7 and Fig. 3.34)

Shrimp and prawn wholesale prices in Ranong's FMO fishing port tended to be highest in January when the quantity of shrimp and prawn landed was low. Then prices were likely to decline but still remained at a higher level than the average monthly price in February and in March when the quantity of shrimp and prawn landed was highest. Shrimp and prawn prices, however, tended to be at a lower level than the average price from April through October, with an exceptional case in March when the price was slightly higher than the average price. Shrimp and prawn prices in Ranong tended to be lowest in July when the quantity of shrimp and prawn landed was low. The shrimp price was also low in August when the quantity of shrimp and prawn landed in Ranong's fishing port was lowest. Prices continued to be at a low level in September and October and then increased to high levels in November and December. (See Table 3.8 and Figure 3.35)

Surat Thani

The quantities of shrimp and prawn landed at Surat Thani's FMO fishing port were high in January, June, October and November. November was a month when the largest quantity of shrimp and prawn was landed in Surat Thani while February was the month of the lowest quantity. (See Table 3.7 and Fig. 3.36)

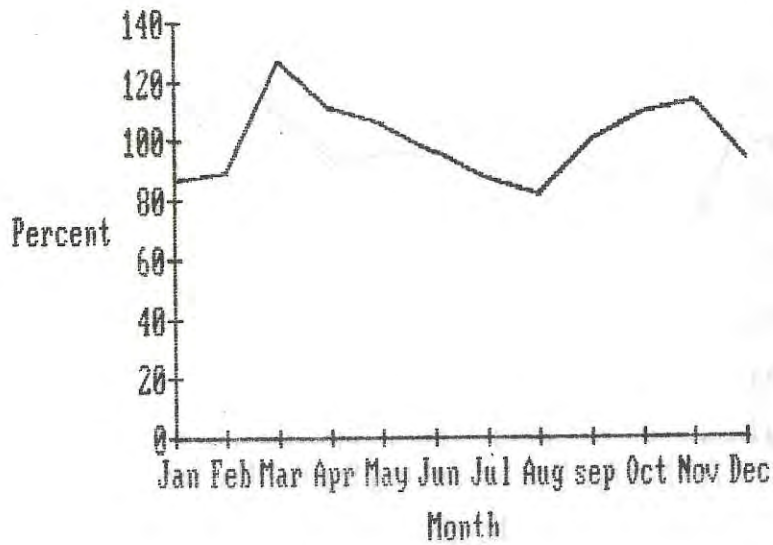


Fig. 3.34 Seasonal Quantity Indices of Shrimp and Prawn at Ranong Fish Market, 1981-1985

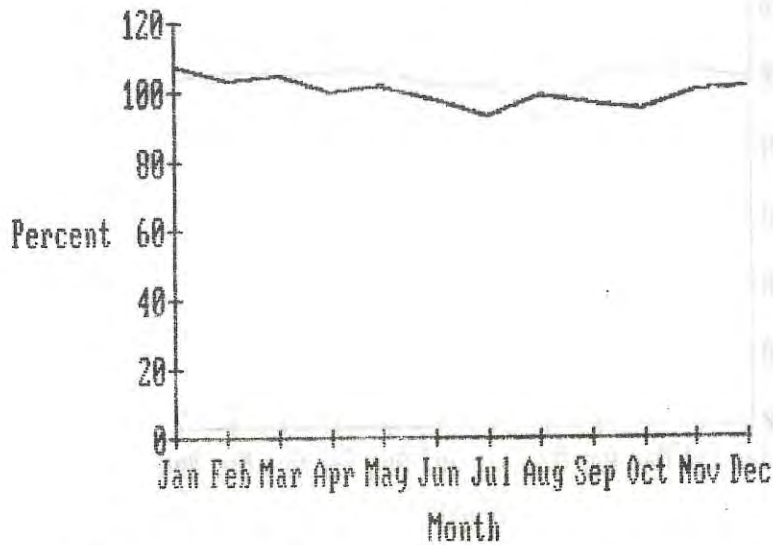


Fig. 3.35 Seasonal Price Indices of Shrimp and Prawn at Ranong Fish Market, 1981-1985

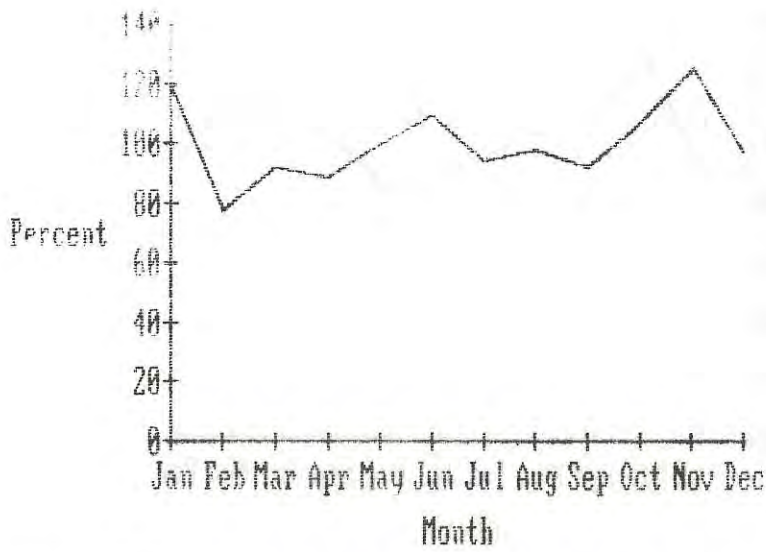


Fig. 3.36 Seasonal Quantity Indices of Shrimp and Prawn at Surat Thani Fish Market, 1981-1985

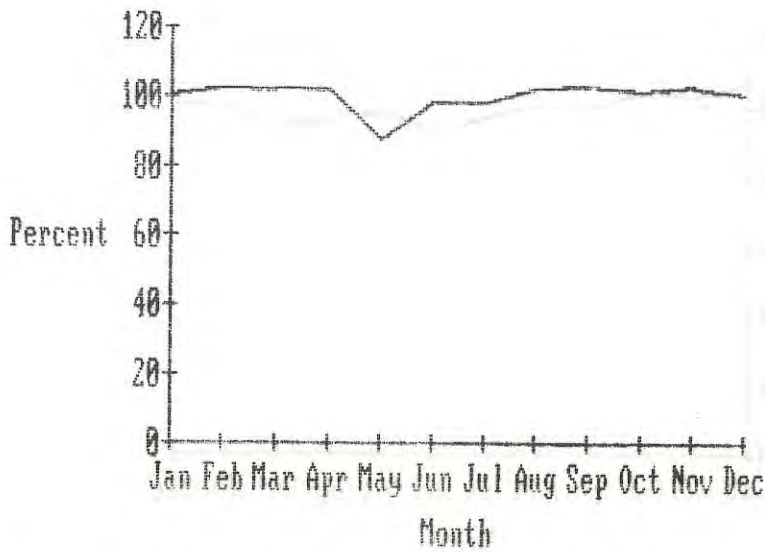


Fig. 3.37 Seasonal Price Indices of Shrimp and Prawn at Surat Thani Fish Market, 1981-1985

Prices of shrimp and prawn landed at Surat Thani's FMO fishing port tended to be high from January through April, then decline to below the average price from May through July and increase to the high levels again from August through December. (See Table 3.8 and Fig. 3.37)

Phuket

The quantity of shrimp and prawn landed at Phuket's FMO fishing port tended to be lower than the average monthly level from January through August, especially in July when the landed quantity was lowest. The landed quantity of shrimp and prawn then sharply increased from September through November and declined again in December. (See Table 3.7 and Fig. 3.38)

Shrimp and prawn prices in Phuket were high in January and February when shrimp prices in Phuket were the highest of the year. Prices declined to lower than the average monthly price in March and April and increased slightly above the average level in May, then declined to be below the average price again from June through September. Shrimp prices increased again to above the average level in October and dropped to the low level in November, then increased again to above the average monthly price in December. (See Table 3.8 and Fig. 3.39)

Songkhla

The quantity of shrimp and prawn landed at Songkhla's FMO fishing port was highest in January. However, quantities of shrimp and prawn landed were below the average monthly level from February through March, with the minimum quantity in March. Landed quantities then increased to high levels from October to December. (See Table 3.7 and Fig. 3.40)

Shrimp and prawn wholesale prices in Songkhla were likely to be higher than the average monthly price from January to June, with the highest price of the year in April when the landed quantity of shrimp and prawn was rather low. From

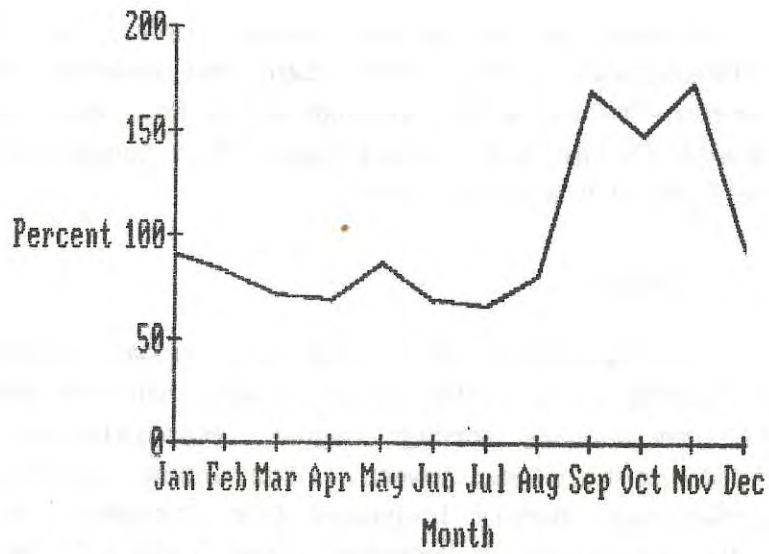


Fig. 3.38 Seasonal Quantity Indices of Shrimp and Prawn at Phuket Fish Market, 1981-1985

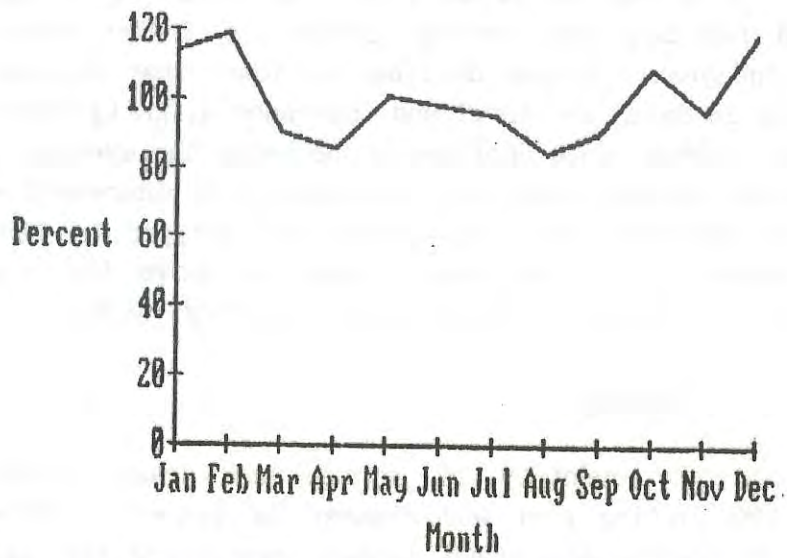


Fig. 3.39 Seasonal Price Indices of Shrimp and Prawn at Phuket Fish Market, 1981-1985

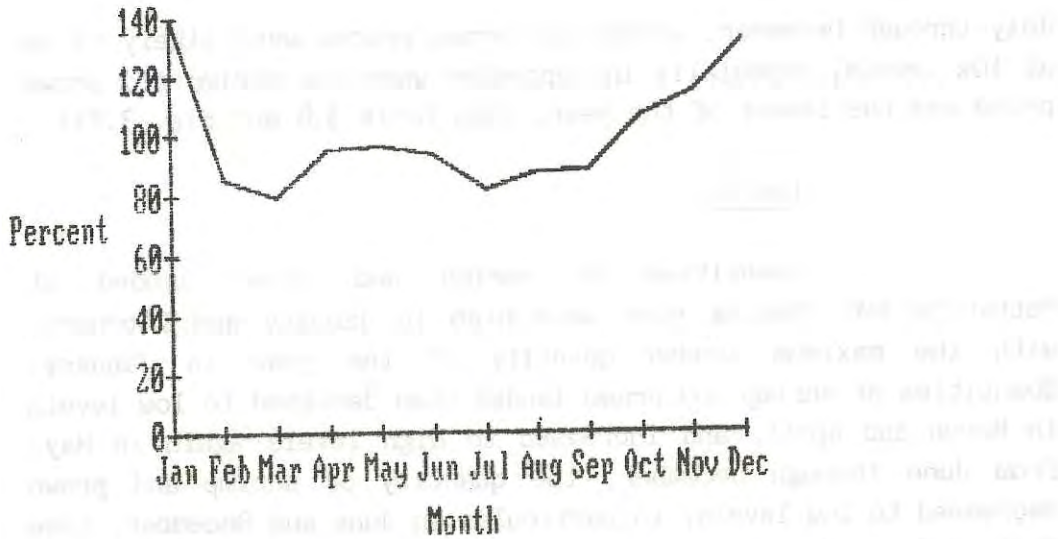


Fig. 3.40 Seasonal Quantity Indices of Shrimp and Prawn at Songkhla Fish Market, 1981-1985

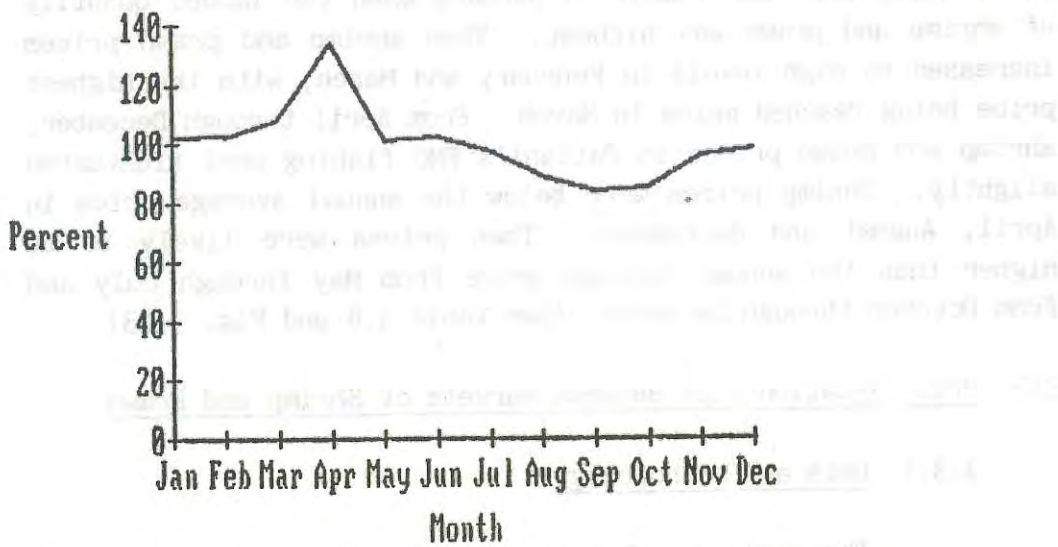


Fig. 3.41 Seasonal Price Indices of Shrimp and Prawn at Songkhla Fish Market, 1981-1985

July through December, shrimp and prawn prices were likely to be at low levels, especially in September when the shrimp and prawn price was the lowest of the year. (See Table 3.8 and Fig. 3.41)

Pattani

Quantities of shrimp and prawn landed at Pattani's FMO fishing port were high in January and February, with the maximum landed quantity of the year in January. Quantities of shrimp and prawn landed then declined to low levels in March and April, and increased to high levels again in May. From June through December, the quantity of shrimp and prawn decreased to low levels, in particular in June and December. (See Table 3.7 and Fig. 3.42)

The price of shrimp and prawn landed at Pattani's FMO fishing port was lowest in January when the landed quantity of shrimp and prawn was highest. Then shrimp and prawn prices increased to high levels in February and March, with the highest price being reached in March. From April through December, shrimp and prawn prices in Pattani's FMO fishing port fluctuated slightly. Shrimp prices were below the annual average price in April, August and September. Then prices were likely to be higher than the annual average price from May through July and from October through December. (See Table 3.8 and Fig. 3.43)

3.3 Price Relationships Between Markets of Shrimp and Prawn

3.3.1 Data and Methodology

The analysis of price relationships between markets of shrimp and prawn used the following data to calculate correlation coefficients of shrimp and prawn wholesale prices among different markets.

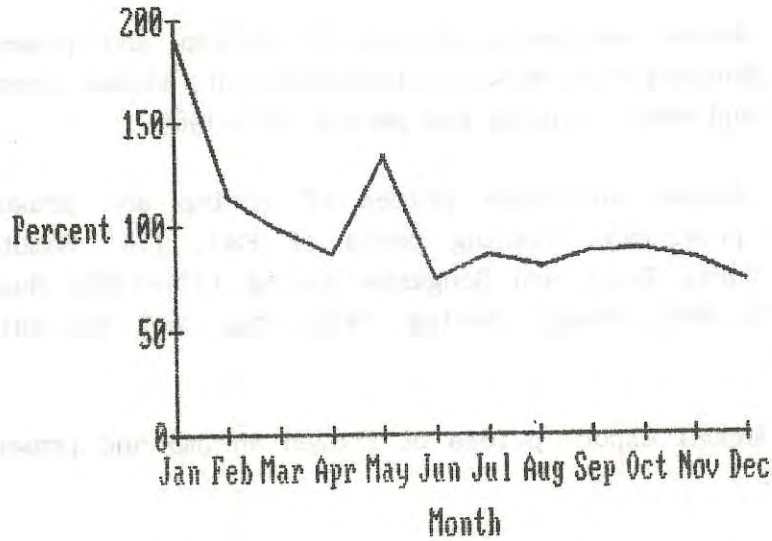


Fig. 3.42 Seasonal Quantity Indices of Shrimp and Prawn at Pattani Fish Market, 1981-1985

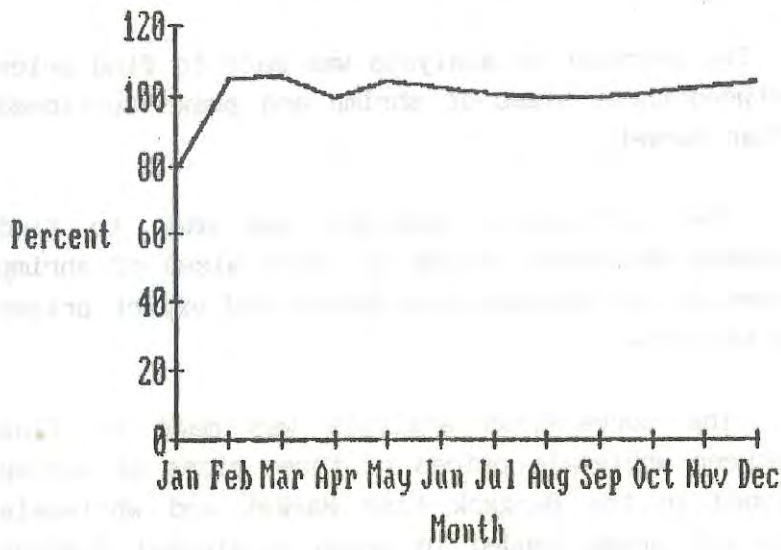


Fig. 3.43 Seasonal Price Indices of Shrimp and Prawn at Pattani Fish Market, 1981-1985

1) Annual wholesale prices of shrimp and prawn auctioned at the Bangkok Fish Market, classified into three sizes as large, medium and small, during the period 1971-1985.

2) Annual wholesale prices of shrimp and prawn landed in seven provincial fishing ports of FMO, i.e. Samut Sakhon, Ranong, Surat Thani and Songkhla during 1971-1985; Hua Hin, during 1975-1985; Phuket during 1978-1985; and Pattani during 1972-1985.

3) Annual export prices of frozen shrimp and prawn during 1971-1985.

The statistical techniques to search for price relationships between markets of shrimp and prawn comprised the following five steps:

(1) The correlation analysis was made to find price relationships between three sizes of shrimp and prawn auctioned in the Bangkok Fish Market.

(2) The correlation analysis was made to find relationships between wholesale prices of three sizes of shrimp and prawn auctioned in the Bangkok Fish Market and export prices of frozen shrimp and prawn.

(3) The correlation analysis was made to find relationships between wholesale prices of three sizes of shrimp and prawn auctioned in the Bangkok Fish Market and wholesale prices of shrimp and prawn landed in seven provincial fishing ports of FMO.

(4) The correlation analysis was made to find price interrelationships between wholesale prices of shrimp and prawn landed in seven provincial fishing ports during the same time period.

(5) The correlation analysis was made to find price relationships between wholesale prices of shrimp and prawn landed in each provincial fishing port and export prices of frozen shrimp and prawn.

3.3.2 Results

Correlation coefficients (r) of shrimp and prawn wholesale prices are shown in Table 3.9. Correlation coefficients represent the degree of closeness of relationships between different prices of shrimp and prawn. For instance, r_{12} shows the relationship between the wholesale price of shrimp and prawn sold in market 1 and the wholesale price in market 2. Hence, the closer the value of r_{12} is to one, the closer is the relationships between the two prices, and the possibility of their moving in the same direction is also high.

1) Bangkok Wholesale Prices

a. Relationships among Wholesale Prices of Three sizes of Shrimp and Prawn in the Bangkok Fish Market

The correlation analysis show high inter-relationship between wholesale prices of three sizes of shrimp and prawn auctioned in the Bangkok Fish Market as their correlation coefficients are positively high. For instance, the correlation coefficient between large-sized shrimp and prawn price and medium-sized shrimp and prawn price was 0.97058, while that of large-sized shrimp and prawn price and small-sized shrimp and prawn price was 0.96975 and that of medium-sized shrimp and prawn price and small-sized shrimp and prawn price was 0.96353. These correlation coefficients show that the possibility of the prices of all three sizes of shrimp and prawn in the Bangkok Fish Market moving in the same direction was as high as 97 percent. Moreover, the correlation coefficient between large-sized and medium-sized shrimp and prawn price was higher than both of correlation coefficients between large-sized and small-sized

Table 3.9 Matrix of Correlation Coefficients of Shrimp Prices in Different Markets

	SHPL	SHPM	SHPS	SHSS	SHPHH	SHPRN	SHPST	SHPPK	SHPSK	SHPPN	SHEP
SHPL	1.000000										
SHPM	0.97058	1.00000									
SHPS	0.96975	0.96353	1.00000								
SHSS	- 0.40927	- 0.4659	- 0.3500	1.00000							
SHPHH	0.72718	0.778	0.75609	- 0.79693	1.00000						
SHPRN	0.80714	0.81438	0.85820	- 0.40445	0.37863	1.00000					
SHPST	- 0.68391	- 0.73514	- 0.63564	0.83904	- 0.76520	- 0.55081	1.00000				
SHPPK	0.68333	0.69200	0.82224	0.40933	0.21138	- 0.4079	0.12844	1.00000			
SHPSK	- 0.83122	- 0.83124	- 0.77980	0.66724	- 0.76520	- 0.71532	0.90092	0.48677	1.00000		
SHPPN	0.81306	0.82486	0.76896	- 0.76877	0.94369	0.57409	- 0.91929	0.07223	- 0.89142	1.00000	
SHEP	0.95251	0.95721	0.91604	- 0.59746	0.84794	0.76219	- 0.79562	0.30488	- 0.86800	0.92941	1.00000

SHPL = Large-sized Shrimp and Prawn Wholesale Price, Bangkok Fish Market
 SHPM = Medium-sized Shrimp and Prawn Wholesale Price, Bangkok Fish Market
 SHPS = Small-sized Shrimp and Prawn Wholesale Price, Bangkok Fish Market
 SHSS = Shrimp and Prawn Wholesale Price, Samut Sakhon Fish Market
 SHPHH = Shrimp and Prawn Wholesale Price, Hua Hin Fish Market
 SHPRN = Shrimp and Prawn Wholesale Price, Ranong Fish Market
 SHPST = Shrimp and Prawn Wholesale Price, Surat Thani Fish Market
 SHPPK = Shrimp and Prawn Wholesale Price, Phuket Fish Market
 SHPSK = Shrimp and Prawn Wholesale Price, Songkhla Fish Market
 SHPPN = Shrimp and Prawn Wholesale Price, Pattani Fish Market
 SHEP = Export Price of Frozen Shrimp and Prawn

shrimp and prawn prices, and that of medium-sized and small-sized shrimp and prawn prices. This shows that wholesale prices of both medium-sized and small-sized shrimp and prawn followed more closely the movement of large-sized shrimp and prawn wholesale price than to that of each other.

b. Relationships between Bangkok Wholesale Price and Export Price

Correlation coefficients of all three sizes of shrimp and prawn wholesale prices in the Bangkok Fish Market and the export price of frozen shrimp and prawn were also high. Correlation coefficients between wholesale price of large-sized shrimp and prawn and export price of frozen shrimp and prawn was 0.95251 and nearly the same as that of medium-sized shrimp and prawn wholesale price and export price ($r = 0.95721$) and slightly higher than that of the small-sized shrimp and prawn wholesale price and the export price of frozen shrimp and prawn ($r = 0.91604$). This shows that there were close relationships between wholesale prices of fresh shrimp and prawn and export prices of frozen shrimp and prawn.

c. Relationships between Bangkok Wholesale Prices and Provincial Wholesale Prices

Bangkok wholesale prices of shrimp and prawn were highly correlated with those of Hua Hin, Ranong and Phuket as their correlation coefficients were positively high. In most cases, average wholesale prices of shrimp and prawn in these provinces were more closely related to the medium-sized shrimp and prawn wholesale price and small-sized shrimp and prawn wholesale price in the Bangkok Fish Market than to the large-sized shrimp and prawn price. This is due to the fact that shrimp and prawn landed in these provincial markets were largely medium and small-sized and were mostly sent to the Bangkok Fish Market, hence shrimp and prawn wholesalers in these markets had also based their buying prices on Bangkok wholesale prices. Therefore wholesale prices of shrimp and prawn in these markets tended to move in the same direction as Bangkok wholesale prices.

In case of Samut Sakhon, Surat Thani, and Songkhla, wholesale prices of shrimp and prawn in these markets had negative correlations with Bangkok wholesale prices of shrimp and prawn. This shows that wholesale prices of shrimp and prawn landed in these provincial markets did not move in parallel with wholesale prices of shrimp and prawn auctioned in the Bangkok Fish Market as trade relationships among these shrimp and prawn markets were not very close.

There was an exceptional case of a high positive correlation coefficient between Bangkok wholesale price and Pattani wholesale price of shrimp and prawn although these two markets are very far apart. This may be due to the quantities of shrimp and prawn landed in Pattani's FMO fishing port each year and to the fact that demand moved in the same direction as that in the Bangkok Fish Market.

2) Provincial Wholesale Prices

Samut Sakhon

Shrimp and prawn wholesale prices in Samut Sakhon's FMO fishing port did not have any positive correlation coefficients with those of the Bangkok Fish Market and export price as quantities of shrimp and prawn landed in Samut Sakhon's FMO fishing port in the early period of this study were not very high. Moreover shrimp and prawn in this market were not sent to the Bangkok Fish Market, hence Samut Sakhon shrimp and prawn wholesalers did not take account of Bangkok wholesale prices and export prices in setting their buying prices. On the other hand, the correlation coefficient between Samut Sakhon and Surat Thani shrimp and prawn wholesale prices shows that shrimp and prawn prices in these two markets were highly correlated ($r = 0.83904$) while that of Samut Sakhon and Songkhla were moderately correlated ($r = 0.66724$) and those of Samut Sakhon and Phuket were slightly correlated ($r = 0.40933$) as shrimp and prawn landed in these provincial fishing ports were transported to Samut Sakhon.

Correlation coefficients between the Samut Sakhon wholesale price and that at Hua Hin, Ranong and Pattani were negative, which shows that shrimp and prawn prices in these markets did not have positive relationships, hence prices did not move in the same direction since there were few trade relationships between these markets.

Hua Hin

The wholesale price of shrimp and prawn landed at Hua Hin's FMO fishing port had a rather high positive correlation with Bangkok wholesale prices. The correlation coefficient of the Hua Hin shrimp and prawn wholesale price and the medium-sized shrimp and prawn wholesale price in the Bangkok Fish Market was 0.77801 and slightly higher than that of Hua Hin shrimp and prawn price and small-sized shrimp and prawn price in the Bangkok Fish Market ($r = 0.75609$) and that of the Hua Hin shrimp and prawn price and the medium-sized shrimp and prawn price in the Bangkok Fish Market. This was due to the fact that most shrimp and prawn landed in Hua Hin's FMO fishing port and sent to the Bangkok Fish Market were medium-sized and small-sized rather than large-sized, hence price movements of shrimp and prawn in Hua Hin were more likely to follow the Bangkok wholesale price of medium-sized than of small-sized shrimp and prawn in the Bangkok Fish Market.

Hua Hin shrimp and prawn wholesale price had rather low positive correlation coefficients or even negative correlation coefficients with shrimp and prawn wholesale prices in other provinces, except Pattani, as there were no trade relationships among shrimp and prawn wholesalers in Hua Hin and those in other provincial markets. Shrimp and prawn wholesale prices in Hua Hin had high positive correlation coefficients with the Pattani shrimp and prawn wholesale price and export price of frozen shrimp and prawn. This was due to the fact that the Hua Hin shrimp and prawn wholesale price had a high positive correlation with the Bangkok wholesale price which in turn had a high positive correlation with Pattani shrimp and prawn wholesale price and the export price of frozen shrimp and prawn.

Ranong

The Ranong shrimp and prawn wholesale price had high correlation with the Bangkok shrimp and prawn wholesale prices. The correlation coefficient of Ranong shrimp and prawn wholesale price and small-sized shrimp and prawn wholesale price in the Bangkok Fish Market was rather high ($r = 0.85820$) and slightly higher than that of the Ranong shrimp and prawn wholesale price and the medium-sized shrimp and prawn wholesale price in the Bangkok Fish Market ($r = 0.81438$) and that of Ranong shrimp and prawn wholesale price and large-sized shrimp and prawn wholesale price in the Bangkok Fish Market ($r = 0.80714$). This was because most shrimp and prawn landed in Ranong's FMO fishing port were sent to the Bangkok Fish Market, hence there was a high tendency for the Ranong shrimp and prawn wholesale prices to follow the movements of the Bangkok shrimp and prawn wholesale prices. Moreover, the Ranong shrimp and prawn wholesale price had a high positive correlation with the export price of frozen shrimp and prawn ($r = 0.76219$) since the Ranong shrimp and prawn wholesale price had high correlation with the Bangkok wholesale price which in turn had a close relationship with the export price of frozen shrimp and prawn.

The Ranong shrimp and prawn wholesale price had a low positive correlation coefficient with the Hua Hin shrimp and prawn wholesale price ($r = 0.37863$) and a moderate correlation coefficient with the Pattani shrimp and prawn wholesale price ($r = 0.57409$), while correlation coefficients between Ranong shrimp and prawn wholesale prices and shrimp and prawn wholesale prices in other provinces were negative. This shows that Ranong shrimp and prawn wholesale prices have a low relationship with those in other provinces and did not move in the same direction with them.

Surat Thani

The shrimp and prawn wholesale price in Surat Thani's FMO fishing port did not have any positive correlation with the Bangkok shrimp and prawn wholesale prices. However, it

had a high correlation with the Samut Sakhon shrimp and prawn wholesale price ($r = 0.83904$) and the Songkhla shrimp and prawn wholesale price ($r = 0.90092$). This was caused by the fact that the shrimp and prawn landed in Surat Thani's FMO fishing port were sent to both Samut Sakhon and Songkhla Fish Markets, hence their prices in these markets moved mostly in the same direction.

On the other hand, the Surat Thani shrimp and prawn wholesale price had a low positive correlation coefficient with the Phuket shrimp and prawn wholesale price and no positive relationships with shrimp and prawn wholesale prices in Hua Hin, Ranong, Pattani and export prices, due to the fact that there were no trade relationships between wholesalers in these markets.

Phuket

Shrimp and prawn wholesale prices in Phuket's FMO fishing port had high positive correlation coefficients with Bangkok wholesale prices of small-sized shrimp and prawn ($r = 0.82224$) and medium-sized shrimp and prawn ($r = 0.692$) and large-sized shrimp and prawn ($r = 0.68333$). This shows that the Phuket shrimp and prawn price had, in general, followed the movement of the Bangkok shrimp and prawn prices. The Phuket shrimp and prawn price, however, had rather low positive correlation coefficients with shrimp and prawn wholesale prices in Samut Sakhon ($r = 0.40933$) and Songkhla ($r = 0.48677$), which were also terminal markets for Phuket shrimp and prawn. Similarly, the Phuket shrimp and prawn wholesale price had very low correlation coefficients with shrimp and prawn wholesale prices in Hua Hin, Surat Thani and Pattani and had negative correlation coefficients with Ranong shrimp and prawn prices. This was due to the fact that Phuket shrimp and prawn wholesalers did not have trade relationships with wholesalers in provincial markets, hence they were not concerned about price movements in these markets in making their buying and selling price decisions. On the other hand, the Phuket shrimp and prawn wholesale price had a low positive correlation coefficient with the export price of frozen

shrimp and prawn ($r = 0.30488$). This also shows that the Phuket shrimp and prawn wholesale price was only slightly influenced by export prices as Phuket shrimp and prawn wholesalers took less account of export prices than of wholesale prices of shrimp and prawn in Bangkok, Samut Sakhon and Songkhla Fish Markets which were their terminal markets.

Songkhla

The Songkhla shrimp and prawn wholesale price did not have any positive correlation coefficients with the Bangkok shrimp and prawn wholesale prices because there were no trade relationships between wholesalers in these two markets. However, the Songkhla shrimp and prawn wholesale price had high positive correlation coefficients with that in Samut Sakhon ($r = 0.66724$) and that in Surat Thani ($r = 0.90092$). This was because shrimp and prawn wholesalers in Songkhla's FMO fishing port also based their buying prices on Samut Sakhon wholesale prices, while shrimp and prawn wholesalers in Surat Thani who sent their products to Songkhla, on the other hand, based their buying prices on the Songkhla wholesale prices. Therefore, movements of Songkhla shrimp and prawn prices were similar to those in these two markets.

Similarly, the Songkhla shrimp and prawn wholesale price had some positive correlation with the Phuket shrimp and prawn wholesale price ($r = 0.48677$) because Phuket shrimp and prawn wholesalers also based their buying prices on those in Songkhla, which was their terminal market as mentioned earlier. However, Songkhla shrimp and prawn wholesale prices had negative correlations with shrimp and prawn wholesale prices in Hua Hin, Ranong, and Pattani as well as the export price of frozen shrimp and prawns, which shows that these prices did not have similar movements as there were no trade relations between wholesalers in these provincial markets and the export market, and those in Songkhla fish market.

Pattani

The Pattani shrimp and prawn wholesale prices had high positive correlation coefficients with the Bangkok wholesale prices of large-sized ($r = 0.81306$), medium-sized ($r = 0.82486$) and small-sized shrimp and prawn ($r = 0.76896$) and the export price of frozen shrimp and prawn ($r = 0.92941$). The Pattani wholesale price of shrimp and prawn also had a high correlation with the Hua Hin shrimp and prawn wholesale price ($r = 0.94369$) and a moderate correlation with the Ranong shrimp and prawn wholesale price ($r = 0.57409$). However, it had no positive correlation with shrimp and prawn wholesale prices in Samut Sakhon, Surat Thani, Phuket and Songkhla. As a matter of fact, Pattani is located at the extreme end of the southern part of Thailand and there were no trade relationships between shrimp and prawn wholesalers in Pattani and those in other provinces except those in Songkhla, hence high correlation coefficients between Pattani and other provincial shrimp and prawn wholesale prices could be interpreted as coincidences in local supply and demand conditions.

3.4 Factors Affecting Shrimp and Prawn Wholesale Prices

3.4.1 Domestic Wholesale Prices

Major factors affecting domestic wholesale prices of shrimp and prawn were believed to include the national production of marine shrimp and prawn, size of the population of the whole Kingdom, per capita income, per capita fish consumption expenditure and export price of frozen shrimp and prawn. While national production of marine shrimp and prawn was considered as a factor affecting the supply side, other factors were considered as those affecting the purchasing power of consumers and hence the demand for Thai marine shrimp and prawn. Both domestic and overseas demands and domestic supply of shrimp and prawn will determine domestic wholesale prices. Hence, national production of marine shrimp and prawn was expected to have a negative impact on domestic wholesale prices, while other factors were expected to have positive influences.

The tests of relationship between domestic wholesale prices of shrimp and prawn and determining factors were made by using the regression analysis with the following symbols:

SHP 1 = domestic wholesale price of shrimp and prawn (Baht/kg)

SHQ 1 = national production of marine shrimp and prawn (tons)

POP 1 = total population in the whole Kingdom (million persons)

PCI = per capita income (Baht)

FCE = per capita fish consumption expenditure (Baht)

SHEP = export price of frozen shrimp and prawn (Baht/kg)

The regression analysis using annual data between 1971 and 1985 gave the following results:

1) Equation representing the relationship between domestic wholesale price of shrimp and prawn (SHP 1), and national production of shrimp and prawn (SHQ 1) was as follow:

$$\text{SHP 1} = 15.30124 + 0.00013 \text{ SHQ 1} \dots\dots(1)$$

(2.03814) (2.02387)

$$R^2 = 0.23959$$

where R^2 = Coefficient of determination, and numbers in parentheses are t-values

2) Equation representing the relationship between domestic wholesale price of shrimp and prawn (SHP 1) and total number of population in the whole Kingdom (POP 1) was as follow:

$$\text{SHP 1} = -12.80409 + 0.00096 \text{ POP 1} \dots\dots(2)$$

(-0.7414) (2.49226)

$$R^2 = 0.32332$$

3) Equation representing the relationship between domestic wholesale price of shrimp and prawn (SHP 1), and per capita income (PCI) was as follow:

$$\text{SHP 1} = 20.17805 + 0.00086 \text{ PCI} \dots\dots(3)$$

(5.01288) (2.70429)

$$R^2 = 0.36002$$

4) Equation representing the relationship between domestic wholesale price of shrimp and prawn (SHP 1) and per capita fish consumption expenditure (FCE) was as follow:

$$\text{SHP 1} = 21.86928 + 0.01511 \text{ FCE} \dots\dots(4)$$

(6.44282) (2.77687)

$$R^2 = 0.37232$$

5) Equation representing the relationship between domestic wholesale price of shrimp and prawn (SHP 1) and export price of frozen shrimp and prawn (SHEP) was as follow:

$$\text{SHP 1} = 12.09549 + 0.17509 \text{ SHEP} \dots\dots(5)$$

(1.96947) (3.13146)

$$R^2 = 0.47131$$

The five equations presented above show positive but low correlations between domestic wholesale price of shrimp and prawn and the five determining factors as R^2 s in these equations are rather low. However, the domestic wholesale price had a positive relationship with all five independent variables and the coefficients of all independent variables are statistically significant. These show that changes in the domestic wholesale price of shrimp and prawn had the same movement patterns as those of national production of shrimp and prawn, total population of the whole Kingdom, per capita income, and per capita fish consumption expenditure. Hence, an increase in the quantity of shrimp and prawn landed in the whole Kingdom did not cause domestic wholesale prices of shrimp and prawn to decline but caused them to increase in the same direction with landed quantity as shown in equation (1). This could be explained as a result of increases in other determining factors which had more positive impacts on the domestic wholesale price, i.e. total population in the whole Kingdom, per capita income and per capita fish consumption expenditure which raised domestic demand for shrimp and prawn as well as an increase in the export price of frozen shrimp and prawn resulting from an increase in overseas demand for shrimp and prawn from Thailand. These explanations are statistically confirmed by equations (2) - (5) which show that the domestic wholesale price of shrimp and prawn will increase in response to increases in these determining factors. However, the low value of R^2 in each equation shows that changes in domestic wholesale price of shrimp and prawn could be explained by a change in value of an independent variable in each equation only to the extent of 24 to 47 percent, the remaining percentage being contributed by other factors not included in the equation. Moreover, the value of R^2 of the equation representing the relationship between domestic wholesale price and export price was higher than that of other equations. This shows that

the export price of frozen shrimp and prawn explains changes in the domestic wholesale price of shrimp and prawn better than other determining factors as generally believed.

3.4.2 Bangkok Wholesale Price

The analysis of factors affecting Bangkok wholesale price of shrimp and prawn considered only the wholesale price of large-sized shrimp and prawn auctioned at the Bangkok Fish Market on an annual basis. Regression equations representing the relationship between Bangkok wholesale price of shrimp and prawn and determining factors included the following symbols of variables:

SHP 2	=	Bangkok wholesale price of large-sized shrimp and prawn (Baht/kg)
SHQ 2	=	quantity of shrimp and prawn landed in the Bangkok Fish Market (tons)
POP 2	=	total population of Bangkok (million persons)
PCI	=	per capita income (Baht)
FCE	=	per capita fish consumption expenditure (Baht)
SHEP	=	export price of frozen shrimp and prawn (Baht/kg)

Regression equations representing the relationship between the Bangkok wholesale price of large-sized shrimp and prawn and its determining factors using annual data between 1971 and 1985 were as follows:

1) Equation representing the relationship between Bangkok wholesale price of large-sized shrimp and prawn (SHP 2) and quantity of shrimp and prawn landed in the Bangkok Fish Market (SHQ 2) was as follows:

$$\text{SHP 2} = 141.48956 - 0.00947 \text{ SHQ 2} \dots\dots\dots(6)$$

(2.55967) (-0.72847)

$$R^2 = 0.03922$$

2) Equation representing the relationship between Bangkok wholesale price of large-sized shrimp and prawn (SHP 2) and total population in Bangkok (POP 2) was as follows:

$$\text{SHP 2} = -116.54951 + 47.19316 (\text{POP 2}) \dots\dots\dots(7)$$

(-3.69342) (7.01293)

$$R^2 = 0.79093$$

3) Equation representing the relationship between Bangkok wholesale price of large-sized shrimp and prawn (SHP 2) and per capita income (PCI) was as follow:

$$\text{SHP 2} = 28.2845 + 0.00647 \text{ PCI} \dots\dots\dots(8)$$

(2.47203) (7.13492)

$$R^2 = 0.79642$$

4) Equation representing the relationship between Bangkok wholesale price of large-sized shrimp and prawn (SHP 2) and per capita fish consumption expenditure (FCE) was as follow:

$$\text{SHP 2} = 42.43965 + 0.11053 \text{ FCE} \dots\dots\dots(9)$$

(4.23166) (6.87346)

$$R^2 = 0.78421$$

5) Equation representing the relationship between Bangkok wholesale price of large-sized shrimp and prawn (SHP 2) and export price of frozen shrimp and prawn (SHEP)

$$\text{SHP 2} = 7.11581 + 0.98882 \text{ SHEP} \dots\dots\dots(10)$$

(0.5585) (8.52471)

$$R^2 = 0.86853$$

Equation (6) above shows a negative relationship between wholesale price and landed quantity of shrimps and prawns. However, the quantity of shrimp and prawn landed in the Bangkok Fish Market was not a good explanatory factor of changes in the Bangkok wholesale price of shrimp and prawn as the value of R^2 of this equation is very low and the coefficient of this independent variable is not statistically significant. However, equations (7)-(10) show that the total Bangkok population, per capita income, per capita fish consumption expenditure and export price of frozen shrimp and prawn are better explanatory factors, as the value of R^2 in each equation is rather high and the coefficient of an independent variable in each equation is statistically significant. Especially, equation (10) shows that changes in the export price of frozen shrimp and prawn could explain, to the extent of about 87 percent, changes in the Bangkok wholesale price of frozen shrimp and prawn, while the remaining percentage was contributed by other factors not included in the equation. Hence, these equations explain that, while the quantity of shrimp and prawn landed in the Bangkok Fish Market increased in recent years, the Bangkok wholesale price of shrimp and prawn also increased since other determining factors affecting the demand for Bangkok shrimp and prawn, and especially the export price of frozen shrimp and prawn, also increased and had a more positive impact on price.

Chapter IV

SQUID AND CUTTLEFISH

4.1 Analysis of Price Trends

4.1.1 Trend of Domestic Wholesale Prices

The analysis of domestic wholesale prices of squid and cuttlefish examined the trend of annual average wholesale prices of squid and cuttlefish during 1971-1985. It was generally believed that domestic wholesale prices of squid and cuttlefish were determined largely by export prices of frozen squid and cuttlefish rather than by domestic supply and demand conditions.

From 1971 to 1985 both quantity and wholesale price of squid and cuttlefish produced in Thailand fluctuated along upward trends. Quantity of squid and cuttlefish landed in Thailand increased from 50,647 tons in 1971 to the maximum level of 132,044 tons in 1983 since squid and cuttlefish fisheries technology had been improved during those years, and Thai marine fisheries operated largely in overseas waters. Quantity of squid and cuttlefish landed in Thailand, however, decreased to 129,269 tons in 1984 and 125,973 tons in 1985 due to the decline in marine fishery resources and loss of overseas fishing grounds owing to the declaration of the exclusive economic zones of neighbouring countries. During these years, domestic wholesale price of squid and cuttlefish increased from 4.00 Baht/kg in 1971 to 23.45 Baht/kg in 1985, while the quantity, value and price of frozen squid and cuttlefish exports increased from 6,007 tons of export quantity, valued at 96 million Baht with an f.o.b. export price of 15.98 Baht/kg in 1971 to 46,290 tons of export quantity, valued at 2,121 million Baht with an f.o.b. export price of 45.82 Baht/kg in 1985. (See Tables 4.1 and 4.2)

Table 4.1 Quantity and Average Wholesale Price of Squid and Cuttlefish in the Whole Kingdom of Thailand

Quantity : Tons
Price : Baht/kg

Year	Quantity	Price
1971	50,647	4.00
1972	65,290	5.00
1973	81,409	8.00
1974	64,629	5.50
1975	64,825	6.59
1976	63,952	8.75
1977	93,694	8.76
1978	93,654	12.65
1979	80,142	15.57
1980	72,313	13.84
1981	80,805	15.74
1982	116,607	17.47
1983	132,044	20.35
1984	129,269	17.61
1985	125,973	23.45

Source : Fisheries Record of Thailand, Department of Fisheries.

Table 4.2 Export Quantity and Price of Fresh and Frozen Squid and Cuttlefish

Quantity : Tons
Price : Baht/kg

Year	Export Quantity of Squid and Cuttlefish	Export Price		
		Average	Squid	Cuttlefish
1971	6,007	15.98	-	15.98
1972	13,230	10.65	-	10.65
1973	14,412	19.55	42.45	19.36
1974	15,992	16.75	16.61	23.77
1975	15,745	32.35	26.25	32.65
1976	20,867	30.09	27.80	31.27
1977	25,739	25.81	20.45	26.87
1978	34,011	30.05	22.90	32.49
1979	39,358	37.39	25.97	40.92
1980	38,641	33.66	29.63	37.92
1981	39,831	33.51	26.38	34.73
1982	42,607	41.83	26.91	43.50
1983	39,321	41.65	26.29	43.13
1984	42,821	39.54	28.53	41.82
1985	46,290	45.82	41.61	60.26

Source : Foreign Trade Statistics of Thailand, The Customs Department.

Major importers of frozen squid and cuttlefish from Thailand were Japan, Italy and France. Therefore changes in the quantity of frozen squid and cuttlefish imported in these countries had a strong impact on both export price and domestic wholesale price of squid and cuttlefish in Thailand.

The trend of squid and cuttlefish domestic wholesale prices during 1971-1985 can be subdivided into three periods. The first was during 1971-1974 when wholesale prices of squid and cuttlefish increased from 4.00 Baht/kg in 1971 to 5.00 Baht/kg in 1972, and 8.00 Baht/kg in 1973. Since the exported quantity of squid and cuttlefish increased about 120 percent in 1972 and because of an increase in the price of diesel oil in 1973, export price and exported quantity of squid and cuttlefish increased by about 83.6 percent and 8.9 percent respectively in 1973. However, domestic wholesale price of squid and cuttlefish decreased from 8.00 Baht/kg in 1973 to 5.50 Baht/kg, or 60.9 percent, in 1974 when the export value and export price of frozen squid and cuttlefish declined about 5 percent and 14.3 percent respectively in spite of an 11 percent increase in the quantity of frozen squid and cuttlefish exported in 1980.

The second period of the domestic wholesale price trend was during 1975-1980 when domestic wholesale prices increased steadily from 6.59 Baht/kg in 1975 to 15.57 Baht/kg in 1979 since both the exported quantity and value, and hence the export price, increased during these years. However, domestic wholesale price of squid and cuttlefish decreased to 13.84 Baht/kg, or 11.1 percent, in 1980 when the quantity of frozen squid and cuttlefish imported by Japan declined drastically and caused the exported quantity and export price of frozen squid and cuttlefish to decline by about 1.8 percent and 10 percent respectively. This had adverse effects on domestic wholesale prices of squid and cuttlefish.

The third period of the domestic wholesale price trend of squid and cuttlefish was during 1975-1980 when domestic wholesale price increased from 13.84 Baht/kg in 1980 to 15.74 Baht/kg, or 13.7 percent, in 1981 when the exported quantity of frozen squid and cuttlefish increased by about 3.1 percent. Domestic wholesale price of squid and cuttlefish increased to 20.35 Baht/kg in 1983 when the quantity of squid and cuttlefish caught in the whole Kingdom that year was the largest in the past 15-year period and the export quantity and price declined about 7.7 percent and 4.3 percent respectively. Hence the increase in the domestic wholesale price that year was caused by higher domestic demand for squid and cuttlefish. Domestic wholesale price of squid and cuttlefish then decreased to 17.61 Baht/kg, or 13.5 percent, in 1984 while the quantity of squid and cuttlefish produced in the whole Kingdom decreased by about 2.1 percent, but the export price of frozen squid and cuttlefish declined by about 5.1 percent resulting from a reduction of the quantity of frozen squid and cuttlefish exported to Italy and because Thailand faced the severe competition in EEC markets of frozen squid and cuttlefish from Poland. Domestic wholesale price of squid and cuttlefish increased again to 23.45 Baht/kg, or 33.2 percent, in 1985 when the quantity of squid and cuttlefish caught in the whole Kingdom declined by about 2.5 percent and the export price of frozen squid and cuttlefish increased by about 15.9 percent. (See Tables 4.1, 4.2 and Figs. 4.1-4.4)

4.1.2 Trend of Bangkok Wholesale Prices

Quantity and wholesale price of squid and cuttlefish landed in the Bangkok Fish Market during 1971-1978 fluctuated highly and moved upwards during the last part of the trend studied. During the first period of the Bangkok wholesale price trend of squid and cuttlefish, wholesale prices increased from 4.00 Baht/kg in 1971 to 14.00 Baht/kg in 1975, while the quantity of squid and cuttlefish landed in the Bangkok Fish Market declined from 2,701 tons in 1971 and 5,698 tons in 1972 to

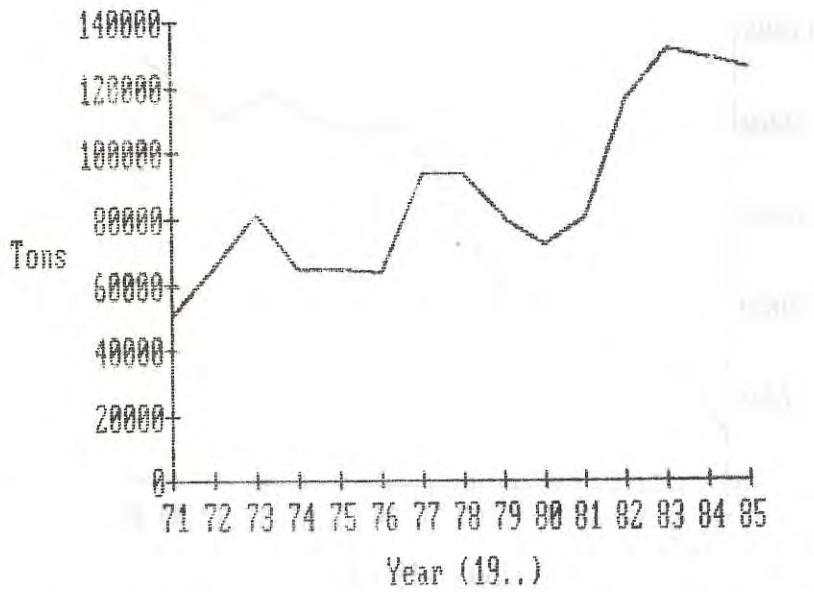


Fig. 4.1 National Quantity of Squid and Cuttlefish

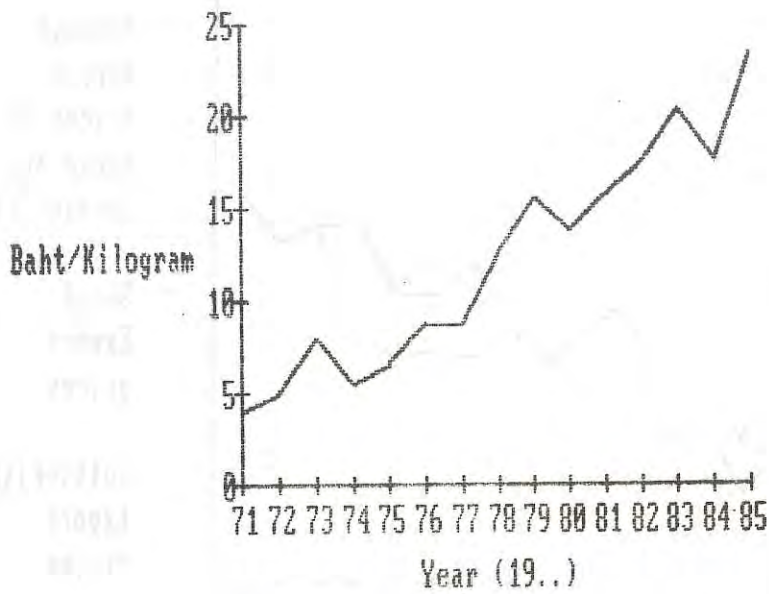


Fig. 4.2 National Wholesale Price of Squid and Cuttlefish

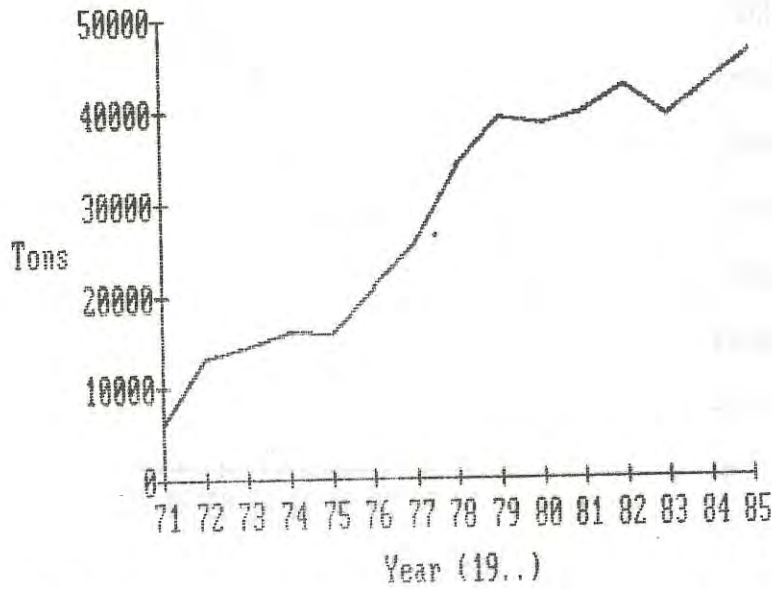


Fig. 4.3 Export Quantity of Squid and Cuttlefish

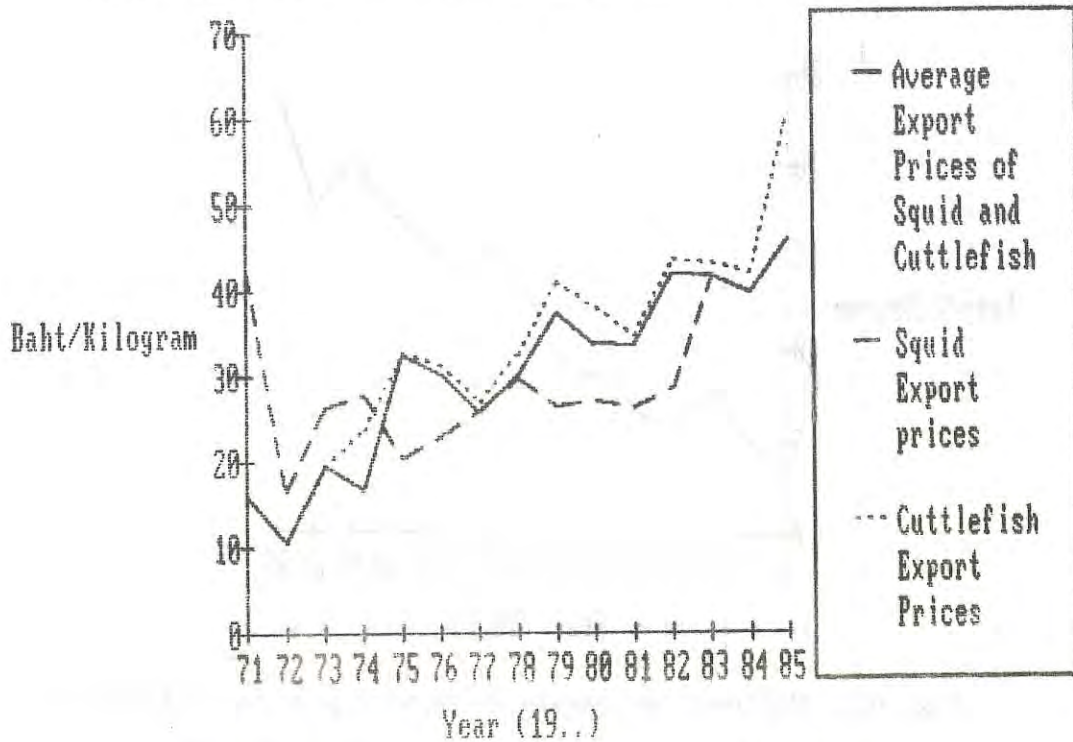


Fig. 4.4 Export Prices of Squid and Cuttlefish

2,508 tons, a minimum quantity in the 15-year period, in 1975. Moreover, export price of frozen squid and cuttlefish also increased during this period, especially in 1975 when the wholesale price of squid and cuttlefish increased by about 75 percent over the previous year and reached the maximum price of the first period of the price trend, since export price of frozen squid and cuttlefish increased by about 93.1 percent and quantity of squid and cuttlefish landed in the Bangkok Fish Market decreased by about 36 percent. Wholesale prices of squid and cuttlefish decreased to 12.00 Baht/kg in 1976 and 9.00 Baht/kg in 1977 while the quantity of squid and cuttlefish landed in the Bangkok Fish Market increased to 2,912 tons, or 16.1 percent, in 1976 and 5,109 tons, or 75.4 percent, in 1977, and export prices of squid and cuttlefish declined about 7 percent in 1976 and 14.2 percent in 1977.

The second period of the Bangkok wholesale price trend of squid and cuttlefish started in 1978 when squid and cuttlefish wholesale price in the Bangkok Fish Market increased to 13.00 Baht/kg, or 44.4 percent, in 1978 while the landed quantity of squid and cuttlefish increased to 6,583 tons, or 28.9 percent, and the export quantity and export price of frozen squid and cuttlefish increased by about 15.7 percent and 16.4 percent respectively. Squid and cuttlefish wholesale price in the Bangkok Fish Market then increased to 16.00 Baht/kg in 1979 and 17.00 Baht/kg in 1980 while the landed quantity of squid and cuttlefish decreased to 6,065 tons in 1979 and increased to 8,743 tons in 1980, and the export price of frozen squid and cuttlefish increased by about 24.4 percent in 1979 and decreased by about 10 percent in 1981. Squid and cuttlefish wholesale price in the Bangkok Fish Market decreased to 14.55 Baht/kg, or 14.4 percent, in 1981 while the quantity of squid and cuttlefish landed in this market increased to 10,748 tons, or 22.9 percent, and the squid and cuttlefish export price decreased by about 4.5 percent.

The third period of the squid and cuttlefish Bangkok wholesale price trend began in 1982 when wholesale prices increased to 20.49 Baht/kg in 1982 and 22.63 Baht/kg in 1983 while landed quantities of squid and cuttlefish increased to 13,502 tons in 1982, and 13,842 tons in 1983, the export price of frozen squid and cuttlefish increased about 24.8 percent in 1982 and decreased about 4.3 percent in 1983. Then the squid and cuttlefish wholesale price in the Bangkok Fish Market declined to 21.35 Bath/kg in 1984 and increased to 23.45 Baht/kg in 1985. When the landed quantities of squid and cuttlefish in this market increased to 14,594 tons in 1984 and decreased to 14,191 tons in 1985, squid and cuttlefish export price declined about 5.1 percent in 1984 and increased about 15.9 percent in 1985. (See Table 4.3 and Figs. 4.5 and 4.6)

4.1.3 Trends of Squid and Cuttlefish Wholesale Prices in the Provincial Markets

1. Data

The data on wholesale prices and quantities of squid and cuttlefish landed in seven FMO fishing ports, i.e., Samut Sakhon, Hua Hin, Ranong, Surat Thani, Phuket, Songkhla and Pattani for the analyses of price trends were annual average wholesale prices and aggregated annual quantities of squid and cuttlefish landed and sold at each fishing port from 1978 to 1985.

Among the seven FMO fishing ports, Samut Sakhon, one of the largest central fish markets, had highest volume of squid and cuttlefish landed, followed by Songkhla and Surat Thani which are located in areas of abundant supplies of squid and cuttlefish and had a higher capacity for producing a large volume of squid and cuttlefish. In 1985, the quantity of squid and cuttlefish landed and sold at Samut Sakhon's FMO fishing port was 20,599 tons as compared with 14,191 tons sold at the Bangkok Fish Market, 12,131 tons at Songkhla, 3,924 tons at Surat Thani, 481 tons at Hua Hin, 554 tons at Ranong, 177 tons at Phuket and 757 tons at Pattani.

Table 4.3 Quantity and Average Wholesale Price of Squid and Cuttlefish at Bangkok Fish Market

Quantity : Tons
Price : Baht/kg

Year	Quantity	Price
1971	2,701	4.00
1972	5,698	5.00
1973	3,484	8.00
1974	3,916	8.00
1975	2,508	14.00
1976	2,912	12.00
1977	5,109	9.00
1978	6,583	13.00
1979	6,065	16.00
1980	8,743	17.00
1981	10,748	14.55
1982	13,502	20.49
1983	13,842	22.63
1984	14,594	21.35
1985	14,191	23.45

Source : Fisheries Record, The Fish Marketing Organization.

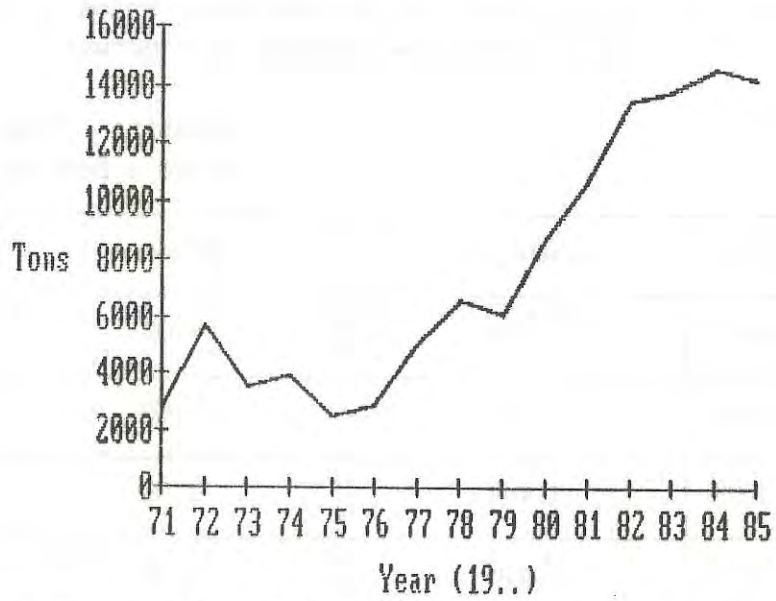


Fig. 4.5 Quantity of Squid and Cuttlefish at Bangkok Fish Market

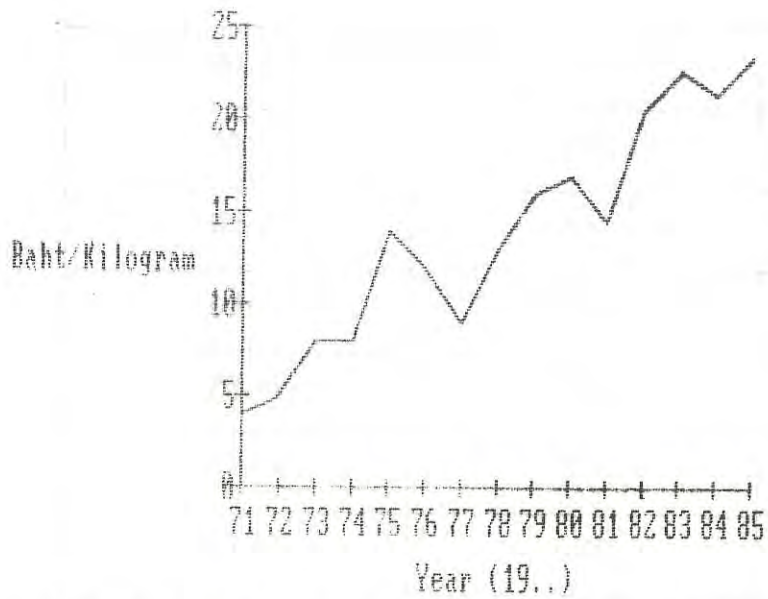


Fig. 4.6 Wholesale Price of Squid and Cuttlefish at Bangkok Fish Market

Comparison of average wholesale prices in each provincial market shows that squid and cuttlefish wholesale prices in Samut Sakhon and Hua Hin were rather high and higher than those in the Bangkok Fish Market. For instance, while average wholesale price of squid and cuttlefish in Bangkok was 23.45 Baht/kg in 1985, that in Samut Sakhon was 33.45 Baht/kg and that in Hua Hin was 34.62 Baht/kg. On the other hand, wholesale prices of squid and cuttlefish were rather low in Songkhla, Phuket and Surat Thani. For example, average wholesale prices of squid and cuttlefish in Songkhla in 1985 were 9.28 Baht/kg, in Phuket 13.48 Baht/kg, and in Surat Thani 13.83 Baht/kg as compared with 17.33 Baht/kg in Ranong and 18.31 Baht/kg in Pattani. This was because squid and cuttlefish landed in Samut Sakhon and Hua Hin fish markets were of a larger size and higher quality than those in other fish markets, hence they commanded a higher price than in the Bangkok Fish Market and in other provincial fish markets. On the other hand, squid and cuttlefish landed in Songkhla, Phuket and Ranong were of smaller size and lower quality than those in other fish markets, hence they fetched lower prices.

2. Prices Trend in Each Provincial Market

Samut Sakhon

Average wholesale price of squid and cuttlefish in Samut Sakhon's FMO fishing port was 22.10 Baht/kg in 1978 and increased to 22.60 Baht/kg, or 2.3 percent, in 1979, while the quantity of squid and cuttlefish landed in this market increased from 4,078 tons in 1978 to 10,595 tons, or 59.8 percent, in 1979. Wholesale prices of squid and cuttlefish decreased to 21.00 Baht/kg, or 7.1 percent, in 1980 when landed quantity increased to 12,638 tons or 19.3 percent. In 1981 landed quantity of squid and cuttlefish dropped to 8,144 tons, or 35.6 percent, and pushed the wholesale price up to 23.91 Baht/kg or 13.9 percent. From 1982 onwards, landed quantity of squid and cuttlefish increased annually from 15,322 tons in 1982 to 20,599 tons in 1985, while

wholesale prices of squid and cuttlefish rose from 28.57 Baht/kg and 29.17 Baht/kg in 1982 and 1983 respectively, then decreased to 25.01 Baht/kg, or 14.3 percent, in 1984 when landed quantity of squid and cuttlefish increased about 11.3 percent that year.

However, wholesale price of squid and cuttlefish again increased to 33.45 Baht/kg, or 33.7 percent, in 1985 when the squid and cuttlefish landed quantity increased about 12.8 percent. (See Tables 4.4, 4.5 and Figs. 4.7, 4.8)

Hua Hin

Wholesale prices of squid and cuttlefish in Hua Hin's FMO fishing port showed a rising trend during 1978-1985. Squid and cuttlefish wholesale price increased from 13.21 Baht/kg in 1978 to 15.34 Baht/kg in 1979 and decreased to 13.27 Baht/kg in 1980, while the landed quantity decreased from 1,530 tons in 1978 to 840 tons, or 45.1 percent, in 1979 and increased again to 932 tons, or 11 percent, in 1980.

Wholesale price of squid and cuttlefish in Hua Hin again increased to 15.55 Baht/kg in 1981, 20.68 Baht/kg in 1982 and 25.42 Baht/kg in 1983, while landed quantity decreased from 1,208 tons in 1981 to 705 tons in 1982 and increased to 1,101 tons in 1983. Wholesale price of squid and cuttlefish decreased to 21.95 Baht/kg, or 15.6 percent, in 1984 when landed quantity increased to 1,101 tons, an increase of about 56.2 percent over the 1983 landed quantity. However the wholesale price of squid and cuttlefish increased to 34.62 Baht/kg, or 61.4 percent, in response to the reduction of landed quantity of squid and cuttlefish in the market to 481 tons, representing a 60 percent decrease that year. (See Tables 4.4, 4.5 and Figs. 4.9, 4.10)

Table 4.4 Quantity of Squid and Cuttlefish Landed at
Major Fish Markets and Fishing Ports

(Tons)

Year	Samut Sakhon	Hua Hin	Ranong	Surat Thani	Phuket	Songkla	Pattani
1978	4,078	1,530	174	2,192	30	9,409	699
1979	10,595	840	445	2,573	208	16,279	1,188
1980	12,638	932	391	2,182	132	10,117	1,108
1981	8,144	1,208	268	2,887	187	11,628	868
1982	15,322	705	368	4,457	436	9,680	967
1983	16,401	1,101	521	3,743	451	14,023	1,268
1984	18,255	1,202	516	4,132	147	14,518	1,328
1985	20,599	481	554	3,924	177	12,131	757

Source : Fisheries Record, The Fish Marketing Organization.

Table 4.5 Average Wholesale Price of Squid and Cuttlefish
Landed at Major Fish Markets and Fishing Ports

(Baht/kg)

Year	Samut Sakhon	Hua Hin	Ranong	Surat Thani	Phuket	Songkla	Pattani
1978	22.10	13.21	11.52	5.62	8.00	18.77	15.68
1979	22.60	15.34	14.65	11.37	8.65	19.25	16.76
1980	21.00	13.27	18.08	10.40	13.42	22.97	18.53
1981	23.91	15.55	17.67	10.14	13.13	14.50	18.65
1982	28.57	20.68	22.05	12.31	16.11	16.79	23.74
1983	29.17	25.42	23.38	12.85	14.18	11.77	27.26
1984	25.01	21.95	18.14	14.51	13.83	9.12	19.15
1985	33.45	34.62	17.33	13.83	13.48	9.28	18.31

Source : Fisheries Record, The Fish Marketing Organization.



Fig. 4.7 Quantity of Squid and Cuttlefish at Samut Sakhon Fish Market

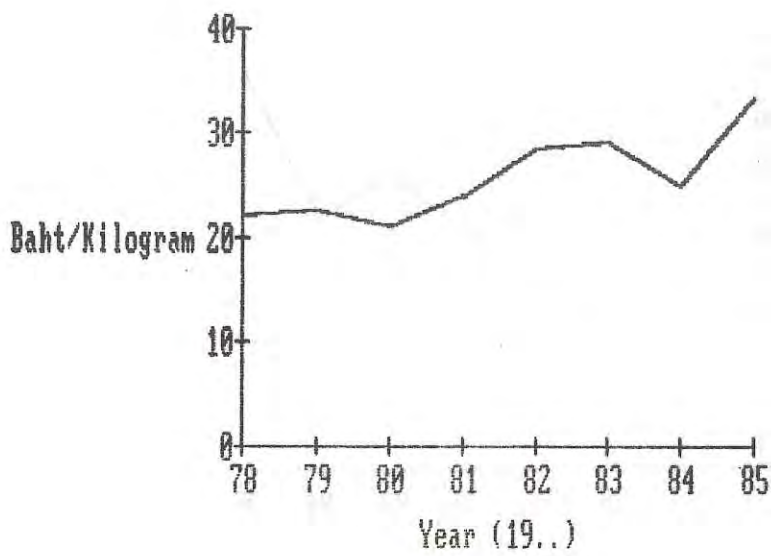


Fig. 4.8 Wholesale Price of Squid and Cuttlefish at Samut Sakhon Fish Market

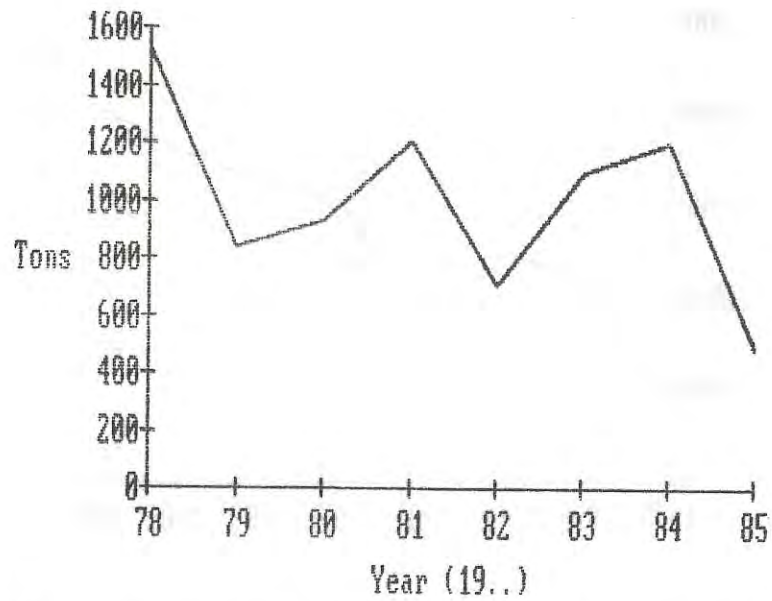


Fig. 4.9 Quantity of Squid and Cuttlefish at Hua Hin Fish Market

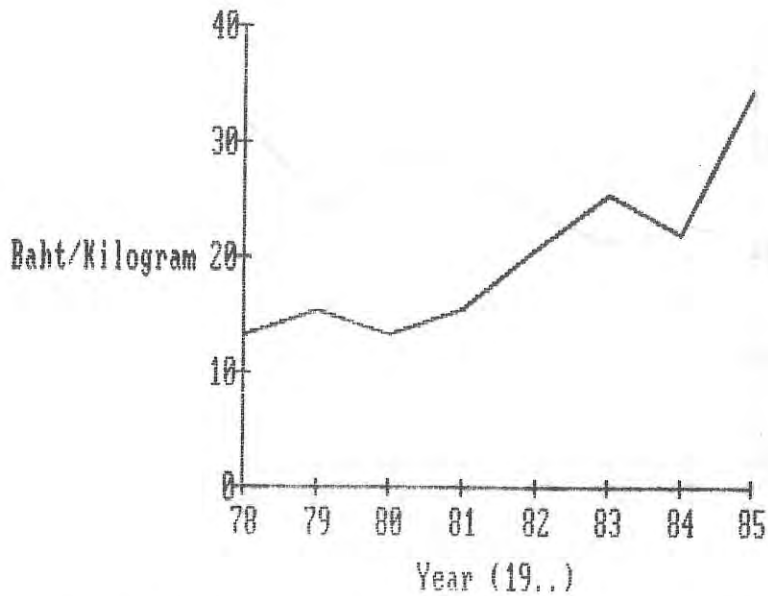


Fig. 4.10 Wholesale Price of Squid and Cuttlefish at Hua Hin Fish Market

Ranong

The first period of the wholesale price trend of squid and cuttlefish landed in Ranong's FMO fishing port during 1978-1985 was from 1978 to 1981. Wholesale prices of squid and cuttlefish landed in Ranong's FMO fishing port rose from 11.52 Baht/kg in 1978 to 14.65 Baht/kg in 1979 and 18.08 Baht/kg in 1980 and declined to 17.67 Baht/kg in 1981, while the landed quantity of squid and cuttlefish in this fishing port increased from 174 tons in 1978 to 445 tons in 1979, and declined to 391 tons in 1980 and 268 tons in 1981. In the second period of the wholesale price trend, prices rose to 22.05 Baht/kg in 1982, and 23.38 Baht/kg, a maximum price, in 1983, then declined to 18.14 Baht/kg in 1984 and 17.33 Baht/kg in 1985, while landed quantity of squid and cuttlefish increased from 368 tons in 1982 to 521 tons in 1983, decreased to 516 tons in 1984 and increased again to 554 tons in 1985. (See Tables 4.4, 4.5 and Figs. 4.11, 4.12)

Surat Thani

Both wholesale price and quantity of squid and cuttlefish landed at Surat Thani's FMO fishing port showed rising trends during 1978-1985. In the first period of the price trend, wholesale prices of squid and cuttlefish landed at FMO's Surat Thani fishing port increased from 5.62 Baht/kg in 1978 to 11.37 Baht/kg in 1979, decreased to 10.40 Baht/kg in 1980 and 10.14 Baht/kg in 1981 while landed quantity of squid and cuttlefish in the market increased from 2,192 tons in 1978 to 2,573 tons in 1979 and decreased to 2,182 tons in 1980, and increased again to 2,887 tons in 1981.

In the second period of the price trend, wholesale prices of squid and cuttlefish rose from 12.31 Baht/kg in 1982 to 12.85 Baht/kg in 1983, 14.51 Baht/kg in 1984 and decreased to 13.83 Baht/kg in 1985, while landed quantity of squid and cuttlefish decreased from 4,457 tons in 1982 to 3,743 tons in 1983, increased to 4,132 tons in 1984 and decreased again to 3,924 tons in 1985. (See Tables 4.4, 4.5 and Figs. 4.13, 4.14)

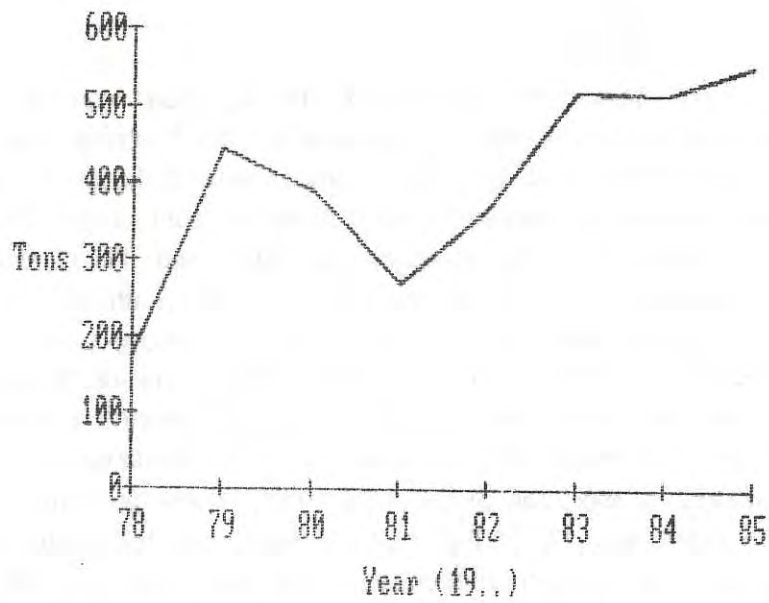


Fig. 4.11 Quantity of Squid and Cuttlefish at Ranong Fish Market

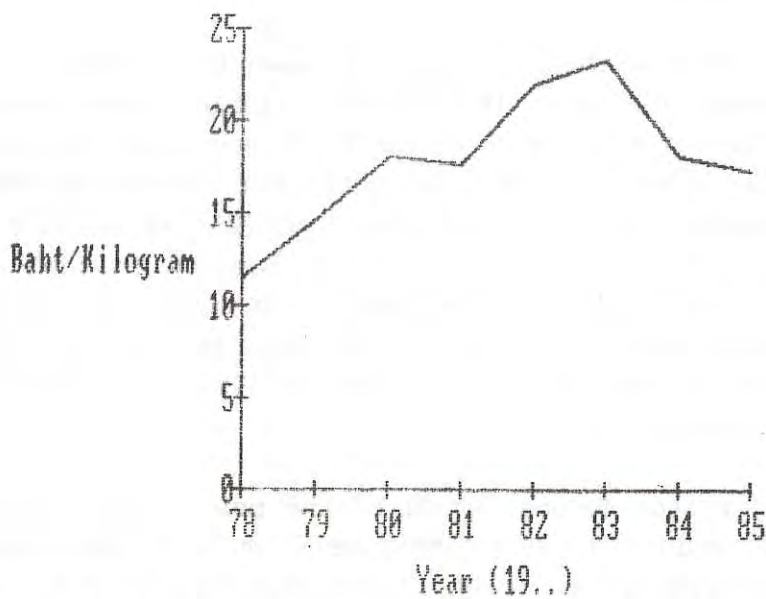


Fig. 4.12 Wholesale Price of Squid and Cuttlefish at Ranong Fish Market

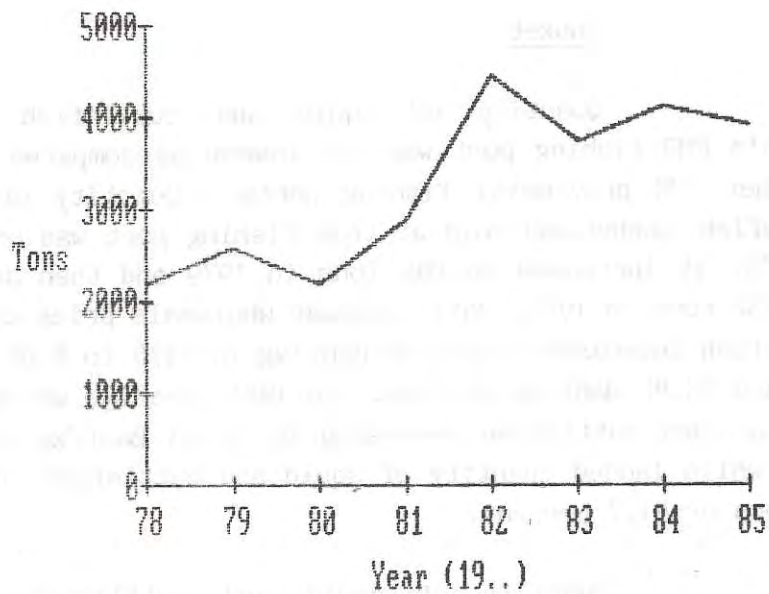


Fig. 4.13 Quantity of Squid and Cuttlefish at Surat Thani Fish Market

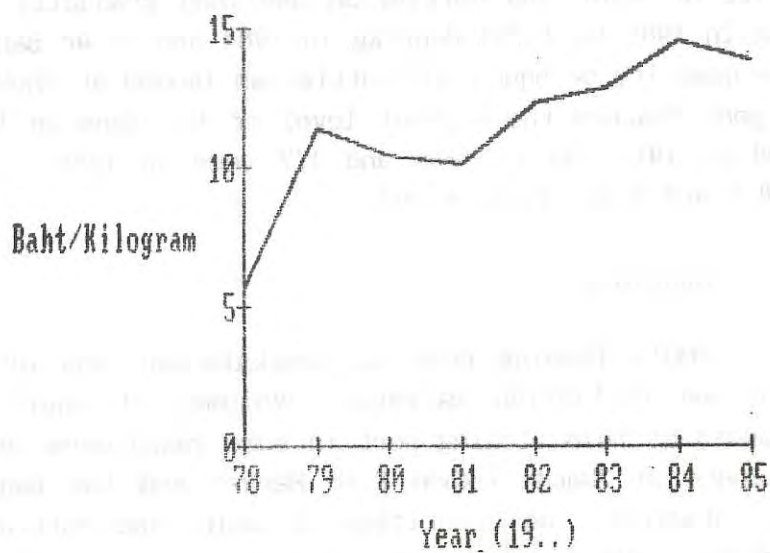


Fig. 4.14 Wholesale Price of Squid and Cuttlefish at Surat Thani Fish Market

Phuket

Quantity of squid and cuttlefish landed at Phuket's FMO fishing port was the lowest as compared with those of other FMO provincial fishing ports. Quantity of squid and cuttlefish landed and sold at this fishing port was only 30 tons in 1978; it increased to 208 tons in 1979 and then decreased to only 132 tons in 1980, while average wholesale price of squid and cuttlefish increased from 8.00 Baht/kg in 1978 to 8.65 Baht/kg in 1979 and 13.42 Baht/kg in 1980. In 1981, average wholesale price of squid and cuttlefish decreased to 13.13 Baht/kg or 2.2 percent, while landed quantity of squid and cuttlefish increased to 187 tons or 41.7 percent.

Quantity of squid and cuttlefish landed in Phuket's FMO fishing port in 1982 increased sharply to 436 tons or 133.2 percent. However, squid and cuttlefish wholesale price increased to 16.11 Baht/kg, a maximum price, in 1982. Then wholesale price of squid and cuttlefish declined gradually from 14.18 Baht/kg in 1983 to 13.83 Baht/kg in 1984 and 13.48 Baht/kg in 1985 while quantity of squid and cuttlefish landed at Phuket's FMO fishing port reached the highest level of 451 tons in 1983, then declined to 147 tons in 1984 and 177 tons in 1985. (See Tables 4.4, 4.5 and Figs. 4.15, 4.16)

Songkhla

FMO's fishing port in Songkhla was one of the largest squid and cuttlefish markets. Volumes of squid and cuttlefish landed at this fishing port in some years were larger than those landed at Samut Sakhon Fish Market and the Bangkok Fish Market. However, the quantities of squid and cuttlefish sold in Songkhla's FMO fishing port in recent years were much lower than those sold in Samut Sakhon Fish Market and the Bangkok Fish Market. For instance, the quantity of squid and cuttlefish landed in Songkhla's FMO fishing port was 14,518 tons in 1984, while quantities in Samut Sakhon and Bangkok were 18,255 tons and

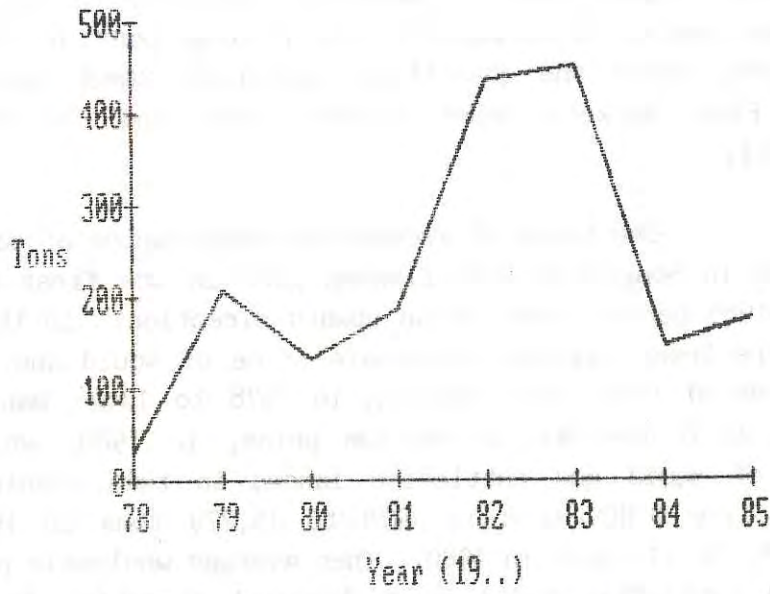


Fig. 4.15 Quantity of Squid and Cuttlefish at Phuket Fish Market

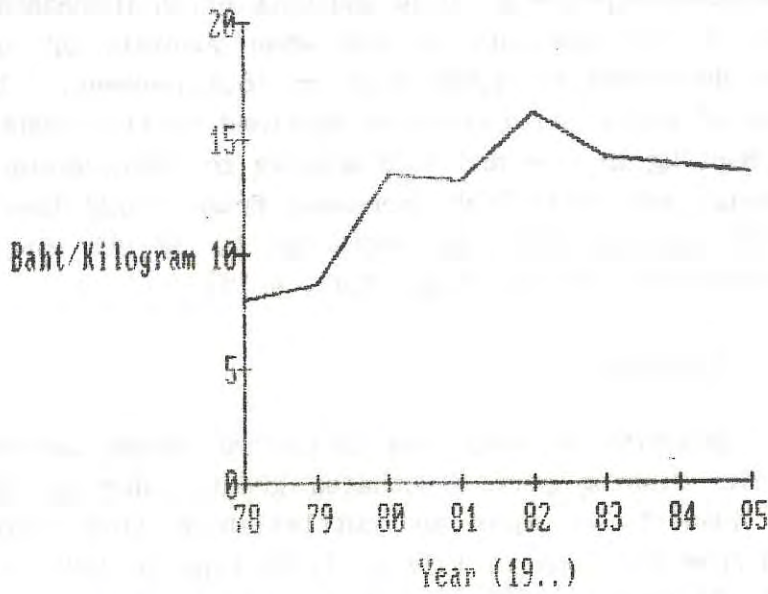


Fig. 4.16 Wholesale Price of Squid and Cuttlefish at Phuket Fish Market

14,594 tons respectively. Similarly, quantity of squid and cuttlefish landed in Songkhla's FMO fishing port in 1985 was 12,131 tons, while the quantities landed at Samut Sakhon and Bangkok Fish Markets were 20,599 tons and 14,191 tons respectively.

The trend of average wholesale price of squid and cuttlefish in Songkhla's FMO fishing port in the first part of the 1978-1985 period moved in an upward direction. In the first part of the trend, average wholesale price of squid and cuttlefish increased from 18.77 Baht/kg in 1978 to 19.25 Baht/kg in 1979 and 22.97 Baht/kg, a maximum price, in 1980, while the quantity of squid and cuttlefish landed in this fishing port increased from 9,409 tons in 1978 to 16,279 tons in 1979 and declined to 10,117 tons in 1980. Then average wholesale price of squid and cuttlefish moved in a downward direction from 1981 onwards. Wholesale price of squid and cuttlefish declined to 14.50 Baht/kg, or 36.9 percent, in 1981 when landed quantity of squid and cuttlefish increased to 11,628 tons or 14.9 percent. However, the wholesale price of squid and cuttlefish increased to 16.79 Baht/kg, or 15.9 percent, in 1982 when quantity of squid and cuttlefish decreased to 9,680 tons or 16.8 percent. Then wholesale price of squid and cuttlefish declined to 11.77 Baht/kg in 1983, 9.12 Baht/kg in 1984 and 9.28 Baht/kg in 1985, while the quantity of squid and cuttlefish increased from 14,023 tons in 1983, to 14,518 tons in 1984 and decreased to 12,131 tons in 1985. (See Tables 4.4, 4.5 and Figs. 4.17, 4.18)

Pattani

Quantity of squid and cuttlefish landed and sold at Pattani's FMO fishing port fluctuated greatly during 1978-1985. Landed quantity of squid and cuttlefish at this fishing port increased from 699 tons in 1978 to 1,188 tons in 1979, then decreased to 1,108 tons in 1980, 868 tons in 1981, and increased again to 967 tons in 1982, 1,268 tons in 1983, 1,328 tons, the maximum quantity, in 1984 and finally decreased to 757 tons in 1985. (See Table 4.4 and Fig. 4.19)

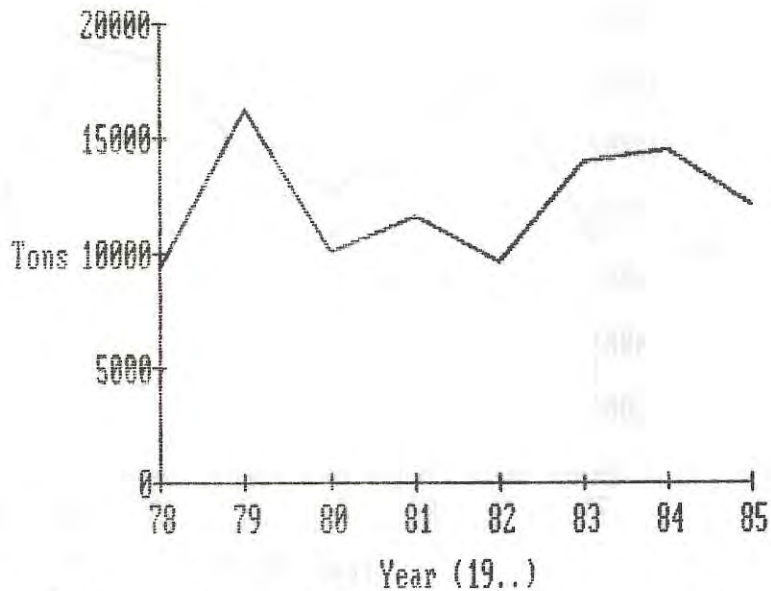


Fig. 4.17 Quantity of Squid and Cuttlefish at Songkhla Fish Market

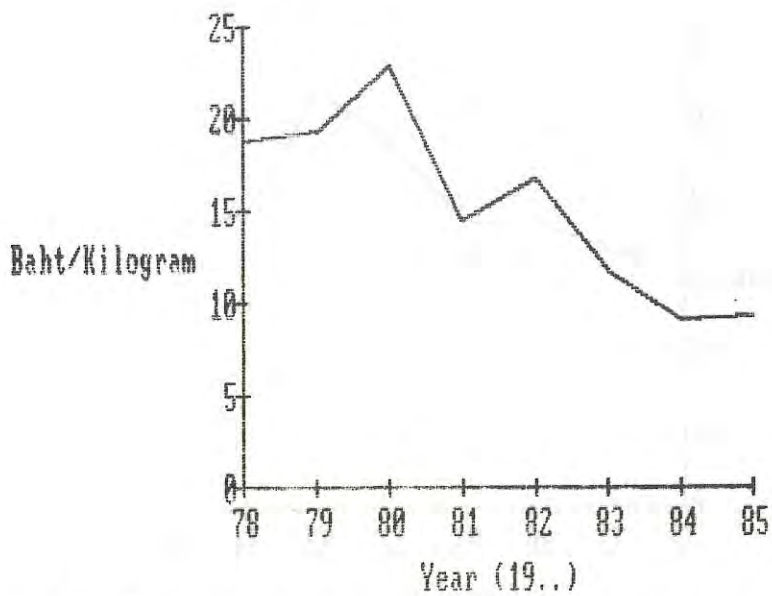


Fig. 4.18 Wholesale Price of Squid and Cuttlefish at Songkhla Fish Market

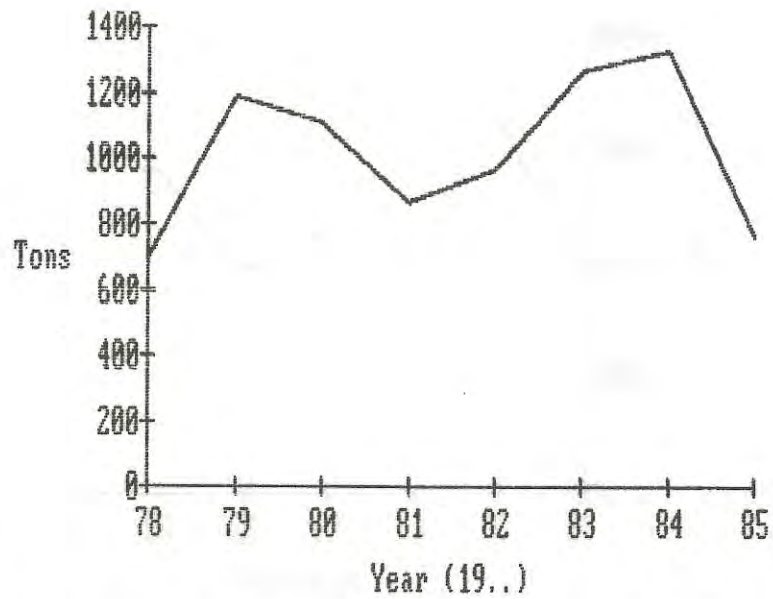


Fig. 4.19 Quantity of Squid and Cuttlefish at Pattani Fish Market

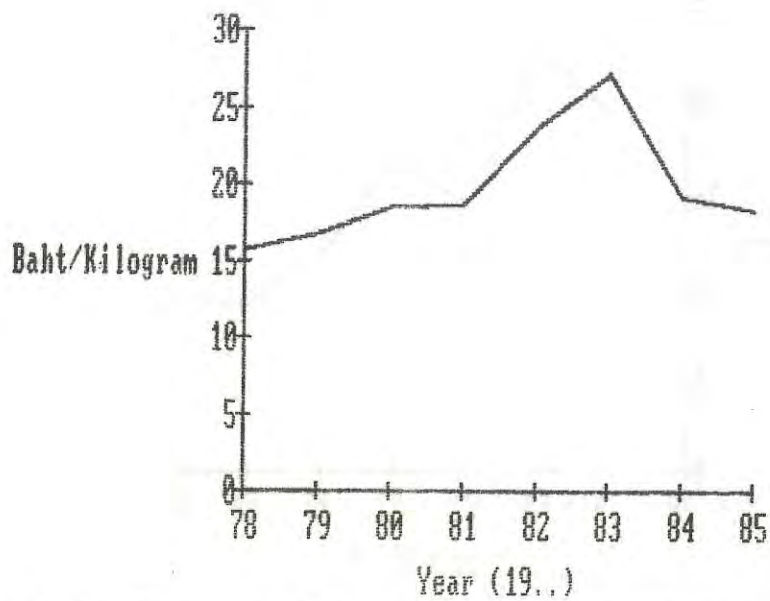


Fig. 4.20 Wholesale Price of Squid and Cuttlefish at Pattani Fish Market

Average wholesale price of squid and cuttlefish in Pattani's FMO fishing port moved steadily in an upward direction during 1978-1983 from 15.68 Baht/kg in 1978 to 27.26 Baht/kg, the maximum price, in 1983. However, wholesale price of squid and cuttlefish declined to 19.15 Baht/kg in 1984 and 18.31 Baht/kg in 1985. (See Table 4.5 and Fig. 4.20)

4.2 Seasonal Indices of Squid and Cuttlefish

4.2.1 Data

The analysis of seasonal price indices and seasonal quantity indices of squid and cuttlefish sold in each market used monthly price and quantity data of squid and cuttlefish sold in that market from 1 January 1981 to 31 December 1985. The seasonal price indices of squid and cuttlefish sold at the Bangkok Fish Market were constructed separately between seasonal price indices of squid and seasonal price indices of cuttlefish, while the quantity indices were constructed aggregately for both squid and cuttlefish. However, the calculations of both seasonal price and quantity indices of squid and cuttlefish sold in each of the seven provincial fishing ports were made aggregately for both squid and cuttlefish.

4.2.2 Results

1. Bangkok Fish Market

The analysis of both squid and cuttlefish monthly wholesale prices in the Bangkok Fish Market from 1 January 1981 to 31 December 1985 shows that, while squid wholesale prices moved in an upward direction, cuttlefish wholesale prices, on the other hand, moved in a downward direction. Moreover, cuttlefish wholesale prices were always higher than squid wholesale prices. For instance, average monthly wholesale price of squid increased from 16.66 Baht/kg in 1981 to 20.20 Baht/kg in 1982, 20.71 Baht/kg in 1983, 21.47 Baht/kg in 1984 and 26.05 Baht/kg in

1985, while average monthly wholesale prices of cuttlefish increased from 19.60 Baht/kg in 1981 to 29.00 Baht/kg in 1982, then decreased to 27.31 Baht/kg in 1983 and 24.08 Baht/kg in 1984 and then increased slightly to 24.75 Baht/kg in 1985.

The analysis of seasonal quantity indices of both squid and cuttlefish landed in the Bangkok Fish Market shows that quantities of squid and cuttlefish landed were usually lower than the average monthly quantity in January and February, and were higher than the average quantity during the period March to June, with the maximum quantity in May. Then quantities of squid and cuttlefish landed declined and were lower than the average monthly quantity from July through December, which was the month of minimum landed quantity. (See Table 4.6 and Fig. 4.21)

Seasonal movements of squid monthly wholesale prices in the Bangkok Fish Market were such that prices were normally higher than the average monthly wholesale price in January, February and March with the maximum price in February when landed quantity of squid and cuttlefish was low and export price of frozen squid was high. Squid wholesale price was also high in December when landed quantity of squid and cuttlefish was the lowest and export price of frozen squids was the highest of the year. Squid wholesale prices were normally lower than the average monthly wholesale price from April through November, especially in May and June when quantities of squid and cuttlefish landed in these months were much lower than those landed in other months, average wholesale price of squid and cuttlefish being lowest in June. (See Tables 4.6, 4.7 and Figs. 4.22, 4.24 and 4.25)

Seasonal movements of cuttlefish monthly wholesale prices in the Bangkok Fish Market were similar to those of squid wholesale prices. Cuttlefish wholesale prices were normally higher than the average monthly wholesale price during the period January to March, and during November and December which were months of low landed quantity of squid and cuttlefish and a high export price for frozen cuttlefish. Cuttlefish wholesale price was highest in November. On the other hand, cuttlefish wholesale prices were normally lower than the average monthly wholesale price between April and June when landed quantities of squid and cuttlefish were abnormally high and export prices of frozen cuttlefish were low, and between August and October when both landed quantities of squid and cuttlefish and export prices of frozen cuttlefish were low owing to low overseas demand. Cuttlefish wholesale price was lowest in August. (See Tables 4.6, 4.7 and Figs. 4.23, 4.26 and 4.27)



Table 4.6 Seasonal Quantity Indices and Seasonal Price Indices of Squid and Cuttlefish at Bangkok Fish Market, 1981-1985

Month	Squid and Cuttlefish Quantity Indices	Price Indices	
		Squid	Cuttlefish
Jan.	88.23	106.17	101.32
Feb.	83.20	112.03	102.20
Mar.	111.70	104.13	101.54
Apr.	124.07	97.68	96.11
May.	134.46	93.75	99.83
Jun.	118.49	93.05	99.90
Jul.	94.20	96.93	100.06
Aug.	88.80	95.00	92.73
Sep.	96.41	98.38	96.03
Oct.	89.95	98.43	98.45
Nov.	95.28	98.32	107.42
Dec.	75.21	106.13	104.20

Table 4.7 Seasonal Quantity Indices and Seasonal Price Indices of Squid and Cuttlefish Export

Month	Squid Export		Cuttlefish Export	
	Quantity	Price	Quantity	Price
Jan.	41.43	111.82	68.49	117.14
Feb.	60.84	100.47	78.63	106.04
Mar.	79.64	102.39	93.92	107.02
Apr.	124.50	97.84	106.12	100.96
May.	152.33	90.84	133.11	98.56
Jun.	143.38	99.82	115.73	90.85
Jul.	110.95	82.00	106.39	94.07
Aug.	84.64	77.17	101.25	95.44
Sep.	100.03	94.13	100.35	94.31
Oct.	113.71	105.86	113.64	99.41
Nov.	98.43	121.26	112.36	93.56
Dec.	90.13	116.41	70.01	102.66

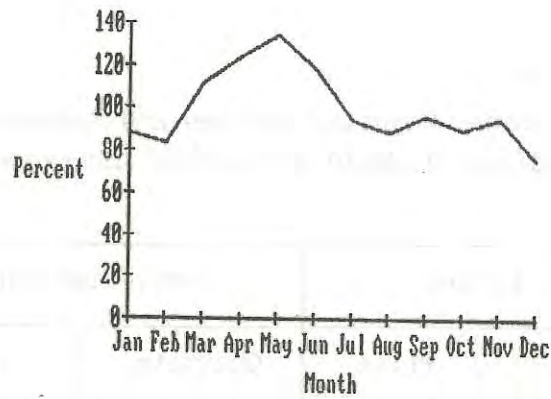


Fig. 4.21 Seasonal Quantity Indices of Squid and Cuttlefish at Bangkok Fish Market, 1981-1985

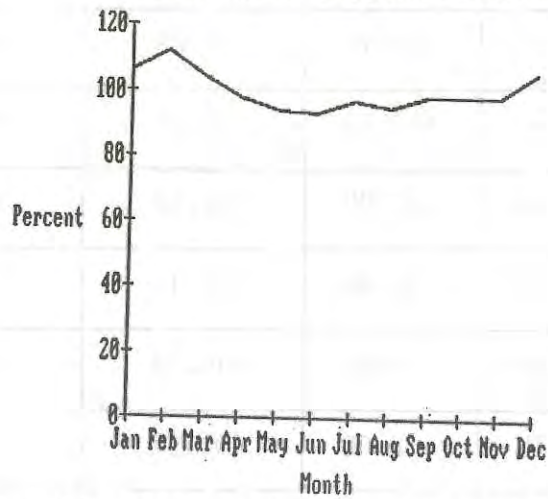


Fig. 4.22 Seasonal Price Indices of Squid at Bangkok Fish Market, 1981-1985

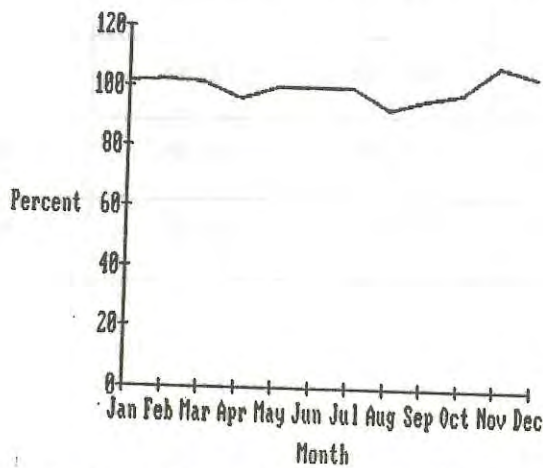


Fig. 4.23 Seasonal Price Indices of Cuttlefish at Bangkok Fish Market, 1981-1985

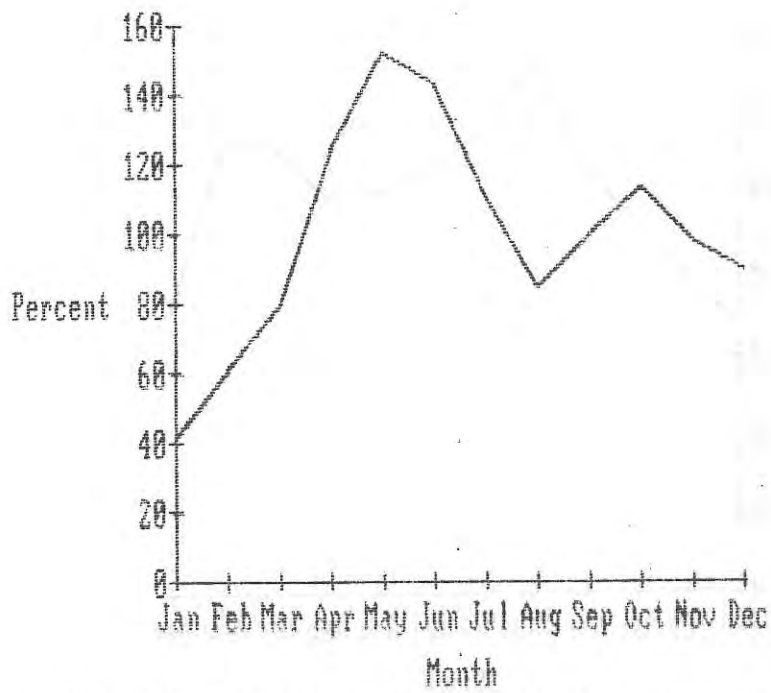


Fig. 4.24 Seasonal Quantity Indices of Squid Export, 1981-1985

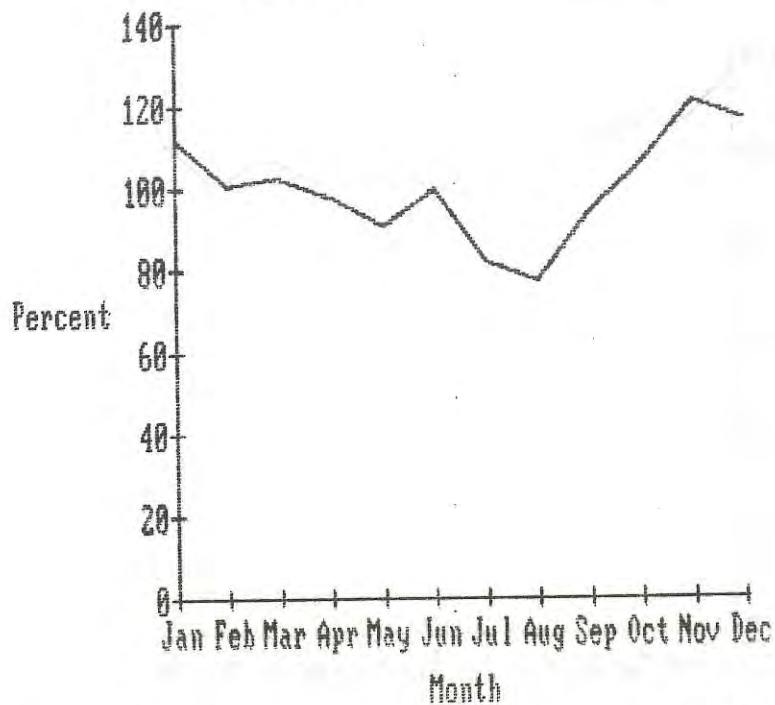


Fig. 4.25 Seasonal Price Indices of Squid Export, 1981-1985

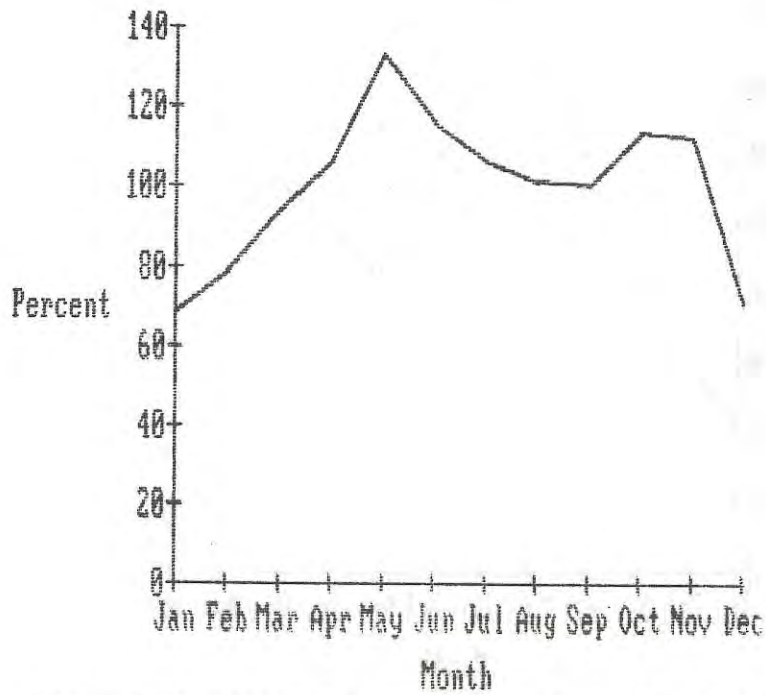


Fig. 4.26 Seasonal Quantity Indices of Cuttlefish Export, 1981-1985

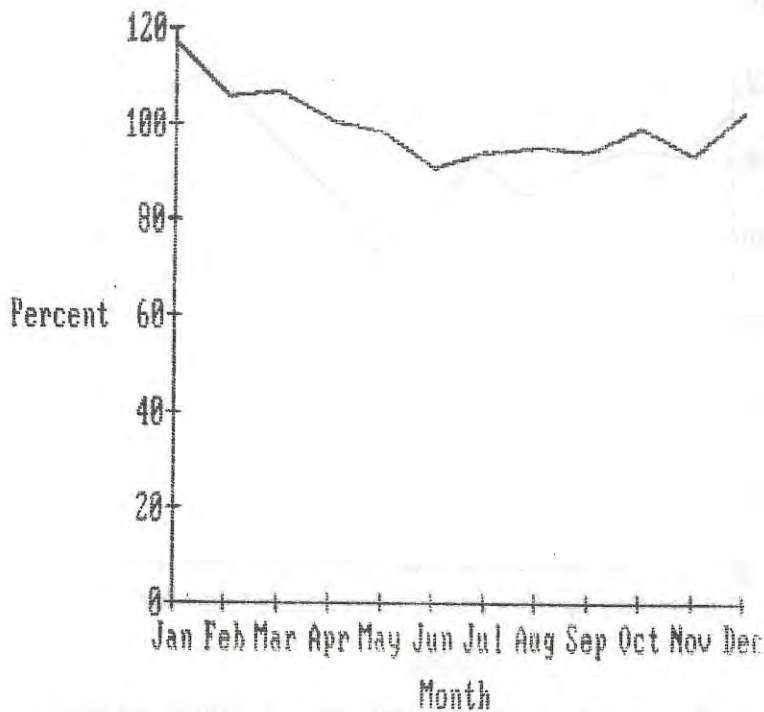


Fig. 4.27 Seasonal Price Indices of Cuttlefish Export, 1981-1985

2. Provincial Fish Markets

Seasonal indices of squid and cuttlefish landed quantities and wholesale prices in seven major provincial fish markets are shown in Tables 4.8 and 4.9. An analysis of each market is given below.

Samut Sakhon

The seasonal quantity movement of squid and cuttlefish landed at the Samut Sakhon Fish Market was similar to that in the Bangkok Fish Market. Landed quantities of squid and cuttlefish were normally lower than the average monthly quantity during the period January to March, then increased to more than the average monthly quantity from April through June, May being the month when the landed quantity was highest. Landed quantities of squid and cuttlefish at the Samut Sakhon Fish Market then declined but were still higher than the average monthly quantity from July through October. Finally, the quantity of squid and cuttlefish declined again to lower than the average quantity in November, and in December, the month of minimum landed quantity in the year. (See Table 4.8 and Fig. 4.28)

Seasonal price movements of squid and cuttlefish landed in Samut Sakhon Fish Market throughout a year were such that monthly wholesale prices were normally high from January through March and also in December. Wholesale price of squid and cuttlefish was highest in January. Prices then declined but were still above the average level in February and March when quantities of squid and cuttlefish landed at this market were low. Wholesale prices of squid and cuttlefish were normally lower than the average monthly wholesale price from April through October, the month of the maximum wholesale price in the year. Squid and cuttlefish wholesale price was still below the average monthly wholesale price in November despite quantities of squid and cuttlefish landed having declined to below the average quantity. However, wholesale price of squid and cuttlefish increased and was above the average monthly wholesale price in December when the landed quantity of squid and cuttlefish in this market was the lowest of the year. (See Table 4.9 and Fig. 4.29)

Table 4.8 Seasonal Quantity Indices of Squid and
Cuttlefish at Provincial Fish Markets, 1981-1985

Month	Samut Sakhon	Hua Hin	Ranong	Surat Thani	Phuket	Songkhla	Pattani
Jan.	82.34	35.94	100.42	72.71	92.39	59.53	67.53
Feb.	76.50	48.10	95.43	56.68	118.34	69.70	97.43
Mar.	97.01	134.77	129.03	68.53	118.66	94.07	87.46
Apr.	114.56	155.93	109.38	109.03	127.94	111.26	88.33
May.	129.92	154.48	99.88	156.05	105.31	123.62	123.28
Jun.	118.42	101.92	80.06	147.62	62.86	116.80	105.80
Jul.	110.08	95.57	88.56	124.02	111.49	114.38	101.15
Aug.	103.10	93.80	79.48	114.74	58.32	117.47	125.81
Sep.	102.03	133.66	90.38	95.30	75.35	118.38	127.03
Oct.	102.03	146.52	98.16	126.80	50.51	125.79	103.07
Nov.	92.36	78.43	120.94	83.43	119.20	95.02	119.63
Dec.	70.64	20.87	108.27	45.08	159.63	53.98	53.49

Table 4.9 Seasonal Price Indices of Squid and Cuttlefish
at Provincial Fish Markets, 1981-1985

Month	Samut Sakhon	Hua Hin	Ranong	Surat Thani	Phuket	Songkhla	Pattani
Jan.	113.67	114.44	106.04	100.53	103.74	102.96	100.97
Feb.	111.50	102.56	96.52	102.44	95.36	101.96	111.17
Mar.	106.17	103.99	91.15	101.76	98.70	105.67	110.42
Apr.	100.10	91.30	91.88	101.03	93.98	96.60	80.41
May.	96.59	97.75	97.20	98.62	116.73	95.48	100.45
Jun.	96.83	86.54	100.06	96.31	92.59	97.79	102.07
Jul.	96.09	89.60	103.59	90.49	95.67	91.33	109.19
Aug.	94.52	91.36	98.35	101.12	96.61	96.70	102.59
Sep.	93.00	93.95	95.14	100.77	101.43	105.13	97.41
Oct.	91.15	111.29	97.21	101.92	100.02	96.35	88.91
Nov.	94.65	107.12	106.22	100.78	102.77	105.55	91.42
Dec.	105.73	110.11	116.65	104.21	102.41	104.48	105.15

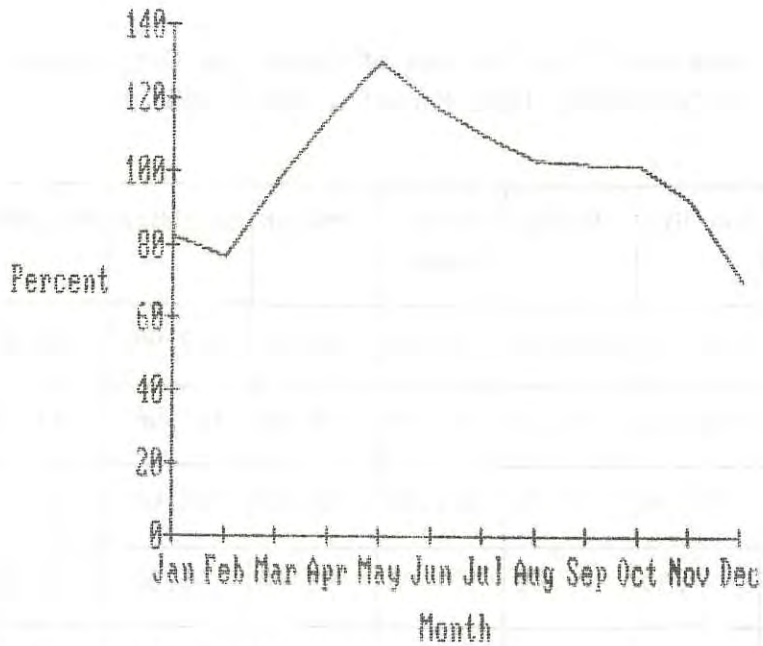


Fig. 4.28 Seasonal Quantity Indices of Squid and Cuttlefish at Samut Sakhon Fish Market, 1981-1985

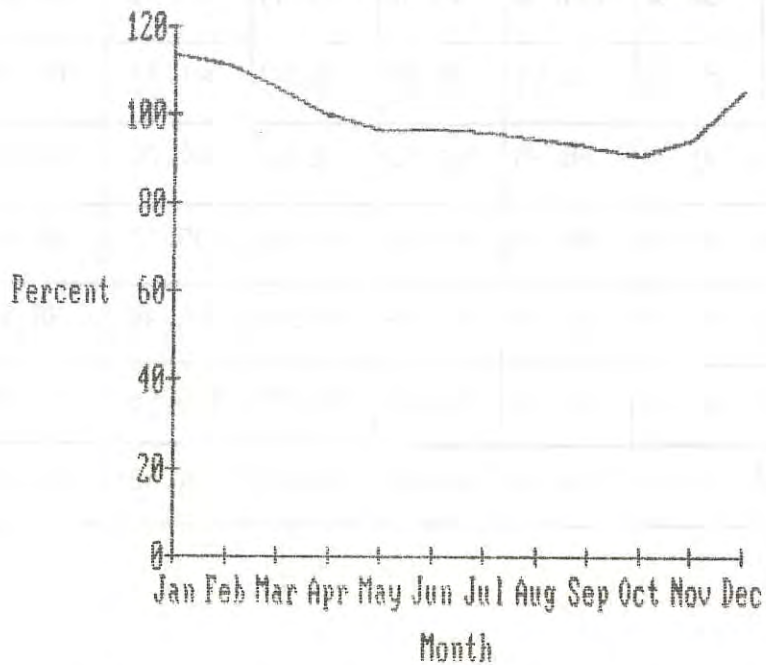


Fig. 4.29 Seasonal Price Indices of Squid and Cuttlefish at Samut Sakhon Fish Market, 1981-1985

Hua Hin

Quantities of squid and cuttlefish landed at Hua Hin's FMO fishing port were normally very low in January and February, then sharply increased to high levels in March, April and May, with the maximum landed quantity in April. Landed quantity of squid and cuttlefish in this fishing port again declined to low levels during June and August, and increased to high levels in September and October. Finally landed quantity of squid and cuttlefish decreased sharply to below the average landed quantity in November and December, the month of the minimum landed quantity. The difference between the landed quantity of squid and cuttlefish in December, the minimum landed quantity, and that in April, the maximum landed quantity, was about 130 percent, which shows that quantities of squid and cuttlefish landed in Hua Hin's FMO fishing port fluctuated greatly throughout the year. (See Table 4.8 and Fig. 4.30)

Squid and cuttlefish wholesale prices in Hua Hin market were at high levels during January to March, and during October to December. Squid and cuttlefish wholesale price at Hua Hin's FMO fishing port was also highest in January as in Samut Sakhon market. This was because landed quantities of squid and cuttlefish were rather low during these periods. On the other hand, squid and cuttlefish wholesale prices at Hua Hin's FMO fishing port were normally low and were below the average level in April, the month of maximum landed quantity, May and June, the month of the minimum wholesale price.

Therefore, the seasonal movement of squid and cuttlefish wholesale prices in Hua Hin throughout the year started to decline after the maximum price in January downward to the minimum level in June, then started to increase to high levels from May through November. (See Table 4.9 and Fig. 4.31)

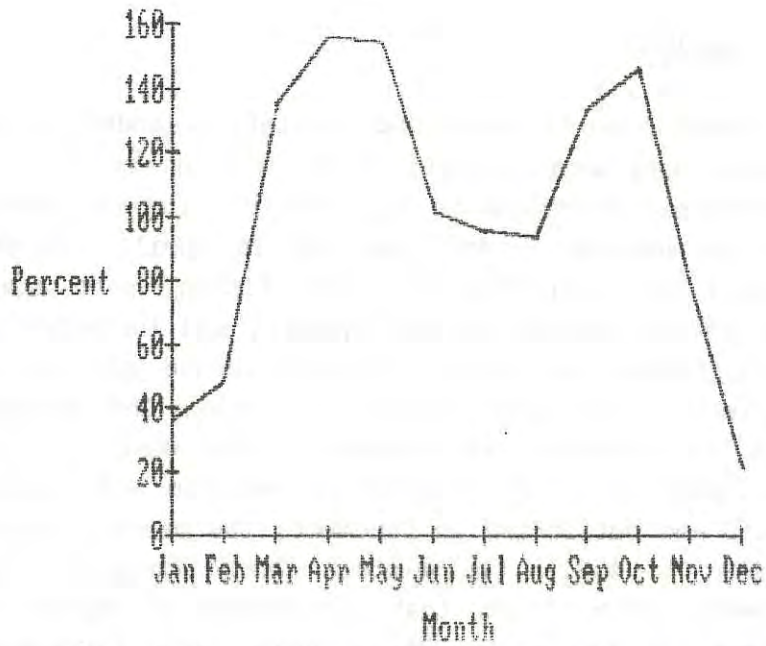


Fig. 4.30 Seasonal Quantity Indices of Squid and Cuttlefish at Hua Hin Fish Market, 1981-1985

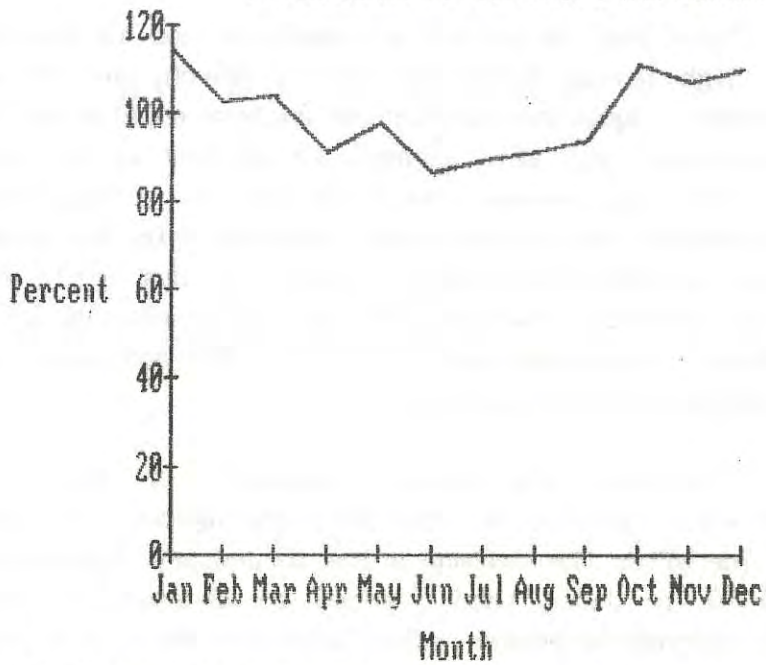


Fig. 4.31 Seasonal Price Indices of Squid and Cuttlefish at Hua Hin Fish Market, 1981-1985

Ranong

Quantity of squid and cuttlefish landed at Ranong's FMO fishing port was at the same level as the average level in January and declined to below the average level in February. Landed quantity of squid and cuttlefish then increased sharply to above the average monthly landed quantity in March, the month of maximum landed quantity and declined slightly but was still above the average landed quantity in April. Landed quantities of squid and cuttlefish in Ranong's FMO fishing port were normally below the average monthly landed quantity during the period May to October, with the minimum landed quantity in August. Then landed quantities increased but were still below the average monthly quantity in September and October and were higher than the average landed quantity in November and December. (See Table 4.8 and Fig. 4.32)

Seasonal movements of squid and cuttlefish wholesale prices in Ranong's FMO fishing port were such that prices were normally higher than the average monthly wholesale price in January, June, July, November and December, the month of maximum wholesale price. On the other hand, squid and cuttlefish wholesale prices were normally below the average monthly wholesale price during the period of February to May and during August to October, with the minimum price in March. Therefore, the cyclical movements of squid and cuttlefish monthly wholesale prices throughout a year were such that prices started to decline from the maximum price in late December to the minimum price in March, then increased again from May to July and dropped to low levels in August and October. Finally, wholesale prices increased to above the average level in November and December. (See Table 4.9 and Fig. 4.33)

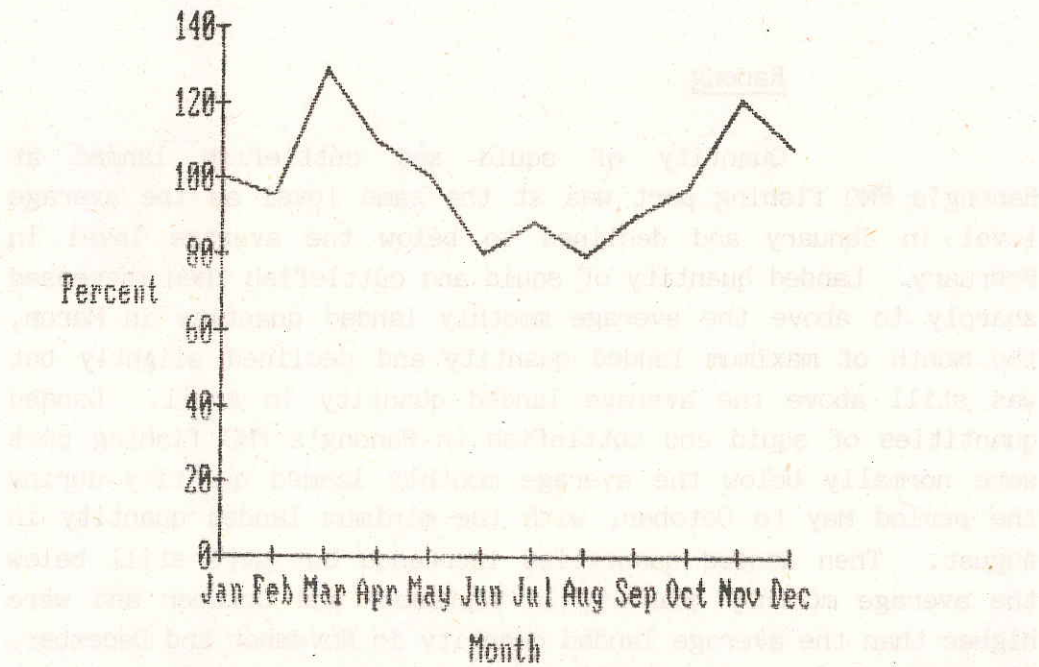


Fig. 4.32 Seasonal Quantity Indices of Squid and Cuttlefish at Ranong Fish Market, 1981-1985

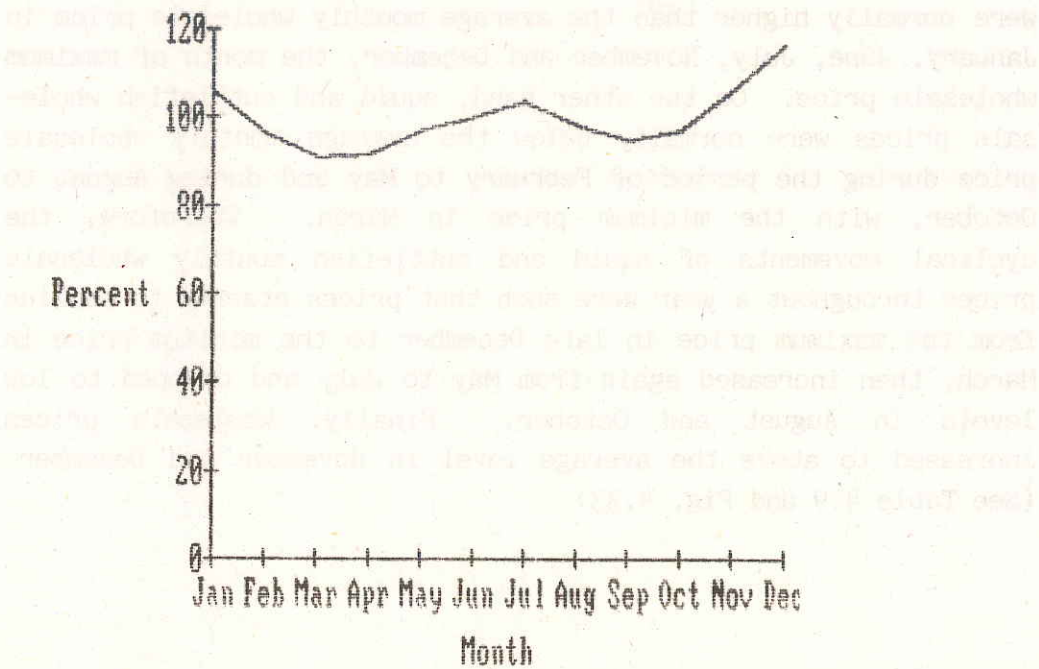


Fig. 4.33 Seasonal Price Indices of Squid and Cuttlefish at Ranong Fish Market, 1981-1985

Surat Thani

Landed quantities of squid and cuttlefish in Surat Thani's FMO fishing port were normally much lower than the average monthly landed quantity in January, February and March, and then increased to above the average level during the period of April to August with the maximum landed quantity in May. Landed quantity of squid and cuttlefish declined to a low level again in September, then increased to a high level in October, and finally declined to low levels in November and December, the month of minimum landed quantity. The difference between the maximum and minimum landed quantities was about 111 percent, which shows that landed quantities of squid and cuttlefish in Surat Thani fluctuated highly throughout the year. (See Table 4.8 and Fig. 4.34)

Seasonal movements of wholesale prices of squid and cuttlefish in Surat Thani's FMO fishing port were such that prices were normally higher than the annual average level during the period January to April and during August to December. Wholesale price was normally highest in December when landed quantity of squid and cuttlefish in this fishing port was the lowest of the year. On the other hand, wholesale prices of squid and cuttlefish in Surat Thani market were normally below the average level in the period starting from May, the month of the maximum landed quantity, through June and July when landed quantities of squid and cuttlefish in Surat Thani's fishing port were rather high. Moreover, the wholesale price of squid and cuttlefish landed in this fishing port was normally lowest in July. (See Table 4.9 and Fig. 4.35)

Phuket

Quantities of squid and cuttlefish landed at Phuket's FMO fishing port fluctuated highly. Landed quantities were normally high in February, March, April, July, November and December, in particular in December when landed quantity of squid

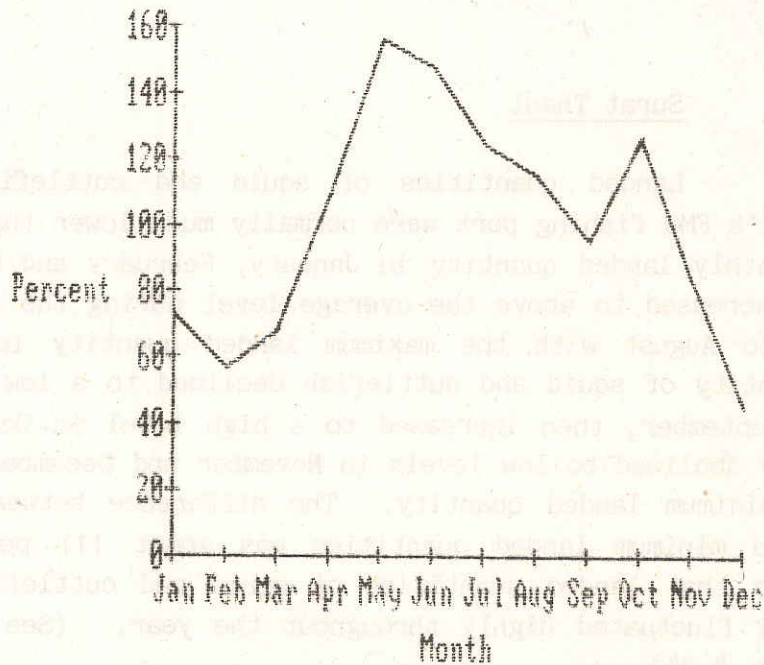


Fig. 4.34 Seasonal Quantity Indices of Squid and Cuttlefish at Surat Thani Fish Market, 1981-1985

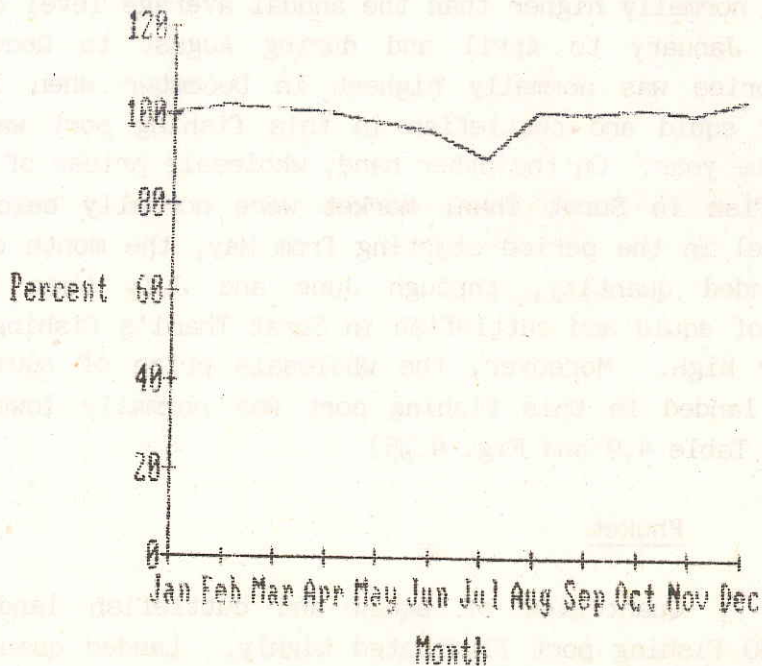


Fig. 4.35 Seasonal Price Indices of Squid and Cuttlefish at Surat Thani Fish Market, 1981-1985

and cuttlefish was the highest. On the other hand, landed quantities were normally low in January, June, August, September and October, in particular in October when the landed quantity was lowest. (See Table 4.8 and Fig. 4.36)

Seasonal movements of monthly wholesale prices of squid and cuttlefish landed at Phuket's FMO fishing port were as follows: prices were high in January, May and during the period of September to December, especially in May when wholesale price was the highest, and prices were low in February, March and April and from June through August, especially in June when the price was the lowest. The cyclical movements of monthly wholesale price were such that prices normally moved downwards from the average monthly wholesale price level in January to the levels below the average wholesale price in February, March and April while landed quantities of squid and cuttlefish in these months were rather high. Average wholesale price of squid and cuttlefish normally reached the maximum price in May when landed quantity declined. Then wholesale price of squid and cuttlefish declined further and reached the minimum price in June when landed quantity of squid and cuttlefish was about 40 percent less than the average monthly landed quantity so that the squid and cuttlefish wholesale market was less active. However, wholesale price of squid and cuttlefish started to rise from July through December. Prices were below the average monthly wholesale price in July and August and above the average wholesale price from September through December. (See Table 4.9 and Fig. 4.37)

Songkhla

Quantities of squid and cuttlefish landed in Songkhla's FMO fishing port were normally higher than the average monthly landed quantity during the period between April and October, with the maximum landed quantity in October. On the other hand, landed quantities were normally below the average monthly landed quantity during the period between January and March and in November and December, with the minimum landed quantity in December. (See Table 4.8 and Fig. 4.38)

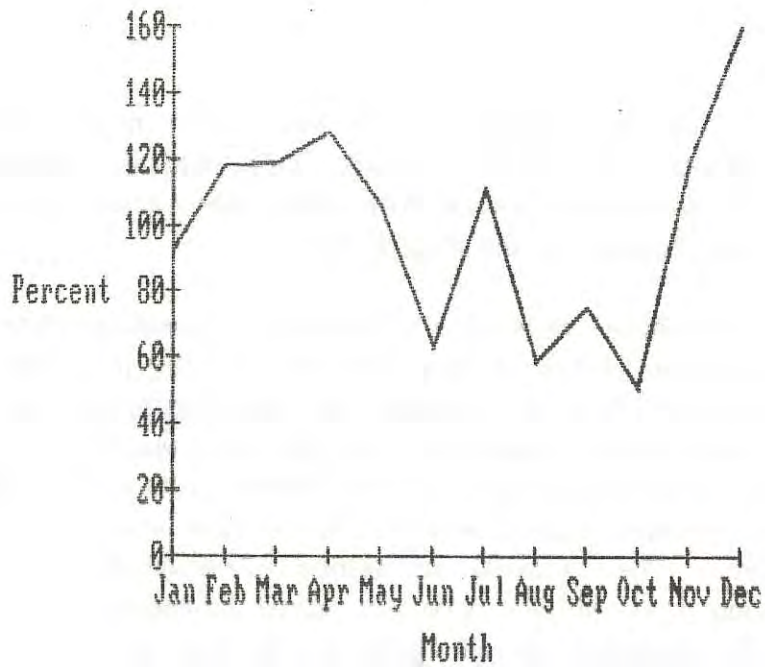


Fig. 4.36 Seasonal Quantity Indices of Squid and Cuttlefish at Phuket Fish Market, 1981-1985

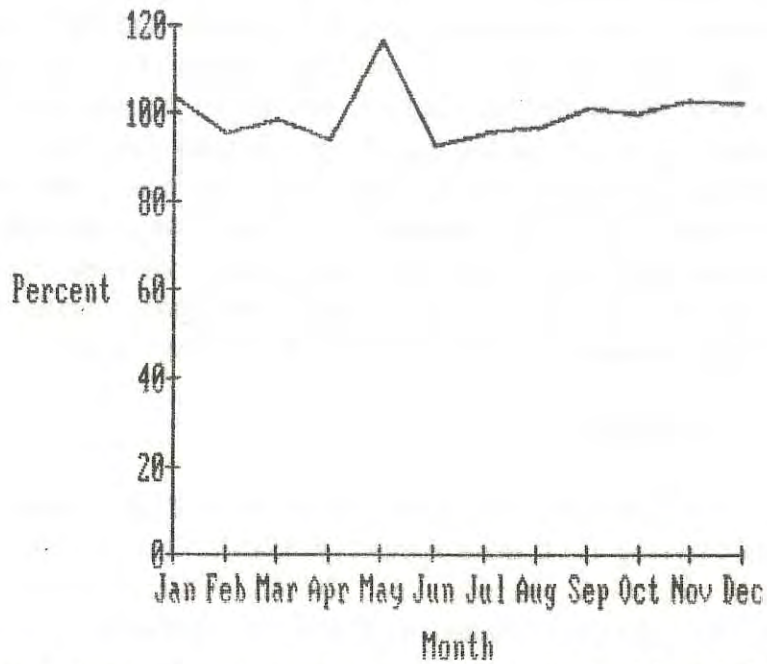


Fig. 4.37 Seasonal Price Indices of Squid and Cuttlefish at Phuket Fish Market, 1981-1985

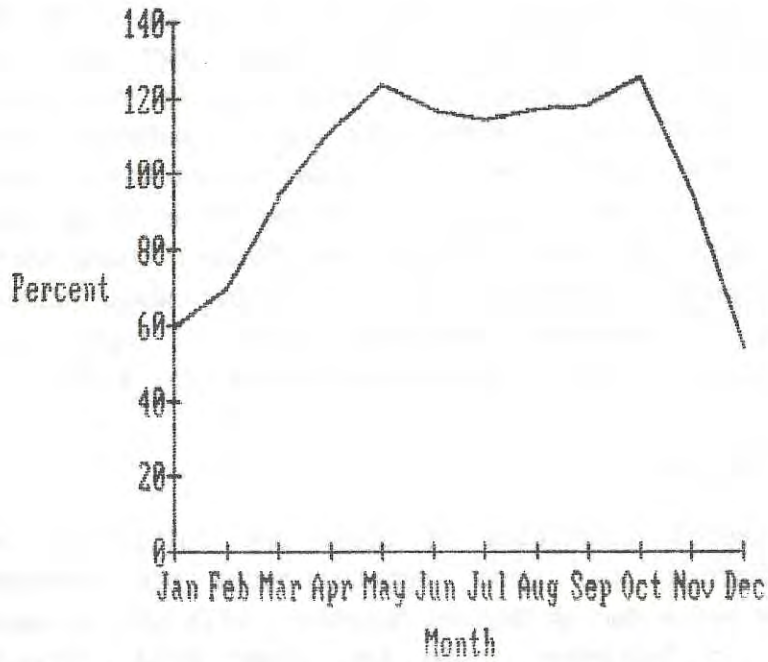


Fig. 4.38 Seasonal Quantity Indices of Squid and Cuttlefish at Songkhla Fish Market, 1981-1985

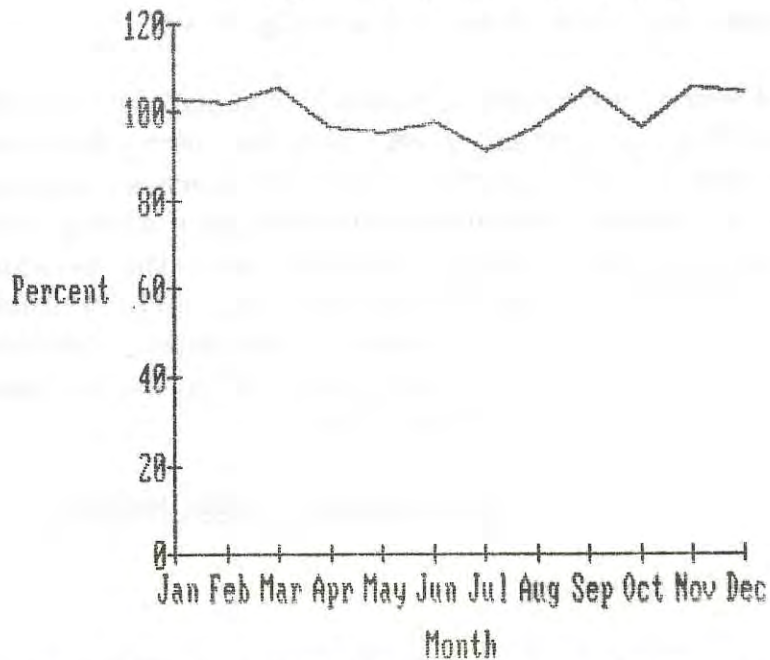


Fig. 4.39 Seasonal Price Indices of Squid and Cuttlefish at Songkhla Fish Market, 1981-1985

Seasonal movements of monthly wholesale prices of squid and cuttlefish at Songkhla's FMO fishing port were as follows: prices were higher than the average monthly wholesale price in January, February, March, September, November and December which were months of low landed quantities, and wholesale price was highest in March. Prices were below the average monthly wholesale price in April and August, which were months of high landed quantities, and in October when landed quantity reached its maximum. Wholesale price of squid and cuttlefish was lowest in July. (See Table 4.9 and Fig. 4.39)

Pattani

Landed quantities of squid and cuttlefish in Pattani's FMO fishing port were normally above the average monthly wholesale price during May and November, with the maximum landed quantity in September. On the other hand, landed quantities were normally below the average monthly landed quantity in January and April and in December, the month of the minimum landed quantity. (See Table 4.8 and Fig. 4.40)

Seasonal movements of monthly wholesale prices of squid and cuttlefish in Pattani's FMO fishing port were as follows: prices were normally higher than the average monthly wholesale price in January, February and March and during the period between May and August and in December, with the maximum price in February when landed quantities were low, while monthly wholesale prices were normally low in April, September, October and November when landed quantities were high, with the minimum price in April. (See Table 4.9 and Fig. 4.41)

4.3 Squid and Cuttlefish Price Relationships Between Markets

4.3.1 Data and Methodology

The study of price relationships between markets for squid and cuttlefish was also made through the analysis of correlation coefficients, using the following data:

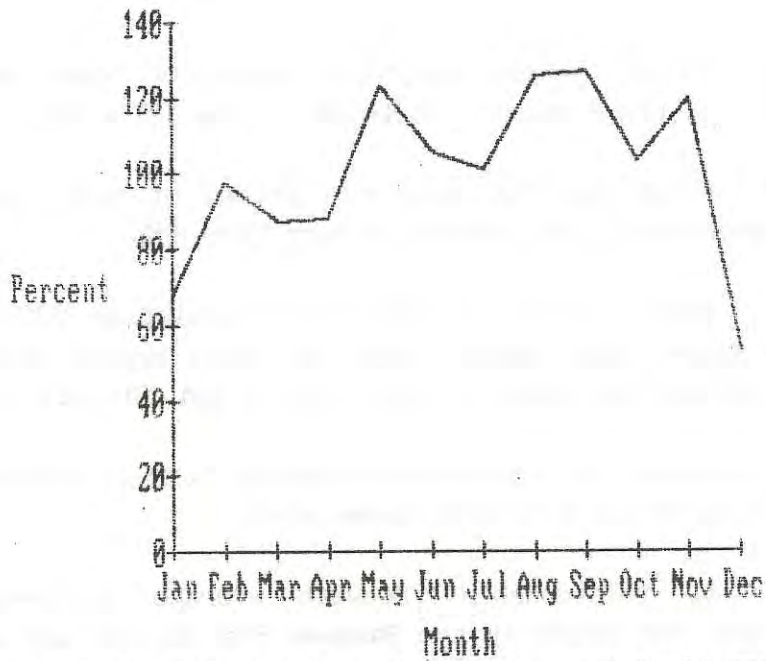


Fig. 4.40 Seasonal Quantity Indices of Squid and Cuttlefish at Pattani Fish Market, 1981-1985

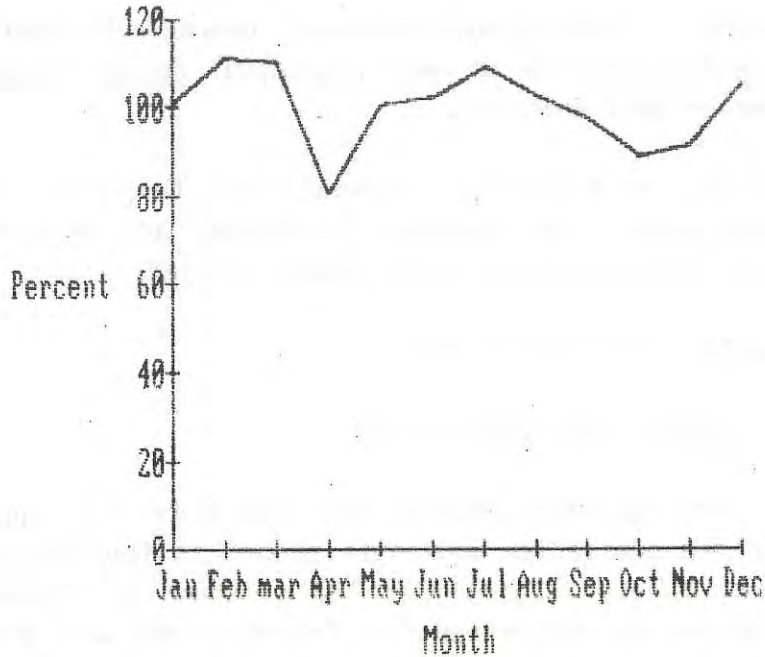


Fig. 4.41 Seasonal Price Indices of Squid and Cuttlefish at Pattani Fish Market, 1981-1985

(1) Annual average wholesale prices of squid and cuttlefish landed at the Bangkok Fish Market during 1971-1985.

(2) Annual average wholesale prices of squid and cuttlefish in seven provincial markets during 1978-1985.

(3) Export prices of squid and cuttlefish during 1971-1985, subdivided into: export price of squid; export price of cuttlefish; and average export price of squid and cuttlefish.

The analyses of price relationships between markets were made according to the following three steps:

Firstly, relationships between average wholesale price of squid and cuttlefish in the Bangkok Fish Market and in the provincial fish markets during the same time period were ascertained.

Secondly, relationships between average wholesale price of squid and cuttlefish in each provincial market during the same time period were analysed.

Finally, relationships between export price and average wholesale price in the Bangkok Fish Market and in seven provincial markets during the same period were studied.

4.3.2 Results (See Table 4.10)

1) Bangkok Wholesale Prices

The analysis shows that movements of squid wholesale prices and cuttlefish wholesale prices in the Bangkok Fish Market were closely related with the movement of average export price of squid and cuttlefish ($r = 0.93491$), and were more closely related with cuttlefish export price ($r = 0.80843$) than to the squid export price ($r = 0.62195$).

Table 4.10 Matrix of Linear Correlation Coefficients of Prices of Squid and Cuttlefish Between Different Markets

	SCPBK	SCPSS	SCPHH	SCPRN	SCPST	SCPPK	SCPSK	SCPPN	SCEP	SQEP	CFEP
SCPBK	1.00000										
SCPSS	0.83227	1.00000									
SCPHH	0.88006	0.95475	1.00000								
SCPRN	0.70261	0.52248	0.42750	1.00000							
SCPST	0.87400	0.62322	0.70705	0.65574	1.00000						
SCPPK	0.69181	0.54210	0.47080	0.88558	0.67083	1.00000					
SCPSK	-0.69839	-0.72862	-0.80428	-0.33788	-0.65761	-0.39624	1.00000				
SCPPN	0.62741	0.50727	0.38342	0.93232	0.47228	0.70301	-0.31626	1.00000			
SCEP	0.93491	0.89966	0.90458	0.61146	0.86081	0.59170	-0.66763	0.53011	1.00000		
SQEP	0.62195	0.68419	0.79126	0.12421	0.55597	0.34411	-0.46807	-0.06963	0.66896	1.00000	
CFEP	0.80843	0.86787	0.92653	0.30195	0.69829	0.38563	-0.58506	0.19083	0.89731	0.90472	1.00000

SCPBK	=	Squid and Cuttlefish Wholesale Price, Bangkok Fish Market
SCPSS	=	Squid and Cuttlefish Wholesale Price, Samut Sakhon Fish Market
SCPHH	=	Squid and Cuttlefish Wholesale Price, Hua Hin Fish Market
SCPRN	=	Squid and Cuttlefish Wholesale Price, Ranong Fish Market
SCPST	=	Squid and Cuttlefish Wholesale Price, Surat Thani Fish Market
SCPPK	=	Squid and Cuttlefish Wholesale Price, Phuket Fish Market
SCPSK	=	Squid and Cuttlefish Wholesale Price, Songkhla Fish Market
SCPPN	=	Squid and Cuttlefish Wholesale Price, Pattani Fish Market
SCEP	=	Squid and Cuttlefish Export Price
SQEP	=	Squid Export Price
CFEP	=	Cuttlefish Export Price

On the other hand, the analysis of price relationships between average wholesale price of squid and cuttlefish in the Bangkok Fish Market and average wholesale price of squid and cuttlefish in the provincial markets shows that Bangkok wholesale price highly correlated with those in Hua Hin market ($r = 0.88006$), Surat Thani market ($r = 0.874$), Samut Sakhon market ($r = 0.83227$) and Ranong market ($r = 0.70261$) and moderately correlated with that in Phuket market ($r = 0.69181$) and Pattani market ($r = 0.62741$). However, there was no positive correlation between Bangkok wholesale price and Songkhla wholesale price of squid and cuttlefish.

2) Provincial Wholesale Prices

Samut Sakhon

Squid and cuttlefish wholesale price in Samut Sakhon market correlated highly with that in the Bangkok Fish Market ($r = 0.83227$) and with the average export price of squid and cuttlefish ($r = 0.89966$). However, Samut Sakhon squid and cuttlefish wholesale prices were more closely related with cuttlefish export prices ($r = 0.86787$) than with squid export prices ($r = 0.68419$). This was because squid and cuttlefish wholesalers in Samut Sakhon market followed closely both export prices and Bangkok wholesale prices of squid and cuttlefish in setting their buying and selling prices. Hence, these prices were closely related.

The analysis of relationships between squid and cuttlefish wholesale price in Samut Sakhon and those in other provincial markets found that the Samut Sakhon wholesale prices were closely related with those in the Hua Hin market ($r = 0.95475$) since both markets are close to each other and a portion of squid and cuttlefish landed in Hua Hin's FMO fishing port was sent to Samut Sakhon fish market. Positive relationships between squid and cuttlefish wholesale price in Samut Sakhon and those in

other provincial markets were moderate (r values range from 0.50727 to 0.62322), except for the Songkhla market where there was a low trade relationship with Samut Sakhon market and the r value was negative.

Hua Hin

Squid and cuttlefish wholesale price in Hua Hin market related highly with those in Samut Sakhon ($r = 0.95475$), Bangkok Fish Market ($r = 0.88006$) and average export price of squid and cuttlefish ($r = 0.90458$), especially with cuttlefish export price ($r = 0.92653$). This was because squid and cuttlefish landed in Hua Hin were sent to both Samut Sakhon and Bangkok Fish Markets. Hence, the Hua Hin squid and cuttlefish wholesale price moved largely in the same direction with that in Samut Sakhon and Bangkok and in turn, with the export price of squid and cuttlefish as both squid and cuttlefish wholesale prices in Samut Sakhon and Bangkok Fish Markets were closely related with the export price of squid and cuttlefish.

Squid and cuttlefish wholesale price in Hua Hin had low positive relationships with prices in other provincial markets and, in particular, had a negative relationship with that in Songkhla market since trade relationships between these markets were low. However, the relationship between Hua Hin and Surat Thani wholesale price was rather high ($r = 0.70705$) since prices in both markets were closely related to the Bangkok Fish Market price.

Ranong

Squid and cuttlefish wholesale price in Ranong's FMO fishing port had a rather high correlation with that in the Bangkok Fish Market ($r = 0.70261$) and moderate correlation with the average export price of squid and cuttlefish ($r = 0.61146$)

and Samut Sakhon squid and cuttlefish wholesale price ($r = 0.52248$). This was because the volume of squid and cuttlefish landed in Ranong's FMO fishing port was not very high, and quantities sent for sale in the Bangkok Fish Market and Samut Sakhon Fish Market and for export were not high. Therefore, squid and cuttlefish wholesale price in Ranong did not follow closely the movements of these prices.

At the provincial market level, squid and cuttlefish wholesale price in Ranong market had a rather high correlation with that in Phuket ($r = 0.88558$) and a moderate correlation with that in Surat Thani ($r = 0.65574$) since these three markets are rather close to each other and prices moved largely in the same direction. Squid and cuttlefish wholesale price in Ranong had a rather low correlation with that in other provincial markets and had a negative correlation with that in Songkhla market ($r = -0.33788$) since there were rather low trade relationships between these markets. On the other hand, wholesale price of squid and cuttlefish in Ranong had a high correlation with that in Pattani ($r = 0.93233$). This was caused mainly by the fact that prices in both markets moved largely in the same direction since supply and demand conditions of squid and cuttlefish in both markets were similar.

Surat Thani

Squid and cuttlefish wholesale price in Surat Thani's FMO fishing port had rather high correlation with that in the Bangkok Fish Market ($r = 0.874$) and with average export price of squid and cuttlefish ($r = 0.86081$) since most squid and cuttlefish landed in Surat Thani's FMO fishing port were sent to the Bangkok Fish Market to be exported, while the relationship between the Surat Thani and Samut Sakhon squid and cuttlefish wholesale prices was moderate ($r = 0.62322$) as trade relationship between these markets was not very high.

Relationships between wholesale price of squid and cuttlefish landed in Surat Thani's FMO fishing port and that in other provincial fishing ports were such that the price relationship was rather high between Surat Thani and Hua Hin markets ($r = 0.70705$) and moderate between Surat Thani and Ranong markets ($r = 0.65574$) and between Surat Thani and Phuket markets ($r = 0.67083$). There was a negative relationship between Surat Thani and Songkhla squid and cuttlefish wholesale prices and a rather low relationship between Surat Thani and Pattani wholesale prices of squid and cuttlefish. These price relationships were dependent upon the degree of trade relationships between Surat Thani squid and cuttlefish wholesalers and those in other provincial markets.

Phuket

Squid and cuttlefish wholesale price in Phuket's FMO fishing port did not have a high relationship with that in the Bangkok Fish Market ($r = 0.69181$) and with that in the Samut Sakhon Fish Market ($r = 0.5421$) and with average export price of squid and cuttlefish ($r = 0.5917$). However, squid and cuttlefish wholesale price in Phuket had a rather high correlation with that in Ranong market ($r = 0.88558$) and moderate correlation with that in Surat Thani market ($r = 0.67083$) since these markets are close to each other. The relationship between the squid and cuttlefish price in Phuket and that in Hua Hin was rather low as there was no trade relationship between these markets. Moreover, the squid and cuttlefish wholesale price in Phuket had a negative relationship with that in Songkhla despite the trade relationship between these two markets being rather high. This can be ascribed to the fact that Phuket squid and cuttlefish wholesalers in Phuket's FMO fishing port and those in Songkhla's FMO fishing port did not take account of each other's buying and selling prices. On the other hand, squid and cuttlefish wholesale price in Phuket's FMO fishing port had a rather high relationship with that in Pattani ($r = 0.70301$). This was because supply and demand conditions in these two markets were similar, hence wholesale prices in both markets were likely to move in the same direction.

Songkhla

The analyses of price relationships between the squid and cuttlefish wholesale price in Songkhla's FMO fishing port and that in Bangkok and Samut Sakhon fish markets and in other provincial fishing port using annual price data show no positive relationships. The monthly price data analyses gave similar results. This shows that movements of squid and cuttlefish wholesale prices in Songkhla's FMO fishing port did not have any relationship with those in other fishing ports nor with the export price of squid and cuttlefish but rather depended upon the current supply and demand conditions in Songkhla's FMO fishing port.

Pattani

Pattani's FMO fishing port is located rather far from other fishing ports, hence trade relationships between squid and cuttlefish wholesalers in Pattani and those in other fishing ports were very low. However, movements of squid and cuttlefish wholesale prices in Pattani had some relation with those in the Bangkok Fish Market ($r = 0.62741$), those in Samut Sakhon Fish Market ($r = 0.50727$) and the average export price of squid and cuttlefish ($r = 0.53011$).

Squid and cuttlefish wholesale price in Pattani's FMO fishing port also had a rather high correlation with that in Ranong ($r = 0.93232$) and that in Phuket ($r = 0.70301$). These high relationships were caused mainly by the fact that demand and supply conditions of squid and cuttlefish landed in these markets were similar, hence prices showed similar patterns. But the relationship between Pattani's squid and cuttlefish wholesale price and prices in Hua Hin and Surat Thani market was rather low, while the relationship was negative for Songkhla squid and cuttlefish wholesale price.

4.4 Factors Affecting Squid and Cuttlefish Wholesale Prices

4.4.1 Domestic Wholesale Prices

Major factors expected to have some influence on domestic wholesale prices of squid and cuttlefish were the national landed quantity of squid and cuttlefish, average export price of squid and cuttlefish, squid export price, cuttlefish export price, size of the national population, per capita income and per capita fish consumption expenditure. While the national landed quantity of squid and cuttlefish was expected to have a negative influence on the domestic wholesale price, all other factors were expected to have positive relationships.

The tests of relationships between the domestic wholesale price of squid and cuttlefish and the above factors were made by regression analysis and used the following symbols for variables:

SQCP 1	=	domestic wholesale price of squid and cuttlefish	(Baht/kg)
SQCQ 1	=	national quantity of squid and cuttlefish	(tons)
SCEP	=	average export price of squid and cuttlefish	(Baht/kg)
SQEP	=	squid export price	(Baht/kg)
CFEP	=	cuttlefish export price	(Baht/kg)
POP 1	=	total national population	(million persons)
PCI	=	per capita income	(Baht)
FCE	=	per capita fish consumption expenditure	(Baht)

The regression analysis, using annual time series data between 1971-1985, gave the following results:

1) Equation representing the relationship between domestic wholesale price of squid and cuttlefish (SQCP 1) and national landed quantity of squid and cuttlefish (SQCQ 1) was as follows:

$$\text{SQCP 1} = -4.94831 + 0.0002 \text{ SQCQ 1} \dots\dots\dots (1)$$

(-1.65269) (5.97275)

$$R^2 = 0.73292$$

2) Equations representing the relationship between domestic wholesale price of squid and cuttlefish (SQCP 1) and export price of squid and cuttlefish (SCEP), export price of squid (SQEP 1) and export price of cuttlefish (CFEP 1) were as follows:

$$\text{SQCP 1} = -3.52597 + 0.51948 \text{ SCEP} \dots\dots\dots(2)$$

(-1.67444) (7.89263)

$$R^2 = 0.82734$$

$$\text{SQCP 1} = -3.9584 + 0.48164 \text{ CFEP} \dots\dots\dots(3)$$

(-1.51307) (6.89085)

$$R^2 = 0.81191$$

$$\text{SQCP 1} = -6.84208 + 0.00085 \text{ SQCQ 1} + 0.34371 \text{ CFEP} \dots\dots(4)$$

(-2.9542) (2.76041) (4.61512)

$$R^2 = 0.89325$$

3) Equation representing the relationship between domestic wholesale price of squid and cuttlefish (SQCP 1) and total national population (POP 1) was as follows:

$$\text{SQCP 1} = -41.60276 + 0.00121 \text{ POP 1} \dots\dots(5)$$

(-8.56283) (11.13683)

$$R^2 = 0.90513$$

4) Equation representing the relationship between domestic wholesale price of squid and cuttlefish (SQCP 1) and per capita income (PCI) was as follows:

$$\text{SQCP 1} = 0.38053 + 0.00104 \text{ PCI} \dots\dots\dots(6)$$

(0.36684) (12.63609)

$$R^2 = 0.92471$$

5) Equation representing the relationship between domestic wholesale price of squid and cuttlefish (SQCP 1) and per capita fish consumption expenditure (FCE) was as follows:

$$\text{SQCP 1} = 2.64891 + 0.01777 \text{ FCE} \dots\dots\dots(7)$$

(2.76723) (11.57618)

$$R^2 = 0.91157$$

All seven equations presented above show rather high positive relationships between average domestic wholesale price of squid and cuttlefish and the six determining factors as values of R^2 in these equations are rather high and positive. Equation (1) shows that domestic wholesale prices of squid and cuttlefish in the past 15 years had positive and statistically significant relationships with national landed quantity of squid and cuttlefish. This implies that both domestic wholesale price and national landed quantity of squid and cuttlefish increased in parallel.

Equation (1) can be interpreted as indicating that an increase of 1,000 tons in national landed quantity of squid and cuttlefish will induce the domestic wholesale price of squid and cuttlefish to rise about 0.20 Baht/kg rather than to depress prices. However, according to the R^2 of equation (1) only 73 percent of the changes in domestic wholesale price of squid and cuttlefish could be explained by changes in national quantity of squid and cuttlefish and the remaining percentage was attributed to other factors not included in this equation.

Equations (2), (3) and (4) show the positive and statistically significant relationships between domestic wholesale price and export price of squid and cuttlefish. Equation (2) shows that an increase of one Baht per kilogram in the average export price of squid and cuttlefish will push up the domestic wholesale price of squid and cuttlefish by about 0.52 Baht/kg. Similarly, equation (3) shows that an increase in the export price of cuttlefish by one Baht/kg will push up the domestic wholesale price of squid and cuttlefish by about 0.48 Baht/kg. According to their R^2 s, these equations could be used to explain the relationships between changes in domestic wholesale prices and those in the average export price of squid and cuttlefish and the export price of cuttlefish about 83 percent and 81 percent respectively. The test of the relationship between domestic wholesale price of squid and cuttlefish and export price of squid gave a low R^2 and an insignificant coefficient of the independent variable. Therefore, its regression equation is not shown here. However, results of equations (2) and (3) show that domestic wholesale price of squid and cuttlefish was affected mainly by export price of squid and cuttlefish, and especially by cuttlefish export price.

When the test of relationship between domestic wholesale price of squid and cuttlefish and both national landed quantity of squid and cuttlefish and export price of cuttlefish was made, the coefficients of both independent variables were still positive and statistically significant as shown in equation (4). This shows that export price of squid and cuttlefish had

a greater influence on domestic wholesale price than national landed quantity had. Hence domestic wholesale price of squid and cuttlefish still increased in spite of the increase in national landed quantity as it was pushed up by the rise in the export price.

Equations (5), (6) and (7) show positive and statistically significant relationships between average domestic wholesale price of squid and cuttlefish and total national population, per capita income and per capita fish consumption expenditure. These equations explain that increases in domestic wholesale prices of squid and cuttlefish in recent years were caused partly by the increase in the size of the national population which raised the demand for seafood resulting in an increase in domestic wholesale prices of squid and cuttlefish (equation (5) can explain this relationship about 90 percent), partly by the increase in per capita income which raised consumers' seafood purchasing power and increased squid and cuttlefish domestic demand and wholesale prices (equation (6) can explain the relationship between domestic wholesale price and per capita income about 92 percent) and finally partly by the increase in per capita fish consumption expenditure of fish consumers (equation (7) can explain this relationship about 91 percent).

Equation (5) shows that an increase in the total national population by one million persons will push up the domestic wholesale price of squid and cuttlefish by about 0.0012 Baht/kg. On the other hand, equation (6) shows that an increase in per capita income of 1,000 Baht will push up the domestic wholesale price of squid and cuttlefish by 1.04 Baht/kg. Finally equation (7) shows that an increase in per capita fish consumption expenditure of about 100 Baht will raise domestic wholesale price of squid and cuttlefish by about 1.78 Baht/kg.

4.4.2 Bangkok Wholesale Prices

Factors expected to affect Bangkok wholesale price of squid and cuttlefish were quantity of squid and cuttlefish landed in the Bangkok Fish Market, average export price of squid and cuttlefish, squid export price, cuttlefish export price, total Bangkok population, per capita income and per capita fish consumption expenditure.

The tests of relationships between Bangkok wholesale price and these determining factors were made by regressional analysis, using the annual time series data between 1971 and 1985 and the following symbols for variables:

- SQCP 2 = wholesale price of squid and cuttlefish in
the Bangkok Fish Market
(Baht/kg)
- SQCQ 2 = quantity of squid and cuttlefish landed in
the Bangkok Fish Market
(tons)
- SCEP = export price of squid and cuttlefish
(Baht/kg)
- SQEP = squid export price (Baht/kg)
- CFEP = cuttlefish export price (Baht/kg)
- POP 2 = total Bangkok population
(million persons)
- PCI = per capita income (Baht)
- FCE = per capita fish consumption expenditure
(Baht)

1. Equation representing the relationship between Bangkok wholesale price of squid and cuttlefish (SQCP 2) and quantity of squid and cuttlefish landed in the Bangkok Fish Market (SQCQ 2) was as follows:

$$\text{SQCP 2} = 4.93382 + 0.00117 \text{ SQCQ 2} \dots\dots\dots(8)$$

(2.79184) (5.86006)

$$R^2 = 0.72539$$

2. Equations representing relationships between Bangkok wholesale price of squid and cuttlefish (SQCP 2) and export price of squid and cuttlefish (SCEP), cuttlefish export price (CFEP) and quantity of squid and cuttlefish landed at the Bangkok Fish Market (SQCQ 2) were as follows:

$$\text{SQCP 2} = -0.47019 + 0.57304 \text{ SCEP} \dots\dots\dots(9)$$

(-2.48587) (13.1334)

$$R^2 = 0.92991$$

$$\text{SQCP 2} = -1.8792 + 0.47771 \text{ CFEP} \dots\dots\dots(10)$$

(-0.83957) (7.98844)

$$R^2 = 0.85297$$

$$\text{SQCP 2} = 0.23715 + 0.00048 \text{ SQCQ 2} + 0.31028 \text{ CFEP} \dots\dots(11)$$

(0.1254) (2.86191) (4.15187)

$$R^2 = 0.91917$$

3. Equations representing the relationship between Bangkok wholesale price of squid and cuttlefish (SQCP 2) and total Bangkok population (POP2) were as follows:

$$\text{SQCP 2} = -19.31528 + 7.17267 \text{ POP2} \dots\dots\dots(12)$$

(-3.67791) (6.40447)

$$R^2 = 0.75934$$

$$\text{SQCP 2} = -11.3983 + 0.00064 \text{ SQCQ 2} + 4.40776 \text{ POP2} \dots(13)$$

(-2.31937) (2.98814) (3.44686)

$$R^2 = 0.86201$$

4. Equation representing the relationship between Bangkok wholesale price of squid and cuttlefish (SQCP 2) and per capita income (PCI) was as follows:

$$\text{SQCP 2} = 1.81873 + 0.00106 \text{ PCI} \dots\dots\dots(14)$$

(1.38948) (10.21783)

$$R^2 = 0.88927$$

5. Equation representing the relationship between Bangkok wholesale price of squid and cuttlefish (SQCP 2) and per capita fish consumption expenditure (FCE) was as follows:

$$\text{SQCP 2} = 4.30085 + 0.01782 \text{ FCE} \dots\dots\dots(15)$$

(3.28076) (8.47712)

$$R^2 = 0.84681$$

Equation (8) shows the positive and statistically significant relationship between wholesale price and quantity of squid and cuttlefish landed in the Bangkok Fish Market. The value of the independent variable coefficient of this equation shows that an increase in quantity of squid and cuttlefish landed in the Bangkok Fish Market of 1,000 tons will cause the wholesale price of squid and cuttlefish in this market to increase by about 1.17 Baht/kg. However, equation (1) could be used to explain this relationship only by 73 percent according to its R^2 value; the remaining percentage was attributed to other factors not included in this equation.

On the other hand, equations (9), (10) and (11) show relationships between wholesale price of squid and cuttlefish in the Bangkok Fish Market and export price of squid and cuttlefish. Equation (9) explains that a 1.00 Baht/kg increase in the average export price of squid and cuttlefish will cause the Bangkok wholesale price of squid and cuttlefish to increase about 0.57 Baht/kg, while equation (10) shows that a 1.00 Baht/kg increase in the cuttlefish export price will cause the wholesale price of squid and cuttlefish in the Bangkok Fish Market to increase about 0.48 Baht/kg. However, both equations (9) and (10) could be used to explain these relationships about 93 percent and 85 percent respectively. Similarly equation (11) shows a positive relationship between Bangkok wholesale price and both Bangkok landed quantity and export price of squid and cuttlefish. The R^2 of equation (11) shows that this equation could be used to explain these relationships about 92 percent.

Equation (12) - (15) show positive and statistically significant relationships between wholesale price of squid and cuttlefish in the Bangkok Fish Market and total Bangkok population, per capita income, and fish consumption expenditure. Equations (12) and (13) both show the positive relationship between Bangkok wholesale price of squid and cuttlefish and total Bangkok population. These two equations show that if the Bangkok population increases by one million persons, it will cause Bangkok wholesale price of squid and cuttlefish to increase by about 7.17 Baht/kg, and by about 4.41 Baht/kg if the quantity of squid and cuttlefish landed in the Bangkok Fish Market was included in the equation. However, equation (12) can be used to explain this relationship about 76 percent according to its R^2 value, while equation (13) can explain this relationship about 86 percent.

Equation (14) shows that if the per capita income increases by about 1,000 Baht, it will induce the wholesale price of squid and cuttlefish in the Bangkok Fish Market to increase by about 1.06 Baht/kg since the Bangkok consumers' purchasing power also increases. Similarly, equation (15) shows that an increase

in per capita fish consumption expenditure of about 100 Baht will push up the wholesale price of squid and cuttlefish by about 1.78 Baht/kg, as the demand for squid and cuttlefish in Bangkok will also increase. Both equations (14) and (15) could be used to explain these relationships about 89 percent and 85 percent respectively.

In summary, the above regression equations show that the quantity of squid and cuttlefish landed in the market did not have much influence on changes in squid and cuttlefish wholesale prices. However, major factors affecting wholesale prices of squid and cuttlefish were export price of squid and cuttlefish, consumers' income, consumers' expenditure on fish consumption and total population.

Chapter V

INDO-PACIFIC MACKEREL

5.1 Analysis of Price Trends

5.1.1 Trend of Domestic Wholesale Price

It is generally believed that changes in domestic wholesale price of Indo-Pacific mackerel in Thailand are affected largely by changes in domestic demand and supply conditions since Indo-Pacific mackerels are consumed mostly within the Kingdom. While quantity of Indo-Pacific mackerel landed throughout the whole Kingdom fluctuated highly from year to year, domestic wholesale prices of Indo-Pacific mackerel increased steadily during the period from 1971 to 1985. Quantity of Indo-Pacific mackerel landed in the whole Kingdom declined from 111,487 tons in 1971 to 31,204 tons, a minimum quantity, in 1974, and then increased gradually to 129,094 tons, a maximum quantity, in 1984, and decreased to 73,328 tons in 1985. (See Table 5.1 and Fig. 5.1)

Domestic wholesale price of Indo-Pacific mackerel, on the other hand, increased from 4.00 Baht/kg in 1971 to 10.97 Baht/kg in 1978 since quantity of Indo-Pacific mackerel landed in the whole Kingdom declined during these years. However, domestic wholesale price of Indo-Pacific mackerel declined to 6.43 Baht/kg, or a 41.4 percent decrease, in response to a 96 percent increase in the landed quantity of Indo-Pacific mackerel resulting from the success of the government's conservation policy in 1978.

From 1980 onwards, domestic wholesale price of Indo-Pacific mackerel increased sharply in spite of the increase in the landed quantity of Indo-Pacific mackerel owing to a rise in domestic demand for Indo-Pacific mackerel. Domestic wholesale price of Indo-Pacific mackerel increased from 8.77 Baht/kg in

Table 5.1 Quantity and Average Wholesale Price of Indo-Pacific Mackerel in the whole Kingdom of Thailand

Quantity : Tons
Price : Baht/kg

Year	Quantity	Price
1971	111,487	4.00
1972	78,064	5.00
1973	88,357	5.00
1974	40,687	6.30
1975	68,871	6.40
1976	53,771	7.91
1977	31,204	9.14
1978	45,271	10.97
1979	88,720	6.43
1980	53,424	8.77
1981	71,701	9.39
1982	86,136	9.18
1983	79,803	10.72
1984	129,094	10.17
1985	73,328	9.33

Source : Fisheries Record of Thailand, Department of Fisheries.

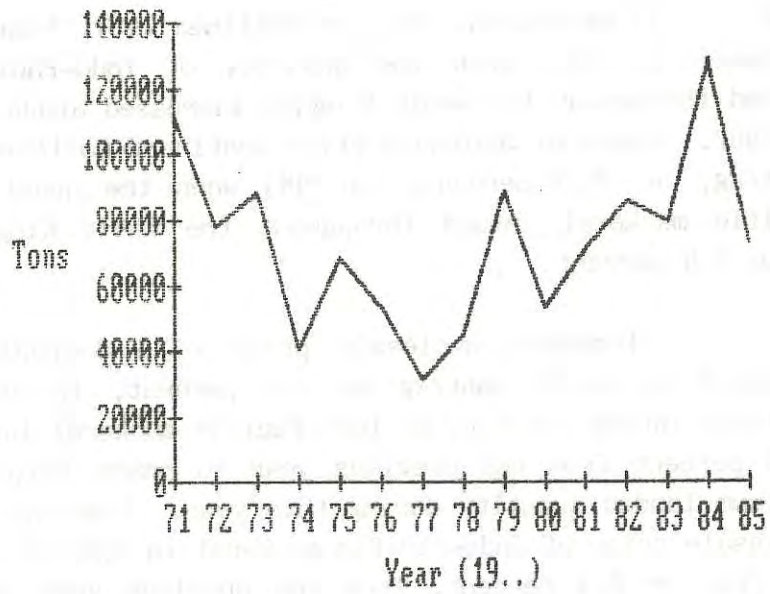


Fig. 5.1 National Quantity of Indo-Pacific Mackerel

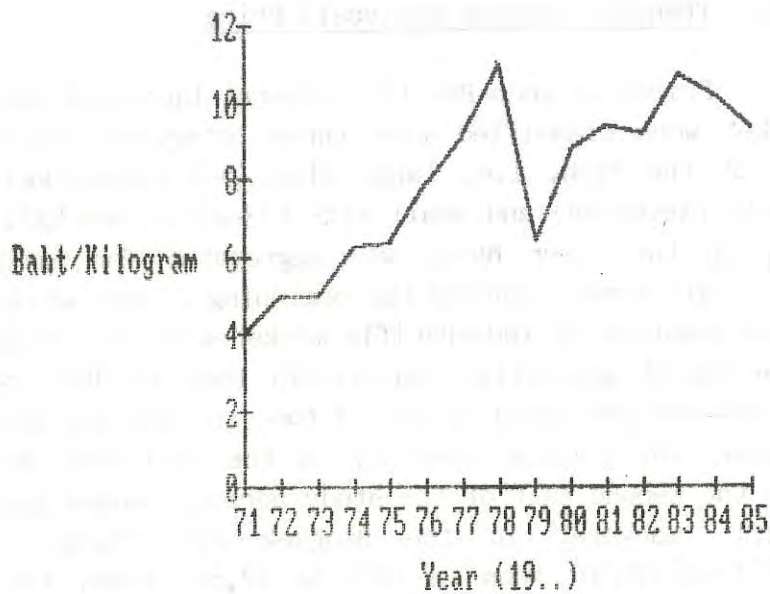


Fig. 5.2 National Wholesale Price of Indo-Pacific Mackerel

1980 to 9.39 Baht/kg in 1981 and declined to 9.18 Baht/kg, or 5.4 percent, in 1982 when the quantity of Indo-Pacific mackerel landed throughout the whole Kingdom increased about 20.1 percent in 1982. Domestic wholesale price continued to increase to 10.72 Baht/kg, or 16.8 percent, in 1983 when the quantity of Indo-Pacific mackerel landed throughout the whole Kingdom declined about 7.4 percent.

Domestic wholesale price of Indo-Pacific mackerel declined to 10.17 Baht/kg or 5.1 percent, in 1984 when the national landed quantity of Indo-Pacific mackerel increased about 61.8 percent from the previous year to reach 129,074 tons, the maximum landed quantity during this year. Finally, the domestic wholesale price of Indo-Pacific mackerel in 1985 declined to 9.33 Baht/kg, or 8.3 percent, from the previous year in spite of a 43.2 percent decrease in the landed quantity owing to the release of frozen Indo-Pacific mackerel into fresh fish markets by many cold storages. (See Table 5.1 and Fig. 5.2)

5.1.2 Trend of Bangkok Wholesale Price

Prices of Indo-Pacific mackerel landed at the Bangkok Fish Market were classified into three categories according to the size of the fish, i.e. large size (5-7 pieces/kg), medium size (10-12 pieces/kg) and small size (13-20 pieces/kg). Landed quantity, on the other hand, was aggregated for Indo-Pacific mackerel of all sizes. During the beginning of the study period, the landed quantity of Indo-Pacific mackerel at the Bangkok Fish Market decreased gradually from 41,875 tons in 1971 to 21,539 tons in 1974 and increased to 30,753 tons in 1975 and declined to 14,731 tons, the minimum quantity in the 1971-1985 period, in 1977. In the second half of the study period, landed quantity of Indo-Pacific mackerel in the Bangkok Fish Market steadily increased from 22,007 tons in 1978 to 47,897 tons, the maximum quantity, in 1981, then declined gradually to 37,792 tons in 1985. (See Table 5.2 and Fig. 5.3)

Table 5.2 Quantity and Wholesale Price of Indo-Pacific Mackerel Landed at Bangkok Fish Market

Quantity : Tons
Price : Baht/kg

Year	Quantity (Total)	Price		
		Large	Medium	Small
1971	41,875	5.50	4.00	2.50
1972	32,025	7.00	5.00	4.50
1973	28,989	9.00	5.00	3.00
1974	21,539	15.00	8.00	4.00
1975	30,753	11.00	6.00	3.00
1976	19,796	12.00	7.00	3.00
1977	14,731	12.00	7.00	3.75
1978	22,007	18.00	10.00	4.00
1979	44,440	12.00	6.50	4.00
1980	41,624	10.00	7.00	4.00
1981	47,897	9.86	7.00	4.00
1982	37,982	14.65	9.50	5.00
1983	39,454	16.33	9.89	5.00
1984	38,937	16.12	9.50	5.00
1985	37,792	14.75	8.48	4.75

Source : Fisheries Record, The Fish Marketing Organization

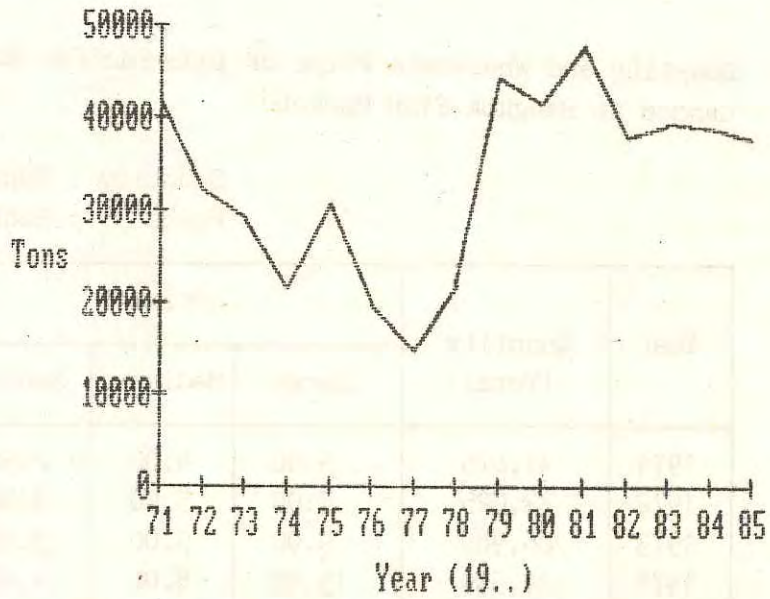


Fig. 5.3 Quantity of Indo-Pacific Mackerel at Bangkok Fish Market

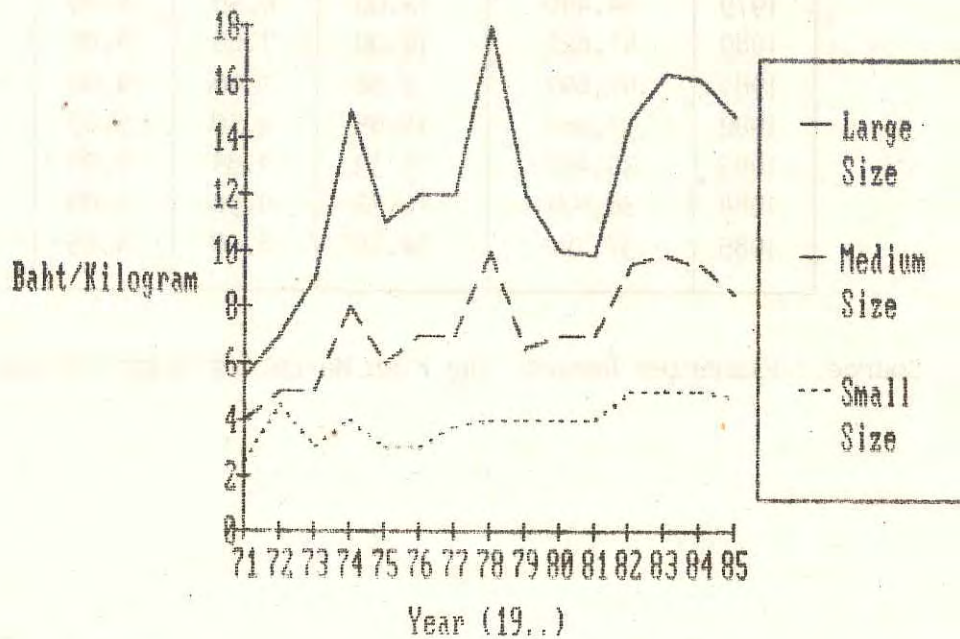


Fig. 5.4 Wholesale Price of Indo-Pacific Mackerel by Size at Bangkok Fish Market

The price trend of the large-sized Indo-Pacific mackerel can be subdivided into three periods. In the first period, wholesale price of Indo-Pacific mackerel increased from 5.50 Baht/kg in 1971 to 11.00 Baht/kg in 1975. In the second period, wholesale price of large-sized Indo-Pacific mackerel increased sharply from 12.00 Baht/kg in 1976 to 18.00 Baht/kg in 1978 and decreased gradually to 9.86 Baht/kg in 1981. In the third period, the wholesale price of Indo-Pacific mackerel increased from 9.86 Baht/kg in 1981 to 14.65 Baht/kg in 1982 and 16.33 Baht/kg in 1983, then declined to 16.12 Baht/kg in 1984 and 14.85 Baht/kg in 1985. Price fluctuations during these three periods were mostly responses to fluctuations in the quantities of Indo-Pacific mackerel landed in the Bangkok Fish Market. (See Table 5.2 and Fig. 5.4)

The price trend of the medium-sized Indo-Pacific mackerel was similar to that of the large-sized Indo-Pacific mackerel. This price trend can also be subdivided into three periods. In the first period, wholesale price of medium-sized Indo-Pacific mackerel increased from 4.00 Baht/kg in 1971 to 8.00 Baht/kg in 1974 and declined to 6.00 Baht/kg in 1975. In the second period, wholesale price of medium-sized Indo-Pacific mackerel increased from 7.00 Baht/kg in both 1976 and 1977 to 10.00 Baht/kg, a maximum price, in 1978 and declined to 6.50 Baht/kg in 1979. In the third period, wholesale price of medium-sized Indo-Pacific mackerel increased from 7.00 Baht/kg in 1980 to 9.89 Baht/kg in 1983 and declined to 8.48 Baht/kg in 1985. (See Table 5.2 and Fig. 5.4)

The price trend of small-sized Indo-Pacific mackerel was rather similar to that of the medium-sized Indo-Pacific mackerel but fluctuated less. In the first period, wholesale price of small-sized Indo-Pacific mackerel increased from 2.50 Baht/kg in 1971 to 4.50 Baht/kg in 1972 in response to 23.5 percent decline in landed quantity of Indo-Pacific mackerel. The price then declined to 3.00 Baht/kg in 1973 in spite of a 9.5 percent decline in total landed quantity of Indo-Pacific mackerel. This responded to an increase in the landed quantity

of small-sized Indo-Pacific mackerel regardless of decreases in landed quantities of large-sized and medium-sized Indo-Pacific mackerel. The price trend of small-sized Indo-Pacific mackerel increased slightly to 4.00 Baht/kg in 1974 and declined to 3.00 Baht/kg in 1975 and 1976. Then prices increased from 3.75 Baht/kg in 1979 to 4.00 Baht/kg from 1978 to 1981 and 5.00 Baht/kg from 1982 to 1984, and declined to 4.75 Baht/kg in 1985. (See Table 5.2 and Fig. 5.4)

5.1.3 Provincial Wholesale Prices

1. Comparison of Provincial Wholesale Prices

Price data of Indo-Pacific mackerel landed in each provincial market, i.e., Samut Sakhon, Hua Hin, Ranong, Surat Thani, Phuket, Songkhla and Pattani, were collected as average price for all sizes. Wholesale prices of Indo-Pacific mackerel landed in provincial markets differed somewhat depending upon local supply and demand conditions and size of Indo-Pacific mackerel landed in the market. Comparison of provincial wholesale price data shows that there were many cases in which Bangkok wholesale prices of Indo-Pacific mackerel were much lower than those in several provincial markets which contradicts the general belief that Bangkok wholesale prices should be higher than provincial wholesale prices owing to transportation costs. For instance, when the Bangkok wholesale price of Indo-Pacific mackerel was 7.58 Baht/kg, Indo-Pacific mackerel wholesale prices were 8.38 Baht/kg in Samut Sakhon, 10.53 Baht/kg in Hua Hin, 8.25 Baht/kg in Ranong and 12.50 Baht/kg in Surat Thani. Similarly, while Indo-Pacific mackerel wholesale price was 9.80 Baht/kg in Bangkok in 1985, it was 16.43 Baht/kg in Ranong, 13.38 Baht/kg in Phuket and 12.53 Baht/kg in Songkhla. Moreover, the analysis also showed that the Indo-Pacific mackerel wholesale prices in Ranong, Surat Thani, Hua Hin and Songkhla were likely to be higher than those in other provinces including Bangkok. This was the result of differences in local demand and supply conditions and the size of the Indo-Pacific mackerel landed. (See Table 5.3)

2. Price Trend in Each Provincial Market

Data on wholesale price and landed quantity of Indo-Pacific mackerel in major fish markets and fishing ports are shown in Table 5.3 and 5.4. Analysis of price trends in each provincial market are as follows:

Samut Sakhon

Changes in wholesale prices of Indo-Pacific mackerel in Samut Sakhon Fish Market were influenced mainly by fluctuations in quantity of Indo-Pacific mackerel landed in this market. Trends of Indo-Pacific mackerel wholesale prices in this market during 1971-1985 can be subdivided into four periods. In the first period, Indo-Pacific mackerel wholesale price increased from 3.55 Baht/kg in 1971 to 5.30 Baht/kg in 1972 and declined to 5.00 Baht/kg in 1973, while landed quantity of Indo-Pacific mackerel decreased from 858 tons in 1971 to 806 tons in 1972 and increased to 1,594 tons in 1973. In the second period, Indo-Pacific mackerel wholesale price increased to 8.10 Baht/kg in 1974, while landed quantity of Indo-Pacific mackerel decreased to 1,340 tons in 1974. Indo-Pacific mackerel wholesale price declined to 7.25 Baht/kg in 1975, while landed quantity increased to 1,841 tons. In the third period, Indo-Pacific mackerel wholesale price increased to 8.38 Baht/kg in 1976 and declined steadily to 4.67 Baht/kg in 1979, while landed quantity increased sharply from 660 tons in 1976 to 4,242 tons in 1979. In the fourth period, Indo-Pacific mackerel wholesale price increased to 6.91 Baht/kg in 1980 and to 8.86 Baht/kg, a maximum price, in 1982. Quantity of Indo-Pacific mackerel landed at the Samut Sakhon Fish Market continued to increase and reached 4,885 tons

Table 5.3 Price of Indo-Pacific Mackerel Landed at Major Fish Markets and Fishing Ports

Unit : Baht/kg

Year	Bangkok	Samut Sakhon	Hua Hin	Ranong	Surat Thani	Phuket	Songkhla	Pattani
1971	4.00	3.55	3.29	3.41	3.48	-	3.54	-
1972	5.33	5.30	4.50	4.50	3.55	-	3.55	5.50
1973	5.67	5.00	6.38	5.00	3.25	-	4.28	5.55
1974	9.00	8.10	9.45	7.00	8.00	-	7.18	7.14
1975	6.67	7.25	10.00	10.00	13.00	-	6.67	7.16
1976	7.33	8.38	11.83	8.25	12.50	-	6.91	6.42
1977	7.58	8.00	10.53	8.51	12.00	-	7.01	8.37
1978	11.67	7.52	8.38	11.67	10.89	6.13	7.77	6.95
1979	12.00	4.67	5.12	12.45	5.66	6.72	8.29	8.42
1980	7.00	6.91	7.79	12.65	6.30	8.74	8.91	11.02
1981	6.95	8.14	8.34	13.35	7.04	8.44	8.91	12.00
1982	9.72	8.86	13.13	14.55	9.10	9.46	9.38	11.82
1983	10.41	8.80	14.08	16.61	10.82	11.50	11.42	8.29
1984	10.12	8.19	10.65	17.72	10.30	13.17	12.46	7.02
1985	9.80	7.43	7.18	16.43	9.06	13.38	12.53	6.44

Source : Fisheries Record, The Fish Marketing Organization.

Table 5.4 Quantity of Indo-Pacific Mackerel Landed at Major Fish Markets and Fishing Ports

Unit : Tons

Year	Bangkok	Samut Sakhon	Hua Hin	Ranong	Surat Thani	Phuket	Songkhla	Pattani
1971	41,875	858	4,795	798	310	-	523	-
1972	32,025	806	1,421	1,798	413	-	802	-
1973	28,989	1,594	2,296	2,317	1,059	-	1,324	750
1974	21,539	1,340	1,230	1,801	314	-	712	1,471
1975	30,753	1,841	3,357	1,519	258	-	1,219	2,782
1976	19,796	660	1,956	1,288	1,506	-	1,762	5,548
1977	14,731	911	3,455	1,526	646	-	1,661	7,115
1978	22,007	2,064	3,899	1,017	682	32	1,565	6,412
1979	44,440	4,242	8,491	1,277	1,287	631	1,762	4,984
1980	41,624	6,125	3,793	782	806	748	1,269	8,316
1981	47,897	2,373	4,181	805	368	1,160	967	7,036
1982	37,982	4,173	4,302	1,280	316	469	975	10,777
1983	39,454	4,589	1,375	4,845	131	576	688	7,318
1984	38,937	5,088	2,036	4,767	196	729	675	10,334
1985	37,792	4,885	4,175	5,083	147	705	856	11,966

Source : Fisheries Record, The Fish Marketing Organization.

in 1985, hence wholesale prices of Indo-Pacific mackerel declined gradually from 8.80 Baht/kg in 1983, 8.19 Baht/kg in 1984 and 7.43 Baht/kg in 1985. (See Tables 5.3, 5.4 and Figs. 5.5, 5.6)

Hua Hin

Wholesale price trend of Indo-Pacific mackerel landed at the Fish Marketing Organization's Hua Hin fishing port during 1971-1985 had two cyclical fluctuations. The first period of the trend was from 1971 to 1979, while the second period was from 1980 to 1985. In the first period, Indo-Pacific mackerel wholesale price increased steadily from 3.29 Baht/kg in 1971 to 11.83 Baht/kg in 1976 and declined annually to 5.12 Baht/kg in 1979, while landed quantity of Indo-Pacific mackerel decreased from 4,795 tons in 1971 to 1,230 tons in 1974 and increased slightly to 3,357 tons in 1975, then declined to 1,956 tons in 1976. Landed quantity of Indo-Pacific mackerel increased again from 3,455 tons in 1977 to reach the maximum landed quantity of 8,491 tons in 1979.

In the second period of the price trend, Indo-Pacific mackerel price increased from 5.12 Baht/kg in 1979 to 7.79 Baht/kg in 1980, while landed quantity of Indo-Pacific mackerel decreased from 8,491 tons in 1979 to 3,793 tons in 1980. Indo-Pacific mackerel wholesale price increased further to reach 14.08 Baht/kg, the maximum price, in 1983 when the quantity of Indo-Pacific mackerel landed at this fishing port was only 1,375 tons. However, Indo-Pacific mackerel wholesale price declined to 10.65 Baht/kg in 1984 and 7.18 Baht/kg in 1985, while landed quantity increased to 2,036 tons in 1984 and 4,175 tons in 1985. (See Tables 5.3, 5.4 and Figs. 5.7, 5.8)

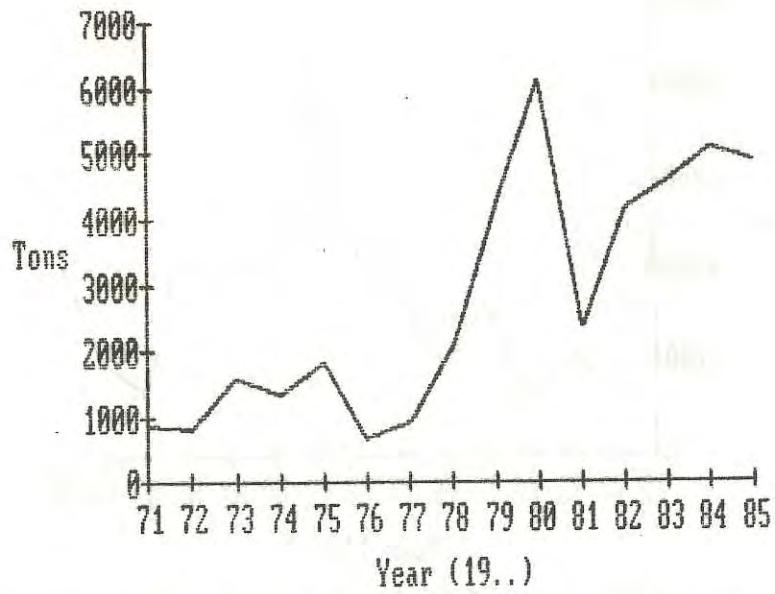


Fig. 5.5 Quantity of Indo-Pacific Mackerel at Samut Sakhon Fish Market

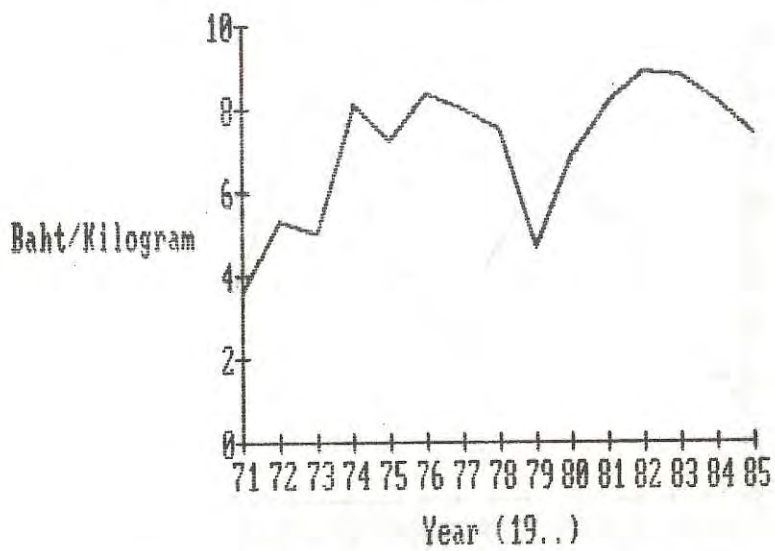


Fig. 5.6 Wholesale Price of Indo-Pacific Mackerel at Samut Sakhon Fish Market

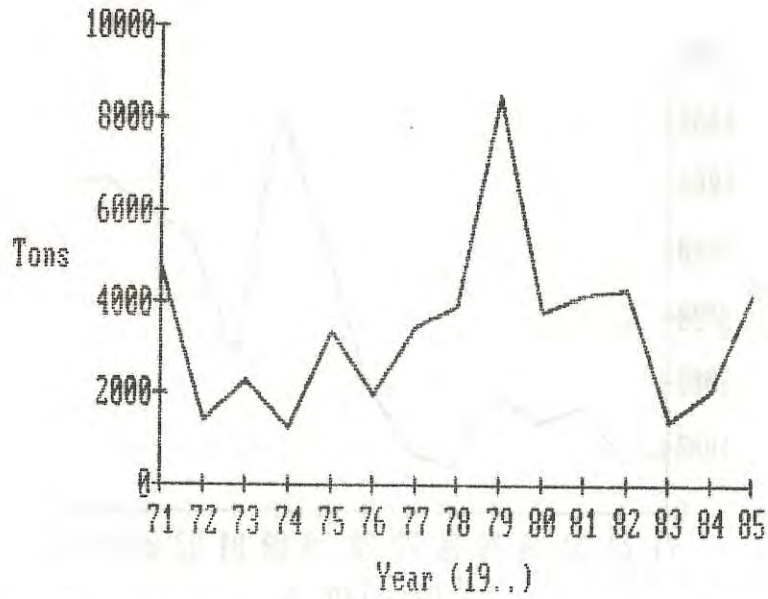


Fig. 5.7 Quantity of Indo-Pacific mackerel at Hua Hin Fish Market

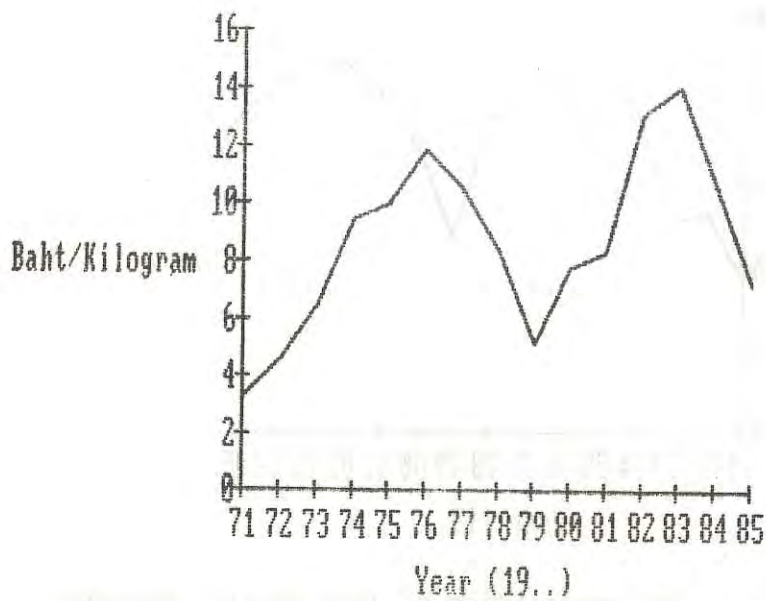


Fig. 5.8 Wholesale Price of Indo-Pacific mackerel at Hua Hin Fish Market

Ranong

Wholesale price of Indo-Pacific mackerel landed at the Fish Marketing Organization's Ranong fishing port increased, in general, during the study period. Indo-Pacific mackerel wholesale price increased steadily from 3.41 Baht/kg in 1971 to 10.00 Baht/kg in 1975 and declined to 8.25 Baht/kg in 1976. From 1977 onward, Indo-Pacific mackerel wholesale price increased steadily from 8.51 Baht/kg to 17.72 Baht/kg in 1984 and 16.43 Baht/kg in 1985. Landed quantity of Indo-Pacific mackerel, on the other hand, increased from 798 tons in 1971 to 2,317 tons in 1973 then declined steadily to 782 tons in 1980 and increased again from 805 tons in 1981 to 5,083 tons in 1985. (See Tables 5.3, 5.4 and Figs. 5.9, 5.10)

Surat Thani

Wholesale prices of Indo-Pacific mackerel landed at the Fish Marketing Organization's fishing port in Surat Thani were rather low during the period 1971-1973. Indo-Pacific mackerel wholesale price was only 3.48 Baht/kg in 1971 when landed quantity of Indo-Pacific mackerel in this fishing port was only 310 tons. The price increased slightly to 3.55 Baht/kg in 1972 when landed quantity increased to 413 tons. Then wholesale price of Indo-Pacific mackerel declined to reach the minimum price of 3.25 Baht/kg when landed quantity of Indo-Pacific mackerel increased sharply to 1,059 tons, or 156 percent, in 1973.

Indo-Pacific mackerel wholesale price increased sharply to 8.00 Baht/kg, or 146 percent, when landed quantity declined to 314 tons in 1974. Then wholesale price increased to reach the maximum price of 13.00 Baht/kg when landed quantity declined to 258 tons in 1975. However, Indo-Pacific mackerel wholesale price dropped to 12.50 Baht/kg when landed quantity increased sharply to 1,506 tons in 1976. Prices continued to decline further to 12.00 Baht/kg in 1977 and 10.89 Baht/kg in 1978 in spite of decreases in landed quantity to 646 tons in 1977 and 682 tons in 1978.

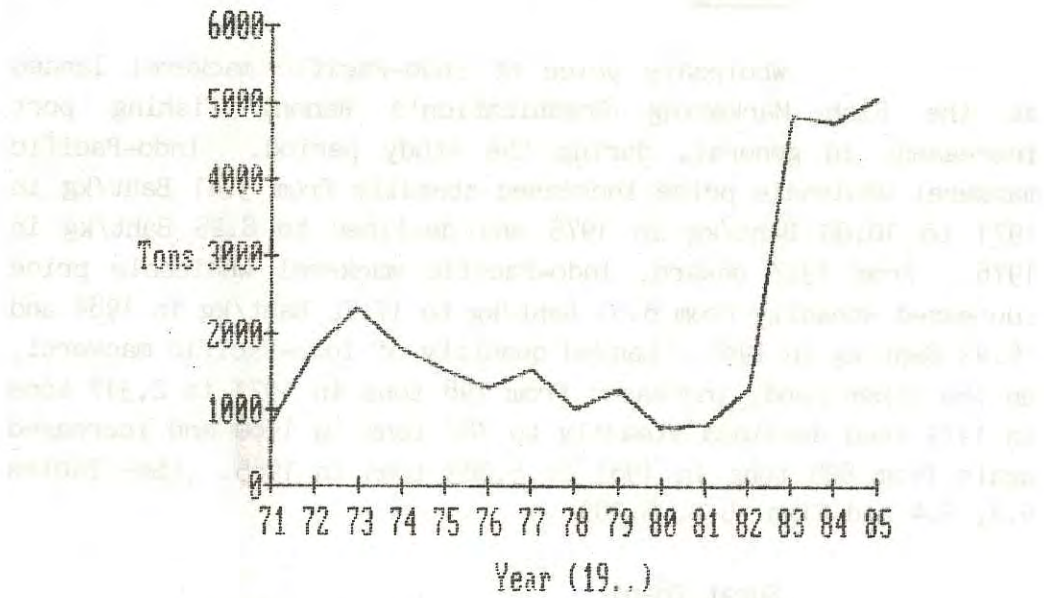


Fig. 5.9 Quantity of Indo-Pacific Mackerel at Ranong Fish Market

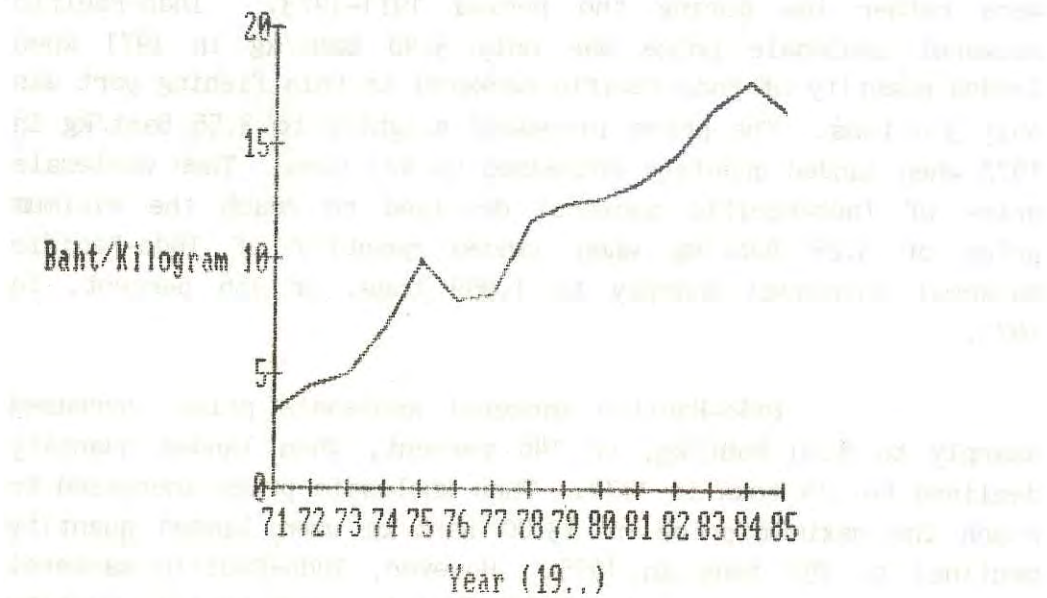


Fig. 5.10 Wholesale Price of Indo-Pacific Mackerel at Ranong Fish Market

Indo-Pacific mackerel wholesale price dropped sharply to a low level again in 1979 when the price declined to 5.66 Baht/kg while landed quantity increased sharply to 1,287 tons. From 1980 onwards, prices continued to increase gradually from 6.30 Baht/kg in 1980 to 10.82 Baht/kg in 1983 and declined to 10.30 Baht/kg in 1984 and 9.06 Baht/kg in 1985, while Indo-Pacific mackerel landed quantity at Surat Thani Fishing port dropped steadily from 806 tons in 1980 to 131 tons, the minimum landed quantity, in 1983, 196 tons in 1984 and 147 tons in 1985. (See Tables 5.3, 5.4 and Figs. 5.11, 5.12)

Phuket

Landed quantity of Indo-Pacific mackerel at the Fish Marketing Organization's fishing port in Phuket started from only 32 tons in 1978 and increased to 1,160 tons, a maximum quantity, in 1981, then declined to 469 tons in 1982, 576 tons in 1983, 729 tons in 1984 and 705 tons in 1985. On the other hand, Indo-Pacific mackerel wholesale price at this fishing port increased steadily in spite of fluctuations in landed quantities. Wholesale price of Indo-Pacific mackerel increased from 6.13 Baht/kg in 1978 to 6.72 Baht/kg in 1979, 8.74 Baht/kg in 1980 and 8.44 Baht/kg in 1981 when the Indo-Pacific mackerel market became more active. Indo-Pacific mackerel wholesale price increased further to 9.46 Baht/kg in 1982, 11.50 Baht/kg in 1983, 13.17 Baht/kg in 1984 and 13.38 Baht/kg in 1985 when landed quantities in these years were rather low. (See Tables 5.3, 5.4 and Figs. 5.13, 5.14)

Songkhla

Indo-Pacific mackerel landed quantity in the Fish Marketing Organization's fishing port in Songkhla fluctuated highly from 523 tons in 1971 to 1,324 tons in 1973, 712 tons in 1974 and from 1,219 tons in 1975 to 1,762 tons in 1976, 1,661 tons in 1977, 1,565 tons in 1978 and 1,762 tons in 1979. From 1980 onwards, Indo-Pacific mackerel landed quantity in this fishing port declined steadily from 1,269 tons in 1980 to 967 tons in 1981, 975 tons in 1982, 688 tons in 1983, 675 tons in 1984 and 856 tons in 1985.

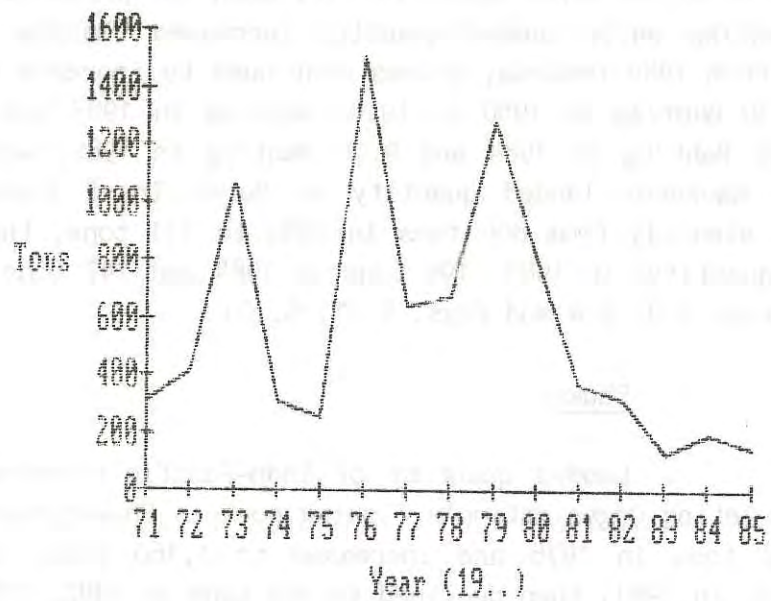


Fig. 5.11 Quantity of Indo-Pacific Mackerel at Surat Thani Fish Market

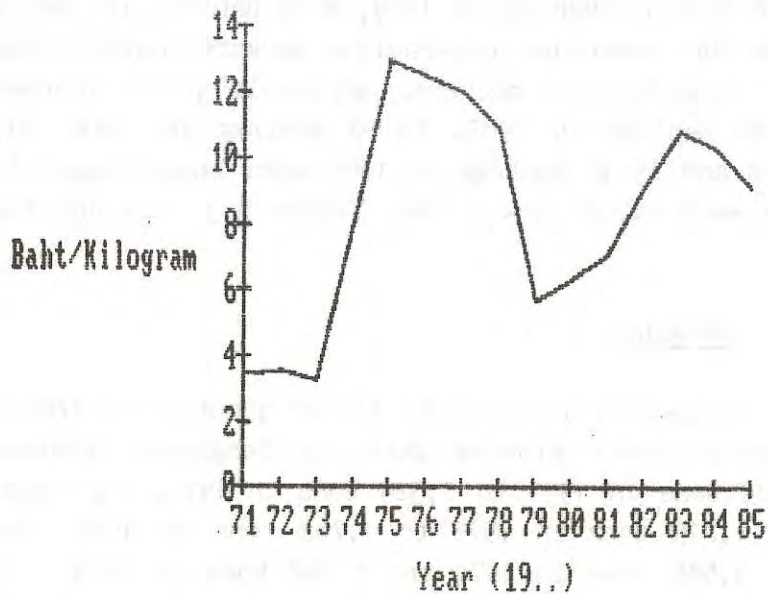


Fig. 5.12 Wholesale Price of Indo-Pacific Mackerel at Surat Thani Fish Market

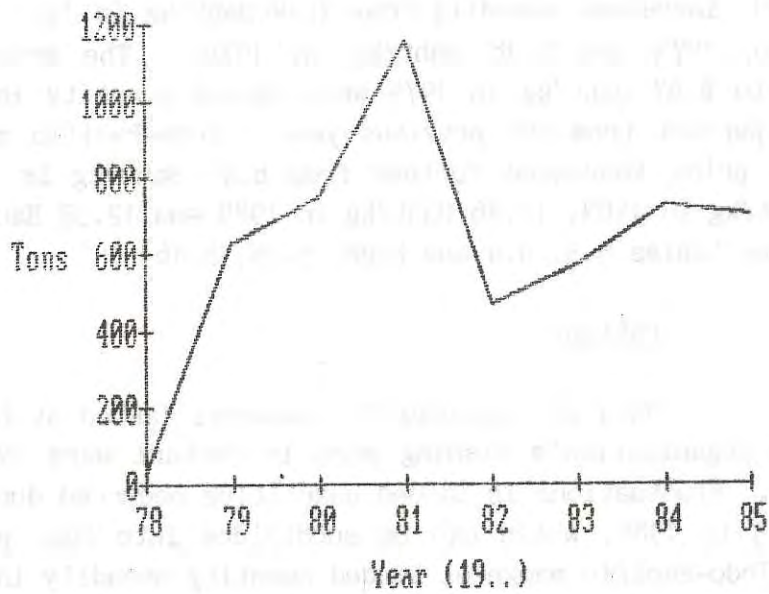


Fig. 5.13 Quantity of Indo-Pacific Mackerel at Phuket Fish Market

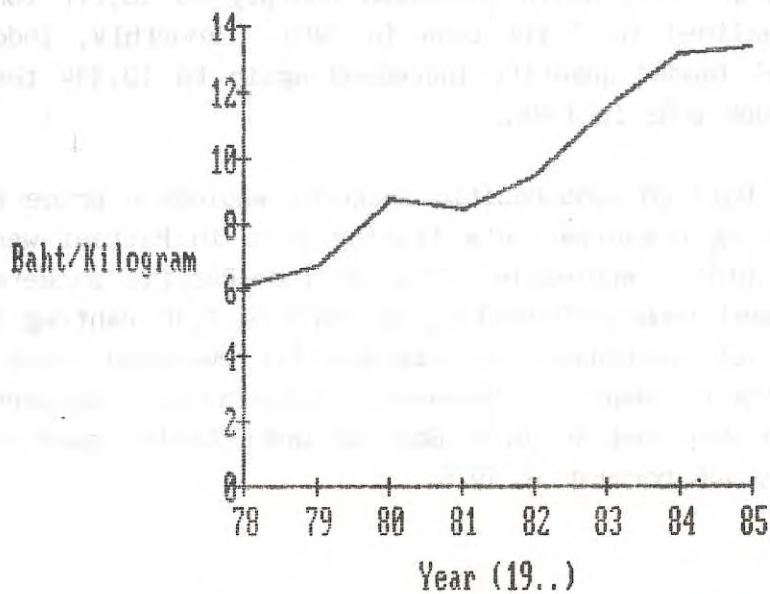


Fig. 5.14 Wholesale Price of Indo-Pacific Mackerel at Phuket Fish Market

Indo-Pacific mackerel wholesale price, on the other hand, increased steadily from 3.54 Baht/kg in 1971 to 4.28 Baht/kg in 1973 and 7.18 Baht/kg in 1974. The price then declined to 6.67 Baht/kg in 1975 when landed quantity increased about 71 percent from the previous year. Indo-Pacific mackerel wholesale price increased further from 6.91 Baht/kg in 1976 to 11.42 Baht/kg in 1983, 12.46 Baht/kg in 1984 and 12.53 Baht/kg in 1985. (See Tables 5.3, 5.4 and Figs. 5.15, 5.16)

Pattani

Data on Indo-Pacific mackerel landed at the Fish Marketing Organization's fishing port in Pattani were available from 1973. Fluctuations in landed quantities occurred during the years 1973 to 1985, which can be subdivided into four periods. Firstly, Indo-Pacific mackerel landed quantity steadily increased from 750 tons in 1973 to 7,115 tons in 1977 and declined to 6,412 tons in 1978 and 4,984 tons in 1979. Secondly, Indo-Pacific mackerel landed quantity increased sharply to 8,316 tons in 1980 and declined to 7,036 tons in 1981. Thirdly, Indo-Pacific mackerel landed quantity again increased sharply to 10,777 tons in 1982 and declined to 7,318 tons in 1983. Fourthly, Indo-Pacific mackerel landed quantity increased again to 10,334 tons in 1984 and 11,966 tons in 1985.

Data on Indo-Pacific mackerel wholesale price at the Fish Marketing Organization's fishing port in Pattani were available from 1972. Wholesale price of Indo-Pacific mackerel steadily increased from 5.50 Baht/kg in 1972 to 7.16 Baht/kg in 1975 in spite of increases in Indo-Pacific mackerel landed quantity in these years. However, Indo-Pacific mackerel wholesale price declined to 6.42 Baht/kg when landed quantity increased nearly 100 percent in 1976.

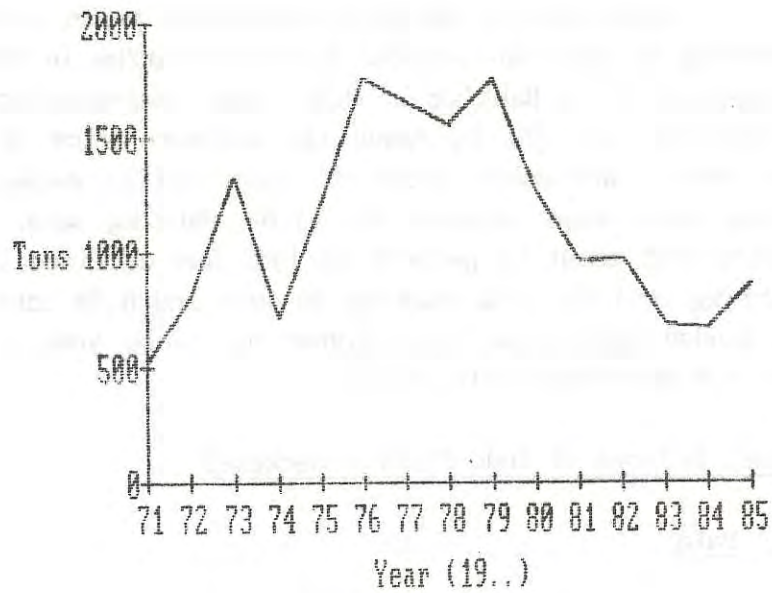


Fig. 5.15 Quantity of Indo-Pacific Mackerel at Songkhla Fish Market

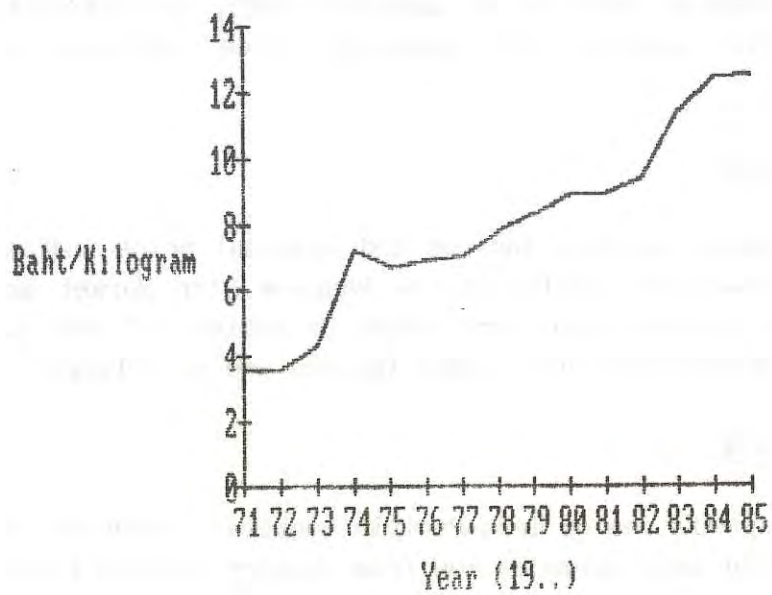


Fig. 5.16 Wholesale Price of Indo-Pacific Mackerel at Songkhla Fish Market

Indo-Pacific mackerel wholesale price increased to 8.37 Baht/kg in 1977 but dropped to 6.95 Baht/kg in 1978 and increased again to 8.42 Baht/kg in 1979, then increased steadily from 8.42 Baht/kg in 1979 to reach the maximum price of 12.00 Baht/kg in 1981. Wholesale price of Indo-Pacific mackerel at this fishing port then dropped to 11.82 Baht/kg when landed quantity increased about 53 percent in 1982 and declined further to 8.29 Baht/kg in 1983, 7.02 Baht/kg in 1984 and 6.44 Baht/kg in 1985 when landed quantities were higher in these years. (See Tables 5.3, 5.4 and Figs. 5.17, 5.18)

5.2 Seasonal Indices of Indo-Pacific Mackerel

5.2.1 Data

The analysis of seasonal price movements of Indo-Pacific mackerel used monthly data on wholesale price and landed quantity in the Bangkok Fish Market and seven provincial fishing ports from 1 January 1984 to 31 December 1985, to calculate seasonal quantity indices and seasonal price indices for comparison.

5.2.2 Results

Seasonal quantity indices and seasonal price indices of Indo-Pacific mackerel landed in the Bangkok Fish Market and seven provincial fishing ports are shown in Tables 5.5 and 5.6 respectively. Interpretation of these indices are as follows:

Bangkok

The quantities of Indo-Pacific mackerel landed at the Bangkok Fish Market were normally low from January through April, and in June and December when there were monsoon conditions in the Gulf of Thailand. Landed quantity of Indo-Pacific mackerel was lowest in February owing to the government policy of closing the Gulf of Thailand to fisheries off the provinces of Prachuap

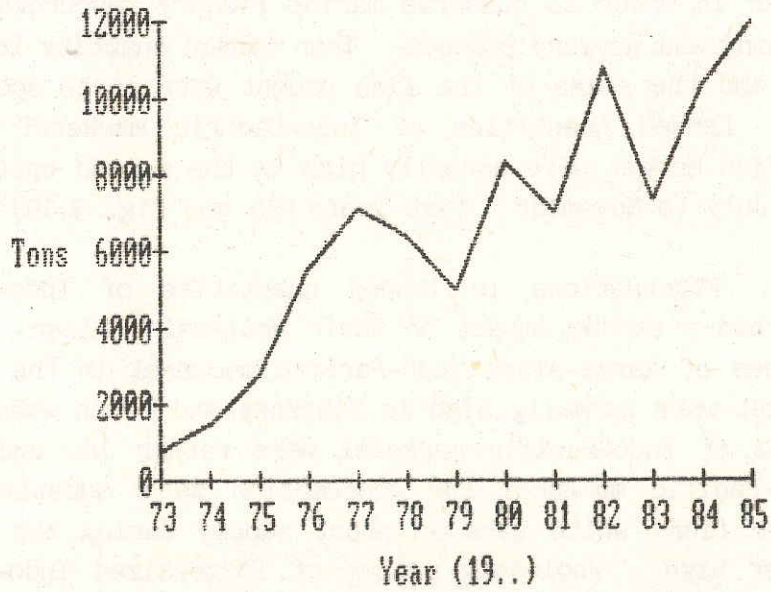


Fig. 5.17 Quantity of Indo-Pacific mackerel at Pattani Fish Market

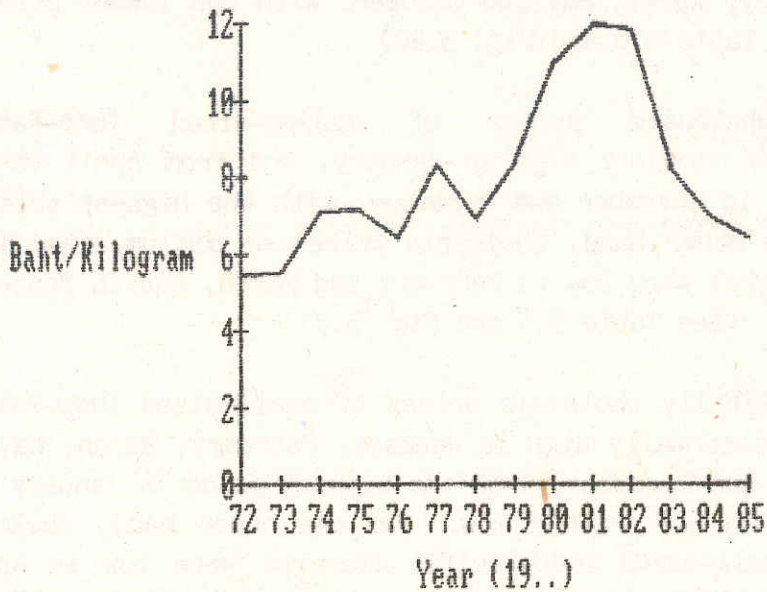


Fig. 5.18 Wholesale Price of Indo-Pacific mackerel at Pattani Fish Market

Khiri Khan down to Surat Thani from 15 February to 15 May of every year in order to conserve marine fishery resources during the spawning and nursery periods. Then landed quantity increased sharply, and the sizes of the fish caught were large soon after 16 May. Landed quantities of Indo-Pacific mackerel at the Bangkok Fish Market were normally high in the second half of May and from July to November. (See Table 5.5 and Fig. 5.19)

Fluctuations in landed quantities of Indo-Pacific mackerel had a strong impact on their wholesale prices. Wholesale prices of large-sized Indo-Pacific mackerel in the Bangkok Fish Market were normally high in February and March when landed quantities of Indo-Pacific mackerel were rather low and demand for Indo-Pacific mackerel for consumption as a substitute for freshwater fish, which were in short supply during the summer, was rather high. Wholesale prices of large-sized Indo-Pacific mackerel were also high during the period June to September, and in November and December, and highest in August. On the other hand, wholesale prices of large-sized Indo-Pacific Mackerel were low in January, April, May and October, with the lowest price in April. (See Table 5.6 and Fig. 5.20)

Wholesale prices of medium-sized Indo-Pacific mackerel were normally high in January, and from April through August, also in November and December, with the highest price in May. On the other hand, wholesale prices of medium-sized Indo-Pacific mackerel were low in February and March, and in September and October. (See Table 5.6 and Fig. 5.21)

Finally wholesale prices of small-sized Indo-Pacific mackerel were normally high in January, February, March, May and June, August and December, with the highest price in January when landed quantity was rather low. On the other hand, wholesale prices of small-sized Indo-Pacific mackerel were low in April, July and from September through November, with the lowest price in October. (See Table 5.6 and Fig. 5.22)

Table 5.5 Seasonal Quantity Indices of Indo-Pacific Mackerel Landed at Bangkok Fish Market and Provincial Fish Markets, 1981-1985

Month	Bangkok	Samut Sakhon	Hua Hin	Ranong	Surat Thani	Phuket	Songkhla	Pattani
Jan.	89.64	83.87	105.74	87.83	92.06	33.43	89.46	95.24
Feb.	74.83	93.14	20.68	147.70	69.14	140.13	73.12	97.11
Mar.	92.77	109.72	6.41	128.78	91.91	121.17	89.95	68.14
Apr.	95.71	89.72	4.07	147.65	101.57	103.78	98.55	79.27
May.	104.66	104.10	18.72	127.54	137.57	123.92	112.75	76.66
Jun.	97.37	108.25	124.04	84.53	114.65	58.51	106.16	101.53
Jul.	110.56	121.36	114.14	86.81	111.44	106.35	100.32	109.32
Aug.	113.06	128.87	143.59	78.20	116.64	94.55	129.87	105.68
Sep.	103.80	124.97	177.74	84.79	101.79	162.57	116.30	105.39
Oct.	114.79	99.81	175.24	87.67	112.27	123.40	131.52	132.41
Nov.	103.74	76.69	172.36	69.71	70.05	84.24	82.49	124.51
Dec.	99.07	59.61	137.33	68.78	80.53	47.94	69.50	104.75

Table 5.6 Seasonal Price Indices of Indo-Pacific Mackerel, 1981-1985

Month	Bangkok Prices			Samut Sakhon	Hua Hin	Ranong	Surat Thani	Phuket	Songkhla	Pattani
	Large	Medium	Small							
Jan.	97.59	105.41	106.33	100.34	105.39	94.02	102.18	100.59	101.19	104.57
Feb.	102.49	97.54	100.63	98.50	106.87	100.10	99.17	102.47	105.71	104.51
Mar.	102.26	97.90	100.31	97.15	103.57	97.17	97.89	102.20	99.43	108.48
Apr.	90.38	100.06	99.90	98.36	105.04	96.63	96.62	101.92	100.94	107.46
May.	93.05	107.88	102.20	103.96	97.17	96.32	98.88	87.44	96.92	97.77
Jun.	100.28	100.52	101.77	106.62	85.78	105.53	102.05	98.03	99.17	95.64
Jul.	100.04	100.94	95.13	103.54	91.41	110.08	98.35	98.20	99.84	96.17
Aug.	108.06	105.78	101.51	102.96	91.51	101.15	103.42	102.29	100.54	96.60
Sep.	101.32	88.82	96.94	102.85	95.78	102.40	98.83	102.58	100.29	96.91
Oct.	93.23	89.16	94.58	92.27	101.67	100.53	97.37	101.20	99.70	95.54
Nov.	106.71	101.28	96.49	96.39	106.23	97.86	100.64	102.40	99.41	97.68
Dec.	104.59	104.72	104.20	97.07	109.58	98.20	104.59	100.69	96.86	99.67

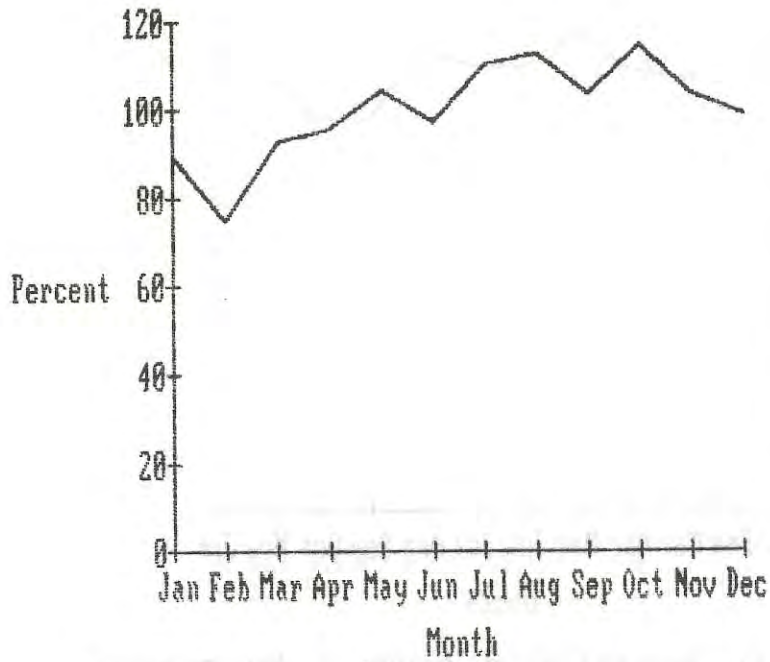


Fig. 5.19 Seasonal Quantity Indices of Indo-Pacific Mackerel at Bangkok Fish Market, 1981-1985

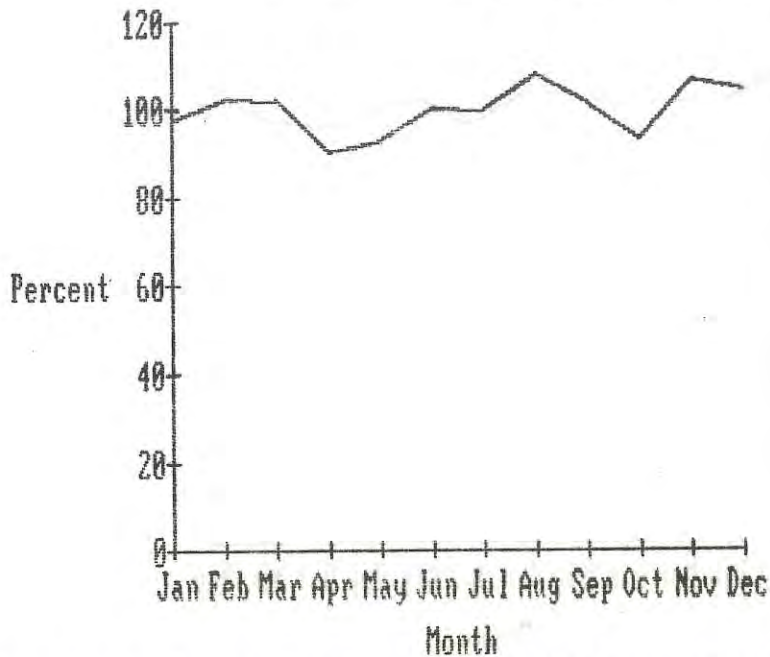


Fig. 5.20 Seasonal Price Indices of Large-sized Indo-Pacific Mackerel at Bangkok Fish Market, 1981-1985

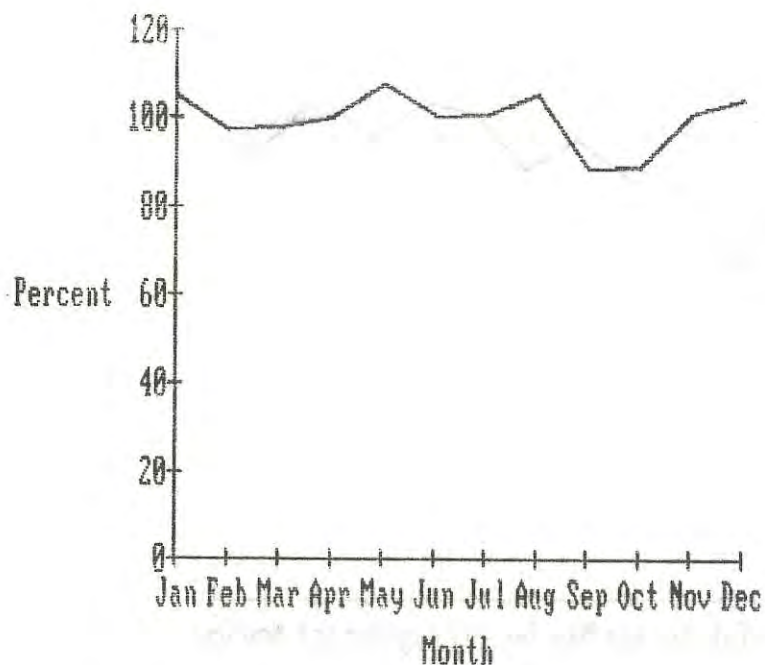


Fig. 5.21 Seasonal Price Indices of Medium-sized Indo-Pacific Mackerel at Bangkok Fish Market, 1981-1985

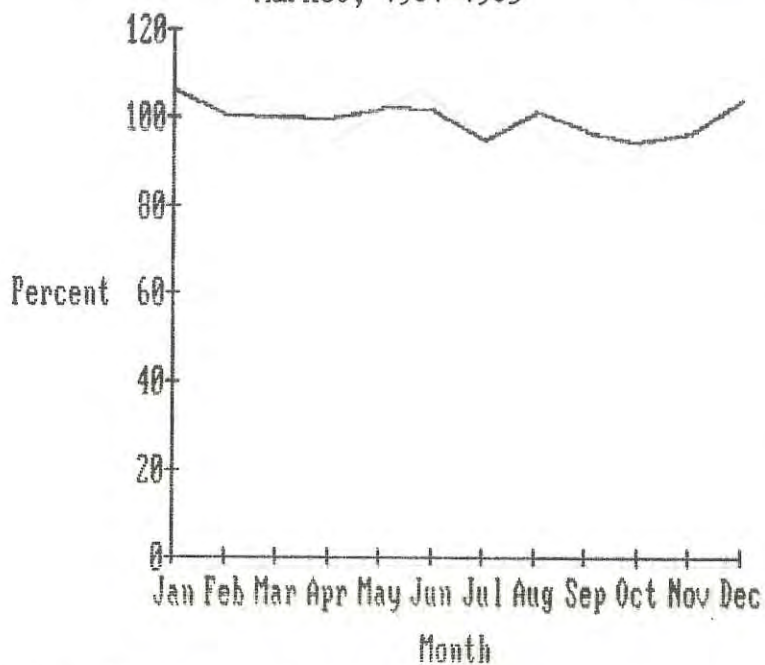


Fig. 5.22 Seasonal Price Indices of Small-sized Indo-Pacific Mackerel at Bangkok Fish Market, 1981-1985

Samut Sakhon

Indo-Pacific mackerel landed quantities in the Samut Sakhon Fish Market were normally low in January, February and April and from October through December, with the lowest landed quantity in December. On the other hand, Indo-Pacific mackerel landed quantities were high in March and from May through September, with the highest quantity in August. (See Table 5.5 and Fig. 5.23)

Monthly wholesale prices of Indo-Pacific mackerel were high in January, and from May through September, with the highest price in June. On the other hand, monthly wholesale prices were low in February through April and from October through December, with the lowest price in October. (See Table 5.6 and Fig. 5.24)

Hua Hin

Indo-Pacific mackerel landed quantities in the Fish Marketing Organization's Hua Hin fishing port were rather low from February through May which corresponded to the closure season of the Gulf of Thailand, and lowest in April. Indo-Pacific mackerel landed quantity increased sharply when the Gulf of Thailand was again opened to fisheries. Hence, landed quantities of Indo-Pacific mackerel were high from June through December and January of the following year, with the highest landed quantity in September. (See Table 5.5 and Fig. 5.25)

Indo-Pacific mackerel wholesale prices were high from February through April when landed quantities were rather low owing to the closure of the Gulf of Thailand, and from October through December and in January of the following year, with the highest price in December. On the other hand, wholesale prices of Indo-Pacific mackerel landed at the Fish Marketing Organization's Hua Hin fishing port were low during the period from May to September, with the lowest price in June. (See Table 5.6 and Fig. 5.26)

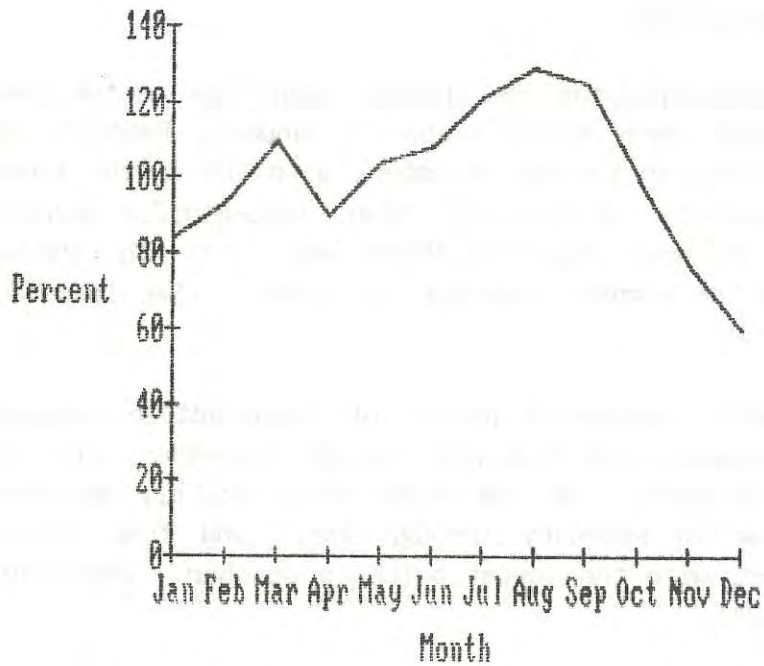


Fig. 5.23 Seasonal Quantity Indices of Indo-Pacific Mackerel at Samut Sakhon Fish Market 1981-1985

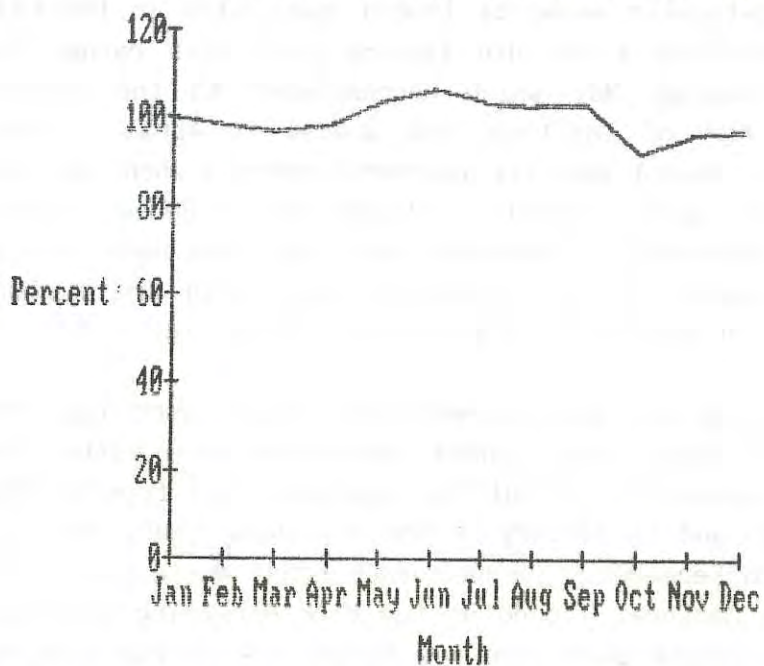


Fig. 5.24 Seasonal Price Indices of Indo-Pacific Mackerel at Samut Sakhon Fish Market, 1981-1985

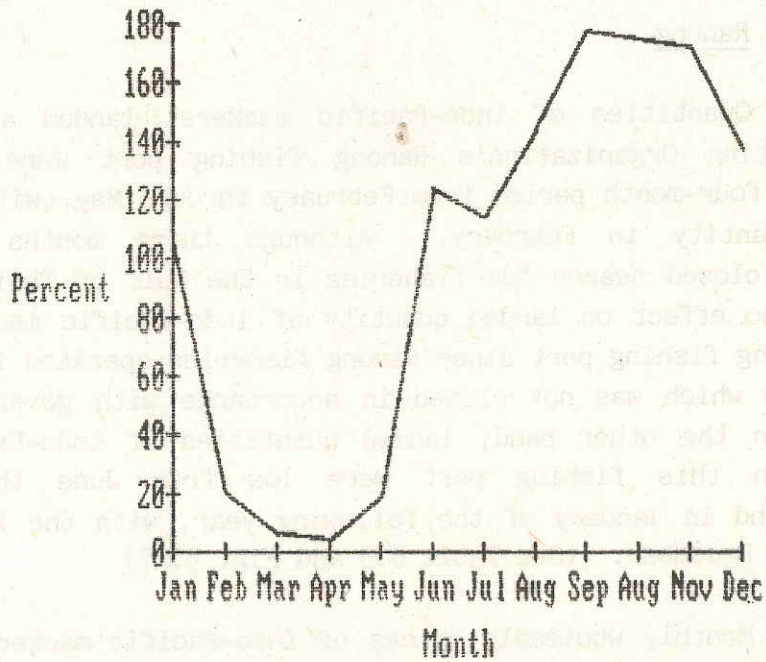


Fig. 5.25 Seasonal Quantity Indices of Indo-Pacific Mackerel at Hua Hin Fish Market 1981-1985

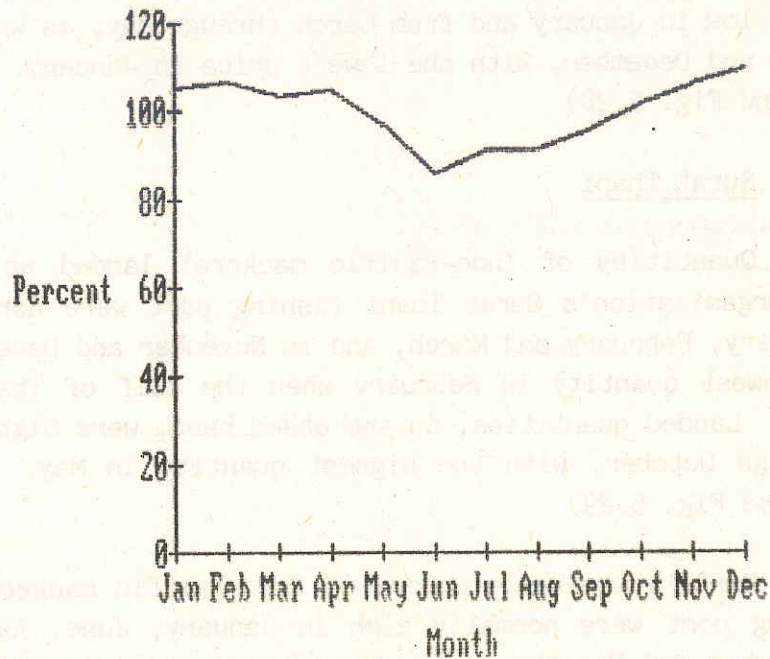


Fig. 5.26 Seasonal Price Indices of Indo-Pacific Mackerel at Hua Hin Fish Market, 1981-1985

Ranong

Quantities of Indo-Pacific mackerel landed at the Fish Marketing Organization's Ranong fishing port were high during the four-month period from February through May, with the highest quantity in February. Although these months were declared a closed season for fisheries in the Gulf of Thailand, there was no effect on landed quantity of Indo-Pacific mackerel at the Ranong fishing port since Ranong fisheries operated in the Andaman Sea which was not closed in accordance with government policy. On the other hand, landed quantities of Indo-Pacific mackerel in this fishing port were low from June through December, and in January of the following year, with the lowest quantity in December. (See Table 5.5 and Fig. 5.27)

Monthly wholesale prices of Indo-Pacific mackerel in Ranong were high in February, and from June through October, with the highest price in June when the landed quantity was rather low. On the other hand, Indo-Pacific mackerel wholesale prices were rather low in January and from March through May, as well as in November and December, with the lowest price in January. (See Table 5.6 and Fig. 5.28)

Surat Thani

Quantities of Indo-Pacific mackerel landed at Fish Marketing Organization's Surat Thani fishing port were normally low in January, February and March, and in November and December, with the lowest quantity in February when the Gulf of Thailand was closed. Landed quantities, on the other hand, were high from April through October, with the highest quantity in May. (See Table 5.5 and Fig. 5.29)

Monthly wholesale prices of Indo-Pacific mackerel in this fishing port were normally high in January, June, August, and in November and December, with the highest price in December when the landed quantity was rather low. On the other hand, wholesale prices were normally low from February through May, and in July, September and October. (See Table 5.6 and Fig. 5.30)

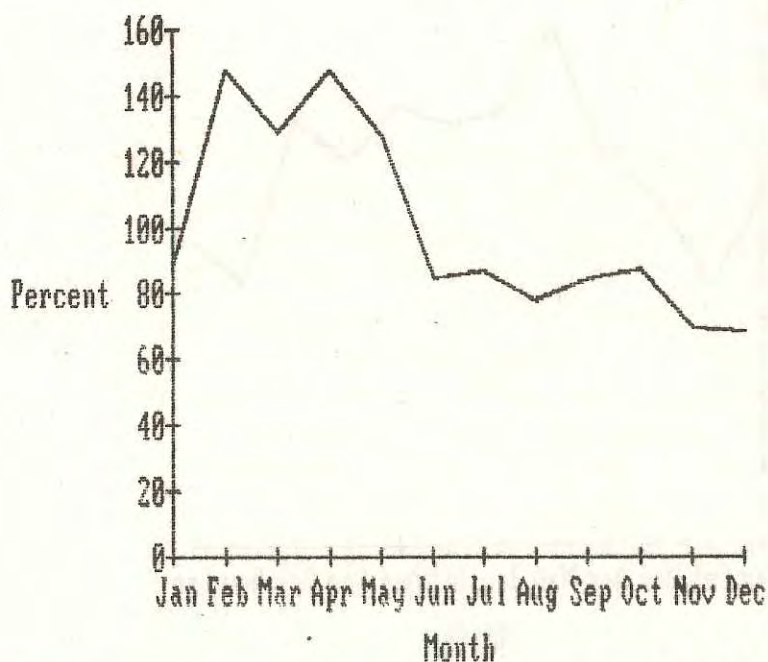


Fig. 5.27 Seasonal Quantity Indices of Indo-Pacific Mackerel at Ranong Fish Market, 1981-1985

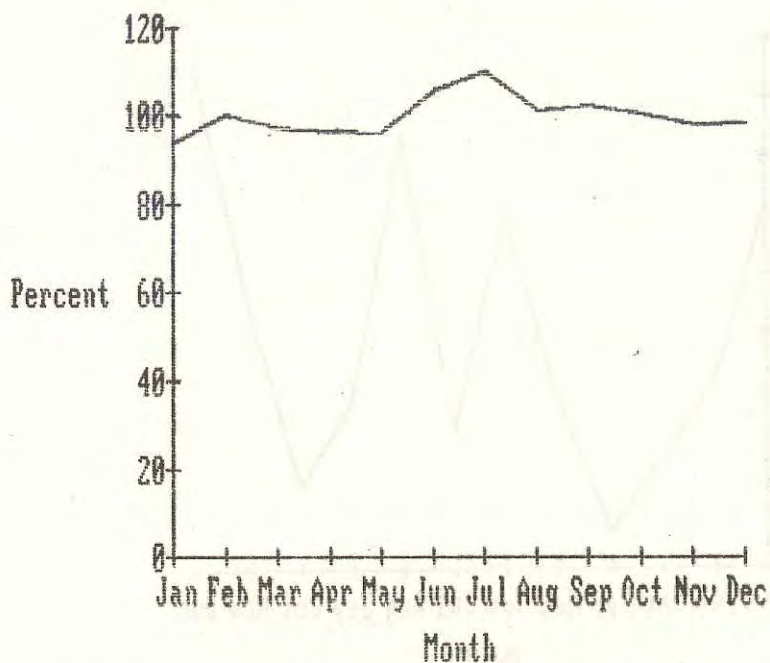


Fig. 5.28 Seasonal Price Indices of Indo-Pacific Mackerel at Ranong Fish Market, 1981-1985

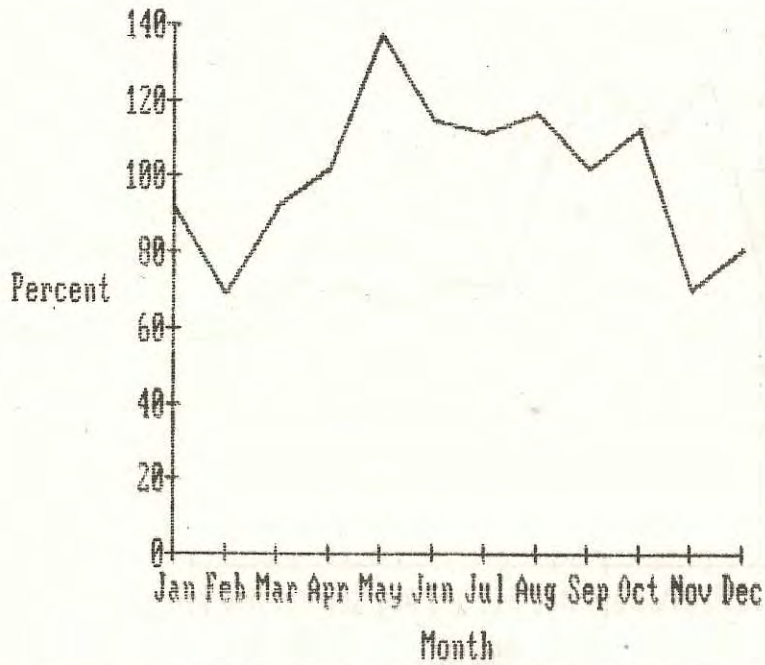


Fig. 5.29 Seasonal Quantity Indices of Indo-Pacific Mackerel at Surat Thani Fish Market, 1981-1985

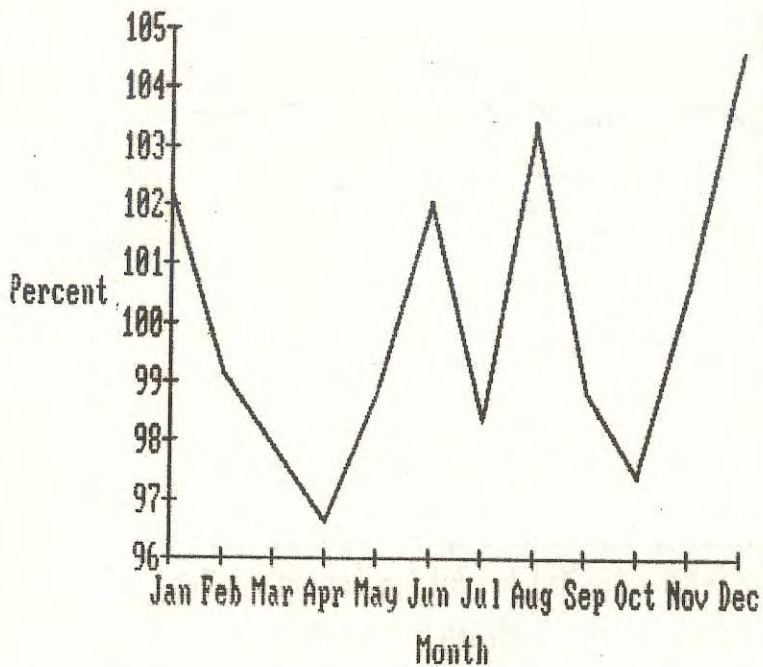


Fig. 5.30 Seasonal Price Indices of Indo-Pacific Mackerel at Surat Thani Fish Market, 1981-1985

Phuket

Fishermen in Phuket caught their fishes in the Andaman Sea hence they were not restricted by the closure policy applicable to the Gulf of Thailand. Quantities of Indo-Pacific mackerel landed in the fishing port of the Fish Marketing Organization in Phuket were high during the periods between February and May, July and September, and in October. On the other hand, landed quantities were low in January, June, September, and November and December, with the lowest quantity in January and December. (See Table 5.5 and Fig. 5.31)

Indo-Pacific mackerel wholesale prices in this fishing port were high from January through April, and from August through December, with the highest price in September. On the other hand, prices were low in May, June and July, with the lowest price in May when the landed quantity was rather high. (See Table 5.6 and Fig. 5.32)

Songkhla

Quantities of Indo-Pacific mackerel landed at the Fish Marketing Organization's fishing port in Songkhla were high from January through April, and in November and December, with the lowest quantity in December. On the other hand, landed quantities were high from May through October, with the highest quantity in October. (See Table 5.5 and Fig. 5.33)

Wholesale prices of Indo-Pacific mackerel at this fishing port were high in January, February, April and in August and September, with the highest price in February when the Indo-Pacific mackerel landed quantity was lowest. Indo-Pacific mackerel wholesale prices, on the other hand, were low in March, and during the period from May through July and from October through December, with the lowest price in December. (See Table 5.6 and Fig. 5.34)

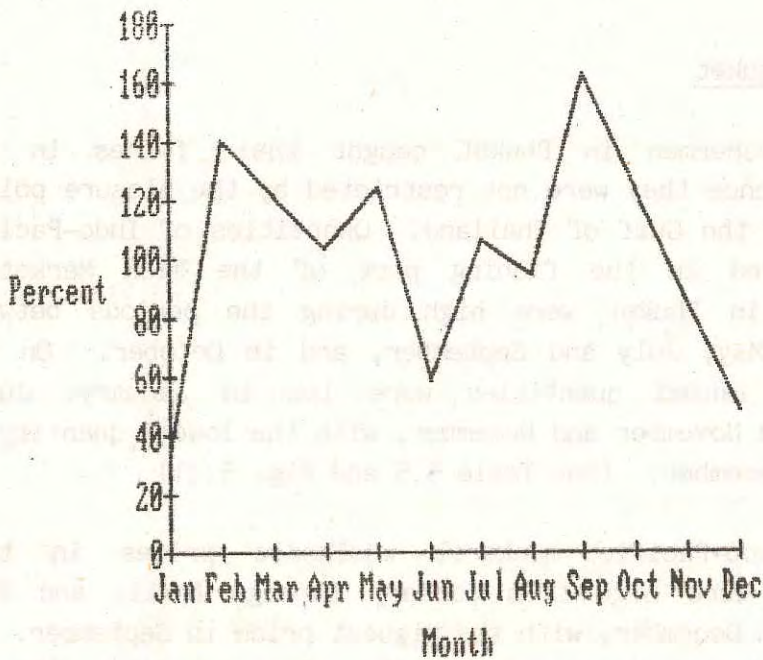


Fig. 5.31 Seasonal Quantity Indices of Indo-Pacific Mackerel at Phuket Fish Market, 1981-1985

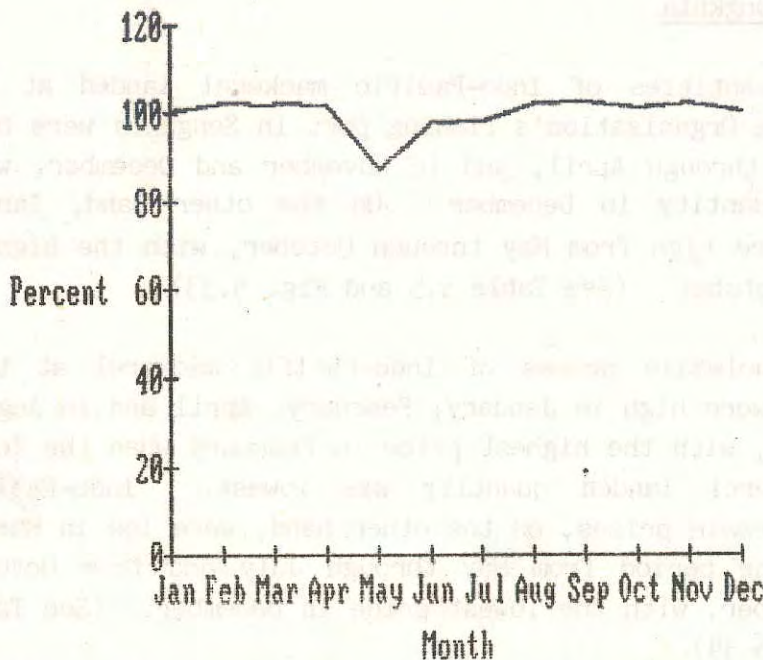


Fig. 5.32 Seasonal Price Indices of Indo-Pacific Mackerel at Phuket Fish Market, 1981-1985

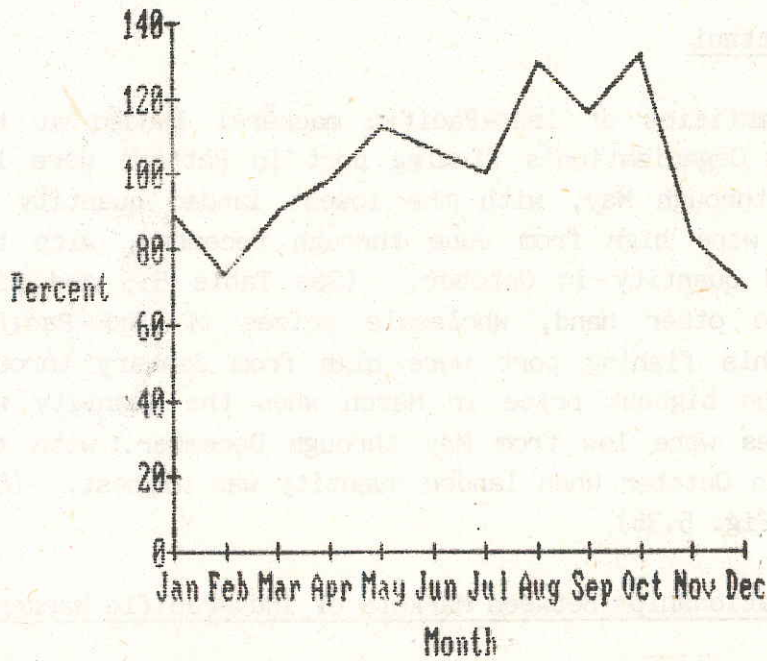


Fig. 5.33 Seasonal Quantity Indices of Indo-Pacific Mackerel at Songkhla Fish Market, 1981-1985

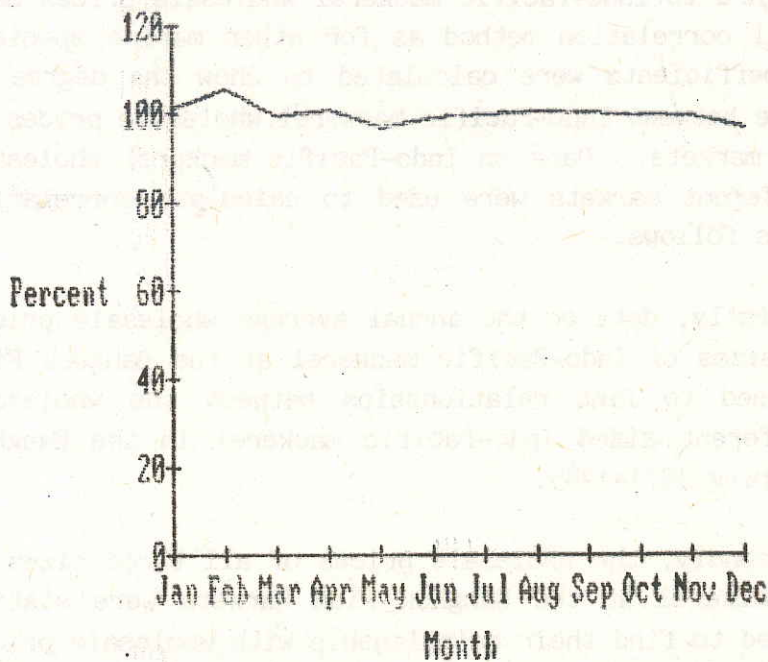


Fig. 5.34 Seasonal Price Indices of Indo-Pacific Mackerel at Songkhla Fish Market, 1981-1985

Pattani

Quantities of Indo-Pacific mackerel landed at the Fish Marketing Organization's fishing port in Pattani were low from January through May, with the lowest landed quantity in March. They were high from June through December, with the highest landed quantity in October. (See Table 5.5 and Fig. 5.35) On the other hand, wholesale prices of Indo-Pacific mackerel in this fishing port were high from January through April, with the highest price in March when the quantity was lowest. Prices were low from May through December, with the lowest price in October when landed quantity was highest. (See Table 5.6 and Fig. 5.36)

5.3 Price Relationships Between Markets of Indo-Pacific Mackerel

5.3.1 Data

The analysis of relationships between different markets in regard to Indo-Pacific mackerel wholesale prices used the statistical correlation method as for other marine species. Correlation coefficients were calculated to show the degree of interdependence between Indo-Pacific mackerel wholesale prices in two different markets. Data on Indo-Pacific mackerel wholesale prices in different markets were used to calculate correlation coefficients as follows.

Firstly, data on the annual average wholesale prices of all three sizes of Indo-Pacific mackerel at the Bangkok Fish Market were used to find relationships between the wholesale prices of different sized Indo-Pacific mackerel in the Bangkok Fish Market during 1971-1985.

Secondly, the wholesale prices of all three sizes of Indo-Pacific mackerel at the Bangkok Fish Markets were statistically analysed to find their relationship with wholesale prices of Indo-Pacific mackerel landed at different provincial fishing ports, i.e., Samut Sakhon, Hua Hin, Ranong, Surat Thani and Songkhla from 1971 to 1985; Phuket from 1978 to 1985; and Pattani from 1973 to 1985.

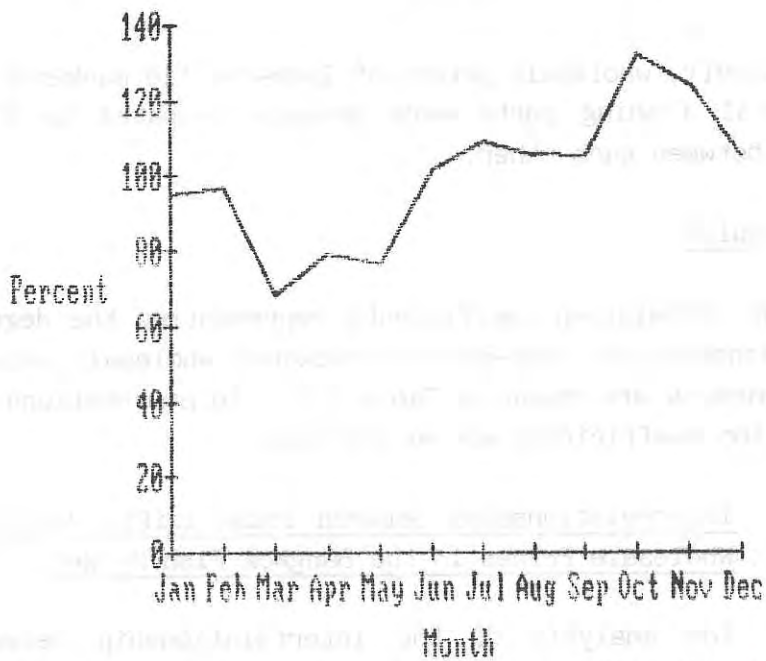


Fig. 5.35 Seasonal Quantity Indices of Indo-Pacific Mackerel at Pattani Fish Market, 1981-1985

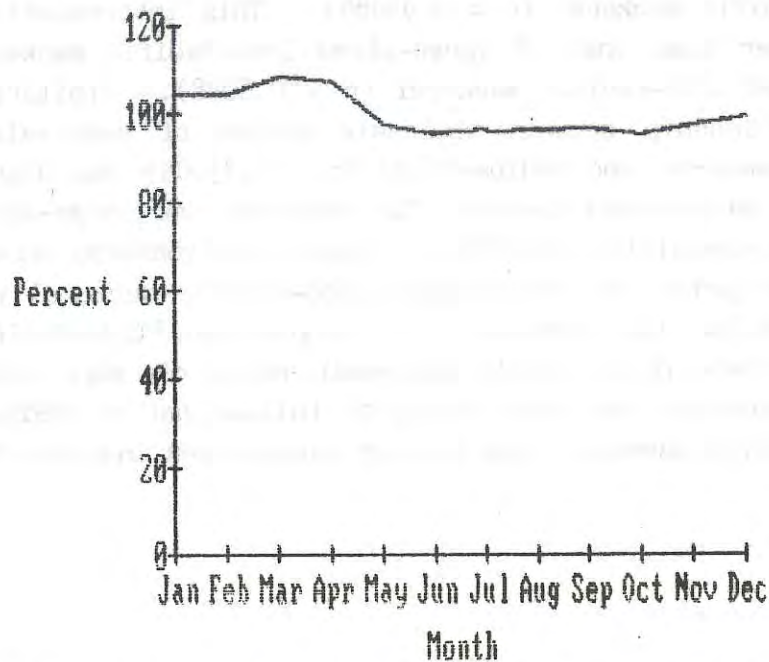


Fig. 5.36 Seasonal Price Indices of Indo-Pacific Mackerel at Pattani Fish Market, 1981-1985

Thirdly, wholesale prices of Indo-Pacific mackerel of seven provincial fishing ports were crossly computed to find relationships between each other.

5.3.2 Results

The correlation coefficients representing the degree of interrelationships of Indo-Pacific mackerel wholesale prices in different markets are shown in Table 5.7. Interpretations of these correlation coefficients are as follows:

1) Interrelationships between Indo-Pacific Mackerel Wholesale Prices in the Bangkok Fish Market

The analysis of the interrelationship between wholesale prices of different sized Indo-Pacific mackerel at the Bangkok Fish Market showed that wholesale price of large-sized Indo-Pacific mackerel was highly correlated with that of medium-sized Indo-Pacific mackerel ($r = 0.94989$). This interrelationship was higher than that of large-sized Indo-Pacific mackerel and small-sized Indo-Pacific mackerel ($r = 0.6048$). Similarly, the interrelationship between wholesale prices of small-sized Indo-Pacific mackerel and medium-sized ($r = 0.73605$) was higher than that of small-sized Indo-Pacific mackerel and large-sized Indo-Pacific mackerel ($r = 0.60480$). These relationships showed that wholesale price of medium-sized Indo-Pacific mackerel was likely to follow the movement of large-sized Indo-Pacific mackerel wholesale price, while wholesale price of small-sized Indo-Pacific mackerel was more likely to follow that of medium-sized Indo-Pacific mackerel than that of large-sized Indo-Pacific mackerel.

Table 5.7 Matrix of Correlation Coefficients of Indo-Pacific Mackerel Prices in Different Markets

	PIPML	PIPM	PIPMS	PIPMSS	PIPMHH	PIPMRN	PIPMST	PIPMFK	PIPMK	PIPMSPN
PIPML	1.00000									
PIPM	0.94989	1.00000								
PIPMS	0.60480	0.73605	1.00000							
PIPMSS	0.71645	0.79184	0.52028	1.00000						
PIPMHH	0.66074	0.71387	0.39948	0.85119	1.00000					
PIPMRN	0.69914	0.79957	0.73937	0.51888	0.53225	1.00000				
PIPMST	0.65719	0.60725	0.15897	0.68687	0.65606	0.51284	1.00000			
PIPMFK	0.30632	0.36571	0.74455	0.41181	0.34908	0.92925	0.42802	1.00000		
PIPMK	0.73726	0.81042	0.72883	0.40705	0.35234	0.96613	0.45022	0.92479	1.00000	
PIPMSPN	0.00184	0.25179	0.26929	0.18747	0.17439	-0.35785	-0.51560	-0.39166	-0.46267	1.00000

PIPML = Large-sized Indo-Pacific Mackerel Wholesale Price, Bangkok Fish Market
 PIPM = Medium-sized Indo-Pacific Mackerel Wholesale Price, Bangkok Fish Market
 PIPMS = Small-sized Indo-Pacific Mackerel Wholesale Price, Bangkok Fish Market
 PIPMSS = Indo-Pacific Mackerel Wholesale Price, Samut Sakhon Fish Market
 PIPMH = Indo-Pacific Mackerel Wholesale Price, Hua Hin Fish Market
 PIPMRN = Indo-Pacific Mackerel Wholesale Price, Ranong Fish Market
 PIPMST = Indo-Pacific Mackerel Wholesale Price, Surat Thani Fish Market
 PIPMK = Indo-Pacific Mackerel Wholesale Price, Phuket Fish Market
 PIPMSK = Indo-Pacific Mackerel Wholesale Price, Songkhla Fish Market
 PIPMPN = Indo-Pacific Mackerel Wholesale Price, Pattani Fish Market

2) Relationship between Bangkok Wholesale Prices and Provincial Wholesale Prices

Provincial wholesale prices of Indo-Pacific mackerel were likely to be more correlated with Bangkok wholesale price of medium-sized Indo-Pacific mackerel than with that of the other two sizes of Indo-Pacific mackerel. This was because data on provincial wholesale prices were average prices of all three sizes of Indo-Pacific mackerel, hence they were rather similar to the Bangkok wholesale price of medium-sized Indo-Pacific mackerel.

Bangkok wholesale prices of large-sized Indo-Pacific mackerel were more closely correlated with those of Songkhla ($r = 0.73726$) and Samut Sakhon ($r = 0.71645$) than with those of other provinces since both Songkhla and Samut Sakhon were also terminal markets of Indo-Pacific mackerel, hence prices in these markets were not very different and moved largely in the same direction.

Bangkok wholesale price of medium-sized Indo-Pacific mackerel was highly correlated with wholesale prices of Indo-Pacific mackerel landed in Songkhla ($r = 0.81042$), Ranong ($r = 0.79957$), Samut Sakhon ($r = 0.79184$), Hua Hin ($r = 0.71387$) and Surat Thani ($r = 0.60725$). Indo-Pacific mackerel wholesale prices in Phuket and Pattani had low correlations with Bangkok wholesale price of medium-sized Indo-Pacific mackerel. In most cases, the degree of interrelationship between Bangkok wholesale price of medium-sized Indo-Pacific mackerel and provincial wholesale prices of Indo-Pacific mackerel was higher than that of Bangkok wholesale price of large-sized Indo-Pacific mackerel and provincial wholesale price of Indo-Pacific mackerel.

Bangkok wholesale price of small-sized Indo-Pacific mackerel had a high interrelationship with Indo-Pacific mackerel wholesale price in Phuket ($r = 0.74455$), Ranong ($r = 0.73937$), Songkhla ($r = 0.72883$) and Samut Sakhon ($r = 0.52028$), while these correlation coefficients were rather low in Hua Hin, Surat Thani and Pattani. In most cases, correlation coefficients between Bangkok wholesale price of small-sized Indo-Pacific

mackerel and the provincial wholesale price of Indo-Pacific mackerel were lower than the correlation coefficient of Bangkok wholesale price of large-sized Indo-Pacific mackerel and Indo-Pacific mackerel wholesale prices in provincial markets and that of Bangkok wholesale price of medium-sized Indo-Pacific mackerel and wholesale price of Indo-Pacific mackerel in most provincial markets, except Phuket and Ranong. In the case of Phuket, wholesale price of Indo-Pacific mackerel landed in this fishing port had a higher correlation with Bangkok wholesale price of small-sized Indo-Pacific mackerel than with Bangkok wholesale prices of the other two sizes of Indo-Pacific mackerel. On the other hand, Ranong wholesale price of Indo-Pacific mackerel had higher correlation with Bangkok wholesale price of small-sized Indo-Pacific mackerel than with that of large-sized Indo-Pacific mackerel but lower than that of medium-sized Indo-Pacific mackerel.

In summary, Bangkok wholesale price of medium-sized Indo-Pacific mackerel had more interrelationship with provincial wholesale prices of Indo-Pacific mackerel than with the wholesale prices of the other two sizes of Indo-Pacific mackerel.

3) Interrelationships between Provincial Wholesale Price of Indo-Pacific Mackerel

Samut Sakhon

Wholesale price of Indo-Pacific mackerel in Samut Sakhon had a rather high correlations with Bangkok wholesale prices of medium-sized Indo-Pacific mackerel ($r = 0.79184$) and large-sized Indo-Pacific mackerel ($r = 0.71645$) since both Samut Sakhon and Bangkok are terminal markets of Indo-Pacific mackerel and are not too far from each other; hence prices in these markets were likely to move in the same direction.

Wholesale price of Indo-Pacific mackerel in Samut Sakhon had a rather high relationship with that of Hua Hin ($r = 0.85119$) since both markets were not too far from each other, and Samut Sakhon is a terminal market for Hua Hin Indo-Pacific mackerel.

On the other hand, the interrelationship between Indo-Pacific mackerel wholesale prices in Samut Sakhon and Surat Thani ($r = 0.68687$) and those in Samut Sakhon and Ranong ($r = 0.51888$) was moderate since Indo-Pacific mackerel in both Surat Thani and Ranong were transported to Samut Sakhon fish market; hence their prices were likely to be correlated. Indo-Pacific mackerel wholesale prices in Phuket, Songkhla and Pattani had a rather low interrelationship with Samut Sakhon wholesale price as shown by their correlation coefficients since there were low direct trade relationships between each of these markets.

Hua Hin

Indo-Pacific mackerel wholesale price in Hua Hin had a rather high interrelationship with that of Samut Sakhon ($r = 0.85119$) and Bangkok wholesale price of medium-sized Indo-Pacific mackerel ($r = 0.71387$) and of large-sized Indo-Pacific mackerel ($r = 0.66074$). However, the interrelationships between wholesale price of Indo-Pacific mackerel in Hua Hin and wholesale prices in Surat Thani ($r = 0.65606$) and Ranong ($r = 0.53225$) were moderate, while interrelationships with wholesale prices in Phuket, Songkhla and Pattani were rather low.

Ranong

Indo-Pacific mackerel wholesale price in Ranong had a rather high interrelationship with that of Songkhla ($r = 0.96613$) and Phuket ($r = 0.92925$) and with Bangkok wholesale prices of medium-sized Indo-Pacific mackerel ($r = 0.79957$) and small-sized Indo-Pacific mackerel ($r = 0.73937$). Ranong Indo-Pacific mackerel wholesale price had moderate interrelationships with that of Hua Hin ($r = 0.53225$), Samut Sakhon ($r = 0.51888$) and Surat Thani ($r = 0.51284$) and a negative interrelationship with Pattani wholesale price of Indo-Pacific mackerel. This was because Ranong Indo-Pacific mackerel were transported to both Bangkok, Songkhla and Samut Sakhon terminal markets; hence wholesale prices of Indo-Pacific mackerel in these markets, and other trade partners of these terminal markets such as Phuket, were highly interdependent and likely to move in the same direction.

Surat Thani

Indo-Pacific mackerel wholesale price in Surat Thani did not have a high interrelationship with prices in other provinces since the landed quantity in this fishing port and the quantity of Indo-Pacific mackerel exported to other provinces were rather small; hence prices did not depend much on wholesale prices in other provinces. However, Indo-Pacific mackerel wholesale price in Surat Thani had high correlation coefficients with that in Samut Sakhon ($r = 0.68687$) and prices of large-sized Indo-Pacific mackerel ($r = 0.65719$) and medium-sized Indo-Pacific mackerel ($r = 0.60725$) in the Bangkok Fish Market since a portion of Indo-Pacific mackerel landed in Surat Thani was transported to both Samut Sakhon and Bangkok. This degree of price relationship between the Surat Thani wholesale price and those of other provincial wholesale prices was similar in the case of Hua Hin ($r = 0.65606$) and Ranong ($r = 0.51284$) since Surat Thani is close to both provinces.

On the other hand, Ranong wholesale price of Indo-Pacific mackerel had a rather low positive relationship with that of Songkhla and a negative relationship with that of Pattani; hence prices in these provinces were unlikely to move in the same direction since there were low trade relationships between these markets.

Phuket

Indo-Pacific mackerel wholesale price in Phuket was highly correlated with that in Ranong ($r = 0.92925$), Songkhla ($r = 0.92479$) and that of small-sized Indo-Pacific mackerel in Bangkok ($r = 0.74455$) since Ranong is fairly close to Phuket, and both Songkhla and Bangkok are terminal markets of Phuket Indo-Pacific mackerel. Phuket wholesale price of Indo-Pacific mackerel had a rather low relationship with that of the other provinces included in this study since Phuket is at a considerable distance from these provinces and has no trade relationships with them.

Songkhla

Songkhla is a terminal market of marine fish in the southern region of Thailand. Songkhla Indo-Pacific mackerel wholesale price had high interrelationships with that of Ranong ($r = 0.96613$) and Phuket ($r = 0.92479$) since Indo-Pacific mackerel landed in these provinces were transported to Songkhla fish market; hence fish wholesalers in these fish markets also used Songkhla wholesale prices as criteria in setting their buying prices. Similarly, Songkhla Indo-Pacific mackerel wholesale price had rather high interrelationship with Bangkok wholesale prices of medium-sized Indo-Pacific mackerel ($r = 0.81042$), large-sized Indo-Pacific mackerel ($r = 0.73726$) and small-sized Indo-Pacific mackerel ($r = 0.72883$) since Songkhla Indo-Pacific mackerel wholesalers also used Bangkok wholesale prices as criteria in setting their buying prices.

Pattani

Indo-Pacific mackerels landed in Pattani were mostly consumed within this province and nearby provinces. Hence Pattani Indo-Pacific mackerel wholesale price had low positive correlations or even negative correlations with Indo-Pacific mackerel wholesale prices of other provinces under study.

5.4 Factors Affecting Indo-Pacific Mackerel Wholesale Prices

The analyses of factors affecting wholesale price of Indo-Pacific mackerel were made only for domestic wholesale price and Bangkok wholesale price because of data limitation in provincial fish markets.

5.4.1 Domestic Wholesale Price

Factors affecting domestic wholesale price of Indo-Pacific mackerel under consideration in this study are quantity of Indo-Pacific mackerel landed throughout the whole Kingdom, per capita income and per capita fish consumption expenditure. The analyses were made through regression equations using annual data between 1971 and 1985, and the following symbols for variables;

- IPMP 1 = domestic wholesale price of
Indo-Pacific mackerel (Baht/kg)
- IPMQ 1 = national landed quantity of Indo-Pacific
mackerel (tons)
- POP1 = total population of the Kingdom
(million persons)
- PCI = per capita income (Baht)
- FCE = per capita fish consumption expenditure
(Baht)
- R^2 = coefficient of determination and numbers
in parentheses coefficients of independent
variables are t-values.

Estimated regression equations representing the relationships between domestic wholesale price of Indo-Pacific mackerel and its determining factors are as follows:

- 1) Equation representing the relationship between Indo-Pacific mackerel domestic wholesale price (IPMP 1) and national landed quantity of Indo-Pacific mackerel (IPMQ 1) and total population in the Kingdom (POP 1) is shown as follow:

$$\text{IPMP 1} = -8.54643 - 0.00002 \text{ IPMQ 1} + 0.00041 \text{ POP1} \dots\dots(1) \\ (-3.05269) \quad (-2.08691) \quad (6.65223)$$

$$R^2 = 0.79548$$

2) Equation representing the relationship between Indo-Pacific mackerel wholesale price (IPMP 1) and national landed quantity of Indo-Pacific mackerel (IPMQ 1) and per capita income (PCI) is shown as follows:

$$\text{IPMP 1} = 6.35066 - 0.00003 \text{ IPMQ 1} + 0.00035 \text{ PCI} \dots\dots(2) \\ (6.46791) \quad (-2.87466) \quad (6.46439)$$

$$R^2 = 0.78611$$

3) Equation representing the relationship between Indo-Pacific mackerel wholesale price (IPMP 1) and national landed quantity (IPMQ 1) and per capita fish consumption expenditure (FCE) is shown as follows:

$$\text{IPMP 1} = 7.28579 - 0.00004 \text{ IPMQ 1} + 0.00625 \text{ FCE} \dots\dots(3) \\ (8.49627) \quad (-3.43279) \quad (7.11002)$$

$$R^2 = 0.81608$$

Equation (1) shows the relationship between domestic wholesale price of Indo-Pacific mackerel and quantity of Indo-Pacific mackerel landed throughout the country and total population in the Kingdom. This equation shows both the negative impact of an increase in the national landed quantity of Indo-Pacific mackerel on its domestic wholesale price and the positive impact of an increase in the total population in the Kingdom on domestic wholesale price of Indo-Pacific mackerel since an increase in landed quantity raises the supply of Indo-Pacific mackerel in the market, hence depresses the wholesale price, while an increase in the size of the population increases

demand for Indo-Pacific mackerel, hence raises the wholesale price. However, both independent variables in this equation can explain about 80 percent of the variations in domestic wholesale price of Indo-Pacific mackerel as shown by the R^2 value. The remaining variations were caused by other factors not included in this equation.

Equation (2) shows the relationship between Indo-Pacific mackerel wholesale price and national landed quantity of domestic wholesale price and per capita income. This equation shows both the negative impact of an increase in the landed quantity and the positive impact of an increase in per capita income and hence an increase in domestic demand for Indo-Pacific mackerel on domestic wholesale price of Indo-Pacific mackerel. The explanation of these relationships is similar to that of equation (1). However, both independent variables in this equation can explain the variation of domestic wholesale price only about 79 percent.

Equation (3) shows the relationship between Indo-Pacific mackerel wholesale price and national landed quantity and per capita fish consumption expenditure. This equation also shows the negative impact of an increase in national landed quantity of Indo-Pacific mackerel and the positive impact of an increase in per capita fish consumption expenditure, i.e., an increase in domestic demand for Indo-Pacific mackerel, on domestic wholesale price of Indo-Pacific mackerel. Both independent variables can explain about 81 percent of the variations in domestic wholesale price.

5.4.2 Bangkok Wholesale Price

The analysis of factors affecting the Bangkok wholesale price of Indo-Pacific mackerel considered only the relationships between wholesale price of large-sized Indo-Pacific mackerel and the quantity of Indo-Pacific mackerel landed in the Bangkok Fish Market, total Bangkok population, per capita income

and per capita fish consumption expenditure. Results of the analyses through regression equations, using annual data between 1971 and 1985 and the following symbols of variables, are shown below;

IPMP 2 = Bangkok wholesale price of large-sized Indo-Pacific mackerel (Baht/kg)

IPMQ 2 = quantity of Indo-Pacific mackerel landed at the Bangkok Fish Market (tons)

POP2 = total Bangkok population (million persons)

PCI = per capita income (Baht)

FCE = per capita fish consumption expenditure (Baht)

Estimated regression equations representing the relationships between Bangkok wholesale price of Indo-Pacific mackerel and its determining factors are as follows:

1) Equation representing the relationship between Indo-Pacific mackerel Bangkok wholesale price (IPMP 2) and landed quantity of Indo-Pacific mackerel at the Bangkok Fish Market (IPMQ 2) and total Bangkok population (POP 2) is shown as follows:

$$\text{IPMP 2} = 0.25072 - 0.00015 \text{ IPMQ 2} + 3.63155 \text{ POP2} \dots (4)$$

(0.06055) (-2.19621) (4.17722)

$$R^2 = 0.61197$$

2) Equation representing the relationship between Indo-Pacific mackerel Bangkok wholesale price (IPMP 2) and landed quantity of Indo-Pacific mackerel at the Bangkok Fish Market (IPMQ 2) and per capita income (PCI) is shown as follows:

$$\text{IPMP 2} = 13.49752 - 0.00024 \text{ IPMQ 2} + 0.0006 \text{ PCI} \dots (5)$$

(6.97571) (-3.83692) (5.27738)

$$R^2 = 0.71325$$

3) Equation representing the relationship between Indo-Pacific mackerel Bangkok wholesale price (IPMP 2) and landed quantity of Indo-Pacific mackerel at the Bangkok Fish Market (IPMQ 2) and per capita fish consumption expenditure (FCE) is shown as follows:

$$\text{IPMP 2} = 14.40122 - 0.00023 \text{ IPMQ 2} + 0.01007 \text{ FCE} \dots (6)$$

(7.39177) (-3.6156) (5.16871)

$$R^2 = 0.35469$$

All these three equations show relationships between Bangkok wholesale price of Indo-Pacific mackerel and all determining factors similar to those of domestic wholesale price. That is, Bangkok wholesale price of Indo-Pacific mackerel will decline when quantity of Indo-Pacific mackerel landed at the Bangkok Fish Market increases, and rise when either the Bangkok population or per capita income and per capita fish consumption expenditure on Indo-Pacific mackerel increases. However, R^2 values of the regression equations are much lower in the case of Bangkok wholesale price than in the case of domestic wholesale price, which shows that relationships between wholesale price of Indo-Pacific mackerel and the affecting factors are better explained by domestic wholesale price equations.

Chapter VI

LITTLE TUNA

6.1 Introduction

Tuna landed at fishing ports throughout the whole Kingdom of Thailand were mainly Little tuna of three species, namely, Longtail tuna, Bonito and Frigate tuna and were used mainly as raw material of tuna canneries. Little tuna has become an economically important fish for Thailand in recent years owing to high foreign demand for Thai canned tuna, especially from the United States and Europe. A rise in foreign demand for Thai canned tuna has increased domestic demand and hence the domestic wholesale price of Little tuna has risen rapidly in recent years.

In spite of Little tuna having become an economically important fish in recent years, data on this species were not as fully available as on other marine species. Available data on Little tuna were only national landed quantity and domestic wholesale price of Little tuna, and quantity and wholesale price of Little tuna landed at the Bangkok Fish Market. No data of Little tuna landed at different provincial fishing ports were available. Annual data of domestic wholesale price and export price of canned tuna were available only for a very short period and were not sufficient for statistical analysis. Hence price analyses of Little tuna were made only for domestic wholesale price trend of Little tuna, Bangkok wholesale price trend and seasonal price movement of Little tuna landed at the Bangkok Fish Market, and factors affecting both domestic and Bangkok wholesale price of Little tuna.

6.2 Domestic Wholesale Price of Little Tuna

The analysis of domestic wholesale price trend of Little tuna was based on annual data of the Department of Fisheries, Ministry of Agriculture and Cooperatives. As the Department of Fisheries classified Little tuna into two species, i.e., Longtail tuna and Bonito, the analysis of price trend was made for both species. As data of annual landed quantity and domestic wholesale price of Longtail tuna were available for the period 1971-1985, while those of Bonito were available for the period 1979-1985, the analysis of Longtail tuna and that of Bonito at the national level were made for different time periods.

6.2.1 Domestic Wholesale Price of Longtail Tuna

The trend of national landed quantity of Longtail tuna from 1971 to 1985 could be subdivided into two periods. The first was from 1971 to 1981, when national landed quantity of Longtail tuna was rather low and the volume did not exceed 13,000 tons per year. Fluctuation in landed quantity of Longtail tuna during this period was from the minimum quantity of the 15-year study period of 6,548 tons in 1971 to the maximum landed quantity during the first period of the price trend of 12,932 tons in 1977 which declined from 10,353 tons in 1978 to 8,671 tons in 1980 and 11,621 tons in 1981. The second period of the price trend began in 1982 when landed quantity of Longtail tuna started to rise from 25,416 tons in 1982 to reach the maximum quantity during the 15-year study period of 53,805 tons in 1983 and declined to 44,378 tons in 1984 and 40,533 tons in 1985. (See Table 6.1 and Fig. 6.1)

The trend of domestic wholesale price of Longtail tuna from 1971 to 1985 could also be subdivided into two periods. The first was from 1971 to 1978 when domestic wholesale price of Longtail tuna increased from only 2.50 Baht/kg in 1971 to 6.78 Baht/kg in 1978. In the second period of the trend, domestic wholesale price of Longtail tuna increased sharply to 14.21 Baht/kg in 1979 when national landed quantity of Longtail tuna increased about 20.8 percent from the previous year. Domestic wholesale price of Longtail tuna rose to the maximum price of the 15-year study period of 15.63 Baht/kg, or about 10 percent, in 1980 when national landed quantity of Longtail tuna declined about 30.7 percent that year. From 1981 onwards, domestic wholesale price of Longtail tuna declined steadily from 13.95 Baht/kg in 1981 to 11.81 Baht/kg in 1982, 12.02 Baht/kg in 1983, 11.27 Baht/kg in 1984 and 11.20 Baht/kg in 1985, while national landed quantity of Longtail tuna increased sharply during this period. (See Table 6.1 and Fig. 6.2)

Table 6.1 National Production and Wholesale Price of Little Tuna

Quantity : Tons

Price : Baht/kg

Year	Longtail tuna		Bonito	
	Quantity	Price	Quantity	Price
1971	6,548	2.50	-	-
1972	6,551	3.00	-	-
1973	7,914	4.00	-	-
1974	9,925	4.40	-	-
1975	12,004	5.80	-	-
1976	9,719	5.85	-	-
1977	12,932	5.81	-	-
1978	10,353	6.78	-	-
1979	12,503	14.21	4,342	20.59
1980	8,671	15.63	5,012	22.64
1981	11,621	13.95	10,652	18.41
1982	25,416	11.81	25,891	9.66
1983	53,805	12.02	32,015	8.79
1984	44,378	11.27	32,460	9.31
1985	40,533	11.20	30,122	11.24

Source : Fisheries Record of Thailand, Department of Fisheries.

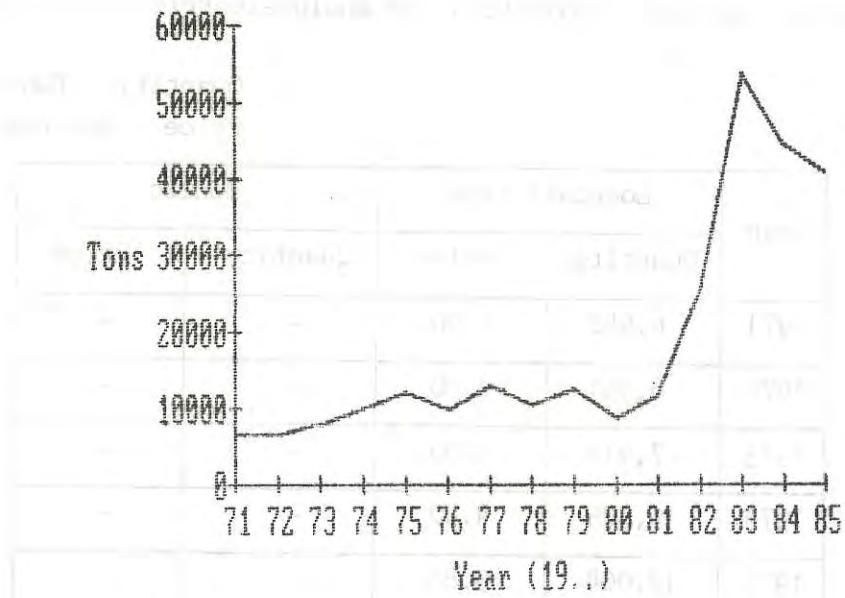


Fig. 6.1 National Production of Longtail Tuna

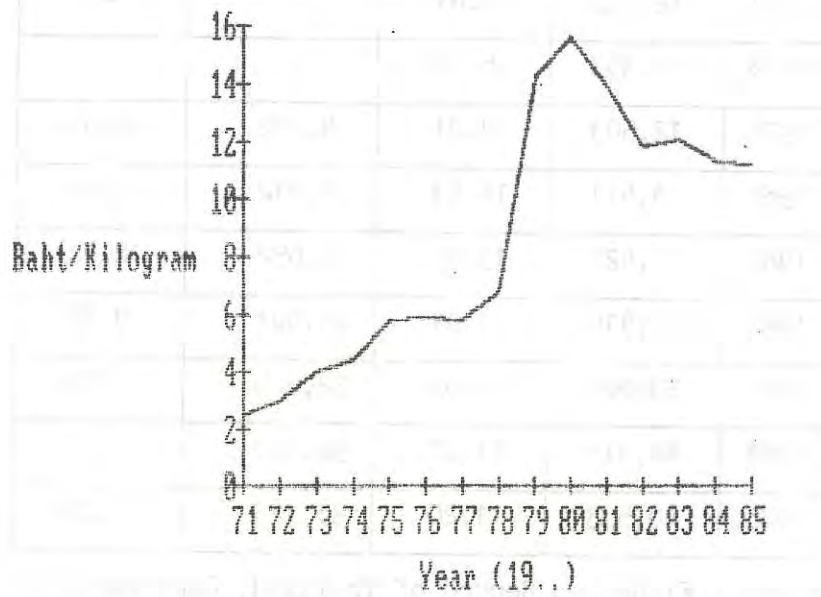


Fig. 6.2 National Wholesale Price of Longtail Tuna

6.2.2 Trend of Domestic Wholesale Price of Bonito

Data on national landed quantity and domestic wholesale price of Bonito have been available since 1979. Owing to an increase in tuna fisheries resulting from high demand for Thai canned tuna, national landed quantity of Bonito increased sharply from 4,342 tons in 1979, and 5,012 tons in 1980 to 10,652 tons in 1981, increased further to 25,981 tons in 1982, 32,015 tons in 1983, reached the maximum landed quantity of 32,460 tons in 1984 and declined slightly to 30,122 tons in 1985. (See Table 6.1 and Fig. 6.3) Domestic wholesale price of Bonito, on the other hand, increased from 20.59 Baht/kg in 1979 to 22.64 Baht/kg in 1980 when national landed quantity of Bonito in these two years was rather low, then declined to 18.41 Baht/kg in 1981 and declined further to reach the minimum price of 8.79 Baht/kg in 1983, 9.31 Baht/kg in 1984 and 11.24 Baht/kg in 1985 when national landed quantity of Bonito was rather high in these years. (See Table 6.1 and Fig. 6.4)

6.3 Bangkok Wholesale Price of Little Tuna

Data on quantity and average wholesale price of Little tuna landed at the Bangkok Fish Market were the aggregate data of both Longtail tuna and Frigate tuna landed at this fish market during the period between 1971 and 1985. The trend of quantity of Little tuna landed at the Bangkok Fish Market during this period could be subdivided into two parts. The first part was from 1971 to 1979 when landed quantity of Little tuna increased from only 370 tons in 1971 and 544 tons in 1972 to 1,174 tons in 1973 and increased further to 2,344 tons in 1979. In the second part, landed quantity of Little tuna declined to 1,551 tons in 1980 and 1,247 tons in 1981, then increased to 2,122 tons in 1982 and increased further to reach the maximum landed quantity of 3,105 tons in 1984, and declined to 2,167 tons in 1985. (See Table 6.2 and Fig. 6.5)

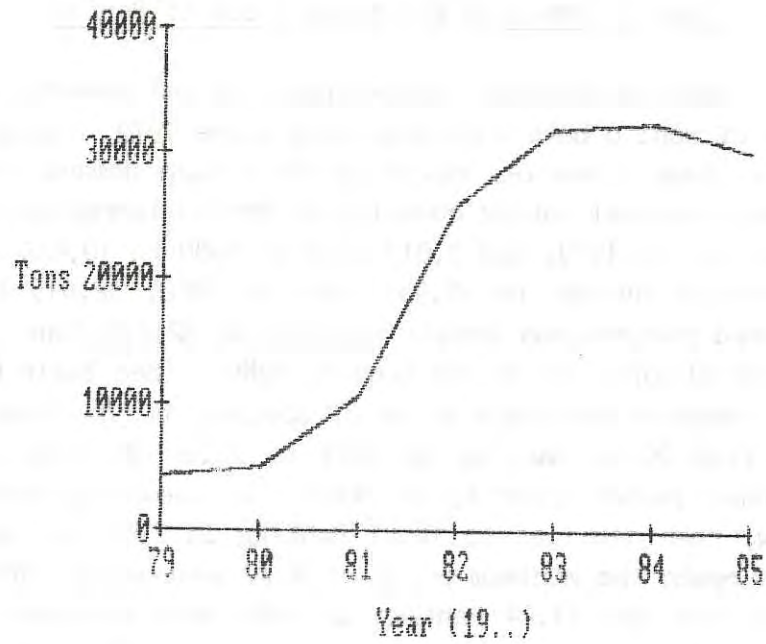


Fig. 6.3 National Production of Bonito

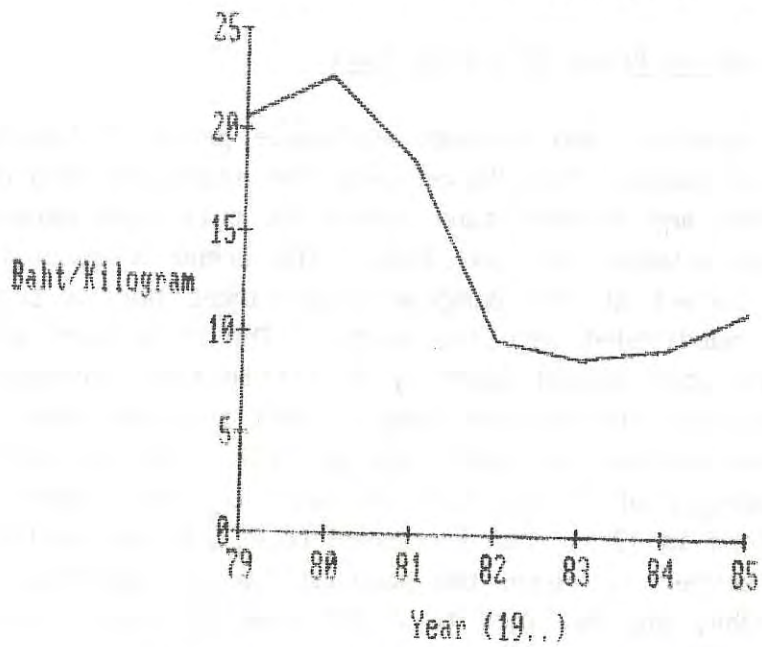


Fig. 6.4 National Wholesale Price of Bonito

Table 6.2 Quantity and Wholesale Price of Little Tuna Auctioned at Bangkok Fish Market

Quantity : Tons
Price : Baht/kg

Year	Quantity	Price
1971	370	2.50
1972	544	3.00
1973	1,174	4.00
1974	1,570	5.00
1975	1,695	5.50
1976	1,878	6.00
1977	1,159	8.00
1978	1,842	12.00
1979	2,344	8.00
1980	1,551	14.00
1981	1,247	19.79
1982	2,122	18.50
1983	2,137	18.15
1984	3,105	14.50
1985	2,167	14.39

Source : Fisheries Record, The Fish Marketing Organization.

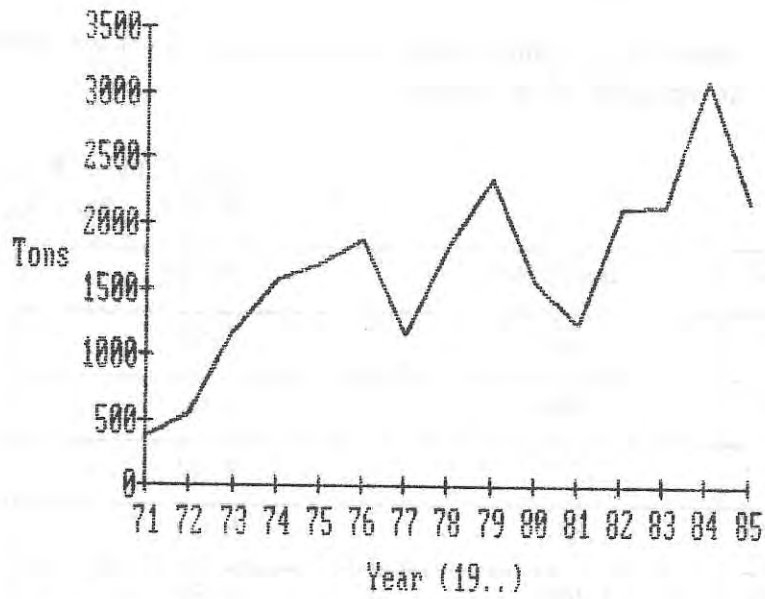


Fig. 6.5 Quantity of Little Tuna at Bangkok Fish Market

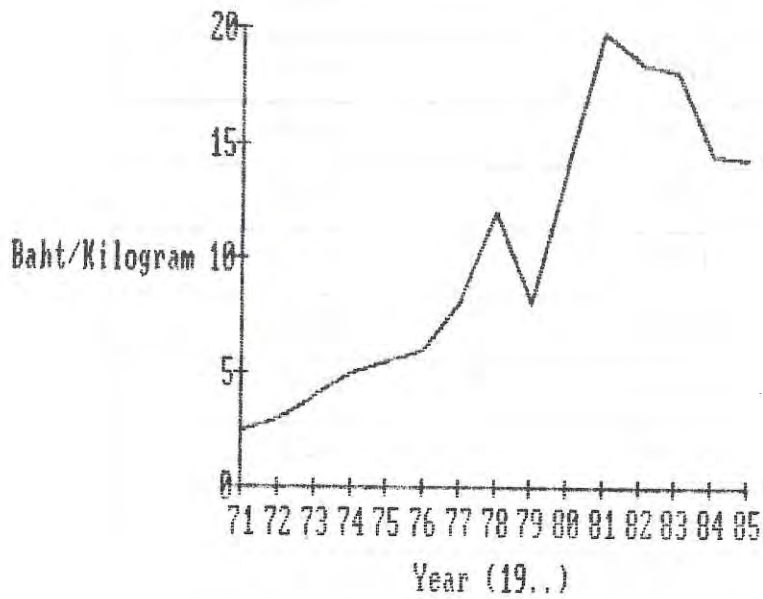


Fig. 6.6 Wholesale Price of Little Tuna at Bangkok Fish Market

Average wholesale price of Little tuna in the Bangkok Fish Market increased from 2.50 Baht/kg in 1971 to 12.00 Baht/kg in 1978 when landed quantity of Little tuna increased from only 370 tons in 1971 to 1,842 tons in 1978. Wholesale price of Little tuna declined to 8.00 Baht/kg, or 33.3 percent, in 1979 when landed quantity of Little tuna increased about 27.3 percent. Wholesale price of Little tuna increased again to 14.00 Baht/kg in 1980 and to the maximum price of 19.79 Baht/kg in 1981 when the quantity of Little tuna landed at this market declined drastically during these two years. Then average wholesale price of Little tuna declined from 18.50 Baht/kg in 1982, 18.15 Baht/kg in 1983 to 14.50 Baht/kg in 1984 and 14.39 Baht/kg in 1985 when landed quantity of Little tuna increased sharply in 1984 and declined slightly in 1985. (See Table 6.2 and Fig. 6.6)

6.4 Seasonal Indices of Little Tuna in the Bangkok Fish Market

6.4.1 Data

The analysis of seasonal price movements of Little tuna could be made only for those in the Bangkok Fish Market since there were no data available for provincial markets. Data used for this analysis were monthly wholesale price and monthly quantity of Longtail tuna, and those of Frigate tuna landed at the Bangkok Fish Market during the period between 1 January 1981 and 31 December 1985.

Comparison of monthly quantity and monthly wholesale price of Longtail tuna and Frigate tuna landed at the Bangkok Fish Market during the period between 1981 and 1985 showed that landed quantity of Longtail tuna was generally lower than that of Frigate tuna, while wholesale price of Longtail tuna was generally higher than that of Frigate tuna.

The quantity of Longtail tuna landed at the Bangkok Fish Market increased from 318.2 tons in 1981 to 734.3 tons in 1982, then declined to 639.8 tons in 1983 and increased again to the maximum quantity of this 5-year period of 1,690.6 tons in 1984, then declined to 782.9 tons in 1985. (See Table 6.3 and Fig. 6.7) Annual average wholesale price of Longtail tuna at the Bangkok Fish Market increased from 21.58 Baht/kg in 1981 to 22.59 Baht/kg in 1982, 24.60 Baht/kg in 1983, then declined to 20.96 Baht/kg in 1984 and 17.53 Baht/kg in 1985. (See Table 6.4 and Fig. 6.8)

During the same period, landed quantity of Frigate tuna at the Bangkok Fish Market increased from 928.2 tons in 1981 to 1,387.8 tons in 1982, 1,497 tons in 1983, then declined to 1,414.2 tons in 1984 and 1,475.4 tons in 1985. (See Table 6.5 and Fig. 6.9) On the other hand, annual average wholesale price of Frigate tuna in this market declined from 15.58 Baht/kg in 1981 to 13.78 Baht/kg in 1982, 11.75 Baht/kg in 1983, 9.88 Baht/kg in 1984, then increased slightly to 11.24 Baht/kg in 1985. (See Table 6.6 and Fig. 6.10)

6.4.2 Results

The analysis of seasonal price movements of Little tuna in the Bangkok Fish Market was made from the comparison between seasonal quantity indices and seasonal price indices of Longtail tuna and between those of Frigate tuna as shown in Tables 6.7 and 6.8.

Quantity of Longtail tuna landed at the Bangkok Fish Market was normally high during the period between January and April, and in July, September and October, with the maximum landed quantity in October. On the other hand, landed quantity was normally low in May, June, August, November and December, with the minimum landed quantity in November. (See Table 6.7 and Fig. 6.11)

Table 6.3 Quantity of Longtail Tuna Landed at Bangkok Fish Market

(MT)

Month	1981	1982	1983	1984	1985
Jan.	43.8	84.7	74.9	93.4	78.8
Feb.	46.6	49.2	109.1	29.9	115.1
Mar.	43.8	72.7	85.6	74.1	55.6
Apr.	27.3	102.2	76.5	104.6	66.7
May.	14.3	53.8	31.7	99.8	46.3
Jun.	5.2	42.8	27.4	104.0	85.2
Jul.	40.1	27.8	48.5	221.5	92.9
Aug.	21.4	65.8	50.8	86.7	62.0
Sep.	30.8	29.1	55.1	221.3	73.9
Oct.	11.2	37.0	38.0	523.4	34.5
Nov.	7.4	65.0	9.7	68.2	13.1
Dec.	26.3	104.3	32.5	63.7	58.8
Total	318.2	734.4	639.8	1,690.6	782.9

Source : Fisheries Record, The Fish Marketing Organization.

Table 6.4 Monthly Wholesale Prices of Longtail Tuna
at Bangkok Fish Market

(Baht/kg)

Month	1981	1982	1983	1984	1985
Jan.	22.00	25.00	24.00	30.00	15.56
Feb.	22.00	24.56	22.50	19.00	15.00
Mar.	18.00	20.00	25.00	25.00	14.00
Apr.	16.00	18.00	20.00	22.50	16.00
May.	16.00	19.20	20.00	25.00	15.00
Jun.	18.00	25.00	20.00	20.00	16.00
Jul.	19.00	22.80	20.00	18.00	20.00
Aug.	22.00	25.00	26.30	20.00	20.00
Sep.	22.00	25.00	27.00	20.00	20.00
Oct.	28.00	24.56	30.00	18.00	18.90
Nov.	28.00	20.00	30.00	18.00	20.00
Dec.	28.00	22.00	30.00	16.00	20.00
Average	21.58	22.59	24.60	20.96	17.53

Source : Fisheries Record, The Fish Marketing Organization.

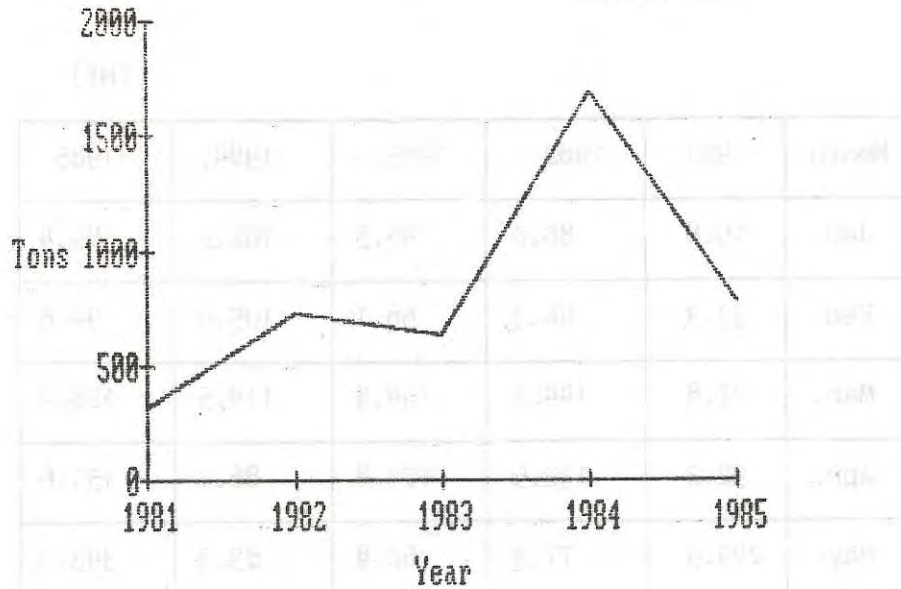


Fig. 6.7 Quantity of Longtail Tuna at Bangkok Fish Market

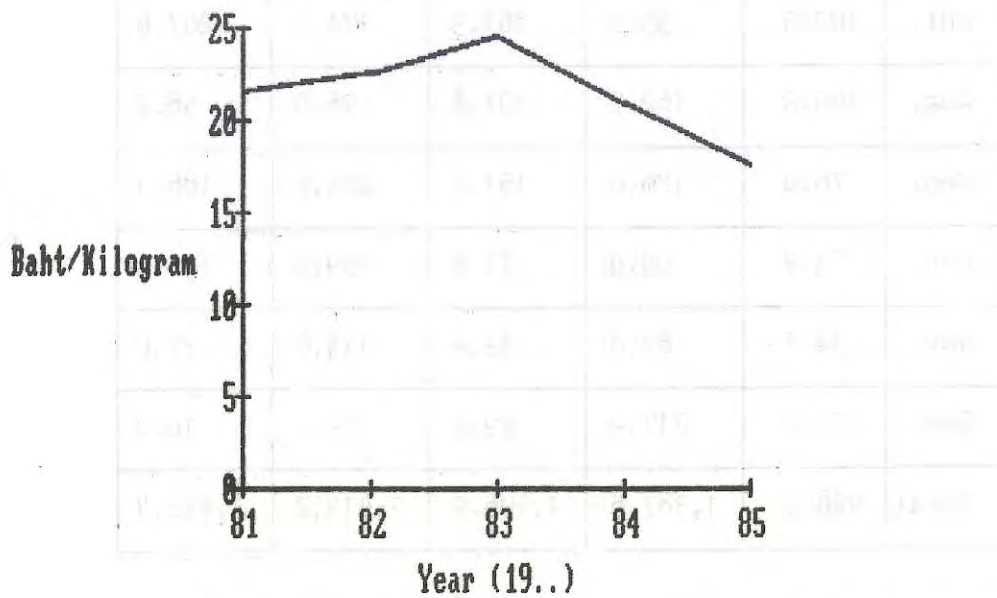


Fig. 6.8 Wholesale Price of Longtail Tuna at Bangkok Fish Market

Table 6.5 Quantity of Frigate Tuna Landed at Bangkok Fish Market

(MT)

Month	1981	1982	1983	1984	1985
Jan.	15.8	80.0	45.3	102.6	89.4
Feb.	33.3	86.3	56.1	105.8	94.6
Mar.	27.8	144.2	154.5	114.5	128.9
Apr.	92.2	132.5	173.8	86.1	151.6
May.	249.5	77.5	60.8	83.3	343.3
Jun.	50.5	154.1	146.1	96.7	72.5
Jul.	102.5	55.2	261.3	171.5	207.6
Aug.	165.3	162.7	307.8	96.0	58.2
Sep.	76.0	126.0	151.3	225.6	186.1
Oct.	53.9	68.6	77.9	159.0	106.2
Nov.	34.7	82.8	32.4	134.0	27.0
Dec.	26.7	217.9	29.6	39.1	10.0
Total	928.2	1,387.8	1,496.9	1,414.2	1,475.4

Source : Fisheries Record, The Fish Marketing Organization.

Table 6.6 Monthly Wholesale Prices of Frigate Tuna
at Bangkok Fish Market

(Baht/kg)

Month	1981	1982	1983	1984	1985
Jan.	18.00	15.00	12.00	12.00	8.00
Feb.	16.00	14.00	12.00	12.00	6.90
Mar.	15.00	12.00	12.00	12.00	8.00
Apr.	14.00	12.00	11.00	11.00	8.00
May.	13.00	12.00	11.00	10.00	8.00
Jun.	14.00	12.00	12.00	10.00	12.04
Jul.	15.00	15.00	11.00	10.00	12.90
Aug.	15.00	15.00	12.00	10.00	15.00
Sep.	15.00	15.00	12.00	8.00	14.00
Oct.	18.00	14.50	12.00	8.00	14.00
Nov.	17.00	12.00	12.00	8.00	14.00
Dec.	17.00	12.00	12.00	7.50	14.00
Average	15.58	13.78	11.75	9.88	11.24

Source : Fisheries Record, The Fish Marketing Organization.

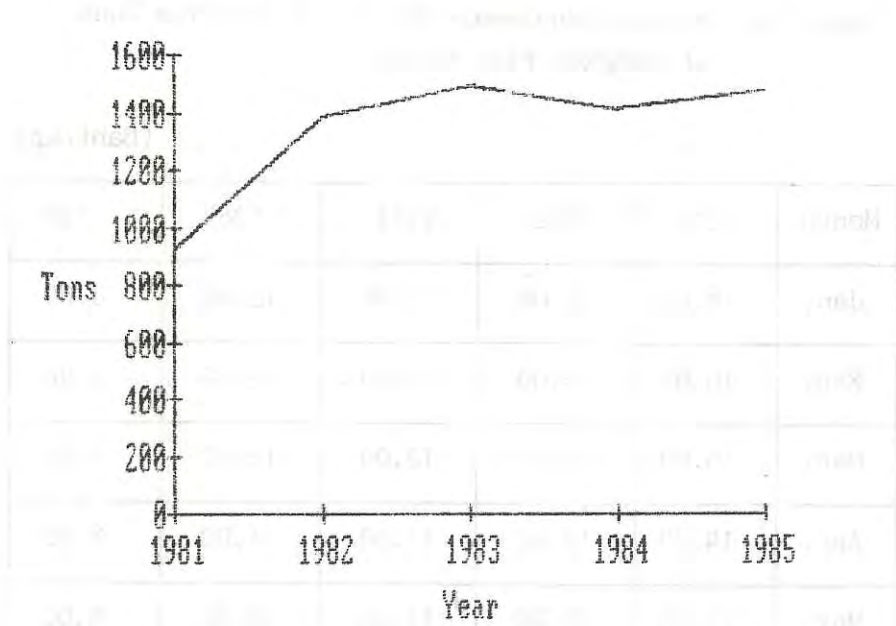


Fig. 6.9 Quantity of Frigate Tuna at Bangkok Fish Market

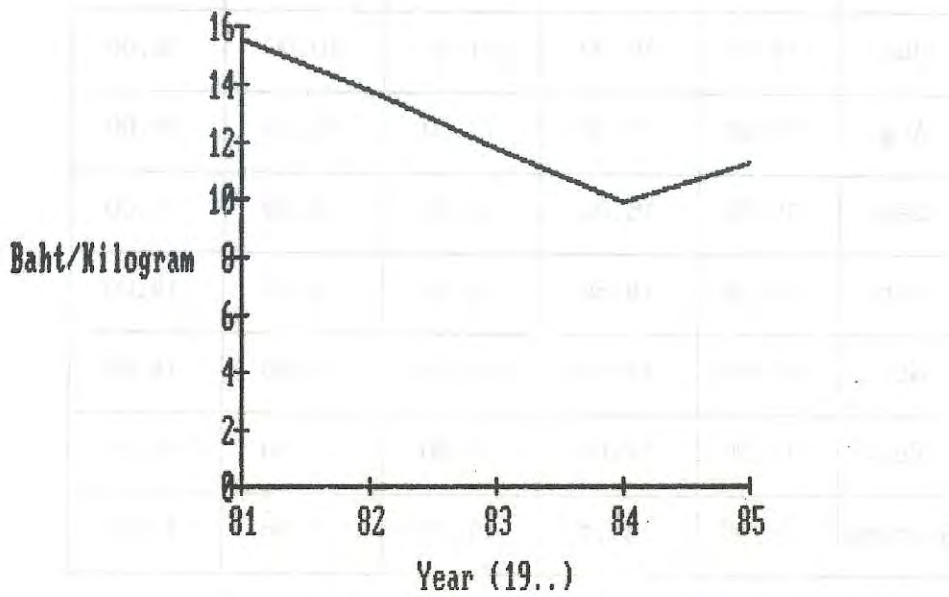


Fig. 6.10 Wholesale Price of Frigate Tuna at Bangkok Fish Market

Seasonal price movement of Longtail tuna at the Bangkok Fish Market was as follows: price was normally high in January and during the period between August and December, with the maximum price in October, and price was normally low in the period between February and July, with the minimum price in April. (See Table 6.8 and Fig. 6.12)

Similarly, seasonal movement of landed quantity of Frigate tuna at the Bangkok Fish Market was as follows: landed quantity was normally high during the periods between March and May, and between July and September, with the maximum landed quantity in August, and landed quantity was normally low in January and February, and in the October and December, with the minimum quantity in November. (See Table 6.7 and Fig. 6.13)

Seasonal price movement of Frigate tuna at the Bangkok Fish market, on the other hand, was as follows: price was normally high in January and in the period between June and December, with the maximum price in October, and price was low during the period between February and May, with the minimum price in May. (See Table 6.8 and Fig. 6.14)

Table 6.7 Seasonal Quantity Indices of Frigate Tuna and Longtail Tuna Landed at Bangkok Fish Market, 1981-1985

Month	Frigate tuna	Longtail tuna
Jan.	66.40	130.66
Feb.	72.31	104.69
Mar.	116.62	108.03
Apr.	110.72	127.46
May.	110.85	75.06
Jun.	97.13	82.93
Jul.	137.17	118.24
Aug.	161.71	84.35
Sep.	124.08	103.55
Oct.	76.25	133.64
Nov.	59.10	47.21
Dec.	67.66	84.18

Table 6.8 Seasonal Price Indices of Frigate Tuna and Longtail Tuna at Bangkok Fish Market, 1981-1985

Month	Bangkok Prices	
	Frigate tuna	Longtail tuna
Jan.	100.39	106.22
Feb.	95.63	92.24
Mar.	95.16	94.82
Apr.	90.92	87.75
May.	89.14	90.96
Jun.	101.39	93.88
Jul.	105.25	94.11
Aug.	106.42	104.55
Sep.	102.73	106.37
Oct.	108.13	113.14
Nov.	102.68	108.21
Dec.	102.14	107.76

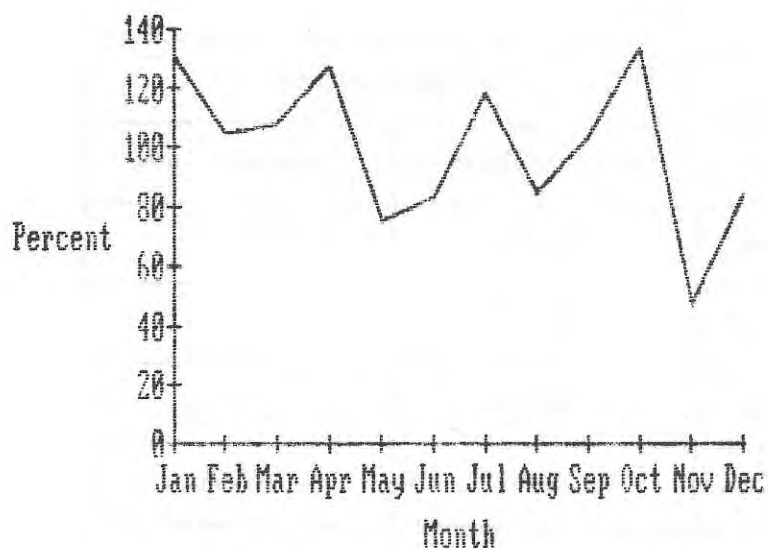


Fig. 6.11 Seasonal Quantity Indices of Longtail Tuna at Bangkok Fish Market, 1981-1985

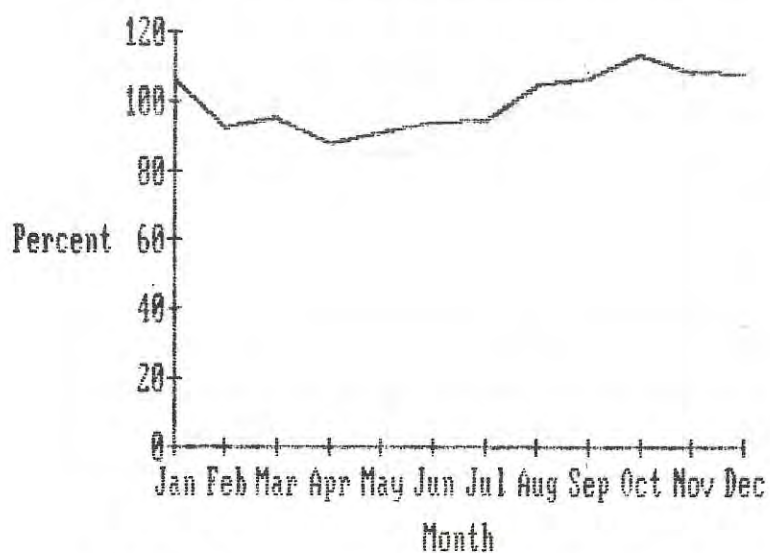


Fig. 6.12 Seasonal Price Indices of Longtail Tuna at Bangkok Fish Market, 1981-1985

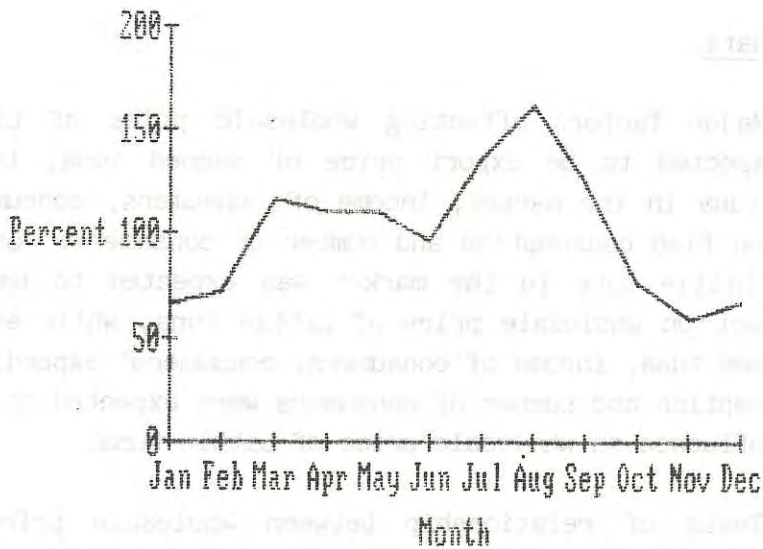


Fig. 6.13 Seasonal Quantity Indices of Frigate Tuna at Bangkok Fish Market, 1981-1985

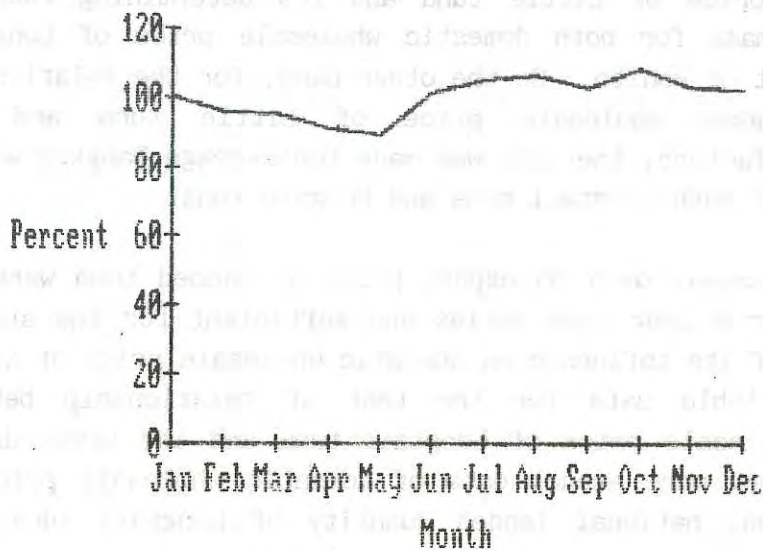


Fig. 6.14 Seasonal Price Indices of Frigate Tuna at Bangkok Fish Market, 1981-1985

6.5 Factors Affecting Wholesale Price of Little Tuna

6.5.1 Data

Major factors affecting wholesale price of Little tuna were expected to be export price of canned tuna, landed quantity of tuna in the market, income of consumers, consumers' expenditure on fish consumption and number of consumers. Landed quantity of Little tuna in the market was expected to have a negative impact on wholesale price of Little tuna, while export price of canned tuna, income of consumers, consumers' expenditure on fish consumption and number of consumers were expected to have a positive influence on wholesale price of Little tuna.

Tests of relationship between wholesale price of Little tuna and its determining factors were made for both domestic wholesale price and Bangkok wholesale price of Little tuna. For the analysis of the relationship between domestic wholesale price of Little tuna and its determining factors, tests were made for both domestic wholesale price of Longtail tuna and that of Bonito. On the other hand, for the relationship between Bangkok wholesale price of Little tuna and its influencing factors, the test was made for average Bangkok wholesale price of both Longtail tuna and Frigate tuna.

Annual data on export price of canned tuna were not available for a long time series and sufficient for the statistical test of its influence on domestic wholesale price of Little tuna. Available data for the test of relationship between domestic wholesale price of Longtail tuna and its other determining factors were annual data of domestic wholesale price of Longtail tuna, national landed quantity of Longtail tuna, per capita income as a proxy of consumers' income, per capita fish consumption expenditure as a proxy of consumers' expenditure on fish consumption and total population of the Kingdom as proxy of number of consumers during the period between 1971 and 1985. Similar data were used to test the relationship between domestic wholesale price of Bonito and its determining factors during 1979 to 1985.

The test of relationship between Bangkok wholesale price of Little tuna and its determining factors, on the other hand, used annual data of Bangkok wholesale price of Little tuna, quantity of Little tuna landed at the Bangkok Fish Market, per capita income, per capita fish consumption expenditure and total Bangkok population in the period between 1971 and 1985. In addition, the test of relationship of export price of canned tuna and Bangkok wholesale price of Little tuna was made by using monthly data for the period from 1 January 1981 to 31 December 1985.

6.5.2 Results

1) Domestic Wholesale Price of Little Tuna

The test of relationships between domestic wholesale price of Longtail tuna and Bonito and their determining factors gave the following results:

a. Domestic Wholesale Price of Longtail Tuna

The tests of relationships between Longtail tuna and their determining factors were made through regression equations, using the following symbols of variables:

LTP 1 = domestic wholesale price of Longtail tuna
(Baht/kg)

LTQ 1 = quantity of Longtail tuna landed throughout
the whole Kingdom (tons)

PCI = per capita income (Baht/kg)

FCE = per capita fish consumption expenditure
(Baht)

POP 1 = total population of the Kingdom

Estimated regression equations are as follows:

(1) Relationship between domestic wholesale price of Longtail tuna (LTP 1) and quantity of Longtail tuna landed throughout the whole Kingdom (LTQ 1) and per capita income (PCI) is shown as the following equation:

$$\text{LTP 1} = -1.02446 - 0.00014 \text{ LTQ 1} + 0.0011 \text{ PCI} \dots\dots\dots(1)$$

(-0.5823) (-2.25989) (5.87899)

$$R^2 = 0.82862$$

(2) Relationship between domestic wholesale price of Longtail tuna (LTP 1) and quantity of Longtail tuna landed throughout the whole Kingdom (LTQ 1) and per capita fish consumption expenditure (FCE) is shown as the following equation:

$$\text{LTP 1} = 2.31469 - 0.00018 \text{ LTQ 1} + 0.01751 \text{ FCE} \dots\dots\dots(2)$$

(1.76196) (-2.27528) (4.79552)

$$R^2 = 0.72457$$

(3) Relationship between domestic wholesale price of Longtail tuna (LTP 1) and total population of the Kingdom (POP 1) is shown as the following equation:

$$\text{LTP 1} = -26.58326 + 0.00079 \text{ (POP 1)} \dots\dots\dots(3)$$

(-4.23975) (5.63307)

$$R^2 = 0.70938$$

Equation (1) shows that domestic wholesale price of Longtail tuna had a negative relationship with quantity of Longtail tuna landed throughout the whole Kingdom and a positive relationship with per capita income. Similarly, equation (2) shows that domestic wholesale price of Longtail tuna had a negative relationship with national landed quantity of Longtail tuna and per capita fish consumption expenditure. R^2 of both equations are rather high and t-values of independent variables in both equations are also statistically acceptable.

Equation (1) shows that a one thousand ton increase in quantity of Longtail tuna landed throughout the whole Kingdom will depress domestic wholesale price of Longtail tuna by about 0.14 Baht/kg if per capita income remains unchanged. Similarly, a one thousand Baht increase in per capita income will push up domestic wholesale price of Longtail tuna by about 1.10 Baht/kg, if national landed quantity of longtail tuna remains unchanged. Equation (2), on the other hand, shows that a one thousand ton increase in quantity of Longtail tuna landed throughout the whole Kingdom will depress domestic wholesale price of Longtail tuna by about 0.18 Baht/kg if per capita fish consumption expenditure remains unchanged. Similarly, a one hundred Baht increase in per capita fish consumption expenditure will raise domestic wholesale price of Longtail tuna by about 1.75 Baht/kg if national landed quantity of Longtail tuna remains unchanged.

Equation (3) shows a positive relationship between domestic wholesale price of Longtail tuna and total population of the Kingdom. However, the impact of an increase in the size of the population on domestic wholesale price of Longtail tuna is minimal.

In summary, without considering the influence of export price of canned tuna on domestic wholesale price of Longtail tuna, major factors affecting domestic wholesale price of Longtail tuna were landed quantity of Longtail tuna, per capita income and per capita fish consumption expenditure.

b. Domestic Wholesale Price of Bonito

The tests of relationship between domestic wholesale price of Bonito and its determining factors were made through regression equations, using the following symbols of variables:

LTP 2 = domestic wholesale price of Bonito (Baht/kg)

LTQ 2 = quantity of Bonito landed throughout the whole Kingdom (tons)

PCI = per capita income (Baht/year)

POP 1 = total population of the Kingdom
(million persons)

Estimation regression equations are as follows:

(1) Relationship between domestic wholesale price of Bonito (LTP 2) and quantity of Bonito landed throughout the whole Kingdom (LTQ 2) is shown as the following equation:

$$\text{LTP 2} = 23.43641 - 0.00045 \text{ LTQ 2} \dots\dots\dots (4)$$

(22.81681) (-10.25707)

$$R^2 = 0.95463$$

(2) Relationship between domestic wholesale price of Bonito (LTP 2) and quantity of Bonito landed throughout the whole Kingdom (LTQ 2) and per capita income (PCI) is shown as the following equation:

$$\text{LTP 2} = 13.90989 - 0.0006 \text{ LTQ 2} + 0.00075 \text{ PCI} \dots\dots\dots (5)$$

(2.65303) (-6.84944) (1.84105)

$$R^2 = 0.97544$$

(3) Relationship between domestic wholesale price of Bonito (LTP 2) and quantity of Bonito landed throughout the whole Kingdom (LTQ 2) and total population of the Kingdom (POP 1) is shown as the following equation:

$$\text{LTP 2} = -20.69881 - 0.00058 \text{ LTQ 2} + 0.00096 \text{ POP 1} \dots\dots\dots (6)$$

(-1.11086) (-9.24378) (2.37051)

$$R^2 = 0.98113$$

Equation (4) shows that domestic wholesale price of Bonito had a negative relationship with the quantity of Bonito landed throughout the whole Kingdom and a positive relationship with per capita income, as expected earlier. A one thousand ton increase in quantity of Bonito landed throughout the whole Kingdom will raise domestic wholesale price of Bonito about 0.45 Baht/kg if all other determining factors are not included in the equation.

Equation (5) shows that a one thousand Baht increase in per capita income will raise domestic wholesale price of Bonito about 0.75 Baht/kg if the quantity of Bonito landed throughout the whole Kingdom remains unchanged.

Equation (6) shows that domestic wholesale price of Bonito had a positive relationship with the total population of the Kingdom. However, the influence of a change in the size of the population in the Kingdom on domestic wholesale price of Bonito is minimal.

The test of relationship between domestic wholesale price of Bonito and per capita fish consumption expenditure gave an unsatisfactory statistical result. Hence, without considering the influence of export price of canned tuna, other major factors affecting domestic wholesale price of Bonito were quantity of Bonito landed throughout the whole Kingdom and per capita income.

2) Bangkok Wholesale Price of Little Tuna

The tests of relationship between Bangkok wholesale price of Little tuna and its determining factors used annual data for the period 1971-1985 and the following symbols of variables:

- LTP 3 = Bangkok wholesale price of Little tuna
(Baht/kg)
- LTQ 3 = quantity of Little tuna landed at the
Bangkok Fish Market
- PCI = per capita income (Baht)
- FCE = per capita fish consumption expenditure
(Baht)
- POP 2 = total population of Bangkok (million
persons)
- R² = coefficient of determination and number in
parentheses are t-values

(1) Relationship between Bangkok wholesale price of Little tuna (LTP 3) and quantity of Little tuna landed at the Bangkok Fish Market (LTQ 3) and per capita income (PCI) is shown as the following equation:

$$\text{LTP 3} = -0.12914 - 0.00289 \text{ LTQ 3} + 0.00137 \text{ PCI} \dots\dots(7)$$

(-0.11232) (-3.13821) (10.99234)

$$R^2 = 0.93915$$

(2) Relationship between Bangkok wholesale price of Little tuna (LTP 3) and quantity of Little tuna landed at the Bangkok Fish Market (LTQ 3) and per capita fish consumption expenditure (FCE) is shown as the following equation:

$$\text{LTP 3} = 2.76119 - 0.00287 \text{ LTQ 3} + 0.02365 \text{ FCE} \dots\dots(8)$$

(1.76663) (-2.18175) (7.53307)

$$R^2 = 0.88159$$

(3) Relationship between Bangkok wholesale price of Little tuna (LTP 3) and total population of Bangkok (POP 2) is shown as the following equation:

$$\text{LTP 3} = -21.52341 + 6.86899 \text{ POP2} \dots \dots \dots (9)$$

(-3.97189) (5.87829)

$$R^2 = 0.74224$$

All three equations above had rather high R^2 s values and statistical acceptable t-values of independent variables.

Equation (7) shows that Bangkok wholesale price of Little tuna had a negative relationship with quantity of Little tuna landed at the Bangkok Fish Market and a positive relationship with per capita income, as expected earlier. A thousand ton increase in quantity of Little tuna landed at the Bangkok Fish Market will depress Bangkok wholesale price of Little tuna about 2.90 Baht/kg if per capita income and all other determining factors remain unchanged. However, if per capita income increases by one hundred Baht while quantity of Little tuna landed at the Bangkok Fish Market and all other determining factors remain unchanged, Bangkok wholesale price of Little tuna will increase by about 0.29 Baht/kg. Similarly, equation (8) shows that a one hundred Baht increase in per capita fish consumption expenditure will raise Bangkok wholesale price of Little tuna about 2.36 Baht/kg, if quantity of Little tuna landed in the Bangkok Fish Market and all other determining factors remain unchanged. On the other hand, equation (9) shows that if the population of Bangkok increases by one million persons while all other determining factors remain unchanged, Bangkok wholesale price of Little tuna will increase by 6.87 Baht/kg owing to the increase in the number of fish consumers.

The test of relationship between Bangkok wholesale price of Little tuna and export price of canned tuna using monthly data gave an unsatisfactory statistic result. Similarly, the test of relationship between Bangkok wholesale price of Longtail tuna or Bangkok wholesale price of Frigate tuna and its determining factors using monthly data gave unsatisfactory statistic results.

Hence, similar conclusions could be drawn from the analysis of factors affecting Bangkok wholesale price of Little tuna as that of domestic wholesale price that, without considering the influence of export price of canned tuna, determining factors of Bangkok wholesale price of Little tuna were quantity of Little tuna landed at the Bangkok Fish Market, per capita income, per capita fish consumption expenditure and total population of Bangkok.

Chapter VII

TRASH FISH

7.1 Trend of Domestic Wholesale Price

Trash fish was used mainly as raw material of fish meal factories. Nearly half of the fish meal produced in Thailand was exported overseas, in particular to Singapore, Malaysia, Indonesia, Taiwan, Hong Kong and the Philippines.

From 1971 onwards, the quantity of trash fish landed throughout the whole Kingdom of Thailand fluctuated while maintaining a rising trend. Quantity of trash fish landed throughout the whole Kingdom increased from 655,329 tons in 1971 to 804,478 tons in 1973 and declined gradually to 620,646 tons, a minimum landed quantity during the 1971-1985 study period, in 1976, then increased sharply to reach the maximum landed quantity of 847,421 tons, in 1978 and fluctuated downward to 753,606 tons in 1985. (See Table 7.1 and Fig. 7.1)

Domestic wholesale price of trash fish, on the other hand, increased from 0.60 Baht/kg in 1971 to 1.50 Baht/kg in 1978 and declined to 1.38 Baht/kg in 1979, then increased sharply to reach the maximum price of 2.05 Baht/kg in 1984 and declined to 1.69 Baht/kg in 1985. (See Table 7.1 and Fig. 7.2) Fluctuation in trash fish domestic wholesale price was generally believed to reflect changes in fish meal domestic wholesale price and export price.

During this period, the quantity of fish meal produced in Thailand increased from 60,922 tons in 1971 to reach the maximum quantity of 203,492 tons in 1984 and declined to 183,000 tons in 1985, (See Table 7.2 and Fig. 7.3) while the quantity of fish meal exported increased from 18,399 tons in 1971 to reach the maximum quantity of 128,469 tons in 1977 then declined steadily to 74,791 tons in 1985. (See Table 7.2 and Fig. 7.4). From the

Table 7.1 Quantity and Average Price of Trash Fish in the Whole Kingdom

Quantity : Tons
Price : Baht/kg

Year	Quantity	Price
1971	655,329	0.60
1972	719,091	0.70
1973	804,478	0.90
1974	690,270	1.00
1975	634,971	1.00
1976	620,646	1.10
1977	836,643	1.25
1978	847,421	1.50
1979	784,267	1.38
1980	786,858	1.84
1981	796,747	1.77
1982	812,789	1.88
1983	803,337	2.02
1984	757,637	2.05
1985	753,606	1.69

Source : Fisheries Record of Thailand, Department of Fisheries

Table 7.2 National Production and Export of Fish Meal

Quantity : Tons
Price : Baht/kg

Year	Production		Export	
	Quantity	Price ^{1/}	Quantity	Price
1971	60,922	n.a.	18,399	2.74
1972	73,176	n.a.	28,194	3.36
1973	91,774	n.a.	24,324	5.16
1974	94,717	6.42	21,946	5.89
1975	94,980	5.02	26,919	5.04
1976	119,880	6.27	49,280	5.07
1977	138,304	7.56	75,617	7.07
1978	197,165	6.85	102,971	7.06
1979	180,956	7.02	128,469	6.88
1980	184,054	10.15	114,343	8.49
1981	186,201	10.33	113,821	8.91
1982	182,047	10.18	83,074	8.43
1983	194,563	10.59	93,246	8.42
1984	203,492	10.42	85,492	8.69
1985	183,000	9.09	74,791	8.09

Source : Foreign Trade Statistics of Thailand, The Customs Department.

Note : ^{1/} Bangkok Wholesale Price of Fish Meal (60% Protein)

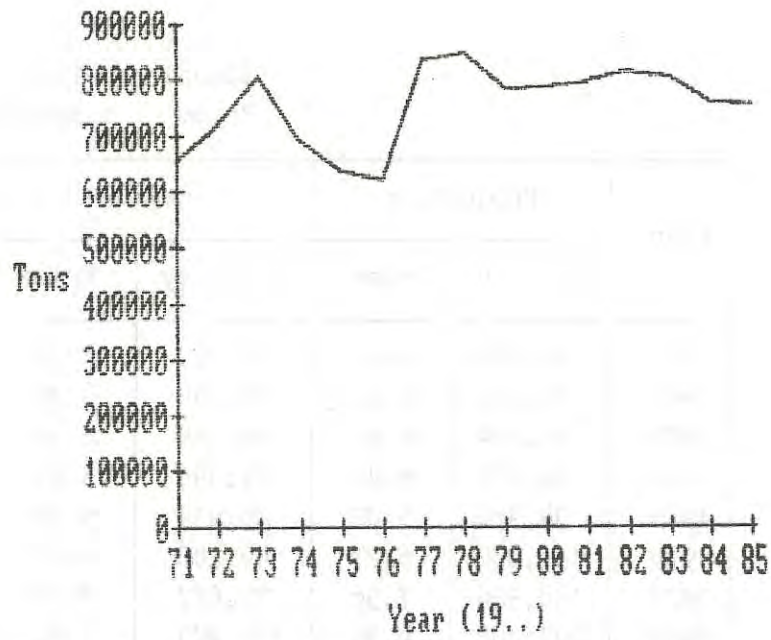


Fig. 7.1 National Production of Trash Fish

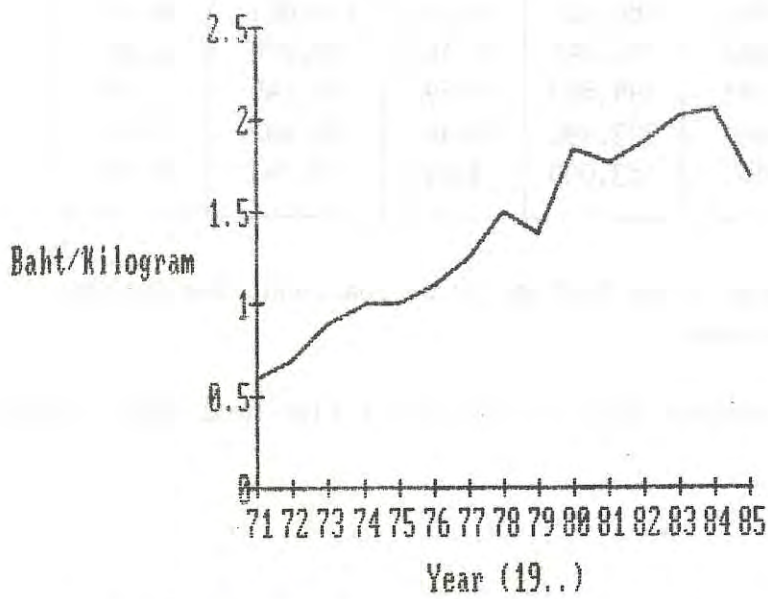


Fig. 7.2 National Wholesale Price of Trash Fish

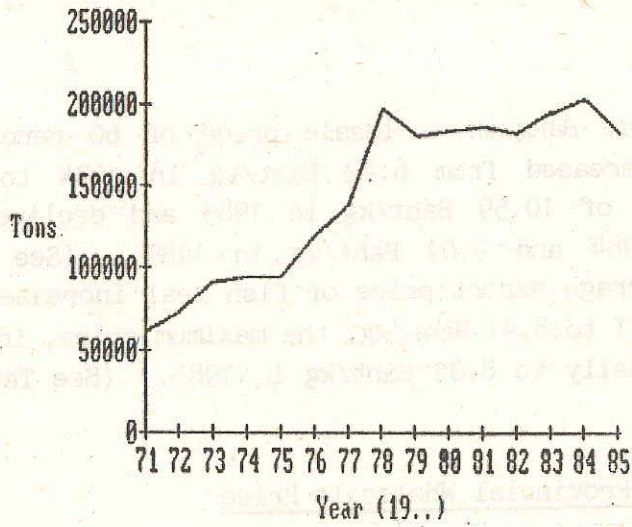


Fig. 7.3 National Production of Fish Meal

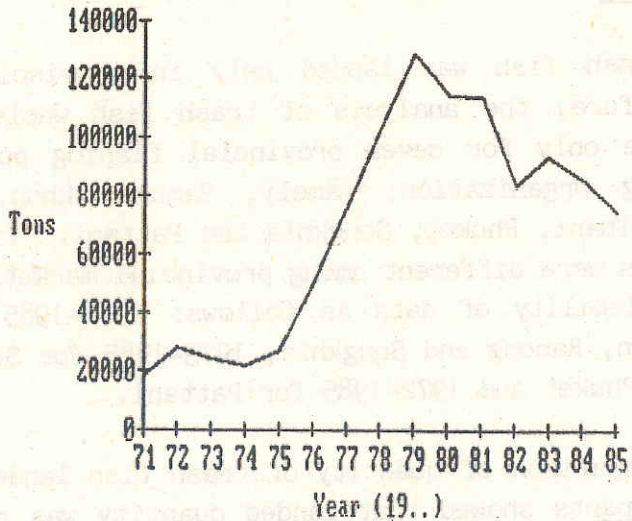


Fig. 7.4 Quantity of Fish Meal Export

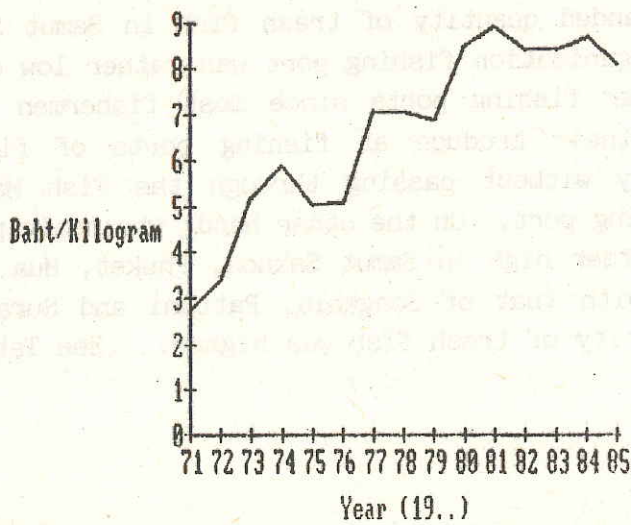


Fig. 7.5 Fish Meal Export Price

available data, Bangkok wholesale price of 60 percent protein fish meal increased from 6.42 Baht/kg in 1974 to reach the maximum price of 10.59 Baht/kg in 1983 and declined to 10.42 Baht/kg in 1984 and 9.09 Baht/kg in 1985. (See Table 7.2) Similarly, average export price of fish meal increased from 2.74 Baht/kg in 1971 to 8.91 Baht/kg, the maximum price, in 1981, then declined gradually to 8.09 Baht/kg in 1985. (See Table 7.2 and Fig. 7.5)

7.2 Trend of Provincial Wholesale Price

7.2.1 Data

Trash fish was landed only in provincial fishing ports. Therefore, the analysis of trash fish wholesale price trend was made only for seven provincial fishing ports of the Fish Marketing Organization, namely, Samut Sakhon, Hua Hin, Ranong, Surat Thani, Phuket, Songkhla and Pattani. Time periods of the analysis were different among provincial markets depending upon the availability of data as follows: 1971-1985 for Samut Sakhon, Hua Hin, Ranong and Songkhla, 1973-1985 for Surat Thani, 1978-1985 for Phuket and 1972-1985 for Pattani.

Comparison of quantity of trash fish landed in these seven fishing ports showed that landed quantity was rather high in Songkhla, Pattani, Ranong, Surat Thani, Hua Hin and Phuket in recent years. Landed quantity of trash fish in Samut Sakhon's Fish Marketing Organization fishing port was rather low compared with that in other fishing ports since most fishermen in this province landed their produce at fishing ports of fish meal factories directly without passing through the Fish Marketing Organization fishing port. On the other hand, wholesale price of trash fish was rather high in Samut Sakhon, Phuket, Hua Hin and Ranong compared with that of Songkhla, Pattani and Surat Thani where landed quantity of trash fish was higher. (See Tables 7.3 and 7.4)

Table 7.3 Quantity of Trash Fish Landed at Major Fishing Ports

(MT)

Year	Samut Sakhon	Hua Hin	Ranong	Surat Thani	Phuket	Songkhla	Pattani
1971	38,578	832	268	-	-	25,261	-
1972	40,036	994	1,410	-	-	33,431	2,828
1973	45,124	2,495	879	348	-	54,246	6,988
1974	34,785	4,003	500	813	-	64,428	10,023
1975	41,270	4,714	60	2,593	-	70,103	8,207
1976	40,058	4,210	220	7,668	-	86,220	14,710
1977	32,679	4,259	744	24,742	-	85,522	20,866
1978	40,033	3,898	28	24,949	47	94,410	25,780
1979	28,085	4,017	110	27,901	2,469	110,493	30,727
1980	27,956	7,602	2,570	25,874	2,467	107,653	34,256
1981	7,299	7,722	4,549	21,377	1,344	109,639	30,445
1982	427	6,950	4,201	19,783	2,834	119,062	42,279
1983	216	6,441	13,720	15,300	8,388	121,053	43,052
1984	310	7,718	13,460	11,781	2,817	119,123	43,430
1985	591	7,375	12,885	11,339	2,894	119,799	42,012

Source : Fisheries Record, The Fish Marketing Organization

Table 7.4 Price of Trash Fish Landed at Major Fishing Ports

(Baht/kg)

Year	Samut Sakhon	Hua Hin	Ranong	Surat Thani	Phuket	Songkhla	Pattani
1971	0.60	0.46	0.50	-	-	0.45	-
1972	0.70	0.65	0.60	-	-	0.48	0.45
1973	0.90	0.83	0.75	1.10	-	0.60	0.67
1974	1.15	1.08	0.90	1.40	-	0.87	0.86
1975	1.03	1.04	0.90	1.25	-	0.76	0.77
1976	1.34	1.16	1.00	1.25	-	0.97	1.04
1977	1.72	1.57	1.21	1.20	-	1.30	1.44
1978	1.69	1.40	1.32	1.23	1.60	1.19	1.40
1979	1.50	1.19	1.33	1.25	1.33	1.10	1.30
1980	2.21	1.67	2.60	1.84	1.72	1.93	1.98
1981	2.51	1.80	1.89	1.84	2.08	1.82	1.82
1982	2.11	2.10	2.14	1.81	2.31	1.86	1.99
1983	2.27	1.99	1.94	1.83	1.90	1.79	1.92
1984	2.06	2.17	2.01	1.89	2.18	1.71	1.93
1985	1.94	1.30	1.72	1.44	1.84	1.42	1.71

Source : Fisheries Record, The Fish Marketing Organization

7.2.2 Analysis of Wholesale Price Trend in Each Market

Samut Sakhon

Quantity of trash fish landed at Samut Sakhon's Fish Marketing Organization fishing port was rather high during the first ten years of the 1971-1985 period. Quantity of trash fish landed at this fishing port increased from 38,578 tons in 1971 to reach the maximum quantity of 45,124 tons in 1973 and then fluctuated between 34,785 tons in 1974, 41,270 tons in 1975 and 27,956 tons in 1980. From 1981 onwards, landed quantity of trash fish in this market declined sharply since most fishermen landed their produce at fishing ports of fish meal factories directly. Landed quantity of trash fish at the Fish Marketing Organization's fishing port declined to 7,299 tons in 1981 and decreased further to 427 tons in 1982, 216 tons, a minimum landed quantity, in 1983, 310 tons in 1984 and 591 tons in 1985. (See Table 7.3 and Fig. 7.6)

Wholesale price of trash fish at Samut Sakhon fish market fluctuated mainly in response to changes in fish meal wholesale price rather than to changes in landed quantity of trash fish in the market. Wholesale prices of trash fish landed at Samut Sakhon Fish Market increased gradually from 0.60 Baht/kg in 1971 to 1.15 Baht/kg in 1974, then declined to 1.03 Baht/kg, or 10.4 percent from the previous year, in 1975 when Bangkok wholesale price of fish meal (60 percent of protein) declined from 6.42 Baht/kg in 1974 to 5.02 Baht/kg, a 21.8 percent decline, in 1975, while landed quantity of trash fish increased about 18.6 percent.

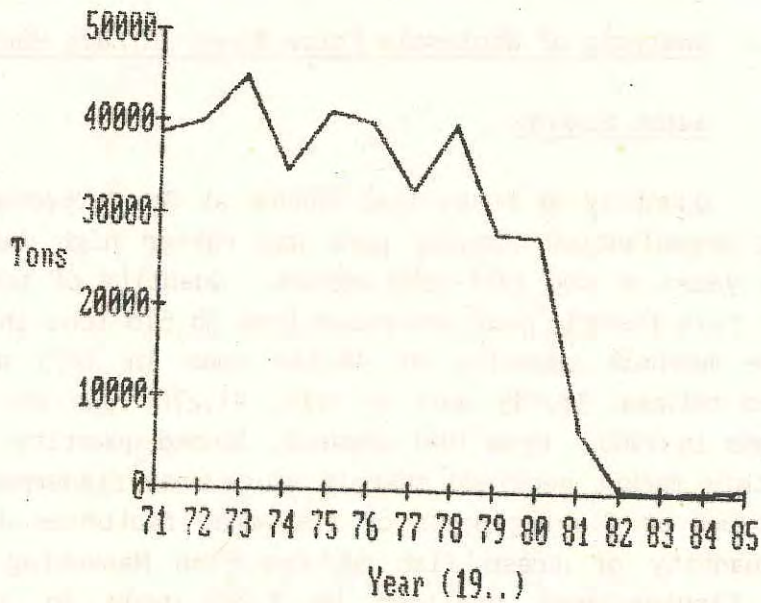


Fig. 7.6 Quantity of Trash Fish at Samut Sakhon Fish Market

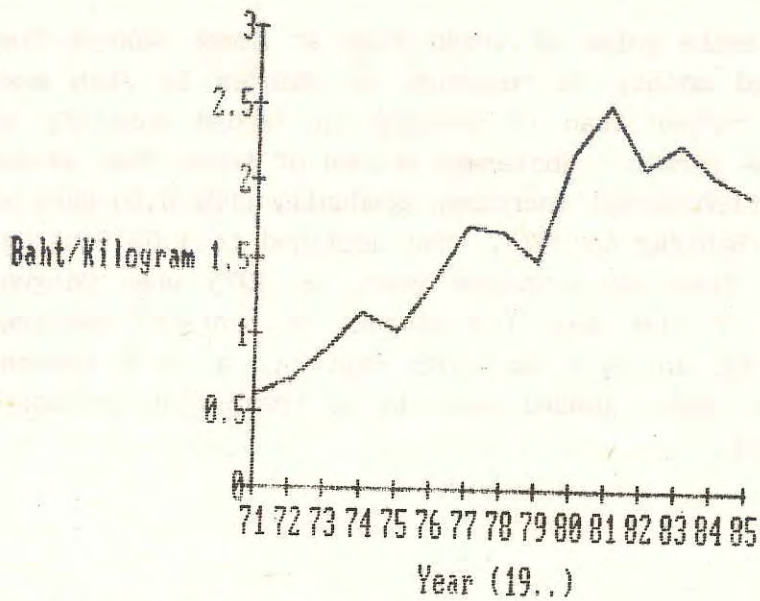


Fig. 7.7 Wholesale Price of Trash Fish at Samut Sakhon Fish Market

Wholesale price of trash fish at Samut Sakhon Fish Market increased to 1.34 Baht/kg, or 30.1 percent, in 1976 when Bangkok wholesale price of fish meal increased about 24.9 percent while landed quantity of trash fish at Samut Sakhon Fish Market declined about 2.9 percent. Wholesale price of trash fish in Samut Sakhon Fish Market increased to 1.72 Baht/kg, or 28.4 percent, in 1977 in spite of a 18.4 percent decline in trash fish landed quantity when Bangkok wholesale price of fish meal increased to 7.56 Baht/kg or 20.6 percent.

Trash fish wholesale price in Samut Sakhon Fish Market declined to 1.69 Baht/kg or 1.7 percent, in 1978 and 1.50 Baht/kg, or 11.2 percent, in 1979 when Bangkok wholesale price of fish meal declined about 9.4 percent in 1978 and increased about 2.5 percent in 1979, while landed quantities of trash fish increased about 22.5 percent in 1978 and declined about 29.9 percent in 1979.

Trash fish wholesale price in Samut Sakhon fish market increased to 2.21 Baht/kg in 1980 and increased further to reach the maximum price of 2.51 Baht/kg in 1981 or increased about 47.7 percent in 1980 and 13.6 percent in 1981, when Bangkok wholesale price of fish meal increased about 44.6 percent in 1980 and 1.8 percent in 1981, and landed quantity at this fishing port declined slightly in 1980 and declined about 73.9 percent to reach 7,299 tons in 1981.

When landed quantity of trash fish in this fishing port declined drastically to 427 tons, or over ninety percent, in 1982, wholesale price of trash fish declined slightly to 2.11 Baht/kg or 15.9 percent. This drastic decline of landed quantity did not have a strong impact on wholesale price of trash fish since trash fish wholesale price depended upon fish meal wholesale price rather than on landed quantity. In 1982 Bangkok wholesale price of fish meal declined to 10.18 Baht/kg or 1.2 percent from 1.5 percent, and pulled down the wholesale price of trash fish in spite of a sharp decline in landed quantity.

Trash fish wholesale price in Samut Sakhon Fish Market increased to 2.27 Baht/kg, or 7.6 percent, in 1983 when Bangkok wholesale price of fish meal increased about 4 percent to 10.59 Baht/kg. Then trash fish wholesale price in the Samut Sakhon Fish Market declined to 2.06 Baht/kg, or 9.3 percent, in 1984 and to 1.94 Baht/kg, or 5.8 percent, in 1985 when Bangkok wholesale prices of fish meal declined to 10.42 Baht/kg, or 1.6 percent, in 1984 and to 9.09 Baht/kg, or 12.8 percent, in 1985, while landed quantity of trash fish declined to 216 tons in 1983 and slightly increased to 310 tons in 1984 and 591 tons in 1985. (See Tables 7.2, 7.3, 7.4 and Figs. 7.6, 7.7)

Hua Hin

Quantity of trash fish landed at the Fish Marketing Organization's fishing port in Hua Hin increased steadily from 832 tons in 1971 to 4,714 tons in 1975, then declined to 3,898 tons in 1978 and increased to reach the maximum landed quantity of 7,722 tons in 1981. From 1982 onwards, landed quantity of trash fish in this fishing port declined slightly from 6,950 tons in 1982 to 6,441 tons in 1983 then increased to 7,718 tons in 1984 and declined slightly to 7,375 tons in 1985. (See Table 7.3 and Fig. 7.8)

Wholesale price of trash fish in Hua Hin's Fish Marketing Organization fishing port was also on a rising trend as was that of landed quantity since changes in wholesale price responded to fluctuations in fish meal wholesale price rather than to fluctuations in landed quantity of trash fish in the market. During the first period of the long-term trend, trash fish wholesale price in Hua Hin's Fish Marketing Organization fishing port increased steadily from 0.46 Baht/kg in 1971 to 1.08 Baht/kg in 1974, then declined to 1.04 Baht/kg, or 3.7 percent, in 1975 when Bangkok wholesale price of fish meal declined from 6.42 Baht/kg in 1974 to 5.02 Baht/kg, or 21.8 percent, in 1975.

Trash fish wholesale price in Hua Hin increased to 1.16 Baht/kg in 1976 and 1.57 Baht/kg in 1977 when Bangkok wholesale price of fish meal rose to 6.27 Baht/kg in 1976 and 7.56 Baht/kg in 1977. Wholesale price of trash fish then declined to 1.40 Baht/kg in 1978 and 1.19 Baht/kg in 1979 when Bangkok wholesale price of fish meal declined to 6.85 Baht/kg in 1978 and 7.02 Baht/kg in 1979.

In the second period of the price trend, trash fish wholesale price rose sharply from 1.67 Baht/kg in 1980 to 2.10 Baht/kg in 1982 and declined to 1.99 Baht/kg in 1983, then increased to reach the maximum price of 2.17 Baht/kg in 1984 and declined to 1.30 Baht/kg in 1985, when Bangkok wholesale price of fish meal increased from 10.15 Baht/kg in 1980 to 10.59 Baht/kg in 1983 and declined to 10.42 Baht/kg in 1984 and 9.09 Baht/kg in 1985. (See Tables 7.2, 7.4 and Fig. 7.9)

Ranong

The trend of quantity of trash fish landed at Ranong's Fish Marketing Organization fishing port during 1971-1985 could be subdivided into three periods. The first was from 1971 to 1979 when landed quantity of trash fish was very low and increased from 268 tons in 1971 to 1,410 tons in 1972 then declined to 60 tons in 1975 and increased again to 744 tons in 1977 before declining to the minimum landed quantity of 28 tons in 1978 and to 110 tons in 1979.

In the second period, landed quantity of trash fish increased to 2,570 tons in 1980 and 4,549 tons in 1981 and 4,201 tons in 1982. In the third period, landed quantity of trash fish increased to reach the maximum quantity of 13,720 tons in 1983 and declined to 13,460 tons in 1984 and 12,885 tons in 1985. (See Table 7.3 and Fig. 7.10)

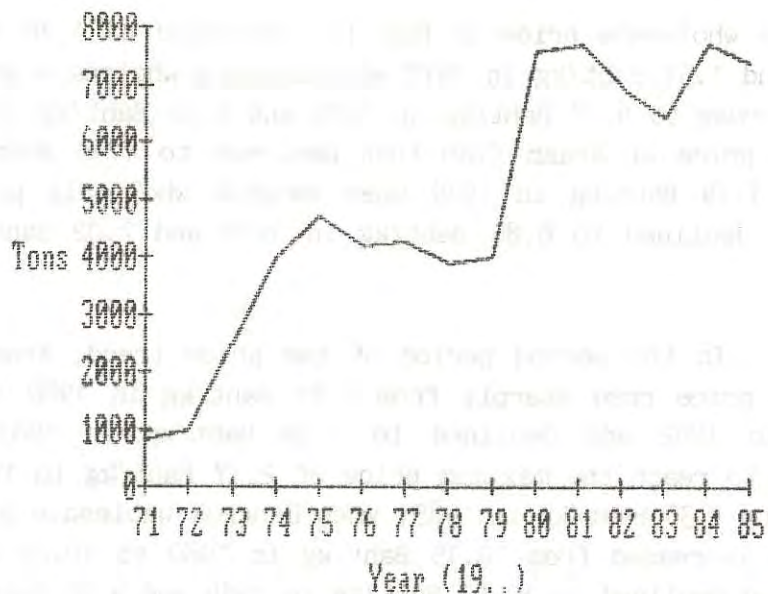


Fig. 7.8 Quantity of Trash Fish at Hua Hin Fish Market

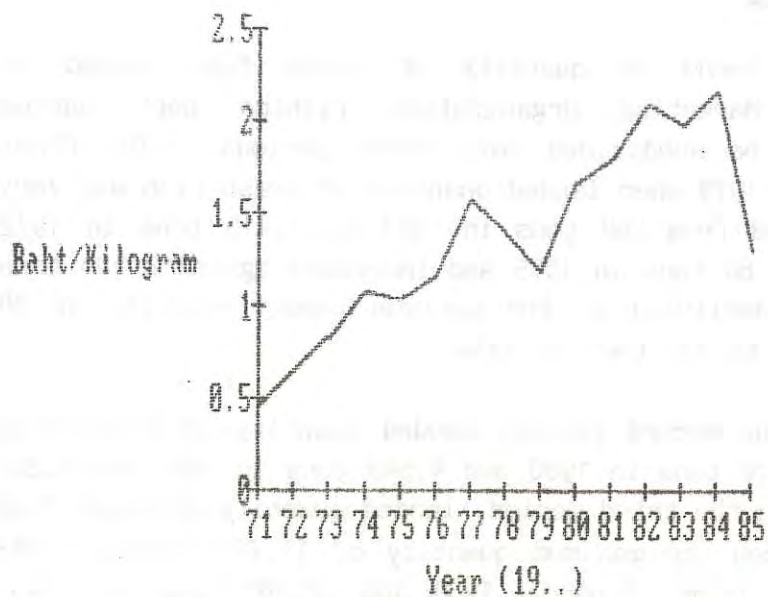


Fig. 7.9 Wholesale Price of Trash Fish at Hua Hin Fish Market

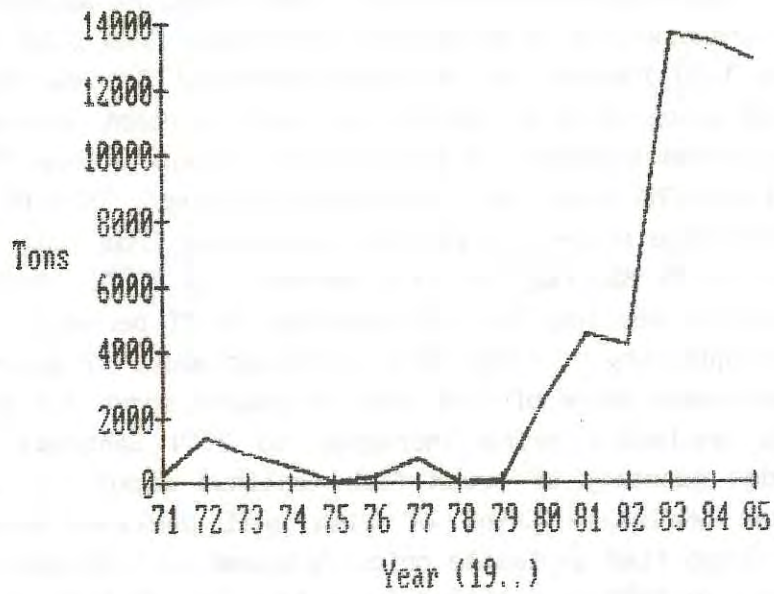


Fig. 7.10 Quantity of Trash Fish at Ranong Fish Market

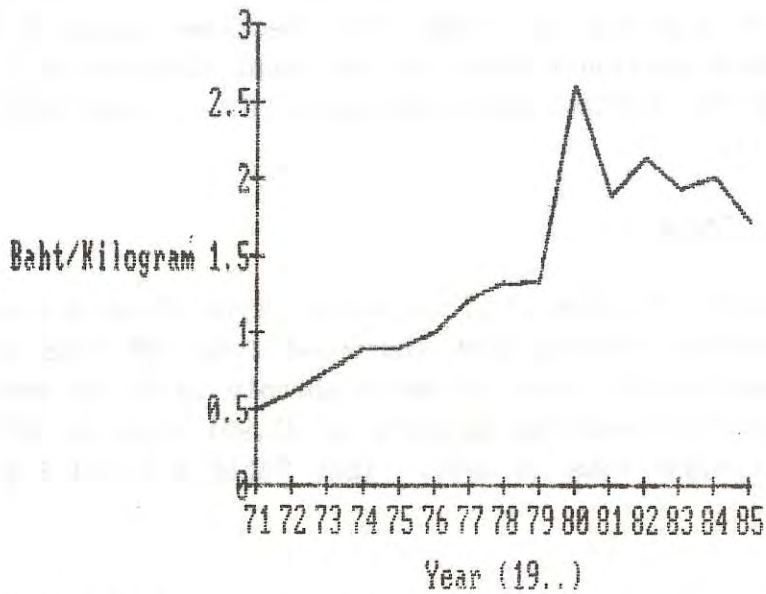


Fig. 7.11 Wholesale Price of Trash Fish at Ranong Fish Market

Wholesale price of trash fish landed at Ranong's Fish Marketing Organization fishing port increased from 0.50 Baht/kg in 1971 to 1.33 Baht/kg in 1979 and increased further to reach the maximum price of 2.60 Baht/kg, or a 95 percent increase, in 1980 when landed quantity of trash fish increased from 110 tons in 1979 to 2,570 tons, or increased 23 times, in 1980 while Bangkok wholesale price of fish meal increased from 7.02 Baht/kg in 1979 to 10.15 Baht/kg, or 44.6 percent, in 1980. Trash fish wholesale price declined to 1.89 Baht/kg, or 27 percent, in 1981 when landed quantity of trash fish increased about 77 percent and Bangkok wholesale price of fish meal increased about 1.8 percent. Trash fish wholesale price increased to 2.14 Baht/kg in 1982 while landed quantity of trash fish declined about 7.7 percent and Bangkok wholesale price of fish meal declined about 1.5 percent. Trash fish wholesale price declined to 1.94 Baht/kg, or 9.4 percent, in 1983 when landed quantity of trash fish increased about three fold over the 1982 quantity. Trash fish wholesale price increased to 2.01 Baht/kg, or 3.6 percent, in 1984 when landed quantity of trash fish declined about 1.9 percent. Trash fish wholesale price declined to 1.72 Baht/kg, or 14.4 percent, in 1985 when landed quantity of trash fish declined about 4.3 percent but Bangkok wholesale price of fish meal declined about 12.8 percent from the previous years wholesale price. (See Table 7.4 and Fig. 7.11)

Surat Thani

Quantity of trash fish landed at Surat Thani's Fish Marketing Organization fishing port increased from 348 tons in 1973 to 7,668 tons in 1976, then increased sharply to 24,742 tons in 1977 and reached the maximum quantity of 27,901 tons in 1979 and declined to 11,339 tons in 1985. (See Table 7.3 and Fig. 7.12)

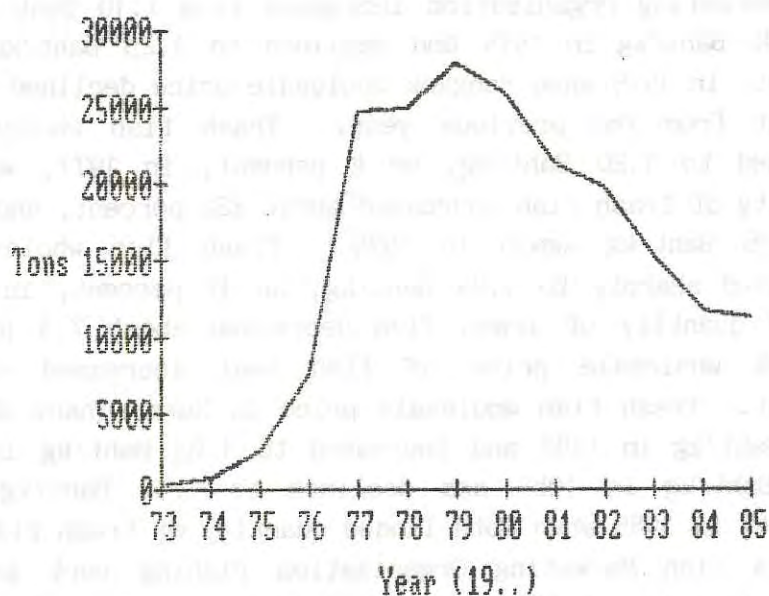


Fig. 7.12 Quantity of Trash Fish at Surat Thani Fish Market

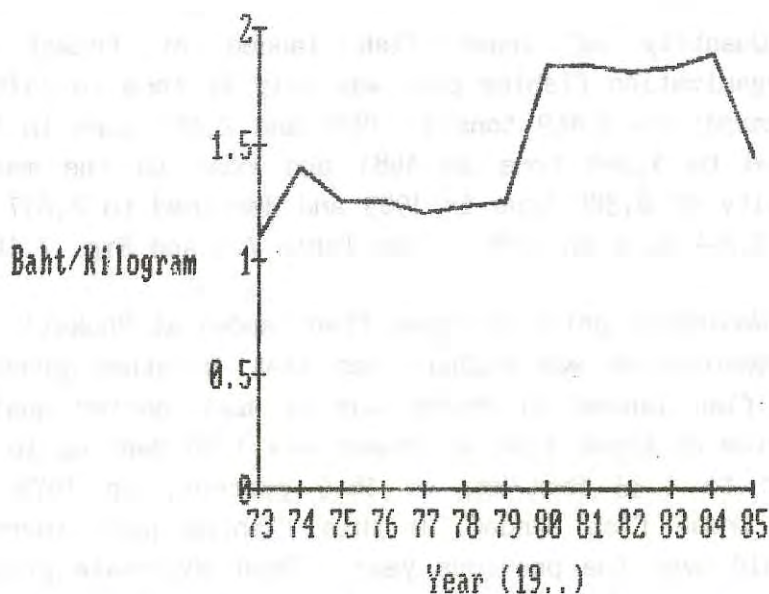


Fig. 7.13 Wholesale Price of Trash Fish at Surat Thani Fish Market

Wholesale price of trash fish landed at Surat Thani's Fish Marketing Organization increased from 1.10 Baht/kg in 1973 to 1.40 Baht/kg in 1974 and declined to 1.25 Baht/kg, or 10.7 percent, in 1975 when Bangkok wholesale price declined about 21.8 percent from the previous year. Trash fish wholesale price declined to 1.20 Baht/kg, or 4 percent, in 1977, when landed quantity of trash fish increased about 222 percent, and increased to 1.25 Baht/kg again in 1979. Trash fish wholesale price increased sharply to 1.84 Baht/kg, or 47 percent, in 1980 when landed quantity of trash fish decreased about 7.3 percent and Bangkok wholesale price of fish meal increased about 44.6 percent. Trash fish wholesale price in Surat Thani declined to 1.81 Baht/kg in 1982 and increased to 1.83 Baht/kg in 1983 and 1.89 Baht/kg in 1984 and declined to 1.44 Baht/kg, or 23.8 percent, in 1985 when both landed quantity of trash fish in Surat Thani's Fish Marketing Organization fishing port and Bangkok wholesale price of fish meal declined that year. (See Table 7.4 and Fig. 7.13)

Phuket

Quantity of trash fish landed at Phuket Fish Marketing Organization fishing port was only 47 tons in 1978 but increased sharply to 2,469 tons in 1979 and 2,467 tons in 1980, then declined to 1,344 tons in 1981 and rose to the maximum landed quantity of 8,388 tons in 1983 and declined to 2,817 tons in 1984 and 2,894 tons in 1985. (See Table 7.3 and Fig. 7.14)

Wholesale price of trash fish landed at Phuket's Fish Marketing Organization was higher than that in other provinces since trash fish landed in Phuket was of much better quality. Wholesale price of trash fish in Phuket was 1.60 Baht/kg in 1978 and declined to 1.33 Baht/kg, or 16.9 percent, in 1979 when quantity of trash fish landed in this fishing port increased nearly 50 fold over the previous year. Then wholesale price of trash fish increased to reach the maximum price of 2.31 Baht/kg in 1982 but declined to 1.90 Baht/kg, or 17.8 percent, in 1983 when trash fish landed quantity increased about 196 percent that

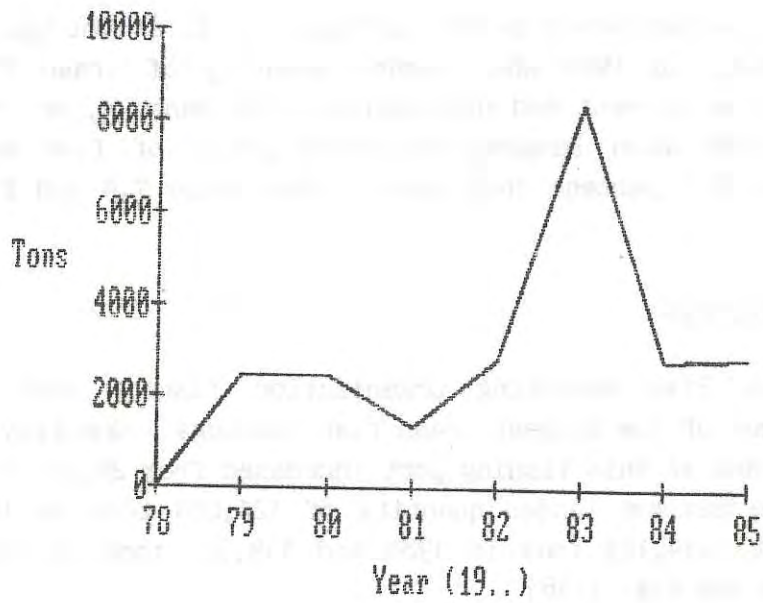


Fig. 7.14 Quantity of Trash Fish at Phuket Fish Market

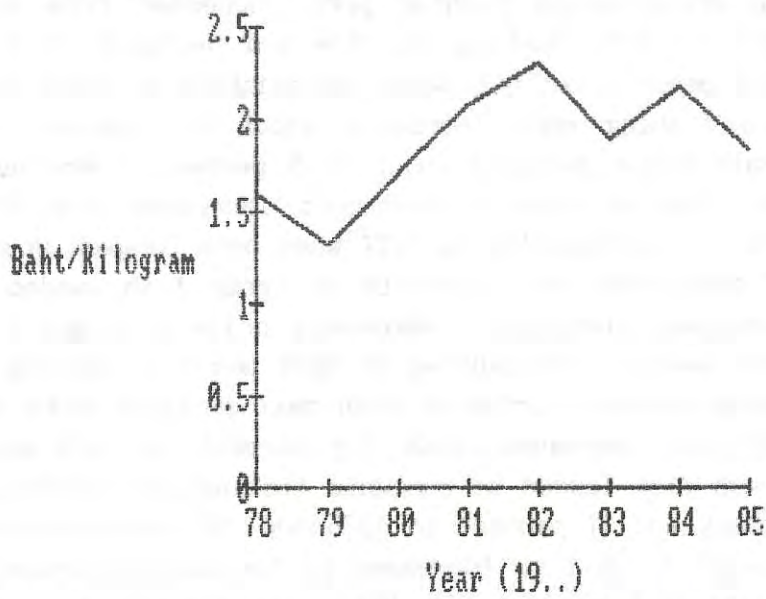


Fig. 7.15 Wholesale Price of Trash Fish at Phuket Fish Market

year. Trash fish wholesale price increased to 2.18 Baht/kg, or 14.7 percent, in 1984 when landed quantity of trash fish declined about 66 percent and declined to 1.84 Baht/kg, or 15.6 percent, in 1985 when Bangkok wholesale price of fish meal declined about 12.7 percent that year. (See Table 7.4 and Fig. 7.15)

Songkhla

The Fish Marketing Organization fishing port at Songkhla was one of the largest trash fish landings. Quantity of trash fish landed at this fishing port increased from 25,261 tons in 1971 to the maximum landed quantity of 121,053 tons in 1983 and declined to 119,123 tons in 1984 and 119,799 tons in 1985. (See Table 7.3 and Fig. 7.16)

Wholesale price of trash fish landed at Songkhla's Fish Marketing Organization fishing port increased from 0.45 Baht/kg in 1971 to 0.87 Baht/kg in 1974 and declined to 0.76 Baht/kg, or 12.6 percent, in 1975 when the quantity of trash fish landed at this fishing port increased about 8.8 percent and Bangkok wholesale price declined about 21.8 percent. Wholesale price of trash fish at this fishing port increased from 0.97 Baht/kg in 1976 to 1.30 Baht/kg in 1977 when both Bangkok wholesale price of fish meal and quantity of trash fish landed at Songkhla fishing port increased. Wholesale price of trash fish at Songkhla declined to 1.19 Baht/kg in 1978 and 1.10 Baht/kg in 1979 when Bangkok wholesale price of fish meal declined about 9.4 percent in 1978 and increased about 2.5 percent in 1979 while quantity of trash fish landed at Songkhla fishing port increased about 10.4 percent and 17 percent in 1978 and 1979 respectively. Wholesale price of trash fish increased to the maximum price of 1.93 Baht/kg, or 75.5 percent, in 1980 when Bangkok wholesale price of fish meal increased about 44.6 percent and quantity of trash fish landed at Songkhla fishing port increased about 2.7

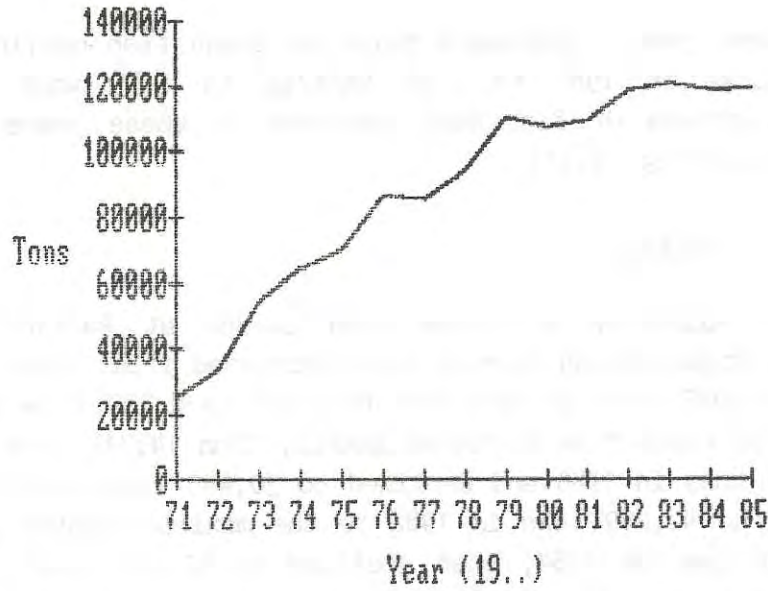


Fig. 7.16 Quantity of Trash Fish at Songkhla Fish Market

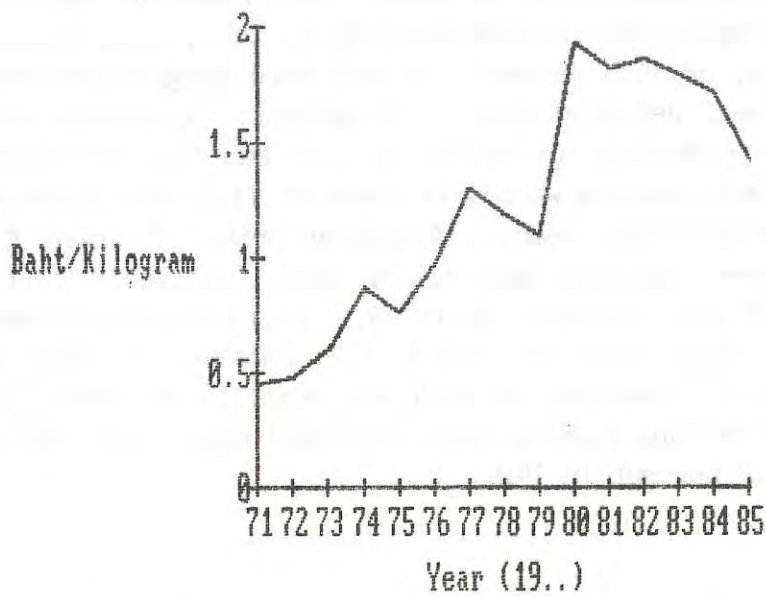


Fig. 7.17 Wholesale Price of Trash Fish at Songkhla Fish Market

percent that year. Wholesale price of trash fish declined from 1.82 Baht/kg in 1981 to 1.42 Baht/kg in 1985 when Bangkok wholesale prices of fish meal declined in these years. (See Table 7.4 and Fig. 7.17)

Pattani

Quantity of trash fish landed at Pattani's Fish Marketing Organization fishing port increased from 2,828 tons in 1972 to 10,023 tons in 1974 and declined to 8,207 tons in 1975. Quantity of trash fish increased sharply from 14,710 tons in 1976 to 34,256 tons in 1980 and declined to 30,445 tons in 1981, then increased to 42,279 tons in 1982 to the maximum landed quantity of 43,430 tons in 1984; then declined to 42,012 tons in 1985. (See Table 7.3 and Fig. 7.18)

Wholesale price of trash fish in Pattani moved generally in the same upward direction as Bangkok wholesale price of fish meal. Wholesale price of trash fish in Pattani increased from 0.45 Baht/kg in 1972 to 0.86 Baht/kg in 1974, then declined to 0.77 Baht/kg, or 10.5 percent, in 1975 when Bangkok wholesale price of fish meal declined about 21.8 percent. Wholesale price of trash fish in Pattani increased to 1.04 Baht/kg, or 35 percent, in 1976 when Bangkok wholesale price of fish meal increased about 24.9 percent that year. Wholesale price of trash fish increased further to 1.44 Baht/kg in 1977, declined to 1.40 Baht/kg in 1978 and 1.30 Baht/kg in 1979 when Bangkok wholesale price of fish meal declined about 9.4 percent in 1978 and increased about 2.5 percent in 1979 and quantity of trash fish landed at this Pattani fishing port increased about 23.6 percent in 1978 and 19.2 percent in 1979.

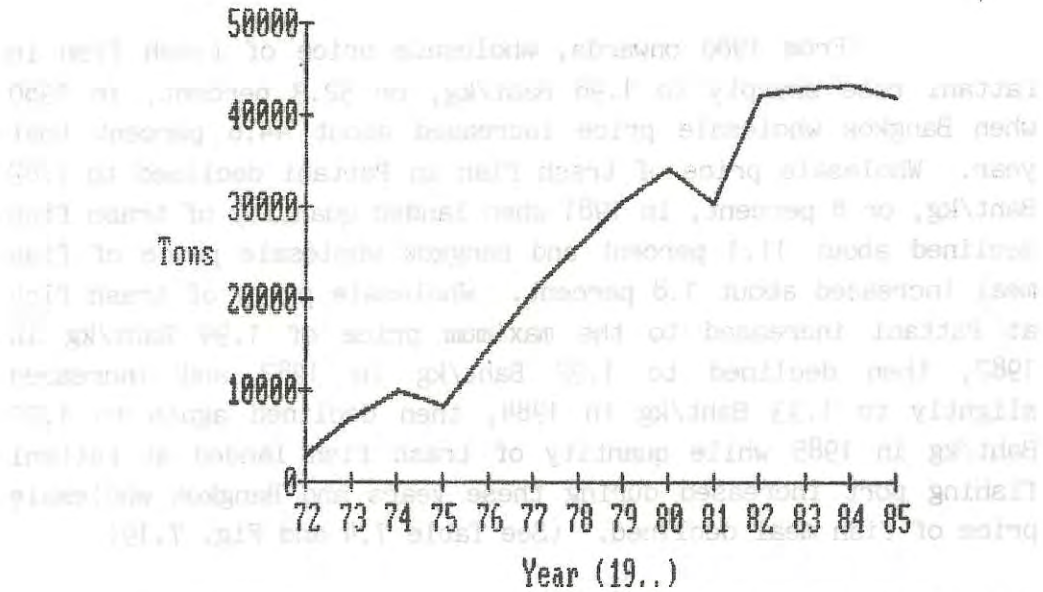


Fig. 7.18 Quantity of Trash Fish at Pattani Fish Market

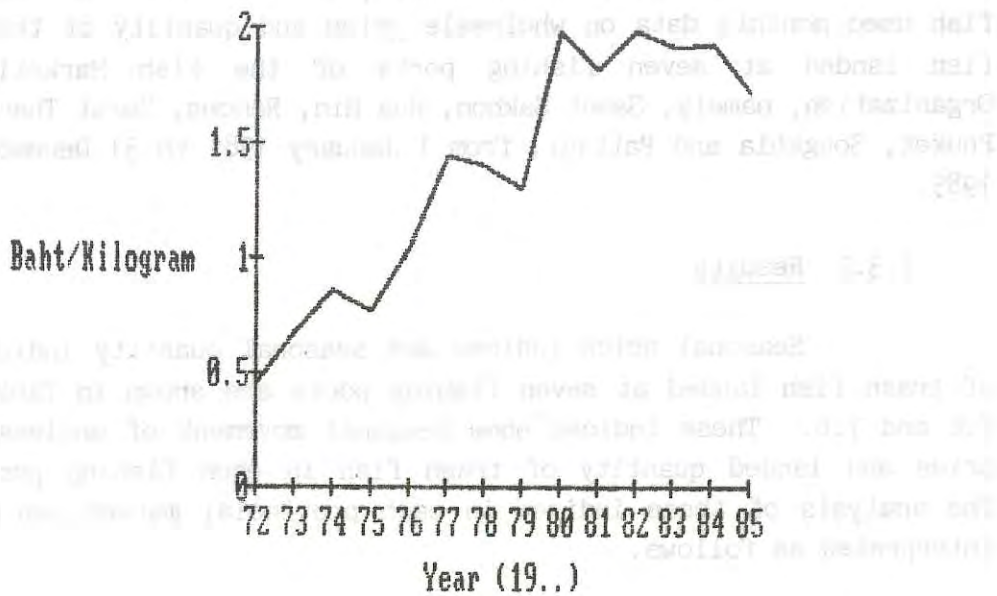


Fig. 7.19 Wholesale Price of Trash Fish at Pattani Fish Market

From 1980 onwards, wholesale price of trash fish in Pattani rose sharply to 1.98 Baht/kg, or 52.3 percent, in 1980 when Bangkok wholesale price increased about 44.6 percent that year. Wholesale price of trash fish in Pattani declined to 1.82 Baht/kg, or 8 percent, in 1981 when landed quantity of trash fish declined about 11.1 percent and Bangkok wholesale price of fish meal increased about 1.8 percent. Wholesale price of trash fish at Pattani increased to the maximum price of 1.99 Baht/kg in 1982, then declined to 1.92 Baht/kg in 1983 and increased slightly to 1.93 Baht/kg in 1984, then declined again to 1.71 Baht/kg in 1985 while quantity of trash fish landed at Pattani fishing port increased during these years and Bangkok wholesale price of fish meal declined. (See Table 7.4 and Fig. 7.19)

7.3 Seasonal Indices of Trash Fish

7.3.1 Data

The analysis of seasonal price movements of trash fish used monthly data on wholesale price and quantity of trash fish landed at seven fishing ports of the Fish Marketing Organization, namely, Samut Sakhon, Hua Hin, Ranong, Surat Thani, Phuket, Songkhla and Pattani, from 1 January 1981 to 31 December 1985.

7.3.2 Results

Seasonal price indices and seasonal quantity indices of trash fish landed at seven fishing ports are shown in Tables 7.5 and 7.6. These indices show seasonal movement of wholesale price and landed quantity of trash fish in each fishing port. The analysis of these indices in each provincial market can be interpreted as follows.

Table 7.5 Seasonal Quantity Indices of Trash Fish at Provincial Fish Market, 1981-1985

Month	Samut Sakhon	Hua Hin	Ranong	Surat Thani	Phuket	Songkhla	Pattani
Jan.	136.11	41.29	103.17	94.07	99.91	70.82	43.61
Feb.	110.82	41.76	123.31	68.76	98.86	75.27	42.60
Mar.	69.88	81.04	114.38	79.53	77.23	86.24	65.05
Apr.	62.03	77.77	103.35	109.67	88.53	95.71	89.91
May.	99.94	115.55	140.80	105.50	141.00	110.21	141.77
Jun.	141.77	112.62	89.49	117.10	69.95	105.08	120.87
Jul.	102.91	137.41	70.52	114.08	103.47	103.85	89.19
Aug.	142.05	141.60	64.77	114.51	69.37	121.98	105.00
Sep.	20.51	148.32	81.58	109.14	65.69	128.77	163.33
Oct.	96.50	151.29	96.18	94.13	143.90	129.27	160.69
Nov.	49.39	92.87	106.78	110.08	131.19	105.83	124.53
Dec.	168.09	58.48	105.67	82.82	110.90	66.98	53.44

Table 7.6 Seasonal Price Indices of Trash Fish at Provincial Fish Market, 1981-1985

Month	Samut Sakhon	Hua Hin	Ranong	Surat Thani	Phuket	Songkhla	Pattani
Jan.	111.34	96.86	99.51	106.89	98.50	111.20	100.37
Feb.	105.25	103.23	103.61	99.99	99.03	120.94	97.47
Mar.	106.60	105.22	96.46	101.20	98.46	117.99	117.69
Apr.	108.79	102.11	93.91	98.63	94.20	92.35	100.49
May.	94.73	106.57	89.76	100.51	96.93	89.11	98.80
Jun.	90.43	98.23	106.42	98.27	99.22	88.21	98.69
Jul.	96.55	93.43	98.47	96.60	100.14	93.09	94.57
Aug.	89.63	95.66	115.33	103.13	102.88	97.67	91.51
Sep.	95.31	98.42	99.05	97.25	105.53	96.72	93.76
Oct.	93.62	98.85	100.34	95.33	106.94	92.01	96.75
Nov.	100.69	100.73	98.20	97.66	98.52	96.90	104.39
Dec.	107.06	100.70	98.73	104.53	99.66	103.80	105.50

Samut Sakhon

Quantity of trash fish landed at Samut Sakhon's Fish Marketing Organization fishing port was normally high in December, January, February and from June through August, with the maximum landed quantity in December. On the other hand, landed quantity was normally low in March, April, May and from September through November, with the minimum landed quantity in September. (See Table 7.5 and Fig. 7.20)

Monthly price movement of trash fish did not respond to that of landed quantity. Wholesale price of trash fish at Samut Sakhon's Fish Marketing Organization fishing port was normally high in November, December and from January through April, with the maximum wholesale price in January. On the other hand, wholesale price was normally low during the period between May and October, with the minimum price in August. (See Table 7.6 and Fig. 7.21)

Hua Hin

Quantity of trash fish landed at Hua Hin's Fish Marketing Organization fishing port was normally high in May and increased further to reach the maximum price in October, while landed quantity was low during the period between January and April, and in November and December, with the minimum landed quantity in January. (See Table 7.5 and Fig. 7.22)

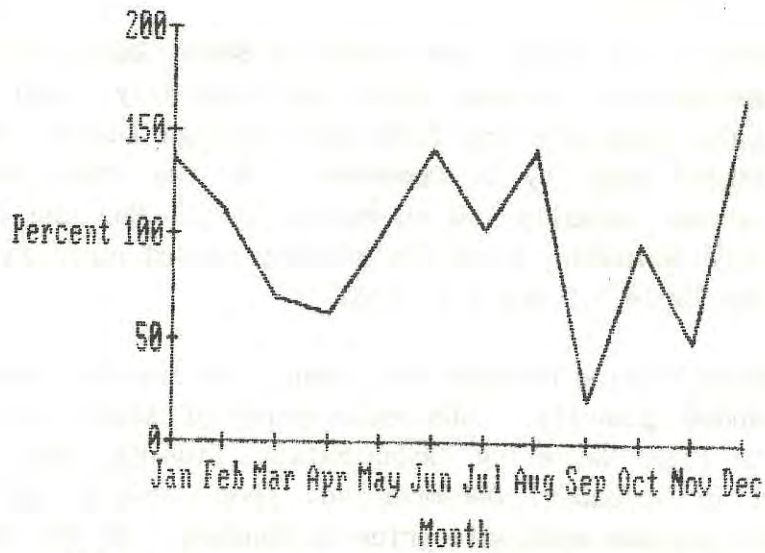


Fig. 7.20 Seasonal Quantity Indices of Trash Fish at Samut Sakhon Fish Market, 1981-1985

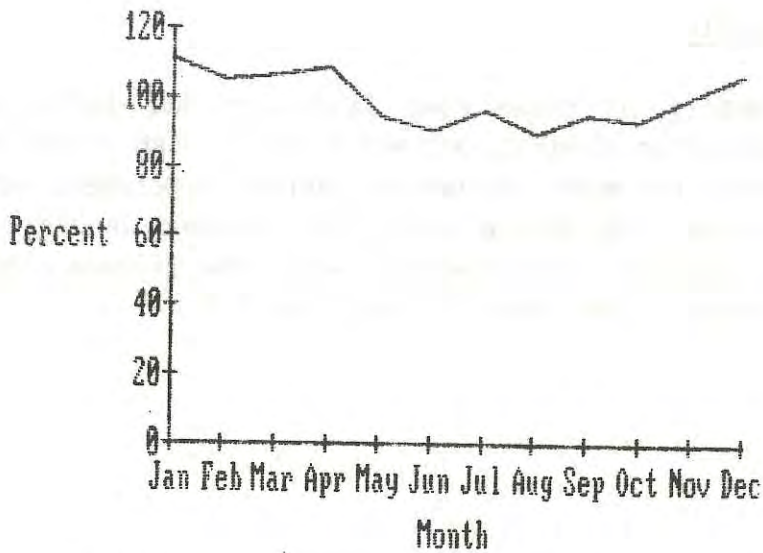


Fig. 7.21 Seasonal Price Indices of Trash Fish at Samut Sakhon Fish Market, 1981-1985

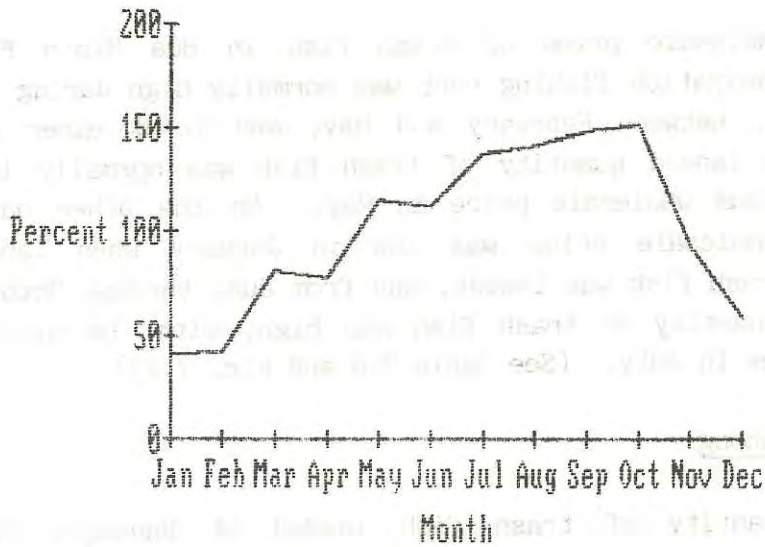


Fig. 7.22 Seasonal Quantity Indices of Trash Fish at Hua Hin Fish Market, 1981-1985

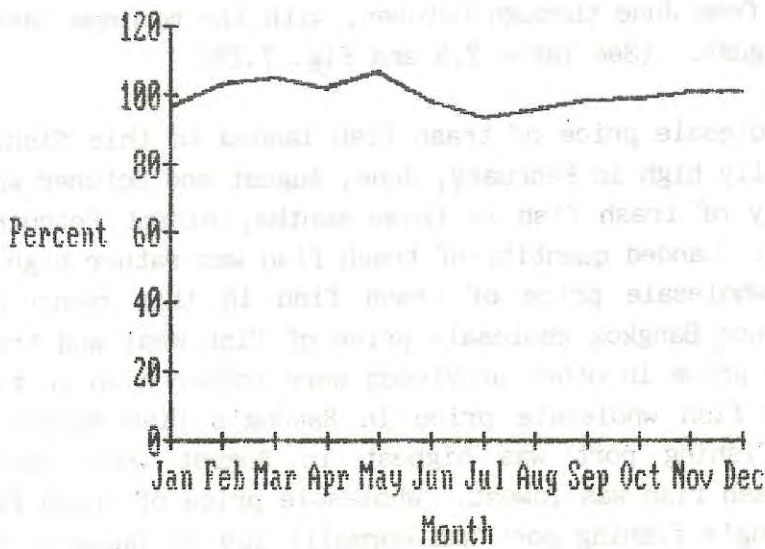


Fig. 7.23 Seasonal Price Indices of Trash Fish at Hua Hin Fish Market, 1981-1985

Wholesale price of trash fish in Hua Hin's Fish Marketing Organization fishing port was normally high during two periods, i.e., between February and May, and in November and December when landed quantity of trash fish was normally low, with the maximum wholesale price in May. On the other hand, trash fish wholesale price was low in January when landed quantity of trash fish was lowest, and from June through October when landed quantity of trash fish was high, with the minimum wholesale price in July. (See Table 7.6 and Fig. 7.23)

Ranong

Quantity of trash fish landed at Ranong's Fish Marketing Organization fishing port was high from January through May, and in November and December, with the maximum landed quantity in May. On the other hand, landed quantity of trash fish was high from June through October, with the minimum landed quantity in August. (See Table 7.5 and Fig. 7.24)

Wholesale price of trash fish landed in this fishing port was normally high in February, June, August and October when landed quantity of trash fish in these months, except February, was rather low. Landed quantity of trash fish was rather high in February but wholesale price of trash fish in this month was rather high since Bangkok wholesale price of fish meal and trash fish wholesale price in other provinces were rather high in this month. Trash fish wholesale price in Ranong's Fish Marketing Organization fishing port was highest in August when landed quantity of trash fish was lowest. Wholesale price of trash fish landed in Ranong's fishing port was normally low in January, and

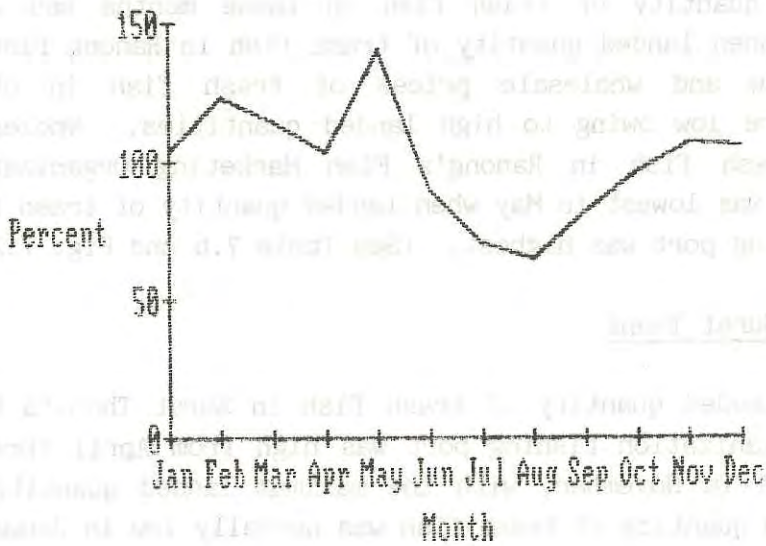


Fig. 7.24 Seasonal Quantity Indices of Trash Fish at Ranong Fish Market, 1981-1985

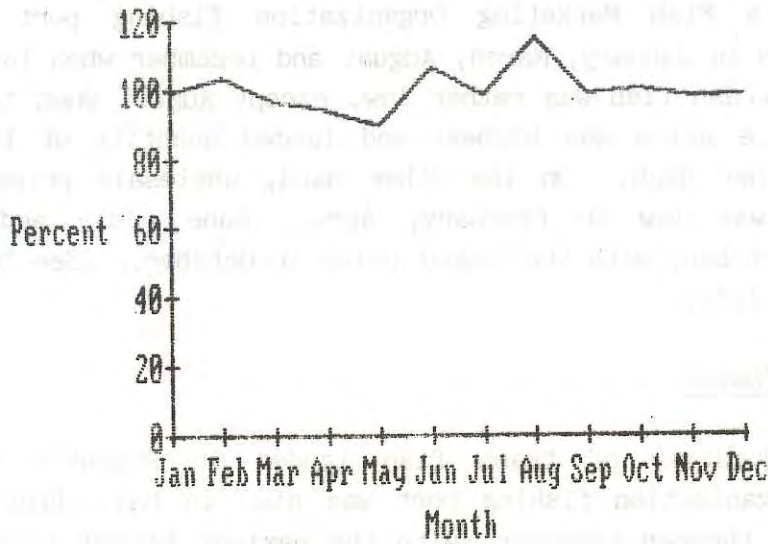


Fig. 7.25 Seasonal Price Indices of Trash Fish at Ranong Fish Market, 1981-1985

from March through May, July, September, November and December when landed quantity of trash fish in these months was high except July when landed quantity of trash fish in Ranong fishing port was low and wholesale prices of trash fish in other provinces were low owing to high landed quantities. Wholesale price of trash fish in Ranong's Fish Marketing Organization fishing port was lowest in May when landed quantity of trash fish in this fishing port was highest. (See Table 7.6 and Fig. 7.25)

Surat Thani

Landed quantity of trash fish in Surat Thani's Fish Marketing Organization fishing port was high from April through September and in November, with the maximum landed quantity in June. Landed quantity of trash fish was normally low in January, February, March, October and December, with the minimum landed quantity in February. (See Table 7.5 and Fig. 7.26)

On the other hand, wholesale price of trash fish in Surat Thani's Fish Marketing Organization fishing port was normally high in January, March, August and December when landed quantity of trash fish was rather low, except August when trash fish wholesale price was highest and landed quantity of trash fish was rather high. On the other hand, wholesale price of trash fish was low in February, April, June, July and in September, October, with the lowest price in October. (See Table 7.6 and Fig. 7.27)

Phuket

Quantity of trash fish landed in Phuket's Fish Marketing Organization fishing port was high in May, July and from October through December, with the maximum landed quantity in October. On the other hand, landed quantity was low from January through April and in June, August and September with the minimum landed quantity in September. (See Table 7.5 and Fig. 7.28)

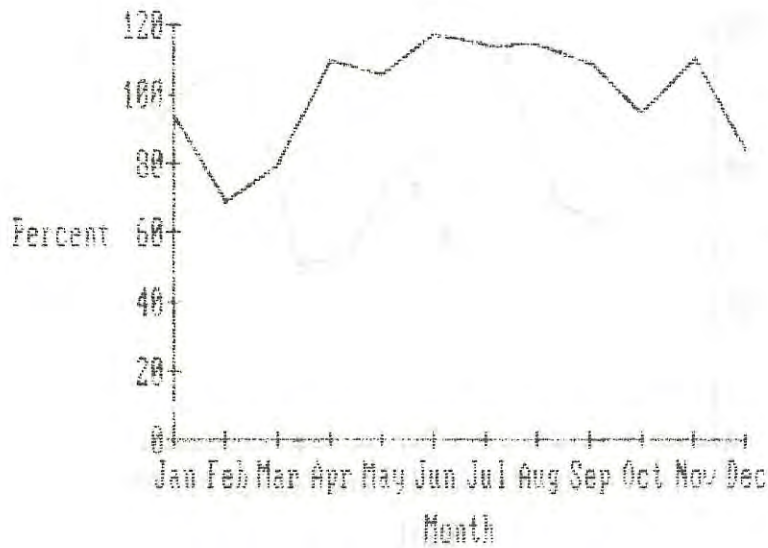


Fig. 7.26 Seasonal Quantity Indices of Trash Fish at Surat Thani Fish Market, 1981-1985

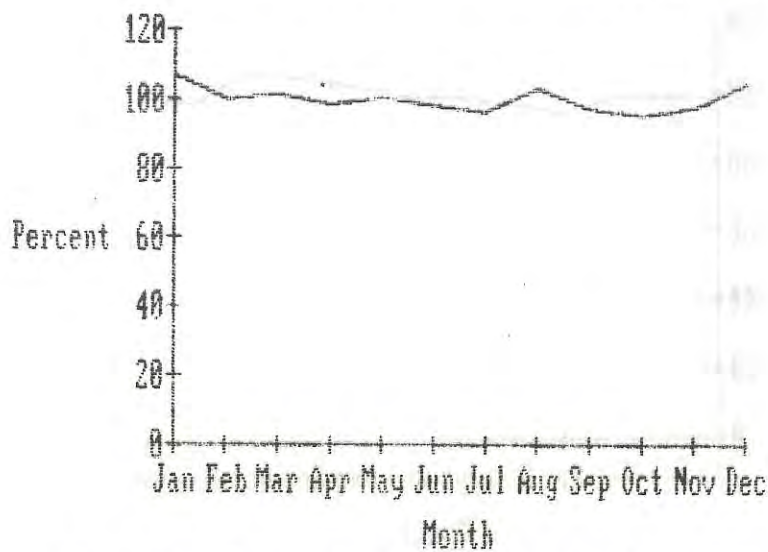


Fig. 7.27 Seasonal Price Indices of Trash Fish at Surat Thani Fish Market, 1981-1985

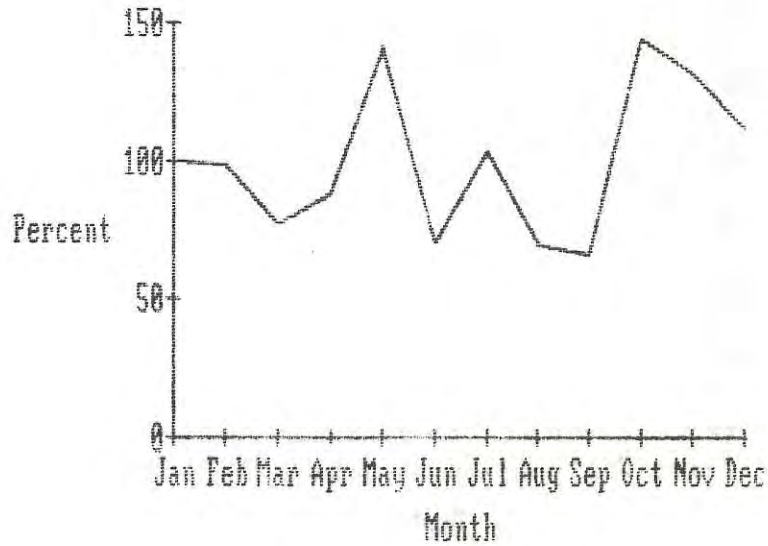


Fig. 7.28 Seasonal Quantity Indices of Trash Fish at Phuket Fish Market, 1981-1985

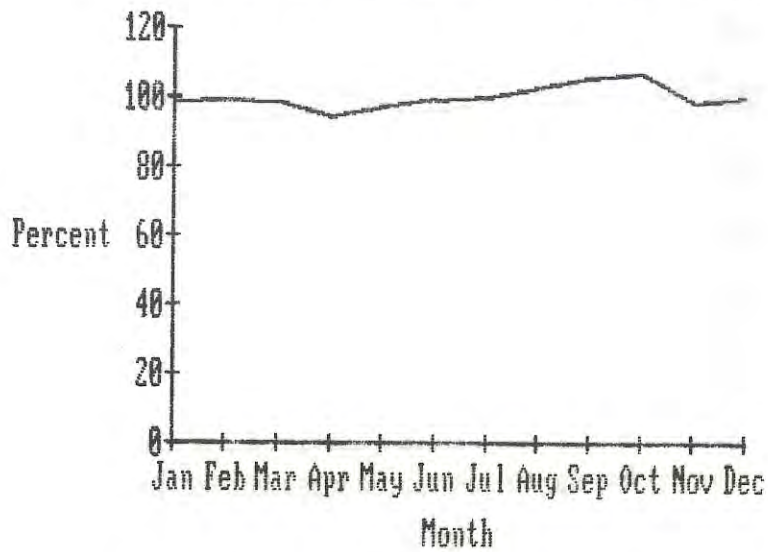


Fig. 7.29 Seasonal Price Indices of Trash Fish at Phuket Fish Market, 1981-1985

Wholesale price of trash fish landed in this fishing port was high from July through October, with the highest price in October when landed quantity of trash fish in this fishing port was highest. On the other hand, wholesale price of trash fish was low from January through June and in November and December, with the minimum price in April. (See Table 7.6 and Fig. 7.29)

Songkhla

Quantity of trash fish landed in Songkhla's Fish Marketing Organization was high from May through November, with the maximum landed quantity in October. On the other hand, landed quantity was normally low in December, and from January through April, with the minimum landed quantity in December. (See Table 7.5 and Fig. 7.30)

Wholesale price of trash fish landed in Songkhla's Fish Marketing Organization fishing port was high in January, February, March and December, with the highest price in February, when landed quantity of trash fish was low in these months. On the other hand, wholesale price of trash fish was low from April through November, with the lowest price in June, when landed quantity of trash fish in this fishing port was high in these months. (See Table 7.6 and Fig. 7.31)

Pattani

Landed quantity of trash fish in Pattani's Fish Marketing Organization fishing port was high in May and June and from August through November with the maximum landed quantity in September. On the other hand, landed quantity of trash fish in this fishing port was normally low during the period January to April, and in July and December, with the minimum landed quantity in February. (See Table 7.5 and Fig. 7.32)

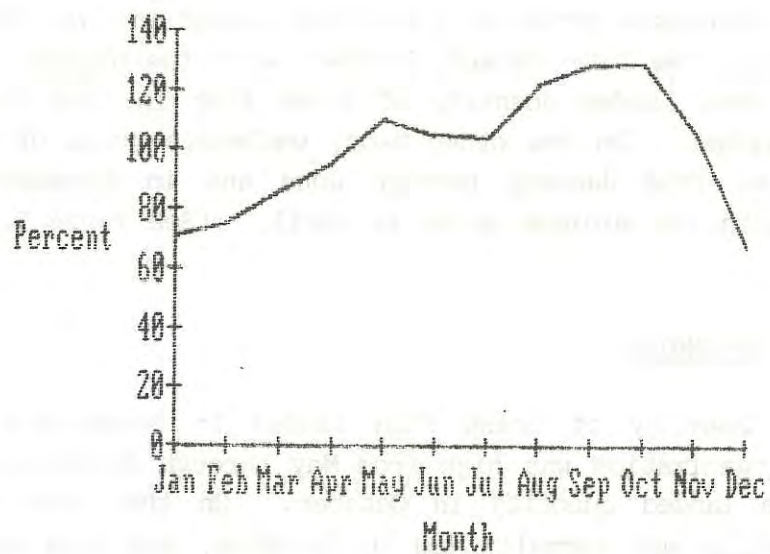


Fig. 7.30 Seasonal Quantity Indices of Trash Fish at Songkhla Fish Market, 1981-1985

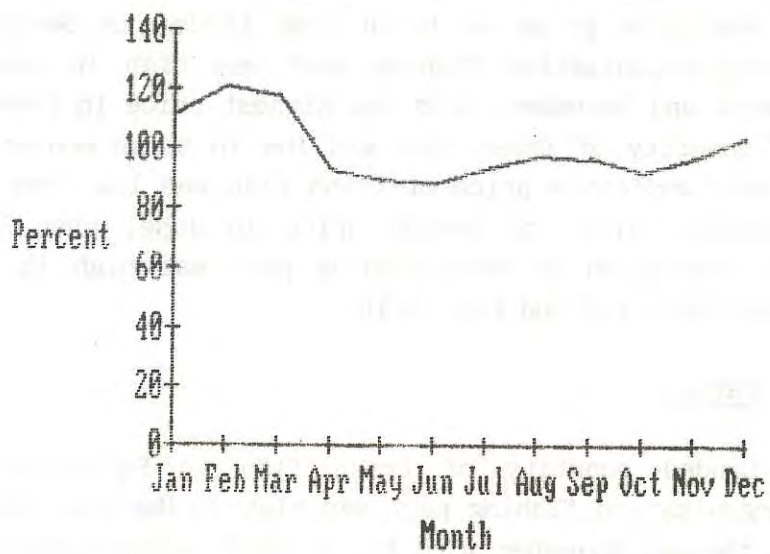


Fig. 7.31 Seasonal Price Indices of Trash Fish at Songkhla Fish Market, 1981-1985

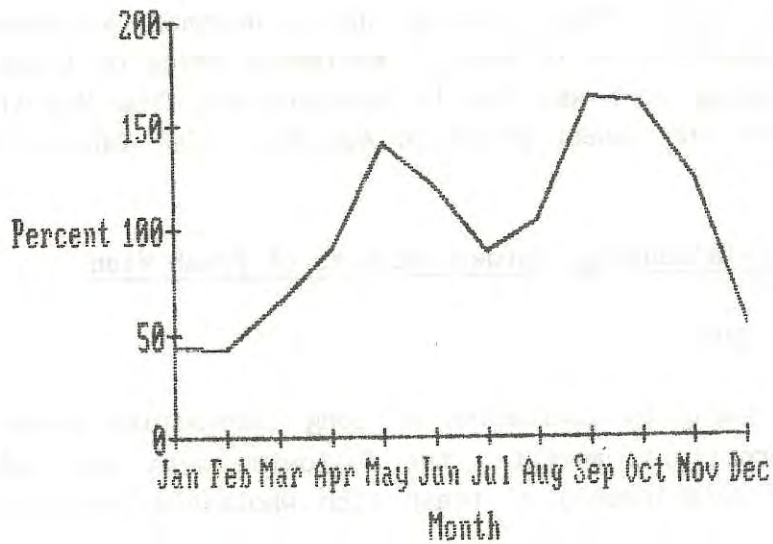


Fig. 7.32 Seasonal Quantity Indices of Trash Fish at Pattani Fish Market, 1981-1985

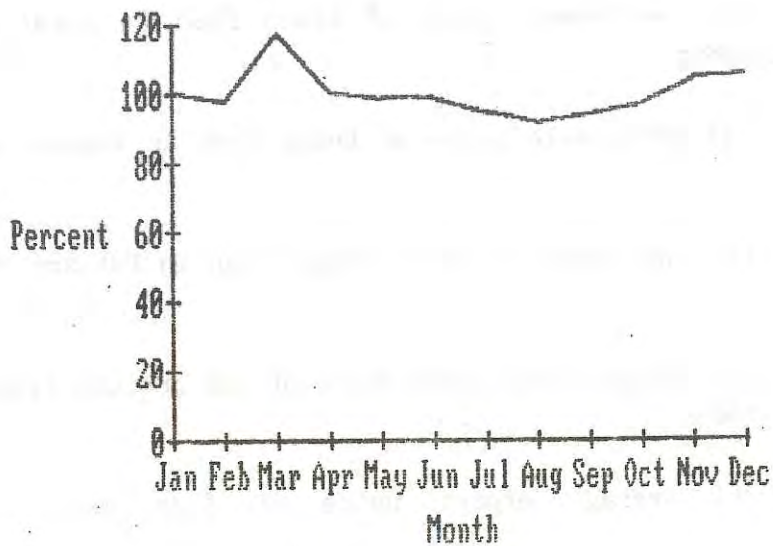


Fig. 7.33 Seasonal Price Indices of Trash Fish at Pattani Fish Market, 1981-1985

On the other hand, wholesale price of trash fish in Pattani was high in January, March, April, November and December, with the highest price in March. Wholesale price of trash fish in this fishing port was low in February and from May through October, with the lowest price in August. (See Table 7.6 and Fig. 7.33)

7.4 Price Relationships Between Markets of Trash Fish

7.4.1 Data

Owing to limitation of long time-series price data for some provincial markets, the following data were used to analyse the relationship of trash fish wholesale price between markets:

- (1) Wholesale price of trash fish in Samut Sakhon, Hua Hin, Ranong, and Songkhla during 1971-1985;
- (2) Wholesale price of trash fish in Surat Thani during 1973-1985;
- (3) Wholesale price of trash fish in Phuket during 1978-1985;
- (4) Wholesale price of trash fish in Pattani during 1972-1985;
- (5) Bangkok wholesale price of 60% protein fish meal during 1974-1985;
- (6) Average export price of fish meal during 1971-1985.

Correlation coefficients were calculated to trace the relationship of trash fish wholesale price between different markets for the same time period. Correlation coefficients were also computed to analyse the relationship between trash fish wholesale price and Bangkok wholesale price and export price of fish meal.

7.4.2 Results

Correlation coefficients representing the inter-relationship of trash fish wholesale prices in different markets, as shown in Table 7.7, indicated that trash fish wholesale prices in the seven provincial fish markets were highly interrelated since trash fish wholesale prices in these markets were all highly related to Bangkok wholesale price and export price of fish meal. The analyses of correlation coefficients showing these relationships can be made for each market as follows:

Samut Sakhon

The correlation coefficient between trash fish wholesale price at Samut Sakhon's Fish Marketing Organization fishing port and Bangkok wholesale price of 60% protein fish meal shows a positive relationship between these two prices. Similarly, the correlation coefficient between trash fish wholesale price at Samut Sakhon and fish meal export price shows a positive relationship between these two prices. About 95 percent and 97 percent of trash fish wholesale price variations in Samut Sakhon were in the same direction as that of Bangkok wholesale price and export price of trash fish respectively.

On the other hand, correlation coefficients showing the interrelationships of trash fish wholesale price between Samut Sakhon Fish Market and that of other provincial fish markets indicated high and positive relationships between these prices. The possibility of Samut Sakhon trash fish wholesale price moving in the same direction as that of other provincial wholesale prices was as high as 98 percent for Songkhla and 84 percent for Surat Thani. There was an exception in the case of Phuket where the correlation coefficient between Samut Sakhon and Phuket trash fish wholesale prices was very low. However, this could be caused by the statistical technique owing to limitation of price data observations.

Table 7.7 Matrix of Linear Correlation Coefficients of Trash Fish Prices at Different Market Levels

	TFPSS	TFPHH	TFPRN	TFPST	TFPPK	TFPSK	TFPPN	FMWP	FMEP
TFPSS	1.00000								
TFPHH	0.91831	1.00000							
TFPRN	0.91008	0.85295	1.00000						
TFPST	0.84154	0.86442	0.88450	1.00000					
TFPPK	0.69017	0.85811	0.53046	0.77645	1.00000				
TFPSK	0.98045	0.94135	0.94859	0.90010	0.74266	1.00000			
TFPPN	0.97104	0.92711	0.95290	0.84325	0.80514	0.98512	1.00000		
FMWP	0.95056	0.88565	0.88098	0.90914	0.79442	0.95250	0.96469	1.00000	
FMEP	0.96650	0.91966	0.88156	0.84123	0.82394	0.95250	0.96967	0.95473	1.00000

N.B.

- TFPSS = Trash Fish Wholesale Price, Samut Sakhon Market
- TFPHH = Trash Fish Wholesale Price, Hua Hin Market
- TFPRN = Trash Fish Wholesale Price, Ranong Market
- TFPST = Trash Fish Wholesale Price, Surat Thani Market
- TFPPK = Trash Fish Wholesale Price, Phuket Market
- TFPSK = Trash Fish Wholesale Price, Songkhla Market
- TFPPN = Trash Fish Wholesale Price, Pattani Market
- FMWP = Fish Meal, 60% Protein, Bangkok Wholesale Price
- FMEP = Fish Meal Export Price

Hua Hin

Hua Hin trash fish wholesale price also had a positive relationship with that of Bangkok wholesale price and export price of fish meal. About 89 percent and 92 percent of Hua Hin trash fish wholesale price variations will be in the same direction as that of Bangkok wholesale price and export price respectively. On the other hand, Hua Hin trash fish wholesale price had rather high positive relationships with trash fish wholesale prices in other provinces, especially Samut Sakhon, Pattani, and Songkhla. About 92 percent, 93 percent and 94 percent of Hua Hin trash fish wholesale price variations will be in the same direction as that of Samut Sakhon, Pattani and Songkhla respectively. Similarly the relationships between Hua Hin trash fish wholesale price and that of Surat Thani, Phuket and Ranong could be expressed as 86 percent for both Surat Thani and Phuket, and 85 percent for Ranong.

Ranong

The trash fish wholesale price in Ranong market had a positive relationship with that of Bangkok wholesale price and export price of fish meal.

The possibility of Ranong trash fish wholesale price moving in the same direction as these two fish meal prices was about 88 percent for both cases. Similarly, the possibility of Ranong trash fish wholesale price moving in the same direction as trash fish wholesale prices in other provinces was about 85 percent for Hua Hin, 88 percent for Surat Thani, 91 percent for Samut Sakhon, 94 percent for Songkhla, 95 percent for Pattani and only 53 percent for Phuket.

Surat Thani

Data on the trash fish wholesale price in Surat Thani were available only from 1973 onwards, hence positive correlation coefficients of Surat Thani were lower in all cases than those of other provinces, except Phuket, for which only limited price data

were available. However, Surat Thani's correlation coefficients show that about 91 percent and 84 percent of trash fish wholesale price variations in Surat Thani had a positive relationship with that of Bangkok wholesale price and export price of fish meal respectively. On the other hand, positive relationships between Surat Thani trash fish wholesale price and that of other provinces could be expressed as 90 percent for Songkhla, 88 percent for Ranong, 86 percent for Hua Hin, 84 percent for Samut Sakhon and Pattani, and only 78 percent for Phuket.

Phuket

As data on trash fish wholesale price in Phuket were available from 1978 onwards, computed correlation coefficients of Phuket in all cases were smaller than those of other provinces. However, these correlation coefficients still show positive relationships between Phuket trash fish wholesale price and fish meal Bangkok wholesale price and export price. These positive relationships were 79 percent for Bangkok wholesale price of fish meal and 82 percent for fish meal export price. Similarly, Phuket trash fish wholesale price had a positive relationship with that of other provinces, ranging from 86 percent for Hua Hin, 80 percent for Pattani, 78 percent for Surat Thani, 74 percent for Songkhla, 69 percent for Samut Sakhon and 53 percent for Ranong.

Songkhla

Songkhla trash fish wholesale price had a rather high positive relationship with both Bangkok wholesale price and export price of fish meal. The possibility of prices moving in the same direction was 95 percent for both cases. Similarly, Songkhla trash fish wholesale price had a high positive relationship with that of other provinces: as much as 98 percent for Samut Sakhon and Pattani, 95 percent for Ranong, 94 percent for Hua Hin, 90 percent for Surat Thani and 74 percent for Phuket.

Pattani

Pattani trash fish wholesale price also had a high positive relationship with Bangkok wholesale price and export price of fish meal. About 96 percent and 97 percent of Pattani trash fish wholesale price variations will be in the same direction of that of these two fish meal prices. Similarly, the relationship between Pattani trash fish wholesale price and that of other provinces were positive and could be expressed as 98 percent for Songkhla, 97 percent for Samut Sakhon, 95 percent for Ranong, 93 percent for Hua Hin, 84 percent for Surat Thani and 81 percent for Phuket.

7.5 Factors Affecting Wholesale Price of Trash Fish

Analyses of factors affecting wholesale price of trash fish were made for both national wholesale price and provincial wholesale price. At the national level, factors affecting national wholesale price of trash fish were expected to be landed quantity of trash fish throughout the whole Kingdom, Bangkok wholesale price of fish meal and export price of fish meal. Similarly, factors affecting provincial wholesale price of trash fish were expected to be quantity of trash fish landed in the province, Bangkok wholesale price of fish meal or fish meal wholesale price in the province. Results of the analyses at both levels were as follows:

7.5.1 Domestic Wholesale Price of Trash Fish

Factors affecting domestic wholesale price of trash fish (TFP) were expected to be quantity of trash fish landed throughout the whole Kingdom (TEQ), Bangkok wholesale price of 60% protein fish meal (FMWP) and average export price of fish meal (FMEP). In order to estimate regression equations representing relationships between domestic wholesale price of trash fish and its determining factors, the following data were used: domestic wholesale price of trash fish, national landed quantity of trash and average export price of trash fish during

the period 1971-1985 and Bangkok wholesale price of 60 percent protein fish meal during 1974-1985. Following symbols of variables were used for the regression equations:

TFP = domestic wholesale price of trash fish (Baht/kg)

TFQ = national landed quantity of trash fish (Ton)

FMWP = Bangkok wholesale price of 60 percent protein fish meal (Baht/kg)

FMEP = export price of fish meal (Baht/kg)

Estimated regression equations are as follows:

1) Equation representing the relationship between domestic wholesale price of trash fish (TFP) and national landed quantity of trash fish (TFQ):

$$\text{TFP} = -1.43023 + 0.000004 \text{ TFQ} \dots\dots\dots(1)$$

(-1.24807) (2.46187)

$$R^2 = 0.31797$$

2) Equation representing the relationship between domestic wholesale price of trash fish (TFP) and Bangkok wholesale price of 60 percent protein fish meal (FMWP):

$$\text{TFP} = 0.00893 + 0.18391 \text{ FMWP} \dots\dots\dots(2)$$

(0.05376) (9.46083)

$$R^2 = 0.89951$$

3) Equation representing the relationship between domestic wholesale price of trash fish (TFP) and export price of fish meal (FMEP):

$$\text{TFP} = -0.16284 + 0.23286 \text{ FMEP} \dots\dots\dots(3)$$

(-1.23527) (12.17651)

$$R^2 = 0.91939$$

4) Equation representing the relationship between Bangkok wholesale price of fish meal (FMWP) and export price of fish meal (FMEP):

$$\text{FMWP} = -1.72595 + 1.36996 \text{ FMEP} \dots\dots\dots(4)$$

(-1.71451) (10.14865)

$$R^2 = 0.9115$$

Equation (1) shows a positive relationship between national landed quantity of trash fish and national wholesale price of trash fish. However R^2 of this equation is rather low, hence the relationship between national landed quantity and domestic wholesale price of trash fish could not be well verified.

Equation (2) shows the positive relationship between domestic wholesale price of trash fish and Bangkok wholesale price of 60 percent protein fish meal. This equation shows that if Bangkok wholesale price of fish meal increases by one Baht/kg, it will induce domestic wholesale price of trash fish to increase about 0.18 Baht/kg. However, this relationship could be explained about 90 percent by variables of equation (1), the remaining percentage depending upon other determining factors not included in the equation.

Equation (3) also shows the positive relationship between national wholesale price of trash fish and export price of trash fish. This equation can be explained as follows: if the average export price of fish meal increases by one Baht/kg, it will induce domestic wholesale price of trash fish to increase about 0.23 Baht/kg, since export price of fish meal has a strong influence on domestic wholesale of fish meal which, in turn, has a strong impact on national wholesale price of fish meal. From its R^2 value, all variables of equation (3) can be used to explain about 92 percent of the positive relationship between domestic wholesale price of trash fish and export price of fish meal, the remaining percentage depending upon other factors not included in this equation.

Equation (4) shows the positive relationship between Bangkok wholesale price of fish meal and export price of fish meal. This equation can be interpreted as indicating that, if the average export price of fish meal increases by one Baht/kg, it will induce Bangkok wholesale price of 60 percent protein fish meal to increase by about 1.37 Baht/kg. Equation (1) can explain this relationship about 91 percent as indicated by its R^2 value.

In summary, these equations show that national landed quantity of trash fish had a minor effect on trash fish domestic wholesale price. However, major factors affecting domestic wholesale price of trash fish are both domestic wholesale price and export price of fish meal.

7.5.2 Provincial Wholesale Price of Trash Fish

Factors affecting wholesale price of trash fish landed at major provincial fishing ports were expected to be quantity of trash fish landed at that fishing port and fish meal wholesale price in that province. The test of the relationship between trash fish wholesale price and quantity of trash fish landed in each province gave a positive result but very low R^2 values, hence it shows that landed quantity of trash fish in each province had a very insignificant impact on the trash fish wholesale price of that province.

The test of the relationship between trash fish wholesale price and fish meal wholesale price in each province used Bangkok wholesale price of fish meal as a proxy of provincial fish meal wholesale prices since the data were not available at the provincial level. Regression equations representing the relationship between trash fish wholesale price in each provincial fish market and fish meal wholesale price are shown in Table 7.8.

These equations show that trash fish wholesale price in each provincial market had a positive relationship with fish meal wholesale price as shown by its R^2 values ranging from 0.63 for Phuket to 0.95 for Songkhla. Moreover these equations show that an increase in Bangkok wholesale price of fish meal by one Baht/kg will induce trash fish wholesale price in the provincial fish market to increase, ranging from 0.13 Baht/kg in Surat Thani to 0.27 Baht/kg in Ranong.

In summary, major factors affecting trash fish wholesale price in the provincial markets was fish meal wholesale price. In turn, a major factor affecting fish meal wholesale price was fish meal export price as indicated earlier.

Table 7.8 Regression Equations Showing Relationships Between Provincial Wholesale Price of Trash Fish and Fish Meal Prices

TFP	C	FMWP	R ²
TFPSS	-0.05560 (-0.28352)	0.22219 (9.68008)	0.90357
TFPHH	0.04849 (0.19118)	0.17906 (6.03135)	0.76282
TFPRN	-0.72993 (-1.84633)	0.27246 (5.88779)	0.77612
TFPST	0.40998 (2.48637)	0.13324 (6.90290)	0.82654
TFPPK	0.32910 (0.67618)	0.16518 (3.20391)	0.63111
TFPSK	-0.30373 (-2.33390)	0.20385 (13.38202)	0.94711
TFPPN	-0.27312 (-1.72544)	0.21459 (11.58159)	0.93062

TFP = Trash Fish Prices

C = Constant

FMWP = Fish Meal Wholesale Price

SS = Samut Sakhon

HH = Hua Hin

RN = Ranong

ST = Surat Thani

PK = Phuket

SK = Songkhla

PN = Pattani

Chapter VIII

SUMMARY AND CONCLUSION

In this study, statistical analyses were made for wholesale prices of five major economically important marine species, namely, Shrimp and Prawn, Squid and Cuttlefish, Indo-Pacific Mackerel, Little Tuna and Trash Fish. Owing to data limitation, statistical analyses were concentrated only on domestic wholesale prices and wholesale prices of these marine species in the Bangkok Fish Market and seven provincial fish markets, i.e., Samut Sakhon, Hua Hin, Ranong, Surat Thani, Phuket, Songkhla and Pattani. Annual wholesale prices and monthly wholesale prices of these marine species recorded by the Fish Marketing Organization were the main data for the analyses.

Long-term trend analyses were made on annual wholesale prices of these marine species at both national and provincial levels. Seasonal price movements were analysed through both seasonal price indices and seasonal quantity indices calculated from monthly wholesale prices and monthly quantities of each of these marine species landed at the Bangkok Fish Market and seven provincial fishing ports from 1 January 1981 to 31 December 1985. Correlation coefficients were calculated to examine price relationships between markets of each marine species. Finally regression equations were constructed to trace major factors affecting both domestic and Bangkok wholesale prices of these marine species.

The price trend analysis indicates that wholesale prices of marine species in this study show long-term rising trends, at both national and provincial levels, in spite of some fluctuations. Both long-term price trend and seasonal price movement analyses indicated that fluctuations in wholesale prices of exportable marine species such as shrimp and prawn, squid and cuttlefish, Little tuna and trash fish were not caused mainly by fluctuations in their landed quantities in the markets but by changes in overseas demand reflected by fluctuations in export

prices of frozen shrimp and prawn, frozen squid and cuttlefish, canned tuna and fish meal. For domestically consumed marine fish such as Indo-Pacific mackerel, however, changes in landed quantity of marine fish in the market had a strong impact on wholesale price of that marine fish.

Regression analyses also indicated that major factors affecting both domestic and Bangkok wholesale prices of shrimp and prawn, squid and cuttlefish, Little tuna and trash fish are export prices of their products and other demand-determining factors including number of consumers (population), per capita income and per capita fish consumption expenditure. Hence, both domestic and Bangkok wholesale prices of these marine species still keep on rising in spite of increases in their landed quantities in the markets if export prices of their products and other demand-determining factors also increase. However, major factors affecting both domestic and Bangkok wholesale prices of Indo-Pacific mackerel are both landed quantity of Indo-Pacific mackerel in the market and demand-determining factors including number of consumers (population), per capita income and per capita fish consumption expenditure. While landed quantity of Indo-Pacific mackerel has a negative impact on its wholesale price, other determining factors have positive impacts. Fluctuations in both domestic and Bangkok wholesale prices of Indo-Pacific mackerel, then, are caused jointly by quantity of Indo-Pacific mackerel landed in the market and other demand-determining factors.

This study also shows that provincial wholesale prices of these marine species are determined not only by local demand and supply conditions but also by external factors including export prices of their products, Bangkok wholesale prices and other provincial wholesale prices of these marine species.

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Appendix A

SIMPLE REGRESSION ANALYSIS

Regression analyses are used in the section on factors affecting wholesale prices of marine species. The simple regression analysis technique is used to investigate factors affecting wholesale prices of shrimp and prawn, squid and cuttlefish, and trash fish. The multiple regression analysis technique, on the other hand, is used to investigate factors affecting wholesale prices of Indo-Pacific mackerel and tuna. Correlation analysis, which is a product of the simple regression analysis, is also used in the section on price relationships between markets of each marine species.

Appendix A explains the methodology of the two-variable linear model or simple regression analysis. Appendix B will explain the methodology of multiple regression analysis. Descriptions and examples are adapted from Dominick Salvatore: Theory and Problems of Statistics and Econometrics, Chapters 6 and 7, Schaum's Outline Series, Mc Graw Hill Inc. 1982. Readers are recommended to consult this book for a comprehensive understanding.

A-1 The Two-Variable Linear Model

The two-variable linear model, or simple regression analysis, is used for testing hypotheses about the relationship between a dependent variable, Y, and an independent or explanatory variable, X, and for prediction. Simple linear regression analysis usually begins by plotting the set of XY values on a scatter diagram and determining by inspection if there exists an approximate linear relationship:

$$Y_i = b_0 + b_1 X_i \dots\dots\dots (A1)$$

Since the points are unlikely to fall precisely on the line, the exact linear relationship in Eq. (A1) must be modified to include a random disturbance, error, or stochastic term, u_i :

$$Y_i = b_0 + b_1 X_i + u_i \quad \dots\dots\dots (A2)$$

The error term is assumed to be (1) normally distributed, with (2) zero expected value or mean, and (3) constant variance, and it is further assumed (4) that the error terms are uncorrelated or unrelated to each other and (5) that the explanatory variable assumes fixed values in repeated sampling (so that X and u_i are also uncorrelated).

Example 1

Table A-1 gives the average wholesale prices (Baht/kg) of shrimps, Y, and the quantities of shrimps, X, (hundred tons) landed at a specified fish market in the 10-year period from 1971 to 1980. The relationships between shrimp wholesale price, Y, and landed quantity, X, in this fish market during the 10-year period are plotted in the scatter diagram of Figure A-1. The relationship between X and Y in Figure A-1 is approximately linear (i.e. the points would fall on or near a straight line). This relationship can be explained roughly by the fact that wholesale prices of shrimps in this fish market during the studied period moved mostly in the same direction with shrimp landed quantities. Hence landed quantity of shrimps had no negative impact on wholesale price of shrimps in this market and wholesale price would not fall when the landed quantity of shrimps increased.

An estimate regression equation used to explain this relationship can be made by using the ordinary least-squares method.

Table A-1 Wholesale Prices and Quantities of shrimps landed at a specified fish market between 1971 and 1980

Price : Baht/kg
Quantity : Hundred tons

Year	n	Y_i (Price)	x_i (Quantity)
1971	1	40	6
1972	2	44	10
1973	3	46	12
1974	4	48	14
1975	5	52	16
1976	6	58	18
1977	7	60	22
1978	8	68	24
1979	9	74	26
1980	10	80	32

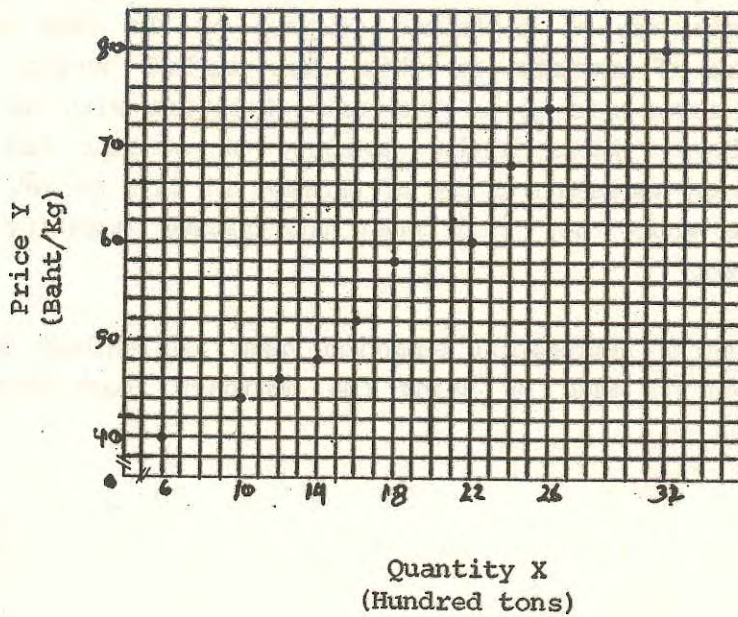


Fig. A-1

A-2 The Ordinary Least-Squares Method

The ordinary least-squares method (OLS) is a technique for fitting the "best" straight line to the sample of XY observations. It involves minimizing the sum of the squared (vertical) deviations of points from the line:

$$\text{Min } \sum (Y_i - \hat{Y}_i)^2 \dots\dots\dots (A3)$$

where Y_i refers to the actual observations, and \hat{Y}_i refers to the corresponding fitted values, so that $Y_i - \hat{Y}_i = e_i$, the residual. This gives the following two normal equations:

$$\sum Y_i = n\hat{b}_0 + \hat{b}_1 \sum X_i \dots\dots\dots (A4)$$

$$\sum X_i Y_i = \hat{b}_0 \sum X_i + \hat{b}_1 \sum X_i^2 \dots\dots\dots (A5)$$

Where n is the number of observations, and \hat{b}_0 and \hat{b}_1 are estimators of the true parameters b_0 and b_1 . Solving simultaneously Eq. (A4) and (A5), we get:

$$\hat{b}_1 = \frac{n \sum X_i Y_i - \sum X_i \sum Y_i}{n \sum X_i^2 - (\sum X_i)^2} \dots\dots\dots (A6)$$

The value of \hat{b}_0 is then given by

$$\hat{b}_0 = \bar{Y} - \hat{b}_1 \bar{X} \dots\dots\dots (A7)$$

It is often useful to use an equivalent formula for estimating \hat{b}_1 :

$$\hat{b}_1 = \frac{\sum x_i y_i}{\sum x_i^2} \dots\dots\dots (A8)$$

where $x_i = X_i - \bar{X}$, and $y_i = Y_i - \bar{Y}$. The estimated least-squares regression (OLS) equation is then

$$\hat{Y}_i = \hat{b}_0 + \hat{b}_1 X_i \dots\dots\dots (A9)$$

Example 2

Table A-2 shows the calculations to estimate the regression equation for the relationship between wholesale price and landed quantity of shrimps in Table 6.1. Using Eq. (A8)

$$\hat{b}_1 = \frac{\sum x_i y_i}{\sum x_i^2} = \frac{956}{576} = 1.66 \quad (\text{the slope of the estimated regression line})$$

$$\hat{b}_0 = \bar{Y} - \hat{b}_1 \bar{X} \approx 57 - (1.66)(18) \approx 57 - 29.88 \approx 27.12 \quad (\text{the } Y \text{ intercept})$$

Table A-2 Calculations of Relationship between Wholesale Price and Landed Quantity of Shrimps

n	Y _i (Price)	X _i (Quantity)	y _i	x _i	x _i y _i	x _i ²
1	40	6	-17	-12	204	144
2	44	10	-13	-8	104	64
3	46	12	-11	-6	66	36
4	48	14	-9	-4	36	16
5	52	16	-5	-2	10	4
6	58	18	1	0	0	0
7	60	22	3	4	12	16
8	68	24	11	6	66	36
9	74	26	17	0	136	64
10	80	32	23	14	322	196
n = 10	ΣY _i = 570 Ȳ = 57	ΣX _i = 180 X̄ = 18	Σy _i = 0	Σx _i = 0	Σx _i y _i = 956	Σx _i ² = 576

Thus the estimated regression equation can be written as follows:

$$Y_i = 27.12 + 1.66 X_i$$

where

Y_i = average wholesale price of shrimps (Baht/kg)

X_i = landed quantity of shrimps (Hundred tons)

This estimated regression equation shows the positive relationship between average wholesale price and landed quantity of shrimps and can be interpreted as indicating that a one-hundred ton increase in landed quantity of shrimps will raise average wholesale price of shrimps in the same fish market about 1.66 Baht/kg. Furthermore, this estimated regression equation can be used to predict shrimp average wholesale price if shrimp landed quantities are known. For example:

Landed Quantity (Hundred tons)		Wholesale Price (Baht/kg)	
if	$x = 5$	then	$y = 27.12 + 1.66(5) = 35.42$
	$x = 10$		$y = 27.12 + 1.66(10) = 43.72$
	$x = 20$		$y = 27.12 + 1.66(20) = 60.52$
	$x = 30$		$y = 27.12 + 1.66(30) = 76.92$
	$x = 40$		$y = 27.12 + 1.66(40) = 93.52$

Fig. A-2 shows the regression line of this equation.

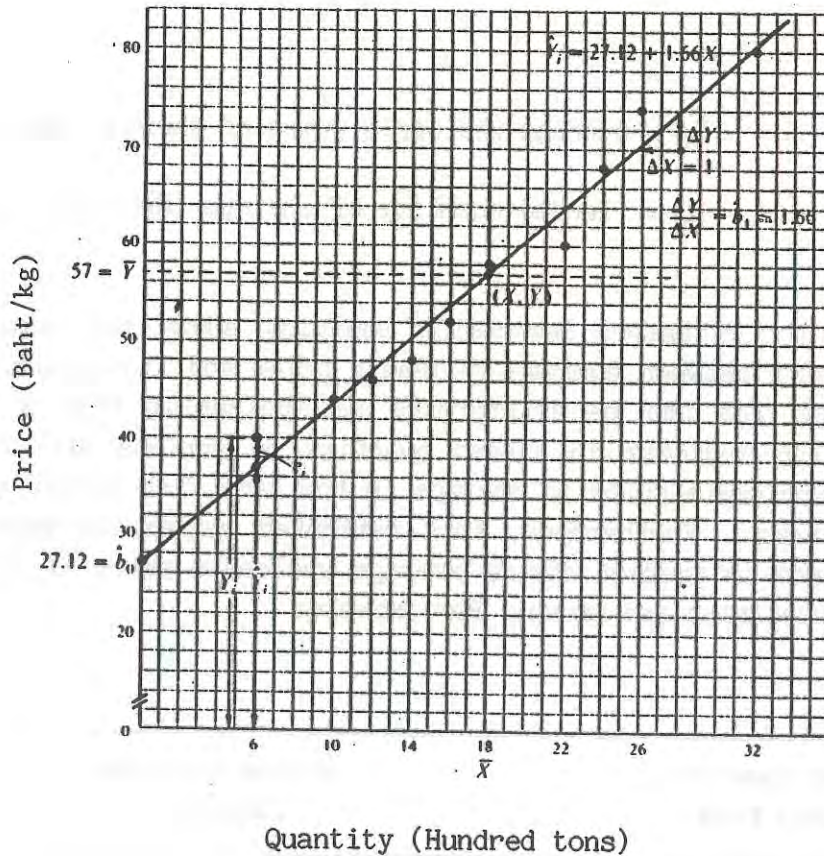


Fig. A-2 Plot of Estimated Regression Line
 $Y_i = 27.12 + 1.66 X_i$

A-3 Tests of Significance of Parameter Estimates

In order to test the statistical significance of the parameter estimates of the regression, \hat{b}_0 and \hat{b}_1 , the t-statistics, t_0 and t_1 , are required. In order to estimate t_0 and t_1 , the variance of \hat{b}_0 and \hat{b}_1 is required, where

$$\text{Var } \hat{b}_0 = \sigma_u^2 \frac{\sum X_i^2}{n \sum x_i^2} \dots\dots\dots (A10)$$

$$\text{Var } \hat{b}_1 = \sigma_u^2 \frac{1}{\sum x_i^2} \dots\dots\dots (A11)$$

Since σ_u^2 is unknown, the residual variance, s^2 , is used as an (unbiased) estimate of σ_u^2 :

$$s^2 = \hat{\sigma}_u^2 = \frac{\sum e_i^2}{n - k} \dots\dots\dots (A12)$$

where k = number of parameter estimates.

Unbiased estimates of the variance of \hat{b}_0 and \hat{b}_1 are then given by

$$s_{\hat{b}_0}^2 = \frac{\sum e_i^2}{n - k} \frac{\sum X_i^2}{n \sum x_i^2} \dots\dots\dots (A13)$$

$$s_{\hat{b}_1}^2 = \frac{\sum e_i^2}{n - k} \frac{1}{\sum x_i^2} \dots\dots\dots (A14)$$

so that $S_{\hat{b}_0}$ and $S_{\hat{b}_1}$ are the standard errors of the estimates. Since u_i is normally distributed, Y_i and therefore \hat{b}_0 and \hat{b}_1 are also normally distributed, so that we can use the t distribution with $n - k$ degrees of freedom, to test hypotheses about and construct confidence intervals for \hat{b}_0 and \hat{b}_1 .

Example 3

Table A-3 (an extension of Table A-2) shows the calculations required to test the statistical significance of \hat{b}_0 and \hat{b}_1 . The values of \hat{Y}_i in Table A-3 are obtained by substituting the values of X_i into the estimated regression equation found in Example 2. (The values of y_i^2 are obtained by squaring y_i from Table A-2 and are to be used in Sec. A-4).

$$s_{\hat{b}_0}^2 = \frac{\sum e_i^2}{n - k} \frac{\sum X_i^2}{n \sum x_i^2} = \frac{47.3056}{10 - 2} \frac{3.816}{10(576)} = 3.92 \quad \text{and} \quad s_{\hat{b}_0} = \sqrt{3.92} = 1.98$$

$$s_{\hat{b}_1}^2 = \frac{\sum e_i^2}{(n - k) \sum x_i^2} = \frac{47.3056}{(10 - 2)576} = 0.01 \quad \text{and} \quad s_{\hat{b}_1} = \sqrt{0.01} = 0.1$$

Table A-3 Calculations to Test Significance of Parameters

Year	Y_i	X_i	\hat{Y}_i	e_i	e_i^2	X_i^2	x_i^2	y_i^2
1	40	6	37.08	2.92	8.5264	36	144	289
2	44	10	43.72	0.28	0.0784	100	64	169
3	46	12	47.04	-1.04	1.0816	144	36	121
4	48	14	50.36	-2.36	5.5696	196	16	81
5	52	16	53.68	-1.68	2.8224	256	4	25
6	58	18	57.00	1.00	1.0000	324	0	1
7	60	22	63.64	-3.64	13.2496	484	16	9
8	68	24	66.96	1.04	1.0816	576	36	121
9	74	26	70.28	3.72	13.8384	676	64	289
10	80	32	80.24	-0.24	0.0576	1,024	196	529
n = 10				$\Sigma e_i = 0$	$\Sigma e_i^2 = 47.3056$	$\Sigma X_i^2 = 3,816$	$\Sigma x_i^2 = 576$	$\Sigma y_i^2 = 1,634$

Therefore, t_0 and t_1 are estimated from the following formulas:

$$t_0 = \frac{\hat{b}_0 - b_0}{S_{\hat{b}_0}} = \frac{27.12 - 0}{1.98} = 13.7$$

$$t_1 = \frac{\hat{b}_1 - b_1}{S_{\hat{b}_1}} = \frac{1.66 - 0}{0.1} = 16.6$$

when both b_0 and b_1 are hypothesized to be zero. Since both t_0 and t_1 exceed $t = 2.306$ with 8 degrees of freedom at the 5% level of significance (from t-Distribution table not shown here), we conclude that both b_0 and b_1 are statistically significant at 5% level.

A-4 Test of Goodness of Fit and Correlation

The closer the observations fall to the regression line (i.e., the smaller the residuals), the greater is the variation in Y "explained" by the estimated regression equation. The total variation in Y is equal to the explained plus the residual variation:

$$\sum (Y_i - \bar{Y})^2 = \sum (Y_i - \hat{Y}_i)^2 + \sum (Y_i - \hat{Y}_i)^2 \dots (A15)$$

Total variation in Y (or total sum of squares)	Explained variation in Y (or regression sum of squares)	Residual variation in Y (or error sum of squares)
TSS	RSS	ESS

Dividing both sides by TSS gives

$$1 = \frac{RSS}{TSS} + \frac{ESS}{TSS}$$

The coefficient of determination, or R^2 , is then defined as the proportion of the total variation in Y "explained" by the regression of Y on X:

$$R^2 = \frac{RSS}{TSS} = 1 - \frac{ESS}{TSS} \dots (A16)$$

R^2 can be calculated by

$$R^2 = \frac{\sum \hat{y}_i^2}{\sum y_i^2} = 1 - \frac{\sum e_i^2}{\sum y_i^2} \dots (A17)$$

where

$$\sum \hat{y}_i^2 = \sum (\hat{Y}_i - \bar{Y})^2$$

R^2 ranges in value from 0 (when the estimated regression equation explains none of the variation in Y) to 1 (when all points lie on the regression line).

The correlation coefficient, r , is given by

$$r = \sqrt{R^2} = \frac{\sum x_i y_i}{\sqrt{\sum x_i^2} \sqrt{\sum y_i^2}} = \sqrt{\hat{b}_1 \frac{\sum x_i y_i}{\sum y_i^2}}$$

r ranges in value from -1 (for perfect negative linear correlation) to $+1$ (for perfect positive linear correlation) and does not imply causality or dependence.

Example 4

The coefficient of determination for the price-quantity of shrimps example can be found from Table A-3:

$$R^2 = 1 - \frac{\sum e_i^2}{\sum y_i^2} = 1 - \frac{47.31}{1,634} = 1 - 0.0290 = 0.9710, \text{ or } 97.10\%$$

Thus the regression equation explains about 97% of the total variation in wholesale price of shrimps. The remaining 3% is attributed to factors included in the error term. Then $r = \sqrt{R^2} = 0.9710 = 0.9854$, or 98.54%, and is positive because \hat{b}_1 is positive.

In summary, the estimated regression equation showing the relationship between average wholesale price and landed quantity of shrimps in a specified fish market can be written in the complete form as follow:

$$Y = 27.12 + 1.66 X$$

t-values (13.7) (16.6)

$$R^2 = 0.9710$$

where Y = average wholesale price of shrimps (Baht/kg)

X = landed quantity of shrimps (Hundred tons)

R^2 = coefficient of determination and numbers in parentheses are t-statistics

The t-values and R^2 of the above regression equation can be repeatedly explained by the fact that the t-values of both estimated parameters \hat{b}_0 and \hat{b}_1 are statistically significant at the 5% level. R^2 value shows that this estimated equation explains about 97% of total variation in shrimp wholesale price. The remaining 3% is attributed to factors included in the error term. That is, about 97% of total variation in shrimp wholesale price can be explained by the variation of quantity of shrimp landed in the fish market. The remaining 3% is attributed to other factors not included in the equation.

The estimated regression equation can be interpreted as indicating that this equation shows the positive relationship between wholesale price and quantity of shrimps landed in the same fish market. A one-hundred ton increase in quantity of shrimps landed in the fish market will raise shrimp wholesale price in this fish market about 1.66 Baht/kg.

Simple regression analysis is used to investigate factors affecting wholesale prices of shrimps and prawns, squids and cuttlefishes, and trash fish. Interpretation of estimated parameters, t-values and R^2 is made in a similar manner as in our previous examples in this Appendix. However, the time frame of the real study period is between 1971 and 1985. Hence, there are 15 observations for each variable. Then $n = 15$ for the calculation of parameters, \hat{b}_0 and \hat{b}_1 , t-values and R^2 as well as the correlation coefficient, r . The degree of freedom ($n-k = 15-2 = 13$) of t-statistics values equal 13. Therefore, the t-values from t-distribution table equal 2.160 at 5% level of significance and 1.771 at 10% level of significance. Hence, if the t-value of any parameter in the estimated regression is greater than 2.160, then that parameter is statistically significant at the 5% level. However, if the t-value is less than 2.160 but greater than 1.771, then that parameter is still statistically significant but at the 10% level.

The coefficients of determination, R^2 and the correlation coefficients, r , are calculated and interpreted in the same manner as in our previous examples in this Appendix.

Appendix B

MULTIPLE REGRESSION ANALYSIS

B-1 The Three-Variable Linear Model

Multiple regression analysis is used for testing hypotheses about the relationship between a dependent variable, Y, and two or more independent variables, Xs, and for prediction. The three-variable linear regression model can be written as

$$Y_i = b_0 + b_1X_{1i} + b_2X_{2i} + u_i \dots\dots\dots (B1)$$

The additional assumption (to those of the simple regression model) is that there is no exact linear relationship between the Xs.

Ordinary least-squares (OLS) parameter estimates for Eq. (B1) can be obtained by minimizing the sum of the squared residuals:

$$\sum e_i^2 = \sum (Y_i - \hat{Y}_i)^2 = \sum (Y_i - \hat{b}_0 - \hat{b}_1X_{1i} - \hat{b}_2X_{2i})^2$$

This gives the following three normal equations

$$\sum Y_i = n\hat{b}_0 + \hat{b}_1 \sum X_{1i} + \hat{b}_2 \sum X_{2i} \dots\dots\dots (B2)$$

$$\sum X_{1i}Y_i = \hat{b}_0 \sum X_{1i} + \hat{b}_1 \sum X_{1i}^2 + \hat{b}_2 \sum X_{1i}X_{2i} \dots\dots\dots (B3)$$

$$\sum X_{2i}Y_i = \hat{b}_0 \sum X_{2i} + \hat{b}_1 \sum X_{1i}X_{2i} + \hat{b}_2 \sum X_{2i}^2 \dots\dots\dots (B4)$$

which (when expressed in deviation form) can be solved simultaneously for \hat{b}_1 and \hat{b}_2 , giving

$$\hat{b}_1 = \frac{(\sum x_1 y)(\sum x_2^2) - (\sum x_2 y)(\sum x_1 x_2)}{(\sum x_1^2)(\sum x_2^2) - (\sum x_1 x_2)^2} \dots\dots\dots (B5)$$

$$\hat{b}_2 = \frac{(\sum x_2 y)(\sum x_1^2) - (\sum x_1 y)(\sum x_1 x_2)}{(\sum x_1^2)(\sum x_2^2) - (\sum x_1 x_2)^2} \dots\dots\dots (B6)$$

$$\hat{b}_0 = \bar{Y} - \hat{b}_1 \bar{X}_1 - \hat{b}_2 \bar{X}_2$$

Then,
$$b_0 = Y - b_1 X_1 - b_2 X_2 \dots\dots\dots (B7)$$

Estimator b_1 measures the change in Y for a unit change in X_1 while holding X_2 constant. b_2 is analogously defined. Estimators b_1 and b_2 are called partial regression coefficients.

Example 1

Table B-1 extends Table A-1 and gives Baht/kg of shrimp wholesale price, Y , hundred tons of shrimp landed quantity, X_1 , and total population of the city to which the fish market belongs, X_2 , in thousands from 1971 to 1980. Using equations (B5), (B6) and (B7) we get

$$\hat{b}_1 = \frac{(\sum x_1 y)(\sum x_2^2) - (\sum x_2 y)(\sum x_1 x_2)}{(\sum x_1^2)(\sum x_2^2) - (\sum x_1 x_2)^2} = \frac{(956)(504) - (900)(524)}{(576)(504) - (524)^2} \approx 0.65$$

$$\hat{b}_2 = \frac{(\sum x_2 y)(\sum x_1^2) - (\sum x_1 y)(\sum x_1 x_2)}{(\sum x_1^2)(\sum x_2^2) - (\sum x_1 x_2)^2} = \frac{(900)(576) - (956)(524)}{(576)(504) - (524)^2} \approx 1.11$$

$$\hat{b}_0 = \bar{Y} - \hat{b}_1 \bar{X}_1 - \hat{b}_2 \bar{X}_2 \approx 57 - (0.65)(18) - (1.11)(12) \approx 31.98$$

Table B-1 Shrimp wholesale price with landed quantity and total population with calculations for Parameters Estimation

Year	Y (Price)	X ₁ (Quantity)	X ₂ (Population)	Y	X ₁	X ₂	X ₁ Y	X ₂ Y	X ₁ X ₂	X ² ₁	X ² ₂
1971	40	6	4	-17	-12	-8	204	136	96	144	64
1972	44	10	4	-13	-8	-8	104	104	64	64	64
1973	46	12	5	-11	-6	-7	66	77	42	36	49
1974	48	14	7	-9	-4	-5	36	45	20	16	25
1975	52	16	9	-5	-2	-3	10	15	6	4	9
1976	58	18	12	1	0	0	0	0	0	0	0
1977	60	22	14	3	4	2	12	6	8	16	4
1978	68	24	20	11	6	8	66	88	48	36	64
1979	74	26	21	17	8	9	136	153	72	64	81
1980	80	32	24	23	14	12	322	276	168	196	144
n=10	ΣY = 570 Ȳ = 57	ΣX ₁ = 180 X̄ ₁ = 18	ΣX ₂ = 120 X̄ ₂ = 12	ΣY = 0	ΣX ₁ = 0	ΣX ₂ = 0	ΣX ₁ Y = 956	ΣX ₂ Y = 900	ΣX ₁ X ₂ = 524	ΣX ₁ ² = 576	ΣX ₂ ² = 504

So that $\hat{Y}_i = 31.98 + 0.65 X_{1i} + 1.10 X_{2i}$

B-2 Tests of Significance of Parameter Estimates

In order to test the statistical significance of the parameter estimates of the multiple regression, the variance of the estimates is required:

$$\text{Var } \hat{b}_1 = \sigma_u^2 \frac{\sum x_2^2}{\sum x_1^2 \sum x_2^2 - (\sum x_1 x_2)^2} \dots\dots\dots (B8)$$

$$\text{Var } \hat{b}_2 = \sigma_u^2 \frac{\sum x_1^2}{\sum x_1^2 \sum x_2^2 - (\sum x_1 x_2)^2} \dots\dots\dots (B9)$$

(b_0 is usually not of primary concern) since σ_u^2 is unknown, the residual variance, s^2 , is used as an unbiased estimate of σ_u^2 :

$$s^2 = \hat{\sigma}_u^2 = \frac{\sum e_i^2}{n - k} \dots\dots\dots (B12)$$

where k = number of parameter estimates.

Unbiased estimates of the variance of \hat{b}_0 and \hat{b}_1 are then given by

$$s_{\hat{b}_1}^2 = \frac{\sum e_i^2}{n - k} \frac{\sum x_2^2}{\sum x_1^2 \sum x_2^2 - (\sum x_1 x_2)^2} \dots\dots\dots (B10)$$

$$s_{\hat{b}_2}^2 = \frac{\sum e_i^2}{n - k} \frac{\sum x_1^2}{\sum x_1^2 \sum x_2^2 - (\sum x_1 x_2)^2} \dots\dots\dots (B11)$$

so that S_{b_1} and S_{b_2} are the standard errors of the estimates. Tests of hypotheses about b_1 and b_2 are conducted as in Sec. A-3.

Example 2

Table B-2 (an extension of Table A-1) shows the additional calculations required to test the statistical significance of \hat{b}_1 and \hat{b}_2 . The values for \hat{Y}_i in Table B-2 are obtained by substituting the values for X_{1i} and X_{2i} into the estimated OLS regression equation found in Example 1. (The values for y_i^2 are

Table B-2 Price-Quantity-Population Calculations to Test Significance of Parameters

Year	Y	X ₁	X ₂	\hat{Y}	e	e ²	y ²
1971	40	6	4	40.32	-0.32	0.1024	289
1972	44	10	4	42.92	1.08	1.1664	169
1973	46	12	5	45.33	0.67	0.4489	121
1974	48	14	7	48.85	-0.85	0.7225	81
1975	52	16	9	52.37	-0.37	0.1369	25
1976	58	18	12	57.00	1.00	1.0000	1
1977	60	22	14	61.82	-1.82	3.3124	9
1978	68	24	20	69.78	-1.78	3.1684	121
1979	74	26	21	72.19	1.81	3.2761	289
1980	80	32	24	79.42	0.58	0.3364	529
n=10					$\Sigma e = 0$	$\Sigma e^2 = 13.6704$	$\Sigma y^2 = 1,634$

obtained by squaring y_1 , from Table B-1 and are to be used in Sec. B-3). Using the values from Table B-2 and B-1, we get

$$s_{b_1}^2 = \frac{\sum e_i^2}{n-k} \frac{\sum x_2^2}{\sum x_1^2 \sum x_2^2 - (\sum x_1 x_2)^2} = \frac{13.6704}{10-3} \frac{504}{(576)(504) - (524)^2} \approx 0.06 \quad \text{and} \quad s_{b_1} \approx 0.24$$

$$s_{b_2}^2 = \frac{\sum e_i^2}{n-k} \frac{\sum x_1^2}{\sum x_1^2 \sum x_2^2 - (\sum x_1 x_2)^2} = \frac{13.6704}{10-3} \frac{576}{(576)(504) - (524)^2} \approx 0.07 \quad \text{and} \quad s_{b_2} \approx 0.27$$

Therefore, $t_1 = \hat{b}_1 / s_{b_1} \approx 0.65 / 0.24 \approx 2.70$, and $t_2 = \hat{b}_2 / s_{b_2} = 1.11 / 0.27 \approx 4.11$. Since both t_1 and t_2 exceed $t = 2.365$ with 7df at the 5% level of significance, both b_1 and b_2 are statistically significant at the 5% level.

B-3 The Coefficient of Multiple Determination

The coefficient of multiple determination, R^2 , is defined as the proportion of the total variation in Y "explained" by the multiple regression of Y on X_1 , and X_2 , and (as shown in Sec. A-4) it can be calculated by

$$R^2 = \frac{\sum \hat{y}_i^2}{\sum y_i^2} = 1 - \frac{\sum e_i^2}{\sum y_i^2} = \frac{\hat{b}_1 \sum yx_1 + \hat{b}_2 \sum yx_2}{\sum y^2}$$

Since the inclusion of additional independent or explanatory variables is likely to increase the $RSS = \sum y_i^2$ for the same $TSS = \sum y_i^2$ (see Sec. A-4), R^2 increases.

Example 3

R^2 for the above example can be found from Table B-2:

$$R^2 = 1 - \frac{\sum e_i^2}{\sum y_i^2} = 1 - \frac{13.6704}{1,634} \approx 1 - 0.0084 = 0.9916, \text{ or } 99.16\%$$

This compares with an R^2 of 97.10% in the simple regression, with landed quantity as the only independent or explanatory variable.

In summary, the estimated regression equation can be written as follow:

$$Y = 31.98 + 0.65 X_1 + 1.10 X_2$$

(2.70) (4.11)

t-values

$$R^2 = 0.992$$

where Y = average wholesale price of shrimps (Baht/kg)

X_1 = landed quantity of shrimps (Hundred tons)

X_2 = total population of the city where the fish market is located. (Thousand persons)

R^2 = coefficient of determination and numbers in parentheses are t-statistics.

Interpretations of t-values and R^2 of this equation are similar to those of the simple regression equation in Appendix A. They show that both estimated parameters b_1 and b_2 are statistically significant at the 5% level, while R^2 shows that this estimated equation explains about 99% of total variation in shrimp wholesale price. The remaining 1% is attributed to factors not included in the equation.

The estimated regression equation can be interpreted in the following manner: the average wholesale price of shrimp has a positive relationship with both landed quantity of shrimps in the fish market and number of persons in the city who are consumers of shrimps in this fish market. If the size of the population remains unchanged, an increase in quantity of shrimps landed in the fish market by one hundred tons will raise wholesale price of shrimp in this market about 0.65 Baht/kg.

On the other hand, if shrimp landed quantity remains unchanged, an increase in the size of the population in the city by one thousand persons will raise average wholesale price of shrimps about 1.10 Baht/kg. If both shrimp landed quantity and total population of the city increase simultaneously, shrimp average wholesale price will increase further. Reasons behind these relationships are left to be explained by each investigator.

Multiple regression analysis is used to investigate factors affecting wholesale prices of Indo-Pacific mackerel and tuna in this study. Interpretations of estimated parameters, t-values and R^2 value in each equation are made in a similar manner as for those of our previous examples. However, t-values of the multiple regression equation with 15 observations ($n = 15$) of one dependent variable and two independent variables ($k = 3$) from the t-Distributions table equal 2.179 at the 5% level of significance and 1.782 at the 10% level of significance (when the degree of freedom equals $n-k = 15-3 = 12$). Hence estimated parameters will be statistically significant at the 5% level if the t-value is greater than 2.179 and is still statistically significant at the 10% level if the t-value is less than 2.179 but greater than 1.782.