TRENDS IN JAPAN-USA SEAFOOD TRADE, WITH AN EMPHASIS ON ALASKA POLLOCK SURIMI, AND THE EFFECTS ON JAPANESE HOUSEHOLD CONSUMPTION OF SURIMI-BASED FOODS

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I. Introduction

In recent decades, Japan has consistently lead the world's nations in total fishery production while maintaining a populous whose per capita consumption of fish and fishery products reached a near world record of 72.7 kg in 1989 ; second only to Icelanders[1]. However, during this same period political and economic forces, both domestic and international, have begun to alter these conditions in Japan. Significant developments in Japan's seafood consumption and production sectors could strongly influence international seafood trade with nations of the world that have come to rely upon strong demand for seafood in Japan.

Japan commands a leading world market for marine products, yet recent decades have seen Japan drop from self-sufficiency in fishery foods to 27% dependent on seafood imports in 1990[2]. International trade in fishery products is one of the few areas in which Japan runs a trade dificit. The establishment in 1976 of marine 200-mile Exclusive Economic Zones (EEZ) by the United States of America (U.S.A. or U.S.) and the former Soviet Union contributed significantly to Japan changing from a net-exporter to a net-importer of fishery products. The onset of the 200-mile era radically restructured international importer-exporter relationships by limiting resource access on the basis of nationality. Japan is not alone as an "EEZ loser". However, given its large involvement in fisheries of the world, it is likely the most negatively affected country in terms of total economic value. Japan's North Pacific Alaska pollock groundfish fishery is a notable example.

Japan's distant water North Pacific trawl fleet, a major contributor to total Japanese landings, was gradually eliminated from operating within the US North Pacific EEZ ; the world's richest groundfish fishing area, Alaska pollock is the world's most abundantly landed fish[3] and the primary target species of groundfish trawlers operating in the North Pacific. The impact of EEZ policy on this fishery, and the domestic Japanese food industry it supports, has been dramatic.

In may 1959, Japanese researchers at Hokkaido Fisheries Research Laboratory in Abashiri, Hokkaido developed a method of freezing minced fish meat called "Surimi"[4] in such a way to maintain its chemical and textural integrity. Surimi is the building block for a myriad of traditional Japanese foods using processed fish.

With this new development, demand for frozen surimi grew in Japan's food processing industry. Ship-based frozen surimi plants or "factory trawlers" enabled Japan to develop the North Pacific Alaska pollock fishery in the 1960's and exploit this previously under-utilized species for surimi. The fishery grew at a phenomenal rate and attracted international fleets during the next several decades. However, by 1991, under the mandate of the Magnuson Fisheries Conservation and Management Act of 1976, the North Pacific groundfish fishery within US waters was eventually 100% "Americanized"[5]. As a result, surimi food processors in Japan now find themselves increasingly dependent on American surimi imports.

Food import-exporters, domestic producers, wholesalers, and retailers serve a keenly discriminating public in Japan. While the percentage of personal dispos-

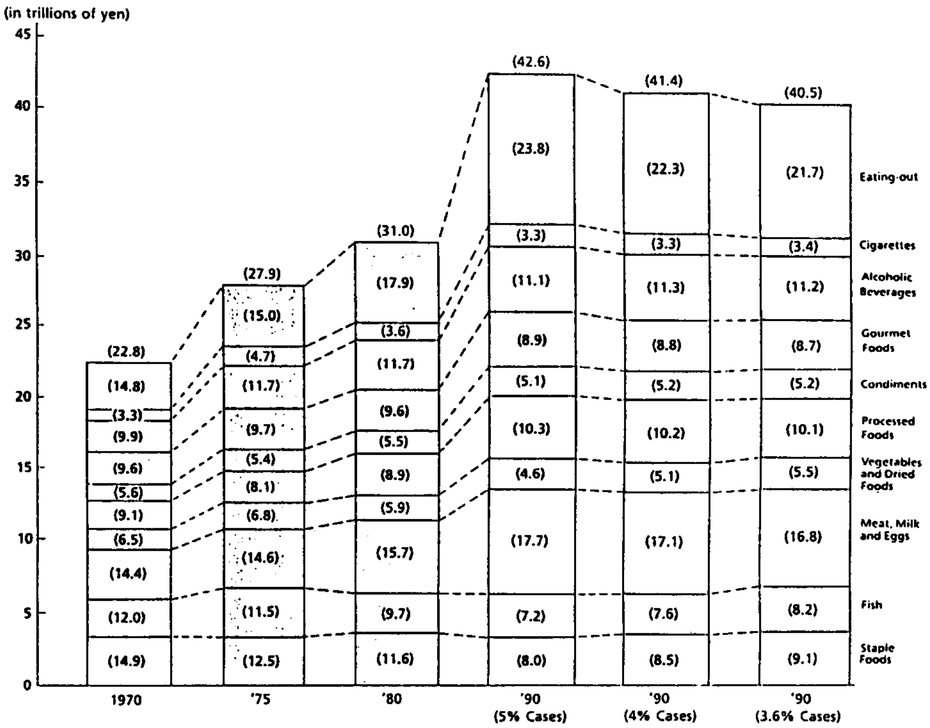

Fig. 1. Transitions in food consumption structure and future predictions (1975 values).
Note: 1. Figures in parenthesis indicate structural rations (%)
2. "Processed Foods" is used in its narrowest sense.
3. 5% Cases, 4% Cases, and 3.6% Cases are the estimated values arrived at by taking 5%, 4%, and 3.6% as the respective average growth ratios for citizens' final consumption expenditures for 1980 to 1990.
Sources: "Food Industry Correlative Structure Basic Survey" (March, 1982) MAFF Food Distribution Agency
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Table 1. National consumption of fishery products in live weight and fish contribution to animal protein supply: Japan, the United States of America, and the world.

Year	Historical Data for Japan				Historical Data for the U.S.A.				Historical Data for the World			
	Per Capita Supply (kg/yr)	Fish Proteins (gr/per	Animal Proteins caput/day)	Fish/ Animal Proteins Ratio (%)	Per Capita Supply (kg/yr)	Fish Proteins (gr/per	Animal Proteins caput/day)	Fish/ Animal Proteins Ratio (%)	Per Capita Supply (kg/yr)	Fish Proteins (gr/per	Animal Proteins caput/day)	Fish/ Animal Proteins Ratio (%)
1961	49.5	15.8	23.3	67.9	14.0	3.1	67.1	4.6	9.1	2.7	19.6	14.0
1962	51.2	16.3	24.9	65.5	14.5	3.3	68.5	4.8	9.3	2.9	20.1	14.4
1963	51.4	16.2	25.3	64.2	14.0	3.1	67.8	4.5	9.6	3.0	20.4	14.6
1964	48.9	13.7	23.8	57.6	13.7	.03	69.3	4.4	10.0	3.0	20.4	14.8
1965	53.1	17.0	27.9	60.9	13.5	3.1	68.8	4.5	10.2	3.1	20.6	15.2
1966	54.3	17.6	29.7	59.5	14.0	3.4	70.2	4.8	10.4	3.2	21.0	15.2
1967	57.1	18.2	31.2	58.3	13.4	2.9	70.6	4.2	10.7	3.2	21.3	15.1
1968	61.0	19.5	33.1	59.1	14.6	3.2	71.5	4.5	10.9	3.3	21.6	15.3
1969	60.2	19.5	34.1	56.7	14.0	3.1	71.8	4.3	10.8	3.3	21.7	15.1
1970	63.5	20.0	35.9	55.7	14.7	3.4	72.8	4.7	10.9	3.3	21.8	15.0
1971	66.8	21.1	37.7	55.9	14.2	3.2	73.2	4.3	11.0	3.3	22.0	15.2
1972	68.5	21.0	38.6	54.4	16.1	3.6	73.4	4.9	11.4	3.4	22.1	15.4
1973	70.9	22.1	40.2	55.0	15.5	3.7	70.6	5.2	11.6	3.5	22.0	15.9
1974	70.6	21.7	39.7	54.7	14.8	3.5	71.2	4.9	11.7	3.5	22.4	15.8
1975	70.6	22.1	40.1	55.1	14.1	3.1	69.3	4.5	11.6	3.5	22.5	15.6
1976	68.6	23.7	42.5	55.7	15.4	3.5	72.4	4.9	11.7	3.5	22.7	15.4
1977	66.3	23.0	42.8	53.7	15.2	3.3	71.9	4.6	11.4	3.4	22.7	15.1
1978	67.2	23.6	44.5	53.1	16.0	3.5	71.4	5.0	11.4	3.4	23.0	15.0
1979	65.0	22.8	44.4	51.4	15.7	3.5	71.2	4.8	11.3	3.4	23.1	14.7
1980	65.5	23.1	44.7	51.6	15.1	3.5	71.1	4.9	11.3	3.4	23.3	14.7
1981	65.1	23.5	45.2	51.9	17.0	3.5	70.5	4.9	11.6	3.5	23.3	14.9
1982	64.4	23.7	45.8	51.7	16.2	3.3	69.5	4.8	11.6	3.5	23.3	15.1
1983	67.1	25.1	47.5	52.7	17.2	3.6	71.1	5.0	11.8	3.6	23.5	15.3
1984	68.3	25.1	48.1	52.3	19.4	3.9	72.0	5.4	12.2	3.7	23.7	15.5
1985	69.5	25.7	49.1	52.4	19.5	4.0	73.0	5.5	13.4	3.7	24.2	15.3
1986	70.0	25.3	49.4	51.2	19.2	4.2	73.6	5.6	12.7	3.8	24.4	15.5
1987	71.5	25.3	51.4	51.1	21.7	4.6	74.5	6.1	13.2	3.9	24.6	15.9
1988	72.1	26.1	52.1	50.1	20.4	4.3	74.8	5.8	13.3	3.9	25.0	15.7
1989	72.7	26.9	53.2	50.6	21.8	4.8	74.9	6.4	13.4	4.0	25.2	15.9

Source: World Apparent Consumption Statistics Based on Food Balance Sheets, FAO. 1991.

able income spent on "dining out" is growing in Japan, food consumption in the home is fundamentally important (Fig. 1). Therefore, household consumption trends, and factors affecting them, are crucial to those interested in the Japanese food consumption market; including those associated with surimi-based foods.

Dramatic growth in the Japanese economy in recent decades has generated ramifications in domestic food consumption habits. Examples of important changes in Japanese household consumption include: a reduced percentage of household food expenditures spent on fishery products; recent declines in per capita daily calories supplied from fish (meat recently surpassing fish in terms of per capita daily calorie supply); a shift toward higher value-added fishery goods; and an increasingly "westernized" diet[6]. The point stressed here is Japanese consumption of seafood products is growing at a decreasing rate and shifting toward processed foods and higher-valued species while meat consumption is increasing. Interestingly, fish consumption in the U.S.A. is increasing and reached 21.8 kg in 1989[7]. However, this must be kept in perspective recognizing Japanese per capita fish consumption remains nearly four times that of an American's. Table 1 reveals Japan's rising meat consumption is outpacing the rate of increases in fish. In 1961 and 1989, the fish/animal protein percentage ratio dropped from 67.9% to 50.6%, respectively. In America this ratio rose slightly from 14% to 16% over the same period.

Rising personal income in Japan, and greater exposure to non-Japanese cultures through travel and exchange, has contributed to changing taste preferences and allowed consumption diversity among competitive commodities and product forms. This study will attempt to quantitatively analyze these shifts over the past decade in Japanese consumption of surimi-based goods and draw comparisons with consumption trends in non-fishery protein sources such as chicken, pork, and beef.

The following is a general outline of this document. Chapter II is a background providing a brief description of Japanese fishery consumption, and then gives an indepth review of world fishery production. Significance of the North Pacific Alaska pollock fishery in world landings, and the role US-EEZ harvests play in this fishery, is emphasized. Chapter III elaborates on international fisheries trade trends over the past twenty years and describes the historical contribution to global fisheries trade made by the United States of America and Japan. The chapter ends with a brief review of Japan's growing dependence on food imports from the United States of America, highlighting on fishery goods. Chapter IV focuses on surimi. It reviews trends in surimi global production, Japanese supply and demand, and surimi price trends. Chapter V presents trends in production and prices of major food commodities manufactured from surimi, such as those that are either baked, fried, steamed, or boiled. Chapter VI is the culmination of the dissertation. The chapter reviews Japanese household consumption of surimi-based foods. These goods are known as "neriseihin" in Japanese. Demand curve analysis is conducted and product substitution implications are discussed. The chapter concludes with an estimate for Japanese household consumption of surimi-based foods through the end of this century.

II. Background: Fishery Consumption in Japan and World Production

1. The Japanese Consumer

In the 1980's recognition of Japan as a world economic power catapulted the Japanese consumer into the international spotlight as the customer to please; it will be shown later how Japanese fisheries demand was a leading indicator. During post-war Japan the stage was set for what Reischauer described as the "economic miracle of the free world"[8]. Trade marks of this era were governmental assistance programs to rebuild traditional industries such as textiles and steel, as well as establish new sectors for manufacturing ships, automotives, semiconductors and computer hardware, photographic and audio visual equipment[9]. Since the post-war era, the Japanese public helped to fund this government infusion of capital into their economy by consistently high rates of saving relative to personal consumption and their diligent, if not sacrificial work ethic. However, the economic bubble of the 1980's has converted a nation of savers into a "nation of consumers"[10].

Factors driving this change include rising levels of income in Japan and the

Table 2. Trends in food demand and supply based on daily per capita transitions in supply of food: 1935-1985. (Unit: g)

		Fiscal 1935	'51	'55	'60	'65	'70	'75	'80	'84	'85
Cereals		418.0	403.4	421.7	409.9	397.2	351.4	331.9	309.3	297.7	295.6
	Rice	346.0	271.6	302.4	314.9	306.2	260.6	240.6	216.3	206.2	204.3
	Wheat	29.0	65.8	68.7	70.6	79.4	84.3	86.1	88.3	87.1	86.9
Potatoes		77.0	110.9	119.2	83.4	58.5	44.2	43.6	47.3	48.4	51.0
Pulses		21.4	14.6	25.8	27.7	26.1	27.7	25.7	23.3	24.5	24.7
Vegetables		205.0	201.8	225.7	273.1	296.4	312.7	299.2	302.2	302.2	296.8
Fruits		61.0	29.9	33.8	61.2	78.0	103.9	116.2	106.3	94.6	101.5
Meats		5.5	5.3	8.3	14.2	25.2	36.6	48.8	61.6	60.5	68.9
Chicken Products		6.4	6.0	10.0	17.2	30.9	39.8	37.5	39.2	40.6	40.8
Milk and Dairy Products		8.7	16.0	33.0	60.9	102.8	137.3	145.6	170.3	186.5	183.9
Fish and Shellfish		37.9	47.3	72.0	76.1	77.0	86.5	95.4	95.3	97.3	98.0
Sugars		36.1	18.2	33.7	41.2	51.4	73.8	68.5	63.9	58.3	57.6
Oils and Fats		2.3	4.3	7.5	11.8	17.2	25.8	29.7	34.5	38.0	38.7

Note : Cereals and potatoes show a great decrease, but on the other hand, animal foods and oils and fats have increased considerably.

Source : Food Balance Sheet, MAFF. However, all figures for 1935 are taken from "Pre-War and Post-War Food Situation" of the Economic Security Headquarters.

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elimination of tax-exempt status for personal savings in the late 1980's. Between 1975 and 1987, Japan's personal sector net financial wealth/income rose from 0.99% to 2.17% while the saving ratio over the same time period fell from 22.8% to 15.1%[11]. Food consumption in Japan is an example of changing consumer behavior as the Japanese palate aligns itself with higher levels of personal affluence.

With the exception of Icelanders, Japanese consume more live-weight equivalent of seafood than any country in the world. Between 1987 and 1989, the population of Japan averaged 122 million. During this period their annual average per capita consumption of fish and fishery products was 72.1 kg[12]. However, an increasing amount of their non-carbohydrate caloric intake is shifting out of fish and into meats. In 1965 and 1988 meat rose from representing 5.8% of an average Japanese non-carbohydrate calory intake to 12.5%, respectively. In contrast, fish dropped from comprising 10.9% to 9.4% of non-carbohydrate calory intake per

Table 3. Japan's rate of self-sufficiency by major crops and other food groupings: 1960-1988. (Unit: %)

Crop	1960	1965	1970	1975	1980	1985	1986	1987	1988
Rice	102	95	106	110	100	107	108	100	100
Wheat	39	28	9	4	10	14	14	14	17
Potatoes	100	100	100	99	96	96	96	94	93
Starch	76	67	41	24	21	19	20	18	15
Pulses	44	25	13	9	7	8	8	9	8
Vegetables	100	100	99	99	97	95	95	94	91
Fruits	100	90	84	84	81	77	74	74	57
Meat	91	90	89	77	81	81	78	76	73
beef	96	95	90	81	72	72	69	64	58
pork	96	100	98	86	87	86	82	80	77
Eggs	101	100	97	97	98	98	97	99	98
Milk products	89	86	89	81	82	85	82	78	76
Fish	111	110	108	100	97	86	86	82	80
Seaweeds	92	88	91	96	74	74	76	72	76
Sugar	18	31	22	15	27	33	34	34	34
Fats & oils	42	31	22	23	29	32	32	30	33
Other Groupings									
Caloric supply	79	73	60	54	53	52	51	49	49
Food grains	89	80	74	69	69	69	69	68	68
Grains	82	62	46	40	33	31	31	30	30
Farm products	91	86	81	77	75	74	73	71	70
Fishery products	113	112	104	92	90	79	84	78	78
Total Food	98	94	88	82	80	76	77	74	72

Source: MAFF, Food Balance Sheet; Fujita, 1991.

capita in 1965 and 1988, respectively[13]. The implication this trend in personal consumption has on specific sectors of the seafood industry is analyzed quantitatively in Chapter VI.

Japan's tremendous growth as an industrial-based nation over the past 30 years has, to a large extent, been done at the expense of its agricultural sector[14]. The country's agricultural potential was inherently limited to begin with since over 66% of Japan is uncultivatable mountainous land and just 12.5% is classified as arable[15]. Therefore, as previously pointed out, it is not surprising that as an archipelago nation it relied heavily on seafood for much of its protein.

However, here in fisheries as well, events of recent years have negatively influenced food productivity. Japanese fisheries production within a foreign nation's 200-mile Exclusive Economic Zone (EEZ) has decreased in recent years[16] with the onset of the 200-mile EEZ era. The overall result is that domestic food production in Japan has been unable to keep up with domestic demand. Table 2 reveals trends in per capita food demand and supply in Japan. The result is Japan's growing "food budget deficit".

Japan's rate of self-sufficiency in foods, in terms of caloric per capita energy intake, has fallen at an annual average rate of 2% between 1960 and 1988. Japan's rate of self-sufficiency in foods was 49% in 1988, the lowest level for any developed country[17]. Table 3 provides the percentages of domestic supply of major crops and food groups consumed in Japan. Declines are evident across the board. Food security is presently a heated debate in Japan. It was a dominant theme among Japanese presentations at the XXI International Conference of Agricultural Economists held in August of 1991 in Tokyo.

The decline in Japan's food security for fishery products is especially apparent. Because of seafood's unique importance in national food consumption in Japan, it is the focus of this dissertation.

2. Some Effects of the International 200-Mile Exclusive Economic Zone (EEZ) Marine Management Policy

Over the past twenty years, with the onset of the 200-mile EEZ era, relationships between fishery importing and exporting nations have radically been revised; most notably between Japan and the USA. North Pacific groundfish is an excellent example.

The Magnuson Fisheries Conservation and Management Act (MFCMA) of 1976 enabled the USA to exert control over international harvesting activities in its North Pacific resource-rich fishing grounds, to its national benefit. Gradual exclusion of foreign fishing fleets occurred as domestic fleets grew sizable enough to harvest the fishery resources allocated under the American domestic fishery management regime. In 1990, for the U.S. Alaska pollock and groundfish fishery, this transition to an all domestic fleet became complete (Fig. 2).

The importance of the North Pacific Alaska pollock fishery, changing roles of major fishing nations that harvest it, resulting shifts in international fisheries trade of Alaska pollock fish-paste or "surimi" (a major international commodity produced from this fishery), and the effect of these changes on Japanese household consumption of surimi-based goods is investigated in this document.

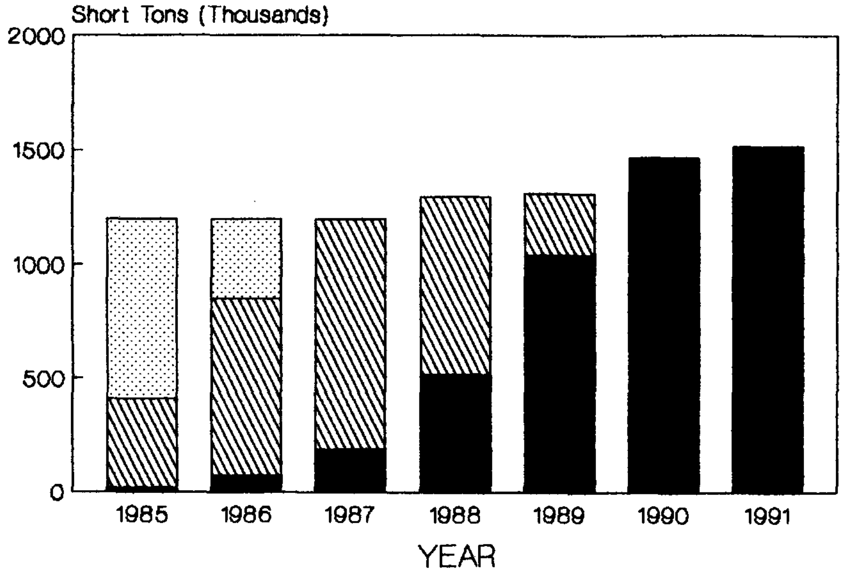


Fig. 2. Alaska pollock total landings within american 200-mile exclusive economic zone: 1985-1991.
Source: North Pacific Flshery Management Council, U.S.A.

Initially however, background is presented on trends in world fishery production and trade with a focus on the North Pacific and its primary fishery harvesting and trading nations. Emphasis is placed on Japan and the United States of America because of their present role as the world's leading fishery importing and exporting nations, respectively.

3. Trends in World Fishery Production

Fishery Catch by Regions of the World: The Role of the North Pacific

World fishery production has experienced impressive growth over the past twenty years both in terms of quantity and value. In 1989, total annual world inland and marine landings essentially reached the long-awaited goal of 100 million metric tons (Fig. 3). This was aided primarily by dramatic increases in Peruvian anchovy (*Engraulis ringens*) harvests, tremendous North Pacific landings sustained in the Alaska pollock (*Theragra chalcogramma*) fishery, large harvests of Japanese pilchard (*Sardinops melanostictus*), and growth in inland waters production during the 1980's; principally from aquaculture.

The North Pacific Ocean has the world's most productive fishing grounds. Over the past 20 years it has consistently been the source of more than 30% of total marine production (Table 4). Fig. 4 graphically represents North Pacific harvests in comparison to the world's other oceans. The six major North Pacific rim fishing nations (USSR, China, Japan, U.S.A., South Korea, and Canada) are contributing to total world catch at an increasingly significant degree (Fig. 5).

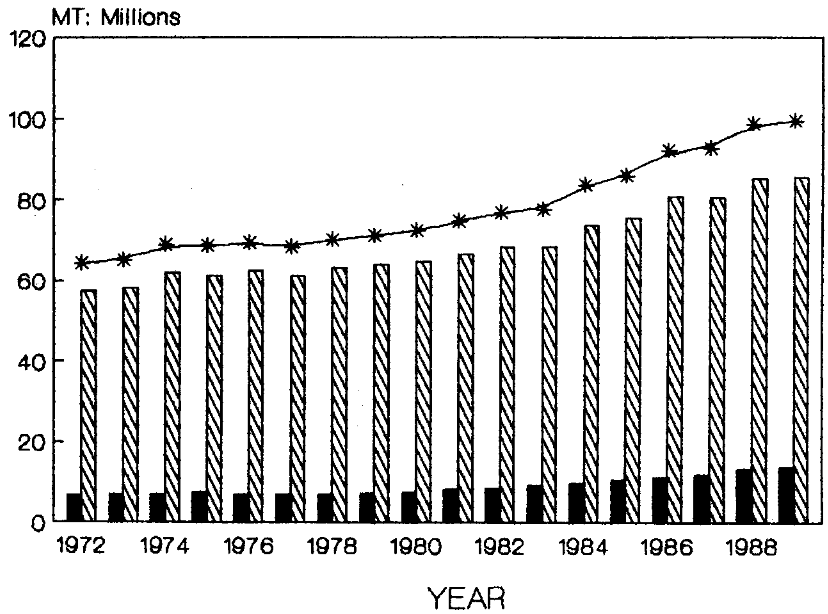


Fig. 3. World total fish production from inland and marine waters: 1972–1989.
Source: FAO Fishery Statistics

Inland Waters Marine Waters Total

Recent Trends in Japanese Fishery Production

Japan is among those former fishing nations that were heavily dependent on access to the North Pacific fishery resources now listed within the U.S.A. EEZ. With the onset of the international 200-mile EEZ era, production dramatically declined among Japan's distant water fisheries (Fig. 6).

Although significant increases have occurred in Japanese offshore landings, the increase is dominantly due to rapid growth in the sardine fishery off northeastern Hokkaido. Japanese pilchard landings in Japan have grown from 17,000 mt to 5.1 million mt from 1970 to 1989. FAO statistics list it as the third dominant species harvested in the world; surpassed only by Alaska pollock and Peruvian anchovy[18]. However, unlike Japan's previous harvests of pollock, the vast majority of sardine landings today are not utilized for human consumption domestically. Rather, they are processed into fishmeal and oil for export.

Japanese pilchard is a cyclical fishery and strong evidence suggests landings have peaked and significant declines have already begun. This marks the beginning for the end of Japan to maintain its position as the world's leading harvesting nation. To underscore this point, FAO fishery statistics indicate that in 1989, for the first time in recent history, Japan had fallen out of first place (behind USSR and China) as the world's top fishing nation in terms of tonnage landed. This is a direct result of the 9% drop between 1988 and 1989 in Japanese pilchard offshore fishery landings (Fig. 6).

Table 4. Percentages of world marine harvests by ocean fishing areas: 1972-1989.

Year	Regions of the Atlantic Ocean					Regions of the Pacific Ocean		
	North (%)	Central A (%)	South B (%)	C & S (A+B) (%)	Indian Ocean (%)	North (%)	Central (%)	South (%)
1972	26	10	7	17	5	32	10	10
1973	27	10	7	17	5	34	11	6
1974	26	10	6	16	5	33	10	9
1975	26	10	6	16	5	34	11	8
1976	26	10	6	16	5	32	11	10
1977	25	10	7	17	6	33	12	7
1978	23	10	8	18	6	32	12	9
1979	23	9	7	16	6	32	12	11
1980	23	11	6	17	6	33	12	11
1981	22	10	6	12	6	33	12	11
1982	20	11	6	17	6	33	11	12
1983	20	11	6	17	7	35	11	10
1984	19	10	5	10	6	36	11	12
1985	19	9	5	14	6	35	12	14
1986	15	9	5	10	6	36	11	16
1987	15	9	7	14	6	36	11	14
1988	16	9	6	12	7	35	10	17
1989	15	8	6	12	7	35	10	19
Average	20	9	6	12	6	32	11	11

Source: FAO Fisheries Catch and Landing Statistics, various years.

Fishery Landings by Major Species: The Role of Alaska Pollock

Given the leading role of North Pacific fisheries in world marine production, it is not surprising to observe that within this region large populations of groundfish and clupeoids reside. These two groups are listed by FAO as the world's leading categories of harvested fish (Fig. 7). Most of the world's leading commercial fish are categorized within these groups. The importance of the top six species in world fishery harvests are listed in Fig. 8. The relative ranking of these top six species among themselves is shown in Fig. 9. In recent decades, in terms of volume landed, Alaska pollock clearly dominates as the world's most important commercial species.

While large catches of Alaska pollock in the past two decades have remained relatively consistent, the ranking of those fishing nations harvesting them has not. Prior to 1977 Japan lead the world in Alaska pollock landings. It now ranks behind the former Soviet Union and America (Fig. 10). Despite this displacement, Japan continues to lead world demand for pollock fishery products, most specifically surimi. This topic is elaborated upon extensively in Chapter IV.

In summary, Japan is the leading industrialized nation of the world in con-

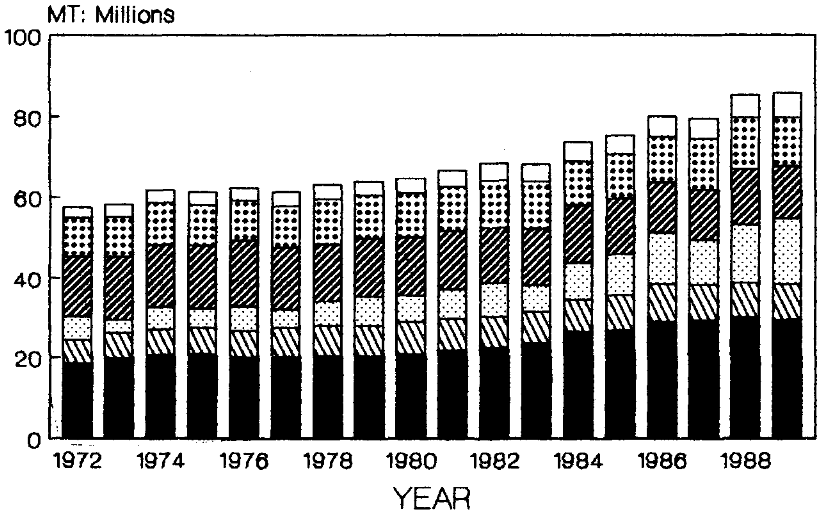


Fig. 4. Total marine fishery production from the world's oceans: 1972-1989.
Source: FAO Fishery Statistics

N.Pacific C.Pacific S.Pacific N.Atlatic C&S.Atlantic Indian

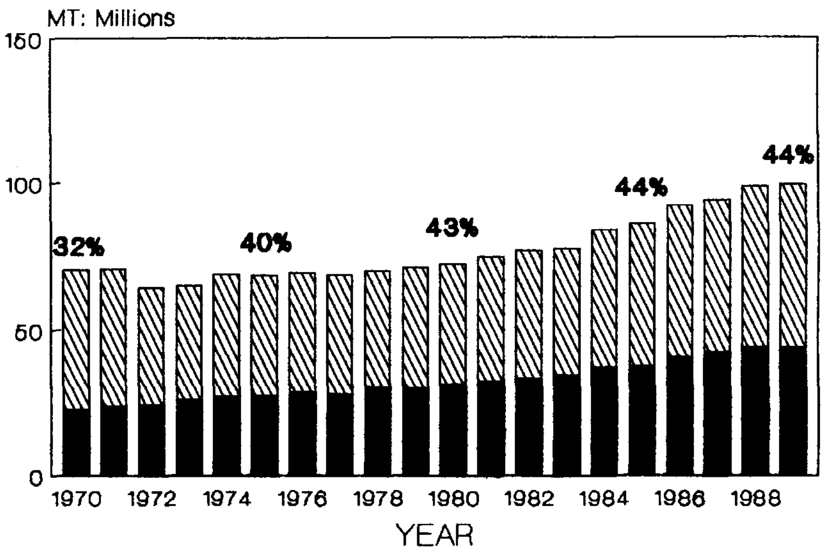


Fig. 5. Landings of six major north pacific fishing nations and percent of world total catch: 1970-1989
Source: FAO Fishery Statistics

Top 6 Countries Other World Catch

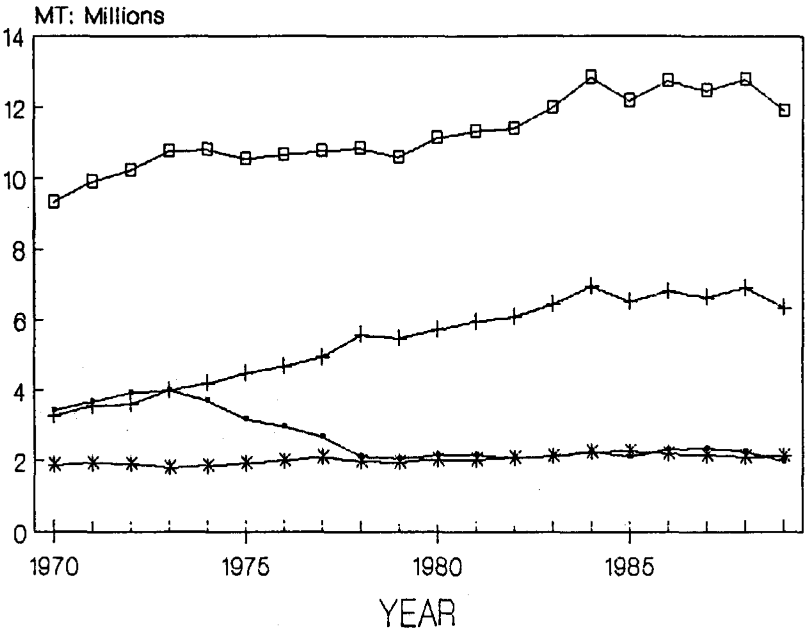


Fig. 6. Japan's total harvests within distant, off-shore & coastal fisheries: 1970-1989.
Source: Japan Ministry of Ag. Forestry & Fisheries: Production Statistics
■: Distant +: Offshore ⋇: Coastal □: Nation Total

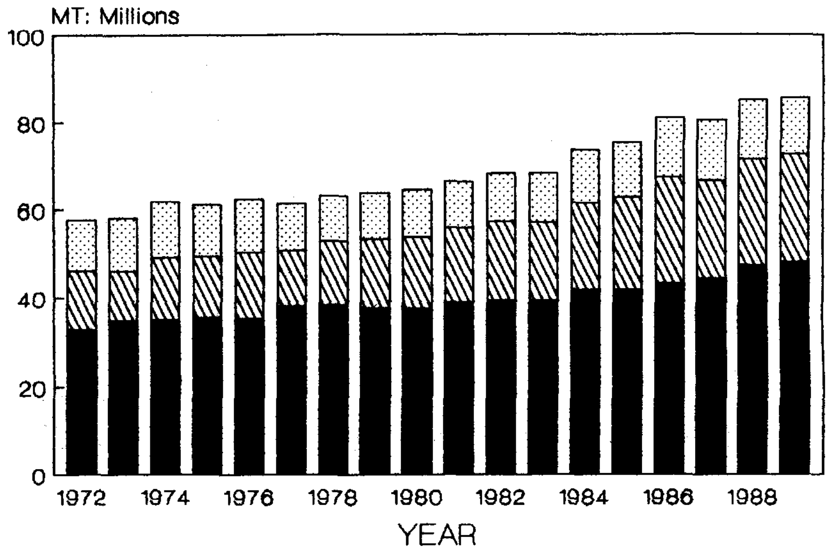


Fig. 7. Two dominant fish groups of global marine catch: 1972-1989.
Source: FAO Fishery Statistics

OTHER MARINE CATCH   CLUPEOIDS   GROUNDFISH

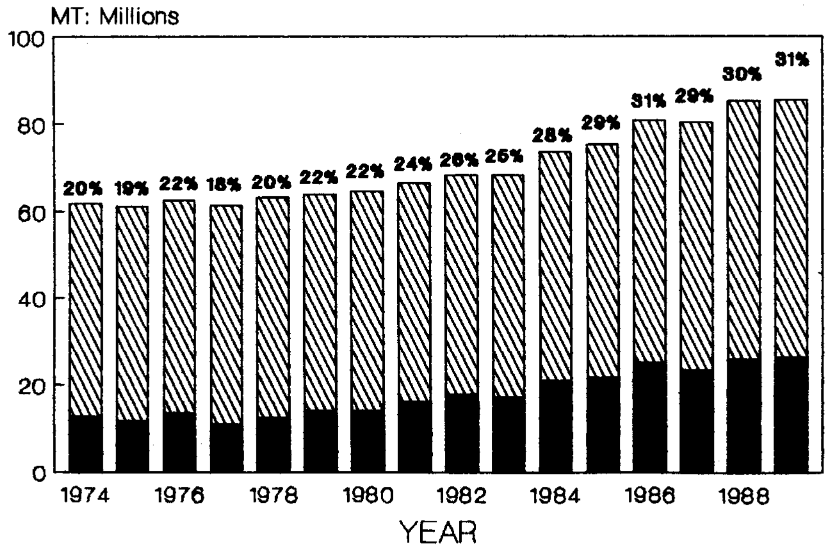


Fig. 8. Percentage of total marine catch composed of six major species: 1974-1989.
Source: FAO Fishery Statistics

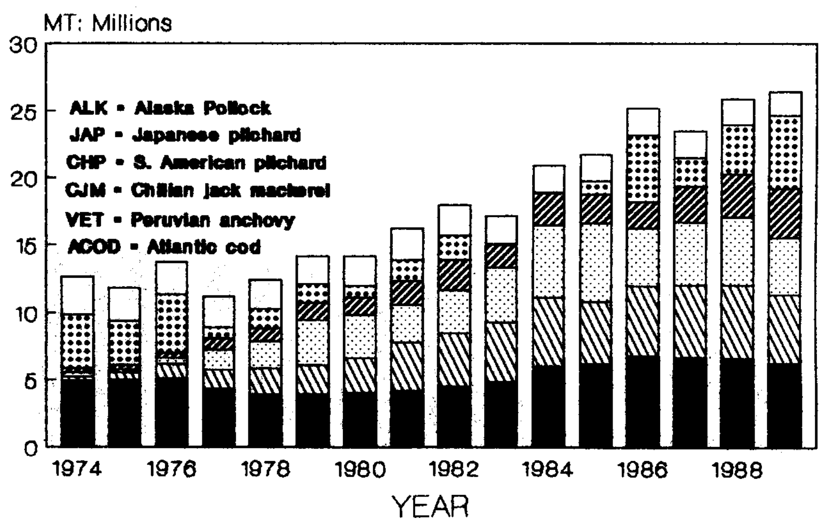


Fig. 9. Breakdown of six major species in world marine catch: 1974-1989.
Source: FAO Fishery Statistics

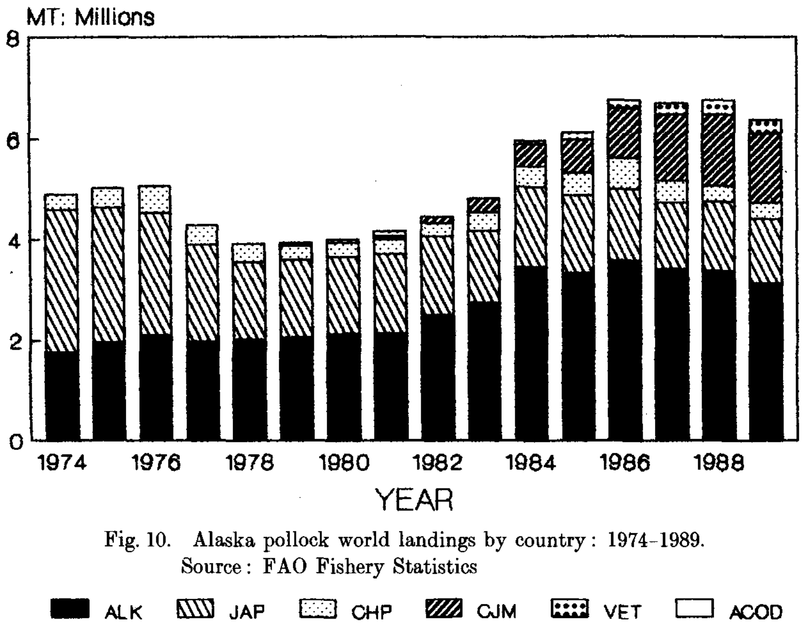


Fig. 10. Alaska pollock world landings by country: 1974-1989.
Source: FAO Fishery Statistics

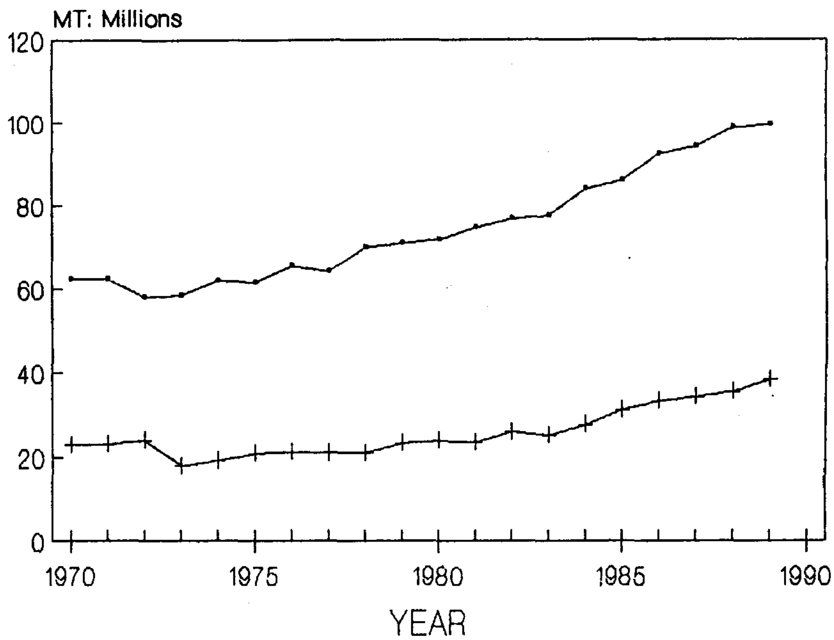


Fig. 11. Total world fishery landings and amount traded on international market: 1970-1989.
Source: FAO Fishery Statistics
■: Total world landings +: World trade quantity

Table 5. Word fishery catch traded on international world market and respective import-export quantities and values : 1970–1989.

Year	Total World Catch (MT)	Quantity Traded (MT)	Percentage Traded (%)	Imports Quantity (MT)	Imports Value (1000US$)	Exports Quantity (MT)	Exports Value (1000 US$)
1970	70352000	22859900	32.5	7461200	3293917	7432800	2944725
1971	70707400	23163700	32.8	7655500	3753731	7618100	3391597
1972	64239800	23984100	37.3	8249300	4556337	8088100	4120570
1973	65095900	17856100	27.4	7097100	6047819	6891800	5539578
1974	68895388	19130900	27.8	7323149	6848020	7086300	6014144
1975	68608203	20846852	30.4	7686853	6940951	7612890	6305413
1976	69353600	21331202	30.8	7935964	8642315	7751851	7836184
1977	68490600	21033123	30.7	7955043	10142451	8079898	9397320
1978	70214700	21019420	29.9	8810231	12514737	8997926	11775996
1979	71237000	23280032	32.7	9924857	15519797	9888713	14775970
1980	72332500	23811219	32.9	9835921	15971080	10216972	15330128
1981	74777500	23442010	31.3	9993034	1669884	10356422	16066566
1982	76862700	26027054	33.9	10708166	16800992	10883212	15555505
1983	77597500	25152241	32.4	10798664	17097430	11206194	15887282
1984	83710500	27565096	32.9	11519898	17171183	12210176	16210104
1985	85988200	31077127	36.1	12937450	18559231	13744794	17327063
1986	92349200	33105580	35.8	13672927	24194586	14923897	23056547
1987	94273500	34192480	36.3	14752750	30509006	15454388	28075674
1988	98762400	35427152	35.9	15826194	35325503	16534311	32370495
1989	99534600	38338032	38.5	16782319	35896003	17048860	32786669

Source : FAO Fishery Statistics, various years.

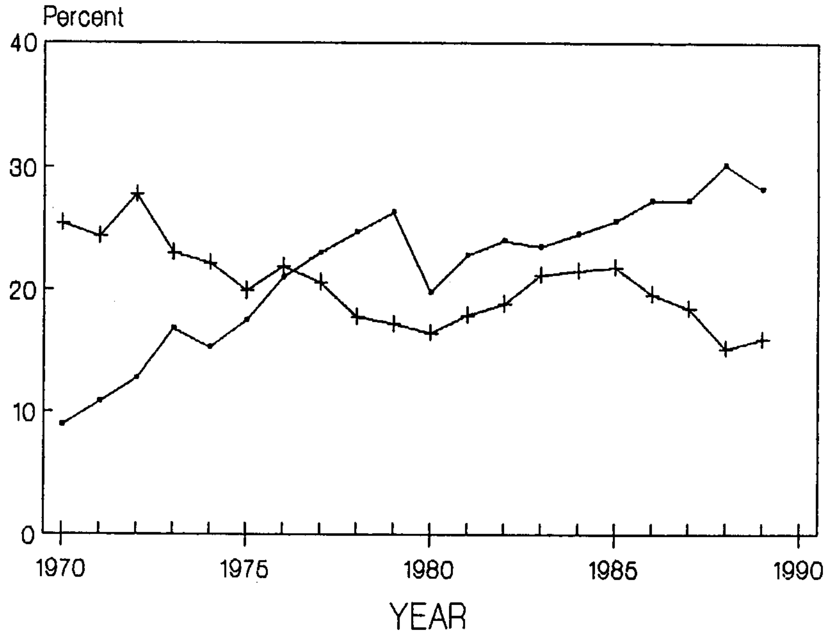


Fig. 12. Japan and U.S.A. percentage of world fishery trade import value: 1970-1989.
Source: Calculated from FAO Fishery Commodity Statistics
■ : Japan + : U.S.A.

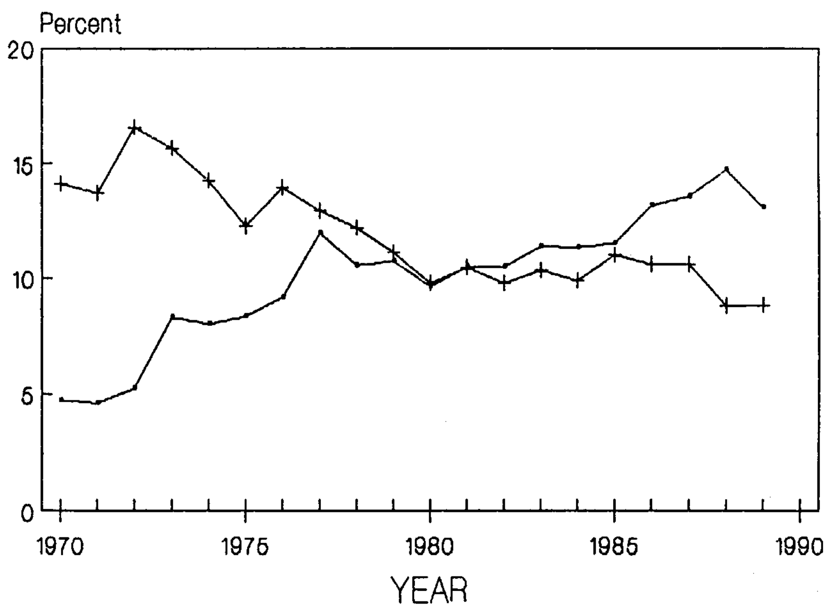


Fig. 13. Japan and U.S.A. percentage of world fishery trade import quantity: 1970-1989.
Source: Calculated from FAO Fishery Commodity Statistics
■ : Japan + : U.S.A.

Table 6. Fishery product import data: 1970-1989.

Year		Import Value (1000 US$)	Import Quantity (MT)	Percent of World Total Import Value (%)	Percent of World Total Import Quantity (%)	Imports Average Price ($/MT)
Japan	1970	291919	352600	8.9	4.7	828
	1971	405007	352700	10.8	4.6	1148
	1972	579634	432800	12.7	5.2	1339
	1973	1019427	592200	16.9	8.3	1721
	1974	1050306	587500	15.3	8.0	1788
	1975	1218062	642800	17.5	8.4	1895
	1976	1811207	730235	21.0	9.2	2480
	1977	2332791	953220	23.0	12.0	2447
	1978	3086923	931740	24.7	10.6	3313
	1979	4077475	1067042	26.3	10.8	3821
	1980	3158660	947162	19.8	9.6	3335
	1981	3793368	1048383	22.8	10.5	3618
	1982	4028404	1121266	24.0	10.5	3593
	1983	4015122	1229936	23.5	11.4	3264
	1984	4207102	1307896	24.5	11.4	3217
	1985	4744277	1490079	25.6	11.5	3184
	1986	6593515	1798384	27.3	13.2	3666
	1987	8308077	2002224	27.2	13.6	4149
	1988	10657771	2330954	30.2	14.7	4572
	1989	10127471	2193751	28.2	13.1	4617
USA	1970	835781	1053100	25.4	14.1	794
	1971	913469	1050900	24.3	13.7	869
	1972	1262990	1364000	27.7	16.5	926
	1973	1392328	1109200	23.0	15.6	1255
	1974	1578599	1042900	22.2	14.2	1456
	1975	1381271	943300	19.9	12.3	1464
	1976	1890912	1106578	21.9	13.9	1709
	1977	2085850	1027857	20.6	12.9	2029
	1978	2228172	1074193	17.8	12.2	2074
	1979	2674168	1104295	17.2	11.1	2422
	1980	2633160	963072	16.5	9.8	2734
	1981	2988195	1043522	17.9	10.4	2864
	1982	3174633	1049103	18.9	9.8	3026
	1983	3621380	1116131	21.2	10.3	3245
	1984	3702490	1140178	21.6	9.9	3247
	1985	4051794	1422878	21.8	11.0	2848
	1986	4748692	1447266	19.6	10.6	3281
	1987	5662329	1560646	18.6	10.6	3628
	1988	5389934	1394034	15.3	8.8	3866
	1989	5756927	1482960	16.0	8.8	3882

Source: FAO. Yearbook of Fishery Commodities Statistics.

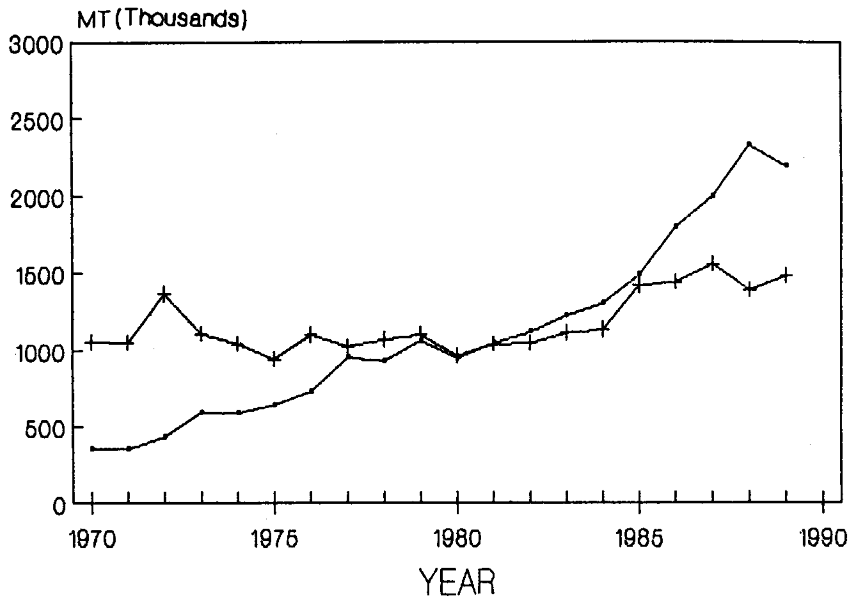


Fig. 14. Total quantity of fishery products imported by Japan and U.S.A.: 1970-1989.
Source: Calculated from FAO Fishery Commodity Statistics
■: Japan +: U.S.A.

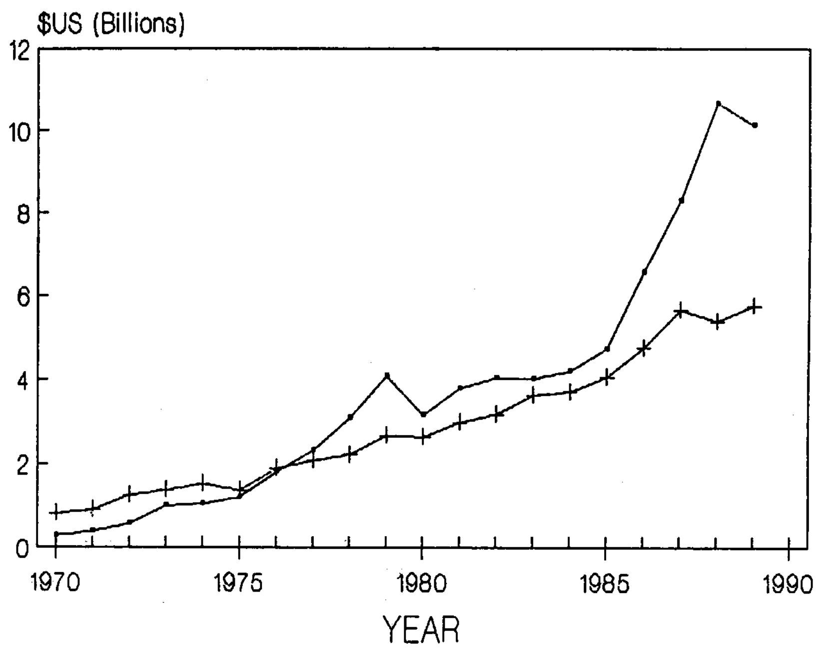


Fig. 15. Total value of fishery products imported by Japan and U.S.A.: 1970-1989.
Source: FAO Fishery Commodity Statistics
■: Japan +: U.S.A.

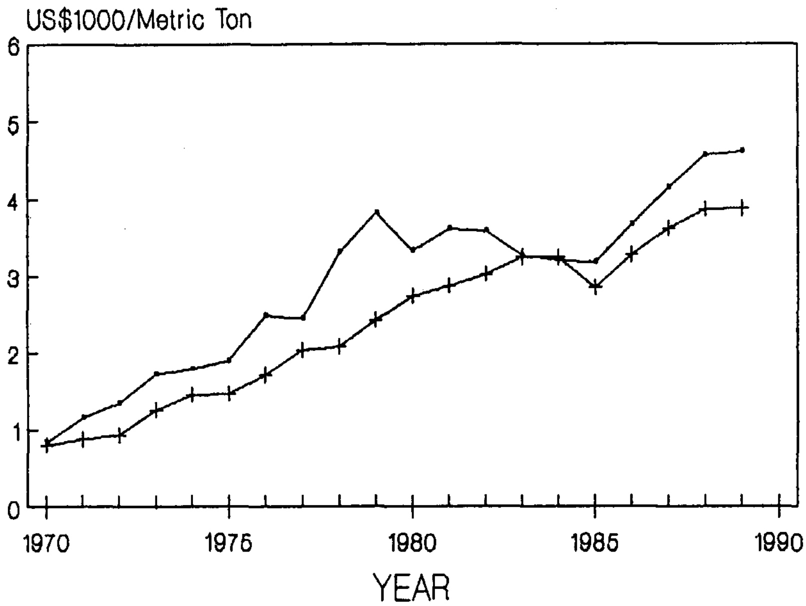


Fig. 16. Average price of fishery products imported by Japan and U.S.A.: 1970-1989.
Source: Calculated from FAO Fishery Commodity Statistics
■: Japan +: U.S.A.

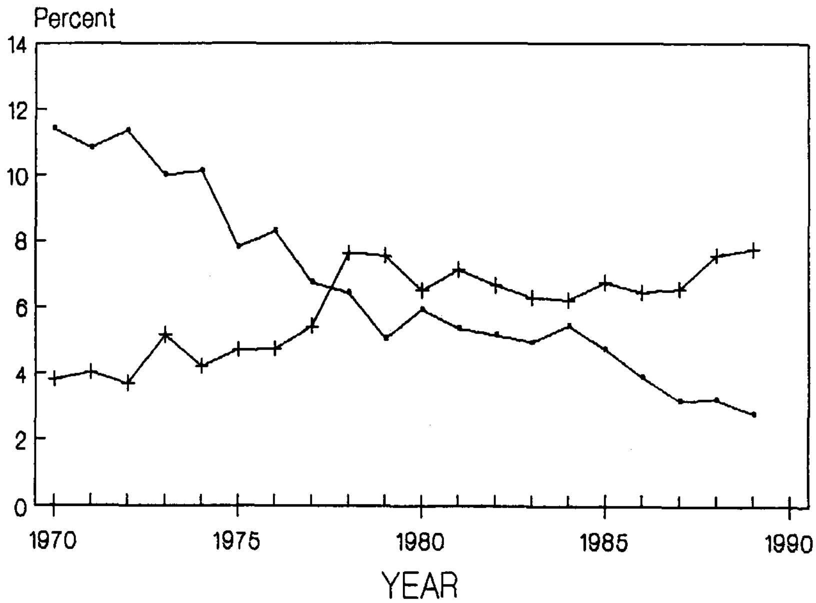


Fig. 17. Japan and U.S.A. percentage of world fishery trade export value: 1970-1989.
Source: Calculated from FAO Fishery Commodity Statistics
■: Japan +: U.S.A.

Table 7. Fishery product export data: 1970-1989.

Year		Export Value (1000 US$)	Export Quantity (MT)	Percent of World Total Export Value (%)	Percent of World Total Export Quantity (%)	Exports Average Price ($/MT)
Japan	1970	335495	534300	11.39	7.19	628
	1971	367364	586200	10.83	7.69	627
	1972	467015	650600	11.33	8.04	718
	1973	553928	674200	10.00	9.78	861
	1974	608114	706200	10.11	9.97	861
	1975	489958	593400	7.77	7.79	826
	1976	642495	642495	8.29	8.29	1011
	1977	631357	582929	6.72	7.21	1083
	1978	754835	745086	6.41	8.28	1013
	1979	719781	714639	5.06	7.23	1007
	1980	905186	716564	5.90	7.01	1263
	1981	863252	683139	5.37	6.60	1264
	1982	800557	702070	5.15	6.45	1140
	1983	787633	667747	4.96	5.96	1179
	1984	881965	887797	5.44	7.27	993
	1985	819840	776750	4.73	5.65	1055
	1986	897851	751281	3.89	5.03	1195
	1987	889828	715726	3.17	4.63	1243
	1988	1037341	971196	3.20	5.87	1068
	1989	919180	812256	2.80	4.76	1132
USA	1970	111879	141600	3.80	1.91	790
	1971	135758	193500	4.00	2.54	702
	1972	151695	174200	3.68	2.15	871
	1973	285192	258200	5.15	3.67	1126
	1974	252641	221800	4.20	3.13	1139
	1975	298034	196300	4.73	2.58	1518
	1976	371899	220080	4.75	2.84	1690
	1977	508064	226034	5.41	2.80	2248
	1977	508064	226034	5.41	2.80	2248
	1978	895709	350348	7.61	3.89	2557
	1978	1070846	355377	7.53	3.59	3013
	1980	993352	966501	6.48	4.57	2129
	1981	1142026	454333	7.11	4.39	2514
	1982	1032248	408807	6.64	3.71	2559
	1983	996651	526541	6.27	4.70	1893
	1984	1002932	1124451	6.19	9.21	892
	1985	1162372	1363610	6.71	9.92	852
	1986	1480990	1765993	6.42	11.83	839
	1988	2441176	2114148	7.54	12.79	1155
	1989	2532444	1548545	7.72	9.08	1635

Source: FAO. Yearbook of Fishery Commodities Statistics.

sumption and production of seafood. In recent decades, Japan has dominated global fisheries. Until recently, this has been true for the Alaska pollock fishery. It is the world's most abundantly harvested fish and resides in the North Pacific Ocean; the world's most productive fishing grounds. Alaska pollock is also the world's primary source-fish for surimi; an increasingly important commodity in international seafood trade. Trends in international fisheries trade are addressed in the next chapter.

III. International Seafood Trade

1. Trends in World Fisheries Trade

Perhaps equally significant as the growth in total world fishery production is the rising quantity and share exchanged on the international market (Fig. 11). For example, in 1989 39% of world landings were traded; the highest percentage in recent history. Economic value of these goods also reached an all time high in 1989 when total world fishery imports valued $35.2 billion[19]. The time series data are presented in Table 5 and Figure 11.

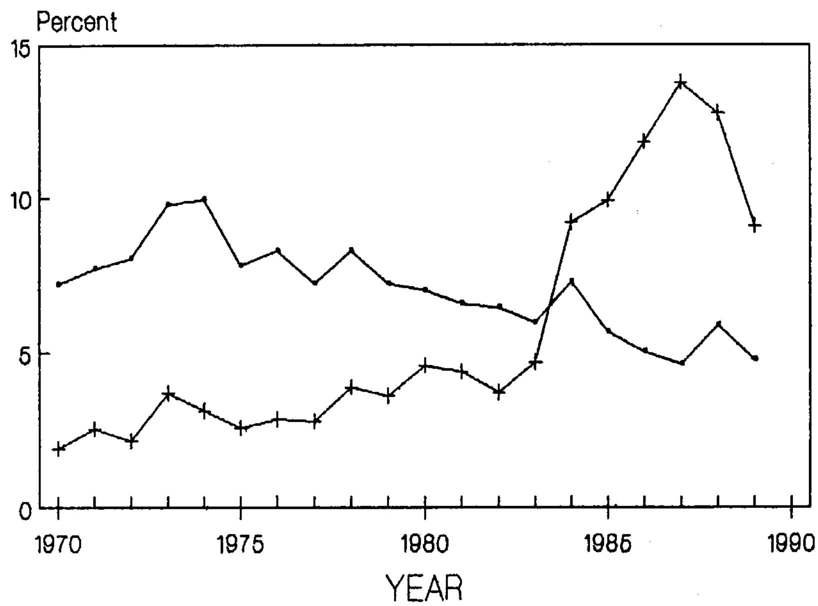


Fig. 18. Japan and U.S.A. percentage of world fishery trade export quantity: 1970-1989.
Source: Calculated from FAO Fishery Commodity Statistics
■: Japan +: U.S.A.

2. Japan and USA International Fisheries Trade in Relation to World Total Imports and Export of Fishery Products

Perspective on Imports

International EEZ marine policy transformed Japan from the world's leading fishery harvesting and exporting nation into a net importer. In contrast, America has reduced its dependence on marine imports. Japan is now the world's leading fishery importing nation in terms of both value and quantity (Fig. 12 & Fig. 13). Statistics for 1989 reveal Japan held 28% of the world's fishery product imported trade volume (2.2 mt valued at $10.1 billion) and is now far and away the number one importing nation of fishery products (Table 6). The United States is a distant second with fishery imports valued at $5.8 billion equaling 16% of world import-traded volume (Table 6).

After 1976, when the U.S.A. initiated its 200-mile policy, the gap rapidly diminished between American and Japanese fishery import quantities (Fig. 14). In terms of total value, Japan fishery imports exceeded those of America in 1977 (Fig. 15). Japan fishery imports have remained highest in the world ever since.

In the past 20 years Japan and the United States have remained the leading markets for imported fishery products. However, they have exchanged relative position as the world's number 1 and 2 importing nation. During this period, the average nominal price of fishery imports to both countries has steadily grown. However, what has not changed is that the Japanese market consistently command-

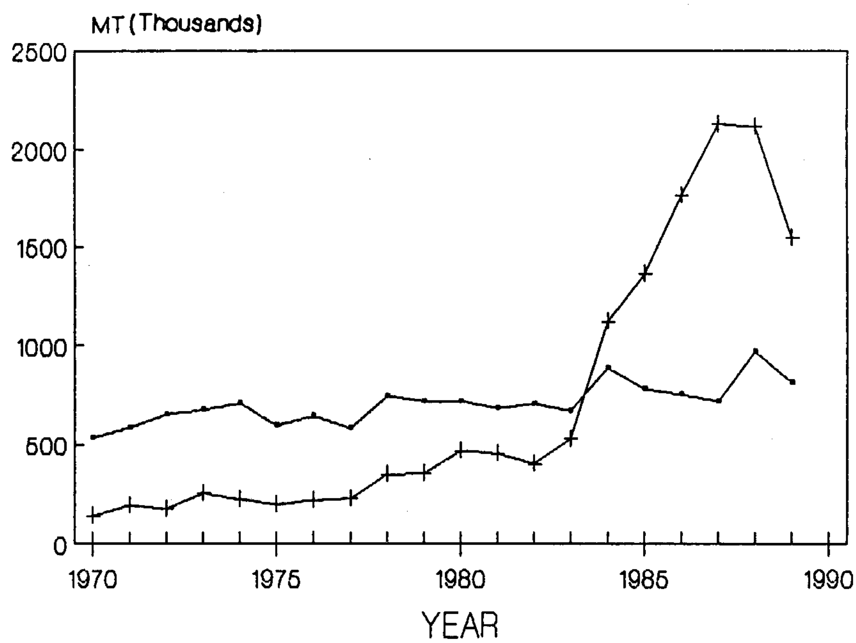


Fig. 19. Total quantity of fishery products exported by Japan and U.S.A.: 1970-1989.
Source: FAO Fishery Commodity Statistics
■: Japan +: U.S.A.

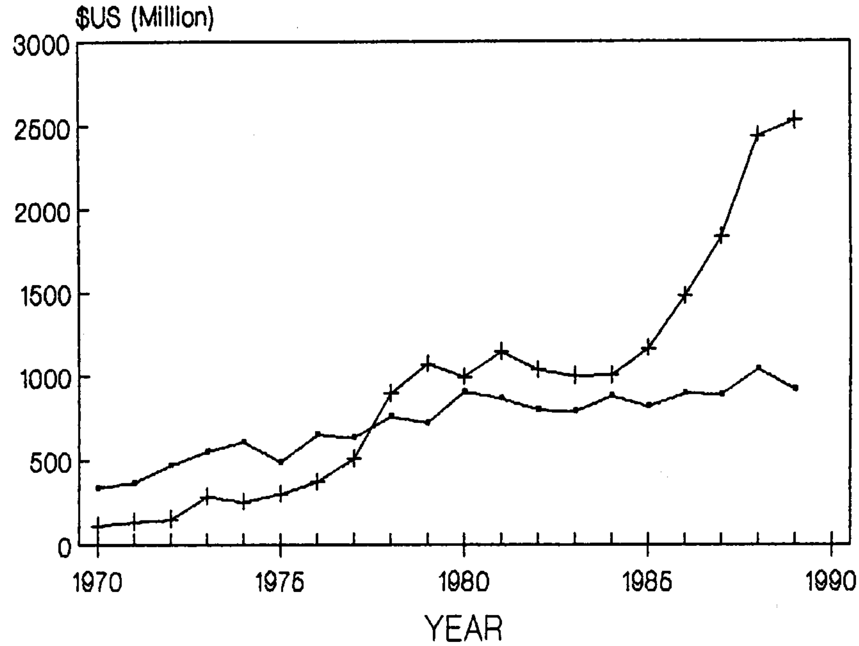


Fig. 20. Total value of fishery products exported from Japan and U.S.A.: 1970-1989.
Source: FAO Fishery Commodity Statistics
■: Japan +: U.S.A.

ed the highest average price for imported fishery goods (Fig. 16). This is a testimony to both strong consumer demand in Japan for high-valued fishery products, and the growing economic strength of the Japanese economy enabling it to successfully bid for quality fishery commodities.

Perspective on Exports

A review of Japan and U.S.A. fishery export trends over the past couple of decades reveals the mirror image of what was observed for imports. In the early 1970's Japan lead world fishery exports, averaging over 10% and 8% of the world share in terms of value and quantity, respectively (Table 7). During the same period the U.S.A. averaged approximately 4% and 3% of world share in terms of traded value and quantitiy, respectively (Table 7).

However, in the late 1980's Japan's share of global fishery exports plummeted to less than 4% and 5% in terms of value and quantity, respectively (Fig. 17 & Fig. 18). In contrast, America's share had grown to average 7% and 11.5% in terms of value and quantity of world fishery exports. As if to typify this dramatic position reversal of America and Japan in the world fishery export market, by 1989 America was the leading world fishery exporting nation in terms of traded value while Japan had dropped to 11th place[20].

The quantity, value, and average price of fishery exports from Japan and the

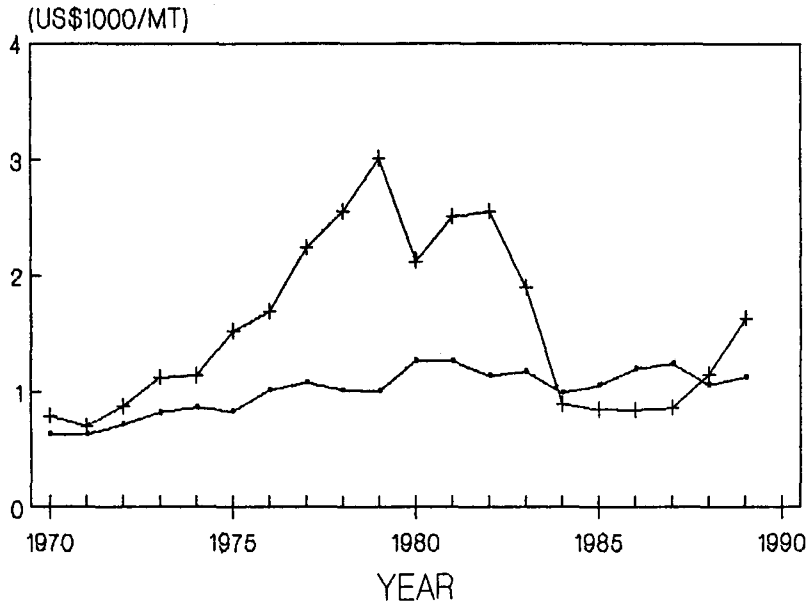


Fig. 21. Average export price of fishery products exported from Japan and U.S.A.: 1970-1989.
Source: Calculated from FAO Fishery Commodity Statistics
■: Japan +: U.S.A.

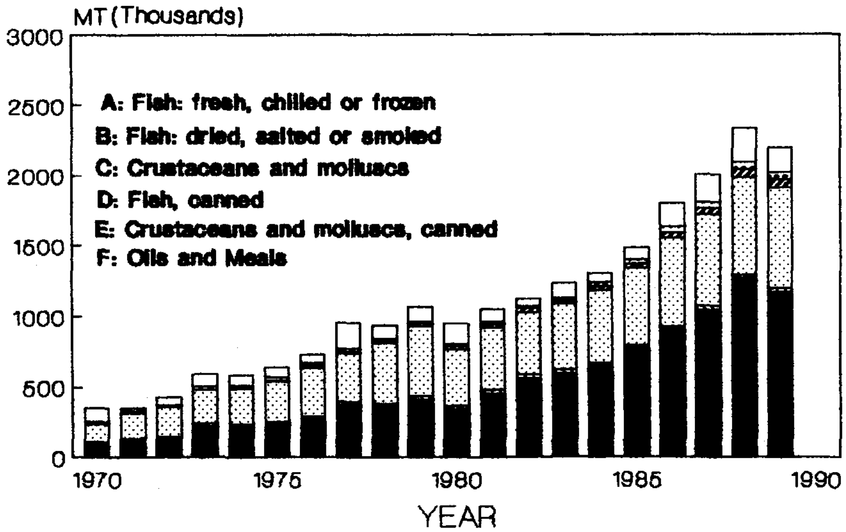


Fig. 22. Japanese import quantities of seven FAO fishery product categories: 1970-1989.
Source: FAO Fishery Commodity Statistics

A B C D E F

Table 8. Japanese imports of seven FAO fishery product categories by quantity and their relative percentages to total national fishery import quantity: 1970–1989.

Year	A	%	B	%	C	%	D	%	E	%	F	%	G	%	F & G	%	Total
1970	103200	29	9300	3	122800	35	9600	3	8100	2	2100	1	97500	28	99600	28	352600
1971	122400	35	7900	2	184700	52	2400	1	11000	3	2600	1	21700	6	24300	7	352700
1972	134200	31	14300	3	209000	48	1900	0	14500	3	2100	0	56800	13	58900	14	432800
1973	222200	38	18100	3	239100	40	2900	0	20300	3	2300	0	87300	15	89600	15	592200
1974	217300	37	18900	3	253700	43	4700	1	17200	3	1200	0	74500	13	75700	13	587500
1975	241200	38	13300	2	287500	45	7000	1	21500	3	1700	0	70600	11	72300	11	642800
1976	271690	37	19309	3	345012	47	10600	1	22556	3	1544	0	59543	8	61087	8	730254
1977	376140	39	19918	2	339581	36	14831	2	19996	2	1611	0	181143	19	182754	19	953220
1978	355966	38	24737	3	427595	46	13534	1	20276	2	4709	1	84923	9	89632	10	931740
1979	411197	39	29047	3	486562	46	18774	2	15033	1	4784	0	101645	10	106429	10	1067042
1980	340772	36	22803	2	399599	42	23432	2	16970	2	2578	0	1410008	15	143586	15	947162
1981	456651	44	25965	2	436552	42	24149	2	18750	2	2248	0	84068	8	86316	8	1048383
1982	562562	50	29272	3	438033	39	24397	2	18887	2	3840	0	44275	4	48115	4	1121266
1983	599749	49	26200	2	458940	37	26010	2	18566	2	5400	0	95071	8	100471	8	122936
1984	648697	50	22582	2	511326	39	28628	2	28017	2	7028	1	61618	5	68646	5	1307896
1985	771485	52	25728	2	541493	36	31372	2	32021	2	7724	1	80256	5	87980	6	1490079
1986	905824	50	22927	1	622261	35	36433	2	41812	2	7629	0	161488	9	169117	9	1798374
1987	1044808	52	25071	1	650967	33	40369	2	46550	2	7161	0	187298	9	194459	10	2002224
1988	1266788	54	44581	1	692348	30	55921	2	54427	2	7383	0	231506	10	238889	10	2880954
1989	1170352	53	24538	1	712826	32	57212	3	53998	2	3383	0	171445	8	174828	8	2193754

Legend : A = Fish : fresh, chilled or frozen ; B = Fish : dried, salted or smoked ; C = Crustaceans and molluscs, fresh, frozen, dried, salted or smoked ; D = Fish, canned ; E = Crustaceans, canned ; F = Oils & Fats ; G = Meals.

Source : FAO Fishery Statistics, various years

Note : percent (%) rounded to nearest whole number.

U.S.A. are listed in Tables 7 and are graphically presented in Fig. 19, 20, and 21, respectively. It is interesting to observe that, from 1970 to 1989, Japan fishery exports actually remained relatively constant between one million and half a million mt (Fig. 19). The nominal value of fishery exports from Japan also grew only marginally (Fig. 20).

Therefore, Japan's decline as a leading fishery exporter did not occur as a result of reduced export volume but rather from its inability to keep pace with growing international fishery product demand in light of existing domestic demand. Contributing to this problem for Japan has been reduced access to foreign waters where it had harvested fishery resources for both domestic consumption and foreign export.

Immediately after America initiated its 200-mile policy in 1977 the value of U.S.A. fishery exports grew more rapidly than export quantity. Obviously, U.S.A. control over productive fishing grounds historically exploited by foreign fishing nations provided it a competitive advantage over those countries. The result initially manifested itself between 1976 and 1983 as a measurable rise in U.S.A. export quantity (Fig. 19) and significantly higher average price for those goods (Fig. 21). The combined effect enabled the total value of U.S.A. fishery exports to exceed that of Japan for the first time in 1978 and continue ahead at an ever increasing degree ever since (Fig. 20).

By the mid-1980's U.S.A.-foreign joint-venture operations significantly increased in high-volume fisheries. The North Pacific groundfish is a prime example (see again Fig. 2). U.S.A.-foreign joint-venture production conducted in U.S.A.

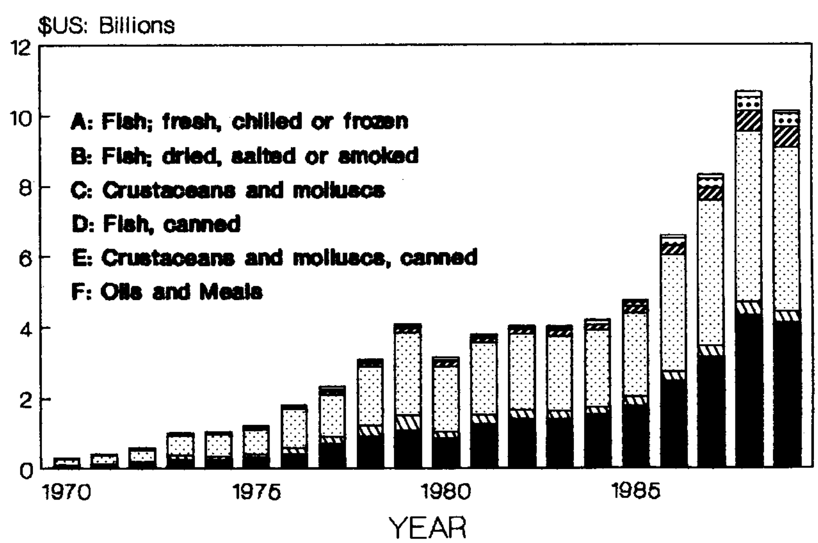


Fig. 23. Japanese import values of seven FAO fishery product categories: 1970–1989.
Source: FAO Fishery Commodity Statistics

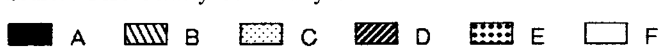


Table 9. Japanese imports of 7 FAO fishery product categories by value and their relative percentages to total national fishery import value: 1970-89. Unit: $US 1000

Year	A	%	B	%	C	%	D	%	E	%	F	%	G	%	F & G	%	Total
1970	62889	22	22492	8	170794	59	7518	3	8449	3	636	0	19141	7	19777	7	291919
1971	82354	20	27996	7	273279	67	3778	1	12538	3	1018	0	4044	1	5062	1	405007
1972	112015	19	61249	11	370672	64	4134	1	19809	4	1141	0	10614	2	11755	2	579634
1973	247501	24	127723	13	556508	55	10118	1	43867	4	1630	0	32069	3	33699	3	1019416
1974	253086	24	113731	11	589459	56	17136	2	47721	5	1952	0	27221	3	29173	3	1050306
1975	328123	27	92763	8	697930	57	26879	2	49586	4	3046	0	19735	2	22781	2	1218062
1976	412487	23	163606	9	1111522	61	45939	3	56090	3	2243	0	19320	1	21563	1	1811207
1977	70519	30	207306	9	1209695	52	65386	3	54345	2	1690	0	93850	4	95540	4	2332791
1978	907237	29	314534	10	1680593	54	78970	3	54218	2	6011	0	45360	1	51371	2	3086923
1979	1085587	27	488104	11	2331995	57	127800	3	47058	1	6278	0	45653	1	51931	1	4077475
1980	854812	27	200367	6	1836316	58	137990	4	45162	1	6744	0	77239	2	83983	3	3158630
1981	1248055	33	283687	7	2022766	53	128714	3	54649	1	6739	0	48758	1	55497	1	3793368
1982	1398158	35	275725	7	2115038	53	155539	4	58639	51	5121	0	20184	1	25305	1	4028404
1983	1397477	35	251496	6	2094224	52	155766	4	60344	2	7543	0	48272	1	55815	1	4015122
1984	1532915	36	214257	5	2159743	51	158173	4	98781	2	9607	0	33626	1	43233	1	4207102
1985	1783988	38	252615	5	2348333	49	196661	4	113341	2	14753	0	34586	1	49339	1	4744277
1986	2497432	38	235733	4	3306727	50	262207	4	188887	3	26928	0	75601	1	102529	2	6593515
1987	3148393	38	329285	4	4110684	49	342895	4	258379	2	12448	0	105993	1	118441	1	8308077
1988	4331365	41	365570	3	4845560	45	580373	5	379381	4	13395	0	142073	1	155468	1	10657717
1989	4108838	41	334692	3	4626961	46	576326	6	370848	4	8578	0	101238	1	109316	1	10127471

Legend: A = Fish: fresh, chilled or frozen; B = Fish: dried, salted or smoked; C = Crustaceans and molluscs, fresh, frozen, dried, salted or smoked; D = Fish, canned; E = Crustaceans, canned; F = Oils & Fats; G = Meals.

Source : FAO Fishery Statistics, various years.

Note : percent (%) rounded to nearest whole number.

Table 10. Japanese import percentage of world total import quantity by 7 FAO fishery product categories: 1970-89.

Year	A (%)	B (%)	C (%)	D (%)	E (%)	F & G (%)
1970	5.1	1.9	24.9	1.6	8.0	2.7
1971	5.8	1.6	32.4	0.4	11.2	0.6
1972	5.6	2.9	30.9	0.3	13.0	1.5
1973	8.1	4.2	34.0	0.4	15.8	3.8
1974	7.8	4.9	33.7	0.6	13.7	3.0
1975	8.9	3.3	35.7	1.0	17.0	2.5
1976	9.5	5.2	37.3	1.2	15.5	2.2
1977	12.3	6.0	38.5	2.0	13.0	6.6
1978	9.6	6.8	41.3	1.6	12.7	3.3
1979	10.1	7.3	39.7	2.2	9.4	3.3
1980	8.2	5.4	35.7	2.4	9.9	4.8
1981	10.4	5.7	38.3	2.3	10.3	3.1
1982	12.3	7.3	35.4	2.7	9.5	1.4
1983	12.4	5.6	34.1	3.0	8.4	3.3
1984	13.0	5.0	34.4	3.2	11.9	2.0
1985	14.3	5.2	33.9	3.2	12.6	2.1
1986	14.9	4.8	35.5	3.5	15.4	4.2
1987	15.1	5.0	33.8	3.8	15.2	4.9
1988	16.6	4.5	32.9	5.1	16.6	5.7
1989	14.8	4.9	31.3	,4.8	17.5	3.8

Legend: A=Fish: fresh, chilled or frozen; B=Fish: dried, salted or smoked; C=Crustaceans & moluscs; D=Fish, canned; E=Crustaceans, canned; F=Oils & Fats; G=Meals

Source: Derived from FAO Fishery Statistics, various years.

waters is listed as an American export by FAO statistics and therefore helps account for the dramatic increase in the U.S.A. export quantity observed in Fig. 19. The majority of these exports were in low value form and resulted in a dramatic drop in the average price of U.S.A. fishery exports. As a result, the period between 1984 to 1987 was the only time in the past 20 years that American fishery exports were lower in average value than those of Japan (Fig. 21). However, given the tremendous volume involved, the overall result was to dramatically increase total export value (Fig. 20).

A discussion on the composition of fishery imports and exports by Japan and America from 1970 through 1989 is presented in Section 3.

Table 11. Japanese import percentage of world total import value by 7 FAO fishery product categories: 1970–89.

Year	A (%)	B (%)	C (%)	D (%)	E (%)	F & G (%)
1970	6.3	7.8	25.6	1.6	5.2	0.5
1971	7.2	8.3	32.7	0.7	0.7	0.1
1972	7.5	14.7	33.3	0.7	9.6	0.3
1973	11.9	23.6	39.6	1.2	14.6	1.4
1974	11.4	19.0	36.5	1.8	13.3	1.2
1975	14.3	15.5	38.8	2.7	13.5	0.8
1976	14.4	23.2	44.2	4.0	12.8	0.8
1977	19.3	27.8	44.9	5.2	10.0	3.5
1978	19.4	31.2	49.5	5.1	8.8	1.9
1979	19.2	34.5	49.3	7.3	6.5	1.6
1980	14.7	16.3	41.3	6.4	5.6	2.8
1981	20.0	21.2	44.1	5.7	6.7	2.0
1982	22.0	23.3	41.9	8.0	6.8	0.7
1983	22.6	21.6	37.8	8.1	6.4	1.8
1984	24.5	20.7	38.5	8.4	10.6	1.2
1985	25.3	21.5	39.8	9.7	11.4	1.2
1986	26.5	16.6	41.2	10.4	13.7	2.5
1987	25.6	17.2	40.9	11.7	14.8	3.0
1988	30.2	18.2	42.8	16.8	19.1	3.7
1989	27.9	17.1	40.2	15.7	20.2	2.4

Legend: A = Fish: fresh, chilled or frozen; B = Fish: dried, salted or smoked; C = Crustaceans & moluscs; D = Fish, canned; E = Crustaceans, canned; F = Oils & Fats; G = Meals

Source: Derived from FAO Fishery Statistics, various years

3. Composition of Japanese and American International Fisheries Trade by FAO Categories

Japan's Fishery Import Composition

The composition of Japanese fishery imports reveals increased demand is focused around fresh/frozen fish, crustaceans and shellfish (Fig. 22). Generally, products in these groups are high quality luxury seafood items such as fish fillets, caviar, shrimp and lobster. The strengthening Japanese economy has resulted in increased consumption of these higher-quality fresh/frozen seafood and is apparent by their rising percentage of total national fishery imports. From 1970 to 1989 fresh/frozen fish increased steadily from 29% to 42% of total seafood imports to Japan (Table 8).

Because of its relatively low price, frozen surimi is an exception within the fresh/frozen fish category. However, its import volume grew significantly in the

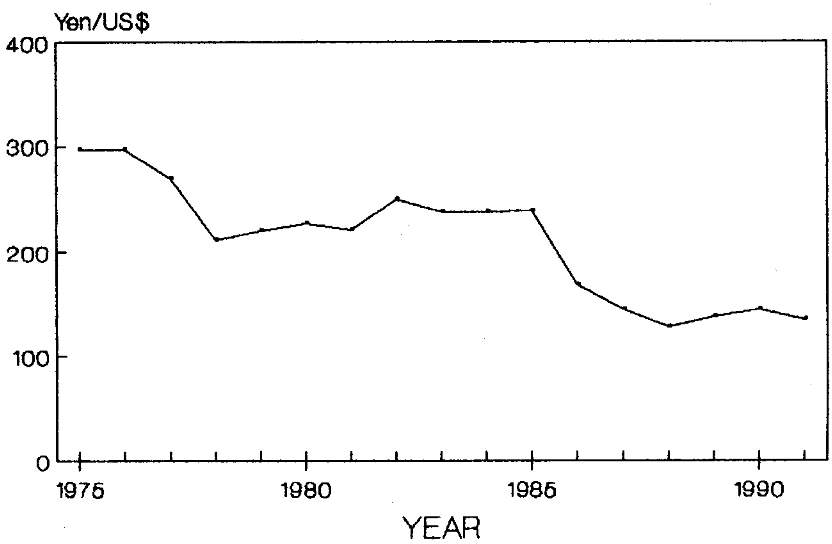


Fig. 24. Appreciation of Japanese yen on international stock market: 1975-1991.
Source: Japan's Weekly Economist Magazine

Table 12. Historical appreciation of official value of Japanese yen on international stock market.

Year	Japanese Yen Value (Yen/US$)
1975	296.8
1976	296.6
1977	268.5
1978	210.4
1979	219.1
1980	226.8
1981	220.5
1982	249.1
1983	237.5
1984	237.5
1985	238.5
1986	168.5
1987	144.6
1988	128.2
1989	138.0
1990	144.8
1991	134.5

Source: The Japanese Mainichi Shimbun's Weekly "Economist" Magazine; Various Issues.

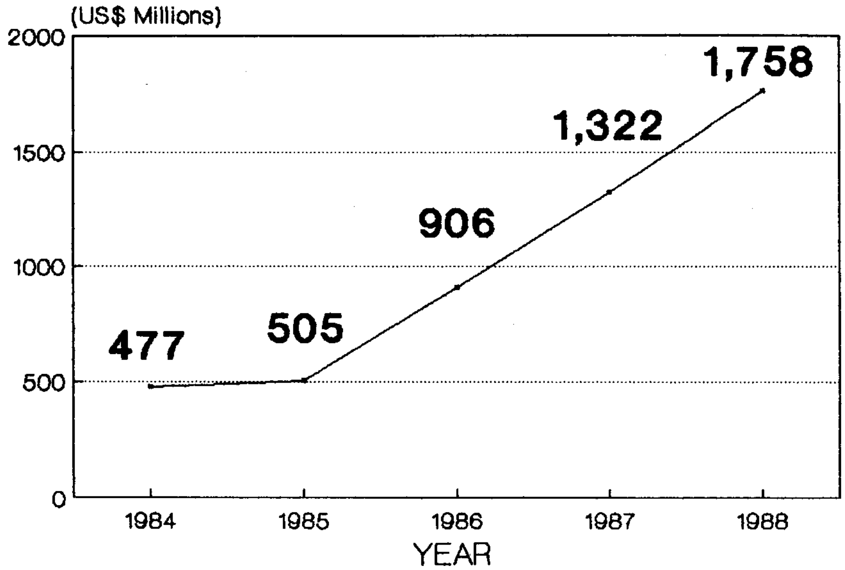


Fig. 25. Value of air freighted food imports into Japan.
Source: "Outline of External Trade" of Japan Tariff Association and JETRO.

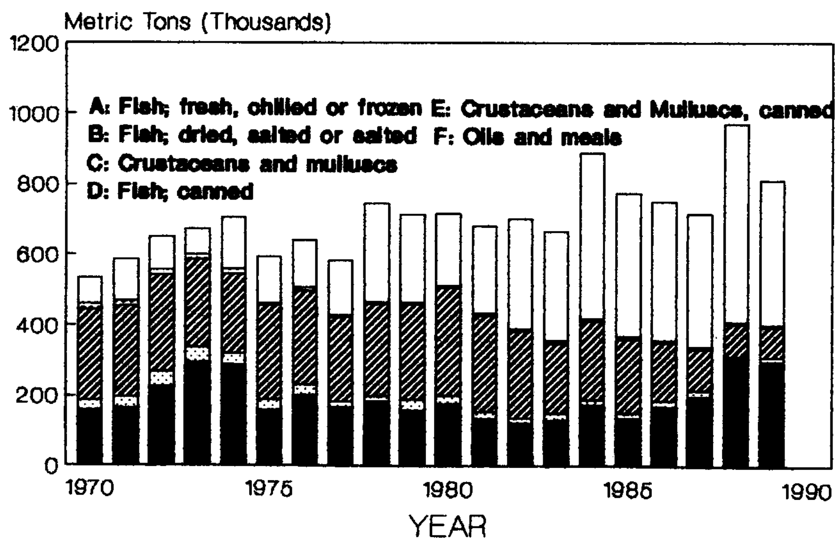


Fig. 26. Japanese export quantities of seven FAO fishery product categories: 1970-1989.
Source: FAO Fishery Commodity Statistics

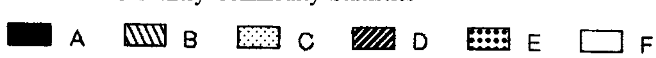


Table 13. Japanese exports of 7 FAO fishery product categories by quantity and their relative percentages of total national fishery export quantity : 1970-89. Unit : M.T.

Year	A	%	B	%	C	%	D	%	E	%	F	%	G	%	F & G	%	Total
1970	154200	29	2500	0	29700	6	256100	48	18100	3	49200	9	24500	5	73700	14	534300
1971	162500	28	2300	0	31400	5	258900	44	14000	2	79400	14	37700	6	117100	20	586200
1972	223300	34	2000	0	41900	6	274200	42	15200	2	65400	10	28600	4	94000	14	650600
1973	293500	44	2500	0	43700	6	245000	36	14500	2	57200	8	17800	3	75000	11	674200
1974	283700	40	4500	1	32600	5	225700	32	12700	2	115700	16	31300	4	147000	21	706200
1975	155000	26	2900	0	32800	6	266900	45	7600	1	78900	13	49300	8	128200	22	593400
1976	200319	31	1848	0	29942	5	267192	42	9141	1	85078	13	48975	8	134053	21	642495
1977	164592	28	1953	0	17625	3	238566	41	6774	1	115953	20	37466	6	153419	26	582929
1978	183914	25	1722	0	13745	2	261429	35	6507	1	213500	29	64269	9	277769	37	745086
1979	155670	22	2017	0	32243	5	270565	38	5616	1	190833	27	57695	8	248528	35	714639
1980	175270	24	2043	0	22987	3	306237	43	6274	1	160499	22	43254	6	203753	28	716564
1981	132750	19	2075	0	21207	3	272436	40	4871	1	176147	26	73653	11	249800	37	683139
1982	121451	17	1937	0	15261	2	246421	35	6016	1	175326	25	135658	19	310984	44	702070
1983	130396	20	1650	0	21099	3	198233	30	6971	1	229799	34	79649	12	309448	46	667797
1984	172929	19	1632	0	16172	2	223434	25	6304	1	331993	37	135333	15	467326	53	887797
1985	135230	17	2001	0	15482	2	209786	27	6844	1	249969	32	157438	20	407407	52	776750
1986	168686	22	1580	0	16370	2	167104	22	5148	1	225201	30	167192	22	392393	52	751281
1987	195962	27	1826	0	17143	2	121677	17	5065	1	157453	22	216593	30	374046	52	715726
1988	305239	31	1588	0	9854	1	88366	9	6051	1	347453	36	212645	22	560098	58	971196
1989	295955	36	1738	0	14157	2	83732	10	6300	1	186515	23	223859	28	410374	51	812256

Legend : A = Fish : fresh, chilled or frozen ; B = Fish : dried, salted or smoked ; C = Crustaceans and molluscs, fresh, frozen, dried, salted or smoked ; D = Fish, canned ; E = Crustaceans, canned ; F = Oils & Fats ; G = Meals.

Source : FAO Fishery Statistics, various years

1980's and contributed to the 10-fold increases in frozen-fish imports from 100,000 mt to over 1 million mt between 1970 and 1989 (Table 8). (Surimi imports to Japan are described in detail in Chapter IV)

Crustaceans and mollusks were the second most abundant seafood category imported by Japan in terms of quantity; increasing from just over 100,000 mt in 1970 to 700,000 mt in 1989 (Table 8). However, during the same two decades this category ranked number one in terms of import value (Fig. 23). Although its percentage of total Japanese seafood import value has lost ground to fresh/frozen fish, in 1989 crustaceans and mollusks equaled U.S.A. billion and commanded 46% of Japanese seafood import value (Table 9). Frozen-fish imports to Japan were valued at just over U.S.A. billion in 1989 composing 41% of the national total. This is up significantly from its 22% in 1970.

Table 10 and Table 11 list Japanese fishery import percentages of world total import quantities and values, respectively. Clearly, in each of the seven FAO human-food fishery product categories, Japan has increased its consumptionary role in the world market. Most notable increases in Japanese dominance are again in fresh/frozen fish, crustaceans and mollusks. Between 1970 and 1989, Japanese fresh/frozen fish import quantity rose from 5% of the world market to 15%. In terms of value, it rose from 6% to 28% during the same period. Over these past 20 years, the Japanese percentage of world crustacean and mollusc import quantities also increased (Table 8). Even more dramatic is the percentage of economic import value of these categories controlled by Japan. In 1989, Japan consumed over 40% of the world's imported fresh/frozen crustaceans and shellfish, 15% of its canned fish,

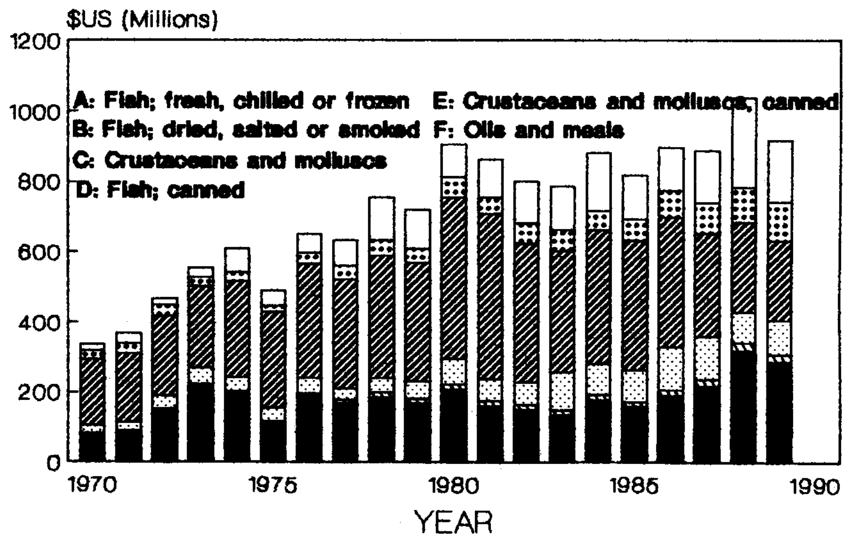


Fig. 27. Japanese export values of seven FAO fishery product categories: 1970–1989.
Source: FAO Fishery Commodity Statistics

Table 14. Japanese exports of 7 FAO fishery product categories by value and their relative percentages of total national fishery export value: 1970-89. Unit: $US 1000

Year	A	%	B	%	C	%	D	%	E	%	F	%	G	%	F & G	%	Total
1970	78169	23	4883	1	22220	7	185424	55	28849	9	108047	3	5103	2	159 0	5	335495
1971	84050	23	4210	1	27164	7	194389	53	29681	8	20340	6	7630	2	27870	8	367364
1972	146624	31	5340	1	37242	8	228751	49	31483	7	11118	2	6457	1	17575	4	467015
1973	215833	39	7171	1	45020	8	233592	42	226420	5	17403	3	8489	2	25892	5	553928
1974	193212	32	7618	1	40800	7	274838	45	26920	4	52130	9	13594	2	65724	11	609112
1975	113074	23	5301	1	36905	8	273263	56	17581	4	25073	5	18761	4	43834	9	489958
1976	189153	29	8121	1	42043	6	327095	50	31753	5	30838	5	20374	3	5 1212	8	649377
1977	165783	26	12123	2	31776	5	313353	50	35850	6	50382	8	22090	3	72472	11	631357
1978	184311	24	13439	2	41640	6	349758	46	43079	6	87298	12	35310	5	122608	16	754835
1979	167068	23	14058	2	50442	7	338198	47	40289	6	72885	10	35841	5	108726	15	718781
1980	208200	23	14967	2	70471	8	460865	51	58153	6	61145	7	31385	8	92530	10	905186
1981	157982	18	19234	2	61727	7	471179	55	46171	5	63053	7	44306	5	107359	12	862652
1982	148075	18	16627	2	61848	8	398812	50	57342	7	52479	27	65374	8	117853	15	800557
1983	134471	17	14345	2	108656	14	346698	44	60022	8	75541	10	47900	6	123441	16	787633
1984	177404	20	15132	2	87248	10	385069	44	53040	6	97583	11	66489	8	164072	19	881965
1985	157169	19	14969	2	90463	11	371487	45	60946	7	61527	8	63279	8	124806	15	819840
1986	190787	21	15581	2	123242	14	370438	41	74480	8	41776	5	81547	9	123323	14	2897851
1987	216808	24	20526	2	121364	14	295247	33	85679	10	34928	4	115276	13	150204	17	889828
1988	317713	31	23820	2	86851	8	255382	25	99123	10	100358	15	154094	10	254452	25	1037341
1989	284811	31	22662	2	97566	11	226774	25	112454	12	32825	4	142088	15	174913	19	919180

Legend: A = Fish: fresh, chilled or frozen; B = Fish: dried, salted or smoked; C = Crustaceans and molluscs, fresh, frozen, dried, salted, or smoked; D = Fish, canned; E = Crustaceans, canned; F = Oils & Fats; G = Meals.

Source: FAO Fishery Statistics, various years

Note: Percent (%) rounded to nearest whole number.

and 20% of globally imported canned crustaceans and mollusks (Table 9).

The strengthening yen in recent years has promoted the buying power of the Japanese on the international seafood market with specific emphasis on fresh-chilled and frozen high-grade products. Yen appreciation contributed to the rising value of Japanese imports when calculated is U.S.A. currency (a conventional FAO practice). (Fig. 24 and Table 12). Private studies have shown a direct relationship between rising seafood imports, shrimp for example, and the strengthening value of the Japanese yen[21]. Similarly, a government publication from the JETRO Agricultural Department indicated the value of air freighted food imports grew 350% from $500 million to $1.8 billion between 1985 and 1988 when the yen appreciated most significantly (Fig. 25). The document indicated that... "High grade-fish/shellfish such as shrimp, tunas and hard roes of fish and fruit/vegetables including asparagus and cherries account for most of the air freighted imports. These foods are imported

Table 15. Japanese export percentage of world total export quantity by 7 FAO fishery product categories: 1970-89.

Year	A (%)	B (%)	C (%)	D (%)	E (%)	F & G (%)
1970	7.2	0.5	6.7	42.2	24.2	2.0
1971	7.5	0.5	6.0	41.3	19.8	3.1
1972	9.4	0.4	6.4	39.2	17.3	2.5
1973	10.9	0.5	6.6	32.3	16.1	3.4
1974	10.8	1.0	4.8	29.5	15.6	5.9
1975	5.5	0.7	4.5	35.9	9.5	4.0
1976	6.9	0.4	3.4	33.3	8.7	5.0
1977	4.9	0.5	2.1	30.8	6.2	5.9
1978	4.8	0.4	1.3	31.9	5.8	10.0
1979	3.7	0.4	2.8	31.9	5.0	8.1
1980	3.9	0.4	2.1	31.1	4.5	6.6
1981	2.9	0.4	1.9	26.5	3.0	8.7
1982	2.5	0.4	1.2	27.6	3.7	9.3
1983	2.5	0.4	1.5	23.0	3.8	10.1
1984	3.2	0.4	1.0	23.7	3.2	13.0
1985	2.2	0.4	0.9	21.3	3.3	9.6
1986	2.3	0.3	0.9	15.7	2.3	9.6
1987	2.6	0.4	0.9	11.3	2.1	9.4
1988	3.6	0.3	0.5	7.7	2.3	13.8
1989	3.7	0.3	0.6	6.7	2.2	8.8

Legend : A=Fish : fresh, chilled or frozen ; B=Fish : dried, salted or smoked ; C=Crustaceans & moluscs ; D=Fish, canned ; E=Crustaceans, canned ; F=Oils & Fats ; G=Meals

Source : Derived from FAO Fishery Statistics, various years

Table 16. Japanese export percentage of world total export value by 7 FAO fishery product categories : 1970-89.

Year	A (%)	B (%)	C (%)	D (%)	E (%)	F & G (%)
1970	8.5	1.8	4.1	39.1	23.3	2.6
1971	7.9	1.4	3.9	35.5	22.2	4.3
1972	10.9	1.4	4.0	33.8	18.8	2.8
1973	11.4	1.4	3.7	26.5	11.5	3.2
1974	10.4	1.3	3.1	27.4	10.8	6.6
1975	5.2	0.9	2.3	28.2	6.8	6.0
1976	7.4	1.2	1.9	27.6	10.2	5.8
1977	4.8	1.7	1.3	23.8	9.6	6.5
1978	4.2	1.5	1.3	22.6	10.1	10.4
1979	3.1	1.3	1.2	19.0	7.8	8.7
1980	3.7	1.2	1.7	21.1	9.0	6.5
1981	2.6	1.3	1.4	20.7	7.1	8.2
1982	2.5	1.4	1.3	20.8	8.4	9.7
1983	2.3	1.4	2.1	17.8	7.5	9.9
1984	3.1	1.7	1.6	19.0	6.7	12.0
1985	2.4	1.5	1.6	17.4	7.4	10.0
1986	2.2	1.2	1.6	13.5	6.4	9.4
1987	2.0	1.2	1.3	9.5	6.0	10.5
1988	2.5	1.2	0.8	7.2	5.8	13.4
1989	2.2	1.3	0.9	6.4	6.3	9.5

Legend : A=Fish : fresh, chilled or frozen ; B=Fish : dried, salted or smoked ; C=Crustaceans & moluscs ; D=Fish, canned ; E=Crustaceans, canned ; F=Oils & Fats ; G=Meals
Source : Derived from FAO Fishery Soatistics, various years

fresh, refrigerated or in low temperature rather than frozen, using transportation devices designed to prevent deterioration."[22]

Japanese Fishery Export Composition

Recent decades have seen Japanese exports remain relatively stable in terms of both quantity and value. However, upon closer investigation it becomes obvious that Japan maintained positive growth in fishery exports only by shifting exports from high-valued goods to low-valued fishery products (Fig. 26). Canned fish dominated export tonnage from Japan in 1970 to 1985 (48%-27% of annual seafood exports, respectively). However, its importance dropped dramatically in the late 1980's to equal only 10% of Japanese seafood exports by 1989 (Table 13). In contrast, fish oils and meals exports rapidly expanded over the same period ; growing from just 14% of Japanese total export quantity in 1970 to 58% in 1988

Table 17. American imports of 7 FAO fishery product categories by quantity and their respective percentages of total national fishery import quantity: 1970-89. Unit: M.T.

Year	A	%	B	%	C	%	D	%	E	%	F	%	G	%	F & G	%	Total
1970	516100	49	35700	3	129500	12	94800	9	23000	2	29300	3	227700	22	257000	24	1056100
1971	518900	49	32500	3	120800	11	76000	7	18900	2	26800	3	257000	24	283800	27	1050900
1972	710600	52	30500	2	137400	10	96300	7	25300	2	8300	1	355600	26	363900	27	1364000
1973	772700	70	30500	3	125000	11	89700	8	24700	2	4500	0	62100	6	66600	6	1109200
1974	668000	68	28500	3	133700	14	116500	12	26900	3	7300	1	6200	1	13500	1	987100
1975	588100	64	27400	3	126700	14	66300	7	2100	0	6400	1	107400	12	113800	12	924400
1976	676318	61	34418	3	142524	13	87312	8	28084	3	10577	1	127347	12	137924	12	1106580
1977	677450	66	28154	3	141824	14	64508	6	34127	3	7867	1	73927	7	81794	8	1027857
1978	759785	71	31499	3	126767	12	73686	7	33895	3	8735	1	39826	4	48561	5	1074193
1979	733812	66	29396	3	137874	12	77437	7	35994	3	8487	1	81295	7	89782	8	1104295
1980	639752	66	24276	3	128362	13	80884	8	33387	3	11472	1	44939	5	56411	6	963072
1982	632535	60	31925	3	156141	15	97372	9	47251	5	7375	1	76504	7	83879	8	1049103
1983	655959	59	30159	3	191265	17	106900	10	61665	6	8549	1	61634	6	70183	6	1116131
1984	637284	56	30760	3	194155	17	131701	12	63044	6	7535	1	75699	7	83234	7	1140178
1985	700805	49	29668	2	207703	14	180945	13	75032	5	9330	1	233003	16	242333	17	1436486
1986	744886	51	30880	2	231578	16	194490	13	66882	5	10473	1	168077	12	178550	12	1447266
1987	816222	52	29073	2	257828	17	183163	12	79554	5	13721	1	181085	12	194806	12	1560646
1988	692713	50	28793	2	266845	19	194515	14	71770	5	12472	1	126926	9	139398	10	1394034
1989	781654	53	31496	2	315813	21	214296	14	36492	2	18737	1	84472	6	103209	7	1482960

Legend : A=Fish: fresh, chilled or frozen; B=Fish: dried, salted or smoked; C=Crustaceans and molluscs, fresh, frozen, dried, salted or smoked; D=Fish, canned; E=Crustaceans, canned; F=Oils & Fats; G=Meals.

Source : FAO Fishery Statistics, various years

Note : Percent (%) rounded to nearest whole number.

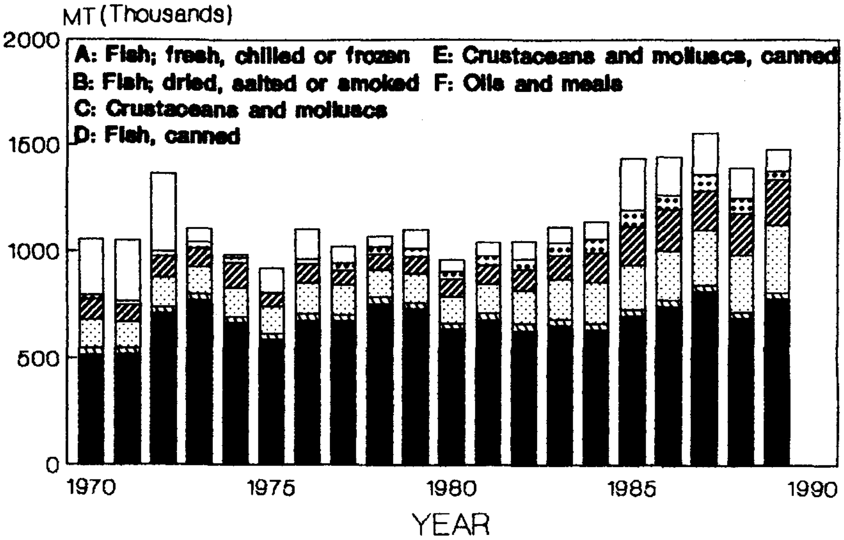
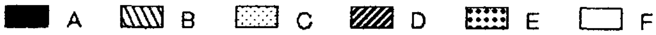


Fig. 28. American import quantities of seven FAO fishery product categories: 1970-1989.
Source: FAO Fishery Commodity Statistics



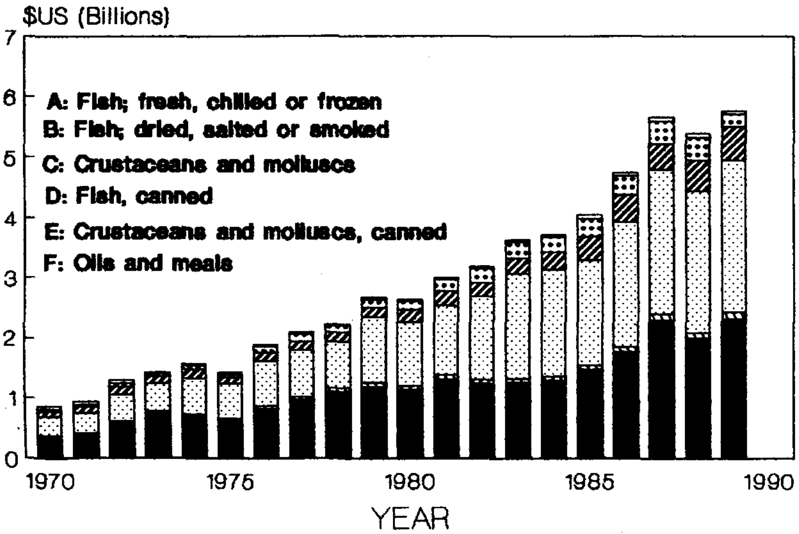


Fig. 29. American import values of seven FAO fishery product categories: 1970-1989.
Source: FAO Fishery Commodity Statistics

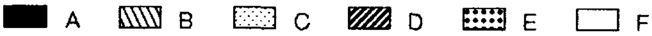


Table 18. American imports of 7 FAO fishery product categories by value and their respective percentages of total national fishery import value: 1970-89. Unit: $US 1000

Year	A	%	B	%	C	%	D	%	E	%	F	%	G	%	F & G	%	Total
1970	343852	40	22074	3	310033	36	90319	11	42758	5	6942	1	37713	4	44655	5	853691
1971	385310	41	24825	3	347448	37	88903	10	41555	4	9325	1	38253	4	47578	5	935619
1972	593100	46	27104	2	442355	34	122654	9	51904	4	2540	0	51627	4	54167	4	1291284
1973	750100	52	34772	2	465016	32	117021	8	51063	4	1522	0	14286	1	15808	1	1433780
1974	697485	44	41074	3	2586500	37	159179	10	72201	5	3739	0	15706	1	19445	1	1575884
1975	628639	44	38704	3	570207	40	101800	7	62912	4	3174	0	23576	2	26750	2	1429012
1976	816377	43	49172	3	750599	40	146368	8	91444	5	4089	0	32872	2	36961	2	1890921
1977	973629	47	48983	2	79506	38	128093	6	115069	6	4082	0	26488	1	30570	1	2085850
1978	1116302	50	61571	3	755206	34	154178	7	123087	6	5251	0	12577	1	17828	1	2228172
1979	1187800	44	65327	2	1088389	41	163422	6	133669	5	5945	0	29616	1	35561	1	2674168
1980	1144344	43	59513	2	1062933	40	203268	8	140330	5	7242	0	15530	1	22772	1	2633160
1981	1316092	44	81442	3	1145402	38	229563	8	188411	6	6812	0	20473	1	27285	1	2988195
1982	1244105	39	75241	2	1363706	43	229891	7	229746	7	6281	0	25663	1	31944	1	3174633
1983	1257302	35	68854	2	1744799	48	249238	7	274012	8	5369	0	21806	1	27175	1	3621380
1984	1291247	35	70945	2	1764361	48	291816	8	253045	7	4551	0	26525	1	31076	1	3702490
1985	1475966	36	71345	2	1742581	43	388954	10	305743	8	5200	0	62005	2	67205	2	4051494
1986	1775914	37	79992	2	2074645	44	436137	9	325466	7	9311	0	47247	1	56558	1	4748692
1987	2304613	41	92945	2	2390819	42	423199	7	378409	7	18912	0	53433	1	72345	1	5662329
1988	2004029	37	88999	2	2347758	44	510431	9	375513	7	9655	0	52960	1	62615	1	5389345
1989	2322480	40	107530	2	2511089	44	562060	10	204583	4	11793	0	37392	1	49185	1	5756927

Legend : A=Fish: fresh, chilled or frozen; B=Fish: dried, salted or smoked; C=Crustaceans and molluscs, frerh, frozen, dried, salted or smoked; D=Fish, canned; E=Crustaceans, canned; F=Oils & Fats; G=Meals.

Source : FAO Fishery Statistics, various years

Note : Percent (%) rounded to nearest whole number.

(Table 13). Japan principally produced these low-valued commodities from Japanese pilchard. The percentage of Japanese seafood exports composed of fresh/frozen fish fluctuated between 29% and 36% from 1970 to 1989. It averaged below 200,000 mt with periodic highs in the early 1970's and late 1980's.

The percentage each of the seven FAO product categories comprises of Japanese seafood export value, generally reflects their distribution of export quantity as well (Fig. 27). However, rising canned fish prices on the world market during the past 20 years has helped soften the economic impact on Japan's dwindling exports of this product. Periodically, during the early 1970's and 1980's, canned fish comprised over half of Japanese seafood export value. Yet despite its dropping to less than 10% of export quantity in 1988 it maintained 25% of export value (Table 14). The export value of low priced seafood goods like fish oils and meals grew most significantly of any FAO category in terms of it percentage to national total export

Table 19. American import percentage of world total import value by 7 FAO fishery product categories: 1970-89.

Year	A (%)	B (%)	C (%)	D (%)	E (%)	F & G (%)
1970	34.7	7.6	46.5	18.7	26.1	34.8
1971	33.6	7.4	41.6	16.6	23.1	31.8
1972	39.8	6.5	39.7	19.5	25.2	45.7
1973	36.0	6.4	33.1	14.4	17.0	10.5
1974	31.4	6.8	36.3	16.7	20.1	7.5
1975	27.4	6.5	31.7	10.3	17.1	13.2
1976	28.5	7.0	29.8	12.6	20.9	17.8
1977	26.8	6.6	29.3	10.1	21.2	12.3
1978	23.8	6.1	22.2	10.0	19.9	5.9
1979	21.0	5.2	23.0	9.4	18.5	11.5
1980	19.7	4.8	23.9	9.4	17.4	7.1
1981	21.1	6.1	25.0	10.2	23.1	9.4
1982	19.5	6.3	27.0	11.9	26.5	13.6
1983	20.3	5.9	31.5	13.0	28.9	10.8
1984	20.6	6.9	31.5	15.6	27.3	9.4
1985	20.9	6.1	29.5	19.1	30.6	22.4
1986	18.9	5.6	25.8	17.3	23.6	27.6
1987	18.8	4.9	23.8	14.5	21.7	40.5
1988	14.0	4.4	20.8	14.8	18.9	21.3
1989	15.8	5.5	21.8	15.3	11.1	23.6

Legend: A=Fish: fresh, chilled or frozen; B=Fish: dried, salted or smoked; C=Crustaceans & molluscs; D=Fish, canned; E=Crustaceans, canned; F=Oils & Fats; G=Meals

Source: Derived from FAO Fishery Statistics, various years value. From 1970 to 1988 oils and meals increased from only 5% of national total annual export value to 25% (Table 14).

Japanese export percentages of annual world export quantities and values within seven FAO fishery categories are listed in Tables 15 and 16, respectively. Japan formerly dominated world fishery exports in canned goods but has since dropped to marginal levels. For example, in 1970 the Japanese percentage of world export quantities of canned fish and crustaceans/mollusks was 42% and 24%, respectively. However, by 1989 this had declined to 7% and 2%, respectively (Table 15). Similar declines are documented in terms of the export value of these goods in relation to their percentage of the world market (Table 16).

American Fishery Import Composition

American seafood import quantities have consistently been dominated by fresh/

Table 20. American import percentage of world total import quantity by 7 FAO fishery product categories: 1970–89.

Year	A (%)	B (%)	C (%)	D (%)	E (%)	F & G (%)
1970	25.4	7.2	26.3	15.6	22.6	6.9
1971	24.5	6.5	21.2	12.4	19.2	7.6
1972	29.8	6.1	20.3	14.6	22.7	9.3
1973	28.1	7.0	17.8	12.7	19.2	2.8
1974	23.9	7.4	17.7	15.9	21.4	0.5
1975	21.7	6.8	15.7	6.3	1.7	3.9
1976	23.7	9.2	15.4	10.2	19.3	5.0
1977	22.1	8.5	16.1	8.5	22.2	3.0
1978	20.6	8.7	12.2	9.0	21.2	1.8
1979	18.0	7.4	11.3	9.2	22.4	2.8
1980	15.4	5.8	11.5	8.4	19.4	1.9
1981	15.5	7.2	12.0	8.5	22.3	2.3
1982	13.8	8.0	12.6	10.9	23.8	2.5
1983	13.6	6.4	14.2	12.2	28.0	2.3
1984	12.8	6.8	13.1	14.8	26.8	2.4
1985	13.0	6.0	13.0	18.7	29.5	5.7
1986	12.3	6.5	13.2	18.6	24.7	4.4
1987	11.8	5.8	13.4	17.1	25.9	4.9
1988	9.1	5.7	12.7	17.8	21.8	3.3
1989	9.9	6.3	13.9	18.0	11.9	2.3

Legend : A = Fish : fresh chilled or frozen ; B = Fish : dried, salted or smoked ; C = Crustaceans & molluscs ; D = Fish, canned ; E = Crustaceans, canned ; F = Oils & Fats ; G = Meals

Source : Derived from FAO Fishery Statistics, varioun years

Table 21. American exports of 7 FAO fishery product categories by value and their relative percentages of national total fishery export value: 1970-89. Unit: $US 1000

Year	A	%	B	%	C	%	D	%	E	%	F	%	G	%	F & G	%	Total
1970	24149	22	8075	7	31991	29	19646	18	10929	10	16407	15	682	1	17089	15	111879
1971	33087	24	10901	8	36930	27	21086	16	12253	9	20032	15	1469	1	21501	16	135758
1972	38261	25	11745	8	41734	28	29952	20	13092	9	15382	10	1529	1	16911	11	151695
1973	76976	27	22372	8	80554	28	41504	15	20791	7	34028	12	8967	3	42995	15	285192
1974	56894	23	18252	7	73052	29	30033	12	17361	7	40240	16	16809	7	57049	23	252641
1975	93503	31	30153	10	81783	27	44311	15	13030	6	28137	9	2117	1	30254	10	298034
1976	113790	31	44819	12	101930	27	47627	13	23364	6	29946	8	10423	3	40369	11	371899
1977	182664	36	73892	15	142780	28	49716	10	26649	5	19779	4	12584	2	32363	6	508064
1978	351458	39	118810	13	277444	31	63678	7	24510	3	42340	5	17469	2	59809	7	895709
1979	444507	42	145584	14	307980	29	102551	10	25127	2	39571	4	5526	1	45097	4	1070346
1980	356469	36	138616	14	229172	23	168452	17	27484	3	52395	5	29137	3	81532	8	1001725
1981	552320	47	144918	12	215850	19	163985	14	24330	2	24572	4	19056	2	61628	5	1163031
1982	602243	56	129297	12	197746	19	84255	8	15834	1	35679	3	3595	0	39274	4	1068649
1983	559897	54	110294	11	166498	16	112290	11	13851	1	59836	6	21749	2	81585	8	1044415
1984	582767	58	96223	10	136613	14	100421	10	10665	1	70980	7	5263	1	76243	8	1002932
1985	754254	65	128545	11	135560	12	93404	8	6893	1	36757	3	6959	1	43716	4	1162372
1986	962409	65	110524	7	238608	16	117161	8	20889	1	20828	1	10571	1	31399	2	1480990
1987	1194035	65	119207	6	355470	19	106791	6	24391	1	23312	1	13245	1	36557	2	1836451
1988	1584846	65	165109	7	458227	19	157355	6	30247	1	21945	1	23447	1	45392	2	2441176
1989	1550204	61	100300	4	528994	21	218726	9	87469	3	21495	1	25256	1	46751	2	2532444

Legend : A = Fish : fresh, chilled or frozen ; B = Fish : dried, salted or smoked ; C = Crustaceans and molluscs, fresh, frozen, dried, salted or smoked ; D = Fish, canned ; E = Crustaceans, canned ; F = Oils & Fats ; G = Meals.

Note : Percent (%) values rounded to nearest whole number.

Source : FAO Fishery Statistics, various years.

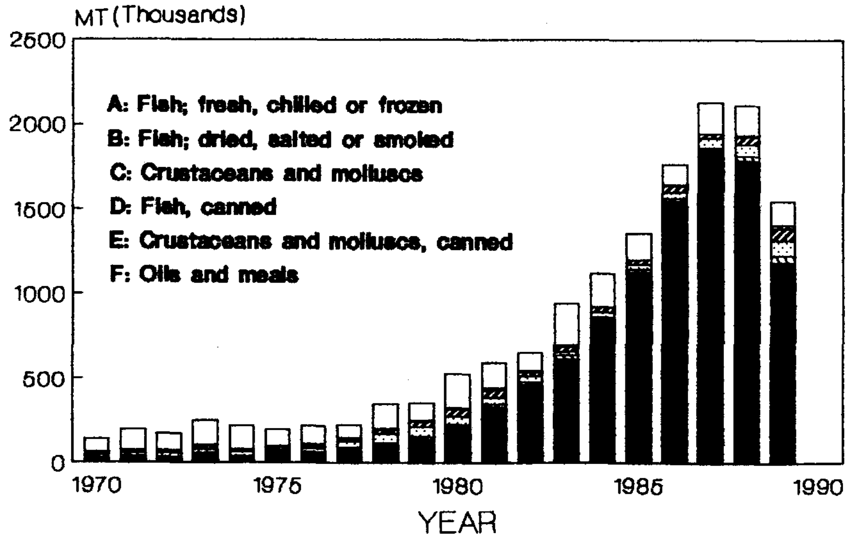


Fig. 30. American export quantities of seven FAO fishery product categories: 1970-1989.
Source: FAO Fishery Commodity Statistics

A B C D E F

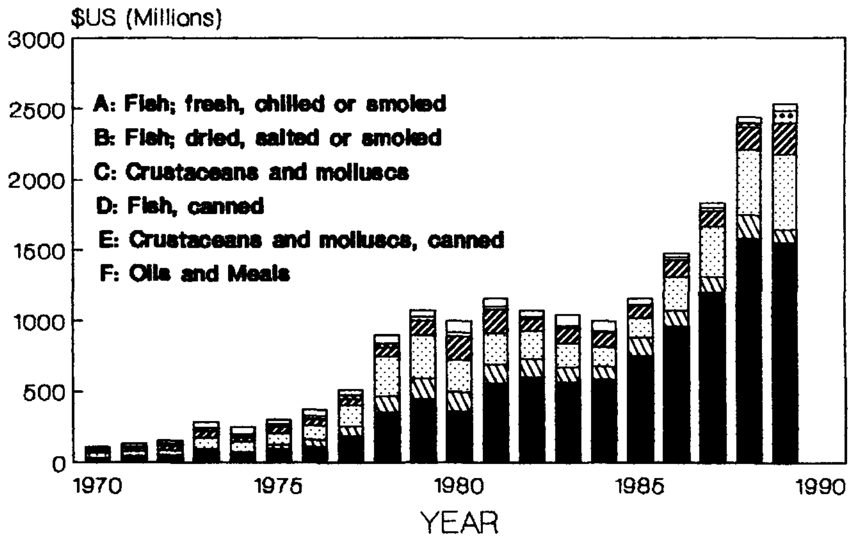


Fig. 31. American export values of seven FAO fishery product categories: 1970-1989.
Source: FAO Fishery Commodity Statistics

A B C D E F

Table 22. American exports of 7 FAO fishery product categories by quantity and their respective percentages of total national fishery export quantity: 1970-89. Unit: M.T.

Year	A	%	B	%	C	%	D	%	E	%	F	%	G	%	F & G	%	Total
1970	21100	15	4200	3	18800	13	10900	8	8000	6	74300	52	4300	3	78600	56	141600
1971	34200	18	3600	2	19700	10	10800	6	9100	5	107000	55	9100	5	116100	60	193500
1972	31100	18	3400	2	19500	11	14100	8	8900	5	87800	50	9400	5	97200	56	174200
1973	49400	20	4300	2	29400	12	14800	6	9400	4	112600	44	33300	13	145900	58	253200
1974	36200	16	3700	2	22500	10	9500	4	7800	4	91700	41	50400	23	142100	64	221800
1975	49100	25	4500	2	22900	12	14400	7	7100	4	87600	45	10700	5	98300	50	196300
1976	54913	25	5923	3	24448	11	14951	7	8481	4	81299	37	30365	14	111664	51	220380
1977	81950	36	10469	5	33920	15	15742	7	7594	3	43607	19	32752	14	76359	34	226034
1978	102511	29	16529	5	54978	16	20866	6	8467	2	100703	29	45994	13	146697	42	350048
1979	134201	38	16080	5	66467	19	26923	8	7426	2	90036	25	14244	4	104280	29	355377
1980	205701	39	18439	3	50963	10	40060	8	7609	1	128824	24	77365	15	206189	39	528961
1981	329146	55	20759	3	42272	7	43110	7	7915	1	108094	18	42662	7	150756	25	593958
1982	460125	70	21205	3	34907	5	27068	4	6590	1	91781	14	16275	2	108056	16	657951
1983	615858	65	19868	2	27074	3	31937	3	2555	0	183290	19	70231	7	253521	27	950813
1984	848333	75	17502	2	29700	3	27682	2	1754	0	181175	16	18305	2	199480	18	1124451
1985	1127583	83	20065	1	30133	2	26105	2	1763	0	126588	9	31373	2	157961	12	1363610
1986	1548530	88	17596	1	39810	2	32703	2	5232	0	87186	5	34936	2	122122	7	1765993
1987	1851215	87	15159	1	57030	3	24465	1	4152	0	122998	5	63672	3	176670	8	2128691
1988	1787570	85	25656	1	70347	3	45565	2	5076	0	67712	3	111722	5	179434	8	2114148
1989	1186623	77	41487	3	87052	6	77154	5	15963	1	91572	6	93694	3	140266	9	1548545

Legend : A = Fish: fresh, chilled or frozen; B = Fish: dried, salted or smoked; C = Crustaceans and molluscs, fresh, frozen, dried, salted or smoked; D = Fish, canned; E = Crustaceans, canned; F = Oils & Fats; G = Meals.

Note : Percent (%) values rounded to nearest whole number.

Source : FAO Fishery Statistics, various years.

frozen fish and, to a lesser extent, crustaceans/mollusks, and canned fish (Fig. 28). Between 1970 and 1989 fresh/frozen fish ranged from 49% to 53% of U.S.A. total import quantity, respectively (Table 17). During these two decades America imported larger quantities of luxury seafoods like crustaceans and mollusks. An increasing percentage of its seafood imports were comprised of these goods. These seafoods grew from 12% of national fishery import quantity to 21% in 1970 and 1989, respectively (Table 17). During this period, exports fluctuated for low-valued commodities like fish meal. A decreasing trend in meal imports is now occurring in America.

Rising prices of crustaceans and mollusks on the world market out-paced nominal growth in prices of the other seven FAO fishery product categories. As a result, by 1982 the contribution of crustaceans and mollusks to import value of seafoods to America eventually exceeded that of fresh/frozen fish (Fig. 29 and Table

Table 23. American export percentage of world total export quantity by 7 FAO fishery product categories: 1970–89.

Year	A (%)	B (%)	C (%)	D (%)	E (%)	F & G (%)
1970	1.0	0.8	4.3	1.8	10.7	2.2
1971	1.6	0.7	3.8	1.7	12.9	3.1
1972	1.3	0.7	3.0	2.0	10.1	2.6
1973	1.8	0.9	4.4	1.9	10.4	6.7
1974	1.4	0.9	3.3	1.2	9.6	5.7
1975	1.7	1.1	3.1	1.9	8.9	3.5
1976	1.9	1.4	2.8	1.9	8.1	4.2
1977	2.5	2.6	4.0	2.0	7.0	2.9
1978	2.7	4.0	5.4	2.5	7.5	5.3
1979	3.1	3.5	5.8	3.2	6.6	3.4
1980	4.6	3.8	4.7	4.1	5.5	6.7
1981	7.1	4.2	3.7	4.2	5.0	5.2
1982	9.6	4.9	2.8	3.0	4.1	3.2
1983	11.8	4.5	1.9	3.7	1.4	8.3
1984	15.6	4.0	1.9	2.9	0.9	5.5
1985	18.1	4.4	1.8	2.6	0.8	3.7
1986	21.2	3.7	2.2	3.1	2.3	3.0
1987	24.1	3.1	2.8	2.3	1.7	4.4
1988	21.2	5.0	3.3	4.0	1.9	4.4
1989	14.8	7.6	3.8	6.2	5.5	3.0

Legend : A = Fish: fresh, chilled or frozen; B = Fish: dried, salted or smoked; C = Crustaceans & molluscs; D = Fish, canned; E = Crustaceans, canned; F = Oils & Fats; G = Meals

Source : Derived from FAO Fishery Statistics, various years.

18). From 1970 to 1989, the contribution of fresh/frozen fish to U.S.A. total import value of seafoods remained relatively constant at approximately 40%. In contrast, growth in percentage value share occurred for the category of crustaceans/mollusks which composed 36% and 44% of total U.S.A. seafood import value in 1970 and 1989, respectively (Table 18).

America's dominance in international trade, in terms of seafood import value, has diminished in all seven FAO fishery product categories during recent decades (Table 19). It has declined in six of the seven groups in terms of quantity (Table 20). The only exception is canned fish where U.S.A. percentage of world seafood import quantity grew from 16% to 18% from 1970 to 1989. This increase occurred during the past decade after regaining from its decline below 10% of world import quantity during the late 1970's.

Table 24. American export percentage of world total export value by 7 FAO fishery product categories: 1970-89.

Year	A (%)	B (%)	C (%)	D (%)	E (%)	F & G (%)
1970	2.6	3.0	5.9	4.1	8.8	3.5
1971	3.1	3.5	5.3	3.9	9.2	4.3
1972	2.8	3.1	4.5	4.4	7.8	3.4
1973	4.1	4.4	6.6	4.7	9.1	6.6
1974	3.1	3.1	5.5	3.0	6.9	7.7
1975	4.3	5.1	5.2	4.6	6.9	5.7
1976	4.5	6.7	4.6	4.0	7.5	6.0
1977	5.3	10.2	5.9	3.8	7.1	3.7
1978	8.0	13.2	8.4	4.1	5.7	6.8
1979	8.3	13.1	7.2	5.8	4.9	4.8
1980	6.4	10.8	5.4	7.7	4.2	7.4
1981	9.1	10.2	5.0	7.2	3.7	6.1
1982	10.4	10.8	4.2	4.4	2.3	4.0
1983	9.8	10.7	3.2	5.8	1.7	8.2
1984	10.0	10.5	2.6	5.0	1.3	7.4
1985	11.5	12.7	2.4	4.4	0.8	4.6
1986	10.9	8.4	3.1	4.3	1.8	2.8
1987	11.1	7.0	3.7	3.4	1.7	2.9
1988	12.6	8.6	4.3	4.4	1.8	2.8
1989	11.8	5.5	5.0	6.2	4.9	2.9

Legend : A=Fish: fresh, chilled or frozen; B=Fish: dried, salted or smoked; C=Crustaceans & molluscs; D=Fish, canned; E=Crustaceans, canned; F=Oils & Fats; G=Meals

Source : Derived from FAO Fishery Statistics, various years.

American Fishery Export Composition

In the early 1970's, prior to America's implementation of its 200-mile EEZ policy, U.S.A. fishery exports were relatively dismal, averaging approximately 200,000 mt valued roughly at U.S.A. $ 2 milliion annual (Fig. 30 and Fig. 31). In 1970, what exports did exist were primarily in the form of fish oil which comprised over 50% of U.S.A. total export quantity and 15% in value (Table 21). By 1980 America had begun realizing its domestic fishery production potential by successfully phasing-out foreign fishing in its 200-mile waters. America was then in a position to exploit this advantage in the world fisheries trade arena. The result was dramatic growth in U.S.A. fishery exports during the past decade in both quantity and value (Fig. 30 and 31).

Far and away fresh/frozen fish constituted the bulk of U.S.A. export quantity this period of rapid expansion. It grew in thare from 15% to 77% of U.S.A. total annual seafood export quantity between 1970 and 1989. In contrast low-valued fish meals and oils dwindled in their significance from 56% to 9% during the same period (Table 22). In terms of export value, in 1989 fresh/frozen fish, crustaceans/mollusks, and canned fish generated the highest gross revenues for U.S.A. seafood exports equalling U.S.A. $ 1.6 billion, U.S.A. $ 529 million, and U.S.A. $ 219 million, respectively.

The 200-mile EEZ policy helped transform America from a minor seafood exporter, principally involved in fish oil, to the world's leader specializing in high-valued fresh/frozen fishery products. American dominance increased in three major seafood categories: fresh/frozen fish and, to a lesser extent, dried-salted-smoked fish, and canned fish. U.S.A. leadership in world seafood exports focused around these commodities. In 1988, U.S.A. exports of these goods composed 21%, 5%, and 4% of world export quantities in those categories, respectively (Table 23). In terms of value, during the same year, they comprised 13%, 9%, and 4%, respectively (Table 24).

An explanation of why U.S.A. exports heavily lean toward fresh/frozen fish would include technological and market demand factors. As illuded to previously, advancements in freeze and chill technologies and development of international travel networks capable of timely transportation of fresh food-stuffs has made international trade of these commodities a viable option under complimentary economic conditions. These technological improvements provide a quality product for international consumption. The combination of high quality and increasingly diverse buyer competition generated sufficiently high prices to sustain economic viability of the practice.

In conjunction with the increased buying power of an appreciated yen, the strong demand for high-quality seafood in Japan has contributed significantly to creating complimentary economic conditions supporting trade in fresh/frozen seafood. This situation bid-up world prices for quality fresh/frozen goods specifically, and the majority of other seafood commodities in general. The degree to which Japan has become increasingly dependent on imported food stuffs, particularly from the United States, is presented below.

4. Japan's Growing Dependence on American Food Imports

In 1990, the total value of goods imported into Japan was ¥33.9 trillion, or ¥233.8 billion*. In the same year, American products accounted for over 22% of this import market: the largest share for any country or region (Table 25). Products originating from the European Community collectively were a distant second capturing 15% of the market. With regard to food imports alone, Table 26 lists the "Top Ten" countries exporting foodstuff to Japan. Their respective values are in U.S. dollars.

By 1990, food comprised 13.5% in total value of all Japanese imports (Table 25). Again, U.S. goods overwhelmingly dominated food imports by commanding one third of the Japanese food import market-share (Table 26). Fig. 32 presents the 1988 shares of the primary individual countries and territories exporting food to Japan. This typically represents food import allocations in recent years.

Previously in Table 3 of Section 1.1 it was shown that between 1960 and 1988 Japan's food calorie supply self-sufficiency ratio had dwindled from 80% to less than 50%; the lowest level among the major developed countries[23]. Wheat, fish, and meat were among those goods displaying dramatic declines in self-sufficiency ratios. All of these are principle commodity groups produced by the United States and

Table 25. Contribution of US food imports, in terms of value and percentages, to Japanese total imports since the onset of the international 200-mile EEZ era: 1977, '80, '85, & '90. (Yen: millions)

Category	1977	1980	1985	1990
Value of all imports into Japan	19131780	31995325	31084935	33855208
Value of all imports into Japan from U.S.	3357384	5558112	6213380	7585904
Total value of food food imports into Japan	2728659	3326440	3718803	4572354
Value of all food imports into Japan from the U.S.	742507	1170632	1222175	1531457
% of value of total imports into Japan from U.S.	17.5	17.4	20.0	22.4
% of Japan's total import value associated with food	14.3	10.3	12.0	13.5
% of value of all U.S. good imported into Jpan associated with food	22.1	22.1	19.7	20.7
% of value of all food imported into Japan from U.S.	27.2	35.2	32.9	33.5

Source: Calculated from Japan Statistical Yearbook. Japan Statistics Bureau, Management and Coordination Agency.

* @¥144.8/$: see Table 12.

Table 26. Food Imports into Japan During 1990 by Country of Origin : 1989–1990.

	89			90		
	Value ($ million)	Annual Growth Rate	Share	Value ($ million)	Annual Growth Rate	Share
United States	10,269,450	△ 5.1	31.5	10,341,518	△ 0.7	31.4
Peoples Requblic of China	2,258,472	△ 8.2	6.9	2,241,044	▼ 0.8	6.8
Taiwan	2,082,348	▼ 6.9	6.4	2,172,370	△ 4.3	6.6
Canada	2,106,110	△ 3.2	6.5	2,106,640	0.0	6.4
Australia	2,116,977	△18.4	6.5	2,060,179	▼ 2.7	6.2
Thailand	1,405,853	△21.8	4.3	1,563,384	△11.2	4.7
Republic of Korea	1,730,191	▼ 8.9	5.3	1,521,254	▼12.1	4.6
France	689,199	△57.9	2.1	953,082	△38.3	2.9
Indonesia	769,729	△ 7.9	2.4	789,018	△ 2.5	2.4
The Philippines	743,244	▼ 3.5	2.3	717,767	▼ 3.4	2.2
Total of ten leading countries	24,171,573		74.2	24,466,256		74.2
EC	2,864,480	△18.0	8.8	3,127,656	△ 9.2	9.5
Others	8,423,665		25.8	8,504,454		25.8

Source : Reprint by permission : JETRO, 1990. AG-41 p. 13.

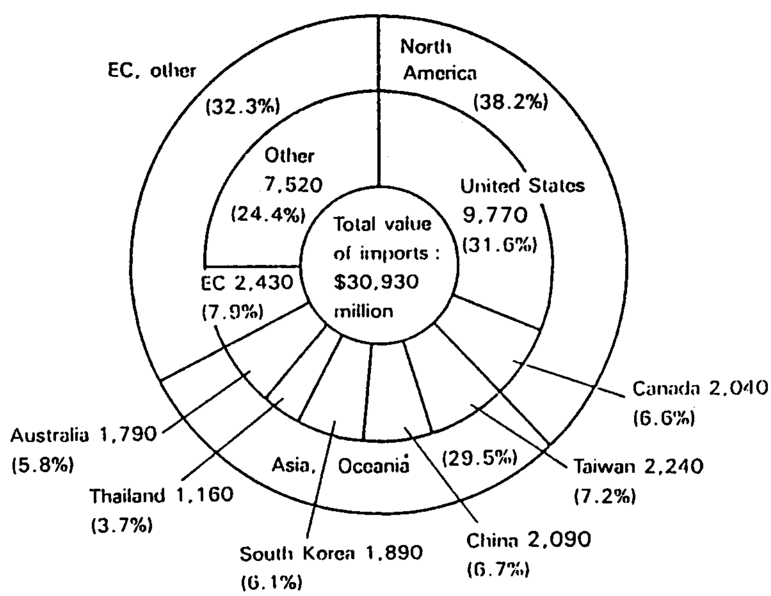


Fig. 32. Shares of individual countries and territories in food imports to Japan during 1988. Reprint by permission : JETRO, 1989. AG-36 p. 5
Source : Trade Statistics of the Ministry of Finance.

exported to Japan.

Japan has been heavily reliant on American grain since World War II (excluding rice which enjoys a total import restriction). In addition, during recent decades the country also experienced growing dependence on foreign meat and seafood imports. For example, between 1977 and 1990 meat rose from representing 9% of Japan's food import value to 16%. Over the same period seafood rose from comprising 22% to 33% of the country's food import value (Table 27). It is not surprising that seafood imports rose during this period in Japan because it had previously maintained the world's largest distant-water fishing fleet. It was at this time that international 200-mile EEZ policy began systematically excluding those fishing fleets from many of their historical fishing grounds; areas which now are within fisheries management jurisdiction of foreign nations.

Over the past decade food accounted for more than 20% of the value of all U.S. exports to Japan (Table 25). Among those American commodities exported to Japan, meat and seafood have grown in significance in terms of value while wheat has diminished. Between 1980 and 1990 meat rose from contributing 8% to 18% of all U.S. exports bound for Japan (Table 28). Decreasing import restrictions on beef, which began in the late 1980's, and growing Japanese consumer demand for beef in their diets are the major contributing factors to this trend. In 1990, U.S. meat obtained 39% of the value of all the meat imported by Japan.

Table 27. Annual values and percentages of specific food groups imported into Japan since the onset of the international 200-Mile EEZ era.
(Yen: millions)

Category	1977	1980	1985	1990
Total value of food imports in Japan	2728659	3326440	3718803	4572354
Value of all meat imports into Japan	257808	345762	458687	726172
Value of all seafood imports into Japan	588470	684334	1096424	1518357
Value of all wheat imports into Japan	200092	279164	234533	146806
Value of all other food imprts into Japan	1682289	2017180	1929159	2181019
% of Japan's food import value associated with meat	9.4	10.4	12.3	15.9
% of Japan's food import value associated with seafood	21.6	20.6	29.5	33.2
% of Japan's food import value associated with wheat	7.3	8.4	6.3	3.2
% of Japan's food import value associated with other foods	61.7	60.6	51.9	47.7

Source: Calculated from Japan Statistical Yearbook. Japan Statistics Bureau, Management and Coordination Agency.

Table 28. Annual values of U.S. food groups imported to Japan and percentages of commodity import (Yen : millions)

Category	1977	1980	1985	1990
Value of all meat imported into Japan from U.S.	53778	98094	133418	281198
Value of all seafood imported into Japan from U.S.	59583	94425	208012	303133
Value of all wheat imported into Japan from U.S.	115877	159011	132761	78356
Value of all other foods imported into Japan from U.S.	513269	819102	747984	868770
% of value of all U.S. goods imported into Japan associated with meat	7.2	8.4	10.9	18.4
% of value of all meat imported into Japan from U.S.	20.9	28.4	29.1	38.7
% of value of all U.S. goods imported into Japan associated with seafood	8.0	8.1	17.0	19.8
% of value of all seafood imported into Japan from U.S.	10.1	13.8	19.0	20.0
% of value of all U.S. goods imported into Japan associated with wheat	15.6	13.6	10.9	5.1
% of value of all wheat imported inot Japan from U.S.	57.9	57.0	56.6	53.4
% of value of all U.S. good imported into Japan associated with other foods	69.1	70.0	61.2	56.7
% of valuy of other foods imported into Japan from U.S.	30.5	40.6	38.8	39.8

Source : Calculated from Japan Statistical Yearbook. Japan Statistics Bureau, Management and Coordination Agency.

Of any developed nation on earth, Japan has become the most heavily dependent on seafood imports. In 1990, seafood alone accounted for over 33% of the value of all foodstuffs imported by Japan (Table 27). This alarming fact is often pointed out within Japan Government publications. "Fish/shellfish accounted for the largest part of Japan's food imports in 1988 (30.7%), followed by meat (13.5%), processed foodstuffs (13.1%), cereals (12.4%), oil seeds (9.5%), fruit/vegetables (8.9%), and others (11.9%). The fact that the ratio of fish/shellfish is so high as to be unparalleled in the world and that the four major food sectors of meat, processed foodstuffs, cereals and fish/shellfish combined account for 70% of food imports indicated an important composition peculiar to Japan."[24)]

American seafood doubled its share of Japan's burgeoning seafood import market, growing from 10% to 20% between 1977 and 1990, respectively. As a

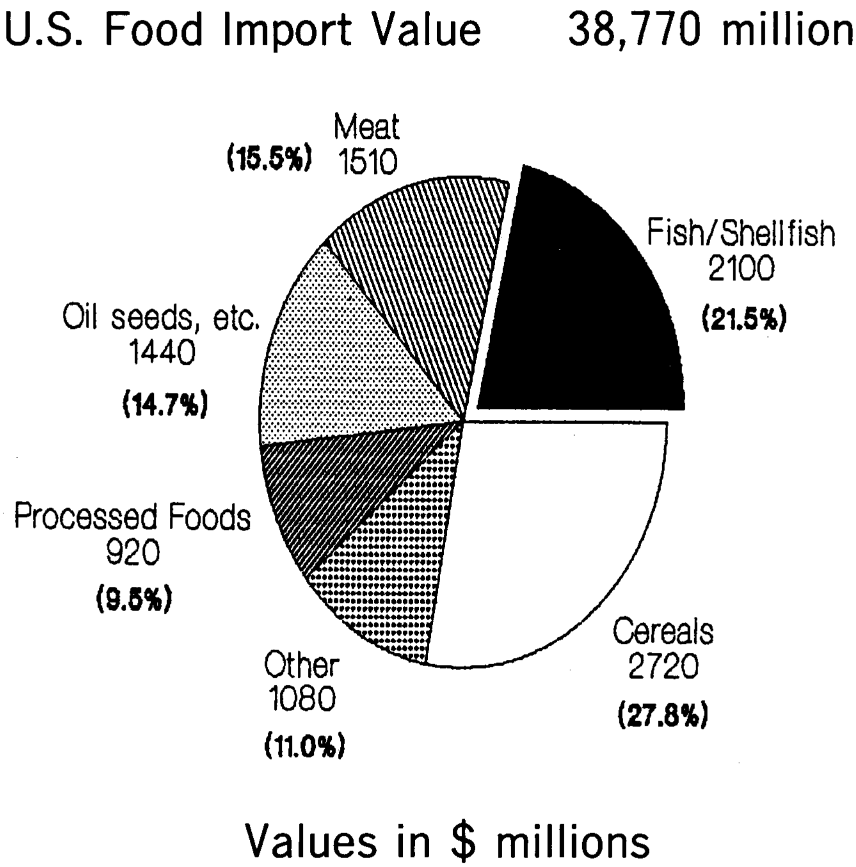


Fig. 33. 1988 Imports into Japan from the U.S.A. by category.
Reprint by permission, JETRO, 1989. AG-36, p. 6.

result, it significantly increased its importance among U.S. exported goods bound for Japan. In 1977 seafood only comprised 8% of the value of all U.S. exports to Japan. However, by 1990 seafood accounted for 20% of the value of all U.S. goods Japan imported (Table 28). Fig. 33 shows 1988 data as an example of how American food imports to Japan break down categorically in recent years.

5. Summary

The point of this entire chapter is to emphasize the dramatic shift underway within Japan's food industry, especially the seafood sector, as a result of trends in the international marketplace. Japan's food industry is changing from being production-export oriented to consumption-import oriented. While being beneficial to the average Japanese consumer, the social and economic effects of this transition will be enormous for many individuals evolved in various sectors of Japan's food production distribution industry. The following is a 1988 quote from The Japan Economic, Trade and Research Organization, a division of Japan's Ministry of Agriculture. "In the area of foodstuffs, where differences in raw material prices between domestic and overseas markets are widening, the Japenses food industry has no choice but to address the problem and consider the development and import of products or advances abroad. Under the food production system so far, it has been comparatively easy for Japanese food businesses to map out plans for the production, distribution and management of their products on the basis of estimated domestic supply and demand. But, when food imports have surpassed the $30 billion mark, there will emerge such a situation whereby the higher the ratio of imports to the domestic food supply rises, the more liable the supply/demand balance is to collapse."[25]

In 1990, the total value of food imports to Japan exceeded $31 billion*. As anticipated, recent years have seen various food production industries in Japan experiencing dramatic restructuring. Japan's seafood industry has especially been negatively affected in this way with the onset of the 200-mile EEZ era. The production, processing, and consumption of minced-fish or "surimi" is studied in depth throughout the remainder of this document to provide an important example of what is occurring with Japan's seafood industry at large. The next chapter will focus on changes occurring within the production and processing sector of Japan's food industry that specifically utilizes this internationally traded seafood commodity: surimi.

IV. Surimi: World Production and Japanese Demand

1. Japanese Surimi Development Background

The process of utilizing fresh minced-fish in a variety of traditional dishes dates back centuries in the Japanese culture[26,27]. Often an abundant and tasty species specific to a given region of Japan's coastline would be harvested by local residents and tediously processed by hand into fresh surimi for immediate consumption. Over time, different locations developed cottage industries that became popular for their specialized neriseihin goods manufactured with the locally famous ingredient fish and process method. Some of these remain today. For example, Sendai City's Sasakamaboko (using cod and flatfish or rockfish surimi mixed), Kochi-Tai kamaboko (flathead and bream), and Hokkaido's Salmon flake kamaboko, to name but a few. Most of these specialized surimi-based goods have limited production because of resource constraints. In addition, the demand for these goods continues to be limited due to their significantly higher relative average price. They are primarily a gift item ("omiyage") commodity.

Historically, flesh surimi had an inherent limitation because of spoilage problems associated with the primitive storage and transportation methods available in the era. The advent of frozen surimi technology revolutionized neriseihin production; enabling its establishment as a major food industry of Japan.

In May 1959, Japanese researchers at Hokkaido Fisheries Research Laboratory

* ¥4.5 trillion (Table 25) @144.8 ¥/$ (Table 12).

in Abashiri, Hokkaido developed a methtd of producing and storing frozen surimi[28) in such a way as to maintain its chemical and textural integrity[29,30). Because surimi is the building block for a myriad of traditional Japanese foods that use processed fish, this breakthrough in overcoming the shelf-life constraint of fresh surimi ushered in a new era for this Japanese industry.

Demand for frozen sumimi grew in Japan's food processing industry with the advent of this development. Ship-based frozen surimi plants or "factory trawlers" enabled Japan to begin developing the North Pacific Alaska pollock fishery in the 1960's and exploit this previously under-utilized species for surimi. The fishery grew at a phenomenal rate and attracted international fleets during the next several decades. However, by 1991, under the mandate of the Magnuson Fisheries Conservation and Management Act of 1976, the North Pacific groundfish fishery within U.S. waters was eventually 100% "Americanized" (see again Fig. 2 in Chapter II). As a result, surimi food processors in Japan now find themselves increasingly dependent on American surimi imports.

2. Japanese Foreign Investment in U.S. Surimi Industry

Successful "Americanization" of the U.S. groundfish fishery resulted in rapid growth in the number of surimi factories in America. The U.S. ranks second only to Japan in the number of facilities. Table 29 lists estimated world surimi operations by country. These include both land-based and sea-based surimi factories. While American growth is evident, Japan presently maintains dominance in world surimi production infrastructure. However, factory ownership alone does not assure production if resource availability remains a constraint. Japanese fisheries corporations recognize this new dimension to their industry and have responded by heavily investing abroad. Such international posturing has allowed Japanese firms diverse involvement in production, distribution, and marketing of marine commodities in order to maintain a leading role in global fisheries trade.

One could speculate that these business-motivated adjustments might also meet Japanese national food security objectives through diverse investment in important world food production sectors. It has been previously pointed-out that Japan suffers the lowest rate of self-sufficiency in foods of any developed country.

Japanese investments in world agricultural sectors has also occurred. A notable example is increased investment in the U.S. beef and citrus industry since the late 1980's when Japan agreed to U.S. demands to begin opening these markets. Given increasing pressure on Japan under GATT negotiations (as well as U.S.-Japan bilateral talks) to open its rice market, the foreign rice industry will likely experience the next wave of Japanese investment. As Table 3 in Chapter II reveals, rice consumption in Japan is the last remaining primary food crop that is 100% domestically produced.

Numerous examples exist demonstrating how large Japanese corporations, predominantly fishery oriented, have responded to the 200-mile era by deemphasizing their direct harvesting interests in favor of a greater role in international trade, distribution, and production of value-added fishery products. A 1991 report by the U.S. State Department of Commerce Office of International Affairs reports…"Nippon Suisan, one of the largest Japanese companies fishing for pollock, reduced its vessel

Table 29. Listing of world surimi factory facilities

Year	Japan		U.S.A.		Korea : Rok		U.S.S.R.	
	S.B.	L.B.	S.B.	L.B.	S.B.	L.B.	S.B.	L.B.
1985	22	40	—	—	1	—	—	—
1986	22	39	—	—	6	—	—	—
1987	21	38	3	3	8	—	—	—
1988	41	37	8	4	9	—	—	—
1989	36	37	16	5	10	—	1	—
1990	35	37	24	6	11	—	1	—
1991	31	36	24	7	11	—	4	—

Note : S.B. is number of Sea-Based vessels
L.B. is number of Land-Based locations
Source : Japan National Surimi Association

crew size from 3,200 in 1977 to only 1,500 in 1988, and plans further reductions to about 800 in the next 3 years. Taiyo Gyogyou has reduced its vessel crews from 4,000 in 1977 to 1,500 in 1988, to be cut to 500 in the next 3 years. It has also reduced its number of fishing vessels by about half."[31]

Nippon Suisan and Taiyo Gyogyou are the two largest fishing corporations in Japan. Their shift away from direct harvesting involvement represents the trend nation-wide in Japan's fishing industry. However, this transition is only part of the picture. While these, and other foreign fishery companies, are reducing their role in their domestically-based harvesting sector of world fisheries, they are expanding investments abroad. The 200-mile era did not eradicate foreign involvement within the fisheries of coastal states. It simply altered their participation from direct harvesters to share holders in these burgeoning fishery industries.

According to a private publication in Japan on fisheries entitled "Suisannenkan", as of December 1989, 192 foreign-based fisheries companies were listed in which Japanese companies either own or had significant investments. These companies are scattered across the globe including Asia (79), the South Pacific (32), Africa (9), Central and South America (26), North America (39), and the USSR (7)[32].

The U.S.-based surimi industry is among those fishing industries of the globe that have attracted a significant degree of foreign investment by Japanese corporations. In 1990, the U.S. surimi production industry consisted of 17 firms (12 sea-based and 5 land-based) operating approximately 29 plants (22 factory trawlers and 7 shore-based)[33]. In January 1991 a Japanese newspaper reviewed foreign investment in the U.S. surimi industry. When compared with the 17 producers identified by Seafood Trend, it became evident that Japanese and Korean firms either owned, had investments or financially associated with 100% of the companies listed (Table 30).

Foreign investment exists in both land and sea-based American surimi production facilities. The advantages have proven clear for such investment diversity. At its June 1991 meeting the North Pacific Fishery Management Council (NPFMC)

(Land-Based and Sea-Based): 1985-91

Argintina		Thailand		Sub Total		Total
S.B.	L.B.	S.B.	L.B.	S.B.	L.B.	
—	—	—	—	23	40	63
—	—	—	—	28	39	67
—	—	—	5	32	46	78
1	—	—	8	59	49	108
1	—	—	11	64	53	117
1	0	0	11	72	54	126
2	—	—	11	72	54	126

Table 30. Foreign investment in U.S. 1990 surimi industry.

Company	Foreign Firm	Type	Country
Alaska Pacific Seafoods	Marubeni	Shore	Japan
Alaska Trawl Fishries	Dairin	At-Sea	Korea
Alyeska	Taiyo/Marubeni	Shore	Japan
Alyseka Ocean Inc.	Hoki/Nichiro	At-Sea	Japan
American Seafoods	Nichiro	At-Sea	Japan
Arctic Alaska	Nippon/Hosui	At-Sea	Japan
Arctic King Fisheries	Kaioh	At-Sea	Japan
Arctic Storm Inc.*	Nikyobo	At-Sea	Japan
Birting Fisheries*	Nippon	At-Sea	Japan
Emerald Seafoods	Sanko	At-Sea	Korea
Glacier Fish	Hoki	At-Sea	Japan
Golden Age Fisheries	Kyokuyo	At-Sea	Japan
Golden Alaska	Nichiro	At-Sea	Japan
Morningstar Fisheries	Hosui	At-Sea	Japan
Oceantrawl	Mitsui Bussan	At-Sea	Japan
Trident Seafoods	Nippon	Shore	Japan
Unisea	Nippon	Shore	Japan
Western Alaska Fisheries	Taiyo	Shore	Japan

* Firm only listed in Minato Shinbun, not Seafood Trend.
Source: Minato Shinbun, 1/31/91, Seafood Trend 5/28/90.

Table 31. Allocations of Alaska pollock and pacific cod total allowable catch among inshore and offshore components within the gulf of Alaska and Bering Sea and Aleutian Islands fisheries.

	Gulf of Alaska				Bering Sea and Aleutian Islands	
	Alaska pollock		Pacific cod		Alaska pollock*	
	Inshore	Offshore	Inshore (%)	Offshore (%)	Inshore (%)	Offshore (%)
Yr. 1	100	bycatch only	90	10	35	65
Yr. 2	〃	〃	〃	〃	40	60
Yr. 3	〃	〃	〃	〃	45	55

* BSAI pollock allocation is phased in over three years.
Source: NPFMC, 1991.

approved Groundfish Fishery Management Plan (FMP) Amendment 23/18 allocating pollock and Pacific cod resources in the Gulf of Alaska and Bering Sea and Aleutian Island pollock fisheries among the industry's offshore and inshore processing components[34]. Table 31 details the inshore-offshore processing allocation for Alaska pollock and Pacific cod harvests from the Bering Sea/Aleutian Islands and the Gulf of Alaska. A Western Alaska Community Quota was also provided for from the BSAI pollock reserve as identified in the BSAI Groundfish FMP. Japanese fisheries corporations have bufferred themselves against risks associated with future shifts in offshore/onshore pollock allocations by securing significant investment in both production sectors.

The issue of foreign inventment in the U.S. fisheries industry has not gone unnoticed in America. Legal action has occurred concerning foreign ownership of American-based vessels fishing within U.S. EEZ waters. The Southeast Shipyard Association in America filed a law suit against the U.S. Coast Guard for its interpretation of the 1987 Anti-Reflagging Act prohibiting foreign ownership of vessel harvest within the U.S. EZZ.

This law had a "grandfather clause" allowing foreign-controlled boats already active in U.S. fisheries to continue. The Coast Guard interpreted this grandfather clause to apply to the boat rather than the vessel owner at that time. The result enabled the boat to be sold to new foreign owners and continue to operate in U.S. waters. Federal Judge John Garrett Penn ruled in April 1991 that the law's intention was to limit foreign ownership, thus indicating the Coast Guard's error of interpretation. In January 1992 Judge Penn, in response to a Coast Guard clarification request, reaffirmed the ruling would apply to all boats owned by foreign interests after the 1988 implementation date. This ruling is in the U.S. Court of Appeals, but if upheld it could potentially affect 50 boats that received the grandfather exemption by the Coast Guard[35].

Refer to Tables 32 and 33 for greater detail on specific American-based surimi production facilities (vessel or onshore) with foreign investment from Japanese or Korean corporations. The reader should remain aware that the industry in is

Table 32. Foreign investment into American sea-based surimi factory trawlers.

Japanese Investor	Vessel Name	Company Name	Entry Date	Vessel Size (ft)	Surimi (tons/day)		Product Potential
Yuki Ka boh	Arctic Enterprise	Arctic Alaska Fisheri	6/87	338	Surimi:	30	H & G/fillet/surimi
〃	U.S. Enterprise	〃	6/87	224	〃	40	Surimi
Nihon Suisan	Kodiak Enterprise	〃	11/89	275	〃	50	H & G/fillet/surimi
〃	Island Enterprise	〃	2/90	304	〃	50	H & G/fillet/surimi/f-m
〃	Ocean Rover	Birting Fisheries	1/90	256	〃	50	H & G/fillet/surimi
〃	Ocean Phoenix	Profish International	12/89	680	〃	100	Fillet/surimi/f-m
〃	Acona	PanPac Seafoods	6/90	286	〃	70	Fillet/surimi/f-m
Nichiro	Golden Alaska	Golden Alaska Seafood	5/90	305	〃	60	Fillet/surimi/f-m
〃	American Empress	American Seafoods	5/89	306	〃	60	Block/surimi/f-m
〃	American Dynasty	〃	8/89	280	〃	60	Surimi/f-m
Hoki Suisan	Pacific Glacier	Glacier Fish Co.	3/89	275	〃	50	Fillet/surimi
Hoki 〃 Nichiro	Alaska Ocean	Alanka Ocean Seafoods	7/90	375	〃	50	Fishmeal/surimi/fillet
Kyokuyo	Michelle Irene	Pacific Orion Seafood	7/89	275	〃	30	Surimi/fillet
Kaioh Suisan	Artic Trawler	Artic King Fisheries	2/87	296	〃	30	Surimi
Mitsui Bussan	Northern Eagle	Oceantrawl, Inc.	3/88	340	〃	60	Surimi/f-m
〃	Northern Jaeger	〃	7/90	336	〃	60	Surimi/f-m
〃	Northern HUwk	〃	7/90	341	〃	60	Surimi/f-m
Nikyobo/Mitsubishi	Artic Storm	Artic Storm, Inc.	2/87	343	〃	60	Surimi/f-m
Hosui	Seattle Enterprise	Artic Alaska Fisherie	11/88	270	〃	40	Fillet/surimi/H & G
〃	Aleutian Speedwell	Merning Star Fisherie	2/89	204	〃	30	Surimi
Sanko (Korean)	Heather Sea	Emerald Seafood	?	292	〃	30	Fillets/block/surimi/f-m
〃	Saga Sea	〃	?	335	〃	30	Fillets/block/surimi/f-m
Dairin (Korean)	Endurance	Alaska Trawl Fisherie	89?	278	〃	30	H & G/fillet/surmi
Taiyo Gyogyou	Excelence	Supreme Alaska Seafood	9/90	+300	〃	65	Surimi

Note : H & G = headed and gutted ; f-m = fishmeal
Source : Minato Shinbun 1/31/91 ; Pacific Fishing Magazine, 9/90 ; and Japan National Surimi Association.

Table 33. Foreign investment into American 1990 Land-based surimi factory operations: as of December 1990

Japanese Investor	Location	Company Name	Date Began	Surimi Annual Capacity (tons/year)	Surimi Daily Capacity (tons/day)	H & G, fillet Daily Capaciy (tons/day)
Taiyo Fisheries	Dutch harbor, AK	Alyeska Seafood	1/87	18000	60	—
〃	〃	Westward Seafood	4/91	20000	100	—
〃	Kodiak, AK	Western Alaska Seafood	9/89	8000	30	—
Nippon Suisan	Dutch Harbor, AK	Unisea (Factory #1)	1/86	—	50	300
〃	〃	Unisea (Factory #2)	9/90	—	60	500
〃	Acton, Ak	Trident Seafoods	9/90	—	60	500
Marubeni	Kodiak, AK	Alaska Pacific Seafoods	1/85	8600	30	—
?	Kribilof, Ak	Sentipore Surimi	pending	—	40	—

Source: Minato Shimbun 1/31/91; Japan National Surimi Association.

constant evolution and that the information presented in Tables 32 and 33 represent the state of the industry at the end of 1990.

3. Distribution Network

By establishing sustainable supply abroad by investing in foreign harvesting and processing sectors, Japanese firms secure products to channel through preexisting fishery distribution systems within their large domestic market. Given the labyrinth marketing and distribution network in Japan, this creates a clear advantage over foreign food trading firms attempting to break into the Japanese market. However, change is occurring despite a variety of hurdles (both clear and unseen) facing newcomers. Primarily due to strong domestic demand, new distribution channels are emerging for fishery imports such as surimi. Imports are increasingly able to establish direct links with large wholesalers and consumer outlets (Fig. 34).

Improved communication between purchasing agents in Japan and their suppliers in America (some also under Japanese control) may have contributed to the observed reduction in excessive swings of frozen surimi kept in storage facilities within Japan (Fig. 35). Between 1984 and 1986, monthly holdings were erratic during the year but year-end levels were relatively constant. In 1987, month-end holdings rose to an all-time high and coincided with the peak of joint-venture fishing operations in the U.S. EZZ groundfish fishery[36]. From 1987 through 1989, the seasonal periodicity of month-end holdings stabilized but began a general downward trend. This is represented by the negative sloping regression line generated from annual average holding values for 1987 through 1991. The dramatic summer slump in holdings became less pronounced in 1990 and 1991 yet the downward trend continued to reach a 10 year low (Fig. 35). For 1991, this decline is primarily a function of record high prices at year-end surpassing ¥800/kg for processed at-sea FA grade pollock surimi. Early 1992 inventory levels rose dramatically in response to dropping prices that approached ¥700/kg by spring.

If domestic monthly demand for frozen surimi also experienced diminished seasonality, the reduced periodicity in holdings could be explained as distributors' responses to domestic demand. However, dispersement displayed no such adjustment. Therefore, improved security among domestic distributors concerning avail-

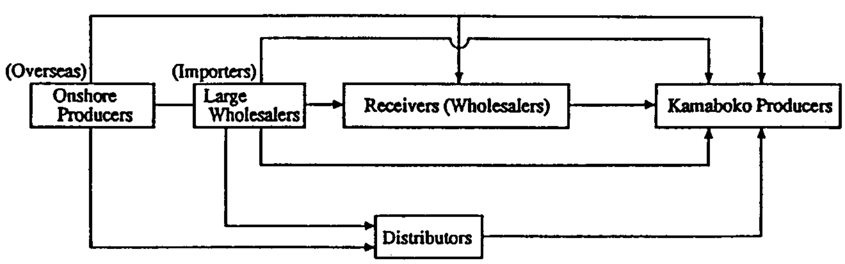


Fig. 34. Simplified schematic of Japanese domestic distribution route of frozen surimi.
Source: "Zenkama"-National Kamaboko Makers Association as presented at JETRO International Forum on Surimi. November, 1992. Tokyo. p. 10.

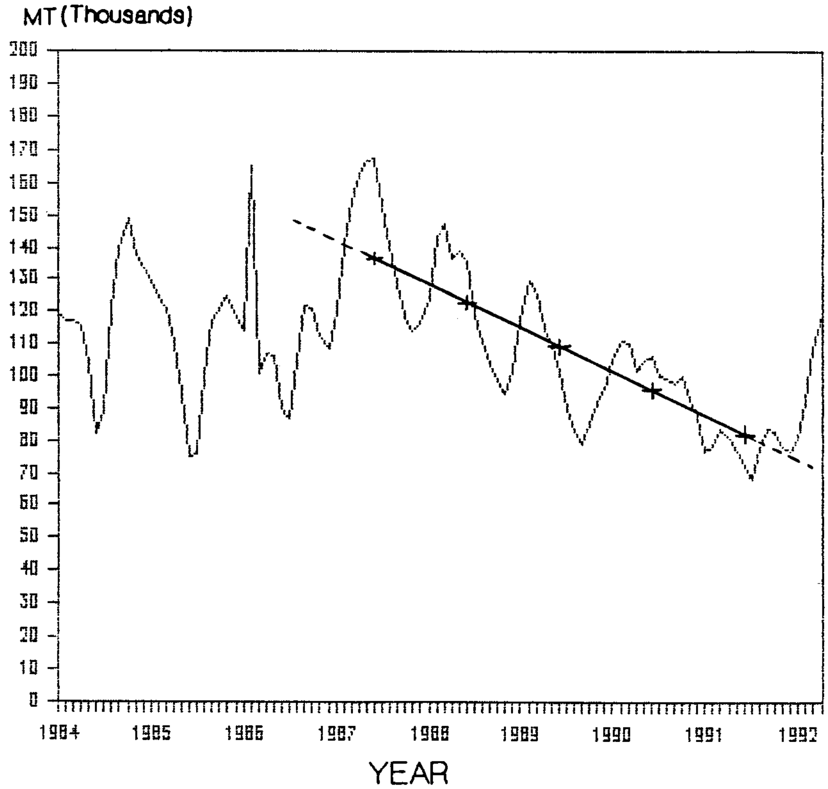


Fig. 35. Month-end levels of frozen surimi in cold storage facilities in Japan: 1/1984-4/1992.

Regression based on values from Jan. 1987 to Dec. 1991.

$\hat{Y} = 27{,}237{,}690 - 13{,}639X \qquad R^2 = 0.90$

(std. error) (7,198) (3,219)

where; $\hat{Y}$ is measured in metric tons and X is the year

able products from North American suppliers is the likely cause of this phenomenon. Investment into North American-based surimi production facilities[37,38] by large vertically integrated Japanese fishery companies such as Nippon Suisan and Tayo Gyogyou supports this interpretation.

Historical monthly dispersement levels of surimi from frozen storage in Japan display winter seasonal peaks (Fig. 36). Japanese production of surimi-based foods is highest from November to January to meet high consumer demand during the New Year holiday. However, what is consistent with historical holding level is the trend of overall decline. If interpreted as an indicator of surimi consumption in Japan, it suggests concern for the international surimi producing community tailoring itself to meet the Japanese market. This topic is later elaborated upon in Chapter VI.

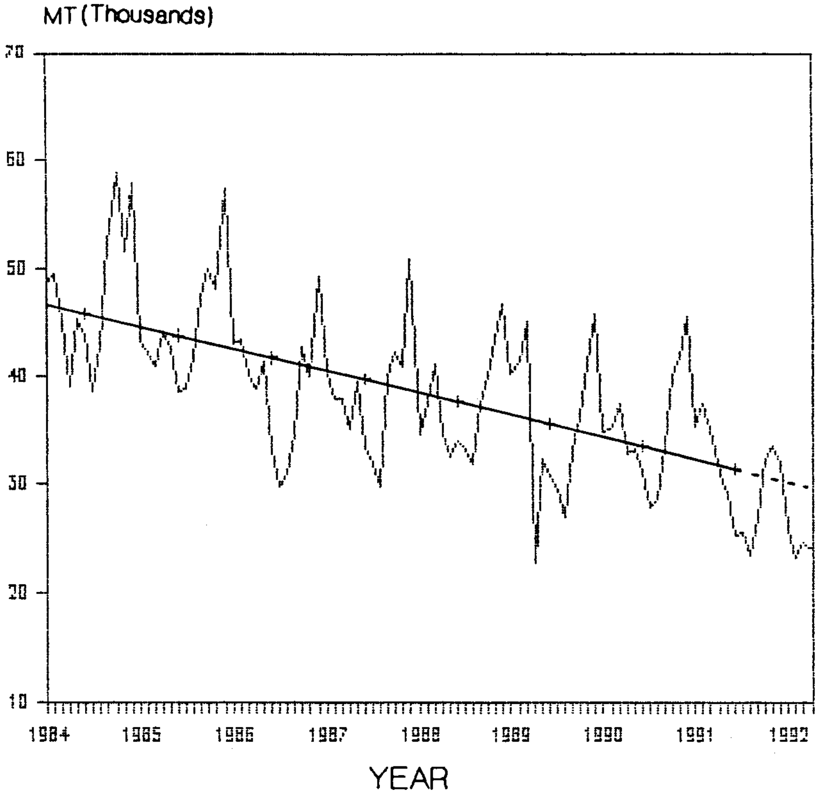


Fig. 36. Monthly dispersement of frozen surimi from cold storage facilities in Japan: 1/1984-4/1992
Regression based on values from Jan. 1984 to Dec. 1991.
$\hat{Y} = 4{,}154{,}769 - 2{,}071X \quad R^2 = 0.88$
(std. error) (1,838) (347)
where; $\hat{Y}$ is measured in metric tons and X is the year

4. Global Production Trends: Japanese and International

Japan's National Surimi Association generated an estimate of recent world surimi production (Table 34). It reveals an increasingly more balanced distribution of production among major surimi producing nations. Japan now shares leadership in surimi production with the U.S.A..

The majority of Alaska pollock world harvesting capacity, and a significant portion of surimi production, is increasingly occurring outside of Japan. Apprehension exists in food processing industries of Japan that depend on adequate supplies of surimi at historically reasonable prices. These concerns were proven justified in 1991 when Japan could not import sufficient quantities of surimi to compensate for its domestic production decline. Besides greater amounts of American-produced surimi being exported to Korea, poor landings of Atlantic cod increased European demand for pollock, most specifically fillets. Higher profitability of fillet sales

Table 34. Listing of world's major surimi producing nations* : production level facility types (Land-based and Sea-based) : 1985-1991. (Unit : 1,000 mt)

Year	Japan			U.S.A.			Korea	U.S.S.R.	Argintina	Thailand	Total
	S.B.	L.B.	S.T.	S.B.	L.B.	S.T.	S.B.	S.B.	S.B.	L.B.	
1985	240	250	490	—	—	0	20	—	—	10	520
1986	240	200	440	—	—	0	20	—	—	20	480
1987	220	260	480	—	20	20	30	—	—	20	550
1988	240	220	460	20	40	60	30	—	—	30	580
1989	150	240	390	40	40	80	30	—	10	20	530
1990	80	200	280	120	50	170	20	—	10	20	500
1991	30	160	190	120	40	160	10	20	10	20	410

Note : S.B. is production from Sea-Based vessels
L.B. is production from Land-Based locations
S.T. is Sub-Total
* : J.V. production values are allocated to producing nations not landing nations.
Source : Japan National Surimi Association

encouraged American processors to reallocate portions of surimi destined pollock into the European market. The result was an overall decline in global surimi production, and more importantly to Japan, reduced amounts of surimi available to import[39].

Japan becoming increasingly dependent on imported surimi was a predictable

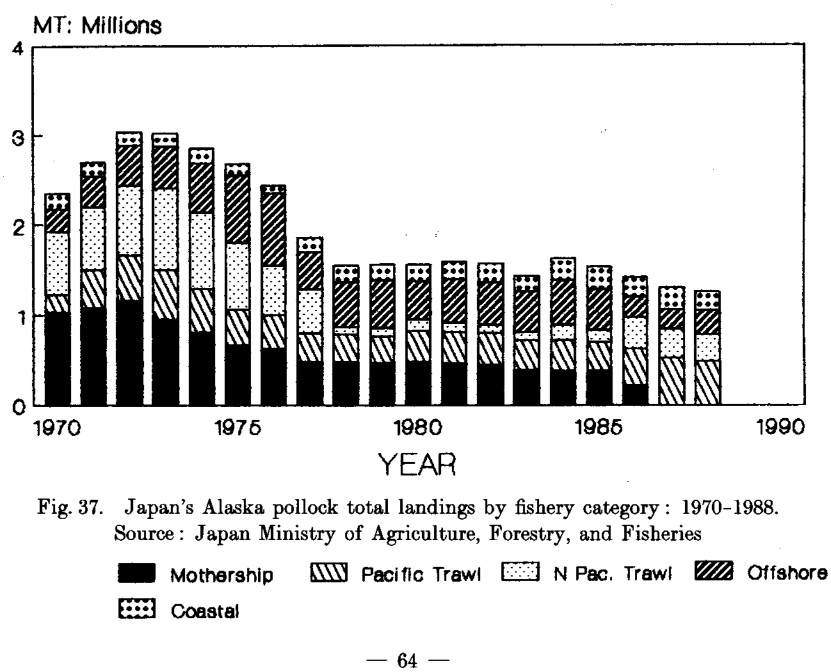


Fig. 37. Japan's Alaska pollock total landings by fishery category : 1970-1988.
Source : Japan Ministry of Agriculture, Forestry, and Fisheries

effect of the EEZ era. Alaska pollock has been the industry's dominant source-fish, since 1959 when Japan developed the industrial technology for surimi production and frozen storage. Fleets of Japanese motherships and Pacific trawlers, primarily operating within the 200 mile zones of other nations, landed the lion-share of Japan's Alaska pollock. The onset of international 200-mile EEZ policy effectively eliminated these distant water fleets as significant pollock harvesting sectors. While efforts to improve pollock harvests from other Japanese fisheries have occurred, due to inherent resource constraints, it has been impossible to compensate domestically for the decline in distant water fleet landings. Alaska pollock harvest from Japan's mothership operations and its North Pacific Trawl fleet experienced the most serious effects (Fig. 37).

Given Alaska pollock's increasing international demand and limited availability, Japan has diversified its surimi production using a variety of different fish.

Table 35. Domestic production of surimi from principal fishes in Japan: 1975-1991. (Unit: Metric Tons)

Year	Total	Alaska* pollock	Sardine, Mackerel	Atka mackerel	horse mackerel	Other
1975	422727	416250	—	2908	5	3564
1976	462738	453154	—	6361	10	3213
1977	446365	428983	—	13044	1	4337
1978	381132	369057	—	5669	1	6405
1979	380909	366366	—	7459	21	7053
1980	374244	355147	—	10853	—	8744
1981	367518	349238	1674	9064	—	7542
1982	383928	366915	2234	7629	—	7150
1983	389805	374380	3914	3141	—	8370
1984	425829	401571	8983	3875	—	11300
1985	396174	364068	13451	3540	—	15115
1986	352349	308957	13168	4451	—	25773
1987	307751	283345	5260	2464	—	16682
1988	291704	267513	4471	5286	—	14434
1989	287070	264447	3215	5973	—	13435
1990	241000	196000	i	i	i	45000
1991	211000	166000	i	i	i	45000

*: Includes fresh and frozen surimi processed at-sea or at land-based facility. J.V production excluded.

i: included within "Other" category.

Note: Non-Alaska pollock surimi is from land-based factories.

Source: Japan Fishery Products Distribution Statistics. 1990-91 values from Ministry of Agriculture, Forestry, and Fisheries, "Monthly Japanese Trade Report"-Ministry of Finance; as presented by All-Japan Kamaboko Makers Association at JETRO Surimi Forum, 1992. Tokyo.

Table 36. Total Alaska pollock landings by Japan occurring in and outside of foreign EEZs. (unit: MT)

Year	Direct Landings in EEZ without Fishing Fees			Direct Landings in EEZ with Fishing Fees			Combined Landings Including Both Fee and Non-Fee			Grand Total*				
	Sub Total	USSR EEZ	USA EEZ	Sub-Total "JV"	USSR EEZ	USA EEZ	Grand Total	USSR EEZ	USA EEZ	EEZ & Non-EEZ Landings by Japan	Non-EEZ* Landings	Percent Non-EEZ	Percent US EEZ	Percent USSR EEZ
1975				66200	66200		66200	66200	0	2743571	2677371	97.6%	0.0%	2.4%
1976				65565	65565		65565	65565	0	2510857	2445292	97.4	0.0	2.6
1977	936400	100000	836400	65323	65323		1001723	165323	836400	1924159	922436	47.9	43.5	8.6
1978	1178040	345000	833040	65461	65461		1243501	410461	833040	1609176	365675	22.7	51.8	25.5
1979	1112909	300000	812909	63773	63773		1176682	363773	812909	1614887	438205	27.1	50.3	22.5
1980	1232572	290000	942572	56500	56500		1289072	346500	942572	1609121	320049	19.9	58.6	21.5
1981	1931887	290000	941887	76338	65000	11338	1308225	355000	953225	1671640	363415	21.7	57.0	21.2
1982	1243981	290000	953971	123864	58000	65864	1367835	348000	1019835	1691345	323510	19.1	60.3	20.6
1983	1087305	290000	797305	276971	66100	210871	1364276	356100	1008176	1711399	347123	20.3	58.9	20.8
1984	1040851	270000	770851	404521	66300	338221	1445372	336300	1109072	2025872	580500	28.7	54.7	16.6
1985	915601	250000	665601	498592	66300	432292	1414193	316300	1097893	2030903	616710	30.4	54.1	15.6
1986	349453	51300	298153	591744	66200	525544	941197	117400	823697	2013536	1072339	53.3	40.9	5.8
1987	128680	124730	3950	780642	104440	676202	909322	229170	680152	2088151	1178829	56.5	32.6	11.0
1988	127620	127620	0	652384	136188	516196	78004	263808	516196	1911479	1131475	59.2	27.0	13.8
1989	121010	121010	0	243700	60200	183500	364710	181210	183500	1397450	1032740	73.9	13.1	13.0

Note : * Landings without fees occurring in USSR EEZ have been subtracted out of national Statistics Describing Domestic Production.

Source : Japan Ministry of Agriculture, Forestry & Fisheries Statistics, National Surimi Association of Japan, other sources.

While most of these alternative fish produce only medium grade surimi, some high-quality species are utilized as local specialty surimi-based products previously described.

Interesting developments are occurring in surimi production from non-traditional surimi fish. For example, in the case of kamaboko which utilizes salmon, production is diversifying. Historically, salmon-flake was combined in a variety of ways with conventional cod-based surimi, and then made into kamaboko. However, since 1991 production of salmon surimi itself has begun as a result of the recent glut of chum salmon. The flooded salmon market results from the highly successful artificial propagation efforts in northern Japan as well as low-priced imports. While production of surimi using alternative fish is dwarfed in comparison to its pollock counterpart, it remains an increasing source of optional surimi (Table 35).

A significant portion of Alaska pollock stocks harvested by Japan reside within the U.S.A. and Soviet EEZ's (Table 36). Percentages of Japanese-landed Alaska pollock harvested in U.S. and USSR waters in recent years are also presented in Table 36. The steadily declining percentage of Japanese-harvested pollock from the U.S. EEZ is an indication of rising U.S. domestic catch, not reduced total landings from the area.

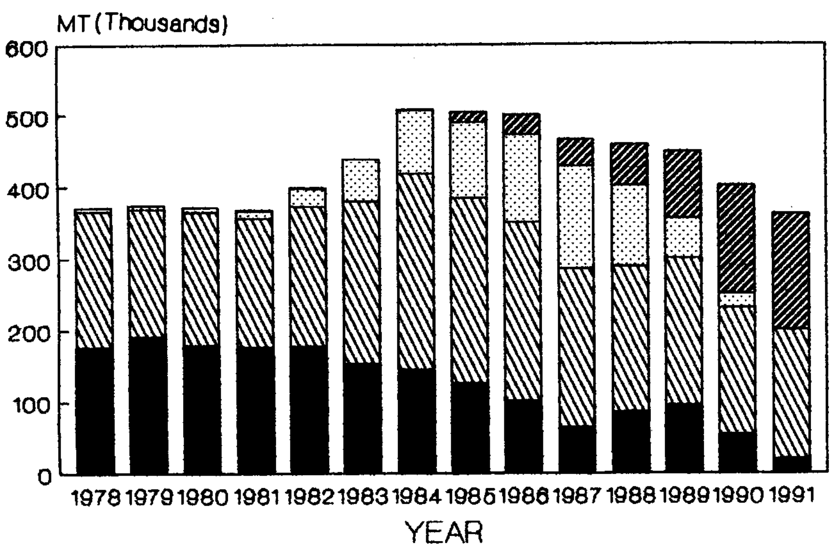


Fig. 38. Japan surimi supply including; domestic production from land-based and sea-based, joint-venture production, and direct imports.
Source: Minato Shimbun; various issues

Sea-based　Land-based　J.V.　Direct Imports

Table 37. Available supply of surimi to the Japanese market including domestic production, Joint-Venture production, and direct imports: 1978-1992.

Year	Japan National Surimi Production Level					Jonit-Venture Surimi and Direct Imports to Japan Listed by Country of Origin										J.V.'s & Imports	Grand Total Domestic, J.V.'s, & Imports
	S.B. Processing Production	L.B. Processing Production			S.B. +L.B. Sub-total	Prouction from Joint-Venture Partners					J.V. Sub-total	Surimi from Direct Imports			Imports sub-total		
		pollock —	other —	Sub-total —		USA	USSR	US+ USSR	N. Korea	US/ Canada		America	S. Korea	Other			
1978	175853	177655	12075	189730	365583			6000			6000				0	6000	371583
1979	190621	162422	14543	176965	367586			6000			6000			0	600	373586	
1980	179331	165818	19097	184915	364246		7327	7327			7327		8		8	7335	371581
1981	176442	160200	18280	178480	354922	2724	8419	11143			11143		63		63	11206	366128
1982	177095	178941	17013	195954	373049	15755	8755	24510			24510		469		469	24979	398028
1983	153593	210855	15425	226280	379873	48103	10105	58208			58208		634		634	58842	438715
1984	146000	248186	24258	272444	418444	79503	9096	88599			88599		1442		1442	90041	508485
1985	126067	226420	32106	258526	384593	96925	8231	105156			105156		4873	10000	14873	120029	504622
1986	101054	105074	43419	248493	349547	114177	8491	122668			122668	7517	8830	12000	28347	151015	500562
1987	64402	195921	24406	220327	284729	129738	13472	143210			143210	7926	8234	21000	37160	180370	465099
1988	85328	177887	24201	202088	287416	95635	14404	110039	1500	2200	113739	26795	5875	25000	57670	171409	458825
1989	96000	180305	22623	202928	298928	30840	9160	4000	2000	15000	57000	700000	3049	20000	93049	150049	448977
1990	54000	147817	28166	175983	229983	0	6378	6378	0	13800	20178	125500	20	2600	151520	171698	401681
1991	20000	130000	50000	180000	200000	0	0	0	0	1000	1000	100000	500	60000	160500	161500	361500
1992	14000	13000	41000	171000	185000	0	0	0	0	3500	35000	120000	5000	112000	237000	240500	425500

Note : 1980-85 US & USSR import values are for cod assumed from J.V. operations and all in surimi form.
1980-84 Korea and "Other" import values are for cod and assumed to be from direct imports (non-JV) in the form of surimi.
1986-89 US & USSR J.V. individual values are based on assuming all USSR surimi imports to Japan are from J.V. opperations.
1986 USA & USSR J.V. total is accurate but individual country allocation is est. based on minato newspaper 1/31/91. And all but 111 mt is surimi from cod.
1987 USA J.V. value includes an estimated 4,541 mt of non-cod surimi
1988 USA J.V. value includes no non-cod surimi (100% pollock).
1989 USA J.V. value includes an estimated 6,960 mt of non-cod surimi and assumed US portion of US/Canada J.V. value.
1990 USA J.V. value includes an estimated 10,000 mt assumed to be associated with US/Canada J.V. operations not US/USSR.

Source : Japanese Import Statistics: 1986-90.; Minato Shimbun 1/31/91, 10/28/91, 6/15/92; Japan National Surimi Assoc.; other sources.

5. Japanese Demand vs World Supply of Surimi

Over the past decade, as landings from American North Pacific trawlers grew, the supply of frozen surimi to the Japanese market has become increasingly import-oriented (Fig. 38). The growing presence of American surimi in the Japanese import market is significant. From 1986 to 1992 direct imports (not including joint-venture product) of American-produced surimi rose from holding 1.5% to 28.2% of the Japanese market. American surimi in Japan peaked in 1990 when it accounted for 31.2% of Japan's supply (Table 37).

American frozen surimi continues to increase its domestic share of the Japanese surimi market. Since domestic demand rapidly out-paces domestic supply, high-quality surimi imports receive increasingly higher prices within the market. Obviously, price distinction is a function of quality. For surimi, quality distinction is primarily created by production conditions. Given the chemical characteristics of pollock, once harvested, meat tissue quality diminishes rapidly over time[40,41,42]. Therefore, due to faster conversion from live fish to frozen surimi, all else being even, factory ship operations produce significantly higher quality surimi than shore-based facilities. Along similar reasoning, not all shore-based surimi is "created equal". The surimi industry in Japan has categorized two grades of surimi from shore-based operations. The result is a multi-tiered pricing structure for surimi in Japan.

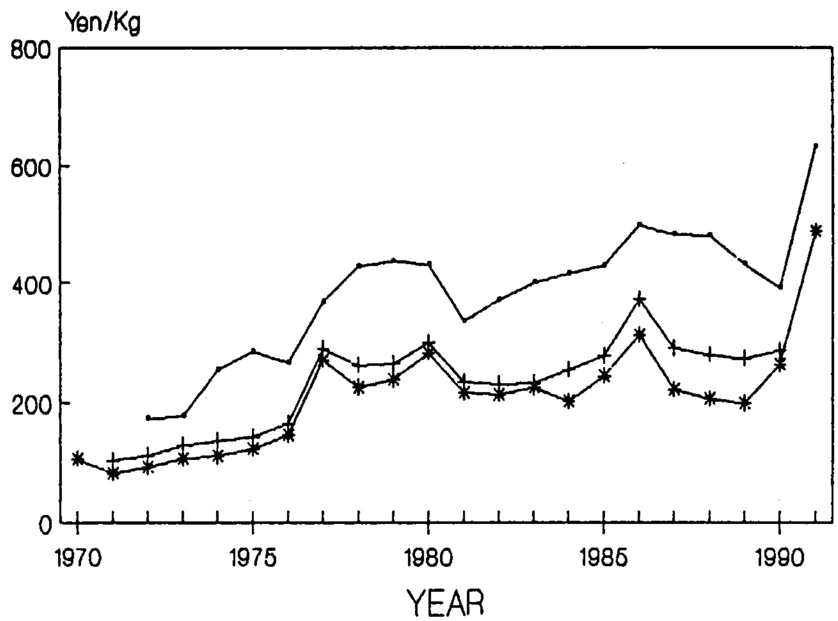


Fig. 39. Annual average prices in Japan for various grades of surimi: 1970–1991.
Source: Japan Surimi Association and Japan Keizai Shimbun (Economic Newspaper)
●: Sea-based +: Land-based Grade 1 ∗: Land-based Grade 2

6. Surimi Price Trends

It comes as no surprise that surimi prices in Japan have increased dramatically since 1976 when both the U.S.A. and USSR initiated their respective 200-mile EEZ policies. Rising demand for this increasigly limited resource has driven prices up in Japan for all three main grades of surimi (Fig. 39). Partly due to speculation and future uncertainty, surimi prices rose dramatically in 1977. The annual average price for high grade sea-based surimi remained high through 1980. However, in 1981 a significant downward price adjustment occurred due, in part, to improved confidence of future product availability resulting from joint-venture arrangements that remained firm throughout the early 1980's. From 1978 to 1990, prices for land-based surimi prices remained relatively constant. Exceptions to this were the 1981 downward price adjustment previously described and the 1986 price peak associated with the dramatic Yen appreciation after the Reagan-Nakasone 1985 Plaza Accord.

However, between January to December 1991, an unprecedented leap occurred, with prices of sea-based and land-based surimi increasing 100% and 50%, respectively. A variety of factors may have contributed to this dramatic surimi price increase in Japan. By 1990 Alaska pollock J.V. operations were phased out in U.S. EEZ waters. To a certain extent, the surimi industry in Japan may have relapsed temporarily into 1977 apprehension over future supply. A stronger argument is

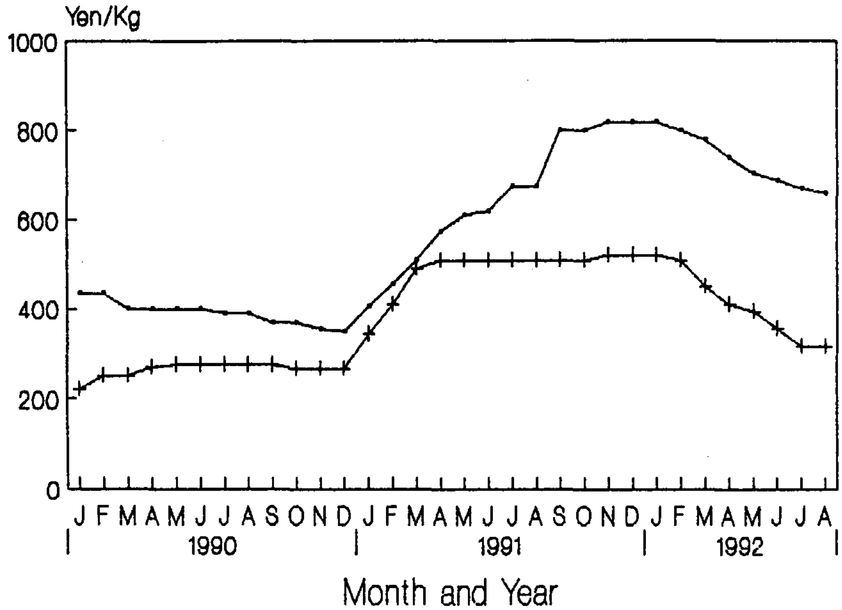


Fig. 40. Monthly average prices in Japan for various grades of surimi: 1/1990-8/1992.
Source: Japan Surimi Association and Japan Keizai Shimbun (Economic Newspaper)
●: Sea-based Surimi +: Land-based Grade 2

that prices for Alaska pollock fillets relative to surimi rose in late-1990 with the decline in the North Atlantic groundfish fishery[43]. This economic climate of relatively high pollock surimi prices may well have been perpetuated by the announcement from Canada's Minister of Fisheries and Oceans for a two year moratorium on the northern Atlantic cod fishery effective June 1992[44].

As a result, competitive demand for Alaska pollock fillets bid surimi prices up on the world market. Prices peaked in Japan by late 1991 when domestic production of surimi-based foods was in full-swing to meet high domestic consumption demand during December and January. As mentioned in Section 3.4, prices began to ease down in the spring and summer of 1992 prompting restocking of low supplies in Japan (again Fig. 35). Fig. 40 reveals the dramatic rise in monthly surimi prices from 1990 through 1991 as well as their tapering off again in early 1992.

Japan's food processing industry manufacturing surimi-based goods ("neriseihin"), is in increasingly difficult financial circumstances. "Dai Pinchi" (big pinch) is a Japanese-English phrase used by industry personnel to describe their economic dilemma[45]. They are trying to remain viable in conditions of rising production costs primarily associated with high surimi prices. Diminishing total production and higher prices for neriseihin foods in Japan are the predictable results and are quantified in Chapter V.

V. Japanese Production and Price Trends of Surimi-based foods: "NERISEIHIN"

1. "Neriseihin" Production in Japan

"Neriseihin" is the Japanese word for foods made from surimi. The historical presence in Japanese culture of neriseihin foods made from fresh surimi was pointed out in Chapter IV. The once tedious task of domestic food preparation in the home has essentially been replaced by factory processing. Fresh surimi dominated the historical household preparation of neriseihin dishes designed for immediate consumption. Therefore, although neriseihis has been produced for centuries in Japan[46], its total volume of production was relatively small compared to current levels resulting from devolopment of frozen surimi technology, industrial processing, refrigeration, and transportation advancements of recent decades.

While there are a variety of neriseihin (surimi-based) foods, they all fall into five general processed cetegories; kamaboko (steamed or to a lesser extent boiled), chikuwa (broiled), agekamaboko (fried), analog seafood (mostly artificial crab meat), and fish ham and sausage. The flavoring and preparation of most of these products is oriented to Asian taste preferences. However, analog seafood is an important exception. Analog seafood products are dominantly in the form of artificial crab meat and, to a lesser extent, scallop meat. Western consumers' growing "health food" orientation favoring affordable seafood over red meat, and perfection within the food additive industry have generated a booming demand for this specialized form of Japan's neriseihin production.

Fig. 41 presents the trend of Japanese neriseihin production by each of these five main categories as well as their accumulated annual production. Understandably, total production strongly correlates with domestic landings in Japan of Alaska

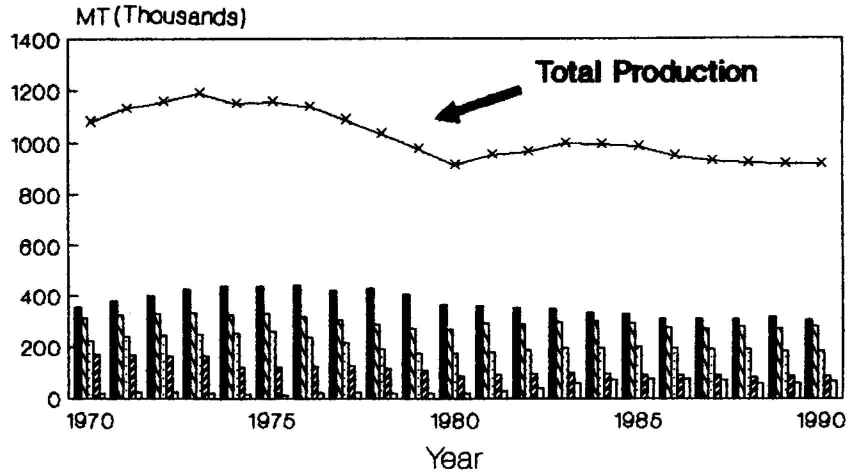


Fig. 41. Japan domestic production of neriseihin (surimi-based foods) by product form: 1970-1991.
Source: Annual Fishery Production Statistic of Japan
All Kamaboko Agekama Chikuwa Fish sausage & ham Analog crab

pollock as seen in Fig. 37 of Chapter IV. The previous chapter clearly presented the dominate role Alaska pollock maintains as the source-fish for over 90% of Japanese surimi production. Alternate surimi source-fish exist and are being pursued. However, no single species can match the volume of Alaska pollock biomass available. Therefore, the lifeline of Japan's neriseihin industry remains firmly connected to thin North Pacific resource and at the mercy of those who control it.

Japanese neriseihin production peaked in the early 1970's at the height of Alaska pollock landings in Japan. During the 1980's, production generally leveled out just under 1 million MT. For the past 20 years "Kamaboko" (including steamed and, to a much lesser extent, boiled product), has been the leading neriseihin product from followed by "agekama" (fried), and "chikuwa" (broiled), fish ham/sausage, and analog seafood. In 1991, approximately 33%, 31%, 20%, 9% and 7% of neriseihin produced in Japan was in the form of kamaboko, agekama, chikuwa, fish ham/sausage, and analog seafood, respectively (Table 38).

Reduced availability and higher prices of Alaska pollock surimi is negatively influencing kamaboko production in Japan. Kamaboko is a high-valued product and primarily produced using high-grade Alaska pollock surimi. In contrast, agekama ("satsumaage") is a fried neriseihin good comprised of 100% non-pollock surimi or a mix of low-grade pollock and non-pollock surimi. While agekama production has also declined overall since the onset of the 200-mile EEZ era began in 1977, it has done so to a lesser extent than kamaboko. In fact, as will be pointed out in Chapter VI kamaboko and satsumaage are competitive goods; albeit weakly.

Table 38. Japanese production of surimi-based foods by category and their respective percentages of total production.
Unit: M.T.

Year	Annual Total	Chikuwa (broiled)	% of Total	Fish ham & sausage	% of Total	Kamaboko* (steamed)	% of Total	Agekama (fried)	% of Total	Analog** seafood	% of Total
1970	1081331	221484	20.5	169539	15.7	356398	33.0	313552	29.0	20358	1.9
1971	1127104	238539	21.2	165368	14.7	379816	33.7	322.161	28.6	21220	1.9
1972	1156200	244615	21.2	162395	14.0	399783	34.6	326623	28.2	22784	2.0
1973	1187466	249172	21.0	164306	13.8	425645	35.8	331474	27.9	16869	1.4
1974	1148698	250946	21.8	120518	10.5	437639	38.1	324149	28.2	15446	1.3
1975	1154970	258882	22.4	120708	10.5	437551	37.9	327068	28.3	10761	0.9
1976	1136747	235278	20.7	123114	10.8	441025	38.8	316929	27.9	20401	1.8
1977	1086962	214393	19.7	125088	11.5	419953	38.6	303224	27.9	24304	2.2
1978	1037216	190911	18.4	113109	10.9	427100	41.2	289481	27.9	166615	1.6
1979	976191	177192	18.2	106815	10.9	402420	41.2	272175	27.9	17589	1.8
1980	911141	174377	19.1	87412	9.6	362104	39.7	269211	29.5	18037	2.0
1981	948882	180678	19.0	91865	9.7	359627	37.9	291412	30.7	25300	2.7
1982	960876	187734	19.5	95152	9.9	352074	36.6	289361	30.1	36555	3.8
1983	996171	194931	19.6	98098	9.8	346557	34.8	297257	29.8	59328	6.0
1984	990449	196221	19.8	94688	9.6	330154	33.3	298063	30.1	71323	7.2
1985	983765	199861	20.3	92279	9.4	327290	33.3	290979	29.6	73356	7.5
1986	945300	195351	20.7	90732	9.6	309375	32.7	276209	29.2	73633	7.8
1987	295933	189297	20.4	89146	9.6	307050	33.2	271488	29.3	68952	7.4
1988	920533	190451	20.7	84304	9.2	307472	33.4	277618	30.2	60688	6.6
1989	915831	184713	20.2	85345	9.3	314199	34.3	273563	29.9	58011	6.3
1990	914774	181693	19.9	85653	9.4	302551	33.1	279607	30.6	65270	7.1
1991	873313	174735	20.0	78331	9.0	290663	33.3	270263	30.9	59321	6.8

Source : Japan Agriculture, Forestry and Fisheries Ministry, Annual Distribution Statistics.

Note : * "Kamaboko" includes kamaboko that has been steamed, boiled, packed or processed in some "other" much less common manner.

Note : ** Analog seafood is listed under "other neriseihin" catagory in national statistics but is identified by Japan Export Trade & Research Office (JETRO) as analog product that is mostly artificial crabmeat with the rest being scallop meat analog.

Supportive of this observation is the general negative correlation between production of kamaboko and agekama in Japan during recent decades (Table 38). As quantified in Chapter VI, should this trend continue for the near future, agekama will grow in importance in terms of both production and domestic consumption over that of combined kamaboko products. This implies that the high prices for quality pollock surimi are driving down its consumption in Japan and encouraging consumer shifts toward fried neriseihin comprised of non-pollock surimi.

During the 1970's fish ham and sausage production was well ahead of analog seafood (15% versus 2% of total production). However, the last 20 years witnessed Japan's fish ham and sausage production drop by half while analog seafood production tripled. Therefore, by 1990 analog seafood production rivaled that of fish ham and sausage. Both domestic and international market forces demanding diverse high quality analog products explain the rapid growth in analog production. A profitable export market for analog seafood, especially in the United States and Europe, was a driving force in increasing domestic production in Japan during the mid-1980's. In addition, fish ham and sausage produced in the 1960's and early 1970's was composed of then inexpensive South Pacific tuna (mostly skipjack). Obviously, tuna is no longer an economical source-fish for relatively low-priced sausage or ham products. This contributed to the decline of fish ham and sausage production and its corresponding reduced percentage of total neriseihin volume.

2. Export of analog seafood meats by product and country of destination

In 1990, 24,000 MT of neriseihin products valued at over $92 million were exported from Japan. This is down from 1988 and 1989 levels primarily due to a 50% drop in export volume of this product to the United States between 1988 and 1990. The value and quantity of all surimi-based food exported by Japan is presented in Table 39.

Table 39. Value and quantity of Japanese exports of all surimi-based foods by country of destination: 1988-1990.

Country	Export Value (US $1000)			Export Quantity (Unit: MT)		
	1988	1989	1990	1988	1989	1990
Total	117905	954951	92374	27566	23397	23885
America	40078	23889	17825	10353	6261	5068
Taiwan	13232	17394	17786	2419	3469	3561
Spain	13082	8451	11378	2663	2109	2925
Holland	12010	10601	8839	2647	2525	2388
France	7470	7275	5982	1512	1717	1425
Australia	4962	5295	5802	1493	1758	1954
England	4219	4697	5552	1042	1307	1601
Hong Kong	3182	4042	5374	680	909	1199
Other	19670	13307	13836	4757	3342	3764

Source: Japan Finance Ministry Trade Statistics in JETRO, 1991.

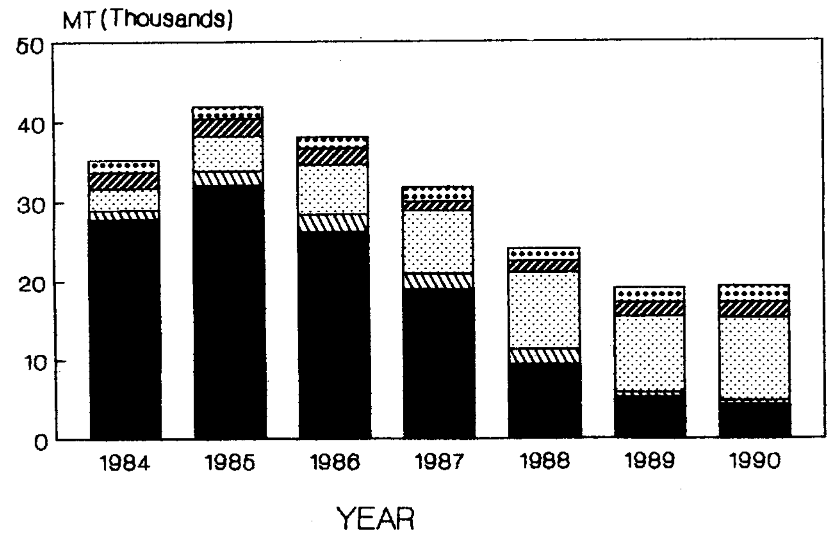


Fig. 42. Japan exports of seafood analog products by country of destination: 1984-1990.
Source: JETRO, Annual Trade Statistics

Exports of analog seafood, mostly artificial crab meat destined for the United States, peaked in 1985 and has declined ever since (Fig. 42). American demand remains strong, yet domestic U.S. production is increasingly capable of supplying the North American market. Western Europe and Australia have become important alternative markets for Japanese seafood analog exports. In 1990, they accounted for 54% and 10% of analog crab meat exported from Japan, respectively (Table 40). This is up considerably from 1984 when W. Europe and Australia only made up 8% and 5% of Japanese analog crab exports. In contrast, from 1984 to 1990, annual exports of Japanese analog crab meat destined for America dropped from 82% to 25%.

International demand for analog seafood meat was the initial force motivating the Japanese neriseihin production sector to dramatically increase output of this commodity. However, in recent years, domestic demand for "flavored kamaboko" has sustained it as an important commodity. Rising prices of surimi have translated into higher prices of neriseihin goods. To sustain profitability and consumer interest, many kamaboko manufacturing firms are diversifying into these high value-added forms of "flavored kamaboko" (which includes analog seafood meat).

The early 1990's saw a variety of these specialty forms of flavored kamaboko being marketed in gift item form with dramatic success. Typical examples include kamaboko mixed with high grade seafood such as seaweed, shrimp, scallop, and sockeye salmon. Kamaboko mixed with locally popular agricultural crops such as corn, potato and asparagus are common also. The most common packaging of this

Table 40. Seafood analog frozen exports from Japan by country of destination: 1984-1990.

(Unit: MT)

Country	1984	% of Total	1985	% of Total	1986	% of Total	1987	% of Total	1988	% of Total	1989	% of Total	1990	% of Total
Total	35298	100.0	41970	100.0	38101	100.0	31732	100.0	24066	100.0	18959	100.0	19249	100.5
crab meat	32461	92.0	38986	92.9	35675	93.6	28356	89.4	21096	87.7	15722	82.9	15993	83.1
U.S.A.	27736	78.6	32064	76.4	26218	68.8	18814	59.3	9321	38.7	5224	27.6	4203	21.8
crab meat	26754	82.4	30900	79.3	25306	70.9	17623	62.1	8729	41.4	4979	31.7	400.0	25.0
Canada	1213	3.4	1828	4.4	2226	5.8	2132	6.7	1870	7.8	568	3.0	540	2.8
crab meat	779	2.4	1413	3.6	1924	5.4	1802	6.4	1682	8.0	465	3.0	430	2.7
West Europe	2737	7.8	4335	10.3	6106	16.0	7815	24.6	9798	40.7	9602	50.6	10522	54.7
crab meat	2602	8.0	4067	10.4	5769	16.2	7109	25.1	8555	40.6	7846	49.9	8693	54.4
Australia	2010	5.7	2215	5.3	2158	5.7	1228	3.9	1486	6.2	1732	9.1	1930	10.0
crab meat	1642	5.1	1873	4.8	1876	5.3	1043	3.7	1276	6.0	1509	9.6	1660	10.4
Other	1602	4.5	1528	3.6	1393	3.7	1743	5.5	1591	6.6	1833	9.7	2054	10.7
crab meat	684	2.1	733	1.9	800	2.2	779	2.7	854	4.0	923	5.9	1210	7.6

Note : Foods with crab analog topping not included.

Source : Japan Frozen Foods Inspection Co-operative and National Export Statistics as presented in JETRO Annual Agriculture and Fishery Trade Handbook: 1989 & 1990.

period is the use of vacuum-sealed clear plastic to optimally display the product to consumers.

In addition to consumers purchasing for conventional household consumption, producers are targeting domestic Japanese tourist with these new flavored kamaboko products. The advantage of targeting domestic tourists is that it boosts summer consumption of kamaboko which is relatively low compared to fall and winter. Traditionally, Japanese tourists buy gifts for relatives and friends that generally represent the area visited. Local varieties of these value-added forms of neriseihin are seen by many in the industry as an important component of the future domestic industry[47].

3. Domestic prices in Japan for major nariseihin products

Historically, the retail price of kamaboko has lead significantly over agekama and chikuwa products[48] (Fig. 43). Over the past decade, prices have increased for all three product forms with kamaboko prices rising more quickly than agekama and chikuwa, whose price rises have paralleled each other. In contrast, since 1977, fish ham and sausage prices have remained relatively constant until 1989 when they began rising.

As the highest quality neriseihin product, kamaboko is among higher-valued seafoods that collectively are increasingly finding their high retail prices in direct competition with those of meats. Over the past decade, kamaboko retail prices

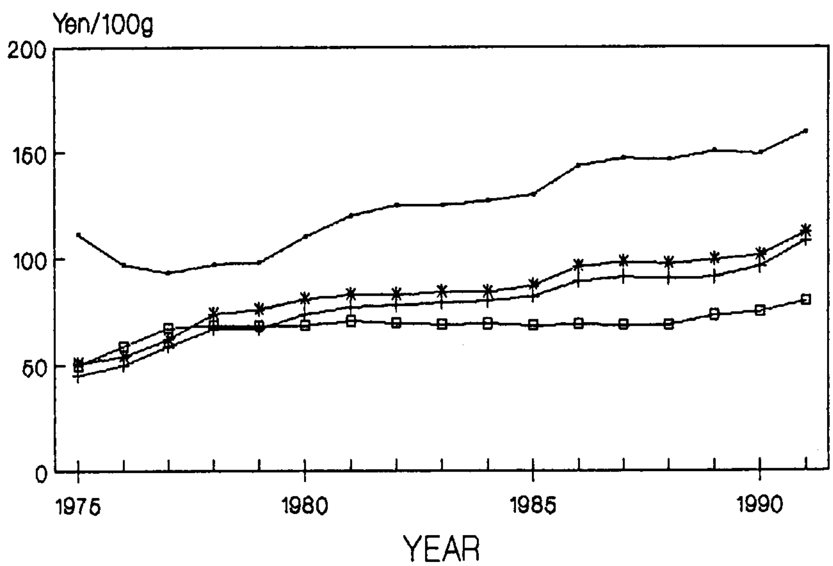


Fig. 43. Retail prices in Japan of four major neriseihin product forms: 1975-1991.
Source: Annual Report on the Family Income and Expenditure Survey; and the Annual Report on the Retail Price Survey
●: (Kamaboko) Steamed +: (Agekama) Fried ∗: (Chikuwa) Baked
□: Ham & Sausage

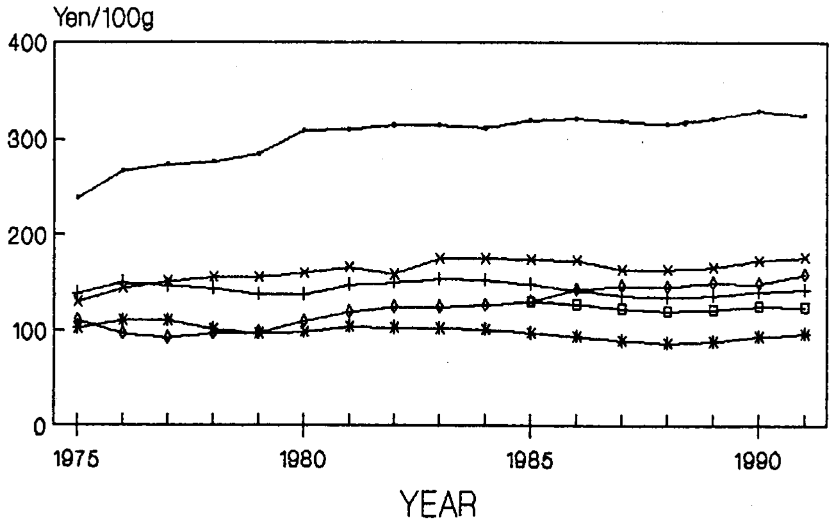


Fig. 44. Retail prices trends of kamaboko and other non-fishery proteins in Japan: 1975-1991.
Source: Japan Annual Report on the Family Income and Expenditure Survey; and the Annual Report on the Retail Price Survey
●: Beef +: Pork *: Chicken □: Ground-meets ×: Other fresh meat
◇: Kamaboko

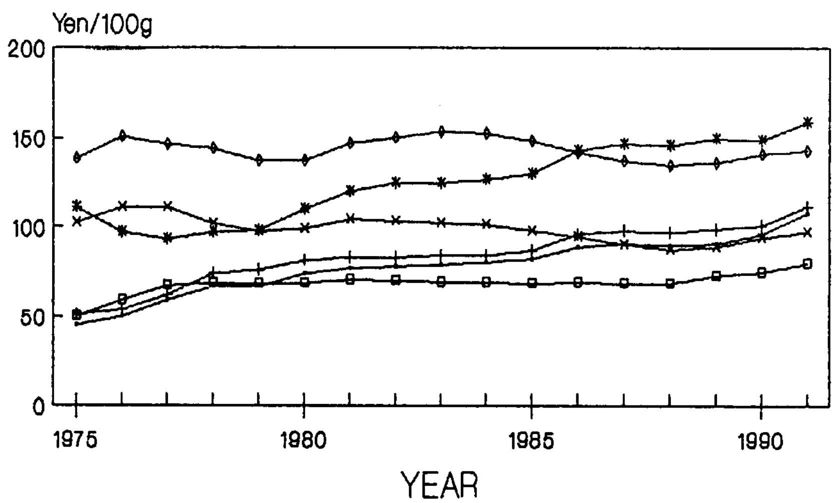


Fig. 45. Retail price trends in Japan of neriseihin and selective meats: 1975-1991.
Source: Japan Annual Report on the Family Income and Expenditure Survey; and the Annual Report on the Retail Price Survey
●: Agekama +: Chikuwa *: Kamaboko □: Fish-sausage
×: Chicken ◇: Pork

have risen sufficiently to exceed those of chicken, ground meats, and pork[49] (Fig. 44). Since 1987, the retail price of chicken has been less than that of chikuwa and agekama (Fig. 45). The degree to which these alternative animal and seafood proteins are considered by Japanese consumers as substitute goods is important when estimating future demand for neriseihin foods in Japan and will be inventigated in the following chapter.

The contribution of this brief chapter has been to compliment the previous presentation of direct correlation between neriseihin production and Alaska pollock landings in Japan, with the following: 1) document clear evidence of the expected inverse relationship between neriseihin total production and its price; and 2) present growing price competitiveness of meats to neriseihin foods in Japan. Chapter 5 will study how Japanese household consumption of neriseihin foods has been influenced by these and other socio-economic factors.

VI. Food Consumption Trends within the Japanese Household

1. Japan's Changing Consumer Behavior in Light of its Rising Level of National Affluence

As pointed out in Chapter One, Japan has emerged as a world economic power in recent decades. It is important to restate that the Japanese have shifted from their traditional position of high rates of saving relative to personal consumption, into a "nation of consumers"[50]. This is a direct result of rising personal income and the elimination of tax-exempt status for personal savings in the late 1980's. Between 1975 and 1987, Japan's personal sector net financial wealth/income rose from 0.99% to 2.17% while the saving ratio over the same time period fell from 22.8% to 15.1%[51]. This economic prosperity has provided many Japanese consumers with opportunities of variety that were otherwise unavailable as their previous level of expendable income.

Visible examples of shifting consumer behavior toward higher priced goods and services include increased leisure-time spent in expensive activities such as travel, sports, and private lessons. (The love affair of the Japanese with golf is the most well known example.) In addition, consumption of durable goods like new automobiles, household appliances, and furniture has increased considerably in Japan during recent years[52]. Table 41 provides a brief list of specific goods and their respective income elasticities ($\cap$) as an indicator of consumption response by Japanese to increased personal wealth.

An income elasticity ($\cap$) greater than 1 indicates the item is considered a "superior" good and consumers will increase the fraction of their income for that item as their incomes rise*. Household durable goods, automobiles and recreational activities are examples of such items for the Japanese consumer.

Similarly, when an item's income elasticity of demand is $0 \leq \cap \leq 1$, it is considered a "normal" good and the fraction of income spent on it decreases as income rises. When $\cap < 0$ the item is considered an "inferior" good. In general, for the average household in Japan, food consumed in the home is a normal good. Of course,

* This assumes constant prices.

Table 41. Income elasticities for selected goods in Japan as calculated for all households during 1991.

Item	Income Elasticity (n)
Household Durables	1.36
domestic durables	0.65
heating & colling appliances	1.30
general furniture	2.46
Domestic non-durable goods	0.47
Domestic services	0.77
Automobiles	1.32
Bicycles	0.93
Recreational durable goods	1.14
Recreational goods	0.89
Recreational services	1.30
hotel charges	1.46
package tours	1.50
lesson fees	1.35
Dining out	1.08
general meals	1.15
school lunch	0.48
Food	0.46
meat	0.76
seafood	0.61
dairy products	0.52
eggs	0.47

Source: Statistics Bureau, Management and Coordination Agency of Japan. Family Income and Expenditure Survey, 1991.

separate foods are relatively more or less sensitive to changes in domestic consumption as income shifts (different $\cap$ values). Some goods may change from being "inferior" to "normal" and/or "superior" for different levels of income. This is important to understand when quantifying changes in Japanese food consumption as they become financially better off.

Findings by Higuchi (1991) indicate the "Japanese-style diet", compared to non-Japanese dietary systems, is characterized by a consistent, an relatively low, daily calorie profile (2,600 kcal calorie supply and 2,000 kcal caloric intake) sustained over increasing levels of income. In general, once caloric supply reaches roughly 2,600 kcal/day, Japanese do not increase total food consumption as their incomes rise but rather have diversified food types within this consumption limit[53]. This finding is supported by the Japanese Government's forecast of total daily calorie supply in the year 2,000 as 2,630 kcal; essentially the same as the 1988 level[54].

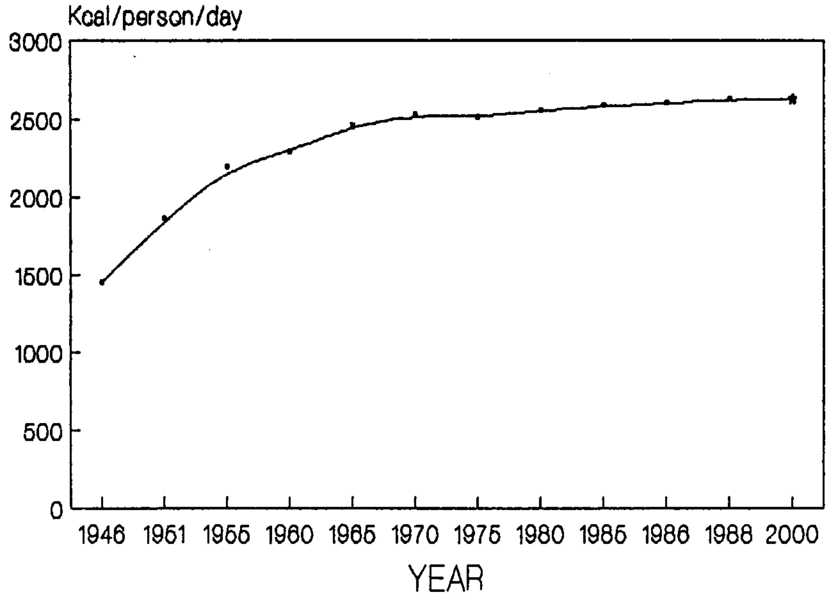


Fig. 46. Japanese per capita caloric supply as a function of average real household income.
Source: MAFF Food Balance Sheets
■: Daily caloric intake ＊: Government estimate

Figure (Fig. 46) graphically represents the historical Japanese per capita caloric supply as a function of average real income per household. Periodic consumption and income statistics from 1946 to 1991 were used to construct the diagram. Income was CPI (1990=100) adjusted to generate "real" values. The government estimate[55] for per capita caloric supply in the year 2000 was incorporated by calculating real income for that year based on 3% real growth using 1990 as the base year.

It would appear that the average individual in Japan does not continue to eat "more of everything" once his or her household reaches a certain degree of wealth. The graph shows that when Japanese reach an average real household income of ¥6 million (reach in 1988), per capita daily caloric supply approaches its limit. The average annual household income in Japan for 1991 was ¥6.6 million. In other words, per capita caloric supply is no longer significantly increasing in Japan. Instead, as caloric supply stabilizes around 2,630 kcal/yr, the Japanese are simply changing what they eat and where they eat it.

2. Dining-out vs Household Consumption in Japan

Obviously, food consumption occurs either at home or when "dinidg out". Japanese have steadily increased the percentage of their expenditures on food and beverages consumed while eating out to reach 27% in 1985[56]. In Table 41 dining out (excluding school lunches) is shown as a superior good ($\cap > 1$) and food in general, (that purchased for home consumption) as a normal good in Japan. The implication is as incomes rise, Japanese are consuming more of what they eat outside the home. In addition, rising income is altering the proportions of different foods consumed relative to one another. For example, with a rise in personal income more meat is consumed ($\cap$ =0.76) in comparison with seafood ($\cap$ =0.61). In addition to rising income, changes in relative commodity prices an shifts in personal taste preferences also influences the relative proportion of what Japanese eat as well as overall food composition.

Engel curves are a means of quantifying this shift in consumption. An Engel curve is a function relating the equilibrium quantity purchased of a commodity to the level of money income[57]. The name is from its creator Christian Lorenz Ernst Engel, a 19th-century German statistician. The slope of the Engel curve at any given point indicates the income elasticity of demand ($\cap$) for the good at that corresponding income level*. An Engel curve implicitly assumes constant prices for the time period evaluated. Engel curves based on data for a given annual period were an attempt to accommodate the assumption since wages are generally

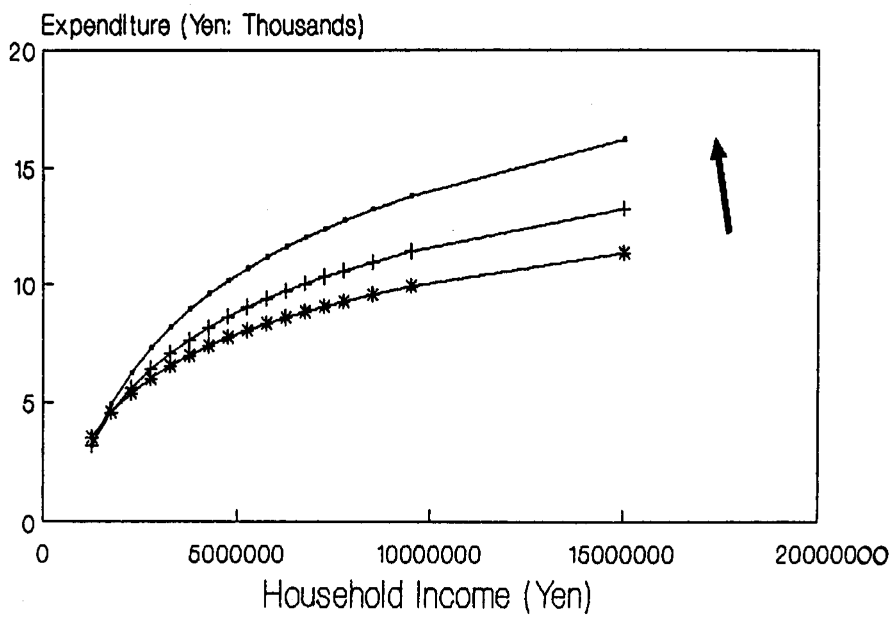


Fig. 47. Dining-out monthly average expenditures as a function of household income: 1980, 1985, 1990.
(CPI adjusted and valued in 1990 Yen.)
Source: Calculated from Annual Report on the Family Income and Expenditure Survey
■: 1990 +: 1985 ∗: 1980

* Generally, income elasticities calculated for a particular good correspond to the average income level for the population under scrutiny.

fixed for the year. Changes observed between Engel curves would then reflect variation in prices and consumption location (dining out versus at home) between different years. The result provides a means of detecting consumption trends for specific foods as well as estimating their future quantity levels. Descriptions of the derivation methods used to generate the various Engel curves are presented in Section3.

It has been shown in Table 41 that Japanese dine out more as their incomes increase. Therefore, provided the assumption holds that increases from current levels of income in Japan will not significantly raise total personal food consumption, an Engel curve depicting Japanese consumption while *dining-out* would shift *upward* over time as incomes rise. Such an Engel curve is difficult to generate since dining-out consumption quantity is not readily available. However, it is possible to use real expenditure on dining-out as a function of household income (as similarly done for beef consumption in America by Huang and Raunikar, (1981)[58]).

Such functions were generated for Japanese households in 1980, 1985, an 1990 based on regression of CPI (1990=100) adjusted expenditures on eating-out (excluding school lunches). The results are seen in Fig. 47 and reflect the predicted upward shift described above. This clearly shows that between 1980 and 1990, the expenditure elasticity associated with dining-out has risen across all income levels.

Conversely, an Engel curve depicting Japanese *household* consumption would

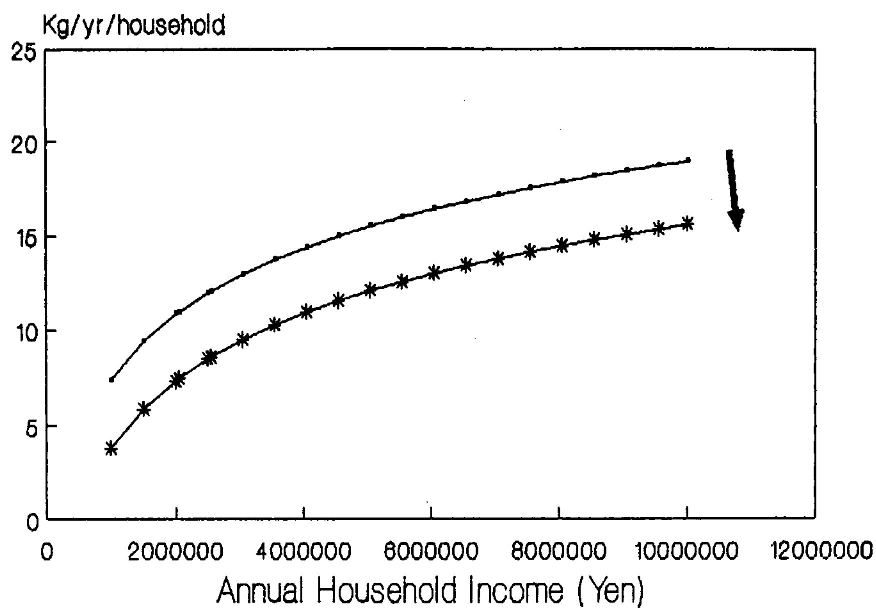


Fig. 48. Engel curves for household consumption of chicken as an example of the "Dining-out Effect": 1980-1990.
Source: Calculated from Annual Report on the Family Income and Expenditure Survey
■: 1980　∗: 1990

shift *downward* as incomes rise. This downward shift could be called the "dining-out effect". A general example of this phenomenon is depicted in Fig. 48 for annual household consumption of chicken between 1980 and 1990*.

The implication is that a curve plotting Japanese per capita total daily caloric supply across increasing levels of average personal income (depicted in Fig. 46) would remain constant over time. This occurs because consumers' trade consumption at home for calories consumed outside the home.

Therefore, as food consumption at home declines, dining-out increases and is thus reflected with corresponding shifts in their respective Engel curves as plotted over progressive years.

Assuming income elasticities for foods in question remain unchanged over time at each income level while household consumption declines, their respective Engel curves would shift downward together relative to one another. However, if a good's elasticity of demand decreases over time within or across income levels, its Engel curve "bends" downward. Fig. 49 is an example of this occurring with consumption of fresh seafood at home from 1980 to 1990. This effect changes its relative position to Engel curves of different goods. Such a shift would represent a change in the proportions of these foods being consumed by households represented within

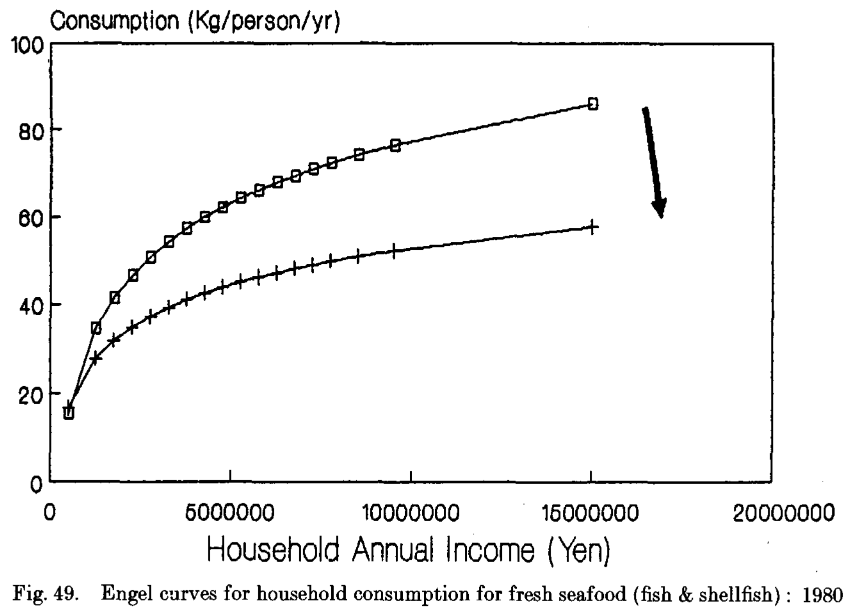


Fig. 49. Engel curves for household consumption for fresh seafood (fish & shellfish): 1980 & 1990.
Source: Calculated from Annual Report on the Family Income and Expenditure Survey
+ : 1990 □ : 1980

* Chicken is used because of its relatively constant retail price during this period (Figure 45 in Chapter V).

the affected levels of income. This could be termed the "price effect" because changing relative food prices (which alter real expendable income) is a strong factor influencing such declining elasticities. In this Chapter, the combined influence of the "dining-out effect" and "price effect" on household food consumption in Japan is quantified for neriseihin goods.

Household consumption is focused upon for the following reasons: 1) while expenditures on dining-out increasingly accounts for more of a family's annual food budget (estimated to be >20% in 1990[59]), household consumption remains the dominant contributor; 2) well-defined national statistics on quantities of different foods consumed while dining-out, and their relative prices, are not available; 3) national statistics on household consumption in Japan do exist.

Analyzing shifts in household consumption of various foods in Japan was primarily made possible by utilizing information provided by the Statistics Bureau, Management and Coordination Agency of Japan as presented in numerous volumes of their Annual Report on the Retail Price Survey and The Annual Report on the Family Income and Expenditure Survey. The emphasis of analyses presented here is on surimi-based foods and alternative (both competitive and complimentary) forms of protein. The implications to consumption while dining-out, and therefore total personal consumption of these goods, is inferred.

3. Engel Curve Derivation Methods

Two sets of Engel curves and their data source

Two sets of Engel curves were derived for various categories of goods consumed in Japan over a period of several years to observe and evaluate the shifts described above. The first set of Engel curves describe per capita consumption for "food groups" such as fresh seafood, fresh meats, and neriseihin foods. The second group describes household consumption of specific foods within the fresh meat and neriseihin food groups. (Another collective neriseihin Engel curve is also calculated among this second set for reasons later described.) These specific foods are; beef, chicken, pork, kamaboko, chikuwa, satsumaage, and fish ham and sausage. Both sets of Engel curves are derived from data provided in the Annual Report on the Family Income and Expenditure Survey. The only difference is in the number of income categories that has data available regarding expenditures (and therefore derivable quantity consumption values) on these specific foods or food groups.

In each Annual Expenditure Survey Report, 18 income categories for that given year (based on "all households" in Japan) are listed with corresponding data on monthly average expenditures per household for aggregated classifications of consumable goods. It is from this table that the following curves were generated; per capita Engel curves for fresh seafood, fresh meats, and neriseihin foods, as well as the dining-out expenditures curve presented previously in Fig. 47.

Unfortunately, expenditures on the specific foods in question are not provided at this high level of income category resolution. However, this reference does separately provide annual average expenditure data for the desired specific foods on the basis of 5 income categories. It is from this latter data set that the Engel curves on household consumption of beef, chicken, pork, kamaboko, chikuwa, satsumaage, and fish sausage/ham were derived. What follows is a description of the derivation method for each set of Engel curves.

Derivation of food group per capita Engel curves

As indicated, the Annual Report on the Family Income and Expenditure Survey provides national domestic household consumption expenditure data on what an average household in 18 income categories spends monthly on "fish-paste products". The four major forms of fish-paste products these aggregated expenditures refer to are satsumaage (fried), chikuma (baked), kamaboko (steamed), and fish ham and sausage. Annual household expenditures by each income group on fish-paste products were derived by multiplying this monthly figure by twelve. In the absence of a national average retail price for fish-paste procucts, greater Tokyo area retail prices on each of the four fish-paste goods were collected from the Annual Report on the Retail Price Survey. These values were used as the national average price for each neriseihin form because they were determined to consistently fall within the range of an estimated national average. An average price for neriseihin foods in general was calculated from these product specific retail prices. This price was divided into the expenditure figures mentioned above to calculate the quantity purchased per average household in each of the 18 yearly income groups for that given year. Per capita consumption was derived by dividing these household values by average household size for the year under evaluation as detailed elsewhere in the Family Income and Expenditure Survey. The average household size in 1980, 1985 and 1990 was 3.82, 3.71, an 3.57 persons, respectively.

These values for neriseihin per capita consumption within the average Japanese households of 18 different income categories were used to conduct linear regression analysis. For example, the derived equation for 1980 is:

$$\hat{Y} = -7402.18 + 1694.38 \log(X)$$

$$\text{std err.} \quad (213.38) \quad (145.42) \qquad R^2 = 0.90$$

$$\text{Degrees of freedom} = 16$$

where: $\hat{Y}$ is estimated per capita consumption (gram/yr) and X is annual household income during the year 1980.

The equation was used to generate corresponding values of estimated per capita household consumption ($\hat{Y}$) as a function of household income (X). For this case example of 1980 household neriseihin consumption, a graphical representation of both the actual consumption data and plotted Engel curves derived through the regression analysis is presented in Fig. 50. In an effort to avoid overly "busy" graphics, Engel curves graphically presented hereafter will not be accompanied by the original data points from which they were derived. However, the derived equations and their corresponding R^2 and standard error values are provided in order to gauge closeness of fit.

The process for deriving Engel curves for fresh seafood (fish and shellfish) and fresh meats was less elaborate because of the existing national average retail prices. Fresh seafood and fresh meat Engel curves were derived by first calculating quantity consumed of each food group within each income category. This was accomplished by taking expenditures for these food groups within each income level and dividing them by their respective annual average price as presented in the Annual Report on

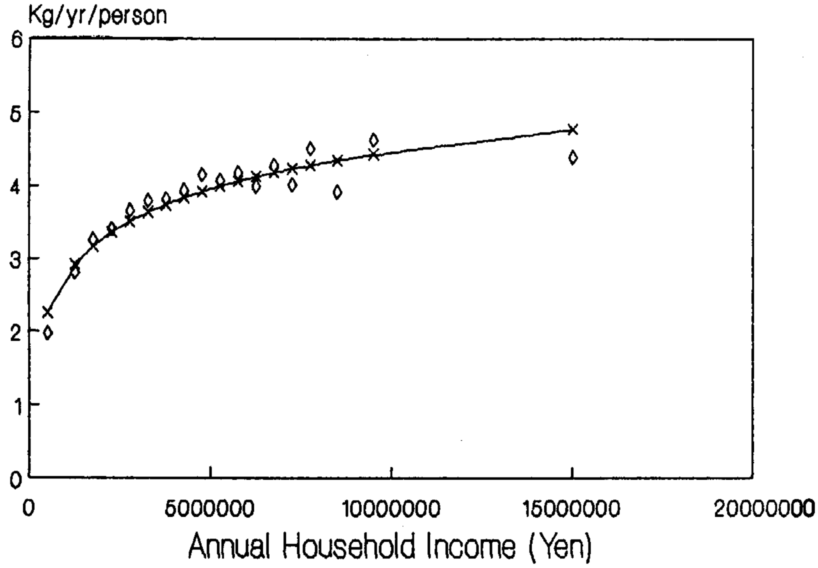


Fig. 50. Japanese household per capita neriseihin consumption Engel curve : regression-based and original 1980 data.
Source : Calculated from Annual Report on the Family Income and Expenditure Survey
× : 1980 Regression Plot ◇ : 1980 Original Data

Family Income and Expenditure Survey. Per capita household consumption was determined by dividing average household population into household consumption values for each income category. Regression analysis was conducted on these per capita consumption values thus producing estimated per capita consumption at home as a function of household income. Engel curves calculated in this fashion for fresh seafood and fresh meat were determined for 1980 and 1990 and are presented in Section 4.

Derivation of Engel Curves for household consumption of specific foods

As previously described, the Annual Report on the Family Income and Expenditure Survey also provides national household consumption expenditure data on what an average household in 5 income categories spends annually on specific foods including beef, chicken, pork, and individual fish-paste products such as satsumaage (fried), chikuwa (baked), kamaboko (steamed), and fish ham and sausage. These expenditure data points were fixed against a specific level of income as determined by the arithmetic mean of the corresponding income level range. The expenditure values for beef, chicken and pork were converted to consumption quantities by dividing them by their respective average annual price as calculated for each income category by the Family Income and Expenditure Survey. Regression analysis was conducted upon these quantities as a function of income, thus generating the Engel curves for beef, chicken and pork for the corresponding year. These curves and their respective equations are presented in Section 5.

A national average retail price for each specific fish-paste product was not presented in the Family Income and Expenditure Survey. Therefohe, for reasons previously described, greater Tokyo area retail prices on each product form were collected from the Annual Report on the Retail Price Survey and used as the national average price. These retail prices were then divided into expenditure figures mentioned above to calculate the specific product quantity purchased per average household in each of the 5 yearly income groups for that given year. Regression analysis was conducted upon these household consumption quantities to generate Engel curves for these specific neriseihin food quantities as a function of income.

In addition to the per capita neriseihin Engel curve described in Section 3, an Engel curve for collective consumption of neriseihin foods was conducted using this data set based on 5 income brackets as well. This was done to compare a neriseihin (combined) Engel curve with beef, chicken and beef as generated by identical data sets. This second set of annual neriseihin Engel curves were derived by summing consumption quantities of each product form within each income group to provide an estimated total quantity of neriseihin goods purchased by an average household within each of the 5 income categories for a given year. Regression analysis was coducted upon these quantites as a function of household income. The resulting Engel curve and their respective equations are presented in Section 5.

4. Japanese Consumption of Seafood and Meats

In recent decades, the "dining-out effect" previously described has caused heusehold food consumption of both fish and meat to decline in Japan for all income levels. However, the relative decline for both food groups is not constant across all levels of income. For example, between 1980 and 1990 per capita consumption at home of fresh seafood has dropped to a greater degree than that of meats. This is true acsoss all levels of household income and is graphically displayed in Fig. 51.

In 1990, as within any given year, meat and seafood consumption at home rose as a function of income. Meat consumption has risen faster than seafood consumption as household income increased. As a result, the Engel curves for per capita household consumption of meat and seafood have converged. This has occurred to such a degree that in 1990, unlike previous years, per capita home consumption of meat was greater than or equal to fresh seafood when annual income became high enough.

According to Japan's Food Balance Sheets in the Statistical Yearbook of Ministry of Agriculture Forestry and Fisheries, the overall caloric supply (dining-out plus household consumption) in the Japanese diet provided by meat surpassed that of fish in 1973. However, intake by weight of seafoods still exceeds that of meat. Yet in this respect also, meat may soon overtake seafood as well. Table 42 presents the growing dominance of meat over seafood in the Japanese diet in terms of caloric supply and consumption by weight.

Determination at what income level per capita household consumption of fresh meat surpasses that of fresh seafood is made possible by their respective Engel curves for 1990. Presented below are the Engel curve equations estimating per capita

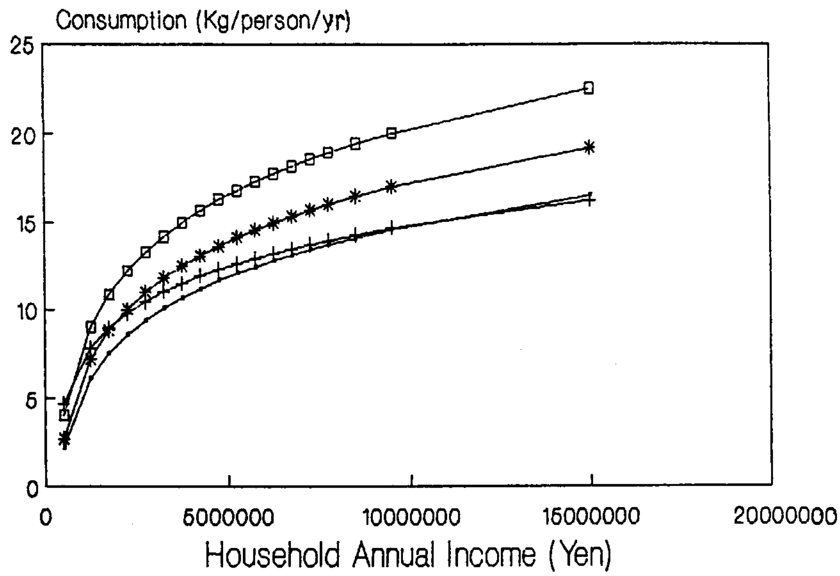


Fig. 51. Japan household per capita consumption Engel curves for fresh meat and seafood: 1980 & 1990.
Source: Calculated from Annual Report on the Family Income and Expenditure Survey
■: 1990 Meat +: 1990 Fish *: 1980 Meat □: 1980 Fish

Table 42. Per capita consumption of meat and seafood in terms of daily caloric and protein supply: 1965-1990.

Year	Per Capita Daily Caloric Supply (kcal)			Per Capita Daily Protein Supply (grams)		
	Total	Seafood	Meat	Total	Seafood	Meat
1965	2,424.2	82.1	56.3	78.0	12.6	6.0
1970	2,971.2	92.2	78.9	76.9	16.0	6.7
1973	2,525.5	98.7	99.4	79.4	17.0	8.4
1975	2,467.2	99.3	102.9	79.8	17.1	8.7
1980	2,512.1	102.9	143.6	80.7	17.7	11.4
1985	2,580.6	135.6	155.1	84.1	18.3	12.6
1990	2,636.7	133.5	180.4	87.8	18.8	14.2

Note : Actual weight not live weight equivalent as represented in table 1 of introduction.
Source : "Food Balance Sheet", within Statisitical Yearbook of Japan's Ministry of Agriculture, Forestry and Fisheries, various years.

consumption of fresh meat and seafood as graphically displayed in Fig. 51.
1990 per capita consumption of fresh meat at home:

$$\hat{Y} = -52.9 \times 10^3 + 9.7 \times 10^3 \log(X)$$
$$\text{(std. error)} \quad (982) \quad (670) \qquad R^2 = 0.93$$

1990 per capita consumption of fresh seafood at home:

$$\hat{Y} = -39.8 \times 10^3 + 7.8 \times 10^3 \log(X)$$
$$\text{(std. error)} \quad (847) \quad (577) \qquad R^2 = 0.92$$

where; $\hat{Y}$ = estimated per capita consumption (gr/yr)
X = annual household nominal income (Yen) and values in parenthesis are standard deviation values.

Simultaneously solving these two equations for X, indicates that per capita consumption at home of fresh meat began to surpass that of fresh seafood when annual household income exceeded ¥10,681,328 ($73,800, @1$/144.8¥).

This shows the clear advantage of Engel curve analysis which allows consideration of per capita consumption at home as it occurs across all levels of household income. It provides perspective to consumption information that often is based on average income conditions and/or general income groups. For example, the Annual Report on the Family Expenditure and Income Survey indicates in 1990, an average Japanese household had 3.56 persons and a monthly income of ¥548, 769, or ¥6,261,084, annually. It also indicates that annual consumption for fresh meat and seafood by this "average" household was 44,403 g and 47,304 g, respectively. On a per capita basis, meat and seafood consumption are 12,473 g and 13,288 g, respectively. These correspond well with the derived Engel curves in Fig. 51.

In the following section, this approach is employed upon the specific seafood category of interest; surimibased foods. Identifying relative shifts in household consumption for neriseihin foods and specific meats like pork, beef and chicken are conducted to provide a greater understanding of changing household eating patterns of these goods as a function of income.

5. Household Consumption of Neriseihin, Beef, Chicken and Pork

In Section 3 the method of Engel curve derivation for specific surimi-based foods was described. As previously stated, this approach also holds for Engel curves derived for beef, chicken, and pork as presented here for comparison. It has been shown that per capita consumption at home of meats and seafoods in general have declined in recent decades. With the help of Engel curves, the relative shifts in household consumption of specific foods of interest are presented.

First, Engel curves of a single food are presented alone for 1980, 1985, and 1990 to display their individual shift over this time period. Secondly, Engel curves for each food are superimposed together for a given year to compare their relative positions. These figures are presented in series to display how these Engel curve shifts for individual foods have altered the relative positions among the other foods in question. This essentially displays the combined quantitative effect of the "dining-out effect" and the "price effect" previously described.

Fig. 52.A, B, C and D show Engel curve shifts between 1980 and 1990 for beef,

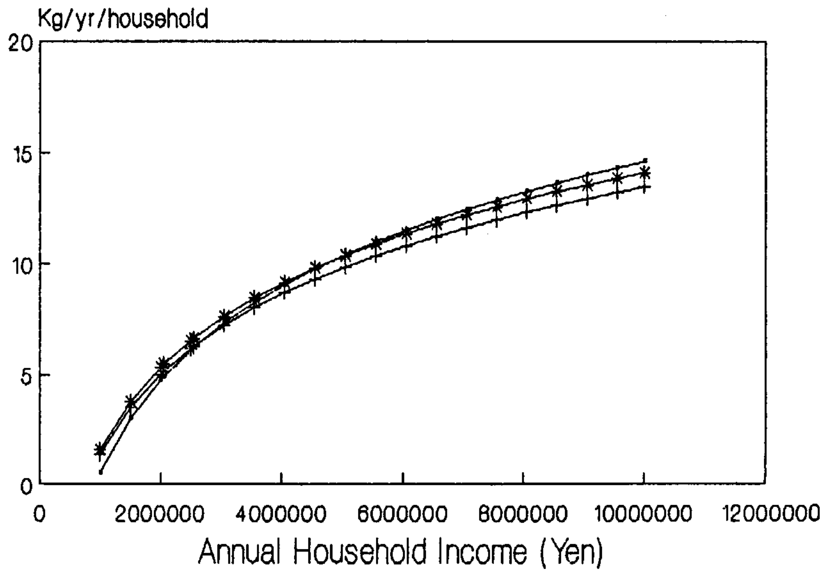


Fig. 52.A. Engel curves for household consumption of beef: 1980, 1985 & 1990.
Source: Calculated from Annual Report on the Family Income and Expenditure Survey
■: 1980 +: 1985 *: 1990

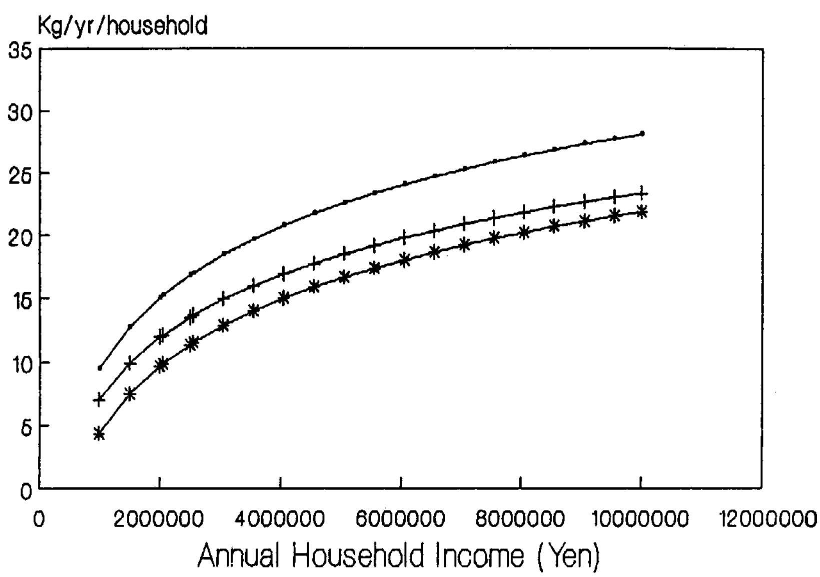


Fig. 52.B. Engel curves for household consumption of pork: 1980, 1985 & 1990.
Source: Calculated from Annual Report on the Family Income and Expenditure Survey
■: 1980 +: 1985 *: 1990

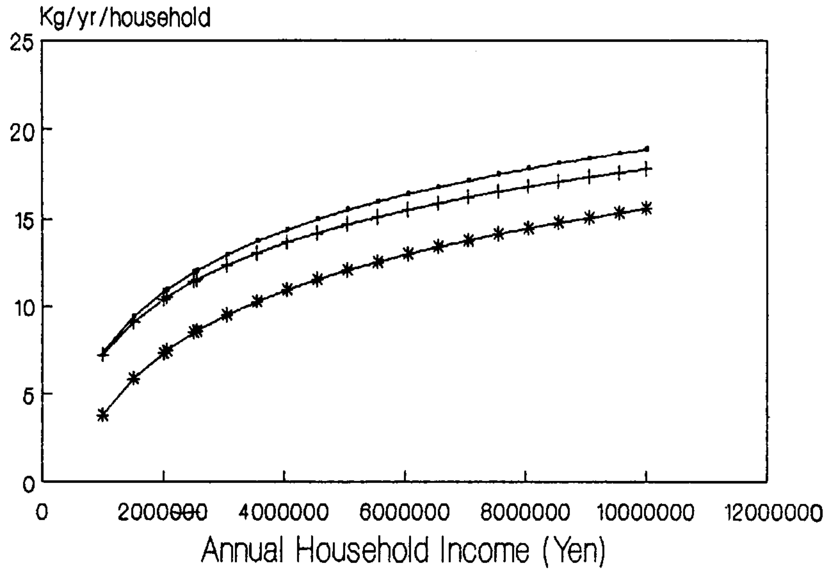


Fig. 52.C. Engel curves for household consumption of chicken: 1980, 1985 & 1990.
Source: Calculated from Annual Report on the Family Income and Expenditure Survey
■: 1980 +: 1985 *: 1990

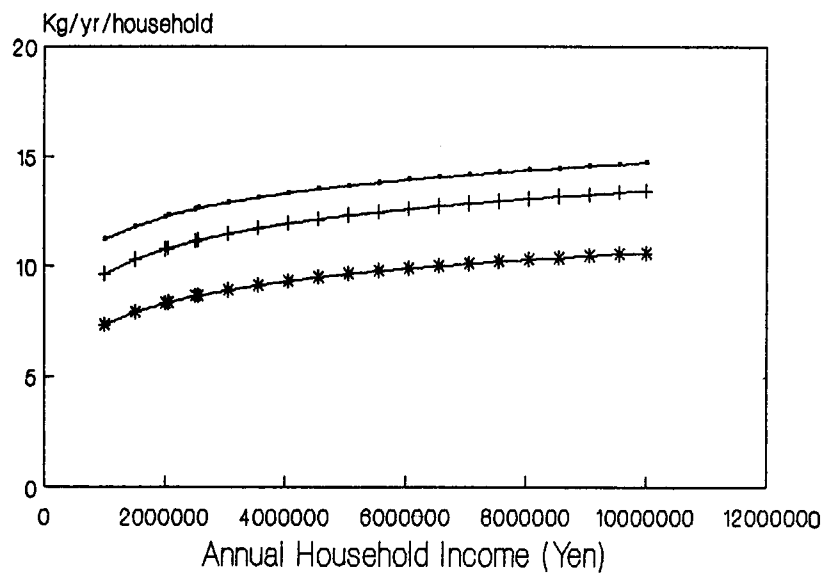


Fig. 52.D. Engel curves for household consumption of neriseihin: 1980, 1985 & 1990.
Source: Calculated from Annual Report on the Family Income and Expenditure Survey
■: 1980 +: 1985 *: 1990

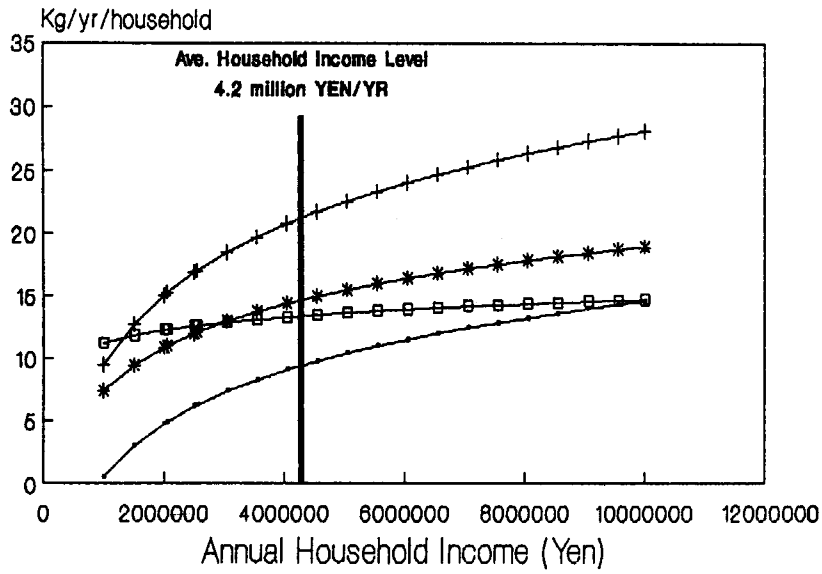


Fig. 53.A. 1980 Engel curves for household consumption of beef, pork, chicken, and neriseihin.
Source: Calculated from Annual Report on the Family Income and Expenditure Survey
■: Beef　+: Pork　*: Chicken　□: Surimi-foods

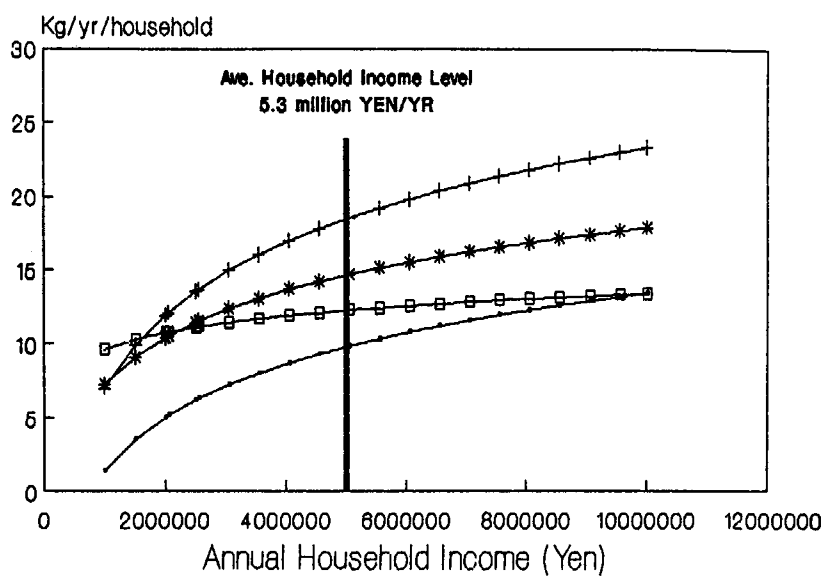


Fig. 53.B. 1985 Engel curves for household consumption of beef, pork, chicken, and neriseihin.
Source: Calculated from Annual Report on the Family Income and Expenditure Survey
■: Beef　+: Pork　*: Chicken　□: Surimi-foods

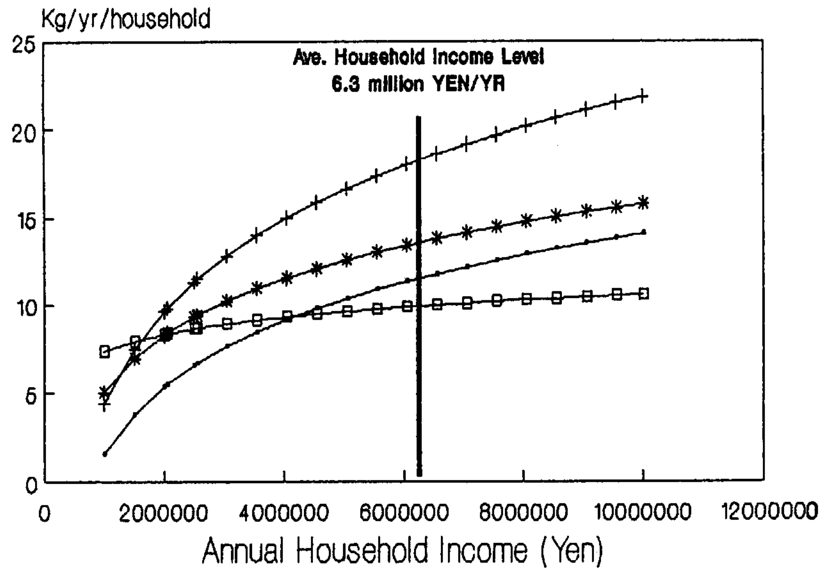


Fig. 53.C. 1990 Engel curves for household consumption of beef, pork, chicken, and neriseihin.
Source : Calculated from Annual Report on the Family Income and Expenditure Survey
■ : Beef + : Pork * : Chicken □ : Surimi-foods

pork, chicken, and of combined neriseihin (the four main forms), respectively. This figure clearly shows the consistent decline in household consumption across all income levels between 1980 and 1990 for all specific foods analyzed.

Beef is the only exception, displaying relatively constant consumption within middle income households (Fig. 52.A.). However, beef consumption slightly increased between 1980 and 1990 for lower income households. This is an expected result for a food with "superior good" characteristics ; as beef is presumed to be for Japanese households. Evidence of this will be discussed later in section 6.

Fig. 52.B, C, and D clearly document the fact of declining household consumption of pork and chicken individually and the collective consumption of the four main neriseihin foods. It now becomes important to identify how these shifts over time in household consumption have affected the proportion of these foods consumed while eating at home, relative to one another across all household income levels. This is accomplished in Fig. 53.A, B, and C that combine Engel curves of each food according to years 1980, 1985, and 1990, respectively. Comparing these figures for different years reveals that in addition to an overall decline in household consumption of these foods, their relative proportion consumed at home has also altered.

The mathematical functions derived by regression analysis for each set of Engel curves are presented below by year.

1980:

Pork	$\hat{Y}=-102.166\times10^3+18.602\times10^3\log(X)$ (1138) (3030)	$R^2=0.93$
Chicken	$\hat{Y}=-61.879\times10^3+11.542\times10^3\log(X)$ (509) (1513)	$R^2=0.95$
Beef	$\hat{Y}=-83.821\times10^3+14.057\times10^3\log(X)$ (244) (649)	$R^2=0.99$
Neriseihin	$\hat{Y}=-9.856\times10^3+3.507\times10^3\log(X)$ (306) (530)	$R^2=0.94$

1985:

Pork	$\hat{Y}=-90.898\times10^3+16.319\times10^3\log(X)$ (706) (1555)	$R^2=0.98$
Chicken	$\hat{Y}=-56.491\times10^3+10.618\times10^3\log(X)$ (551) (1275)	$R^2=0.96$
Beef	$\hat{Y}=-71.150\times10^3+12.087\times10^3\log(X)$ (244) (1540)	$R^2=0.93$
Neriseihin	$\hat{Y}=-13.183\times10^3+3.801\times10^3\log(X)$ (306) (607)	$R^2=0.93$

1990:

Pork	$\hat{Y}=-100.455\times10^3+1.742\times10^3\log(X)$ (825) (2065)	$R^2=0.96$
Chicken	$\hat{Y}=-67.037\times10^3+11.802\times10^3\log(X)$ (594) (1637)	$R^2=0.95$
Beef	$\hat{Y}=-73.516\times10^3+12.514\times10^3\log(X)$ (243) (608)	$R^2=0.99$
Neriseihin	$\hat{Y}=-12.273\times10^3+3.268\times10^3\log(X)$ (280) (503)	$R^2=0.93$

where ; $\hat{Y}$ = estimated quantity consumed (grams) per home, and X = annual household nominal income (yen). (Standard error values are in parenthesis under corresponding estimates.)

To help visualize the implications of these shifts specifically to the average household in Japan, a vertical line corresponding to average household income for the year in question is provided. Using this average household income level (X) as a reference, the estimated quantities consumed at home ($\hat{Y}$) of each food for the average household in Japan during 1980, 1985, and 1990 are quantified and presented in Table 43.

This table also presents calculated annual rate of change in consumption by the average income household for the first and second half of the decade for each food. With the exception of pork, these results clearly show the most dramatic shifts occurring in the late 1980's. Neriseihin consumption dropped most significantly at an annual rate of 6%, followed by chicken and pork's annual decline of 2.5% and 0.6%, respectively. Beef consumption grew throughout the decade within the average income home at an annual rate of 1.8% and 2.6% between 1980-'85 and 1985-'90, respectively. Pork's decline in consumption occurred most dramatically

Table 43. Estimated household consumption of pork, chicken, beef, and neriseihin (4 forms collectively) within an average income household representative of the years 1980, 1985, & 1990.

	Year				
Food	1980[a] (g/yr)	1985[b] (g/yr)	Annual Rate of Change: '80-'85 (%)	1990[c] (g/yr)	Annual Rate of Change: '85-'90 (%)
pork	21,029	18,886	−2.2	18,299	−0.6
chicken	14,529	14,937	+0.6	13,178	−2.5
beef	9,275	10,162	+1.8	11.4540	+2.6
neriseihin*	13,371	13,299	−0.1	9,937	−6.0

[a]: based on annual average household income of ¥4196232;
[b]: based on annual average household income of ¥5338152;
[c]: based on annaual average household income of ¥6261084; as reported in Annual Report on the Family Income and Expenditure Survey, 1991.
Note : * Neriseihin includes four main product forms.
Source : Figures calculated using respective Engel curve equations for each food at corresponding year as presented in Section 5.5

in the first half of the 1980's at a rate of 2.2% annually.

The most noticeable of these shifts in relative consumption quantity per household, is the increase in beef consumption over neriseihin foods combined. In similar fashion, beef consumption at home has gained on pork and chicken; although its quantity consumed has yet to actually surpass pork or chicken at even the very highest household income levels. However, should this trend continue, household consumption of beef is likely to overtake that of chicken in the coming decade in terms of grams consumed and perhaps within the next few years in terms of per capita caloric supply (see again Table 42). Because of pork's importance in the Japanese diet, its dominant position is not perceived to be threatened.

Fig. 54.A, B, C, and D present the downward shift in household consumption from 1980 to 1990 of the following four main neriseihin foods: kamaboko, satsumaage, chikuwa, and fish ham & sausage, respectively. All display a steady decline between, with the exception of chikuwa's relatively constant status between 1980 and 1985 for middle and low income households.

Fig. 55.A, B, and C present how these shifts in individual neriseihin Engel curves have altered the relative consumption proportions. In general it reveals how kamaboko has lost ground to satsumaage even though its elasticity is higher (steeper slope) than that of the fried product form. In other words, as one compares consumption between households of differeing incomes within a given year, such as 1990, intake of kamaboko increases faster than satsumaage as income rises even

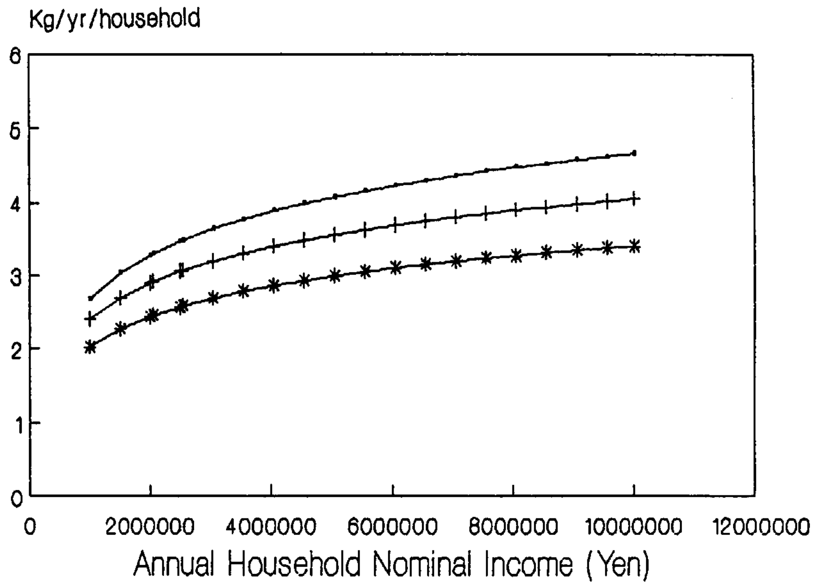


Fig. 54.A. Kamaboko household consumption Engel curves: 1980, 1985, & 1990.
Source: Calculated from Annual Report on the Family Income and Expenditure Survey
■: 1980 +: 1985 *: 1990

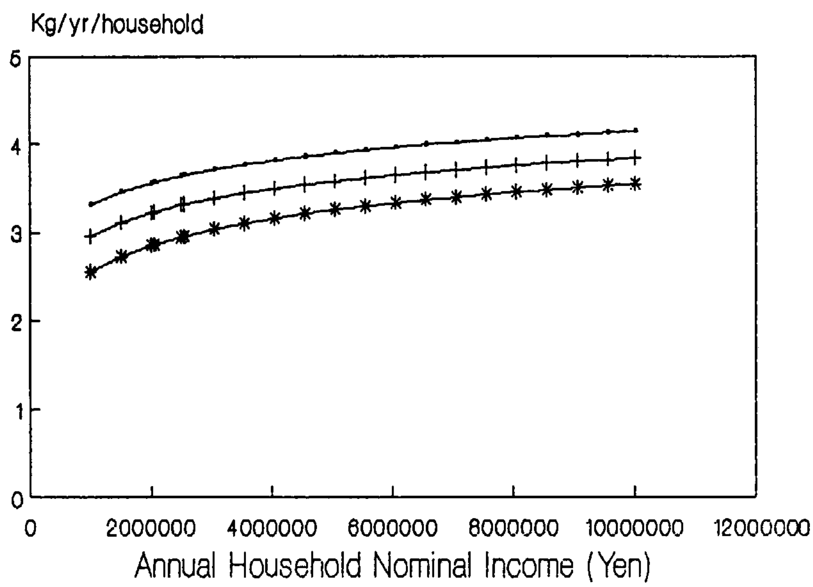


Fig. 54.B. Satsumaage household consumption Engel curves: 1980, 1985, & 1990.
Source: Calculated from Annual Report on the Family Income and Expenditure Survey
■: 1980 +: 1985 *: 1990

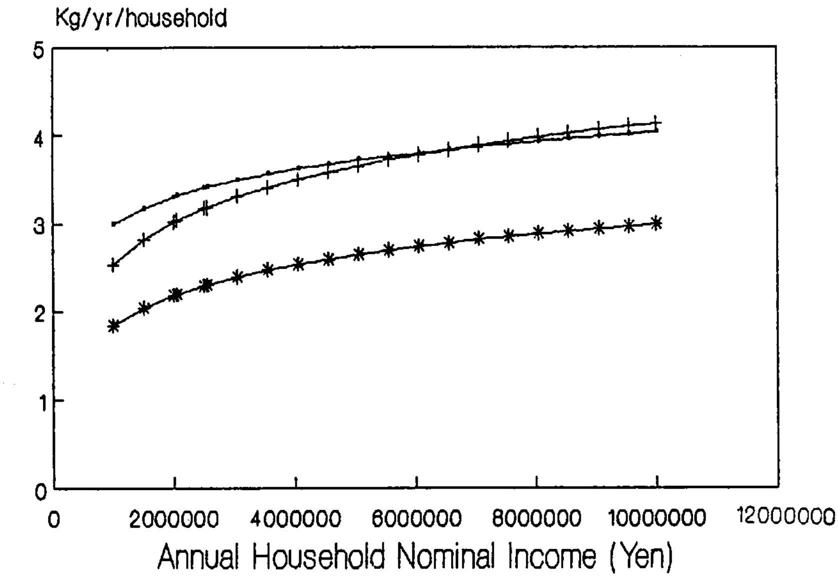


Fig. 54.C. Chikuwa household consumption Engel curves: 1980, 1985, & 1990.
Source: Calculated from Annual Report on the Family Income and Expenditure Survey
■: 1980 +: 1985 *: 1990

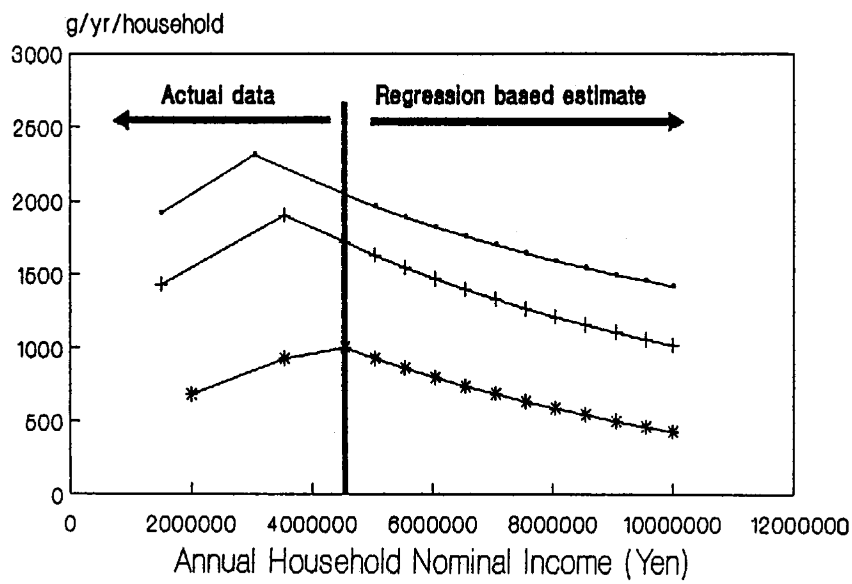


Fig. 54.D. Fish ham & sausage household consumption Engel curves: 1980, 1985, & 1990.
Source: Calculated from Annual Report on the Family Income and Expenditure Survey
■: 1980 +: 1985 *: 1990

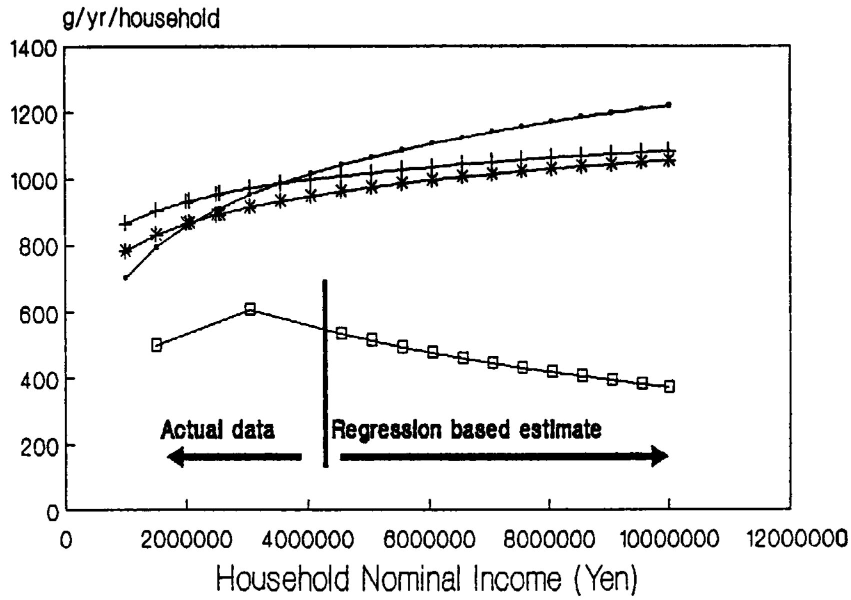


Fig. 55.A. Per capita neriseihin Engel curves: 1980.
Source: Calculated from Annual Report on the Family Income and Expenditure Survey
■: Kamaboko +: Satsumaage ∗: Chikuwa □: Fish ham & Sausage

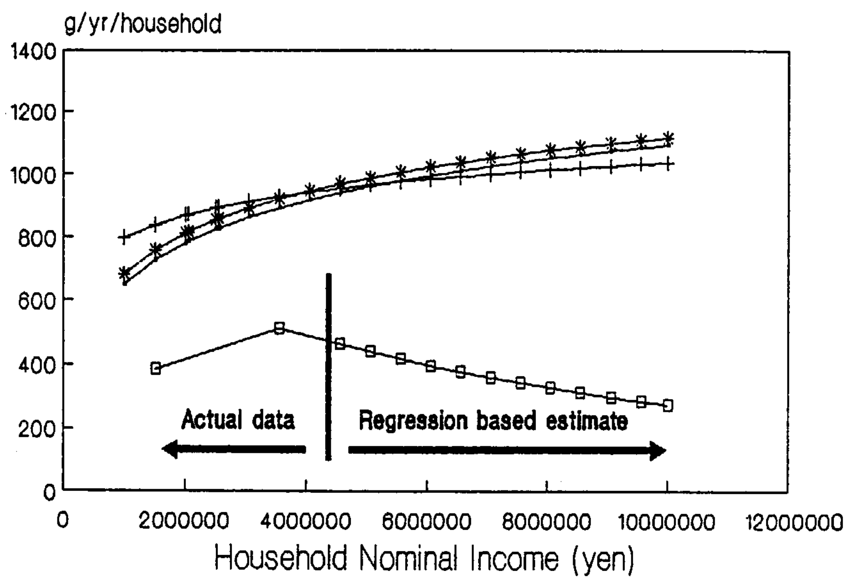


Fig. 55.B. Per capita neriseihin Engel curves: 1985.
Source: Calculated from Annual Report on the Family Income and Expenditure Survey
■: Kamaboko +: Satsumaage ∗: Chikuwa □: Fish ham & Sausage

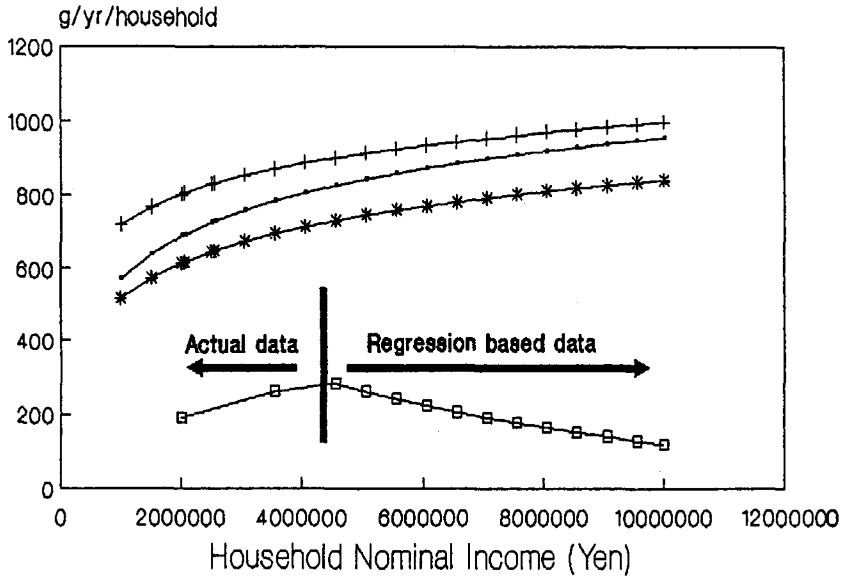


Fig. 55.C. Per capita neriseihin Engel curves: 1990.
Source: Calculated from Annual Report on the Family Income and Expenditure Survey
■: Kamaboko +: Satsumaage *: Chikuwa □: Fish ham & Sausage

though total satsumaage consumption is greater than that of kamaboko.

In 1990, chikuwa settled into a position of the third most commonly consumed surimi-based food consumed at all income levels. The regression curve for fish sausage and ham was based on the downward portion of its curve beginning in the lower-middle income level. It ranks least among the neriseihin foods consumed at home and displays a distinct negatively sloping curve suggesting its inferior good characteristic.

6. Demand Analysis of Neriseihin Products and Potentially Competitive Fresh Meats

Several studies have investigated the competitiveness of kamaboko, chikuwa, satsumaage, and fish ham and sausage between beef, chicken, and pork in Japan[60,61,62]. An extensive work by Kim *et al.*, (1988) conducted demand analysis on household consumption in Japan of these specific surimi-based foods generating Marchallian cross-price elasticities. The substitutional and complimentary nature of surimi-based foods and alternative meat proteins such as beef, chicken and pork are investigated for their contribution in explaining the previously described shifts in household consumption of these foods.

In this study as well, an attempt was made to generate cross-price elasticities based on recent data through 1990 in order to estimate the substitutional relationsihips among fresh meats and surimi-based foods as consumed at home in Japan during the recent decade. This investigation and Kim's both analyze Japanese household expenditure data as occurring over slightly different time periods. The work by Kim *et al.* (1988) used the more elaborate (and preferred) Almost Ideal Demand System[63] modified to accommodate seasonality. In this subsection a more simplistic single equation approach using Ordinary Least Squares (OLS) analysis was conducted. Therefore, for this reason and others, result consistencies between this study (based on 1979-1990 data) and that by Kim's (based on 1976-1985) are mixed. Some of the differences and similarities between these two works are discussed. Unfortunately, this frustration associated with inconsistent results describing substitutional relationships of various meats and seafoods in Japan is common as addressed by Dyck's review[64] and by others[65,66], and requires further extensive study.

The present study analyzed annual household expenditure data on fresh-fish, fresh-meats, beef, chicken, pork, kamaboko, chikuwa, satsumaage, and fish ham and sausage as presented in various issues of the Annual Report on the Family Income and Expenditure Survey. OLS regression analysis was conducted utilizing the SHAZAM statistical computer program run on an IBM compatible Zenith Data Systems laptop computer. The regression results using this annual data from 1979 to 1990 are presented below.

The general linear demand functional form used is as follows:

$$\log(Q_x)=f(\log P_x,\ \log P_j,\ \log Y)$$

where Q_x is the quantity consumed per home of commodity x, P_x is the estimated retail price of commodity x and P_j is the estimated retail price of commodity j as described in section 3. Variable Y is the nominal annual household income of an average income home in Japan. Appendix I lists all demand function equations as generated by the OLS regression procedure along with their corresponding t-statistic, standard error, R^2, and adjusted R^2 values. Presented in Table 44 are the cross-price, own-price, and income elasticities as derived by this method.

As expected, with the exception of fresh-fish and fish ham and sausage, the own-price elasticities were negative for all products. Kim *et al.* also generated this curious positive own-price elasticity for fish ham and sausage. Beef and fresh meat in general have the anticipated largest own-price elasticities. However, this analysis suggests the dubious condition of kamaboko, chikuwa, and satsumaage being price elastic ($\eta>1$) while chicken and pork are very inelastic ($\eta<0.5$).

Both studies recognized fresh-fish, chikuwa and satsumaage as weak substitutes of kamaboko. However, kim also identified pork and chicken as kamaboko substitutes where this study did not. Kim's results suggested chikuwa has several weak substitutes that if ranked from weakest to strongest include fresh-fish, kamaboko, beef, satsumaage, and fish ham and sausage, respectively. In this study, only fish ham and sausage was seen as a substitute of chikuwa, the others being compliments.

This analysis also bore out, as did kim's results, the general similarity of substitutional relationships of kamaboko and chikuwa to these other foods. This is not surprising given the compatibility these two surimi-based products have with common Japanese dishes that each are often served in. It has been the experience of the author, that even in Japanese "soups" the two are interchangeable. However, kamaboko is viewed as being more commonly used in soups than chikuwa; with the

Table 44. Cross-price elasticities, own-price elasticities, and income elasticities of fresh-fish, fresh-meats, beef, chicken, pork, kamaboko, chikuwa, satsumaage, and fish sausage & ham as derived from single equation ordinary least squares analyses.

	Price of:									
	Kamaboko	Chikuwa	Satsumaage	Fish Ham & Sausage	Beef	Pork	Chicken	Fresh Fish	Fresh Meats	Income Elastisties
Quantity Demanded of:										
Kamaboke	−1.07	−.16	.18	.40	.43	1.18	−1.07	.52	.53	−.38
Chikuwa	.19	−1.27	.36	−.14	.71	.10	−1.17	.26	2.12*	−.77
Satsumaage	.13	−.04	−1.05	−.85	.21	−1.82	−1.07	−.22	5.42*	−.62
Fish ham	−.11	.23	−1.61	0.43	1.44	−1.59	4.56*	1.71	−1.00*	−.38
Beef	−5.1	.00	.73	−.31	−1.41	−1.14	−.54	.36	2.80	.33
Fork@	−.34	−.08	.30	.00	.78	−.38	−.18	.06	.49	−.28
Chicken	−.56	−.04	.70	−.55	.86	.54	−.11	.33	−.75	.15
Fresh-fish	.22	−.29	.30	−.42	−.41	−.70	−.18	.14	1.23	−.58
Fresh-meats	−.34	−.54	.46	−.08	.41	.47	.05	.38	−1.29	.04

Source : Based on calculations as presented in Appendix.
Note : @ pork values are based on 1978 through 1990, all others are 1979 through 1990.
* values are unexplainably large.

exception perhaps of "oden". This latter point is contrary to Kim's perception.

Both investigations dientified sastumaage as a complimentary good with pork; the most abundantly consumed meat in Japan. This analysis suggested sastumaage is also a complimentary good with Japan's second most profusely eaten meat at home: chicken (see again Fig. 53.C). Conversely, both works also indicated kamaboko and chikuwa as weak substitutes for pork. Kim identified both pork and chicken as substitutes for kamaboko. Recall that retail kamaboko prices have exceeded pork and chicken since 1986 and 1980, respectively. (Please see again Fig. 45 in Chapter V.)

These factors can help explain the observation that sastumaage household consumption has declined the least of all neriseihin foods. Indeed in the late 1980's, home consumption of this fried food began to distance its lead over chikuwa and started to out-pace kamaboko consumption (Fig. 56).

How beef corresponds with these other foods is important because Japan phased-out import quotas on beef between 1988 and 1991. This liberalized beef trade policy is a direct result of US-Japan trade negotiations. Between 1987 and 1990 beef imported into Japan grew from 319,000 mt to 549,000 mt[67]. As a result, import beef prices in Japan are on the decline with wholesale prices dropping below 80 yen/100 g in 1988[68]. This study indicated that beef consumption would rise if prices increased for satsumaage and fresh fish overall. Kim's effort also included

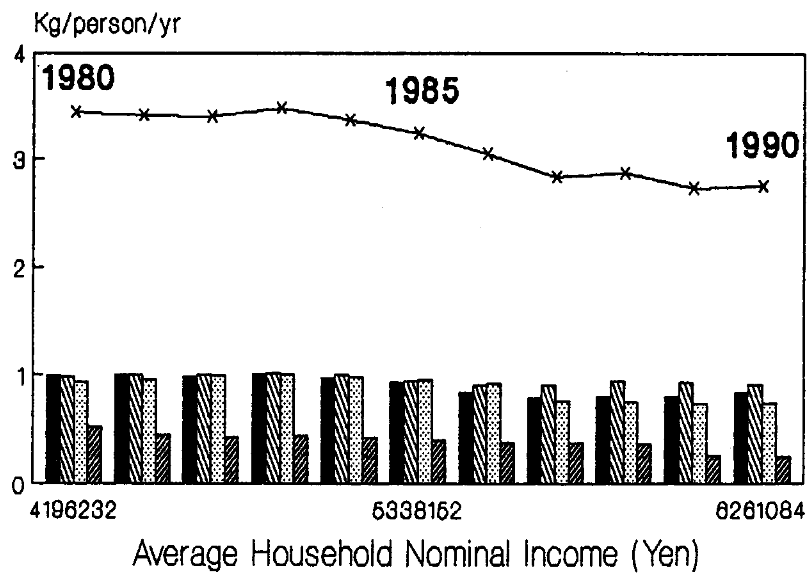


Fig. 56. Annual per capita home consumption of surimi foods as a function of average household dominal income.
Source: Annual Report on Family Income and Expenditure Survey
× : Total
Kamaboko Satsumaage Chikuwa Fish-sausage

chikuwa. A separate demand analysis of beef in Japan by Mori *et al.* (1990) supports this finding by also indicating imported beef as a weak substitute for processed fish and low valued fish in general within the Japanese household[69].

The above mentioned work by Mori *et al.* (1990) indicated that beef was a substitute (ranked in increasing order) for high-valued seafood, processed fish, and low-valued fish. Also, the general category of fresh meats (as well as individual beef, chicken, and pork,) was found here to substitute for fresh fish. This helps explain the declining consumption of seafood in proportion to meats an displayed previously by their respective annual Engel curves as seen in Fig. 51.

Various meats as weak substitutes for any of the neriseihin foods should be a subject of thoughtful consideration for surimi industries of the world that target the Japanese market. This is especially significant given the dramatic rise in prices of surimi-based foods in Japan during recent years while beef, pork, and chicken prices have risen only modestly. At the same time, imported beef has experienced downward price movement. These facts point to a continued decline in household consumption of kamaboko, chikuwa and fish sausage.

With the exception of beef, chicken and overall fresh meats, the income elasticities evaluated at the mean for all foods studied here were negative. This is contrary to Kim's results and suggests household consumption of these respective foods will continue to decline as household incomes rise rather than increase.

The overall implication of this inquiry into substitutional relationships between neriseihin foods and alternative meat proteins, is that growth in household consumption of neriseihin foods in Japan is unlikely. A "base" consumption level of these foods is expected in the Japanese household given its "traditional food" characteristics. However, until this lower limit is reached, neriseihin consumption in Japan will continue to decline. Contributing to this decline is the continuation of decreasing prices of neriseihin substitutes and increases in retail prices of neriseihin foods; due primarily to higher priced surimi imports.

Given the importance of Japan's surimi-based food industry to the growing number of international surimi suppliers, an attempt to estimate this market's "base consumption limit" is considered prudent. In the following section, future household consumption of neriseihin foods is estimated out to the end of this century.

7. Estimated Future Japanese Consumption of Neriseihin at Home

In an attempt to present future per capita consumption estimates of neriseihin in Japan, the Engel curves for neriseihin were converted to estimate per capita consumption as a function of household nominal income (CPI adjusted to 1990 income levels). Regression analysis was conducted on the per capita neriseihin consumption quantity as evaluated at the average household nominal income level for 1980 through 1990.

In Fig. 57, this regression curve is plotted against neriseihin Engel curves of the 1980's and presents the estimated per capita consumption of neriseihin at home as a function of average household income (CPI adjusted to 1990). If these Engel curves continue to shift downward as future income rises, then this regression curve estimates total neriseihin future per capita consumption in future average income

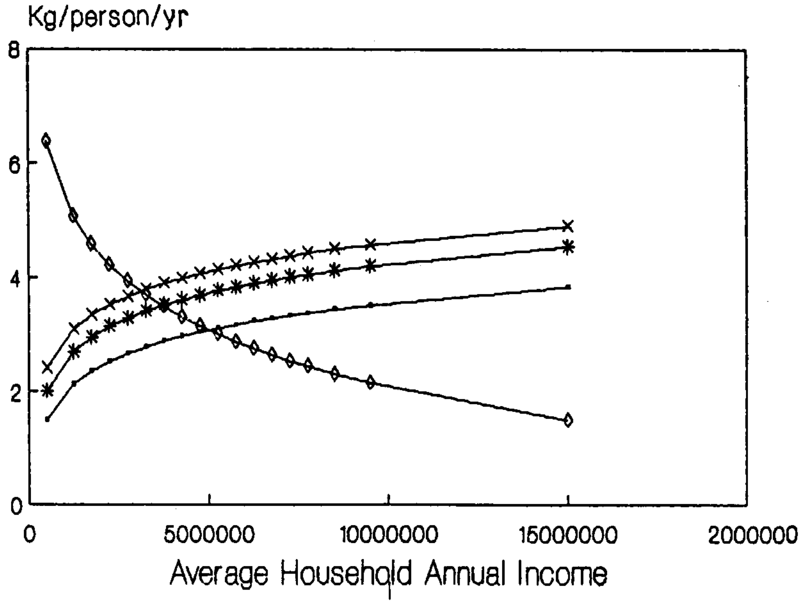


Fig. 57. 1980, 1985, & 1990 annual per capita Engel curves and estimated equilibrium consumption levels of neriseihin as a function of average household annual income. All curves are CPI adjusted to 1990 income values.
Source : Calculated from Annual Report on the Family Income and Expenditure Survey
■ : 1990 * : 1985 × : 1980 ◇ : Consumption estimate

homes.

An alternative, and more optimistic, means of estimating per capita consumption at home is simply to assume no future change from the 1990 neriseihin Engel curve. Under this assumption, future per capita consumption in an average income household is calculated for each neriseihin product form by inserting the estimated future household income level into the product's corresponding 1990 Engel curve function. The results of this "Maximum" future estimate are graphically displayed in Fig. 58.

In similar fashion, inserting the same estimated future income level into the less optimistic regression function corresponding to each product form generates an estimated minimum consumption level for that forecasted average income home. These "Minimum" future consumption estimates are shown in Fig. 59.

The total neriseihin maximum and minimum consumption estimates for future levels of average household income are graphically presented in Fig. 60. Presented below are the corresponding equations for the 1990 per capita Engel curve equation in Fig. 60 and the equation for regression estimated per capita consumption within the average income home (CPI adjusted to 1990 income values).

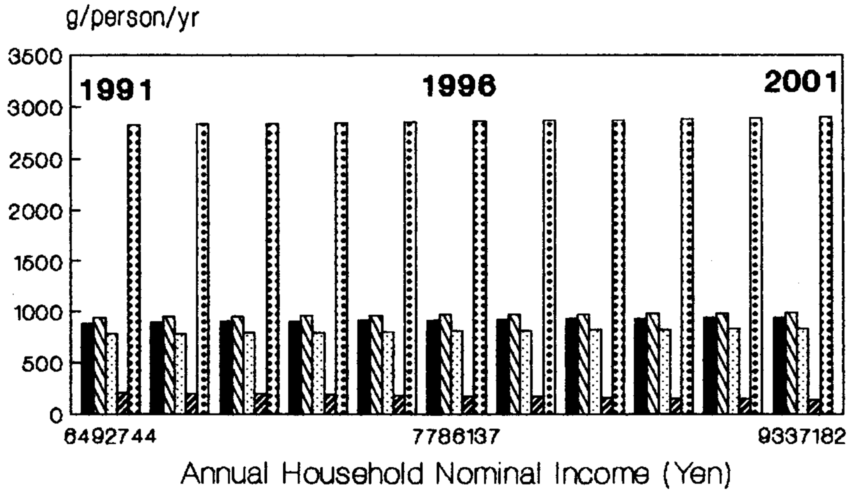


Fig. 58. Engel curve based on maximum estimated future per capita consumption at home for Japan: 1991-2001.
Source: Calculated from Annual Report on the Family Income and Expenditure Survey

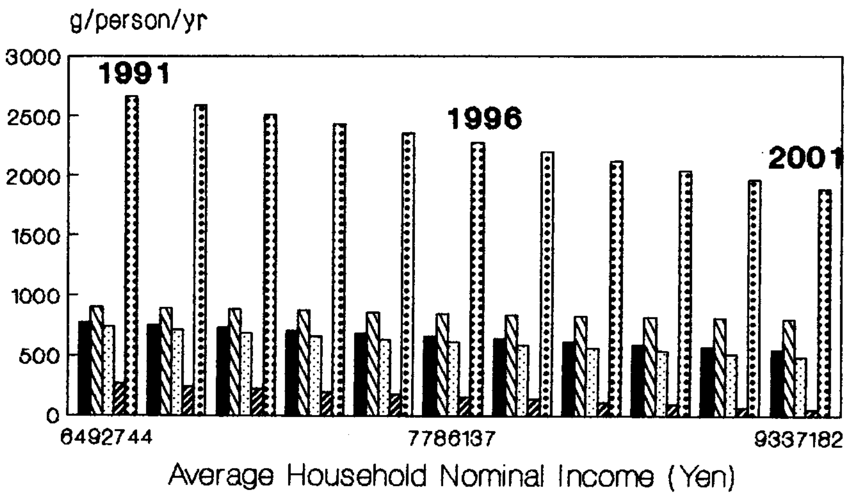


Fig. 59. Regression estimated per capita future consumption of neriseihin in average income home: 1991-2001.
Source: Calculated from Annual Report on the Family Income and Expenditure Survey

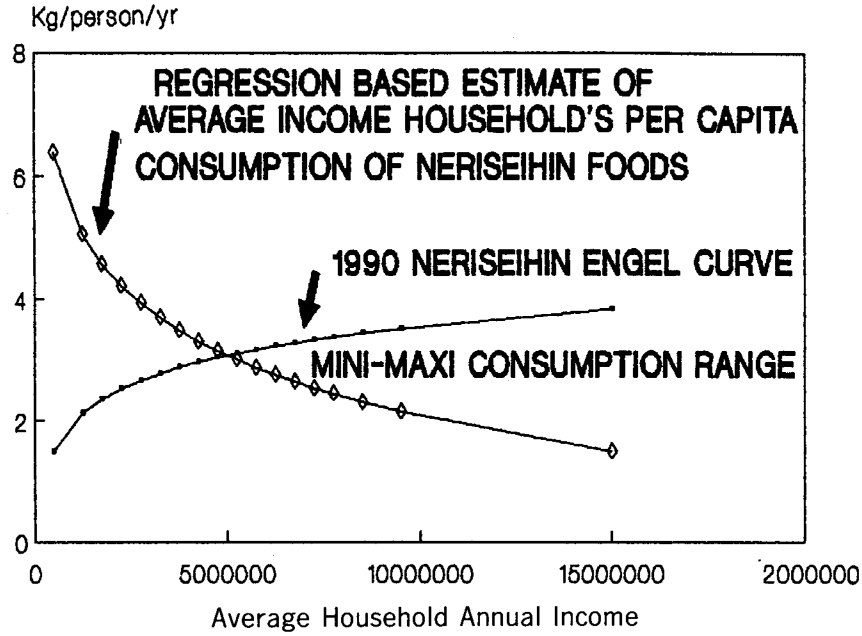


Fig. 60. Estimated minimum and maximum future per capita neriseihin consumption in Japan's average income household.
Source: Calculated from Annual Report on the Family Income and Expenditure Survey
■: 1990 ◇: Consumption estimate

1990 Engel Curve:

$$Q_{1990} = -17.533 \times 10^3 + 1.583 \times 10^3 \log(X_i) \qquad R^2 = 0.93$$

(Std. Err.) (159) (109)

Regression Curve:

$$Q_{reg} = 25.219 \times 10^3 - 3.306 \times 10^3 \log(X_{ave\ i})$$

where Q_{1990} is the estimated future consumption quantity (grams) of neriseihin consumed at home by an individual living in a household with an income level of $X(i)$. Q_{reg} is the estimated future consumption quantity (grams) consumed at home by an individual living in a future year's average income hosehold ($X_{ave\ i}$). Therefore, estimating a minimum and maximum per capita consumption level within the average income household of future years is possible ($X_i = X_{ave\ i}$) by incorporating estimated future annual average income levels into both equations. This minimum-maximum range in per capita consumption of neriseihin within Japan's future average income household is presented in Table 45.

8. Summarizing Results of Historic, and Estimated Future Consumption of Neriseihin within Japanese Households

In this chapter, shifting eating patterns and the general decline in household

Table 45. Estimated minimum & maximum future per capita consumption of neriseihin products.

Year	Household Incone (Yen/yr)	Total Maximum (g/yr)	Total Minimum (g/yr)	Kamaboko Maximum (g/yr)	Kamaboko Minimum (g/yr)	Satsumaage Maximum (g/yr)	Satsumaage Minimum (g/yr)	Chikuwa Maximum (g/yr)	Chikuwa Minimum (g/yr)	Fish ham & sausage Maximum (g/yr)	Fish ham & sausage Minimum (g/yr)
1991	6490000	2816	2697	884	779	944	904	779	747	209	268
1992	6730000	2824	2645	890	769	949	897	784	731	201	253
1993	6980000	2832	2593	896	749	953	891	789	715	194	238
1994	7240000	2841	2541	903	735	957	884	794	698	186	224
1995	7510000	2849	2488	909	720	962	878	799	682	179	209
1996	7790000	2857	2436	915	705	966	871	805	666	171	194
1997	8070000	2865	2384	921	691	970	865	810	650	164	179
1998	8370000	2873	2332	927	676	975	858	815	634	157	164
1999	8680000	2881	2280	933	661	979	852	820	617	149	150
2000	9000000	2889	2228	939	647	984	845	825	601	142	135
2001	9340000	2898	2175	945	632	988	839	830	585	134	120

Note : Optimistically assumes annual household income growth of 3.7% as recorded from 1980-1990.
Minimum values calculated from specific product's corresponding "minimum" regression formulae and CPI adjusted to correspond to 1990 income values.
Maximum values calculated from specific product's corresponding "maximum" 1990 Engel curves.

Source : Engel curve and regression forumlae as presented in Chapter 6.7 calculated from MAFF Annual on the Family Income Expenditure Survey (various years).

consumption of surimi-based foods and alternative proteins in Japan have been quantified. It has been shown that the Japanese are eating at home less. In addition, of the protein they do consume in the household, pork and chicken continue, at a declining rate, to be the number one and two most popular meat forms. However, perhaps more importantly is the increasingly significant role of beef consumption in the home. Beef was the only meat that displayed an increasing household consumption level. Cross-price elasticity analysis conducted here indicate beef, pork, and chicken were at least weak substitutes for fresh fish.

Fried neriseihin (satsumaage) consumption has declined the least of the other surimi-based foods. Among the factors contributing to this is that the price of satsumaage has increased the least compared to kamaboko and chikuwa. This has primarily been made possible by the relatively lower price of Grade 2 surimi used for fried surimi-based foods as compared to high-quality surimi used in kamaboko and chikuwa manufacturing.

The implication for future household consumption of surimi-based foods is not promising. At the most, neriseihin consumption in the home may increase slightly as household incomes rise. However, it is considered more likely by the author that household consumption of surimi-based foods will continue to decline until a minimum level is reached that generally reflects the "cultural" consumption requirement level. (For example, neriseihin foods are an essential component of a Japanese New Year's party.) Of the 4 main neriseihin forms, satsumaage (fried) will become the more abundantly consumed product. This is consistent with the rising level of fatty foods in the Japanese diet.

Kamaboko will become more of a luxury item as manufacturers produce new combinations of kamaboko with high-price seafood (Shrimp, sockeye salmon, abalone, scallops, etc..) in an attempt to capture a greater percentage of consumer surplus with these improved value-added products. The kamaboko industry recognizes that the quantity purchased by consumers is declining, but also understands that the demand for that limited level of product is relatively inelastic.

VII. Conclusions

At the onset, this dissertation utilized historical data on international seafood trade to document the decline of Japan as the world leader in seafood landings and exports. Since 1977, Japan has become the world's leading seafood importing nation. It was shown that the U.S.A. has replaced Japan as the leading seafood exporter since 1978. This period marked the beginning of Japan's growing dependance on American seafood imports: a crucial point for a nation whose populous leads the industrialized world in per capita seafood consumption.

Japan has digressed from a high-volume exporter of high-valued seafood, such as fresh and frozen foods, to one whose volume of fishery exports is dominated by low-valued seafood products such as meal, oils and fats. Canned seafood once dominated Japan's fishery export volume, yet has declined by 50% since 1970. However, rising world prices for canned seafood, especially in America, has sustained its total export value. This transition for Japan shifting from the number one nation harvesting and exporting seafood to world leader in fishery imports, has shown clearly to correlate strongly with the onset of the 200-mile Exclusive Economic Zone era.

For the North Pacific, the world's most productive fishing grounds, the EEZ era began in 1977 when the U.S.A. and former Soviet Union independently implemented their respective EEZ legislation.

The North Pacific groundfish fishery, Alaska pollock specifically, was highlighted as a major example of how international 200-mile EEZ marine management policy has negatively influenced Japanese fishery production. By 1960, just prior to the 200-mile EEZ era, Japanese researchers perfected frozen surimi technology. This initiated Japan's rapid exploitation of this North Pacific groundfish. Alaska pollock was an under-utilized species prior to Japan developing this fishery via its mothership and distant-water trawl fishing fleets. Alaska pollock now ranks as the world's most abundantly harvested species, surpassing six million metric tons annually. By 1990 Japan was completely excluded from directly harvesting Alaska pollock within waters of the North Pacific that have since become encompassed within American management jurisdiction. The 200-mile era effectively terminated the leadership role of Japan as primary harvester of this marine resource cornucopia of the North Pacific.

Domestic sectors of the seafood processing industry in Japan that utilized this resource grew significantly after full-scale exploitation began in the 1960's. Japanese processors of neriseihin (surimi-based) foods grew in number and production capacity. Because neriseihin is a traditional Japanese food, the domestic market was well established and demand was strong. However, as management authority over North Pacific groundfish resources was claimed by the U.S.A. and former Soviet Union, this now expanded surimi-dependent industry of Japan found itself increasingly reliant on imported surimi.

The kamaboko industry in Japan was one such sector that has been heavily affected. Surimi prices rose as import dependency grew, negatively influencing production and domestic consumption. In an innovative approach to develop international demand for kamaboko, Japanese manufacturers perfected analog crab meat production by the early 1980's. The world market, especially America with its growing "health conscience" consumers, was ripe for this type of low-calory high-protein seafood. As a result, exports of analog crab meat kamaboko grew to a maximum of 42 thousand MT in 1985; over 75% of which was destined for the U.S.A.

However, as the Alaska pollock harvesting and processing industries of the U.S. developed, not only did surimi production grow in America but also manufacturing of surimi-based foods; most specifically crab meat analog. As a result, once again U.S. production supplied its domestic market and Japanese exports to American fell dramatically. By 1990, analog seafood exports by Japan had dropped to 19 thousand MT with the majority sent to western Europe in the form of analog crab, scallop, and abalone.

Recently the Japanese domestic seafood market underwent transition as consumers became increasingly more selective as their personal wealth rose in the 1980's during the growth of their national "bubble economy". Demand for high-valued fresh/frozen seafoods, now primarily import goods, grew over medium- and low-valued processed seafoods. Neriseihin foods would be included in these latter categories and its consumption in the average Japanese home was shown to decline between 1980 and 1990 as household income rose.

An important aspect of changing consumer behavior in Japan includes the dramatic growth in personal expenditures on dining-out as Japanese began consuming less of their caloric intake while in the home. In addition to eating-out more, the Japanese are consuming more meat. Among Japanese, the rate of growth in per capita meat consumption (supply) is faster than that of seafood. This is true in terms of both caloric and gram weight supply. Relaxation of meat import quotas in the late 1980's, due to U.S.-Japan bilateral trade negotiations, has helped accelerate this trend. Another contributing factor was price increases among seafoods over those of comparably desirable meats, thus adding to the competitiveness of this alternative protein sources to the average consumer whether or not they are dining outside the home.

Increased personal wealth has also contributed to narrowing the gap between per capita daily protein supply (grams) of seafood over meat. Demand analysis conducted on Japanese household consumption supported previous findings that meat was a substitute (albeit weakly) for seafood and that expenditures (consumption) on meat increased faster than those on seafood as average household income rose.

Japanese household consumption was investigated as a function of income over time using Engel curves to quantitatively revealed the declining consumption of seafoods in general, and neriseihin specifically. Competitive meats including pork and chicken were also analyzed and also revealed declining consumption in the average income home during the past ten years but to a lesser extent than neriseihin foods. As anticipated, beef was shown to be the exception with household consumption actually increasing over time as average income rose.

Regression analysis on average income household consumption of specific neriseihin food forms as derived from Engel curves, were used to estimate the minimum amount of neriseihin consumed per capita at home across future annual income levels through the year 2001. The 1990 neriseihin Engel curve was used as the maximum estimate. Arange of future per capita household consumption for each neriseihin form was thus generated.

Per capita household consumption in Japan during the year 2001 for the average income household is estimated to be between 2,200 and 2,900 g/yr. Fried neriseihin is predicted to lead consumption ranging between 840 and 990 g/person/yr. The higher-quality boiled kamaboko and chikuwa will be consumed at a rate between 630 and 950 g/person/yr and 590 and 830 g/person/yr, respectively. Fish ham/sausage is a distant forth with a consumption ranging between 120 and 130 g/person/yr.

The implication of this estimated trend suggests greater demand for second grade surimi, since it is primarily utilized in fried neriseihin foods, and continued high prices (above 700 yen/kg) for grade 1 surimi as it is utilized in increasingly specialized value-added kamaboko products. Although future kamaboko consumption in the home is predicted to decrease in Japan, the minimum level purchased is considered highly inelastic and producers will produce a product perceived capable of extracting maximum consumer surplus.

Although personal wealth has grown significantly during recent decades, Japanese per capita caloric intake has risen only marginally to approach an estimated limit of approximately 2,600 kcal per day. Transition within the average Japanese diet has come from replacing the form and quality of foods consumed rather than an increase in overall quantity eaten. The Japanese diet has grown higher in fat content with a trend toward greater consumption of meats and high-valued seafoods. This trend had lead some physicians to associate the changing Japanese diet with "diseases of the affluent". This would include increased heart disease, stomach and intestinal cancers, obesity and its related illnesses.

Imported foods are growing in importance within the Japanese diet. The past two decades have witnessed dramatically declining rates of self-sufficiency for nearly all major food crops in Japan. Japan's dependance on imported foods has grown so dramatically as to raise concerns within the country regarding national food security. This dimension has intensified the internal debate within Japan regarding the inevitable fate of the Japanese rice marked being opened to imports under tarrification schemes dictated under the General Agreement on Tariffs and Trade which have been negotiated under the auspices of the Uruguay Round.

VIII. Summary

The point of this exercise has been to emphasize the dramatic shift underway within Japan's food industry, especially the seafood sector, as a result of trends in the international marketplace. Japan's food industry is changing from being production-export oriented to consumption-import oriented. While being beneficial to the average Japanese consumer, the social and economic effects of this transition will be enormous for many individuals involved in various domestic sectors of Japan's food production-distribution industry.

In 1990, total value of all food imported by Japan exceeded $31 billion (¥4.5 trillion). As anticipated, recent years have seen various food production industries in Japan experience dramatic restructuring. Japan's seafood industry has especially been affected in this way with the onset of the 200-mile EEZ era. The future of Japan's fisheries industry holds increasing diversification into trading subsidiaries, more and more of which will be located abroad. Branch purchasing offices located in the hub of foreign fishery trading markets will continue to grow. The majority of production facilities and capacity for major fisheries like Alaska pollock that were previously dominated by domestic Japanese industry will shift abroad. An example of this trend of growing Japanese investment in international seafood sectors is the surimi industry.

Successful "Americanization" of the U.S. groundfish fishery resulted in rapid growth in the number of surimi factories in America. The U.S. now ranks second only to Japan in the number of facilities. These include both land-based and sea-based surimi factories. However, factory ownership alone does not assure production if resource availability remains a constraint. Japanese fisheries corporations recognize this new dimension to their industry and have responded by heavily investing abroad. Such international posturing has allowed Japanese firms diverse involvement in production, distribution, and marketing of marine commodities in order to maintain a leading role in global fisheries trade even though they are losing position as world leaders in production/harvesting.

One could speculate that these business-motivated adjustments might also meet Japanese national food security objectives through diverse investment in important world food production sectors. Recalling that Japan suffers the lowest rate of self-sufficiency in foods of any developed country could encourage such conjecture.

Numerous examples exist demonstrating how large Japanese corporations, predominantly fishery oriented, have responded to the 200-mile era by deemphasizing their direct harvesting interests in favor of a greater role in international trade, distribution, and production of value-added fishery products.

Nippon Suisan and Taiyo Gyogyo are the two largest fishing corporations in Japan. Their shift away from direct harvesting involvement represents the trend nation-wide in Japan's fishing industry that has all but been completed.

The Japanese response to the 200-mile era is clear. While Japanese fishery companies reduce their domestically-based harvesting sectors of world fisheries, they are expanding counter investments abroad. The 200-mile era did not eradicate foreign involvement within the fisheries of coastal states. It simply altered their participation from direct harvesters to share holders in these burgeoning fishery industries.

Such international investments should not necessarily be perceived with apprehension. It is the view of the author that a world with greater interdependence between national economies via personal, corporate and national investment generates positive global synergism manifesting cooperation and symbiotic relationships spanning boarders and cultures. Such a world economy with heightened inter-reliance on commerce and trade improves the international socio-economic climate conductive to world security and peace.

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APPENDIX

The following presents statistical analyses generating cross-price, own-price, and income elasticity values for seafood and meats as pertaining to household consumption in Japan. The calculations are based on data for 1979 through 1990 as described in various issues of the Annual Report on the Family Income and Expenditure Survey, and the Annual Report on the Retail Price Survey. Both data sources are published annually by the Statistics Bureau Management and Coordination Agency of Japan.

The analyses were conducted using the SHAZAM statistical package developed by Dr. K.J. White of the University of British Columbia. Duplications of the computer print-outs for each "run" calculating the various elasticity relationships between alternating dependent and independent variables are presented below. However, in order to provide interpretation of the various coded-names for each variable used, the definitions of each variable code are provided.

CODE SYMBOL	MEANING OR VARIABLE NAME
ols	Ordinary Least Square (analysis)
lgai	Annual nominal income of an average Japanese household (logarithm of yen value)
lgffq	fresh fish quantity consumed per average household (logarithm of purchased quantity)
lgffpp	log of annual average fresh fish retail price
lgfmq	fresh meat quantity consumed per average household (logarithm of purchased quantity)
lgfmpp	log of annual average fresh meat retail price
lgqb	beef quantity consumed per average household (logarithm of purchased quantity)
lgpb	log of annual average beef retail price
lgqp	pork quantity consumed per average household (logarithm of purchased quantity)
lgpp	log of annual average pork retail price
lgqcn	chicken quantity consumed per average household (logarithm of purchased quantity)
lgpcn	log of annual average chicken retail price
lgqk	kamaboko quantity consumed per average household (logarithm of purchased quantity)
lgpcn	log of annual average kamaboko retail price
lgqs	satsumaage quantity consumed per average household (logarithm of purchased quantity)
lgps	log of annual average satsumaage retail price

lgqca	chikuwa quantity consumed per average household (logarithm of purchased quantity)
lgpca	log of annual average chikuwa retail price
lgqfs	fish ham and sausage quantity consumed per average household (logarithm of purchased quantity)
lgpfs	log of annual average fish ham and sausage retail price

OLS analysis: fresh fish quantity as dependent variable

```
REQUIRED MEMORY IS PAR=    6 CURRENT PAR=  234
OLS ESTIMATION
      13 OBSERVATIONS      DEPENDENT VARIABLE = LGFFQ
...NOTE..SAMPLE RANGE SET TO:     3,    15

 R-SQUARE =  0.9664      R-SQUARE ADJUSTED =  0.7983
VARIANCE OF THE ESTIMATE =  0.10207E-03
STANDARD ERROR OF THE ESTIMATE =  0.10103E-01
MEAN OF DEPENDENT VARIABLE =   4.7333
LOG OF THE LIKELIHOOD FUNCTION(IF DEPVAR LOG) = -8.07892

MODEL SELECTION TESTS - SEE JUDGE ET.AL.(1985, P.242)
 AKAIKE (1969) FINAL PREDICTION ERROR- FPE =   0.18844E-03
   (FPE ALSO KNOWN AS AMEMIYA PREDICTION CRITERION -PC)
 AKAIKE (1973) INFORMATION CRITERION- AIC =  -9.3693
 SCHWARZ(1978) CRITERION-SC =  -8.8913
```

VARIABLE NAME	ESTIMATED COEFFICIENT	STANDARD ERROR	T-RATIO 2 DF	PARTIAL CORR.	STANDARDIZED COEFFICIENT	ELAS AT MEANS
LGAI	-0.57989	0.59218	-0.97924	-0.5693	-1.8599	-0.57989
LGFFPP	0.14395	0.55252	0.26054	0.1812	0.25294	0.14395
LGFMPP	1.2335	3.2481	0.37977	0.2593	0.79109	1.2335
LGPB	-0.40558	1.0009	-0.40522	-0.2755	-0.38807	-0.40558
LGPP	-0.69522	2.2356	-0.31098	-0.2148	-0.60304	-0.69522
LGPCN	-0.17476	1.6157	-0.10816	-0.0763	-0.19925	-0.17476
LGPS	0.30000	1.0582	0.28349	0.1965	0.45668	0.30000
LGPCA	-0.29344	0.43911	-0.66826	-0.4272	-0.73556	-0.29344
LGPFS	-0.42384	0.84975	-0.49878	-0.3326	-0.22560	-0.42384
LGPK	0.22534	0.58757	0.38352	0.2617	0.65607	0.22534
CONSTANT	8.7146	2.4641	3.5366	0.9285	0.00000E+00	8.7146

OLS analysis: fresh meat quantity as dependent variable

```
REQUIRED MEMORY IS PAR=    4 CURRENT PAR=   39
OLS ESTIMATION
      13 OBSERVATIONS      DEPENDENT VARIABLE = LGFMQ
...NOTE..SAMPLE RANGE SET TO:     3,    15

 R-SQUARE =  0.9316      R-SQUARE ADJUSTED =  0.5898
VARIANCE OF THE ESTIMATE =  0.49552E-04
STANDARD ERROR OF THE ESTIMATE =  0.70393E-02
MEAN OF DEPENDENT VARIABLE =   4.6589
LOG OF THE LIKELIHOOD FUNCTION(IF DEPVAR LOG) = -2.41443

MODEL SELECTION TESTS - SEE JUDGE ET.AL.(1985, P.242)
 AKAIKE (1969) FINAL PREDICTION ERROR- FPE =   0.91481E-04
   (FPE ALSO KNOWN AS AMEMIYA PREDICTION CRITERION -PC)
 AKAIKE (1973) INFORMATION CRITERION- AIC =  -10.092
 SCHWARZ(1978) CRITERION-SC =  -9.6139
```

Variable Name	Estimated Coefficient	Standard Error	T-Ratio 2 DF	Partial Corr.	Standard Coefficient	Elasticity at Means
LGAI	0.40932E-01	0.47038	0.087019	0.0614	0.28843	0.040932
LGFFPP	0.37810	0.40975	0.92279	0.5465	1.4092	0.37810
LGPB	0.41070	0.98640	0.41636	0.2824	0.94402	0.41070
LGPP	0.47350	1.7498	0.27061	0.1879	0.84471	0.47350
LGPCN	0.46727E-01	0.92340	0.050603	0.0358	0.12704	0.46725
LGPS	0.45795	0.89071	0.51413	0.3417	1.6808	0.45795
LGPCA	-0.54070E-01	0.32118	-0.16834	0.1182	0.30008	-0.54070E-01
LGPFS	-0.81155E-01	0.62680	-0.12948	-0.0912	-0.64135E-01	-0.81155E-01
LGPK	-0.33746	0.53085	-0.63570	-0.4100	-2.2005	-0.33746
LGFMPP	-1.2920	2.6769	-0.48265	-0.3230	-1.6035	-1.2920
CONSTANT	4.3881	2.2477	1.9523	0.8098	0.00000E+00	4.3881

OLS analysis : beef quantity as dependent variable

```
DEPENDENT VARIABLE = LGQB
 R-SQUARE =  0.9907      R-SQUARE ADJUSTED =  0.9444
VARIANCE OF THE ESTIMATE =  0.79169E-04
STANDARD ERROR OF THE ESTIMATE =  0.88977E-02
MEAN OF DEPENDENT VARIABLE =    3.4156
LOG OF THE LIKELIHOOD FUNCTION(IF DEPVAR LOG) =  10.7038

MODEL SELECTION TESTS - SEE JUDGE ET.AL.(1985, P.242)
 AKAIKE (1969) FINAL PREDICTION ERROR- FPE =   0.14616E-03
   (FPE ALSO KNOWN AS AMEMIYA PREDICTION CRITERION -PC)
 AKAIKE (1973) INFORMATION CRITERION- AIC =  -9.6234
 SCHWARZ(1978) CRITERION-SC =  -9.1454
```

VARIABLE NAME	ESTIMATED COEFFICIENT	STANDARD ERROR	T-RATIO 2 DF	PARTIAL CORR.	STANDARDIZED COEFFICIENT	ELASTICITY AT MEANS
LGAI	0.33212	0.59457	0.55859	0.3674	0.68179	0.33212
LGFFPP	0.36187	0.51793	0.69869	0.4429	0.39292	0.36187
LGFMPP	2.7953	3.3836	0.82613	0.5044	1.0107	2.7953
LGPB	-1.4063	1.2468	-1.1279	-0.6235	-0.94169	-1.4063
LGPP	-1.1435	2.2117	-0.51702	-0.3434	-0.59429	-1.1435
LGPCN	-0.53946	1.1672	-0.46219	-0.3106	-0.42728	-0.53946
LGPS	0.73094	1.1259	0.64923	0.4172	0.78153.	0.73094
LGPCA	0.38396E-02	0.40598	0.94576E-02	0.0067	0.62078E-02	0.38396E-02
LGPFS	-0.30889	0.79227	-0.38988	-0.2658	-0.71115E-01	-0.30889
LGPK	-0.51371	0.67100	-0.76559	-0.4761	-0.97587	-0.51371
CONSTANT	1.4941	2.8410	0.52590	0.3485	0.00000E+00	1.4941

OLS analysis : pork quantity as dependent variable

```
:_ols lgqp lgai lgffpp lgfmpp lgpb lgpp lgpcn lgps lgpca lgpfs lgpk / loglog
REQUIRED MEMORY IS PAR=    8 CURRENT PAR=   39
OLS ESTIMATION
      14 OBSERVATIONS      DEPENDENT VARIABLE = LGQP
...NOTE..SAMPLE RANGE SET TO:     2,    15

 R-SQUARE =  1.0000      R-SQUARE ADJUSTED =  0.9999
VARIANCE OF THE ESTIMATE =  0.73580E-04
STANDARD ERROR OF THE ESTIMATE =  0.85779E-02
MEAN OF DEPENDENT VARIABLE =    3.4073
LOG OF THE LIKELIHOOD FUNCTION(IF DEPVAR LOG) =  9.83632

MODEL SELECTION TESTS - SEE JUDGE ET.AL.(1985, P.242)
 AKAIKE (1969) FINAL PREDICTION ERROR- FPE =   0.13139E-03
   (FPE ALSO KNOWN AS AMEMIYA PREDICTION CRITERION -PC)
 AKAIKE (1973) INFORMATION CRITERION- AIC =  -9.4862
 SCHWARZ(1978) CRITERION-SC =  -8.9840
```

VARIABLE NAME	ESTIMATED COEFFICIENT	STANDARD ERROR	T-RATIO 3 DF	PARTIAL CORR.	STANDARDIZED COEFFICIENT	ELAS AT MEANS
LGAI	-0.28279	0.33078	-0.85491	-0.4426	-169.03	-0.28279
LGFFPP	0.58893E-01	0.46090	0.12778	0.0736	392.21	0.58893E-01
LGFMPP	0.49050	2.4077	0.20372	0.1168	0.15533	0.49050
LGPB	0.77789	0.53266	1.4604	0.6446	0.48075	0.77789
LGPP	-0.37782	1.3113	-0.28812	-0.1641	-0.13538	-0.37782
LGPCN	-0.17980	0.64869	-0.27717	-0.1580	-0.10865	-0.17980
LGPS	0.29781	0.42487	0.70095	0.3751	0.13033	0.29781
LGPCA	-0.79038E-01	0.35004	-0.22580	-0.1293	-0.29841E-01	-0.79038E-01
LGPFS	0.64724E-02	0.85992E-01	0.75268E-01	0.0434	222.56	0.64724E-02
LGPK	-0.34138	0.16906	-2.0193	-0.7590	-0.11781	-0.34138
CONSTANT	3.9007	1.5490	2.5181	0.8239	0.00000E+00	3.9007

OLS analysis: chicken quantity as dependent variable

```
:_ols lgqcn lgai lgffpp lgfmpp lgpb lgpp lgpcn lgps lgpca lgpfs lgpk /


REQUIRED MEMORY IS PAR=    10 CURRENT PAR=    39
OLS ESTIMATION
      13 OBSERVATIONS     DEPENDENT VARIABLE = LGQCN
...NOTE..SAMPLE RANGE SET TO:     3,    15

 R-SQUARE =  0.9609      R-SQUARE ADJUSTED =  0.7651
VARIANCE OF THE ESTIMATE =  0.17431E-03
STANDARD ERROR OF THE ESTIMATE =  0.13202E-01
MEAN OF DEPENDENT VARIABLE =    3.5730
LOG OF THE LIKELIHOOD FUNCTION(IF DEPVAR LOG) =  3.52706

MODEL SELECTION TESTS - SEE JUDGE ET.AL.(1985, P.242)
 AKAIKE (1969) FINAL PREDICTION ERROR- FPE =   0.32180E-03
   (FPE ALSO KNOWN AS AMEMIYA PREDICTION CRITERION -PC)
 AKAIKE (1973) INFORMATION CRITERION- AIC =  -8.8342
 SCHWARZ(1978) CRITERION-SC =  -8.3562
```

VARIABLE NAME	ESTIMATED COEFFICIENT	STANDARD ERROR	T-RATIO 2 DF	PARTIAL CORR.	STANDARDIZED COEFFICIENT	ELAS AT MEANS
LGAI	0.14627	0.88222	0.16580	0.1164	0.41587	0.14627
LGFFPP	0.33357	0.76851	0.43405	0.2934	0.50161	0.33357
LGFMPP	-0.75033	5.0207	-0.14945	-0.1051	-0.37571	-0.75033
LGPB	0.85796	1.8500	0.46376	0.3116	0.79568	0.85796
LGPP	0.54365	3.2817	0.16566	0.1163	0.39130	0.54365
LGPCN	-0.11304	1.7319	-0.65272E-01	-0.0461	-0.12400	-0.11304
LGPS	0.69939	1.6706	0.41866	0.2839	1.0357	0.69939
LGPCA	-0.40025E-01	0.60239	-0.66444E-01	-0.0469	-0.89625E-01	-0.40025E-01
LGPFS	-0.54819	1.1756	-0.46632	-0.3132	-0.17479	-0.54819
LGPK	-0.56042	0.99563	-0.56288	-0.3698	-1.4744	-0.56042
CONSTANT	1.3831	4.2156	0.32809	0.2260	0.00000E+00	1.3831

OLS analysis: kamaboko quantity as dependent variable

```
REQUIRED MEMORY IS PAR=     5 CURRENT PAR=  234
OLS ESTIMATION
      13 OBSERVATIONS     DEPENDENT VARIABLE = LGQK
...NOTE..SAMPLE RANGE SET TO:      3,    15

 R-SQUARE =  0.9921      R-SQUARE ADJUSTED =  0.9524
VARIANCE OF THE ESTIMATE =  0.13220E-03
STANDARD ERROR OF THE ESTIMATE =  0.11498E-01
MEAN OF DEPENDENT VARIABLE =   2.9684
LOG OF THE LIKELIHOOD FUNCTION(IF DEPVAR LOG) =  13.1833

MODEL SELECTION TESTS - SEE JUDGE ET.AL.(1985, P.242)
 AKAIKE (1969) FINAL PREDICTION ERROR- FPE =   0.24407E-03
   (FPE ALSO KNOWN AS AMEMIYA PREDICTION CRITERION -PC)
 AKAIKE (1973) INFORMATION CRITERION- AIC =  -9.1107
 SCHWARZ(1978) CRITERION-SC =  -8.6326
```

VARIABLE NAME	ESTIMATED COEFFICIENT	STANDARD ERROR	T-RATIO 2 DF	PARTIAL CORR.	STANDARDIZED COEFFICIENT	ELAS AT MEANS
LGAI	-0.38054	0.67395	-0.56464	-0.3708	-0.52088	-0.38054
LGFFPP	0.51158	0.62881	0.81356	0.4986	0.38363	0.51158
LGPB	0.43173	1.1391	0.37902	0.2589	0.17630	0.43173
LGPP	1.1869	2.5442	0.46650	0.3133	0.43938	1.1869
LGPCN	-1.0724	1.8388	-0.58319	-0.3812	-0.52180	-1.0724
LGPS	0.17958	1.2044	0.14911	0.1049	0.11667	0.17958
LGPCA	-0.15537	0.49975	-0.31090	-0.2147	-0.16621	-0.15537
LGPFS	0.39545	0.96709	0.40891	0.2778	0.89831E-01	0.39545
LGPK	-1.0702	0.66870	-1.6004	-0.7494	-1.3298	-1.0702
LGFMPP	0.52707	3.6966	0.14258	0.1003	0.14426	0.52707
CONSTANT	3.2157	2.8044	1.1467	0.6298	0.00000E+00	3.2157

OLS analysis: satsumaage quantity as dependent variable

```
REQUIRED MEMORY IS PAR=     4 CURRENT PAR=  234
OLS ESTIMATION
      13 OBSERVATIONS     DEPENDENT VARIABLE = LGQS
...NOTE..SAMPLE RANGE SET TO:      3,    15

 R-SQUARE =  0.9774      R-SQUARE ADJUSTED =  0.8645
VARIANCE OF THE ESTIMATE =  0.50302E-04
STANDARD ERROR OF THE ESTIMATE =  0.70924E-02
MEAN OF DEPENDENT VARIABLE =   2.9840
LOG OF THE LIKELIHOOD FUNCTION(IF DEPVAR LOG) =  19.2615

MODEL SELECTION TESTS - SEE JUDGE ET.AL.(1985, P.242)
 AKAIKE (1969) FINAL PREDICTION ERROR- FPE =   0.92865E-04
   (FPE ALSO KNOWN AS AMEMIYA PREDICTION CRITERION -PC)
 AKAIKE (1973) INFORMATION CRITERION- AIC =  -10.077
 SCHWARZ(1978) CRITERION-SC =  -9.5989
```

VARIABLE NAME	ESTIMATED COEFFICIENT	STANDARD ERROR	T-RATIO 2 DF	PARTIAL CORR.	STANDARDIZED COEFFICIENT	ELAS AT MEANS
LGAI	-0.62061	0.41572	-1.4929	-0.7260	-2.3238	-0.62061
LGFFPP	-0.21953	0.38787	-0.56598	-0.3716	-0.45033	-0.21953
LGFMPP	5.4158	2.2802	2.3752	0.8592	4.0550	5.4158
LGPB	0.21294	0.70262	0.30307	0.2095	0.23787	0.21294
LGPP	-1.8222	1.5694	-1.1611	-0.6346	-1.8453	-1.8222
LGPCN	-1.0741	1.1342	-0.94698	-0.5564	-1.4297	-1.0741
LGPS	-1.0536	0.74289	-1.4182	-0.7081	-1.8723	-1.0536
LGPCA	-0.36413E-01	0.30826	-0.11812	-0.0832	-0.10656	-0.36413E-01
LGPFS	-0.84717	0.59653	-1.4202	-0.7086	-0.52643	-0.84717
LGPK	0.12998	0.41247	0.31513	0.2175	0.44181	0.12998
CONSTANT	4.5022	1.7298	2.6027	0.8787	0.00000E+00	4.5022

OLS analysis: chikuwa quantity as dependent variable

```
REQUIRED MEMORY IS PAR=     5 CURRENT PAR=  234
OLS ESTIMATION
      13 OBSERVATIONS       DEPENDENT VARIABLE = LGQCA
...NOTE..SAMPLE RANGE SET TO:      3,    15

 R-SQUARE =  0.9989       R-SQUARE ADJUSTED =   0.9934
VARIANCE OF THE ESTIMATE =   0.18370E-04
STANDARD ERROR OF THE ESTIMATE =   0.42860E-02
MEAN OF DEPENDENT VARIABLE =    2.9488
LOG OF THE LIKELIHOOD FUNCTION(IF DEPVAR LOG) =   26.2678

MODEL SELECTION TESTS - SEE JUDGE ET.AL.(1985, P.242)
 AKAIKE (1969) FINAL PREDICTION ERROR- FPE =    0.33913E-04
   (FPE ALSO KNOWN AS AMEMIYA PREDICTION CRITERION -PC)
 AKAIKE (1973) INFORMATION CRITERION- AIC =  -11.084
 SCHWARZ(1978) CRITERION-SC =   -10.606
```

VARIABLE NAME	ESTIMATED COEFFICIENT	STANDARD ERROR	T-RATIO 2 DF	PARTIAL CORR.	STANDARDIZED COEFFICIENT	ELAS AT MEANS
LGAI	-0.76810	0.25122	-3.0575	-0.9076	-1.0511	-0.76810
LGFFPP	0.26384	0.23440	1.1256	0.6228	0.19781	0.26384
LGFMPP	2.1243	1.3779	1.5417	0.7369	0.58132	2.1243
LGPB	0.70488	0.42460	1.6601	.0.7612	0.28778	0.70488
LGPP	0.10408	0.94839	0.10974	0.0774	0.38520E-01	0.10408
LGPCN	-1.1731	0.68543	-1.7115	-0.7709	-0.57071	-1.1731
LGPS	0.36192	0.44894	0.80617	0.4952	0.23507	0.36192
LGPCA	-1.2721	0.18628	-6.8287	-0.9792	-1.3606	-1.2721
LGPFS	-0.40750	0.36049	-1.1304	-0.6244	-0.92549E-01	-0.40750
LGPK	0.18784	0.24926	0.75360	0.4703	0.23335	0.18784
CONSTANT	5.2526	1.0454	5.0247	0.9626	0.00000E+00	5.2526

OLS: fish ham and sausage quantity as dependent variable

```
REQUIRED MEMORY IS PAR=     6 CURRENT PAR=  234
OLS ESTIMATION
      13 OBSERVATIONS       DEPENDENT VARIABLE = LGQFS
...NOTE..SAMPLE RANGE SET TO:      3,    15

 R-SQUARE =  0.9472       R-SQUARE ADJUSTED =   0.6833
VARIANCE OF THE ESTIMATE =   0.39549E-02
STANDARD ERROR OF THE ESTIMATE =   0.62888E-01
MEAN OF DEPENDENT VARIABLE =    2.6913
LOG OF THE LIKELIHOOD FUNCTION(IF DEPVAR LOG) =  -5.30367

MODEL SELECTION TESTS - SEE JUDGE ET.AL.(1985, P.242)
 AKAIKE (1969) FINAL PREDICTION ERROR- FPE =    0.73013E-02
   (FPE ALSO KNOWN AS AMEMIYA PREDICTION CRITERION -PC)
 AKAIKE (1973) INFORMATION CRITERION- AIC =  -5.7123
 SCHWARZ(1978) CRITERION-SC =   -5.2343
```

VARIABLE NAME	ESTIMATED COEFFICIENT	STANDARD ERROR	T-RATIO 2 DF	PARTIAL CORR.	STANDARDIZED COEFFICIENT	ELAS AT MEANS
LGAI	-0.38159	3.6861	-0.10352	-0.0730	-0.24635	-0.38159
LGFFPP	1.7077	3.4393	0.49654	0.3313	0.60401	1.7077
LGFMPP	-5.9987	.20.218	-0.29670	-0.2053	-0.77440	-5.9987
LGPB	1.4368	6.2301	0.23062	0.1609	0.27672	1.4368
LGPP	-1.5901	13.916	-0.11426	-0.0805	-0.27763	-1.5901
LGPCN	4.5588	10.057	0.45328	0.3052	1.0462	4.5588
LGPS	-1.6110	6.5872	-0.24456	-0.1704	-0.49363	-1.6110
LGPCA	0.23365	2.7333	0.85482E-01	0.0603	0.11789	0.23365
LGPFS	0.42550	5.2894	0.80443E-01	0.0568	0.45588E-01	0.42550
LGPK	-0.11249	3.6574	-0.30758E-01	-0.0217	-0.65926E-01	-0.11249
CONSTANT	7.8007	15.338	0.50857	0.3384	0.00000E+00	7.8007