

# Trade and Management: Exclusive Economic Zones and the Changing Japanese Surimi Market

JOHN T. SPROUL and LEWIS E. QUEIROLO

## Introduction

Japan has traditionally enjoyed virtual self-sufficiency in the supply of seafood to its domestic markets. Yet, in recent decades, Japanese suppliers have become increasingly dependent upon imports to meet consumer demand for

**ABSTRACT**— *The United States' increasing competitive advantage in international seafood trade in Alaska walleye pollock, Theragra chalcogramma, has contributed to higher prices for surimi-based goods and structural changes in seafood production and trade in Japan. The objectives of this analytical investigation include: 1) Evaluation of the role reversal of Japan and the United States in international seafood trade and 2) quantification of the impact of rising prices of frozen surimi on household consumption of surimi-based foods in Japan. This study documents Japan's regression from "seafood self-sufficiency" to increasing dependence on imported products and raw materials. In particular, Japan's growing dependence on American fishermen and seafood producers is described.*

*Surimi production by the United States, and its emerging dominance over Japanese sources of supply, are especially significant. Results of the analysis suggest that Japanese consumer demand for surimi-based foodstuffs correlates directly with "competitive" food prices, e.g., pork, chicken, and beef, and inversely with personal income. Also revealed is how rising household income and relative price shifts among competing animal protein sources in the Japanese diet have contributed to declining household consumption of surimi-based foods, specifically, and a shift away from seafoods in favor of beef, in general.*

*The linkages between, for example, Japanese domestic seafood production and consumption, international trade in marine products, and resource management decisions in the U.S. EEZ present a picture of a changing global marketplace. Increasingly, actions in one arena will have perhaps profound implications in the others.*

many of these fish products. In 1970, for example, Japan was virtually 100% self-sufficient in seafood production and supply. By 1988, however, according to U.N. Food and Agriculture Organization data, nearly one-fourth of Japan's domestic seafood supply was derived from imports (Table 1). Indeed, by the late 1980's and early 1990's, seafood was among the few areas of international commerce in which Japan registered a "trade deficit."

John T. Sproul is Research Associate in Fisheries Economics and Development, University of British Columbia, Fisheries Centre, 2204 Main Mall, Vancouver, B.C., Can. V6T 1Z4, and Lewis E. Queirolo is Alaska Regional Economist, Alaska Fisheries Science Center, National Marine Fisheries Service, NOAA, 7600 Sand Point Way N.E., Seattle, WA 98115-0070. Seniority of authorship is shared.

## Japan's Evolving Role in World Fisheries Trade

With the U.N. Convention on the Law of the Sea, most of the world's coastal nations (which had not formerly and unilaterally extended management jurisdiction over adjacent waters) instituted new resource management regimes in connection with the establishment of maritime Exclusive Economic Zones (EEZ). These regulatory changes have directly contributed to a fundamental shift in the relative status of the world's coastal and distant-water fishing nations (Queirolo and Johnston, 1992).

Japan, historically among the largest distant-water fishing powers in the world, was, as a result, profoundly impacted by this new ocean management

Table 1. — Japan's rate of self-sufficiency by major crops and other food groupings, 1960–88.<sup>1</sup>

Item	Percent self-sufficiency								
	1960	1965	1970	1975	1980	1985	1986	1987	1988
<b>Crop</b>									
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 and oils	42	31	22	23	29	32	32	30	33
<b>Other groupings</b>									
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
<b>Total food</b>	<b>98</b>	<b>94</b>	<b>88</b>	<b>82</b>	<b>80</b>	<b>76</b>	<b>77</b>	<b>74</b>	<b>72</b>

<sup>1</sup> Source: MAFF, Food Balance Sheet; Fujita, 1991.

strategy. Over a very short period of time, Japan's status in the world seafood market changed from a "net-exporter" of fishery products, to that of a "net-importer," dependent on external supplies to meet domestic demand.

Prior to the middle 1970's, Japan consistently reported annual catches and seafood exports which ranked at, or very near, the top among all nations. Likewise, the value of these catches and exports ranked number one among all reporting nations, over this period.

Over roughly the same interval of time, Japan ranked a relatively distant third, behind the United States and the Federal Republic of Germany, respectively, in terms of "volume of fishery

imports," despite the very much greater role of seafood in the daily diet of the Japanese consumer.<sup>1</sup>

Beginning in 1982, and in each year thereafter, however, Japan surpassed the U.S. as the world's leading seafood importing nation, on the basis of product volume (1977 on the basis of value) (FAO, 1970-90). By 1989, Japan imported seafood valued at over US\$10 billion, while U.S. imports were valued at less than US\$6 billion (Fig. 1). In like fashion, since 1978, the United States has repeatedly outpaced Japan as the leading seafood exporter (on the basis

<sup>1</sup> Japan ranked second, behind the United States, in terms of the value of imports over this period.

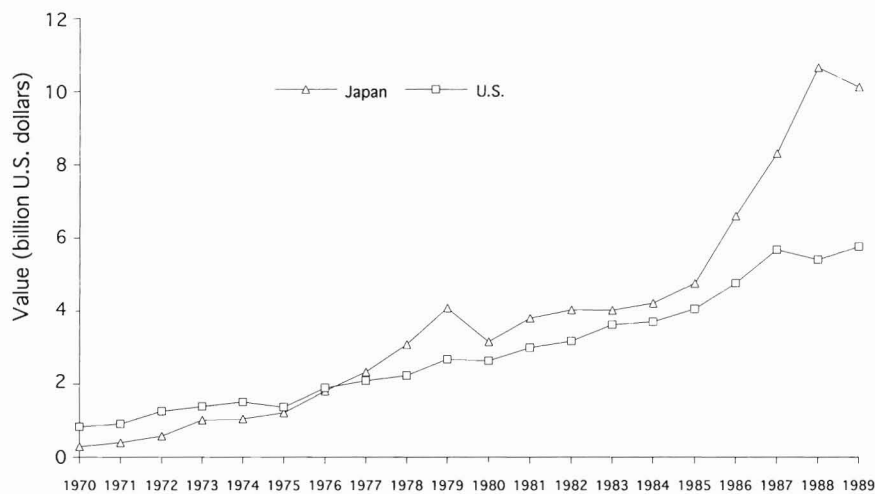


Figure 1. — Value of fishery products imported by Japan and the United States, 1970-89.

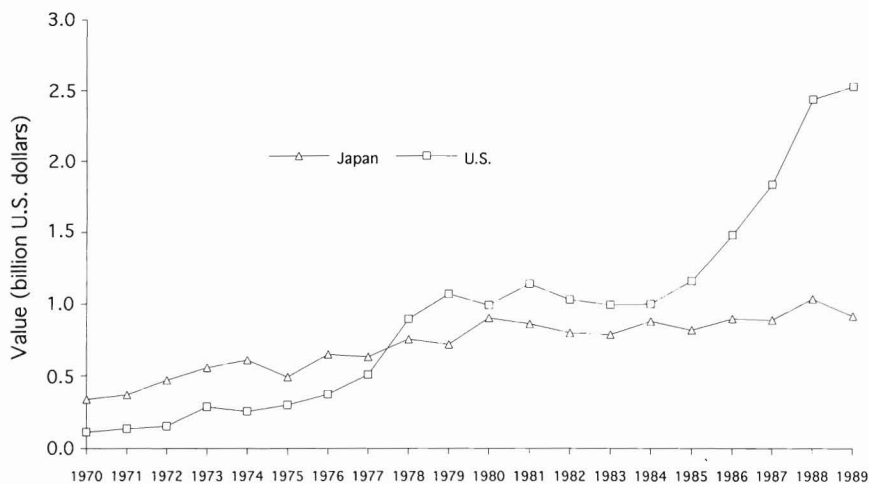


Figure 2. — Value of fishery products exported by Japan and the United States, 1970-89.

of value) marking the beginning of Japan's dependence on U.S. seafood suppliers and the reversal of their respective roles in the world seafood marketplace (Fig. 2). Such dependency constitutes a critical juncture in the history of a nation that maintains a population whose per capita annual consumption of fish and fishery products reached a near world record of 72.7 kg in 1989, second only to Iceland (FAO, 1991).

With the increasing trend towards "westernization" of the Japanese culture, the contribution of seafood to the average Japanese diet is decreasing. Nonetheless, seafood consumption remains extremely high relative to the rest of the world. For example, between 1961 and 1989, the "fish-to-animal protein" ratio in the average Japanese diet dropped from 67.9% to 50.6%. Over the same period in the United States, this ratio rose slightly from 4.6% to 6.4%.

In addition, Japan's role as a supplier of seafood in the world marketplace has been significantly altered. From a supplier of high-volume/high-valued seafood, such as fresh and fresh-frozen food products, Japan has become primarily an exporter of relatively low-valued seafood commodities, such as fish meal, oils, and soluble fats (Sproul, 1992a). Canned seafood once accounted for a significant share of Japan's fishery exports. Yet, between 1970 and 1989, Japanese exports of canned fish products declined by more than 65%. Rising world prices for canned seafood, especially in the United States, to some extent sustained Japan's total seafood export value.

### The Decision to Establish an EEZ

As suggested above, Exclusive Economic Zones, extending in most cases up to 200 n.mi. seaward from the coast of the declaratory country, radically restructured the world's ocean fisheries. In so doing, it simultaneously reordered international importer-exporter relationships by limiting resource access to the majority of the world's fishery resources on the basis of nationality.

By the mid-1970's, in the view of the U.S. Congress, certain stocks of fish in the oceans adjacent to the United States had been severely overexploited. At

least in part, this was believed to be a consequence of the rapid growth in fishing pressure and inadequate international management and conservation practices. The best scientific information available suggested that some of these ocean stocks had reached a point where their very survival was in doubt, while many others appeared to be in serious danger of reaching the same degraded state.

Existing international fishery agreements were not preventing this destruction, nor were they mitigating the continued overfishing of these highly valued resources. Therefore, the U.S. Congress resolved to institute a national conservation and management program, extending over the United States' living marine resources to prevent further degradation and to provide for the rebuilding of overexploited stocks.

The Congress also envisioned a program that would facilitate the "domestic" development of fisheries that, at the time, were underutilized, or not utilized at all, by the U.S. industry. The clear intent was to assure that benefits from employment, food supply, and commerce deriving from these fisheries would accrue to U.S. citizens. The result was adoption of the Magnuson Fisheries Conservation and Management Act of 1976 (MFCMA or Act). And, after implementation of the MFCMA, foreign participation in virtually all northeastern Pacific and eastern Bering Sea fisheries was brought under U.S. jurisdiction, and most were dramatically curtailed.

In debating the Act, the U.S. Congress acknowledged that many coastal areas of the United States are historically dependent upon fishing and affiliated activities. The Congress further cited what it believed to be the adverse impact that massive foreign fishing fleets operating in waters adjacent to these communities had on them. Thus, in light of these findings, the Act was explicitly designed to promote domestic utilization of the fisheries resources of the EEZ, through displacement of foreign capacity and fishing activities.

To this end, a number of innovative management strategies were developed by the National Oceanic and Atmo-

spheric Administration's National Marine Fisheries Service, the agency principally charged with implementation of the Act. One important example was the "Fish and Chips" policy. "Fish and Chips" was first informally articulated in the late-1970's. Reportedly, the initial use of "Fish and Chips" in negotiations took place in May 1977, when U.S. representatives discussed foreign fisheries allocations in the newly established U.S. EEZ with representatives from Italy, Spain, the EEC, and Japan (Freese, 1985). Subsequently, the policy was in large degree institutionalized in the form of the American Fisheries Promotion Act of 1980 (AFPA). As Freese (1985:157) notes, "The American Fisheries Promotion Act of 1980 increased the number of criteria (upon which access to the U.S. EEZ was based) to include cooperation of foreign nations in removing trade barriers, the purchasing of joint-venture and shoreside processed products, the minimization of gear conflicts, and the transfer of technology."

As suggested, "Fish and Chips" was intended to facilitate the accelerated development of the U.S. domestic fishing industry. By rewarding foreign operators with temporary access to the U.S. EEZ, in return for fishing and processing technology transference, as well as access to overseas markets, these management policies contributed to the "Americanization" of fisheries for do-

mestically underutilized species and greatly expanded participation by U.S. firms in the world fisheries marketplace. Under this management strategy, direct foreign access to fisheries allocations (referred to as TALFF) or cooperative operational allocations with U.S. fishermen (referred to as Joint-Venture Processing) were employed to reward cooperative foreign operators and punish uncooperative nations. While the "Fish and Chips" policy was not without its problems and critics, and was not always rigorously or consistently applied, it nonetheless reflected a management philosophy geared to the rapid growth of the U.S. domestic fishing and processing sectors, a philosophy consistent with the intent of the MFCMA.

By 1990, the fishery for Alaska or walleye pollock, *Theragra chalcogramma*, was totally "Americanized" (Fig. 3); and by 1991, as a result of the joint mandates of the MFCMA and AFPA, the entire North Pacific groundfish fisheries within U.S. waters were 100% "Americanized" (North Pacific Fishery Management Council, 1991), i.e., all direct foreign fishing activity within the North Pacific EEZ was eliminated, whether TALFF or Joint-Venture Processing. The impact of this policy on the northeastern Pacific pollock fishery and, in particular, the domestic Japanese food industry it supported, is the focus of the balance of this paper.

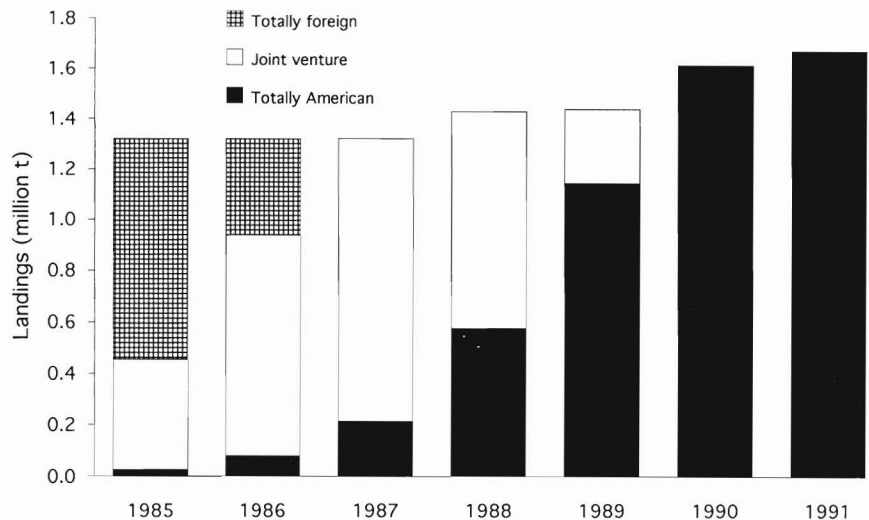


Figure 3. — Total landings of walleye pollock in the U.S. 200-mile EEZ, 1985-91.

## An Historical Context

According to Chitwood (1969), "The first trawling for groundfish off Alaska by an Asian nation occurred in 1929 when Japanese vessels explored the eastern Bering Sea. This exploration led to the development of a full scale commercial fishery in the eastern Bering Sea in 1933." These early Bering Sea groundfish fisheries were reportedly producing fish oil and meal. By 1940, additional Japanese groundfish trawl fisheries in this area had begun to produce catches which were frozen for human consumption.

World War II forced the Japanese to curtail distant-water fisheries, including those in the northeastern Pacific and Bering Sea. By the middle 1950's, however, Japanese trawlers were once again harvesting walleye pollock, among other species, from these waters. During the early 1960's, the Japanese groundfish trawl fleet had expanded westward along the Aleutian chain and into the Gulf of Alaska.

This expansion was, in part, dependent upon a technological development made in early 1959 at the Hokkaido Fisheries Research Laboratory, Abashiri, Japan. Researchers there perfected a method of freezing processed minced fish meat which maintained both the chemical and textural integrity of the flesh. The resulting fish paste was referred to as surimi (Nishiya et al., 1961), and it is used to produce processed foods for human consumption.

Fresh surimi had long been the principal building block for a myriad of traditional Japanese foods using processed fish. However, until it was possible to produce a high quality frozen surimi, product storage, transportation, and shelf life were very limited. With the Hokkaido technological developments, demand for frozen surimi grew in Japan's food processing industry. In the 1960's, factory trawlers (ship-based frozen surimi plants) enabled Japan to dramatically increase exploitation of the previously underutilized North Pacific pollock resource. The fishery grew at an unprecedented rate, with Japanese commercial pollock catches increasing rapidly through the late 1960's and

reaching a peak in 1972 of 1.6 million metric tons (t).

Following Japan's lead, several other nations began to harvest pollock from these waters (Table 2). These included distant-water fleets from the former U.S.S.R., the Republic of Korea, and, somewhat later, Taiwan, Poland, and the Federal Republic of Germany.

Walleye pollock is the primary species targeted by surimi producers in the North Pacific, with annual commercial catches, worldwide, reported to surpass 6,000,000 t (FAO, 1990). In the early 1970's, Japan's distant-water North Pacific trawl fleet, composed of factory trawlers and mothership operations, was the main domestic source supplying walleye pollock to the Japanese market (Fig. 4).

### Japan's Neriseihin Market

Walleye pollock is the preferred species in the production of surimi (Table 3). Japanese processors of surimi-based foods (neriseihin) grew dramatically in number as did production capacity during the expansionary period of Japan's North Pacific distant-water trawl fleet. However, as management authority over North Pacific groundfish resources was

claimed by the United States and Russia, this expanded surimi-dependent industry itself became increasingly reliant on imported surimi (Fig. 5).

Japan's National Surimi Association recently estimated annual world surimi production (Table 4). Their report revealed the increasing U.S. importance among major surimi producing nations. In just over 5 years (1985-91), Japan fell from the position of undisputed world surimi production leader to one of shared leadership with the United States.

Worldwide, the majority of walleye pollock harvesting capacity exists outside of Japan. In combination with the significant portion of surimi production occurring outside of Japan, apprehension within Japanese food processing industries that depend on adequate supplies of surimi at historically reasonable prices, intensified. These concerns were proven to be justified when, in 1991, 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, only a portion of which is re-exported to Japan, poor landings of At-

Table 2. — Annual pollock catches in the eastern Bering Sea by foreign distant water fleets.

Year	Pollock catch (t)						
	Japan	USSR	ROK	Taiwan	Poland	FRG	Other
1964	174,792						
1965	230,551						
1966	261,648						
1967	550,362						
1968	700,981 <sup>1</sup>		1,200 <sup>2</sup>				
1969	830,494	27,295	5,000				
1970	1,231,145	20,420	5,000				
1971	1,513,923	219,840	10,000				
1972	1,651,438	213,896 <sup>3</sup>	9,200				
1973	147,814	280,005	3,100				
1974	1,252,777	309,613	26,000				
1975	1,136,731	216,567	3,438				
1976	913,279	179,212	85,331				
1977	868,732	63,467	45,227	944			
1978	821,306	92,714	62,371	3,040			
1979	749,229	58,880	83,658	1,952	20,162		
1980	786,768	2,155	107,608	4,962	40,340	5,967	
1981	765,287		104,942	3,367	48,391	9,580	
1982	746,972		150,525	4,220		1,625	
1983	654,939		170,007			10,038	
1984	626,335	12,268	167,887		46,900	8,304	48
1985	584,484	1,504	160,735		22,696		
1986	256,178		76,313		3,616		1,043

<sup>1</sup> The Japanese also harvested small amounts of pollock from the Gulf of Alaska. From 1967 through 1975, for example, they reported catches ranging from 6 t to 30 t.

<sup>2</sup> Some trace amounts of pollock were reported from the Gulf of Alaska.

<sup>3</sup> The U.S.S.R. also reported landings of pollock in the Gulf of Alaska, although the amounts were quite small. Only trace amounts were reported before 1972. Between 1972 and 1975, catches ranged from 20 t to 38 t.

lantic cod, *Gadus morhua*, increased European demand for walleye pollock, in the form of fillets. Higher profitability from fillet sales encouraged American processors to reallocate portions of their catch from surimi production to fillets destined for the European market. The result was an overall decline in global surimi production and, more importantly to Japan, reduced amounts of surimi available for importation.

### Japanese Demand vs. World Supply of Surimi

The growing presence of U.S.-produced surimi in the Japanese import market is significant. From 1986 to 1992, direct imports (not including joint-venture products) of U.S.-produced surimi rose from 1.5% to 28.2% of the Japanese market, peaking in 1990, when it accounted for 31.2% of total supply (Sproul, 1992b).

Japanese domestic demand for surimi has continued to exceed domestic supply. Through 1991, "high-quality" surimi imports received an increasingly higher market price. Traditionally, price differentiation is a function of quality. For surimi, quality distinction is primarily attributed to production conditions. Given the enzymatic and biochemical characteristics of pollock, once harvested, tissue quality diminishes rapidly (Ehira and Uchiyama, 1974; Lerk, et al., 1965; Ang and Hultin, 1991). The Japanese generally believe that, due to faster conversion from live fish to frozen surimi, factory ship operations produce higher quality surimi. Following this reasoning, Japanese importers categorize surimi into several grades, based partly on whether it was produced by at-sea or shore-based operations. The result is a multi-tiered, grade-dependent, hierarchy of the surimi product based on both real and perceived quality differences.<sup>2</sup>

<sup>2</sup> Technological advances in surimi production, as well as improvements in fish handling and transportation of catch, have reportedly narrowed the perceived quality gap between at-sea and shore-based surimi. Indeed, at the time of this writing, shore-based processors operating in the Bering Sea and Gulf of Alaska produce surimi of all three principal grades, including "SA" or highest grade product. Likewise, at-sea processors do not produce a single, high-grade prod-

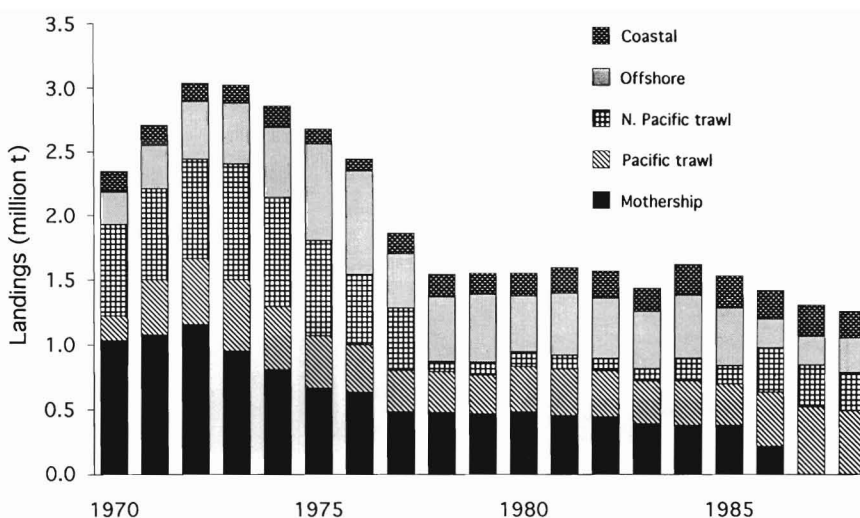


Figure 4. — Japanese landings of walleye pollock.

Table 3. — Production of surimi from principal fishes in Japan: 1975–89.<sup>1</sup>

Year	Total	Production (t)				
		Walleye <sup>2</sup> pollock	Sardine, mackerel	Atka mackerel	Horse mackerel	Other
1975	422,727	416,250		2,908	5	3,564
1976	462,738	453,154		6,361	10	3,213
1977	446,365	428,983		13,044	1	4,337
1978	381,132	369,057		5,669	1	6,405
1979	380,909	366,366		7,459	21	7,053
1980	374,244	355,147		10,353		8,744
1981	367,518	349,238	1,674	9,064		7,542
1982	383,928	366,915	2,234	7,629		7,150
1983	389,805	374,380	3,914	3,141		8,370
1984	425,829	401,571	8,983	3,875		11,300
1985	396,174	364,068	13,451	3,540		15,115
1986	352,349	308,957	13,168	4,451		25,773
1987	307,751	283,345	5,260	2,464		16,682
1988	291,704	267,513	4,471	5,286		14,434
1989	287,070	264,447	3,215	5,973		13,435
1990	241,000	196,000	I <sup>3</sup>	I	I	45,000
1991	211,000	166,000	I	I	I	45,000

<sup>1</sup> 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.

<sup>2</sup> Includes fresh and frozen surimi processed at-sea or at land-based facility. J.V production excluded.

<sup>3</sup> I = included within "Other" category.

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

While the distinction has become less meaningful, the Japanese convention of distinguishing between "at-sea" and "shore-based" sources of pollock surimi will be retained for purposes of examining trends in product supply and price for the balance of this paper.

uct, but instead respond to market signals and changing fish quality to produce the most appropriate grade of surimi at any given time. It would, therefore, be inappropriate to place too great an emphasis on the distinction between at-sea and shore-based product.

### Surimi Price Trends

Surimi prices in Japan have increased dramatically since 1976 for all three principal grades of surimi (Fig. 6). In part, due to speculation and uncertainty about future supply, surimi prices rose dramatically in 1977. The annual average price for high grade at-sea surimi remained high through 1980. However, in 1981, a significant downward price adjustment occurred, due partly to improved confidence in future product availability resulting from joint-venture

arrangements with U.S. catcher boats that remained firm throughout the early 1980's. From 1978 to 1990, prices for shore-based surimi remained relatively constant. Exceptions to this were the 1981 downward price adjustment pre-

viously described and the 1986 price peak associated with the dramatic appreciation in the Japanese yen.<sup>3</sup>

<sup>3</sup> The strong appreciation in the value of the Yen followed the Reagan-Nakasone 1985 Plaza Accord.

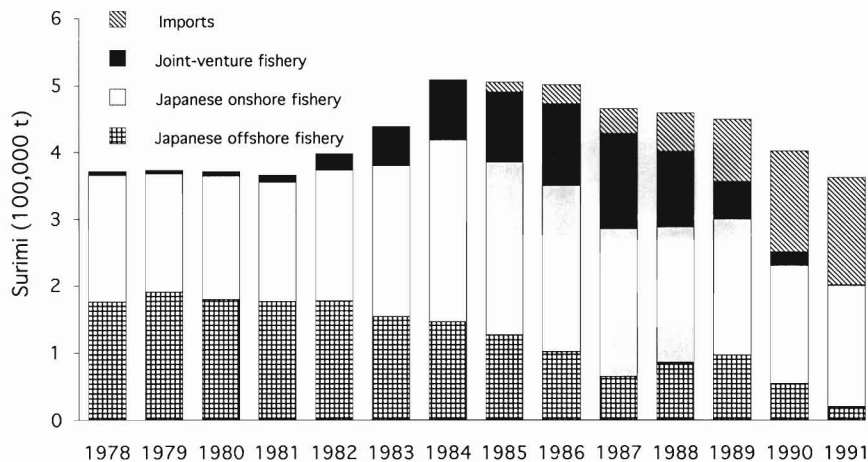


Figure 5. — Japan's sources of surimi.

Table 4. — World's major surimi producing nations,<sup>1</sup> 1985-91.

Year	Production (1,000 t)										Total	
	Japan			U.S.A.			Korea	U.S.S.R.	Argentina	Thailand		
	S.B. <sup>2</sup>	L.B. <sup>3</sup>	S.T. <sup>4</sup>	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

<sup>1</sup> J.V. production values are allocated to producing nations not landing nations. Source: Japan National Surimi Association.

<sup>2</sup> S.B. is production from Sea-Based vessels

<sup>3</sup> L.B. is production from Land-Based locations.

<sup>4</sup> S.T. is Sub-Total.

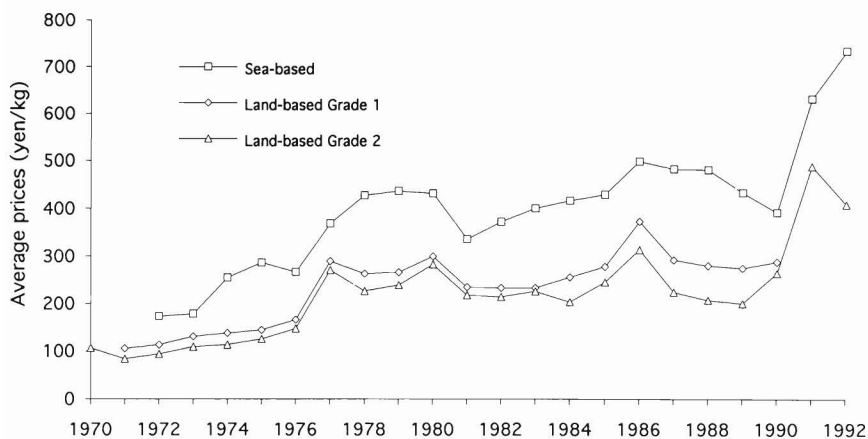


Figure 6. — Average surimi prices in Japan.

However, between January and December 1991, prices of at-sea and shore-based surimi increased 100% and 50%, respectively (Fig. 7). Several factors contributed to this dramatic surge in Japan. As previously noted, domestic demand outpaced available surimi supply in Japan during 1990. In addition, by that same year, walleye pollock joint-venture operations had been phased out in the U.S. EEZ. To some extent, this caused the surimi industry in Japan to relapse temporarily into its 1977 apprehension over future supply. To exacerbate matters further, prices for walleye pollock fillets, relative to surimi, rose in late 1990 with the decline in the North Atlantic groundfish fishery (Freese, 1991). 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 of a 2-year moratorium on the northern Atlantic cod fishery effective June 1992 (World Fishing, 1992).

As a result, demand for walleye pollock fillets bid surimi prices up on the world market. Prices peaked in Japan in late 1991 when domestic production of surimi-based foods was in full-swing to meet high seasonal domestic consumer demand during December and January. Figure 7 reveals the dramatic rise in monthly surimi prices from late 1990 through 1991, as well as their tapering off again in early 1992. Restocking of low frozen surimi cold-storage inventories in Japan was prompted in the spring and summer of 1992 as prices began to ease (Fig. 8).

### Japan's Changing Consumer Behavior

The Japanese have shifted from their traditional position of high rates of saving relative to personal consumption, to a "nation of consumers" (Emmott, 1989). 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 private sector net financial wealth-to-income ratio rose from 0.99% to 2.17%, while the saving ratio over the same time period fell from 22.8% to 15.1% (OECD, 1990).

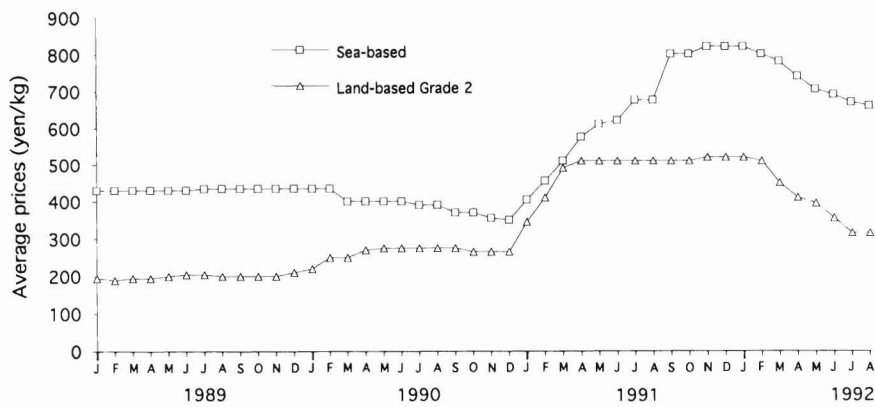


Figure 7. — Average monthly surimi prices in Japan, January 1990 to August 1992.

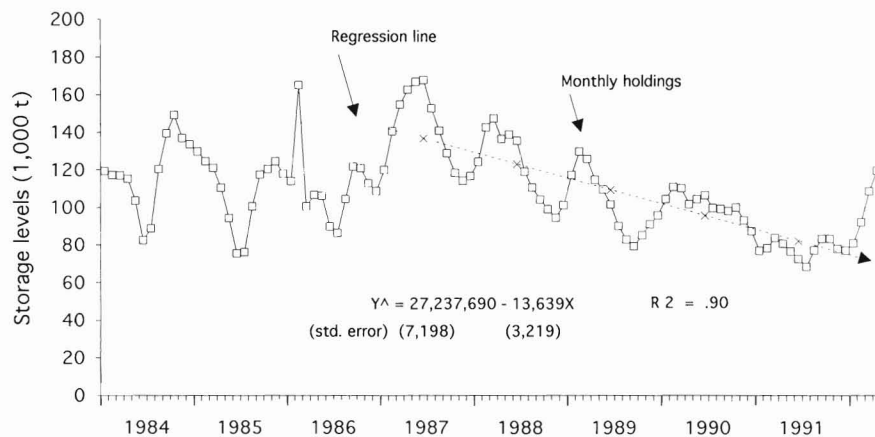


Figure 8. — Month-end levels of frozen surimi in cold storage in Japan, January 1984 to April 1992. Regression based on values from January 1987 to December 1991.

This economic prosperity has provided many Japanese consumers with opportunities that were otherwise unavailable at their previous level of expendable income. The Japanese domestic seafood market underwent transition as consumers became increasingly more selective as their personal wealth rose in the 1980's during the rapid growth of the national "bubble" economy.<sup>4</sup> Demand for high-valued fresh/frozen seafoods, now primarily import goods, grew. Generally, neriseihin foods would be among those processed food groups which Japanese consumers substituted for and moved away from.

Over the past decade, several factors have broadened the list of foods con-

sidered "acceptable" in the Japanese marketplace. These have encouraged diversity in consumption among seafoods and between competitive meat product forms. Among these influences are "price effects" resulting from nationalized EEZ fishing jurisdiction, "income effects" due to rising Japanese personal wages, and "taste effects" created by greater exposure through travel and exposure to nontraditional Japanese cultures and consumables.

#### Engel Curve Analysis

Trends in Japanese household consumption were investigated as a function of income, over time (1980 through 1990), using Engel curves to quantify consumption patterns of neriseihin and competitive protein sources, i.e., chicken, pork and beef.<sup>5</sup> Changes observed between Engel curves of these

commodities, but during the same year, would reflect variations in the relative consumption of each food category within the home. The result provides a means of detecting consumption trends for specific food groups.

The Annual Report on the Family Income and Expenditure Survey provides household expenditure data on specific foods (SBMCAJ, 1991). The expenditure values for neriseihin, beef, chicken and pork were converted to consumption quantities by dividing them by their respective average annual price as calculated for each income category. Regression analysis was conducted on these quantities as a function of income, generating Engel curves for each food category for the years 1980, 1985, and 1990. Figure 9 A, B, and C combines Engel curves of each food for the years 1980, 1985, and 1990, respectively. These data thus give comparisons among the years in household consumption of these foods.

To help visualize the implications of these shifts specifically to the average household in Japan, a vertical line corresponding to average nominal household annual income is provided in Figure 9 A, B, C. Using this average household income level ( $\bar{X}$ ) as a reference, the estimated quantities consumed at home ( $Y^$ ) of each food group for the average household in Japan during 1980, 1985, and 1990, are quantified and presented in Table 5.

As hypothesized, the annual rate of change in household consumption of neriseihin dropped most significantly in Japan during the second half of the 1980's (also Table 5). This correlated with a time of dramatic yen appreciation that followed the 1985 Plaza Accord.<sup>3</sup> It created conditions that allowed previously expensive foreign produced

<sup>5</sup> Engel curves are a means of quantifying shifts in consumption over time across and within income brackets. An Engel curve is a function relating the equilibrium quantity purchased of a commodity to the level of money income. The slope of the Engel curve at any given point indicates the income elasticity of demand for the good at that corresponding income level. Generally, income elasticities calculated for a particular good correspond to the average income level for the population under scrutiny. An Engel curve implicitly assumes constant prices for the time period evaluated.

<sup>4</sup> This phrase is commonly used by the Japanese media to describe the rapid growth of Japan's national economy during the late 1980's.

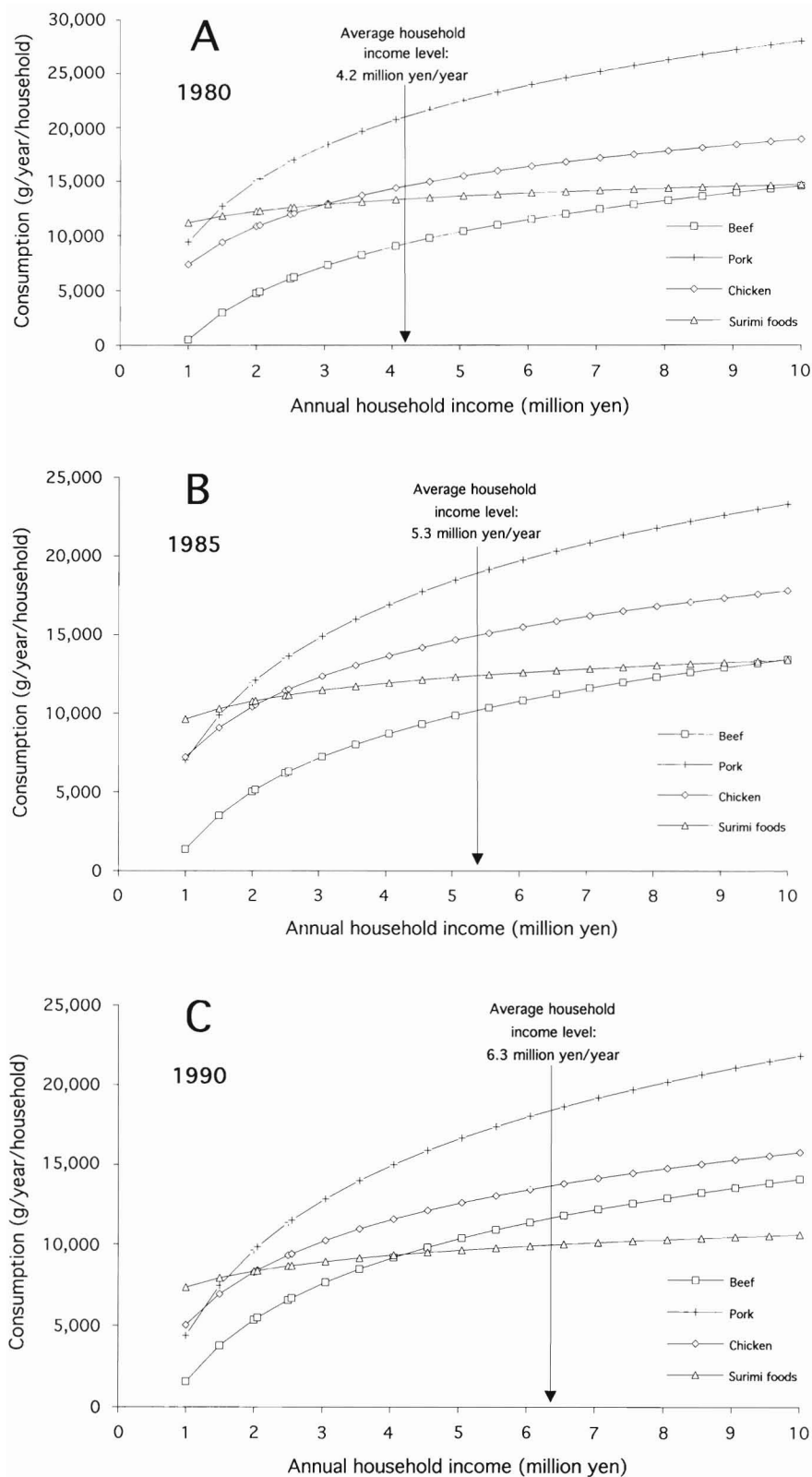


Figure 9. — Engel curves for Japanese household consumption of beef, pork, chicken, and neriseihin, collectively presented by year: A=1980, B=1985, and C=1990.

goods to appear increasingly more price competitive, relative to domestic products. This period proved especially devastating for neriseihin consumption, given its exacerbated problem of rising real prices.

These results confirm the evolving nature of the Japanese consumer's food preferences, as reflected in the retail marketplace. While the reasons for these changes are complex and numerous, we would argue that an important factor has been the increased dependence of Japan on "import" sources for many of its primary animal protein food stuffs, but particularly for seafoods. Had international fisheries management not so suddenly and broadly excluded Japan from directly accessing distant-water fisheries resources, the patterns of change within the Japanese market, cited above, may not have been so pronounced nor so rapid. The result may have been a more systematic and less disruptive adjustment to a changing world marketplace.

### Summary

Over the past decade, significant shifts in consumption patterns have occurred within Japanese households, especially in terms of specific seafoods. These have occurred in part as a result of trends in the international marketplace and marine resource management regime. As a result, Japan's food industry is changing from being production-export oriented to consumption-import oriented.

In 1990, total value of all food imported by Japan exceeded US\$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 been especially hard hit by the onset of the 200-mile EEZ era. Shifts in relative commodity prices and annual personal income have contributed to influencing household consumption patterns in Japan. Changes occurring between 1980 and 1990 were quantified using Engel curve analysis. The relevance of this exercise was to present implications for seafood demand in Japan resulting from relative price shifts among fish products and close competi-



**Table 5. — Estimated household consumption of pork, chicken, beef, and neriseihin within an average income household representative of 1980, 1985, and 1990.**

Food item	Consumption				
	1980 <sup>1</sup> (g/yr)	1985 <sup>2</sup> (g/yr)	Annual rate of change: 1980–85 (%)	1990 <sup>3</sup> (g/yr)	Annual rate of change: 1985–90 (%)
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	11,540	+2.6
Neriseihin	13,371	13,299	-0.1	9,937	-6.0

<sup>1</sup> based on annual average household income of ¥4,196,232;

<sup>2</sup> based on annual average household income of ¥5,338,152;

<sup>3</sup> based on annual average household income of ¥6,261,084; as reported in Annual Report on the Family Income and Expenditure Survey, 1991. Note: All figures calculated using respective Engel curve equations for each food at corresponding year.

itive animal protein sources. Disproportionally rapid price increases among specific marine products relative to competitive proteins can potentially occur from external fisheries management decisions made by government bodies endowed with authority over those resources.

Generally, the mandate of most international and national marine resource management authorities is to protect future biological viability of their fishery stocks. In the case of the Magnuson Act of 1976, socioeconomic criteria are also incorporated in an attempt to attain "optimum sustainable yield" (as contrasted with "maximum sustainable yield) from the resource (Federal Register, 1983). Implied in this concept is a degree of responsibility by managers to domestic interests utilizing the resource.

Therefore, to this end, the implications that U.S. management decisions have for Japanese household consumption via market effects might well be considered by decision makers. That is, when the management decisions undertaken by one government have such profoundly significant influences, both short- and long-term, on demand in a key world seafood market, these im-

pacts should be explicitly assessed and appropriately weighted in the decision process. Certainly, the linkages between national and/or international fishery management institutions and domestic food policies among users of these important resources need more careful examination. How the concerns of the EEZ nations and those of traditional user nations can be jointly accommodated in the management decision process is a challenge which will confront all parties well into the 21st century.

### Literature Cited

Ang, J., and H. Hultin. 1991. Denaturation of cod myosin during freezing after modification with formaldehyde. *J. Food Sci.* 54(4):814–818.

Chitwood, P. E. 1969. Japanese, Soviet, and South Korean fisheries off Alaska: Development and history through 1966. U.S. Dep. Inter., Fish Wild. Serv., Bur. Commer. Fish., Circ. 310, 34 p.

Ehira, S., and H. Uchiyama. 1974. Freshness-lowering rates of cod and sea bream viewed from changes in bacterial count, total volatile base- and trimethylamin-nitrogen, and ATP related compounds. *Bull. Jpn. Soc. Sci. Fish.* 40(5):479–487.

Emmott, B. 1989. *The sun also sets: Why Japan will not be number one.* Simon and Schuster Publ., N.Y.

FAO. 1970–90. *Yearbook of fishery statistics: catches and landings; Food Agric. Organ. U.N., var. years, vol., no., pagin.*

\_\_\_\_\_. 1991. Food and Agriculture Organization of the United Nations. Fish and fishery products: World apparent consumption statistics based on food balance sheets (1961–1989). Rome, p. 111, 120.

Federal Register. 1983. Guidelines for fishery management plans. 48(35) Pt. 602, § 602.11, 18 February.

Freese, S. P. 1985. The Magnuson Fishery Conservation and Management Act and the role of economics: The Mid-Atlantic surf clam and Atlantic squid experiences. Univ. Del., Ph.D. dissert., unpubl.

\_\_\_\_\_. 1991. An overview of the pollock processing industry. Addendum I to the Regulatory Impact Review/Initial Regulatory Flexibility Analysis of Proposed Inshore/Offshore Allocation Alternatives for Amendments 18/23 to the Groundfish Fishery Management Plans for the Gulf of Alaska and the Bering Sea/Aleutian Islands. U.S. Dep. Commer., NOAA, Natl. Mar. Fish. Serv., 12 p.

Fujita, N. 1991. Agriculture and agricultural policy in Japan. In *The Committee for the Japanese Agriculture Session (Editor), Food consumption in Japanese agriculture*, p. 39–46. XXI Int. Assoc. Agric. Econ. Conf., Tokyo.

Lerk, P., R. Adams, and L. Farber. 1965. Bacteriology of spoilage of fish. III. Characteristics of spoilers. *Appl. Microbiol.* 21:101–120.

Nishiya, K., K. Tamoto, T. Fukumi, S. Aizawa, F. Takeda, O. Tanaka, and T. Kitabayashi. 1961. Study on the freezing of surimi and its applications. *Fish. Agency Jpn., Hokk. Fish. Res. Lab., Rep.* 18:122–135.

North Pacific Fishery Management Council. 1991. Newsletter: Alaska groundfish fisheries fully Americanized in 1991. #6–90:1.

OECD. 1990. Economic studies report. Organ. Econ. Coop. Develop. Paris, Rep. 14, 40 p.

Queirolo, L. E., and R. S. Johnston. 1992. Cooperative fishing arrangements between coastal countries and distant water fleets. In *Proc. Sixth Biennial Conf. Int. Inst. Fish. Econ. Trade*, Paris.

SBMCAJ (Statistics Bureau Management and Coordination Agency of Japan). 1991. Annual report on the family income and expenditure survey. Stat. Bur. Manage. Coordination Agency Jpn., Off. Prime Minister, Tokyo, p. 77–78.

Sproul, J. T. 1992a. Trends in Japan-USA seafood trade, with an emphasis on Alaska pollock surimi, and the effects on Japanese household consumption of surimi-based foods. Hokkaido Univ. Fac. Fish., Ph.D. dissert., unpubl.

\_\_\_\_\_. 1992b. Effects of North Pacific 200-mile exclusive economic zone marine management policy on Japanese seafood production, trade, and food security. *Bull. Fac. Fish. Hokkaido Univ.* 43(3):124–151.

World Fishing. 1992. Canadian moratorium cripples Newfoundland cod fishery. *Feature-Canada. World Fishing Aug.*: 2–3.