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**Salmon – A Study of  
Global Supply and Demand**

by

**Trond Bjørndal  
Gunnar A. Knapp  
Audun Lem**

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# **Salmon – A Study of Global Supply and Demand**

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## **EXECUTIVE SUMMARY**

The international markets for salmon have developed enormously over the last decades. Total global supply of farmed and wild salmon has increased almost fourfold from 550,000 tonnes in 1980 to more than 2 million tonnes in 2002. The main cause of the supply increase is a rise in aquaculture production from less than 15,000 tonnes in 1980 to an estimated 1.3 million tonnes in 2002. Since 1997 supply from aquaculture has been higher than from wild salmon fisheries.

The major producers of farmed salmon are Norway and Chile. Of wild salmon, the largest suppliers are the USA, Japan and the Russian Federation.

The most important markets for salmon are the European Union, Japan and the USA. New salmon markets are developing in Central and Eastern Europe, South East Asia and China, and in South America.

With growing output, prices on salmon have shown a long-term decline, although price vacillations from year to year may be significant, due to short-term swings in supply. Production costs in aquaculture have also decreased thanks to economies of scale, improved technology and better feed.

Salmon consumption is increasing in most markets and new product variations and value-added products are being introduced. Industry observers expect consumption of salmon to grow further, although at lower growth rates than experienced so far.

# 1 INTRODUCTION

There are six commercially important salmon species. One (*Salmo salar*) is native to the Atlantic Ocean, the other five (all genus *Oncorhynchus*) to the Pacific.<sup>1</sup> Commonly, salmon trout (genus *Oncorhynchus*) is also considered a salmon species, as will be the case in this report. Salmon is supplied by the capture fisheries that harvest wild stocks and fish farms which culture Atlantic and the more valuable of the Pacific species.

In this report, salmon production is analysed in chapter 2. The worldwide supply of salmon from both the capture fishery and aquaculture will be considered as the products from these two sources compete in the market. Salmon markets will be considered in chapter 3, with an emphasis on the United States, the European Union and Japan. Markets for canned and organic salmon will be dealt with in chapter 4. The appendices contain further data on the wild harvest of salmon and an overview of statistical sources.

Unless otherwise stated, all values presented in this report are nominal values.

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<sup>1</sup> There is a sixth Pacific species, masu or cherry salmon (*Oncorhynchus masou*), harvested in negligible quantities, see chapter 2.2.

## 2 GLOBAL SALMON PRODUCTION

This chapter provides a description of the development of global salmon production from capture fisheries and salmon aquaculture.

### 2.1 The Global Supply of Salmon

The global supply of farmed and wild salmon species has increased almost fourfold from 550,000 tonnes in 1980 to 2.14 million tonnes in 2001 (Figure 2.1.1). The global salmon aquaculture production has experienced a tremendous growth since the early 1980s. From an annual production of 12,800 tonnes in 1980, it was estimated at more than 1.3 million tonnes in 2001. In comparison, the wild-caught quantities increased from 537,000 tonnes in 1980 to 812,000 tonnes in 2001, however, this is down from a peak of 997,000 tonnes in 1995. Since 1997 the farmed quantities have been higher than the wild-caught.

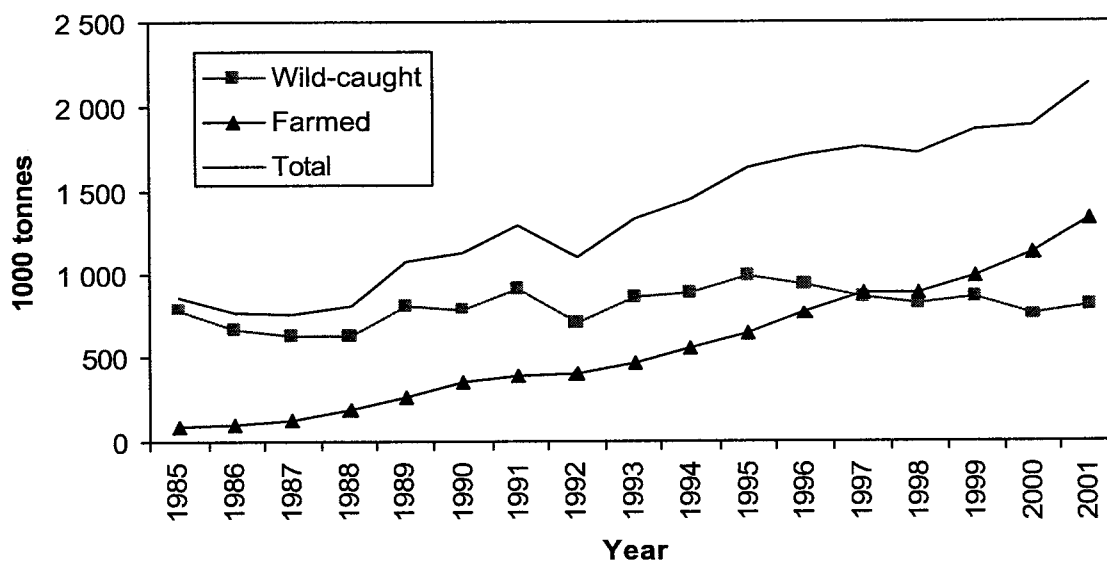


Figure 2.1.1. Total Production of Salmon and Salmon trout (Wild and farmed) 1985-2001.

As shown in Figure 2.1.1 wild salmon catches increased until 1995, but have henceforth declined until 2000. A pronounced characteristic of wild salmon fisheries, however, is the large fluctuations in catches from year to year. As a simplification one can say that

farmed salmon is the source of the trend growth in total salmon supply, while wild salmon is mainly responsible for year-to-year fluctuations.

Today, more than 60 % of the world's salmon supply is farmed salmon. With a continued production growth the market share of farmed salmon can be expected to increase further, since it is not anticipated that catches of wild salmon shall remain at the same high levels experienced in recent years.

The bulk of the catches of wild salmon are made up by the three species pink (*Oncorhynchus gorbusha*), chum (*Oncorhynchus keta*) and sockeye (*Oncorhynchus nerka*), while the aquaculture mainly farms Atlantic salmon (*Salmo salar*), coho (*Oncorhynchus kisutch*) and salmon trout (*Oncorhynchus mykiss*). In the mid 1980s, the global supply of salmon was dominated by chum, pink and sockeye. As the aquaculture production has accelerated, however, Atlantic salmon has become the leading species world-wide, with an increase in production from 70,000 tonnes in 1986 to 996,000 tonnes in 2001. This raised Atlantic salmon's share in global harvest from 9% in 1986 to 47% in 2001. The harvested quantities of both pink and chum also grew in this period, but the production shares fell from 27% and 33% in 1986 to 18% and 14% in 2001, respectively. Sockeye accounted for 18% of global harvest in 1986, but due to reductions in catches and increased farmed salmon production, its share was only 5% in 2001. Thereby it was surpassed by farmed coho with a 6% share in 2001 and farmed salmon trout, with a 9% share in 2001. The harvest of the main species can be seen in Figure 2.1.2 for the selected years 1986, 1992, 1995, 1998 and 2001.

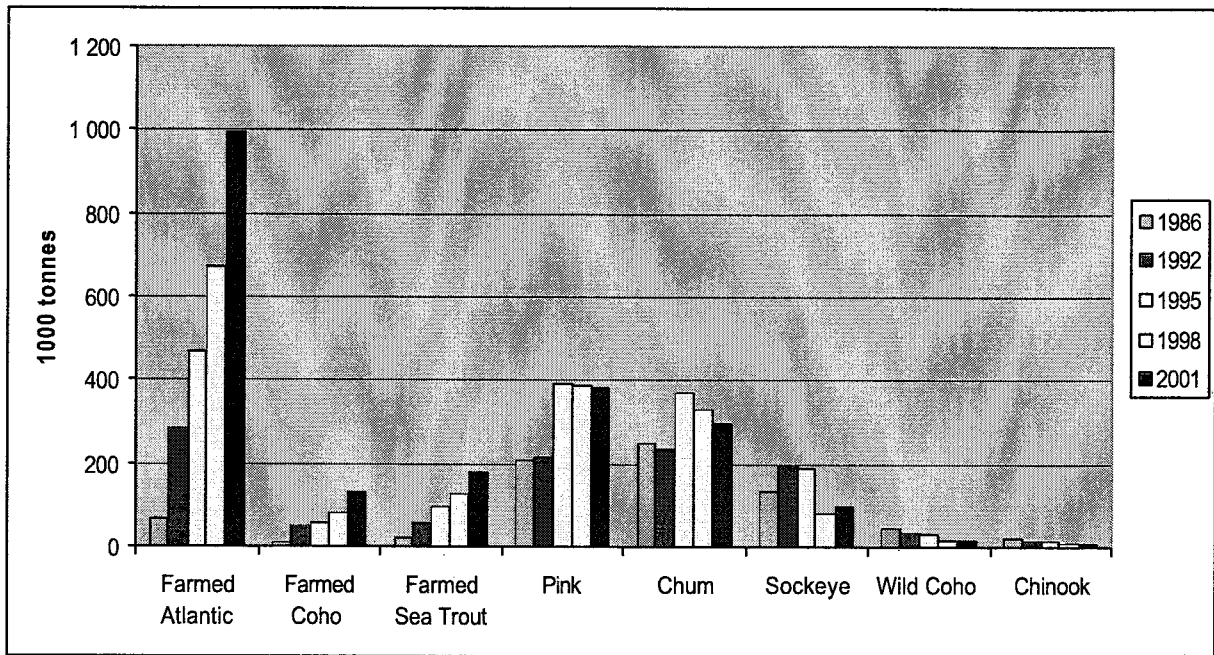


Figure 2.1.2. Harvest of Main Salmon Species in selected years.

## 2.2 Wild Salmon Production

In this section we review trends in wild salmon production and factors affecting wild salmon production. Appendix A provides a detailed discussion of our data sources for wild salmon production, and a table showing our assumptions for wild salmon harvests by species and country for the period 1980-2001. Except where otherwise noted, all of the tables and figures in this section are based on these assumptions.

As shown in Table 2.2.1, there are wild commercial harvests of seven salmon species. In addition to pink, chum and sockeye salmon, there are also wild harvests of coho salmon (*Oncorhynchus kisutch*), chinook salmon (*Oncorhynchus tshawytscha*), masu salmon (*Oncorhynchus masou*), and Atlantic salmon (*Salmo salar*). Wild commercial harvests of masu salmon and Atlantic salmon are very small and we do not consider them further in this report.

Table 2.2.1. Commercially Harvested Wild Salmon Species

Species	Other common names	Scientific name	Average world wild harvest, 1996-2000 (MT)
Pink salmon	Humpback salmon	<i>Oncorhynchus gorbuscha</i>	331,477
Chum salmon	Dog salmon; Keta salmon	<i>Oncorhynchus keta</i>	326,180
Sockeye salmon	Red salmon	<i>Oncorhynchus nerka</i>	130,469
Coho salmon	Silver salmon	<i>Oncorhynchus kisutch</i>	18,791
Chinook salmon	King salmon; Spring salmon	<i>Oncorhynchus tshawytscha</i>	10,085
Masu salmon	Cherry salmon	<i>Oncorhynchus masou</i>	2,148
Atlantic salmon		<i>Salmo salar</i>	5,302
<b>Total</b>			<b>824,452</b>

Figure 2.2.1 shows trends in world wild salmon harvests by species from 1980-2001. Total world wild salmon harvests rose during the 1980s and early 1990s from just over 500 thousand tonnes to almost a peak of 1 million tonnes in 1995, falling below 800 thousand tonnes by 2000. Pink salmon, chum salmon, and sockeye salmon—in that order—account for most commercial production. Both sockeye and chum salmon harvests rose during the 1980s and early 1990s while declining in the late 1990s. Pink salmon harvests were sharply higher in the 1990s than in the 1980s, and have not shown any significant recent upward or downward trend.

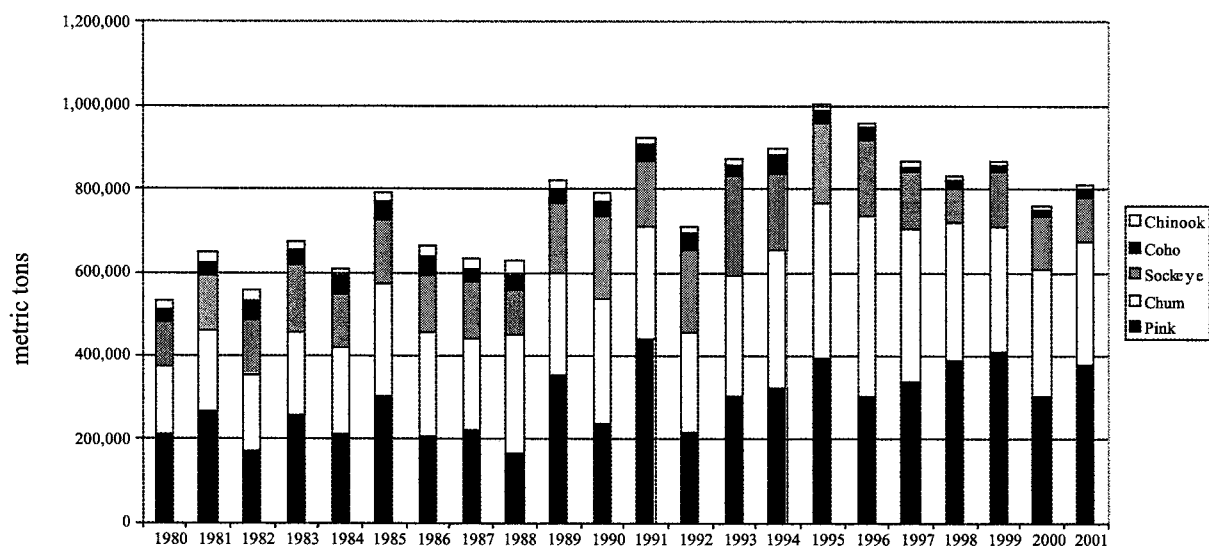


Figure 2.2.1 World Wild Salmon Harvests by Species

Figure 2.2.2. shows the distribution of catches of wild salmon between the four main harvesting countries. The United States is the leading wild salmon producer, accounting for about 44% of the total global catch over the period 1980-2001. Over the same period, Japan accounted for 27% of the total wild catch, Russia accounted for 20%, and Canada accounted for 8%.

The importance of the different Pacific salmon species differs among the countries catching wild salmon. The US catches mainly pink salmon and sockeye, but chum has gained in relative importance in recent years while sockeye catches have decreased. Over 80% of the Japanese catches are chum. Russia catches mostly pink salmon, while Canada lands mostly pink salmon and sockeye.

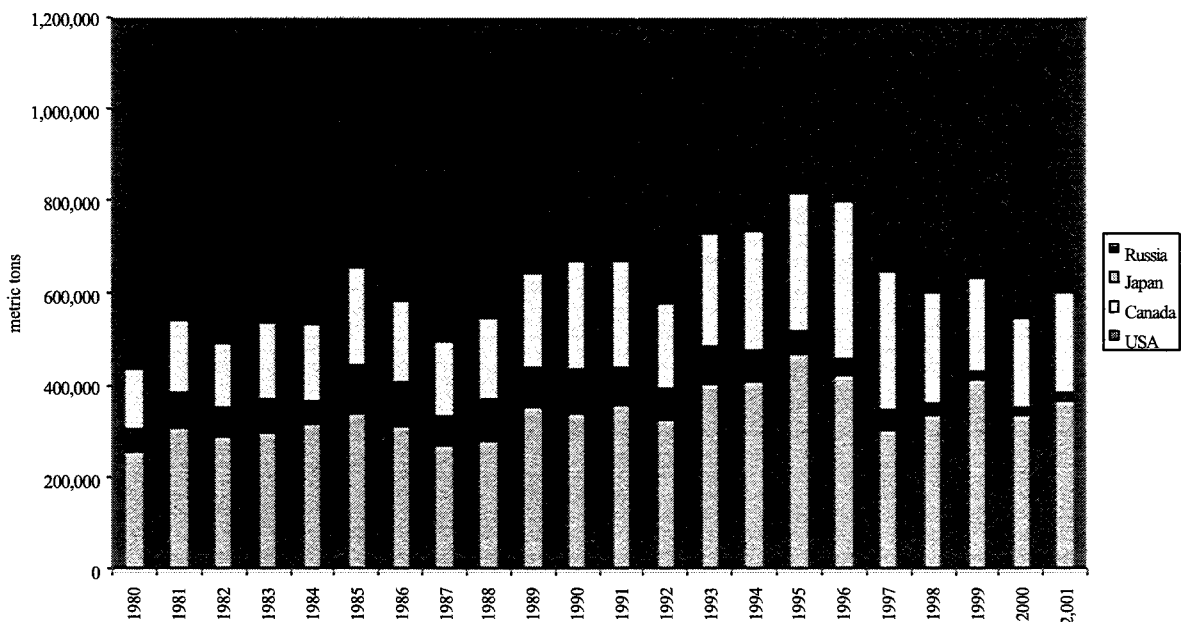


Figure 2.2.2. World Wild Salmon Harvests by Country

### 2.2.1 Hatchery Production of Wild Salmon

Salmon released by hatcheries account for a significant share of the world's wild salmon production. As shown in Table 2.2.2, during the 1990s, about five billion juvenile salmon were released annually by hatcheries in Canada, Japan, Russia and the United States. Most of the hatchery releases are chum salmon (primarily from Japanese and United States hatcheries) and pink salmon (primarily from US and Russian hatcheries).



Table 2.2.2. Hatchery Releases of Juvenile Salmon, by Species and Country (millions of fish)

Species	Country	1993	1994	1995	1996	1997	1998	1999	2000
Pink	Canada	22	42	67	35	58	37	13	15
	Japan	138	140	118	138	137	141	142	139
	Russia	292	246	252	311	328	324	268	338
	USA	819	794	921	1,004	773	878	878	881
	<b>Total</b>	<b>1,271</b>	<b>1,222</b>	<b>1,358</b>	<b>1,487</b>	<b>1,296</b>	<b>1,379</b>	<b>1,301</b>	<b>1,373</b>
Chum	Canada	227	217	216	153	191	223	154	75
	Japan	1,960	2,052	2,019	2,010	1,943	1,874	1,868	1,817
	Russia	236	207	219	305	280	282	279	326
	USA	528	467	532	594	520	524	515	546
	<b>Total</b>	<b>2,951</b>	<b>2,943</b>	<b>2,987</b>	<b>3,063</b>	<b>2,934</b>	<b>2,903</b>	<b>2,816</b>	<b>2,765</b>
Sockeye, Chinook, Coho, Steelhead & Cherry	Canada	398	320	248	186	404	173	208	232
	Japan	19	16	14	17	18	15	16	16
	Russia	3	7	7	11	10	10	19	7
	USA	390	468	513	489	410	447	314	359
<b>Total</b>	<b>Total</b>	<b>810</b>	<b>810</b>	<b>782</b>	<b>704</b>	<b>842</b>	<b>646</b>	<b>556</b>	<b>614</b>
Total	Canada	646	578	530	375	653	433	375	322
	Japan	2,116	2,208	2,151	2,165	2,097	2,030	2,026	1,972
	Russia	532	460	478	627	619	616	566	671
	USA	1,738	1,728	1,966	2,088	1,703	1,849	1,707	1,787
	<b>Total</b>	<b>Total</b>	<b>5,031</b>	<b>4,974</b>	<b>5,126</b>	<b>5,254</b>	<b>5,072</b>	<b>4,928</b>	<b>4,673</b>

As shown in Table 2.2.3, hatchery fish account for almost all Japanese chum salmon harvests, about 30% of U.S. pink salmon harvests, and about 64% of U.S. chum salmon harvests. We do not have data on the contribution of hatchery fish to catches in Canada and Russia, although comparison of releases in those countries with releases in the United States and Japan suggest that hatchery catches for Canada and Russia are significant. Based solely on the United States and Japanese catches, we may conclude that hatchery fish represented at least 39% of world wild salmon harvests during the period 1995-99. It is likely that the actual contribution of hatchery fish, including Russian and Canadian catches, was closer to 50%.

Table 2.2.3. Minimum Estimate of Contribution of Hatchery Salmon to World Wild Salmon Production

Species	Country	Average hatchery releases, 1993-97	Average catch, 1995-99	Estimated catch of hatchery fish	Minimum estimate of hatchery share
Pink	Canada	48	10,811		
	Japan	135	23,143		
	Russia	292	165,540		
	USA	874	167,731	49,701	30%
	Total	1,348	367,225	49,701	14%
Chum	Canada	201	10,433		
	Japan	1,997	245,254	245,254	100%
	Russia	249	24,574		
	USA	529	79,778	50,986	64%
	Total	2,975	360,038	296,240	82%
Sockeye, Chinook, & Coho	Canada	311	14,676		
	Japan	17	6,319		
	Russia	8	17,417		
	USA	454	139,274	8,723	6%
	Total	789	177,685	8,723	5%
Total	Canada	556	35,919		
	Japan	2,148	274,716	245,254	89%
	Russia	543	207,531		
	USA	1,845	386,783	109,411	28%
	Total	5,091	904,948	354,665	39%

Note: Pink hatchery releases are for the period 1994-98. Minimum estimate of hatchery share is based only on United States catches and Japanese chum catches.

### 2.2.2 Factors Influencing Wild Salmon Supply

Harvests of wild salmon are affected by a wide variety of natural and anthropogenic factors. The combined effect of these factors is to give wild salmon supply the following characteristics:

- ? Wild salmon harvests fluctuate significantly from year to year due to natural variation in the environment.
- ? Wild salmon harvests also fluctuate significantly over longer-time periods due to natural variation in the environment as well as human-caused changes in the environment.
- ? In the short-term, wild salmon harvests are highly price inelastic: short-term changes in market conditions have little immediate effect on supply

? Over the longer term, wild salmon harvests are more price elastic: sustained changes in market conditions may have a significant effect on supply.

As illustrated in Figure 2.2.3, wild salmon harvests fluctuate significantly from year to year. This annual harvest variation is mainly due to annual variation in the multiple natural environments which wild salmon experience during their complex migratory life-cycle. Variations in stream temperature, current and turbidity affect salmon survival in freshwater environments. Variation in ocean temperature and currents affect the abundance of salmon predator and prey species and salmon survival in marine environments. Variation in the number of salmon which survive to return to spawn—partly reflecting commercial catches—affects the number of eggs which are laid for future generations. A low or high number of salmon returning to spawn in any given year may be echoed in two to five years (depending upon the species) when the next generation hatched from those eggs returns to spawn. (A clear example may be seen in Russian harvests of pink salmon during the period 1981-91, when pink salmon harvests were high during the odd years and low during the even years in (see Figure 2.2.2).

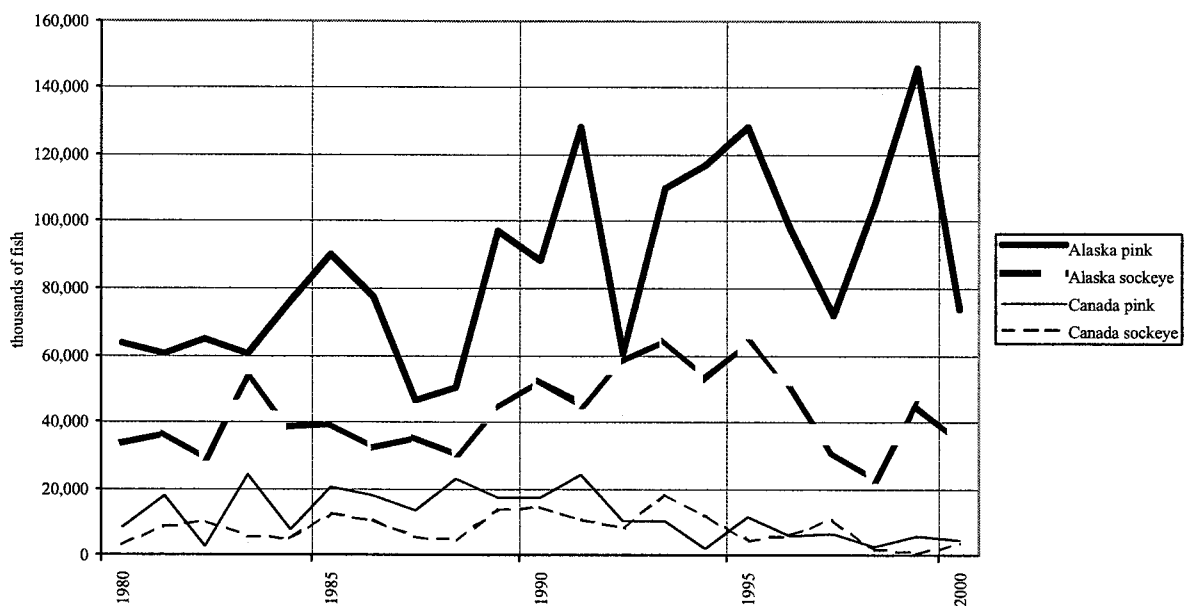


Figure 2.2.3. Alaska and Canada Annual Harvests of Sockeye and Pink Salmon, 1980-2000

Wild salmon harvests vary not only from year to year but also over longer-term cycles. As can be seen in Figure 2.2.4, there were significant fluctuations in average decadal harvests of wild Pacific salmon during the 20<sup>th</sup> century. While long-term variation in historical harvests of Pacific salmon may partly be attributed to changes in harvesting effort, they are also correlated with multi-decadal “regime shifts” in North Pacific ocean temperatures and currents, which affect nutrient upwelling and availability of feed for salmon and their prey and predator species. The causes of regime shifts are not well

understood, nor the mechanisms by which they affect ocean survival of wild salmon. Changes in ocean conditions affect different species in different ways, and may tend to increase runs of a given species to some areas, while reducing runs of the same species to other areas. The 1980s and 1990s were a period of historically high salmon harvests. Future regime shifts could significantly affect harvests, but it is difficult to predict when regime shifts may occur or how they are likely to affect harvests.

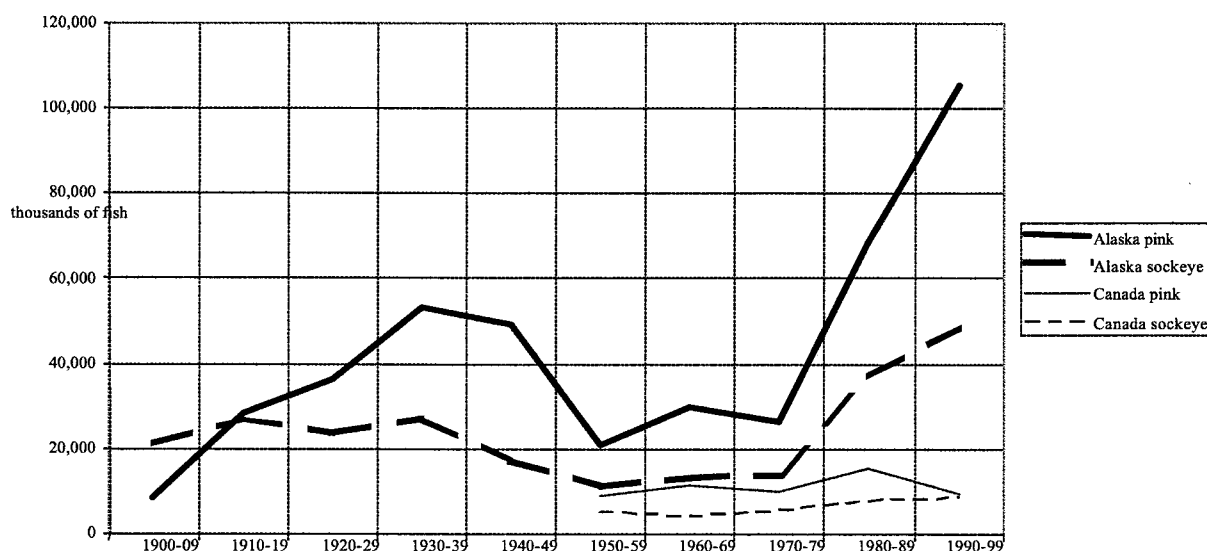


Figure 2.2.4. Alaska and Canada Average Decadal Harvests of Sockeye and Pink Salmon, 1900-1999

Human caused changes in the environment may also have long-term effects on wild salmon harvests. Over-harvesting, construction of dams, and pollution of rivers have contributed to the decline of once-healthy wild salmon runs in many places, such as the US Pacific northwest states. However, it is unlikely that these factors will lead to large further declines in natural wild salmon harvests in the near future. The largest remaining wild salmon runs do not face immediate human-caused environmental threats because they are in remote areas of Alaska and Russia. Management agencies seek to allow adequate escapement of salmon to spawning streams to allow commercial harvests to be sustained (although inadequate enforcement could lead to over-harvesting of some Russian salmon stocks). Certainly, however, over the long term the future of the wild salmon industry depends on conservative harvest rates and protection of salmon streams and spawning habitat.

In the short-term, wild salmon supply is price inelastic: changes in market conditions have little immediate effect on wild salmon harvests. The volume of salmon available for harvest in any given year is limited by the number of fish returning from the ocean,

so fishermen cannot harvest more salmon in response to an increase in prices. In contrast, if prices fall, some salmon runs may go unharvested, but most available wild salmon have been harvested even at the significantly lower ex-vessel price levels of recent years.

Over the longer-term, it is likely that wild salmon harvests are more price elastic, so that sustained changes in market conditions may have a significant effect on supply. In particular, changes in prices affect the economic viability of salmon hatcheries and are thus likely to affect numbers of hatchery releases over time. Changes in prices may also affect the long-term economic viability of harvesting and processing wild salmon. However, economic inefficiencies in North American salmon fisheries provide something of a buffer against the effects of lower prices on harvests, because of the potential to increase efficiency in response to lower prices.

### 2.2.3 United States of America, Wild Salmon Production

The USA was traditionally the world's leading supplier of salmon. This changed recently. In 1997, Norway surpassed the USA. In 2000, the Chilean production including salmon trout was slightly higher than that of the USA. However, the USA is still the world's largest supplier of wild salmon. As shown in Figure 2.2.5, pink, sockeye and chum salmon account for the largest shares of the United States wild salmon harvest, respectively.

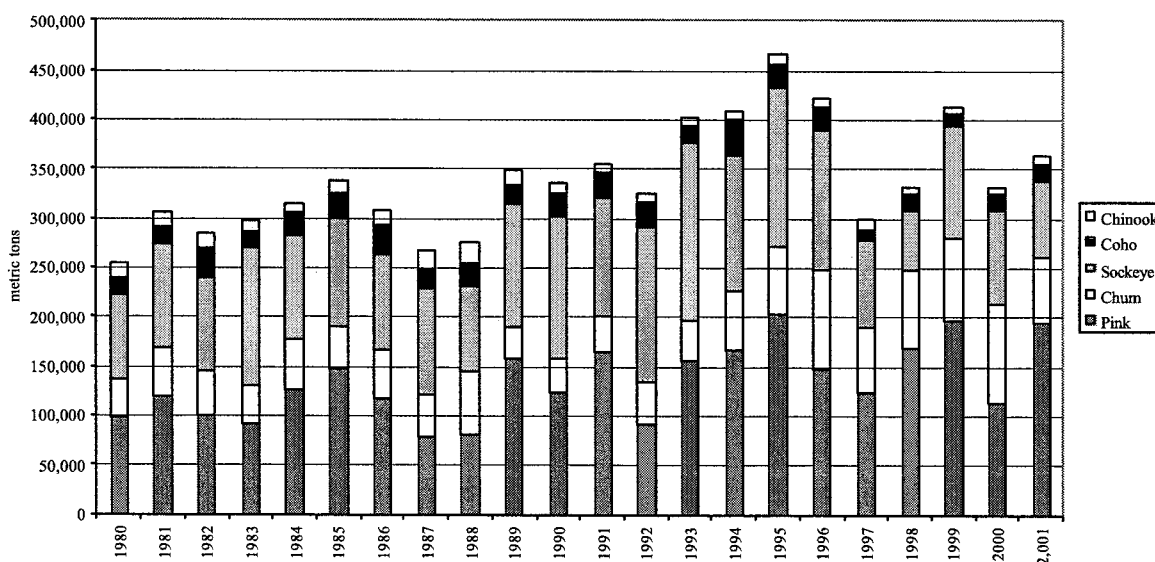


Figure 2.2.5. United States Wild Salmon Harvests, by Species

Alaska accounts for almost all of the United States commercial wild salmon harvests, although small volumes are harvested in Washington, Oregon and California. Between

1995 and 2001, Alaska accounted for more than 96% of United States pink, sockeye and chum salmon harvests, 92% of coho salmon harvests, and 48% of Chinook salmon harvests. In the remainder of this section we focus on Alaska salmon production only, because much more comprehensive data are available for Alaska than for the relatively minor production from other states.

As shown in Table 2.2.4, Alaska salmon harvests reached record levels in 1993-96, with a peak of 449,000 tonnes in 1995, with pink (197,200 tonnes) and sockeye (158,600 tonnes) the most important species in terms of quantity. Subsequently landings have fallen to a level of 347,200 tonnes in 2001. The sockeye salmon catch declined significantly to 77,000 tonnes in 2001. Chum salmon catches rose to a peak of 97,800 tonnes in 2000 but fell off sharply to 58,600 tonnes in 2001.

**Table 2.2.4. Alaska Salmon Harvests, 1990-2001**

	Species	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Harvest volume (MT)	Chinook	5.0	4.6	4.7	4.9	5.1	5.5	4.1	5.4	4.6	3.3	2.7	2.7
	Sockeye	138.5	115.8	155.0	171.3	132.1	158.6	142.3	85.5	58.0	112.2	93.7	77.0
	Coho	17.5	18.6	23.1	17.1	33.3	21.7	20.1	10.7	16.7	12.9	14.4	15.0
	Pink	122.6	153.5	92.2	151.5	165.3	197.2	140.9	120.4	169.5	195.8	111.1	193.8
	Chum	26.8	30.2	31.8	32.6	48.1	65.8	86.0	63.9	74.4	83.4	97.8	58.6
	<b>Total</b>	<b>310.4</b>	<b>322.8</b>	<b>306.8</b>	<b>377.4</b>	<b>383.9</b>	<b>448.8</b>	<b>393.3</b>	<b>286.0</b>	<b>323.3</b>	<b>407.6</b>	<b>319.6</b>	<b>347.2</b>
Harvest value (\$ million)	Chinook	21.2	21.8	24.1	17.5	15.8	17.5	12.5	18.3	11.9	16.7	10.0	8.4
	Sockeye	392.2	214.6	455.5	286.7	309.1	314.6	283.7	185.3	149.3	247.0	154.2	96.7
	Coho	39.5	32.7	47.6	32.0	65.1	28.0	22.6	18.6	20.2	24.0	17.0	14.5
	Pink	90.3	49.3	41.6	54.1	70.3	81.2	30.4	39.4	51.0	60.4	32.8	49.1
	Chum	27.0	20.7	28.9	32.0	27.8	45.7	31.0	35.0	30.4	35.2	58.0	47.4
	<b>Total</b>	<b>570.2</b>	<b>339.1</b>	<b>597.6</b>	<b>422.3</b>	<b>488.1</b>	<b>487.0</b>	<b>380.2</b>	<b>296.6</b>	<b>262.7</b>	<b>383.3</b>	<b>271.9</b>	<b>216.0</b>
Average ex-vessel price (\$/kg)	Chinook	\$4.26	\$4.70	\$5.14	\$3.57	\$3.11	\$3.20	\$3.06	\$3.39	\$2.58	\$5.01	\$3.68	\$3.12
	Sockeye	\$2.83	\$1.85	\$2.94	\$1.67	\$2.34	\$1.98	\$1.99	\$2.17	\$2.57	\$2.20	\$1.65	\$1.26
	Coho	\$2.25	\$1.76	\$2.06	\$1.87	\$1.95	\$1.29	\$1.13	\$1.74	\$1.21	\$1.86	\$1.18	\$0.96
	Pink	\$0.74	\$0.32	\$0.45	\$0.36	\$0.43	\$0.41	\$0.22	\$0.33	\$0.30	\$0.31	\$0.29	\$0.25
	Chum	\$1.01	\$0.68	\$0.91	\$0.98	\$0.58	\$0.69	\$0.36	\$0.55	\$0.41	\$0.42	\$0.59	\$0.81

As shown in Figure 2.2.6, in recent years hatcheries have accounted for more than 65% of Alaska chum salmon harvests and more than 30% of Alaska pink salmon harvests. Alaska's salmon hatcheries, located mainly in southeast and southcentral Alaska, are private non-profit corporations funded partly by a tax on harvesters and partly by "cost-recovery" harvests conducted by the hatcheries in terminal areas adjacent to the hatcheries. As salmon prices have declined, many of the hatchery corporations have encountered difficulties in repaying state loans, as well as criticism from fishermen in other regions of the state who claim that excessive hatchery production of pink and chum salmon has contributed to depressed prices.

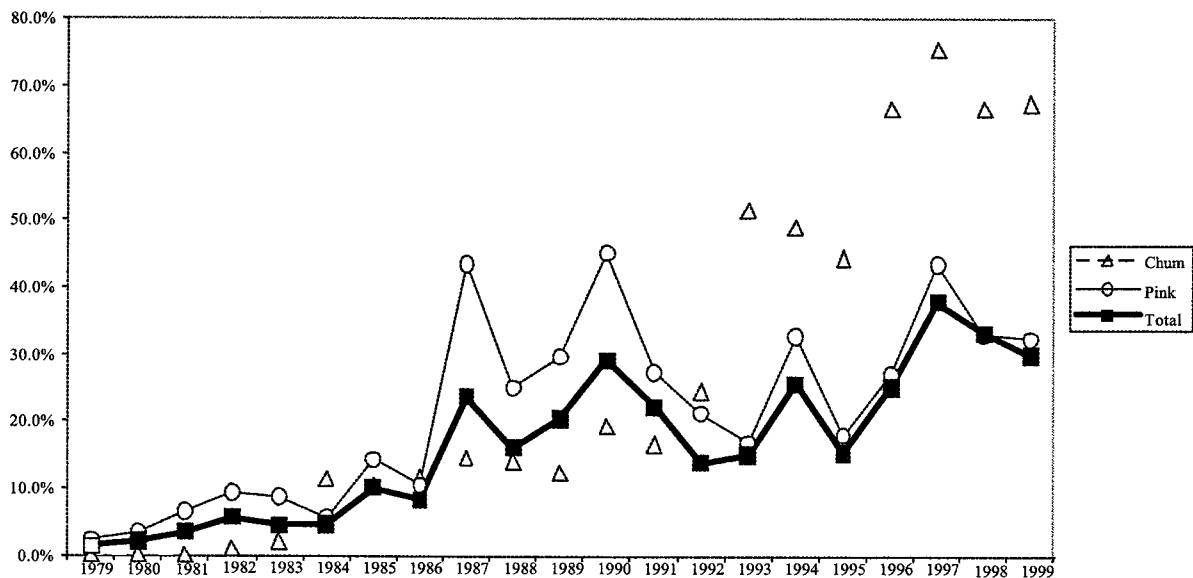


Figure 2.2.6. Hatchery Share of Alaska Wild Salmon Harvests

Far more dramatic than changes in volume have been changes in the value of U.S. landings. As shown in Table 2.2.4, the ex-vessel value of the Alaska salmon harvest fell by more than half from \$570.2 million in 1990 to \$216 million in 2001. As values are given in nominal dollars, the reduction in real value is even greater.

The drop in value resulted primarily from a sharp drop in ex-vessel prices. Between 1990 and 2001, the Alaska nominal ex-vessel price of sockeye declined from \$2.83/kg to \$1.26/kg and the price of pink salmon declined from \$0.74/kg to \$0.25/kg. The price of chum salmon declined from \$1.01/kg in 1990 to \$0.41/kg in 1998, but rose to \$0.81/kg in 2001 (mainly due to an increase in the price of chum salmon roe as Japanese chum salmon harvests declined during this period).

The drastic decline in ex-vessel prices for Alaska wild salmon is due to a combination of factors, which vary in importance for different species. For sockeye, chinook and coho salmon the most important factor has been the emergence of salmon aquaculture and rapidly expanding supply of competing farmed salmon and trout in major end markets. For pink salmon, very high production of canned pink salmon in the face of stagnant or declining world demand for canned salmon likely played a greater role. For pink salmon, prices have been affected by rapidly increasing Alaska production, as well as competition with Japanese chum salmon and with farmed salmon.

Alaska has 27 different area and gear-specific salmon fisheries which are managed under a limited entry system with transferable permits. The most important gear types

are purse seines, drift gillnets, set gill nets, and troll gear. In order to encourage an owner-operated small-boat fishery, boats may fish only with permit holders on board, a permit holder may participate in only one salmon fishery per season, and there are restrictions on overall boat length. These restrictions have generally succeeded with respect to social goals, but large numbers of small boats fishing competitively adds to costs and makes it difficult for fishermen and processors to produce fish of consistent high quality.

As shown in Table 2.2.5, there is a great deal of variation between Alaska salmon fisheries in volume harvested, earnings, numbers of permits and average permit prices. The most valuable fisheries are gillnet fisheries in Bristol Bay, Prince William Sound, and Southeast Alaska, and purse seine fisheries in Southeast Alaska, Prince William Sound, and Kodiak.

**Table 2.2.5. Overview of Alaska Salmon Fisheries, 2000**

Area	Gear	Total volume harvested (MT)	Total gross earnings (\$000)	Number of permits	Number of permits fished	Average gross earnings (\$)	Average permit price
Southeast	Purse Seine	64,099	38,061	416	356	106,912	39,300
Prince William Sound	Purse Seine	48,951	18,003	268	130	138,485	22,000
Bristol Bay	Drift Gillnet	47,491	68,442	1,896	1,823	37,543	80,500
Kodiak	Purse Seine	22,642	16,714	383	223	74,952	20,400
Southeast	Drift Gillnet	14,114	11,738	480	422	27,816	33,000
Prince William Sound	Drift Gillnet	12,904	20,326	541	526	38,642	59,300
Bristol Bay	Set Gillnet	11,176	15,978	1,013	921	17,349	32,400
Ak Pen./Aleutian Is.	Purse Seine	9,743	5,988	121	76	78,795	48,800
Chignik	Purse Seine	7,608	12,630	99	99	127,573	
Ak Peninsula	Drift Gillnet	7,353	13,152	161	156	84,310	46,400
Statewide	Power Gurdy	6,523	13,966	963	712	19,615	14,600
	Troll						
Kodiak	Set Gillnet	5,353	6,351	188	172	36,923	7,800
Ak Peninsula	Set Gillnet	3,551	5,161	113	109	47,345	88,900
Cook Inlet	Drift Gillnet	2,909	4,439	577	513	8,652	32,300
Cook Inlet	Set Gillnet	2,491	4,320	745	533	8,105	12,200
Kuskokwim	Set Gillnet	1,657	1,256	823	623	2,015	6,500
Cook Inlet	Purse Seine	1,082	1,029	83	36	28,591	15,800
Yakutat	Set Gillnet	1,056	1,491	170	125	11,930	28,100
Kotzebue	Set Gillnet	622	247	191	64	3,856	2,000
Prince William Sound	Set Gillnet	568	1,008	30	29	34,759	60,500
Norton Sound	Set Gillnet	323	154	193	78	1,980	4,500
Statewide	Hand Troll	304	826	1,329	315	2,621	4,100
Lower Yukon	Set Gillnet	95	701	704	560	1,252	12,100
Kodiak	Beach Seine	0	0	34	2	0	16,400
Upper Yukon	Fish Wheel	0	0	161	0	0	7,700
Atka/Amlia Islands	Set Gillnet	0	0	2	0	0	
Upper Yukon	Set Gillnet	0	0	72	0	0	7,500
<b>Total</b>	<b>All</b>	<b>272,613</b>	<b>261,980</b>	<b>11,756</b>	<b>8,603</b>	<b>940,021</b>	<b>27,042</b>



As shown in Table 2.2.6, as the value of Alaska salmon harvests has declined, there has been a significant decline in the value of permit prices in Alaska salmon fisheries, reflecting the declining profitability of the fisheries. In some fisheries, this has resulted in significant numbers of permits not being fished. While creating economic hardship for permit holders, these changes have also increased the economic efficiency of the fishery. Also reflecting the decline in value of the fishery has been a decline in the number of plants processing salmon in Alaska.

Table 2.2.6. Changes in Selected Alaska Salmon Fisheries between 1986-90 and 2000

Area	Gear	Gross Earnings in 2000 as % of 1986-90 average	Average permit price in 2000 as % of 1986-90 average	Permits fished in 2001 as % of 1986-90 average
Bristol Bay	Drift gill net	44%	45%	85%
Southeast	Purse seine	72%	59%	92%
PWS	Drift gill net	80%	59%	101%
PWS	Purse seine	61%	13%	58%
Chignik	Purse seine	57%	68%	91%
Cook Inlet	Drift gill net	11%	24%	100%
Kuskokwim	Gill net	17%	60%	64%
Lower Yukon	Gill net	9%	51%	Not available

Table 2.2.7 summarises average Alaska salmon production by product for the years 1989-91 and 1999-2001, as well as average United States salmon exports for the years 1999-2001. During the years 1999-2001, frozen salmon accounted for 47% of Alaska salmon production, canned salmon accounted for 44%, and fresh salmon accounted for 9%. However, there were significant differences between species in production. Frozen salmon accounted for 78% of chum salmon production and 62% of sockeye salmon but only 18% of pink salmon production. Canned salmon accounted for 77% of pink salmon production and 33% of sockeye salmon production but only 7% of chum salmon production. Fresh salmon accounted for 15% of chum salmon production, but less than 6% of pink and sockeye salmon production.

**Table 2.2.7. Average Alaska Salmon Production and U.S. Salmon Exports, 1989-91 and 1999-2001**

	Product	Chinook	Sockeye	Coho	Pink	Chum	Total
Average Alaska production, 1989-1991 (MT)	Canned	98	17,110	658	55,027	2,445	75,338
	Fresh	708	1,695	728	4,570	2,842	10,543
	Frozen	3,212	71,176	11,482	16,891	13,578	116,339
	Other	15	214	24	2	44	298
	<b>Total</b>	<b>4,033</b>	<b>90,196</b>	<b>12,891</b>	<b>76,489</b>	<b>18,909</b>	<b>202,517</b>
Average Alaska production, 1999-2001 (MT)	Canned	47	21,525	1,282	65,238	3,343	91,552
	Fresh	841	3,139	1,337	4,793	6,983	19,024
	Frozen	1,388	40,660	8,279	15,137	35,747	99,430
	Other	8	145	47		9	318
	<b>Total</b>	<b>2,284</b>	<b>65,469</b>	<b>10,945</b>	<b>85,168</b>	<b>46,078</b>	<b>209,944</b>
Average U.S. Exports, 1999-2001 (MT)	Canned <sup>a</sup>		20,210		15,627	1,032	36,869
	Fresh	243	3,130	539	4,582	5,919	14,412
	Frozen	892	33,663	6,778	10,915	16,926	69,174
	<b>Total</b>	<b>1,134</b>	<b>57,003</b>	<b>7,317</b>	<b>31,124</b>	<b>23,877</b>	<b>120,455</b>
Share of Alaska production, 1989-1991 (MT)	Canned	2.4%	19.0%	5.1%	71.9%	12.9%	37.2%
	Fresh	17.6%	1.9%	5.6%	6.0%	15.0%	5.2%
	Frozen	79.6%	78.9%	89.1%	22.1%	71.8%	57.4%
	Other	0.4%	0.2%	0.2%	0.0%	0.2%	0.1%
	<b>Total</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>
Share of Alaska production, 1999-2001 (MT)	Canned	2.1%	32.9%	11.7%	76.6%	7.3%	43.6%
	Fresh	36.8%	4.8%	12.2%	5.6%	15.2%	9.1%
	Frozen	60.8%	62.1%	75.6%	17.8%	77.6%	47.4%
	Other	0.3%	0.2%	0.4%	0.0%	0.0%	0.2%
	<b>Total</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>
U.S. Exports as % of Alaska production, 1999-2001	Canned	0.0%	93.9%	0.0%	24.0%	30.9%	40.3%
	Fresh	28.9%	99.7%	40.3%	95.6%	84.8%	75.8%
	Frozen	64.2%	82.8%	81.9%	72.1%	47.3%	69.6%
	<b>Total</b>	<b>49.7%</b>	<b>87.1%</b>	<b>66.9%</b>	<b>36.5%</b>	<b>51.8%</b>	<b>57.4%</b>

<sup>a</sup> Does not include 7,816 MT of canned salmon production for which the species was not specified in United States export data.

Responding to changes in market conditions and harvests, the canned share of pink salmon production increased from 72% to 77% between 1989-1991 and 1999-2001, while the canned share of sockeye salmon production increased dramatically from 19% to 33%. The fresh share of total production increased from 5% to 9%, while the frozen share decreased from 57% to 47%.

A comparison of United States exports with Alaska production volume provides an indicator of the relative importance of domestic and export markets for U.S. production. The relative importance of export markets is slightly overstated by the table because data on production for Washington, Oregon and California are not included because they are not available.

More than half of United States production is exported, including about 70% of frozen production and 40% of canned production. The importance of export markets varies significantly by species. About 87% of sockeye salmon production is exported, compared with only about 52% of chum salmon and 37% of pink salmon.

As shown in Table 2.2.8, Japan is by far the most important export market for U.S. frozen salmon, accounting for 52% of U.S. frozen salmon exports during the period 1999-2001, and 86% of U.S. exports of frozen sockeye salmon. The other most important export markets are Canada, France, and China. China is an important export market only for chum and pink salmon. It is likely that a substantial share of frozen salmon exports to China is reprocessed into canned salmon, taking advantage of lower labour costs in China.

Table 2.2.8. Average United States Exports of Frozen Salmon, by Species and Country, 1999-2001

	Country	Chinook	Sockeye	Coho	Pink	Chum	Total
Frozen salmon exports (MT)	Japan	638	28,782	3,620	1,042	1,999	36,082
	Canada	71	1,809	725	728	1,358	4,692
	France	16	297	572	2,127	2,442	5,454
	China	41	750	118	2,296	2,861	6,066
	Denmark	23	89	160	309	1,126	1,708
	Germany	7	139	220	1,679	888	2,933
	United Kingdom	92	103	185	470	285	1,135
	Other countries	102	1,694	1,218	3,029	5,966	12,008
	<b>Total</b>	<b>892</b>	<b>33,663</b>	<b>6,778</b>	<b>10,915</b>	<b>16,926</b>	<b>69,174</b>
Share of frozen salmon exports	Japan	71.6%	85.5%	53.4%	9.5%	11.8%	52.2%
	Canada	8.0%	5.4%	10.7%	6.7%	8.0%	6.8%
	France	1.8%	0.9%	8.4%	19.5%	14.4%	7.9%
	China	4.6%	2.2%	1.7%	21.0%	16.9%	8.8%
	Denmark	2.6%	0.3%	2.4%	2.8%	6.7%	2.5%
	Germany	0.7%	0.4%	3.2%	15.4%	5.2%	4.2%
	United Kingdom	10.3%	0.3%	2.7%	4.3%	1.7%	1.6%
	Other countries	11.4%	5.0%	18.0%	27.8%	35.2%	17.4%
	<b>Total</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>

As shown in Table 2.2.9, Canada is by far the most important export market for U.S. fresh salmon, accounting for 82% of U.S. fresh salmon exports during the period 1999-2001. However, much of the fresh salmon exported to Canada is exported unprocessed for canning in British Columbia processing plants. Relatively small volumes of fresh salmon are exported to Japan and European markets.

**Table 2.2.9. Average United States Exports of Fresh Salmon, by Species and Country, 1999-2001**

	Country	Chinook	Sockeye	Coho	Pink	Chum	Total
Fresh salmon exports (MT)	Japan	120	803	32		194	1,149
	Canada	108	2,245	239	4,157	5,135	11,884
	France	3		85	195	30	313
	China	3		62	97	53	216
	Denmark					30	30
	Germany		58	51	66	54	229
	United Kingdom	3	5	159	126	75	368
	Other countries	10	39	86	112	376	622
	<b>Total</b>	<b>243</b>	<b>3,130</b>	<b>539</b>	<b>4,582</b>	<b>5,919</b>	<b>14,412</b>
	Share of fresh salmon exports	Japan	49.6%	25.6%	5.9%	0.0%	3.3%
Canada		44.5%	71.7%	44.3%	90.7%	86.8%	82.5%
France		1.2%	0.0%	15.8%	4.2%	0.5%	2.2%
China		1.4%	0.0%	11.5%	2.1%	0.9%	1.5%
Denmark		0.0%	0.0%	0.0%	0.0%	0.5%	0.2%
Germany		0.0%	1.9%	9.5%	1.4%	0.9%	1.6%
United Kingdom		1.2%	0.2%	29.5%	2.8%	1.3%	2.6%
Other countries		4.2%	1.2%	16.0%	2.4%	6.3%	4.3%
<b>Total</b>		<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>

As shown in Table 2.2.10, the United Kingdom and Canada are the most important export markets for U.S. canned salmon, followed by Australia and the Netherlands.

Table 2.2.10. Average United States Exports of Canned Salmon, by Species and Country, 1999-2001

	Country	Sockeye	Pink	Chum	Unspecified	Total
Canned salmon exports (MT)	United Kingdom	13,703	4,737	55	340	18,835
	Canada	3,616	4,915	66	4,394	12,991
	Australia	946	3,256	13	387	4,603
	Netherlands	901	824	294	177	2,196
	Belgium	105	233	17	76	431
	Other countries	939	1,662	601	2,442	5,645
	<b>Total</b>		<b>20,210</b>	<b>15,627</b>	<b>1,032</b>	<b>7,817</b>
Share of canned salmon exports	United Kingdom	67.8%	30.3%	5.3%	4.3%	42.1%
	Canada	17.9%	31.5%	6.4%	56.2%	29.1%
	Australia	4.7%	20.8%	1.3%	5.0%	10.3%
	Netherlands	4.5%	5.3%	28.5%	2.3%	4.9%
	Belgium	0.5%	1.5%	1.7%	1.0%	1.0%
	Other countries	4.6%	10.6%	58.2%	31.2%	12.6%
	<b>Total</b>		<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>

Salmon markets will be analysed in detail in chapters 3 and 4.

### Outlook

The United States and Alaska in particular have seen a substantial loss of market share in the 1980s and 1990s, as salmon farming has expanded. The sharp decline in salmon prices and harvest value has created an economic crisis in the industry, reflected in the drop in permit values, the decline in participation in the number of permits fished, and the closure of many processing plants. However, these changes have not yet led to a significant drop in harvests, because most salmon runs can still be fully harvested and processed even with lower numbers of boats and fishermen.

Since the early 1990s, the Alaska salmon industry and Alaska politicians have been engaged in a discussion about how to respond to competition from farmed salmon and the changing economic circumstances of the industry. Except for the consolidation of fishing fleets and processors driven by economic pressures, there has been little change in the management of the fisheries. However, recently there has been increasing discussion of the need to restructure the fisheries so as to reduce costs and increase the quality of the fish. The diversity of Alaska salmon fisheries, the large number of fishery dependent communities, and traditional mistrust between Alaska fishermen and the largely Seattle-based processing industry (with significant foreign ownership) suggest

that significant changes to the fisheries will be politically difficult to achieve and will not happen rapidly.

#### 2.2.4 Japan Wild Salmon Production

As shown in Figure 2.2.7, Japanese wild salmon catches are mainly of chum with some small additional quantities of pink and other salmon species. Japan is the world's largest producer of chum salmon, accounting for between 54% and 73% of world chum salmon harvests between 1995 and 2001. Japanese chum catches peaked in 1996 at more than 280,000 tonnes, and then declined to less than 170,000 tonnes in 2000 before rising again in 2001.

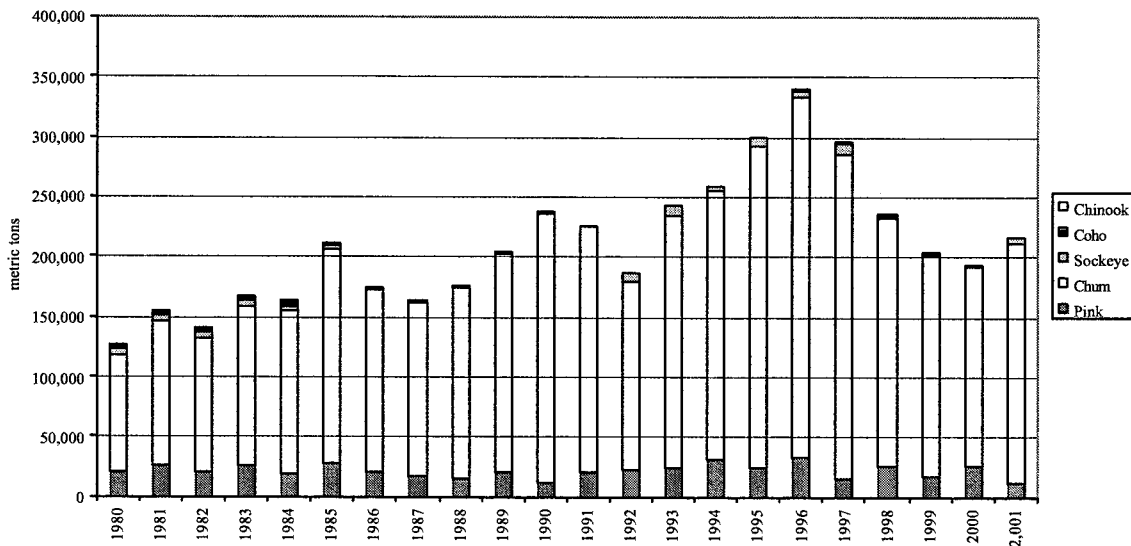


Figure 2.2.7: Japanese Wild Salmon Harvests, by Species

As is discussed in appendix 5.1 to this report (Wild Pacific Salmon Harvest Data Appendix), there are significant inconsistencies between different data sources for Japanese wild salmon harvests. Examples of these inconsistencies may be seen in Table 2.2.11, which provides Japanese chum salmon harvest data from a number of different sources.

There are at least three different reasons for these inconsistencies. First, data vary with respect to the weight basis for which catch is reported (round weight or processed weight). Second, data vary with respect to the area for which catch is reported. Some sources report only catches in Japanese coastal waters. Others include Japanese freshwater and coastal catches. Others include “high-sea” catches by Japanese vessels

in the Russian Exclusive Economic Zone, under agreements with Russia negotiated by Japanese fishing organisations. Third, data vary with respect to the year basis (calendar year or May-April). Interpreting Japanese salmon harvest data is complicated because most sources do not report details of weight basis, area basis, and year basis. However, all data sources show the same general trends in harvests. Figure 2.2.7 is based on FAO Fishstat data (for 1980-2000) and Bill Atkinson's News Report data (for 2001). The chum salmon harvest data in Figures 2.2.8-2.2.10 are based on data from the NPAFC 2001 Provisional Report and do not include high-sea harvests.

Table 2.2.11: Japanese Chum Salmon Data, Various Sources (MT)

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
<b>FAO Fishstat + Database</b>										
Chum salmon Harvests	158,163	209,500	223,107	267,718	299,881	269,183	206,622	182,866	165,834	217,359
<b>NPAFC Reports</b>										
Chum salmon Harvests		187,858	191,523	231,053	266,145	237,348	178,539	158,301	139,928	
<i>Hatchery releases (millions of fish)</i>		1,960	2,052	2,019	2,010	1,943	1,874	1,868	1,817	
<b>NPAFC 2001 Provisional Report</b>										
Coastal harvests	137,114	187,664	191,190	230,705	265,787	236,993	178,142	157,909	139,608	86,930
Freshwater harvests	8,630	12,240	16,806	17,736	19,502	18,588	15,583	12,449	12,558	2,588
Pacific landbased or offshore harvests	86	194	333	348	358	355	397	392	320	248
Total chum salmon Harvests	145,830	200,098	208,329	248,789	285,647	255,936	194,122	170,750	152,486	89,766
<b>Bill Atkinson's News Report (a)</b>										
High-Sea harvests	16,330	8,500	11,170	14,880	12,700	13,800	13,240	12,800	12,000	8,100
Fall chum harvests, Total	133,000	181,800	186,500	228,600	260,600	230,800	173,300	155,000		
Hokkaido	82,000	118,500	140,670	171,100	173,300	167,000	131,300	125,000		
Honshu	51,000	63,300	45,830	57,500	87,300	63,800	42,000	30,000		
Total chum salmon harvests	149,330	190,300	197,670	243,480	273,300	244,600	186,540	167,800		
<i>Japanese salmon exports (MT)</i>	360	350	10,360	23,410	40,970	28,300	9,530			
<b>Bill Atkinson's News Report (b)</b>										
Spring chum harvests							15,500	14,000	13,700	9,500
Fall chum harvests							172,000	154,000	140,000	190,000
Total chum salmon Harvests							187,500	168,000	153,700	199,500

Note: Table 2.2.11 continues on the following page

Table 2.2.11 (Continued)

Seafood News										
Spring chum Production	15,000	8,000	11,000	14,700	12,420	13,800	14,000	12,500	11,700	8,100
Fall chum Production	104,000	145,600	149,000	183,200	206,000	183,000	139,000	124,000	108,000	158,100
Total chum salmon Production	119,000	153,600	160,000	197,900	218,420	196,800	153,000	136,500	119,700	166,200
<i>Average price paid for chum salmon in Iwate coastal markets (yen/kilo)</i>	695	445	370	212	154	281	365	482	462	306

Note: Except where otherwise noted, all data are for chum salmon harvests and are in metric tonnes. Definitions may vary with respect to year basis (calendar year or May-April); area of catch (all areas, Japanese waters only, or Japanese coastal only), and weight basis (round or processed).

NPAFC reports are North Pacific Anadromous Fish Commission statistical reports (1993-98) and annual reports (1999-2001).

NPAFC 2001 Provisional Reports data are from NPAFC Doc. No. 578, Rev. No. 1, "A Provisional Report on the 2001 Salmon Season," October 2001.

Bill Atkinson's News Report (a): 1992-1994: November 12, 1997; 1995-1999: December 8, 1999; 2000-2001: February 6, 2002. (b) December 12, 2001.

Seafood News data are from Suisan Tsushin (Seafood News), Marine Products Power Data Book, 2002, page 3.

For years, Japan has had an extensive ocean ranching programme for salmon. Almost all Japanese "coastal" and "freshwater" salmon harvests are of salmon released from hatcheries on the northern islands of Hokkaido and Honshu. Roughly 4% of the released fish return to the rivers (Nakamoto, 2000). Chum salmon released from hatcheries—which account for most of the Japanese catch—are harvested in the fall and are known as "fall chum" or fall salmon." Chum salmon harvested by the Japanese "high-sea" fleet are harvested in the spring and are known as "spring chum." Spring chum are considered a high quality salmon and command a much higher market price than fall chum.

Figure 2.2.8 shows the dramatic growth in Japanese chum salmon harvests between 1975 and 1996. Most of the chum salmon are caught in coastal waters. Hatchery releases began to decline in 1995 in response to lower prices paid for chum salmon. This was reflected two years later in a decline in chum salmon harvests. However, part of the decline in harvests may also be due to lower ocean survival rates.



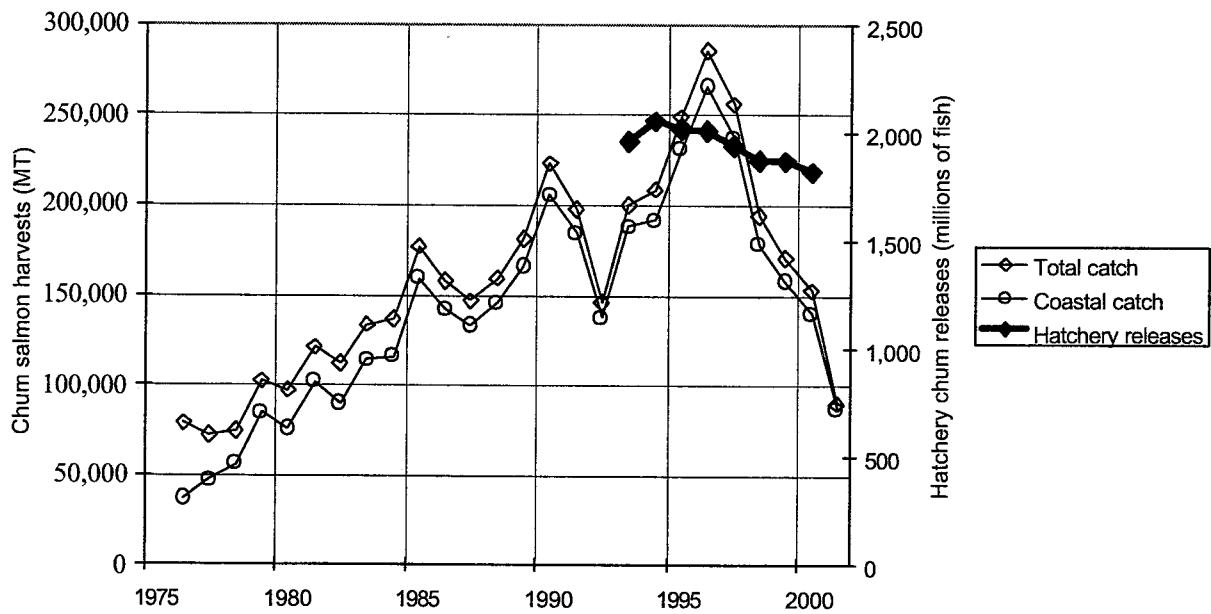
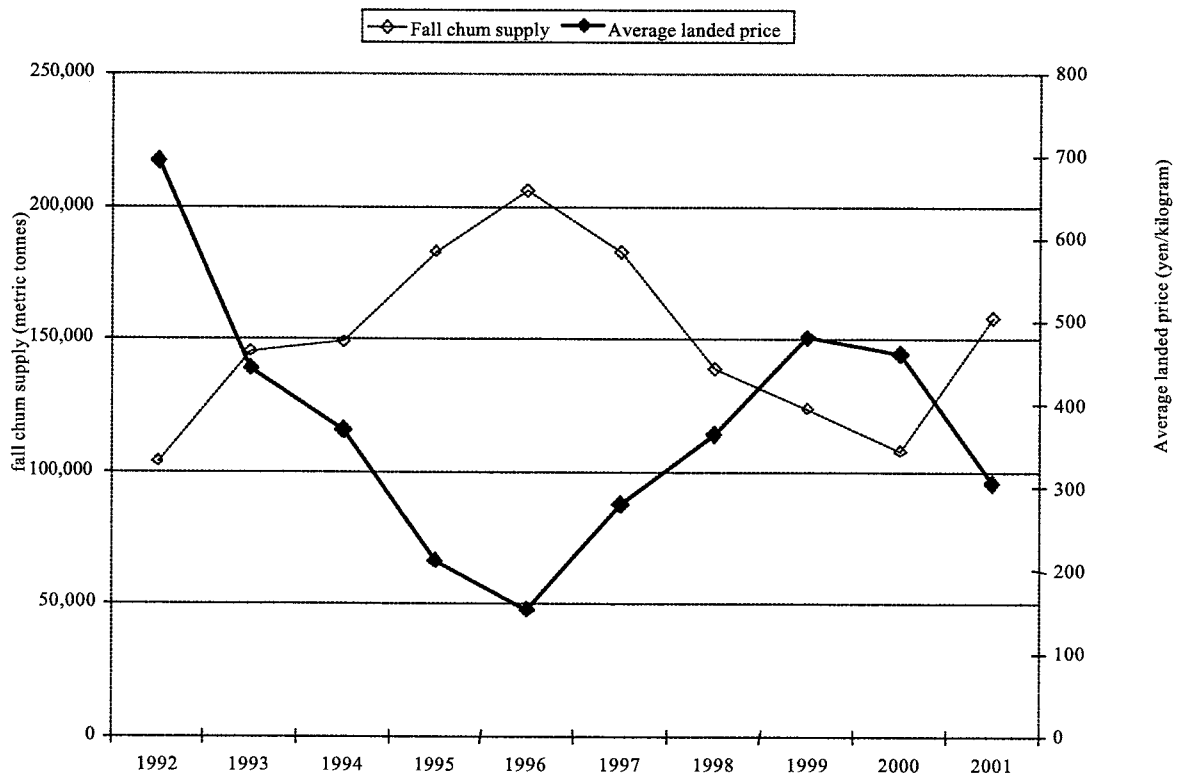


Figure 2.2.8. Japanese Chum Salmon Harvests and Hatchery Releases

Rapid increases in Japanese chum salmon harvests during the early 1990s led to a dramatic decline in the prices paid to Japanese fishermen for chum salmon, shown in Figure 2.2.9. As Japanese harvests declined sharply after 1996, prices rose from 1997 through 1999. Prices fell in 2000 despite a smaller harvest, probably due to a record Alaska chum salmon harvest in that year. Prices fell further in 2001 as Japanese fall chum harvests increased again.



**Figure 2.2.9. Japanese Chum Salmon Harvests and Average Prices Paid to Fishermen**

Historically, almost all Japanese salmon production has been consumed in Japan, which is the world’s largest salmon importing nation. However, from 1994 to 1998, Japan exported significant volumes of chum salmon, with exports peaking in 1996 at 41,000 metric tonnes.

**2.2.5 Russia Wild Salmon Production**

As shown in Figure 2.2.10, pink salmon account for most Russian wild salmon harvests, with smaller volumes of chum and sockeye salmon. Prior to 1992 pink salmon harvests were substantially higher in odd-numbered years, but this two-year cycle has been less apparent in recent years.

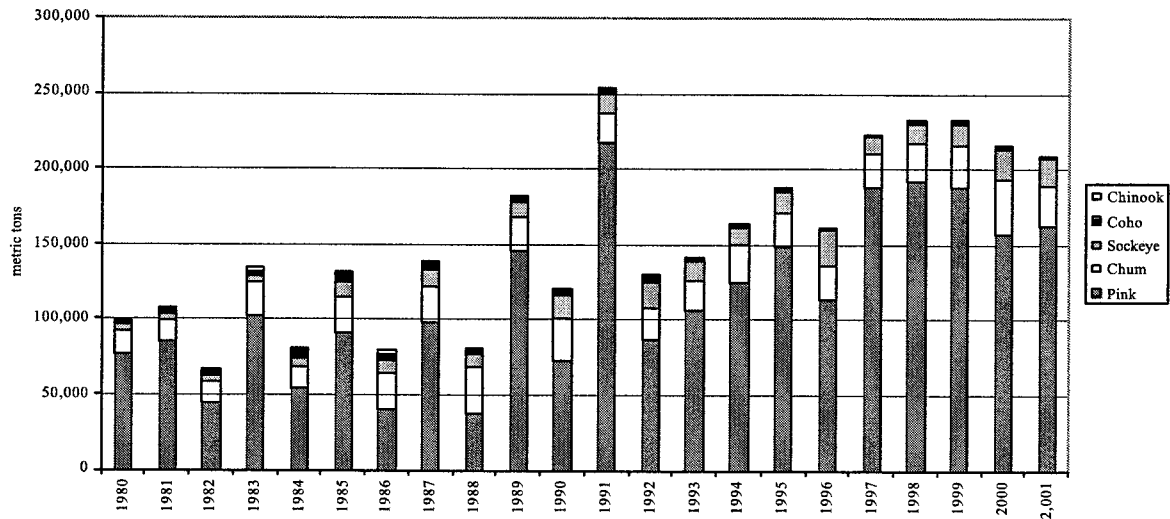


Figure 2.2.10: Russian Wild Salmon Harvests, by Species

As shown in Table 2.2.12, salmon are harvested along the coast of the Russian Far East including as Sakhalin Island and the Kurile Islands. The largest volumes are harvested in Kamchatka and the South Kuriles. Domestic and foreign driftnet fleets also harvest salmon offshore in the Exclusive Economic Zone. While these driftnet catches represent only 11% of the total salmon harvest volume, they represent more of chum and sockeye salmon harvests.

Table 2.2.12. Average Russian Salmon Harvests, 1996-99, by Area (MT)

	Pink	Chum	Sockeye	Coho	Chinook	Masu	Total
Western Bering Sea	35	1,304	109				1,449
East Kamchatka	45,897	3,506	5,941	930	476		56,749
West Kamchatka	39,781	1,531	5,984	503	115		47,915
East Sakhalin	47,712	1,261					48,973
Northwest Sakhalin	1,039	573					1,612
Southwest Sakhalin	1,314	924					2,238
South Kuriles	25,094	1,296					26,390
North Kuriles	136	184					321
Sea of Okhotsk, continental coast	6,349	11,317	29	285			17,981
Sea of Okhotsk, Amur Basis	1,019	1,840					2,859
Sea of Okhotsk, Primorye Region	1,647	51					1,698
<b>Total coastal harvests</b>	<b>170,024</b>	<b>23,789</b>	<b>12,063</b>	<b>1,718</b>	<b>590</b>	<b>0</b>	<b>208,185</b>
Russian EEZ, domestic and foreign driftnet	1,230	13,962	6,313	692	307	2	22,505
Research harvests							5,919
<b>Total, Far-Eastern Region</b>							<b>236,609</b>

Table 2.2.13 shows harvests of foreign fleets in the Russian Exclusive Economic Zone. Available data suggest that foreign fleets accounted for all driftnet harvests in the EEZ after 1997. Catches by foreign fleets declined during the second half of the 1990s. Foreign fleets are primarily Japanese vessels which operate in the Russian EEZ under agreements negotiated between Russia and Japanese fishing organisations. Fees paid by these organisations in return for fishing quotas have been used to finance hatchery construction in the Russian Far East.

Table 2.2.13. Salmon Harvests by Foreign Fleets in the Russian EEZ (MT)

	1993	1994	1995	1996	1997	1998	1999	2000
Pink	4,948	797	3,007	900	1,857	918	802	n.a.
Chum	8,597	14,264	18,796	14,710	13,488	12,012	12,657	n.a.
Sockeye	7,705	3,699	6,146	5,644	9,150	2,645	2,657	n.a.
Coho	186	35	234	628	579	709	486	n.a.
Chinook	419	187	126	159	462	329	223	n.a.
All species	21,855	18,982	28,316	22,042	25,535	16,616	16,825	14,946

We do not have data on the share of Russian salmon harvests attributable to hatcheries. Based on the data presented above in Table 2.2.12, we may estimate that if Russian hatchery releases had the same survival and catch rates as Alaska hatchery releases, then hatcheries would account for about 10% of Russian pink salmon harvests and almost all Russian chum salmon harvests. However, because survival and catch rates may well differ dramatically between Alaska and Russia, these are not reliable estimates. They do however suggest that hatcheries account for a relatively greater share of Russian chum production than pink production.

Detailed data are not available for the products produced from Russian wild salmon harvests or where they are sold. Traditionally important products include canned salmon and dried salmon. During the 1990s, an increasing share of Russian sockeye and coho salmon was exported to Japan. This can be seen by comparing Russian harvest data with Japanese import data, as shown in Table 2.2.14. A much smaller share of other species (mainly pink and chum salmon) was exported to Japan.

Table 2.2.14. Comparison of Russian Harvests with Japanese Imports from Russia

		1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Russian harvests (MT)	Sockeye	15,716	13,141	10,808	14,227	22,891	10,177	12,767	14,889	19,548	18,058
	Coho	4584	2328	2265	1479	1976	1310	2319	1668	2278	1377
	Other	109,431	126,538	150,772	171,787	136,785	211,201	218,041	216,136	194,107	189,880
Japanese imports from Russia (MT)	Sockeye	5,919	7,407	7,501	9,947	17,901	10,368	11,412	12,186	16,354	17,489
	Coho		158	149	281	503	285	1,261	1,460	1,195	1,137
	Other	9,993	13,723	21,175	3,715	3,562	9,554	27,639	11,014	8,394	7,903
Japanese imports as % of Russian harvests	Sockeye	38%	56%	69%	70%	78%	102%	89%	82%	84%	97%
	Coho	0%	7%	7%	19%	25%	22%	54%	88%	52%	83%
	Other Pacific	9%	11%	14%	2%	3%	5%	13%	5%	4%	4%
Average import price (Yen/kg)	Sockeye	600	459	781	495	549	598	826	676	537	585
	Coho		260	367	216	241	340	296	284	265	207
	Other	112	128	113	147	181	166	125	157	142	203

## 2.2.6 Canada Wild Salmon Production

As shown in Figure 2.2.11, Canadian wild salmon harvests declined sharply during the 1990s from average volumes of more than 80,000 metric tonnes to average harvests of less than 20,000 metric tonnes. Between 1990 and 2001, Canada's share of total world wild salmon harvests fell from 12% in 1990 to 3%. Harvests declined for all species. Changing water temperatures and other ocean conditions affecting salmon survival likely played an important role in the decline, as well as the combined effects of past over-harvesting and harvest restrictions implemented by managers to rebuild salmon runs.

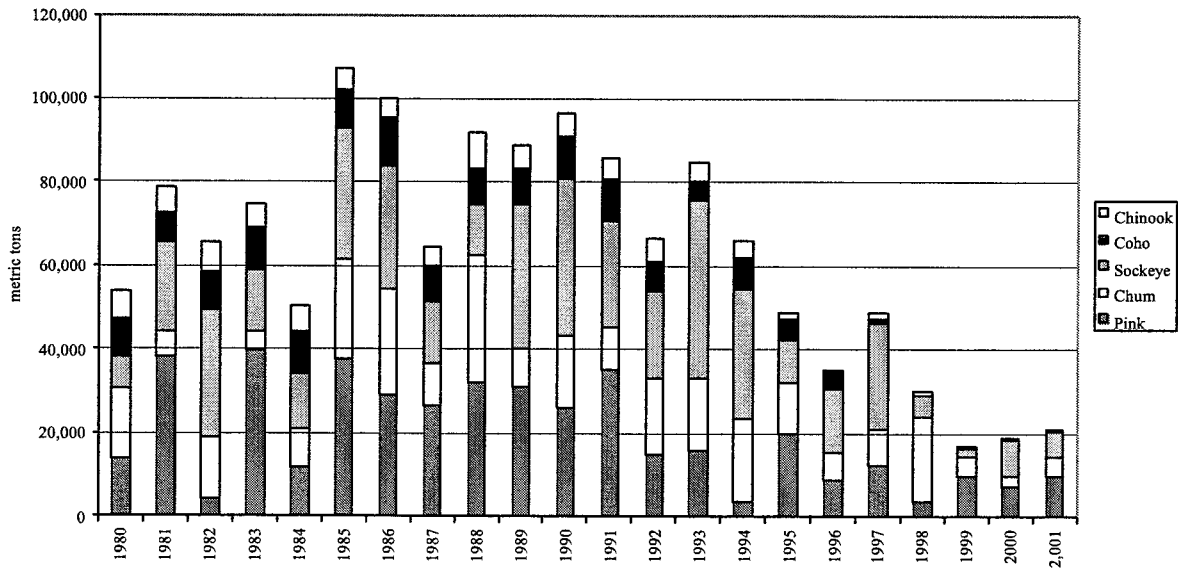


Figure 2.2.11: Canadian Wild Salmon Harvests, by Species

As shown in Table 2.2.15, the decline in ex-vessel value of Canadian wild salmon harvests has been even more precipitous than the decline in volume, due to the combined effect of lower volumes and lower prices. The ex-vessel value in 2001 of CAD 23.7 million was less than one-tenth the 1990 value of CAD 263.3 million.

Table 2.2.15. Volume and Value of Canadian Wild Salmon Harvests

Year	Harvest volume (metric tonnes)						Ex-Vessel Value (\$ Canadian)					
	Chinook	Sockeye	Coho	Pink	Chum	Total	Chinook	Sockeye	Coho	Pink	Chum	Total
1982	7.1	30.2	9.3	4.0	15.1	65.7	31.2	78.8	26.1	3.2	25.5	164.9
1983	5.4	14.3	10.5	39.6	4.9	74.7	17.6	36.6	22.5	26.7	7.6	111.0
1984	6.3	12.9	10.1	12.1	9.0	50.3	37.3	46.0	35.5	10.7	14.9	144.5
1985	5.5	31.6	9.0	37.7	23.7	107.4	25.6	120.4	26.6	39.0	34.8	246.3
1986	5.0	30.9	13.3	29.5	25.2	103.8	19.7	143.3	39.3	25.7	37.6	265.5
1987	5.3	15.0	8.4	26.9	11.0	66.7	30.5	87.4	33.7	33.5	26.8	211.9
1988	5.9	11.9	7.1	32.2	30.3	87.4	43.8	96.4	37.7	49.3	84.6	311.8
1989	5.2	34.4	8.7	31.0	9.3	88.7	20.2	169.3	19.3	33.5	13.8	256.0
1990	5.2	37.1	10.6	26.2	17.2	96.3	20.5	160.7	28.1	27.0	27.1	263.3
1991	5.1	25.2	10.1	35.1	10.2	85.6	19.6	84.6	25.3	30.0	12.9	172.4
1992	5.3	20.9	7.3	14.9	18.0	66.5	24.4	110.4	20.6	10.8	25.5	191.7
1993	4.8	42.5	4.3	16.0	17.3	85.0	14.6	140.6	10.9	11.5	23.3	201.0
1994	3.6	30.8	7.7	3.4	20.3	65.8	14.1	195.2	22.6	2.3	22.0	256.3
1995	1.5	10.5	4.9	19.8	12.1	48.8	5.5	40.7	13.4	14.3	11.8	85.7
1996	0.5	15.5	3.9	8.6	6.5	35.0	1.4	75.5	10.3	5.0	4.9	97.2
1997	1.7	25.3	0.7	12.2	8.7	48.6	5.8	89.0	1.8	6.6	6.5	109.7
1998	1.4	5.1	0.0	3.9	19.9	30.3	5.5	32.9	0.0	2.8	12.8	54.0
1999	0.8	1.7	0.0	9.5	4.9	17.0	4.1	12.4	0.1	5.6	4.1	26.3
2000	0.5	8.5	0.0	7.1	2.8	18.9	2.8	39.5	0.0	4.7	3.3	50.4
2001	0.6	5.9	0.0	9.9	4.6	21.0	1.9	13.1	0.1	5.4	3.3	23.7

Table 2.2.16 shows the volume and value of products produced from British Columbia wild salmon in 1996, the most recent year for which detailed data have been published. Canned salmon accounted for 30% of the volume and 51% of the value of production, while frozen dressed salmon accounted for 43% of the volume and 24% of the value.

Table 2.2.16. British Columbia Salmon Production, by Product and Species, 1996

	Quantity (MT)						Value (\$000 Canadian)					
	Chinook	Sockeye	Coho	Pink	Chum	Total	Chinook	Sockeye	Coho	Pink	Chum	Total
Canned	44	7,694	326	997	880	9,941	732	93,479	2,686	43,801	3,339	144,037
Fresh Round	20	335	13	48	193	609	62	1,388	41	42	213	1,746
Fresh Dressed	151	459	551	339	2,331	3,831	1,006	3,991	2,462	668	4,345	12,472
Frozen Round	0	0	7	0	71	78	0	0	12	0	120	132
Frozen Dressed	266	4,614	2,440	2,245	4,579	14,144	1,682	40,027	12,607	4,618	8,231	67,165
Fzn. Steaks/Fillets	18	293	220	199	1,137	1,867	298	4,323	2,121	805	7,125	14,672
Salted	15	534	0	0	0	549	169	7,469	0	0	0	7,638
Smoked	72	538	109	30	391	1,140	1,521	12,128	2,256	426	4,002	20,333
Roe	4	49	11	31	77	172	51	276	66	140	584	1,117
Caviar	9	22	0	1	212	244	182	552	0	18	4,591	5,343
Portion Pack	20	119	0	0	176	315	461	2,823	0	0	1,811	5,095
<b>Total</b>	<b>619</b>	<b>14,657</b>	<b>3,677</b>	<b>3,890</b>	<b>10,047</b>	<b>32,890</b>	<b>6,164</b>	<b>166,543</b>	<b>24,254</b>	<b>51,385</b>	<b>34,452</b>	<b>282,798</b>
<b>Share of total</b>												
Canned	7.1%	52.5%	8.9%	25.6%	8.8%	30.2%	11.9%	56.1%	11.1%	85.2%	9.7%	50.9%
Fresh Round	3.2%	2.3%	0.4%	1.2%	1.9%	1.9%	1.0%	0.8%	0.2%	0.1%	0.6%	0.6%
Fresh Dressed	24.4%	3.1%	15.0%	8.7%	23.2%	11.6%	16.3%	2.4%	10.2%	1.3%	12.6%	4.4%
Frozen Round	0.0%	0.0%	0.2%	0.0%	0.7%	0.2%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%
Frozen Dressed	43.0%	31.5%	66.4%	57.7%	45.6%	43.0%	27.3%	24.0%	52.0%	9.0%	23.9%	23.8%
Fzn. Steaks/Fillets	2.9%	2.0%	6.0%	5.1%	11.3%	5.7%	4.8%	2.6%	8.7%	1.6%	20.7%	5.2%
Salted	2.4%	3.6%	0.0%	0.0%	0.0%	1.7%	2.7%	4.5%	0.0%	0.0%	0.0%	2.7%
Smoked	11.6%	3.7%	3.0%	0.8%	3.9%	3.5%	24.7%	7.3%	9.3%	0.8%	11.6%	7.2%
Roe	0.6%	0.3%	0.3%	0.8%	0.8%	0.5%	0.8%	0.2%	0.3%	0.3%	1.7%	0.4%
Caviar	1.5%	0.2%	0.0%	0.0%	2.1%	0.7%	3.0%	0.3%	0.0%	0.0%	13.3%	1.9%
Portion Pack	3.2%	0.8%	0.0%	0.0%	1.8%	1.0%	7.5%	1.7%	0.0%	0.0%	5.3%	1.8%
<b>Total</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>

In 1990, Canadian exports of wild salmon products were valued at CAD 455 million, but by the end of the decade this had declined to CAD 104 million, a 77% decline in nominal terms. Importantly, a very large proportion of recent exports has in fact been

the re-export of Russian and Alaskan landed salmon that were canned in underutilised British Columbia processing plants.<sup>2</sup>

A number of wild salmon stocks exploited by Canadian fishermen have been over-exploited; and certain stocks may even have been driven close to extinction. In response to this crisis, during the 1990s the Canadian government implemented a CAD 500 million programme to reduce the salmon fleet, assist coastal communities to adjust and rehabilitate the stocks. Restructuring is largely complete and the fleet has been reduced by nearly 70 percent. It is hoped that this restructuring, in combination with the 1999 Pacific Salmon Agreement between the United States and Canada, will lead to improved management of stocks harvested by both these countries. In any case, it will take time for stocks to rebuild. Therefore, prospects for the Canada's wild salmon fisheries in the short to medium run remain rather bleak.

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<sup>2</sup> British Columbia Ministry of Finance and Corporate Relations, *British Columbia's Fish Product and Seafood Industry in the 1990s*, May 2001, Victoria, BC, page 50.



## 2.3 Farmed Salmon Production

The production of farmed salmon is concentrated on the three species Atlantic salmon, salmon trout and coho. In addition, smaller quantities of cherry and chinook are being farmed. Atlantic salmon is the dominating species, accounting for 76% of the total farmed quantities in 2001. Salmon trout follows with around 14% of the total harvest, while coho accounts for around 10%. The development in farmed salmon production can be seen in Figure 2.3.1.

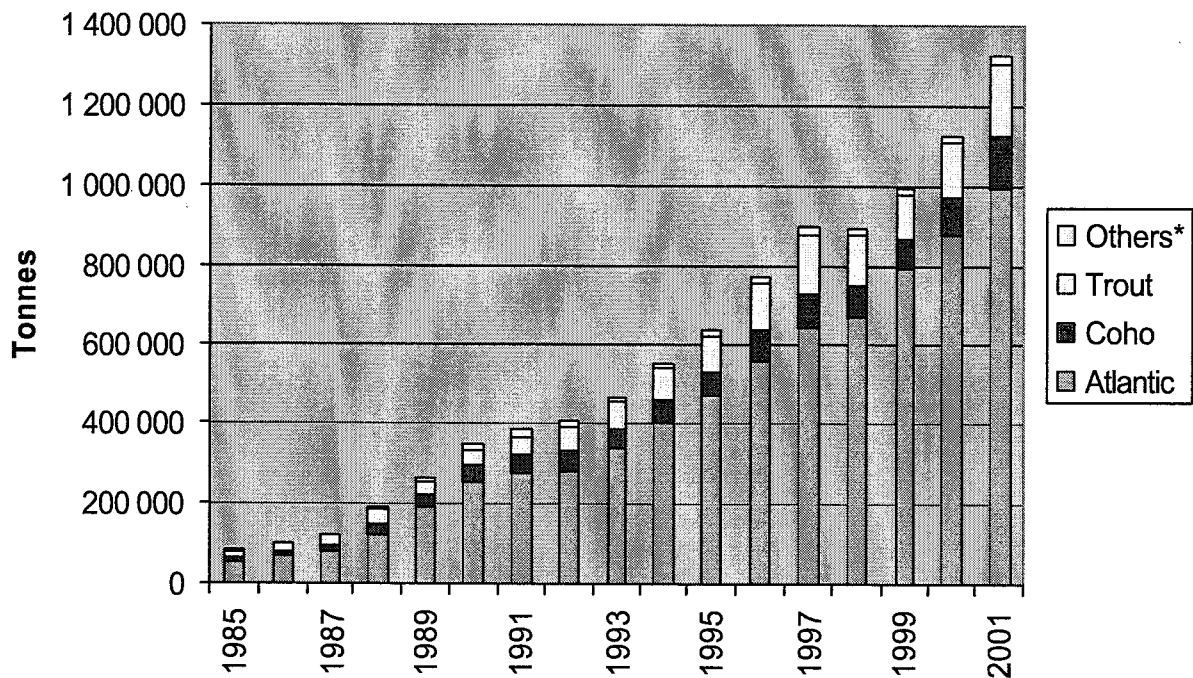


Figure 2.3.1. Farmed Salmon and Salmon Trout, 1985-2001.

\* Others include chinook and cherry

From the very beginning, the production of farmed salmon has been dominated by a few nations. Four countries supply around 90% of the total production. These are Norway, Chile, the UK and Canada. Their production shares over time are illustrated in Figure 2.3.2.

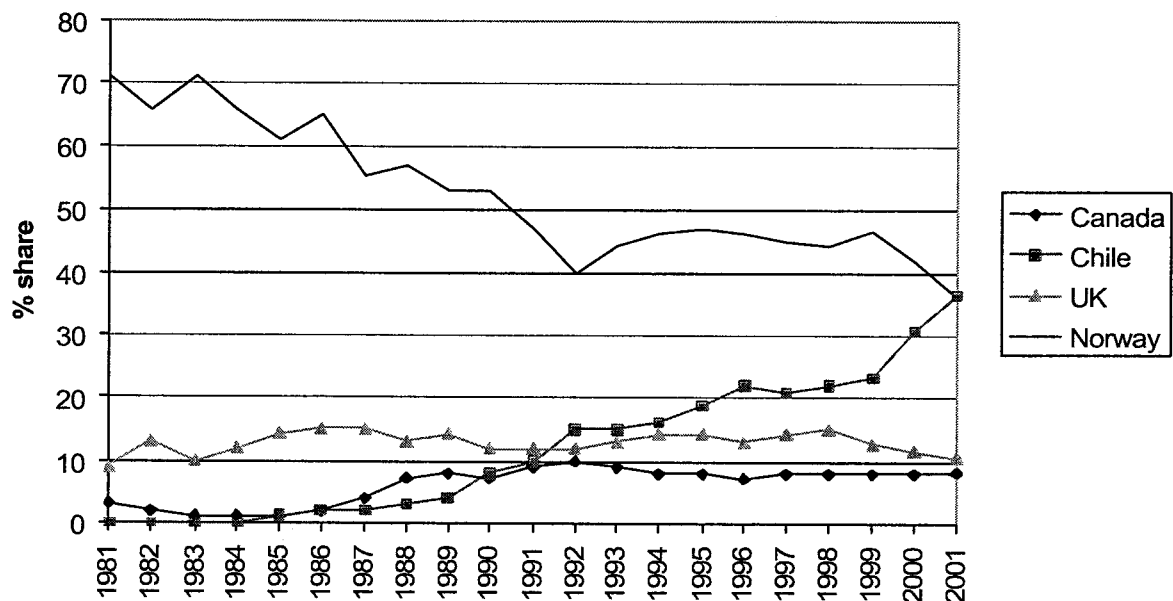


Figure 2.3.2. Shares in World Production of Farmed Salmon 1981-2001.

Several trends dominate the picture. The first is Norway's leading but diminishing position throughout the period. Norway's share in farmed production fell from 70% in 1981 to 40% in 1992. To some extent, this decline was probably bound to happen, due to transfer of best-practice production technologies from Norway to other countries. However, there is no doubt it was accentuated by Norwegian entry and ownership regulations as these represented incentives to invest in other countries. Since the second half of the 1980s, Norwegian capital has been involved in salmon firms in virtually all salmon producing countries. Due to the salmon market crisis around 1990, Norwegian ownership regulations were disbanded. A restructuring process then started in Norway as firms merged and larger firms were created, and Norwegian market share actually increased to a level of 47% in 1995. As a consequence of anti-dumping allegations from the EU in 1996, new regulations were introduced, including feed quotas per farm that effectively limit production. Ever since, with the exception of 1999, Norway has been losing market share to a level of 36.6% in 2001.

The second important trend is the rise of Chile as a major producer of farmed salmon. Chile is today the largest salmon producer<sup>3</sup>, with 37.1% of total production. There are relatively few restrictions on salmon farming in Chile. The cost level is low compared to other salmon producers and, with many foreign firms in the industry, Chile shares the

<sup>3</sup> According to the data used in this report, Chile's farmed production was larger than that of Norway in 2001. Other sources show that Norway had the highest production in 2001. We do not know for certain why the different sources give different information. One explanation could be differences in the weight basis for which production is reported.

same knowledge base as everybody else. Hence, it appears that Chile is the country where the productivity growth has been the fastest, and based on the development in its production share, this seems to be the case. The only major disadvantages for Chile are the lack of infrastructure in Region XI, where much of the future expansion of the industry may take place, and the long distance to markets, and therefore high transportation costs. Furthermore, as Chile has become a major producer it is increasingly targeted in anti-dumping complaints, first in the US in 1998, and then in the EU in 2002. The only setback in Chile's production share was in 1999, which can be attributed partly to the Asian crisis in 1997-98 and partly due to the uncertainty following the US dumping complaint.

Canada and the UK have in common that they have access to or are located within two of the main salmon markets, Canada to the US market due to North American Free Trade Agreement (NAFTA) while the UK is in the EU. One would think that, first the Norwegian regulations and trade problems, and later the Chilean trade problems should have benefitted these producers. The Canadian industry grew in the 1980s, but its share of the production has been virtually constant during the 1990s. The UK industry was in place fairly early, and has had a fairly stable production share during the last two decades. However, it reached a historic bottom level of about 11% in 2001. Both the Canadian and UK industries have had a productivity growth that is close to industry average over the period, but neither producer has been able to benefit from the trade restrictions and regulations faced by Norway and Chile. For Canada, lack of availability of sites could be an explanation. For Scotland, it may be due to variables such as disease problems and the high value of the pound sterling or due to more long term constraints that limit future expansion of production. Both reasons imply reduced profitability for Scottish farmers. This is a concern for Chilean and Norwegian farmers, as it provides an incentive for anti-dumping complaints by Scottish producers.

The four main producers have increased their combined share of production during the last decade. The only smaller producer that grows at a similar pace as the four big ones is the Faroe Islands. One may wonder what happened to Japan, which in the early 1980s was the second largest producer in the world, and to the US, Australia, Ireland and Iceland. It appears that regulations and problems with suitable locations have hindered growth to a large extent. It may also be that these industries, because of their small size, never benefitted from external scale effects associated with larger scale operations.

In the remainder of this section, we will give an overview over the main producers of farmed salmon.

### 2.3.1. Norway

Norway is the world's leading producer of farmed salmon. In 2002 the estimated output was about 521,000 tonnes (round weight), see Table 2.3.1. From 1990 to 2000 the

industry almost tripled its production, with the average annual growth rate equalling 11.9% for the decade.

Table 2.3.1 Annual Norwegian Production of Salmon and Salmon Trout 1990-2002 (tonnes)<sup>a</sup>

Year	Salmon	Trout	Total
1990	165,000	4,000	169,000
1991	156,000	6,000	162,000
1992	141,000	8,000	149,000
1993	170,000	9,000	179,000
1994	207,000	15,000	222,000
1995	249,000	14,000	263,000
1996	292,000	23,000	315,000
1997	316,000	34,000	350,000
1998	343,000	47,000	390,000
1999	412,000	50,000	462,000
2000	422,000	49,000	471,000
2001	411,000	66,000	477,000
2002	444,000	77,000	521,000

<sup>a</sup> Figures are “whole fish equivalents”, i.e., round, bled weight.

Source: Norwegian Fish Farmers Association.

The salmon farms are spread out along the long coastline with its many fjords, inlets and islands, which in combination with stable water temperatures (4-15°C) and good infrastructure provide an excellent environment for salmon farming.

The tremendous growth in output throughout the 1990s has not been matched by a corresponding increase in the number of production facilities and man-hours. Increased productivity in terms of feeding routines as well as disease prevention has improved the feed conversion ratios, shortened the on-growing period and lowered the mortality rates. Of particular importance was the development of an efficient vaccine for furunculosis in 1992. As a result, average production costs per kilo salmon have dropped almost continuously for the industry since the late 1980s.

In 2001 there were 244 smolt farms and 822 on-growing sites in operation, including salmon trout producers. In total, around 3,500 people were employed in the industry in 2000, counting both full time and seasonal workers. The salmon farmers constitute a highly diverse group of companies. There has been an increasing tendency towards consolidation in recent years. In 2001, the four largest firms in the industry controlled 28.3% of production capacity, measured as the number of licences fully or partially owned, while the 10 largest firms controlled 46% of production capacity. At the same time, the industry has become more international, with ownership structures across

national borders. In addition to vertical integration into processing facilities and sales offices in the EU, the Norwegian salmon industry also has increasing ownership interests in both the Chilean and Scottish salmon farming industry.

Table 2.3.2. Value of Norwegian Salmon Exports by Main Markets, 1995-2002 (Current NOK)

	1995	1996	1997	1998	1999	2000	2001	2002
Value (mill. NOK)	6,790	6,992	7,657	8,766	10,771	12,285	10,008	9,543
EU	80.3%	78.6%	75.7%	75.3%	68.6%	67.8%	65.4%	65.1%
Japan	9.8%	10.4%	10.3%	9.8%	13.7%	12.8%	13.5%	11.0%
USA	2.0%	1.6%	1.6%	2.2%	5.2%	4.8%	4.6%	4.7%
NOK per kg round weight equivalent								
EU	27.66	24.69	24.38	26.16	26.49	29.28	28.47	22.49
Japan	31.56	27.74	28.43	29.17	29.51	34.60	35.45	25.29
USA	37.45	36.36	40.06	35.42	33.36	39.97	53.71	31.35

Norway's major markets for salmon are the EU and Japan (cf. Table 2.3.2). In 2001, the Norwegian industry exported salmon for 10 billion NOK. The EU is by far the most important market. In 1995 over 80% of the export revenue came from the EU market, while this percentage had been reduced to 65.4% in 2001. The EU introduced a price floor for salmon in 1997 and a cap on annual increases in exports after pressure from Scottish salmon producers. Hence further output increases could not be absorbed in the market through price reductions. It is likely that this has led Norwegian exporters to target other markets for the increased production quantities, reducing the industry's overall dependence on the EU market.

Japan is the second most important market, accounting for 13.5% of total salmon export value in 2001. This share has been increasing for the last part of the 1990s, up from 9.8% in 1995. Japan mainly buys frozen salmon and is also an important market for salmon trout from Norway.

The US market plays a modest role for the Norwegian salmon industry, accounting for only 4.6% of the total export value in 2001. USA was an important market until the beginning of the 1990s, but after the Norwegian salmon producers were found guilty of dumping, a 26% tariff was introduced for round fish in 1991. This effectively put an end to Norwegian exports to the US for most of the 1990s. Over the last years, however, increasing amounts of fresh fillets, not being subject to the aforementioned duty, have been exported to the US. This is reflected in higher average prices for the US exports, averaging NOK 37.10 per kilo round fish equivalent from 1995-2000, compared to NOK 26.44 for exports to the EU and NOK 30.17 for the Japanese market.

A more detailed survey of Norwegian salmon exports from 1995 to 2001 is shown in Table 2.3.3. The main product form is round fresh, chilled salmon, of which almost 80% are exported to the EU countries. The EU and Japan together bought about 88% of the round, fresh salmon in 2001.

Table 2.3.3 Norwegian Salmon Exports by Product Form and Destination, 1995-2002<sup>a</sup>

	1995	1996	1997	1998	1999	2000	2001	2002
Total fresh, chilled salmon	169,450	191,126	205,235	222,698	255,473	268,139	262,099	276,224
Japan	6.6%	6.7%	7.5%	7.5%	8.5%	9.3%	10.2%	8.6%
USA	0.1%	0.1%	0.0%	0.1%	0.3%	0.3%	0.3%	0.5%
EU	89.8%	88.6%	87.3%	86.6%	83.9%	82.3%	77.9%	76.2%
Total frozen salmon	19,719	23,024	27,875	29,660	41,373	36,237	38,191	39,409
Japan	28.4%	31.1%	18.7%	17.2%	33.2%	19.3%	10.0%	8.6%
USA	8.5%	5.8%	3.7%	6.1%	6.9%	9.1%	7.1%	7.0%
EU	28.6%	22.8%	18.7%	15.2%	10.4%	10.9%	12.4%	5.5%
Russia	3.1%	8.0%	22.7%	22.9%	10.7%	15.5%	27.9%	36.3%
Israel	3.3%	4.9%	6.5%	7.8%	7.7%	8.5%	10.7%	9.1%
Taiwan, Prov. of China	16.2%	12.5%	11.5%	7.3%	11.5%	9.5%	3.9%	2.6%
Total fresh fillet	6,010	10,278	12,434	12,432	18,088	15,585	14,042	17,127
Japan	4.4%	4.2%	4.9%	4.6%	5.5%	6.7%	3.7%	3.2%
USA	0.4%	0.1%	0.4%	7.0%	29.9%	23.3%	14.9%	16.2%
EU	88.0%	90.2%	88.2%	79.4%	56.9%	63.3%	75.0%	74.0%
Total frozen fillet	9,334	10,630	12,383	13,406	19,120	18,730	19,638	22,638
Japan	12.5%	17.6%	18.3%	17.5%	25.7%	26.1%	34.0%	28.2%
USA	5.4%	4.5%	4.0%	5.1%	8.7%	8.6%	8.1%	7.7%
EU	75.3%	71.9%	67.8%	68.8%	57.6%	55.6%	45.8%	49.5%
Total Smoked	1,835	2,113	2,446	2,677	3,243	3,361	3,602	3,689
Total Marinated	0	97	214	262	309	333	207	132
Total Processed/Canned	947	847	638	551	437	1,010	802	708
Total Vacuum Packed	0	0	145	277	57	71	162	89

<sup>a</sup> Volumes refer to tonnes of product weight.

For round, frozen salmon there are several important markets. Russia and Israel are emerging markets for frozen salmon, buying 27.9% and 10.7% of the Norwegian export quantities, respectively, in 2001. Japan is a major buyer, with 19.3% of exported quantities in 2000, down to 10% in 2001. Many other Asian countries are important markets for Norwegian frozen salmon, most notably Taiwan, Province of China, but also China (including Hong Kong), Singapore and the Republic of Korea, reflecting a strong marketing effort in these countries throughout the 1990s. The EU has reduced its

relative importance as a market for round frozen salmon, reducing its share from 28.6% in 1995 to 12.4% in 2001.

The Norwegian exports of fresh salmon fillets nearly tripled from 1995 to 2001, while exports of frozen fillets doubled in the same period. The EU is the main market for both these product forms, taking 75.0% and 45.8% of the exported volumes in 2001, respectively. These shares have shown a downward trend from 1995, however, while the exports to both Japan and the USA have increased. In particular, the US market has increased its share in fresh fillets, going from virtually nothing in 1997, to 29.9% in 1999, but then down to 14.9% in 2001. Norway also exports smaller quantities of smoked, marinated, processed/canned and vacuum-packed salmon.

### Outlook

Expansion during the last decade can be attributed to productivity improvements and larger output per farm. This is because the number of fish farm licences has remained almost unchanged since the end of the 1980s. In autumn 2002 40 new licences were made available by the government; all of these have not yet been awarded. It has been announced that another 50 licences will be awarded in 2003. It will, however, take a few years for them to be fully operational.

Norway has been hard hit by trade restrictions. The countervailing duty imposed by the US in 1991 on fresh/frozen salmon from Norway, effectively eliminated this market segment for Norwegian producers and exporters. Norway is not a member of the European Union. As a non-member, it faces tariffs on exports to the EU. These are considerably higher for processed (smoked, marinated, ready-to-eat products) than for unprocessed products (fresh, frozen, chilled). As a consequence, processing of salmon in Norway has never become important, except for filleting. This situation is not likely to change.

Norway also faces other trade restrictions with the EU. As a consequence of a dumping and subsidy complaint by Scottish fish farmers, the European Commission initiated an investigation of Norwegian exports in 1996. A Salmon Agreement between Norway and the EU was agreed upon in 1997 and represents a solution to "the Salmon Case", i.e., the investigation based on dumping allegations. The Agreement introduced i.a. a minimum price for Norwegian salmon exports, indicative ceilings on the export of Norwegian salmon to the EU market, and a 3% marketing levy on the value of Norwegian salmon exports to the EU. Proceeds from the marketing levy are i.a. used for generic promotion of salmon in the EU. Because of the threat of trade measures, the Norwegian government in 1995 introduced a system of feed quotas for the production of salmon, i.e., the amount of feed that may be used by a farm during one year. This has contributed to limiting the expansion in output.

The current agreement with the EU expired in 2002 but was prolonged until February 2003. It appears that all measures against Norwegian salmon exports to the EU will be abandoned. However, the Norwegian Government will maintain the marketing levy until the end of 2004.

These trade issues have, of course, made other markets more attractive. As noted above, exports have been increasing to Japan, China (including Hong Kong), Taiwan, Province of China, Singapore and the Republic of Korea, as well as Russia and Israel. Although these markets are interesting in their own right, the attention they have received is also due to trade restrictions in the US and the EU markets.

### 2.3.2. Chile

The Chilean salmon aquaculture industry has expanded very rapidly from the mid 1980s. The production is concentrated on the three species Atlantic salmon (*Salmo salar*), coho salmon (*Oncorhynchus kisutch*) and salmon trout (*Oncorhynchus mykiss*). Annual harvests can be seen in Table 2.3.4.

From 1,119 tonnes recorded in 1985, production was 484,300 tonnes in 2001, including salmon trout. In 2002, it fell back slightly, to 451,000 tonnes. In the 1990-2000 period, the average annual growth rate was 27%. Coho was initially the predominant species. In 1992 it was surpassed by Atlantic salmon in production volume. Smaller quantities of chinook (*Oncorhynchus tshawytscha*) and cherry (*Oncorhynchus massou*) have also been farmed, but are of minor importance. The production of salmon trout has accelerated in the 1990s and surpassed the level of coho production in 1997.

Total salmonid production decreased from 1998 to 1999. This was due to the Asia crisis that hit Chile severely, as Japan is one of its main markets. The decrease was particularly pronounced for salmon trout, where Japan is the dominant market. Subsequently production increased at a rapid rate, but fell back again in 2002.



Table 2.3.4 Annual Chilean Production of Salmon and Salmon Trout 1985-2002 (tonnes)

	Atlantic	Coho	Others <sup>a</sup>	Total Salmon	Salmon Trout	Total Salmonid Production
1985		500		500	619	1,119
1986		1,144		1,144	1,007	2,151
1987	41	1,769		1,810	945	2,755
1988	165	4,040	3	4,208	1,267	5,475
1989	1,860	6,930	11	8,801	2,871	11,672
1990	9,478	13,298	345	23,121	5,481	28,602
1991	14,957	17,954	1,164	34,075	8,393	42,468
1992	23,715	22,165	735	46,615	15,515	62,130
1993	29,180	25,150	859	55,189	22,257	77,446
1994	34,175	34,524	379	69,078	32,866	101,944
1995	54,250	44,037	371	98,658	42,719	141,377
1996	77,327	66,988	341	144,656	54,429	199,085
1997	96,675	73,408	738	170,821	77,110	247,931
1998	107,066	76,954	108	184,128	75,108	259,236
1999	103,200	76,300	0	179,500	50,400	229,900
2000	166,800	93,500	2,500	262,800	79,500	342,300
2001 <sup>b</sup>	244,800	128,000	3,700	376,500	107,800	484,300
2002	248,407	94,927	2,248	345,600	105,410	451,000

<sup>a</sup> Chinook and cherry.

<sup>b</sup> Preliminary.

Sources: 1985-1998: Bjørndal and Aarland (1999).

1999-2001: Sernap

2002: Acquanoticias

Salmon is not a native species to Chile, still excellent climatic conditions for salmon farming are provided in the southern part of the country. The Chilean salmon industry is concentrated around Puerto Montt and the Chiloé Island in region X, about 1,000 km south of Santiago, but extends also into regions XI and XII.

The Chilean salmon industry has developed with a minimum of government intervention, in the spirit of the free market economy (Bjørndal, 2002). In addition to the favourable environmental conditions, it has also benefitted from low labour and feed costs, as Chile is the world's second largest producer of fish meal. The Chilean salmon industry has mainly developed with venture capital from large, Santiago-based companies. In addition, there are no restrictions on foreign ownership in the salmon industry, and today Canadian, Japanese, Scottish and Norwegian salmon farming interests are all represented through joint ventures or fully-owned subsidiaries. The degree of concentration in the industry is fairly large, with the four largest firms

accounting for 34.8% of exports in 2001, and the 10 largest firms accounting for 59.8% of exports.

The Chilean salmon industry has been geared towards export markets since the very beginning since domestic fish consumption is low in general. The main markets are the US for Atlantic salmon, and Japan for coho and salmon trout. An overview of export quantities is given in Table 2.3.5, while Table 2.3.6 gives an overview by species and main markets.

Table 2.3.5 Total Chilean Exports of Salmonids by Species 1987-2002 (Tonnes)<sup>a</sup>

	Atlantic	Coho	Salmon Trout	Total
1987	3.2	1,014.0	661.5	1,678.7
1988	61.9	3,105.2	883.1	4,050.2
1989	1,485.3	4,896.9	1,759.5	8,160.8
1990	8,392.4	11,676.0	4,043.5	24,286.2
1991	12,497.7	14,287.7	5,452.6	32,939.2
1992	19,964.1	17,565.0	11,092.6	49,871.7
1993	24,846.0	17,982.4	12,296.4	60,752.5
1994	26,793.6	24,757.0	15,803.5	76,545.8
1995	39,366.3	30,946.5	22,919.5	97,832.0
1996	53,838.0	42,982.0	35,831.8	134,292.8
1997	64,740.3	44,112.3	47,700.5	160,327.6
1998	67,336.0	57,190.0	56,958.0	181,614.0
1999	63,620.8	56,560.3	34,650.4	154,904.0
2000	94,589.0	64,394.0	46,573.0	206,254.0
2001	140,041.0	91,580.0	68,457.0	300,304.0
2002	162,000.0	94,000.0	74,000.0	331,403.0

<sup>a</sup> The weight refers to the weight of the exported products, and not round weight. These numbers are therefore not directly comparable with the production volumes given in Table 2.3.4.

Sources: IFOP (1987-1997)

Asociación de Productores de Salmón y Trucha de Chile (1998-2002).

As shown in Table 2.3.6, Atlantic salmon is mainly exported fresh/chilled, but as this share has declined from 89% in 1990 to 61% in 2001; the share being exported frozen has increased accordingly, to 38% in 2001.

The US is the main market for fresh salmon, buying around 90% of the exports. Brazil has emerged as another main buyer of fresh Atlantic salmon, taking 9% of the quantities in 2001. Japan used to be a considerable market for fresh chilled salmon, but their share has decreased from 11% in 1995 to only 0.3% in 2001.

Frozen Atlantic salmon is mainly exported to USA and EU, buying 31% and 42% of the quantities in 2001, respectively, while Japan accounted for 22% and Brazil bought 5% of the exported quantities. For coho and salmon trout, the exports are highly concentrated on the Japanese market. 96% and 94% of the export quantities are exported frozen, respectively, of which almost all is bought by Japan.

**Table 2.3.6 Chilean Exports of Salmon by Species and Main Markets, 1990-2001**

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
<b><i>Atlantic</i></b>												
<b><u>Fresh, chilled</u></b>	89 %	87 %	77 %	74 %	78 %	78 %	79 %	73 %	72 %	68%	65%	61%
USA	91 %	93 %	91 %	94 %	91 %	83 %	82 %	82 %	83%	84%	86%	90%
Japan	8%	7%	7%	4%	6%	11%	8%	5%	2%	1%	1%	0%
Brazil	0%	0%	0%	0%	1%	5%	8%	10%	10%	9%	8%	9%
<b><u>Frozen</u></b>									26%	29%	34%	38%
USA									36%	37%	31%	31%
EU									32%	29%	29%	42%
Japan									11%	17%	15%	22%
Brazil									7%	6%	7%	5%
<b><i>Coho</i></b>												
<b><u>Frozen</u></b>	88 %	94 %	99 %	97 %	96 %	97 %	92 %	91 %	94%	97%	97%	96%
Japan	90 %	93 %	98 %	96 %	95 %	93 %	97 %	97 %	94%	99%	99%	96%
<b><i>Salmon Trout</i></b>												
<b><u>Frozen</u></b>	88 %	97 %	98 %	98 %	95 %	96 %	93 %	91 %	88%	94%	93%	94%
Japan	57 %	67 %	80 %	83 %	85 %	89 %	90 %	86 %	92%	96%	94%	90%
<b><u>Fresh, chilled</u></b>	10 %	2 %	1 %	2 %	4 %	2 %	3 %	3 %	7%	1%	2%	2%
USA	90 %	95 %	98 %	83 %	99 %	88 %	63 %	84 %	92%	96%	94%	94%

In 2002, the largest market for Chile was the USA with 43 % of exports, followed by Japan 41 %, the EU 6 %, South and Central America with 5 % and other markets; 5 %.

A particularly interesting feature of the Chilean salmon aquaculture industry is that it has developed a very large export of salmon fillets to the US (Table 2.3.7). In fact, the degree of processing is higher in Chile than in Norway. This can, at least partly, be attributed to lower wages in Chile than in Norway. While wage differentials have been found to have limited effect when it comes to farming, they do appear to give Chile a competitive advantage vis-à-vis Norway when it comes to processing (Bjørndal, 2002).

Table 2.3.7 Chilean Exports of Salmon and Trout Fillets to the US Market 1998-2002, Tonnes<sup>a</sup>

	1998	1999	2000	2001	2002
Quantity (Tonnes)	41,904	39,487	59,413	81,675	97,511

<sup>a</sup> Product weight. Fresh and frozen fillets. The figures actually represent imports of the US and may thus be somewhat different from export figures.

Source: National Marine Fisheries Service, Fisheries Statistics and Economics Divisions.

### Outlook

The Chilean salmon aquaculture industry is expected to continue expanding at a fairly high rate. The potential for further expansion is good. However, much of the expansion will take place in Region XI, which lacks good infrastructure. Although the Chilean industry has potential for further cost reductions, this may to some extent be counterbalanced by more production farther south where cost of production is likely to be higher than in Region X (Bjørndal, 2002).

In June 1997 a group of salmon producers from Maine and Washington placed allegations against Chilean exporters of all forms of fresh Atlantic salmon to the US market. The accusations included receiving subsidies from the Chilean national treasury, as well as practising dumping on the US market. After a long procedure, this led to the imposition of an average duty of 4.54% while some companies are levied no duty. In 2002, salmon farmers in Chile (and the Faroe Islands) were accused of dumping salmon in the EU, an accusation that has been bitterly opposed by the farmers in question. It is not anticipated that an anti-dumping duty or any other measure will be introduced against Chilean salmon.

This situation shows that both Chile and Norway are very dependent on market access. Furthermore, although exports to Latin America (Brazil, in particular) and the EU have been increasing, Chile is largely dependent on two markets – Japan and the US. This makes the Chilean aquaculture industry very vulnerable to economic downturns in these two countries as witnessed by recent events.

### 2.3.3. The United Kingdom

Commercial farming of Atlantic salmon in Scotland commenced in the 1970s, following developments in Norway. Production of this species has since expanded steadily throughout the 1980s and 1990s. Scottish production in 2000 was 131,000 tonnes with 140,000 recorded for 2001 (FEAP, 2002). The development in the production of salmon is shown in Table 2.3.8. This indicates some levelling-off of production levels from

1999 which reflects adverse industry conditions in particular the impact of the viral disease Infectious Salmon Anaemia.

Table 2.3.8 Salmon Production in Scotland 1984-2002. Tonnes.

Year	Tonnes	Year	Tonnes
1984	3,912	1994	64,266
1985	6,921	1995	70,322
1986	10,337	1996	83,344
1987	12,721	1997	99,422
1988	17,951	1998	110,917
1989	28,603	1999	126,684
1990	32,004	2000	130,837
1991	40,657	2001	131,000
1992	36,302	2002 <sup>a</sup>	133,000
1993	48,791		

a) Estimate

Source: Fisheries Research Service, 1984-2000. Kontali 2001-2002

Fish farming is one of the most important industries in the coastal regions of Scotland. From small beginnings the industry has grown into a multi-million pound business, employing thousands of people in some of the most remote and economically vulnerable parts of Scotland; some 6,500 jobs have been attributed to the sector (SQS, 2002). Salmon farming in Scotland was established primarily by Marine Harvest Ltd in 1968, then part of the Unilever Group. Most of the sea sites are located in the west coast, producing 67% of the harvest and the remaining 33% is produced on the Orkney and Shetland Islands.

The number of companies registered with SERAD and actively producing salmon in 2000 was 68, as compared to 132 in 1993. This continues the trend of salmon production being concentrated within fewer companies. Twenty-two companies were still registered as active, although producing no fish for harvest in 2000, an increase from only one company in 1999. These 90 companies have 346 registered active sites, although only 163 were producing fish in 2000.

The Scottish salmon industry underwent a radical transformation in January 2000 in response to the changing industrial structure. The concentration of power within the sector demanded that there be a review of the role of the four main bodies then present:

the Scottish Salmon Growers Association, the Scottish Salmon Board, Scottish Quality Salmon and the Scottish Salmon Producers Organisation. The organisation to emerge from this review, Scottish Quality Salmon (SQS), represents an amalgamation of the first three organisations mentioned and leaves the Scottish Salmon Producers Organisation to function as a Producer Organisation.

SQS is intended to operate as a market oriented organisation for the industry whereby product is certified to have attained a certain standard of specifications. These standards are enforced through Food Certification Scotland and are communicated to the market via the Tartan Quality Mark by a variety of promotional instruments. SQS is reported to account for around 65% of Scottish tonnage and a similar proportion of smoked output.

The emphasis of the SQS scheme is upon the quality of the Tartan Quality Mark and this has supported some degree of product and price differentiation in the market. The more notable manifestation of this has been the award of the Label Rouge in France which is a highly regarded recognition of quality attainment awarded to only a select range of products. Scottish salmon was the first fish and the first non-French product to achieve this status and this has helped to ensure primacy within this market and elsewhere.

Scotland is the only major producer of farmed salmon with a large domestic market. Nevertheless, exports are also considerable and represent roughly 50% of output; farmed salmon accounts for some 40% of all Scottish food exports (SQS, 2002). Most product is exported as fresh or chilled product (Table 2.3.9). Exports of cured product are, however, also important, in particular because the unit value is considerable.

Table 2.3.9 UK Exports of Salmon, Quantity and Value, 1999-2000.

	1999		2000		2001		2002	
	Tonnes	£'000	Tonnes	£'000	Tonnes	£'000	Tonnes	£'000
Fresh or Chilled	51,209	133,067	44,027	118,073	49,401	108,591	41,203	99,515
Frozen	2,226	4,712	1,239	3,282	2,023	3,782	1,818	3,785
Cured	3,768	26,852	4,264	34,915	3,194	29,806	3,348	2,853
Prepared/preserved	1,476	6,113	1,375	5,540	1,158	4,012	885	6,258

Source: UK National Statistics

### Outlook

Potential sites for salmon farming in Scotland appear to have been exhausted. Thus, increased production will mainly come from productivity improvements, unless new offshore technology should become economically viable. The scope for productivity improvements is, however, substantial, as Scotland has been badly affected by diseases for a number of years.

It has proved difficult for Scottish farmers to compete with Norwegian farmers on the basis of price. The Scottish product has increasingly orientated itself to an emphasis upon quality rather than high volume with a lower price. The limitations of output from Scotland, especially compared to Norway, inhibit the ability to compete on price and there seems no reason to foresee any change in this. The emphasis upon quality has permeated the supply chain, and even the more stringent health controls, which are benefitting quality.

#### 2.3.4. Canada

Salmon farming in Canada started in British Columbia in the early 1970s and later was developed in Eastern Canada. Total output reached 105,306 tonnes in 2001, of which British Columbia represents 64% and New Brunswick 32% (Table 2.3.10). Currently, production in Nova Scotia and Newfoundland is very limited although it is projected to increase significantly in the medium term. Total farm gate value was CAD \$ 469 million in 2001 (Table 2.3.11).

Table 2.3.10 Salmon Aquaculture Production, by Province, Canada, 1995-2001, Tonnes.

Year	New Brunswick	Nova Scotia	Newfoundland	British Columbia	Total
1995	14,490	630	115	27,275	42,510
1996	16,380	1,125	295	27,756	45,556
1997	18,585	1,112	613	36,465	56,775
1998	14,232	1,785	401	42,200	58,618
1999	22,000	791	399	49,700	72,890
2000	29,100	3,425	670	49,000	82,195
2001	33,900	2,614	1,092	67,700	105,306

Source: Statistics Canada, Cansim, Agr. Div. Stc. 23-603-XPE, and Statistics Canada, 23-222-XIE

Table 2.3.11 Farmgate Value of Salmon Aquaculture Production, by Province, Canada, 1995-2001, Million CAD \$.

Year	New Brunswick	Nova Scotia	Newfoundland	British Columbia	Total
1995	111.6	4.1	0.8	170.4	286.9
1996	122.5	6.7	1.7	155.9	287.2
1997	139.0	6.4	2.7	175.9	324.0
1998	106.7	10.5	2.9	228.9	349.0
1999	150.0	7.0	2.5	290.6	450.1
2000	181.5	18.9	5.0	278.4	483.8
2001	180.0	14.4	5.2	269.4	469.0

Source: Statistics Canada, Cansim, Agr. Div. Stc. 23-603-XPE, and Statistics Canada, 23-222-XIE

When salmon farming developed in British Columbia, only two Pacific species, coho and chinook, were reared. Atlantic salmon were introduced at the end of the 1980s (Bjørndal, 1990). Subsequently, Atlantics became the preferred species, representing 86% of British Columbia's output in terms of volume and 80% in terms of value in 2001 (Tables 2.3.12 and 2.3.13). No Pacific salmon are farmed in New Brunswick, Nova Scotia and Newfoundland.

Table 2.3.12 Salmon Farming in British Columbia, 1998-2001, Volume (Tonnes) by Species.

	Atlantic	Chinook	Coho & other	Total
1998	33,100	6,600	2,600	42,300
1999	38,700	8,800	1,600	49,100
2000	39,300	8,000	2,100	49,400
2001	58,000	7,200	2,500	67,700

Source: BC Ministry of Agriculture and Fisheries

[http://www.agf.gov.bc.ca/fish\\_stats/aqua-salmon.html](http://www.agf.gov.bc.ca/fish_stats/aqua-salmon.html)

Table 2.3.13 Salmon Farming in British Columbia, 1998-2001, Farmgate Value (Million CAD\$) by Species.

	Atlantic	Chinook	Coho & other	Total
1998	179.5	39.5	9.9	292.2
1999	224.1	55.6	12.0	292.2
2000	218.1	55.4	8.2	281.7
2001	216.3	44.0	9.1	269.4

Source: BC Ministry of Agriculture and Fisheries

[http://www.agf.gov.bc.ca/fish\\_stats/aqua-salmon.html](http://www.agf.gov.bc.ca/fish_stats/aqua-salmon.html)



Both Nova Scotia and Newfoundland farm significant volumes of salmon trout (steelhead). These are not included in the data presented above. Salmon trout production for 1995-2001 is given in Table 2.3.14.

Table 2.3.14 Salmon Trout (Steelhead) Production and Value, Newfoundland and Nova Scotia (1995-2001).

Year	Newfoundland		Nova Scotia		Canada	
	tonnes	'000\$	tonnes	'000\$	tonnes	'000\$
1995	447	2,190	440	1,868	887	4,058
1996	734	3,210	363	1,454	1,097	4,664
1997	355	1,475	591	2,683	946	4,158
1998	1,316	6,919	1,038	6,095	2,354	13,014
1999	2,078	11,402	3,924	17,352	6,002	28,754
2000	842	5,494	4,681	19,395	5,523	24,889
2001	1,719	9,752	2,986	9,777	4,705	19,529

Source: Statistics Canada, Cansim, Agr. Div. Stc. 23-603-XPE, and Statistics Canada, 23-222-XIE

Table 2.3.15 provides information about Canadian exports of farmed salmon for the period 1995-2001. Over that period the volume of exports increased by over 80 percent and the value of exports by more than 70 percent. Nearly all exports are in a fresh or chilled form, and nearly all are destined for the United States.

Table 2.3.15 Farmed Salmon Exports, Volume and Value (1995-2001).

Year	Total		United States		U.S. as % of	
	Volume	Value	Volume	Value	Volume	Value
	Tonnes	\$millions	Tonnes	\$millions		
1995	28,967	244	28,013	234	97%	96%
1996	30,322	245	29,629	237	98%	97%
1997	39,176	319	37,941	308	97%	97%
1998	43,961	351	42,022	334	96%	95%
1999	43,836	368	42,390	355	97%	97%
2000	44,723	361	43,443	350	97%	97%
2001	53,925	422	51,924	407	96%	96%

Source: Statistics Canada, Custom Data Retrieval.

### Outlook

The scope for increased production of farmed salmon and salmon trout in New Brunswick and Newfoundland is very limited for reasons of site availability and unfavourable biological conditions. There is room for some expansion in Nova Scotia and, in theory, for substantial growth in British Columbia. As a result of strong

opposition to salmon farming from environmental and native groups, fishermen and residents, a moratorium on the issuance of new salmon farming licences was imposed in 1995. The moratorium was lifted in September 2002, but given continued public opposition to the industry it is likely that the government will proceed cautiously in granting new licences. Under the circumstances it is difficult to predict future Canadian production. Expansion on the East Coast will be limited for geographical and biological reasons. On the West Coast, hostile public opinion will likely continue to hinder industry growth.

### 2.3.5. Other Farmed Salmon Producers

In the early 1980s, Japan was the second largest producer of farmed salmon in the world. Production increased steadily from 1,855 tonnes in 1980 to a peak of 25,730 tonnes in 1991. Subsequently production has been decreasing; in 2001, output was 11,600 tonnes.

Japan farms coho salmon. Because of the water temperatures, the growing season is fairly short, which means that fish weight may be less than in Chile. Moreover, production is not as industrialised as in Chile. For these reasons, it has been difficult for Japanese farmers to compete with their Chilean counterparts. This is also why Japan has lost market share.

Table 2.3.16 Farmed Coho Salmon Production, Japan, 1980-2001, Tonnes.

Year	Tonnes	Year	Tonnes
1980	1,855	1991	25,730
1981	1,150	1992	25,519
1982	2,122	1993	21,148
1983	2,760	1994	22,824
1984	5,049	1995	13,524
1985	6,990	1996	8,401
1986	7,533	1997	9,927
1987	12,177	1998	8,721
1988	16,496	1999	11,148
1989	19,849	2000	13,107
1990	23,608	2001	11,616

Source: FAO, Fishstat+

Other producers of farmed Atlantic salmon are Ireland, the Faroe Islands, Iceland, Australia and the United States of America (Table 2.3.16). Irish production has more or less levelled off in recent years. Ireland also produces small quantities of salmon trout

(Table 2.3.17). The Faroe Islands, on the other hand, have increased their production substantially, taking advantage of the fact that increases in production in Norway have been limited by feed quotas. The Icelandic production is small and production takes place in land-based facilities. The potential for increased production is limited. The production of Australia has also levelled off in recent years. Tasmania is the centre for salmon farming in Australia. In the United States, Atlantic salmon is farmed in Maine and the state of Washington. Production is not expected to increase as new sites are not likely to become available, particularly due to environmental constraints.

Table 2.3.17 Farmed Atlantic Salmon Production, Various Countries, 1995-2002, Tonnes<sup>a</sup>.

	1995	1996	1997	1998	1999	2000	2001	2002
Ireland	11,500	13,000	15,000	16,800	18,600	19,300	23,700	22,000
Faroe Islands	8,100	17,000	20,500	19,200	36,000	30,000	41,000	42,000
Iceland	2,500	2,500	2,500	2,700	3,000	3,000	2,100	4,000
Australia <sup>b</sup>	7,627	7,647	7,069	9,195	10,907	12,223	15,500	13,000
USA	14,204	13,906	18,028	14,523	17,742	22,395	22,000 <sup>c</sup>	15,000

<sup>a</sup> Figures are "whole fish equivalents", i.e., round, bled weight.

<sup>b</sup> For Australia, figures are for the financial year (July 1 to June 30) so that e.g. the 1995 entry corresponds to July 1, 1995 to June 30, 1996.

<sup>c</sup> Estimate.

Sources: Kontali Analyse for Ireland, Faroe Islands and Iceland.

ABARE (2002), Australian Fisheries Statistics 2001, ABARE, Canberra for Australia.

National Marine Fisheries Service of USA.

Table 2.3.18 Farmed Salmon Trout Production, 1998-2001, Tonnes<sup>a</sup>.

	1998	1999	2000	2001
Ireland	300	1,100	1,400	1,600

<sup>a</sup> Figures are "whole fish equivalents", i.e., round, bled weight.

Source: Kontali Analyse.

Two-thirds of the Irish production are exported, the rest is consumed in the domestic market. Almost all Irish exports go to the EU, predominantly as fresh product. Almost the entire Faeroese production is exported, again with the EU as the main market (87% of exported quantity in 2000). Most exports are whole product, mainly fresh. Exports of smoked salmon have, however, been increasing in recent years and represented 15% of whole weight equivalents in 2000.

In New Zealand, the salmon aquaculture industry is based on the rearing of chinook salmon (Table 2.3.19).

Table 2.3.19 Farmed Chinook Salmon Production, New Zealand, 1994-2001, Tonnes <sup>a</sup>.

	1994	1995	1996	1997	1998	1999	2000	2001
New Zealand	5,000	5,000	6,000	7,000	7,000	7,000	7,200	8,500

<sup>a</sup> Figures are “whole fish equivalents”, i.e., round, bled weight.

Source: 1994 – 2000: Kontali Analyse.

2001: R. Kearney, personal communication (preliminary estimate).

### 3. MARKETS FOR FRESH AND FROZEN SALMON

#### 3.1 The United States of America

The United States is second only to Japan in consumption of fresh and frozen salmon, and United States salmon consumption is growing rapidly. Although the United States is the world's largest producer of wild salmon, the United States fresh and frozen salmon market is increasingly dominated by imported farmed Atlantic salmon.

##### United States Seafood Consumption

As shown in Figure 3.1.1, United States per capita seafood consumption is far below that of traditional seafood consuming countries such as Japan and Norway, and is roughly comparable to levels in Canada and the United Kingdom. As was the case for most other industrialised countries, United States per capita seafood consumption was relatively stable during the 1990s.

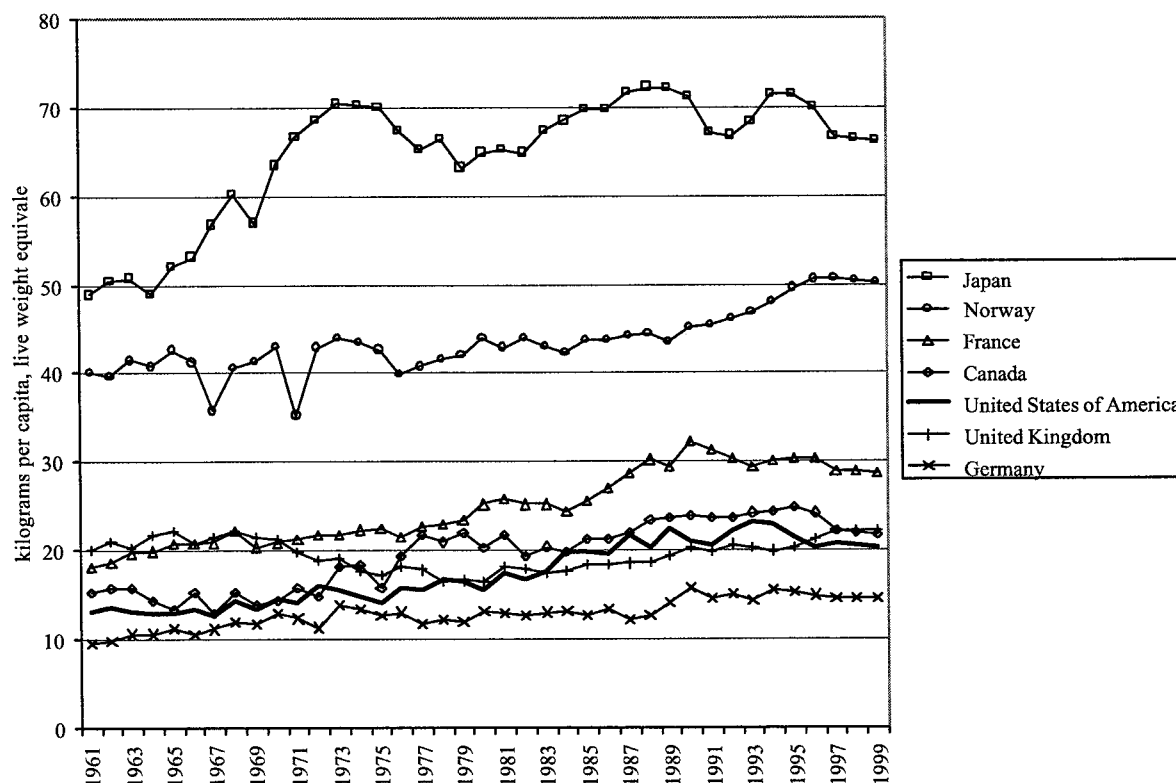


Figure 3.1.1. Per Capita Seafood Consumption in Selected Countries

Source: FAO

As shown in Figure 3.1.2, United States per capita seafood consumption is low in comparison with meat and poultry. Annual average consumption of fish was only 6.9 kgs per person in 2000, in comparison with 31.0 kgs per person for chicken, 30.0 kgs per person for beef, and 22.9 kgs per person for pork, lamb and veal.

Annual consumption of chicken has been increasing steadily for several decades. The dramatic increase in poultry consumption—also seen in other industrialised countries—is due to a combination of factors including lower prices, an increasing variety of more and more convenient product forms, and a trend among United States consumers towards a more healthful diet. This latter trend is promising for the seafood industry, and can in particular benefit the salmon industry due to the positive media attention omega-3 acids from fatty fish species have received.

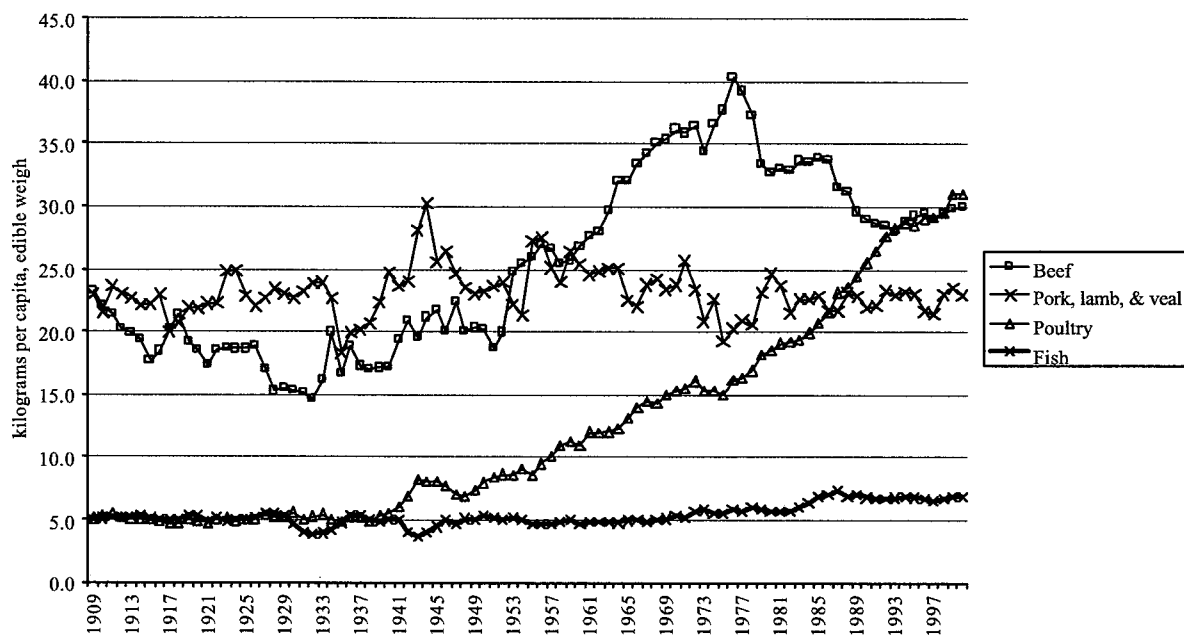
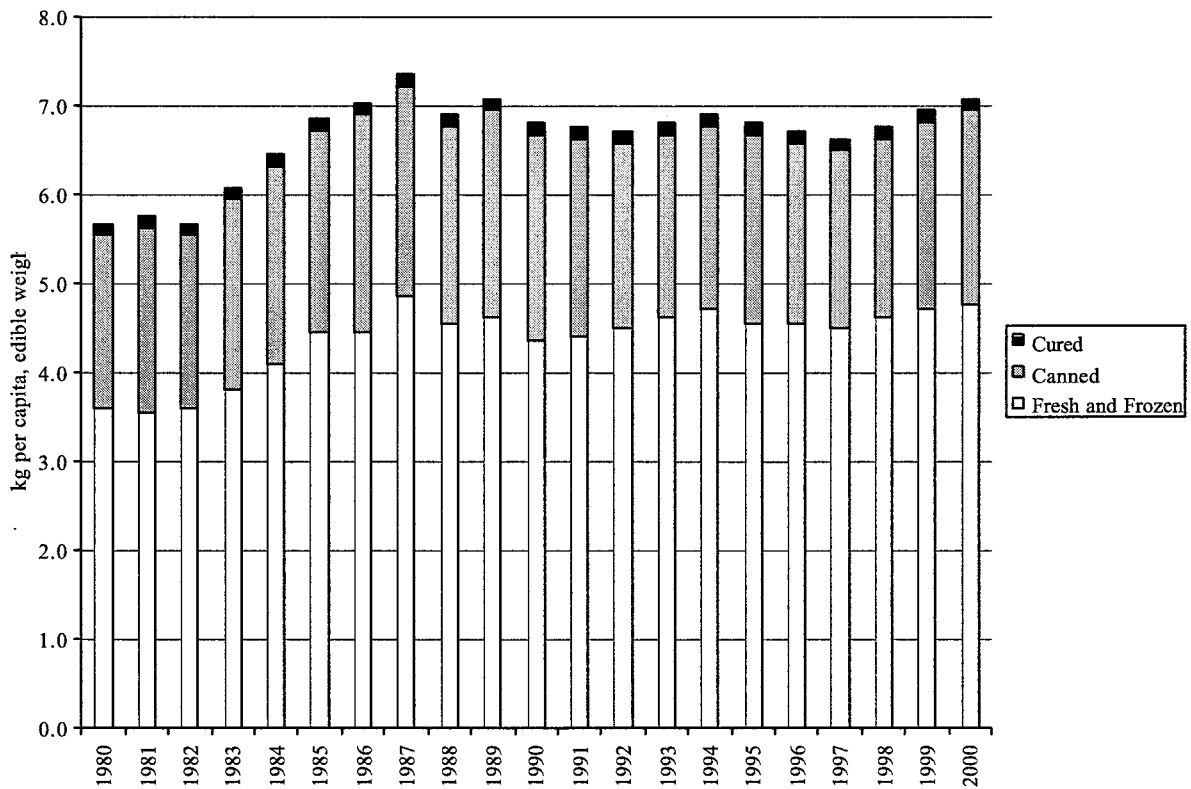


Figure 3.1.2. United States Per Capita Consumption of Meat, Poultry and Fish (edible weight)

As shown in Figure 3.1.3, United States per capita consumption of fish and shellfish increased during the early 1980s, due to growth in fresh and frozen consumption, but was relatively stable in the 1990s at about 7.0 kgs per capita.



**Figure 3.1.3. United States Per Capita Consumption of Fish and Shellfish, 1980-2000 (edible weight)**

Figure 3.1.4 shows estimated United States per capita fish consumption for the top six species. In 2001, salmon ranked third after shrimp and canned tuna. Estimated per capita consumption of salmon increased rapidly during the 1990s, and rose an impressive 31% from 1997 to 1999. This rapid growth in salmon consumption has taken place when total per capita seafood consumption has had very little growth, suggesting that salmon may have gained from other species.

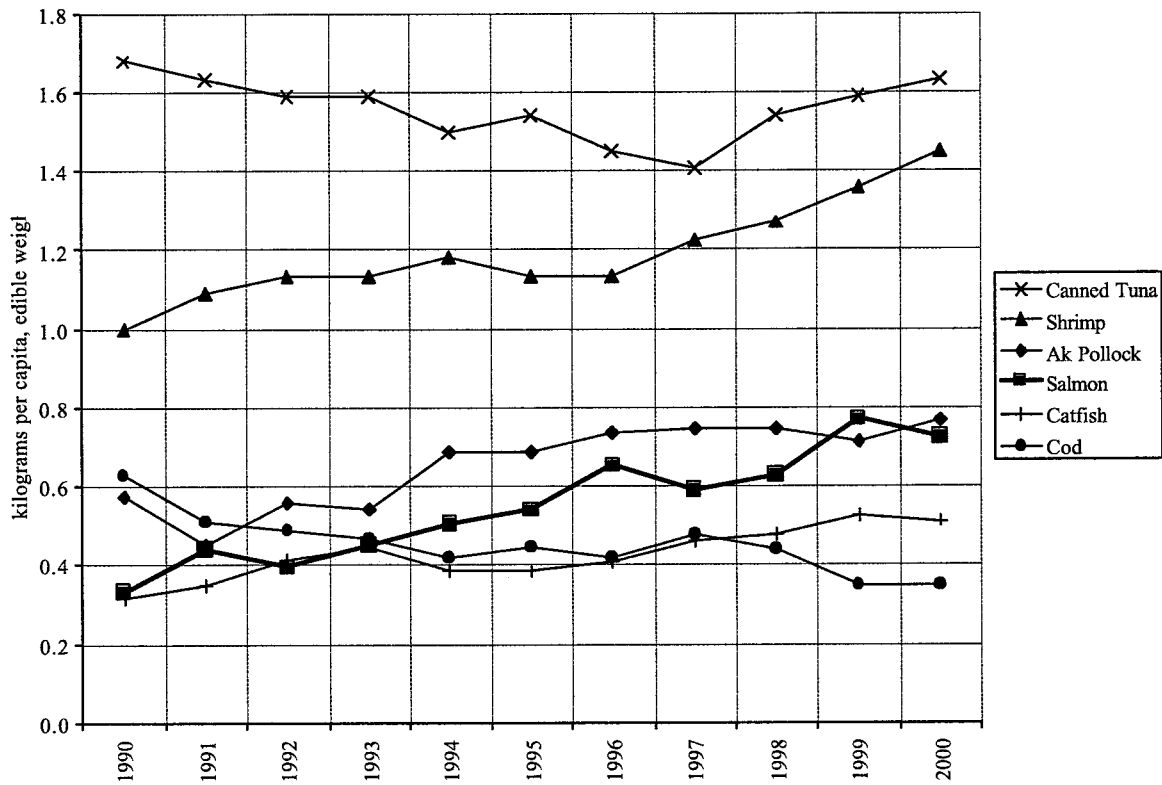
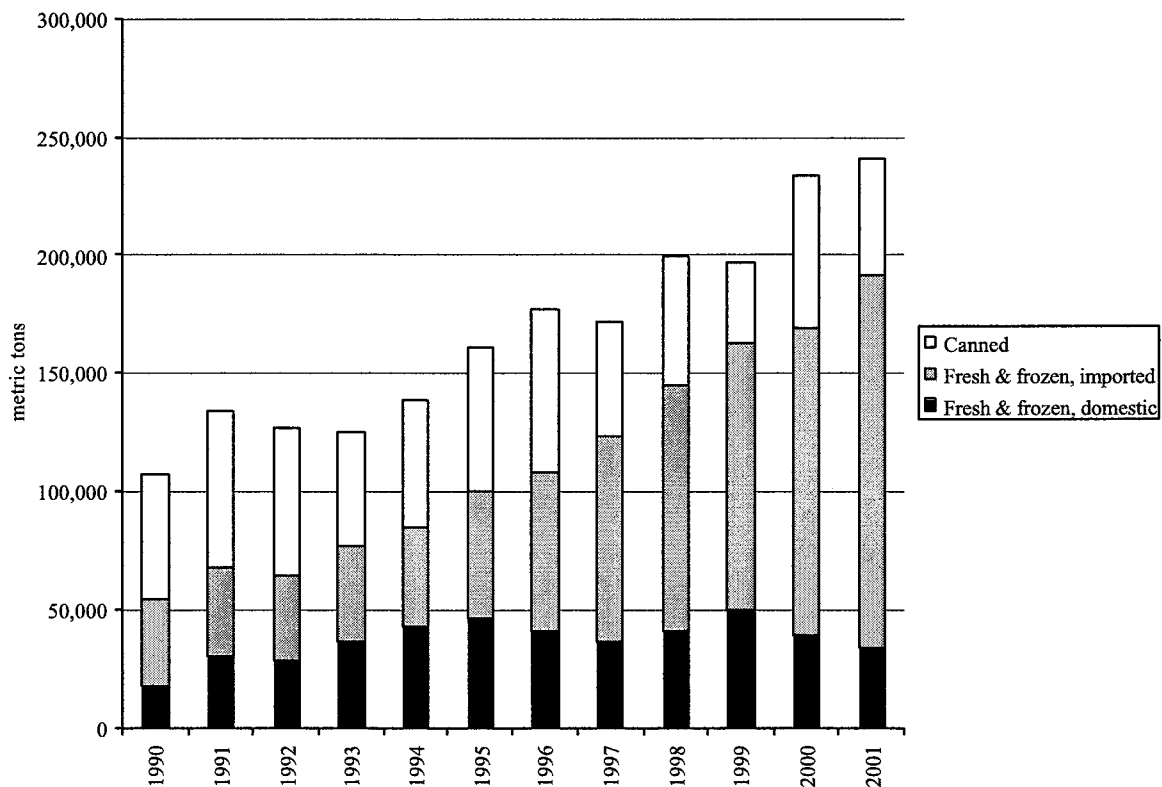


Figure 3.1.4. Estimated U.S. Per Capita Fish Consumption: Top Six Species.

Estimated United States Salmon Consumption

There are three major components of United States salmon consumption: domestic fresh & frozen salmon, imported fresh & frozen salmon, and canned salmon. Figure 3.1.5 shows estimates of total U.S. consumption of each of these three components in terms of edible weight. Each is driven by different factors and exhibits different trends over time.





**Figure 3.1.5. Estimated U.S. Salmon Consumption (edible weight)**

U.S. consumption of domestic fresh and frozen salmon increased during the 1990s as wild harvests increased but declined in 2000 and 2001. Estimated consumption varies significantly from year to year, reflecting variation in wild harvests. Between 1995 and 2001, estimated consumption ranged between 30,000 and 50,000 metric tonnes.

U.S. consumption of imported fresh and frozen salmon—almost entirely farmed—increased dramatically from 37,000 tonnes in 1990 to 157,000 tonnes in 2001. In 2001, imported salmon accounted for more than 80% of estimated fresh and frozen salmon consumption. Imports of fresh and frozen salmon have been the main factor driving the rapid increase in U.S. per capita salmon consumption.

U.S. consumption of canned salmon—almost entirely domestic production from wild harvests—is a significant but declining share of U.S. salmon consumption, due to the rapid increase in fresh and frozen salmon consumption. Canned salmon consumption also varies widely from year to year because of variations in U.S. wild salmon harvests.

Below, we discuss the United States market for fresh and frozen salmon in greater detail. We discuss the market for canned salmon in Section 4.1.

### Consumption of Domestic Fresh and Frozen Salmon

Table 3.1.1 shows estimates of average annual U.S. fresh and frozen salmon consumption for the years 1999-2001. The estimates of U.S. consumption from domestic production were derived by subtracting exports from estimated fresh and frozen production, and adjusting for inventory accumulation. Because of inconsistencies between data sources and the uncertainty of yield assumptions, the estimates should be considered only approximate. However, they serve to illustrate the relative scale of harvests, canned and fresh and frozen production, exports, imports, and consumption for each species

Domestic fresh and frozen salmon - mostly wild Pacific salmon - accounted for only about 24% of U.S. consumption. Imports - mostly farmed Atlantic salmon - accounted for about 76% of U.S. consumption.

Between 1999 and 2001 only about 22% of U.S. production was consumed domestically in fresh or frozen form, for two reasons. First, about 40% of U.S. production was canned (primarily pink and sockeye salmon). Second, about 68% of U.S. fresh and frozen production was exported. As a result, imports dominate the U.S. market, despite the fact that the United States is the world's largest producer of wild Pacific salmon.

Chum salmon accounted the largest share (45%) of consumption from domestic production, even though chum salmon harvests were lower than pink and sockeye salmon harvests. This is because a lower share of chum salmon is canned than for pink or sockeye salmon, and a lower share of fresh and frozen chum salmon production is exported than for sockeye.

**Table 3.1.1. Estimated Average Annual U.S. Production and Consumption of Fresh & Frozen Salmon by Species, 1999-2001 (MT)**

	Weight basis	Atlantic	Chinook	Sockeye	Coho	Pink	Chum	Unspecified	Total
<b>Harvests</b>	Round	21,380	7,294	95,020	16,153	168,324	83,015		391,188
<b>U.S. Production</b>									
Fresh & frozen salmon	Processed	15,394	5,383	44,349	11,139	20,302	45,012		141,578
Canned salmon	Processed	0	50	22,303	1,311	66,576	3,389		93,628
<i>Fresh &amp; frozen share of production</i>		100%	99%	67%	89%	23%	93%		60%
<i>Canned share of production</i>		0%	1%	33%	11%	77%	7%		40%
<b>U.S. fresh &amp; frozen production</b>									
U.S. Production	Processed	15,394	5,383	44,349	11,139	20,302	45,012		141,578
Exports	Processed	6,901	1,134	36,793	7,317	15,497	22,844	5,140	95,626
Domestic consumption from U.S. production	Processed	8,493	4,062	7,244	3,309	5,678	23,411		52,198
	Edible	6,705	3,207	5,719	2,613	4,483	18,482		41,209
<i>Export share*</i>		45%	21%	83%	66%	76%	51%		68%
<i>Domestic share*</i>		55%	75%	16%	30%	28%	52%		37%
<b>U.S. consumption</b>									
Domestic consumption from U.S. production	Processed	8,493	4,062	7,244	3,309	5,678	23,411		52,198
	Edible	6,705	3,207	5,719	2,613	4,483	18,482		41,209
Imports	Processed	134,491	3,172	217	759	605	3,071	7,873	150,189
	Edible	120,149	2,411	156	577	436	2,488	7,185	133,402
Total U.S. consumption	Edible	126,854	5,618	5,875	3,190	4,919	20,970	7,185	174,611
<i>Domestic share</i>		5%	57%	97%	82%	91%	88%	0%	24%
<i>Import share</i>		95%	43%	3%	18%	9%	12%	100%	76%
<b>Share of total U.S. consumption</b>									
<i>Domestic</i>		16%	8%	14%	6%	11%	45%	0%	100%
<i>Imports</i>		90%	2%	0%	0%	0%	2%	5%	100%
<i>Total</i>		73%	3%	3%	2%	3%	12%	4%	100%

\*Share may not add to 100% because domestic consumption from U.S. production is adjusted for inventory accumulation.

As shown in Table 3.1.2, estimated U.S. consumption of domestic wild Pacific salmon varied widely from year to year during the 1990s, primarily due to year-to-year variation in harvest levels and the share allocated to canned production. In contrast, estimated consumption of farmed Atlantic salmon grew rapidly, primarily due to rapid growth in imports.

**Table 3.1.2. Estimated U.S. Consumption of Fresh and Frozen Salmon, 1990-2001 (MT)**

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Atlantic	15,777	19,658	23,813	28,846	31,308	43,987	52,650	70,717	87,722	102,497	123,989	154,077
Chinook	12,927	14,388	9,845	8,652	6,354	8,856	9,394	7,927	7,215	6,005	5,665	5,184
Sockeye	2,332	886	1,544	6,036	7,762	2,844	3,456	5,013	4,705	7,449	5,179	4,997
Coho	5,773	5,318	4,553	3,882	8,862	7,815	7,423	3,670	5,208	2,810	1,587	5,172
Pink	3,220	12,160	9,815	12,777	5,925	6,528	5,025	7,121	8,711	7,419	4,580	2,757
Chum	11,400	12,264	12,051	15,589	22,176	26,739	21,663	19,063	20,035	27,933	21,605	13,372
Unspecified	3,497	3,255	2,939	1,386	2,594	3,247	8,283	9,963	11,161	8,801	6,894	5,861
Total	54,925	67,930	64,560	77,169	84,981	100,016	107,895	123,475	144,756	162,914	169,500	191,420

**Imported Fresh and Frozen Salmon**

The most important factor in the growth of United States fresh and frozen salmon consumption has been rapid growth in imports. As shown in Table 3.1.3, between 1990 and 2001 total fresh and frozen salmon imports more than tripled by product weight, increasing from 47,918 tonnes in 1990 to 175,091 tonnes in 2001. Farmed salmon accounted for all of this increase, increasing eight-fold from 19,193 tonnes to 165,136 tonnes, while imports of wild salmon declined.<sup>4</sup>

**Table 3.1.3. United States Imports of Fresh and Frozen Salmon, 1990-2001: Wild and Farmed (MT)**

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Farmed	19,193	22,167	31,588	36,351	37,281	53,778	64,185	79,089	98,316	112,384	129,320	165,136
Wild	28,725	26,727	15,774	16,331	16,919	13,363	17,393	25,131	21,819	16,997	16,775	9,955
Total	47,918	48,894	47,363	52,682	54,199	67,141	81,577	104,219	120,135	129,382	146,095	175,091

As shown in Table 3.1.4, United States imports of farmed fresh and frozen salmon consist almost entirely of Atlantic salmon. Imports of farmed fresh and frozen chinook and coho salmon are relatively small and have declined in recent years.

**Table 3.1.4. United States Imports of Fresh and Frozen Farmed Salmon, by Species, 1990-2000 (MT)**

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Atlantic	19,193	18,165	23,829	31,042	32,953	47,392	57,175	74,360	93,001	108,738	126,292	161,581
Chinook	0	3,712	7,409	4,809	3,842	6,286	6,600	4,180	4,518	3,115	2,586	2,759
Coho	0	290	350	500	485	100	410	549	798	532	442	796
Total	19,193	22,167	31,588	36,351	37,281	53,778	64,185	79,089	98,316	112,384	129,320	165,136

<sup>4</sup>For this analysis, all imports not clearly identifiable as farmed were coded as wild. Thus Table 3.1.1 may overstate actual wild salmon imports.

As shown in Table 3.1.5, fresh salmon accounts for 89% of farmed salmon imports, although the frozen share has been increasing gradually in recent years. A more dramatic change is the rapid growth in value-added imports. Fillets increased from 16% of total imports in 1995 to 59% of total imports in 2000.

**Table 3.1.5. United States Imports of Fresh and Frozen Farmed Salmon, by Product, 1990-2001**

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
<b>Metric tonnes</b>												
Fresh fillets	0	0	0	0	0	7,044	12,968	23,322	36,064	46,327	58,125	83,182
Other fresh	16,305	20,762	29,738	33,499	34,692	42,176	46,339	48,982	53,592	55,070	56,639	63,276
Total fresh	16,305	20,762	29,738	33,499	34,692	49,221	59,307	72,305	89,656	101,397	114,765	146,459
Frozen fillets	0	0	0	0	0	1,816	1,873	3,170	5,283	6,591	9,727	14,892
Other frozen	2,887	1,405	1,850	2,851	2,589	2,742	3,004	3,614	3,377	4,396	4,828	3,786
Total frozen	2,887	1,405	1,850	2,851	2,589	4,558	4,877	6,784	8,660	10,987	14,555	18,677
Total	19,193	22,167	31,588	36,351	37,281	53,778	64,185	79,089	98,316	112,384	129,320	165,136
<b>Percent</b>												
Fresh fillets						13%	20%	29%	37%	41%	45%	50%
Other fresh	85%	94%	94%	92%	93%	78%	72%	62%	55%	49%	44%	38%
Total fresh	85%	94%	94%	92%	93%	92%	92%	91%	91%	90%	89%	89%
Frozen fillets						3%	3%	4%	5%	6%	8%	9%
Other frozen	15%	6%	6%	8%	7%	5%	5%	5%	3%	4%	4%	2%
Total frozen	15%	6%	6%	8%	7%	8%	8%	9%	9%	10%	11%	11%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Note: Imports of fillets were not reported separately until 1995. Other products are primarily round.

As shown in Table 3.1.6, Chile and Canada are the two main suppliers of imported farmed fresh and frozen salmon to the United States market, followed distantly by the Norway and the United Kingdom. Chile surpassed Canada as the leading supplier in 2000, and by 2001 accounted for more than half of U.S. imports.

**Table 3.1.6. United States Imports of Fresh and Frozen Farmed Salmon, by Country, 1990-2001**

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
<b>Metric tones</b>												
Chile	4,534	5,419	10,433	13,042	11,099	21,346	28,955	33,687	43,932	41,787	63,161	84,771
Canada	4,615	12,384	18,198	19,315	22,828	28,573	30,666	40,270	46,177	48,091	47,428	65,637
Norway	7,199	665	511	1,845	1,580	2,290	1,935	1,730	3,029	9,149	7,940	6,586
United Kingdom	695	1,133	306	235	592	814	1,352	1,400	2,986	7,425	6,583	6,266
Other countries	2,149	2,566	2,140	1,914	1,182	755	1,277	2,003	2,192	5,932	4,208	1,876
<b>Total</b>	<b>19,193</b>	<b>22,167</b>	<b>31,588</b>	<b>36,351</b>	<b>37,281</b>	<b>53,778</b>	<b>64,185</b>	<b>79,089</b>	<b>98,316</b>	<b>112,384</b>	<b>129,320</b>	<b>165,136</b>
<b>Percent</b>												
Chile	24%	24%	33%	36%	30%	40%	45%	43%	45%	37%	49%	51%
Canada	24%	56%	58%	53%	61%	53%	48%	51%	47%	43%	37%	40%
Norway	38%	3%	2%	5%	4%	4%	3%	2%	3%	8%	6%	4%
United Kingdom	4%	5%	1%	1%	2%	2%	2%	2%	3%	7%	5%	4%
Other countries	11%	12%	7%	5%	3%	1%	2%	3%	2%	5%	3%	1%
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

Until 1990, Norway was the leading supplier of farmed salmon to the United States market. However, imports from Norway virtually disappeared from the U.S. market after dumping allegations in 1991 resulted in a 26% import duty on fresh round salmon from Norway. Since 1999, however, there has been an increased presence of Norwegian salmon products not subject to the tariff, most notably fresh and frozen fillets, as well as frozen round Atlantic salmon.

As shown in Table 3.1.7, the rapid growth in imports from Chile has consisted almost entirely of value-added fillets. In contrast, fillets account for only a small share of imports from Canada. Thus Chile is the main supplier of fillets to the U.S. market, while Canada is the main supplier of round (headed and gutted) product.

**Table 3.1.7. United States Imports of Fresh and Frozen Farmed Salmon, by Country and Product, 1990-2001 (MT)**

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
<b>Chile</b>												
Fillets						7,886	13,817	23,196	35,432	38,095	57,717	79,871
Other products	4,534	5,419	10,433	13,042	11,099	13,460	15,138	10,491	8,500	3,692	5,444	4,900
<b>Total</b>	<b>4,534</b>	<b>5,419</b>	<b>10,433</b>	<b>13,042</b>	<b>11,099</b>	<b>21,346</b>	<b>28,955</b>	<b>33,687</b>	<b>43,932</b>	<b>41,787</b>	<b>63,161</b>	<b>84,771</b>
<b>Canada</b>												
Fillets						295	471	2,195	3,954	5,488	3,920	13,691
Other products	4,615	12,384	18,198	19,315	22,828	28,278	30,195	38,075	42,224	42,603	43,508	51,946
<b>Total</b>	<b>4,615</b>	<b>12,384</b>	<b>18,198</b>	<b>19,315</b>	<b>22,828</b>	<b>28,573</b>	<b>30,666</b>	<b>40,270</b>	<b>46,177</b>	<b>48,091</b>	<b>47,428</b>	<b>65,637</b>
<b>Other countries</b>												
Fillets						679	553	1,102	1,962	9,336	6,216	4,512
Other products	10,044	4,364	2,957	3,994	3,354	3,179	4,010	4,031	6,245	13,171	12,515	10,216
<b>Total</b>	<b>10,044</b>	<b>4,364</b>	<b>2,957</b>	<b>3,994</b>	<b>3,354</b>	<b>3,859</b>	<b>4,564</b>	<b>5,133</b>	<b>8,207</b>	<b>22,507</b>	<b>18,730</b>	<b>14,728</b>
<b>Total</b>												
Fillets						8,861	14,842	26,492	41,347	52,918	67,853	98,074
Other products	19,193	22,167	31,588	36,351	37,281	44,918	49,343	52,597	56,969	59,466	61,467	67,062
<b>Total</b>	<b>19,193</b>	<b>22,167</b>	<b>31,588</b>	<b>36,351</b>	<b>37,281</b>	<b>53,778</b>	<b>64,185</b>	<b>79,089</b>	<b>98,316</b>	<b>112,384</b>	<b>129,320</b>	<b>165,136</b>

\*Imports of fillets were not reported separately until 1995. "Other products" are primarily headed and gutted.

As shown in Table 3.1.8, the United States also imports modest volumes of fresh and frozen wild salmon, mainly from Canada. Apparent total imports of wild salmon declined from 29 thousand tonnes in 1990 to 10 thousand tonnes in 2001. However, because all imports not clearly identifiable as farmed were coded as wild for this analysis, these tables may overstate actual wild salmon imports. In addition, because the number of salmon product categories in U.S. trade statistics increased during the 1990s, making it possible to identify some farmed products previously aggregated with wild products, the tables may overstate the apparent decline in wild salmon imports. Chum salmon accounted for the largest share of apparent wild salmon imports during the 1990s (32%), followed by chinook salmon (14%). The species was unspecified for 34% of apparent wild salmon imports.

**Table 3.1.8. United States Imports of Fresh and Frozen Wild Salmon, by Country, 1990-2001 (MT)**

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
<b>Canada</b>	<b>21,440</b>	<b>19,729</b>	<b>12,121</b>	<b>14,518</b>	<b>14,305</b>	<b>10,293</b>	<b>8,187</b>	<b>10,299</b>	<b>9,641</b>	<b>9,019</b>	<b>10,506</b>	<b>5,476</b>
<b>Other countries</b>	<b>7,285</b>	<b>6,998</b>	<b>3,654</b>	<b>1,813</b>	<b>2,614</b>	<b>3,070</b>	<b>9,206</b>	<b>14,832</b>	<b>12,178</b>	<b>7,979</b>	<b>6,269</b>	<b>4,480</b>
<b>Total</b>	<b>28,725</b>	<b>26,727</b>	<b>15,774</b>	<b>16,331</b>	<b>16,919</b>	<b>13,363</b>	<b>17,393</b>	<b>25,131</b>	<b>21,819</b>	<b>16,997</b>	<b>16,775</b>	<b>9,955</b>

## Price Trends

One measure of price trends in the U.S. fresh and frozen salmon market is provided by average import prices (calculated by dividing reported import value by import volume). Table 3.1.9 shows trends in average prices for selected products which collectively accounted for 95% of U.S. import volume in 2001. Because the number of product categories for which import data are reported has increased over time, data from earlier years for some products include products reported separately in later years. For example, prior to 1998, the data for “fresh, Atlantic, farmed” include “fresh fillets, Atlantic, farmed.”

**Table 3.1.9. United States Import Volume and Average Import Price, Selected Fresh and Frozen Salmon Products, 1990-2001**

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
<b>Import volume ( 000 MT)</b>												
Fresh fillets, Atlantic, farmed									36.1	46.3	58.1	83.2
Fresh, Atlantic, farmed		7.6	22.0	28.2	30.4	35.8	39.3	44.3	48.3	51.4	53.6	59.7
Fresh, Chinook, farmed		3.7	7.4	4.8	3.8	6.3	6.6	4.2	4.5	3.1	2.6	2.8
Fresh, Chinook, wild		0.6	0.6	0.7	0.5	0.2	0.2	0.2	0.3	0.1	0.1	0.2
Fresh, Chum, wild	3.8	4.2	4.1	4.3	5.3	4.5	3.8	3.2	4.0	2.3	1.5	0.8
Frozen fillets, Atlantic, farmed						1.8	1.9	3.2	5.3	6.6	9.7	14.9
Frozen, Atlantic, farmed	2.9	1.4	1.8	2.9	2.6	2.7	3.0	3.6	3.4	4.4	4.8	3.8
Frozen, Chum, wild	1.9	1.7	1.6	2.7	3.0	2.0	1.4	7.0	2.5	2.3	1.3	1.1
Frozen, Pink, wild	0.5	0.5	0.3	0.2	0.2	0.2	0.2	0.4	0.1	0.3	0.8	0.3
All other	38.9	29.2	9.5	8.9	8.5	13.6	25.2	38.1	15.8	12.4	13.5	8.5
Total	47.9	48.9	47.4	52.7	54.2	67.1	81.6	104.2	120.1	129.4	146.1	175.1
<b>Average import price (\$/kilo)</b>												
Fresh fillets, Atlantic, farmed									\$5.78	\$6.23	\$5.96	\$4.81
Fresh, Atlantic, farmed		\$5.94	\$5.67	\$5.44	\$5.49	\$5.32	\$4.97	\$5.33	\$5.05	\$5.32	\$5.10	\$4.70
Fresh, Chinook, farmed		\$5.29	\$5.29	\$5.66	\$5.87	\$6.09	\$5.77	\$6.06	\$5.27	\$5.01	\$5.29	\$4.01
Fresh, Chinook, wild		\$4.30	\$4.93	\$3.83	\$4.84	\$3.79	\$3.52	\$4.46	\$4.59	\$5.26	\$4.80	\$4.46
Fresh, Chum, wild	\$2.68	\$2.01	\$2.03	\$1.89	\$1.50	\$1.59	\$1.38	\$1.33	\$1.04	\$1.20	\$1.53	\$1.51
Frozen fillets, Atlantic, farmed						\$6.37	\$6.21	\$6.06	\$5.82	\$6.33	\$6.59	\$4.86
Frozen, Atlantic, farmed	\$6.01	\$5.91	\$6.19	\$5.21	\$5.30	\$5.35	\$4.88	\$4.35	\$4.64	\$4.36	\$4.68	\$4.00
Frozen, Chum, wild	\$2.59	\$2.11	\$2.03	\$1.98	\$1.61	\$1.49	\$1.25	\$1.36	\$1.36	\$1.32	\$1.50	\$1.46
Frozen, Pink, wild	\$2.46	\$1.84	\$1.41	\$2.07	\$2.17	\$1.53	\$1.71	\$1.86	\$2.00	\$1.59	\$1.30	\$1.59

Figures 3.1.6-3.1.8 compare trends in average import prices for selected products. As shown in Figure 3.1.6, between 1991 and 1996 average prices for fresh Atlantic salmon—the largest import product category at the time—fell from \$5.94/kilo to \$4.97/kilo. Prices then fluctuated for several years before falling to \$4.70/kilo in 2001. Prices for frozen Atlantic salmon exhibited a similar downward trend, but fell further to



\$4.35/kilo in 1997 and \$4.00/kilo in 2001. Prices for fresh and frozen fillets—reported separately beginning in 1998—are above prices for non-fillet prices, but the gap narrowed significantly when fillet prices dropped by more than \$1.00/kilo in 2001.

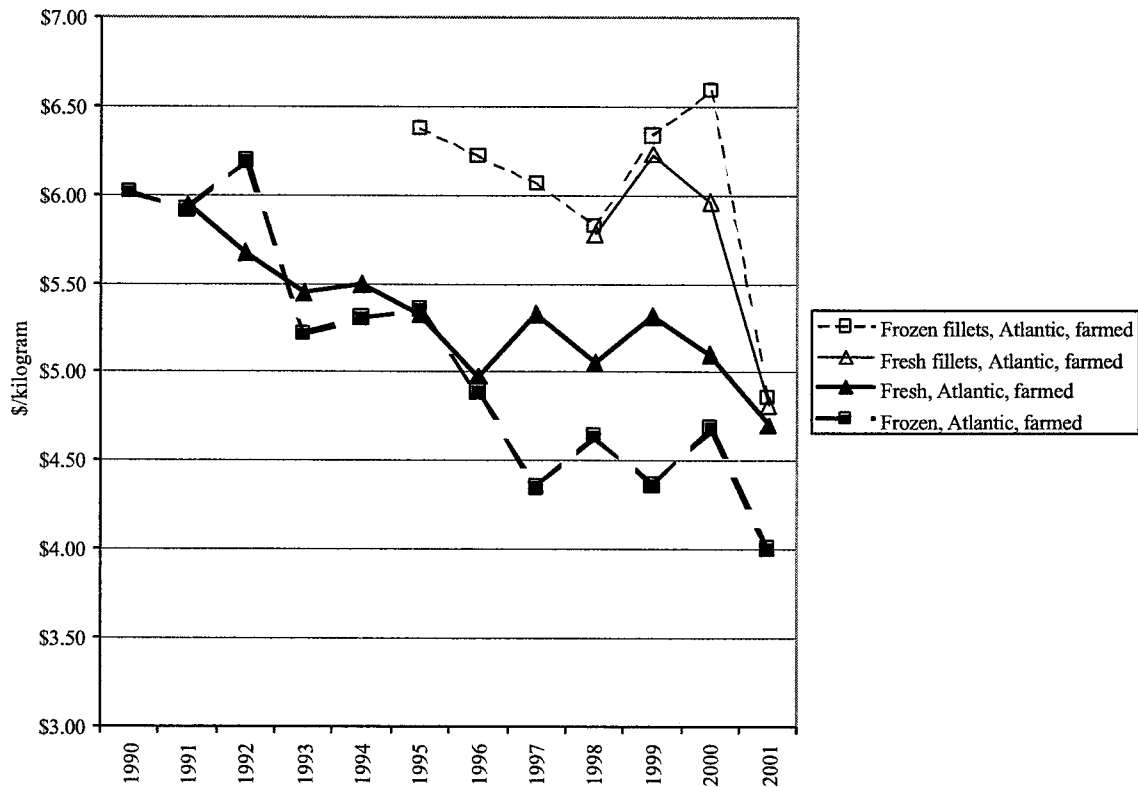


Figure 3.1.6. Trends in U.S. Average Import Prices for Atlantic Salmon

As shown in Figure 3.1.7, average prices for fresh farmed chinook salmon have been similar to prices for fresh farmed Atlantic salmon—suggesting that these products are viewed as roughly comparable in the market. Prior to 1999, prices for fresh wild chinook were one to two dollars lower per kg than for fresh farmed chinook. However, since 1999 fresh farmed and wild chinook salmon commanded similar average import prices. Note, however, that import volumes of wild chinook are much lower than import volumes of farmed chinook.

Average import prices of fresh wild chum salmon were far lower than for fresh farmed or wild Atlantic and chinook—an indicator that wild chum salmon is viewed as a much lower quality product. However, fresh chum salmon prices have exhibited similar trends to fresh Atlantic prices, suggesting that these products do substitute to some extent.

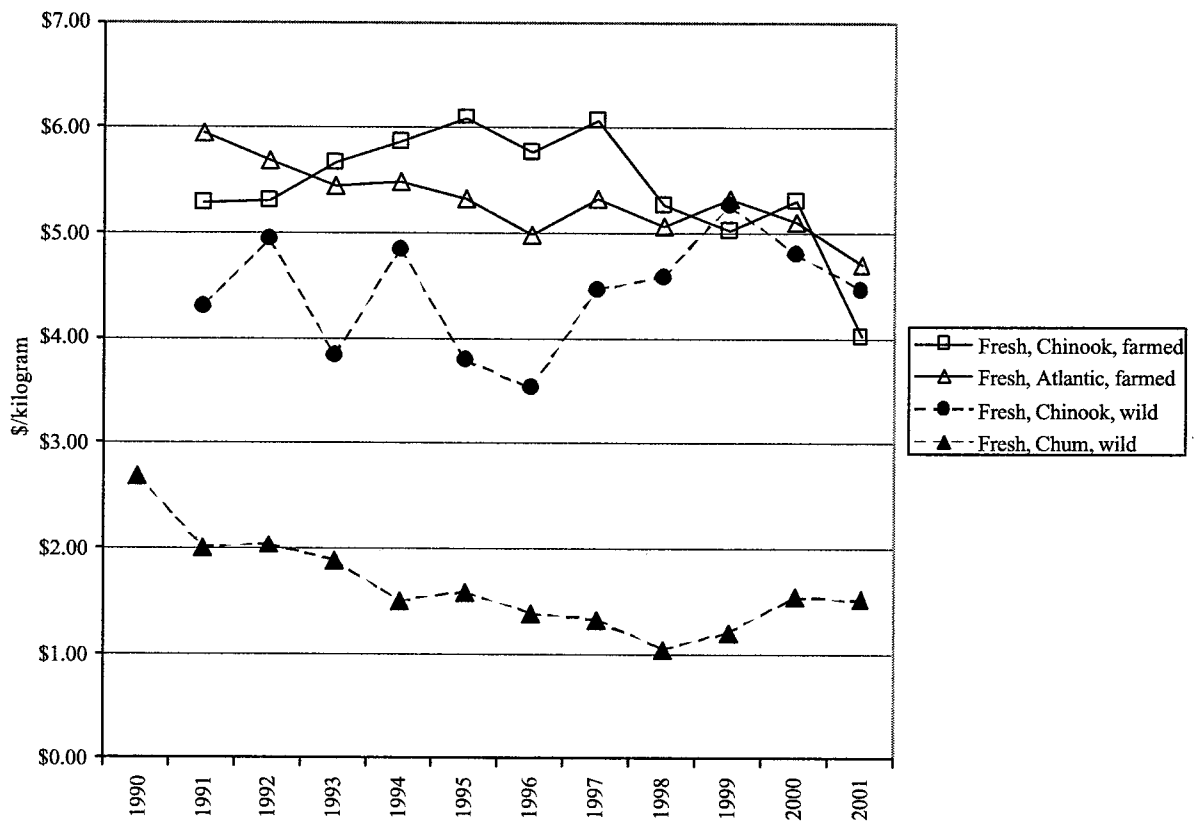
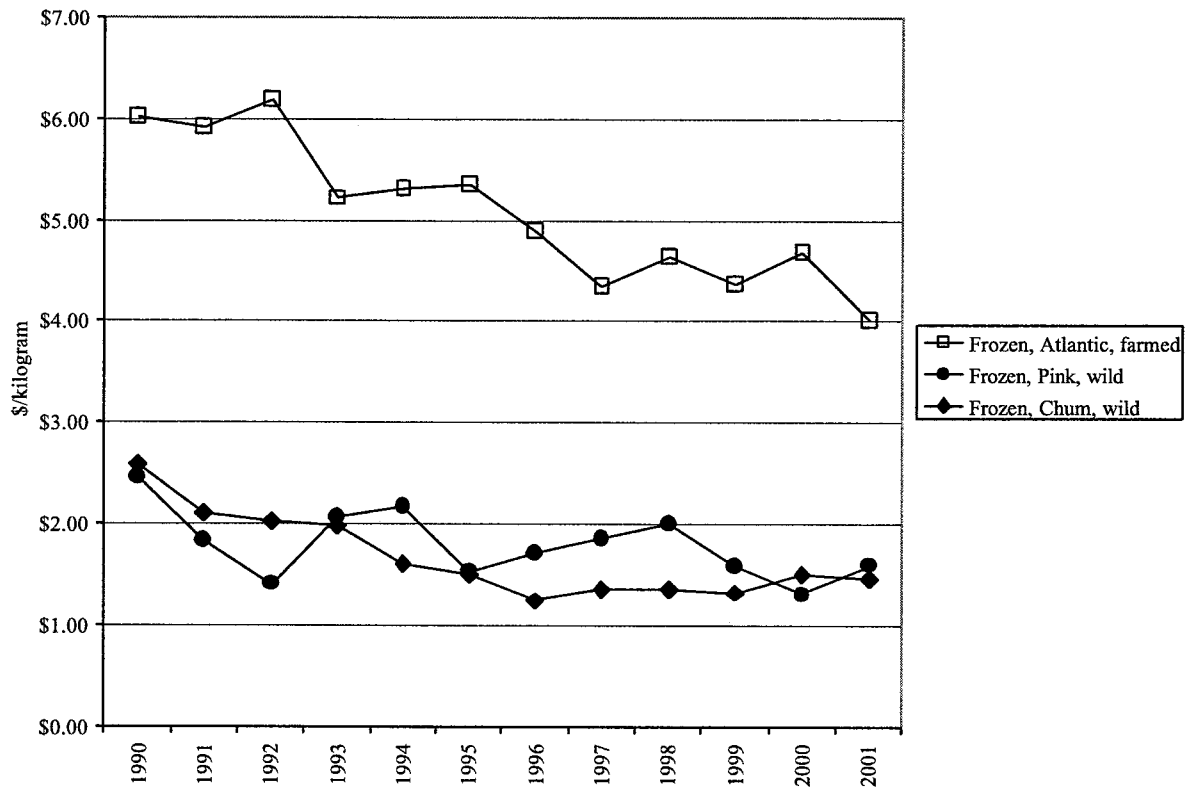


Figure 3.1.7. Trends in U.S. Average Import Prices for Farmed and Wild Fresh Salmon

As shown in Figure 3.1.8, average import prices of frozen wild chum and pink salmon were far lower than for frozen farmed Atlantic salmon—an indicator that these wild species are viewed as much lower quality products.



**Figure 3.1.8. Trends in U.S. Average Import Prices for Farmed and Wild Frozen Salmon**

Because of rapid structural change in the United States salmon market associated with the introduction of new product forms and expanded availability, it is difficult to model statistically the factors determining United States salmon prices in recent years. However, it is likely that price trends in recent years reflect the combined effects of rapid growth in both demand for and supply of imported farmed salmon. United States demand for salmon (volume demanded at any given price) has expanded as a result of expanded availability of salmon--in more retail stores and food service outlets, in more product forms, for more of the year--and as consumers have become increasingly familiar with salmon. Supply (volume offered for supply at any given price) has expanded as a result of expanded production capacity and falling costs of production. We would expect to see falling prices in years in which demand rose less rapidly than supply, and rising prices in years in which demand rose more rapidly than supply.

Trends in United States imports and average import prices, shown in Figure 3.1.9, are consistent with both rising demand and supply. Rapid growth in imports was accompanied by a generally downward trend in prices during the period 1990-2001 (suggesting that growth in supply exceeded growth in demand), although prices held

stayed the same or rose for several years in the late 1990s (suggesting that growth in demand exceeded growth in supply in these years).

As shown in Figure 3.1.10, there was an inverse relationship between annual changes in imports and changes in average import prices of fresh Atlantic salmon. Prices tended to rise in years when import growth fell, and to fall in years when import growth increased (except in 1996). This is what we would expect if demand were increasing relatively more steadily from year to year than supply.

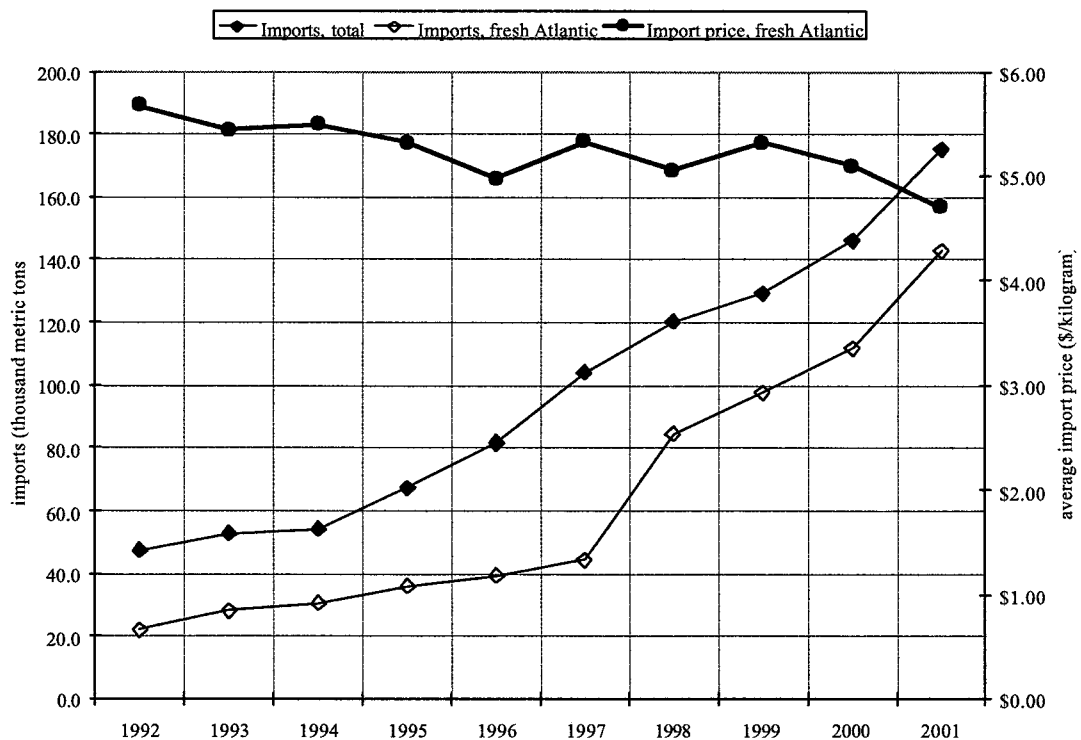
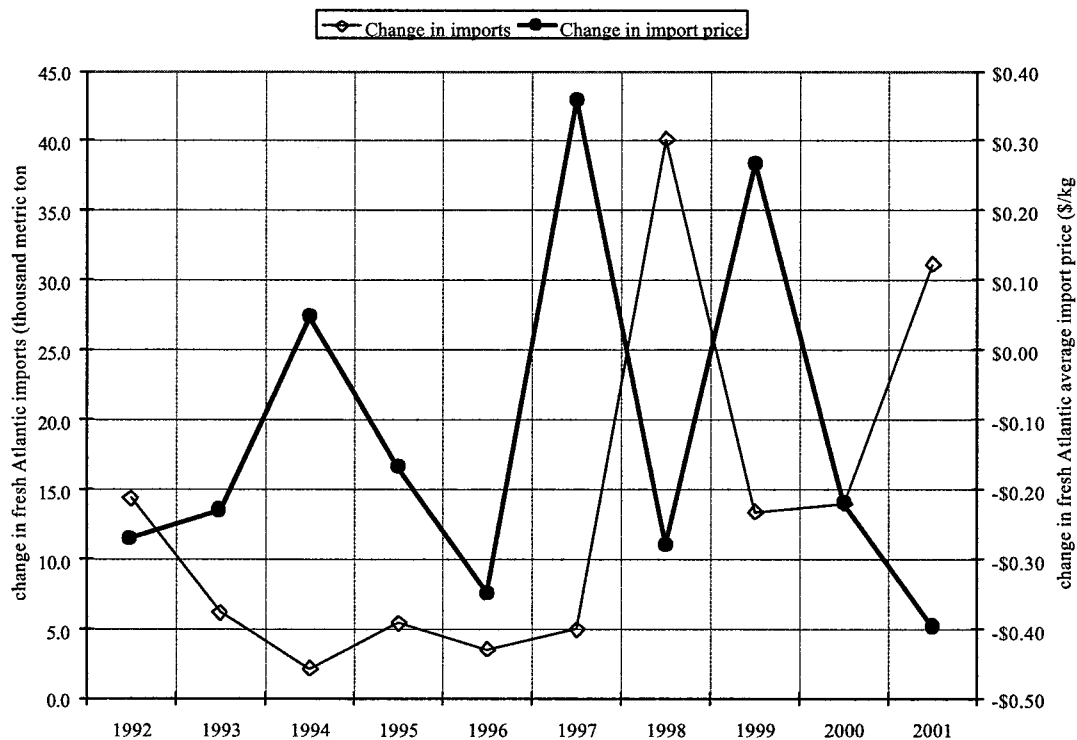


Figure 3.1.9. United States Salmon Imports and Average Import Price of Fresh Atlantic Salmon



**Figure 3.1.10. Change in United States Imports and Average Import Price of Fresh Atlantic Salmon**

Figures 3.1.11 through 3.1.14 show more detailed weekly U.S. salmon wholesale prices for the years 1995-2001, which illustrate how salmon prices vary by size, region, product and species. In each of these figures, the line in bold shows the price of fresh Atlantic salmon, 8-10 pounds, FOB Northeast, domestic and Canadian production. Prices of fresh Atlantic salmon dropped sharply in 2001 (but recovered somewhat in 2002). A clear seasonal pattern is apparent, with prices higher in the spring and summer and lower in the fall and winter.

As shown in Figure 3.1.11, prices tend to be higher for larger fish—but this is not always the case. Prices for different sizes track closely over time, indicating that different size classes are close substitutes.

As shown in Figure 3.1.12, prices tend to be higher in the Northeast than on the West Coast. This results from differences in supply sources, transportation costs, and seasonal competition from wild Alaska salmon.

As shown in Figure 3.1.13, prices are significantly higher for fresh Atlantic salmon fillets (boneless, 3-4 pounds, imported from Chile) than for dressed fresh Atlantic salmon. However, as imports of salmon fillets have increased, the price premium commanded by fillets has declined.

As shown in Figure 3.1.14, prices are substantially higher for fresh farmed Atlantic salmon than for fresh wild chum salmon. Fresh chum salmon are available only seasonally. Prices typically drop sharply within a few weeks of the start of the season, as supply increases.

Figure 3.1.11: Wholesale Prices of Fresh Atlantic Salmon, by Size Class

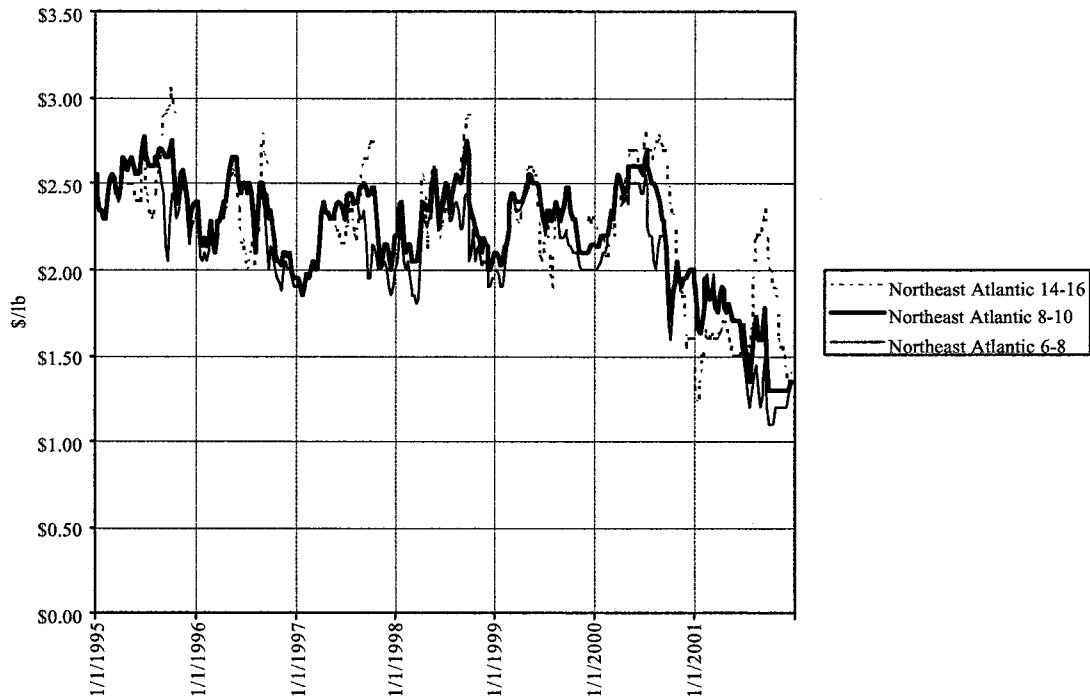


Figure 3.1.12: Wholesale Prices of Fresh Atlantic Salmon, by Region

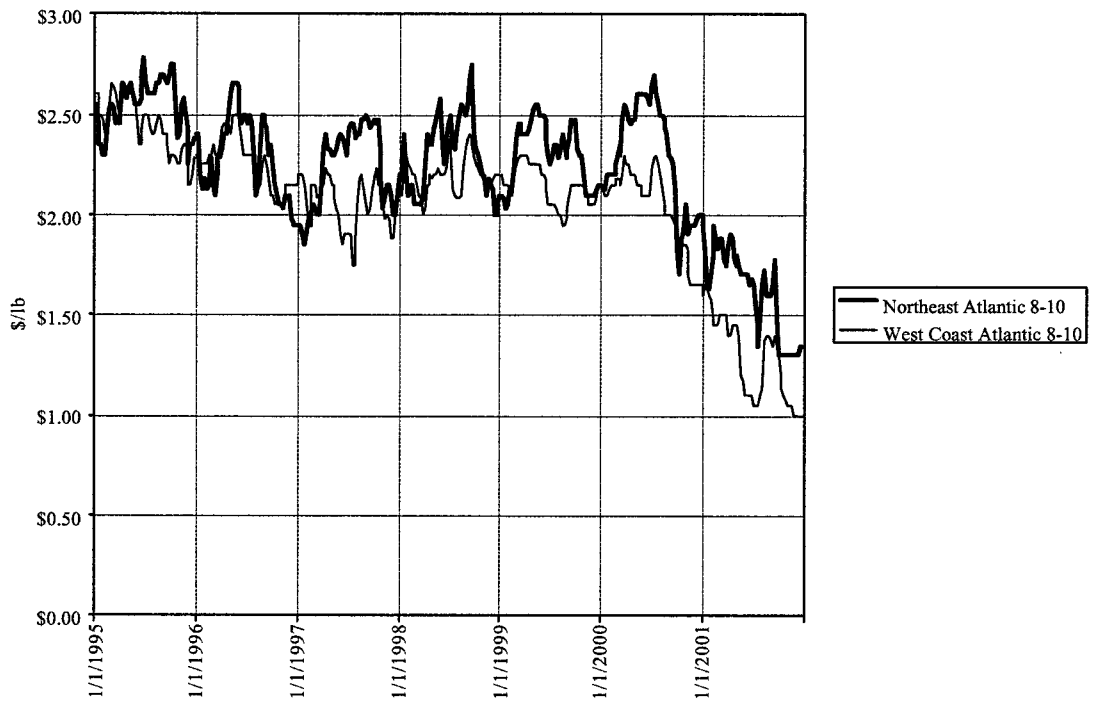


Figure 3.1.13: Wholesale Prices of Fresh Atlantic Salmon, by Product

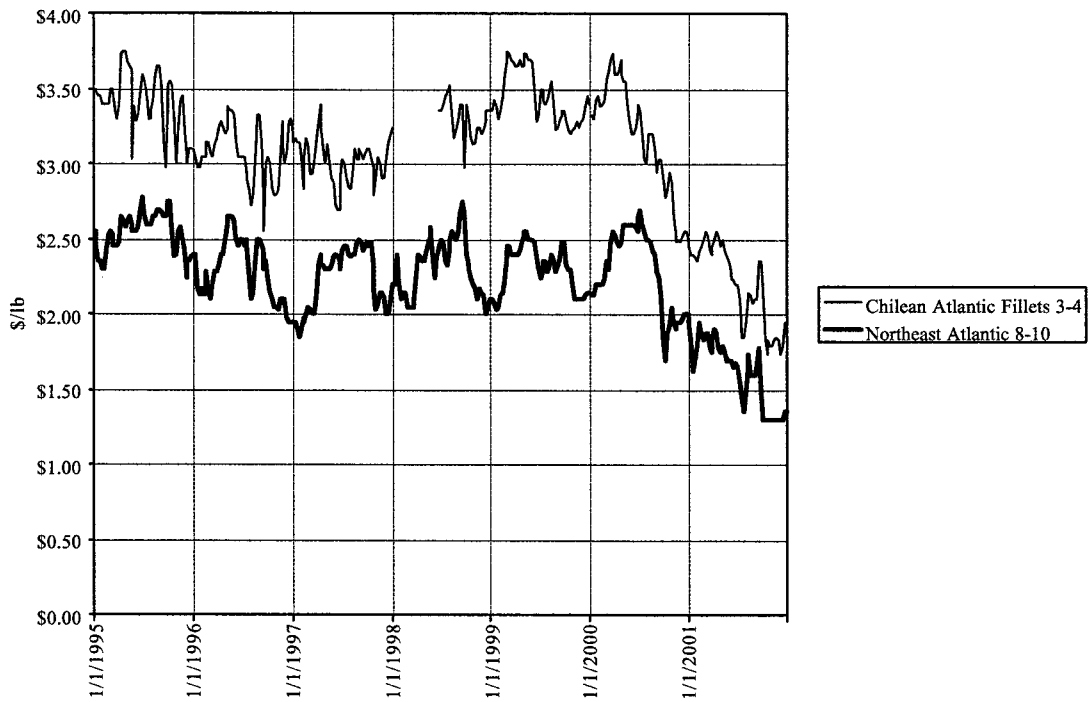
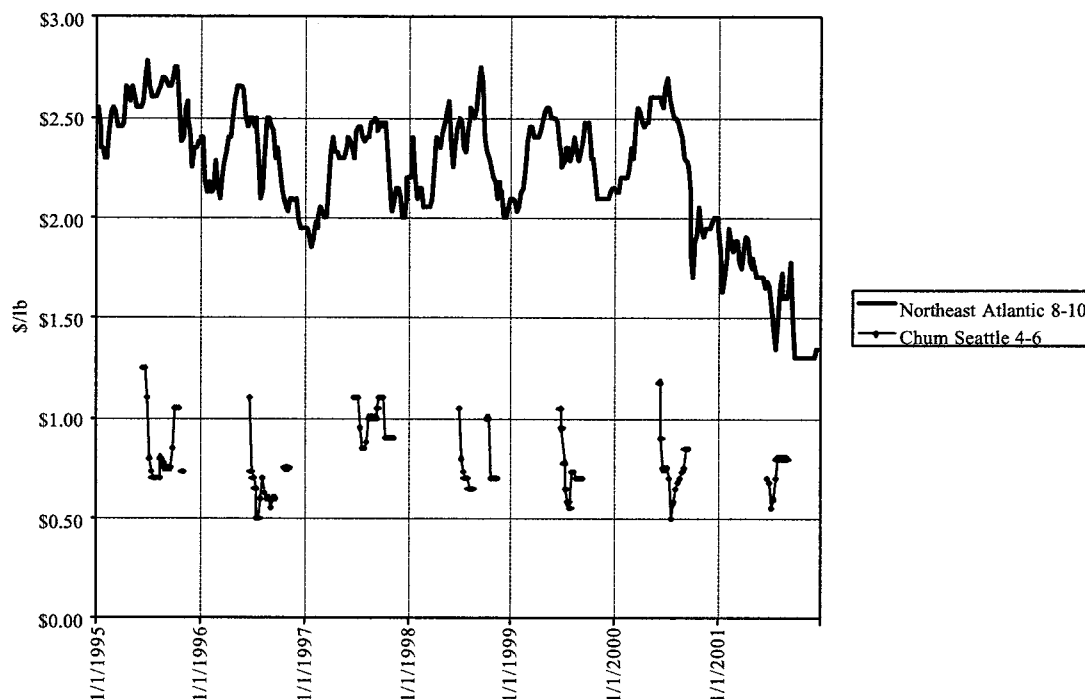


Figure 3.1.14: Wholesale Prices of Fresh Atlantic Salmon and Fresh Chum Salmon



### Market Trends

Although the United States salmon market is clearly large and growing rapidly, relatively little detailed information is publicly available on where salmon is sold, the product forms in which it is sold, and who is buying it. The following discussion is based on the limited information available from different sources.

Salmon is sold both in retail stores and in food service establishments (restaurants, employee cafeterias, institutional dining halls, etc.). Although no data are available on the relative shares of salmon sold by retail and food service, data for all U.S. seafood products combined suggest that roughly similar shares of seafood (by volume) are sold by retail and food service. As shown in Table 3.1.10, the estimated total value of wholesale purchases was about the same for retail and food service over the period 1993-2001. (The total value of sales to consumers was substantially higher for food service than for retail, reflecting the fact that food service sales include preparation and service). Absent more detailed information, it seems reasonable to assume that both retail and food service account for large shares of U.S. salmon sales—although it is not clear which accounts for a larger share.



**Table 3.1.10: Estimated U.S. Seafood Wholesale Purchases and Retail Sales (millions of dollars)**

		1993	1994	1995	1996	1997	1998	1999	2000	2001
Retail	Wholesale purchases	\$8,859	\$9,248	\$8,891	\$9,717	\$11,129	\$12,444	\$12,309	\$12,074	\$12,616
	Margin	\$3,130	\$3,268	\$3,143	\$3,433	\$3,720	\$4,158	\$4,114	\$4,035	\$4,216
	Sales to consumers	\$11,989	\$12,516	\$12,034	\$13,150	\$14,849	\$16,602	\$16,423	\$16,109	\$16,832
Food Service	Wholesale purchases	\$9,087	\$9,349	\$9,269	\$9,817	\$11,083	\$11,476	\$12,605	\$13,454	\$13,529
	Margin	\$16,603	\$17,083	\$16,936	\$17,938	\$20,616	\$20,933	\$22,993	\$24,542	\$24,677
	Sales to consumers	\$25,690	\$26,432	\$26,205	\$27,755	\$31,699	\$32,409	\$35,598	\$37,996	\$38,206
Total	Wholesale purchases	\$17,946	\$18,597	\$18,160	\$19,534	\$22,212	\$23,920	\$24,914	\$25,528	\$26,145
	Margin	\$19,733	\$20,351	\$20,079	\$21,371	\$24,336	\$25,091	\$27,107	\$28,577	\$28,893
	Sales to consumers	\$37,679	\$38,948	\$38,239	\$40,905	\$46,548	\$49,011	\$52,021	\$54,105	\$55,038
Retail share	Wholesale purchases	49%	50%	49%	50%	50%	52%	49%	47%	48%
	Margin	16%	16%	16%	16%	15%	17%	15%	14%	15%
	Sales to consumers	32%	32%	31%	32%	32%	34%	32%	30%	31%

Source: National Marine Fisheries Service: *Fisheries of the United States*

Salmon is the leading food service seafood menu item and is estimated to be on 39% of all food service operation menus, including 71% of “Fine Dining” restaurant menus, 71% of “Hotel/Motel” restaurant menus, and 49% of “Casual/Theme” restaurant menus.<sup>5</sup> Salmon was the “most commonly menued centre-of-the-plate fin fish” at 21% of restaurants in a 2001 survey, more than double the shares of the next leading fish species (catfish and cod).<sup>6</sup>

### **3.2 The Japanese Salmon Market**

Japan is the single largest fish market in the world. According to FAO food balance estimates, Japan consumed 8.2 mill. tonnes of seafood (round weight equivalent) in 2000, compared with 6.1 mill. tonnes for the United States and 14.8 mill. tonnes for all of Europe combined. Japanese per capita seafood consumption in 2000 was estimated

<sup>5</sup> Restaurants and Institutions 2001 Menu Census, as cited in H.M. Johnson and Associates, *2002 Annual Report on the United States Seafood Industry*.

<sup>6</sup> Datassential Research, Inc. research for Restaurant Hospitality Magazine, as cited in H.M. Johnson and Associates, *2002 Annual Report on the United States Seafood Industry*.

at 64.8 kilograms, compared with 21.4 kilograms for the United States and 20.4 kilograms for Europe. Japan is also the largest salmon market in the world. Total Japanese salmon supply (dressed weight equivalent) has exceeded 400,000 tonnes in every year since 1993.

### Overview of Japanese Salmon Consumption and Products

A very wide variety of salmon species and products are consumed in Japan.<sup>7</sup> Salmon consumption varies by geographical area and time of year. Since salmon has traditionally been caught in the northern parts of Japan, salmon consumption is significantly higher in northern Japan than in southern Japan. Salmon expenditures as a share of total expenditures on seafood and meat are highest in Sapporo, the capital of the northern region Hokkaido, where about 85% of Japan's total salmon catch is landed.<sup>8</sup> In contrast, consumption of sockeye salmon, most of which is imported, is higher in southern Japan.

Historically, Japanese salmon consumption has been highly seasonal. Japanese fish consumption has always fluctuated with the local availability of different species, as well as their changes in quality throughout the year. For example, fall chum salmon consumption is concentrated during the harvest period between September to December. However, seasonal consumption patterns have weakened somewhat over time as freezing technology allowed salmon to be consumed at times other than during the run, imports have expanded the times at which wild species are available, and farmed salmon and trout from both the northern and southern hemispheres has become available year round.

Another important factor contributing to fluctuations in salmon consumption throughout the year is the celebration of different holidays and major social events. Sending gifts is often an important part of different celebrations, and salmon products are highly rated gifts. Smoked salmon is a popular item for the midyear present giving (first half of July). Smoked salmon is also often bought as year-end presents, which are sent out in mid December to express gratitude for kindness throughout the year. One of the most popular gifts for this occasion is wild-caught Japanese salted spring chum. Other salmon products well suited as year-end presents include salted sockeye and head-on, gill-out, gutted salmon. Except for smoked salmon, farmed salmon do not generally make popular gift items.

The preparation of salmon varies by species. Grilling is the most common preparation of salmon in Japan. Fillets of smaller fish are grilled whole, and fillets of larger fish are cut into rather small slices, called *kirimi*, which may be natural, salted or marinated.

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<sup>7</sup> For an excellent and thorough appraisal of the Japanese seafood market see Nakamoto (2000).

<sup>8</sup> Nakamoto (2000, Table 10, p. 45).

Grilled salmon is served in a number of different ways. Together with a bowl of steamed rice it may be an important part of lunch, dinner, or traditional Japanese breakfast. It is a common element in a range of prepared meals, sold either “ready-to-eat”, “ready-to-heat”, or “ready-to-cook.” It is also a common filling for rice balls, a popular lunch item with a role in the Japanese diet analogous to the Western sandwich.

Unsalted salmon may also be broiled with a sauce, for instance *teriyaki* sauce, or pan-fried with butter for a “Western” preparation. Smoked salmon remains a high-end product, typically consumed in hotels and at banquets.

Traditionally, salmon was not consumed raw in Japan, because of the presence of parasites in wild salmon. However, since the introduction of farmed salmon on the Japanese market, consumption of raw salmon has increased. Salmon *sashimi* (sliced raw fish) is widely available in supermarkets, restaurants and sushi bars.

*Aramaki* style salmon is head-on, gutted fish heavily layered in granular salt. *Aramaki* style salmon was formerly a major salmon product form, particularly for fall chum salmon, but has declined in importance as incomes have increased and food preparation time has decreased.

Usage and preparation of salmon differs by species depending on the texture of the meat, the oil content and the colour. While wild salmon was traditionally preferred, farmed salmon has gained increasing acceptance in the Japanese market as wild salmon supply has declined and farmed supply has expanded dramatically. Farmed salmon has the advantage of control over the production process so that fish can be uniformly grown to meet specifications in terms of size, flesh colour and oil content, which is an extremely important factor in a strongly competitive market with very high quality standards.

Wild sockeye has been preferred for its intense red colour and is still highly appreciated in the Kansai region of southern Japan. Sockeye is most commonly sold as salted *kirimi*. However, due to poor sockeye catches in recent years, many Japanese have become used to farmed coho or salmon trout, which both offer the same reddish flesh colour, as substitutes for wild-caught sockeye.

Farmed coho has benefitted from the long presence of wild coho on the Japanese market. Similar to wild sockeye, coho is also most commonly sold as salted *kirimi*.

Salmon trout is the most versatile species in the salmon market. Appreciated for its red flesh and high oil content, salmon trout is sold salted as *kirimi*, raw as *sashimi* or *sushi*, defrosted for pan-frying, marinated, or processed as smoked trout. For its many uses, salmon trout has gained a strong position on the Japanese market.

Air-freighted chilled Atlantic salmon is used raw in high-end markets such as *sashimi* and *sushi* at sushi bars and restaurants. Frozen Atlantic salmon is prepared pan-fried. Atlantic salmon is not suitable for *kirimi* as the meat texture tends to become dry. Marketers have attempted to promote the sale of salmon cutlets for steak or barbecue use, but as the Japanese are unaccustomed to this product form, sales have been rather slow.

Over the past decade there has been a dramatic shift in Japanese salmon consumption from salted salmon to fresh, chilled and defrosted salmon (Figure 3.2.1). This shift was caused partly by increasing consumer awareness of the health benefits of reduced salt consumption, and partly by a shift in the relative shares in total salmon supply of fall chum salmon (traditionally salted) and imported farmed salmon.

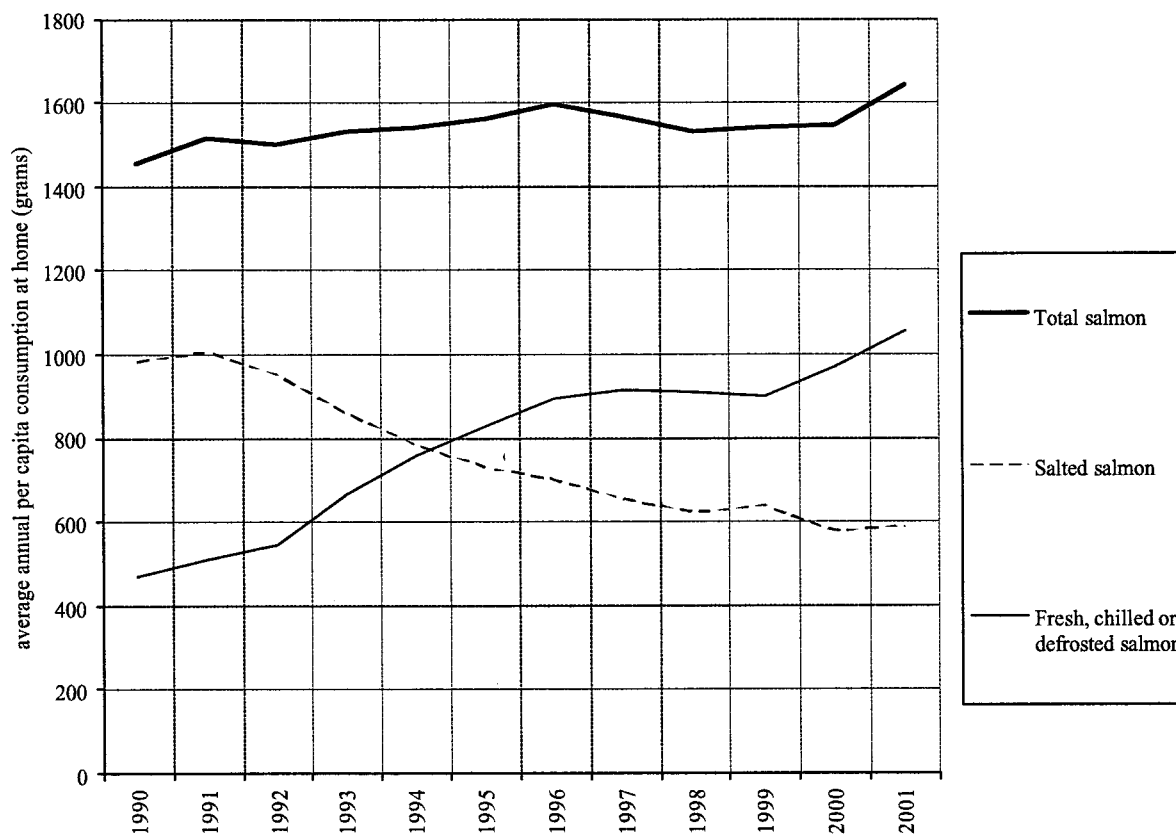


Figure 3.2.1. Japanese Average Annual Per Capita Home Consumption of Salmon (grams)

### Japanese Salmon Supply

Table 3.2.1 summarizes Japanese salmon supply for the years 1991-2001. Over this time period, Japan consumed large volumes of salmon from many different sources.

Total Japanese salmon supply and the composition of supply also changed significantly during this period. To understand trends in Japanese salmon supply, it is useful to review supply trends from three different perspectives: trends in supply by species, trends in the relative supply of domestic and imported salmon, and trends in the relative supply of wild and farmed salmon.

**Table 3.2.1. Japanese Salmon Supply, 1991-2001 (tonnes, semi-dressed basis)**

Species	Origin	Category	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
<b>Sockeye</b>	<b>Total</b>	<b>Total</b>	<b>88,400</b>	<b>106,900</b>	<b>142,200</b>	<b>120,950</b>	<b>105,230</b>	<b>108,810</b>	<b>74,750</b>	<b>47,000</b>	<b>61,600</b>	<b>59,300</b>	<b>54,800</b>
	Imported	Wild	80,000	100,000	133,900	118,000	100,700	103,600	65,900	42,000	54,800	55,400	50,800
	Domestic	High Seas	8,400	6,900	8,300	2,950	4,530	5,210	8,850	5,000	6,800	3,900	4,000
<b>Chum</b>	<b>Total</b>	<b>Total</b>	<b>160,000</b>	<b>126,000</b>	<b>157,600</b>	<b>167,250</b>	<b>200,500</b>	<b>222,420</b>	<b>198,800</b>	<b>155,000</b>	<b>146,000</b>	<b>125,200</b>	<b>168,100</b>
	Imported	Wild	4,000	7,000	4,000	7,250	2,600	4,000	2,000	2,000	9,500	5,500	1,900
	Domestic	High Seas	12,000	15,000	8,000	11,000	14,700	12,420	13,800	14,000	12,500	11,700	8,100
	Domestic	Fall Chum	144,000	104,000	145,600	149,000	183,200	206,000	183,000	139,000	124,000	108,000	158,100
<b>Pink</b>	<b>Total</b>	<b>Total</b>	<b>48,500</b>	<b>38,000</b>	<b>46,300</b>	<b>50,900</b>	<b>31,850</b>	<b>30,030</b>	<b>24,430</b>	<b>51,000</b>	<b>33,000</b>	<b>34,900</b>	<b>16,700</b>
	Imported	Wild	16,500	10,000	22,400	22,000	4,500	3,000	8,000	30,000	13,500	6,800	6,700
	Domestic	High Seas	18,000	10,000	5,400	5,000	9,350	5,140	6,430	5,000	5,500	7,100	3,400
	Domestic	Japan Sea	6,000	6,000	3,500	2,200	3,000	1,190	1,500	3,000	3,000	1,000	1,000
	Domestic	Other	8,000	12,000	15,000	21,700	15,000	20,700	8,500	13,000	11,000	20,000	5,600
<b>Coho</b>	<b>Total</b>	<b>Total</b>	<b>49,900</b>	<b>44,400</b>	<b>42,000</b>	<b>55,120</b>	<b>56,370</b>	<b>56,730</b>	<b>60,690</b>	<b>65,000</b>	<b>66,600</b>	<b>81,000</b>	<b>104,900</b>
	Imported	Farmed	13,000	17,500	16,400	23,100	30,000	38,010	46,800	50,000	47,400	64,100	85,600
	Imported	Wild	15,000	9,000	8,600	16,000	12,000	9,630	3,500	6,000	6,400	3,400	6,800
	Domestic	Farmed	21,600	17,600	16,800	16,000	14,200	8,580	10,000	8,800	12,000	13,000	12,100
	Domestic	High Seas	300	300	200	20	170	510	390	200	800	500	400
<b>Chinook</b>	<b>Total</b>	<b>Total</b>	<b>5,000</b>	<b>6,600</b>	<b>8,700</b>	<b>9,400</b>	<b>8,650</b>	<b>7,500</b>	<b>6,300</b>	<b>3,800</b>	<b>4,600</b>	<b>3,900</b>	<b>5,600</b>
	Imported	Farmed	600	2,200	3,900	3,900	4,250	5,300	3,000	2,800	2,600	2,400	4,900
	Imported	Wild	4,000	4,000	4,500	5,500	4,400	2,200	3,300	1,000	2,000	1,500	700
	Domestic	High Seas	400	400	300	0	0	0	0	0	0	0	0
<b>Trout</b>	Imported	Farmed	8,900	10,000	20,200	28,600	29,000	44,100	57,300	60,000	73,500	71,500	97,200
<b>Atlantic</b>	Imported	Farmed	11,000	15,300	15,600	20,600	25,000	28,600	28,000	26,000	39,800	34,200	38,400
<b>Total</b>	<b>Total</b>	<b>Total</b>	<b>371,700</b>	<b>347,200</b>	<b>432,600</b>	<b>452,820</b>	<b>456,600</b>	<b>498,190</b>	<b>450,270</b>	<b>407,800</b>	<b>425,100</b>	<b>410,000</b>	<b>485,700</b>
		Wild	316,600	284,600	359,700	360,620	354,150	373,600	305,170	260,200	249,800	224,800	247,500
		Farmed	55,100	62,600	72,900	92,200	102,450	124,590	145,100	147,600	175,300	185,200	238,200
		Domestic	218,700	172,200	203,100	207,870	244,150	259,750	232,470	188,000	175,600	165,200	192,700
	Imported	153,000	175,000	229,500	244,950	212,450	238,440	217,800	219,800	249,500	244,800	293,000	

As shown in Figure 3.2.2, total Japanese salmon supply increased dramatically from 371,000 tonnes in 1991 to almost 500,000 tonnes in 1996, and then declined to about 410,000 tonnes in 2000 before rising again dramatically in 2001. Three major factors drove these changes in supply. First, there were significant fluctuations in Japanese harvests of fall chum salmon released by hatcheries in northern Japan, which accounted for between 26% and 41% of total supply during this period. Fall chum salmon harvests peaked in 1996 at 206,000 tonnes and then fell by almost half to 108,000 tonnes in 2000, before rising again to 158,000 tonnes in 2001. Thus, changes in the fall chum harvest—resulting primarily from the effects of changing ocean conditions on hatchery returns—have a significant effect on total Japanese salmon supply and consumption.

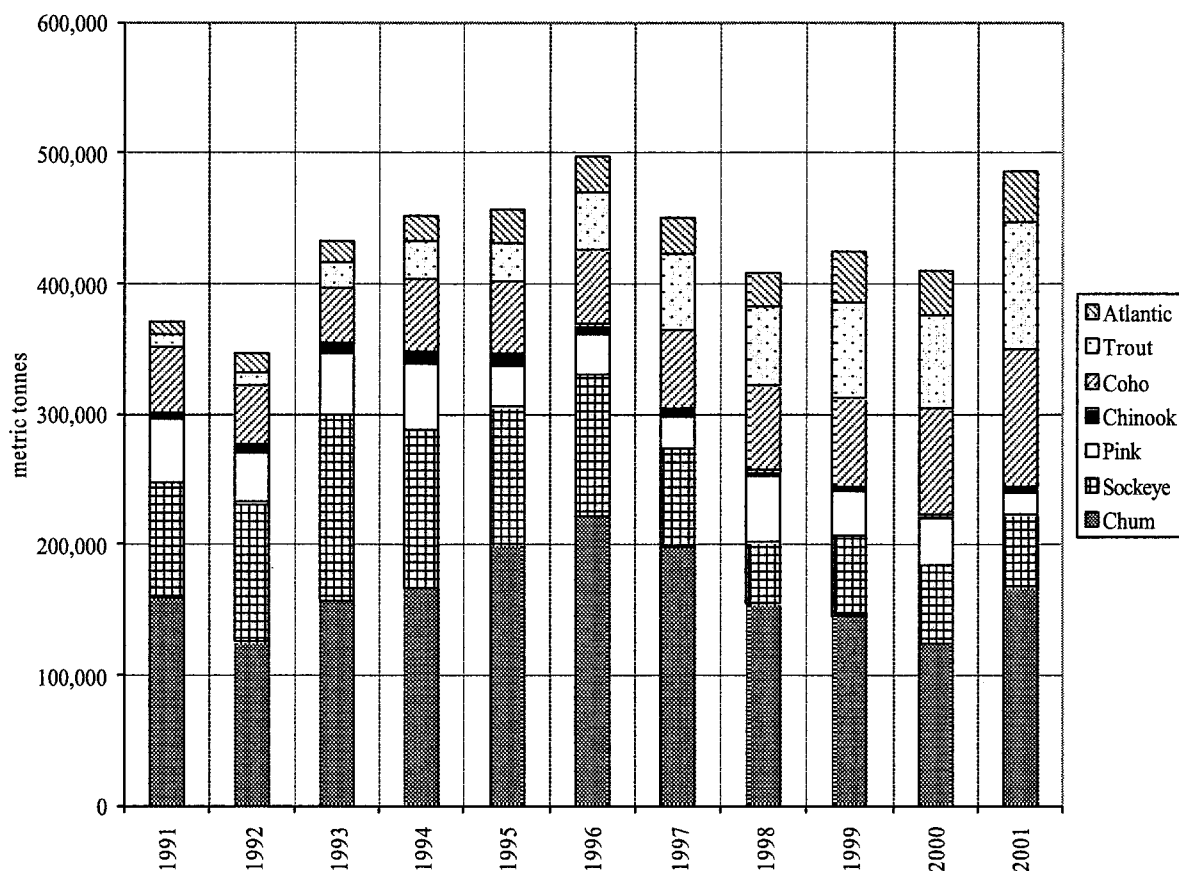


Figure 3.2.2: Japanese Salmon Supply, by Species (tonnes)

Second, Japanese supply of wild sockeye salmon—most of which is imported from the United States and Russia—peaked at 142,000 tonnes in 1993 and then declined dramatically to 55,000 tonnes in 2001. Most of the decline in Japanese supply was due to a decline in harvests of sockeye salmon in Alaska and Canada. Another factor was a shift in North American sockeye salmon production from freezing to canning (partly reversing the shift from canning to freezing which occurred in the late 1970s and early 1980s) as the profitability of freezing relative to canning declined.

Third, Japanese imports of farmed salmon increased dramatically over this period. Japanese imports of farmed coho salmon (almost entirely from Chile) increased from 13,000 tonnes in 1991 to 86,000 tonnes in 2001. Over the same time period, imports of farmed trout (primarily from Chile and Norway) increased even more dramatically, from 9,000 tonnes in 1991 to 97,000 tonnes in 2001. Imports of farmed Atlantic salmon increased from 11,000 tonnes in 1991 to 38,000 tonnes in 2001.

As shown in Figure 3.2.3, the combined effect of the decline in the supply of wild fall chum and sockeye salmon and the increase in the supply of farmed coho, trout and Atlantic salmon was a dramatic shift in the relative contributions of wild and farmed salmon to Japanese supply. Between 1991 and 2001, farmed salmon and trout increased from 15% to 49% of total Japanese supply.

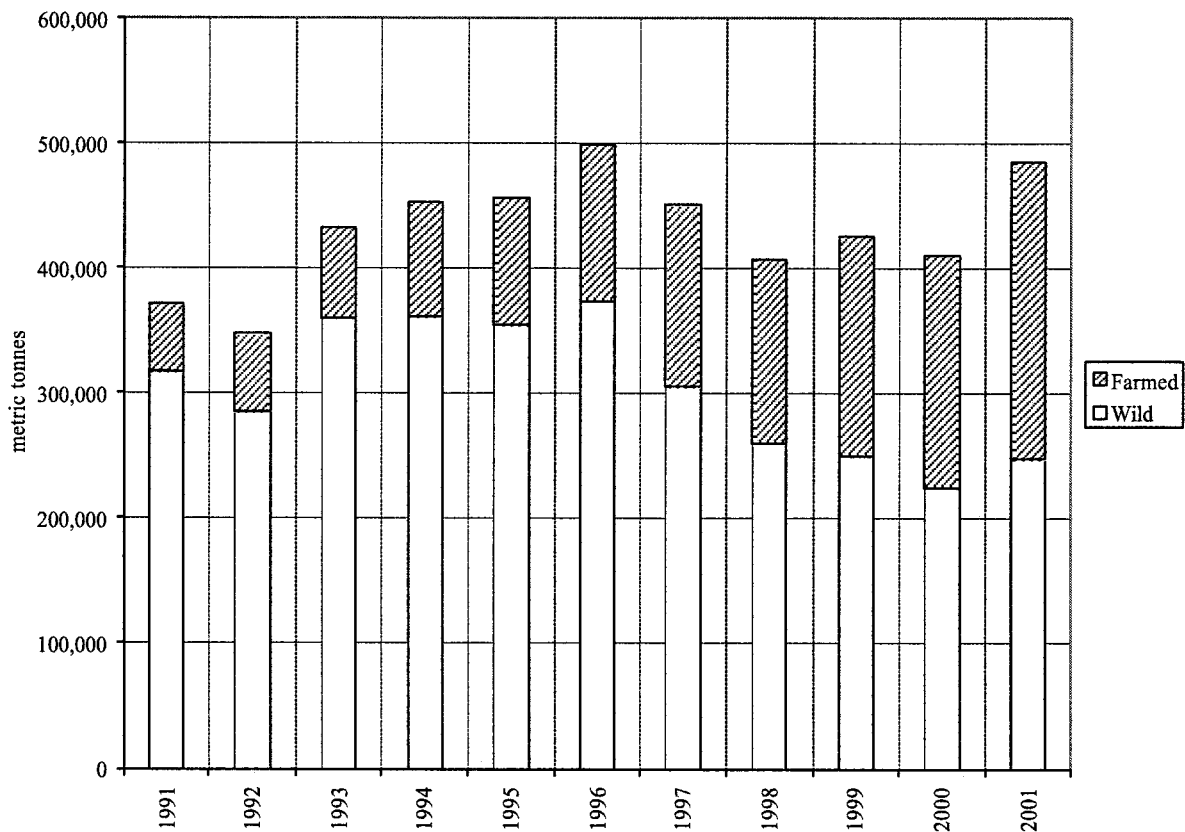
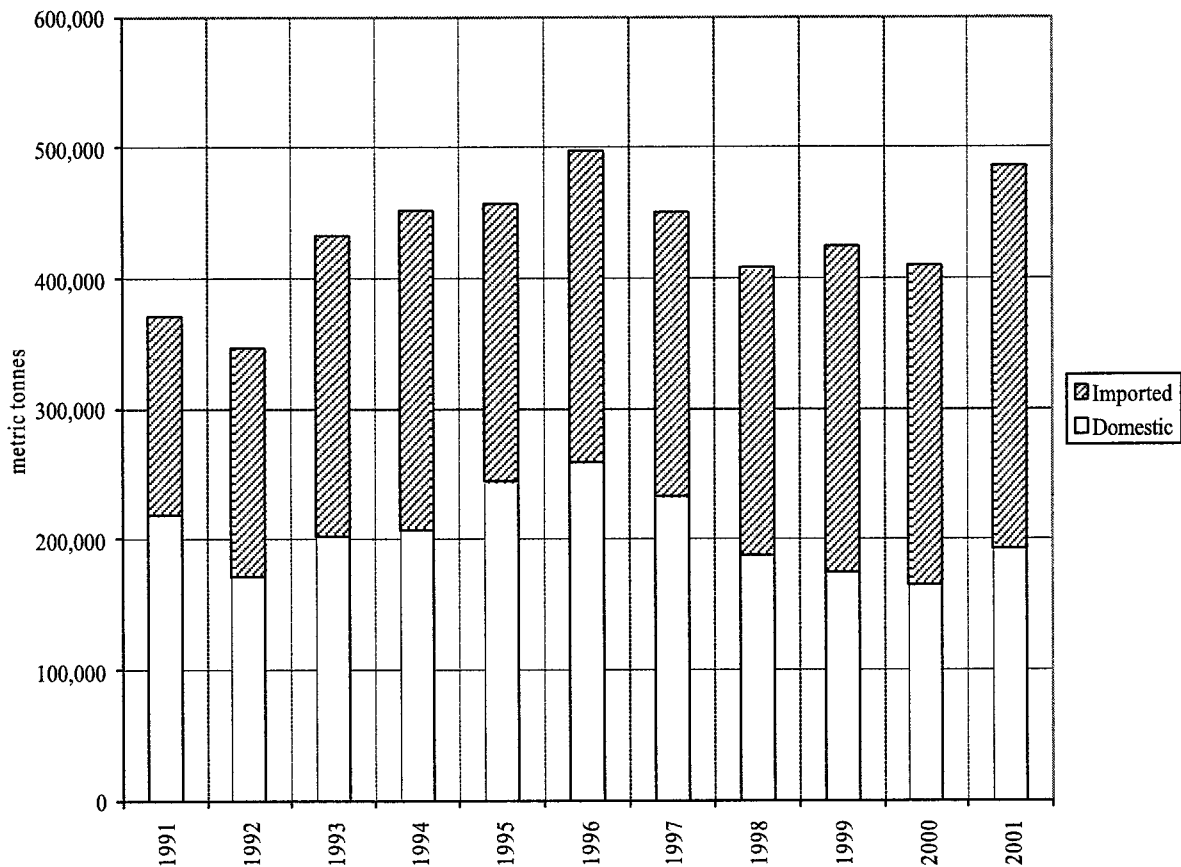


Figure 3.2.3: Japanese Salmon Supply: Wild and Farmed

As shown in Figure 3.2.4, a similar though less pronounced shift took place over the same time period in the relative contributions of domestic production and imports to Japanese salmon supply. Imports increased from 41% of total supply in 1991 to 60% of total supply in 2001, as the growth in farmed salmon imports exceeded the decline in wild sockeye salmon imports.



**Figure 3.2.4: Japanese Salmon Supply: Domestic and Imported.**

### Japanese Salmon Imports

Table 3.2.2 provides more detailed data for Japanese salmon and trout imports for the years 1993-2001 (import data by species are not available for years before 1993). During this period, total Japanese salmon imports (including fillets) ranged from 219,000 tonnes in 1995 to 299,000 tonnes in 2001. Total imports have not followed a consistent trend but have rather gone up and down, reflecting the combined effects of different trends in imports of different species from different countries.



Table 3.2.2. Japanese Salmon and Trout Imports, 1993-2001 (tonnes)

Product	Species	Type	Country	1993	1994	1995	1996	1997	1998	1999	2000	2001
Fresh	Total	Total	Total	13,688	18,431	21,250	22,229	22,236	21,537	25,774	29,419	32,067
	Atlantic	Farmed	Total	10,763	16,065	18,605	19,233	20,921	19,991	24,020	27,596	29,621
			Norway	8,196	12,354	11,437	13,093	15,434	15,972	21,514	24,786	26,647
			Other	2,567	3,711	7,167	6,140	5,488	4,019	2,506	2,809	2,975
	Other	Wild	Total	2,925	2,366	2,645	2,996	1,314	1,546	1,754	1,823	2,446
Frozen	Total	Total	Total	214,851	224,778	181,727	211,193	186,557	202,074	212,671	202,797	244,414
	Atlantic	Farmed	Total	4,714	4,591	7,385	8,929	7,039	5,912	15,777	6,633	7,836
			Norway	3,244	3,163	5,297	7,204	5,078	4,531	14,362	4,673	2,842
			Chile	1,417	1,187	1,373	1,314	1,843	1,349	1,103	1,911	4,669
			Other	53	241	714	411	118	32	312	50	325
	Trout	Farmed	Total	15,787	28,557	30,476	36,472	50,332	59,691	63,444	59,829	82,990
			Chile	8,580	17,350	19,485	22,592	31,303	40,508	25,264	33,096	47,744
			Norway	4,358	7,543	7,569	11,426	16,244	17,685	30,268	23,593	32,101
			Other	2,849	3,664	3,423	2,454	2,785	1,497	7,912	3,140	3,145
	Coho	Total	Total	24,984	39,223	41,265	47,642	47,082	56,215	53,765	66,910	88,577
		Farmed	Chile	16,439	23,112	29,832	38,010	43,588	49,553	47,397	63,488	84,804
		Other	8,545	16,111	11,433	9,632	3,494	6,662	3,398	3,422	3,773	
	Sockeye	Wild	Total	132,639	115,879	90,588	101,274	63,970	47,235	53,621	54,078	49,633
			USA	110,359	92,702	77,080	79,251	43,595	33,142	40,954	35,397	29,166
			Canada	14,870	15,467	3,441	4,030	9,958	2,491	481	2,079	2,938
			Russia	7,407	7,501	9,947	17,901	10,368	11,412	12,186	16,354	17,489
			Other	3	210	120	92	49	190	1	249	40
	Oth. Pac.	Total	Total	36,480	36,416	11,874	12,735	15,704	32,540	24,995	14,124	13,736
		Farmed	Chile	4,823	698	452	362	425	258	90	635	1,376
			NZ	1,335	1,205	1,745	3,218	1,901	1,629	1,648	1,281	1,836
			USA	11,465	10,248	4,750	3,849	2,820	1,942	8,519	2,805	867
		Wild	Russia	13,723	21,175	3,715	3,562	9,554	27,639	11,014	8,394	7,903
			Canada	4,729	2,651	1,119	1,717	968	945	3,552	973	1,691
Other			404	438	94	27	35	127	172	36	64	
Other	Total	Total	249	111	138	4,142	2,429	482	1,068	1,222	1,642	
Total fresh & frozen				228,539	243,209	202,977	233,422	208,792	223,611	238,446	232,215	276,481
Fillets	Trout	Farmed	Chile	11,702	13,368	15,769	7,512	12,272	11,390	12,422	12,920	22,106
Total including fillets				240,241	256,577	218,746	240,934	221,064	235,001	250,868	245,135	298,587

Notes: For fresh salmon, "Other" species are mostly wild but include small volumes of farmed trout. "Other Pacific" salmon includes chinook, chum and pink salmon. "Other Pacific" salmon from Canada is mostly wild but may include small volumes of farmed chinook salmon. Imports of "salmon-related products" are reported separately from other salmon import data. Trout fillets from Chile, reported in the next-to-last row of the table, are the only significant component of salmon-related products. The table does not include small import volumes (less than 2,000 tonnes annually) of canned and preserved salmon products.

As shown in Figure 3.2.5, Japanese salmon imports may be divided into four broad categories: frozen "red-fleshed" salmon (sockeye, coho and trout), other Pacific salmon (chinook, pink and chum), frozen Atlantic salmon, and fresh salmon (primarily Atlantic salmon). Of these categories, frozen "red-fleshed salmon" is by far the most significant, accounting for between 72% and 83% of total Japanese salmon imports in recent years, as well as most of the year-to-year change in imports. However, imports of fresh salmon grew steadily from 14,000 tonnes in 1993 to 32,000 tonnes in 2001, and the share of fresh salmon in Japanese imports increased from 5.7% in 1993 to 10.7% in 2001. Imports of frozen "other Pacific" salmon have trended downwards (primarily because of declining imports of wild salmon from the United States and Canada) but exhibited significant year-to-year fluctuations from year to year (primarily because of fluctuations in imports of frozen pink and chum salmon from Russia).

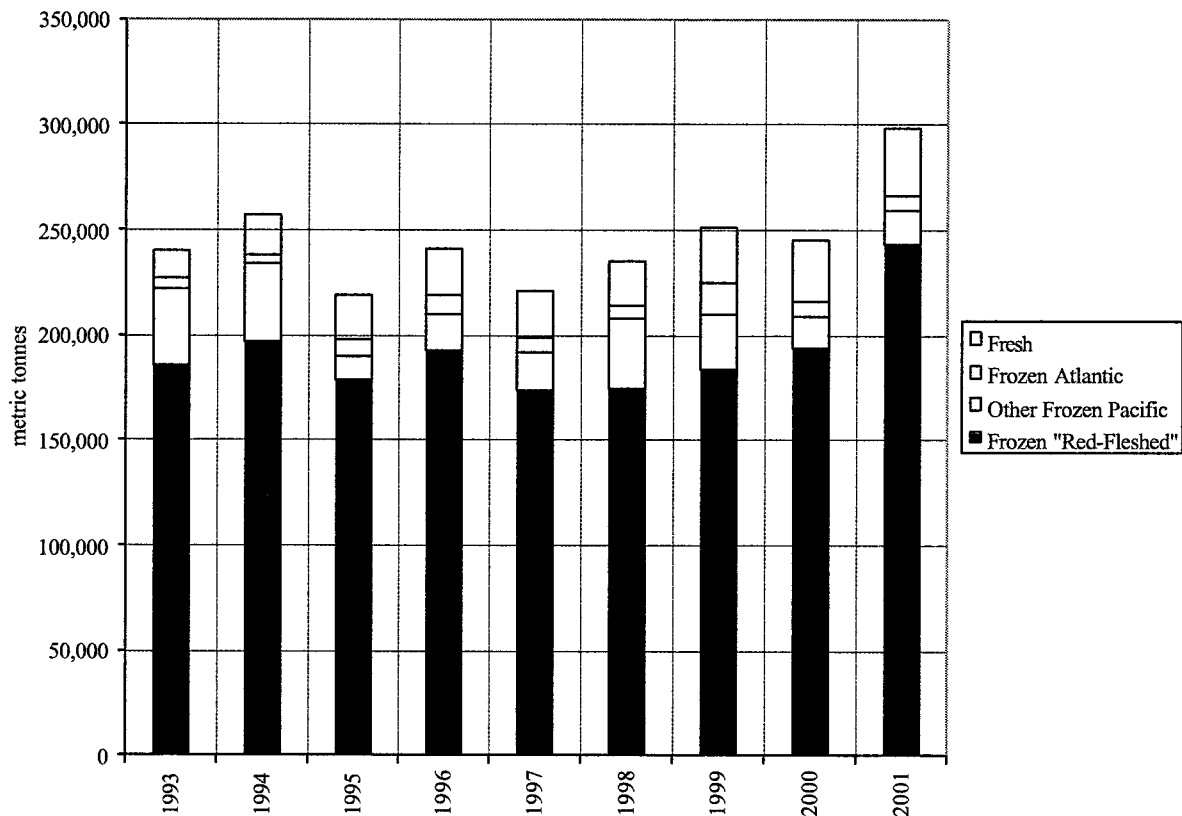


Figure 3.2.5. Japanese Salmon and Trout Imports, 1993-2001 (tonnes).

As shown in Figure 3.2.6, the composition of Japanese imports of frozen “red-fleshed” salmon shifted dramatically between 1993 and 2001. Over this period, frozen sockeye imports fell from 133,000 tonnes to 50,000 tonnes, the combined result of a decline in United States and Canadian sockeye harvests as well as a decline in the share of the harvest which was frozen. Imports of frozen Russian sockeye increased from 7,000 tonnes to 17,000 tonnes, and from 6% to 35% of total Japanese frozen sockeye salmon imports.

While imports of frozen wild sockeye were declining, Japanese imports of frozen farmed coho and trout increased dramatically, from 52,000 tonnes in 1993 to 194,000 tonnes in 2001, or from 28% to 80% of total imports of frozen “red-fleshed salmon.” By the end of the period, imports of frozen coho consisted almost entirely of farmed coho from Chile. Chile also accounted for about two-thirds of frozen trout imports (including trout fillets), while Norway accounted for most of the rest.

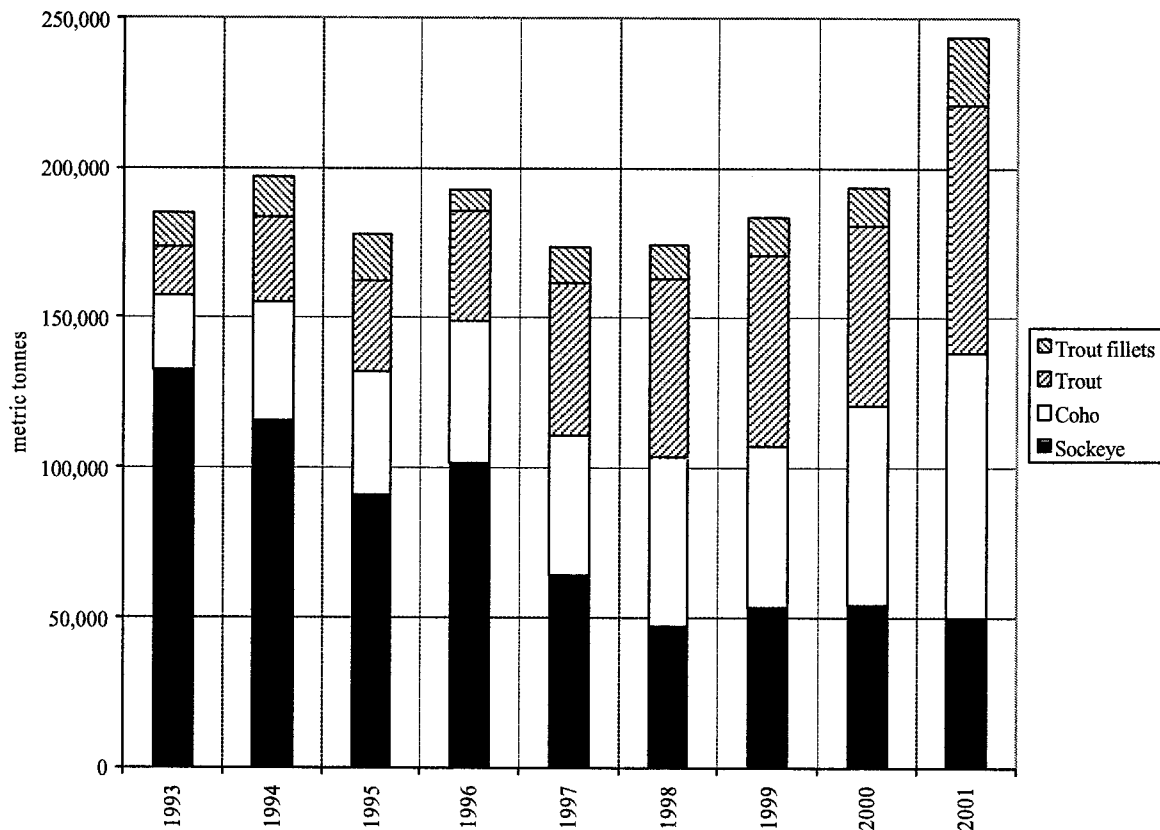


Figure 3.2.6. Japanese Imports of “Red-Fleshed” Salmon, 1993-2001

As shown in Figure 3.2.7, the sharp decline in imports of wild salmon from the United States combined with rapid growth imports of farmed salmon from Norway and Chile have led to a dramatic shift in the relative shares of these countries in Japanese imports. Between 1993 and 2001, the United States’ share of Japanese imports fell from 51% to 10%, while the Chilean share increased from 18% to 54% and the Norwegian share increased from 7% to 21%.

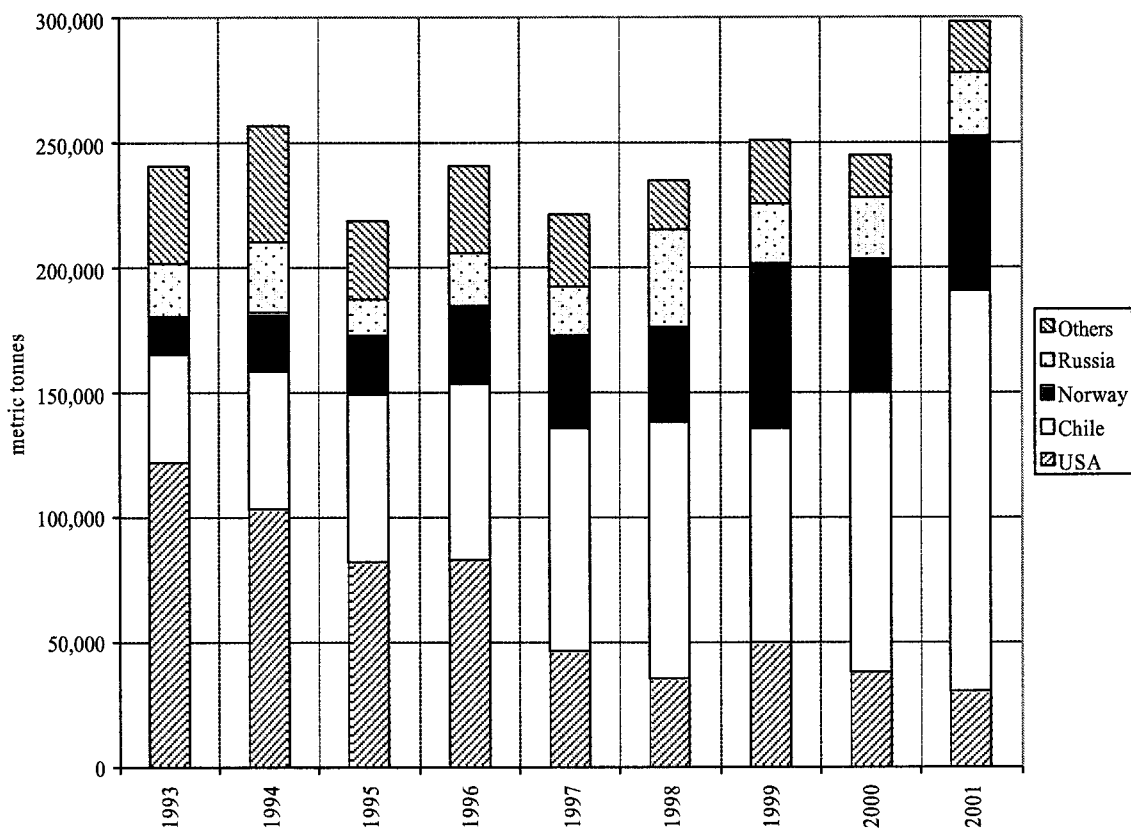


Figure 3.2.7. Japanese Salmon Imports by Country, 1993-2001 (tonnes).

Figure 3.2.8 shows the seasonal pattern of Japanese salmon imports for the years 1997-2001. Imports of wild salmon—frozen sockeye and frozen “other Pacific” salmon—are concentrated in the months of July, August, September and October—reflecting the timing of North Pacific wild salmon runs. In contrast, imports of frozen coho salmon (mostly Chilean) are concentrated in the months of December through April, corresponding to the southern hemisphere summer slaughtering season. Imports of frozen trout exhibit a similar but less pronounced seasonal variation, in part because farmed trout are imported from both the southern hemisphere (Chile) and the northern hemisphere (Norway and other countries). Imports of fresh Atlantic salmon are distributed relatively evenly over the year.

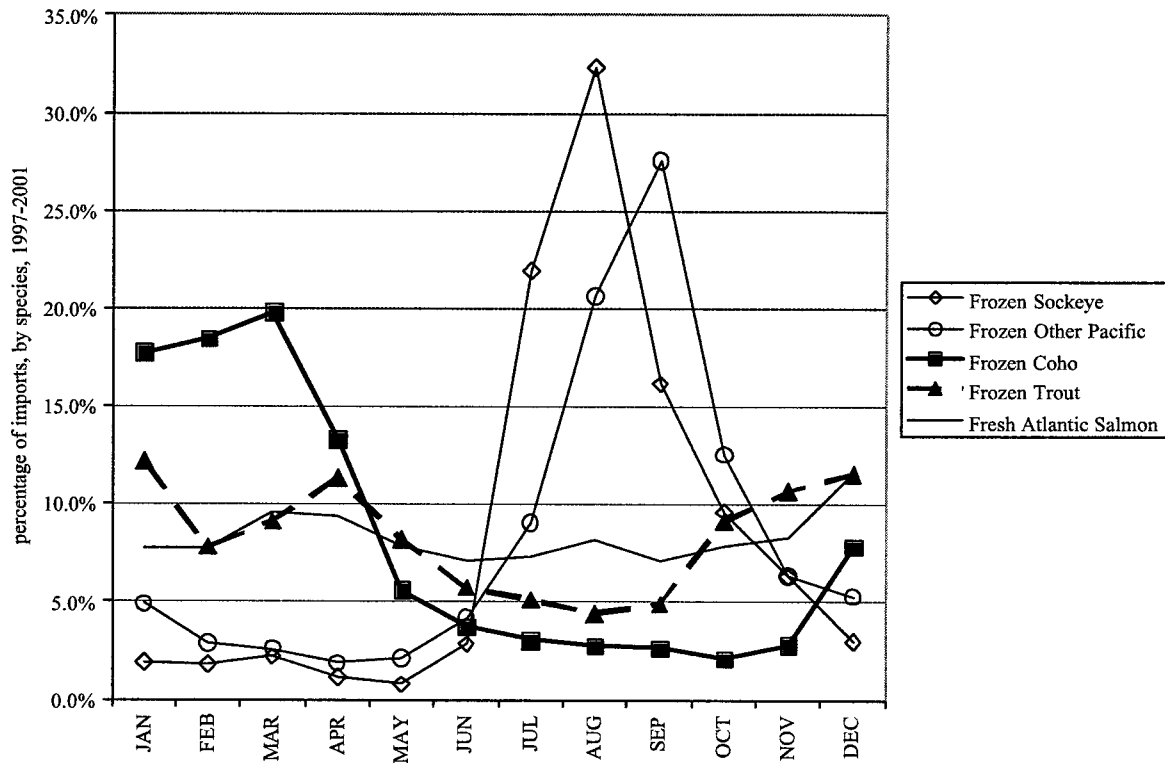


Figure 3.2.8. Seasonal Variation in Japanese Salmon Imports, 1997-2001

As shown in Figure 3.2.9, the shift in the composition of Japanese imports from wild to farmed salmon between 1993 and 2001 was reflected in a significant change in the timing of imports over the year. In 1993, imports of frozen “red-fleshed” salmon were concentrated in the period July through October. By 2001, imports were much more evenly distributed over the year, with the highest share of imports arriving in the winter months of December-April a much more evenly distributed over the year,

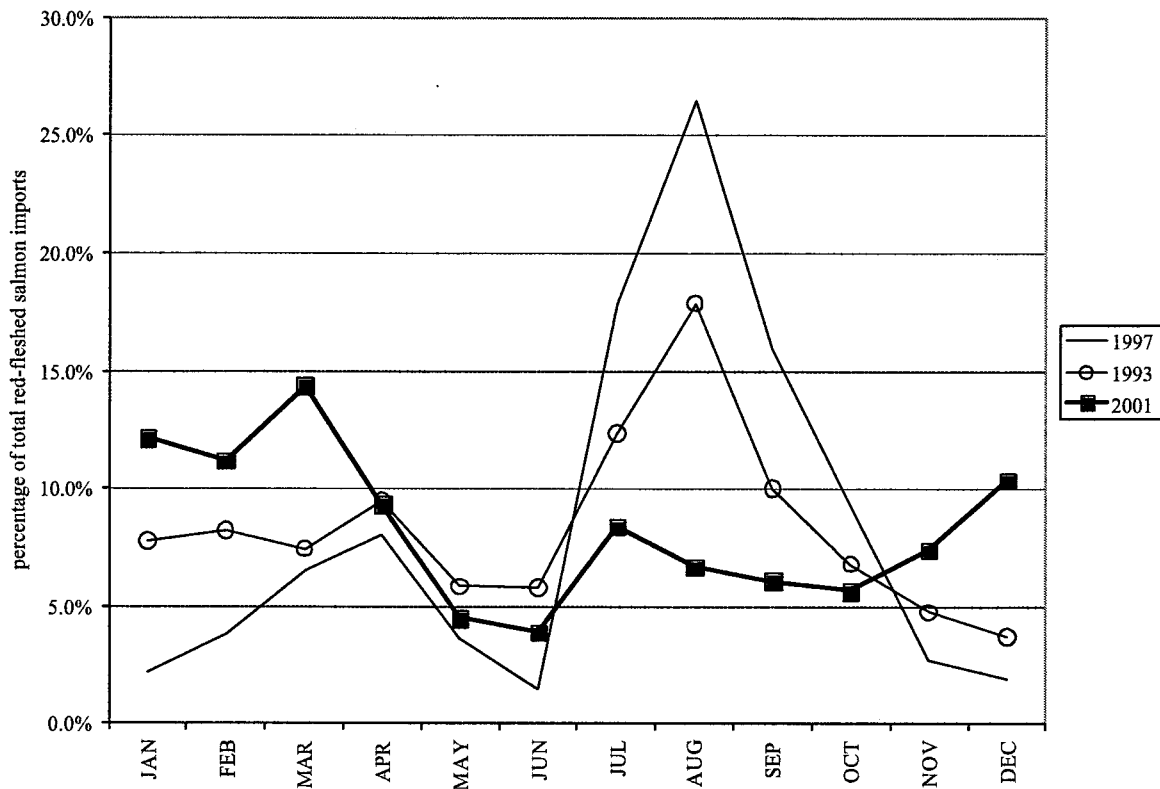
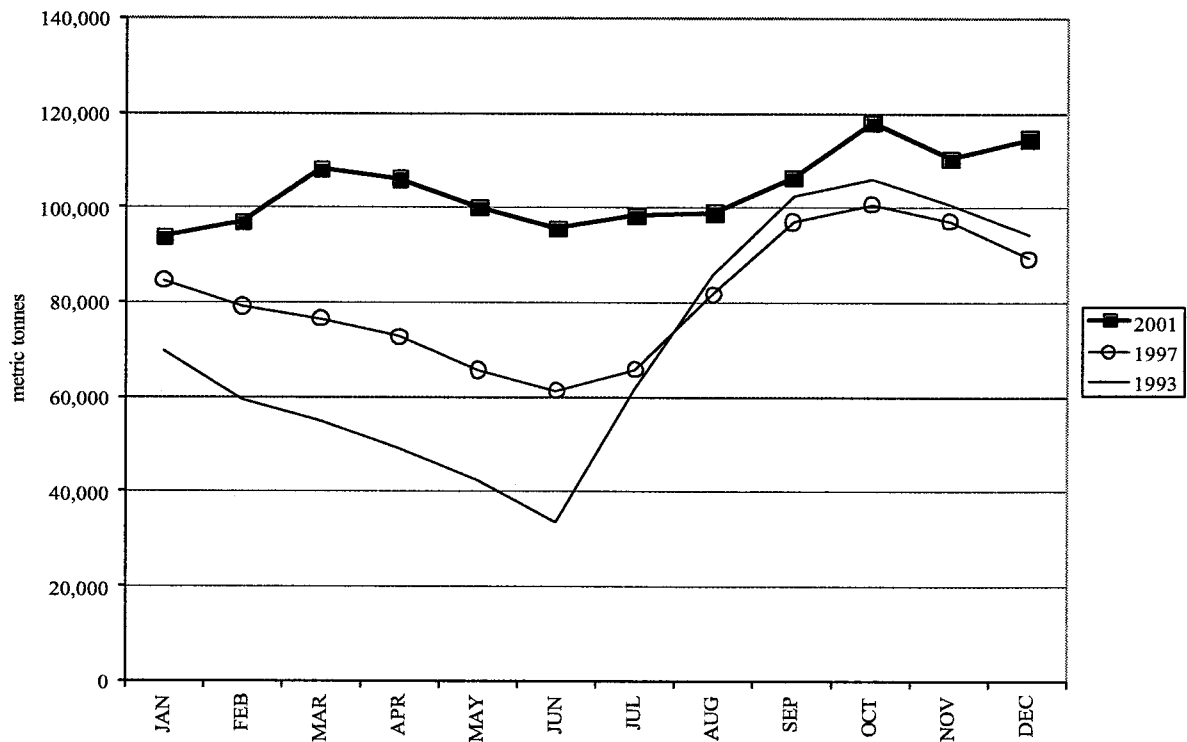


Figure 3.2.9. Timing of Japanese Frozen “Red-Fleshed” Salmon Imports: 1993, 1997 and 2001

Changes in the composition and timing of Japanese imports are also reflected in Japanese salmon inventories. As shown in Figure 3.2.10, in 1993 when Japanese frozen salmon imports were still dominated by wild salmon, inventories of frozen salmon and trout increased rapidly during the summer months, peaking in October, and thereafter declined steadily. In 2001, with a more even distribution in the timing of imports, there were two “peaks” in imports—one in March due to the accumulation of Chilean coho imports, and the other in October due to the accumulation of wild salmon imports. In addition, higher total import volumes were reflected in higher frozen inventories over the entire year.



**Figure 3.2.10. Japanese Inventories of Frozen Salmon and Trout: 1993, 1997 & 2001 (metric tonnes)**

### Japanese Salmon Prices

Figure 3.2.11 shows Japanese monthly average wholesale prices for frozen red-fleshed salmon (sockeye, coho and trout). Prices for all three species exhibit substantial variation within and between years. In general, prices of frozen coho and frozen salmon trout follow each other quite closely, suggesting that these species are close substitutes. Prices for frozen sockeye exhibit some correlation with prices of frozen coho and trout, but clearly diverge after years of low Alaska sockeye harvests such as 1992, 1997, 1998 and 2001. This suggests that part of Japanese demand for red-fleshed salmon is sockeye-specific. Prices for frozen coho and trout dropped precipitously from 1999 through 2001 (but recovered in the second half of 2002).

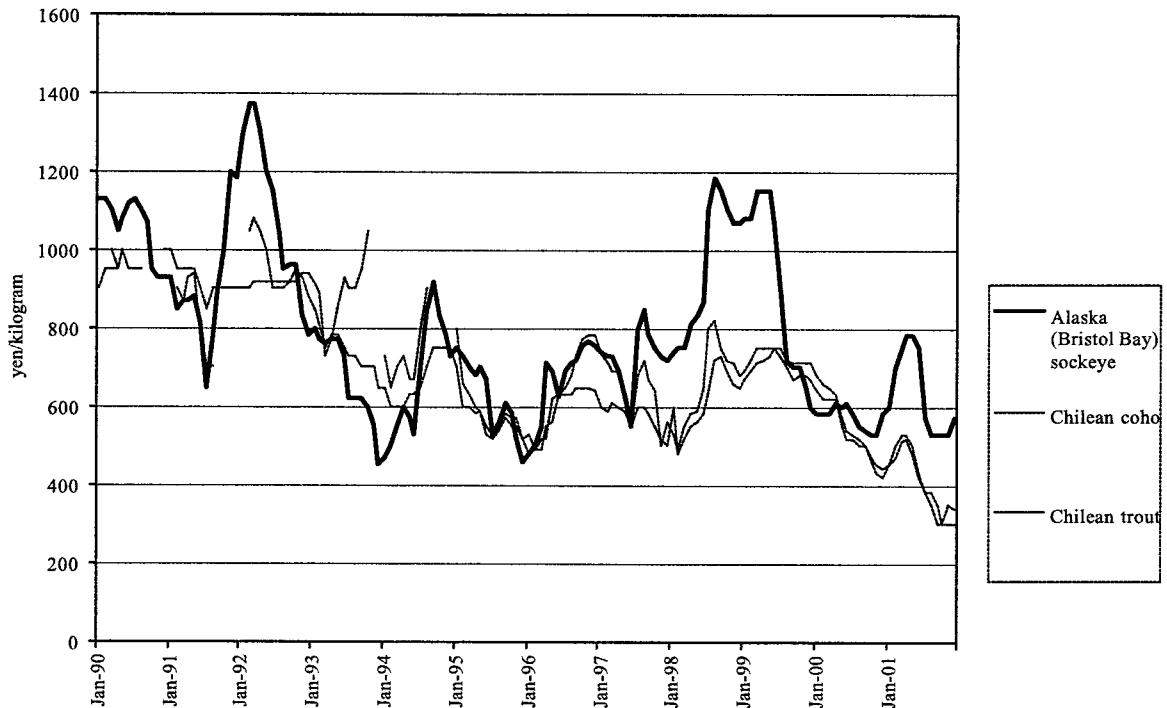


Figure 3.2.11. Japanese Wholesale Prices for Frozen Red-Fleshed Salmon (#1 grade, 4-6 pounds)

In the Japanese trade press, changes in prices are attributed to numerous factors, including wild salmon harvests and the extent to which they correspond to preseason projections, farmed salmon production and imports, and increases or decreases in frozen salmon inventories. Market psychology and speculation also play a role in wide price swings. When the market is perceived to be “falling,” buyers are reluctant to buy, contributing to downward pressure on price. When the market is perceived to be rising, buyers rush to buy, contributing to upward pressure on price.

Although they are not always easy to perceive in short-term market conditions, broader forces of supply and demand appear to drive the market over the longer term. As shown in Figure 3.2.12, there is a clear inverse relationship between the average annual price of frozen red-fleshed salmon (weighted by import volume over the May-April “salmon year”) and estimated consumption of frozen red-fleshed salmon (imports plus decline in frozen inventories of salmon and trout). The dramatic decline in prices of frozen coho and trout between 1999 and 2001 appears to have resulted from the rapid growth in imports of frozen red-fleshed salmon over this time period.



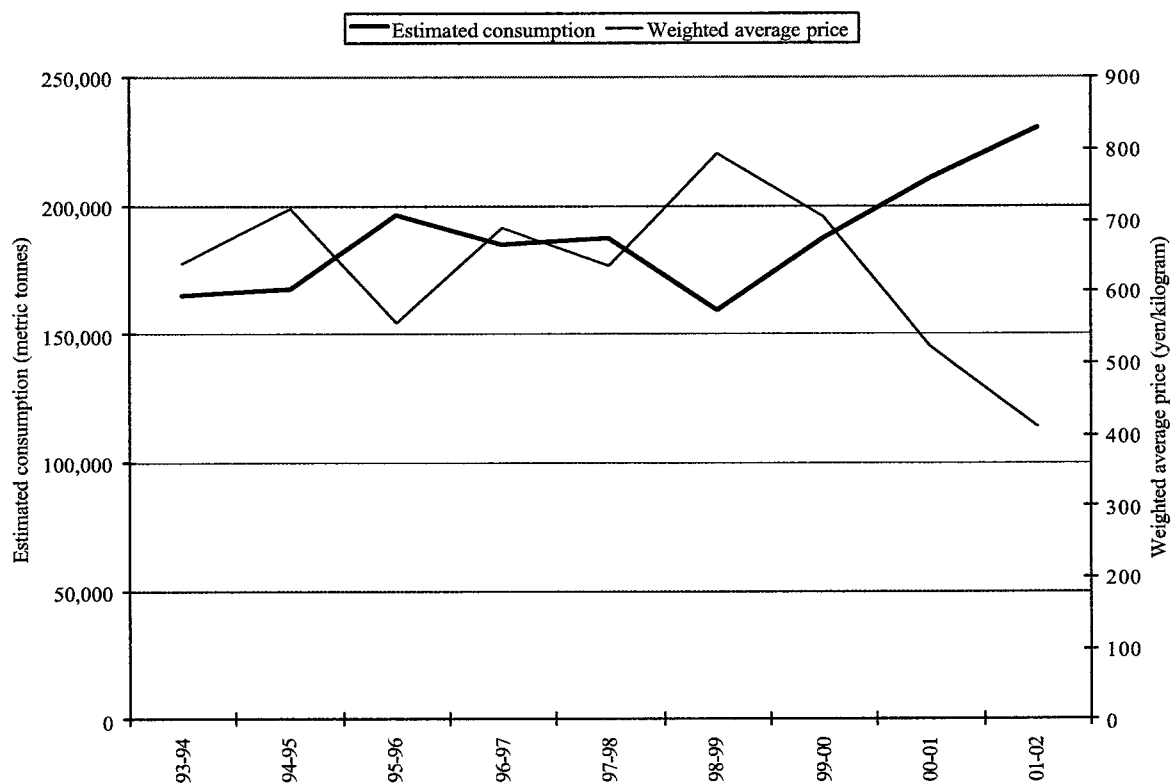


Figure 3.2.12. Weighted Average Wholesale Prices and Estimated Consumption of Frozen Red-Fleshed Salmon.

Figure 3.2.13 shows Japanese import prices for fresh and frozen Atlantic salmon. In general, prices for fresh Atlantic salmon are above prices for frozen red-fleshed salmon (except for sockeye salmon when it is in short supply). Prices for frozen Atlantic salmon are slightly higher than for frozen coho and trout, but follow similar longer term price trends, although their prices exhibit relatively little correlation in the short-term.

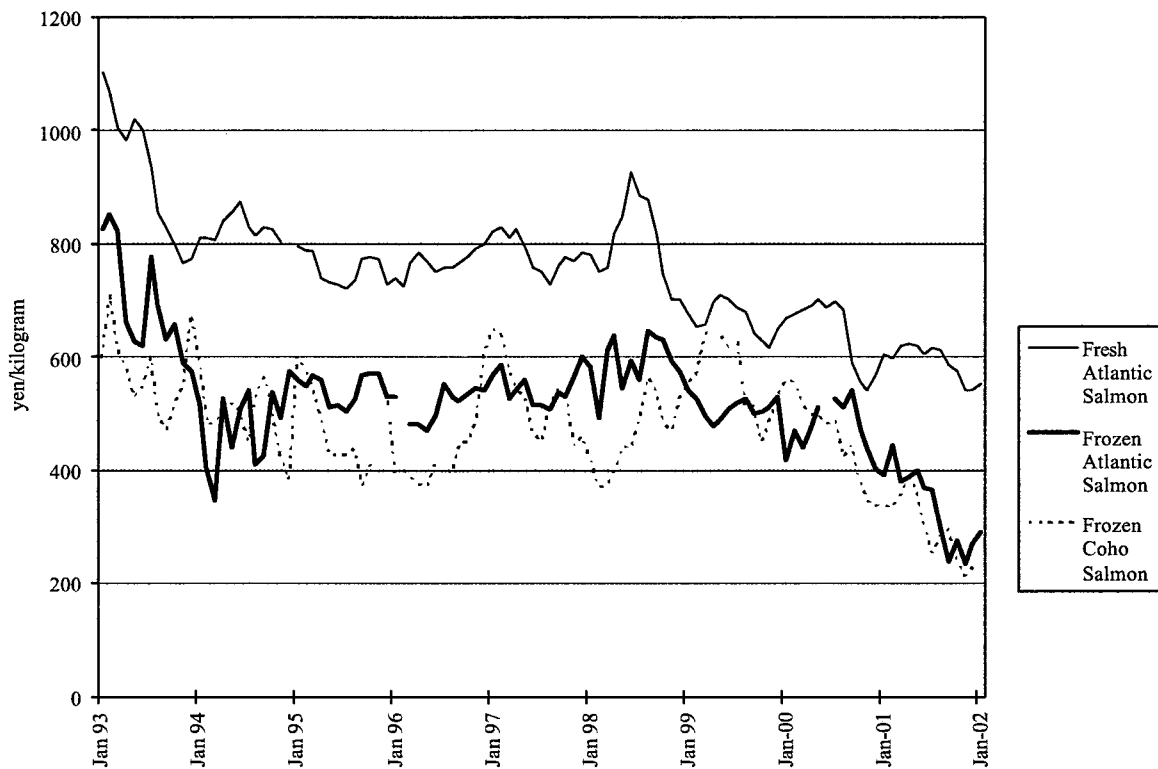


Figure 3.2.13. Japanese Import Prices for Fresh and Frozen Atlantic Salmon and Frozen Coho Salmon

As was discussed in Section 2.2 (see Figure 2.2.9), prices for fall chum salmon are driven primarily by Japanese fall chum landings, reflecting a clear inverse relationship between harvests and prices. As shown in Figure 3.2.14, from 1991 to 2001 wholesale prices for salted fall chum salmon were below landed prices paid to fishermen for fall chum salmon. The explanation of this apparent paradox is that a substantial portion of the landed value of fall chum salmon derives not from the flesh of the fish but rather from chum salmon roe.

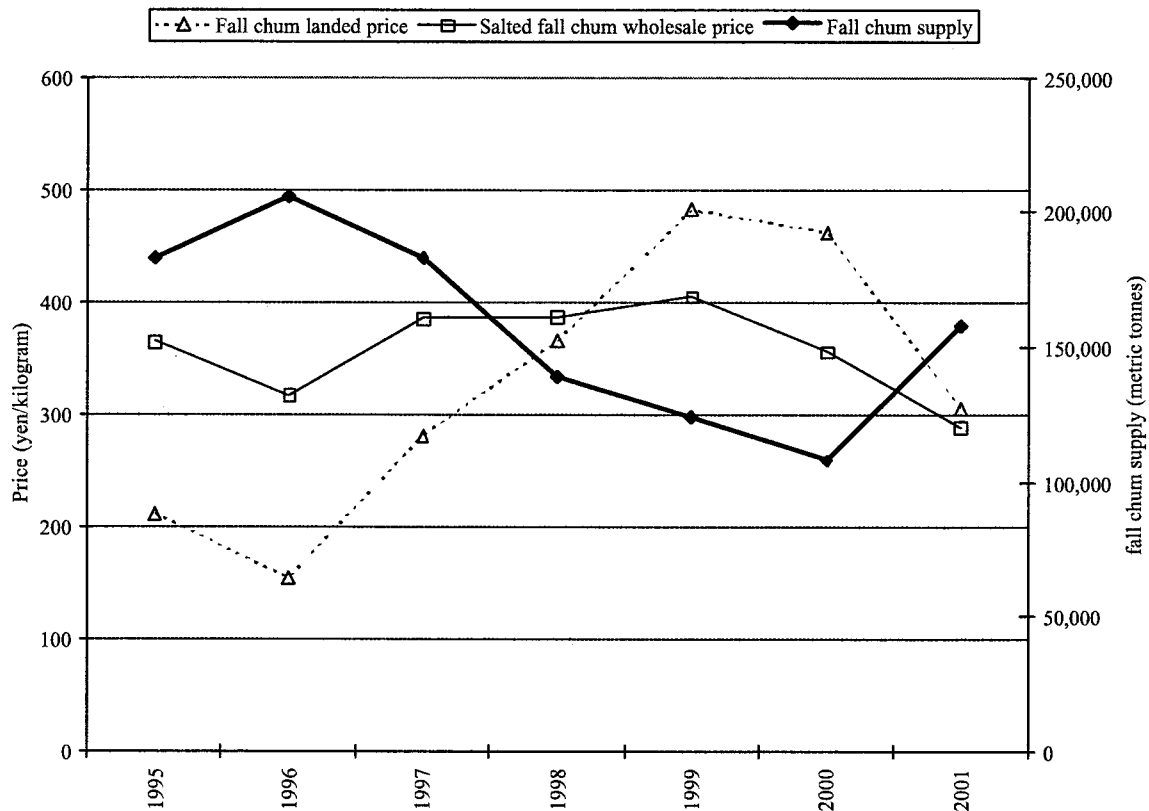


Figure 3.2.14. Fall Chum Supply, Fall Chum Landed Price, and Salted Fall Chum Wholesale Price

Figure 3.2.15 shows average prices paid by Japanese households for salmon. The prices were calculated from Family Income and Expenditure Survey data, by dividing expenditures by purchased volume, and thus reflect weighted average prices for all species and products. However, they suggest that between 1992 and 1996 and again between 1999 and 2001, there was a significant decline in average prices paid by Japanese households for salmon. It seems likely that lower consumer prices played an important role in encouraging Japanese consumers to absorb very substantial increases in total salmon supply over this time period.

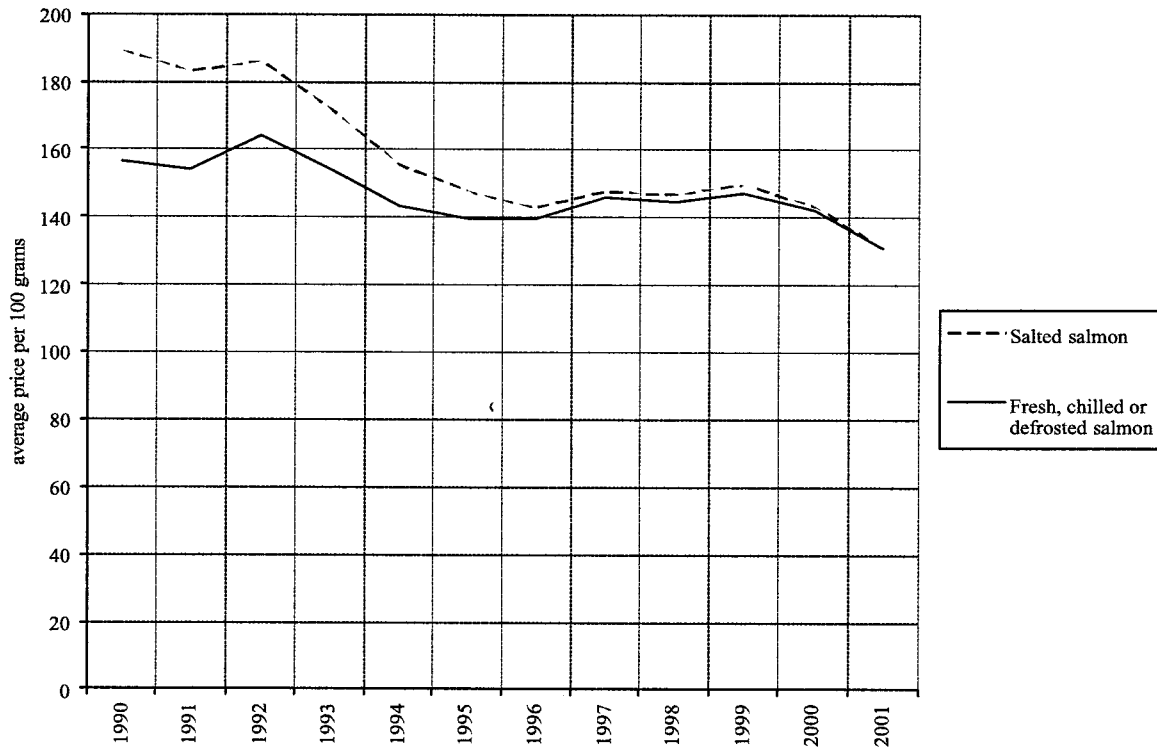


Figure 3.2.15. Average Prices Paid by Households for Salmon (All Species Combined)

### Outlook for the Japanese Salmon Market

In contrast to the United States and most countries in Europe, Japan may be considered a mature market for salmon. Per capita consumption is high, salmon is widely available, and consumers are very familiar with salmon. Thus it seems unlikely that total salmon consumption will grow significantly as a result of expanded demand (defined as the volume consumers are willing to purchase at a given price). Instead, further significant increases in consumption will likely require lower prices, as occurred during the 1990s.

A number of other factors are likely to affect the Japanese salmon market. Japan is undergoing significant demographic transitions, including the decline of multigenerational families and the subsequent move towards nuclear families or one-person households, as well as the aging of the population. These demographic changes have brought about changes in eating habits and food consumption patterns. Sales of prepared, precooked, and take-out meals have increased. Older people tend to maintain a diet with more fish.

There is a growing concern for health issues. The population in general has shifted away from salty fish products to less salty ones. There is also increased awareness of genetically modified products, and people are willing to pay a price premium to eat “safe” food.

The continuing economic recession has tightened many Japanese families’ food budgets. While consumers remain very quality conscious they also want value for their money.

It is difficult to assess the combined impact of these factors on Japanese salmon demand and consumption. However, it is clear that the Japanese salmon market will remain very large and very important. Although total salmon consumption may not rise as rapidly as in other markets, the Japanese market will provide very important opportunities for those salmon producers able to produce high quality products which respond to the demands of Japanese consumers.

### ***3.3. The European Union (EU) and other Western European markets***

#### ***3.3.1. France***

Overall, France is the second largest market for fish and fishery products in the European Union (after Spain). The average consumption of seafood per capita was 29.9 kg in 2001<sup>9</sup>, well above the average 24.9 kilos per capita in Europe as a whole, and ranking France fourth among the EU countries. France is also the main European marketplace for salmon. Counting all product forms, salmon constitutes about 10% of the French fish consumption, equivalent to an annual per capita consumption of roughly 2 kg salmon<sup>10</sup>.

Almost all the salmon consumed in France is imported from abroad. France has a considerable domestic production of smaller sized trout reared in fresh water, yielding a total production volume of 46,000 tonnes in 1998<sup>11</sup>, but this industry caters to a market segment separate from that of the salmon market.

Total salmon imports have been increasing throughout the 1990s, from 81,000 tonnes in 1990 to almost 120,000 tonnes in 2001<sup>12</sup>. In particular, the imports of Atlantic salmon

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<sup>9</sup> Source: FAO.

<sup>10</sup> Whole weight equivalents. Source: OFIMER.

<sup>11</sup> Source: FAO (Fishstat+ database)

<sup>12</sup> Source: FAO (Fishstat+ database) for 1990-2001.

have more than doubled over this same period, going from 40,000 tonnes in 1990 to nearly 89,000 tonnes in 1999, and decreasing slightly thereafter. In contrast, the imports of frozen Pacific salmon have dropped significantly, from 17,000 tonnes in 1992 to just over 9,000 tonnes in 2001. There has also been a large increase in imports of salmon fillets, and especially of frozen fillets. The details of French salmon imports are reported in Table 3.3.1.

Table 3.3.1. French Imports of Salmon 1990-2001 (metric tonnes product weight).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
<b><i>Atlantic salmon</i></b>												
Fresh/chilled	40,480	45,579	49,802	51,951	59,268	64,921	69,032	65,744	73,149	88,488	74,666	82,066
Frozen	14,538	17,415	11,943	5,454	2,366	4,308	3,559	1,356	1,504	1,361	1,128	1,538
<b><i>Pacific salmon</i></b>												
Frozen	13,214	14,924	17,020	14,348	13,560	12,539	13,816	13,158	6,920	8,962	8,105	9,184
<b><i>Salmon fillets</i></b>												
Fresh/chilled	559	907	859	1,292	883	1,306	2,509	2,541	4,446	5,597	3,568	1,632
Frozen	1,189	2,363	2,646	3,363	3,777	4,631	6,156	6,643	6,819	8,331	10,601	11,134
<b><i>Salmonoids</i></b>												
Fresh/chilled	319	323	118	404	808	720	3,504	4,597	4,768	8,548	7,152	7,430
Frozen	1,460	1,653	1,055	318	605	499	580	591	206	302	574	523
<b><i>Canned salmon</i></b>												
	3,779	2,436	2,292	2,901	3,717	2,672	2,597	2,634	3,121	2,772	2,922	2,147
<b><i>Smoked salmon</i></b>												
	2,162	2,316	2,737	2,281	2,471	2,817	1,988	2,941	3,027	2,831	2,810	2,760

Source: FAO 1990-2001

The vast increase in salmon supply on the French market has been accompanied by significant price reductions over the last decade, although there are large fluctuations from year to year. Figure 3.3.1 shows the price development for Norwegian fresh Atlantic salmon, as well as US frozen sockeye and coho, plotted against French imports of salmon, excluding processed products. There is a pronounced downward trend in the price of fresh Atlantic salmon from Norway, the most important salmon species. Average import price fell by over 1 USD, from USD 4.64 per kilo in 1995 to USD 3.63 per kilo in 2000. For the US Pacific species prices have fluctuated more. Frozen sockeye prices decreased by 48% from 1995 to 1996, from USD 3.95 per kilo to USD 2.07 per kilo. However, prices increased considerably over the next four years to average USD 4.94 in 2000. US coho generally fetches somewhat lower prices, falling

from USD 3.41 per kilo in 1995 to USD 2.71 per kilo in 1996, and then gradually increasing to USD 3.64 per kilo in 2000.

Overall, French salmon imports were valued at USD 461 million in 1998<sup>13</sup>. In 1999 salmon accounted for 15% the value of French seafood imports, making it the second most important seafood species ranked by import value, only surpassed by shrimp. Imports of salmon were valued at over 3 billion FFR, of which 2.2 billion FFR came from whole fresh salmon alone, and fresh salmon represented 45% of the value of fresh fish imports<sup>14</sup>.

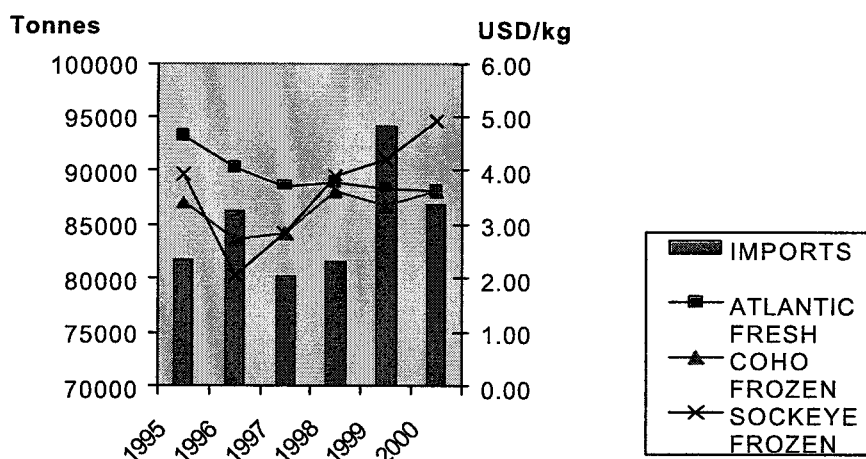


Figure 3.3-1. French Salmon Imports<sup>a</sup> and Norwegian and US Export Prices<sup>b</sup> 1995-2000.

<sup>a</sup> Excluding processed products.

<sup>b</sup> Current prices, excluding fillets and other processed products. Norwegian prices have been converted using official exchange rates from the Bank of Norway.

Source: FAO; Kontali Analyse; Norwegian Seafood Export Council; US trade statistics.

France imports salmon predominantly from European producers. Norway is the main supplier of Atlantic salmon with 60% of the imported volumes in 2000, while the UK supplied 22%. Denmark, Ireland and the Faeroe Islands are the other main producers exporting to France. The US dominate the imports of Pacific salmon with 91% in 2000, and Canada supplying the remaining volumes. Chile was virtually absent on the French market during the 1990s, but in recent years smaller quantities of frozen Atlantic salmon have been imported from Chile, totalling 3,506 tonnes in 2000<sup>15</sup>. An obstacle for the Chilean salmon producers is the lack of an efficient low-cost export route between the two countries for the transportation of fresh, chilled salmon. In addition, the US market

<sup>13</sup> Source: FAO (Fishstat+ database)

<sup>14</sup> Source: OFIMER

<sup>15</sup> Source: Chilean Export Statistics

normally pays higher prices than the European for fresh salmon. In the French frozen food service market Chilean producers have succeeded in establishing a growing presence. Imports of canned salmon come mostly from the US, whereas the smoked salmon is imported from the UK, Denmark and Ireland.

### Consumption<sup>16</sup>

The imported salmon quantities are divided equally among retail sales, restaurant and catering, and the processing industry, which consists mainly of the smokehouses.

Salmon is the principal fresh species consumed at home, with about 15% of the home consumption market for fresh fish. Fresh and smoked salmon together attain around 30% of the market value for fresh and smoked fish. The retail chains dominate sales of fresh salmon to households, with 81% of the purchase value, compared to 63% for fresh fish in general. This difference has developed over a number of years, as the price of salmon sold through the hyper and supermarkets has been decreasing on average 4% per year for whole salmon, and 2% per year for fillets, while the price of fresh fish in general has been increasing on average 2% per year. The year 2000, however, saw a change in this trend, as retail prices increased and quantities dropped. Due to an average price increase of 13%, sales of whole salmon plummeted by 35%, and that of fillets by 6%, and this adverse change was much stronger for the traditional fishmongers than for the supermarkets. Also smoked salmon experienced market setbacks, but to a lesser degree.

Fresh salmon consumption is shared equally between home consumption and the restaurant/catering industry. Of the latter, restaurants account for 75% of the consumption and the catering industry for the remaining 25%.

### The Smoking Industry

The smoking industry utilises around 30,000 tonnes of imported salmon per year. 95% of the raw material is farmed salmon. Industry output increased steadily in the 1990s to reach 20,000 tonnes in 2001<sup>17</sup>, of which the bulk is sold through the retail sector. Most of the production is sold in the domestic market and only about 10% is exported, mainly to Italy and Belgium.

The demand for smoked salmon is seasonal, although less so than in the past with Christmas/New Year and Easter being the peak seasons. The festivity celebrations also shift demand towards more high-quality products, i.e., Scottish and Irish salmon, as well as high-end Norwegian products.

The smoking industry experienced major structural changes during the last half of the 1990s. After very good years in the 1980s, the industry suffered several setbacks in the

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<sup>16</sup> Source: OFIMER

<sup>17</sup> Source: FAO (Fishstat+ database).



early 1990s. Quality had deteriorated as injecting brine and smoke flavour had become commonplace, and subsequently prices plummeted. Since then extensive consolidation has taken place, and the retail sales of smoked salmon are now dominated by 10-15 smoking companies. The focus on improving product quality and regaining consumer confidence has been largely successful, and the industry experienced considerable sales growth during the latter half of the 1990. In 1999 the industry expected boosting sales due to the upcoming millennium celebration, but the optimistic expectations did not materialise. On the contrary, due to major ISA disease problems in Scotland, supplies were short, and raw material prices increased. Firms relying on the spot market were caught off-guard. At the same time the smokehouses had precommitted to contracts with the retail industry and therefore had little opportunity to pass the increasing costs on to the consumers. As such, the smoking industry continues to experience difficulties, caught in the middle between the producers and the marketers.

Product differentiation is a key strategy for the French industry and there has been an increasing range of new product presentations. These include:

- smoked organic salmon
- return of smoked wild (Pacific) salmon as a market niche
- wide range of pack weights (from 50 grams to 1 kg)
- quality labels (*Label rouge*)
- traceability information on packs
- smoked salmon cubes.

### Outlook

The great success of salmon on the French market can largely be attributed to the stable supply throughout the year and a wide selection of high-quality products sold at reasonable prices, due to technological advances and economies of scale in the production of farmed salmon. However, as the market matures, consumers become more focused on geographic origin, production process and quality standards. In general, Scottish and Irish farmed salmon has been perceived to be of higher quality than the Norwegian product. Following the mad cow disease and the ISA crisis in the Scottish salmon farming industry consumers have become increasingly aware of the salmon farming process. Salmon farmers experienced difficulties in countering the rumours of bone meal mixed into the salmon feed, and due to the negative publicity farmed salmon lost some of its natural image, giving organically farmed salmon and wild salmon, as well as other wild species, a competitive advantage. In the future it therefore seems reasonable to expect an increased importance of product labelling and greater focus on geographic origin and mode of production.

### 3.3.2. Germany

Table 3.3.2 gives data on the supply of salmon to the German market for 1995 and 1998-2001. Not surprisingly, fresh Atlantic salmon is the most important product form. However, what is most striking is the increase in the supply of salmon fillets which more than trebled from 1995 to 1999, when it leveled off. The supplies of fresh Atlantic salmon and frozen Pacific salmon appear to have leveled off somewhat in later years.

Table 3.3.2. Supply of Salmon to Germany, 1995 and 1998-2001, Tonnes.

Product Form	1995	1998	1999	2000	2001
Fresh Atlantic salmon	25,854	33,987	29,636	32,149	34,040
Fresh Pacific salmon	10	748	253	248	98
Frozen Atlantic salmon	778	952	1,154	958	406
Frozen Pacific salmon	813	4,208	2,885	4,815	3,983
Fresh/frozen salmon fillets	5,803	13,894	18,792	18,671	18,899
Smoked salmon	6,036	8,020	6,658	6,705	8,212

Source: Kontali Analyse

For fresh Atlantic salmon, Norway in 2000 had a market share of 57%, followed by the United Kingdom (21%) and Denmark (17%). Norway and Denmark have lost market share, while the UK has gained market share for fresh Atlantic salmon.

Regarding fresh/frozen salmon fillets, in 2000 Denmark, supplying roughly equal quantities of fresh and frozen, had a market share of 36%, Norway, exporting mostly frozen fillets, had a market share of 30%, the UK, exporting predominantly fresh fillets, had a market share of 18.6%, while Chile, exporting frozen fillets, had a share of 12%. In the period under consideration, in particular the UK and Denmark have gained market share.

Denmark is the dominant supplier of imported smoked salmon with a market share of 89% in 2000, followed by Poland and the Faeroe Isles. Germany also has several domestic smokehouses relying on fresh imported raw material from Norway, Ireland and the United Kingdom, the largest being the Bavarian based Laschinger Group.

Salmon is consumed both at home and in restaurants. Organic salmon is a growing niche, although volumes are still small. Germany is a very price conscious market and the relatively low price of salmon is seen as a key factor in increasing sales further. Frozen salmon products and especially portions are widely distributed through national discount chains such as ALDI. Supermarkets and hypermarkets have increased their

share of salmon sales and with the recent liberalisation of store opening hours, salmon sales through the retail chains are expected to grow.

### 3.3.3. United Kingdom<sup>18</sup>

The UK produced almost 140,000 tonnes salmon in 2001, an increase of 7 percent compared with 2000. The bulk of this production is consumed domestically as fresh or smoked product. France is the key export market, accounting for 50 % of exports; other important markets are Spain, Germany and the U.S., each importing more than 5,000 tonnes of salmon from the UK in 2001.

At the same time as exports increased, UK imports of salmon fell. Total imports were less than 14,000 tonnes, almost half the 1999 salmon import volume. Norway remains the key foreign supplier to the UK, although Chilean salmon is gaining market share. Imports from the U.S. have also shown notable growth, increasing by 53 % in 2001 to 1,844 tonnes of mostly frozen Alaskan salmon. Norway's salmon exports to the UK picked up again in 2002, to 14,000 tonnes (round weight equivalents), from 11,900 tonnes in 2001.

The Seafish Industry Authority estimates the UK home consumption market for fresh and chilled salmon to be worth US\$207 million in 2001. In value terms this makes salmon the most important species in the fresh and chilled sector. Additionally, an estimated 28,200 tonnes of fresh salmon was used in smoked salmon production. This generated just under 10,000 MT of saleable product, with a 40:30:30 split between in-house consumption, food service segment and exports.

The UK continues to be the most important export market for U.S. canned salmon. With no domestic production of canned salmon, the UK is almost wholly reliant on the U.S. and Canada for its supplies of canned Pacific salmon. Consumption of canned salmon is mainly bought by older generation consumers. Despite some year by year oscillations, demand is holding up quite well.

### 3.3.4. Spain

The supply of salmon to Spain increased considerably throughout the 1990s (Table 3.5.4). Salmon in Spain is mainly consumed as a fresh product. Smokers also primarily

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<sup>18</sup> Sources: United States Department of Agriculture (USDA, GAIN report #UK2025) and Norwegian Seafood Export Council

purchase fresh salmon. In 2000, Norway had a market share of 62% for fresh Atlantic salmon, down from 72% in 1995. Denmark supplied 17% of fresh Atlantic salmon and the UK 13%. Almost all frozen Pacific salmon was imported from the United States. In 2002, Norway's salmon exports to Spain increased from the previous year by 17 % in volume to 21,670 tonnes (round weight equivalents) and 10 % in value to 474 million NOK.

Spain also produces trout for the domestic market. Production has been increasing steadily and reached 31,000 tonnes in 2001, up from 26,000 tonnes in 1997<sup>19</sup>.

**Table 3.3.4. Supply of Salmon to Spain, 1995 and 1998-2001, Tonnes.**

Product Form	1995	1998	1999	2000	2001
Fresh Atlantic salmon	19,410	24,705	27,417	24,608	33,624
Fresh Pacific salmon	0	36	0	113	33
Frozen Atlantic salmon	552	545	720	874	138
Frozen Pacific salmon	1,512	682	987	2,900	2,264
Fresh/frozen salmon fillets	238	789	840	751	351
Smoked salmon	344	235	160	251	572

Source: Kontali Analyse

### 3.3.5. Italy

The supply of salmon to Italy is given in Table 3.5.5. In 2000, Norway had a market share for fresh Atlantic salmon of 78%, only marginally down from 1995 (81%), while Denmark supplied 18%. For salmon fillets, Norway had a market share of 60%, Denmark 24% and Chile 16%. For imported smoked salmon, Denmark had a market share of 80%, and the UK 12%.

**Table 3.3.5. Supply of Salmon to Italy, 1995 and 1998-2001, Tonnes.**

Product Form	1995	1998	1999	2000	2001
Fresh Atlantic salmon	9,291	12,914	13,237	12,486	14,388
Frozen Atlantic salmon	463	346	342	304	476
Frozen Pacific salmon	1,256	666	538	764	970
Fresh/frozen salmon fillets	492	2,772	2,736	2,652	3,426
Canned salmon	741	298	317	217	83
Smoked salmon	3,114	4,654	4,397	5,173	5,996

Source: Kontali Analyse

<sup>19</sup> FEAP

Italy is a large importer of fish and fishery products and ranks today as the fifth largest importer in the world. Salmon consumption and imports have grown in the last decade in line with this increase, but the main beneficiary among farmed finfish has been Mediterranean seabass and seabream from Greece but also from domestic sources. The current market in Italy for bass and bream is estimated at 70,000 tonnes<sup>20</sup>.

Italy also produces significant amounts of trout although volumes have been declining from 51,000 tonnes in 1997 to 44,000 tonnes in 2001<sup>21</sup>. The decline is for white flesh portion size trout (from 28,000 to 19,000 tonnes) whereas the production of pink flesh portion trout has been slowly increasing from 22,000 to 24,000 tonnes over the same period.

As in most other European countries, the bulk of salmon sales are through the super and hypermarkets. Although fish consumption in Italy is higher on the coast, the islands and in the south, salmon consumption is concentrated in northern Italy and is only slowly penetrating the rest of the peninsula, although the larger cities in the south now also consume significant quantities of salmon.

Italy has several important smokeries that produce mostly for the domestic market. The raw material is for the most part fresh Atlantics but niche markets exist for wild coho and chinook. Unable to compete with low cost producers in Northern Europe, especially in Denmark, the Italian smokehouses specialise in high quality products for the specialty shops and top brands for the retail channel.

### 3.3.6. Portugal

At more than 60 kilos per caput (live weight), Portugal has one of the highest fish consumption rates in Europe. Cod in particular is a favourite with consumers, but declining supplies and rising cod prices coupled with improved distribution channels for fresh fish through the super and hypermarkets have opened the market for imported farmed species such as salmon and increasingly also for seabass and seabream. Norway exported 1,700 tonnes (round fish equivalents) of salmon to Portugal in 2002, a sharp decline from 3,100 tonnes in 2001. Chilean frozen salmon is also making in-roads into the Portuguese market and has been taking share from both fresh Norwegian and Alaskan frozen salmon.

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<sup>20</sup> FAO GLOBEFISH Seabass and seabream market reports, February 2003, at [www.globefish.org](http://www.globefish.org)

<sup>21</sup> FEAP

Table 3.3.6. Portuguese Salmon Imports 1999-2001, Product Weight, Tonnes

Tonnes	1999	2000	2001
Fresh	2,909	3,136	3,043
Fresh fillets	25	14	28
Frozen	839	634	514
Frozen fillets	17	53	51
Smoked	116	120	144
Canned	48	35	51

Source: EUROSTAT

### 3.3.7. Netherlands

The Netherlands is an important European supplier of fish and fishery products. The country's active traders source fish from all over the world and re-export to other Community markets along with fishery products from the country's own resources. Traditionally domestic fish consumption has lagged behind other European countries but grew rapidly in the 1990s to reach 20 kilos in 1999<sup>22</sup> (live weight equivalents). Household spending on fish grew 39% from 1995 to 2000 with salmon being one of the major factors behind this growth. Sales of smoked salmon increased by 260 % in the same period becoming the second most popular fish product after herring. Norway's exports of salmon to the Netherlands reached 16,600 tonnes in 2002 (round fish equivalents) of which nearly all was fresh whole salmon and some fresh fillets.

The country also imports frozen Alaskan salmon as well as significant quantities of canned salmon, mainly from Alaska and Canada. Volumes are remarkably stable although share has been lost in the overall market of salmon to fresh and smoked products. US exports to the Netherlands of canned salmon reached 3,100 tonnes in 2002 and of frozen salmon nearly 1,600 tonnes.

Table 3.3.7. Netherlands Canned Salmon Imports, tonnes

Tonnes	1999	2000	2001
USA	1,523	1,339	2,131
Russia	338	509	1,195
Germany	699	791	981
Canada	2,580	2,551	493
Belgium	170	277	361
Others	689	499	457
<b>Total</b>	<b>5,999</b>	<b>5,966</b>	<b>5,618</b>

Source: USDA The Netherlands, Fishery Products, 2002

<sup>22</sup> FAO Fisheries Circular No. 821 Revision 6, Food Balance Sheets 1961-1999

The Netherlands is also home to the world's largest salmon producer, Nutreco with farmed salmon operations in Norway, Scotland, Ireland, Canada, Chile and Australia. In total, the company supplies 16 % of the world's farmed salmon<sup>23</sup>.

### 3.3.8. Belgium

Belgium is a medium-sized salmon market and has several important smokeries. Norway is the largest supplier of Atlantic salmon with 7,400 tonnes exported in 2002 (round fish equivalents), slightly down from 2001 (7,600 tonnes). Average fish consumption per year has been stable for some time at around 20 kg per capita.

Table 3.3.8 Belgian Salmon Imports 1999-2001, product weight, tonnes

tonnes	1999	2000	2001
Fresh	7,752	8,029	7,991
Fresh fillets	1,712	1,992	1,882
Frozen	1,546	1,927	1,890
Frozen fillets	1,738	2,242	2,385
Smoked	2,856	2,785	2,654
Canned	2,822	3,255	2,602

Source: EUROSTAT

The Belgian seafood market<sup>24</sup> is very sophisticated with numerous processed convenience products available to the consumer. Belgian retail chains were among the first to make extensive use of modified atmosphere packaging (MAP) for sales of whitefish and today a high percentage of retail sales of fresh fish and live shellfish are in MAP or in other prepacked forms. In this respect, the Belgian retail sector is in advance of most of its counterparts in other European countries. The Belgian processing industry, which is heavily import reliant, has mostly moved from bulk importing and filleting activities to prepacking for the retail as well as catering sectors.

Seafood distribution in Belgium is experiencing similar changes to those occurring in other European countries with increasing levels of concentration and internationalisation in both the retail and catering sectors. The takeover of the large retail chain, GB by the French Carrefour Group in 2000 has intensified competition in most areas including seafood. One result of the takeover is the increased emphasis by Delhaize, Belgian's largest retailer in terms of food sales, on the quality end of the food sector.

<sup>23</sup> Company information from [www.nutreco.com](http://www.nutreco.com)

<sup>24</sup> Information mainly sourced from BIM reports (Irish Sea Fisheries Board)

In the catering sector, international food service companies, such as Sodexo, are increasing market share at the expense of local independent operations. Domestic seafood suppliers such as Pieters, now part of the Norwegian salmon producer Fjord, are in turn streamlining their product range as well as offering private label production to the retailers.

### 3.3.9. Greece

One of Europe's more recent markets for salmon, Greece has in relatively short time acquired a taste also for salmon. Fish consumption rose sharply in the last decade from 19 kg in 1989 to 25 kg live weight per capita in 1999<sup>25</sup>. The driving force of the rising consumption is improved fresh fish distribution through the growing super and hypermarket chains as well as Greece's own aquaculture industry which supplies large amounts of seabream to the domestic market ( the seabass is mostly exported). But as shown in table 3.5.9., salmon imports have also benefited from the rise in consumption. Norway's exports of fresh salmon to Greece reached 541 tonnes in 2002.

Table 3.3.9. Greece Salmon Imports 1999-2001, product weight in tonnes

Tonnes	1999	2000	2001
Fresh round	319	n.a.	735
Fresh fillets	22	19	16
Frozen round	385	575	368
Frozen fillets	59	25	60
Smoked	505	767	n.a.
Canned	327	408	n.a.

Source: EUROSTAT

### 3.3.10. Denmark

Denmark is an important trader of fresh salmon from Norway and the Faeroe Isles. In fact, Denmark is Norway's second largest market for salmon after France and imported 71,000 tonnes of salmon from Norway in 2002 (round weight equivalents). Its processing industry and smokehouses import raw material which is re-exported as finished products all over the world but especially in Europe. Denmark is thus a major producer and exporter of smoked salmon and of portions and fillets. In the market for smoked salmon, Denmark has been a very competitive producer but rising labour costs

<sup>25</sup> FAO Fisheries Circular No. 821 Revision 6, Food Balance Sheets 1961-1999



have moved some operators to set up production in accession countries such as Poland and Estonia.

The local market is limited and amply supplied by domestic operators.

### 3.3.11. Sweden

Sweden is an important salmon market with neighbouring Norway as the leading supplier with exports of more than 20,000 tonnes in 2002. 70 % of the exports from Norway are whole fresh salmon, but the share of fresh fillets is increasing.

The Swedish retail food market is dominated by three groups; ICA, Coop and Axfood, which account for nearly 90 percent of the retail food market. Swedish consumption patterns are moving towards increased demand for convenience and value-added foods.

### 3.3.12. Austria

Seafood consumption in Austria is low but slowly rising. Per capita consumption increased from 9 kg in 1990 to 11 kg in 1999<sup>26</sup> (live weight equivalents). Household purchasing power is very high but most Austrian families spend only about 1% of their total food budget on purchases of fish and fish products.

Fresh fish is consumed mostly in restaurants, whereas for home consumption natural or breaded frozen fillets or sticks of cod, hake and flatfish, are preferred. Salmon consumption is rising but volumes are still moderate at around 1,000 tonnes yearly.

### 3.3.13. Switzerland

Swiss consumers, only approximately seven million in number, have the highest per capita income in Europe. The Swiss retail market is very concentrated and dominated by two food chains, Migros and Coop, which account for 75 percent of Swiss food sales.

Norwegian exports of salmon to Switzerland have been rising from 5,300 tonnes in 2000, to 7,200 tonnes in 2001 and 9,800 tonnes in 2002, an increase of 85 % in only two years. Switzerland also imports increasing quantities of expensive high-quality smoked salmon and is the home country of several small boutique smokeries. The Swiss market is also a key market for eco-labelled seafood including smoked Alaskan salmon.

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<sup>26</sup> FAO Fisheries Circular No. 821, Revision 6, Food Balance Sheets 1961-1999

### 3.4. Emerging Markets

#### 3.4.1. The Russian Federation

Atlantic salmon is consumed west of the Ural Mountains, mainly in Moscow, St. Petersburg and the other large cities with more than a million inhabitants and significant purchasing power. Pacific salmon is also consumed and is sold mainly frozen, salted or canned.

Table 3.4.1. Supply of Salmon to Russia, 1998-2001, Tonnes.

Product Form	1998	1999	2000	2001
Fresh Atlantic salmon	423	364	1,567	2,580
Frozen Atlantic salmon	6,874	4,587	6,025	11,664
Frozen Pacific salmon	364	0	6	0
Frozen trout	2,525	333	821	2,390
Fresh/frozen salmon fillets	269	119	131	384
Smoked salmon	131	62	30	7

Source: Kontali Analyse

Norway is the main exporter of Atlantic salmon to Russia. In 2002 Russia was the 8<sup>th</sup> most important export market for Norwegian salmon and the most important market for frozen salmon.

Russian importers demand mostly the larger salmon sizes because it is more cost efficient in production. Most of the salmon is lightly salted by the importers or sold frozen to shops and markets. Overall, 70-80% of the salmon is consumed lightly salted. Only in recent years have the Russians started to heat-treat Atlantic salmon, usually by baking or frying it. New consumption patterns such as these are first adopted by younger consumers with high levels of education and income.

Although the volumes of fresh salmon imports remain relatively low, the trend is positive. In 2002 almost 4,000 tonnes were exported from Norway to Russia.

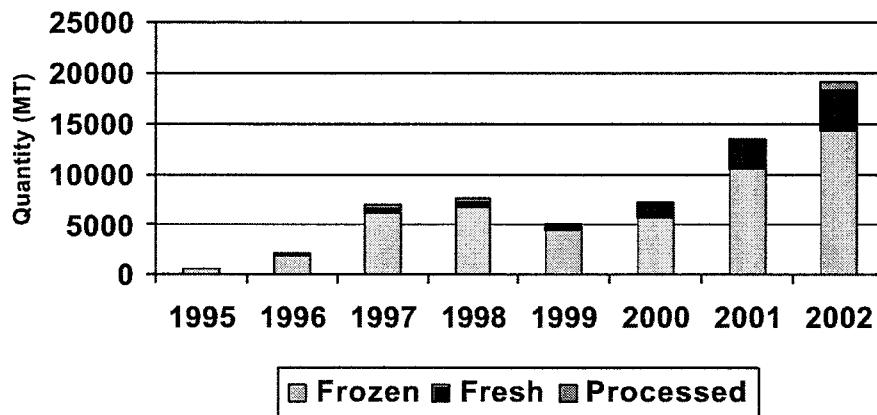


Figure 3.4.1. Norwegian Export of Salmon to Russia, 1995-2002

Source: Norwegian Seafood Export Council

Norwegian exports of salmon trout to Russia show a similar trend as for salmon. In 2002 almost 7,000 tonnes of (frozen and fresh) salmon trout were exported from Norway to Russia. This is a 300% increase compared to 2001.

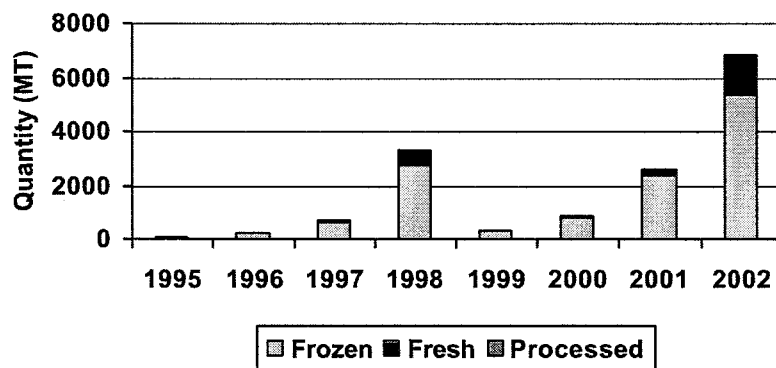


Figure 3.4.1. Norwegian Export of Salmon to Russia, 1995-2002

Source: Norwegian Seafood Export Council

Russian distribution channels are undergoing large changes and particularly in the retail segment. Distributors at the various levels of the distribution chain are gradually upgrading to a higher and more modern level of standards.

Traditional outdoor markets are still the most important distribution channel but are slowly losing market share to retail outlets. The Russian authorities are closing down

outdoor markets and moving them inside into more formal structures in order to achieve better food safety standards as well as combating the unregulated or “grey” economy.

The retail segment, particularly super- and hyper markets is developing fast. At the end of the 1990’s only a few supermarket chains had been established in Moscow, each with a few outlets. Only some years later, large chains, both national and international, are opening up shops in Moscow and the other large cities.

See appendix 5.2. for names of retail chains in Russia.

The emergence of super and hypermarkets in Moscow will facilitate the distribution of salmon and increase safety and quality standards. During the summer months poor cooling facilities in the outdoor markets are clearly detrimental to product quality and safety whereas the supermarkets are better equipped to maintain the cold chain for seafood products. The product range in the supermarkets is generally also wider than at the markets and the consumer avoids the haggling on prices. In the years to come, the growth of the supermarket segment will most certainly increase the availability and sales of imported farmed salmon.

### 3.4.2. Poland

The Polish market is expanding rapidly its consumption of salmon. Norway is the largest exporter with a market share of more than 90%. In 2002 Norway exported approximately 13.000 tonnes (round weight) of salmon to Poland. Of this Poland processed (mainly smoked) and re-exported approximately 3,000 tonnes (round weight) to Germany and Denmark.

Table 3.4.2. Supply of Salmon to Poland, 1998-2001, Tonnes.

Product Form	1998	1999	2000	2001
Fresh Atlantic salmon	1,051	2,870	4,231	7,211
Frozen Atlantic salmon	628	579	325	316
Frozen Pacific salmon	0	95	142	40
Fresh/frozen salmon fillets	283	111	99	218
Smoked salmon	945	691	199	117

Source: Kontali Analyse

The consumption of salmon is highest in the large cities. It is also in and around the large cities that the big super and hypermarket chains have their outlets. Since the middle of the 90’s there has been a substantial growth in the super and hypermarket segment in Poland. In the period 1995-2001 the number of hypermarkets increased from

10 to 136, and in 2000-01 alone grew by 21%. By the end of 2005 it is likely that there will be 200 hypermarkets and 1400 supermarkets operating<sup>27</sup>.

Salmon is mainly purchased in super and hypermarkets, and to some extent from fish mongers. For some years smoked salmon has been the most popular salmon product, but this is about to change as consumption is turning more towards fresh salmon.

According to the Sea Fisheries Institute<sup>28</sup>, the largest smokehouses in Poland in 2003 are:

ALMAR from Kartuzy;

KARI from Marciszów, [www.kari.com.pl](http://www.kari.com.pl)

KORAL from Tczew <http://www.koral.pl>;

MILAREX&MORPOL from Duninowo, [www.milarex.com](http://www.milarex.com);

PRORYB from Rumia;

RAFA from Wladyslawowo;

SUEMPOL from Bielsk Podlaski <http://www.suempolfish.pl>

Traditionally the greatest consumption of fish and especially of carp has been around holidays and Christmas in particular. The demand for salmon has also been the highest around Christmas, but parallel with the growth of super and hypermarkets the availability and thereby the consumption of salmon has increased throughout the year with less seasonal variance.

### 3.4.3. The Baltic Countries

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<sup>27</sup> Source: CAL Company Assistance and [www.retailpoland.com](http://www.retailpoland.com)

<sup>28</sup> Source: Dr. Emil Kuzebski in communication to FAO GLOBEFISH

he combined population of Estonia, Latvia and Lithuania may not be large at around 7.5 million inhabitants but salmon imports have now topped 7,500 tonnes from Norway alone. The main reason for the increasing imports are higher domestic consumption of salmon thanks to very competitive prices for farmed salmon, vastly improved distribution systems for fresh food and fish products through the modernised retail distribution system and an expansion of the local fish processing industry, in particular of smokeries with Scandinavian capital. The Baltic countries re-export unprocessed salmon to Russia and export increasing amounts of processed salmon products to Western Europe. With the imminent accession to the European Union, exports from these countries are anticipated to expand dramatically.

#### 3.4.4. China

China is still in a strong economic growth phase, and an expanding middle class enjoys increasing purchasing power. It is therefore likely that the market for Atlantic salmon will keep growing. However, distribution and quality will also be important factors in increasing consumption. China's entry into the WTO in December 2001 should contribute positively in this respect as it facilitates foreign investments in processing and distribution.

Table 3.4.3. An estimate of China's Salmon Imports 1999-2002 (from selected countries and salmon species)

<b>Approximate market size for Atlantic Salmon (MT)</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>
Norwegian exports to China	3,564	3,762	3,318	2,780
Norwegian exports to Hong Kong, SAR China	6,194	6,785	7,481	8,031
Chilean exports to China	123	279	3,526	n.a.
Canadian exports to China	26	6	6	n.a.
UK exports to China	1	1	46	n.a.
Denmark's exports to China	0	12	8	n.a.

Source: Norwegian Seafood Export Council, Kontali Analyse

As shown in Table 3.4.3. Norway is the largest exporter of Atlantic salmon to China (including Hong Kong). According to EUROSTAT, the United Kingdom exported 226 tonnes fresh salmon to Hong Kong but only 5 tonnes directly to China in 2001. Chile is also increasing its exports to China.

China also imports increasing quantities of Pacific salmon from Alaska and Canada. Of the 39,143 tonnes of Pacific salmon imported in 2002, 21,000 tonnes came from Japan; the rest from Canada and the US. Some of China's Pacific salmon imports serve as raw

material for its processing industry which re-exports salmon portions or other processed salmon products.

Table 3.4.4. China's Trade Statistics for Salmon 2002

	<b>Exports MT</b>	<b>Imports MT</b>	<b>Value Exports 10,000 USD</b>	<b>Value Imports 10,000 USD</b>
Atlantic, fresh	0	408	0	155.66
other, fresh	0	1,935	0	504.80
Frozen	0	833	0.02	99.02
other, frozen	560	39,143	76.03	3,594.50
Atlantic, frozen	19	837	2.71	139.27
other frozen	69	3,322	7.00	368.08
Atlantic, smoked	6	0	3.76	0.01
other, smoked	104	20	27.59	26.45
Atlantic, prepared	133	0	34.93	0
other, prepared	420	0	128.85	0
<b>Total</b>	<b>1,313</b>	<b>46,502</b>	<b>280.89</b>	<b>4,887.81</b>

Source: INFOYU, Beijing, 2003.

The entry of more frozen salmon into the market in 2002 has contributed to increased consumption of salmon as reasonable prices attracted new consumers who earlier could not afford to buy the product.

Salmon is both consumed raw as sushi and sashimi or heat-treated and used in traditional Chinese dishes.

#### 3.4.5. Hong Kong, China SAR

Salmon exports to Hong Kong have grown in recent years, but experience from the economic setbacks in 1997-98 and 2000-02 shows that the market for salmon depends heavily on the general economic climate. Tourism and international travel are important contributors to the local economy. The SARS epidemic in 2003 reduced salmon imports but the long term trend of growing salmon imports is not expected to be affected.

During an economic crisis the hotel and restaurant businesses suffer particularly hard. In spite of this exports of salmon to Hong Kong have shown a positive development for several years. However, it is important to note that a large part of the total imports to Hong Kong are re-exported to China.

### 3.4.6. Taiwan, Province of China

Seafood is an important part of the diet in Taiwan, Province of China. Fish is consumed on average 22 times per month and other seafood dishes 10 times per month. There are strong preferences for fresh seafood, but frozen seafood demand is also increasing.

Competition is strong on the market for salmon and sea trout. Canada and Norway are the largest suppliers of fresh salmon. In recent years Chile has entered the frozen market and is offering more competitively priced products.

### 3.4.7. Other South-East Asian Markets

Table 3.4.5. South-East Asian Salmon Markets for Norwegian salmon

<b>Norwegian exports of fresh and frozen salmon to South-East Asia, 1998-2002</b>				
<b>In metric tonnes</b>	<b>1998</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>
Singapore	1,452	2,487	2,062	2,523
Thailand	249	875	1,192	1,404
China	2,924	3,223	3,318	2,780
Taiwan, Prov. of China	3,475	5,531	3,803	3,303
Korea, Republic.	1,101	3,116	3,257	3,137
Hong Kong, SAR China	3,995	5,941	7,481	8,031
Viet Nam	43	48	80	151
Philippines	188	409	427	656
Malaysia	197	501	533	762
Indonesia	46	181	263	388
Macao, China	37	48	41	9
East-Timor	0	0	0	6
Laos	0	0	3	0
<b>Total S-E Asia</b>	<b>13,708</b>	<b>22,359</b>	<b>22,460</b>	<b>21,924</b>

Source: Norwegian Seafood Export Council, SSB

#### 3.4.7.1. Singapore

Salmon exports to Singapore have been showing an upward trend, but experience from the economic setbacks in 1997-98 and 2000-02 shows how the salmon market depends on the general economic climate. The recent impact of SARS is also expected to influence salmon consumption, at least in the short term.



About 60% of the 4 million population are considered to have medium to high purchasing power. Salmon is an accepted product in all consumer groups in Singapore.

#### 3.4.7.2. Korea, Republic of

According to Asia Monitor, the Republic of Korea had a BNP/Capita of US\$ 8,800 in 2001 which is anticipated to increase to US\$ 11,100 in 2003. Economic growth of 5% was expected for 2002 increasing to 7% in 2003.

Per capita consumption of seafood is high at 52 kg<sup>29</sup>. Norwegian salmon exports to the Republic of Korea in round weight equivalents reached 3,700 tonnes in 2002. In product weight, 2,300 tonnes of Norway's exports were frozen salmon. Norway exported 750 tonnes of fresh salmon to the country in 2002<sup>30</sup>.

Most of the salmon is imported frozen and then smoked. A small part of the imports is fresh salmon.

#### 3.4.7.3. Malaysia

Malaysia has one of the highest prosperity levels in South-East Asia after Singapore and Brunei. Middle and high income groups constitute 60% of the total population (approx. 15 million out of 23 million people). Per capita fish consumption is among the highest in the world at almost 60 kg<sup>31</sup> and fish is well accepted by all ethnic groups. There are strong preferences for fresh fish.

### 3.5. South America

Although traditionally not large consumers of fish, the countries of South America have benefited from their closeness to the farmed salmon production in Chile. Brazil has already become an important market for salmon and accounted for 9 % of Chile's fresh Atlantic salmon exports in 2001 and 5 % of the frozen Atlantics. Argentina also showed good growth in salmon imports for several years up to the economic crisis in 2002. In both countries, the growing role of super and hypermarkets in food distribution and the large conglomeration of people in the metropolitan areas should facilitate further increases in salmon sales and consumption.

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<sup>29</sup> FAO Fisheries Circular No.821 Revision 6, Food balance sheets 1961-1999

<sup>30</sup> Norwegian Seafood Export Council statistics

<sup>31</sup> Source: FAO Fisheries Circular No. 821 Revision 6, Food balance sheets 1961-1999

## **4. MARKETS FOR OTHER SALMON PRODUCTS**

### **4.1. *Canned Salmon Markets***

Historically, canned salmon was the most important salmon product form. Although most of the world's salmon production is now sold in fresh and frozen markets, canned salmon remains an important and valuable product form for United States, Canadian and Russian salmon capture fisheries.

The United States and Canadian Pacific salmon fisheries were developed in the late 19<sup>th</sup> century following the invention of canning technology by salmon canning companies, which established salmon canneries along the Pacific coast of North American from California to Alaska.

In the 1970s, following technological improvements in freezing and transportation and rapid growth in Japanese demand, a shift to freezing occurred. This can be seen in the share of canned salmon in total Alaska production, shown in Figure 4.1.1. While most pink salmon continued to be canned, there was a dramatic decrease in the canned share of sockeye and chum salmon. In the late 1990s, however, the canned share of sockeye salmon began to rise again, due to the decline in the price of frozen sockeye salmon relative to canned salmon.

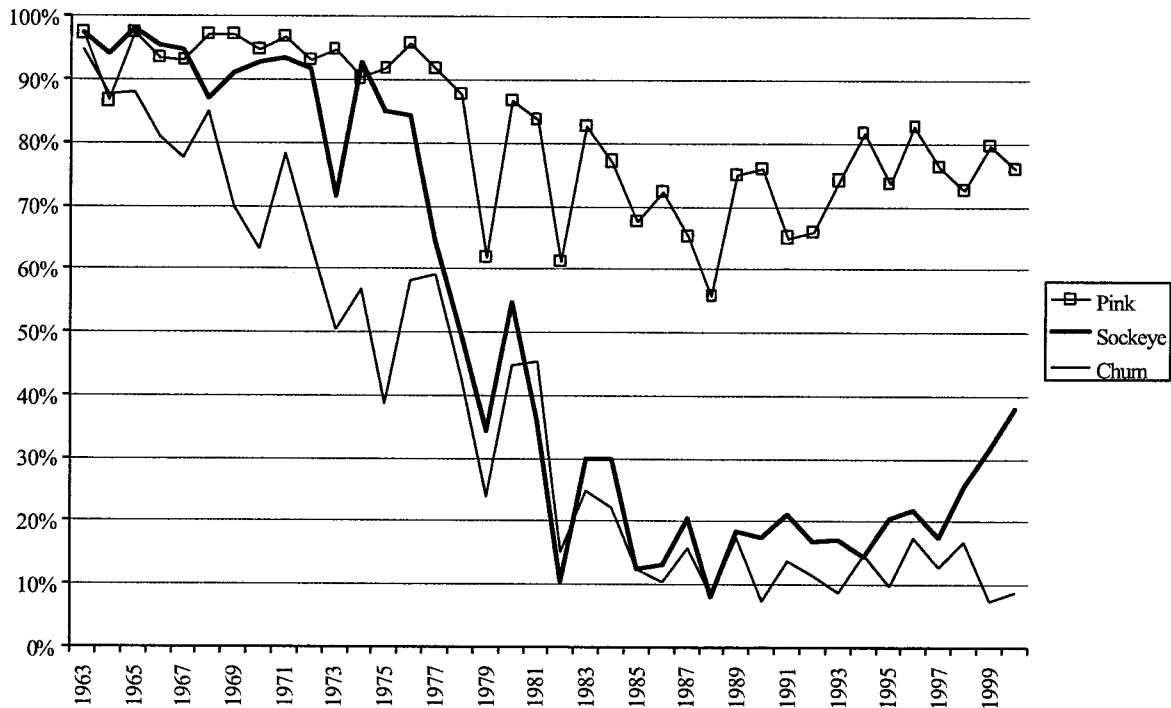
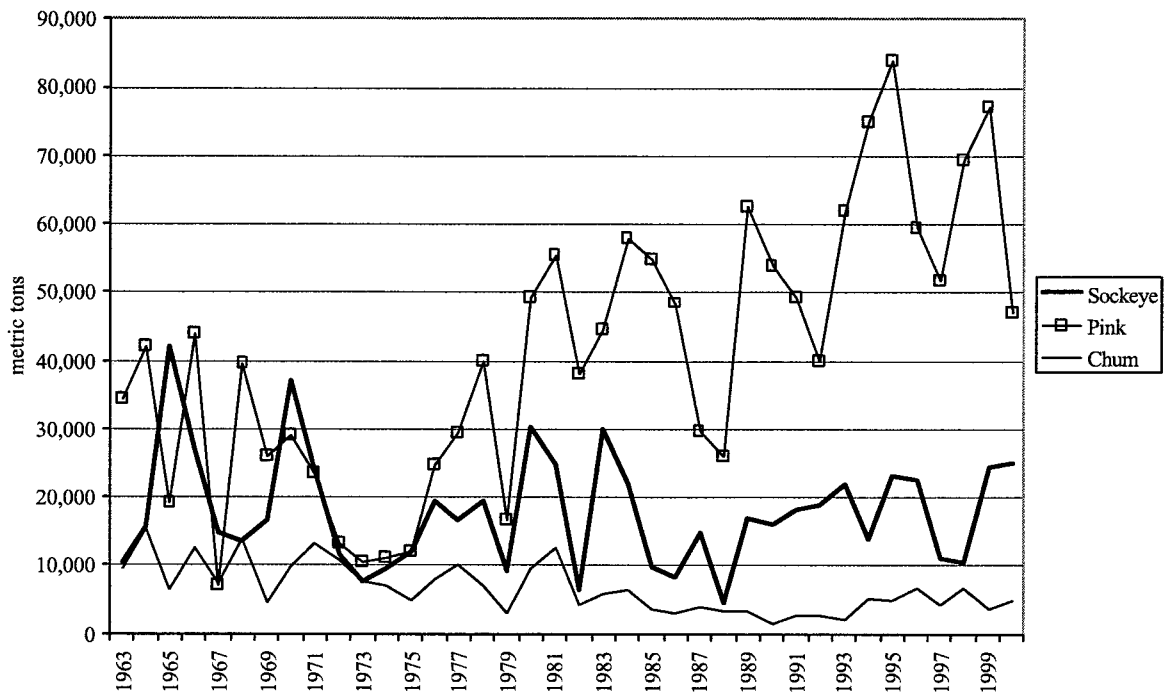


Figure 4.1.1. Canned Share of Alaska Production of Pink, Sockeye and Chum Salmon, 1963-2000

Total canned salmon production depends on both the wild salmon harvest as well as the share of the harvest which is canned. Higher catches led to dramatic increases in canned pink salmon production in the 1980s and 1990s, as shown in Figure 4.1.2. Canned sockeye salmon production has remained at approximately the same volumes as in the 1970s, with the increase in total sockeye salmon catches approximately offsetting the decline in the share of harvests which is canned.



**Figure 4.1.2. Alaska Production of Canned Pink, Sockeye and Chum Salmon 1962-2000, Metric Tonnes.**

As shown in Table 4.1.1, sockeye salmon and pink salmon account for almost all North American canned salmon production. Canned production data by species are not available for Russia, but Russian canned production is primarily pink salmon because pink salmon account for most of the Russian salmon harvest.

**Table 4.1.1. United States and Canadian 1999 Canned Salmon Pack, by Species (Cases, 48-tall Basis).**

Species	United States	Canada	Total
Chinook	2,842	0	2,842
Sockeye	1,211,348	188,583	1,399,931
Coho	43,169	12,599	55,768
Pink	3,956,910	729,703	4,686,613
Chum	174,846	31,400	206,246
<b>Total</b>	<b>5,389,114</b>	<b>962,285</b>	<b>6,351,399</b>

### Canned Salmon Product Forms

The most important North American canned salmon product forms are “talls,” “halves” and “quarters.” Historically, a “tall” was a 1-pound can, a “half” was a ½ pound can, and a “quarter” was a ¼ pound can. Over time, the actual fish weight in a standard can has declined, so that a standard “tall” can now contains 14.25 ounces of fish.

Canned salmon are typically sold in cases of 24 or 48 cans. Production is commonly reported in cases on a “48-tall basis,” or the fish weight equivalent of a case of 48 “tall” cans. On a 48-tall basis, one million cases is equivalent to 20,072 metric tonnes, as illustrated in Table 4.1.2.

Table 4.1.2. Canned Salmon Volume Conversion Factors

Units	Conversion factors	Example
Cases (48 tall)	48 cans/case	1 million cases = 48 million cans
Pounds	14.75 ounces/"tall" can 16 ounces/pound	48 million cans = 44.25 millions pounds
Metric tonnes	2,204.6 pounds/metric tonne	44.25 million pounds = 20,072 metric tonnes

As shown in Table 4.1.3, halves are the most common can size for sockeye salmon, while tall is the most common can size for pink salmon. The relative share of different sizes in the total pack varies from year to year, reflecting annual differences in the regional distribution of harvests (because different regions have different relative capacity for producing cans of different sizes) as well as annual differences in relative prices of cans of different sizes.

Table 4.1.3. United States Canned Salmon Pack, by Size, 2000 and 2001.

	Sockeye salmon		Pink salmon	
	2000	2001	2000	2001
Talls	440,559	247,059	1,894,841	2,938,763
Halves	1,598,988	1,182,379	740,621	1,424,102
Quarters	137,171	36,237	51,835	59,911
<b>Total (48-tall basis)</b>	<b>1,275,006</b>	<b>847,323</b>	<b>2,352,837</b>	<b>3,756,764</b>

Historically, cans of salmon included the skin and bones (which are soft and edible). In recent years, production of “skinless-boneless” canned salmon has increased, which

offers consumers a more attractive product. Another recent new product form has been plastic pouches, which are thermally processed similarly to canned salmon. At present however, these products, which cost more to produce, represent only a small share of total production.

### Canned Salmon Production

Figure 4.1.3 shows FAO figures for canned salmon production for the United States, Canada, ex-USSR and other countries. The United States is the largest producer, followed by ex-USSR or Canada, depending on the year. Total world canned salmon production varies widely from year to year, as it does for all three major producing countries. This reflects high annual variation in harvests of wild Pacific salmon—in particular for pink salmon, which accounts for most of United States and Russian canned salmon production volume.

Other countries producing canned salmon include (in approximate order of volume) Japan, The Republic of Korea, Thailand, Denmark, Norway, Italy, Sweden, France and Chile. Of these, the Korean and Thai production is likely wild salmon harvested in Russia, while production in Chile and by European canneries is from farmed salmon.

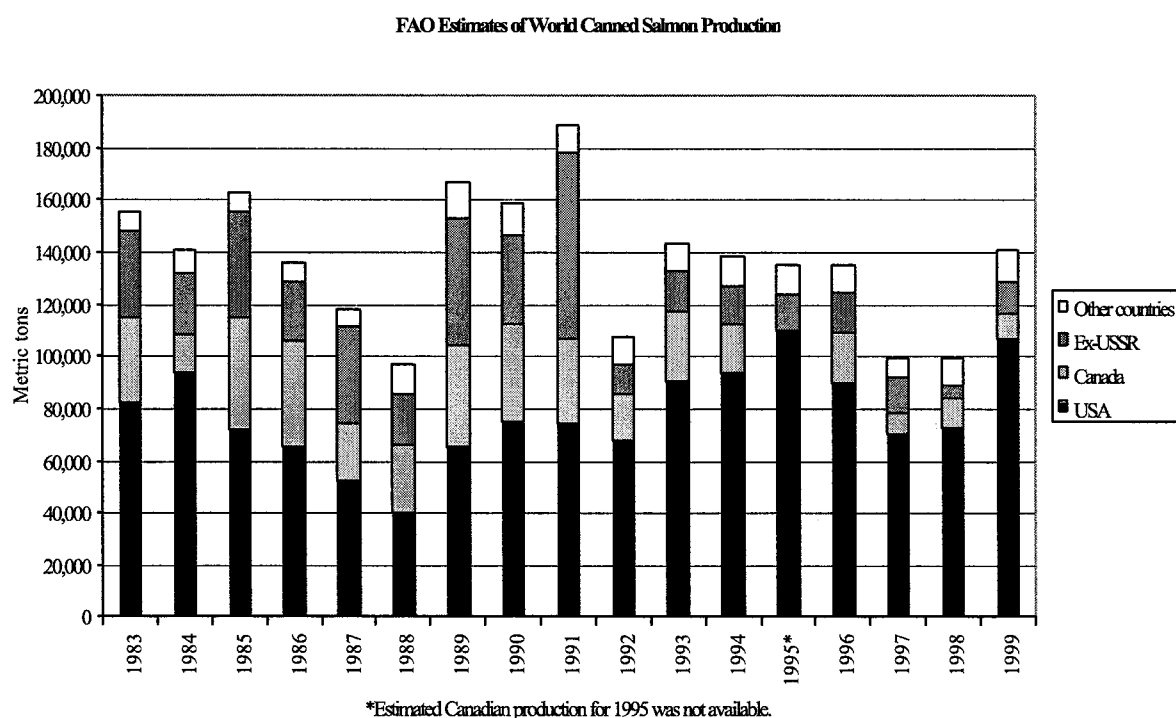


Figure 4.1.3. World Canned Salmon Production 1983-99, Metric Tonnes (Source: FAO).

Table 4.1.4 summarises U.S. and Canadian production of canned sockeye (red salmon) and pink salmon of talls and halves for the years 1985-2001. (Similar data on Russian canned production by species and can size are not available). During this period, the total pack of canned red salmon ranged between 443 thousand cases and 1.6 million cases (between 8.9 and 37.5 thousand metric tonnes) while the total pack of canned pink salmon ranged between 2.0 million cases and 4.9 million cases (between 48.0 and 91.0 thousand metric tonnes). The United States dominates North American production of both canned pink salmon and canned sockeye salmon, although the Canadian share of sockeye salmon is relatively higher. Some of the Canadian production is from salmon harvested in Alaska but canned at plants in Canada.

Table 4.1.4. U.S. and Canadian Production of Canned Salmon (cases, 48-tall basis).

	Canned Red Pack			Canned Pink Pack		
	U.S.	Canada	Total	U.S.	Canada	Total
1985	466,958	590,302	1,057,260	2,639,454	1,067,301	3,706,755
1986	413,635	622,245	1,035,880	2,276,593	970,521	3,247,114
1987	732,559	330,959	1,063,518	1,427,666	613,926	2,041,592
1988	237,183	206,327	443,510	1,378,741	736,300	2,115,041
1989	724,699	644,818	1,369,517	3,278,995	974,181	4,253,176
1990	1,135,417	732,133	1,867,550	2,776,437	806,024	3,582,461
1991	904,770	430,608	1,335,378	3,114,250	1,023,395	4,137,645
1992	914,543	313,759	1,228,302	1,998,340	387,146	2,385,486
1993	1,077,119	638,763	1,715,882	3,243,358	507,602	3,750,960
1994	813,812	307,019	1,120,831	3,640,639	406,416	4,047,055
1995	1,189,623	389,510	1,579,133	4,037,293	843,186	4,880,479
1996	1,118,377	396,049	1,514,426	2,936,474	535,816	3,472,290
1997	578,399	419,509	997,908	2,656,026	268,628	2,924,654
1998	524,391	103,572	627,963	3,429,390	528,994	3,958,384
1999	1,211,348	188,527	1,399,875	3,956,910	730,567	4,687,477
2000	1,275,006	339,632	1,614,638	2,352,837	293,554	2,646,391
2001	847,323	144,813	992,136	3,756,764	488,178	4,244,942

Canned salmon is processed during the summer harvest season but sold over the course of the entire year. As a result, large inventories of canned salmon are built up during the late summer and early fall, which are then drawn down over the winter and spring. Figure 4.1.4 shows U.S. canned pink salmon inventories over a three-year period, 1988-89, 1989-90 and 1990-91 (more recent data are not available). Over this period, progressively larger harvests and canned packs resulted in a progressively larger build-up of stocks. This in turn resulted in lower prices, which stimulated higher consumption and more rapid drawdown of stocks, reflected in a steeper slope on the graph. The level of “carryover” inventories at the start of a new harvest season—an indicator of the tightness of supply conditions for canned salmon—is considered a key market indicator by the industry.

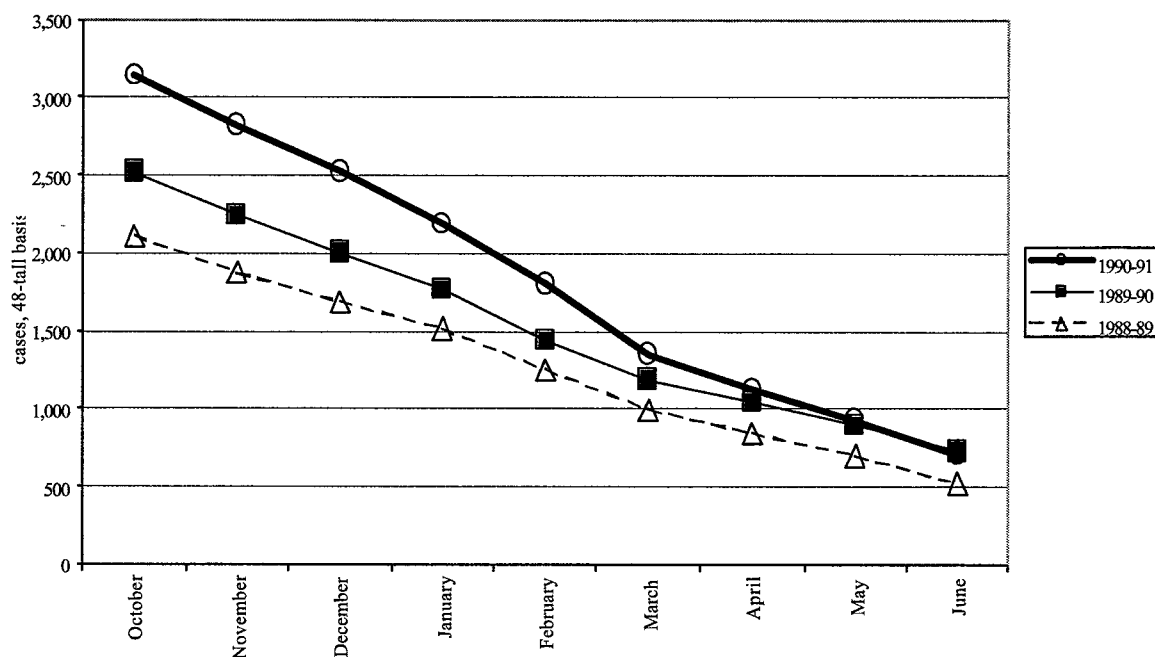


Figure 4.1.4. United States Canned Pink Salmon Stocks, 1988-89 through 1990-91.

### Canned Salmon Markets

The most important markets for canned salmon are the United States, Canada, the United Kingdom, Australia, Belgium and the Netherlands. Table 4.1.5 provides estimates of average annual consumption of canned salmon for these countries for the years 1995-99. These estimates are based on U.S. and Canadian canned production data, FAO estimates of canned production from other countries, U.S. and Canadian export data, and import data for other countries. U.S. and Canadian production was estimated by subtracting average exports from average pack. The estimates of canned sockeye and pink consumption are only for canned salmon produced in the United States and Canada, because data for canned production by species were not available for other countries.



Table 4.1.5. Estimated Average Canned Salmon Production and Consumption, by Country, 1995-99.

Species		Producing Country			Total
		USA	Canada	Other	
Pink salmon	Pack (000 cases, 48-tall basis)	3,403	581		3,985
	Production (MT)	71,860	12,277		84,137
	Exports (MT)	18,483	5,779		24,262
	<i>Estimated consumption (MT):</i>				
	United States	53,377	120		53,497
	Canada	6,977	6,498		13,474
	United Kingdom	6,004	1,907		7,911
	Australia	2,642	793		3,435
	Belgium	354	825		1,180
	Netherlands	1,068	278		1,346
Other countries	1,438	1,856		3,294	
Sockeye salmon	Pack (000 cases, 48-tall basis)	924	299		1,224
	Production (MT)	19,520	6,323		25,842
	Exports (MT)	19,085	3,730		22,815
	<i>Estimated consumption (MT):</i>				
	United States	435	54		489
	Canada	3,443	2,593		6,036
	United Kingdom	11,840	2,822		14,662
	Australia	1,697	371		2,067
	Belgium	209	76		285
	Netherlands	1,383	54		1,436
Other countries	512	354		867	
Total	Pack (000 cases, 48-tall basis)	4,586	951	n.a.	n.a.
All Species	Production (MT)	96,844	20,087	22,274	139,205
	Exports (MT)	41,353	9,997	n.a.	51,349
<i>Estimated consumption (MT):</i>					
	United States	55,491	177	0	55,668
	Canada	12,230	10,090	0	22,320
	United Kingdom	18,646	4,892	1,905	25,443
	Australia	4,596	1,231	n.a.	n.a.
	Belgium	593	927	n.a.	n.a.
	Netherlands	2,755	358	1,669	4,782
	Other countries	2,533	2,411	18,700	30,991

Note: United States and Canadian consumption estimated as production minus exports. Consumption in other countries estimated as United States and Canadian exports plus imports from other countries.

The United States is by far the biggest end-market for North American canned pink salmon. U.S. exports of canned pink salmon averaged only about 29% of total production for the years 1995-99. In contrast, the United Kingdom is the largest market for canned sockeye salmon. Comparing production and export data suggests that almost all United States canned sockeye salmon production is exported.

It is likely that much of the canned salmon produced in Russia is also consumed in Russia. However, we do not have sufficient data to estimate actual Russian consumption.

### United States Canned Salmon Market

Figure 4.1.5 shows United States per capita consumption of canned fish products. Per capita canned salmon consumption varies widely from year, reflecting differences in the canned pack and available supply and related changes in retail prices and promotions. Between 1980 and 2001, per capita consumption of canned salmon varied from a low of 0.14 kilograms per capita to a high of 0.27 kilograms per capita. U.S. consumption of canned fish is dominated by canned tuna. During the same time period, per capita canned salmon consumption was between 8% and 19% of per capita canned tuna consumption.

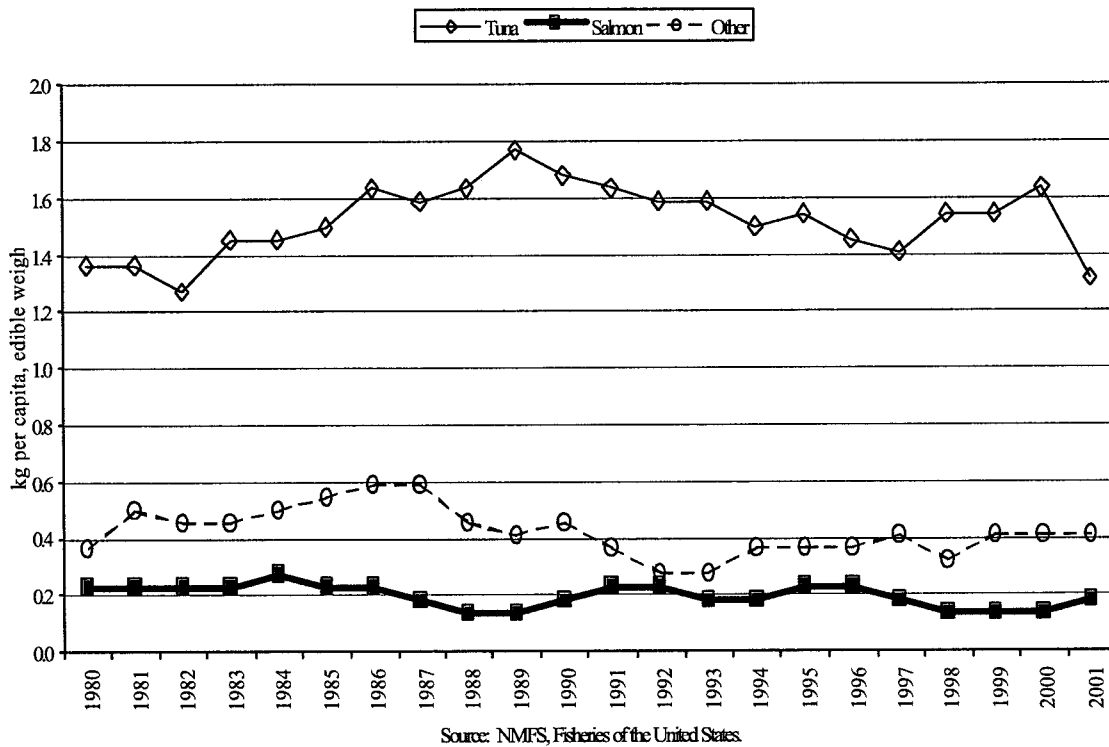


Figure 4.1.5. United States Kg / Per Capita Consumption of Canned Fish Products, 1980-2001.

The United States has two distinct markets for canned pink salmon and canned sockeye salmon. The canned pink market is much larger than the canned sockeye market. As shown in Figure 4.1.6, canned pink salmon prices typically range between \$1.50 and \$2.00 for a 14.75 ounce “tall” can. Consumption varies widely by region, with the highest consumption in the southeast. As shown in Figure 4.1.7, canned pink salmon consumption peaks is highly seasonal, peaking in March. Canned pink salmon is used in sandwiches and wraps, or to make a fried salmon patty. Its low price makes it especially attractive to low-income households, including a large portion of retired citizens.

In the United States market canned sockeye is a higher-priced product, with average retail prices per tall can generally ranging between \$3.50 and \$5.00 per pound. Canned reds are most commonly used in mousses, pates and terrines.

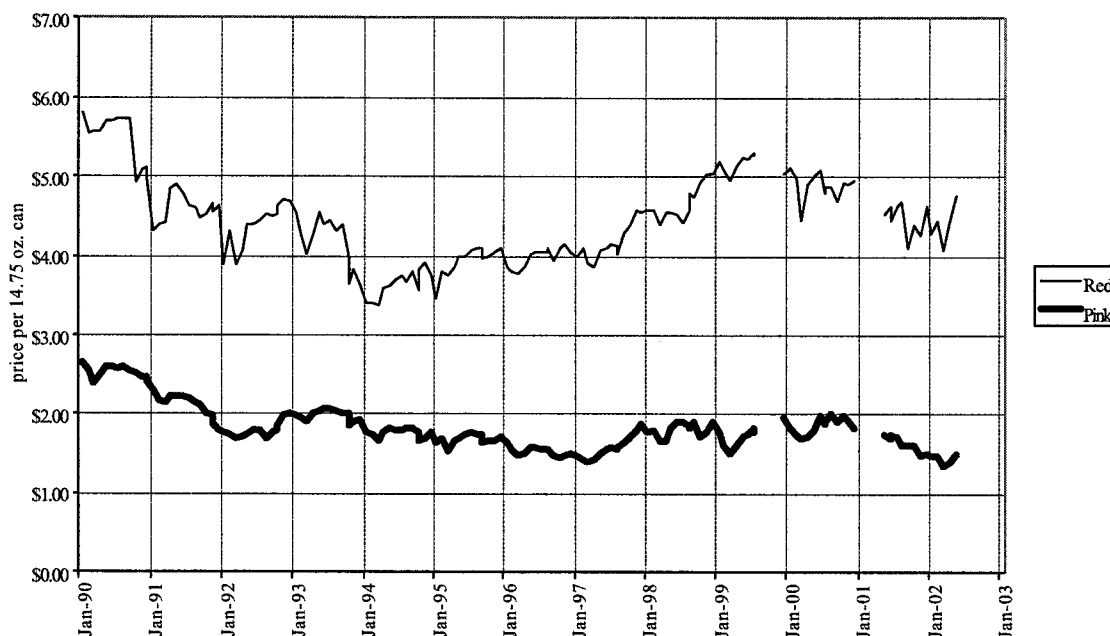


Figure 4.1.6. Average Retail Prices for Canned Salmon in United States Supermarkets.

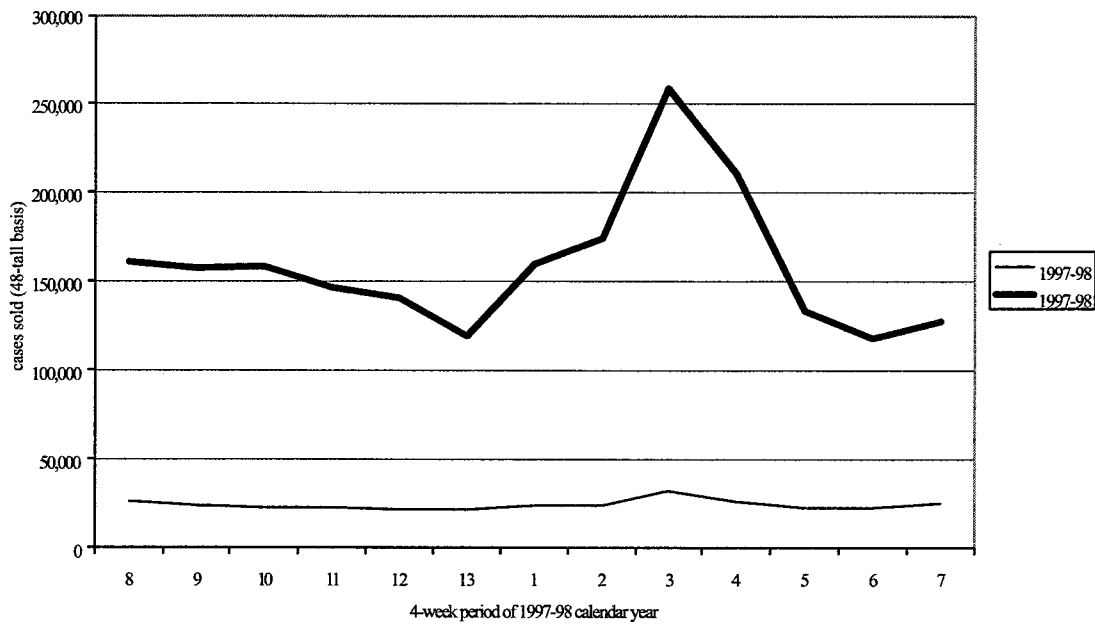


Figure 4.1.7. Monthly Sales of Canned Salmon in U.S. Supermarkets, 1997-98.

#### European Canned Salmon Market

As shown by the import data in Table 4.1.6, in recent years European canned salmon consumption has ranged between 30 and 60 thousand tonnes. Total consumption varies widely from year to year, reflecting variation in wild supply. The United Kingdom accounts for by far the largest share of canned salmon consumption, followed by the Netherlands, France and Belgium and Luxembourg. Local niche markets for canned farmed salmon exist mainly in France and Italy but also in Spain, Greece and Germany.

Table 4.1.6. Imports of Canned Salmon in Selected European Countries (1000 metric tonnes).

	UK	Netherlands	France	Belgium & Luxembourg	Ireland	Germany	Italy	Finland	Total
1984	21.5	5.7	3.1	2.3	1.1	n.a.	0.6	0.2	34.5
1985	18.9	4.9	2.5	2.4	0.9	n.a.	0.7	0.1	30.4
1986	27.7	5.3	4.0	3.0	1.2	n.a.	0.8	0.2	42.2
1987	25.7	5.6	3.9	3.3	1.6	n.a.	0.9	0.3	41.3
1988	21.3	5.2	3.6	2.6	1.2	0.2	0.8	0.1	35.0
1989	19.4	4.9	4.7	2.5	1.0	0.3	0.7	0.2	33.7
1990	24.4	6.1	3.8	2.9	1.4	0.4	1.0	0.2	40.2
1991	34.1	6.1	2.4	2.8	1.9	0.7	1.1	0.1	49.2
1992	30.9	6.7	2.3	2.8	2.2	0.6	1.7	0.2	47.4
1993	28.7	5.0	2.9	3.0	1.8	0.5	1.6	0.2	43.7
1994	31.1	5.9	3.7	2.9	2.3	1.6	1.5	0.2	49.3
1995	24.7	5.8	2.7	3.2	2.1	2.3	1.1	0.2	42.1
1996	29.9	6.4	2.6	2.8	2.1	2.6	1.0	0.2	47.6
1997	27.3	5.8	2.7	2.8	1.7	3.7	0.9	0.1	45.0
1998	24.3	6.4	3.1	2.6	1.9	4.0	0.7	0.2	43.2
1999	22.5	5.7	2.8	2.8	1.8	2.9	0.8	0.1	39.3
2000	28.2	5.8	2.9	3.2	1.7	3.2	0.7	0.2	45.9
2001	41.1	6.1	2.1	2.8	2.6	2.6	0.5	0.1	57.9

#### Canned Salmon Prices

Table 4.1.7 shows average wholesale case prices for Alaska canned salmon. Prices peaked in 1987 and 1988 due to two consecutive years of low harvests and low canned salmon packs. Wholesale prices fell sharply between 1989 and 1991, and have since fluctuated while trending downwards.

Table 4.1.7. Average Wholesale Case Prices for Alaska Canned Salmon (48-tall basis).

	Pink talls	Pink halves	Sockeye talls	Sockeye halves
1985-86	\$56.35	\$32.01	\$118.82	\$77.58
1986-87	\$69.31	\$41.13	\$187.28	\$96.87
1987-88	\$94.08	\$55.99	\$172.00	\$91.57
1988-89	\$129.79	\$76.69	\$233.58	\$129.60
1989-90	\$79.96	\$49.32	\$169.40	\$92.07
1990-91	\$68.84	\$39.24	\$130.31	\$79.48
1991-92	\$54.20	\$31.54	\$122.69	\$69.97
1992-93	\$66.01	\$43.87	\$125.63	\$77.99
1993-94	\$54.96	\$35.95	\$94.50	\$57.84
1994-95	\$49.69	\$35.99	\$118.57	\$78.42
1995-96	\$45.62	\$27.47	\$119.06	\$78.62
1996-97	\$43.45	\$27.69	\$118.55	\$74.79
1997-98	\$53.08	\$37.94	\$138.82	\$79.93
1998-99	\$48.81	\$31.69	\$161.04	\$96.16
1999-00	\$43.48	\$26.83	\$123.03	\$85.02
2000-01	\$49.54	\$33.79	\$108.54	\$62.05

In the short-term, prices for canned salmon are driven by the available supply. Prices fall when the canned pack is large, and especially when there is a large pack combined with large carryover inventories at the start of the season. This may be seen in Figures 4.1.8 and 4.1.9, which compare two-year running averages of the total North American canned sockeye and pink salmon packs with two-year running averages of the average wholesale case prices. We use two-year running averages because a substantial portion of the pack in any given year may be carried over for sale in the following year. For both species, there is a clear inverse relationship between pack and average case price.

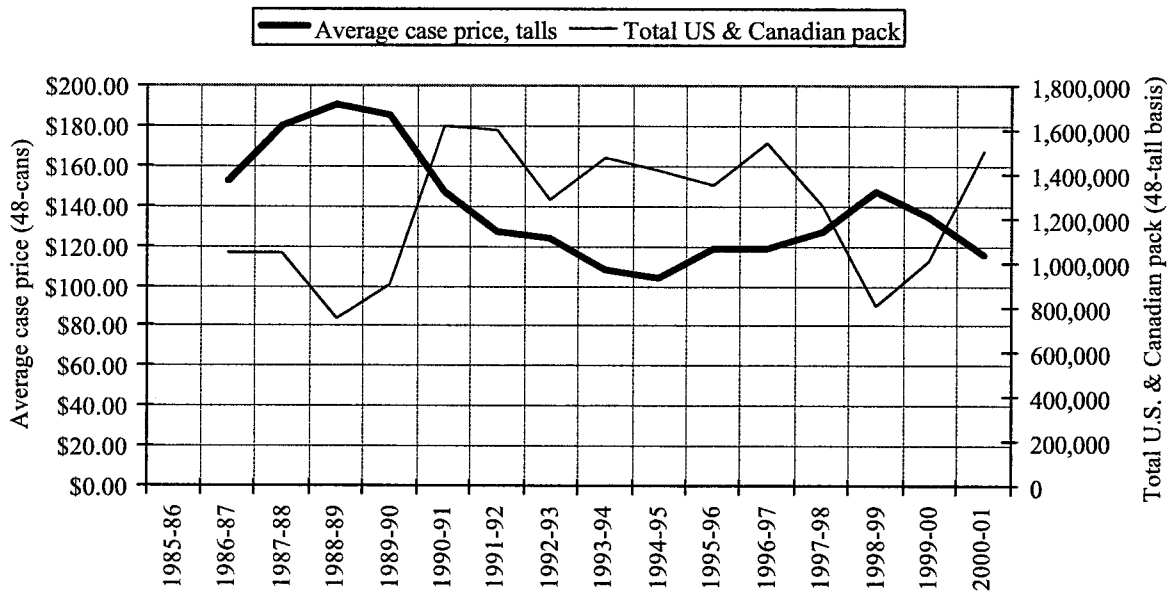


Figure 4.1.8. Alaska Sockeye Salmon Case Prices and North American Canned Sockeye Pack, Two Year Running Averages.

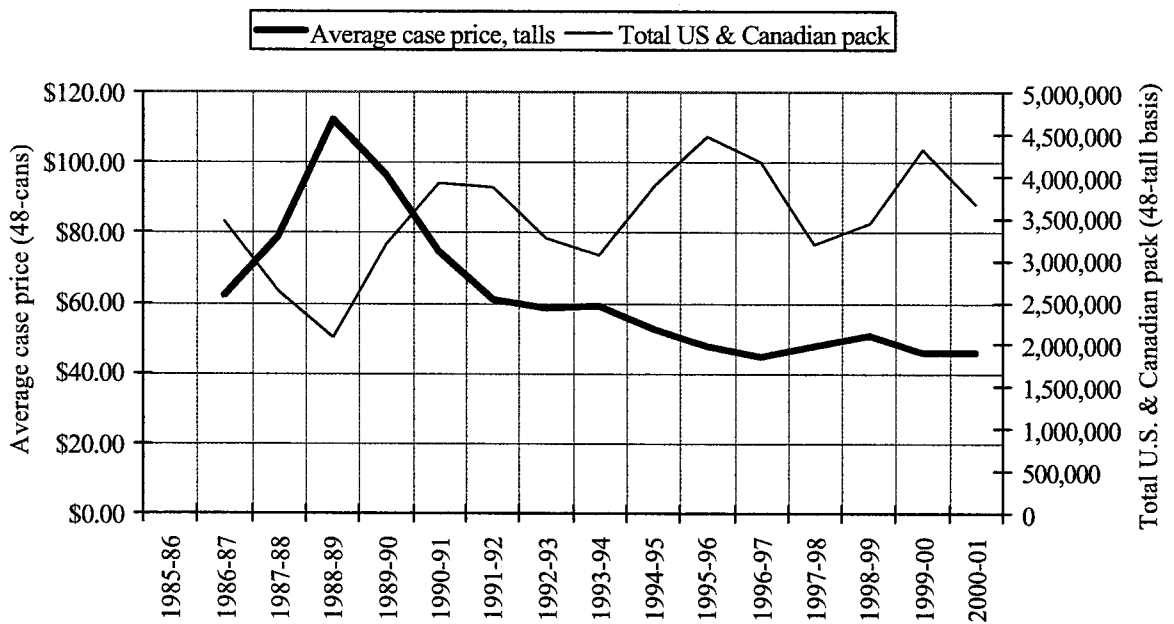


Figure 4.1.9. Alaska Pink Salmon Case Prices and North American Canned Pink Pack, Two Year Running Averages.

## 4.2. *The Salmon Roe Market*

As female salmon mature, they produce eggs or roe. Salmon roe is an important and valuable salmon product, especially in the Japanese and Russian markets. Although most of the world's salmon roe production is from wild salmon, production of roe from farmed salmon and trout is growing in importance and offers considerable economic opportunity for the future. In this section, we briefly review world markets for salmon roe. We focus on Alaska production for the Japanese market because more data are available for these areas than for other producing areas and markets.

### Salmon Roe Products

There are two main salmon roe products, to which we refer here by their Japanese names: *sujiko* and *ikura*. *Sujiko* is salmon eggs sold in whole skeins. *Sujiko* is consumed primarily in Japan. *Ikura* is individual salmon eggs or salmon caviar. *Ikura* is consumed in Japan, Russia and Europe. (The Russian word for "caviar" is *ikra*.) *Sujiko* accounts for about 60% of Japanese salmon roe consumption and *ikura* accounts for about 40%.

Most of the roe from wild Alaska salmon species other than chum salmon is processed into *sujiko*, which is considerably easier to produce than *ikura*. To make *sujiko*, egg skeins are removed from the fish, soaked in brine, and then sorted, culled (for broken skeins) and graded by color and size. They are then carefully packed in wooden boxes and dried for several days at air temperature. Heavy weights are placed on pallets of eggs to compress the eggs in the boxes. High quality *sujiko* requires firm, unbroken skeins and full, tender eggs.

In Japan, *sujiko* is eaten both in restaurants and at home. In restaurants, *sujiko* is cut into bite-size pieces and served with soy sauce and grated radish along with hot sake. At home *sujiko* is usually served over steamed rice.

*Ikura* for the Japanese market is produced primarily from chum salmon eggs. This is partly because chum salmon have larger eggs than other species, which are easier to pick up with chopsticks. In addition, chum salmon are the primary salmon species native to Japanese waters, and were the traditional species used for *ikura* in Japan.

To make *ikura*, egg skeins are soaked in brine for a few minutes to firm the eggs up slightly. Then the eggs are manually rubbed off from the skeins through a screen into a brine, which further firms up the whole egg. The eggs are then sorted, culled to remove broken eggs, and dried at air temperature to drain the brine and complete the curing process. More modern technologies use enzymes to dissolve salmon skeins, rather than rubbing the eggs off the skeins.



For high-quality ikura, individual egg shells must be tender and easy to chew, with uniform egg size and a transparent, bright orange-red colour. In Japan, ikura is consumed in sushi bars wrapped in dried seaweed, and at home sprinkled raw on steamed rice.

In wild salmon, the quality of the roe improves as the salmon enter fresh water, while skin colour and flesh quality begin to deteriorate. For this reason, roe quality is highest for “terminal” wild salmon fisheries in which harvests occur in or near the rivers to which the salmon are returning. In contrast, the fish flesh from terminal wild salmon fisheries is generally considered to be of lower quality.

To date, relatively little roe is produced from farmed salmon, because most farmed salmon are harvested well before they start to mature sexually. Thus most world salmon roe production is from wild salmon. However, production of roe from Scandinavian farmed trout, considered to be of high quality, is increasing and could have significant effects on future roe markets.

#### Alaska Salmon Roe Production

Table 4.2.1 provides an overview of Alaska salmon roe production. The data in the table do not distinguish between ikura and sujiko production. In general, however, most chum salmon roe is ikura and most roe production from other species is sujiko. Variation between species and between years in the relative shares of these two products accounts for some of the differences between species and from year to year.

Roe volume as a percentage of total harvest volume (referred to as “roe yield”) varies between species as well as from year to year. In general, roe yields are higher for chum salmon than for other species.

Prices are lowest for pink salmon roe. Between 1995 and 2001, prices for pink salmon roe ranged between \$5.07/kg and \$11.03/kg. Prices are highest for chum salmon roe. Between 1995 and 2001, prices for chum salmon roe ranged between \$11.57/kg and \$24.51/kg.

During the years 1995-2001, the total value of Alaska salmon roe production was between \$50 million and \$155 million. Thus roe was clearly a highly valuable product. Roe value accounted for between 9% and 21% of the total wholesale value of Alaska salmon. However, roe accounted for a much higher share of the wholesale value of Alaska chum salmon. In 1999, when chum salmon roe prices were high due to low Japanese ikura production (because of low Japanese fall chum catches), the wholesale value of the roe produced from Alaska chum salmon exceeded the wholesale value of the flesh.

**Table 4.2.1. Overview of Alaska Salmon Roe Production Volume and Value, 1995-2001**

	Species	1995	1996	1997	1998	1999	2000	2001
Roe volume as % of harvest volume	Chinook	2.8%	5.9%	1.8%	1.8%	1.8%	1.6%	3.6%
	Sockeye	1.7%	1.8%	2.1%	1.8%	1.8%	1.9%	2.3%
	Coho	2.3%	2.1%	1.8%	1.5%	1.6%	2.4%	1.9%
	Pink	1.7%	1.0%	1.7%	1.6%	1.3%	2.8%	2.2%
	Chum	3.8%	3.4%	2.9%	3.3%	3.3%	4.1%	4.1%
	TOTAL	2.0%	1.9%	2.1%	2.0%	1.9%	2.9%	2.5%
Roe volume (metric tonnes)	Chinook	155	241	98	82	61	43	96
	Sockeye	2,745	2,611	1,797	1,071	2,005	1,756	1,768
	Coho	502	430	190	255	210	348	279
	Pink	3,273	1,475	1,994	2,696	2,551	3,156	4,281
	Chum	2,511	2,893	1,866	2,434	2,747	3,985	2,411
	TOTAL	9,185	7,650	5,945	6,538	7,575	9,287	8,836
Average wholesale price of roe (\$/kilogram)	Chinook	\$9.98	\$9.08	\$7.64	\$7.60	\$7.62	\$11.48	\$13.40
	Sockeye	\$13.43	\$10.43	\$9.77	\$9.51	\$11.14	\$11.09	\$10.18
	Coho	\$10.06	\$8.24	\$6.64	\$7.29	\$8.52	\$10.63	\$10.24
	Pink	\$6.00	\$5.07	\$5.38	\$5.50	\$7.30	\$10.63	\$11.03
	Chum	\$15.18	\$11.57	\$10.79	\$13.36	\$16.19	\$24.51	\$19.52
	TOTAL	\$11.02	\$9.66	\$8.48	\$9.18	\$11.58	\$16.68	\$13.18
Roe value (\$1000)	Chinook	1,544	2,193	747	622	465	492	1,289
	Sockeye	36,857	27,232	17,560	10,188	22,345	19,481	18,008
	Coho	5,048	3,539	1,262	1,863	1,793	3,696	2,857
	Pink	19,633	7,475	10,727	14,833	18,618	33,546	47,209
	Chum	38,128	33,487	20,139	32,516	44,477	97,682	47,058
	TOTAL	101,210	73,927	50,436	60,022	87,697	154,896	116,422
Roe value as share of total wholesale value of Alaska salmon products	Chinook	5.1%	10.1%	2.8%	3.1%	2.0%	3.1%	8.3%
	Sockeye	6.6%	4.6%	5.0%	3.5%	4.8%	5.8%	7.8%
	Coho	6.5%	6.2%	3.9%	4.1%	4.1%	8.5%	8.3%
	Pink	7.3%	4.5%	6.2%	6.7%	8.0%	20.1%	21.1%
	Chum	36.9%	41.4%	26.3%	38.0%	44.1%	58.3%	47.9%
	TOTAL	9.8%	8.0%	7.6%	9.1%	10.1%	21.2%	19.3%

Table 4.2.2. provides an overview of United States salmon roe exports based on United States trade statistics. Comparing Tables 4.2.1 and 4.2.2, it is apparent that most United States salmon roe production is exported to Japan. The trade data do not distinguish between sujiko and ikura, or between roe of different species. Reported export volumes and values correspond roughly with those shown in Table 4.1.1 for Alaska salmon production, except that reported export values are significantly less than reported wholesale values for the years 1998-2001. One possible explanation may be that the different data sources use different definitions of "value."

**Table 4.2.2. Overview of United States Salmon Roe Exports, 1995-2001**

	Species	1995	1996	1997	1998	1999	2000	2001
Export volume (metric tonnes)	Japan	10,824	11,935	7,301	6,365	6,088	7,771	7,464
	Other countries	516	742	632	770	1,258	958	1,163
	Total	11,339	12,677	7,934	7,136	7,346	8,729	8,627
Export value (\$1000)	Japan	124,384	93,364	58,308	47,430	62,407	92,422	75,017
	Other countries	4,074	4,401	5,176	3,252	8,307	7,135	8,034
	Total	128,458	97,765	63,484	50,682	70,714	99,557	83,051
Average price (\$/kilogram)	Japan	\$11.49	\$7.82	\$7.99	\$7.45	\$10.25	\$11.89	\$10.05
	Other countries	\$7.90	\$5.93	\$8.19	\$4.22	\$6.60	\$7.45	\$6.91
	Total	\$11.33	\$7.71	\$8.00	\$7.10	\$9.63	\$11.41	\$9.63

The United States accounts for by far the largest share of Japanese imports of sujiko and ikura (Table 4.2.3). Import volumes of sujiko declined from 1996 to 2001, reflecting lower sockeye salmon harvests, while import volumes of ikura increased until 2000 due to higher United States Chum salmon harvests.

**Table 4.2.3. Japanese Salmon Roe Imports, 1996-2001 (metric tonnes)**

Product	Country	1996	1997	1998	1999	2000	2001
Sujiko	Russia	113	46	42	58	64	98
	Canada	194	310	165	147	131	150
	USA	5,945	5,260	3,716	3,617	3,451	3,104
	Norway	1	9	124	85	43	3
	Denmark	423	573	575	578	596	665
	Finland	264	235	206	308	295	312
	Chile	286	167	154	130	76	78
	TOTAL	7,243	6,604	4,990	4,888	4,662	4,410
Ikura	Russia	19	38	49	236	161	194
	Canada	370	296	734	569	454	325
	USA	2,030	1,607	2,518	3,156	4,370	3,280
	TOTAL	2,428	1,950	3,315	3,985	5,015	3,994

Salmon roe prices vary from year to year, reflecting changes in Japanese domestic supply (primarily ikura from fall chum harvests) and import supply (Table 4.2.4). The sharp peak in ikura prices in 2000 resulted from very low fall chum harvests, which reduced domestic ikura supply.

Table 4.2.4. Average Annual Japanese Import Prices for Salmon Roe, 1996-2001 (yen/kilogram)

Product	1996	1997	1998	1999	2000	2001
Sujiko	1,411	1,306	1,473	1,525	1,474	1,558
Ikura	1,986	2,002	2,142	2,166	2,859	2,555

Table 4.2.5 shows wholesale prices for various salmon roe products at the Tokyo Central Wholesale Market in October of 2002. The table provides an indication of the variety of products available and the price ranges for which they were selling. Prices vary significantly by species, origin and grade. Farmed salmon trout sujiko from Denmark and Finland commanded prices comparable to higher priced wild sockeye salmon sujiko.

Table 4.2.5. Wholesale Price at the Tokyo Central Wholesale Market, October 1-10, 2002

Product	Species	Origin	Grade	Low price (yen/kg)	High price (yen/kg)	Low price (\$/kg)	High price (\$/kg)
Sujiko	Sockeye salmon	Alaska Bristol Bay	Grade 1	2,900	3,000	\$23.77	\$24.59
			Grade 2	2,500	2,600	\$20.49	\$21.31
			Grade 3	2,100	2,200	\$17.21	\$18.03
		Alaska Prince William Sound	Grade 1	3,000	3,100	\$24.59	\$25.41
			Grade 2	2,600	2,700	\$21.31	\$22.13
			Grade 3	2,200	2,300	\$18.03	\$18.85
		Alaska Port Moller	Grade 1	3,100	3,200	\$25.41	\$26.23
			Grade 2	2,800	2,900	\$22.95	\$23.77
			Grade 3	2,500	2,600	\$20.49	\$21.31
	Pink salmon	Alaska Prince William Sound	Grade 1	1,800	2,000	\$14.75	\$16.39
			Grade 2	1,400	1,600	\$11.48	\$13.11
			Grade 3	1,000	1,200	\$8.20	\$9.84
	Salmon trout	Denmark	Grade 1	3,200	3,400	\$26.23	\$27.87
			Grade 2	2,800	3,000	\$22.95	\$24.59
			Grade 3	2,400	2,600	\$19.67	\$21.31
Salmon trout	Finland	Grade 1	2,900	3,000	\$23.77	\$24.59	
		Grade 2	2,500	2,600	\$20.49	\$21.31	
		Grade 3	2,100	2,200	\$17.21	\$18.03	
Ikura	Chum salmon	Japan		4,200	4,500	\$34.43	\$36.89
		Alaska Southeast		3,000	3,100	\$24.59	\$25.41

Note: prices in \$/kg were calculated using an exchange rate of 122 yen per dollar.

### 4.3. Smoked Salmon

In most markets, the traditional way of consuming salmon was as smoked salmon. Usually it was imported as a finished product or produced locally based on imported raw material from capture fisheries. It was highly priced and distributed through speciality stores and delicatessen. Demand was seasonal and mainly linked to the Christmas and Easter holidays or to other occasions of celebrations. This situation changed in the 1980s and early 1990s. The farmed salmon industry with its availability of all year round supplies in nearly unlimited quantities made the smokehouses increase their production and target the super and hypermarkets in the distribution of their products.

Smoked salmon today has almost become ubiquitous in world markets with the raw material sourced from most available sources. The market however is extremely fragmented. Products in all price categories can be found in most countries with price depending on the scarcity of the raw material, the fillet size, whether it is wild or farmed, and especially on the production process. Production cost is strictly correlated with product yield, and the more the salmon is trimmed, the higher the cost. Likewise, the different methods of salting have wide implications on cost; salting by hand is naturally more expensive than by salt injection not only in terms of labour costs but also in yield as the former method makes the product lose weight whereas the latter adds weight.

Table 4.3.1. Smoked Salmon Production 1996-2001, Metric tonnes

Country	1996	1997	1998	1999	2000	2001
France	19,748	20,196	16,529	19,104	19,000	20,000
Denmark	13,645	14,644	14,418	15,787	15,663	16,261
Germany	6,011	5,063	5,409	8,040	15,112	12,963
United Kingdom	12,000	11,000	10,090	10,498	10,249	9,187
United States	4,072	5,116	5,348	5,556	5,251	5,425
Japan	8,612	7,853	5,804	5,091	4,591	4,600
Spain	1,976	2,113	2,860	3,207	4,000	3,309
Norway	2,350	2,446	2,677	3,255	3,359	3,602
Netherlands	3,600	3,668	3,496	3,315	3,049	3,060
Belgium	2,802	2,773	2,676	2,396	2,543	2,617
Russian Fed.	n.a.	2,457	1,650	1,402	1,530	1,428
Canada	658	501	437	312	529	658
Italy	354	619	500	500	500	1,200
Faeroe Islands	671	407	657	379	453	711
Ireland	375	357	336	407	453	424
New Zealand	138	246	197	228	235	216
Chile	596	689	612	611	186	343
Sweden	n.a.	83	157	19	152	221
<b>Total</b>	<b>77,686</b>	<b>80,302</b>	<b>73,905</b>	<b>80,333</b>	<b>86,969</b>	<b>86,270</b>

Source: FAO

In Europe, the large continental producers smoke mainly for the domestic market whereas Denmark, Norway, and the United Kingdom have significant exports. Italy has some local production but the majority of consumption is based on imported smoked salmon with 6,500 tonnes imported in 2000.

Total smoked salmon imports in 2001 as reported by FAO reached more than 36,000 tonnes. One decade earlier, in 1990, imports were a mere 12,680 tonnes.

Table 4.3.2. Smoked Salmon Imports 1996-2001, Metric tonnes.

<b>Country</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>
Germany	6,715	6,612	8,357	8,078
Italy	5,654	5,743	6,451	6,262
Belgium	2,821	2,861	2,816	2,654
France	3,027	2,831	2,810	2,760
Netherlands	1,739	2,984	2,275	1,227
Denmark	2,124	1,808	2,236	2,086
USA	973	1,543	1,823	2,235
Austria	923	850	938	1,450
Poland	688	932	856	347
Greece	171	504	766	2,793
Switzerland	641	712	709	796
Japan	611	520	552	596
Spain	335	218	449	438
Sweden	405	403	359	234
United Kingdom	124	366	334	404
Australia	196	272	303	484
Mexico	98	99	283	469
Canada	242	291	240	32
China, Hong Kong SAR	174	183	206	161
<b>World total</b>	<b>29,394</b>	<b>31,578</b>	<b>34,822</b>	<b>36,033</b>

Source: FAO

#### **4.4. Organic Salmon**<sup>32</sup>

Organic production of salmon requires complete control with all inputs, hence organic salmon is a farmed product. In order to be certified organic, the production has to comply with a set of production standards such as disease treatment, fish density, feed quality, processing, fish welfare, etc. Organic production of salmon is based on four principles. First, consumers are supposed to know what they are eating, that is, what the product contains and how it is produced. Second, the salmon's welfare has to be considered in such a way that its natural needs are attended to. Third, organic production is supposed to be sustainable with an effective use of resources and with minimal pollution. And fourth, the food shall not contain chemical components that are potentially damaging for humans. Organic production requires organic certification of all parts of the value chain, including feed producers and slaughtering houses.

The certification is detailed in rules set up by organic certification organisations. The origin of these organisations was to counter negative impacts due to the intense industrialisation of agriculture. There are several such organisations around the world, and those in Norway, Sweden, Germany, and the United Kingdom have set up specific rules for certification of organic salmon. The certification bodies are organised by the International Federation of Organic Agriculture Movements (IFOAM). The certification, however, is not limited to the industry in the home country of the certification organisation. An Irish salmon farm, for instance, is certified by a German certification organisation. This over-national contact makes sense, as the market for the products is international.

Some argue that a wild salmon is an organic salmon, but this is not correct. Organic certification means that a certification organisation guarantees a certain level of different production inputs, and in order to accomplish this a detailed control and surveillance system is necessary. The organisations require compliance with these rules in order to issue permissions to use the organic label in product marketing.

Organic produce has demonstrated a remarkable increase in the food markets over the past few years. Recent incidents such as BSE, salmonella pandemics, dioxin controversies, the debate over GMO in food production, and even the foot and mouth disease have raised consumers' awareness and scepticism of the procedures of industrial food production. Consumers look for systems that convey trust and confidence as part of the food quality. In addition, the principle of free trade has been strengthened. This implies a reduction of old systems that controlled food quality. In accordance with liberal philosophy, more responsibility for choosing between "good" and "bad" are now put in the hands of the consumers. For the consumers to be able to make these choices,

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<sup>32</sup> This section is largely based on a contribution by Bernt Aarset, Centre for Fisheries Economics.

they have to be informed. Hence labelling, and an organic label is one in a spectrum of such labels.

In short, the development is supply as well as demand driven. It is demand driven in the way that there is an increasing demand for organic products in general. However, no one demanded organic salmon until a test production was launched, initiated, and implemented by a group of industrial actors.

Organic salmon production is still very small, measured by production volume. However, changes in European legislation require more documentation of any industrially manufactured food product and thus make a direct comparison with conventionally produced salmon simpler. An increase in demand for this product is thus expected. In addition, price premiums for organic salmon are accepted by niche consumers, although costs of production are also higher.

The producer countries are currently the United Kingdom, Ireland and Norway. Consumption is expected to take place in western markets that already have a high demand for organic products such as North European countries, North America and probably Japan.



## 5. APPENDICES

### 5.1. *Wild Pacific Salmon Harvest Data*

In this appendix we review the sources of data for wild Pacific salmon harvests used in this report. Different data sources for wild salmon harvests vary widely. There are numerous inconsistencies in data from international, national and regional sources. In addition, data from the same sources are frequently revised.

One international source of data for wild salmon harvests is the FAO FISHSTAT+ database. FISHSTAT+ is a set of software and databases developed and maintained by FAO to provide access to various FAO fisheries statistics. The software and databases may be found at [www.fao.org/fi/statist/FISOFT/FISHPLUS.asp](http://www.fao.org/fi/statist/FISOFT/FISHPLUS.asp).

For this report, we use FAO FISHSTAT+ data for wild Pacific salmon harvests except where FAO FISHSTAT+ differ substantially from other data sources which we believe to be more accurate. We describe these exceptions below.

Another international source of data is the annual reports and statistical yearbooks of the North Pacific Anadromous Fish Commission (NPAFC). Each year NPAFC reports commercial catch data by species and companies, as provided to NPAFC by member countries.

Table 5.1.1 compares four different sources of data for United States salmon harvests. ADFG are harvest data for Alaska downloaded from the Alaska Department of Fish and Game website [www.cf.adfg.state.ak.us/geninfo/finfish/salmon/salmhome.htm](http://www.cf.adfg.state.ak.us/geninfo/finfish/salmon/salmhome.htm). NMFS data are data for Alaska, Washington, Oregon and California downloaded from the National Marine Fisheries Service (NMFS) commercial landings website [http://www.st.nmfs.gov/commercial/landings/annual\\_landings.html](http://www.st.nmfs.gov/commercial/landings/annual_landings.html). We use the term “NMFS data” to refer to the NMFS data for all four states, and we use the term “ADFG and NMFS data” to refer to data calculated by adding the ADFG data for Alaska and the NMFS data for Washington, Oregon and California.

**Table 5.1.1. Comparison of Selected Data Sources for United States Wild Pacific Salmon Harvests, 1997-2000 (metric tonnes, round weight).**

Source	Species	1997	1998	1999	2000
FAO FISHSTAT+ data	Chinook	9,876	7,361	6,929	7,303
	Sockeye	87,299	58,396	110,836	94,422
	Coho	10,555	16,305	13,259	15,350
	Pink	102,965	150,856	173,316	94,440
	Chum	46,794	59,394	65,295	73,633
NMFS data	Chinook	10,261	7,112	6,865	7,035
	Sockeye	86,756	58,396	110,836	94,427
	Coho	10,531	16,397	13,268	15,358
	Pink	99,569	150,859	173,316	94,440
	Chum	47,274	59,692	65,316	73,638
NPAFC data	Chinook	8,663	7,210	6,831	7,295
	Sockeye	88,418	59,075	115,267	95,095
	Coho	10,872	17,048	14,101	16,537
	Pink	125,674	169,648	196,088	114,092
	Chum	61,331	76,881	86,004	99,771
ADFG & NMFS data	Chinook	10,561	7,281	6,961	7,381
	Sockeye	88,675	59,507	112,280	95,073
	Coho	11,125	17,496	13,909	16,614
	Pink	123,621	169,529	195,865	113,854
	Chum	65,854	77,986	84,552	99,264

The ADFG & NMFS data are very similar to the NPAFC data. The FAO FISHSTAT+ data and the NMFS data are similar to these sources for Chinook, sockeye and coho salmon but substantially lower for pink and chum salmon. For this report, we use ADFG & NMFS data for United States wild Pacific salmon harvests, because the FAO Fishstat+ data appear to substantially understate U.S. pink and chum salmon harvests. It is likely that the NMFS data for Alaska understate Alaska harvests of chum and pink salmon. This understatement is reflected in the FAO data, which is derived from NMFS data.

Table 5.1.2 compares three different sources of data for Canadian wild Pacific salmon harvests. The British Columbia Salmon Marketing Council data are from that organisation's website [www.bcsalmon.ca/database/catch/wtspyr0.htm](http://www.bcsalmon.ca/database/catch/wtspyr0.htm), where they are cited as derived from catch statistics prepared by the Department of Fisheries and Oceans. All three data sources are very similar. For this report, we use FAO Fishstat+ data for Canadian wild Pacific salmon harvests for the years 1980-2000 and BC Salmon Marketing Council data for 2001.

Table 5.1.2. Comparison of Selected Data Sources for Canadian Wild Pacific Salmon Harvests, 1997-2000 (metric tonnes, round weight).

Source	Species	1997	1998	1999	2000
FAO FISHSTAT+ data	Chinook	1,662	1,386	742	505
	Sockeye	25,353	5,041	1,653	8,401
	Coho	751	16	14	13
	Pink	12,241	3,920	9,529	7,094
	Chum	8,685	19,903	4,937	2,762
NPAFC data	Chinook	1,475	1,203	740	510
	Sockeye	24,603	4,833	1,640	8,503
	Coho	663	16	10	13
	Pink	11,923	3,900	9,530	7,126
	Chum	8,649	19,797	4,940	2,774
BC Salmon Marketing Council Data	Chinook	1,674	1,397	803	508
	Sockeye	25,306	5,058	1,706	8,514
	Coho	748	18	27	9
	Pink	12,215	3,919	9,526	7,126
	Chum	8,673	19,904	4,949	2,771

Table 5.1.3 compares three different sources of data for Japanese wild Pacific salmon harvests. The Japanese press estimates for 1997 are from *Bill Atkinson's News Report*, December 22, 1999. The Japanese press estimates for 1998-2000 are from *Bill Atkinson's News Report*, December 12, 2001.

There are significant differences between all three sets of data. The NPAFC data show only insignificant Japanese harvests of sockeye salmon, while the other two data sets show harvests of 2,000-10,000 tonnes. The likely cause for this is that the NPAFC data do not include harvests of sockeye (and other species) by Japanese vessels fishing in the Russian Exclusive Economic Zone under negotiated agreements. The FISHSTAT+ data are also inconsistent with Japanese press estimates which show higher levels of sockeye salmon harvests. In contrast, the FAO Fishstat+ data for Japanese chum salmon harvests are substantially higher than for the other two sources. We do not know the reasons for inconsistencies between these data sources or which are more accurate. For this report, we use FAO Fishstat+ data for Japanese wild Pacific salmon harvests for the years 1980-2000 and Japanese press estimates for 2001.

Table 5.1.3. Comparison of Selected Data Sources for Japanese Wild Pacific Salmon Harvests, 1997-2000 (metric tonnes, round weight).

Source	Species	1997	1998	1999	2000
FAO Fishstat+ data	Chinook	825	534	270	52
	Sockeye	9,246	2,768	2,750	216
	Coho	575	746	508	17
	Pink	15,844	25,337	16,902	26,602
	Chum	269,183	206,622	182,866	165,834
	Masu	1,800	2,570	1,979	1,811
NPAFC data	Chinook	253	205	48	48
	Sockeye	7	5	3	3
	Coho	101	37	22	6
	Pink	13,040	22,328	14,821	23,797
	Chum	237,348	178,539	158,301	139,928
	Masu	990	1,731	1,129	954
Japanese Press data	Chinook	0	0	0	
	Sockeye	10,300	6,000	7,500	4,500
	Coho				
	Pink	17,500	22,500	18,100	27,000
	Chum	247,000	187,500	168,000	153,700
	Masu				

Table 5.1.4 compares FAO FISHSTAT+ data and NPAFC data for Russian wild Pacific salmon harvests. Except for sockeye salmon, data from both sources are fairly close. For this report, we use FAO Fishstat+ data for Russian wild Pacific salmon harvests for the years 1980-2000. For the year 2001, we use Japanese press estimates from *Bill Atkinson's News Report* for December 12, 2001. However, we are unable to judge how accurate these data for 2001 may be.

Table 5.1.4. Comparison of Selected Data Sources for Russian Wild Pacific Salmon Harvests, 1997-2000 (metric tonnes, round weight).

Source	Species	1997	1998	1999	2000
FAO Fishstat+ data	Chinook	636	556	793	479
	Sockeye	10,177	12,767	14,889	19,548
	Coho	1,310	2,319	1,668	2,278
	Pink	187,667	191,439	187,181	157,138
	Chum	22,898	26,046	28,162	36,490
NPAFC data	Chinook	1,063	461	717	454
	Sockeye	18,100	10,135	11,927	15,107
	Coho	2,463	1,697	1,246	1,707
	Pink	190,246	192,095	187,734	147,568
	Chum	32,920	25,135	23,637	30,768

Table 5.1.5 summarises the data we use in this report for wild Pacific salmon harvests by country and species for the period 1980-2000. Except for the United States, the data are FAO Fishstat+ data. Except where otherwise noted these data are the basis for tables and graphs of wild Pacific salmon harvests in this report.

**Table 5.1.5. Assumed Wild Pacific Salmon Harvests by Country and Species (metric tonnes, round weight)**

Country	Species	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
USA	Chinook	13,647	13,999	16,686	10,589	9,769	12,757	15,000	19,781	22,030	15,270	12,282
	Sockeye	86,051	105,912	93,888	139,672	105,522	108,053	96,129	107,451	87,967	123,810	144,207
	Coho	17,649	17,129	28,701	15,453	23,737	26,864	30,127	18,768	22,764	20,763	22,772
	Pink	98,865	120,331	99,410	91,870	125,534	147,967	117,619	79,165	80,695	157,251	123,318
	Chum	37,351	47,895	46,580	38,594	50,821	43,053	49,862	42,763	63,351	32,395	33,878
	<b>TOTAL</b>	<b>253,563</b>	<b>305,266</b>	<b>285,266</b>	<b>296,179</b>	<b>315,383</b>	<b>338,693</b>	<b>308,739</b>	<b>267,928</b>	<b>276,808</b>	<b>349,489</b>	<b>336,456</b>
Canada	Chinook	6,540	5,916	7,092	5,378	6,254	5,469	4,411	4,994	8,653	5,235	5,228
	Sockeye	7,727	21,000	30,143	14,326	12,877	31,568	29,811	14,823	11,943	34,383	37,134
	Coho	9,025	7,514	9,297	10,461	10,089	8,977	11,666	8,251	8,865	8,752	10,569
	Pink	13,718	38,253	3,977	39,538	12,058	37,701	29,264	26,519	32,217	31,004	26,240
	Chum	16,809	6,157	15,091	4,899	9,003	23,646	24,922	10,182	30,297	9,322	17,181
	<b>TOTAL</b>	<b>53,819</b>	<b>78,840</b>	<b>65,600</b>	<b>74,602</b>	<b>50,281</b>	<b>107,361</b>	<b>100,074</b>	<b>64,769</b>	<b>91,975</b>	<b>88,696</b>	<b>96,352</b>
Japan	Chinook	2,484	1,381	1,018	691	663	686	568	704	352	369	295
	Sockeye	6,070	5,227	4,269	4,527	3,482	2,586	2,284	1,686	754	863	644
	Coho	1,779	2,135	2,900	2,932	3,870	1,776	7	0	687	613	429
	Pink	20,101	25,509	20,797	25,323	18,770	27,620	20,165	17,092	15,214	19,949	12,544
	Chum	96,920	120,801	111,760	133,465	136,351	178,654	151,491	144,131	159,348	181,599	223,273
	<b>TOTAL</b>	<b>127,354</b>	<b>155,053</b>	<b>140,744</b>	<b>166,938</b>	<b>163,136</b>	<b>211,322</b>	<b>174,515</b>	<b>163,613</b>	<b>176,355</b>	<b>203,393</b>	<b>237,185</b>
Russia	Chinook	1,057	1,399	1,342	1,778	1,683	1,831	2,217	1,661	1,617	1,241	1,250
	Sockeye	3,888	3,833	2,967	4,256	6,299	9,622	8,099	11,473	8,465	9,856	16,457
	Coho	2,486	3,623	3,798	3,579	4,843	5,993	4,924	3,730	2,734	2,965	2,253
	Pink	77,367	84,470	45,140	102,207	54,665	90,905	40,399	97,713	37,751	145,625	72,850
	Chum	14,556	14,740	13,969	21,799	13,742	23,537	23,434	23,662	30,490	21,651	27,142
	<b>TOTAL</b>	<b>99,354</b>	<b>108,065</b>	<b>67,216</b>	<b>133,619</b>	<b>81,232</b>	<b>131,888</b>	<b>79,073</b>	<b>138,239</b>	<b>81,057</b>	<b>181,338</b>	<b>119,952</b>
Total	Chinook	23,728	22,695	26,138	18,436	18,369	20,743	22,196	27,140	32,652	22,115	19,055
	Sockeye	103,736	135,972	131,267	162,781	128,180	151,829	136,323	135,433	109,129	168,912	198,442
	Coho	30,939	30,401	44,696	32,425	42,539	43,610	46,724	30,749	35,050	33,093	36,023
	Pink	210,051	268,563	169,324	258,938	211,027	304,193	207,447	220,489	165,877	353,829	234,952
	Chum	165,636	189,593	187,400	198,757	209,917	268,890	249,709	220,738	283,486	244,967	301,474
	<b>TOTAL</b>	<b>534,090</b>	<b>647,224</b>	<b>558,826</b>	<b>671,338</b>	<b>610,032</b>	<b>789,264</b>	<b>662,401</b>	<b>634,549</b>	<b>626,195</b>	<b>822,916</b>	<b>789,945</b>

Note: Table 5.1.5 continues on the following page.

**Table 5.1.5. (Continued)**

Country	Species	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
USA	Chinook	9,413	8,255	8,464	8,313	11,495	9,028	10,561	7,281	6,961	7,381	7,541
	Sockeye	120,396	157,273	178,004	138,343	160,031	141,727	88,675	59,507	112,280	95,073	77,707
	Coho	25,012	25,875	18,312	35,622	24,002	22,291	11,125	17,496	13,909	16,614	17,937
	Pink	164,571	92,395	155,539	165,493	202,150	147,492	123,621	169,529	195,865	113,854	195,255
	Chum	36,201	41,173	42,047	60,593	69,183	101,312	65,854	77,986	84,552	99,264	65,230
	<b>TOTAL</b>	<b>355,593</b>	<b>324,971</b>	<b>402,368</b>	<b>408,364</b>	<b>466,861</b>	<b>421,850</b>	<b>299,836</b>	<b>331,799</b>	<b>413,566</b>	<b>332,186</b>	<b>363,670</b>
Canada	Chinook	5,058	5,336	4,817	3,573	1,510	455	1,662	1,386	742	505	576
	Sockeye	25,211	20,938	42,529	30,828	10,533	15,525	25,353	5,041	1,653	8,401	5,910
	Coho	10,053	7,328	4,316	7,713	4,866	3,871	751	16	14	13	36
	Pink	35,096	14,913	16,046	3,383	19,767	8,597	12,241	3,920	9,529	7,094	9,929
	Chum	10,236	17,964	17,273	20,323	12,115	6,524	8,685	19,903	4,937	2,762	4,577
	<b>TOTAL</b>	<b>85,654</b>	<b>66,479</b>	<b>84,981</b>	<b>65,820</b>	<b>48,791</b>	<b>34,972</b>	<b>48,692</b>	<b>30,266</b>	<b>16,875</b>	<b>18,775</b>	<b>21,029</b>
Japan	Chinook	291	661	615	364	195	250	825	534	270	52	0
	Sockeye	478	5,851	7,805	3,787	6,234	5,723	9,246	2,768	2,750	216	4,700
	Coho	325	567	207	0	270	701	575	746	508	17	0
	Pink	21,587	21,902	24,845	32,074	25,037	32,595	15,844	25,337	16,902	26,602	11,700
	Chum	203,435	158,163	209,500	223,107	267,718	299,881	269,183	206,622	182,866	165,834	199,500
	<b>TOTAL</b>	<b>226,116</b>	<b>187,144</b>	<b>242,972</b>	<b>259,332</b>	<b>299,454</b>	<b>339,150</b>	<b>295,673</b>	<b>236,007</b>	<b>203,296</b>	<b>192,721</b>	<b>215,900</b>
Russia	Chinook	1,128	1,261	1,284	1,101	875	521	636	556	793	479	1,000
	Sockeye	13,605	15,716	13,141	10,808	14,227	22,891	10,177	12,767	14,889	19,548	20,000
	Coho	2,803	4,584	2,328	2,265	1,479	1,976	1,310	2,319	1,668	2,278	1,000
	Pink	217,742	86,879	106,045	124,953	148,231	113,181	187,667	191,439	187,181	157,138	150,000
	Chum	18,713	21,291	19,209	24,718	22,681	23,083	22,898	26,046	28,162	36,490	5,000
	<b>TOTAL</b>	<b>253,991</b>	<b>129,731</b>	<b>142,007</b>	<b>163,845</b>	<b>187,493</b>	<b>161,652</b>	<b>222,688</b>	<b>233,127</b>	<b>232,693</b>	<b>215,933</b>	<b>177,000</b>
Total	Chinook	15,890	15,513	15,180	13,351	14,075	10,254	13,684	9,757	8,766	8,417	9,117
	Sockeye	159,690	199,778	241,479	183,766	191,025	185,866	133,451	80,083	131,572	123,238	108,317
	Coho	38,193	38,354	25,163	45,600	30,617	28,839	13,761	20,577	16,099	18,922	18,973
	Pink	438,996	216,089	302,475	325,903	395,185	301,865	339,373	390,225	409,477	304,688	366,884
	Chum	268,585	238,591	288,029	328,741	371,697	430,800	366,620	330,557	300,517	304,350	274,307
	<b>TOTAL</b>	<b>921,354</b>	<b>708,325</b>	<b>872,328</b>	<b>897,361</b>	<b>1,002,599</b>	<b>957,624</b>	<b>866,889</b>	<b>831,199</b>	<b>866,430</b>	<b>759,615</b>	<b>777,599</b>

Note that for all countries, the data for wild Pacific salmon harvests in Table 5.1.5 include “ranched” salmon released from salmon hatcheries. We do not include small harvests of masu or cherry salmon in Japan.

## 5.2 Retail chains in the Russian Federation

The major national retail chains include<sup>33</sup>:

Perekrestok: more than 45 shops ([www.perekriostok.ru](http://www.perekriostok.ru))

Pyatyorotchka: about 150 shops in Moscow and St. Petersburg, with a target of 200 shops by the end of 2003 ([www.e5.ru](http://www.e5.ru))

Paterson: 18 shops in Moscow, St. Petersburg and Tver ([www.paterson.ru](http://www.paterson.ru))

Bin: 18 supermarkets and planning several new openings

7<sup>th</sup> Continent: more than 30 supermarkets and shopping centres and planning 15 new openings in 2003 alone ([www.7cont.ru](http://www.7cont.ru))

12 Months: 11 shops in Moscow.

Kopeika: 25 shops in Moscow

ABK: 15 shops in Moscow ([www.abk.ru](http://www.abk.ru))

The international chains include:

Ramenka (Turkey) has been in the market since 1997 and has now around 15 hypermarkets/shopping centres. It is planning to open another 50 shops over the next 2-3 years. ([www.ramstore.ru](http://www.ramstore.ru))

Auchan (France) has 2 shopping centres in Moscow. ([www.auchan.ru](http://www.auchan.ru))

Metro (Germany) has 2 shops and will invest 600 mill. EUR by 2007. ([www.metroag.ru](http://www.metroag.ru))

Spar (Netherlands) has 6 shops and will have 30 shops within 3 years. ([www.spar.ru](http://www.spar.ru))

Carrefour (France) has for the moment only a representative office in the Russian Federation

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<sup>33</sup> Sources: company web-sites

Stockman (Finland) has a couple of high quality supermarkets in Moscow and St.Petersburg. ([www.stockmann.ru](http://www.stockmann.ru))

Ikea (Sweden) has 3 furniture stores and IKEA restaurants serve salmon at the rate of around 3 tonnes per week. ([www.ikea.ru](http://www.ikea.ru))

### 5.3. Notes on Data Sources for Selected Tables and Figures

#### Chapter 2.

Table 2.2.1. Commercially Harvested Wild Salmon Species. Average harvest data for 1996-2000 are from FAO FAOSTAT+ database.]

Figure 2.2.1. World Wild Salmon Harvests by Species.  
[Excel file: FAO World Supply 01!C- World wild by species]

Table 2.2.2: Hatchery Releases of Juvenile Salmon, by Species and Country (millions of fish). Data are from North Pacific Anadromous Fish Commission Statistical and Annual Reports. Data for 1997-2000 are preliminary.

Figure 2.2.3. Alaska and Canada Annual Harvests of Sockeye and Pink Salmon, 1980-2000

Alaska data are from the website of the Alaska Department of Fish and Game ([www.cf.adfg.state.ak.us](http://www.cf.adfg.state.ak.us)). Canadian data are from North Pacific Anadromous Fish Commission, "A Provisional Report on the 2001 Salmon Season, NPAFC Doc No. 578, Revision 1 (October 2001).

Figure 2.2.4. Alaska and Canada Average Decadal Harvests of Sockeye and Pink Salmon, 1900-1999

Alaska data for 1900-1969 are from from Alaska Department of Fish and Game, "Alaska Commercial Salmon Catches, 1878-1981", January 1982. Alaska data for 1970-2000 are from the website of the Alaska Department of Fish and Game ([www.cf.adfg.state.ak.us](http://www.cf.adfg.state.ak.us)). Canadian data are from North Pacific Anadromous Fish Commission, "A Provisional Report on the 2001 Salmon Season, NPAFC Doc No. 578, Revision 1 (October 2001).

Figure 2.2.5: United States Wild Salmon Harvests, by Species  
[Excel file: FAO World Supply 01!C- US wild by species]



Table 2.2.4. Alaska Salmon Harvests, 1990-2001. Data are from the website of the Alaska Department of Fish and Game, Commercial Fisheries Division, at [www.cf.adfg.state.ak.us/cf\\_home](http://www.cf.adfg.state.ak.us/cf_home).

Figure 2.2.6: Hatchery Share of Alaska Wild Salmon Harvests. Data are from Alaska Salmon Enhancement Program annual reports, available at the website of the Alaska Department of Fish and Game, Commercial Fisheries Division, at [www.cf.adfg.state.ak.us/cf\\_home](http://www.cf.adfg.state.ak.us/cf_home).

Table 2.2.5. Overview of Alaska Salmon Fisheries, 2000. Data are from Alaska Commercial Fisheries Entry Commission (CFEC) Basic Information Tables downloaded from the CFEC website at [www.cfec.state.ak.us](http://www.cfec.state.ak.us).

Table 2.2.6. Changes in Selected Alaska Salmon Fisheries between 1986-90 and 2000. Data are from Alaska Commercial Fisheries Entry Commission (CFEC) Basic Information Tables downloaded from the CFEC website at [www.cfec.state.ak.us](http://www.cfec.state.ak.us).

Table 2.2.7. Average Alaska Salmon Production and U.S. Salmon Exports, 1989-91 and 1999-2001. Alaska production data are Alaska Department of Fish and Game (ADFG) data based on Commercial Operator Annual Reports. U.S. Export data are from the National Marine Fisheries Service (NMFS) Foreign Trade Information website at [www.st.nmfs.gov/st1/trade/](http://www.st.nmfs.gov/st1/trade/).

Table 2.2.8. Average United States Exports of Frozen Salmon, by Species and Country, 1999-2001  
Data are from the National Marine Fisheries Service Foreign Trade Information website at [www.st.nmfs.gov/st1/trade/index.html](http://www.st.nmfs.gov/st1/trade/index.html).

Table 2.2.9. Average United States Exports of Fresh Salmon, by Species and Country, 1999-2001  
Data are from the National Marine Fisheries Service Foreign Trade Information website at [www.st.nmfs.gov/st1/trade/index.html](http://www.st.nmfs.gov/st1/trade/index.html).

Table 2.2.10. Average United States Exports of Canned Salmon, by Species and Country, 1999-2001  
Data are from the National Marine Fisheries Service Foreign Trade Information website at [www.st.nmfs.gov/st1/trade/index.html](http://www.st.nmfs.gov/st1/trade/index.html).

Figure 2.2.7: Japanese Wild Salmon Harvests, by Species  
[Excel file: FAO World Supply 01!C-Japan wild by species ]

Table 2.2.11: Japanese Chum Salmon Data, Various Sources (MT)  
[Excel file: FAO World Supply 01!T-Selected chum data ]

Figure 2.2.8. Japanese Chum Salmon Harvests and Hatchery Releases. Catch data are from the North Pacific Anadromous Fish Commission, “A Provisional Report on the 2001 Salmon Season,” NPAFC Doc. No. 578, Rev. No. 1, October 2001, page 15. Original sources are a number of different NPAFC and FAO documents. Hatchery release data are from North Pacific Anadromous Fish Commission Statistical and Annual Reports. Data for 1997-2000 are preliminary.

Figure 2.2.9. Japanese Chum Salmon Harvests and Average Prices Paid to Fishermen Catch data are from the North Pacific Anadromous Fish Commission, “A Provisional Report on the 2001 Salmon Season,” NPAFC Doc. No. 578, Rev. No. 1, October 2001, page 15. Original sources are a number of different NPAFC and FAO documents. Price data are from Suisan Tsushin (Seafood News), *Marine Products Power Data Book*, 2002, page 29. Data are prices paid to fishermen for fish sold at auction in markets in coastal towns, for chum salmon landed in Iwate Prefecture only.

Figure 2.2.10: Russian Wild Salmon Harvests, by Species  
[Excel file: FAO World Supply 01!C- Russia wild by species]

Table 2.2.12. Average Russian Salmon Harvests by Area, 1996-99 (MT).  
Data are from [www.fish-net.ru/fishing/los\\_stat.shtml](http://www.fish-net.ru/fishing/los_stat.shtml). The original source is TINRO (Pacific Institute of Fisheries and Oceanography).

Figure 2.2.13. Salmon Harvests by Foreign Fleets in the Russian EEZ (MT).  
Data are from North Pacific Anadromous Fish Commission Statistical Reports (1993:1997) and Annual Reports (1998-2000). Catch by species in 1998 and 1999 is TINRO data reported at [http://www.fish-net.ru/fishing/los\\_stat.shtml](http://www.fish-net.ru/fishing/los_stat.shtml). Although it is reported as being the catch of domestic and foreign fleets, the total is the same as that reported in the NPAFC annual reports as being for foreign fleets.

Table 2.2.14. Comparison of Russian Harvests with Japanese Imports from Russia  
Japanese import data are from Suisan Tsushin (Seafood News), *Marine Products Power Data Book*, 2002, pages 14-15.

Figure 2.2.11: Canadian Wild Salmon Harvests, by Species  
[Excel file: FAO World Supply 01!C- Canada wild by species]

Table 2.2.15. Volume and Value of Canadian Wild Salmon Harvests  
Data are from British Columbia Salmon Marketing Council website at [www.bcsalmon.ca](http://www.bcsalmon.ca).

Table 2.2.16. British Columbia Salmon Production, by Product and Species, 1996  
Data are from British Columbia Ministry of Agriculture, Food and Fisheries, "Fisheries Production Statistics of British Columbia 1996," pages 23-24.

### **Chapter 3.1.**

Figure 3.1.1. Per Capita Seafood Consumption in Selected Countries. FAO "Food Supply" estimates from FAOSTAT database, available on-line at <http://apps.fao.org/default.htm>.

Figure 3.1.2 United States Per Capita Consumption of Meat, Poultry and Fish (edible weight). Data are from the U.S. Department of Agriculture Per Capita Food Consumption Data System at [www.ers.usda.gov/data/foodconsumption/spreadsheets.asp](http://www.ers.usda.gov/data/foodconsumption/spreadsheets.asp), Commodity spreadsheet "Meats, per capita consumption."

Figure 3.1.3. United States Per Capita Consumption of Fish and Shellfish, 1980-2000 (edible weight). Data are from National Marine Fisheries Service, *Fisheries of the United States*.

Figure 3.1.4. Estimated U.S. Per Capita Fish Consumption: Top Six Species. Data are estimates prepared by the National Fisheries Institute, as reported at [www.nfi.org](http://www.nfi.org) and in H.M. Johnson & Associates, Annual Report on the United States Seafood Industry, various issues.

Table 3.1.1: Estimated U.S. Salmon Consumption (edible weight). Edible weight of consumption of domestic fresh and frozen salmon was estimated by beginning with the total round weight of U.S. domestic wild harvests and farmed production, subtracting the estimated round weight of canned production and fresh and frozen exports, adjusting the remaining round weight for assumed edible yield, and adjusting for changes in frozen inventories. Because of the numerous assumptions required for these calculations, the estimates should be considered only approximate. Edible weight of consumption of imported fresh and frozen salmon was estimated by adjusting U.S. imports by assumed edible weight coefficients (between 72% and 100%, depending upon species and product).

Table 3.1.2. Estimated U.S. Consumption of Fresh and Frozen Salmon 1990-2000 (MT) (See notes for Table 3.1.1).

Tables 3.1.3-3.1.10: United States Salmon Imports, 1990-2000. All data are from the National Marine Fisheries Service Foreign Trade in Fisheries Products web-site: [www.st.nmfs.gov/st1/trade/index.html](http://www.st.nmfs.gov/st1/trade/index.html).

## **Chapter 3.2.**

Figure 3.2.1. Japanese Average Annual Per Capita Consumption of Salmon at Home (grams). Data are from Suisan Tsushin (Seafood News), *Marine Products Power Data Book*, 2002, page 33. The original source was the Annual Report on the Family Income and Expenditure Survey conducted by the Japan Statistics Bureau Management and Coordination Agency of Japan. The data do not include consumption of salmon outside of the home. Per capita consumption was calculated by dividing annual average household consumption by the average number of persons per family.

Table 3.2.1. Japanese Salmon Supply, 1991-2001 (tonnes). Data for 1991 are from Suisan Tsushin (Seafood News), *Marine Products Power Data Book*, 2001, page 3. Data for 1992-2001 are from Suisan Tsushin (Seafood News), *Marine Products Power Data Book*, 2002, page 3. Note: All data are for supply on a semi-dressed basis. Data for fall chum salmon supply are converted to a semi-dressed basis assuming an 80% yield. Because sources differ, data for Japanese domestic supply may not correspond exactly to data for Japanese wild and farmed salmon production presented earlier in this report.

Figure 3.2.2-3.2.4: Japanese Salmon Supply. These figures are based on the data in Table 3.2.1.

Table 3.2.2. Japanese Salmon and Trout Imports, 1993-2001 (tonnes). Data are from Suisan Tsushin (Seafood News), *Marine Products Power Data Book*, 2002, pages 14-17.

Figures 3.2.5-3.2.7. Japanese Salmon Imports. These figures are based on the data in Table 3.2.2.

Figure 3.2.8. Seasonal Variation in Japanese Salmon Imports, 1997-2001

Data for frozen sockeye, frozen coho, frozen other Pacific and frozen trout are from Suisan Tsushin (Seafood News), *Marine Products Power Data Book*, 2002, pages 18-21. Data for fresh Atlantics are from *Bill Atkinson's News Report*, various issues.

Figure 3.2.9. Timing of Japanese Frozen "Red-Fleshed" Salmon Imports: 1993, 1997 and 2001

Data for 1993 are from *Bill Atkinson's News Report*, various issues. Data for 1997 and 2001 are from Suisan Tsushin (Seafood News), *Marine Products Power Data Book*,

2002, pages 18-21. Beginning with data for 1997, Japanese import data by product and species (but not by country) are also available on United States' National Marine Fisheries Service website at [www.st.nmfs.gov/st1/market\\_news/index.html](http://www.st.nmfs.gov/st1/market_news/index.html).

Figure 3.2.10. Japanese Inventories of Frozen Salmon and Trout: 1993, 1997 & 2001 (metric tonnes)

Data are from *Bill Atkinson's News Report*, various issues. Beginning with data for 1997, Japanese inventory data are also available on United States' National Marine Fisheries Service website at [www.st.nmfs.gov/st1/market\\_news/index.html](http://www.st.nmfs.gov/st1/market_news/index.html).

Figure 3.2.11. Japanese Wholesale Prices for Frozen Red-Fleshed Salmon (#1 grade, 4-6 pounds)

Data are from Suisan Tsushin (Seafood News), *Marine Products Power Data Book*, 2002, page 6.

Figure 3.2.12. Weighted Average Wholesale Prices and Estimated Consumption of Frozen Red-Fleshed Salmon. The average annual price of frozen red-fleshed salmon was calculating by weighting average annual (unweighted) prices for each species by total import volume over the May-April "salmon year." Consumption of frozen red-fleshed salmon was estimated as imports plus the decline over the "salmon year" in frozen inventories of salmon and trout.

Figure 3.2.13. Japanese Import Prices for Fresh and Frozen Atlantic Salmon and Frozen Coho Salmon. Data are from *Bill Atkinson's News Report*, various issues. Beginning in 1997, data are also available on the United States' National Marine Fisheries Service website at [www.st.nmfs.gov/st1/market\\_news/index.html](http://www.st.nmfs.gov/st1/market_news/index.html).

Figure 3.2.14. Fall Chum Supply, Fall Chum Landed Price, and Salted Fall Chum Wholesale Price.

Data are from Suisan Tsushin (Seafood News), *Marine Products Power Data Book*, 2002, pages 3, 29 and 46.

Figure 3.2.15. Average Prices Paid by Households for Salmon (All Species Combined). Calculated from household consumption and household size data from Suisan Tsushin (Seafood News), *Marine Products Power Data Book*, 2002, page 33.

## **Chapter 4.1.**

Figure 4.1.1. Canned Share of Alaska Production of Pink, Sockeye and Chum Salmon. Production data are from annual "Commercial Operator Annual Reports" submitted to the Alaska Department of Fish and Game by Alaska salmon processors.

Figure 4.1.2. Alaska Production of Canned Pink, Sockeye and Chum Salmon. Production data are from annual “Commercial Operator Annual Reports” submitted to the Alaska Department of Fish and Game by Alaska salmon processors.

Table 4.1.1. United States and Canadian 1999 Canned Salmon Pack, by Species (Cases, 48-tall basis) U.S. data are from the National Food Processors Association (NFPA), Canned Salmon Pack report. Data for Canada are from the BC Ministry of Agriculture, Forestry and Food, British Columbia Canned Salmon Pack Bulletin.

Table 4.1.2. Canned Salmon Volume Conversion Factors  
[EXCEL Source file: FAO Canned!One million cases]

Table 4.1.3. United States Canned Salmon Pack, by Size, 2000 and 2001. Data are from National Food Processors Association (NFPA), Canned Salmon Pack reports.

Figure 4.1.3. FAO Estimates of World Canned Salmon Production. Data are from FAO Globefish, *Commodity Update Salmon*, January 2002, page 57. This source reports a canned salmon pack for Canada of 144,821 MT. We assume that this figure is an error because it is clearly inconsistent with estimated total world production of 167,790 MT.

Table 4.1.4. U.S. and Canadian Production of Canned Salmon (cases, 48-tall basis) U.S. data are from National Food Processors Association (NFPA), Canned Salmon Pack reports. Data for Canada are from BC Ministry of Agriculture, Forestry and Food, British Columbia Canned Salmon Pack Bulletin.

Figure 4.1.4. United States Canned Pink Salmon Stocks, 1988-89 through 1990-91. Data are from National Food Processors Association Canned Inventory reports. These reports are no longer publicly available.

Table 4.1.5. Estimated Average Canned Salmon Production and Consumption, by Country, 1995-99. Canned pack data for the United States are from National Food Processors Association (NFPA), Canned Salmon Pack reports. Canned pack data for Canada are from BC Ministry of Agriculture, Forestry and Food, British Columbia Canned Salmon Pack Report. United States export data are from the National Marine Fisheries Service Foreign Trade in Fisheries Products website. Canadian export data were provided Statistics Canada, International Trade Division. Production data for “other” countries are from Globefish, *Commodity Update Salmon*, January 2002, page 57. These data were not available on a species-level basis. U.S. and Canadian consumption was estimated as U.S. production minus exports. Consumption for other countries was estimated as the sum of U.S. and Canadian exports to those countries plus reported imports from other countries. Note that estimates of canned pink and canned

sockeye consumption for these countries do not include imports of these species from countries other than the United States or Canada. All estimates were calculated based on averages for a five year period, rather than for individual years, to average out the effects of differences between the calendar years in which canned salmon is produced and when it is exported and/or consumed.

Figure 4.1.5. United States Kg / Per Capita Consumption of Canned Fish Products. Data are estimates of canned fish per capita consumption (edible weight) from the annual National Marine Fisheries Service statistical report *Fisheries of the United States*.

Figure 4.1.6. Average Retail Prices for Canned Salmon in United States Supermarkets. Data are from scantrack data provided to the Alaska Seafood Marketing Institute by Nielsen Marketing Research. Data are for sales by large stores in major U.S. markets.

Figure 4.1.7. Monthly Sales of Canned Salmon in U.S. Supermarkets, 1997-98 Data are from scantrack data provided to the Alaska Seafood Marketing Institute by Nielsen Marketing Research. Data are for sales by large stores in major U.S. markets.

Table 4.1.6. Imports of Canned Salmon in Selected European Countries (1000 metric tonnes). Data are from FAO Globefish, Commodity Update Salmon, September 2000. AN 012352, Original Source EUROSTAT 20000901.

Table 4.1.7. Average Wholesale Prices for Alaska Canned Salmon (48-tall basis) Data are unweighted averages of monthly data for the period September-August from Alaska Department of Revenue, Canned Salmon Average Wholesale Price Reports, statewide data (through August 2000) and the Alaska Salmon Price Report, Bristol Bay data (beginning September 2000).

Figure 4.1.8. Alaska Sockeye Salmon Case Prices and North American Canned Sockeye Pack, Two Year Running Averages.

[EXCEL file: FAO canned!C-Sockeye price pack 2 year]

Figure 4.1.9. Alaska Pink Salmon Case Prices and North American Canned Pink Pack, Two Year Running Averages

[EXCEL file: FAO canned!C-Pink price pack 2 year]

## **Chapter 4.2**

Table 4.2.1. Overview of Alaska Salmon Roe Production Volume and Value, 1995-2001. Calculated from Alaska Department of Fish and Game Commercial Operator Annual Report data. Because these data slightly understate production (due to under-

reporting), the table may slightly understate roe volume as a percentage of total harvest volume.

Table 4.2.2. Overview of United States Salmon Roe Exports, 1995-2001. Data are from National Marine Fisheries Service “Foreign Trade Information” website at [www.st.nmfs.gov/trade/index.html](http://www.st.nmfs.gov/trade/index.html).

Tables 4.2.3 and 4.2.4. Japanese Salmon Roe Imports and Average Import Prices. Data are from Suisan Tsushin (Seafood News), *Marine Products Power Data Book*, 2001 (pages 86 and 87) and 2002 (pages 85 and 86).

Table 4.2.5. Wholesale Price at the Tokyo Central Wholesale Market, October 1-10, 2002. Data are from National Marine Fisheries Service “Fishery Market News” website at [www.st.nmfs.gov/market\\_news/index.html](http://www.st.nmfs.gov/market_news/index.html).



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