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ECONOMIC EFFECTS OF THE UNITED NATIONS MORATORIUM ON HIGH SEAS DRIFTNET FISHING

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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Fisheries Science Center

NOAA Technical Memorandum NMFS

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Foreword

This report was prepared under cooperative agreement with the Joint Institute for the Study of the Atmosphere and Ocean (JISAO Task III-V), University of Washington, funded by the National Marine Fisheries Service, Southwest Fisheries Science Center, Honolulu Laboratory. Because the report was prepared independently under contract, its conclusions do not necessarily represent those of the National Marine Fisheries Service.

Preface

Driftnet fishing gear is "made of a single or several rectangular panels of net webbing linked together and suspended vertically by floats on the top of the panels and sinkers at the bottom. It drifts with the winds and the currents, thus creating a webbing curtain in which the fish are entangled. The mesh size varies according to the type of fishery: 110-130 millimeters (mm) (stretched) for salmon; 110-120 mm for squid and 170-180 mm for large-mesh driftnets. The minimum unit of the nets is usually 30-50 meters long. About a hundred such units linked together for a section 2-5 km long. Various numbers of sections may be combined" (M. Hayashi;1991, p 357). Large-scale driftnets typically consist of four to ten such sections, disconnected from each other at intervals. A single large-scale drift net vessel would commonly deploy nets of up to 40 km in total length.

Japan, South Korea, and Taiwan operated large-scale driftnet fishing vessels on the high seas of the North and South Pacific ocean during the 1970s and 1980s. Driftnet salmon fishing fleets had been active within 200 miles of Alaska and northeast Asia since the 1950s under regulatory frameworks involving all major states of origin of Pacific salmon. The squid driftnet fishery was developed by Japanese fishermen in the late 1970s in the central North Pacific, and it rapidly became a major fishery with annual harvests of as much as 300,000 metric tons of squid. Large-mesh driftnet fishing targeting on albacore and billfish had its origin in the century-old fishery in Japanese coastal waters. It expanded into a major operation by Japan and Taiwan in the North Pacific in the 1970s with catches reaching up to about 50,000 metric tons.

The Asian high seas driftnet fleet expanded from 592 vessels in 1980 to 782 vessels in 1988, and then declined to 629 vessels in 1992. The expansion of the fleet was due to a number of factors, including the technical superiority of driftnets for harvesting neon flying squid over alternative means, such as jigging or trawling and the ready availability of vessels and crew from the declining salmon driftnet fishery. Many of the Japanese squid vessels originated from the declining Bering Sea and high seas salmon gill net fishery. Other Asian driftnet vessels were specially built or converted for the fishery. The moderate decline in the fleet during the late 1980's may be attributed to aging vessels and crew, high wage costs in Japan, and threats of international sanctions on large scale driftnet fishing. United Nations resolution 44/225 on large-scale high seas driftnet fishing (December 1989) focused attention on possible ecological effects of the fishery, especially the incidental catch of marine mammals, birds, and salmon. After reviewing scientific information, much of it collected aboard high seas fishing vessels, the United Nations found that it could not be sure that driftnet fishing would not cause unacceptable harm to resources of the North Pacific. In December of 1991, the UN General Assembly passed resolution 46/215, calling for a world wide moratorium on high seas large scale driftnet fishing.

In response to the UN Resolution, the high seas driftnet fleets of Japan, Korea, and Taiwan were phased out by the end of 1992. This abrupt change in the high seas fishery regime left the fishing fleets, labor force, and fishing communities to adjust in a variety of ways. Driftnet fishing vessels could be: (1) be de-commissioned or scrapped, (2) shifted to alternative high seas fisheries, (3) transferred to coastal fisheries of the flag nations, or (4) converted alternative gear to continue fishing for squid (jigging or trawling) on the high seas. The consequences of these responses (or, more likely, a mix of these responses) could include economic hardship among vessel owners, reduced employment and interrupted careers in fishing ports, expansion of fishing effort in alternate fisheries, expanded harvests of alternative fish stocks, and some repercussions in Asian and world fish markets.

Depending upon the disposition of the fleet, the phase-out may have significant effects on other fisheries of Japan, Korea, and Taiwan. Further, loss of harvest from the high seas fishery will have repercussions in Asian markets for squid, albacore, and other species. More aggressive development of alternative stocks of squid is possible. US. interests may be directly or indirectly affected by some avenues of adaptation by the driftnet fishing fleet. For example, the albacore fishery on the Pacific coast of the US. may rebound due to both increased availability of fish and enhanced market demand. Finally, effective monitoring and enforcement of the UN. resolution will depend upon whether the existing fleets remain predominantly within the purview of nations likely to honor international agreements on the high seas.

Objectives

The overall objectives of this project were to (1) document the status and trends in the driftnet fleet, (2) summarize industry and governmental plans for the near future, and (3) assess possible fleet adaptations to the moratorium from a political/economic perspective. Status and trends includes information on (a) numbers, size, age, and capabilities of the existing fleet, and (b) institutional restrictions on opportunities for vessels and labor to shift into alternative fisheries. Information on plans includes expressed intentions of fleet operators and government officials in the three Asian nations, and an extended assessment of logical options for the fleet. The political and economic assessment will focus on strategies and actions likely to flow from private economic decision-making and from international and domestic political pressures in the Asian fishing nations.

Acknowledgments

This research could not have been conducted without the cooperation, assistance, and advice of a large number of knowledgeable people. We appreciate the help of all those who volunteered their time and effort to inform us of circumstances in the driftnet fishery and of future plans for the driftnet fleet. For originating the study grant, assistance in framing the issues, and help in developing contacts, we thank Dr. George Boehlert, Dr. Samuel Pooley, and Dr. Jerry Wetherall of the NMFS's Honolulu Laboratory. For providing important background information prior to the field research, we thank Dr. Ed Miles, Dr. William Burke, Kate Meyers, and Jay Hastings. During field research in Japan, the following individuals were especially helpful to Todd Mittleman: Mr. Kazuo Shima, Deputy Director General, Fisheries Agency of Japan; Mr. Shingo Ota, Fisheries Agency of Japan; Dr. Kiyotaka Ohtani, Professor in the Faculty of Fisheries, Hokkaido University; Dr. Hiroshi Masuda, Professor in Faculty of Fisheries, Hokkaido University; Mr. John T. Sproul Sr., Fisheries Business Economics, Hokkaido University; Mr. Doug Ancona, Regional Attache for Oceans, Fisheries, and Environment at the US Embassy; Mr. Nasaka, Fisheries Division, US. Embassy; Mr. Choong-Shin Oh and Mr. Mean-Jhong Kim, International Cooperation Division, National Fisheries Administration, Korea; Dr. Seoung-Yong Hong, Korea Ocean Research and Development Institute; Dr. Shean-Ya Yeh, Professor, National Taiwan University; Mr. James Sha, Chief, Fisheries Division, Council of Agriculture, Taiwan; Mr. Ming Chu, President, and Mr. Thomas Lin of Ming Tai Co.; Dr. Nien-Tsu Hu, Professor, National Sun-Yat Sen University, and all of the other individuals who were generous with their time and efforts that are listed in Appendix 2.

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The Asian high seas driftnet fleet harvesting neon flying squid (*Ommastrephes bartrami*), albacore tuna (*Thunnus Alalunga*), and billfish developed during the 1970's, expanded during the 1980's, and officially withdrew from the high seas by the end of 1992. The Japanese fleet developed first, followed by the South Korean and Taiwanese fleets. Initially, the high seas driftnet fishery engaged salmon fishermen using small-mesh driftnets. Their move to the high seas was prompted by a steady decline in access to EEZs of the US and USSR for salmon fishing. The large-mesh driftnet fleet targeting tuna and billfish expanded from historic coastal fishing areas onto the high seas. While large-scale driftnets of both types proved effective at harvesting the intended high seas species, they also raised international concerns about bycatch of marine mammals, birds, turtles, and miscellaneous fishes (especially salmon in the squid fishery). Some critics of the fishery claimed that it caused adverse impacts on the North Pacific ecosystem. Public opinion in North America, spurred on by publicity campaigns of various "environmental" organizations and salmon fishing interests, began to turn against large scale high seas driftnetting. During the late 1980's diplomatic efforts of the United States, Canada, South Pacific island nations, and other nations sought to ban the use of large-scale driftnets on the high seas. This resulted in the eventual adoption of UN resolution 46/215 which calls for a moratorium on the fleet and an official end to the fishery as of January 1, 1993.

This report documents the rise and decline of the high seas fishery. It also attempts to forecast the likely disposition of the driftnet fishing vessels of Japan, Korea, and Taiwan. Further, we briefly assess some of the likely economic and social impacts associated with UN resolution 46/215. Outside the Asian fishing nations, the economic and social impacts associated with the UN resolution banning driftnetting have not been widely discussed or publicized. Given the intensity of the continuing debate in the United States over economic and social impacts of endangered species protection and wilderness preservation, this is surprising. The compilation of information contained herein should serve to complete the story of international efforts to regulate the high seas fishery of the North Pacific.

Because much our information on this issue was gained from personal interviews in Asian countries at a time when the fleet was adapting to the driftnet ban, completeness of field collected data cannot be guaranteed. Additionally, because government compensation programs and decisions regarding vessel conversions had not yet been finalized during the time field work was conducted, some of our information on fleet composition and disposition is preliminary. Given these reservations, the information in this study provides the most complete information available.

History

The high seas driftnet fishery has its roots in the 1840's when Japanese coastal fishermen targeted bluefin tuna off the Pacific coast of Japan (Watanabe 1991). While coastal driftnet fishing has long been important to Japan and other major fishing nations, distant-water and high seas driftnet fishing became important only after World War II. As early as 1952, Japan used driftnets beyond USSR territorial waters to catch salmon. This fishery expanded east and soon covered waters in the Bering Sea and western North Pacific as mothership operations were conducted off the USSR. and Alaska. The peak of the Japanese mothership salmon driftnet fishery was in 1959, when 16 motherships and 460 catcher boats operated in the fishery (NOAA

EIS/Preliminary Fishery Management Plan, 1977). The adoption of the 200-mile Exclusive Economic Zones led to the eventual decline of this salmon fishery, as both the US and USSR reduced fishing permitted in their respective zones. In 1978, after re-negotiation of the International North Pacific Fishery Commission (INPFC) treaty, the mothership fishery consisted of four motherships, each with 6 scout boats and 37 catcher boats. In 1988, the fishery was reduced to a single mothership with 43 catcher boats operating on the high seas on the North Pacific and Bering Sea.

As the salmon mothership operations were being forced out of EEZs in the north Pacific, Japanese fishermen found that significant bycatches of neon flying squid occurred in the southern portion of their fishing grounds. Many of the independent (i.e. non-mothership) salmon fishing vessels converted to harvest squid on the high seas. One report cites 1978 as the first year of widespread Japanese squid driftnet fishing for squid (Hayase et al. 1991). Korea and Taiwan were soon to follow the Japanese, as Korean vessels entered the North Pacific squid driftnet fishery in 1979, and Taiwanese vessels began using driftnets to catch flying squid in 1980 (Tung & Yeh 1991). Also during the 1970's, the Japanese large-mesh fishery expanded outside coastal waters as series of floating gillnets proved effective in taking marlins, swordfish, albacore, and other tunas. Taiwan also developed a large-mesh driftnet fleet, whereas Korean driftnet fishermen remained focused on squid fishing with small-mesh nets.

The high seas driftnet fishery can be divided into four main parts: (1) the mothership salmon driftnet fishery, (2) the land based salmon driftnet fishery, (3) the squid driftnet fishery and (4) the large-mesh driftnet fishery. As noted, the mothership salmon driftnet fleet declined in the number during the 1970's, until only one mothership remained in the fishery in 1988. Because this development was largely unrelated to the UN Resolution on high seas driftnet fishing, the mothership salmon driftnet fishery will not be featured in the following discussions. The remaining land-based driftnet fishery for salmon is now officially confined to 200-mile coastal waters of north Pacific fishing nations. Clandestine large-scale driftnet fishing for salmon and other species on the high seas of the north Pacific may continue, but this is presumably a declining and unimportant fishery at present.

The large-mesh driftnet vessels initially targeted billfish, then moved to albacore tuna. In later years, skipjack tuna catch nearly equalled catch of albacore catch in the Japanese large-mesh fishery (Nakano et al. 1991). The Japanese and Taiwanese fleets have participated in both the squid and large-mesh driftnet fishery, while the Korean driftnet fleet fished exclusively for squid in the North Pacific. Vessels participating in the salmon and squid driftnet fishery operated in the North Pacific whereas vessels involved in the large-mesh driftnet fishery operated in both the North and South Pacific, with Taiwanese vessels also operating in the Indian ocean. Both Japan and Taiwan had large-mesh vessels operating in the South Pacific. Due to opposition from South Pacific nations and the establishment of the Wellington Convention, Japan suspended driftnet operations in the South Pacific in 1990. Taiwan followed suit in 1991. Japan pointed out that the withdrawal from the South Pacific was not based on fears that driftnet fishing was destroying marine life. Instead, Japan stated that the decision to terminate the driftnet fishery in the South Pacific related to its recognition of the importance of the region's albacore tuna stocks and awareness of South Pacific nations' concerns about the impacts of driftnet fishing on these stocks (Doulman & Wright 1991). Korea, which operated one exploratory large-mesh driftnet vessel in the South Pacific in 1988-1989, suspended operations shortly thereafter, joining Japan and Taiwan in prohibiting nationals from driftnetting for tunas in the South Pacific.

Driftnet vessels from all three countries suspended fishing in the North Pacific in December, 1992, in compliance with UN resolution 46/215. Taiwanese large-mesh driftnet vessels continued operations in the Indian Ocean during the last year of the high seas driftnet fishery, as 31 large-mesh vessels were permitted to fish in the Indian ocean in 1992 (Fisheries Division, Taiwan Council of Agriculture).

Most of the high seas driftnet fleet concentrated on squid fishing in the North Pacific ocean. As displayed in Table 1-1, the number of vessels from Japan declined during the 1980's, while the Taiwanese and Korean fleets increased in numbers through the early 1980's reaching a peak number in 1988 and 1990 respectively. International pressure then precipitated a decline in the number of vessels participating in the driftnet fleet in the late 1980's and early 1990's. In 1992, the final year of the high seas driftnet fishery, licenses were only issued for the squid and large-mesh driftnet fisheries (Taiwanese licensing does not differentiate between large-mesh and squid driftnet vessels and Korean vessels fished exclusively for squid). Japanese salmon driftnet vessels fished for Asian origin salmon from May - August as the land based fleet fished in Japanese coastal waters and on the high seas up until July 1991. According to data obtained from the Japan Squid Driftnet Association, the majority of the larger salmon driftnet vessels constructed for the high seas concentrated the remainder of their annual fishing effort towards the squid and large-mesh driftnet fisheries.

Because the high seas salmon fishery is now extinquished by international treaty, our discussion of the driftnet fleet is limited to the high seas squid and large-mesh driftnet fisheries. As a result, land-based salmon driftnet vessels not participating in the high seas fishery are not covered in our fleet statistics. This is a minor issue, since the majority of the Japanese land-based salmon driftnet fleet does participate in the squid or large-mesh driftnet fishery. In 1989, 157 Japanese vessels held licenses to fish in the land-based salmon driftnet fishery. According to the Japan Driftnet Association, at least 107 of these vessels participated in either the squid or large-mesh driftnet fisheries. Therefore, in directing this study's attention of the current high seas driftnet fleet, a relatively small fleet of coastal drift net vessels (about 50 in number) will be excluded from the discussion.

1. Japanese High Seas Driftnet Fleet

This section describes in more detail the two Japanese high seas driftnet fleets using large-mesh nets for tuna and billfish and the smaller mesh nets for squid. Large-mesh vessels have operated in both the North and South Pacific and have targeted billfish, tunas (primarily albacore), and skipjack. In the early 1980's the large-mesh fleet had increased in size and areas fished, and expanded further to the east in the North Pacific in search of albacore (Watanabe 1991). As noted in Tables 1-2 and 1-3, the Japan Fisheries Agency has recorded the numbers of large-mesh vessels operating by year, but official licensing did not begin until the 1989-1990 season (the official large-mesh season runs from July to June of the following year). Official government licenses were issued for squid driftnet fishing in 1981, due in part to pressure from the squid jigging fishery within Japanese coastal waters. Squid driftnet vessels are licensed to fish only outside of Japanese waters.

Table 1-1. North Pacific Squid Driftnet Fleet (Number of Vessels Holding Squid Driftnet Licenses or Actively Fishing)

Year	Japan	Korea	Taiwan**	Total
1981	534	14	44	592
1982	529	34	73	636
1983	515	60	101	676
1984	505	99	146	750
1985	502	111	124	737
1986	492	97	110	699
1987	478	117	94	689
1988	463	140	179	782
1989	460	150	167	777
1990	457	157	138	752
1991	454	142	110	706
1992	426	139*	64	629

* In 1992, the Fisheries Administration reported 139 vessels licensed for the driftnet fishery, but it also reported that 34 vessels were converted to other uses during the year.
**Some vessels listed as squid driftnet vessels may also have operated as large-mesh driftnet vessels.
Sources: Japan - Hayase et al. 1991 & FAJ Reports, Korea -An et al. 1991 and Fisheries Administration Reports; Taiwan - Tung & Yeh and Fisheries Div., Council of Agriculture information.

Large-mesh Fleet

During 1973-1988, the Japanese large-mesh driftnet fleet caught between 8,000 and 40,000 metric tons per year of marlins, tunas, and other fish (Table 1-2). During this period, there were no special licenses issued for high seas large-mesh driftnet fishing. Large-mesh vessels operated both inside and outside Japanese coastal waters before the official licensing system was introduced in 1989. Hence, reported fleet size and catch include activities from the Japanese EEZ.

The first year of official licensing for large-mesh vessels was in 1989-1990. The new official season ran from June to July of the following year. Although there was a decline of sixty large mesh vessels in the South Pacific in 1990 due to the Japanese decision to withdraw from driftnet activities in the South Pacific, this does not fully account for the much smaller number of large mesh vessels licensed in 1989-1990 when compared to 1988. Only 189 vessels were licensed to operate on the high seas in 1989-1990. It was pointed out by a Fisheries Agency official that the dramatic decrease in the number of vessels licensed in 1989-1990 as compared to

1988 is due to the fact that not all of the 459 vessels listed as participating in the large-mesh driftnet fishery fished on the high seas in 1988, one year before official licensing. Over 200 of the 459 vessels were only in the 10-100 gross tons size class (Table 3-5) , signifying smaller vessels that operated in coastal waters.

Squid Driftnet Fleet

Due to the efficiency of driftnets for catching neon flying squid, the first years of the squid driftnet fishery witnessed a large number of vessels operating in the North Pacific. It has been estimated that there were over 800 squid driftnet vessels in Japanese coastal waters and on the high seas in November 1978 (Hayase *et al.* 1991). Because of growing friction between Japanese squid jigging vessels and squid driftnet vessels, a limited entry system was introduced in 1981 in which licenses were only issued for high seas. Although the large-mesh driftnet fishery had a longer history than the squid driftnet fishery, the Japan Fisheries Agency began an official licensing program earlier in the history of the squid driftnet fishery. Squid driftnet vessels were required to fish well away from the coastal fishery, in waters east of 170 E.

The Japanese squid driftnet fleet, which numbered 534 vessels in 1981, gradually declined over the years until the final year of the fishery, 1992, when 426 vessels held licenses for the fishery. This gradual decrease can be attributed to two factors: (1) Fisheries Agency objectives to increase what one fishery industry representative called "efficiency in the fleet," which saw the number of larger vessels increase and the number of smaller vessels decrease, and (2) Vessel owners that held licenses only to maintain a position in the fishery might have given up their licenses over the years. In responses to questions about the first factor, it was reported by a fisheries industry representative that the Fisheries Agency wanted to allocate licenses to a fewer number of large vessels rather than to many small type vessels attempting to enter the fishery. This move was thought of as promoting greater "efficiency" in the fishery by decreasing the number of vessels in the fishery while increasing vessel size . As can be seen in Table 3-5 listing vessel capabilities, of the 534 vessels that held licenses in 1981, there were 371 small and 163 large class vessels. In 1990, of the 457 vessels that held licenses, there were 195 small and 262 large class vessels. Therefore, fishing effort could have increased through the 1980'seven though total vessel numbers declined. Additionally, because vessels must fish in order to maintain licenses, a number of vessels that merely owned licenses in order to remain in the fishery even though they did not participate in the fishery could have relinquished their licenses over the years - later being replaced by a fewer number of larger vessels.

Table 1-2: Japanese Large-mesh Driftnet fishery: Fleet Size and Catch

Year	Vessels Numbers	Marlins mt	Tunas All mt	Albacore mt	Skipjack mt	Others mt	Total mt
1973	501	5239	220	--	429	2595	8483
1974	380	55079	587	--	370	2002	8057
1975	351	11432	780	--	469	2711	15394
1976	396	8912	2168	--	708	5019	16807
1977	314	8851	2558	--	1377	5937	18723
1978	292	10050	6582	--	1965	6904	25501
1979	394	4986	5388	--	1014	12683	24071
1980	457	8050	6049	--	1273	17777	33149
1981	559	7524	17585	16825	2828	5601	33537
1982	717	4603	19079	17217	7940	12884	44505
1983	620	1587	10123	8307	5883	17294	37887
1984	547	4216	12086	10776	6810	10638	33750
1985	470	6259	14939	12894	4521	5921	31640
1986	474	8301	12184	7269	8785	7200	36469
1987	460	4532	8006	7221	7733	4798	25070
1988	459	5124	15623	15132	13038	6299	40083

Source: Nakano, Okada, and Watanabe, 1991.

Table 1-3. Official Japanese Large-mesh Licensed Fleet

1989-90	189
1990-91	149
1991-92	49

Source: Fisheries Agency of Japan.

2. Korean High Seas Driftnet Fleet

As shown in Table 1-1, the number of vessels that held licenses in the Korean squid driftnet fleet increased from 14 vessels in 1981 to 157 in 1990, and then dropped off to 139 vessels by the end of 1992. Korean squid driftnet vessels targeted neon flying squid and operated on the high seas in the North Pacific. Surprisingly, Korean vessels operated within 200 miles of the Japanese coast, some operating up to within 12 miles, even though Japanese squid driftnet vessels were prohibited from fishing in this zone. This situation existed because Korea and Japan do not recognize each other's 200 mile exclusive economic zones.

3. Taiwanese High Seas Driftnet Fleet

Taiwanese driftnet vessels first moved into the North Pacific Ocean in 1980. While the Taiwanese fleet targeted neon flying squid, there was much controversy over the alleged illegal targeting of salmon stocks. US fisheries enforcement authorities actively pursued the illegal high seas salmon fishery, using both at-sea monitoring and boardings and on-shore investigative methods. The height of the Taiwanese driftnet fishery in the North Pacific occured in 1988 when 179 vessels operated there. The number of Taiwanese vessels participating in the North Pacific squid and large-mesh driftnet fisheries fluctuated throughout the 1980's until the last years of the fishery as only 64 vessels were allowed by the government to fish in 1992.

Taiwanese vessels participated in the South Pacific driftnet fishery beginning in 1988, numbering an estimated 60 to 130 vessels at the end of the year (Doulman & Wright 1991). The Taiwanese fleet then declined to 11 vessels in 1989 as pressure from South Pacific nations intensified. Taiwan decided to withdraw all driftnet vessels from the South Pacific in July 1991. Taiwanese large-mesh driftnet vessels also operated in the Indian Ocean from the mid-1980's until 1992. A high ranking official from the Taiwan Fisheries Division, Council of Agriculture confirmed that 113 vessels operated in the Indian Ocean in 1991. This number fell to 31 in 1992.

Because driftnetting is not considered an official full-time fishery, the Taiwanese government does not issue traditional "full-time" licenses to driftnet vessels. Authority for high seas driftnet fishing is simply attached to another license. Nevertheless, many vessels actually operated in the driftnet fishery on a full-time basis. Table 1-1 shows the number of driftnet vessels allowed to operate on the high seas in the Pacific, including vessels targeting both squid and large-mesh species, but it does not include vessels that operated in the South Pacific and Indian ocean throughout the 1980's. As reported in the Fisheries Yearbook Taiwan Area for 1991 the far-seas, large-mesh gill net fleet harvested 90,982 mt, consisting mainly of albacore, other tunas, and sharks, and worth N.T. $ 5,090,863 thousand (US $ 203,634,520). The far-seas squid gill net fleet caught 51,326 mt of squid worth N.T. $ 2,555,221 thousand (US $ 102,208,840). These totals include harvests from all oceans.

4. UN Resolution 46/215 and Selecting a Base Year for Fleet Size

When discussing the impacts associated with the ban on high seas driftnet fleets of Taiwan, Korea, and Japan, we need a base year and fleet size from which to measure change. Although changing political and economic circumstances created an environment in which fleet sizes varied over the years from 1970 to 1992, it is important to establish a base fleet that likely would have continued fishing without the driftnet moratorium. The driftnet fleets were undergoing changes in both size and configuration (nationality, vessel size, fishing locations) during the 1980's due to a variety of economic and internal social/political decisions in the home countries. On top of these internal pressures, international political pressures such as the Wellington Convention and UN General Assembly discussions on the high seas driftnet fishery imposed external pressure on driftnetting nations. Ultimately, the most critical influence on the fleet was UN resolution 46/215. Consequently, we take the fleet just prior to the acceptance of resolution 46/215 as the logical base fleet size.

On December 22, 1989, the UN General Assembly adopted a predecessor to Resolution 46/215, Resolution No. 44/225, entitled "Large-Scale Pelagic Driftnet Fishing and its Impact On the Living Marine Resources of the World's Oceans and Seas." The General Assembly Resolution called for the following actions:

1. A review of the best available scientific data on the impact of large-scale pelagic driftnet fishing by June 30, 1991, with a view to establishing a regime for cooperative regulation and monitoring.

2. A moratoria on all large-scale pelagic driftnet fishing on the High Seas by June 30, 1992 with an understanding that the moratoria would not be imposed, or if implemented, can be lifted should effective conservation and management measures be taken based on statistically sound analysis.

3. An immediate cessation of further expansion of large-scale pelagic driftnet fishing on the High Seas of the North Pacific and all other High Seas outside the Pacific Ocean until there is statistically sound analysis for the establishment of effective conservation and management measures.

4. An immediate reduction on a progressive basis of large-scale pelagic driftnet fishing activities in the South Pacific by July 1, 1991 until appropriate conservation and management arrangements for South Pacific albacore resources are entered.

After the drafting of UN resolution 44/225, Japan, Korea, and Taiwan made a greater effort to provide data, including the bycatch statistics as called for in the UN resolution. All three countries invested resources in observer programs in the attempt to gain information on bycatch data. Each nation harbored hopes of maintaining driftnet fleets at current sizes due to the importance of the fishery. Countries opposing the high seas driftnet fishery viewed the situation differently. When the UN General Assembly discussed the issue again, previous to the adoption of resolution 46/215 in December 1991, it appeared that providing statistically sound evidence entailed criteria that would be impossible for driftnet nations to provide. In the view of many of the nations opposing any driftnet activity on the high seas, statistically sound evidence was needed to establish the absence of harm to the marine environment and ecosystem in the North Pacific. Due to the extreme difficulty of providing such proof, the stage was set for UN resolution 46/215, entirely banning driftnetting on the high seas.

On December 20, 1991, the United Nations General Assembly adopted Resolution No. 46/215 on large-scale pelagic driftnet fishing which superseded the preceding resolution No. 44/225. The new resolution called on the international community to implement the following actions:

1. Reduction the number of vessels, length of nets, and area of operation so as to achieve, by June 30 1992, a 50 percent reduction in fishing effort.
2. Continue to ensure that the areas of operation of large-scale pelagic high seas driftnet fishing are not expanded.
3. Ensure that a global moratorium on all large-scale pelagic driftnet fishing is fully implemented on the high seas of the world's oceans and seas by December 31, 1992.

UN Resolution 44/225, the predecessor to Resolution 46/215, called for a moratoria only if driftnetting nations could not provide "statistically sound analysis" for the establishment of effective conservation and management measures. Consequently, those involved with the driftnet fishery in Japan, Korea, and Taiwan undertook cooperative research efforts, such as the at-sea observer program, to provide such statistically sound evidence. Dr. Yeong Gong, who is Director of the Korea Fisheries Research Institute and is extensively involved with the driftnet fishery and the research efforts, noted that Korea, Japan, and Taiwan thought that a thorough international observation and reported program for driftnet bycatch statistics would begin fulfilling the objectives of Resolution 44/225. By cooperating in an international data collection program, as called for in Resolution 44/225, it was believed by many in Japan, Korea, and Taiwan that they could assure the continued operation of the driftnet fishery on the high seas. Instead, the United States and other members of the UN General Assembly determined that adequate analysis had not been provided to deal with concerns about potential adverse effects on the North Pacific ecosystem. This resulted in resolution 46/215 and the eventual ban of the fishery. Dr. Gong is among a group of fisheries officials in Japan, Korea, and Taiwan with similar viewpoint. He stated that even though driftnetting nations were expected to provide scientific information on bycatch statistics and the impacts on the environment, the UN General Assembly, supported by the U.S., determined that the fishery was environmentally destructive despite a lack of data to support this theory. Dr. Gong also reiterated that the guidelines in which the driftnet fishery was judged in terms of bearing the burden of proof of "statistically sound evidence" is not applied to domestic fisheries in those countries supporting the driftnet ban.

The history of UN resolutions 44/225 and 46/215 and the experience of Taiwan, Japan, and Korea have a large bearing on choice of base year and base fleet size in the study. Because government officials in all three Asian countries believed that the driftnet fishery would be allowed to continue operating on the high seas if information such as bycatch data was provided, decisions regarding the phasing out of the fleet did not occur until resolution 46/215 was adopted on December 20, 1991. Therefore, through 1991 individuals involved with the driftnet fishery operated on the high seas with the understanding that if those in the fishery cooperated in the collection of data, the fishery would not be entirely phased out. After 1991, those involved with the driftnet fisheries learned that the fishery would end as of December 31, 1992. This is reflected in the driftnet fleet size operating in 1992. As seen in Table 1-1, 1992 saw a decrease in the Taiwanese and Korean driftnet fleets, as only 105 Korean vessels and a total of 95 Taiwanese vessels (64 N. Pacific & 31 Indian Ocean) took part in the high seas driftnet fishery that year. In 1992, a number of vessels in Korea (34) had already been converted to other uses, and in Taiwan, 93 vessels had been bought back by the government to be used as artificial reefs.

Because Asian fishing nations began to reduce their active fishing fleets in 1992 in accordance with UN Resolution 46/215, 1991 is the last year in which the high seas driftnet fleet operated at a level consistent with previous years. Therefore, 1991 has been chosen as the base year to which comparisons will be conducted. The analysis of likely fleet disposition will deal with the fleet as it existed in 1991; and the summary of economic and social impacts will focus on the fate of the fishing fleet, labor force, and local economies in driftnet fishing ports as they were in 1991.

Chapter II - Methodology: Data Collection and Assessment of Moratorium Impacts

To comple information on the fate and future of the driftnet fleet and economic impacts associated with the UN driftnet moratorium, the authors combined field research with literature and data searches. Data and literature searches were conducted in both the US and Asian countries, and field work was conducted in all three driftnetting nations. Because little information on fleet characteristics and future plans for driftnet vessels is published or easily available, much of the information used in the study was gained during field work in the three driftnet fishing nations. This field work utilized the elite interview technique to collect information relating to fleets and the social and economic impacts associated with the driftnet ban.

1. The Elite Interview Technique

The elite interview technique involves in-depth discussions with people who are in positions of power in important organizations and agencies. Elite interviewing requires a mix of structured and open-ended discussion which seeks to establish facts where direct collection of data is impossible. Interviews were conducted in capital cities and home ports of driftnet vessels so as to gain a clearer, first-hand understanding of current developments. A wide range of individuals involved with the driftnet fishery were interviewed, including people in government agencies and in the private sector. From government officials we sought statistics regarding the licensed fishing fleet and information about government intentions for vessel owner compensation programs and for future uses of driftnet vessels. Local government officials were also interviewed and asked similar questions about plans for the driftnet fleet and the social and economic impacts home ports will be faced with after the driftnet ban becomes effective. Interviews were not limited just to bureaucratic institutions that were responsible for driftnet policy issues. The heads of the Driftnet Associations of all three countries were interviewed in addition to individuals involved in the fishing and seafood industry. Those that were interviewed in the fishing industry included vessel and company owners that had been directly involved with the driftnet fishery.

Interviews were conducted in Japanese and English during field work in Japan, and in English or with the aid of an interpreter in Korea and Taiwan. An interpreter was used for interviews in Korea and Taiwan when the individual being interviewed did not speak English. A general format for interviews was prepared in advance, which loosely structured the interviews so as to assure completeness without imposing artificial rigidity.

2. Methodological Considerations and Data Needs

It is important to address a number of methodological issues in order to better understand how collected data will be used. These include: (1) What were the objectives of the study? (2) What information was gained during data searches and fieldwork? (3) What information was not available/what data gaps exist? and finally, (4) How will collected data be used in the study?

The objectives of the study are to: (1) document the status and trends of the current driftnet fleet , (2) summarize industry and governmental plans for the near future, (3) assess various fleet adaptations to the moratorium and the strategies and actions that are likely to flow from private economic decision making, (4) obtain information on markets for driftnet caught species, and (5) collect preliminary data in each of the three countries on the social and economic impacts associated with the driftnet ban. "Status" and "trends" as noted in objective (1) refers to information on numbers, size, age, costs, and capabilities of the existing fleet and institutional restrictions on opportunities for vessels and labor to shift into alternative fisheries. Information on "plans" as noted in objective (2) encompasses the expressed intentions of fleet operators and government officials in each country and their assessments of logical options for the fleet.

Taking the above objectives into consideration, it was apparent that objectives (1), (2), and (3) depended on obtaining information on the present status/characteristics of the fleet and the future of ex-driftnet vessels. When addressing information concerning the present status of the fleet, updated information was obtained on the number of vessels that each Asian nation's government issued licenses to/allowed to fish during recent years. What is not known is the exact number of license holding vessels that actually fished during each year. During certain years, it is possible that vessels that held licenses did not fish due to factors such as market conditions or better opportunities in alternative fisheries.

Information on other fleet characteristics were obtained during data searches and fieldwork in each country. Vessel distributions in terms of vessel size (e.g. gross registered tons, or GRT) are documented for each country. Vessel age distributions were based on figures citing fleet averages. A breakdown denoting the exact age of individual driftnet vessels was available only for the Korean fleet and 75 Taiwanese driftnet vessels. General information on vessel operating costs was collected in each country with contacts in Japan providing the most complete information on vessels costs. Rough estimates in relation to operating costs were voiced during interviews with vessel owners in Korea and Taiwan whereas data collected in Japan offers more complete figures on expenditures and vessel operating costs for driftnet vessels.

Fulfilling the objectives of acquiring more information on the future of ex-driftnet vessels entailed an analysis of government and industry plans for the future. Government plans can be identified as official policies within the fisheries agencies relating to the future of the fleets and the implementation of government programs such as compensation schemes. Information was gathered in all three countries on compensation programs and official government policies concerning the future of the driftnet fishery and driftnet vessels.

Obtaining information on industry plans for the future largely entailed seeking information on responses to the following variables: (a) government compensation programs, (b) institutional restrictions and opportunities in alternative fisheries, (c) vessel operating costs compared to other fisheries, and (d) vessel capabilities. These variables were the most important when addressing the third objective, "assess fleet adaptations in response to the moratorium and the strategies that are likely to flow from private economic decision-making." This objective, which essentially is the crux of the study, depends on the variables mentioned above because vessel owners must take a wide number of factors into consideration when making decisions concerning the future of the fleet. Only after considering these variables can estimates be made about fleet adaptations in response to the moratorium. Many of the interviews with individuals in the private sector of each of the countries focused on these topics with the hopes of using such information in the construction of a matrix that would be used to estimate the future of the fleet based on strategies that are likely to flow from private economic decision making. An estimation of these strategies flowing from private economic decision making in the form of a matrix will hopefully address questions about the projected disposition of the driftnet fleet.

3. Economic Strategies and the Projected Disposition of the Driftnet Fleet

We assume that the ultimate disposition of the fleet depends upon economic decisions of vessels owners. These decisions are assumed to be largely private, self-interested decisions based upon a rational assessment of economic pay-offs in a number of alternatives for vessel deployment. The economic pay-offs and the alternatives available will in turn depend upon government policies (e.g. compensation programs for vessel decommissioning and provisions for licensing ocean fisheries), the vessel's characteristics (age, size, power, gear), and associated economic parameters in alternative fisheries (e.g. fish prices and vessel operating costs). Our general concept is that vessel owners will obtain information about each of these factors, will assess the prospective economic returns from alternative vessel deployments, and will select the action which promises to maximize private economic return. The action selected could be a single choice (e.g. scrap the vessel or convert to tuna longlining) or it could be a multi-fishery choice (e.g. fishing effort split between tuna longlining and squid jigging). Because government policies and economic circumstances differ among nations, and because the current capital investments and capabilities vary among vessels, we expect a wide variety of responses to the challenge posed by the high seas drift net moratorium. Hence, a thorough and accurate projection of fleet disposition would require detailed information regarding (1) the status of the existing fleet, (2) the economic consequences of alternative vessel deployments, (3) the government policies for vessel licensing and compensation, and (4) the behavioral characteristics of economic decision makers in each of the nations.

The elite interviews and literature surveys provide some information on most of these classes of information. However, much of the detailed economic information is proprietary and unavailable to us. Consequently, our projected driftnet fleet disposition is based upon relatively rudimentary and often incomplete knowledge of prospective economic opportunities. Nevertheless, our analysis is consistent with the notion that economic decision making determines the ultimate fleet disposition. The following paragraphs describe how the analysis is structured to reflect the economic decisions as we conceive of them. The various steps in the analysis involve (1) displaying the options for driftnet vessel owners of each nation, (2) delineating the factors likely to influence vessel owners' decisions, (3) judging the likely effects of various economic factors on vessel deployment decisions, and (4) expressing the aggregate result of the deployment decisions as a distribution of the baseline fleet across alternatives.

Options for Driftnet Vessels

Based upon information obtained through interviews in the three Asian fishing nations, we determined that there are five primary options for drift net fishing vessels: (1) scrapping the vessel; or participating in one of the four alternative fishing modes (2) squid jigging, (3) tuna longlining or skipjack pole and line fishing, (4) trawl and bottom longlining, and (5) saury dipnet fishing. These five options are listed as column headings in the Driftnet Fleet Disposition Matrix (Figure 2-1). The column labeled "Scrapping" is further subdivided to allow for projections based upon stated government and industry plans and for our additional projections based upon residual vessels having little or no other feasible options. This is explained in greater detail in Chapter IV.

Figure 2-1. Driftnet Fleet Disposition Matrix

		SCRAPPING		ALTERNATIVE FISHERIES			
Country	# Licensed Vessels (1991)	Planned	Estimated	Squid Jigging	Tuna Long-line, Skipjack Pole & Line	Trawl and Bottom Longline	Saury Dipnet
Japan							
Korea							
Taiwan							

Factors Influencing Choice of Vessel Deployment Option

Each vessel owner is presumed to have some past investment in the fishing vessel and fishing gear, and to have important ties to the fishing crew and community. Much of the economic investment is irretrievably committed to the fishing vessels and its operation. Hence, the cost of past investments (economic and otherwise) are taken as sunk costs in the sense that they cannot be recovered. Sunk costs have little influence on decisions regarding future deployment of the fleet. Further, decisions about future deployment are affected mainly by prospective consequences of future actions; past economic returns from various high seas fisheries influence these decisions only to the extent that past experience affects current expectations of future rewards.

Since the most obvious response to the high seas driftnet ban would be to scrap the vessel, we gauge the economic consequences of alternative vessel deployment relative to the economic value received for scrapping the vessel. This economic value is quantified in two ways. Government compensation programs stipulate specific payments for scrapping of vessels. We describe the compensation programs in Chapter IV. In the absence of a compensation program, a vessel owner might be offered a payment for the scrap value of the steel in the vessel. However, dismantling fishing vessels for scrap steel tends to be unprofitable for the scrappers. Hence, scrapping a vessel in the absence of a compensation program may involve a net additional cost to the vessel owner. We obtained some information about this cost during the field interviews.

Further, ties to the crew and community will influence decisions precipitated by the high seas drift net moratorium. Continued fishing activity will help to soften the economic blow to fishing crews and communities. Hence, we suspect that continued fishing would be a preferred option for vessels owners unless the economic prospects in alternative fisheries is too bleak, there are no government licenses available for those fisheries, or government compensation for scrapping the vessel is an economically attractive option. We have no way of quantifying this factor, but we note that it could account for continued fishing activities even when the highest prospective private economic return in alternative fisheries is relatively poor.

Judging Likely Effects of Economic Factors

A vessel owner is clearly influenced by availability of government licenses for alternative fisheries and by the prospective economic returns in those fisheries. Our field investigation discovered the existence of license limitations for most fisheries operated in high seas and distant waters. In some cases, the government had no intention of expanding the licensed fleet in order to accommodate the shifting of drift net vessels into alternative fisheries. Where this occurs, our approach is to assume no deployment of that nation's driftnet vessels to the fishery in question.

Prospective economic returns for alternative fisheries are undoubtedly influential in vessel owner's decision making. Due to data limitations described earlier, however, we do not estimate these alternative economic returns in any detail. Nevertheless, a series of factors related to profitability are brought to bear in projecting the fleet disposition. For example, the costs of transferring to an alternative fishery depend upon whether the vessel is already configured to fish in that fishery. Hence, we examine the extent of past multi-fishery activity by driftnet vessels in assessing likely future fishing decisions. Where a vessel has not previously engaged in a particular fishery, two factors seem particularly influential. First, whether a vessel can successfully convert depends upon its size and general capabilities. Smaller driftnet vessels are unlikely to be converted to tuna longlining even if licenses are available, because of safety and endurance requirements of extended distant water operations in tuna longlining. Hence, we examine the size distribution of each national driftnet fleet in assessing the likelihood of various vessel conversion options. Second, the cost of conversion depends upon the vessel's vintage and technical configuration. For some conversions, e.g. to tuna longlining, very advanced refrigeration systems are now considered necessary. It will be less profitable to invest the additional amount necessary in an older vessel, having a limited operational lifetime, than in a newer vessel. Hence, for some of the conversion options, the age of vessels is taken as an influential factor.

Projecting Aggregate Fleet Dispositions

Our projection distributes the baseline driftnet fleet for each nation across the five alternative categories (again see Figure 2-1) based upon consolidated information regarding all the influential economic and programmatic considerations described above. Because the information available to us is varied in type and detail, this process of projection requires common sense and subjective judgment on our part which departs from a clear statement of economic decision making as described above. We provide sufficient details of the process to permit the reader to judge the result and to re-analyze the information as desired.

Summary

Our approach to projecting driftnet fleet disposition adheres generally to the notion of rational economic decision making by vessel owners. We assume vessel owners face a sequence of decisions involving comparison of prospective economic pay-offs among discrete alternative options. First, the owner must examine the economic consequences of decommissioning (or scrapping) the vessel. These consequences depend critically on the nature of government compensation programs designed to assist the driftnet fleet in responding to the high seas moratorium. Second, to assess the economic returns from continued operation, the vessel owner must determine in which alternative fisheries the vessel could be deployed. To begin this assessment, the vessel owner determines which fisheries are available under government licensing policies, and then considers whether the vessel's age and size characteristics make conversion feasible. The final step is a detailed economic assessment of each alternative, examining conversion costs, projected catch rates, fish prices, and operating costs. Since we lack the detailed information available to vessel owners, we do not attempt to mimic this economic decision making process in making our projections. Instead, we distribute the fleet across five alternative deployments using information gleaned from the field interviews. The relevant information includes data on government compensation programs, license restrictions and opportunities in alternative fisheries, general size and age characteristics of the national fleets, and anecdotal information on conversion costs and capabilities required for alternative fisheries.

4. Information on Driftnet Species Markets and Socioeconomic Impacts

Information on markets for driftnet caught species was obtained during interviews and literature searches, whereas information concerning social and economic impacts was obtained exclusively during field research in each country. Data on driftnet caught species is straightforward and offers statistics on catch value, catch volume, markets for driftnet caught species, and potential market opportunities for ex-driftnet vessels. Data on social and economic impacts is preliminary because the driftnet fishery had not yet ended at the time of field research. Estimates for affected crew members are likely to be more accurate than estimates for community wide effects. Figures noting socioeconomic impacts in Korea and Taiwan focus on the port cities of Kaohsiung in Taiwan and the city of Pusan in Korea. These are the main driftnet port cities, and they were visited by the associate researcher during field research. Much of the information on the socioeconomic impacts of the driftnet ban in Japan is based on interviews in the city of Hakodate, which serves as a good example of a port city in Japan that has depended on the driftnet fishery.

In addition to economic ramifications for each country, we summarize information highlighting the significance of reduced harvests of driftnet-caught fish species in the context of world fish supplies. This information summary relies heavily upon published catch information and upon unpublished reports on the driftnet fishery which were distributed at the International North Pacific Fisheries Commission Symposium in Tokyo, November 4-6, 1991 and at the Scientific Review of the North Pacific High Seas Driftnet Fisheries in Sidney, British Columbia, Canada, June 11-14, 1991.

Chapter III - Variables Affecting Private Economic Decisions in Relation to the Future of the Fleet

As noted in the previous chapter, economic decisions are largely influenced by the following variables: (a) government compensation programs, (b) institutional restrictions and opportunities in other fisheries, (b) operating costs in other fisheries, and (d) inherent vessel capabilities. The following section addresses these variables by country. The first variables vessel owners are likely to consider when deciding whether to scrap, convert, or maintain a vessel are government compensation programs and institutional restrictions on entering other high seas fisheries. Institutional restrictions in the form of license limitations in alternative fisheries had a large impact on decisions concerning vessel re-deployment in alternative fisheries. Additionally, it was apparent that choices by vessel owners in relation to plans for scrapping were largely influenced by government compensation programs. If compensation was not available or was not acceptable to those in the fishing industry, vessel owners were less likely to scrap their vessels. This was reflected in the finding that the two countries (Taiwan and Korea) with lower compensation figures in US dollars saw a larger percentage of vessel owners stating that they will convert their vessels as opposed to accepting what they viewed as inadequate compensation allowances.

1. Compensation Programs

Japan

The Japan Fisheries Agency has developed a compensation program for driftnet vessels. To be eligible for compensation, a vessel must have fished in one of the driftnet fisheries at least two of the last three years. The program deals with four classes of vessel: (1) large vessels (> 130 tons) used exclusively for drift net fishing, (2) large vessels used seasonally in driftnet fishing, (3) small vessels (130 tons or less) used exclusively in driftnet fishing; and (4) small vessels used seasonally in driftnet fishing. These compensation amounts are shown in Table 3-1. The Government of Japan will offer compensation to owners of large-mesh driftnet vessels only in 1992, while offering compensation to squid driftnet vessels over a three year period. A government official confirmed that the Finance Ministry has given final approval for the compensation program.

Three components of the program are (1) a compensation payment from the government of Japan, (2) a payment to cover the costs of scrapping a vessel, and (3) an additional compensation payment from the prefectural government. These three sources of payment and the totals for each year and type of vessel are listed in the Table 3-1.

Compensation payments are made to the vessel owner; none of this goes to affected crew members. Vessel owners will be entitled to dispose of their vessels in any manner they wish as long as they do not attempt to continue operating in the driftnet fishery. As to why vessel owners may apply for compensation allowances over three years, a government official reported that this was due more in part to two factors: budgetary constraints during FAJ and finance ministry negotiations, and vessel owners might opt to apply for compensation during a later year if they are involved in other fisheries.

According to a Department of Commerce unclassified memo, the fishing industry is requesting up to three other compensation packages from the government: a special retirement allowance that includes unemployment insurance for an extended period in addition to the cost of vocational training for the 7,500 affected crew members; rescue measures for the squid processing industry, which is estimated at 40-50 billion yen (US$ 275-345 million) in 1990; a financial rescue measure for the gear and equipment industry as compensation for the loss of business.

Table 3-1. Japanese Government Compensation Program

Vessel tonnage/ operation	Year of retirement	Compensation (1)	Expenses for scrapping (2)	Gov't of Japan total (3)	Prefecture (4)	Total (5)	Total in US $ (6)
		1,000s of yen	1,000s of yen	1,000s of yen	1,000s/yen	1,000s of yen	
Large-type Exclusive Driftnet.	1992	61,600 (26,200)	48,500	110,100 (99,000)	24,300	132,400 (125,200)	1,073,170
	1993	55,500	42,000	97,500	21,000	118,500	963,414
	1994	49,500	37,700	87,200	18,800	106,000	861,788
Large-type Seasonal DRIFTNET.	1992	45,000 (18,600)	57,200	102,200 (75,800)	28,600	130,800 (104,400)	1,063,414
	1993	39,000	53,200	92,200	26,600	118,800	965,853
	1994	32,900	51,000	83,900	25,500	109,400	889,430
Small-type Exclusive DRIFTNET.	1992	40,500 (26,700)	28,300	68,800 (55,000)	14,200	83,000 (69,200)	674,796
	1993	37,500	27,900	65,400	14,000	79,400	645,528
	1994	34,400	27,000	61,400	13,500	74,900	608,943
Small-type Seasonal DRIFTNET.	1992	24,700 (18,500)	27,500	52,200 (46,000)	13,700	65,900 (59,700)	535,722
	1993	22,700	27,300	50,000	13,700	63,700	517,886
	1994	20,700	27,000	47,700	13,500	61,200	497,560

Large-type vessels = more than 130 tons
Small-type vessels = less than 130 tons
( ) = figure for large mesh driftnet vessels when different

Source: Fisheries Agency of Japan

Korea

The Korean government is planning to establish a compensation fund in which vessel owners may receive 37 million won ($48,000 U.S.) for conversion costs and 7.9 billion won ($13,000 U.S.) for scrapping costs since the scrapping costs must be paid by the vessel owner (it was reported by the Driftnet Association that the cost of scrapping could run up to $60,000 per vessel). Many vessel owners have reported to the Squid Driftnet Association that they have no choice but to convert since government compensation only covers a very small percentage of the value of their vessels. A Korea Ocean Research and Development Institute (KORDI) translation of a newspaper article reported that vessel owners can receive approximately US$50,000 from the government compensation program for each vessel. Reportedly, they are dissatisfied with this figure and are demanding $1 million as compensation for each vessel.

One Korean government official stated the Korean government does not have the ability to compensate Korean vessel owners at the same rate the Japanese government is offering. A large number of Korean vessel owners are dissatisfied with this. Some have reported that continued driftnet fishing is their only means for survival.

An official from KORDI offered another insight as to why the government compensation program in Japan was better funded than the program in Korea. It was pointed out that fishing unions in Korea are a relatively new phenomena, having been in existence for only the last decade or so. Because the Japanese fishing industry unions and cooperatives have established their influence over a longer history, fishermen in Japan have been better organized than Korean fishermen, and they have been able to exert more pressure on their government and fisheries agency.

Taiwan

The Taiwanese government established a buy-back program in 1990 that is the most aggressive program of the three nations. Most of the vessels that have been bought-back have been used as artificial reefs. A government source stated that 93 vessels have already been bought back and 69 have applied for conversion loans as of March 5, 1993. All buy-back vessels will "either be used as artificial reefs or destroyed." The same government source noted that up to 400 vessels have been involved in the driftnet fishery on a part-time basis in the past and that these vessels are all eligible for the compensation program. In order to receive government compensation (not conversion loans), vessels need not have fished in the driftnet fishery for a certain number of years. To be eligible for conversion loans, vessels must have participated in the driftnet fishery for at least one year.

The government program gives vessel owners a choice of either taking out a low interest loan (5.25%) with a maximum amount of NT $5,000,000 ($200,000 U.S.) to help finance conversion costs, or the government will buy back a vessel at NT $12,000 ($480) per GRT with a maximum of NT $5,000,000 per vessel offered to the owner for compensation. Scrapping costs are paid by the government. Additionally, before December 31, 1992, any vessel owner may convert his combined driftnet vessel building quota into constructing tuna purse seiners of at least 1,000 GRT. As opposed to Korea, where vessel owners must pay scrapping costs, the Taiwanese government pays for scrapping costs although the majority of vessels will be used as artificial reefs.

As in Korea, many vessel owners have complained that government compensation covers only a small percentage of the vessel's worth. The Driftnet Fishery Association reported that the cost of many vessels was $30 million N.T. ($1.2 million) and that the $5 million N.T. ($200,000) being offered by the government was a negligible amount. An official from the Driftnet Association stated that "a minority of vessel owners are willing to sell their vessels back to the government - and if the buyback policy does not change we will take to the streets." He also stated that fishermen would be happier if the government would buy back driftnet gear and nets since the government encouraged entry into the driftnet fishery in the first place. One vessel owner said that "if the government really wanted to end all driftnetting, they should buy back all of the nets to assure an end to driftnetting." He was also indignant about not being reimbursed by the government for satellite transmitters that the fisheries administration required vessel owners to purchase if they participated in the North Pacific driftnet fishery.

2. Institutional Restrictions and Opportunities in Alternative Fisheries

Japan

The Fisheries Agency of Japan has stated that it will not expand licenses in alternative fisheries in order to create new opportunities for ex-driftnet vessels. Vessels can either: 1.) remain in the fishery if the vessel previously held a license in that fishery, 2.) withdraw from the fishery, or 3.) if an ex-driftnet vessel was to enter an new/alternative fishery, a license must be purchased from a vessel that already owns a license in that particular fishery. As stated by an official from the Oshima Prefectural Office Fisheries Division, "If a vessel was to convert to the distant water squid jigging fishery, they cannot obtain a new license, they can only buy a license to replace a previous squid jigging vessel."

Table 3-2. Number of Fishing Vessels by Type Licensed in Japan in 1992.

	Vessel Licenses	Allowed to operate on high seas	Pacific Ocean	Atlantic Ocean	Indian Ocean
Squid Driftnet	426	426	426	0	0
Large mesh. Driftnet	*69	52	52	0	0
Purse Seine	52	52	39	2	11
Skipjack Pole and Line.	306	291	291	0	0
Tuna Longline	1480	1116	848	134	134
Dragnet	37	30	30	7	0
Squid Jigging	613	45	45	0	0
Saury Dip Net	402	10	10	0	0
Total	3442	2029	1741	143	145

* = reduced to 18 as of July 1, 1992
Source: Fisheries Agency of Japan

It appears that one opportunity for ex-driftnet vessels is the distant water squid jigging fishery. A number of individuals in Japan involved with the driftnet fishery stated that the distant water squid jigging fishery was the most likely alternative for a small number of vessels that will not receive compensation. Even though vessels must purchase licenses for the fishery if they do not already own one, fisheries off such countries as Peru and Argentina are expanding opportunities for foreign squid jigging vessels. In March 1992, the Peruvian government auctioned squid jigging licenses to foreign vessels for the first time. Japan received 17 licenses and an allocation of 80,000 tons against poundage fees of nearly $700,000 per vessel ("Latest Developments in Asian Fisheries," May- June 1992).

Other reports indicate that the distant water squid jigging fishery is not a very promising alternative for driftnet vessels. A number of fishermen noted that due to the low price of squid and higher costs of running lighting equipment and purchasing squid jigging licenses, the squid jigging fishery off South America would be a risky undertaking by ex-driftnet vessels. A number of individuals also stated that there has been a decline in the total catch of the distant water squid jigging fleet in South American waters. The Japan Squid Jigging Vessel Association announced that in 1991-1992, there was an overall catch of approximately 80,000 tons of squid, which was a decrease of roughly 30,000 tons from the 1990- 1991 season . This decrease was attributed to poor catches in the Southwest Atlantic and fleet reductions there and in New Zealand ("Latest Developments in Asian Fisheries" May-June, 1992). The same report noted a decrease of 29 percent in the overall catch in the South Atlantic compared to the previous season and a decrease in catch rates of 15 percent in New Zealand waters even though catch per vessel increased by 154 percent. This implies that the number of Japanese vessels in the New Zealand squid jigging fishery declined in number. Findings such as these, along with the current low price of squid in the Japanese market, would seem to discourage driftnet vessel owners from entering the distant water squid jigging fishery.

Another alternative fishery for driftnet vessels is the Russian Salmon fishery. Although data concerning the numbers of vessels involved with such operations was not obtained, it appears that the sale of Russian salmon quotas in coastal waters to Japanese vessels might be a precursor for salmon driftnet activities in the Russian Exclusive Economic Zone. This would be one fishery that could provide a number of opportunities for driftnet vessels that had to halt operations in response to the moratorium. Although the UN moratorium on driftnetting prohibits the use of driftnets on the high seas, it does not prohibit the use of driftnets in nations' exclusive economic zones. Because the continued operations of driftnet vessels after the driftnet moratorium could ignite political opposition, even though operations would be limited to waters within the Soviet EEZ, information concerning this fishery is very difficult to obtain.

The tuna longline fishery was never mentioned as a feasible alternative for ex-driftnet vessels due to the high costs of updating refrigeration capabilities and other factors discussed in the section on "vessel capabilities." During elite interviews in Japan the only fishery other than squid jigging discussed as feasible alternatives for ex-driftnet vessels was the saury dip net fishery. With that fishery there remains the problem of license limitation.

Korea

A Korean government official stated that the Fisheries Administration will try to expand licenses in distant water fisheries such as the squid jigging fishery off South America in order to ameliorate hardships due to the ban. This contrasts with the stated intentions of the Japanese government regarding license regulations. When asked if the tuna or trawl fisheries would be expanded in order to make room for newer ex-driftnet vessels, an official replied that he did not foresee either of these fisheries being expanded in order to lessen the impacts of the driftnet moratorium. According to a Fisheries Administration representative, the Korean government is currently negotiating with Argentina to expand squid jigging license agreements in Argentine waters. The following information from a Department of Commerce/NOAA/NMFS publication mentions existing Korean-Argentine activities that could provide possible opportunities for ex-driftnet vessels that are hoping to become involved in squid jigging operations in Argentine waters:

"Twenty South Korean fishing companies are forming joint-ventures with an unknown number of Argentine companies. The principal Korean companies involved in these joint-ventures are Daerim and Samho while some of the participating Argentine companies include Harengus, Mellino, and Antartida Pesquera Industrial (API). Over 30 ROK vessels will be involved in the ventures. Argentine sources estimate a near doubling of the squid harvest for 1992 to 100,000 metric tons, a figure that may be overly optimistic. South Korean squid fishermen have been operating in the South Atlantic (off the coast of the Falkland Islands and elsewhere outside Argentina's 200 mile zone) for several years. The Korean government is trying to assist its distant-water fishermen who have difficulty obtaining access to fishing grounds by offering special import privileges for foreign joint-venture companies involving Korean participation. Argentina, for its part, seeks to more fully utilize coastal resources and hopes the new Korean joint-ventures will enable it to increase catches." (From "Latest Developments in Pacific Rim Fisheries," Sept.-Oct. 1992.)

Table 3-3. Number of Korean Distant Water Fishing Vessels by Fishery Licensed in 1991:

Tuna	284
* Squid (Jigging & Driftnet)	250
North Pacific Trawl	43
General Trawl	138
Shrimp Trawl & Others	85

* In 1991, 142 vessels held licenses in the squid driftnet fishery - the remainder operated as squid jigging vessels. Source: Korea Deep Seas Fisheries Association

Taiwan

The Taiwanese government states a position closer to that of the Japanese than the Korean government. They will not expand licenses in other distant water fisheries, but driftnet vessels may enter these fisheries if they previously held a license in one of the four fisheries in which the government allocates licenses. As stated by a government official from the Kaohsiung Municipal Fisheries Office, "we do not see the government increasing the number of licenses in the traditional fisheries." All driftnet vessels previously owned licenses in one of the four government licensed main fisheries although it was stated that purse seine vessels did not participate in the driftnet fishery. Due to vast differences in the capabilities and technology of purse seine and driftnet vessels, purse seine license owners did not participate in the driftnet fishery. Taiwanese driftnet vessels that had previously held longline, jigging, or trawl licenses participated in the driftnet fishery on a part time basis although in reality they often driftnetted full-time. This is because the Taiwanese government never issued official full-time driftnet licenses. The fisheries in which the government issues licenses are:

1. Tuna longlining
2. Squid jigging
3. Trawling
4. Purse Seining

According to a government official from the Fisheries Division, Taiwan Council of Agriculture, the majority of driftnet vessel owners previously owned tuna longline licenses. Therefore, as opposed to Korea and Japan, a greater number will convert back to tuna longlining. Conversion of driftnet vessels to tuna longline vessels is contingent upon vessel owners having previously held a tuna longline license. It also appears that the government is encouraging driftnet vessel conversions to the albacore longline fishery. A senior manager of one of the largest fishing companies in Taiwan, reiterated this point in stating that "the government is encouraging driftnet vessels to convert to tuna longline vessels." The senior manager said that this is due to the more promising market conditions in the albacore longline fishery compared to the other alternative fisheries such as squid jigging. A knowledgeable individual who has been working in the South Pacific stated that a few Taiwanese vessels have already converted to tuna longliners. The same individual noted that most of the albacore longlining activity in the South Pacific was from Taiwanese vessels as Japanese and Korean vessels have opted to not re-enter the fishery due to low prices in the past. It was mentioned that prices have recently risen for albacore, which might explain why Taiwanese vessels have re-entered this fishery.

3. Operating Costs and Vessel Capabilities

Costs - Japan

The Hokkaido Pelagic Fishing Association estimated that vessel owners paid an average of roughly 40 million yen ($325,200 U.S.) per driftnet vessel. A fish and vessel broker in Tokyo noted that the value of driftnet vessels on the international market ranges from 10 - 40 million yen ($81,300-$325,200). These figures are close enough to corroborate the notion that a relatively new and technically up-to-date vessel is worth around $325,000; while older and less capable vessels would sell for a substantial discount from the new price.

Two sources of physical characteristics and costs for a Japanese squid driftnet vessels are the Hokkaiko Faculty of Fisheries, Hokkaido University, Hakodate and the Driftnet Section, Fisheries Agency of Japan. Data from the two sources are displayed on the following page in Tables 3-4a and 3-4b. These two data sets exhibit surprising consistency. Vessel size and number of employees for the two cost data sets was nearly identical. The most noticeable difference was net revenue, with the vessel noted in the Hokkaido University Faculty of Fisheries data showing a gain of Y 4,923,000 and the vessel noted in the Fisheries Agency of Japan data reporting a loss of Y 12,880,000.

Vessel Capabilities - Japan

A large number of the older driftnet vessels (15-20 years old) were built for the tuna longline fishery although a small number were originally trawlers. In the late 1970's and early 1980's, many vessels owners decided to enter the North Pacific driftnet fishery. In the early years of the 1980's, some vessel owners considered re-entering the tuna longline fishery, but the costs of updating refrigeration technology was prohibitive, so many of these vessels committed to staying in the driftnet fishery (Personal comm. - Hokkaido Pelagic Fishing Association).

Based upon conversions in Hokkaido, we fish that Japanese driftnet vessels are unlikely to convert to tuna longline fishing due to the older average age of driftnet vessels, license limitation in tuna fishing, and the high cost of converting driftnet vessels to compete with newer tuna longline vessels that have modern freezing technology. Therefore, we consider it unlikely many driftnet vessels will be converted to tuna longliners. However, those vessels that have a squid jigging license are more likely to enter the distant water squid jigging fishery.

As mentioned above, the inability of many driftnet vessels to enter the tuna longline fishery is due to outdated refrigeration systems. The same is true with driftnet vessels hoping to enter the skipjack pole and line fishery. The All-Japan Purse Seine Fisheries Association has developed a new fish preservation system that will "super chill" catch. During the pasts two years, the system was tested on offshore skipjack pole and line vessels ("Latest Developments in Asian Fisheries July-August 1992"). The same report noted that if the new refrigeration system is successful, it will be considered a revolutionary development because red flesh fish such as sardines, mackerel, and skipjack are so difficult to keep fresh after being caught. Therefore, it is unlikely that ex-driftnet vessels will be able to enter the skipjack pole and line fishery unless they are willing to invest large sums of money in the newest refrigeration technology. This investment is not likely due to the fact that most driftnet vessels are over 15 years old.

Table 3-4a. Characteristics and Costs for Hakodate Squid driftnet vessel.

Vessel Characteristic	Magnitude	In US Dollars
Tonnage:	320 tons	
Vessel Age:	20 years	
# of employees:	16	
Amount of catch (in tons)	579	
Total Revenue	208,166,000 yen	$1,486,900
Total Costs:	203,243,000	$1,451,735
Wages:	69,866,000	
Fuel costs:	29,493,000	
Cost of management:	41,921,000	
Misc. materials	33,775,000	
Other:	19,623,000	
Depreciation:	1,492,000	
Margin	7,073,000	
Net Revenue:	4,923,000	$ 35,164

Source: Hokkaido Faculty of Fisheries, Hokkaido University, Hakodate.

Table 3-4b. Characteristics and Costs for Average Japanese Driftnet Vessel

Vessel Characteristic	Magnitude	
Tonnage:	338.22 tons	
Horse Power:	923 Hp	
Vessel Age:	17.1 years	
Fishing Days:	107 days	
# of employees	15.6 persons	
Cost/Revenue	in Yen	In 1991 US $
Total Revenue:	187,821,000	$1,395,401
Total costs:	200,701,000	$1,491,092
Operational costs	178,779,000:	
Labor expenses:	75,282,000	
Vessel maintenance:	16,967,000	
Fishing gear:	17,475,000	
Fuel	21,416,000	
Other	47,639,000	
Depreciation:	21,922,000	$162,868
Building	435,000	
Vessel:	10,926,000	
Fishing gear:	9,990,000	
Others:	571,000	
Net Revenue:	-12,880,000	($ 95,691)

Source: Driftnet Section, Fisheries Agency of Japan.

The elite interviews sought information on whether vessel owners not eligible for government compensation will sell their vessels to foreign countries. The Director of the Hokkaido Pelagic Fishing Association replied that vessel owners are not allowed to sell their vessels if the vessel has been financed by a government loan. A subsidized vessel is not exportable. Also, he noted that other countries will not buy ex-driftnet vessels due to maintenance problems and the old age of the vessels.

Table 3-5. Japanese Squid Driftnet Vessel Size Distributions, 1981 - 1990. (Small = < 130 tons Large = > 130 tons)

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Small	371	326	285	265	259	237	209	202	196	195
Large	163	203	230	240	243	255	269	261	264	262
Total	534	529	515	505	502	492	478	463	460	457

Source: Hayase *et al.* 1991

Table 3-6. Number of Japanese Large-mesh Driftnet Vessels by Size in Gross Tons in 1988:

Tonnage Class	1988
10 - 49 GT	134
50 - 99	74
100 - 199	133
200 - 299	55
300 - 399	38
400 - 499	25
Total	459

Source: Watanabe, 1991

<u>Costs - Korea</u>

The Korea Deep Seas Fishery Association estimated that the price of a driftnet vessel 350 GRT and above was approximately 400 million won ($509,000), and a vessel 250 - 350 GRT cost approximately 300 million won ($382,000). A breakdown of vessel operating costs such as the cost data provided in the section on Japan was not available - only vague estimates from personal communication. In terms of vessel operating costs, the Korea Squid Driftnet Association estimated that the operation costs of most companies was 80 - 85% of total sales revenue although this number is difficult to calculate due to the range of vessel sizes. Estimating vessel operating costs, the Director of the Korea Squid Driftnet Association gave the following figures:

- 20% for fuel
- 40% for crew wages
- 15% for net costs/net repair
- 15% transfer ship
- 10% other

Vessel Capabilities - Korea

It was reported by a government official from the Korean Fisheries Administration that the majority of driftnet vessels operated as tuna longliners before operating as squid driftnet vessels.

Table 3-7. Korean Squid Driftnet Size Distributions 1980 - 1990

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
100 +		1	2	2	2	2	4	7	7	9	8
200 +	6	19	33	55	62	62	75	90	91	96	91
300 +	4	6	11	20	25	28	27	27	35	38	31
400+	4	7	14	22	22	5	11	14	15	12	12
500 +								1	1		
600 +								1	1	2	
700 +		1									
Total	14	34	60	99	111	97	117	140	150	157	142

Source: An *et al.*

Table 3-8. Korean Squid Driftnet Vessel Age Distributions 1980 - 1990

Age	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1 - 5					1			2			
6 - 10	1	3	7	13	11	3		6	3		
11 - 15	3	4	12	17	22	9	18	22	23	22	5
16 - 20	10	27	30	54	37	28	29	27	33	38	22
> 21			11	15	40	57	70	83	91	97	115
Total	14	34	60	99	111	97	117	140	150	157	142

Source: An *et al.*

Costs - Taiwan

In addition to reviewing driftnet vessel operating costs, it is also important to look at the different costs associated with the two types of fisheries Taiwanese driftnet vessels are likely to convert to if vessel owners decide to convert instead of taking part in the government compensation program. A vessel owner that has owned both driftnet and tuna longline vessels stated that driftnet vessel costs are considerably lower than tuna longline costs. This is due to a number of reasons:

- driftnet vessels do not need to purchase bait whereas tuna longliners must.

- tuna longliners must be newer and better kept vessels because they operate further from home and repair costs are much higher in foreign ports if the vessel needs repairs/maintenance.

- equipment for driftnet vessels is not as expensive as equipment for other fisheries ("nets are not expensive when compared to other types of gear" - Taiwanese fishing company representative)

It was reported by the Taiwan Squid Driftnet Association that the cost to convert a driftnet vessel to a longline was approximately $8 million N.T. ($320,000). The Kaohsiung Municipal Fisheries Office estimated that the cost to convert a driftnet vessel to a tuna longline was approximately $10 million N.T. ($400,000). One vessel owner said that it has cost him $12 million N.T. ($480,000) to convert his five year old, 700 ton vessel that was built for driftnetting to a tuna longliner (Due to the environment in Taiwan during fieldwork in which the fishing industry was upset about government compensation numbers and was negotiating for higher figures, it is possible that the conversion estimates noted above are substantially exaggerated). The same vessel owner noted above reported that due to the low price and oversupply of squid, he never considered the possibility of converting his vessel to a squid jigging vessel. License costs must also be considered because if vessel owners do not own a tuna longline license, they must purchase a license and replace a vessel that previously owned a tuna longline license.

If vessels are to convert to squid jigging vessels, they must purchase at least 40 - 50 sets of jigging machines and invest in lighting equipment. $10 million N.T. ($400,000) was a figure quoted by a vessel owner as the cost of converting a driftnet vessel to a squid jigging vessel. The Squid Driftnet Fishery Association stated that most driftnet vessels are too small to be converted to squid jigging vessels. It was reported that many driftnet vessels average 350 tons in size and the average size for squid jigging vessels is 700 - 800 tons.

Reliable statistics for vessel costs and profit margins were difficult to obtain in Taiwan, but one vessel owner estimated the following break even rates:

- 2-3 tons/day for a squid driftnet vessel

- roughly 4 tons/day for a squid jigging vessel due to the higher cost of running lighting equipment (this figure of 4 tons/day is based on neon flying squid if vessels were to jig for such species)

The above estimate of 2-3 tons/day as a break even rate was also used as an estimate by one company representative that noted that 2-3 tons/day would be enough for a squid jigging vessel in the N. Pacific to "keep the ship running." The same company representative said that "vessel owners might jig in the N. Pacific even though research has shown that neon flying squid cannot be caught efficiently with jigging gear because it is better to continue ship operations than to take the ship out of service and pay moorage." Additionally, it was noted that if neon flying squid prices were to rise due to the moratorium and scarcity of the product, then it might be in the interest of some vessel owners to jig for squid in the North Pacific even though it has been declared by fisheries research institutes in Korea and Japan to be economically inefficient.

Vessel Capabilities - Taiwan

Table 3-9. Taiwanese Squid Driftnet Vessel Size Distributions 1983 - 1987

	1983	1984	1985	1986	1987
100 +	9	6	5	7	4
200 +	47	45	47	59	42
300 +	35	64	54	35	30
400 +	7	23	15	3	4
500 +	3	6	3	1	
600 +					
700 +		2		4	5
800 +					1
Total	101	146	124	110	87

Source: Tung & Yeh

Table 3-10. Age Distribution of 75 Taiwanese Driftnet Vessels HoldingTuna Longline Licenses:

Age	Number of Vessels (total tonnage)
< 5 years	6 vessels (3,728.64 tons)
5 - 10 years	11 vessels (3,909.15 tons)
10 -15 years	14 vessels (5,549.41 tons)
15 - 20 years	28 vessels (7,618 tons)
20 -25 years	11 vessels (3, 277.88 tons)
> 25 years	5 vessels (1,811.95 tons)

Source: Taiwan Deep Seas Tuna Boat Exporters Association

Chapter IV - Estimated Fate and Disposition of the Driftnet Fleet

1. Japan - Number of Licensed Vessels

As discussed in Chapter II, we chose the fleet size operating in 1991 as a base fleet from which to assess the fate of the fleet. Column 2 of the driftnet fleet matrix in Figure 4-2 lists the numbers of licensed vessels by country for the base year of 1991. Japan had 454 vessels licensed for the squid driftnet fishery and 69 vessels licensed for the large-mesh driftnet fishery (with the large-mesh season running from July-June of the following year, 1991-92). When analyzing the fate and future of the Japanese driftnet fleet, 454 licensed vessels will be taken as the base, rather than adding the 69 large-mesh driftnet vessels to the 454 squid driftnet vessels licensed for 1991. This is because essentially all of the large-mesh vessels that operated on the high seas also held squid driftnet licenses. As illustrated in Figure 4-1, of the 386 vessels that were documented by the Squid Driftnet Association, 100 percent of the large-mesh vessels also operated as squid driftnet vessels. We can therefore be confident that by using the figure 454 for the Japanese fleet, this will cover most, if not all of the large-mesh vessels that operated in 1991. Although the data in Figure 4-1 is based on information gathered in 1989, it was stated by a Driftnet Association official that this data can serve as a good example of fishery involvement in 1990 and 1991 since fishery activity patterns are nearly the same.

Figure 4-1 Patterns of Fishery Activity by Month in 1989 for 386 Japanese Driftnet Vessels:

Months of the Year (1 2 3 4 5 6 7 8 9 10 11 12)					Number of Vessels
Squid Driftnet					58
Billfish Largemesh	Squid Driftnet				109
Skipjack & Tuna	Billfish L.M.	Squid Driftnet			22
Billfish Largemesh	Salmon Driftnet	Squid Driftnet			18
Skipjack P.L. & Tuna L.L.	Salmon Driftnet	Squid Driftnet			40
Billfish Largemesh	Salmon Driftnet	Squid D.N.	Saury	Squid D.N.	49
Squid Jigging	Squid Driftnet	Squid Jigging			45
Deep Sea Trawl & Bottom Longliner	Squid Driftnet	Trawl & Bottom L.L.			45
				TOTAL	*386

* Only 386 of the 460 vessels that owned a driftnet fishing license in 1989 are listed. The remaining 74 vessels are involved in a much wider variety of fisheries than mentioned above, so they are very difficult to account for (Driftnet Association - pers. comm.). The Japan Driftnet Association did state that the above distribution of fishery involvement is common and can serve as a good example of fishery involvement in more recent years.

* Source: Japan Driftnet Association

Figure 4-2. Projected Disposition of Base Driftnet Fleet (Driftnet Fleet Matrix)

		SCRAPPING		**ALTERNATIVE FISHERIES			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Country	# Lic.Vess. (1991)	Planned	Estimated "probable"	Squid Jigging	Tuna L.L. & Skipjack P.L.	Trawl & Bottom L.L.	Saury Dipnet
Japan	454	280	98	26	32	18	---
Korea	142	30	---	90	---	---	22
Taiwan	223	60	---	55	90	18	---

** The numbers listed under "alternative fisheries" do not necessarily mean that an increased number of vessels will enter new/alternative fisheries. Numbers only indicate the number of driftnet vessels that previously held licenses in these fisheries and whose owners may decide to continue or expand operations in these same fisheries. The only vessels listed under alternative fisheries that will actually convert into fisheries that they previously did not hold licenses in are vessels in the Korean fleet since many will convert to the squid jigging fishery for the first time. Therefore, except for Korea, the number of Japanese and Taiwanese vessels actually entering new/alternative fisheries may not increase although it is possible that total effort could increase due to an extension of fishing seasons in part-time or past fisheries in response to the driftnet moratorium.

Scrapping

Of the 426 Japanese driftnet vessels that held a squid driftnet license by the end of 1992, it was estimated by the Japan Squid Driftnet Association that approximately 270-290 vessel owners will scrap their vessels. This is also the number of vessels that will be eligible for government compensation because they have fished two of the last three years. It was reiterated by the Driftnet Association that because most driftnet vessels are over 15 years old, virtually all of the vessels that are eligible for compensation will be scrapped. In column (3) of Figure 4-2, which notes the number of vessels planned for scrapping, 280 was chosen as the average of the estimate of "270-290" given by the Japan Squid Driftnet Association. 280 vessels are categorized as "planned" for scrapping because this figure was quoted by an official source (the Driftnet Association) during fieldwork as the number of vessels they foresee being scrapped in the future. This does not preclude that only 280 vessels will be scrapped in the future. It is possible that vessel owners who are not eligible for government compensation might have to scrap their vessels because they will not be able to survive in alternative fisheries - this number will be listed under "estimated scrapping," or column (4) later in this section. 280 vessels will then be subtracted from the base year fleet of 454 in the matrix in order to determine the number of vessels that will remain after those planned for scrapping are retired. The resulting number is 174. Therefore, of the 454 driftnet vessels noted in column (1), estimations need to be made as to what will happen to the 174 vessels that are now unaccounted for in the matrix after subtracting those planned for scrapping.

Before assessing whether or what percentage of the 174 remaining vessels will be scrapped, it is important to look at the likelihood of these remaining vessels entering alternative fisheries. This is difficult because information does not exist as to which vessels will be scrapped or converted for uses in alternative fisheries - decisions are still in the process of being made. Information is lacking on the characteristics of the vessels that are planned for scrapping, which makes it difficult to ascertain the potential uses of the 174 remaining vessels that must choose between scrapping without government compensation or alternative fisheries. In making the attempt to estimate the future disposition of the Japanese driftnet fleet, it is possible that vessels might be listed in one of the columns under "alternative fisheries" when in fact the vessel owner might decide in the end that he cannot economically survive in these fisheries. But, by looking at past patterns of fishery involvement, it is hoped that estimates of vessel involvement in alternative fisheries will be as accurate as possible while taking into consideration the lack of data on current and future decisions by vessel owners.

Alternative Fisheries

When estimating the number of vessels that might enter alternative fisheries, it is important to refer back to Figure 4-1. Although Figure 4-1 depicts patterns of fishery activity for squid driftnet vessels in 1989, the Driftnet Association stated that patterns were almost the same in 1990 and 1991. Looking at past patterns of fishery involvement, the following question was asked: "not being able to participate in the squid and large-mesh driftnet fisheries, which of the fisheries that driftnet vessels have been involved with in the past might be feasible alternative fisheries?" Because the saury dipnet fishery was noted as only operating for one month (October-November) a year, it was ruled out as feasible alternative fishery. This was not the case with the squid jigging fishery. The squid jigging fishery saw vessels operating in that fishery for 7 months of the year, so it was assumed that squid jigging could be a feasible alternative for ex-driftnet vessels. The tuna longline/skipjack pole and line fishery was viewed as a feasible alternative fishery for driftnet vessels to continue operations. This was due to the fact that vessels were active for roughly 6 months a year and this fishery could be continued because of the longer seasons involved with tuna longline and skipjack pole and line fisheries in the tropics. The trawl/bottom longline fishery operated for approximately 7 months and was also viewed as being a feasible alternative fishery for driftnet vessels that also operated as trawl/bottom longline vessels during the year.

Table 4-1. Japanese Squid Driftnet Vessel Participation in other Part Time Fisheries, 1991

	%	# of Vess.(out of 454)
Large Mesh (Billfish)	42.7	193
Salmon Driftnet	29.5	134
Saury Dipnet	25.6	116
Tuna L.L. & Skipjack P.L.	18.3	83
Squid Jigging	15.2	69
Trawlers	7.3	33
Bottom Longliners	2.9	13
Other	4.0	18
Exclusively Squid Driftnet	12.1	55

In 1991, there were 454 vessels ranging in size from 59-500 tons licensed for the driftnet fishery (vessels could have participated in more than one alternative fishery)Source: Suisan Nenkan, 1992

Turning to Table 4-1, listing similar information but for 1991, we can see that 69 out of the 454 vessels that held squid driftnet licenses also fished in the squid jigging fishery for approximately 7 months a year. It can then be concluded that 15.2% of the driftnet fleet in 1991 operated as, and will probably be able to continue fishing as squid jigging vessels. The number in Column (5) of the driftnet fleet Matrix, 26, was derived by applying this percentage (15.2%) to the 174 remaining vessels in the Japanese driftnet fleet that will not receive compensation and are not planned for scrapping. Therefore, the resulting estimated number of ex-driftnet vessels that might continue fishing in the squid jigging fishery based on estimations is 26. Taking into consideration data gaps, this approach was chosen as the best approach to estimating how many vessels might be able to survive by moving to an alternative fishery such as the squid jigging fishery.

The same approach as above was also applied to the skipjack pole and line, tuna longline, deep sea trawl, and bottom longline fisheries. As seen in Table 4-1, the tuna longline and skipjack pole and line fishery saw 18.3% of the driftnet fleet in 1991 concentrate effort in these two fisheries when not operating as driftnet vessels. Therefore, when applying this percentage to the number of remaining vessels that were not listed as planned for scrapping (174), the resulting number is 32, which is listed in Column (6) of the driftnet fleet matrix. The trawl and bottom longline fishery witnessed 46 driftnet vessels (10.1% of the fleet) operating in this fishery during 1991. When this percentage is applied to the number of vessels not planned for scrapping, the resulting figure is 18, as noted in column (7) of the matrix. The remainder of vessels (98) that are not estimated to enter alternative fisheries are listed as "estimated" for scrapping in column (4) of figure 4-2.

When considering the accuracy of making estimates based on this approach, numbers of vessels listed under alternative fisheries were compared with estimates given by the Driftnet Association of the number of ex-driftnet vessels that might continue operations in alternative fisheries. During fieldwork in Japan, it was stated by a Driftnet Association representative that "of the 136 driftnet vessels licensed in 1992 that are not eligible for government compensation, 30 to 40 vessels might attempt to survive by participating in other fisheries, the most likely option being the distant water squid jigging fishery - the other 100 or so vessel owners are faced with the worst situation in that they will not receive any compensation from the government and will probably end up having to scrap their vessels." Another report (Dept. of Commerce unclassified memo) notes that of the 426 vessel owners that held licenses in 1992, 10% said they were interested in squid jigging and 10% said they had not decided whether to stop driftnetting or convert to other uses. The other 80% simply stated that they will end driftnetting operations at the end of 1992. Based on this information, 42 vessel owners showed interest in squid jigging operations and 42 stated they have not yet decided whether to stop driftnetting or convert to other gear. This leaves open the possibility of another 42 vessels converting to another fishery for a total of 84 vessels that might continue efforts in alternative fisheries. This total of 84 vessels is very close to this study's estimate of a total of 76 Japanese driftnet vessels that might continue operations in alternative fisheries.

Looking at the matrix, it is apparent that the total number of Japanese driftnet vessels that are estimated as continuing operations in all feasible alternative fisheries (76) is greater than the 30-40 estimated by the Driftnet Association, but very close to the number of vessels (84) noted in the Department of Commerce information. The Driftnet Association stated that almost all vessel owners that do not receive government compensation will end up scrapping their vessels, which is why only "30-40 vessels" was offered as the number of vessels entering alternative fisheries. Our assessment displayed in Figure 4-2 makes the assumption that not all of the vessel owners that are eligible for government compensation will scrap their vessels. This is why the figure of 76 is higher then the estimate of 30-40 offered by the Driftnet Association.

2. Korea - Number of Licensed Vessels

Since Korea did not have a large-mesh driftnet fishery, we need not adjust for double-counting of vessels in multiple driftnet fleets. Therefore, 142 stands as the total number of driftnet vessels that operated in the Korean driftnet fishery in 1991.

Scrapping and Alternative Fisheries

In 1992, the number of licensed vessels was only reduced by two from the previous year, to 139. Of the 139 vessels licensed for the driftnet fishery in 1992, 34 vessels were converted to other uses during the year, which left a total of 105 vessels. When asked to which fisheries the 34 vessels had been converted to, the Fisheries Administration replied that "80 percent were converted to squid jigging vessels and the remaining 20 percent to saury dipnet vessels." Of the remaining 105 vessels that fished in 1992, it was stated by a Fisheries Administration official that 75 vessels will be converted and 30 vessels will be scrapped and used as artificial reefs. The 75 vessels that will be converted to alternative fisheries will be converted to squid jigging vessels and saury dipnet vessels at approximately the same ratio as the 34 vessels that have already been converted - 80% to squid jiggers and 20% to saury dipnetters (Fisheries Administration Official, pers. comm.).

From this information concerning disposition of the Korean fleet, it can be concluded that 30 vessels from the base year fleet of 142 will be scrapped and a total of 109 vessels (34 already converted + 75 planned for conversion) have been or will be converted to squid jigging vessels and saury dipnetters at a ratio of 80% and 20% respectively. We add the three vessels unaccounted for to the 109 vessels that have been or will be converted, giving a total of 112 vessels. Of the 112 vessels that have been or will be converted, an estimated 90 vessels (80%) will be converted to squid jigging vessels and 22 (20%) will be converted to saury dipnetting vessels. These numbers are displayed in columns (5) and (8) of the driftnet fleet matrix in Figure 4-2.

3. Taiwan - Number of Licensed Vessels

Taiwan has both a large-mesh and squid driftnet vessels, but it did not differentiate between large-mesh and squid driftnet vessels in the licensing process. Consequently, the 223 vessels listed as being allowed to operate on the high seas by the Taiwanese government in 1991 included vessels that operated as both squid and large-mesh driftnet vessels. The fleet was distributed geographically with 110 vessels in the North Pacific and 113 in the Indian Ocean. No Taiwanese driftnet vessels were allowed to operate in the South Pacific in 1991.

During 1992, 95 vessels operated in the driftnet fishery, of which 31 vessels operated in the Indian Ocean and 64 operated in the North Pacific. The North Pacific fleet decreased in 1992 by roughly 50% from the previous year (110) due to compliance with UN Resolution 46/215, which called for a 50% reduction in effort by June 30, 1992.

Scrapping

It was stated by the Fisheries Department, Council of Agriculture, that 93 vessels have already been bought-back by the government and were used as artificial reefs or destroyed. These 93 vessels were drawn from a larger fleet of vessels than the 223 vessels listed in column (1). The Fisheries Department stated that the 93 vessels were bought-back from "up to 400 vessels that have been involved with the driftnet fishery over the years." Information obtained from the Fisheries Department (Table 4-2) notes that 344 vessels participated in the fishery in recent years. Although "up to 400 vessels" were noted as participating in the fishery, the figure of 344 vessels will be used to generate our estimates simply because it can be quantified. To reconcile the divergent vessel numbers, it is assumed that the 93 vessels already bought back came from a fleet of roughly 344 vessels. The buy-back program has reduced the fleet by 93/344 = 27%. In 1991, the base year for the driftnet fleet matrix, 223 vessels (rather than 334) were in the active fishing fleet. To fill in the matrix, we take 223 to be the base fleet size and 27% to be the proportion that will be scrapped by the Taiwanese government. This accounts for the estimate of 60 vessels planned for scrapping. Later, we will subtract 60 from the base fleet size of 223 to estimate the number of vessels that might continue operations in alternative fisheries.

Alternative Fisheries

As already noted in the section on institutional restrictions and opportunities in alternative fisheries, driftnet vessel owners held licenses in three of the four traditional distant water fisheries the licensed by the government: (1) tuna longlining, (2) trawlers, (3) squid jigging, and (4) purse seining. Purse seining is not a feasible alternative for ex-driftnet vessels, because driftnet vessels are not capable of reaching required speeds for effective purse seine operation. Further, purse seining typically calls for newer and more technologically advanced vessels. Therefore, the three feasible alternative fisheries that driftnet vessels are allowed to continue operations in are the tuna longline, trawl, and squid jigging fishery. Table 4-2 lists the types of licenses driftnet vessel owners hold and includes information on vessel owners that were not allowed to operate in the driftnet fishery in 1992, but participated in the fishery in the past.

Table 4-2. Full-time Licenses on Taiwanese Vessels in the Driftnet Fishery in 1992.

	Tuna Longlining	Squid Jigging	Trawling	Total
Full-time licenses owned by driftnet vessels allowed to operate in the N. Pacific in 1992	35	24	5	64
Full-time licenses owned by driftnet vessels allowed to operate in the Indian Ocean in 1992	24	3	4	31
Vessels registered for the part-time driftnet fishery but not able to operate in 1992	131	89	29	249
Total	190	116	38	344

Source: Fisheries Department, Council of Agriculture, Taiwan.

According to the above information provided by the Fisheries Department, of the 344 driftnet vessels that were listed, most of the vessels held either tuna longline or squid jigging licenses. These vessels will be free to re-enter these fisheries if vessel owners decide to return to these alternative fisheries instead of accepting government compensation. Before estimating the number of vessels that might re-enter the tuna longline, squid jigging, or trawl fisheries, it is important to create a table listing involvement by percentage of the fleet in alternative fisheries. Just as was done in the section on Japan, percentages can then be applied to the number of vessels that remain after subtracting the number of vessels that have been or are planned for scrapping.

Table 4-3. Percentage Breakdown of Licenses Held in Alternative Fisheries by 344 Taiwanese Vessels that have Participated in the Driftnet Fishery in Recent Years

Fishery	# of Lic. Vessels	%
Tuna Longline	190	55
Squid Jigging	116	34
Trawling	38	11
Total	344	100%

Source: Fisheries Department, Council of Agriculture, Taiwan.

After subtracting the 60 vessels planned for scrapping from the base year fleet of 223 vessels, the resulting number is 163 . Once again it must be asked, "what alternative fisheries might the remaining 163 vessels be re-deployed to?" In order to address this question, percentages from Table 4-3 will be applied to these 163 remaining vessels. Using percentages from table 4-3 as a basis for making estimates on the base year fleet, it can be assumed that approximately 55 percent hold tuna longline licenses, 34 percent own squid jigging licenses, and 11 percent own trawling licenses. When applying these percentages to the 163 vessels that remain in our base year fleet, the resulting numbers are 90, 55, and 18 respectively. These numbers can be seen in the driftnet fleet matrix under alternative fisheries that Taiwanese driftnet vessels might re-enter.

Chapter V - Review of Economic and Social Effects of the Driftnet Moratorium

The economic and social effects of the driftnet moratorium occur in three categories: (1) reductions in harvests of marine species taken by driftnet, resulting in reduced local fish supplies (market sales) and associated economic benefits; (2) direct and indirect impacts in communities supporting the driftnet fleets, as measured by changes in incomes, employment, and other social indicators in fishing and related economic sectors; and (3) effects on regional and world fish markets previously supplied by driftnet fish, including secondary reactions by other squid and tuna fishing fleets in response to the demise of the driftnet fleet. The direct reductions in harvest and market value of reduced fish supplied are relatively easily gauged, because they are concentrated in the three Asia nations and are reflected in the squid and tuna markets of those nations. We measure these effects simply as the potential reduction in value of fish products supplied.

Assessment of the second category requires more involved computation and reasoning. A comprehensive socio-economic impact assessment would contain a detailed description of the affected communities before the driftnet moratorium and a forecast of conditions afterwards. Both specific economic conditions (such as changes in employment patterns, income changes, and regional industrial production) and social factors (e.g. structural unemployment created by loss of driftnet fishing jobs, changes in social support service needs) would be examined. Many quantitative economic impact assessments rely upon a formal "input-output model" or "economic base model" to assess direct and secondary (or multiplier) effects of a change in economic activity. Since the information needed for such an analysis (including an input-output model) were not obtained through our field work, we are unable to provide a full socio-economic impact assessment. Instead, we describe some obvious direct economic impacts of the driftnet ban supplemented by anecdotal information on possible indirect effects on economic sectors ancillary to the driftnet fishing fleet. Without suggesting specific interpretations, we also include in this report related and relevant data obtained during the field study. We suggest some likely economic and social effects where our information seems strong enough to support conclusions.

Effects of the driftnet moratorium on world fish supplies and markets will be less certain and likely more muted than the direct effects on fishing communities. Two reasons for this are (1) the importance of driftnet harvests to total world supplies are relatively moderate, and (2) other fisheries may expand to provide substitute supplies of fish products. Our assessment of this range of effects is relatively rudimentary. We gauge the likely impact on world fish by the fraction of supply accounted for by the north Pacific driftnet fleet, and we note the existence of alternate fishing methods and regional fisheries which might provide substitute supplies of fish products.

The first Section below reviews information concerning impacts likely to occur in the Asian nations. Each subsection covers one nation and includes the first two categories of effects described above. Section 2 attempts to place the effects of driftnet moratorium in broader perspective, focusing on effects of the reduced supply of squid and tunas on world fish supplies and fish markets. We attempt to gauge the likely magnitude of these effects, but we do not claim to have quantified the likely effects with great accuracy.

1. Economic Repercussions in Driftnet Fishing Nations

A. Japan

Impact on Domestic Market - Squid

Tuna and squid rank first and third respectively in terms of annual per household expenditure among seafood market categories in Japan (Table 5-1) Squid ranks first in terms of per household quantity consumed. As reported in S. Sonu (1989) the major species of squid caught and consumed are Japanese flying squid (*Todarodes pacificus*), neon flying squid (*Ommastrephidae bartrami*), *Illex argentinus*, and *Nototodarus sloani*. During the 1960s and early 1970s, *T. pacificus* was the major squid species in Japan, making up well over half of the total catch which ranged from 440 to 560 thousand metric tons. In the late 1970s and early 1980s, the fishery experienced a significant drop. The Japanese fishing industry responded to reduced availability of *T. pacificus* by expanding into less familiar waters, including the north Pacific driftnet fishery. Other areas of the world have emerged as important squid fishing grounds, particularly the southwest Atlantic around the Falkland Islands and off Argentina, in the western Central Pacific off Thailand, and in the Southwest Pacific around New Zealand and Australia. Only the north Pacific fishery for neon flying squid is carried out with large-scale driftnets.

The annual catch of neon flying squid by the Japanese north Pacific driftnet fleet ranged from about 131 thousand to almost 200 thousand metric tons during 1986-1990 (Table 5-11), while total squid catch of Japan ranged from 449 to 748 thousand metric tons. Thus, during its heyday, the driftnet fleet provided about 26 percent of a very important component of the Japanese seafood supply. According to the Fisheries Agency of Japan, the total value of the squid driftnet fishery in 1990 was 44 billion yen (equals $300 million at a 145 Yen/$ exchange rate). This implies an average price of 244 thousand Yen/mt ($1,682 US/mt), which is below the range of 300 to 500 thousand Yen/per mt during 1981 to 1987 reported in Sonu (1989). Sonu also reports that wide fluctuations in squid supplies have caused gyrations in the exvessel prices of both *T. pacificus* and *O. bartrami.* The exvessel price of fresh *T. pacificus* rose from less than 300 Yen/kg in 1980 to about 750 Yen/kg in 1986 as the annual landings fell from about 150 thousand mt to less than 40 thousand mt. Subsequently, the price proceeded to drop to 525 Yen/kg in 1987 as the annual catch of *T. pacificus* recovered to nearly 500 thousand mt. Hence, there is demonstrated sensitivity of Japanese squid price to landings.

Almost all Japanese driftnet caught squid is marketed domestically as three main products: 1.) "roll" squid - frozen mantle without fins and skin, 2.) "Ika-kun" - smoked and sliced, and 3.) "daruma" - seasoned and dry mantle (Yatsu 1991). "Roll" squid is sold as a frozen food, "ika-kun" is processed into squid jerky, and "daruma" squid is processed into a soft "saki ika," which is another type of squid jerky. Different types of "ika-kun and "saki ika" are very popular party foods and snack items.

The average catch of neon flying squid per vessel is 3.8 - 7.9 tons per operation (1983-1990), and the average annual value per vessel ranged from 71 - 124 million yen during 1981-1988 (Yatsu 1991). This corresponds to an annual value ranging from 38 to 62 billion yen during 1981-1988. According to sources in Japan, it is unlikely that alternate gears types, such as jigging or trawling, will generate revenues sufficient to justify the continued operation of fishing vessels in the neon flying squid area of the north Pacific. The neon flying squid is apparently too soft-fleshed for such a large animal to stay on a squid jig; they fall off as the jig is raised to the deck of the vessel. Trawls seem an impractical gear due to the dispersed distribution of this species of squid.

This description of the domestic squid situation in Japan suggests the potential importance of driftnet-caught squid supply, the likelihood that the *O. bartrami* stock will go unfished unless driftnets are permitted, and the sensitivity of squid prices in Japan to the annual supply of squid. The broader impact on fish markets of losing that supply depends upon whether alternate gear can substitute for the driftnet and upon the degree to which squid fisheries in other areas can make up for the reduced catch of *O. bartrami.*

Table 5-1. Japan's Annual Per Household consumption of Fresh and Frozen Fish and Shellfish by Major Species. 1988-90.

	Expenditure (yen)			Quantity (kg)		
Species	1988	1989	1990	1988	1989	1990
Tuna	9,549	9,925	10,277	3.23	4.08	4.00
Shrimp	7,514	7,849	7,889	3.21	3.44	3.34
Squid	6,170	5,908	5,675	5.98	5.99	5.29
Yellowtail	4,410	4,205	4,715	2.18	1.97	2.32
Salmon	1,872	2,158	2,633	1.13	1.40	1.68
Mackerel*	827	967	750	1.47	1.71	1.23

* Excludes jack mackerel and Spanish mackerel.
Source: Suisan Keizai Shinbun, March 1, 990 & March 4, 1991 (As reported in S. Sonu. Japans' Tuna Market)

Table 5-2. Annual Japanese Harvest of Squid by Major Species

Species	1986	1987	1988
		metric tons	
T. Pacificus	61,180	138,733	119,256
O. bartrami	107,951	131,791	101,100
I. argentinus	95,000	240,000	200,000
N. sloani	40,000	52,000	47,000
Overall Squid Catch	448,540	748,007	654,210

Source: Four Species: Hokkai Keizai Shinbun, February 2, 1989. Hokkaido Fisheries Association, 1988. (Reported in S. Sonu, 1989);
Overall Catch: FAO Yearbook of Fishery Statistics. 1990. (p. 578)

Table 5-3. Landings and Price of Major Products of Flying Squid Sold in Japan in 1985-1990

Tons	1985	1986	1987	1988	1989	1990
Round	6,348	3,175	849	287	175	---
Nuki	29,915	14,032	16,669	14,492	17,765	18,864
Hiraki	34,147	33.020	48,076	30,681	36,107	44,099
Hiraki-mimitori	15,836	15,143	26,564	20,552	22,603	27,845
Arms	9,228	14,116	12,120	17,052	15,301	12,275
Fins	2,261	3,608	2,630	2,164	3,143	2,470
Others	849	3,145	2,454	1,101	741	27
Total	98,584	86,239	109,362	86,329	95,835	105,580
Price (yen/kilo)						
Round	303	304	275	288	190	---
Nuki	536	532	295	418	324	---
Hiraki	582	565	321	423	381	---
Hiraki-mimitori	636	635	371	481	442	---
Arms	138	199	187	200	99	---
Fins	285	236	147	200	139	---
Overall	500	483	310	382	330	353

Nuki = mantle without internal organs/uncut
Hiraki = mantle without internal organs cut at traditional axis
Hiraki-mimitori = "hiraki" without fins
Arms = arms, tentacles and distal part of head

Source: "A Review of the Japanese Squid Driftnet Fishery," Akihiku Yatsu, 1991.

Impact on Domestic Market - Tuna

Japanese landings of tuna species (including skipjack, which is not considered a tuna in Japan) average 690 thousand mt during 1985 - 1990. As indicated in Table 5-4, a small portion of this total (2.8 to 4.1 percent) was accounted for by the Japanese large-mesh driftnet fleet. Further, the species most frequently taken by driftnets -- albacore and skipjack -- are not the most important or most valuable species. According to the Fisheries Agency of Japan, the total landed value of the large-mesh driftnet fishery in 1991 was 10 billion yen with a total catch of 40,000 metric tons; of this, 15,000 was albacore (US Embassy, Japan - Fisheries Office). Most of the albacore caught by driftnet vessels is sold for consumption in foreign markets such as the US as a canned product. The Japanese consume very little canned albacore.

Table 5-4. Japanese Annual Landings, Imports, and Exports of Tuna Species

Species	1985	1986	1987	1988	1989	1990
			1,000s of metric tons			
Skipjack	315	412	331	434	338	299
Yellowfin	134	125	122	111	113	93
Bigeye	149	170	161	144	149	114
Albacore	58	50	50	45	48	44
Bluefin	30	24	27	19	22	13
Total Catch	686	781	691	753	670	563
% of Total by Driftnet	2.8	2.7	2.3	4.1		
% of Albacore by Driftnet	25.7	14.5	14.4	33.6		
% of Skipjack by Driftnet	2.1	2.1	2.3	3.8		
Imports	141	135	185	209	206	258
Exports	47	69	43	128	72	51

Source: Sunee Sonu. 1991. (p. 35) and Table 2-1.

Impacts on Employment

Most respondents in the elite interviews stated that unemployment would be the largest problem facing communities that were involved with the driftnet fishery. Local governments and fishing cooperatives are now struggling with ways to approach this problem. As noted by the Director of the Hokkaido Pelagic Fishery Cooperative, "This was a shock to us because there was no planning - we only found out (about the moratorium) last year - we really were not aware of how strong a chance the moratorium had of succeeding - we did not plan and have been caught off-guard as to how to deal with the problem of unemployment."

Approximately 8,000 people were employed in the driftnet fishery; of this number, 95 percent were crew (Driftnet Association). Of the 8,000 people that face unemployment due to the driftnet moratorium, it was estimated by the Driftnet Association that 60 percent face unemployment without the possibility of finding work in other fishery related positions. Due to the over-capacity of other distant water fisheries and the inability of driftnet vessels entering any coastal fisheries, unemployment could cause troublesome social problems in such driftnet fishing communities as the city of Hachinohe -- the driftnet port with largest landings. Other major driftnet port cities in Japan that have depended on the driftnet fishery (squid and large-mesh) include Hakodate, Kushiro, Kesennuma, Ishinomaki and Shiogama.

Unemployment will extend beyond former crew members as suppliers to the fleet and processors of squid from the fleet are affected. Industries that will feel the largest impact include net makers, processors, gear and repair companies, with net makers being the hardest hit due to the nearly 100 percent dependence on the driftnet fishery. Of the 19 net making factories in the Hakodate area, it was reported that 13 will be shut down and the remaining 6 will face curtailed operations due to the moratorium (Oshima Prefectural Office). The 19 net making factories employed 104 full-time and 146 temporary workers. It was also reported that of the 10 large processing factories in the Hakodate area that process squid products, half of them will be greatly affected by the moratorium. The ten factories employed 311 full-time and 130 temporary workers (Oshima Prefectural Office).

The number of fishery workers in Japan decreased 3 percent in 1990 (to 370,000 employees) compared to 1989. About 80 percent of male fishery workers are 40 years or older ("Latest Developments in Asian Fisheries, May-June 1992). The average older age of Japanese fishermen makes it difficult for driftnet fishermen to find new positions outside the fishing industry. In Japan, a society that traditionally hires employees at a young age for lifetime employment, the prospect of a 40 - 50 year old fisherman finding employment opportunities in a new industry appears to be quite discouraging.

Local Impacts in Japan: Focus on Hakodate

Hakodate city, located in southern Hokkaido, is a major squid fishing port in Japan. Although the city of Hachinohe on the island of Honshu is a much larger squid driftnet base, Hakodate serves as a good example of a port city in Japan that has had strong links with the squid driftnet fishery. The total value of squid production in the Hakodate area is 345 billion yen, with 45 percent of this being driftnet caught squid or a*ka ika* (Oshima Pref. Fisheries Office) The following information was provided by the Fisheries Bureau of the Hakodate City Government Office.

Table 5-5. Number of Vessels in Japan and Hakodate that Own Squid Driftnet Licenses:

	In Japan	In Hakodate
No. vessels licensed	454	32
No. operating in 1991	288	24
No. licensed not operating in 1991	166	8

Table 5-6. Processed Seafood and Neon Flying Squid Processed in Hakodate.

	No. of Processing. Factories	No. of Employees	All Seafood Processors.		Neon Flying Squid Processors	
			Volume mt	Value mil. yen	Volume mt	Value mil. yen
1988	138	4,500	57,508	77,406	10,473	18,139
1989	138	4,500(est.)	63,886	85,845	10,768	20,858
1990	138	4,500(est.)	69,189	94,809	12,434	23,698

Table 5-7. Total Volume and Value of Raw Materials in Hakodate.

	All Seafood Processed		Neon Flying Squid	
	Volume mt	Value mil. yen	Volume mt	Value mil. yen
1989	63,422	26,281	12,236	3,674
1990	59,530	28,937	13,259	4,298
1991	56,320	27,292	7,197	3,182

Table 5-8. 1991 Revenue of Related Industries in Hakodate from Squid Driftnet Vessels.

	total value mi. yen	# companies	employees
Fuel suppliers	1,583	6	345
Net industry	1,574	22	638
Repair & Maint.	1,005	23	1,095
Landing/Loading	123	3	100
Other	541	--	--
Total	4,826	54	2,178

Table 5-9. Value of Goods Purchased by Squid Driftnet Vessels in Hakodate, 1991 (million yen):

	Vessels based in Hakodate (24)	Vessels based outside Hakodate (28)	Total (52)
Fuel/Machine Oil	675	563	1,238
Nets and Gear	792	457	1,249
Repairs	585	508	1,093
Food Supplies	139	160	299
Non-Durable goods	101	67	168
Other	44	30	74
Total	2,336	1,785	4,121

The total number of crew members aboard the 24 squid driftnet vessels departing from Hakodate was 347. Of the 347 crew members, 160 actually live in Hakodate city.

B. Korea

Impact on Markets

The total production of squid by Korean coastal and distant water fisheries in 1991 was 360,000 mt, of which 100,000 mt was driftnet caught squid (Squid Driftnet Association). The Driftnet Association estimated that the 105 squid driftnet vessels operating in 1992 caught an average of 900 mt of squid with a value of approximately 1 million won ($1,125 U.S.) per mt. This permits us to extrapolate a total exvessel value of driftnet squid harvest of about $112.5 million US (100 billion won). Because the Korean driftnet vessels harvest these squid in both coastal and high seas areas, it is not clear what proportion of the total will be lost due to the UN's high seas large-scale driftnet moratorium. Based upon catch and effort locations reported for the 1990 observe data base in Gong, Kim, An, and Hwang (1991), however, only a small portion of the catch appears to occur within 200 miles of land. Hence, for practical purposes, we can assume that the neon flying squid catch will fall to near zero without the high seas driftnet fishery.

Almost all driftnet caught squid is marketed domestically in Korea, with a small amount of processed driftnet caught squid being exported to Japan and the US. In 1990, 5,788 mt were exported to Japan and 182 mt were exported to the US according to a paper submitted by the Korea National Fisheries Research and Development Agency to the Scientific Review of North Pacific High Seas Driftnet Fisheries, June 11-14, 1991. As in Japan, a large percentage of neon flying squid is consumed as a dried and seasoned product and is enjoyed as a popular snack item.

Impact on Employment

Because Korean driftnet vessels are considerably larger (250-300 tons) than those of Japan, crew size per vessel is greater, averaging size being 25. Total crew members in 1991 as reported by the Korea Deep Seas Fishery Association was listed at 2,586 - 16.2 percent of the total number of crew members involved in distant water fisheries. Discrepancies among these figures exist. The Driftnet Association and the Deep Seas Fishery Association report that average crew size is 25 per vessel. With 142 vessels licensed in 1991, the total number of crewmen being affected should be approximately 3,550 rather than 2,586. It is possible that average crew size is less than 25 or that the figure of 2,586 did not include all 142 vessels. The number of affected crew members does not include those in other industries that will be affected by the ban. A high ranking official from the Squid Driftnet Association stated that, "because most vessels are owned by one company, and each company employs between 4-5 people, another 400-500 people must be added to the unemployment ranks."

Other industries that will be affected include net makers, processors, and companies involved with vessel repair, maintenance, and supply. Roughly 3,300 employees that worked in 69 processing and manufacturing plants that depended on driftnet caught squid will by affected by the moratorium (Korean National Fisheries Research and Development Agency Bibliography - Paper submitted to the Scientific Review of North Pacific High Seas Driftnet Fisheries in Sidney British Columbia., Canada, June 11-14, 1991). The Korea Squid Driftnet Association conducted a study that estimated 15,750 people in a wide variety of industries in the Pusan area will be affected due to the economic side effects of the moratorium (Driftnet Association, personal communication.). The director of the Driftnet Association reiterated that the hardest hit industry would be the net makers, second hardest hit being processors, and third hardest hit vessel repair companies.

C. Taiwan

Impact on Markets

As shown in Table 5-11 below, annual catch of neon flying squid by the Taiwanese driftnet fleet has varied between 10,478 mt and 29,696 mt in recent years. The total catch by the small mesh driftnet fleet in 1990 consisted of 16,600 mt of squid, 13,600 mt of tunas, and 5,700 mt of other species (Yeh and Tong, 1990). The large mesh fleet caught a total of 125,112 mt of fish in 1990, an increase of 34,221 mt over 1989 (Taiwan Fisheries Bureau, Provincial Government of Taiwan). The Taiwan Deep Seas Tuna Boatowners Exporters Association reported 40,000 mt of driftnet caught tuna species, 25,000 mt of which was sold in the domestic market and 15,000 mt was exported. Most of the driftnet caught albacore was exported to canneries in Thailand.

A large majority of neon flying squid caught by driftnetters is consumed in Taiwan. Over 50% is consumed as a dried/seasoned product. Some neon flying squid is consumed in soup or cooked. One company owner reported that 20% of his catch has been sold to Japan and Spain as longline bait. A possible substitute for neon flying squid is a large squid species caught in Peruvian waters. Although the taste is slightly different, companies are looking into using this species as a substitute.

According to a fishery products company representative, the albacore market looks like the most favorable fishery for Taiwanese ex-driftnet vessels to enter. The only problem being that longliners face higher labor costs due to the extended periods of time longline vessels spend at sea. The fishery sector that has benefited the most from the driftnet moratorium is the albacore longline fishery since this fishery has traditionally competed with the large mesh albacore driftnet fishery. The same company representative also reported that his company will pursue more licenses for contract vessels in Argentine waters for the squid jigging fishery even though prices for squid are presently very low. It was also reported by a company representative that squid prices were low because vessels flying foreign flags in Panamanian and Argentine waters were selling squid on the world market, lowering the price of squid. It is unclear how much squid is caught by these vessels or how much the price is affected by re-flagged vessels.

The Kaohsiung Municipal Fisheries Office reiterated the general consensus in Taiwan that the albacore longline fishery was the most profitable alternative for ex-driftnet vessels. An owner of a net manufacturing company foresees a rise in albacore tuna prices because the conversion to longline vessels from albacore large mesh vessels is less efficient. Crew on longline vessels remain at sea for up to two years and catch rates are lower than on driftnet vessels. Almost all albacore caught by Taiwanese vessels is canned or exported to foreign countries, such as Thailand.

A senior manager from a large fishing company stated that it is very likely that the Taiwanese will lower barriers to imports of squid next year. However, the local squid industry is adamant and wants continued protection. The greatest potential opportunity for squid market expansion, according to the same senior manager, is the Mainland Chinese market. Mainland China appears to be a market of the future for squid products, but Korea was viewed as one of the strongest domestic markets at the present time. A number of fishing industry representatives stated that in terms of the world squid markets, the Korean domestic market is the strongest and offers the highest prices, which is why many Korean ex-driftnet vessels will convert to squid jigging vessels whereas a smaller percentage of vessel owners will do so in Japan and Taiwan.

Impact on Employment

In comparison to Japan and Korea, unemployment in Taiwan will have considerably less impact, since a large number of the crew members on Taiwanese distant water vessels are not Taiwanese nationals. Although government regulations limit foreign crew to 33%, actual numbers are higher. One vessel owner stated that it is very common for at least 50% or more of the crew to be from the Philippines and Mainland China. Social costs to Taiwanese society differ from Japan and Korea in that unemployment rates among Taiwanese nationals will not be as high, but losses by vessel owners and related industries will impact the Kaohsiung economy due to the moratorium.

The owner of a net making company in Kaohsiung in which 30 percent of his company's production was driftnets, stated that loss of income as opposed to unemployment was a greater concern due to the shortage of workers in Taiwan. As stated by the net manufacturing company owner, "in Taiwan, we are short of workers - if anything, we need more workers, so unemployment will not be as large of a problem." The same company exports roughly 90 percent of its net products, so there will be a greater reliance on exports. Some of the countries that import net from the company include the U.S., Canada, Venezuela, Peru, Chile, and a wide range of countries in Europe.

2. Broad Effects of the Driftnet Moratorium on World Fisheries and Markets

Because the major species caught in driftnet fishing (especially squid and tunas) are traded around the world, broader impacts of the driftnet ban will be felt though effects on world fish supplies. Given alternative sources of squid and tuna fish products, we would expect the other sources to fill some of the gap in supply caused by termination of the driftnet fishery. There will likely still be some price increases in response to overall supply reductions. Tables 5-10 through 5-14 provide a basis for much of the discussion of these possible impacts.

A major initial effect of the worldwide moratorium on high seas large-scale driftnet fishing will be a reduction in overall supply of squid, tuna, and billfish to Asian fishing nations. We attempt to assess the likely magnitude of these effects and to gauge whether world markets will react with significant price increases. Secondary effects are of two main types: (1) vessels shifting from driftnetting to other gear may continue to catch squid, tuna, and billfish which could compensate to some extent for the initial drop in production, and (2) vessels shifting to unrelated fisheries could generate increases in harvests of different target species. Because many of the driftnet vessels will be scrapped, we do not expect harvests by vessels shifting to alternate fisheries to compensate for the reduced supply from the driftnet fishery. A final, but probably minor, effect of the drift net moratorium will be improvement in fisheries of non-driftnet fishing nations due to improved fish stock abundance and improved market conditions. Fisheries most likely to be affected include the North American salmon fisheries, albacore troll fishery, tuna and billfish longline fisheries, squid trawl and jigging fisheries of the south Atlantic and west coast of South America.

A. Squid

The primary effect on squid fisheries and markets depends upon the degree to which neon flying squid harvests contribute to overall squid supply. Annual world squid harvests have varied between 1 million and 2.1 million mt during the 1980s (Table 5-10). Of the total volume of squid caught, the neon flying squid taken in the north Pacific driftnet fishery accounted for between 12 and 20 percent. As noted earlier, we do not expect the neon flying squid fishery to be resumed by vessels deploying another fishing gear. Although other squid species are typically converted to different consumer products, some increase in other squid harvests could buffer the effects of the contraction in supply of neon flying squid. As some vessels from the Taiwanese and Korean fleet shift to other fishing grounds, increased harvests may occur in the south Atlantic Ocean and, possibly, in the Indian Ocean. However, since we do not know the likelihood of increased yields from squid stocks in those areas, we cannot predict that shifting of ex-driftnet fleets will cause an overall increase in squid catches.

The maximum likely impact of the driftnet moratorium on world squid markets obviously occurs if no alternate fishery expands to harvest neon flying squid and other squid fishing areas do not yield increased harvests. In this case, the major economic effect would be an increase in market prices for squid products. This increase would not be uniform among species, because the neon flying squid serves a specific market for dried squid products and is not considered a good substitute for other squid species in Taiwan, Korea, or Japan. Hence, the greatest upward pressure on squid and other seafood products would occur among species that provide close substitutes in consumption for dried squid. Since there are a number of these species and products, and because some other squid fisheries are likely to expand in response to a price increase, we would expect the overall market demand relationship to exhibit fairly high price elasticity. This means that the increase in price caused by loss of the neon flying squid fishery would be smaller than the supply reduction in percentage terms. Since the maximum quantity reduction would be in the range of 12 to 20 percent for world squid as a whole, the price increase is unlikely to be greater than, say, 5 to 10 percent.

The likely beneficiaries of this price increase are the remaining squid fishing fleets. As noted in Table 5-12, the Soviet fleet was a major force in world squid fisheries along with the Japan and Korea. Given the turmoil in the Russia fisheries sector at present, it is unclear whether they will be taking advantage of market opportunities to increase earnings from squid fishing operations. The economic losers of the price increase are clearly the consumers of squid, again primarily in the three Asian fishing nations.

Table 5-10. World Squid, Cuttlefish, and Octopus Catches in 1990.

	(1)	(2)	(3)	(4)	(5)	(6)
	Total Squids, Cuttlefishes, and Octopuses	Octopuses All Types	Common Cuttlefish	Cuttlefishes Bobtail Squid	Other Cephalopods	Total Squids *
			metric tons			
1981	1,441,322	224,188	14,820	164,462	8,862	1,028,990
1982	1,653,271	202,227	17,610	221,572	10,995	1,200,867
1983	1,706,963	250,239	18,669	254,314	14,235	1,169,506
1984	1,707,963	212,371	19,293	229,382	27,704	1,219,213
1985	1,787,221	210,695	22,509	215,054	36,096	1,302,867
1986	1,746,158	250,302	23,500	210,376	28,058	1,233,922
1987	2,317,629	245,337	22,681	174,012	51,377	1,824,222
1988	2,286,541	250,802	29,268	176,688	69,275	1,760,508
1989	2,709,454	270,911	27,421	191,193	108,574	2,111,355
1990	2,354,773	281,568	27,441	190,839	55,060	1,799,865

Source: FAO Yearbook of Fishery Statistics, 1990.
* Total squid reckoned by subtracting columns 2-5 from column 1.

Table 5-11. Neon flying squid catch by the North Pacific driftnet fishery.

Year	Japan	Korea	Taiwan	Total	Percent of World Supply
			metric tons		
1980	121,500	3,017	5,732	130,749	
1981	103,163	6,062	15,405	124,630	12.1
1982	144,711	21,364	24,749	190,824	15.9
1983	180,721	37,732	23,469	241,922	20.7
1984	103,723	49,440	27,600	180,763	14.8
1985	147,616	70,761	21,800	240,177	18.4
1986	131,368	59,023	13,887	204,278	16.6
1987	198,330	84,470	18,578	301,378	16.5
1988	135,216	100,898	10,478	246,592	14.0
1989	177,312	134,074	29,696	341,082	16.2
1990	180,000	122,504	16,600	319,104	17.7

Source: An, Gong & Kim, 1991 and Table 5-10.

Table 5-12. Squid Catch by Top Three Countries and Total World Catch 1980-1987..

Country	1980	1981	1982	1983	1984	1985	1986	1987
	---------------- 1,000s of metric tons ------------------------							
Japan	669.7	509.4	543.0	530.7	504.5	511.7	448.6	748.0
Korea	69.8	83.0	83.6	77.7	96.3	122.2	146.1	233.3
USSR.	51.0	44.5	67.6	53.4	66.7	121.9	114.9	103.0

Source: Sonu, Sunee. 1989. Export Opportunities for US Squid.

B. Tunas

The total world fishery for tuna and tuna-like species (includes marlins and bonitos) was expanding during the 1980s. According to the FAO Yearbook, total nominal catches increased steadily from 2.6 million mt in 1981 to 4.2 million mt in 1990. Against this backdrop, the driftnet catch of tunas and marlins makes a rather small contribution to world supply. The driftnet fishing moratorium could affect the fishery for tunas and tuna-like species in one of two ways: (1) the stocks previously fished by the driftnets might increase or become available to alternative gears, and (2) the prices for tuna species in markets served by the driftnet fleet might experience some increase in price. This effect is likely to be rather small, because the driftnet fleet took a relatively small portion of the annual world harvests of these species and because there are large numbers of vessels available for deploying alternative gear in pursuit of those fish (e.g. longline and purse seine).

Total world tuna catches (Table 5-14) are predominantly skipjack, yellowfin, bigeye, albacore, and bluefin tunas. The five species are not all close substitutes. Although the canned tuna market seems to treat yellowfin, bigeye, bluefin, and skipjack as close substitutes, albacore is a premium canned product. In contrast, the fresh and frozen tuna market in Japan treats albacore as a less desirable product, and gives a huge premium to well-preserved fresh or frozen yellowfin, bigeye, or bluefin tunas that can be consumed in the sashimi market. As indicated in Table 1-2, the Japanese large-mesh driftnet fleet takes mainly albacore, skipjack, and marlins. The total quantity of harvests from the Japanese driftnet fleet, for example, represented only 2.8 to 4.1 percent of the supply of albacore and skipjack tuna. In general then, against a backdrop of expanding world tuna supplies, it is unlikely that any significant price effect will be experienced due to the loss of driftnet-caught tunas.

In the specific case of albacore, the driftnet fleet took a significant fraction of world supply. Table 5-13 indicates that driftnets accounted for about 37 percent of the total albacore (mostly taken in the North Pacific and Indian Oceans) during 1990. Because most of the albacore is used for canned product, it is unlikely that a drop in supply of albacore tuna will have any repercussion on fresh and frozen tuna product markets. Since canned tuna is a widely traded commodity, we expect some contraction in supply of canned albacore tuna to be felt in the major consuming nations, including the United States and western Europe. This effect will be moderated by (1) substitutability between canned albacore and canned yellowfin/skipjack tuna, and (2) expansion in albacore fishing by longline and trolling fleets in response to increased demand for their products. Quantitative prediction of the ultimate impact on albacore product markets and fisheries is hazardous. Hence, any price increase for albacore will probably be very moderate but perceptible.

Table 5-13 . Estimated World Catch of Albacore Tuna by Region and Gear Type, 1990

	Driftnet	Longline	Other	Total
		metric tons		
North Pacific	36730	14700	2595	69545
South Pacific	7526	25764	6722	40062
North Atlantic	3900	2100	30000	36000
South Atlantic	0	18100	4400	22500
Indian	25703	6492	325	32520
Total	73859	67156	59612	200627
Percent by Gear	36.8	33.5	29.7	

Source: J. Wetherall. Personal communication.

Table 5-14. World Tuna Catch, by Major Species, 1986-1990.

Species	1986	1987	1988	1989	1990
			1,000 metric tons		
Skipjack	1,079	1,033	1,281	1,221	1,239
Yellowfin	794	867	896	936	987
Bigeye	257	249	232	237	258
Albacore	211	217	223	244	232
So. Bluefin	62	57	49	49	--

Source: FAO. Yearbook of Fishery Statistics 1990, Catches and Landings. Vol. 70.

Chapter VI - Conclusion

Although Japan, Korea, and Taiwan had similar interests in the high seas driftnet fisheries, the likely future disposition of each country's fleet differs on a number of levels. Vessel owners from all three countries faced similar decisions on whether to scrap, convert, or maintain vessels in certain fisheries, but final decisions by vessel owners as reflected in estimated fleet dispositions are different for each country. This is due to differences in the variables noted as affecting strategies flowing from private economic decisions by vessels owners. Government compensation programs, restrictions and opportunities in alternative fisheries, and vessel capabilities differed among Japan, Korea, and Taiwan. Therefore, vessel owner responses will differ, and this study's estimates of future fleet dispositions as outlined in the driftnet fleet matrix differs among nations.

The variable, "government compensation programs," was clearly influential in affecting vessel owners' decisions. In the case of Japan, a far greater number of vessels will be scrapped compared to numbers in Korea and Taiwan. A total of 378 out of 454 base year vessels, or 83% of the Japanese fleet, was listed in the driftnet fleet matrix as planned or estimated for scrapping. In Korea, only 21% of the fleet (30 out of 142 base year vessels) is expected to be scrapped, and in Taiwan, the corresponding number is 27% (60 out of 223 base year vessels).

These substantial differences in the percentage of vessels likely to be scrapped are directly related to the amount offered to vessel owners as compensation. Japan, the country with the largest percentage of vessels planned and estimated for scrapping, had a far better financed compensation program then Korea or Taiwan. Japan offered owners of large-scale exclusive and seasonal driftnet vessels roughly $1 million US whereas Taiwan offered all vessel owners a maximum of $200,000 U.S.. Korea's compensation program offered the least amount of compensation with vessels owners eligible for only $50,000 U.S.. These figures obviously affected vessels owners' stated intentions to either scrap their vessels or remain in an alternative fishery in that the incentive to scrap a vessel lessened in response to what vessel owners viewed as unfair or low compensation figures. A number of vessel owners in Taiwan and Korea stated they would not scrap their vessels due to low compensation allowances.

The better financed compensation program in Japan was due not only to the greater GNP and relative wealth of Japan when compared to Korea and Taiwan, but also other factors. These are: (1) a greater level of domestic political pressure exerted in Japan by fishermen on the Fisheries Agency due to the higher level of organization within the fishing industry and (2) the political influence of rural areas such as Hokkaido and other fishing areas on the ruling party (LDP). In Japan, rural areas such as Hokkaido exert greater pressure on government than many urban areas due to the way in which voting constituencies are drawn up. This enables groups such as rice farmers and fishermen to exert greater influence on government policies.

Compensation programs reflected not only each country's relative wealth, as Japan, the country with the highest GNP offered the highest levels of compensation, but also the political dynamics extraneous to fisheries issues. Taiwan, which established a buy-back program nearly three years ago (in July 1990), was the first country to start such a program. This early response by the Taiwanese has less to do with bycatch concerns than with higher level political issues and the fact that Taiwan is in a more precarious political situation compared to Japan or Korea. Taiwan is more sensitive to US demands due to relative isolation in the international community. As stated by an official from the Fisheries Division, Council of Agriculture, "we are not a member of the UN, so there was more pressure from the U.S." This pressure, in the form of demands to withdraw from the driftnet fishery most likely precipitated the early establishment of a compensation program compared to Korea and Japan.

Restrictions and opportunities in alternative fisheries also differ among the three countries. Japanese and Taiwanese driftnet vessel owners were more limited in their ability to enter new fisheries compared to Korean driftnet vessel owners. In the case of Japan, vessel owners could continue or expand operations in fisheries they had been participating in when not driftnet fishing, but were restricted from entering new fisheries. In Taiwan, vessel owners are able to re-enter fisheries they held licenses in previous to participating in the driftnet fishery, but are not allowed to enter new fisheries in which they do not hold licenses for. Korea differs from Japan and Taiwan in that the Fisheries Administration has stated that they will try to expand opportunities in the squid jigging fishery off South America in order to ameliorate the impacts of the driftnet moratorium on vessel owners. Of the Korean base year fleet of 142, it was noted that 90 vessels will be converted to squid jigging vessels. A Fisheries Administration official confirmed the percentages used in estimating this number and it is apparent that this ratio of vessels entering the squid jigging fishery (63%) is far greater than in Japan and Taiwan. This significant difference is related not only to restrictions in alternative fisheries but also the opportunities in alternative fisheries. As discussed in Chapter III-2, Korean companies have already been pursuing opportunities in the distant water squid jigging fishery. Taiwanese and Japanese fishing industry representatives explained this difference by stating that the Korean domestic market for squid was by far the strongest of the three countries. This helps to explain the larger numbers of Korean vessels converting to squid jigging vessels.

Vessel costs and capabilities were also a major factor in the differences between the three countries. Just as a large number of vessels will convert to squid jigging vessels in the Korean fleet, most of the re-deployment to alternative fisheries in the Taiwanese fleet will be to tuna longlining vessels (an estimated 90 vessels out of the base year fleet of 223). Whereas vessel owners in Japan stated that conversion to tuna longline vessels would be impossible due to the older age of vessels and vessel capabilities, Taiwanese vessel owners openly stated their intentions to move back into the tuna longline fishery. It was even reported by one company representative that the government was encouraging conversions back to tuna longline vessels for vessels that previously held tuna longlining licenses. In this case, vessel capability seems to be a dominant factor in determining future fleet disposition. As noted in Table 3-9, a large percentage of Taiwanese driftnet vessels were under 15 years old, some under 5 years old, whereas most Korean and Japanese vessels were over 15 years old. As stated by a Taiwanese vessel owner, "tuna longliners must be newer and better kept vessels because they operate further from home and repair costs are much higher in foreign ports if the vessel needs repairs or maintenance." Vessels costs were also an important consideration in analysis since it is assumed that it is less expensive for Taiwanese vessels to operate compared to Japanese and Korean vessels due to the high percentage of foreign crew on Taiwanese vessels. In Japan and Korea, the fishing crew consists entirely of nationals whereas the crew on Taiwanese vessels is often over 50% foreign nationals from low wage countries such as mainland China and the Philippines.

The overall impacts of the high seas driftnet moratorium are not easily summarized due to data gaps, differences in economic values and practices among nations, and uncertainties concerning the future deployment and fishing performance of the fleet. Nevertheless, it is perhaps useful to examine the following tables which encapsulate the general magnitudes of likely economic impacts. The total number of people employed on vessels in the high seas driftnet fleet is estimated to exceed 16,000 (Table 5-15). After the estimated vessel scrapping in all three nations, and assuming the crew size remains constant on vessels shifting to other fisheries, somewhat over 8,000 crew will lose their positions on driftnet vessels. Some of these people will find jobs on other fishing vessels or in related industries, but a large proportion are likely to be left without full-time employment for at least a short period of time. Especially in Japan some older crew members experiencing difficulty in the transition to land-based employment may face extended period of unemployment or underemployment. In Taiwan, much of unemployed crew are likely to be non-citizens. Without additional information regarding nationality and labor market conditions, we cannot project effects on employment prospects of these dislocated crew members. Beyond the direct effects on fishing crew, the driftnet moratorium is likely to cause proportional reductions in employment in fish processing and fishing fleet support sectors.

Table 5-15. Number of Crew Affected by the Moratorium

	Number of Vessels	No. Vessels to be Scrapped	Average Crew per Vessel	Total Crew in Fleet	No. Crew Affected
Japan	454	378	16	7,264	6,048
Korea	142	30	25	3,550	750
Taiwan	223	60	25[1]	5,575	1,500
Total	819	468	---	16,389	8,298

[1] No specific crew size estimate was available for Taiwan; we used the Korean crew size as an surrogate because the Taiwanese vessels were of the larger type prevalent in Korea. Also, many of the crew on Taiwanese vessels are not Taiwanese nationals.

The main effects of the driftnet moratorium on seafood production and markets stem from loss of raw product supply. While it is difficult to forecast the full ramifications of the changes set into motion by the moratorium, we can roughly assess the reduced supply of fish in specific categories. A simple indicator of economic impact is the gross exvessel market value of the raw fish products generated by the high seas driftnet fleet. As summarized in Table 5-16, the total market value of squid and tuna/billfish catch was about $ 785 in 1991. If the entire fleet simply stopped fishing and no alternative sources of substitute seafood products existed, this figure would represent a first-cut estimate of the economic loss.

Three additional aspects should be considered in a more complete assessment of economic impact. First, shifting of the fleet to alternative fisheries will attenuate the actual contraction in raw product supply, reducing the estimated impact. A rough estimate of this effect takes the estimated proportion of the fleet that will be scrapped from Table 5-15, and assumes that vessels shifting to alternative fisheries maintain their annual earnings from fish sales. With this approach the reduction in exvessel market value of fish landings equals the proportional fleet reduction times initial exvessel value. As shown in Table 5-16, the resulting value loss would be about $ 414 million.

Table 5-16. Estimated Reduction in Gross Market Value of Fish Harvested by the High Seas Driftnet Fleet

	Exvessel Value			Percent	Reduced
	Squid Fleet	Large-mesh Fleet	Total	Reduction	Value
	--------Millions of US $ ------				
Japan	$ 303	$ 69	$ 372.	83.25	$310
Korea	$ 106	--	$ 106	21.1	$22
Taiwan	$ 204	$ 102	$ 306	26.9	$82
Total	$ 613	$ 171	$ 785	--	$414

Source: Japan - Squid value from p. 40; large-mesh fishery value from p. 43.
Korea - Squid fishery value from p. 46.
Taiwan- Squid and large-mesh fishery values from p. 7.

A second consideration is that a reduction in supply of seafood from driftnets will induce price increases and, possibly, increased supply of competing products from other fishing fleets. As noted earlier in this report, we expect these price effects to be relatively minor. Nevertheless, one source of economic loss in seafood consuming nations will result from increased prices of tuna and squid products. Third, reduced landings will affect wholesale and retail sectors as well as the primary production sector. Hence, the economic losses associated with prohibitions on high seas driftnet fishing will be transmitted to "downstream" economic sectors in the three Asian fishing nations. While we do not possess the appropriate economic models to estimate these secondary impacts, it is often found that the full income impact of reduced economic activity is about twice the initial impact. It is reasonable to suppose that the full effects of the moratorium may significantly exceed the initial $414 million drop in market value of landed fish.

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Appendix 1: List of Contacts During Field Work in Japan, Korea, and Taiwan

Period of field study: November 15 - December 17 (32 days: 16 days in Japan, 8 days in Korea, and 8 days in Taiwan).

The following is a list of foreign contacts that were interviewed by the associate investigator, Todd Mittleman, during the period of fieldwork noted above.

Japan

Nov. 18: Mr. Eietsu Hirano, Managing Director, Hokkaido Pelagic Fishing Association.

Nov. 18: Mr. Minoru Misakawa, Chief, Fisheries Section, Agriculture, Forestry & Fisheries Department, Hakodate City Hall, Hokkaido.

Nov. 19: Mr. Kazuki Watanabe, Fisheries Section, Oshima District Office, Hokkaido Regional Government Office.

* The associate investigator would like to thank both Dr. Kiyotaka Ohtani, Professor, Faculty of Fisheries, Hokkaido University, and John T. Sproul, Ph. D. student at Hokkaido University, who were very helpful and generous with their time during field studies in Hakodate.

Nov. 20: Dr. Tsuneo Nishiyama, Dean and Professor, Department of Marine Science, Hokkaido Tokai University.

Nov. 24: Mr. Shingo Ota, Driftnet Section, Fisheries Agency of Japan.

Nov. 25: Mr. Douglas Ancona, Fisheries Attache, Embassy of the United States, Tokyo.

Nov. 26: Mr. Bill Court, President, Transpac Fisheries Co., Tokyo.

Nov. 30: Mr. Tsutomu Ozaki and Kazuyasu Kando, Executive Director, Japan Squid Driftnet Fishery Association & Japan Large Mesh Driftnet Fishery Association.

Nov. 30: Mr. Kazuo Shima, Deputy Director General, Fisheries Agency of Japan.

Korea

Dec. 2: Dr. Seoung-Yong Hong, Director, Ocean Industry and Policy Division, Korea Ocean Research & Development Institute.

Dec. 3: Mr. K.Y. Kim and Mr. Shim Sang Man, Managing Director, Korea Deep Seas Fisheries Association, Seoul.

Dec. 4: Mr. Mean-Jhong Kim, Director, International Cooperation Division, National Fisheries Administration, Republic of Korea.

Dec. 7: Mr. Young Bae Kim, Managing Director, Korea Distant Water Squid Driftnet Fisheries Association, Pusan.

Dec. 8: Dr. Yeong Gong, Director, Department of Oceanography and Marine Resources, National Fisheries Research & Development Agency, Keongnam, Korea.

* The associate investigator would like to thank Mr. Choong-Shin Oh of the International Cooperation Division, Korea Fisheries Administration, for his assistance and interpretation during interviews in Seoul and Pusan over the time period noted above.

Taiwan

Dec. 10: Mr. James Sha, Chief, and Mrs. Yuh-Chen Chern, Specialist, Driftnet Section, Marine Fisheries Division, Council of Agriculture, Taiwan.

Dec. 10: Dr. Shean-Ya Yeh, Professor, National Taiwan University.

Dec. 11: Mr. Ming Chu, President, Ming Tai Co. and Chairman, Taiwan Deep Sea Tuna Boatowners and Exporters Association; Mr. Thomas Lin, Ming Tai Co.

Dec. 14: Mr. Tsay Tzu-Yaw, Division Chief, and Mr. Sheng-Wei Huang, Director, Fisheries Bureau of Reconstruction, Kaohsiung Municipal Government.

Dec. 14: Mr. Alfred Chiang and Suzanne Lu, Senior Managers, and Mr. W.S. Chou, Senior Vice President, F.C.F. Fishery Co., Ltd., Kaohsiung.

Dec. 15: Mr. Yen-Shan Huang, Director, Taiwan Squid Driftnet Fishery Association and Chairman, Squid Marketing and Promotion Group, Kaohsiung.

Dec. 15; Mr. James Tsai, Member of National Assembly, Executive Director, Taiwan Deep Sea Tuna Boatowners and Exporters Association, and President, Kwan Tai Fishery Co., Ltd.

Dec. 15: Mr. George Hsieh, Vice General Manager, Kant Huang, President, Kaisers Industries Corporation.

* The associate investigator would like to thank Dr. Nien-Tsu Hu, Professor of Marine Policy, National Sun-Yat Sen University, for his time and assistance during the visit to Kaohsiung Dec. 13 - 15.

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